OVERVIEW & SCRUTINY COMMITTEE:

WATER MANAGEMENT CYCLE WORKING GROUP

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MAIDSTONE
Borough Council

WATER MANAGEMENT CYCLE WORKING GROUP

INFORMATION PACK

This pack is intended to support the working group in conducting its evidence collection meetings across December 2022 and January 2023.

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Review lines of Enquiry

The lines of enquiry are outlined below, with the specific areas of interest highlighted by the group (so far) as being included as sub-headings.

a) Supply of Water

   a. Mitigating effects of increased rainfall, including capacity
   b. General supply of water:
      i. Consultation with Environment Agency and Water companies on the supply of water
      ii. Southeast water had suggested providing information on supply issues to loose & Coxheath, alongside drought management and communications in extreme weather.

b) Disposal of Water

   a. Importance and influence of development management (including considerations at planning committee)
   b. Flooding mitigation Mechanisms
      i. To effectively control water
      ii. Natural flood mitigation measures; ditches, hedging, additional tree cover, wetlands, etc.
   c. Management of highway and surface water flooding
   d. Working with partners, including interviewing landowner associations/representatives.

c) Disposal of Sewage in Water Courses

   a. Combined systems (also relevant to point b) and link to foul and surface water mixing.
   b. Council powers and partnership Working, e.g. development management, planning and lobbying.
   c. Working with partners
   d. Water neutrality and planning (lobbying as a possibility)

Water Management Cycle Working Group – Evidence List

Line of Enquiry	**Areas of Focus**	**Proposed Evidence to Support**	**Provided for:** Internal consultation, External consultation OR Both.
Supply of Water	Mitigating effects of increased rainfall, including capacity General supply of water	Gov.UK Guidance on Water Supply, Wastewater and Water Quality (Planning) Water supply, wastewater and water quality - GOV.UK (www.gov.uk) Applicable sections of National Planning Policy Framework* (see wealdon council links below) National Planning Policy Framework - GOV.UK (www.gov.uk) Summary document for the Southern Water consultation on the draft Water Resources Management Plan southern-waters-draft-water-resources-management-plan-non-technical-summary.pdf (southernwater.co.uk) Draft Water Resources Management Plan 2025 to 2075 Highlights	Internal & External Internal External External

		Actions taken by water providers, reference to Loose and Coxheath (to be provided by southeast water) *Verbal Evidence collection from internal officers and External Stakeholders.*	*Internal & External*
Disposal of Water	Importance and influence of development management (including considerations at planning committee)	Briefing Note provided to the Executive on Water Quality Motion your-councillors (maidstone.gov.uk) Gov.UK Guidance on Water Supply, Waste Water and Water Quality (Planning)	Internal & External Internal & External
	Flooding mitigation Mechanisms: i. To effectively control water ii. Natural flood mitigation measures; ditches, hedging, additional tree cover, wetlands, etc.	SERT – Environmental Land Management Schemes Information Environmental Land Management Schemes (ELMS) - South East Rivers Trust Natural Flood Management in the Medway Natural Flood Management in the Medway - South East Rivers Trust	External External
	Management of highway and surface water flooding	Briefing note provided by MG	Internal & External

	Working with partners, including interviewing landowner associations/representatives.	Tree Cover Article (Urban Centre for Green Metrics in Great Britain: A geospatial and socioecological study)	Internal
		EA Chief Executive Speech, 'Surface Water: The biggest flood risk of all'. Surface water: The biggest flood risk of all - GOV.UK (www.gov.uk)	Internal & External
		Maidstone Surface Water Management Plan (KCC) Maidstone surface water management plan - Kent County Council	External
		Environment Agency Data on Water Quality *(to be received)*	External
		Drainage and Wastewater Management Plan (DWMP) Draft for Consultation. draft-drainage-and-wastewater-management-plan.pdf (southernwater.co.uk)	External
		Verbal Evidence collection from internal officers and External Stakeholders.	*Internal & External*

Disposal of Sewage in Water Courses	Combined systems (also relevant to point b) Council powers and partnership Working, e.g., development management, planning and lobbying. Working with partners (Water neutrality and planning (lobbying as a possibility)	Gov.UK Guidance on Water Supply, Waste Water and Water Quality (Planning) Drainage and Wastewater Management Plan (DWMP) Draft for Consultation (Southern Water) draft-drainage-and-wastewater-management-plan.pdf (southernwater.co.uk) DWMP Investment Plan for Sewer Flooding (Southern Water) dwmp-investment-plan-sewer-flooding.pdf (southernwater.co.uk) DWMP Investment Plan for Wastewater Compliance and Pollution (Southern Water) dwmp-investment-plan-compliance-pollution.pdf (southernwater.co.uk) *Verbal Evidence collection from internal officers and External Stakeholders.*	Internal & External External External External *Internal & External*
Other	Medway Flood Partnership; 4 Year Update Report. Biodiversity and Climate Change Action Plan, with relevant actions to the review highlighted: your-councillors (maidstone.gov.uk)		

	Short-Term and Long-Term Risk of Areas within Maidstone *(specific areas to be identified)* - Example drafted for Maidstone House - Learn more about this area's flood risk - GOV.UK (check-long-term-flood-risk.service.gov.uk) MBC – Strategic Flood Risk Assessment & appendices: Local Plan Evidence - MBC Local Plan (maidstone.gov.uk) Data on complaints relating to water management/sewage/flooding – MBC and KCC *(to be received).* Briefing Note on how flooding/sewage is considered as part of the planning application (Development Management) Process

EXAMPLE OF WEALDON COUNCIL AS REQUESTED BY THE GROUP

*Wealdon Council Review: Link to website pages: Strategic Flood Risk Assessment - Wealden District Council - Wealden District Council

Wealdon Council press release 'Southern Water to take Action': Wealden pushes Southern Water to take action - Wealden District Council - Wealden District Council

Supply of Water

Gov.UK Guidance on Water Supply, Waste Water and Water Quality (Planning)
Water supply, wastewater and water quality - GOV.UK (www.gov.uk)
This document sets out the factors which need to be considered when plan- making for water supply, wastewater and waste quality concerns.

It details ways that flood risk can be reduced, by improving the design of a development. This should include permeable surfaces, sustainable drainage systems, removing artificial physical modifications and recreating natural features. Water quality can be improved by protecting and enhancing green infrastructure.

Water supply should be addressed through authorities' strategic policies, so will not need to be considered for most planning applications, except from large developments not identified in the plan, significant works required to connect the water supply or where a plan requires enhanced water efficiency in new developments. It is important to identify suitable sites for water supply infrastructure. In two-tier areas there will need to be close working between the district and county councils.

Throughout the guidance, it highlights the importance of early-stage communication between strategic policy making authorities, the Environment Agency, Catchment Partnerships and Water & Sewage Companies.

Applicable sections of National Planning Policy Framework
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

Under the section on Planning for Climate Change, pages 45- 46, it states that plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity etc. New development should be planned for ways that avoid increased vulnerability to the range of impacts arising from climate change.

Under the section on Planning and Flood Risk, pages 46- 48, it states that strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. This should consider impacts on local areas suspectable to flooding and advice from the Environment Agency and other relevant authorities. All Plans should apply a sequential, risk based approach to steer new development to areas with the lowest risk of flooding from any source. Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate.

Summary document for the Southern Water consultation on the draft Water Resources Management Plan
southern-waters-draft-water-resources-management-plan-non-technical-summary.pdf (southernwater.co.uk)

This summary document provides information on what a Water Resources Management Plan is, the consultation process that Southern Water is facilitating and the waste strategy in 15-year periods up until 2075.

Reference is made to Kent County on pages: 6, 7, 8, 9, 17, 20, 21 & 22.

Survey can be completed here: WRMP24 Survey (southernwater.co.uk)

Draft Water Resources Management Plan 2025 to 2075 Highlights (South East Water)
04e9cbe34f2bf1559afa39043f0580b3_1._Highlights_document.pdf (amazonaws.com)

This provides information on South East Water's Draft Water Resources Management Plan 2025 to 2075

Reference is made to Kent County on pages: 3, 7, 11, 12 and 13.

Specific reference is made to Maidstone on pages: 5 and 12.

Consultation Response can be submitted here: Water Resources Management Plan | Get Involved South East Water (engagementhq.com)

Briefing Note Provided to Executive on Water Quality Motion
your-councillors (maidstone.gov.uk)

The Water Quality Motion presented to Full Council was then presented to the Executive for their consideration. The contents within the reference to the Executive that are applicable to this review have been highlighted in bold; points 3, 4, 5, 6, and 10.

The briefing note provided to all Members has also been included, as this outlines the applicable guidance and/or legislation in relation to Water Quality.

Disposal of Water

Environmental Land Management Schemes (ELMS)
https://www.southeastriverstrust.org/projects/environmental-land-management-schemes-elms/

The Southeast Rivers Trust is part of the national pilot for the Environmental Land Management Schemes (ELMS) in the Beault and Little Stour Catchments in Kent.

This scheme works with farmers, water companies and other stakeholders on various focus areas including the protection of water supply through managing farmed and natural landscapes and trying to combine public funding with funding from private sources, such as water companies.

Over the course of the next few months, the scheme will be running workshops to gain farmers' views about natural assets on their land which contribute to water supply and whether they are willing to do anything else, what they can monitor on their land, and how they want information on spatial priorities to be shared.

Natural Flood Management in the Medway **https://www.southeastriverstrust.org/projects/natural-flood-management-in-the-medway/**

Natural Flood Management (NFM) imitates natural processes to reduce flood risk downstream. Examples include tree planting, leaky dams and creation and temporary water storage areas. This was implemented in four sites across Medway, including Sissinghurst Castle, Bedgebury, the Alder Stream (a tributary of the river medway), The School Stream, (a tributary of the River Beault). This project was delivered with funding from the EU Interreg North Sea FRAMES project, Maidstone Borough Council, Defra and the Environment Agency.

Examples of NFM measures implemented at the Alder Stream include the installation of 90 LWS to hold back water. 11 hectares of degraded ancient woodland were also fenced to prevent grazing and allow vegetation to recover – all of which will help intercept rainwater.

Briefing Note provided by the Director of Finance, Resources and Business Improvement

(no link available)

This briefing note was presented to the Working Group ahead of its meeting on the 5 December 2022. The briefing note outlines the actions that have been taken by the Council in relation to flooding/flood mitigation and partnership working.

Urban Centre for Green Metrics in Great Britain: A Geospatial and socioecological study
Urban centre green metrics in Great Britain: A geospatial and socioecological study | PLOS ONE

This article looks at the definition of urban centres in great Britain, maps and characterises the green attributes of those urban centre and whether the 'level of greenness within urban centre is reflected across the wider urban area' amongst other things.

Maidstone borough is specifically referenced on page 10 of the document, in a table demonstrating urban centres and their green attribute scores.

This document is publicly accessible.

EA Chief Executive Speech, 'Surface Water: The biggest flood risk of all'
https://www.gov.uk/government/news/surface-water-the-biggest-flood-risk-of-all

This speech is by the Environment Agency Chief Executive from 2018, which addresses the greatest challenges and impacts of surface water flooding, how legislation has evolved and ways we can combat surface water flooding in the future.

Surface Water Flooding is more likely to occur in poor urban areas with high density housing, as well areas with large maize production. The biggest challenges with surface water flooding are that it is the hardest to predict, has a large reach and there is a lack of public awareness towards it.

The speech identifies ways to increase resilience to Surface Water Flooding:

- Sustainable Drainage Systems- The environment Agency is working with developers, local authorities and the water companies to support the integration of SUDs into as many locations as possible.
- starting far upstream in the planning process so that new developments are themselves laid out in ways which reduce surface water and other risks.
- Prevention of climate change
- Public Awareness/ encouraging Local Authorities to implement preventions.

Maidstone Surface Water Management Plan
Maidstone surface water management plan - Kent County Council

This Surface Water Management Plan is for residents within the borough, produced for Kent County Council, to understand the flood risk arising from local flooding, to encompass surface runoff, groundwater and ordinary watercourses. The SWMP aims to identify what the local flood risk issues are, their effect and options to manage these.

On page 1, the main aims and objectives of the plan are outlined.

On pages 8-9, the historical flooding experienced across Maidstone is highlighted, with Sustainable Drainage systems mentioned from pages 13-14.

On page 22, the SWMP Action Plan is shown.

The appendices can be accessed using this link and are as follows: Maidstone surface water management plan - Kent County Council

Appendix 1 – Maidstone Rural North
Appendix 2 – Maidstone Rural Mid
Appendix 3 – Maidstone Rural West
Appendix 4 – Maidstone Rural East

Disposal of Sewage in Water Courses

Drainage and Wastewater Management Plan (DWMP) Draft for Consultation (Southern Water)

This Drainage and Wastewater Management Plan (DWMP) is for customers across Kent, Sussex, Hampshire and on the Isle of Wight. It sets out the investment needs to provide resilient drainage and wastewater services over the next 25 years.

On page 12, 12 main challenges are identified. Examples include nutrient enrichment, affordability, climate change, population increase, public health, cleanliness, agenising infrastructure etc:

On page 14, there are 14 main planning objectives. This includes internal sewer flooding risk, pollution risk, secure nutrient neutrality, risk of sewer flooding in a one in 50-year storm etc.

Throughout the plan the biggest challenges for Kent were highlighted:

- Infiltration; particularly in East Kent.
- Pollution from Nitrate. In Thanet, over £60 million has been invested to repair and line underground tunnels containing sewers to prevent escape of sewage into the chalk aquifer.
- North Kent and Medway were both highlight as catchments with largest areas for concern.

Drainage and Wastewater Management Plan (DWMP) Investment Plan for Sewer Flooding Planning Objectives 1, 4, 7 and 10

Sets out the investment needs to reduce the risks from sewer flooding. It uses data and evidence to assess the risk of sewer flooding in 2020 and, where possible, for future risks up to 2050.

Contains 4 planning objectives: PO1- Internal Flooding, PO4: Risk of Sewer Flooding in a 1 in 50 year storm PO7: Annualised Flood Risk (Hydraulic Overload) PO10: Surface water management.

Under each objective there are the Investment Needs that are required to reduce the risks from compliance and pollution to Band 0 (not significant level of risk). The options and investment needs are not committed funding but an identification of the needs for funding.

Areas throughout Kent are included within the investment plan, such as Tonbridge, Tunbridge Wells, and Sittingbourne. Within Maidstone Borough, Staplehurst is also referred to under several planning objectives (see tables below):

PO1: Internal Flooding, on pages 13 and 14.

Specific Location	Risk Band	Option	Indicative Cost	Indicative Timescale
Marden Road	2	Customer education campaigns to reduce FOG and unflushable items	115k	Short
Marden Road	2	Proactive jetting	10k	Short
Marden Road	2	Identify causes and possible hydraulic solution to marden road flood.	230k	Short

PO4 and 7: Risk of Flooding in a Storm on page 17 and on page 40.

Specific Location in Staplehurst	Risk Band	Option	Indicative Cost	Indicative Timescale
Catchment Wide	2	Surveys and reverification to improve model confidence and accuracy of stimulations.	275 k	Short
South	2	Investigate infiltration and exfiltration to identify causes and the highest risk areas	275k	Short
South	2	Work with local council to migate surface water flooding in coastal areas through implementation of SuDS	£TBC	Long
North/ Southern West Areas	2	for surface water separation to provide a long term solution to reduce flooding in the town and storm overflow discharges	£TBC	long

DWMP Investment Plan for Wastewater Compliance and Pollution (Southern Water)

dwmp-investment-plan-compliance-pollution.pdf (southernwater.co.uk)

Sets out the Investment Needs to reduce the risks of non-compliance with the permits for our wastewater treatment works that are issued by the Environment Agency and wider permits to reduce the risks of pollution.

Following Planning Objectives: are PO2: Risk of Pollution, PO6: WTW Water Quality Compliance, PO8: WTW Dry Weather Flow Compliance.

Areas throughout Kent are included within the investment plan, such as Tonbridge, Tunbridge Wells, and Sittingbourne. Within Maidstone Borough, Staplehurst is also referred to under several planning objectives (see tables below):

PO2: Risk of Pollution, on pages 8, 11, 13, 15

Specific Location in Staplehurst	Risk Band	Option	Indicative Cost	Indicative Timescale
WTW	2	Improve resilience to reduce pollution incidents	1,000K	Short/ Medium
Staplehurst WTW, Bathurst Road Staplehurst WPS	2	improve the resilience of pumping stations to reduce pollution incidents due to operational failures	235k	Short
Catchment Wide	2	customer education campaign to reduce FOG and unflushable items in the sewers	115k	short
Catchment Wide	2	Proactive Jetting	25k	Short
Areas in South	2	Investigate infiltration and exhilaration to	275k	Short

		identify the causes and highest risk areas.		

PO6: WTW Quality Compliance, page 17.

Specific Location in Staplehurst	Risk Band	Option	Indicative Cost	Indicative Timescale
WTW	1	Increase biological process capacity at Staplehurst WTW.	745k	

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Other Documents

Medway Flood Partnership, 4-year update report
Medway flood action plan - year 4 report - GOV.UK (www.gov.uk)

This document provides a 4-year update on the Medway Flood Partnership since 2017, and an update on the actions completed/to be completed.

Specific References to Maidstone Borough Council can be found in actions:

5, 6, 7, 8, 9, 12, 19 – New Actions; Highway drainage pilot, Mote Park Lake Reservoir Act Works, 20, 30, 31, 35, 36, 37, 40, 42, 44, 45, 46, 48, 51, 52 & 54.

Biodiversity and Climate Change Action Plan (BDCCAP)
your-councillors (maidstone.gov.uk)

The Council's BDCCAP was agreed by the de-commissioned Policy and Resources Committee, and an updated action log for the plan was recently presented to the Communities, Housing and Environment Policy Advisory Committee

The relevant actions relating to the working group's lines of enquiry have been included within this information pack.

Maidstone Borough Council, Strategic Flood Risk Assessment (Addendum Report) & Appendices:
Local Plan Evidence - MBC Local Plan (maidstone.gov.uk)

This SRA Addendum report provides an update to elements of the Level 1 SRFA prepared for the Council in 2008. It is included within the documents for the Council's Adopted Local Plan 2017.

On pages 12, 13 and 14, the introduction, objectives and outputs are referenced.

From page 18, Section 2 of the document references the Planning Framework and Flood Risk Policy.

On pages 18-19, the roles and responsibilities in Maidstone Borough as outlined within the Flood and Water Management Act 2011 are outlined.

From page 29, Section 3 of the document references understanding flood risk in Maidstone Borough.

The associated appendices can be accessed using the link above and are:

Appendix A – Watercourses Map
Appendix B – Flood Zones Map
Appendix C – Climate Change Flood Map
Appendix D – Surface Water Flood Risk Map
Appendix E – Groundwater Flood Risk Map
Appendix F – Flood Warning Areas Map

Briefing Note on how flooding/sewage is considered as part of the planning application (Development Management) Process

(no link available)

This briefing note has been produced by the Principal Planning Officer to provide additional information on the how flooding/sewage is considered as part of the planning application (development management) process, in response to the group's previous request to have information relating to land clearances.

Guidance

Water supply, wastewater and water quality

Advises on how planning can ensure water quality and the delivery of adequate water and wastewater infrastructure.

From:
Department for Levelling Up, Housing and Communities (/government/organisations/department-for-levelling-up-housing-and-communities) and Ministry of Housing, Communities & Local Government (/government/organisations/ministry-of-housing-communities-and-local-government)

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Contents

Guidance amended - see previous version (https://webarchive.nationalarchives.gov.uk/20190606212040/https://www.gov.uk/guidance/water-supply-wastewater-and-water-quality).

Where plans are being prepared under the transitional arrangements set out in Annex 1 to the revised National Planning Policy Framework (https://www.gov.uk/government/publications/national-planning-policy-framework--2), the policies in the previous version of the framework published in 2012 (http://webarchive.nationalarchives.gov.uk/20180608095821/https:/www.gov.uk/government/publications/national-planning-policy-framework--2) will continue to apply, as will any previous guidance which has been superseded since the new framework was published in July 2018. If you'd like an email alert when changes are made to planning guidance please subscribe (https://www.gov.uk/topic/planning-development/planning-officer-guidance/email-signup).

Water supply, wastewater and water quality – introduction

What is the legal and policy framework for the water environment?

The Water Environment Regulations 2017 (http://www.legislation.gov.uk/uksi/2017/407/contents/made) apply to surface waters (including some coastal waters) and groundwater (water below the surface of the ground). These regulations set out requirements to prevent the deterioration of aquatic ecosystems; protect, enhance and restore water bodies to 'good' status; and achieve compliance with standards and objectives for protected areas. Local planning authorities must, in exercising their functions (http://www.legislation.gov.uk/uksi/2003/3242/regulation/17/made), have regard to River Basin Management Plans (https://www.gov.uk/government/collections/river-basin-management-plans-2015). These plans contain the main issues for the water environment and the actions needed to tackle them.

The National policy statement for waste water (https://www.gov.uk/government/publications/national-policy-statement-for-waste-water) forms part of the overall framework of national planning policy.

Related policy:

- paragraph 170 (https://gov.uk/guidance/national-planning-policy-framework/15-conserving-and-enhancing-the-natural-environment)
- paragraph 180 (https://gov.uk/guidance/national-planning-policy-framework/15-conserving-and-enhancing-the-natural-environment#para180)
- paragraph 20 (https://gov.uk/guidance/national-planning-policy-framework/3-plan-making#para20)

Paragraph: 001 Reference ID: 34-001-20161116

Revision date: 22 07 2019

How can the planning system plan positively for water supply and quality?

Multiple benefits for people and the environment can be achievable through good design and mitigation. For example, flood risk can be reduced (https://www.gov.uk/guidance/flood-risk-and-coastal-change) and biodiversity and amenity improved by designing development that includes permeable surfaces and other sustainable drainage systems, removing artificial physical modifications (for example, weirs and concrete channels) and recreating natural features. Water quality can be improved by protecting and enhancing green infrastructure and further information on this can be found in the planning practice guidance on the Natural Environment (https://www.gov.uk/guidance/natural-environment).

Good design and mitigation measures can be secured through site specific policies for allocated sites and through non-site specific policies on water infrastructure and protecting the water environment. For example, they can be used to ensure that new development and mains water and wastewater infrastructure provision is aligned and to ensure new development is phased and not occupied until the necessary works relating to water and wastewater have been carried out. Local planning authorities can use planning conditions (https://www.gov.uk/guidance/use-of-planning-conditions) and / or obligations (https://www.gov.uk/guidance/planning-obligations) to secure mitigation and compensatory measures where the relevant tests are met. Planning obligations can be used to set out requirements relating to monitoring water quality, habitat creation and maintenance and the transfer of assets where this mitigates an impact on water quality.

Paragraph: 019 Reference ID: 34-019-20140306

Revision date: 22 07 2019

Water supply, wastewater and water quality – considerations in plan making

What are the water supply, wastewater and water quality concerns that plans need to address?

These will vary depending on the character of the local area, the type of issues the plan (https://www.gov.uk/guidance/plan-making) covers and the contribution that can be made to a 'catchment-based approach (https://www.gov.uk/guidance/water-supply-wastewater-and-water-quality#catchment-based-approach)' to water. Wastewater treatment plants are waste developments and handled by the waste planning authority. In plan-making, there are a number of broad considerations relevant to water supply and water quality:

- infrastructure (water supply and wastewater)
- water quality
- wastewater
- cross-boundary concerns
- strategic environmental assessment and sustainability appraisal
- habitats regulations assessments.

Early discussions between strategic policy-making authorities and water and sewerage companies can help to ensure that proposed growth and environmental objectives are reflected in company business plans. Growth that requires new water supply should also be reflected in companies' long-term water resources management plans. This will help ensure that the necessary infrastructure is funded through the water industry's price review (https://www.ofwat.gov.uk/pricereview/).

Strategic policy-making authorities will also need to consider the objectives in the government's 25 Year Environment Plan (https://www.gov.uk/government/publications/25-year-environment-plan) to reduce the damaging abstraction of water from rivers and groundwater, and to reach or exceed objectives for rivers, lakes, coastal and ground waters that are specially protected.

Paragraph: 002 Reference ID: 34-002-20140306

Revision date: 22 07 2019

What might need to be considered when planning for water infrastructure, water quality and wastewater?

Planning for water infrastructure:
Plan-making may need to consider:

- identifying suitable sites for new or enhanced waste water and water supply infrastructure. When identifying sites it is important to recognise that water and wastewater infrastructure can have specific locational needs (and often consists of engineering works rather than new buildings). This means exceptionally otherwise protected areas may have to be considered, where this is consistent with their designation.
- existing and proposed development in the vicinity of a location under consideration for water and wastewater infrastructure. In two-tier areas there will need to be close working between the district and county councils.

- whether new development is appropriate near to sites used (or proposed) for water and wastewater infrastructure (for example, odour may be a concern).
- phasing new development so that water and wastewater infrastructure will be in place when and where needed. The impact on designated sites of importance for biodiversity should be considered to ensure the required infrastructure is in place before any environmental effects occur.

Paragraph: 005 Reference ID: 34-005-20140306

Revision date: 06 03 2014

Water quality:

Plan-making may need to consider:

- how to help protect and enhance local surface water and groundwater in ways that allow new development to proceed and avoids costly assessment at the planning application stage. For example, can the plan steer potentially polluting development away from the most sensitive areas, particularly those in the vicinity of drinking water supplies (designated source protection zones or near surface water drinking water abstractions)
- where an assessment of the potential impacts on water bodies and protected areas under the Water Environment Regulations 2017 (http://www.legislation.gov.uk/uksi/2017/407/made) may be required, consider the type or location of new development
- whether measures to improve water quality, for example sustainable drainage schemes, can be used to address impacts on water quality in addition to mitigating flood risk

Related policy:

- paragraph 170 (https://gov.uk/guidance/national-planning-policy-framework/15-conserving-and-enhancing-the-natural-environment)
- paragraph 180 (https://gov.uk/guidance/national-planning-policy-framework/15-conserving-and-enhancing-the-natural-environment#para180)
- paragraph 20 (https://gov.uk/guidance/national-planning-policy-framework/3-plan-making#para20)

Paragraph: 006 Reference ID: 34-006-20161116

Revision date: 22 07 2019

Wastewater:

Plan-making may need to consider:

- the sufficiency and capacity of wastewater infrastructure
- the circumstances where wastewater from new development would not be expected to drain to a public sewer
- the capacity of the environment to receive effluent from development in different parts of a strategic policy-making authority's area without preventing relevant statutory objectives being met

Related policy:

- paragraph 20 (https://gov.uk/guidance/national-planning-policy-framework/3-plan-making#para20)

Paragraph: 007 Reference ID: 34-007-20140306

Revision date: 22 07 2019

Cross-boundary issues:

Water supply and water quality issues often cross local authority boundaries and can be best considered on a catchment basis. Liaison between strategic policy-making authorities, the Environment Agency, catchment partnerships and water and sewerage companies from the outset (at the plan scoping and evidence gathering stages of plan-making) will help to identify water supply and quality issues, the need for new water and wastewater infrastructure to fully account for proposed growth and other relevant issues such as flood risk. The duty to cooperate (https://www.gov.uk/guidance/plan-making#maintaining-effective-cooperation) across boundaries applies to water supply and quality issues, and should be evidenced through a Statement of Common Ground (https://www.gov.uk/guidance/plan-making#maintaining-effective-cooperation).

The Department for Environment, Food and Rural Affairs has published a policy framework to encourage the wider adoption of an integrated catchment-based approach (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/204231/pb13934-water-environment-catchment-based-approach.pdf) to improving the quality of the water environment:

- to deliver positive and sustained outcomes for the water environment by promoting a better understanding of the environment at a local level; and
- to encourage local collaboration and more transparent decision-making when both planning and delivering activities to improve the water environment

The framework explains that adopting this approach will promote the development of more appropriate river basin management plans (which underpin the delivery of the objectives of the Water Environment Regulations 2017 (http://www.legislation.gov.uk/uksi/2017/407/contents/made)) but will also provide a platform for engagement, discussion and decisions of much wider benefit including tackling diffuse agricultural and urban pollution, and widespread, historical alterations to the natural form of channels.

Related policy:

- paragraph 20 (https://gov.uk/guidance/national-planning-policy-framework/3-plan-making#para20)
- paragraphs 24-27 (https://gov.uk/guidance/national-planning-policy-framework/3-plan-making#para24)

Paragraph: 008 Reference ID: 34-008-20140306

Revision date: 22 07 2019

Using strategic environmental assessment and sustainability appraisal:

Water supply and quality are considerations in strategic environmental assessment and sustainability appraisal (https://www.gov.uk/guidance/strategic-environmental-assessment-and-sustainability-appraisal). Sustainability appraisal objectives could include preventing deterioration of current water body status, taking climate change into account and seeking opportunities to improve water bodies.

Paragraph: 009 Reference ID: 34-009-20140306

Revision date: 22 07 2019

Information about the water environment

Where is there information about the water environment?

The River Basin Management Plan is the key over-arching source of information on the water environment, including the condition of water bodies and measures to help meet the objectives of the Water Environment Regulations 2017 (http://www.legislation.gov.uk/uksi/2017/407/introduction/made).

Other sources of information on the water environment include:

- the Water Industry National Environment Programme (https://data.gov.uk/dataset/a1b25bcb-9d42-4227-9b3a-34782763f0c0/water-industry-national-environment-programme) published by the Environment Agency, which

outlines actions for all 20 water and sewerage companies operating in England to complete between 2020 and 2025, in order to contribute towards meeting their environmental obligations

- statutory water company water resource management plans
- water and sewerage company business plans
- information published by the Environment Agency (https://www.gov.uk/government/organisations/environment-agency), including flood and coastal risk management plans and strategies, abstraction management, public registers, groundwater vulnerability maps and the location of source protection zones
- water cycle studies
- water and sewerage company drainage strategies
- Local Record Centres (http://www.alerc.org.uk/), which may hold relevant information on the water environment
- information from environmental statements
- diffuse water pollution plans and nutrient management plans (https://www.gov.uk/government/collections/nutrient-management-plans), produced by Natural England and the Environment Agency, for internationally and nationally designated sites of importance for biodiversity and where relevant other SSSIs

Paragraph: 010 Reference ID: 34-010-20140306

Revision date: 22 07 2019

What are river basin management plans?

River basin management plans describe the river basin district and the pressures that the water environment faces. The plans show long term objectives, what these mean for the current state of the water environment and how organisations and communities will work together to improve the water environment. There are 8 river basin management plans covering England (https://www.gov.uk/government/collections/river-basin-management-plans-2015). They are produced by the Environment Agency (https://www.gov.uk/government/organisations/environment-agency) and approved by the Secretary of State for Environment, Food and Rural Affairs.

Paragraph: 011 Reference ID: 34-011-20161116

Revision date: 22 07 2019

What is a water cycle study?

A water cycle study is a voluntary study that helps organisations work together to plan for sustainable growth. It uses water and planning evidence to understand environmental and infrastructure capacity. It can identify joined up and cost effective solutions, that are resilient to climate change for the lifetime of the development.

The study provides evidence for plans (https://www.gov.uk/guidance/plan-making) and sustainability appraisals and is ideally done at an early stage of plan-making. Local authorities (or groups of local authorities) usually lead water cycle studies, as a chief aim is to provide evidence for sound plans, but other partners often include the Environment Agency and water companies.

Paragraph: 012 Reference ID: 34-012-20140306

Revision date: 22 07 2019

What is a drainage strategy?

A drainage strategy can be prepared by water and sewerage companies and sets out how they intend to deliver statutory drainage functions and meet customer needs within a particular catchment. The Environment Agency and Ofwat have published a Drainage Strategy Framework (https://www.ofwat.gov.uk/wp-content/uploads/2015/12/rpt_com201305drainagestrategy1.pdf) which sets out principles and best practice for water and sewerage companies to develop catchment based drainage strategies.

Paragraph: 013 Reference ID: 34-013-20140306

Revision date: 22 07 2019

How can the Environment Agency help?

The Environment Agency can often provide help to plan-makers and applicants by:

- identifying the circumstances in which water quality is likely to be a significant planning issue and, where it is, the scope and content of any assessments that may be needed
- advising whether an environmental permit or other consent is likely to be required before the proposed development can start operating (they have published guidance for developments requiring planning permission and environmental permits (https://www.gov.uk/government/publications/developments-requiring-planning-permission-and-environmental-permits)). If so, whether there are any significant water issues that may arise at the permitting stage – so there are 'no surprises' and to help ensure that regulation is not duplicated by planning and permitting
- clarifying any special permit requirements that might affect the likelihood of getting planning permission

Paragraph: 014 Reference ID: 34-014-20140306

Revision date: 22 07 2019

Water and neighbourhood planning

Are water issues relevant to neighbourhood planning?

Protecting and improving water bodies may be relevant when drawing up a neighbourhood plan (https://www.gov.uk/guidance/neighbourhood-planning--2) or considering a neighbourhood development order. It is always useful to consult the local planning authority about whether water could be a concern.

Paragraph: 015 Reference ID: 34-015-20140306

Revision date: 22 07 2019

Water supply, wastewater and water quality – considerations for planning applications:

Water supply

Early engagement with the local planning authority, the Environment Agency and relevant water and sewerage companies as appropriate can help establish whether particular water and wastewater issues need to be considered.

Planning for the necessary water supply would normally be addressed through authorities' strategic policies, which can be reflected in water companies' water resources management plans Water supply is therefore unlikely to be a consideration for most planning applications. Exceptions might include:

- large developments not identified in plans that are likely to require a large amount of water; and/or
- significant works required to connect the water supply; and/ or
- where a plan requires enhanced water efficiency in new developments as part of a strategy to manage water demand locally and help deliver new development.

Water quality

Water quality is only likely to be a significant planning concern when a proposal would:

- involve physical modifications to a water body such as flood storage areas, channel diversions and dredging, removing natural barriers, construction of new locks, new culverts, major bridges, new barrages/dams, new weirs (including for

hydropower) and removal of existing weirs; and/or

- indirectly affect water bodies, for example,
  - as a result of new development such as the redevelopment of land that may be affected by contamination, mineral workings, water or wastewater treatment, waste management facilities and transport schemes including culverts and bridges;
  - result in runoff into surface water sewers that drain directly, or via combined sewers, into sensitive waterbodies e.g. water bodies with local, national or international habitat designations;
  - through a lack of adequate infrastructure to deal with wastewater
  - through a lack of adequate infrastructure to deal with wastewater where development occurs in an area where there is a strategic water quality plan e.g. Nutrient Management Plans (https://www.gov.uk/government/collections/nutrient-management-plans), River Basin Management Plans, water cycle studies, diffuse water pollution plans or sewerage undertakers' drainage strategies which set out strategies to manage water quality locally and help deliver new development.

Assessing impacts on water quality

Where water quality has the potential to be a significant planning concern an applicant should be able to explain how the proposed development would affect a relevant water body in a river basin management plan or designated sites of importance for biodiversity, and how they propose to mitigate the impacts.

Where it is likely that a proposal would have a significant adverse impact on water quality then a more detailed assessment will be required. The assessment should form part of the environmental statement, if one is required because of a likely significant effect on water.

When a detailed assessment is needed, the components are likely to include:

- the likely impacts of the proposed development (including physical modifications) on water quantity and flow, river continuity and groundwater connectivity, and biological elements (flora and fauna)
- how the proposed development will affect measures in the river basin management plan to achieve good status in water bodies to ensure local authorities discharge their duty to have regard to river basin management plans when exercising their duties, including making planning decisions
- how it is intended the development will comply with other relevant regulatory requirements relating to the water environment (such as those relating to bathing waters, shellfish waters, freshwater fish, drinking water, internationally and

nationally designated sites of importance for biodiversity) bearing in mind compliance will be secured through the Environment Agency's permitting responsibilities

Paragraph: 016 Reference ID: 34-016-20140306

Revision date: 22 07 2019

What is good status in water bodies?

Good status for surface water bodies depends on biological quality (such as fish), physico-chemical conditions (for example oxygen or ammonia) and hydromorphological conditions (physical characteristics, such as size, shape and structure of a channel, and hydrology – the flow and quantity of water). Good status for groundwater bodies takes account of quantity and chemical status.

Paragraph: 017 Reference ID: 34-017-20140306

Revision date: 22 07 2019

Can planning permission be granted for developments that harm water bodies?

Changes to scheme design and mitigation will often avoid harm to water bodies. In the few cases where a detailed assessment indicates that development will have a significant adverse impact on water quality then the proposed development will only be acceptable where the conditions in Article 4.7 of the Water Framework Directive (https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32000L0060) 2000/60/EC having regard to the river basin management plan are satisfied. The Environment Agency may be able to advise on meeting those requirements.

There is a general duty on all public bodies (http://www.legislation.gov.uk/uksi/2017/407/contents/made) to provide information and such assistance as the Environment Agency may reasonably seek in connection with exercising their responsibilities for implementing the Water Environment Regulations 2017. Where this has been requested by the Environment Agency, the local planning authority should notify the Environment Agency if planning permission is granted for a new development likely to lead to a deterioration of a water body.

Paragraph: 018 Reference ID: 34-018-20161116

Revision date: 22 07 2019

Are there particular considerations that apply in areas with inadequate wastewater infrastructure?

The preparation of plans should be the focus for ensuring that investment plans of water and sewerage companies align with development needs. If there are concerns arising from a planning application about the capacity of wastewater infrastructure, applicants can be asked to provide information about how the proposed development will be drained and wastewater dealt with. Applications for developments relying on anything other than connection to a public sewage treatment plant will need to be supported by sufficient information to understand the potential implications for the water environment.

When drawing up wastewater treatment proposals for any development, the first presumption is to provide a system of foul drainage discharging into a public sewer to be treated at a public sewage treatment works (those provided and operated by the water and sewerage companies). This will need to be done in consultation with the sewerage company of the area.

The timescales for works to be carried out by the sewerage company do not always fit with development needs. In such cases, local planning authorities will want to consider how new development can be phased, for example so it is not occupied until any necessary improvements to the public sewage system have been carried out. Read further information on conditions (https://www.gov.uk/guidance/use-of-planning-conditions#para008).

Where a connection to a public sewage treatment plant is not feasible (in terms of cost and/or practicality) a package sewage treatment plant can be considered. This could either be adopted in due course by the sewerage company or owned and operated by a sewerage undertaker appointed under a new appointment or variation (https://www.ofwat.gov.uk/regulated-companies/markets/nav-market/). The package sewage treatment plant must comply with the general binding rules (https://www.gov.uk/guidance/general-binding-rules-small-sewage-discharge-to-the-ground), or a permit will be required. A package sewage treatment plant must be used if the treated effluent is being discharged to surface water.

A proposal for a package sewage treatment plant and infrastructure should set out clearly the responsibility and means of operation and management to ensure that the permit is not likely to be infringed in the life of the plant. There may also be effects on amenity and traffic to be considered because of the need for sludge to be removed by tankers. Where a system will rely on the use of a drainage field consideration may be given to the need to periodically replace that drainage field in a new area of land in order for the sewerage system to continue to function properly.

Septic tanks or package sewage treatment plants may only be considered if it can be clearly demonstrated by the applicant that discharging into a public sewer is not feasible (taking into account cost and/or practicability and whether the package treatment plant poses a risk to a designated site) in accordance with Approved

Document H of the Building Regulations 2010. Septic tanks must not discharge effluent to surface water and must comply with the general binding rules, or a permit will be required.

Related policy:

- paragraph 170 (https://gov.uk/guidance/national-planning-policy-framework/15-conserving-and-enhancing-the-natural-environment)
- paragraph 180 (https://gov.uk/guidance/national-planning-policy-framework/15-conserving-and-enhancing-the-natural-environment#para180)

Paragraph: 020 Reference ID: 34-020-20140306

Revision date: 22 07 2019

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Contents

1. Introduction

1. The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied[1]. It provides a framework within which locally-prepared plans for housing and other development can be produced.

2. Planning law requires that applications for planning permission be determined in accordance with the development plan[2], unless material considerations indicate otherwise[3]. The National Planning Policy Framework must be taken into account in preparing the development plan, and is a material consideration in planning decisions. Planning policies and decisions must also reflect relevant international obligations and statutory requirements.

3. The Framework should be read as a whole (including its footnotes and annexes). General references to planning policies in the Framework should be applied in a way that is appropriate to the type of plan being produced, taking into account policy on plan-making in chapter 3.

4. The Framework should be read in conjunction with the Government's planning policy for traveller sites, and its planning policy for waste. When preparing plans or making decisions on applications for these types of development, regard should also be had to the policies in this Framework, where relevant.

5. The Framework does not contain specific policies for nationally significant infrastructure projects. These are determined in accordance with the decision-making framework in the Planning Act 2008 (as amended) and relevant national policy statements for major infrastructure, as well as any other matters that are relevant (which may include the National Planning Policy Framework). National policy statements form part of the overall framework of national planning policy, and may be a material consideration in preparing plans and making decisions on planning applications.

6. Other statements of government policy may be material when preparing plans or deciding applications, such as relevant Written Ministerial Statements and endorsed recommendations of the National Infrastructure Commission.

[1] This document replaces the previous version of the National Planning Policy Framework published in February 2019.
[2] This includes local and neighbourhood plans that have been brought into force and any spatial development strategies produced by combined authorities or elected Mayors (see Glossary).
[3] Section 38(6) of the Planning and Compulsory Purchase Act 2004 and section 70(2) of the Town and Country Planning Act 1990.

2. Achieving sustainable development

7. The purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs[4]. At a similarly high level, members of the United Nations – including the United Kingdom – have agreed to pursue the 17 Global Goals for Sustainable Development in the period to 2030. These address social progress, economic well-being and environmental protection[5].

8. Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

   a) **an economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

   b) **a social objective** – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering well-designed, beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and

   c) **an environmental objective** – to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

9. These objectives should be delivered through the preparation and implementation of plans and the application of the policies in this Framework; they are not criteria against which every decision can or should be judged. Planning policies and decisions should play an active role in guiding development towards sustainable solutions, but in doing so should take local circumstances into account, to reflect the character, needs and opportunities of each area.

10. So that sustainable development is pursued in a positive way, at the heart of the Framework is a **presumption in favour of sustainable development** (paragraph 11).

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[4] Resolution 42/187 of the United Nations General Assembly.
[5] Transforming our World: the 2030 Agenda for Sustainable Development.

The presumption in favour of sustainable development

11. Plans and decisions should apply a presumption in favour of sustainable development.

For **plan-making** this means that:

a) all plans should promote a sustainable pattern of development that seeks to: meet the development needs of their area; align growth and infrastructure; improve the environment; mitigate climate change (including by making effective use of land in urban areas) and adapt to its effects;

b) strategic policies should, as a minimum, provide for objectively assessed needs for housing and other uses, as well as any needs that cannot be met within neighbouring areas[6], unless:

   i. the application of policies in this Framework that protect areas or assets of particular importance provides a strong reason for restricting the overall scale, type or distribution of development in the plan area[7]; or

   ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.

For **decision-taking** this means:

c) approving development proposals that accord with an up-to-date development plan without delay; or

d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date[8], granting permission unless:

   i. the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed[7]; or

   ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.

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[6] As established through statements of common ground (see paragraph 27).

[7] The policies referred to are those in this Framework (rather than those in development plans) relating to: habitats sites (and those sites listed in paragraph 181) and/or designated as Sites of Special Scientific Interest; land designated as Green Belt, Local Green Space, an Area of Outstanding Natural Beauty, a National Park (or within the Broads Authority) or defined as Heritage Coast; irreplaceable habitats; designated heritage assets (and other heritage assets of archaeological interest referred to in footnote 68); and areas at risk of flooding or coastal change.

[8] This includes, for applications involving the provision of housing, situations where the local planning authority cannot demonstrate a five year supply of deliverable housing sites (with the appropriate buffer, as set out in paragraph 74); or where the Housing Delivery Test indicates that the delivery of housing was substantially below (less than 75% of) the housing requirement over the previous three years.

12. The presumption in favour of sustainable development does not change the statutory status of the development plan as the starting point for decision-making. Where a planning application conflicts with an up-to-date development plan (including any neighbourhood plans that form part of the development plan), permission should not usually be granted. Local planning authorities may take decisions that depart from an up-to-date development plan, but only if material considerations in a particular case indicate that the plan should not be followed.

13. The application of the presumption has implications for the way communities engage in neighbourhood planning. Neighbourhood plans should support the delivery of strategic policies contained in local plans or spatial development strategies; and should shape and direct development that is outside of these strategic policies.

14. In situations where the presumption (at paragraph 11d) applies to applications involving the provision of housing, the adverse impact of allowing development that conflicts with the neighbourhood plan is likely to significantly and demonstrably outweigh the benefits, provided all of the following apply[9]:

    a) the neighbourhood plan became part of the development plan two years or less before the date on which the decision is made;

    b) the neighbourhood plan contains policies and allocations to meet its identified housing requirement;

    c) the local planning authority has at least a three year supply of deliverable housing sites (against its five year housing supply requirement, including the appropriate buffer as set out in paragraph 74); and

    d) the local planning authority's housing delivery was at least 45% of that required[10] over the previous three years.

[9] Transitional arrangements are set out in Annex 1.
[10] Assessed against the Housing Delivery Test, from November 2018 onwards.

3. Plan-making

15. The planning system should be genuinely plan-led. Succinct and up-to-date plans should provide a positive vision for the future of each area; a framework for addressing housing needs and other economic, social and environmental priorities; and a platform for local people to shape their surroundings.

16. Plans should:

a) be prepared with the objective of contributing to the achievement of sustainable development[11];

b) be prepared positively, in a way that is aspirational but deliverable;

c) be shaped by early, proportionate and effective engagement between plan-makers and communities, local organisations, businesses, infrastructure providers and operators and statutory consultees;

d) contain policies that are clearly written and unambiguous, so it is evident how a decision maker should react to development proposals;

e) be accessible through the use of digital tools to assist public involvement and policy presentation; and

f) serve a clear purpose, avoiding unnecessary duplication of policies that apply to a particular area (including policies in this Framework, where relevant).

The plan-making framework

17. The development plan must include strategic policies to address each local planning authority's priorities for the development and use of land in its area[12]. These strategic policies can be produced in different ways, depending on the issues and opportunities facing each area. They can be contained in:

a) joint or individual local plans, produced by authorities working together or independently (and which may also contain non-strategic policies); and/or

b) a spatial development strategy produced by an elected Mayor or combined authority, where plan-making powers have been conferred.

18. Policies to address non-strategic matters should be included in local plans that contain both strategic and non-strategic policies, and/or in local or neighbourhood plans that contain just non-strategic policies.

19. The development plan for an area comprises the combination of strategic and non-strategic policies which are in force at a particular time.

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[11] This is a legal requirement of local planning authorities exercising their plan-making functions (section 39(2) of the Planning and Compulsory Purchase Act 2004).
[12] Section 19(1B-1E) of the Planning and Compulsory Purchase Act 2004.

Strategic policies

20. Strategic policies should set out an overall strategy for the pattern, scale and design quality of places, and make sufficient provision[13] for:

    a) housing (including affordable housing), employment, retail, leisure and other commercial development;

    b) infrastructure for transport, telecommunications, security, waste management, water supply, wastewater, flood risk and coastal change management, and the provision of minerals and energy (including heat);

    c) community facilities (such as health, education and cultural infrastructure); and

    d) conservation and enhancement of the natural, built and historic environment, including landscapes and green infrastructure, and planning measures to address climate change mitigation and adaptation.

21. Plans should make explicit which policies are strategic policies[14]. These should be limited to those necessary to address the strategic priorities of the area (and any relevant cross-boundary issues), to provide a clear starting point for any non-strategic policies that are needed. Strategic policies should not extend to detailed matters that are more appropriately dealt with through neighbourhood plans or other non-strategic policies.

22. Strategic policies should look ahead over a minimum 15 year period from adoption[15], to anticipate and respond to long-term requirements and opportunities, such as those arising from major improvements in infrastructure. Where larger scale developments such as new settlements or significant extensions to existing villages and towns form part of the strategy for the area, policies should be set within a vision that looks further ahead (at least 30 years), to take into account the likely timescale for delivery.[16]

23. Broad locations for development should be indicated on a key diagram, and land-use designations and allocations identified on a policies map. Strategic policies should provide a clear strategy for bringing sufficient land forward, and at a sufficient rate, to address objectively assessed needs over the plan period, in line with the presumption in favour of sustainable development. This should include planning for and allocating sufficient sites to deliver the strategic priorities of the area (except insofar as these needs can be demonstrated to be met more appropriately through other mechanisms, such as brownfield registers or non-strategic policies)[17].

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[13] In line with the presumption in favour of sustainable development.
[14] Where a single local plan is prepared the non-strategic policies should be clearly distinguished from the strategic policies.
[15] Except in relation to town centre development, as set out in chapter 7.
[16] Transitional arrangements are set out in Annex 1.
[17] For spatial development strategies, allocations, land use designations and a policies map are needed only where the power to make allocations has been conferred.

Maintaining effective cooperation

24. Local planning authorities and county councils (in two-tier areas) are under a duty to cooperate with each other, and with other prescribed bodies, on strategic matters that cross administrative boundaries.

25. Strategic policy-making authorities should collaborate to identify the relevant strategic matters which they need to address in their plans. They should also engage with their local communities and relevant bodies including Local Enterprise Partnerships, Local Nature Partnerships, the Marine Management Organisation, county councils, infrastructure providers, elected Mayors and combined authorities (in cases where Mayors or combined authorities do not have plan-making powers).

26. Effective and on-going joint working between strategic policy-making authorities and relevant bodies is integral to the production of a positively prepared and justified strategy. In particular, joint working should help to determine where additional infrastructure is necessary, and whether development needs that cannot be met wholly within a particular plan area could be met elsewhere.

27. In order to demonstrate effective and on-going joint working, strategic policy-making authorities should prepare and maintain one or more statements of common ground, documenting the cross-boundary matters being addressed and progress in cooperating to address these. These should be produced using the approach set out in national planning guidance, and be made publicly available throughout the plan-making process to provide transparency.

Non-strategic policies

28. Non-strategic policies should be used by local planning authorities and communities to set out more detailed policies for specific areas, neighbourhoods or types of development. This can include allocating sites, the provision of infrastructure and community facilities at a local level, establishing design principles, conserving and enhancing the natural and historic environment and setting out other development management policies.

29. Neighbourhood planning gives communities the power to develop a shared vision for their area. Neighbourhood plans can shape, direct and help to deliver sustainable development, by influencing local planning decisions as part of the statutory development plan. Neighbourhood plans should not promote less development than set out in the strategic policies for the area, or undermine those strategic policies[18].

30. Once a neighbourhood plan has been brought into force, the policies it contains take precedence over existing non-strategic policies in a local plan covering the neighbourhood area, where they are in conflict; unless they are superseded by strategic or non-strategic policies that are adopted subsequently.

[18] Neighbourhood plans must be in general conformity with the strategic policies contained in any development plan that covers their area.

Preparing and reviewing plans

31. The preparation and review of all policies should be underpinned by relevant and up-to-date evidence. This should be adequate and proportionate, focused tightly on supporting and justifying the policies concerned, and take into account relevant market signals.

32. Local plans and spatial development strategies should be informed throughout their preparation by a sustainability appraisal that meets the relevant legal requirements[19]. This should demonstrate how the plan has addressed relevant economic, social and environmental objectives (including opportunities for net gains). Significant adverse impacts on these objectives should be avoided and, wherever possible, alternative options which reduce or eliminate such impacts should be pursued. Where significant adverse impacts are unavoidable, suitable mitigation measures should be proposed (or, where this is not possible, compensatory measures should be considered).

33. Policies in local plans and spatial development strategies should be reviewed to assess whether they need updating at least once every five years, and should then be updated as necessary[20]. Reviews should be completed no later than five years from the adoption date of a plan, and should take into account changing circumstances affecting the area, or any relevant changes in national policy. Relevant strategic policies will need updating at least once every five years if their applicable local housing need figure has changed significantly; and they are likely to require earlier review if local housing need is expected to change significantly in the near future.

Development contributions

34. Plans should set out the contributions expected from development. This should include setting out the levels and types of affordable housing provision required, along with other infrastructure (such as that needed for education, health, transport, flood and water management, green and digital infrastructure). Such policies should not undermine the deliverability of the plan.

Examining plans

35. Local plans and spatial development strategies are examined to assess whether they have been prepared in accordance with legal and procedural requirements, and whether they are sound. Plans are ‘sound’ if they are:

[19] The reference to relevant legal requirements refers to Strategic Environmental Assessment. Neighbourhood plans may require Strategic Environmental Assessment, but only where there are potentially significant environmental effects.

[20] Reviews at least every five years are a legal requirement for all local plans (Regulation 10A of the Town and Country Planning (Local Planning) (England) Regulations 2012).

a) **Positively prepared** – providing a strategy which, as a minimum, seeks to meet the area's objectively assessed needs[21]; and is informed by agreements with other authorities, so that unmet need from neighbouring areas is accommodated where it is practical to do so and is consistent with achieving sustainable development;

b) **Justified** – an appropriate strategy, taking into account the reasonable alternatives, and based on proportionate evidence;

c) **Effective** – deliverable over the plan period, and based on effective joint working on cross-boundary strategic matters that have been dealt with rather than deferred, as evidenced by the statement of common ground; and

d) **Consistent with national policy** – enabling the delivery of sustainable development in accordance with the policies in this Framework and other statements of national planning policy, where relevant.

36. These tests of soundness will be applied to non-strategic policies[22] in a proportionate way, taking into account the extent to which they are consistent with relevant strategic policies for the area.

37. Neighbourhood plans must meet certain 'basic conditions' and other legal requirements[23] before they can come into force. These are tested through an independent examination before the neighbourhood plan may proceed to referendum.

[21] Where this relates to housing, such needs should be assessed using a clear and justified method, as set out in paragraph 61 of this Framework.
[22] Where these are contained in a local plan.
[23] As set out in paragraph 8 of Schedule 4B to the Town and Country Planning Act 1990 (as amended).

4. Decision-making

38. Local planning authorities should approach decisions on proposed development in a positive and creative way. They should use the full range of planning tools available, including brownfield registers and permission in principle, and work proactively with applicants to secure developments that will improve the economic, social and environmental conditions of the area. Decision-makers at every level should seek to approve applications for sustainable development where possible.

Pre-application engagement and front-loading

39. Early engagement has significant potential to improve the efficiency and effectiveness of the planning application system for all parties. Good quality pre-application discussion enables better coordination between public and private resources and improved outcomes for the community.

40. Local planning authorities have a key role to play in encouraging other parties to take maximum advantage of the pre-application stage. They cannot require that a developer engages with them before submitting a planning application, but they should encourage take-up of any pre-application services they offer. They should also, where they think this would be beneficial, encourage any applicants who are not already required to do so by law to engage with the local community and, where relevant, with statutory and non-statutory consultees, before submitting their applications.

41. The more issues that can be resolved at pre-application stage, including the need to deliver improvements in infrastructure and affordable housing, the greater the benefits. For their role in the planning system to be effective and positive, statutory planning consultees will need to take the same early, pro-active approach, and provide advice in a timely manner throughout the development process. This assists local planning authorities in issuing timely decisions, helping to ensure that applicants do not experience unnecessary delays and costs.

42. The participation of other consenting bodies in pre-application discussions should enable early consideration of all the fundamental issues relating to whether a particular development will be acceptable in principle, even where other consents relating to how a development is built or operated are needed at a later stage. Wherever possible, parallel processing of other consents should be encouraged to help speed up the process and resolve any issues as early as possible.

43. The right information is crucial to good decision-making, particularly where formal assessments are required (such as Environmental Impact Assessment, Habitats Regulations assessment and flood risk assessment). To avoid delay, applicants should discuss what information is needed with the local planning authority and expert bodies as early as possible.

44. Local planning authorities should publish a list of their information requirements for applications for planning permission. These requirements should be kept to the minimum needed to make decisions, and should be reviewed at least every two

years. Local planning authorities should only request supporting information that is relevant, necessary and material to the application in question.

45. Local planning authorities should consult the appropriate bodies when considering applications for the siting of, or changes to, major hazard sites, installations or pipelines, or for development around them.

46. Applicants and local planning authorities should consider the potential for voluntary planning performance agreements, where this might achieve a faster and more effective application process. Planning performance agreements are likely to be needed for applications that are particularly large or complex to determine.

Determining applications

47. Planning law requires that applications for planning permission be determined in accordance with the development plan, unless material considerations indicate otherwise. Decisions on applications should be made as quickly as possible, and within statutory timescales unless a longer period has been agreed by the applicant in writing.

48. Local planning authorities may give weight to relevant policies in emerging plans according to:

a) the stage of preparation of the emerging plan (the more advanced its preparation, the greater the weight that may be given);

b) the extent to which there are unresolved objections to relevant policies (the less significant the unresolved objections, the greater the weight that may be given); and

c) the degree of consistency of the relevant policies in the emerging plan to this Framework (the closer the policies in the emerging plan to the policies in the Framework, the greater the weight that may be given)[24].

49. However, in the context of the Framework – and in particular the presumption in favour of sustainable development – arguments that an application is premature are unlikely to justify a refusal of planning permission other than in the limited circumstances where both:

a) the development proposed is so substantial, or its cumulative effect would be so significant, that to grant permission would undermine the plan-making process by predetermining decisions about the scale, location or phasing of new development that are central to an emerging plan; and

b) the emerging plan is at an advanced stage but is not yet formally part of the development plan for the area.

[24] During the transitional period for emerging plans submitted for examination (set out in paragraph 220), consistency should be tested against the original Framework published in March 2012.

50. Refusal of planning permission on grounds of prematurity will seldom be justified where a draft plan has yet to be submitted for examination; or – in the case of a neighbourhood plan – before the end of the local planning authority publicity period on the draft plan. Where planning permission is refused on grounds of prematurity, the local planning authority will need to indicate clearly how granting permission for the development concerned would prejudice the outcome of the plan-making process.

Tailoring planning controls to local circumstances

51. Local planning authorities are encouraged to use Local Development Orders to set the planning framework for particular areas or categories of development where the impacts would be acceptable, and in particular where this would promote economic, social or environmental gains for the area.

52. Communities can use Neighbourhood Development Orders and Community Right to Build Orders to grant planning permission. These require the support of the local community through a referendum. Local planning authorities should take a proactive and positive approach to such proposals, working collaboratively with community organisations to resolve any issues before draft orders are submitted for examination.

53. The use of Article 4 directions to remove national permitted development rights should:

- where they relate to change from non-residential use to residential use, be limited to situations where an Article 4 direction is necessary to avoid wholly unacceptable adverse impacts (this could include the loss of the essential core of a primary shopping area which would seriously undermine its vitality and viability, but would be very unlikely to extend to the whole of a town centre)
- in other cases, be limited to situations where an Article 4 direction is necessary to protect local amenity or the well-being of the area (this could include the use of Article 4 directions to require planning permission for the demolition of local facilities)
- in all cases, be based on robust evidence, and apply to the smallest geographical area possible.

54. Similarly, planning conditions should not be used to restrict national permitted development rights unless there is clear justification to do so.

Planning conditions and obligations

55. Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition.

56. Planning conditions should be kept to a minimum and only imposed where they are necessary, relevant to planning and to the development to be permitted, enforceable, precise and reasonable in all other respects. Agreeing conditions early is beneficial to all parties involved in the process and can speed up decision-making. Conditions that are required to be discharged before development commences should be avoided, unless there is a clear justification[25].

57. Planning obligations must only be sought where they meet all of the following tests[26]:

a) necessary to make the development acceptable in planning terms;

b) directly related to the development; and

c) fairly and reasonably related in scale and kind to the development.

58. Where up-to-date policies have set out the contributions expected from development, planning applications that comply with them should be assumed to be viable. It is up to the applicant to demonstrate whether particular circumstances justify the need for a viability assessment at the application stage. The weight to be given to a viability assessment is a matter for the decision maker, having regard to all the circumstances in the case, including whether the plan and the viability evidence underpinning it is up to date, and any change in site circumstances since the plan was brought into force. All viability assessments, including any undertaken at the plan-making stage, should reflect the recommended approach in national planning guidance, including standardised inputs, and should be made publicly available.

Enforcement

59. Effective enforcement is important to maintain public confidence in the planning system. Enforcement action is discretionary, and local planning authorities should act proportionately in responding to suspected breaches of planning control. They should consider publishing a local enforcement plan to manage enforcement proactively, in a way that is appropriate to their area. This should set out how they will monitor the implementation of planning permissions, investigate alleged cases of unauthorised development and take action where appropriate.

[25] Sections 100ZA(4-6) of the Town and Country Planning Act 1990 will require the applicant's written agreement to the terms of a pre-commencement condition, unless prescribed circumstances apply.
[26] Set out in Regulation 122(2) of the Community Infrastructure Levy Regulations 2010.

5. Delivering a sufficient supply of homes

60. To support the Government's objective of significantly boosting the supply of homes, it is important that a sufficient amount and variety of land can come forward where it is needed, that the needs of groups with specific housing requirements are addressed and that land with permission is developed without unnecessary delay.

61. To determine the minimum number of homes needed, strategic policies should be informed by a local housing need assessment, conducted using the standard method in national planning guidance – unless exceptional circumstances justify an alternative approach which also reflects current and future demographic trends and market signals. In addition to the local housing need figure, any needs that cannot be met within neighbouring areas should also be taken into account in establishing the amount of housing to be planned for.

62. Within this context, the size, type and tenure of housing needed for different groups in the community should be assessed and reflected in planning policies (including, but not limited to, those who require affordable housing, families with children, older people, students, people with disabilities, service families, travellers[27], people who rent their homes and people wishing to commission or build their own homes[28]).

63. Where a need for affordable housing is identified, planning policies should specify the type of affordable housing required[29], and expect it to be met on-site unless:

    a) off-site provision or an appropriate financial contribution in lieu can be robustly justified; and

    b) the agreed approach contributes to the objective of creating mixed and balanced communities.

64. Provision of affordable housing should not be sought for residential developments that are not major developments, other than in designated rural areas (where policies may set out a lower threshold of 5 units or fewer). To support the re-use of brownfield land, where vacant buildings are being reused or redeveloped, any affordable housing contribution due should be reduced by a proportionate amount[30].

65. Where major development involving the provision of housing is proposed, planning policies and decisions should expect at least 10% of the total number of homes to

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[27] Planning Policy for Traveller Sites sets out how travellers' housing needs should be assessed for those covered by the definition in Annex 1 of that document.
[28] Under section 1 of the Self Build and Custom Housebuilding Act 2015, local authorities are required to keep a register of those seeking to acquire serviced plots in the area for their own self-build and custom house building. They are also subject to duties under sections 2 and 2A of the Act to have regard to this and to give enough suitable development permissions to meet the identified demand. Self and custom-build properties could provide market or affordable housing.
[29] Applying the definition in Annex 2 to this Framework.
[30] Equivalent to the existing gross floorspace of the existing buildings. This does not apply to vacant buildings which have been abandoned.

be available for affordable home ownership[31], unless this would exceed the level of affordable housing required in the area, or significantly prejudice the ability to meet the identified affordable housing needs of specific groups. Exemptions to this 10% requirement should also be made where the site or proposed development:

a) provides solely for Build to Rent homes;

b) provides specialist accommodation for a group of people with specific needs (such as purpose-built accommodation for the elderly or students);

c) is proposed to be developed by people who wish to build or commission their own homes; or

d) is exclusively for affordable housing, an entry-level exception site or a rural exception site.

66. Strategic policy-making authorities should establish a housing requirement figure for their whole area, which shows the extent to which their identified housing need (and any needs that cannot be met within neighbouring areas) can be met over the plan period. Within this overall requirement, strategic policies should also set out a housing requirement for designated neighbourhood areas which reflects the overall strategy for the pattern and scale of development and any relevant allocations[32]. Once the strategic policies have been adopted, these figures should not need re-testing at the neighbourhood plan examination, unless there has been a significant change in circumstances that affects the requirement.

67. Where it is not possible to provide a requirement figure for a neighbourhood area[33], the local planning authority should provide an indicative figure, if requested to do so by the neighbourhood planning body. This figure should take into account factors such as the latest evidence of local housing need, the population of the neighbourhood area and the most recently available planning strategy of the local planning authority.

Identifying land for homes

68. Strategic policy-making authorities should have a clear understanding of the land available in their area through the preparation of a strategic housing land availability assessment. From this, planning policies should identify a sufficient supply and mix of sites, taking into account their availability, suitability and likely economic viability. Planning policies should identify a supply of:

a) specific, deliverable sites for years one to five of the plan period[34]; and

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[31] As part of the overall affordable housing contribution from the site.
[32] Except where a Mayoral, combined authority or high-level joint plan is being prepared as a framework for strategic policies at the individual local authority level; in which case it may be most appropriate for the local authority plans to provide the requirement figure.
[33] Because a neighbourhood area is designated at a late stage in the strategic policy-making process, or after strategic policies have been adopted; or in instances where strategic policies for housing are out of date.
[34] With an appropriate buffer, as set out in paragraph 74. See Glossary for definitions of deliverable and developable.

b) specific, developable sites or broad locations for growth, for years 6-10 and, where possible, for years 11-15 of the plan.

69. Small and medium sized sites can make an important contribution to meeting the housing requirement of an area, and are often built-out relatively quickly. To promote the development of a good mix of sites local planning authorities should:

a) identify, through the development plan and brownfield registers, land to accommodate at least 10% of their housing requirement on sites no larger than one hectare; unless it can be shown, through the preparation of relevant plan policies, that there are strong reasons why this 10% target cannot be achieved;

b) use tools such as area-wide design assessments and Local Development Orders to help bring small and medium sized sites forward;

c) support the development of windfall sites through their policies and decisions – giving great weight to the benefits of using suitable sites within existing settlements for homes; and

d) work with developers to encourage the sub-division of large sites where this could help to speed up the delivery of homes.

70. Neighbourhood planning groups should also give particular consideration to the opportunities for allocating small and medium-sized sites (of a size consistent with paragraph 69a) suitable for housing in their area.

71. Where an allowance is to be made for windfall sites as part of anticipated supply, there should be compelling evidence that they will provide a reliable source of supply. Any allowance should be realistic having regard to the strategic housing land availability assessment, historic windfall delivery rates and expected future trends. Plans should consider the case for setting out policies to resist inappropriate development of residential gardens, for example where development would cause harm to the local area.

72. Local planning authorities should support the development of entry-level exception sites, suitable for first time buyers (or those looking to rent their first home), unless the need for such homes is already being met within the authority's area. These sites should be on land which is not already allocated for housing and should:

a) comprise of entry-level homes that offer one or more types of affordable housing as defined in Annex 2 of this Framework; and

b) be adjacent to existing settlements, proportionate in size to them[35], not compromise the protection given to areas or assets of particular importance in this Framework[36], and comply with any local design policies and standards.

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[35] Entry-level exception sites should not be larger than one hectare in size or exceed 5% of the size of the existing settlement.

[36] i.e. the areas referred to in footnote 7. Entry-level exception sites should not be permitted in National Parks (or within the Broads Authority), Areas of Outstanding Natural Beauty or land designated as Green Belt.

73. The supply of large numbers of new homes can often be best achieved through planning for larger scale development, such as new settlements or significant extensions to existing villages and towns, provided they are well located and designed, and supported by the necessary infrastructure and facilities (including a genuine choice of transport modes). Working with the support of their communities, and with other authorities if appropriate, strategic policy-making authorities should identify suitable locations for such development where this can help to meet identified needs in a sustainable way. In doing so, they should:

a) consider the opportunities presented by existing or planned investment in infrastructure, the area's economic potential and the scope for net environmental gains;

b) ensure that their size and location will support a sustainable community, with sufficient access to services and employment opportunities within the development itself (without expecting an unrealistic level of self-containment), or in larger towns to which there is good access;

c) set clear expectations for the quality of the places to be created and how this can be maintained (such as by following Garden City principles); and ensure that appropriate tools such as masterplans and design guides or codes are used to secure a variety of well-designed and beautiful homes to meet the needs of different groups in the community;

d) make a realistic assessment of likely rates of delivery, given the lead-in times for large scale sites, and identify opportunities for supporting rapid implementation (such as through joint ventures or locally-led development corporations)[37]; and

e) consider whether it is appropriate to establish Green Belt around or adjoining new developments of significant size.

Maintaining supply and delivery

74. Strategic policies should include a trajectory illustrating the expected rate of housing delivery over the plan period, and all plans should consider whether it is appropriate to set out the anticipated rate of development for specific sites. Local planning authorities should identify and update annually a supply of specific deliverable sites sufficient to provide a minimum of five years' worth of housing against their housing requirement set out in adopted strategic policies[38], or against their local housing need where the strategic policies are more than five years old[39].

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[37] The delivery of large scale developments may need to extend beyond an individual plan period, and the associated infrastructure requirements may not be capable of being identified fully at the outset. Anticipated rates of delivery and infrastructure requirements should, therefore, be kept under review and reflected as policies are updated.

[38] For the avoidance of doubt, a five year supply of deliverable sites for travellers – as defined in Annex 1 to Planning Policy for Traveller Sites – should be assessed separately, in line with the policy in that document.

[39] Unless these strategic policies have been reviewed and found not to require updating. Where local housing need is used as the basis for assessing whether a five year supply of specific deliverable sites exists, it should be calculated using the standard method set out in national planning guidance.

The supply of specific deliverable sites should in addition include a buffer (moved forward from later in the plan period) of:

a) 5% to ensure choice and competition in the market for land; or

b) 10% where the local planning authority wishes to demonstrate a five year supply of deliverable sites through an annual position statement or recently adopted plan[40], to account for any fluctuations in the market during that year; or

c) 20% where there has been significant under delivery of housing over the previous three years, to improve the prospect of achieving the planned supply[41].

75. A five year supply of deliverable housing sites, with the appropriate buffer, can be demonstrated where it has been established in a recently adopted plan, or in a subsequent annual position statement which:

a) has been produced through engagement with developers and others who have an impact on delivery, and been considered by the Secretary of State; and

b) incorporates the recommendation of the Secretary of State, where the position on specific sites could not be agreed during the engagement process.

76. To maintain the supply of housing, local planning authorities should monitor progress in building out sites which have permission. Where the Housing Delivery Test indicates that delivery has fallen below 95% of the local planning authority's housing requirement over the previous three years, the authority should prepare an action plan in line with national planning guidance, to assess the causes of under-delivery and identify actions to increase delivery in future years.

77. To help ensure that proposals for housing development are implemented in a timely manner, local planning authorities should consider imposing a planning condition providing that development must begin within a timescale shorter than the relevant default period, where this would expedite the development without threatening its deliverability or viability. For major development involving the provision of housing, local planning authorities should also assess why any earlier grant of planning permission for a similar development on the same site did not start.

Rural housing

78. In rural areas, planning policies and decisions should be responsive to local circumstances and support housing developments that reflect local needs. Local planning authorities should support opportunities to bring forward rural exception sites that will provide affordable housing to meet identified local needs, and consider whether allowing some market housing on these sites would help to facilitate this.

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[40] For the purposes of paragraphs 74b and 75 a plan adopted between 1 May and 31 October will be considered 'recently adopted' until 31 October of the following year; and a plan adopted between 1 November and 30 April will be considered recently adopted until 31 October in the same year.
[41] This will be measured against the Housing Delivery Test, where this indicates that delivery was below 85% of the housing requirement.

79. To promote sustainable development in rural areas, housing should be located where it will enhance or maintain the vitality of rural communities. Planning policies should identify opportunities for villages to grow and thrive, especially where this will support local services. Where there are groups of smaller settlements, development in one village may support services in a village nearby.

80. Planning policies and decisions should avoid the development of isolated homes in the countryside unless one or more of the following circumstances apply:

a) there is an essential need for a rural worker, including those taking majority control of a farm business, to live permanently at or near their place of work in the countryside;

b) the development would represent the optimal viable use of a heritage asset or would be appropriate enabling development to secure the future of heritage assets;

c) the development would re-use redundant or disused buildings and enhance its immediate setting;

d) the development would involve the subdivision of an existing residential building; or

e) the design is of exceptional quality, in that it:

- is truly outstanding, reflecting the highest standards in architecture, and would help to raise standards of design more generally in rural areas; and
- would significantly enhance its immediate setting, and be sensitive to the defining characteristics of the local area.

6. Building a strong, competitive economy

81. Planning policies and decisions should help create the conditions in which businesses can invest, expand and adapt. Significant weight should be placed on the need to support economic growth and productivity, taking into account both local business needs and wider opportunities for development. The approach taken should allow each area to build on its strengths, counter any weaknesses and address the challenges of the future. This is particularly important where Britain can be a global leader in driving innovation[42], and in areas with high levels of productivity, which should be able to capitalise on their performance and potential.

82. Planning policies should:

a) set out a clear economic vision and strategy which positively and proactively encourages sustainable economic growth, having regard to Local Industrial Strategies and other local policies for economic development and regeneration;

b) set criteria, or identify strategic sites, for local and inward investment to match the strategy and to meet anticipated needs over the plan period;

c) seek to address potential barriers to investment, such as inadequate infrastructure, services or housing, or a poor environment; and

d) be flexible enough to accommodate needs not anticipated in the plan, allow for new and flexible working practices (such as live-work accommodation), and to enable a rapid response to changes in economic circumstances.

83. Planning policies and decisions should recognise and address the specific locational requirements of different sectors. This includes making provision for clusters or networks of knowledge and data-driven, creative or high technology industries; and for storage and distribution operations at a variety of scales and in suitably accessible locations.

Supporting a prosperous rural economy

84. Planning policies and decisions should enable:

a) the sustainable growth and expansion of all types of business in rural areas, both through conversion of existing buildings and well-designed new buildings;

b) the development and diversification of agricultural and other land-based rural businesses;

[42] The Government's Industrial Strategy sets out a vision to drive productivity improvements across the UK, identifies a number of Grand Challenges facing all nations, and sets out a delivery programme to make the UK a leader in four of these: artificial intelligence and big data; clean growth; future mobility; and catering for an ageing society. HM Government (2017) *Industrial Strategy: Building a Britain fit for the future*.

c) sustainable rural tourism and leisure developments which respect the character of the countryside; and

d) the retention and development of accessible local services and community facilities, such as local shops, meeting places, sports venues, open space, cultural buildings, public houses and places of worship.

85. Planning policies and decisions should recognise that sites to meet local business and community needs in rural areas may have to be found adjacent to or beyond existing settlements, and in locations that are not well served by public transport. In these circumstances it will be important to ensure that development is sensitive to its surroundings, does not have an unacceptable impact on local roads and exploits any opportunities to make a location more sustainable (for example by improving the scope for access on foot, by cycling or by public transport). The use of previously developed land, and sites that are physically well-related to existing settlements, should be encouraged where suitable opportunities exist.

7. Ensuring the vitality of town centres

86. Planning policies and decisions should support the role that town centres play at the heart of local communities, by taking a positive approach to their growth, management and adaptation. Planning policies should:

a) define a network and hierarchy of town centres and promote their long-term vitality and viability – by allowing them to grow and diversify in a way that can respond to rapid changes in the retail and leisure industries, allows a suitable mix of uses (including housing) and reflects their distinctive characters;

b) define the extent of town centres and primary shopping areas, and make clear the range of uses permitted in such locations, as part of a positive strategy for the future of each centre;

c) retain and enhance existing markets and, where appropriate, re-introduce or create new ones;

d) allocate a range of suitable sites in town centres to meet the scale and type of development likely to be needed, looking at least ten years ahead. Meeting anticipated needs for retail, leisure, office and other main town centre uses over this period should not be compromised by limited site availability, so town centre boundaries should be kept under review where necessary;

e) where suitable and viable town centre sites are not available for main town centre uses, allocate appropriate edge of centre sites that are well connected to the town centre. If sufficient edge of centre sites cannot be identified, policies should explain how identified needs can be met in other accessible locations that are well connected to the town centre; and

f) recognise that residential development often plays an important role in ensuring the vitality of centres and encourage residential development on appropriate sites.

87. Local planning authorities should apply a sequential test to planning applications for main town centre uses which are neither in an existing centre nor in accordance with an up-to-date plan. Main town centre uses should be located in town centres, then in edge of centre locations; and only if suitable sites are not available (or expected to become available within a reasonable period) should out of centre sites be considered.

88. When considering edge of centre and out of centre proposals, preference should be given to accessible sites which are well connected to the town centre. Applicants and local planning authorities should demonstrate flexibility on issues such as format and scale, so that opportunities to utilise suitable town centre or edge of centre sites are fully explored.

89. This sequential approach should not be applied to applications for small scale rural offices or other small scale rural development.

90. When assessing applications for retail and leisure development outside town centres, which are not in accordance with an up-to-date plan, local planning authorities should require an impact assessment if the development is over a proportionate, locally set floorspace threshold (if there is no locally set threshold, the default threshold is 2,500m^2 of gross floorspace). This should include assessment of:

a) the impact of the proposal on existing, committed and planned public and private investment in a centre or centres in the catchment area of the proposal; and

b) the impact of the proposal on town centre vitality and viability, including local consumer choice and trade in the town centre and the wider retail catchment (as applicable to the scale and nature of the scheme).

91. Where an application fails to satisfy the sequential test or is likely to have significant adverse impact on one or more of the considerations in paragraph 90, it should be refused.

8. Promoting healthy and safe communities

92. Planning policies and decisions should aim to achieve healthy, inclusive and safe places which:

a) promote social interaction, including opportunities for meetings between people who might not otherwise come into contact with each other – for example through mixed-use developments, strong neighbourhood centres, street layouts that allow for easy pedestrian and cycle connections within and between neighbourhoods, and active street frontages;

b) are safe and accessible, so that crime and disorder, and the fear of crime, do not undermine the quality of life or community cohesion – for example through the use of attractive, well-designed, clear and legible pedestrian and cycle routes, and high quality public space, which encourage the active and continual use of public areas; and

c) enable and support healthy lifestyles, especially where this would address identified local health and well-being needs – for example through the provision of safe and accessible green infrastructure, sports facilities, local shops, access to healthier food, allotments and layouts that encourage walking and cycling.

93. To provide the social, recreational and cultural facilities and services the community needs, planning policies and decisions should:

a) plan positively for the provision and use of shared spaces, community facilities (such as local shops, meeting places, sports venues, open space, cultural buildings, public houses and places of worship) and other local services to enhance the sustainability of communities and residential environments;

b) take into account and support the delivery of local strategies to improve health, social and cultural well-being for all sections of the community;

c) guard against the unnecessary loss of valued facilities and services, particularly where this would reduce the community's ability to meet its day-to-day needs;

d) ensure that established shops, facilities and services are able to develop and modernise, and are retained for the benefit of the community; and

e) ensure an integrated approach to considering the location of housing, economic uses and community facilities and services.

94. Planning policies and decisions should consider the social, economic and environmental benefits of estate regeneration. Local planning authorities should use their planning powers to help deliver estate regeneration to a high standard.

95. It is important that a sufficient choice of school places is available to meet the needs of existing and new communities. Local planning authorities should take a proactive, positive and collaborative approach to meeting this requirement, and to development that will widen choice in education. They should:

a) give great weight to the need to create, expand or alter schools through the preparation of plans and decisions on applications; and

b) work with school promoters, delivery partners and statutory bodies to identify and resolve key planning issues before applications are submitted.

96. To ensure faster delivery of other public service infrastructure such as further education colleges, hospitals and criminal justice accommodation, local planning authorities should also work proactively and positively with promoters, delivery partners and statutory bodies to plan for required facilities and resolve key planning issues before applications are submitted.

97. Planning policies and decisions should promote public safety and take into account wider security and defence requirements by:

a) anticipating and addressing possible malicious threats and natural hazards, especially in locations where large numbers of people are expected to congregate[43]. Policies for relevant areas (such as town centre and regeneration frameworks), and the layout and design of developments, should be informed by the most up-to-date information available from the police and other agencies about the nature of potential threats and their implications. This includes appropriate and proportionate steps that can be taken to reduce vulnerability, increase resilience and ensure public safety and security; and

b) recognising and supporting development required for operational defence and security purposes, and ensuring that operational sites are not affected adversely by the impact of other development proposed in the area.

Open space and recreation

98. Access to a network of high quality open spaces and opportunities for sport and physical activity is important for the health and well-being of communities, and can deliver wider benefits for nature and support efforts to address climate change. Planning policies should be based on robust and up-to-date assessments of the need for open space, sport and recreation facilities (including quantitative or qualitative deficits or surpluses) and opportunities for new provision. Information gained from the assessments should be used to determine what open space, sport and recreational provision is needed, which plans should then seek to accommodate.

99. Existing open space, sports and recreational buildings and land, including playing fields, should not be built on unless:

a) an assessment has been undertaken which has clearly shown the open space, buildings or land to be surplus to requirements; or

[43] This includes transport hubs, night-time economy venues, cinemas and theatres, sports stadia and arenas, shopping centres, health and education establishments, places of worship, hotels and restaurants, visitor attractions and commercial centres.

b) the loss resulting from the proposed development would be replaced by equivalent or better provision in terms of quantity and quality in a suitable location; or

c) the development is for alternative sports and recreational provision, the benefits of which clearly outweigh the loss of the current or former use.

100. Planning policies and decisions should protect and enhance public rights of way and access, including taking opportunities to provide better facilities for users, for example by adding links to existing rights of way networks including National Trails.

101. The designation of land as Local Green Space through local and neighbourhood plans allows communities to identify and protect green areas of particular importance to them. Designating land as Local Green Space should be consistent with the local planning of sustainable development and complement investment in sufficient homes, jobs and other essential services. Local Green Spaces should only be designated when a plan is prepared or updated, and be capable of enduring beyond the end of the plan period.

102. The Local Green Space designation should only be used where the green space is:

a) in reasonably close proximity to the community it serves;

b) demonstrably special to a local community and holds a particular local significance, for example because of its beauty, historic significance, recreational value (including as a playing field), tranquillity or richness of its wildlife; and

c) local in character and is not an extensive tract of land.

103. Policies for managing development within a Local Green Space should be consistent with those for Green Belts.

9. Promoting sustainable transport

104. Transport issues should be considered from the earliest stages of plan-making and development proposals, so that:

a) the potential impacts of development on transport networks can be addressed;

b) opportunities from existing or proposed transport infrastructure, and changing transport technology and usage, are realised – for example in relation to the scale, location or density of development that can be accommodated;

c) opportunities to promote walking, cycling and public transport use are identified and pursued;

d) the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains; and

e) patterns of movement, streets, parking and other transport considerations are integral to the design of schemes, and contribute to making high quality places.

105. The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making.

106. Planning policies should:

a) support an appropriate mix of uses across an area, and within larger scale sites, to minimise the number and length of journeys needed for employment, shopping, leisure, education and other activities;

b) be prepared with the active involvement of local highways authorities, other transport infrastructure providers and operators and neighbouring councils, so that strategies and investments for supporting sustainable transport and development patterns are aligned;

c) identify and protect, where there is robust evidence, sites and routes which could be critical in developing infrastructure to widen transport choice and realise opportunities for large scale development;

d) provide for attractive and well-designed walking and cycling networks with supporting facilities such as secure cycle parking (drawing on Local Cycling and Walking Infrastructure Plans);

e) provide for any large scale transport facilities that need to be located in the area[44], and the infrastructure and wider development required to support their operation, expansion and contribution to the wider economy. In doing so they should take into account whether such development is likely to be a nationally significant infrastructure project and any relevant national policy statements; and

f) recognise the importance of maintaining a national network of general aviation airfields, and their need to adapt and change over time – taking into account their economic value in serving business, leisure, training and emergency service needs, and the Government's General Aviation Strategy[45].

107. If setting local parking standards for residential and non-residential development, policies should take into account:

a) the accessibility of the development;

b) the type, mix and use of development;

c) the availability of and opportunities for public transport;

d) local car ownership levels; and

e) the need to ensure an adequate provision of spaces for charging plug-in and other ultra-low emission vehicles.

108. Maximum parking standards for residential and non-residential development should only be set where there is a clear and compelling justification that they are necessary for managing the local road network, or for optimising the density of development in city and town centres and other locations that are well served by public transport (in accordance with chapter 11 of this Framework). In town centres, local authorities should seek to improve the quality of parking so that it is convenient, safe and secure, alongside measures to promote accessibility for pedestrians and cyclists.

109. Planning policies and decisions should recognise the importance of providing adequate overnight lorry parking facilities, taking into account any local shortages, to reduce the risk of parking in locations that lack proper facilities or could cause a nuisance. Proposals for new or expanded distribution centres should make provision for sufficient lorry parking to cater for their anticipated use.

Considering development proposals

110. In assessing sites that may be allocated for development in plans, or specific applications for development, it should be ensured that:

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[44] Policies for large scale facilities should, where necessary, be developed through collaboration between strategic policy-making authorities and other relevant bodies. Examples of such facilities include ports, airports, interchanges for rail freight, public transport projects and roadside services. The primary function of roadside services should be to support the safety and welfare of the road user (and most such proposals are unlikely to be nationally significant infrastructure projects).

[45] Department for Transport (2015) *General Aviation Strategy*.

a) appropriate opportunities to promote sustainable transport modes can be – or have been – taken up, given the type of development and its location;

b) safe and suitable access to the site can be achieved for all users;

c) the design of streets, parking areas, other transport elements and the content of associated standards reflects current national guidance, including the National Design Guide and the National Model Design Code [46]; and

d) any significant impacts from the development on the transport network (in terms of capacity and congestion), or on highway safety, can be cost effectively mitigated to an acceptable degree.

111. Development should only be prevented or refused on highways grounds if there would be an unacceptable impact on highway safety, or the residual cumulative impacts on the road network would be severe.

112. Within this context, applications for development should:

a) give priority first to pedestrian and cycle movements, both within the scheme and with neighbouring areas; and second – so far as possible – to facilitating access to high quality public transport, with layouts that maximise the catchment area for bus or other public transport services, and appropriate facilities that encourage public transport use;

b) address the needs of people with disabilities and reduced mobility in relation to all modes of transport;

c) create places that are safe, secure and attractive – which minimise the scope for conflicts between pedestrians, cyclists and vehicles, avoid unnecessary street clutter, and respond to local character and design standards;

d) allow for the efficient delivery of goods, and access by service and emergency vehicles; and

e) be designed to enable charging of plug-in and other ultra-low emission vehicles in safe, accessible and convenient locations.

113. All developments that will generate significant amounts of movement should be required to provide a travel plan, and the application should be supported by a transport statement or transport assessment so that the likely impacts of the proposal can be assessed.

[46] Policies and decisions should not make use of or reflect the former Design Bulletin 32, which was withdrawn in 2007.

10. Supporting high quality communications

114. Advanced, high quality and reliable communications infrastructure is essential for economic growth and social well-being. Planning policies and decisions should support the expansion of electronic communications networks, including next generation mobile technology (such as 5G) and full fibre broadband connections. Policies should set out how high quality digital infrastructure, providing access to services from a range of providers, is expected to be delivered and upgraded over time; and should prioritise full fibre connections to existing and new developments (as these connections will, in almost all cases, provide the optimum solution).

115. The number of radio and electronic communications masts, and the sites for such installations, should be kept to a minimum consistent with the needs of consumers, the efficient operation of the network and providing reasonable capacity for future expansion. Use of existing masts, buildings and other structures for new electronic communications capability (including wireless) should be encouraged. Where new sites are required (such as for new 5G networks, or for connected transport and smart city applications), equipment should be sympathetically designed and camouflaged where appropriate.

116. Local planning authorities should not impose a ban on new electronic communications development in certain areas, impose blanket Article 4 directions over a wide area or a wide range of electronic communications development, or insist on minimum distances between new electronic communications development and existing development. They should ensure that:

a) they have evidence to demonstrate that electronic communications infrastructure is not expected to cause significant and irremediable interference with other electrical equipment, air traffic services or instrumentation operated in the national interest; and

b) they have considered the possibility of the construction of new buildings or other structures interfering with broadcast and electronic communications services.

117. Applications for electronic communications development (including applications for prior approval under the General Permitted Development Order) should be supported by the necessary evidence to justify the proposed development. This should include:

a) the outcome of consultations with organisations with an interest in the proposed development, in particular with the relevant body where a mast is to be installed near a school or college, or within a statutory safeguarding zone surrounding an aerodrome, technical site or military explosives storage area; and

b) for an addition to an existing mast or base station, a statement that self-certifies that the cumulative exposure, when operational, will not exceed International Commission guidelines on non-ionising radiation protection; or

c) for a new mast or base station, evidence that the applicant has explored the possibility of erecting antennas on an existing building, mast or other structure

and a statement that self-certifies that, when operational, International Commission guidelines will be met.

118. Local planning authorities must determine applications on planning grounds only. They should not seek to prevent competition between different operators, question the need for an electronic communications system, or set health safeguards different from the International Commission guidelines for public exposure.

11. Making effective use of land

119. Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land[47].

120. Planning policies and decisions should:

a) encourage multiple benefits from both urban and rural land, including through mixed use schemes and taking opportunities to achieve net environmental gains – such as developments that would enable new habitat creation or improve public access to the countryside;

b) recognise that some undeveloped land can perform many functions, such as for wildlife, recreation, flood risk mitigation, cooling/shading, carbon storage or food production;

c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land;

d) promote and support the development of under-utilised land and buildings, especially if this would help to meet identified needs for housing where land supply is constrained and available sites could be used more effectively (for example converting space above shops, and building on or above service yards, car parks, lock-ups and railway infrastructure)[48]; and

e) support opportunities to use the airspace above existing residential and commercial premises for new homes. In particular, they should allow upward extensions where the development would be consistent with the prevailing height and form of neighbouring properties and the overall street scene, is well-designed (including complying with any local design policies and standards), and can maintain safe access and egress for occupiers.

121. Local planning authorities, and other plan-making bodies, should take a proactive role in identifying and helping to bring forward land that may be suitable for meeting development needs, including suitable sites on brownfield registers or held in public ownership, using the full range of powers available to them. This should include identifying opportunities to facilitate land assembly, supported where necessary by compulsory purchase powers, where this can help to bring more land forward for meeting development needs and/or secure better development outcomes.

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[47] Except where this would conflict with other policies in this Framework, including causing harm to designated sites of importance for biodiversity.

[48] As part of this approach, plans and decisions should support efforts to identify and bring back into residential use empty homes and other buildings, supported by the use of compulsory purchase powers where appropriate.

122. Planning policies and decisions need to reflect changes in the demand for land. They should be informed by regular reviews of both the land allocated for development in plans, and of land availability. Where the local planning authority considers there to be no reasonable prospect of an application coming forward for the use allocated in a plan:

a) it should, as part of plan updates, reallocate the land for a more deliverable use that can help to address identified needs (or, if appropriate, deallocate a site which is undeveloped); and

b) in the interim, prior to updating the plan, applications for alternative uses on the land should be supported, where the proposed use would contribute to meeting an unmet need for development in the area.

123. Local planning authorities should also take a positive approach to applications for alternative uses of land which is currently developed but not allocated for a specific purpose in plans, where this would help to meet identified development needs. In particular, they should support proposals to:

a) use retail and employment land for homes in areas of high housing demand, provided this would not undermine key economic sectors or sites or the vitality and viability of town centres, and would be compatible with other policies in this Framework; and

b) make more effective use of sites that provide community services such as schools and hospitals, provided this maintains or improves the quality of service provision and access to open space.

Achieving appropriate densities

124. Planning policies and decisions should support development that makes efficient use of land, taking into account:

a) the identified need for different types of housing and other forms of development, and the availability of land suitable for accommodating it;

b) local market conditions and viability;

c) the availability and capacity of infrastructure and services – both existing and proposed – as well as their potential for further improvement and the scope to promote sustainable travel modes that limit future car use;

d) the desirability of maintaining an area's prevailing character and setting (including residential gardens), or of promoting regeneration and change; and

e) the importance of securing well-designed, attractive and healthy places.

125. Area-based character assessments, design guides and codes and masterplans can be used to help ensure that land is used efficiently while also creating beautiful and sustainable places. Where there is an existing or anticipated shortage of land for meeting identified housing needs, it is especially important that planning policies

and decisions avoid homes being built at low densities, and ensure that developments make optimal use of the potential of each site. In these circumstances:

a) plans should contain policies to optimise the use of land in their area and meet as much of the identified need for housing as possible. This will be tested robustly at examination, and should include the use of minimum density standards for city and town centres and other locations that are well served by public transport. These standards should seek a significant uplift in the average density of residential development within these areas, unless it can be shown that there are strong reasons why this would be inappropriate;

b) the use of minimum density standards should also be considered for other parts of the plan area. It may be appropriate to set out a range of densities that reflect the accessibility and potential of different areas, rather than one broad density range; and

c) local planning authorities should refuse applications which they consider fail to make efficient use of land, taking into account the policies in this Framework. In this context, when considering applications for housing, authorities should take a flexible approach in applying policies or guidance relating to daylight and sunlight, where they would otherwise inhibit making efficient use of a site (as long as the resulting scheme would provide acceptable living standards).

12. Achieving well-designed places

126. The creation of high quality, beautiful and sustainable buildings and places is fundamental to what the planning and development process should achieve. Good design is a key aspect of sustainable development, creates better places in which to live and work and helps make development acceptable to communities. Being clear about design expectations, and how these will be tested, is essential for achieving this. So too is effective engagement between applicants, communities, local planning authorities and other interests throughout the process.

127. Plans should, at the most appropriate level, set out a clear design vision and expectations, so that applicants have as much certainty as possible about what is likely to be acceptable. Design policies should be developed with local communities so they reflect local aspirations, and are grounded in an understanding and evaluation of each area's defining characteristics. Neighbourhood planning groups can play an important role in identifying the special qualities of each area and explaining how this should be reflected in development, both through their own plans and by engaging in the production of design policy, guidance and codes by local planning authorities and developers.

128. To provide maximum clarity about design expectations at an early stage, all local planning authorities should prepare design guides or codes consistent with the principles set out in the National Design Guide and National Model Design Code, and which reflect local character and design preferences. Design guides and codes provide a local framework for creating beautiful and distinctive places with a consistent and high quality standard of design. Their geographic coverage, level of detail and degree of prescription should be tailored to the circumstances and scale of change in each place, and should allow a suitable degree of variety.

129. Design guides and codes can be prepared at an area-wide, neighbourhood or site-specific scale, and to carry weight in decision-making should be produced either as part of a plan or as supplementary planning documents. Landowners and developers may contribute to these exercises, but may also choose to prepare design codes in support of a planning application for sites they wish to develop. Whoever prepares them, all guides and codes should be based on effective community engagement and reflect local aspirations for the development of their area, taking into account the guidance contained in the National Design Guide and the National Model Design Code. These national documents should be used to guide decisions on applications in the absence of locally produced design guides or design codes.

130. Planning policies and decisions should ensure that developments:

a) will function well and add to the overall quality of the area, not just for the short term but over the lifetime of the development;

b) are visually attractive as a result of good architecture, layout and appropriate and effective landscaping;

c) are sympathetic to local character and history, including the surrounding built environment and landscape setting, while not preventing or discouraging appropriate innovation or change (such as increased densities);

d) establish or maintain a strong sense of place, using the arrangement of streets, spaces, building types and materials to create attractive, welcoming and distinctive places to live, work and visit;

e) optimise the potential of the site to accommodate and sustain an appropriate amount and mix of development (including green and other public space) and support local facilities and transport networks; and

f) create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users[49]; and where crime and disorder, and the fear of crime, do not undermine the quality of life or community cohesion and resilience.

131. Trees make an important contribution to the character and quality of urban environments, and can also help mitigate and adapt to climate change. Planning policies and decisions should ensure that new streets are tree-lined[50], that opportunities are taken to incorporate trees elsewhere in developments (such as parks and community orchards), that appropriate measures are in place to secure the long-term maintenance of newly-planted trees, and that existing trees are retained wherever possible. Applicants and local planning authorities should work with highways officers and tree officers to ensure that the right trees are planted in the right places, and solutions are found that are compatible with highways standards and the needs of different users.

132. Design quality should be considered throughout the evolution and assessment of individual proposals. Early discussion between applicants, the local planning authority and local community about the design and style of emerging schemes is important for clarifying expectations and reconciling local and commercial interests. Applicants should work closely with those affected by their proposals to evolve designs that take account of the views of the community. Applications that can demonstrate early, proactive and effective engagement with the community should be looked on more favourably than those that cannot.

133. Local planning authorities should ensure that they have access to, and make appropriate use of, tools and processes for assessing and improving the design of development. These include workshops to engage the local community, design advice and review arrangements, and assessment frameworks such as Building for a Healthy Life[51]. These are of most benefit if used as early as possible in the evolution of schemes, and are particularly important for significant projects such as large scale housing and mixed use developments. In assessing applications, local

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[49] Planning policies for housing should make use of the Government's optional technical standards for accessible and adaptable housing, where this would address an identified need for such properties. Policies may also make use of the nationally described space standard, where the need for an internal space standard can be justified.

[50] Unless, in specific cases, there are clear, justifiable and compelling reasons why this would be inappropriate.

[51] Birkbeck D and Kruczkowski S et al (2020) *Building for a Healthy Life*

planning authorities should have regard to the outcome from these processes, including any recommendations made by design review panels.

134. Development that is not well designed should be refused, especially where it fails to reflect local design policies and government guidance on design[52], taking into account any local design guidance and supplementary planning documents such as design guides and codes. Conversely, significant weight should be given to:

a) development which reflects local design policies and government guidance on design, taking into account any local design guidance and supplementary planning documents such as design guides and codes; and/or
b) outstanding or innovative designs which promote high levels of sustainability, or help raise the standard of design more generally in an area, so long as they fit in with the overall form and layout of their surroundings.

135. Local planning authorities should seek to ensure that the quality of approved development is not materially diminished between permission and completion, as a result of changes being made to the permitted scheme (for example through changes to approved details such as the materials used).

136. The quality and character of places can suffer when advertisements are poorly sited and designed. A separate consent process within the planning system controls the display of advertisements, which should be operated in a way which is simple, efficient and effective. Advertisements should be subject to control only in the interests of amenity and public safety, taking account of cumulative impacts.

[52] Contained in the National Design Guide and National Model Design Code.

13. Protecting Green Belt land

137. The Government attaches great importance to Green Belts. The fundamental aim of Green Belt policy is to prevent urban sprawl by keeping land permanently open; the essential characteristics of Green Belts are their openness and their permanence.

138. Green Belt serves five purposes:

a) to check the unrestricted sprawl of large built-up areas;

b) to prevent neighbouring towns merging into one another;

c) to assist in safeguarding the countryside from encroachment;

d) to preserve the setting and special character of historic towns; and

e) to assist in urban regeneration, by encouraging the recycling of derelict and other urban land.

139. The general extent of Green Belts across the country is already established. New Green Belts should only be established in exceptional circumstances, for example when planning for larger scale development such as new settlements or major urban extensions. Any proposals for new Green Belts should be set out in strategic policies, which should:

a) demonstrate why normal planning and development management policies would not be adequate;

b) set out whether any major changes in circumstances have made the adoption of this exceptional measure necessary;

c) show what the consequences of the proposal would be for sustainable development;

d) demonstrate the necessity for the Green Belt and its consistency with strategic policies for adjoining areas; and

e) show how the Green Belt would meet the other objectives of the Framework.

140. Once established, Green Belt boundaries should only be altered where exceptional circumstances are fully evidenced and justified, through the preparation or updating of plans. Strategic policies should establish the need for any changes to Green Belt boundaries, having regard to their intended permanence in the long term, so they can endure beyond the plan period. Where a need for changes to Green Belt boundaries has been established through strategic policies, detailed amendments to those boundaries may be made through non-strategic policies, including neighbourhood plans.

141. Before concluding that exceptional circumstances exist to justify changes to Green Belt boundaries, the strategic policy-making authority should be able to demonstrate that it has examined fully all other reasonable options for meeting its identified need for development. This will be assessed through the examination of its strategic policies, which will take into account the preceding paragraph, and whether the strategy:

a) makes as much use as possible of suitable brownfield sites and underutilised land;

b) optimises the density of development in line with the policies in chapter 11 of this Framework, including whether policies promote a significant uplift in minimum density standards in town and city centres and other locations well served by public transport; and

c) has been informed by discussions with neighbouring authorities about whether they could accommodate some of the identified need for development, as demonstrated through the statement of common ground.

142. When drawing up or reviewing Green Belt boundaries, the need to promote sustainable patterns of development should be taken into account. Strategic policy-making authorities should consider the consequences for sustainable development of channelling development towards urban areas inside the Green Belt boundary, towards towns and villages inset within the Green Belt or towards locations beyond the outer Green Belt boundary. Where it has been concluded that it is necessary to release Green Belt land for development, plans should give first consideration to land which has been previously-developed and/or is well-served by public transport. They should also set out ways in which the impact of removing land from the Green Belt can be offset through compensatory improvements to the environmental quality and accessibility of remaining Green Belt land.

143. When defining Green Belt boundaries, plans should:

a) ensure consistency with the development plan's strategy for meeting identified requirements for sustainable development;

b) not include land which it is unnecessary to keep permanently open;

c) where necessary, identify areas of safeguarded land between the urban area and the Green Belt, in order to meet longer-term development needs stretching well beyond the plan period;

d) make clear that the safeguarded land is not allocated for development at the present time. Planning permission for the permanent development of safeguarded land should only be granted following an update to a plan which proposes the development;

e) be able to demonstrate that Green Belt boundaries will not need to be altered at the end of the plan period; and

f) define boundaries clearly, using physical features that are readily recognisable and likely to be permanent.

144. If it is necessary to restrict development in a village primarily because of the important contribution which the open character of the village makes to the openness of the Green Belt, the village should be included in the Green Belt. If, however, the character of the village needs to be protected for other reasons, other means should be used, such as conservation area or normal development management policies, and the village should be excluded from the Green Belt.

145. Once Green Belts have been defined, local planning authorities should plan positively to enhance their beneficial use, such as looking for opportunities to provide access; to provide opportunities for outdoor sport and recreation; to retain and enhance landscapes, visual amenity and biodiversity; or to improve damaged and derelict land.

146. The National Forest and Community Forests offer valuable opportunities for improving the environment around towns and cities, by upgrading the landscape and providing for recreation and wildlife. The National Forest Strategy and an approved Community Forest Plan may be a material consideration in preparing development plans and in deciding planning applications. Any development proposals within the National Forest and Community Forests in the Green Belt should be subject to the normal policies for controlling development in Green Belts.

Proposals affecting the Green Belt

147. Inappropriate development is, by definition, harmful to the Green Belt and should not be approved except in very special circumstances.

148. When considering any planning application, local planning authorities should ensure that substantial weight is given to any harm to the Green Belt. ‘Very special circumstances’ will not exist unless the potential harm to the Green Belt by reason of inappropriateness, and any other harm resulting from the proposal, is clearly outweighed by other considerations.

149. A local planning authority should regard the construction of new buildings as inappropriate in the Green Belt. Exceptions to this are:

a) buildings for agriculture and forestry;

b) the provision of appropriate facilities (in connection with the existing use of land or a change of use) for outdoor sport, outdoor recreation, cemeteries and burial grounds and allotments; as long as the facilities preserve the openness of the Green Belt and do not conflict with the purposes of including land within it;

c) the extension or alteration of a building provided that it does not result in disproportionate additions over and above the size of the original building;

d) the replacement of a building, provided the new building is in the same use and not materially larger than the one it replaces;

e) limited infilling in villages;

f) limited affordable housing for local community needs under policies set out in the development plan (including policies for rural exception sites); and

g) limited infilling or the partial or complete redevelopment of previously developed land, whether redundant or in continuing use (excluding temporary buildings), which would:

– not have a greater impact on the openness of the Green Belt than the existing development; or

– not cause substantial harm to the openness of the Green Belt, where the development would re-use previously developed land and contribute to meeting an identified affordable housing need within the area of the local planning authority.

150. Certain other forms of development are also not inappropriate in the Green Belt provided they preserve its openness and do not conflict with the purposes of including land within it. These are:

a) mineral extraction;

b) engineering operations;

c) local transport infrastructure which can demonstrate a requirement for a Green Belt location;

d) the re-use of buildings provided that the buildings are of permanent and substantial construction;

e) material changes in the use of land (such as changes of use for outdoor sport or recreation, or for cemeteries and burial grounds); and

f) development, including buildings, brought forward under a Community Right to Build Order or Neighbourhood Development Order.

151. When located in the Green Belt, elements of many renewable energy projects will comprise inappropriate development. In such cases developers will need to demonstrate very special circumstances if projects are to proceed. Such very special circumstances may include the wider environmental benefits associated with increased production of energy from renewable sources.

14. Meeting the challenge of climate change, flooding and coastal change

152. The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Planning for climate change

153. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures[53]. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

154. New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

155. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

[53] In line with the objectives and provisions of the Climate Change Act 2008.

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

156. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

157. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

158. When determining planning applications for renewable and low carbon development, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

b) approve the application if its impacts are (or can be made) acceptable[54]. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

Planning and flood risk

159. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

160. Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

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[54] Except for applications for the repowering of existing wind turbines, a proposed wind energy development involving one or more turbines should not be considered acceptable unless it is in an area identified as suitable for wind energy development in the development plan; and, following consultation, it can be demonstrated that the planning impacts identified by the affected local community have been fully addressed and the proposal has their backing.

161. All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

a) applying the sequential test and then, if necessary, the exception test as set out below;

b) safeguarding land from development that is required, or likely to be required, for current or future flood management;

c) using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management); and

d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

162. The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

163. If it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3.

164. The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. To pass the exception test it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

165. Both elements of the exception test should be satisfied for development to be allocated or permitted.

166. Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan-

making stage, or if more recent information about existing or potential flood risk should be taken into account.

167. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[55]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

168. Applications for some minor development and changes of use[56] should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55.

169. Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a) take account of advice from the lead local flood authority;

b) have appropriate proposed minimum operational standards;

c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d) where possible, provide multifunctional benefits.

Coastal change

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[55] A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

[56] This includes householder development, small non-residential extensions (with a footprint of less than 250m^2) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate.

170. In coastal areas, planning policies and decisions should take account of the UK Marine Policy Statement and marine plans. Integrated Coastal Zone Management should be pursued across local authority and land/sea boundaries, to ensure effective alignment of the terrestrial and marine planning regimes.

171. Plans should reduce risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating the impacts of physical changes to the coast. They should identify as a Coastal Change Management Area any area likely to be affected by physical changes to the coast, and:

a) be clear as to what development will be appropriate in such areas and in what circumstances; and

b) make provision for development and infrastructure that needs to be relocated away from Coastal Change Management Areas.

172. Development in a Coastal Change Management Area will be appropriate only where it is demonstrated that:

a) it will be safe over its planned lifetime and not have an unacceptable impact on coastal change;

b) the character of the coast including designations is not compromised;

c) the development provides wider sustainability benefits; and

d) the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast[57].

173. Local planning authorities should limit the planned lifetime of development in a Coastal Change Management Area through temporary permission and restoration conditions, where this is necessary to reduce a potentially unacceptable level of future risk to people and the development.

[57] As required by the Marine and Coastal Access Act 2009.

15. Conserving and enhancing the natural environment

174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);

b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;

c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate;

d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

175. Plans should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework[58]; take a strategic approach to maintaining and enhancing networks of habitats and green infrastructure; and plan for the enhancement of natural capital at a catchment or landscape scale across local authority boundaries.

176. Great weight should be given to conserving and enhancing landscape and scenic beauty in National Parks, the Broads and Areas of Outstanding Natural Beauty which have the highest status of protection in relation to these issues. The conservation and enhancement of wildlife and cultural heritage are also important considerations in these areas, and should be given great weight in National Parks

[58] Where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality.

and the Broads[59]. The scale and extent of development within all these designated areas should be limited, while development within their setting should be sensitively located and designed to avoid or minimise adverse impacts on the designated areas.

177. When considering applications for development within National Parks, the Broads and Areas of Outstanding Natural Beauty, permission should be refused for major development[60] other than in exceptional circumstances, and where it can be demonstrated that the development is in the public interest. Consideration of such applications should include an assessment of:

a) the need for the development, including in terms of any national considerations, and the impact of permitting it, or refusing it, upon the local economy;

b) the cost of, and scope for, developing outside the designated area, or meeting the need for it in some other way; and

c) any detrimental effect on the environment, the landscape and recreational opportunities, and the extent to which that could be moderated.

178. Within areas defined as Heritage Coast (and that do not already fall within one of the designated areas mentioned in paragraph 176), planning policies and decisions should be consistent with the special character of the area and the importance of its conservation. Major development within a Heritage Coast is unlikely to be appropriate, unless it is compatible with its special character.

Habitats and biodiversity

179. To protect and enhance biodiversity and geodiversity, plans should:

a) Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity[61]; wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation[62]; and

b) promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity.

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[59] *English National Parks and the Broads: UK Government Vision and Circular 2010* provides further guidance and information about their statutory purposes, management and other matters.
[60] For the purposes of paragraphs 176 and 177, whether a proposal is 'major development' is a matter for the decision maker, taking into account its nature, scale and setting, and whether it could have a significant adverse impact on the purposes for which the area has been designated or defined.
[61] Circular 06/2005 provides further guidance in respect of statutory obligations for biodiversity and geological conservation and their impact within the planning system.
[62] Where areas that are part of the Nature Recovery Network are identified in plans, it may be appropriate to specify the types of development that may be suitable within them.

180. When determining planning applications, local planning authorities should apply the following principles:

a) if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;

b) development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest;

c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons[63] and a suitable compensation strategy exists; and

d) development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate.

181. The following should be given the same protection as habitats sites:

a) potential Special Protection Areas and possible Special Areas of Conservation;

b) listed or proposed Ramsar sites[64]; and

c) sites identified, or required, as compensatory measures for adverse effects on habitats sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites.

182. The presumption in favour of sustainable development does not apply where the plan or project is likely to have a significant effect on a habitats site (either alone or in combination with other plans or projects), unless an appropriate assessment has concluded that the plan or project will not adversely affect the integrity of the habitats site.

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[63] For example, infrastructure projects (including nationally significant infrastructure projects, orders under the Transport and Works Act and hybrid bills), where the public benefit would clearly outweigh the loss or deterioration of habitat.

[64] Potential Special Protection Areas, possible Special Areas of Conservation and proposed Ramsar sites are sites on which Government has initiated public consultation on the scientific case for designation as a Special Protection Area, candidate Special Area of Conservation or Ramsar site.

Ground conditions and pollution

183. Planning policies and decisions should ensure that:

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

184. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[65];

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.

186. Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when

[65] See Explanatory Note to the *Noise Policy Statement for England* (Department for Environment, Food & Rural Affairs, 2010).

determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.

187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

188. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

16. Conserving and enhancing the historic environment

189. Heritage assets range from sites and buildings of local historic value to those of the highest significance, such as World Heritage Sites which are internationally recognised to be of Outstanding Universal Value[66]. These assets are an irreplaceable resource, and should be conserved in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of existing and future generations[67].

190. Plans should set out a positive strategy for the conservation and enjoyment of the historic environment, including heritage assets most at risk through neglect, decay or other threats. This strategy should take into account:

a) the desirability of sustaining and enhancing the significance of heritage assets, and putting them to viable uses consistent with their conservation;

b) the wider social, cultural, economic and environmental benefits that conservation of the historic environment can bring;

c) the desirability of new development making a positive contribution to local character and distinctiveness; and

d) opportunities to draw on the contribution made by the historic environment to the character of a place.

191. When considering the designation of conservation areas, local planning authorities should ensure that an area justifies such status because of its special architectural or historic interest, and that the concept of conservation is not devalued through the designation of areas that lack special interest.

192. Local planning authorities should maintain or have access to a historic environment record. This should contain up-to-date evidence about the historic environment in their area and be used to:

a) assess the significance of heritage assets and the contribution they make to their environment; and

b) predict the likelihood that currently unidentified heritage assets, particularly sites of historic and archaeological interest, will be discovered in the future.

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[66] Some World Heritage Sites are inscribed by UNESCO to be of natural significance rather than cultural significance; and in some cases they are inscribed for both their natural and cultural significance.
[67] The policies set out in this chapter relate, as applicable, to the heritage-related consent regimes for which local planning authorities are responsible under the Planning (Listed Buildings and Conservation Areas) Act 1990, as well as to plan-making and decision-making.

193. Local planning authorities should make information about the historic environment, gathered as part of policy-making or development management, publicly accessible.

Proposals affecting heritage assets

194. In determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum the relevant historic environment record should have been consulted and the heritage assets assessed using appropriate expertise where necessary. Where a site on which development is proposed includes, or has the potential to include, heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where necessary, a field evaluation.

195. Local planning authorities should identify and assess the particular significance of any heritage asset that may be affected by a proposal (including by development affecting the setting of a heritage asset) taking account of the available evidence and any necessary expertise. They should take this into account when considering the impact of a proposal on a heritage asset, to avoid or minimise any conflict between the heritage asset's conservation and any aspect of the proposal.

196. Where there is evidence of deliberate neglect of, or damage to, a heritage asset, the deteriorated state of the heritage asset should not be taken into account in any decision.

197. In determining applications, local planning authorities should take account of:

a) the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;

b) the positive contribution that conservation of heritage assets can make to sustainable communities including their economic vitality; and

c) the desirability of new development making a positive contribution to local character and distinctiveness.

198. In considering any applications to remove or alter a historic statue, plaque, memorial or monument (whether listed or not), local planning authorities should have regard to the importance of their retention in situ and, where appropriate, of explaining their historic and social context rather than removal.

Considering potential impacts

199. When considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation (and the more important the asset, the greater the weight should be). This is irrespective of whether any potential harm amounts to substantial harm, total loss or less than substantial harm to its significance.

200. Any harm to, or loss of, the significance of a designated heritage asset (from its alteration or destruction, or from development within its setting), should require clear and convincing justification. Substantial harm to or loss of:

a) grade II listed buildings, or grade II registered parks or gardens, should be exceptional;

b) assets of the highest significance, notably scheduled monuments, protected wreck sites, registered battlefields, grade I and II* listed buildings, grade I and II* registered parks and gardens, and World Heritage Sites, should be wholly exceptional[68].

201. Where a proposed development will lead to substantial harm to (or total loss of significance of) a designated heritage asset, local planning authorities should refuse consent, unless it can be demonstrated that the substantial harm or total loss is necessary to achieve substantial public benefits that outweigh that harm or loss, or all of the following apply:

a) the nature of the heritage asset prevents all reasonable uses of the site; and

b) no viable use of the heritage asset itself can be found in the medium term through appropriate marketing that will enable its conservation; and

c) conservation by grant-funding or some form of not for profit, charitable or public ownership is demonstrably not possible; and

d) the harm or loss is outweighed by the benefit of bringing the site back into use.

202. Where a development proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal including, where appropriate, securing its optimum viable use.

203. The effect of an application on the significance of a non-designated heritage asset should be taken into account in determining the application. In weighing

[68] Non-designated heritage assets of archaeological interest, which are demonstrably of equivalent significance to scheduled monuments, should be considered subject to the policies for designated heritage assets.

applications that directly or indirectly affect non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.

204. Local planning authorities should not permit the loss of the whole or part of a heritage asset without taking all reasonable steps to ensure the new development will proceed after the loss has occurred.

205. Local planning authorities should require developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible[69]. However, the ability to record evidence of our past should not be a factor in deciding whether such loss should be permitted.

206. Local planning authorities should look for opportunities for new development within Conservation Areas and World Heritage Sites, and within the setting of heritage assets, to enhance or better reveal their significance. Proposals that preserve those elements of the setting that make a positive contribution to the asset (or which better reveal its significance) should be treated favourably.

207. Not all elements of a Conservation Area or World Heritage Site will necessarily contribute to its significance. Loss of a building (or other element) which makes a positive contribution to the significance of the Conservation Area or World Heritage Site should be treated either as substantial harm under paragraph 201 or less than substantial harm under paragraph 202, as appropriate, taking into account the relative significance of the element affected and its contribution to the significance of the Conservation Area or World Heritage Site as a whole.

208. Local planning authorities should assess whether the benefits of a proposal for enabling development, which would otherwise conflict with planning policies but which would secure the future conservation of a heritage asset, outweigh the disbenefits of departing from those policies.

[69] Copies of evidence should be deposited with the relevant historic environment record, and any archives with a local museum or other public depository.

17. Facilitating the sustainable use of minerals

209. It is essential that there is a sufficient supply of minerals to provide the infrastructure, buildings, energy and goods that the country needs. Since minerals are a finite natural resource, and can only be worked where they are found, best use needs to be made of them to secure their long-term conservation.

210. Planning policies should:

a) provide for the extraction of mineral resources of local and national importance, but not identify new sites or extensions to existing sites for peat extraction;

b) so far as practicable, take account of the contribution that substitute or secondary and recycled materials and minerals waste would make to the supply of materials, before considering extraction of primary materials, whilst aiming to source minerals supplies indigenously;

c) safeguard mineral resources by defining Mineral Safeguarding Areas and Mineral Consultation Areas[70]; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked);

d) set out policies to encourage the prior extraction of minerals, where practical and environmentally feasible, if it is necessary for non-mineral development to take place;

e) safeguard existing, planned and potential sites for: the bulk transport, handling and processing of minerals; the manufacture of concrete and concrete products; and the handling, processing and distribution of substitute, recycled and secondary aggregate material;

f) set out criteria or requirements to ensure that permitted and proposed operations do not have unacceptable adverse impacts on the natural and historic environment or human health, taking into account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality;

g) when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction; and

h) ensure that worked land is reclaimed at the earliest opportunity, taking account of aviation safety, and that high quality restoration and aftercare of mineral sites takes place.

[70] Primarily in two tier areas as stated in Annex 2: Glossary

211. When determining planning applications, great weight should be given to the benefits of mineral extraction, including to the economy[71]. In considering proposals for mineral extraction, minerals planning authorities should:

a) as far as is practical, provide for the maintenance of landbanks of non-energy minerals from outside National Parks, the Broads, Areas of Outstanding Natural Beauty and World Heritage Sites, scheduled monuments and conservation areas;

b) ensure that there are no unacceptable adverse impacts on the natural and historic environment, human health or aviation safety, and take into account the cumulative effect of multiple impacts from individual sites and/or from a number of sites in a locality;

c) ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source[72], and establish appropriate noise limits for extraction in proximity to noise sensitive properties;

d) not grant planning permission for peat extraction from new or extended sites;

e) provide for restoration and aftercare at the earliest opportunity, to be carried out to high environmental standards, through the application of appropriate conditions. Bonds or other financial guarantees to underpin planning conditions should only be sought in exceptional circumstances;

f) consider how to meet any demand for the extraction of building stone needed for the repair of heritage assets, taking account of the need to protect designated sites; and

g) recognise the small-scale nature and impact of building and roofing stone quarries, and the need for a flexible approach to the duration of planning permissions reflecting the intermittent or low rate of working at many sites.

212. Local planning authorities should not normally permit other development proposals in Mineral Safeguarding Areas if it might constrain potential future use for mineral working.

Maintaining supply

213. Minerals planning authorities should plan for a steady and adequate supply of aggregates by:

a) preparing an annual Local Aggregate Assessment, either individually or jointly, to forecast future demand, based on a rolling average of 10 years' sales data and other relevant local information, and an assessment of all supply options (including marine dredged, secondary and recycled sources);

[71] Except in relation to the extraction of coal, where the policy at paragraph 217 of this Framework applies.
[72] National planning guidance on minerals sets out how these policies should be implemented.

b) participating in the operation of an Aggregate Working Party and taking the advice of that party into account when preparing their Local Aggregate Assessment;

c) making provision for the land-won and other elements of their Local Aggregate Assessment in their mineral plans, taking account of the advice of the Aggregate Working Parties and the National Aggregate Co-ordinating Group as appropriate. Such provision should take the form of specific sites, preferred areas and/or areas of search and locational criteria as appropriate;

d) taking account of any published National and Sub National Guidelines on future provision which should be used as a guideline when planning for the future demand for and supply of aggregates;

e) using landbanks of aggregate minerals reserves principally as an indicator of the security of aggregate minerals supply, and to indicate the additional provision that needs to be made for new aggregate extraction and alternative supplies in mineral plans;

f) maintaining landbanks of at least 7 years for sand and gravel and at least 10 years for crushed rock, whilst ensuring that the capacity of operations to supply a wide range of materials is not compromised[73];

g) ensuring that large landbanks bound up in very few sites do not stifle competition; and

h) calculating and maintaining separate landbanks for any aggregate materials of a specific type or quality which have a distinct and separate market.

214. Minerals planning authorities should plan for a steady and adequate supply of industrial minerals by:

a) co-operating with neighbouring and more distant authorities to ensure an adequate provision of industrial minerals to support their likely use in industrial and manufacturing processes;

b) encouraging safeguarding or stockpiling so that important minerals remain available for use;

c) maintaining a stock of permitted reserves to support the level of actual and proposed investment required for new or existing plant, and the maintenance and improvement of existing plant and equipment[74]; and

d) taking account of the need for provision of brick clay from a number of different sources to enable appropriate blends to be made.

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[73] Longer periods may be appropriate to take account of the need to supply a range of types of aggregates, locations of permitted reserves relative to markets, and productive capacity of permitted sites.
[74] These reserves should be at least 10 years for individual silica sand sites; at least 15 years for cement primary (chalk and limestone) and secondary (clay and shale) materials to maintain an existing plant, and for silica sand sites where significant new capital is required; and at least 25 years for brick clay, and for cement primary and secondary materials to support a new kiln.

Oil, gas and coal exploration and extraction

215. Minerals planning authorities should:

a) when planning for on-shore oil and gas development, clearly distinguish between, and plan positively for, the three phases of development (exploration, appraisal and production), whilst ensuring appropriate monitoring and site restoration is provided for;

b) encourage underground gas and carbon storage and associated infrastructure if local geological circumstances indicate its feasibility;

c) indicate any areas where coal extraction and the disposal of colliery spoil may be acceptable;

d) encourage the capture and use of methane from coal mines in active and abandoned coalfield areas; and

e) provide for coal producers to extract separately, and if necessary stockpile, fireclay so that it remains available for use.

216. When determining planning applications, minerals planning authorities should ensure that the integrity and safety of underground storage facilities are appropriate, taking into account the maintenance of gas pressure, prevention of leakage of gas and the avoidance of pollution.

217. Planning permission should not be granted for the extraction of coal unless:

a) the proposal is environmentally acceptable, or can be made so by planning conditions or obligations; or

b) if it is not environmentally acceptable, then it provides national, local or community benefits which clearly outweigh its likely impacts (taking all relevant matters into account, including any residual environmental impacts).

Annex 1: Implementation

218. The policies in this Framework are material considerations which should be taken into account in dealing with applications from the day of its publication. Plans may also need to be revised to reflect policy changes which this Framework has made.

219. However, existing policies should not be considered out-of-date simply because they were adopted or made prior to the publication of this Framework. Due weight should be given to them, according to their degree of consistency with this Framework (the closer the policies in the plan to the policies in the Framework, the greater the weight that may be given).

220. The policies in the original National Planning Policy Framework published in March 2012 will apply for the purpose of examining plans, where those plans were submitted on or before 24 January 2019. Where such plans are withdrawn or otherwise do not proceed to become part of the development plan, the policies contained in this Framework will apply to any subsequent plan produced for the area concerned.

221. For the purposes of the policy on larger-scale development in paragraph 22, this applies only to plans that have not reached Regulation 19 of the Town and Country Planning (Local Planning) (England) Regulations 2012 (pre-submission) stage at the point this version is published (for Spatial Development Strategies this would refer to consultation under section 335(2) of the Greater London Authority Act 1999).

222. The Housing Delivery Test will apply the day following publication of the results, at which point they supersede previously published results. Until new Housing Delivery Test results are published, the previously published result should be used. For the purpose of footnote 8 in this Framework, delivery of housing which was substantially below the housing requirement means where the Housing Delivery Test results:

    a) for years 2016/17 to 2018/19 (Housing Delivery Test: 2019 Measurement, published 13 February 2020), indicated that delivery was below 45% of housing required over the previous three years;

    b) for years 2017/18 to 2019/20 (Housing Delivery Test: 2020 Measurement, published 19 January 2021), and in subsequent years indicate that delivery was below 75% of housing required over the previous three years.

223. The Government will continue to explore with individual areas the potential for planning freedoms and flexibilities, for example where this would facilitate an increase in the amount of housing that can be delivered.

Annex 2: Glossary

Affordable housing: housing for sale or rent, for those whose needs are not met by the market (including housing that provides a subsidised route to home ownership and/or is for essential local workers); and which complies with one or more of the following definitions:

a) **Affordable housing for rent:** meets all of the following conditions: (a) the rent is set in accordance with the Government's rent policy for Social Rent or Affordable Rent, or is at least 20% below local market rents (including service charges where applicable); (b) the landlord is a registered provider, except where it is included as part of a Build to Rent scheme (in which case the landlord need not be a registered provider); and (c) it includes provisions to remain at an affordable price for future eligible households, or for the subsidy to be recycled for alternative affordable housing provision. For Build to Rent schemes affordable housing for rent is expected to be the normal form of affordable housing provision (and, in this context, is known as Affordable Private Rent).

b) **Starter homes:** is as specified in Sections 2 and 3 of the Housing and Planning Act 2016 and any secondary legislation made under these sections. The definition of a starter home should reflect the meaning set out in statute and any such secondary legislation at the time of plan-preparation or decision-making. Where secondary legislation has the effect of limiting a household's eligibility to purchase a starter home to those with a particular maximum level of household income, those restrictions should be used.

c) **Discounted market sales housing:** is that sold at a discount of at least 20% below local market value. Eligibility is determined with regard to local incomes and local house prices. Provisions should be in place to ensure housing remains at a discount for future eligible households.

d) **Other affordable routes to home ownership:** is housing provided for sale that provides a route to ownership for those who could not achieve home ownership through the market. It includes shared ownership, relevant equity loans, other low cost homes for sale (at a price equivalent to at least 20% below local market value) and rent to buy (which includes a period of intermediate rent). Where public grant funding is provided, there should be provisions for the homes to remain at an affordable price for future eligible households, or for any receipts to be recycled for alternative affordable housing provision, or refunded to Government or the relevant authority specified in the funding agreement.

Air quality management areas: Areas designated by local authorities because they are not likely to achieve national air quality objectives by the relevant deadlines.

Ancient or veteran tree: A tree which, because of its age, size and condition, is of exceptional biodiversity, cultural or heritage value. All ancient trees are veteran trees. Not all veteran trees are old enough to be ancient, but are old relative to other trees of the same species. Very few trees of any species reach the ancient life-stage.

Ancient woodland: An area that has been wooded continuously since at least 1600 AD. It includes ancient semi-natural woodland and plantations on ancient woodland sites (PAWS).

Annual position statement: A document setting out the 5 year housing land supply position on 1st April each year, prepared by the local planning authority in consultation with developers and others who have an impact on delivery.

Archaeological interest: There will be archaeological interest in a heritage asset if it holds, or potentially holds, evidence of past human activity worthy of expert investigation at some point.

Article 4 direction: A direction made under Article 4 of the Town and Country Planning (General Permitted Development) (England) Order 2015 which withdraws permitted development rights granted by that Order.

Best and most versatile agricultural land: Land in grades 1, 2 and 3a of the Agricultural Land Classification.

Brownfield land: See Previously developed land.

Brownfield land registers: Registers of previously developed land that local planning authorities consider to be appropriate for residential development, having regard to criteria in the Town and Country Planning (Brownfield Land Registers) Regulations 2017. Local planning authorities will be able to trigger a grant of permission in principle for residential development on suitable sites in their registers where they follow the required procedures.

Build to Rent: Purpose built housing that is typically 100% rented out. It can form part of a wider multi-tenure development comprising either flats or houses, but should be on the same site and/or contiguous with the main development. Schemes will usually offer longer tenancy agreements of three years or more, and will typically be professionally managed stock in single ownership and management control.

Climate change adaptation: Adjustments made to natural or human systems in response to the actual or anticipated impacts of climate change, to mitigate harm or exploit beneficial opportunities.

Climate change mitigation: Action to reduce the impact of human activity on the climate system, primarily through reducing greenhouse gas emissions.

Coastal change management area: An area identified in plans as likely to be affected by physical change to the shoreline through erosion, coastal landslip, permanent inundation or coastal accretion.

Community forest: An area identified through the England Community Forest Programme to revitalise countryside and green space in and around major conurbations.

Community Right to Build Order: An Order made by the local planning authority (under the Town and Country Planning Act 1990) that grants planning permission for a site-specific development proposal or classes of development.

Competent person (to prepare site investigation information): A person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation.

Conservation (for heritage policy): The process of maintaining and managing change to a heritage asset in a way that sustains and, where appropriate, enhances its significance.

Decentralised energy: Local renewable and local low carbon energy sources.

Deliverable: To be considered deliverable, sites for housing should be available now, offer a suitable location for development now, and be achievable with a realistic prospect that housing will be delivered on the site within five years. In particular:

a) sites which do not involve major development and have planning permission, and all sites with detailed planning permission, should be considered deliverable until permission expires, unless there is clear evidence that homes will not be delivered within five years (for example because they are no longer viable, there is no longer a demand for the type of units or sites have long term phasing plans).
b) where a site has outline planning permission for major development, has been allocated in a development plan, has a grant of permission in principle, or is identified on a brownfield register, it should only be considered deliverable where there is clear evidence that housing completions will begin on site within five years.

Design code: A set of illustrated design requirements that provide specific, detailed parameters for the physical development of a site or area. The graphic and written components of the code should build upon a design vision, such as a masterplan or other design and development framework for a site or area.

Design guide: A document providing guidance on how development can be carried out in accordance with good design practice, often produced by a local authority.

Designated heritage asset: A World Heritage Site, Scheduled Monument, Listed Building, Protected Wreck Site, Registered Park and Garden, Registered Battlefield or Conservation Area designated under the relevant legislation.

Designated rural areas: National Parks, Areas of Outstanding Natural Beauty and areas designated as ‘rural’ under Section 157 of the Housing Act 1985.

Developable: To be considered developable, sites should be in a suitable location for housing development with a reasonable prospect that they will be available and could be viably developed at the point envisaged.

Development plan: Is defined in section 38 of the Planning and Compulsory Purchase Act 2004, and includes adopted local plans, neighbourhood plans that have been made and published spatial development strategies, together with any regional strategy policies that remain in force. Neighbourhood plans that have been approved at referendum are also part of the development plan, unless the local planning authority decides that the neighbourhood plan should not be made.

Edge of centre: For retail purposes, a location that is well connected to, and up to 300 metres from, the primary shopping area. For all other main town centre uses, a location within 300 metres of a town centre boundary. For office development, this includes locations outside the town centre but within 500 metres of a public transport interchange. In determining whether a site falls within the definition of edge of centre, account should be taken of local circumstances.

Entry-level exception site: A site that provides entry-level homes suitable for first time buyers (or equivalent, for those looking to rent), in line with paragraph 72 of this Framework.

Environmental impact assessment: A procedure to be followed for certain types of project to ensure that decisions are made in full knowledge of any likely significant effects on the environment.

Essential local workers: Public sector employees who provide frontline services in areas including health, education and community safety – such as NHS staff, teachers, police, firefighters and military personnel, social care and childcare workers.

General aviation airfields: Licenced or unlicenced aerodromes with hard or grass runways, often with extensive areas of open land related to aviation activity.

Geodiversity: The range of rocks, minerals, fossils, soils and landforms.

Green infrastructure: A network of multi-functional green and blue spaces and other natural features, urban and rural, which is capable of delivering a wide range of environmental, economic, health and wellbeing benefits for nature, climate, local and wider communities and prosperity.

Habitats site: Any site which would be included within the definition at regulation 8 of the Conservation of Habitats and Species Regulations 2017 for the purpose of those regulations, including candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation, Special Protection Areas and any relevant Marine Sites.

Heritage asset: A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. It includes designated heritage assets and assets identified by the local planning authority (including local listing).

Heritage coast: Areas of undeveloped coastline which are managed to conserve their natural beauty and, where appropriate, to improve accessibility for visitors.

Historic environment: All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora.

Historic environment record: Information services that seek to provide access to comprehensive and dynamic resources relating to the historic environment of a defined geographic area for public benefit and use.

Housing Delivery Test: Measures net homes delivered in a local authority area against the homes required, using national statistics and local authority data. The Secretary of State will publish the Housing Delivery Test results for each local authority in England every November.

International, national and locally designated sites of importance for biodiversity: All international sites (Special Areas of Conservation, Special Protection Areas, and Ramsar sites), national sites (Sites of Special Scientific Interest) and locally designated sites including Local Wildlife Sites.

Irreplaceable habitat: Habitats which would be technically very difficult (or take a very significant time) to restore, recreate or replace once destroyed, taking into account their age, uniqueness, species diversity or rarity. They include ancient woodland, ancient and veteran trees, blanket bog, limestone pavement, sand dunes, salt marsh and lowland fen.

Local Development Order: An Order made by a local planning authority (under the Town and Country Planning Act 1990) that grants planning permission for a specific development proposal or classes of development.

Local Enterprise Partnership: A body, designated by the Secretary of State for Housing, Communities and Local Government, established for the purpose of creating or improving the conditions for economic growth in an area.

Local housing need: The number of homes identified as being needed through the application of the standard method set out in national planning guidance (or, in the context of preparing strategic policies only, this may be calculated using a justified alternative approach as provided for in paragraph 61 of this Framework).

Local Nature Partnership: A body, designated by the Secretary of State for Environment, Food and Rural Affairs, established for the purpose of protecting and improving the natural environment in an area and the benefits derived from it.

Local planning authority: The public authority whose duty it is to carry out specific planning functions for a particular area. All references to local planning authority include the district council, London borough council, county council, Broads Authority, National Park Authority, the Mayor of London and a development corporation, to the extent appropriate to their responsibilities.

Local plan: A plan for the future development of a local area, drawn up by the local planning authority in consultation with the community. In law this is described as the development plan documents adopted under the Planning and Compulsory Purchase Act 2004. A local plan can consist of either strategic or non-strategic policies, or a combination of the two.

Main town centre uses: Retail development (including warehouse clubs and factory outlet centres); leisure, entertainment and more intensive sport and recreation uses (including cinemas, restaurants, drive-through restaurants, bars and pubs, nightclubs, casinos, health and fitness centres, indoor bowling centres and bingo halls); offices; and arts, culture and tourism development (including theatres, museums, galleries and concert halls, hotels and conference facilities).

Major development[75]**:** For housing, development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more. For non-residential development

[75] Other than for the specific purposes of paragraphs 176 and 177 in this Framework.

it means additional floorspace of 1,000m^2 or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management Procedure) (England) Order 2015.

Major hazard sites, installations and pipelines: Sites and infrastructure, including licensed explosive sites and nuclear installations, around which Health and Safety Executive (and Office for Nuclear Regulation) consultation distances to mitigate the consequences to public safety of major accidents may apply.

Minerals resources of local and national importance: Minerals which are necessary to meet society's needs, including aggregates, brickclay (especially Etruria Marl and fireclay), silica sand (including high grade silica sands), coal derived fly ash in single use deposits, cement raw materials, gypsum, salt, fluorspar, shallow and deep-mined coal, oil and gas (including conventional and unconventional hydrocarbons), tungsten, kaolin, ball clay, potash, polyhalite and local minerals of importance to heritage assets and local distinctiveness.

Mineral Consultation Area: a geographical area based on a Mineral Safeguarding Area, where the district or borough council should consult the Mineral Planning Authority for any proposals for non-minerals development.

Mineral Safeguarding Area: An area designated by minerals planning authorities which covers known deposits of minerals which are desired to be kept safeguarded from unnecessary sterilisation by non-mineral development.

National trails: Long distance routes for walking, cycling and horse riding.

Natural Flood Management: managing flood and coastal erosion risk by protecting, restoring and emulating the natural 'regulating' function of catchments, rivers, floodplains and coasts.

Nature Recovery Network: An expanding, increasingly connected, network of wildlife-rich habitats supporting species recovery, alongside wider benefits such as carbon capture, water quality improvements, natural flood risk management and recreation. It includes the existing network of protected sites and other wildlife rich habitats as well as and landscape or catchment scale recovery areas where there is coordinated action for species and habitats.

Neighbourhood Development Order: An Order made by a local planning authority (under the Town and Country Planning Act 1990) through which parish councils and neighbourhood forums can grant planning permission for a specific development proposal or classes of development.

Neighbourhood plan: A plan prepared by a parish council or neighbourhood forum for a designated neighbourhood area. In law this is described as a neighbourhood development plan in the Planning and Compulsory Purchase Act 2004.

Non-strategic policies: Policies contained in a neighbourhood plan, or those policies in a local plan that are not strategic policies.

Older people: People over or approaching retirement age, including the active, newly-retired through to the very frail elderly; and whose housing needs can encompass accessible, adaptable general needs housing through to the full range of retirement and specialised housing for those with support or care needs.

Open space: All open space of public value, including not just land, but also areas of water (such as rivers, canals, lakes and reservoirs) which offer important opportunities for sport and recreation and can act as a visual amenity.

Original building: A building as it existed on 1 July 1948 or, if constructed after 1 July 1948, as it was built originally.

Out of centre: A location which is not in or on the edge of a centre but not necessarily outside the urban area.

Out of town: A location out of centre that is outside the existing urban area.

Outstanding universal value: Cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations. An individual Statement of Outstanding Universal Value is agreed and adopted by the UNESCO World Heritage Committee for each World Heritage Site.

People with disabilities: People have a disability if they have a physical or mental impairment, and that impairment has a substantial and long-term adverse effect on their ability to carry out normal day-to-day activities. These persons include, but are not limited to, people with ambulatory difficulties, blindness, learning difficulties, autism and mental health needs.

Permission in principle: A form of planning consent which establishes that a site is suitable for a specified amount of housing-led development in principle. Following a grant of permission in principle, the site must receive a grant of technical details consent before development can proceed.

Planning condition: A condition imposed on a grant of planning permission (in accordance with the Town and Country Planning Act 1990) or a condition included in a Local Development Order or Neighbourhood Development Order.

Planning obligation: A legal agreement entered into under section 106 of the Town and Country Planning Act 1990 to mitigate the impacts of a development proposal.

Playing field: The whole of a site which encompasses at least one playing pitch as defined in the Town and Country Planning (Development Management Procedure) (England) Order 2015.

Previously developed land: Land which is or was occupied by a permanent structure, including the curtilage of the developed land (although it should not be assumed that the whole of the curtilage should be developed) and any associated fixed surface infrastructure. This excludes: land that is or was last occupied by agricultural or forestry buildings; land that has been developed for minerals extraction or waste disposal by landfill, where provision for restoration has been made through development management procedures; land in built-up areas such as residential gardens, parks, recreation grounds

and allotments; and land that was previously developed but where the remains of the permanent structure or fixed surface structure have blended into the landscape.

Primary shopping area: Defined area where retail development is concentrated.

Priority habitats and species: Species and Habitats of Principal Importance included in the England Biodiversity List published by the Secretary of State under section 41 of the Natural Environment and Rural Communities Act 2006.

Ramsar sites: Wetlands of international importance, designated under the 1971 Ramsar Convention.

Renewable and low carbon energy: Includes energy for heating and cooling as well as generating electricity. Renewable energy covers those energy flows that occur naturally and repeatedly in the environment – from the wind, the fall of water, the movement of the oceans, from the sun and also from biomass and deep geothermal heat. Low carbon technologies are those that can help reduce emissions (compared to conventional use of fossil fuels).

Rural exception sites: Small sites used for affordable housing in perpetuity where sites would not normally be used for housing. Rural exception sites seek to address the needs of the local community by accommodating households who are either current residents or have an existing family or employment connection. A proportion of market homes may be allowed on the site at the local planning authority's discretion, for example where essential to enable the delivery of affordable units without grant funding.

Recycled aggregates: aggregates resulting from the processing of inorganic materials previously used in construction, e.g. construction and demolition waste.

Safeguarding zone: An area defined in Circular 01/03: *Safeguarding aerodromes, technical sites and military explosives storage areas*, to which specific safeguarding provisions apply.

Secondary aggregates: aggregates from industrial wastes such as glass (cullet), incinerator bottom ash, coal derived fly ash, railway ballast, fine ceramic waste (pitcher), and scrap tyres; and industrial and minerals by-products, notably waste from china clay, coal and slate extraction and spent foundry sand. These can also include hydraulically bound materials.

Self-build and custom-build housing: Housing built by an individual, a group of individuals, or persons working with or for them, to be occupied by that individual. Such housing can be either market or affordable housing. A legal definition, for the purpose of applying the Self-build and Custom Housebuilding Act 2015 (as amended), is contained in section 1(A1) and (A2) of that Act.

Setting of a heritage asset: The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.

Significance (for heritage policy): The value of a heritage asset to this and future

generations because of its heritage interest. The interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting. For World Heritage Sites, the cultural value described within each site's Statement of Outstanding Universal Value forms part of its significance.

Special Areas of Conservation: Areas defined by regulation 3 of the Conservation of Habitats and Species Regulations 2017 which have been given special protection as important conservation sites.

Special Protection Areas: Areas classified under regulation 15 of the Conservation of Habitats and Species Regulations 2017 which have been identified as being of international importance for the breeding, feeding, wintering or the migration of rare and vulnerable species of birds.

Site investigation information: Includes a risk assessment of land potentially affected by contamination, or ground stability and slope stability reports, as appropriate. All investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 Investigation of Potentially Contaminated Sites – Code of Practice).

Site of Special Scientific Interest: Sites designated by Natural England under the Wildlife and Countryside Act 1981.

Spatial development strategy: A plan containing strategic policies prepared by a Mayor or a combined authority. It includes the London Plan (prepared under provisions in the Greater London Authority Act 1999) and plans prepared by combined authorities that have been given equivalent plan-making functions by an order made under the Local Democracy, Economic Development and Construction Act 2009 (as amended).

Stepping stones: Pockets of habitat that, while not necessarily connected, facilitate the movement of species across otherwise inhospitable landscapes.

Strategic environmental assessment: A procedure (set out in the Environmental Assessment of Plans and Programmes Regulations 2004) which requires the formal environmental assessment of certain plans and programmes which are likely to have significant effects on the environment.

Strategic policies: Policies and site allocations which address strategic priorities in line with the requirements of Section 19 (1B-E) of the Planning and Compulsory Purchase Act 2004.

Strategic policy-making authorities: Those authorities responsible for producing strategic policies (local planning authorities, and elected Mayors or combined authorities, where this power has been conferred). This definition applies whether the authority is in the process of producing strategic policies or not.

Supplementary planning documents: Documents which add further detail to the policies in the development plan. They can be used to provide further guidance for development on specific sites, or on particular issues, such as design. Supplementary planning documents are capable of being a material consideration in planning decisions but are not

part of the development plan.

Sustainable transport modes: Any efficient, safe and accessible means of transport with overall low impact on the environment, including walking and cycling, ultra low and zero emission vehicles, car sharing and public transport.

Town centre: Area defined on the local authority's policies map, including the primary shopping area and areas predominantly occupied by main town centre uses within or adjacent to the primary shopping area. References to town centres or centres apply to city centres, town centres, district centres and local centres but exclude small parades of shops of purely neighbourhood significance. Unless they are identified as centres in the development plan, existing out-of-centre developments, comprising or including main town centre uses, do not constitute town centres.

Transport assessment: A comprehensive and systematic process that sets out transport issues relating to a proposed development. It identifies measures required to improve accessibility and safety for all modes of travel, particularly for alternatives to the car such as walking, cycling and public transport, and measures that will be needed deal with the anticipated transport impacts of the development.

Transport statement: A simplified version of a transport assessment where it is agreed the transport issues arising from development proposals are limited and a full transport assessment is not required.

Travel plan: A long-term management strategy for an organisation or site that seeks to deliver sustainable transport objectives and is regularly reviewed.

Wildlife corridor: Areas of habitat connecting wildlife populations.

Windfall sites: Sites not specifically identified in the development plan.

Annex 3: Flood risk vulnerability classification

ESSENTIAL INFRASTRUCTURE

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; and water treatment works that need to remain operational in times of flood.
- Wind turbines.
- Solar farms

HIGHLY VULNERABLE

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as ‘Essential Infrastructure’.)

MORE VULNERABLE

- Hospitals
- Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

LESS VULNERABLE

- Police, ambulance and fire stations which are not required to be operational during flooding.

- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the ‘more vulnerable’ class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
- Car parks.

WATER-COMPATIBLE DEVELOPMENT

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

* Landfill is as defined in Schedule 10 of the Environmental Permitting (England and Wales) Regulations 2010.

Securing a resilient future for water in the South East

A consultation on our draft Water Resources Management Plan

14 November 2022 to 20 February 2023

from Southern Water

Contents

Introduction

Welcome to our consultation on how we'll secure high-quality, reliable drinking water for the future.

Water scarcity and shortfalls driven by climate change, population growth and increasing demand from industry are a reality.

Our draft water resources management plan is about the decisions we need to take to make sure there's enough water for everyone in our region, now and in the future, and to protect and enhance our shared environment.

This is the first time we've developed a plan collaboratively with other water companies, our regulators and other large water users such as agriculture, energy generators and paper producers.

Our plan enables us to adapt to different challenges in the future. For the first 10 years we follow a "core pathway" with the actions we need to take regardless of future challenges.

Longer-term, our plan includes the different pathways we can choose to follow depending on how much more water we need to protect the environment and ensure our services are resilient. Each pathway has a different mix of options to make sure we're able to provide Water for Life into the future.

Our plan embraces new technology and outlines a mix of actions to reduce demand and increase supply. These will make our services more resilient, meaning the drought restrictions we saw over the summer will become less likely, while we also protect and improve the environment we rely on.

We're maintaining our industry-leading commitments to help customers to use less water and reduce leakage by at least half by 2050.

We're also investigating how we can work with nature to protect our water sources and increase their resilience while also protecting and improving our natural environment for future generations.

Alongside this, we need to invest significantly in new infrastructure. This includes desalination in Sussex and Kent, water recycling across our region, new strategic pipelines to move water to where we need it and making much better use of storage – both underground and using reservoirs.

Delivering this requires ambition and collaboration so we can embrace opportunities to use new technology and ways of working.

We're not starting from square one. We've already helped our customers become some of the most water efficient in the UK and our leakage performance is amongst the best in the industry. We're building on work already underway through our Water for Life – Hampshire programme.

This includes working with Portsmouth Water on Havant Thicket reservoir, the first new reservoir in the South East in decades, and our water recycling pilot – proving a concept that will be rolled out across our region.

I'm confident we will create the resilient water future our customers, rightly, expect. And that we can enhance our natural environment, leaving it in a better condition for future generations.

However, we can't achieve this without our customers and stakeholders. That's why it's so important to me that we hear from as many of you as possible. We look forward to hearing your views and working together to provide Water for Life.

Lawrence Gosden
Chief Executive Officer

Our plan at a glance

Our Water Resources Management Plan looks at least 50 years ahead at our future water needs.

By 2040, if we do nothing, we could face a 300 million litre per day shortfall in water supplies. By 2075, this shortfall could increase to over 500 million litres per day.

This is because more water will be needed as the population grows and less will be available as the climate changes.

We will need to leave more water in the environment to keep it healthy, so we may need to replace more than a quarter of the water supplies we currently use by 2050.

We are also making our water supplies more resilient to severe droughts so we are less likely to introduce emergency restrictions that will limit how much water you can use, such as Temporary Use Bans (TUBs).

This combination of factors means that we need to invest in reducing demand and developing new sources of water.

Our draft plan provides an early look at the mix of options we could use to maintain your water supplies in the future.

Our draft WRMP includes:

- Reducing leakage by at least 50% by 2050 and could reduce it by as much as 62% - by embracing new technology and replacing old water mains
- Our ambition to reduce average daily use to 100 litres per person per day by 2040. However, our demand forecast requires a reduction to 109 litres per person per day by 2040
- Developing water recycling schemes in several locations providing extra water to help supplement the flows in rivers and to refill reservoirs, particularly during dry weather
- Building more pipelines to transfer water from our neighbouring companies, following the development of new sources of water in other areas
- Using desalination plants to turn seawater into drinking water in some areas
- Collaborating with land users and environmental groups to improve the water sources we rely upon, so they are resilient for the future.

We're consulting on our draft plan until February next year and it's really important we hear from our customers and stakeholders.

You can respond to our consultation questions, email or write to us to provide your feedback.

There are lots of ways that you can have your say

1. Take part in our online survey at **southernwater.co.uk/HaveYourSay.**
2. Email **Defra** at **water.resources@defra.gov.uk**, putting Southern Water draft water resources management plan in the subject line, and copying in **wrmp@southernwater.co.uk.**
3. Print out our survey or write a response and send it to Defra at:
   Water Resources Management Plan Consultation (Southern Water)
   Water Services
   Department for Environment, Food and Rural Affairs
   Seacole Ground Floor
   2 Marsham Street
   London
   SW1 4DF.

If you have any issues accessing our consultation or have any questions relating to it please contact us at **wrmp@southernwater.co.uk**.

You can read the technical documents that accompany this consultation at **southernwater.co.uk/wrmp**.

What is a Water Resources Management Plan?

We supply drinking water to more than one million homes and businesses in the South East.

We plan ahead to make sure there will always be enough water available, when and where we need it.

To do this, we work out how much water we will need in the future and how much will be available to supply. If we need extra water, we identify ways to secure supplies. This includes schemes that can either provide more water or reduce demand.

We also look at ways we can work with nature to improve the quality and health of the sources that we take water from. This will help protect and improve the environment, so we have sustainable water supplies in the future.

Every water company in England and Wales produces a WRMP and update it every five years. We must all plan at least 25 years ahead. Our draft WRMP covers the period from 2023–75.

For the first time, a regional plan has informed our WRMP. **Water Resources South East (WRSE)** is producing the regional plan for the South East. The draft regional plan considers the future water needs of the whole region, including the environment and large water-using sectors.

Both of our plans are best value, which means they consider the needs of water users and the environment, and drives increased resilience to droughts and environmental improvements.

WRSE consulted on its least cost emerging regional plan in January 2022 and received over 1,150 responses.

Since March 2022, WRSE has been developing a draft best value regional plan which it is consulting on from November 2022. These plans have informed our draft WRMP. We'll continue to align our WRMP with the regional plan to help futureproof our region's water supplies.

[1] Future-proofing our water supplies, a consultation on our emerging regional plan for South East England WRSE; WRSE, January 2022

Our priorities

Our vision is to create a resilient water future for customers in the South East. Our four key priorities will allow us to achieve our ambitions for the the good of our customers, communities and the environment.

To meet future challenges we know that we'll need to focus on these priorities and take action at different times and at varying pace. We'll also need to adapt to the future changes that will impact on our business.

Our priorities	Our WRMP will:
Ensuring a reliable supply of high-quality water for the future 	• Make our supplies more resilient to severe drought • Reduce leakage • Provide extra water supplies to meet demands of climate change and population growth • Lower water use in homes and businesses
Protecting and improving the environment 	• Reduce water use which will help lower operational carbon emissions • Include nature-based solutions
Understanding and supporting our customers and communities 	• Support our customers and communities to use less water • Help customers understand their water use better
Enabling and empowering our people 	• Use technology and innovation to enhance our performance • Collaborate with stakeholders and partners to take a nature first approach

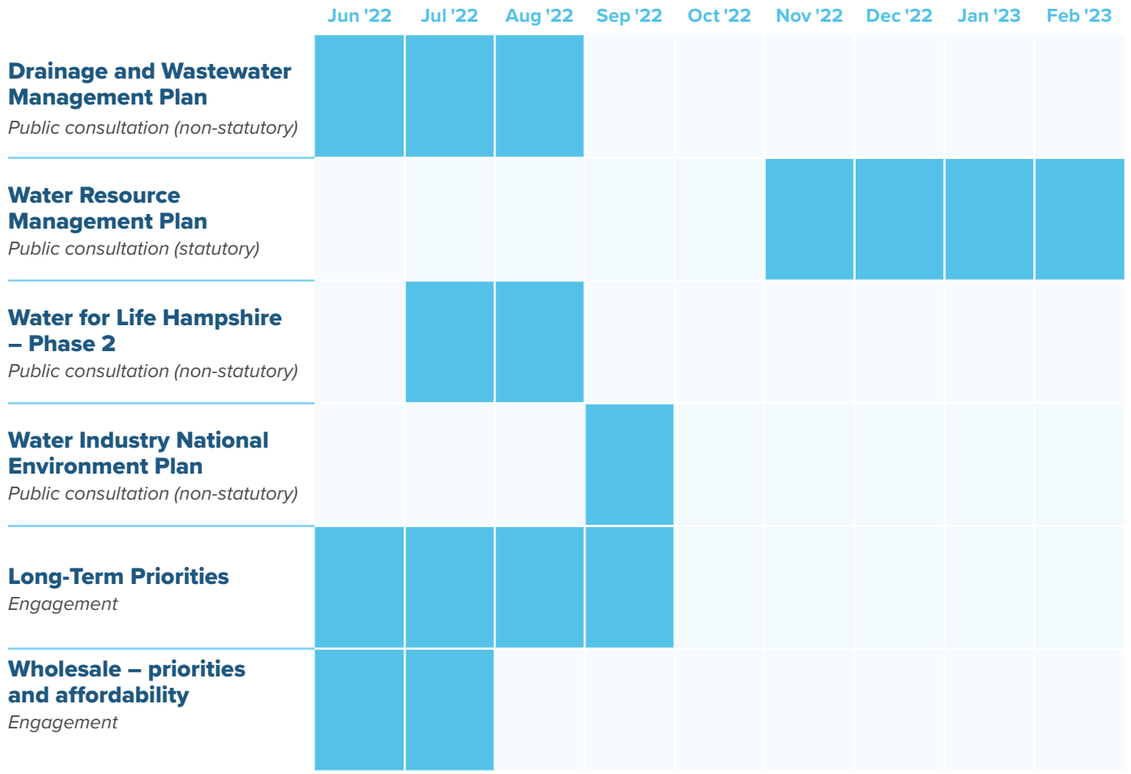
The role of technology

A central part of our long-term strategy is to use technology to help us overcome our future challenges. We are becoming more digitally enabled, using technology from source to tap to make our service smarter, faster and more resilient.

How we are developing our future plans

Our WRMP is one of several strategic plans we develop that help us plan our future investment in your services. The schemes identified through these plans will be included in our Long-Term Delivery Strategy – a 25-year strategy that will inform our five-yearly business plan.

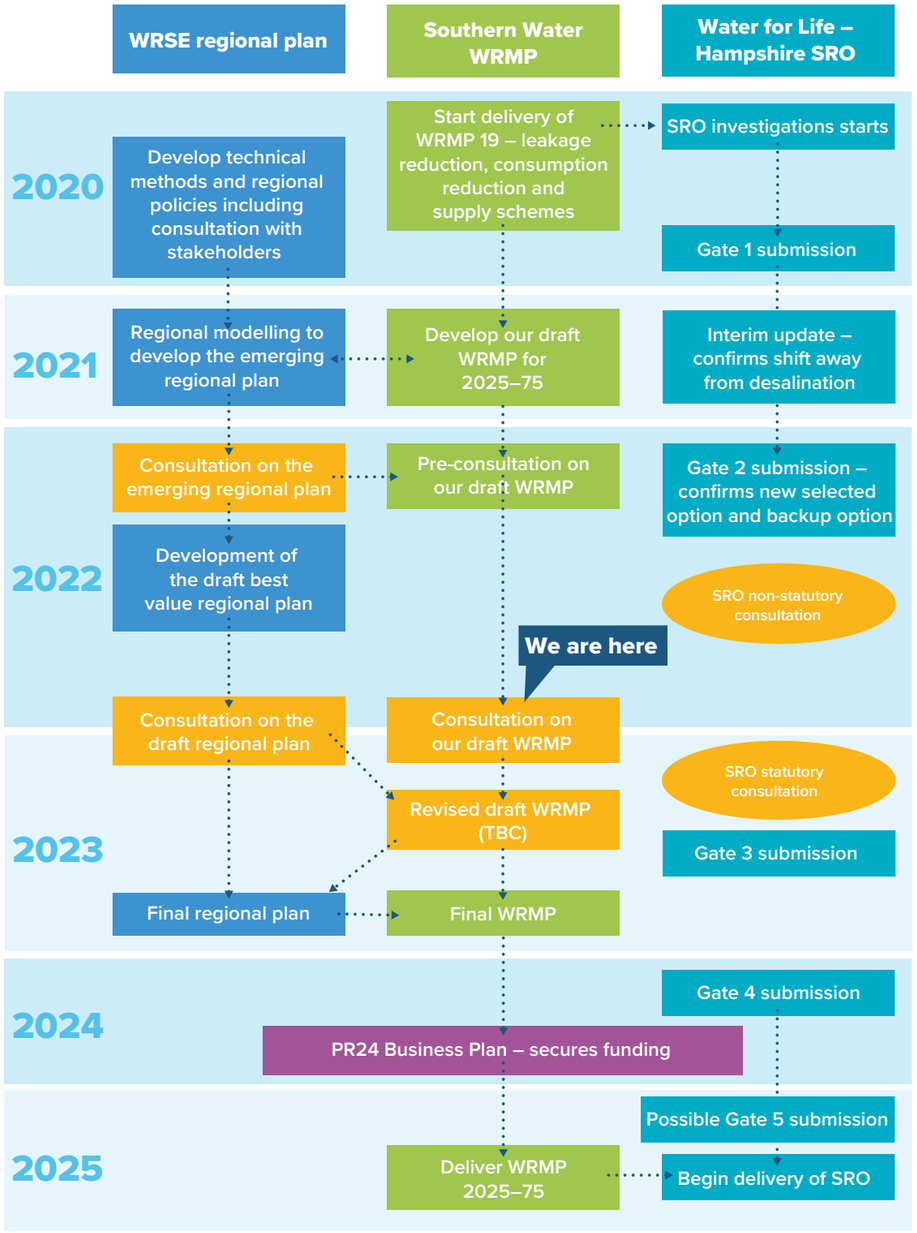
We are currently developing our Long-Term Delivery Strategy and we'll publish it next year alongside our Business Plan for 2025 –30. Ofwat will evaluate our Business Plan and determine the level of investment we can make, setting bills for 2025-2030.



Developing our WRMP

Our journey so far and what will happen next

Our draft WRMP aligns with the regional plan, developed collaboratively with WRSE. We are also investigating some strategic resource options (SROs) which we identified in our current plan (WRMP19). This includes a large SRO, as well as a number of smaller projects, in our Western Area. We describe this as our Water for Life – Hampshire programme.



Strategic Resource Options (SROs)

WRMPs are strategic plans required by law, that demonstrate how a water company will meet its water supply duties. They identify feasible schemes to help achieve the supply demand balance. In our last WRMP, we identified several large schemes that could be needed to provide resilient water supplies for the future. These schemes are described as Strategic Resource Options (SROs). Since 2019, we have been investigating the SROs further, in conjunction with other water companies and RAPID – the Regulators' Alliance for Progressing Infrastructure Development.

We are working closely with RAPID through its collaborative process. This is helping us develop our schemes from concept to delivery and will give us greater certainty from 2025. It involves us following a process where, at specified stages, or gates, we submit more detailed information for RAPID to consider. RAPID then determines whether the option should be developed further.

Our Hampshire SRO is necessary to meet our WRMP19 supply and demand balance, as confirmed in our 2021 WRMP19 Annual Review and RAPID's Gate 2. This project has been progressing in parallel to the development of this draft WRMP.

Our draft WRMP has used updated future forecasts and reflects wider regional needs. Therefore, some of the information around the schemes in this plan may differ slightly to those presented through the RAPID gated process to date. As these processes continue in parallel, information on the schemes will become more aligned.

'The innovative nature of RAPID allows three regulators to come together, collaborate and work with water companies to better understand challenges and manage risks. Ultimately, we want the sector to drive forward solutions that contribute to resilient water supplies that enhance the environment, deliver value for money, meet the needs of public health and protect customers over the long term.'

Paul Hickey, Managing Director, RAPID

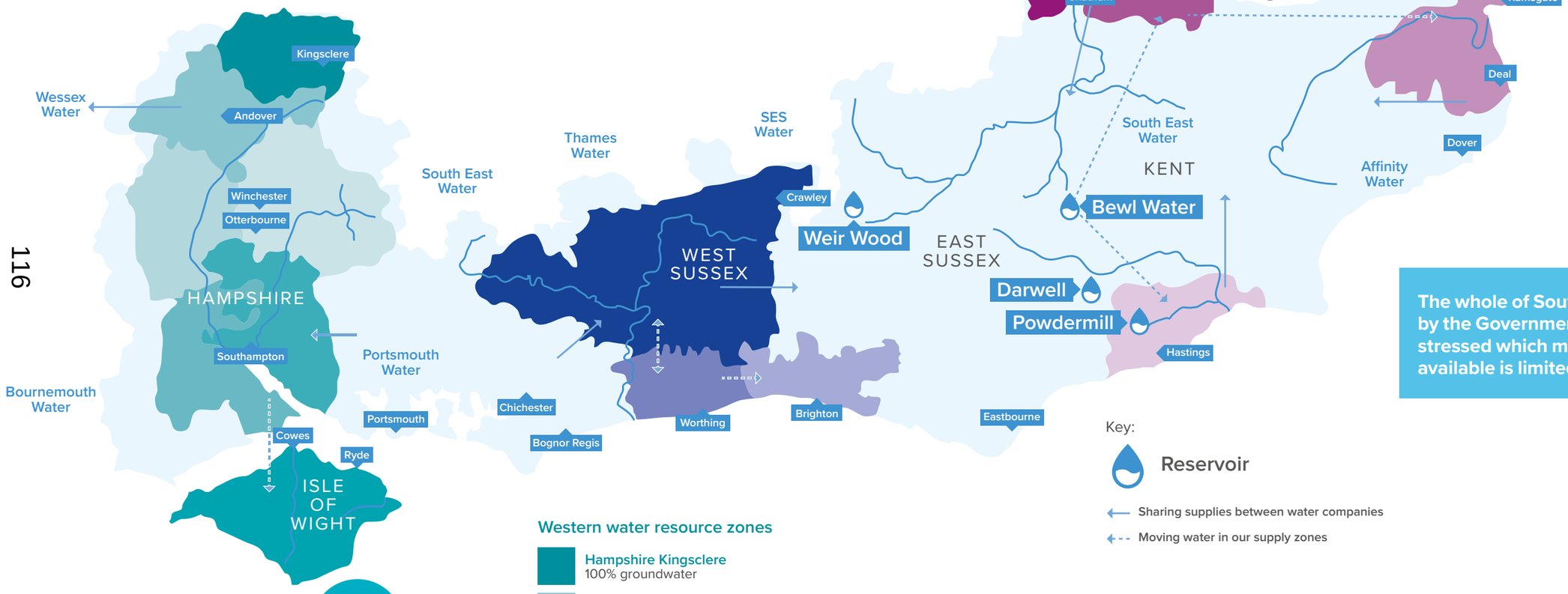
The emerging regional plan published by WRSE in January 2022 provided an early look at the options that could be needed across the region. It objectively assessed 1,400 different options, including the options we have been investigating as part of the SRO process. Once the regional plan and our WRMP are finalised, they will determine the amount of water needed and identify the best value option to secure it. This will inform any revision to our WRMP.

Where your water comes from today

We supply water to parts of Kent, Sussex, Hampshire and the Isle of Wight.

Where the water comes from, how it is supplied and how much is used varies across each county. We divide our supply area into 14 'water resource zones' which are shown on the map.

About 70% of the water we supply comes from groundwater. These supplies are stored underground in rocks and soils called aquifers and we pump them up to the surface. The rest comes from rivers and streams, some of which are supported by chalk-fed groundwater. In some areas, reservoirs store water that is typically pumped from nearby rivers when flows are high. Our natural water resources are split into catchment areas – we take water from eight catchments across the South East.



Key:

Reservoir

Sharing supplies between water companies

Moving water in our supply zones

Western Area

Much of the water supplied in the Western Area comes from underground sources. In South Hampshire, the River Test and River Itchen provide the majority of supplies while on the Isle of Wight around a quarter comes from the River Yar.

Water is transferred from South Hampshire to the Isle of Wight to supplement its water supplies. Water can also be transferred from Portsmouth Water's area to South Hampshire.

89% of homes are metered in Hampshire

95% of homes are metered on the Isle of Wight

Average water use:

Hampshire – 129 litres per person per day

Isle of Wight – 131 litres per person per day

Western water resource zones

- **Hampshire Kingsclere** 100% groundwater
- **Hampshire Andover** 100% groundwater
- **Hampshire Rural** 100% groundwater
- **Hampshire Winchester** 100% groundwater
- **Hampshire Southampton East** 52% river, 48% groundwater
- **Hampshire Southampton West** 100% river
- **Isle of Wight** 47% groundwater, 23% river, 30% transfers

Central Area

Brighton, Worthing and surrounding areas rely predominately on the groundwater sources beneath the South Downs. Sussex North is supplied from a mix of water sources including the River Arun and the Western Rother, Weir Wood reservoir near East Grinstead and a transfer from Portsmouth Water. There are pipelines that allow water to be moved between our Sussex North and Worthing water resource zones in both directions, and from Worthing to Brighton.

84% of homes are metered

Average water use:

139 litres per person per day

Central water resource zones

- **Sussex North** 35% groundwater, 51% river, 8% reservoir, 6% transfers
- **Sussex Worthing** 98% groundwater, 2% transfers
- **Sussex Brighton** 100% groundwater

The whole of South East England is classed by the Government as being seriously water stressed which means the amount of water available is limited.

Eastern Area

Our Kent supply areas take most of their water from groundwater. The rest comes from the River Medway, some of which is stored in Bewl Water reservoir before it is released back into the River Medway where it is abstracted. Hastings in East Sussex takes most of its water from Darwell reservoir which stores water from the River Rother and Powdermill reservoir which stores water from the River Brede. We can transfer water from Medway to Thanet and from Medway to Hastings.

88% of homes are metered

Average water use:

132 litres per person per day

Eastern water resource zones

- **Kent Medway East** 100% groundwater
- **Kent Medway West** 56% river and reservoir 44% groundwater
- **Kent Thanet** 79% groundwater, 21% transfers
- **Sussex Hastings** 5% groundwater, 79% reservoir, 16% transfers

What we've done since our last plan

Since 2020, we have been progressing the schemes identified in our current WRMP.

Reducing leaks and helping customers use less water

We have been helping our customers use less water. Our customers use around 134 litres per day, which is less than in most other areas. However, the COVID-19 pandemic has changed how people are using water. Household water use increased by around 10% because more people worked from home during the pandemic and many still are. Business and commercial water use has fallen. Lockdowns affected some of our work to help people use less, such as fitting meters and carrying out home water audits.

To reduce leaks and help our customers use less water, we have:

- installed 7,000 sensors that move around our pipes to monitor leaks and intelligent loggers so we can detect and repair them quicker
- improved how we manage the pressure within our pipes to reduce leakage, without impacting on customers' supplies
- developed plans to replace some of our leakiest water mains in parts of Hampshire, East Kent and the Isle of Wight which will start next year
- seen 7,000 customers register for 'Get Water Fit', an online service to help them use less water
- carried out around 8,600 in-home water audits and installed more than 15,700 water saving products since COVID-19 restrictions were relaxed
- run a series of behaviour change campaigns using digital media, TV and outdoor advertising such as on buses and at train stations
- developed our water efficiency education programme with the charity City to Sea
- worked in partnership with local councils, schools and other community groups to promote ways to use less water and provide extra help and support.

Developing new water sources and pipelines

This includes work to develop new sources of water and move water around more easily.

We have:

- helped Portsmouth Water get planning permission for a new reservoir at Havant Thicket. Once built, Portsmouth Water will be able to provide us with up to 21 million litres of water per day from their existing sources. Preparatory work to build the reservoir has started and it should be operational by 2029
- improved the connectivity of our network in north Sussex so we can move water around more easily
- installed a new pipe to connect us to SES Water so they can supply some of our customers in Crawley
- connected our pipes to South East Water's so they can provide additional water in north Sussex if needed
- worked with other users who take water from the Western Rother catchment in north Sussex to improve how we manage water supplies
- progressed our plans to recommission two groundwater sources in north Sussex
- investigated sites for an underground reservoir in West Sussex to store water from the Rivers Rother and Arun but none were suitable
- started to change one of our abstraction licences in Kent to give us more flexibility in how we use our groundwater sources
- progressed design work on some new water supply schemes such as water recycling in Littlehampton and on the River Medway and desalination on the Sussex coast
- investigated how we can improve our water transfer network in Hampshire so we can move water around more easily
- worked with Portsmouth Water to see whether they can provide us with any more water from their sources using an existing pipeline
- started to plan a new pipeline that will transfer water from South East Water to our Thanet area which should be operational by 2025.

Protecting the environment in north Sussex

We've been working with the Environment Agency and Natural England to understand how our groundwater source near Pulborough affects nearby habitats. This is so we can agree how much water we should take from it in the future. While this continues, we are using as little as possible from the source. We're working with local councils so there is enough water for new homes in the area without it impacting on habitats and wildlife.

Water for Life – Hampshire

Our last WRMP identified the need for a major new strategic resource in Hampshire, which we're delivering through our Water for Life – Hampshire programme.

Through the RAPID gated process, we undertook an options appraisal process that investigated alternative options for this new strategic resource. We considered a range of environmental and planning criteria, alongside the delivery of our legal obligations to rank the different options. These included:

- a desalination plant on the Solent
- alternative water recycling schemes
- a transfer from the West Country
- a direct pipeline from Havant Thicket reservoir to our Hampshire supply area.

We found the desalination plant was the lowest ranked of the options, so we are not progressing it any further. This was supported by our regulators. We have continued investigating options for a water recycling scheme and pipeline.

This led to the development of an option – The Hampshire Water Transfer and Water Recycling Project – that involves a new pipeline from Havant Thicket reservoir to a water supply works in south Hampshire. The pipeline could transfer up to 90 million litres per day. A new water recycling plant at Havant would produce highly treated, recycled water to supplement the water supplies in Havant Thicket reservoir. Currently, we need this to provide between 15 and 60 million litres per day. This would help keep the reservoir topped up, including during drought periods.

This option has emerged as our preferred scheme following our options appraisal as part of the RAPID gated process. We're also working on a backup option, consisting of a water recycling scheme that would transfer highly treated water into a new lake. This would act as a buffer, before the water is transferred to a water supply works and treated to drinking water standard.

Options appraised through the RAPID gated process were included in the many options put to WRSE and appraised separately for the needs of the regional plan.

We have engaged with regulators, local stakeholders and customers throughout these investigations to understand and incorporate their views. Between 5 July 2022 and 16 August 2022, we consulted on this scheme as we need to progress it urgently to address the shortfall of water in Hampshire. We received 570 responses from a wide range of organisations.

In summer 2023, we will hold our next public consultation and engage on the developing Hampshire Water Transfer and Water Recycling Project, especially the proposed pipeline route, more details on the proposed sites for the water recycling plant and any likely environmental impact from the proposals.

To find out more, visit **southernwater.co.uk/our-story/water-for-life-hampshire**.

Protect and improve the water sources we rely upon

We rely on water from the natural environment to supply our customers.

Since 2020, we have strengthened our focus on catchment management. Our team is delivering catchment and nature-based schemes across the region. They are working with local stakeholders to protect and restore the environment, so it is more resilient and able to adapt to climate change. We have:

- been working with farmers, farm clusters and local stakeholders across our region to address nitrates. This includes funding a series of farm trials and reduction measures to prevent further nitrate pollution
- continued monitoring on the River Itchen, River Test, Western Rother, River Arun and the River Medway to address pesticide risk. We have undertaken land mapping and modelling to help prevent further pesticide pollution
- been working with farmers in the River Beult catchment where water sources are at high risk from pesticides. We have funded a full-time position at Kent Wildlife Trust and helped establish a farming cluster
- continued monitoring the River Test and Itchen to understand how our abstraction affects them. We have started a project on the River Anton (Upper Test) to improve this chalk stream in partnership with local stakeholders
- progressed our work to protect and improve the Brighton Chalk Block with The Aquifer Partnership. This includes Brighton and Hove City Council, South Downs National Park Authority, the Environment Agency and others. We have been working with farmers, allotment owners, golf courses and the equine sector
- been monitoring the Western Rother and River Arun to understand the impact of our abstractions. We are also planning a natural capital mapping exercise to identify where we can improve the environment
- identified schemes to improve water quality and restore habitats with South East Rivers Trust including on the River Beult.

Managing our water supplies during droughts

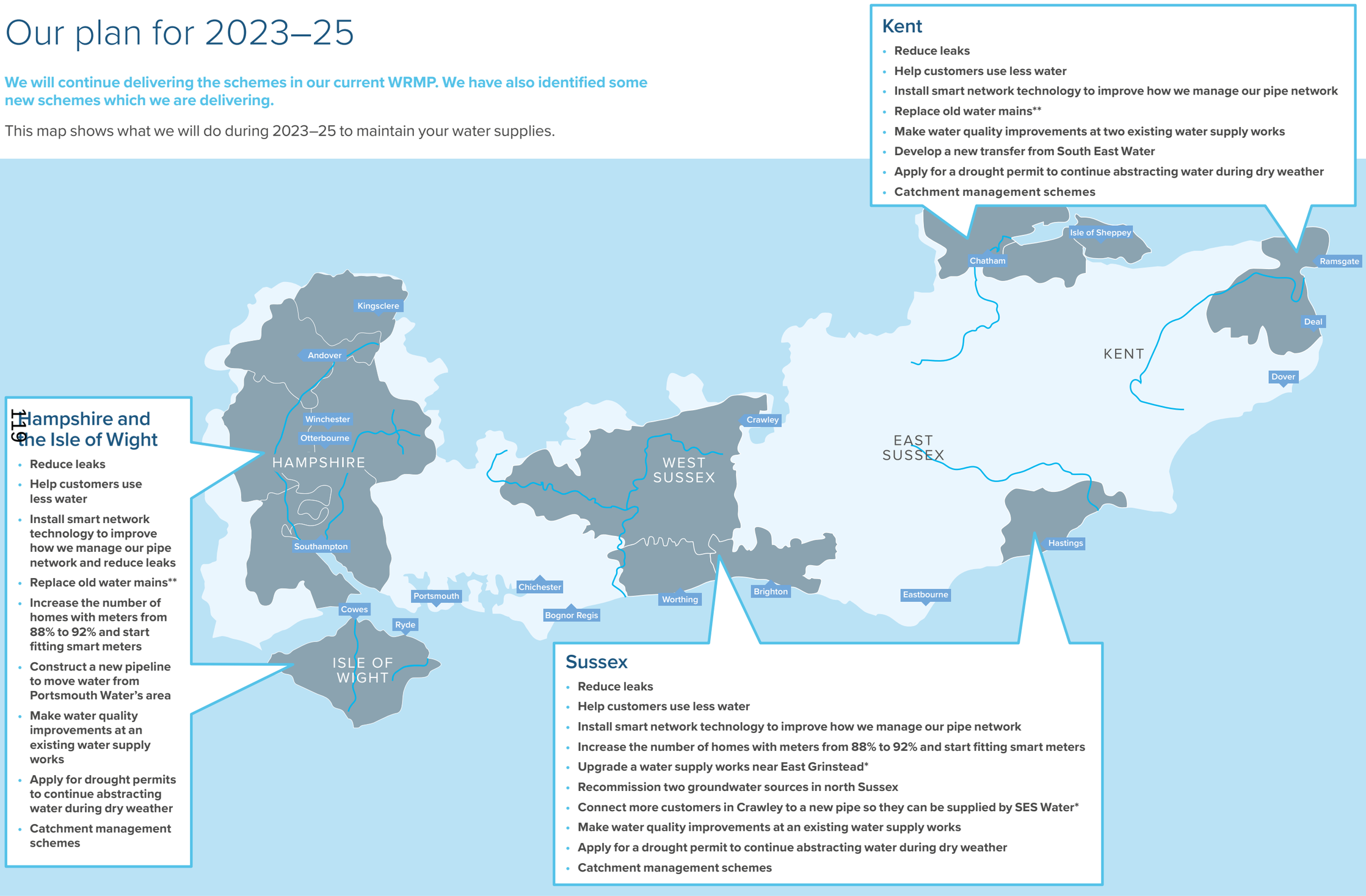
In our WRMP19, we included options to apply for drought orders and drought permits for some of our water sources. These allow us to continue abstracting water during prolonged dry weather – such as we experienced in summer 2022.

We applied to the Environment Agency for a drought permit to continue taking water from the River Test in July 2022. This meant that, for the first time since 2012, we had to impose restrictions on our customers' water use. This was to protect the river and ensure enough water was available for essential supplies. Drought orders and permits and temporary restrictions on customers' use remain an option in our plan in line with our Drought Plan.

Our plan for 2023–25

We will continue delivering the schemes in our current WRMP. We have also identified some new schemes which we are delivering.

This map shows what we will do during 2023–25 to maintain your water supplies.



Hampshire and the Isle of Wight

- Reduce leaks
- Help customers use less water
- Install smart network technology to improve how we manage our pipe network and reduce leaks
- Replace old water mains**
- Increase the number of homes with meters from 88% to 92% and start fitting smart meters
- Construct a new pipeline to move water from Portsmouth Water's area
- Make water quality improvements at an existing water supply works
- Apply for drought permits to continue abstracting water during dry weather
- Catchment management schemes

Sussex

- Reduce leaks
- Help customers use less water
- Install smart network technology to improve how we manage our pipe network
- Increase the number of homes with meters from 88% to 92% and start fitting smart meters
- Upgrade a water supply works near East Grinstead*
- Recommission two groundwater sources in north Sussex
- Connect more customers in Crawley to a new pipe so they can be supplied by SES Water*
- Make water quality improvements at an existing water supply works
- Apply for a drought permit to continue abstracting water during dry weather
- Catchment management schemes

Kent

- Reduce leaks
- Help customers use less water
- Install smart network technology to improve how we manage our pipe network
- Replace old water mains**
- Make water quality improvements at two existing water supply works
- Develop a new transfer from South East Water
- Apply for a drought permit to continue abstracting water during dry weather
- Catchment management schemes

* New scheme not included in WRMP19 ** part of our leakage reduction programme

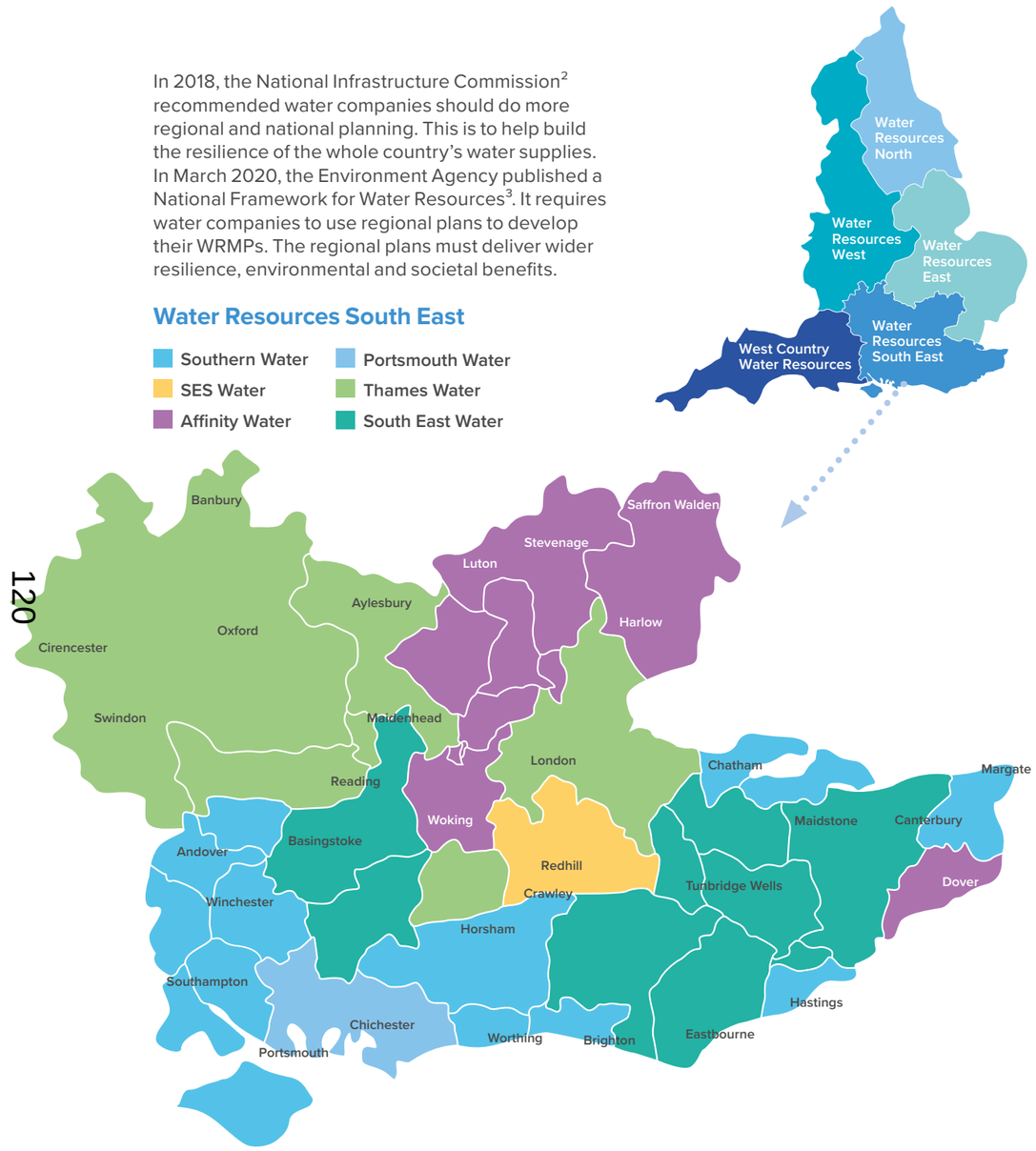
Regional plans

How we've changed our approach to water resource planning

In 2018, the National Infrastructure Commission[2] recommended water companies should do more regional and national planning. This is to help build the resilience of the whole country's water supplies. In March 2020, the Environment Agency published a National Framework for Water Resources[3]. It requires water companies to use regional plans to develop their WRMPs. The regional plans must deliver wider resilience, environmental and societal benefits.

Water Resources South East

- Southern Water
- Portsmouth Water
- SES Water
- Thames Water
- Affinity Water
- South East Water



We've been part of WRSE for nearly 30 years, working collaboratively with our neighbouring companies to plan the region's water supplies.

This has now led to regional planning being adopted across the country. There are four other regional groups, and all the English water companies are a member of at least one.

Regional plans look beyond the boundaries of the individual water companies. They identify the options that will deliver the most benefit to people across the region, its environment and the sectors that rely most on water. This could result in the identification of different options than if the six companies continued to develop their plans on their own. This could include options that one company would develop, which could provide water to others.

Together with WRSE, we have produced updated forecasts which are being used to predict how much water we'll need in the future. WRSE published an emerging regional plan in January 2022 for consultation. The plan presented the most cost-efficient solution for securing the region's water supplies, while meeting all the legal, regulatory and policy outcomes required.

WRSE has updated the plan with assessments of the extra benefits it could deliver such as increasing biodiversity, enhancing natural capital and making water supplies more resilient. WRSE is consulting on the draft best value regional plan from November 2022 until February 2023. It will then update its plan, working with the other regions to ensure alignment.

We will update our draft WRMP with feedback from this consultation and WRSE's consultation on its draft regional plan. If our plan changes, we will likely re-consult next year.

What is a best value plan?

A best value plan considers a range of factors beyond economic cost. This helps identify the wider benefits water resource schemes can deliver. Together with WRSE we have developed a best value framework. The framework includes criteria and metrics to assess the different options that could feature in the regional plan. You can read a summary of **WRSE's best value planning framework here**.

Do you agree that our WRMP should reflect the best value regional plan, so we are aligned with our neighbouring water companies?

[2] Preparing for a drier future, England's water infrastructure needs: The National Infrastructure Commission, April 2018
[3] Meeting our future water needs: a national framework for water resources: Environment Agency, March 2020

How we have developed our draft plan

We are working with WRSE to develop the regional plan. We intend for our final WRMP to align with the regional plan.

Together, we have:

- received more than 1,150 responses to an emerging regional plan consultation (January to March 2022)
- developed an adaptive planning approach that represents a range of future scenarios
- developed the technical methods being used to produce the regional plan
- developed and applied a framework to identify our best value plan – using criteria and metrics developed with customers' and stakeholders' preferences
- developed a range of population and climate change scenarios
- worked with the Environment Agency to develop a range of future abstraction reduction scenarios to determine how much water we should leave in the environment to protect and enhance it, this work is ongoing
- produced forecasts to project how much extra water the region needs
- developed an environmental assessment process that includes all the legal requirements
- included valuation techniques such as biodiversity net-gain and natural capital in our environmental assessment and conducted an initial environmental assessment
- listened to the views of our customers to understand their priorities and preferences
- identified more than 2,400 options, including a range of new options such as nature-based solutions and schemes with other water users
- assessed these options to identify which the regional plan should consider
- rejected over 1,000 options because they are too damaging to the environment or not reliable enough sources of water
- included 1,400 options in the regional investment model
- identified which set of options, when combined, will deliver the water we need
- published a draft best value regional plan for consultation.

What do you want from your water service?

We've engaged with more than 3,000 customers and stakeholders to develop our draft WRMP.

Customers have told us they:

- support the collaborative approach being taken to long-term water resource planning through WRSE
- understand the challenges of population growth and climate change and support us taking action to ensure resilient water supplies
- expect us to protect the environment
- welcome the focus on reducing abstraction, although they want to see more detail on how this will be achieved
- expect us to start by making use of the water we already have by reducing leakage and promoting water efficiency
- have concerns about over-reliance on demand-side activity
- welcome the balance of different water supply options in the emerging regional plan, so we are not reliant on one type more than others
- particularly welcome aquifer storage and recovery as being innovative and having a positive environmental impact
- feel water recycling is an important part of the long-term solution because its sustainable and environmentally friendly, but assurances are needed around water quality
- view reservoirs as positive because of the environmental, health and community benefits they can bring
- have some concerns about desalination and water transfers from other regions
- support catchment management, although it's recognised it may only produce a small amount of extra water.

What are we planning for?

We are planning to deliver resilient water supplies for the future. Our draft WRMP looks ahead to 2075 to understand how much water we are likely to need.

We provide around 560 million litres of water per day. In the future, if we do nothing there will be a shortfall in water supplies. We could need:

- an extra 238 million litres of water per day by 2030
- an extra 319 million litres of water per day by 2035
- between 339 and 527 million more litres of water per day by 2050
- between 370 and 596 million more litres of water per day by 2070.

This is because there are three main pressures on our water supplies – a growing population, climate change and the need to protect and improve our environment.

We develop a range forecasts for each of these pressures to help us understand what impact different future scenarios could have on our water supplies. This is important as the further ahead we look, the more uncertain it gets so our plan must be able to adapt to the future that occurs.

Population growth

The population in the areas we supply is projected to grow between 6% and 32% from 2025–75. Our growth forecasts are based on a variety of projections including local authority housing plans and data produced by the Office of National Statistics. Growth hot spots are expected to include Andover, parts of rural Hampshire and Worthing in West Sussex.

This could result in the demand for water increasing by between 63 million and 180 million litres per day by 2075 as we need to supply more people, although this will depend on how water efficient we all become.

Climate change

Climate change is expected to reduce how much water we can supply from some of our existing water sources. This means that during drought events, which are expected to become more frequent, there won't be as much water available.

We've considered a wide range of drought events. This includes some which are more severe than those we have experienced in the past. This helps us understand which of our water sources are likely to be most affected so we can plan ahead. We've used the latest UK climate projections (CP18) produced by the Met Office. This shows that we could lose up to 37 million litres of water per day by 2075.

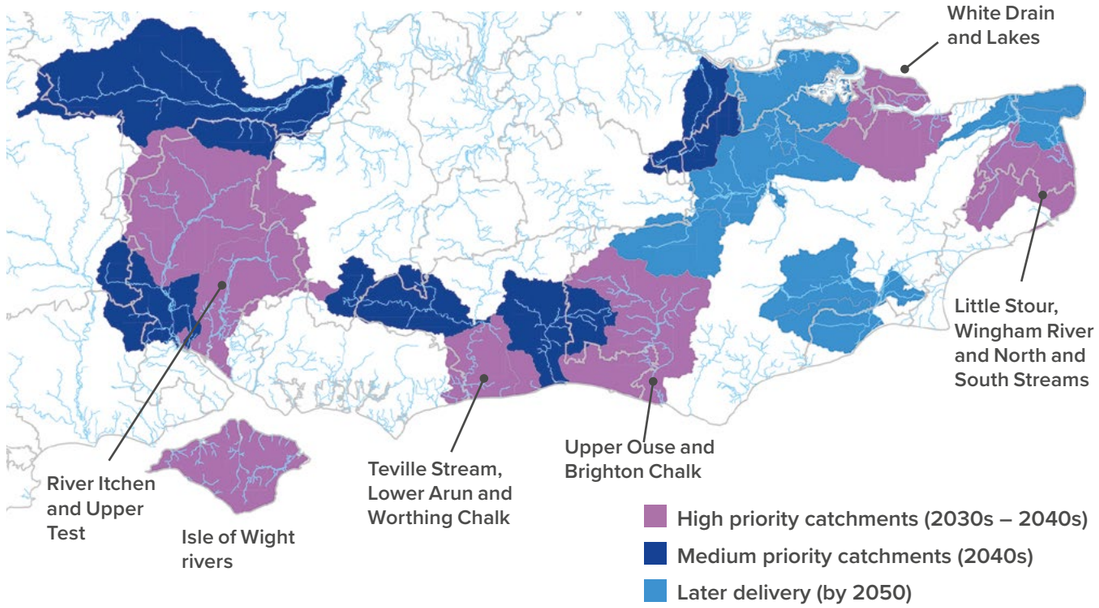
Environmental protection and improvement

The biggest challenge we face is how to sustainably provide water. This means that we will need to reduce how much water we abstract from some of our existing, more sensitive sources and replace them with new ones.

We still don't know exactly where, when or by how much we'll need to reduce our existing abstractions by. WRSE's draft regional plan estimates that, region-wide, we could need to reduce abstraction by between 390 million litres per day and 1,100 million litres per day by 2050 to protect the environment.

We have already reduced how much water we take from the Rivers Test and Itchen during a drought by 190 million litres per day to protect these iconic chalk streams. Additionally, we might need to further reduce how much water we take from sources across our region by between 93 million litres per day and 250 million litres per day by 2050 during droughts. This could mean replacing over a third of the water we currently supply.

This map shows where and when we may need to reduce our abstraction in the future.



We have investigations underway into most of our groundwater sources with a focus on those that support chalk streams. This includes considering where we might cap how much water we abstract from certain sources to prevent damage to the environment. We are also looking at where abstraction reduction and other catchment-focused activities could deliver long-term environmental benefits.

Our high-priority catchments are those where we are likely to need to reduce our abstractions by 2040. These investigations will inform what is included in the next Water Industry National Improvement Programme (WINEP). We are collaboratively developing this with the Environment Agency and local stakeholders.

The sources we are currently investigating include:

- the River Itchen
- the Upper River Test
- the Isle of Wight rivers
- the Teville Stream and Worthing chalk sources
- the Lower Arun sources
- the Upper Ouse and Brighton chalk sources
- the Little Stour and Wingham River
- White Drain and Lakes
- North and South Streams.

This work is continuing and will ultimately provide a long-term environmental forecast on which we will base our WRMP.

Increasing resilience to drought

Droughts occur when there is period of prolonged, dry weather. The National Infrastructure Commission found that, nationally, there was a one in four chance of a serious drought occurring by 2050. The Government has set a new planning requirement for water companies to make their supplies more resilient so that emergency restrictions would only be needed in a one in 500-year drought event. The UK has not experienced a drought this severe since we started recording rainfall data over 100 years ago.

We already plan to this level of resilience. However, we rely on drought orders and drought permits that allow us to continue abstracting water during dry weather.

Our aim is to reduce our reliance on these measures and stop using them by 2040 at the latest. To do this, we need to find 120 million litres of extra water per day. This will help protect the environment and increase our resilience. After 2040, we would only use them if we experienced a severe drought (more serious than a one in 500-year event).

How our WRMP links to our Drought Plan

Water Resource Management Plans look ahead to identify the investment needed to secure water supplies for the future, while Drought Plans set out what we will do if a drought occurs.

Our Drought Plan takes a phased approach and explains what measures we will take as a drought becomes more serious. This includes making more water available such as by continuing to abstract water during dry weather, and reducing demand by introducing restrictions on water use.

We are more likely to need to introduce drought actions in Hampshire and the Isle of Wight until we develop new sources of water to replace those no longer available due to changes in our abstraction licences. This has been agreed with the Environment Agency.

You can read more about our Drought Plan on our website: **southernwater.co.uk/our-story/water-resources-planning/our-drought-plan**.

To protect the environment, we currently have a lower level of service in our Central area, covering West Sussex and Brighton and Hove compared to our target. This means up to 2027 there is an increased likelihood of needing to impose restrictions on water use. We have set out our plan to address this gap. Do you have any comments or concerns about this level of service in our Central area and our plan to address it?

We propose to stop using drought orders and permits that allow us to continue abstracting from the environment after 2040, unless we experience a severe drought. This means we'll need to develop new water supplies to replace them. Do you agree with this approach and the timescale we are proposing to deliver it?

Drought actions	Likelihood of use		
	Hampshire and Isle of Wight	West Sussex and Brighton & Hove	East Sussex and Kent
Temporary Use Bans	Once in every five years on average until 2030 Once in every 10 years after 2030	Once in every five to 10 years on average until 2027 Once in every 10 years after 2027	Once in every 10 years on average
Drought Order to restrict water use – Non-Essential Use Ban	Once in every 20 years on average	Once in every five to 10 years on average until 2027 Once in every 20 years after 2027	Once in every 20 years on average
Emergency drought measures – standpipes and rota cuts	Less than once in every 200 years until 2040 Once in every 500 years after 2040	Less than once in every 100 years until 2030 Less than once in every 200 years between 2030 and 2040 Once in every 500 years after 2040	Less than once in every 200 years until 2040 Once in every 500 years after 2040
Drought orders and drought permits to increase supplies	Once in every five years until 2030 Once in every 20 years until 2040 After 2040 no use of drought orders or drought permits	Once in every 20 years until 2040 After 2040 no use of drought orders or drought permits	Once in every 20 years until 2040 After 2040 no use of drought orders or drought permits

Planning for an uncertain future

We know the future is uncertain which is why we have developed an adaptive plan to secure our future water supplies.

WRSE used a range of forecasts for population growth, climate change and abstraction reduction to predict what different scenarios would mean for water supplies across the region. It used these scenarios to develop and test its plan to futureproof water supplies.

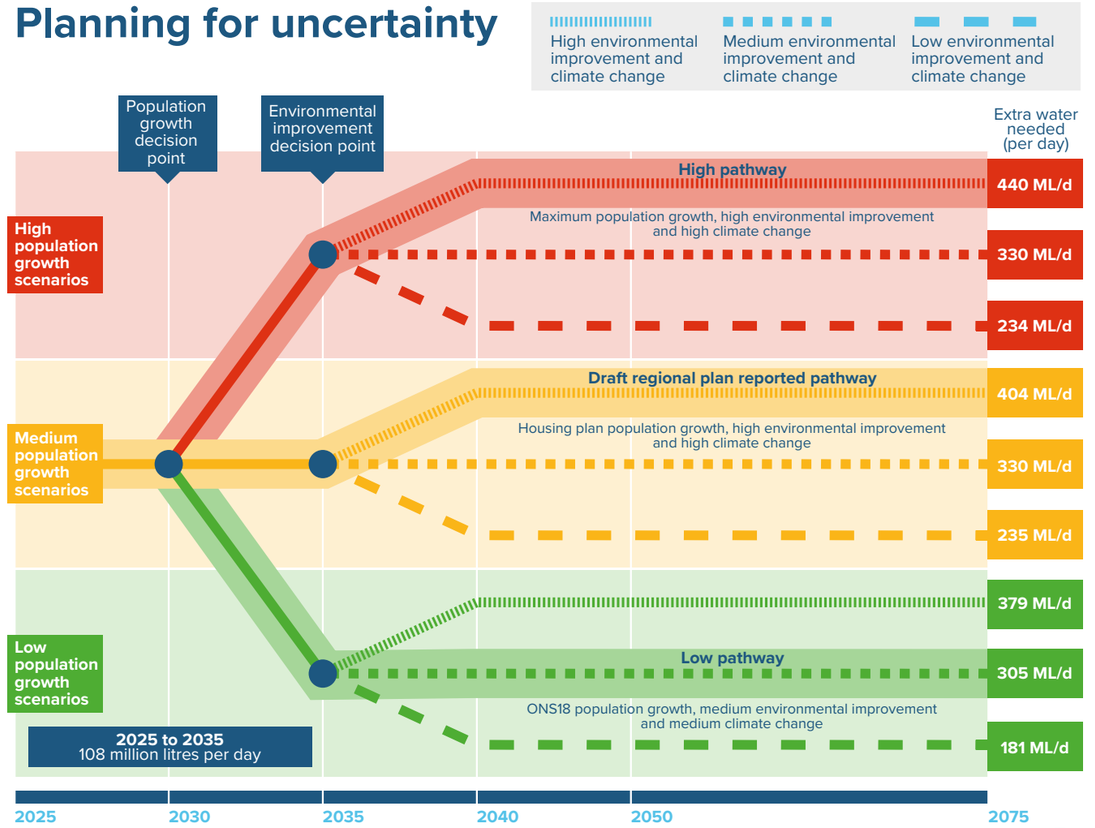
This adaptive planning approach means we can see how much water would be needed in different future scenarios and which options we might need to develop in each. WRSE's draft regional plan has identified a core pathway to 2035, which outlines the 'no regrets' options needed in all future scenarios.

In 2035, this branches into three pathways depending on the level of population growth we could experience. After that, there are nine pathways we could experience depending on the impacts of climate change and how much we need to reduce abstraction to improve the environment.

Below we show how much additional water we may need when we look at some different future scenarios we could face. In each, abstraction reduction is the biggest driver of new water supplies.

We will update our draft WRMP with feedback from our consultation and WRSE's draft regional plan consultation. This will enable us to identify the 'no-regrets' options needed and which we must progress urgently.

Planning for uncertainty



We have considered a range of future scenarios in our adaptive planning approach. Are there any other future scenarios that you think we should consider?

What options have been considered?

We have considered a range of different options that could either lower the demand for water, protect our existing supplies or make more water available.

Reducing leaks

Reducing how much water is lost from leaks on our pipes and the pipes and plumbing in our customers' homes and business.

Pros: Lower levels of leakage will reduce how much water is wasted and will make our supplies more resilient. It could help to avoid the need to develop some new sources of water. It will also help reduce carbon emissions.

Cons: The more leakage is reduced the harder and more expensive it becomes to find the remaining leaks. Some activities like replacing old water mains can cause disruption for local communities. Further reduction in leakage will be dependent on new technology be developed.

Reservoirs

We could build new reservoirs to store water from rivers when flows are high and from other sources, such as water recycling plants. We could also make our existing reservoirs bigger.

Pros: They can provide a resilient water supply, including during the summer. They can provide long-term benefits to communities and the economy such as new leisure and recreational facilities.

Cons: There are few suitable locations within our supply area. Reservoirs can take a long time to plan and build, and their construction could impact on local communities and the environment.

Helping customers use less water

Reducing demand for water by working with our customers to help them become more water efficient.

Pros: Lower levels of water use across society will help make our water supplies more resilient and could avoid the need to develop some new sources of water. It will also help reduce carbon emissions.

Cons: It is reliant on people taking action and maintaining a lower level of water use.

Water recycling

Treated wastewater would undergo further, enhanced treatment. The water would be either released into a river, to boost flows and enable us to abstract it again, or into an existing lake or reservoir. The water would be treated to drinking water standard before being supplied to customers. It is a technique used widely in other parts of the world such as California.

Pros: It can provide a resilient water supply, including during severe, prolonged droughts. Recycling plants can be made bigger if more water is needed in the future.

Cons: It is energy intensive, can involve constructing long pipelines which are disruptive to build and could impact on the environment. The approach taken will depend on which catchment the water is released back into.

Drainage and Wastewater Management Plan (DWMP)

For the first time, we are developing a Drainage and Wastewater Management Plan (DWMP) for our supply area. It is considering the long-term management of our wastewater network.

It identifies that water that is currently released out to sea is a valuable resource which could instead be recycled back into our catchments and used again to provide additional drinking water supplies. Our draft WRMP has several schemes that could recycle treated water.

We consulted on our draft DWMP until September 2022 and will publish an updated version soon. You can read more about our DWMP here: **southernwater.co.uk/dwmp**.

Desalination

Seawater would be abstracted and treated to drinking water standard before being supplied to customers. Desalination is used in the Middle East and Africa. There is also a desalination plant in London.

Pros: It will provide a resilient water supply, including during severe, prolonged droughts. Desalination plants can be made bigger if more water is needed in the future.

Cons: It is energy intensive, expensive to run and could impact on the marine environment. The concentrated salt byproduct must be safely disposed of.

Transfers from other water companies

Water could be moved into our area from a neighbouring company, following the development of a new water source or additional water being made available.

Pros: New strategic resources could be developed in one area that provide benefit to multiple companies, providing more resilient water supplies.

Cons: The construction of new pipelines can cause disruption to local communities.

Increasing underground water supplies

We could abstract water from rivers during the winter when flows are high and pump it underground to increase water supplies within the aquifer. Managed Aquifer Recharge (MARS) which involves supplementing the natural water supply within the aquifer and Aquifer Storage and Recovery (ASR) which involves developing additional underground storage.

Pros: It has low carbon and environmental impact and will provide additional water supplies during the summer.

Cons: There are limited locations where it can be used because it requires specific ground conditions. It can take a long time to test whether a scheme will be possible.

Groundwater source improvements

We could improve how we abstract water from our existing groundwater sources so more is available, without impacting on the environment.

Pros: Low carbon impact and little disruption to the local area.

Cons: The amount of additional water available will be limited.

Catchment management and nature-based solutions

We could collaborate with landowners, farmers and environmental groups to improve the quality of our water sources and make them more resilient to drought. This could make some additional water available and help adapt to climate change impacts whilst improving habitats for wildlife.

Pros: It will help improve the environment, reduce our need to treat water and deliver wider benefits such as increased biodiversity and reduced flood risk.

Cons: Limited additional water will be made available and the effectiveness of some of the techniques are uncertain and need further investigation.

Drought orders and permits

During periods of severe dry-weather, we can apply to either continue taking water or take more water from the environment to maintain supplies. These are usually accompanied by restrictions on customers' water use. We're committed to no longer using these after 2040.

Pros: They give us extra flexibility during droughts to maintain essential supplies. We would need to invest more to phase out their use before 2040.

Cons: They risk damaging the environment at a time when water availability is already stressed. Restrictions on customers' use are unpopular and may cause disruption to our daily lives and economic activity.

Our strategy to supply water

Our draft WRMP has been directly informed by our work as part of WRSE on the draft best value regional plan, which identified four priorities to secure water supplies.

1. **Efficient use of water and minimal wastage across society.**
2. **New water sources that provide resilient and sustainable supplies.**
3. **A network that can move water around the region.**
4. **Catchment and nature-based solutions that improve the environment we rely upon.**

Efficient use of water and minimal wastage across society

Saving water and reducing wastage across society is critical to help improve the environment and make our water supplies more resilient. WRSE's draft regional plan shows that, by 2050, ongoing demand management could provide over half the additional water needed.

Saving water and reducing wastage will secure up to 40% of the water we need by 2040, including the temporary restrictions on water use included in our Drought plan. This then falls in future years as we develop more new sources and stop using drought orders and permits.

Reducing leakage

Reducing leakage is at the forefront of our activity to secure resilient and sustainable water resources. We're proposing to reduce leakage by at least 50% by 2050, and could increase this to 62% depending on how we deliver it. We have one of the lowest levels of leakage of all the water companies. At present, it accounts for 17% of the total water we put into supply. By 2050 we will have reduced leakage to less than 8% under average weather conditions.

Leakage today (2021/22): 92 million litres per day

Leakage by 2050: 46 million litres per day

How could we do it?

We'll:

- improve the monitoring of our water network by installing more sensors and bring all our leakage data together into a digitalised system to help us detect and prioritise repairs
- improve how we manage pressure in our network
- replace water mains that are prone to frequent bursts and leaks
- roll out smart meters to our customers which alert us to leaks at their homes and businesses and we'll help get them fixed quickly
- make use of emerging technology such as remote sensors, thermal imagery, satellites and drones to detect leaks
- progress the development of innovative, fibre optic technology to provide data about leakage across the network.

Do you support our plan to at least halve leakage by 2050?

Water efficiency

Helping customers use less water is essential to securing a resilient water future. Our draft WRMP includes the target to reduce daily household use to 109 litres per person by 2040. This aligns with the regional plan and is more ambitious than government's target of 110 litres by 2050.

We have a more stretching ambition to reduce average use to 100 litres per day by 2040 and are developing plans to achieve this. However, changes to working patterns and household demand have made this more challenging to deliver. This is why it is not part of our draft WRMP.

Water use today (2021/22): Household customers = 134 litres per person per day

Water use by 2040: Household customers = 109 litres per person per day

How could we do it?

We'll:

- replace customers' meters with smart meters that will send us near real-time data on how much water is being used
- use this to target our support including providing home visits, help and advice and installing water saving devices at their properties
- run public campaigns to encourage water efficiency – including working with the education sector
- introduce innovative tariffs, subject to customer acceptability, to incentivise water efficiency and work with local communities to encourage savings across local areas
- trial innovative solutions to reduce water usage in the home and in gardens
- work with government, policy makers and other stakeholders to promote the adoption of more water efficient policies and standards.

Do you support us achieving our WRMP target of reducing average personal daily use to 109 litres by 2040 or should we retain our more ambitious target of 100 litres per person per day by 2040?

The role of Government in reducing demand for water

Achieving our target to lower water use relies on the government introducing mandatory labelling on products that use water by 2024. This will help customers choose products that use less water.

The draft best value regional plan identified other measures that the government could take to help consumers reduce their water use:

- Minimum standards for devices that use water by 2045
- Amendments to building regulations for new homes and retrofits to deliver more water efficient housing by 2060.

Together, these measures could lower water use and offset investment in new resources across the region. If they were introduced earlier, they could help customers reduce their water use more quickly and at a lower cost.

Do you support additional proposed government interventions and the timing of their introduction?

Our draft plan for the next 15 years relies heavily on measures that reduce demand for water. The water savings they deliver must be sustained. We will keep this under review. If they do not deliver the savings needed we may need to develop new water sources sooner than set out in our plan.

Temporary water restrictions

Our plan includes the use of temporary restrictions to reduce water use during droughts, in line with our Drought Plan (see page 24). These restrictions typically reduce demand by 6% across our supply area. These measures include:

- Temporary Use Bans (TUBs) which restrict certain household activities such as using a hosepipe or sprinkler to wash your car or water your garden
- Non-Essential Use Bans (NEUBs) that reduce water use by businesses by restricting activities such as watering plants and cleaning windows.

If we were to stop using these measures, we would need to find an additional 20 million litres of water per day which could require the development of more new water sources.

Our plan continues to rely upon temporary restrictions on water use to help lower demand during droughts to avoid further investment in new supplies. Do you agree with our approach to continue using temporary water restrictions during droughts?

New water sources to provide resilient and sustainable supplies

WRSE's draft regional plan has identified schemes we could need to develop in the future.

These are typically in areas where we need to reduce the amount we take from the environment to protect the environment and reducing demand alone will not make up the shortfall.

Our adaptive planning approach identifies 'no regrets' schemes we predict are needed in all future scenarios. It also identifies which schemes could be needed under different scenarios further into the future.

Hampshire and the Isle of Wight

We need a new source of water to meet the supply deficit in Hampshire and to deliver wider environmental objectives. Our draft best value plan includes an option to transfer 90 million litres of water a day from Havant Thicket reservoir to the Southampton area, which is consistent with both the SRO we are progressing and WRSE's draft regional plan.

As part of the SRO development, we also identified the need for a water recycling plant to supplement supplies into the reservoir to meet the needs of customers and the environment as part of a regional solution.

In summer 2022, we consulted on our proposals for this SRO. This is based on the needs and challenges we identified in our WRMP19. We will consult on this option in more detail in summer 2023. We are also ensuring this scheme can meet the longer-term regional needs WRSE outlines.

Until a new resource is built, we may need to continue using drought orders and drought permits to help secure supplies during droughts. We are progressing the SRO alongside our WRMP to reduce the need for these measures as quickly as we can.

We may also need to develop other new sources depending on the future we face. We may also need to abstract water from the River Test when flows are high to supplement the underground aquifer.

Additionally, we are investigating a strategic pipeline which could transfer up to 120 million litres per day from Thames Water. This depends on new sources being developed in Thames Water's area, all of which are being considered through the SRO process.

One of the new sources in Thames Water's area is the South East Strategic Reservoir, or SESRO. We've based our best value plan on WRSE's regional plan which includes an option for SESRO at 100Mm3, which would enable the strategic transfer into Hampshire. If the size and timing of SESRO changed it would impact our wider plans. For example, a larger reservoir could mean we need a smaller water recycling plant supplementing Havant Thicket reservoir. However, if SESRO was smaller or delayed, we may need to invest in alternative sources such as desalination or water recycling elsewhere in Hampshire.

A new strategic reservoir is an integral part of the regional best value plan for the South East. Do you have any comments on the size of the new reservoir?

Does your position change if the size of that reservoir (which will supply the transfer into Hampshire) impacts on the size of water recycling plant needed at Havant Thicket? (See section seven in our technical document for more information)

Hampshire and the Isle of Wight

West Sussex and Brighton and Hove

We need to develop new sources of water to secure water supplies for customers and the environment across our central supply area, covering West Sussex and Brighton and Hove.

We are developing a water recycling scheme near Littlehampton, which will transfer water to the Pulborough area.

A new reservoir close to the village of Blackstone, near Henfield in West Sussex would store water from the nearby River Adur to supply parts of Sussex.

We've previously identified the need for a new source of water on the Sussex coast before 2030. The options we're considering including the development of a groundwater source and a desalination scheme.

Depending on which of the future scenarios we are in, we may need to introduce desalination near the tidal River Arun.

Kent and East Sussex

The first option likely to be needed in Kent is a water recycling scheme on the River Medway. This would support our existing abstraction on the river. In some futures, we could raise the level of Bewl Water reservoir slightly so it can store more water after 2040.

Depending on the challenges we face in the future, we've identified the need for several desalination plants, and additional water recycling schemes. This includes desalination plants on the Isle of Sheppey, in East Thanet and on the Thames Estuary providing between 8 million and 40 million litres a day by 2050.

In the future, we may need to increase how much water we recycle from our plant on the River Medway. We may also need a recycling scheme in Tunbridge Wells, as well as one near Hastings which would be used to supplement Darwell reservoir.

In the short-term, we aim to work with a large industrial water user in Kent to provide them with recycled wastewater and enable us to use their existing groundwater sources to supply customers.

Our strategy includes a mix of new water sources that together will provide resilient and sustainable supplies for the future and address the challenges we face in each of our supply areas.

Do you support our strategy to develop new pipelines that will transfer water into our supply area, that is made available through the development of new strategic water sources in other water companies' supply areas?

Do you agree that water recycling has a role to play in securing water supplies for the future?

Our plan has shown we could need a desalination plant in Sussex by 2030 and that more could be needed in the future if we experience high population growth, and we need to reduce how much water we take from sensitive sources. Do you think we should use desalination to provide additional water supplies?

Our plan has identified the need for a new reservoir to store water in West Sussex. Do you think we should investigate this further to establish whether it could provide a new source for the area?

Do you think we should look at water recycling options where water is stored in reservoirs, lakes or other waterbodies as well as those where it is released back into nearby rivers and abstracted again?

Do you have any additional comments on any of the schemes we have proposed in our draft plan?

A network that can move water around the region

We have a network of pipelines that move water to where it's needed most. This includes within and between our water resources zones – and with our neighbouring companies.

Working with other water companies, we will build new pipelines to transfer water across the South East. This will help increase our region's resilience, and the resilience of our own supplies.

In the next few years, we will improve our ability to move water around Hampshire. This includes a new 21 million litres per day transfer when Havant Thicket reservoir is completed by 2030. We'll also continue improving how we move water between our water resource zones.

Longer term, we could transfer up to 120 million litres per day from Thames Water into Hampshire. This option depends on new sources being available in Thames Water's area. Additionally, we could build a new transfer from Havant Thicket reservoir to Sussex.

We already share water with our neighbouring companies, and these transfers are a crucial part of our collective resilience. We'll continue working with other water companies, including SES Water and South East Water, to build on our existing connections and develop new ones where needed.

Do you agree that we should develop our pipeline network so we can move more water between our supply areas and share supplies with our neighbouring water companies?

Catchment and nature-based solutions

Working with nature by using catchment and nature-based schemes will protect and improve the environment we rely upon.

This will help us secure sustainable water supplies for the future. It will also deliver wider benefits such as increasing biodiversity and lowering carbon emissions.

We want to improve the environment so it can better adapt to the challenges ahead. This is supported by our customers who value the environment more than ever before. Our 'Catchment First' programme is maximising opportunities to collaboratively deliver long-term environmental improvements. Our aim is to take a twin-track approach where we use traditional engineering schemes where needed to achieve compliance. But, where we can, reduce our reliance on them by increasing our use of catchment and nature based solutions.

Achieving sustainable abstractions

Do you support our ambition to proactively use catchment and nature-based solutions where we can to help improve the quality of the water sources we rely upon so we can abstract water sustainably and deliver wider environmental benefits?

We will continue investigating the impact our abstractions have on the environment. Where we can, we will deliver schemes that improve the water bodies we rely upon, so we don't need to make as significant reductions to our abstractions. The amount of water we do abstract will be sustainable for the future.

Reducing nitrate levels in groundwater

Nitrate pollution will impact both the quality and quantity of our groundwater sources. By working with farmers and other land users we will take action to protect 42 of our groundwater sources and make them more resilient.

Improving the resilience of our surface water sources

Where we abstract from rivers and streams, we'll work with partners to understand what factors could impact on the quality of our raw water sources. We'll take action to mitigate them while also delivering wider environment benefits such as increasing natural capital and reducing flooding.

Do you think that others who benefit from a healthy water environment should contribute to the cost of delivering these solutions?

Do you or your organisation have similar work planned in our catchments? Do you have any views on how best we can co-ordinate this work so we achieve the most benefits?

How we'll provide your water

Our strategy to supply your water includes a mix of options to increase supplies and reduce demand.

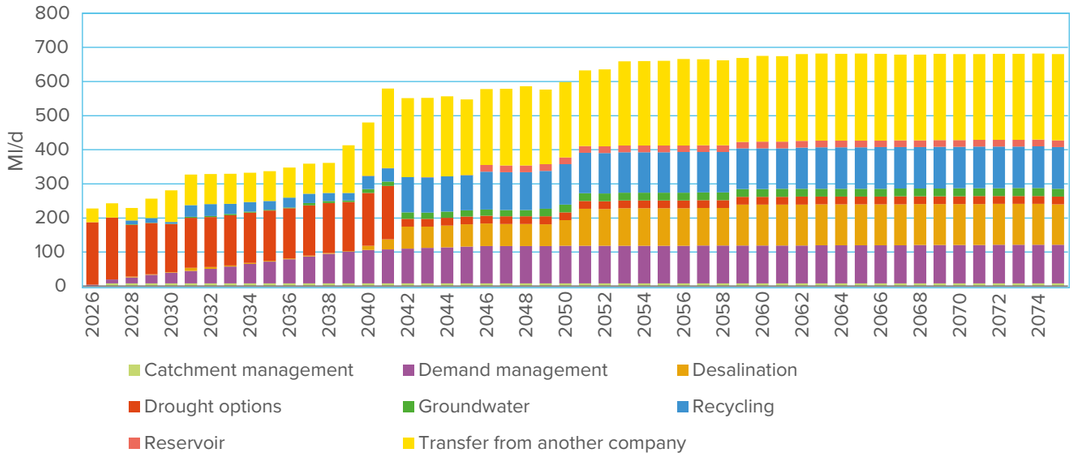
Between 2025–35:

- demand management measures including leakage reduction and helping people use less water make up around a third of the water we need
- drought orders and permits that allow us to continue abstracting water during a drought contribute over a third of the water, while we develop new supplies
- we'll introduce water recycling schemes in Havant, Littlehampton, Sandown and on the River Medway
- we'll transfer more water from Portsmouth Water and possibly from SES Water and South East Water
- catchment management schemes will help improve the quality and resilience of our water sources.
- we might introduce desalination on the Sussex coast.

After 2035:

- we stop relying on drought orders and permits that allow us to continue abstracting water during dry weather
- demand management continues to play an important role and we will maintain lower levels of leakage and water use
- water recycling and transfers from other companies contribute around two thirds of the additional water we need, this includes a large transfer from Thames Water which is dependent on a major new source of water being developed
- we build a new reservoir in West Sussex
- desalination, improvements to groundwater storage and reservoirs provide the rest.

The graph below shows the mix of solutions we could use to maintain your water supplies in the future.



Our draft WRMP includes options that will reduce demand and a mix of different schemes to produce extra water supplies. Do you think our plan strikes the right balance between demand and supply solutions?

The costs and carbon footprint of our best value plan

As part of WRSE, we've developed a best value plan to secure resilient and sustainable water supplies for the future. This means the investments we're proposing have been chosen because they will deliver wider benefits for customers, businesses and the environment.

They will help protect and improve the environment, support biodiversity and natural capital gains and increase our resilience to more extreme weather events. We have also considered customers' preferences for different types of option.

This will mean our supplies will be more reliable, and more water will be left in our rivers. It also means we are less likely to need to introduce emergency water restrictions, such as standpipes in the street, if a severe drought occurs in the future.

We are committed to achieving net zero operational carbon emissions by 2030. So, when developing the options in our plan we considered the carbon impact of all of them to make sure we can accomplish this.

The table below shows the total cost of our plan over our next three five-year investment periods, known as AMPs. It also shows how the average impact on bills at the end of each AMP, compared to bills in 2019/20.

Next year, we'll consult on our Long Term Delivery Strategy as we finalise our business plan - which will include the costs and benefits of all our activities. We'll submit this to our regulator in October 2023, who then determines the amount of investment we can make.

We're committed to delivering our plan as efficiently as possible - providing best value for our customers and the environment and securing Water for Life. You can read more about the costs of our plans and the possible impacts on customers' bills in section seven of our technical report, available on our website: **southernwater.co.uk/wrmp**.

Total cost of plan over our next three investment periods

	AMP 8 (2025 - 30)	AMP9 (2030 - 35)	AMP10 (2035 - 40)
Total cost*	£1,529m	£561m	£2,064m
Average increase from customers' bills in 19/20	£84.57	£110.91	£178.14

Water strategy for 2025–35

This map shows how we could provide resilient and sustainable water supplies between 2025 and 2030.

Key

- Less than five million litres of water each day.
- Between five and 50 million litres of water each day.
- More than 50 million litres of water each day.
- Reduce demand for water
- Drought action
- New sources of water and transfers
- Catchment or nature-based scheme

Hampshire and the Isle of Wight

1. Reduce leaks
2. Help customers use less water
3. Apply for a drought order on the River Test to continue abstracting water during dry weather
4. Receive up to 90 million litres of water from Portsmouth Water through a new pipeline
5. Build new pipelines so we can move water around our Hampshire area
6. Catchment schemes to address nitrates and pesticides and improve the resilience of our water sources
7. Recycle water from our Sandown site
8. Develop groundwater sources near Newbury, Romsey and Newchurch
9. Recycle water at Budds Farm wastewater treatment works and store it in Havant Thicket reservoir before transferring it through a new pipeline to our Otterbourne water supply works for treatment
10. Upgrade two water supply works in Hampshire to enable us to treat more water

West Sussex and Brighton and Hove

11. Reduce leaks
12. Help customers use less water
13. Recycle water from our Littlehampton wastewater treatment works and transfer it via the River Rother to our water supply works near Pulborough
14. Apply for drought orders and permits on the River Rother to continue abstracting water during dry weather
15. Apply for a drought permit on a groundwater source near Worthing to continue abstracting water during dry weather
16. Catchment schemes to address nitrates and pesticides and improve the resilience of our water sources
17. Build a desalination plant (or alternative source) on the Sussex coast
18. Import water from Portsmouth Water, SES Water and South East Water

East Sussex and Kent

19. Reduce leaks
20. Help customers use less water
21. Apply for a drought permit/order on the River Medway to continue abstracting water during dry weather
22. Catchment schemes to address nitrates and pesticides and improve the resilience of our water sources
23. Recycle water from a water recycling plant near the River Medway and release it into a storage reservoir near our Rochester supply works
24. Work with a large industrial water user to provide them with recycled wastewater and enable us to use their existing groundwater sources

Temporary Use Bans (TUBs) and Non Essential Use Bans (NEUBS) to be used during droughts in line with our Drought Plan.

Water strategy for 2035–50

This map shows how we could provide resilient and sustainable water supplies between 2035–50.

Hampshire and the Isle of Wight

1. Reduce leaks
2. Help customers use less water
3. Upgrade an existing water supply works so it can treat more water
4. Take water from the River Test when flows are high in the winter and use it to supplement our underground water supplies
5. Make improvements to an existing groundwater source on the Isle of Wight
6. Catchment schemes to address nitrates and pesticides and improve the resilience of our water sources
7. Receive up to 120 million litres a day from Thames Water

Temporary Use Bans (TUBs) and Non Essential Use Bans (NEUBS) to be used during droughts in line with our Drought Plan.

West Sussex and Brighton and Hove

8. Reduce leaks
9. Help customers use less water
10. Trade licences with farmers and support them to develop additional on-site storage to better use the water available during the winter
11. Apply for a drought permit on a groundwater source near Arundel to continue abstracting during dry weather
12. Build a new reservoir in Sussex to store water from the River Adur
13. Catchment schemes to address nitrates and pesticides and improve the resilience of our water sources
14. Import more water from Portsmouth Water to near Pulborough and upgrade our treatment works to supply more water
15. Develop a groundwater source near Petworth

East Sussex and Kent

16. Recycle water near Hastings and store it in Darwell reservoir before treating it at a nearby water supply works
17. Reduce leaks
18. Help customers use less water
19. Improve an existing groundwater source near Gravesend
20. Catchment schemes to address nitrates and pesticides and improve the resilience of our water sources
21. Desalination plants on the Thames Estuary, Thanet coast and the Isle of Sheppey
22. Increase the size of Bewl Water reservoir

Water strategy for 2050–75

This map shows how we could provide resilient and sustainable water supplies between 2050–75.

Temporary Use Bans (TUBs) and Non Essential Use Bans (NEUBS) to be used during droughts in line with our Drought Plan.

Hampshire and the Isle of Wight

1. Reduce leaks
2. Help customers to maintain a sustainable level of water use
3. Recycle water from our wastewater treatment works near Woolston
4. Ongoing work to use catchment management and nature-based solutions to improve the environment

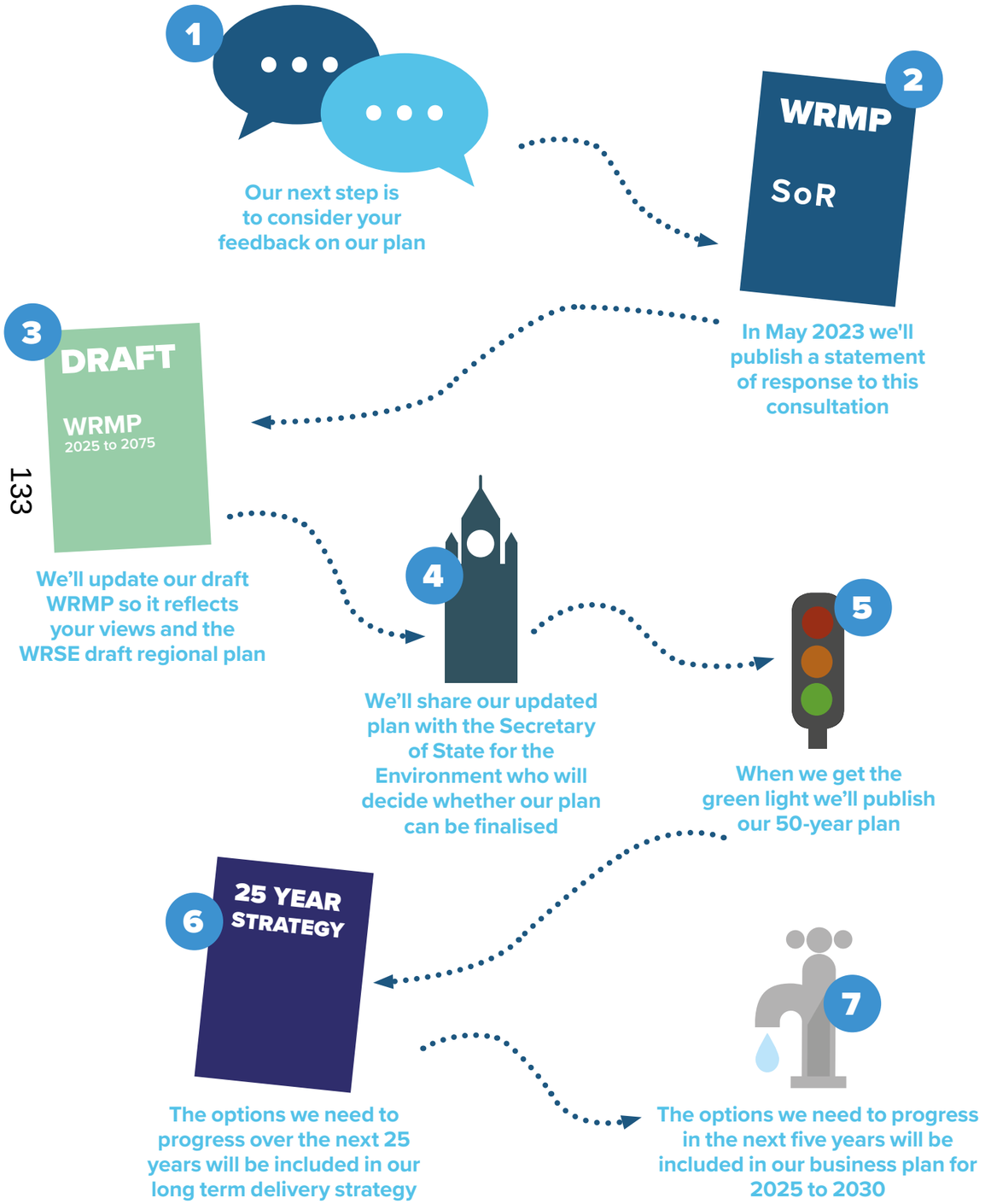
West Sussex and Brighton and Hove

5. Reduce leaks
6. Help customers to maintain a sustainable level of water use
7. Recycle water near Horsham and transfer it through a new pipeline to an existing reservoir near Pulborough before it is treated and supplied to customers
8. Ongoing work to use catchment management and nature-based solutions to improve the environment
9. Build a desalination plant on the tidal River Arun

East Sussex and Kent

10. Reduce leaks
11. Help customers to maintain a sustainable level of water use
12. Ongoing work to use catchment management and nature based solutions to improve the environment

What happens next?



How you can respond to our consultation

There are lots of ways you can have your say

1. Take part in our online survey at **southernwater.co.uk/HaveYourSay**.
2. Email **Defra** at **water.resources@defra.gov.uk**, putting Southern Water draft water resources management plan in the subject line, and copying in **wrmp@southernwater.co.uk**.
3. Print out our survey or write a response and send it to Defra at:
   Water Resources Management Plan Consultation (Southern Water)
   Water Services
   Department for Environment, Food and Rural Affairs
   Seacole Ground Floor
   2 Marsham Street
   London
   SW1 4DF.

If you have any issues accessing our consultation or have any questions relating to it please contact us at **wrmp@southernwater.co.uk**.

You can read the technical documents that accompany this consultation at **southernwater.co.uk/wrmp**.

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from Southern Water

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south east water

Draft Water Resources Management Plan 2025 to 2075 Highlights

135

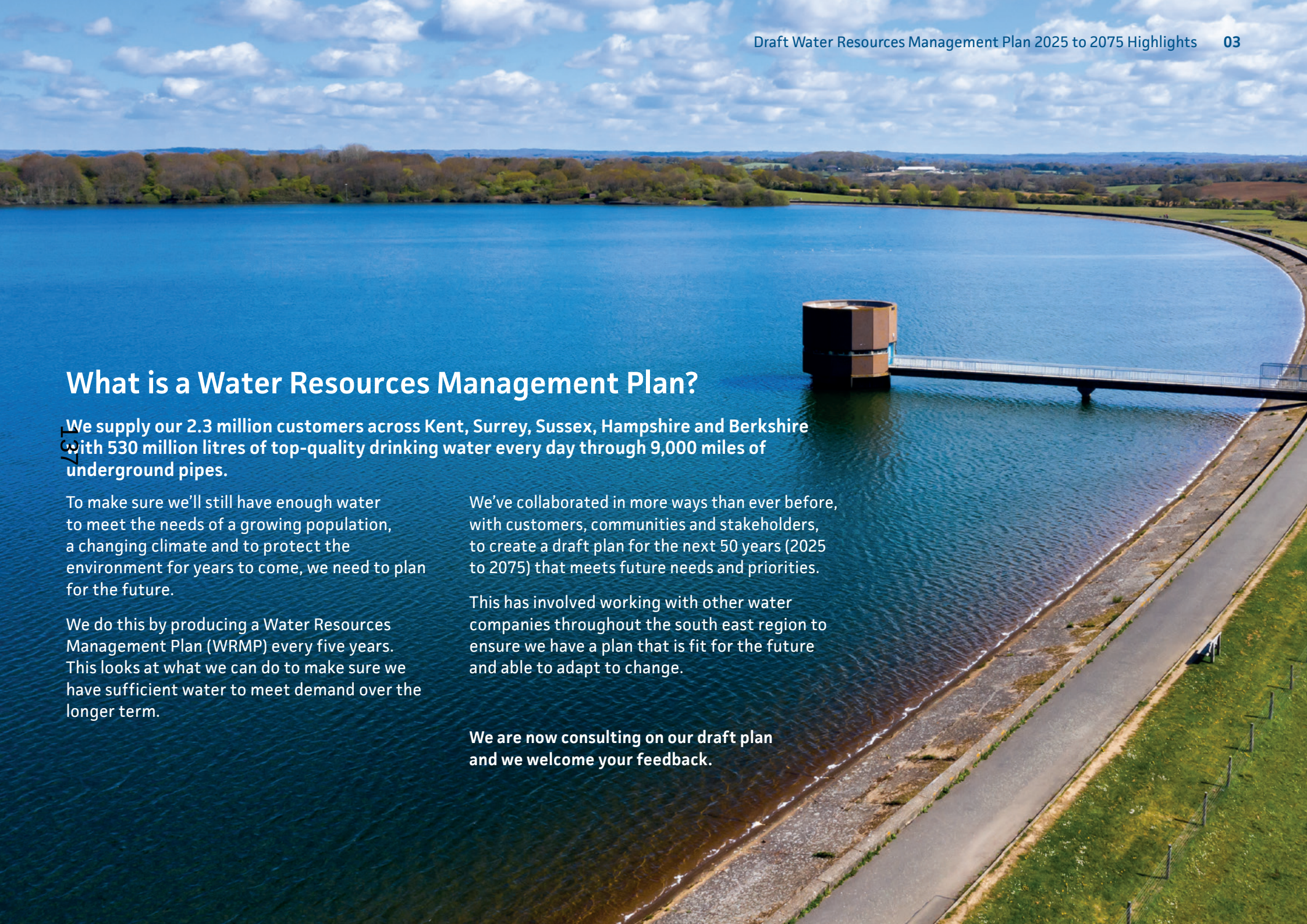
Introduction

A resilient water supply is more important than ever due to the challenges of population growth, climate change and the need to protect our natural environment.

Contents

Read more online

draft Water Resources Management Plan:
southeastwater.co.uk/futurewater



What is a Water Resources Management Plan?

We supply our 2.3 million customers across Kent, Surrey, Sussex, Hampshire and Berkshire with 530 million litres of top-quality drinking water every day through 9,000 miles of underground pipes.

To make sure we'll still have enough water to meet the needs of a growing population, a changing climate and to protect the environment for years to come, we need to plan for the future.

We do this by producing a Water Resources Management Plan (WRMP) every five years. This looks at what we can do to make sure we have sufficient water to meet demand over the longer term.

We've collaborated in more ways than ever before, with customers, communities and stakeholders, to create a draft plan for the next 50 years (2025 to 2075) that meets future needs and priorities.

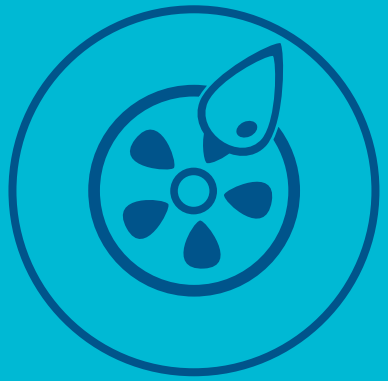
This has involved working with other water companies throughout the south east region to ensure we have a plan that is fit for the future and able to adapt to change.

We are now consulting on our draft plan and we welcome your feedback.

Key facts

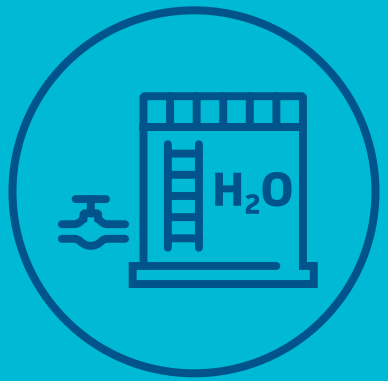
2.3 million customers in our supply area

530 million litres* of water treated each day



150 litres of water used by each customer, on average, every day

60p* is the average daily household bill



87 treatment works operate 24/7

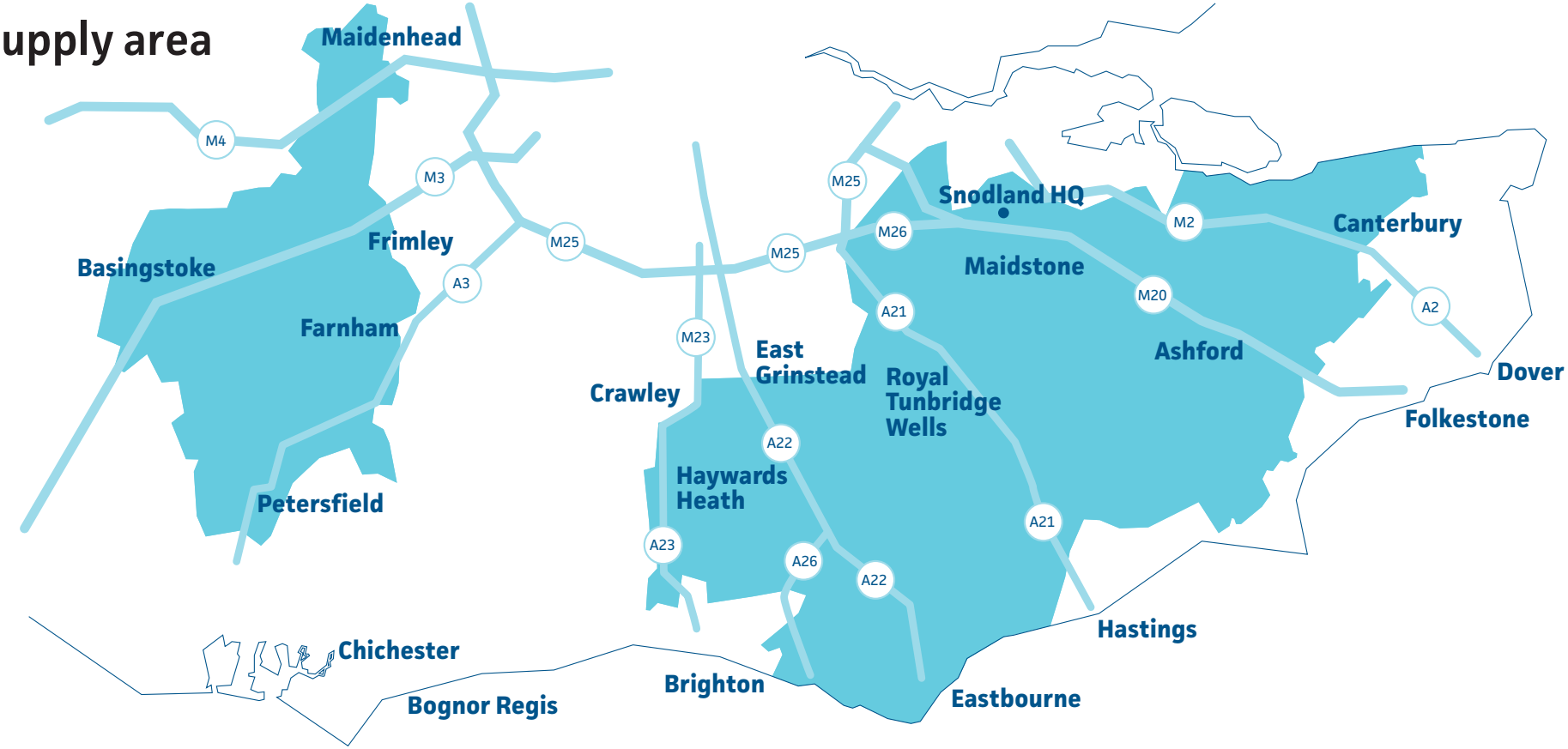
9,000 miles of hidden underground pipework

33 Sites of Special Scientific Interest are managed by us

500,000 water quality tests undertaken each year

*2021/22 figures

Our supply area



Due to our warm, dry climate, the south east region is classed by the Environment Agency as an area of serious water stress.

Our own assessments show there's a high risk to our water supplies due to a growing population, climate change uncertainty and restricted supply availability. During the drought conditions of summer 2022, demand for water rose to 650 million litres of water a day.

That's the equivalent of supplying an additional four towns the size of Maidstone or Eastbourne. We rely heavily on regular rainfall across our supply area to keep taps flowing.

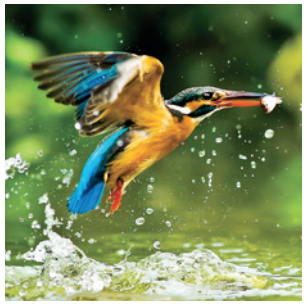
As well as ensuring we have enough water for our customers' taps, we must also make sure we have sufficient water for our precious environment.

Our supply area is rich in biodiversity, cultural heritage, protected landscapes and ancient woodland. It's therefore vital that we take the right long-term decisions that will protect our environment as well as our water supplies.

Our 25-year Environment Plan sets out our commitment to protecting and improving the environment and leaving it in a better place for future generations. This commitment has helped to shape our draft WRMP.

What challenges do we have?

Our aim is to always have enough water for all our customers even when demand for water is very high in hot and dry weather, but the following challenges mean we face a potential shortfall of up to 225 million litres of water a day by 2075.



Growing population and more housing

By 2049/50, the population in our supply area is set to rise from 2.26 million to 2.81 million people – a 25 per cent increase from 2019/20.

Our long-term forecast predicts that the population could rise by a further five per cent (minimum) or 26 per cent (maximum) by 2075.

Protecting the environment

Protecting and improving the environment is central to how we manage our water. Tighter environmental protection is being adopted to protect our precious natural landscape and the diverse wildlife that inhabit it.

This protection extends to reductions in the amount of water we abstract from the environment.

Changing weather patterns

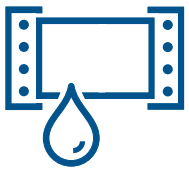
We're already operating in a water-stressed area, but we need to prepare for more hot and dry weather like the 2022 drought conditions.

Climate change and changing rainfall patterns mean there may be less water available – to turn into clean drinking water – in some of our rivers and underground sources in the future.

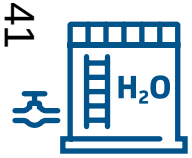
Achievements since our last plan

We've made significant progress since our last water resources management plan in 2019, even though we had to change some of our priorities during the Covid-19 pandemic.

Achievements include:



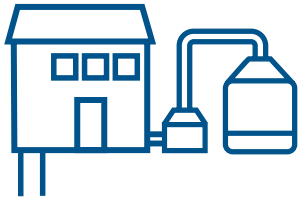
Reducing leakage by 33.5 per cent since 2002/2003 and meeting or exceeding our leak target for 20 consecutive years. In the last two years, we have reduced the amount of water lost through leaks by an extra four million litres a day.



Developing a major new water treatment works in Kent, providing an extra 18 million litres of water a day by 2025.

Reducing water use through behavioural change programmes, offering free water-saving devices to customers, and encouraging customers to save water through communications campaigns and initiatives such as our Household Neighbour Comparison report.

Working with landowners to reduce nitrates on more than 1,387 hectares of farmland, reducing water treatment costs.



Starting a scheme to replace the current Bewl to Darwell bulk supply transfer.

Progressing plans for a new reservoir at Broad Oak near Canterbury, Kent, which will provide an extra 22 million litres a day, and a second reservoir at Arlington, East Sussex, to boost supplies by an extra 18 million litres a day.

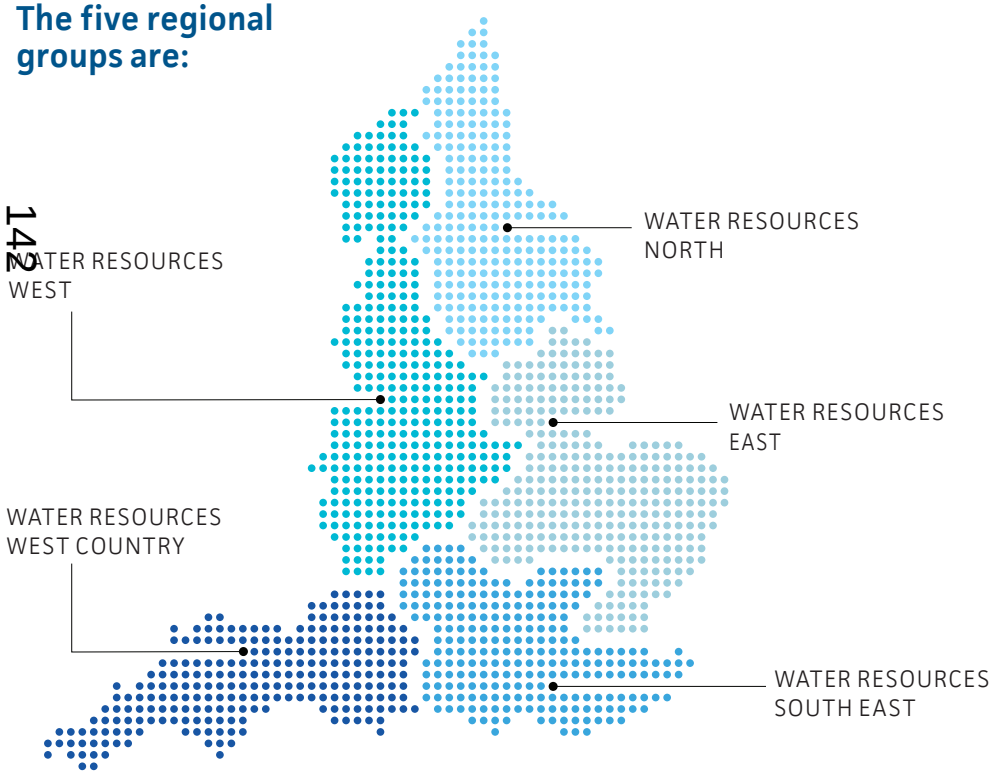
Becoming the first UK water company to publish a 25-year plan for the environment.

How we created our plans

Since our last plan in 2019, there's been a new approach to water resource management planning.

This has involved water companies across the south east region working together to create a region-wide plan first, through the Water Resources South East alliance. This has been mirrored across the country too, giving us a national picture of water resources for the first time.

The five regional groups are:



The regional plan has been the starting point for our company plan, and takes into account:

- Population growth
- protection of the environment
- dry weather/drought resilience
- climate change.

We've worked with more groups and individuals than ever before, in more ways than ever before, to create a draft plan that will meet future requirements.

Our customers, colleagues and community groups, as well as local authorities, environmental organisations, other water companies and various stakeholder groups, have all had input into our plan.

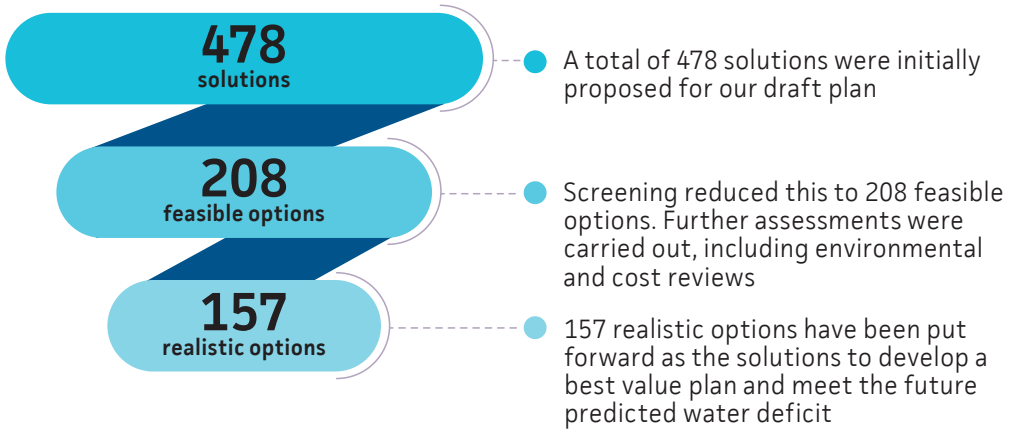
We've gathered information from customer surveys and focus groups and carried out further research to find out customer preferences and priorities.

Feedback from this summer's Temporary Use Ban (hosepipe ban) has also given us useful insight and we'll add any further learnings from this event as we continue to develop our plan.

The options considered look to tackle the future predicted water deficit by:

- Ensuring the most efficient use of water through further leakage reductions and water efficiency initiatives
- developing catchment and nature-based schemes that improve the water sources we rely upon
- creating a new network that can move water around the region and improving the connectivity of our existing network
- providing new sources that provide sustainable and resilient supplies.

As a result of all the information and insight gathered:



Alongside the best value regional plan, we have also developed our own alternative plan. This is because we believe there are alternatives to the options selected which could improve resilience and bring environmental and social enhancements earlier.

What does our plan say?

The regional best value plan

Our draft plan sets out the investment needed between 2025 and 2075 to secure clean drinking water supplies for years to come.

Key priorities include:

- Finding and fixing even more leaks using the latest technology. We remain on target to reduce leaks by 15 per cent by 2025
- a commitment to reduce our 2017/18 leakage levels by 50 per cent by 2050, and continue to make more reductions by 2075
- investing £2.2 billion over the next 50 years to build large-scale infrastructure projects such as reservoirs, water recycling plants and desalination schemes
- investing £2.1 billion by 2050 to drive down leaks and reduce water use
- reducing the amount of water we remove (abstract) from the environment by 158 million litres a day by 2050 to support thriving habitats
- supporting our customers to reduce demand for water through, for example, smart metering and water efficiency initiatives
- reducing household water use down to 112 litres per customer, per day by 2050 through a focus on changing long-term water use behaviour.

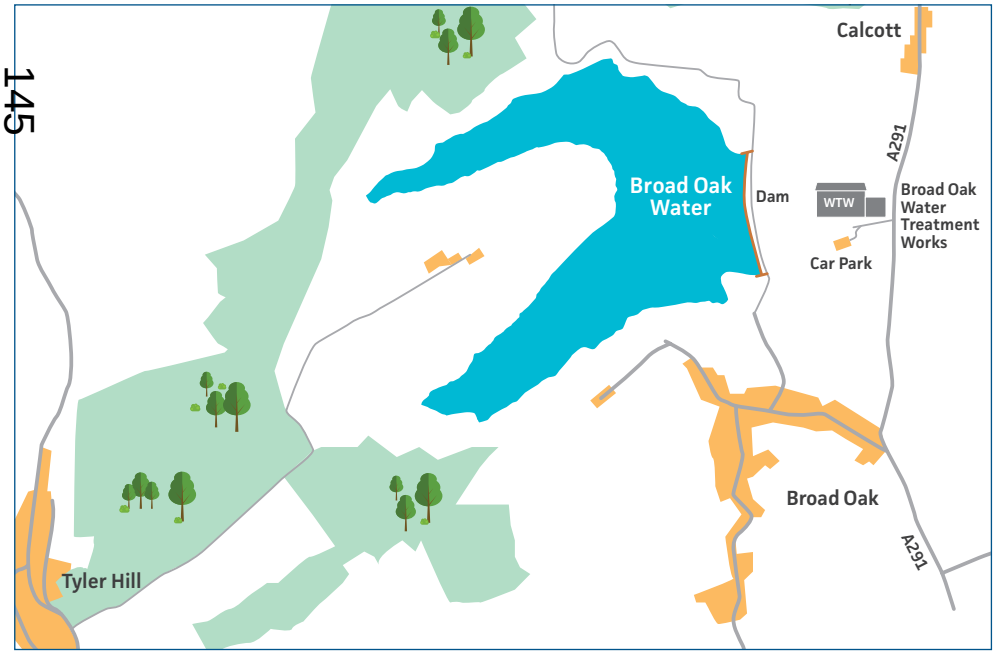
Our alternative plan

We've also built on the regional plan to create an alternative plan. This involves delivering some of our solutions earlier than proposed in the regional plan and also includes more added environmental value and wider benefits for the communities we serve.

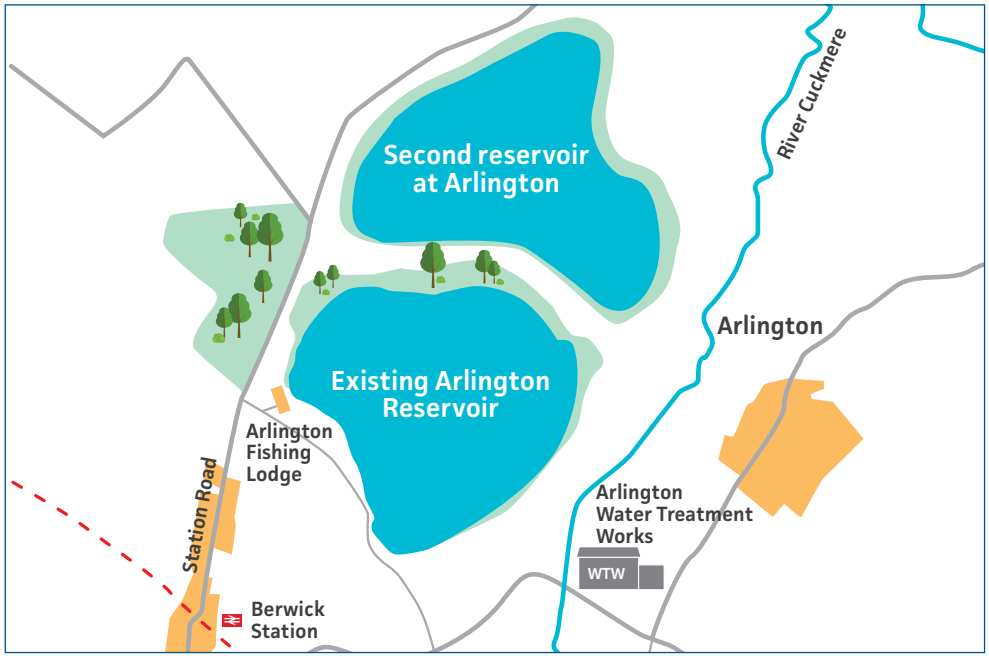
Our plan includes shorter term and longer term supply options that will help us to avoid a deficit in our supply and demand of water, while making sure we meet the needs of our customers and the environment during the 50-year lifespan of our plan.

Our alternative plan includes:

- Bringing forward plans to build Broad Oak Reservoir in Kent in 2033 instead of 2036 to provide an additional 22 million litres of water a day.



- A second reservoir at Arlington in East Sussex in 2041 to provide an additional 18 million litres of water a day, to be delivered instead of our proposed recycling facility at Peacehaven water treatment works.



- Bringing forward or, in some cases, introducing a series of new pipelines to transport additional volumes of water around our supply area.

New shorter term supply options in our draft best value and alternative plan – 2025 to 2040

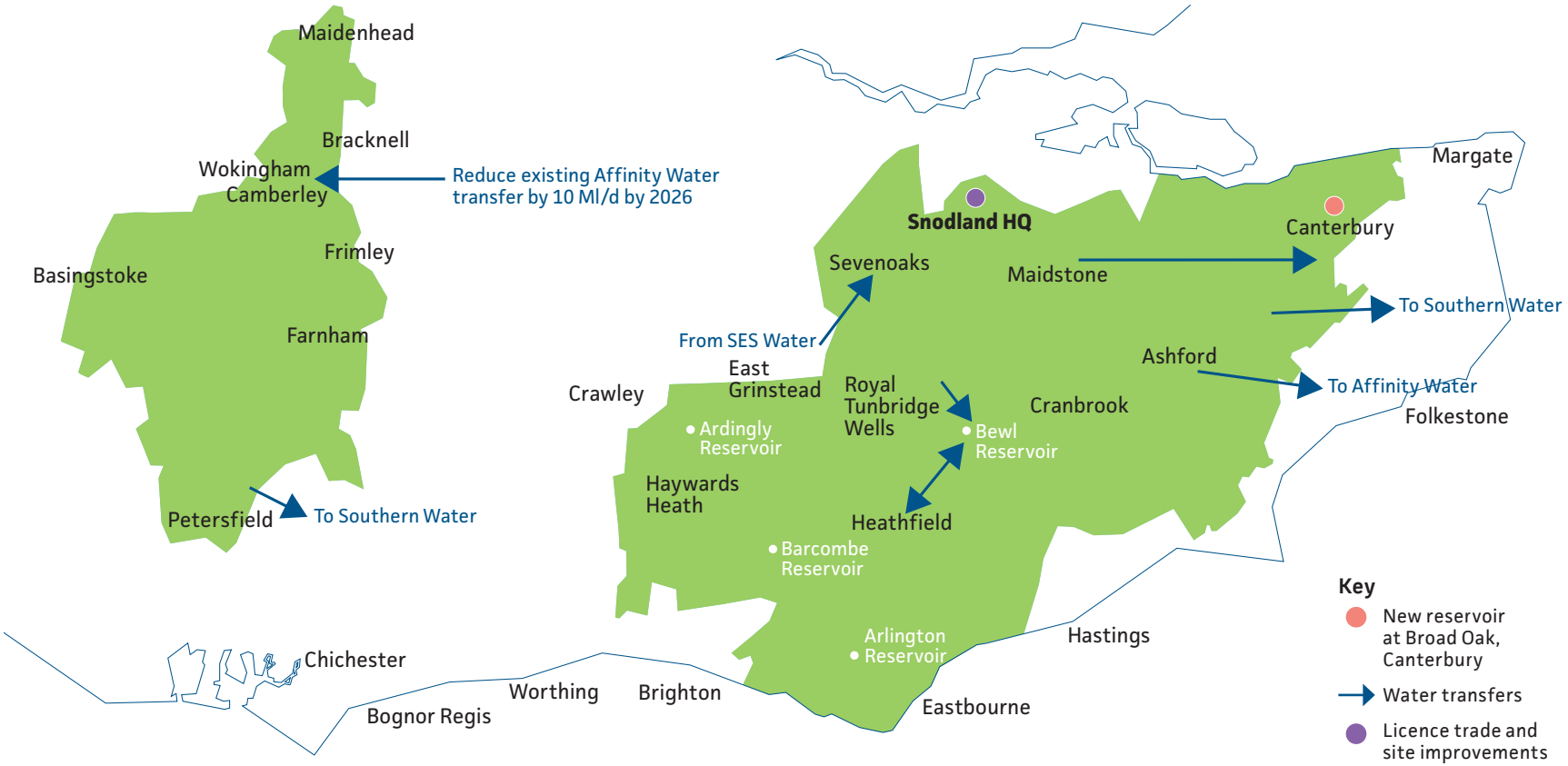
Options include:

- Developing new water transfer schemes to and from other water companies
- building a new reservoir at Broad Oak in Canterbury (Kent) by 2033 or 2036 and pipe network improvement schemes to distribute the water
- new company water transfer schemes between our own water resource zones
- developing a new groundwater source in Maidstone (Kent) through a licence trade and local network improvements
- sub-zonal schemes to improve our network connectivity.

Reducing leakage
by 36% by 2040*

Reducing customer demand
to 124 litres a day by 2040

*% Reduction (from 2017/18 levels)



New longer term supply options in our draft best value and alternative plan – 2041 to 2075

Options include:

- Developing new water transfer schemes to and from other water companies
- two new company water transfer schemes between our own water resource zones
- better complementary use of surface and groundwater sources on the River Ouse in Haywards Heath (West Sussex)
- developing a new water recycling facility to treat effluent from Peacehaven water treatment works in Eastbourne (East Sussex) by 2041
- upgrading an existing groundwater source in Ashford (Kent) and local network improvements
- building a new desalination scheme at Reculver in Ashford (Kent) and improvements to network connectivity by 2046
- building a new reservoir at Broyle Place, or Arlington (East Sussex) by 2075
- improvements to water pipe connectivity across our supply area.

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Reducing leakage
by 50% by 2050, then 56% by 2075*

Reducing customer demand
to 112 litres a day by 2050

*% Reduction (from 2017/18 levels)

Have your say

We would now like to hear your views about our draft plan and our alternative plan.

We've produced several documents containing more detailed information about our future plans, which can be found online at

southeastwater.co.uk/futurewater

There's also an online form, which sends your feedback directly to us and to the Department for Environment, Food and Rural Affairs (Defra), on our consultation hub at:

getinvolvedsoutheastwater.uk.engagementhq.com/wrmp24

We recognise that some of you may prefer, or need, to view hard copies of the documents instead. You can do this at our offices:

South East Water
Rocfort Road
Snodland
Kent
ME6 5AH

South East Water Scientific Services
Orion Building
3 Columbus Drive
Southwood
Farnborough
Hampshire
GU14 0NZ

We are open:
Monday to Friday: 9am to 5pm
Closed on Saturday and Sunday.

You can also send any comments directly to the Secretary of State for the Department for Environment, Food and Rural Affairs using the details below.

By email:
water.resources@defra.gov.uk

By post:
Water Resources Management Plan
Water Services
Department for Environment, Food and Rural Affairs
Seacole 3rd Floor
2 Marsham Street
London SW1P 4DF

The consultation will run for 14 weeks, the closing date is available on our website.

Thank you for your interest in our draft Water Resources Management Plan. We hope you have found it interesting and we look forward to receiving your feedback.

What happens next?

When the consultation closes, we'll consider all the feedback we receive.

We'll then prepare and publish a statement of response. This will cover all the comments made, how we've considered them, and whether we've made any changes to our plan as a result.

At the same time, we'll publish a revised plan which will include any changes we've made.

Both the statement of response and the revised plan will be submitted to Defra and published on our website.

Anyone commenting on our draft plan during the current consultation period will automatically be informed when we publish our statement of response and revised plan.

Facebook and Twitter: @sewateruk

@officialsewateruk

Find out more about our draft Water Resources Management Plan:
southeastwater.co.uk/futurewater

Our vision is to be the water company people want to be supplied by and want to work for.

Briefing note for full Council 20th July 20

Item 14: Notice of motion – Water Quality

The proposed motion highlights a range of concerns in relation to water quality, including:

- Waste - water discharges into rivers and seas
- Impact on wildlife and on human health
- Reported quantity of sewage spills into the River Medway
- The impact of new development on sewage and wastewater treatment systems
- The cumulative impact of new development and the existing pressures on water courses

The motion then invites full Council to make resolutions in relation to 8 different matters. For ease of reference for Members, these 8 points are set out below together with responses in order to assist members in formulating a view.

It is worth noting at the outset here that whilst the Council will undoubtedly have influence on the issues at the heart of the proposed motion, its direct powers are more focussed around the management of new development rather than existing development (Point 1 below). The Community Protection Team also has certain direct powers around private drainage and misconnections to surface water drainage networks which outflow into water courses, but this is mainly small scale and domestic in nature.

It is the utility providers and regulatory bodies that do have responsibility for water management (Southern Water and Environment Agency)

1. Recognise this Council's obligation to protect its streams and rivers, including from the cumulative impacts of pollution, in line with its local planning policy and the National Planning Policy Framework.

The Council has no powers within either local planning policy or the national planning policy framework to influence the impacts of existing development. However, if the above wording were to specifically reference the impacts of new development, then the Council can seek to influence this as part of local planning policy and development management functions within the context of the national planning policy framework –

Set out below are the relevant aspects of national planning policy and emerging local planning policy that are relevant to water quality.

National planning policy as articulated through the National Planning Policy Framework (2021) sets out the Governments approach to planning policies and planning decisions. Within the document the following paragraphs set out the Government's approach to water management, especially wastewater:

- *Paragraph 20 (b) – Strategic Policies in Local Plans should consider wastewater infrastructure*
- *Paragraph 34 – plans should set out the developer contributions needed for infrastructure, including water management*
- *Paragraph 174(e) – planning policies and decisions should not contribute to pollution, including water pollution, and should improve water quality.*

Within the adopted Maidstone Local Plan 2011-2031 the Council has policies to manage a development's impact on water. These include policies to minimise a development's water pollution impact (Policy DM3 Natural Environment) and improve water efficiency (Policy DM2 Sustainable Design).

In the submitted Local Plan Review the Council has developed policies to manage growth in a way that will try to mitigate its impacts on the rivers and streams. This has been done through the management of pollution impacts and better water efficiency. The relevant proposed policies are listed below:

Maidstone Local Plan Review 2022-2037

- *Policy LPRSP14(a) Natural Environment*
- *Policy LPRSP14(c) Climate Change*
- *Policy LPRQ&D1 Sustainable Design*

In addition to the above, the council works with the utility providers and regulatory bodies that do have responsibility for water management (Southern Water and Environment Agency) to develop the relevant infrastructure projects to support the growth proposed in the Local Plan and Local Plan Review. These are set out in the Infrastructure Delivery Plan and are updated annually as part of the monitoring process.

2. **Recognise that there is clear evidence of deterioration of water quality due to cumulative impacts of multiple sewage discharge events or 'sewerage overload'.**

Members may well choose to confirm that they recognise the issues described in this point and to request that it is a matter explored with the relevant agencies through the scrutiny process (see point 6 below).

3 Ensure that an evidence base is compiled that assesses the cumulative impact of sewage discharges so that this is factored into decisions made in new iterations of the local plan, including the overall level of future development.

The Council has no control over the monitoring of discharges or cumulative impacts thereof and would not be in a position to compile the suggested evidence base.

However, this might also be a matter for the scrutiny process (point 6 below) to explore with the relevant agencies in order to encourage the compilation of the data requested – at which point officers could establish how this might be considered in developing policy.

4. **Seek to better understand the cumulative impact of wastewater discharges, including untreated sewage, on our local rivers, wildlife and the health of our residents.**

5. Continue to take a lead on addressing this issue, working constructively with other agencies and local authorities.

Points 4 and 5 are possibly best considered jointly. Undoubtedly, it is appropriate for the Council to seek to better understand the matters at the heart of this motion, albeit with limited direct controls other than in relation to new development. Therefore, one of the most effective mechanisms in seeking to obtain information will be working collaboratively with other local authorities and agencies in order to lobby, obtain information from, and seek to influence the relevant statutory or regulatory bodies.

Point 6 below, refers to the fact that this issue is on the work programme for the Overview and Scrutiny Committee and the benefits of joint working in order to increase the levels of knowledge, understanding and influence around this matter may well be something that members would wish to recommend forms part of that work.

6. **Ask the Overview and Scrutiny Committee to invite the Chief Executive of Southern Water plus senior representatives from the Environment Agency and Natural England to attend a meeting to answer questions on the current levels of CSO and sewage plant discharge.**

   This matter has been confirmed as a subject area for the Overview and Scrutiny Committee to consider.

7. **Ask Southern Water, from this date onwards, in its planning consultation responses for major developments, to clarify which treatment works will be managing the sewerage; whether it has the information available to assess the impact on the number or duration of sewage discharges into local rivers or seas, and if it does have this information to share it (noting that this can only be requested not required).**

   Under Section 106 of the Water Industry Act 1991, land owners enjoy the right to connect up ("communicate") with the mains drainage system. The quality of the discharge from treatment works is regulated by the Environment Agency so Southern Water regularly have their licenses reviewed with the treatment works being the subject of WINEP (Water Industry Natural Environment programme) five-yearly reviews.

   The Development Management function could request information in relation to treatment works etc, but water companies would not be bound to provide this and in the absence of contextual information, it would not be possible to base a recommendation to Committee upon it. The notable exception here are the areas (River Sour Catchment for Maidstone) which are impacted by Natural England Guidance around Nitrate and Phosphate levels, in which planning decisions are necessarily based on detail around how these levels will be managed and kept within the confines of guidance.

8. **Request that planning officers, from now onwards, include in all reports relating to major development a specific section on the impact on watercourses, including the potential for the development to affect sewage outflow into watercourses (ie. cumulative impact), or to flag if this information is not fully available, so that this information (or the lack of it) is clearly and transparently set out.**

   Clearly, some of the points above, not least the inclusion of this topic on the work programme for the Overview and Scrutiny Committee, will assist both Members and Officers in developing their knowledge, and thus their ability to influence this important topic.

   It nonetheless remains important that, in presenting reports to Members, Officers are qualified in providing advice or views around the particular impacts of specific actions. Therefore, other than the controls provided within the existing policy framework (see point 1 above) it is unlikely that officers will be in a position in relation to the majority of matters around sewage outflow, and impacts thereof, to provide the detail of information referred to in this point. Moreover, were officers to attempt to do this by way of either a narrative or referencing specific impacts, this could leave decisions based on or influenced by this information open to challenge.

As the following webpages couldn’t be converted to PDF documents, please use the below links to access the pages:

SERT – Environmental Land Management Schemes

Environmental Land Management Schemes (ELMS) - South East Rivers Trust

SERT – Natural Flood Management in the river Medway

Natural Flood Management in the Medway - South East Rivers Trust

WATER MANAGEMENT CYCLE

BRIEFING ON ROLE OF MAIDSTONE BOROUGH COUNCIL

This briefing note describes a number of activities and interventions of Maidstone Borough Council relevant to the Water Management Cycle. It is not intended as an exhaustive description of all the ways in which the Council interacts with the Water Management Cycle. However, by describing specific actions carried out by MBC it will give an indication of the contribution that the Council can make.

The note covers the following areas:

- Flood resilience
- Development management
- Emergency planning
- Biodiversity and climate change

1. Flood resilience

This area of work has acquired a much higher profile since the floods of 2013/14 in the Maidstone area. Initially, there was a focus on potential large-scale interventions, such as flood barriers. However, it is now recognised that flooding can take many forms, and a wide range of resilience measures are appropriate, including developing the capacity of the community to respond to flood emergencies, maintenance of watercourses, natural flood management, household-scale flood defences as well as infrastructure improvements. The following describes initiatives on which Maidstone Borough Council has led or has participated as part of the Medway Flood Partnership.

Expansion of Leigh Flood Storage Area (FSA)

The Leigh FSA is located in Tonbridge & Malling, upstream of Maidstone. The Environment Agency proposes to increase the storage capacity of the existing FSA by carrying out works which will allow water to be stored to a greater depth. They will also construct an embankment in Hildenborough to prevent flooding from the River Medway. The works are intended to reduce flood risk to approximately 230 homes. The total cost will be £21 million.

There is no direct benefit to communities downstream, but Maidstone Borough Council is a statutory consultee and has commented on the scheme, which has now (November 2022) received planning permission.

Middle Medway Flood Resilience Scheme

This scheme involved the installation of Property-level Flood Resilience (PFR) measures for properties at very significant risk of flooding. 256 homes in the area of the Medway / Teise / Beult confluence have benefited. The scheme was co-ordinated by the Environment Agency, with MBC supporting engagement with the local communities. The scheme received government funding up to £7,500 per property through Flood Defence Grant in Aid (FDGiA) with additional funding provided by the Southern Regional Flood and Coastal Committee (SRFCC).

Mote Park Lake

Following the mandatory 10 year review under the Reservoirs Act 1975 of the Mote Park Lake reservoir in 2014, the Council received recommendations for measures in the interests of safety. The measures advised that the spillway capacity of the lake be increased to reduce risk of failure of the dam due to overtopping, to as low as reasonably practicable.

Accordingly, works were carried out in 2020 comprising a 50m wide auxiliary spillway, an abutment formed with grass covered articulated concrete blocks and a wave wall. A certificate under Section 10(6) of the Reservoirs Act 1975 was issued by a member of the All Reservoirs Panel which has been accepted by the Environment Agency, ensuring that the Council's legal obligations for the works have been discharged. A final element in the works, concerning the sluice gates, has recently been completed.

Medway Street Flood Barrier

The Council has developed a scheme to manage flood risk in the area of Medway Street, Maidstone. The scheme was originally conceived as part of the Bridges Gyratory Scheme. Prior to construction of this scheme, there had been flooding in the Lower High Street area, which was attributed to the flow of water through the subways beneath the A229. As a consequence, the two subways either side of the High Street were blocked up. The Medway Street subway, which also acts as a conduit for flood water to reach the lower High Street area, was kept open as it was considered important to retain pedestrian access to the riverside. However, this led to a residual flood risk, which it is now proposed to address by means of a glass flood barrier in place of the existing pedestrian barrier opposite Drakes, with additional returns constructed to contain flood water.

Development of the scheme has unfortunately been much delayed, in spite of agreement in principle in 2017 by KCC and the Council to go ahead with it. The East Kent Engineering Partnership has now been appointed as Employer's Agent for the works and has secured an additional £100,000 funding from the SRFCC which will enable the project to be delivered in 2023.

Maintenance

Maintaining watercourses, drains and sewers is essential to minimise the risk of flooding. Kent County Council is the Lead Local Flood Authority (LLFA) for the area and has the prime responsibility for co-ordinating this work. Maidstone Borough Council works closely with the relevant officers at KCC to identify and address problems in our borough. We hold a small budget of £30,000 per annum which allows us to carry out drainage works and maintenance works to ordinary watercourses. Normally these works would be the responsibility of the landowner, but in some situations it is more cost-effective to fund the work ourselves rather than relying on enforcement action.

Natural Flood Management

Natural Flood Management (NFM) is the alteration, restoration or use of landscape features to reduce flood risk to properties. There are a wide range of techniques

used including small 'leaky dams', new hedgerows, river bank restoration, targeted tree planting and techniques to hold water temporarily on land to 'slow the flow', reduce and delay flood peaks and store more water away from homes. As well as helping to reduce flood risk, NFM techniques also provide wider social and environmental benefits by improving the environment and wildlife for people to enjoy.

The Council has part-funded an NFM scheme, carried out by the South East Rivers Trust (SERT), to manage flood risk along the Hogg Stream (also known as School Stream) in Headcorn. SERT engaged with landowners in the area and obtained agreement to install NFM structures to help mitigate flooding downstream. Specifically, a flood storage pond has been created and a number of Leaky Woody Structures have been installed.

Approval was given by Policy & Resources Committee in 2021 for a further NFM scheme, which involves the development of a 2.2 hectare wetland on unproductive farmland that lies South of Carpenters Lane in Staplehurst. This scheme is currently going through the planning approval process.

Community Resilience

Notwithstanding the erection of physical flood resilience measures, communities in areas at risk need to be prepared, particularly as incidents of flooding become more frequent and unpredictable. For example, in summer 2021 there were a number of incidents of flash flooding, in areas which had not seen flooding in recent memory.

MBC can help build community resilience. We have provided advice and guidance to parish councils to enable them to develop community flood plans. We maintain a stock of sandbags and stand ready to distribute them as necessary. The council's emergency response arrangements include specific provision for potential flooding incidents over the winter months.

2. Emergency Planning

The Flood and Water Management Act 2010 gives the Environment Agency (EA) a strategic overview of the management of flood and coastal erosion risk. It also gives upper tier local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas. Kent County Council is the lead local flood authority exercising these the responsibilities in our area.

Maidstone Council is also a risk management authority, which provides a statutory basis for the work carried out by the Council and described above under 'flood resilience'. Specifically, in relation to emergency planning, we work together with other local authorities as a member of the Kent Resilience Forum to manage flood risk in emergency situations.

3. Development Management

As part of the National Planning Policy Framework (NPPF), the Council maintains a Strategic Flood Risk Assessment (SFRA). This is considered as part of the Local

Plan Review process. It provides flood risk evidence and sets out a long-term strategy to support the management and planning of development, protect the environment, deliver infrastructure and promote sustainable communities within the Local Plan Review area.

It also supports the selection of site allocations in the emerging Local Plan Review and provides information and guidance to be used in the preparation of Flood Risk Assessments in support of site-specific planning applications.

4. Biodiversity and Climate Change

The Council has a Biodiversity and Climate Change Action Plan. Within this, a series of actions respond to the need to adapt to Climate Change. These include many of the measures described above which address flood risk.

MG/01.12.2022

PLOS ONE

RESEARCH ARTICLE

Urban centre green metrics in Great Britain: A geospatial and socioecological study

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Abstract

Green infrastructure plays a vital role in urban ecosystems. This includes sustaining biodiversity and human health. Despite a large number of studies investigating greenspace disparities in suburban areas, no known studies have compared the green attributes (e.g., trees, greenness, and greenspaces) of urban *centres*. Consequently, there may be uncharacterised socioecological disparities between the cores of urban areas (e.g., city centres). This is important because people spend considerable time in urban centres due to employment, retail and leisure opportunities. Therefore, the availability of—and disparities in—green infrastructure in urban centres can affect many lives and potentially underscore a socio-ecological justice issue. To facilitate comparisons between urban centres in Great Britain, we analysed open data of urban centre boundaries with a central business district and population of $\geq$100,000 ($n = 68$). Given the various elements that contribute to 'greenness', we combine a range of different measurements (trees, greenness, and accessible greenspaces) into a single indicator. We applied the normalised difference vegetation index (NDVI) to estimate the mean greenness of urban centres and the wider urban area (using a 1 km buffer) and determined the proportion of publicly accessible greenspace within each urban centre with Ordnance Survey Open Greenspace data. Finally, we applied a land cover classification algorithm using i-Tree Canopy to estimate tree coverage. This is the first study to define and rank urban centres based on multiple green attributes. The results suggest important differences in the proportion of green attributes between urban centres. For instance, Exeter scored the highest with a mean NDVI of 0.15, a tree coverage of 11.67%, and an OS Greenspace coverage of 0.05%, and Glasgow the lowest with a mean NDVI of 0.02, a tree cover of 1.95% and an OS Greenspace coverage of 0.00%. We also demonstrated that population size negatively associated with greenness and tree coverage, but not greenspaces, and that green attributes negatively associated with deprivation. This is important because it suggests that health-promoting and biodiversity-supporting resources diminish as population and deprivation increase. Disparities in green infrastructure across the country, along with the population and deprivation-associated trends, are important in terms of socioecological and equity justice. This study provides a baseline and stimulus to

Medicine, Dentistry and Health Sciences Research Fellowship., Dr Suzanne Mavoa University of Sheffield, Open Access publishing agreement with PLOS ONE, Dr Jake M. Robinson and Dr. Paul Brindley.

Competing interests: The authors have declared that no competing interests exist.

help local authorities and urban planners create and monitor equitable greening interventions in urban/city centres.

Introduction

It is projected that nearly 70% of the world's population will be living in towns and cities by 2050 [1]. The process of urbanisation places considerable pressure on biodiversity and human health [2]; for example, by degrading habitats and increasing harmful pollutants such as gases (e.g., nitrogen dioxide, sulphur dioxide, ozone) and particulate matter [3].

Evidence shows that green infrastructure, including trees, hedgerows, green roofs, and parks, plays a vital role in urban ecosystem integrity [4, 5]. This includes sustaining biodiversity. For example, many animals rely upon the resources associated with semi-natural habitats (e.g. vegetation communities provide nutrition and refuge for invertebrates, birds, mammals, reptiles and amphibians). Green infrastructure can provide habitat corridors and connections to the broader landscape, allowing animals, plants, and microbes to disperse and exchange genes [6, 7]. Additionally, green infrastructure provides a range of human health and wellbeing benefits. Indeed, street trees can reduce the negative health impacts associated with the urban heat island effect, and hedgerows can act as pollution barriers [8, 9]. Greenspaces provide supportive environments for recreation [10], conviviality, and creativity [11]. These urban green attributes can also reduce stress and anxiety [12], provide positive affect [e.g., 13], and potentially help regulate the immune system via interactions with environmental microbiota [14, 15].

Studies assessing the presence and impacts of urban green attributes typically focus on the places where most people reside, such as suburban zones [16–18]. Several studies have also used remote sensing-based green cover identification methods in cities. For instance, NDVI is widely used to estimate green cover in urban areas [19, 20], and the Enhanced Vegetation Index (EVI) has also been used [21]. NDVI is considered more sensitive to leaf chlorophyll concentrations via the red spectral band (620–670 nm), while EVI more sensitive to canopy structure and leaf area via the near-infrared (NIR) band (840–875 nm) [22]. Ordnance Survey's (Britain's national mapping agency) Open Greenspace data is also widely used in urban greenspace studies to explore the distribution of publicly accessible greenspaces [23, 24]. However, no known studies have comparatively assessed the urban green attributes of urban/city *centres* using multiple metrics–although studies have assessed individual green attributes across the wider suburban area [e.g., 25, 26].

Many people from diverse backgrounds spend considerable time (e.g. for employment, shopping, and recreation) in urban centres [27]. Therefore, urban centres are places where populations from otherwise socioeconomically disparate areas merge and mingle. However, little is known about the equity of green infrastructure provision in city centres. Disparities in this infrastructure could underscore an important socio-ecological justice issue, with some populations gaining the benefits of healthy urban ecosystems and others enduring the disbenefits of poor green infrastructure provision. The same applies to biodiversity––i.e., it is important to understand potential disparities in wildlife-supporting habitats in city centres. Considering these factors, we argue that more emphasis should be placed on mapping and enhancing the green attributes (e.g., trees, broader vegetation cover, and publicly accessible greenspaces such as parks) of urban cores/centres. In doing so, there is considerable potential to provide a range of positive health benefits to many people across the socioeconomic spectrum via the augmented provision of health-promoting green features such as urban forests

and recreational greenspaces. There is also potential to enhance biodiversity and interspecies health.

Urban centres can be challenging to define due to being complex socioeconomic systems that evolve with expanding and contracting spatial and compositional extents [28–30]. Past research has defined urban centres based on land-use plans [27] or postcodes [31]. Yet, there is no consistent and robust dataset for GB-wide urban centres using these approaches. However, we identified an established, standardised approach using the Consumer Data Research Centre's (CDRC) national-level geodata packs [32].

Objectives

The main objectives of this study were to: **(a)** define urban centres in Great Britain (GB) (Northern Ireland was excluded due to data unavailability); **(b)** map and characterise the green attributes of urban centres in Great Britain (based on three different metrics for robustness: greenness as defined by the NDVI—a remote sensing metric; tree coverage; and publicly accessible greenspaces such as parks and sports fields), and provide a table of rankings to establish vital baseline data; **(c)** determine whether the level of greenness within urban centres is reflected across the wider urban area (1 km radius); **(d)** determine whether there is a relationship between the size of the urban area (as a whole) and level of green attributes within the urban centre, and **(e)** determine whether there is a relationship between relative deprivation and level of green attributes within urban centres. These objectives allowed us to map and understand potential disparities in green infrastructure provision in Great British urban centres. To achieve these aims, we applied a range of geospatial methods, including the manipulation of data from a density spatial clustering of applications with noise (DBSCAN), along with the normalised difference vegetation index (NDVI), the i-Tree Canopy land classification algorithm, and OS Open Greenspace data.

Materials and methods

GB urban centre boundaries

To define the boundaries of GB urban centres (Fig 1), we used the CDRC's national-level geodata packs to acquire boundaries and centroids for retail centres [32]. The data were produced from the 2015 local data company's (LDC) retail units location dataset. CRDC built these retail centre boundaries using the Graph-DBSCAN clustering method [29]. This method implements a sparse graph representation of retail unit locations based on a distance-constrained k-nearest neighbour adjacency list that is decomposed using the Depth First Search algorithm [29].

We used the Retail Centre Typology (2018) linked with the CDRC boundaries. This multidimensional taxonomy of retail and consumption spaces focuses on four domains: (1) the composition of spaces; (2) the diversity of spaces; (3) the function of spaces; and (4) the economic vitality of the centres [32]. We used filters to select the CDRC retail centre typology "*premium retail and leisure destinations of semi-regional importance*". This typology is classed as the highest level regional urban centre based on the above criteria. The other inclusion criterion was the selection of retail boundaries within settlements with a population size of at least 100,000. This helped to reduce highly skewed comparative scenarios, e.g. comparing the small city of St David's in Wales (population size: <1,500) with Birmingham in England (population size: >1,000,000). We used QGIS version 3.4 [33] and ArcGIS version 10.8 [34] to import the CDRC.gpkg file and extract the retail centre boundary layers by using in-built algorithms, creating new feature layers (geopackageFeatureTable). QGIS was used to create shapefiles from these boundary features in new vector layers (Layer > New > New Shapefile Layer) and to

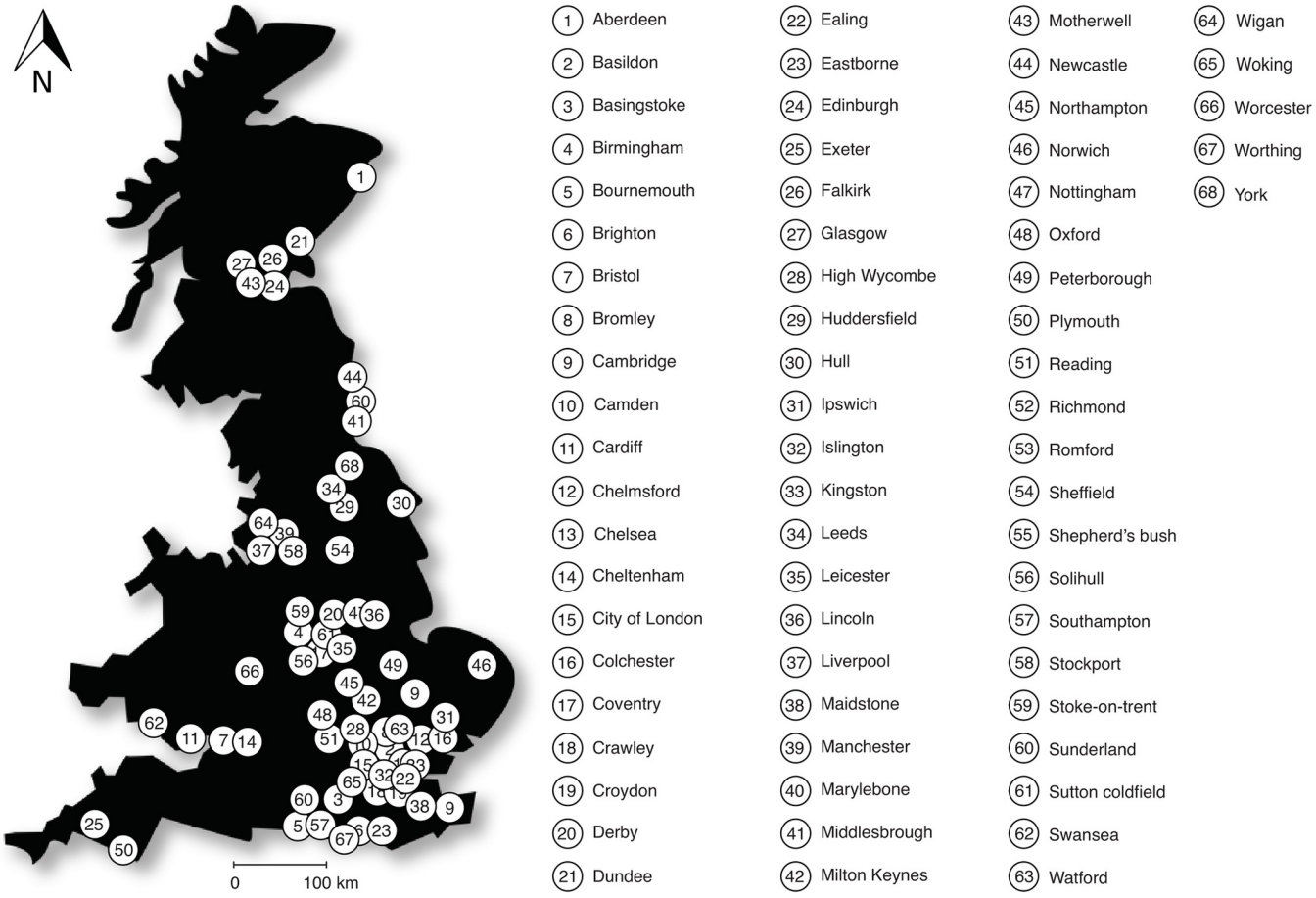

Fig 1. Distribution of the 68 GB urban centres. These comprise 59 in England, 3 in Wales, and 6 in Scotland. Urban centres are listed in alphabetical order. The outline of the GB map was from www.pixabay.com and used under a CC-BY-4.0 licence.

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process the geospatial data. We acquired population data from the Office for National Statistics NOMIS web portal [35]. Population estimates were based on 2011 Census data (which uses OS Built-Up Area boundaries; [36]) and were downloaded as a.csv file and integrated into the urban centre attribute tables in ArcGIS via the Add Join algorithm (Data Management). We excluded urban centres in Northern Ireland due to a lack of appropriate spatial data to define urban boundaries and greenspaces.

Mean greenness

To estimate the mean greenness of each GB urban centre, we acquired the Copernicus Sentinel-2 atmospherically-corrected satellite imagery (10 m resolution). The Sentinel-2 satellite collected this dataset in 2019, and it was downloaded by the researchers from the EDINA Digimap Service in August 2020 [37]. The Sentinel-2 images used were cloud-free composites collected on various dates and sourced across the calendar year 2019. We acquired spectral bands 4 (Red) and 8 (Near Infrared) and applied the Normalised Difference Vegetation Index equation as follows:

$$\mathrm{NDVI} = \frac{Near\ Infrared - Red}{Near\ Infrared + Red}$$

This equation provides a score of between -1 to 1. The score provides an estimation of land-cover greenness (a proxy for chlorophyll output), where -1 represents a very low level of greenness and 1 represents a very high level of greenness. This 'greenness' score has been used as a proxy for vegetation biomass and vegetation cover in other green infrastructure and geospatial studies [38, 39], hence being considered suitable for this study (whilst recognising other indices are available). In QGIS, we created an algebraic expression to process the raster (.tif) files, i.e. the two Sentinel-2 spectral band layers: red and near-infrared using the algebraic expression calculator. Using the zonal statistics raster analysis tool, we calculated the mean NDVI values (with negative values removed as they may represent water bodies) for all areas within the predefined GB urban centre boundaries. We also calculated the mean NDVI values of radial buffers spanning 1 km from the urban centre boundaries (e.g., by importing the Sentinel 2 files, creating new polygon layers and using the Raster Calculator expressions: applying the NDVI formula ("band 8"–"band 4") / ("band 8" + "band 4") for each tile and saving as.tif). The urban centre boundaries were clipped out in ArcGIS using a cookie-cutter approach (via Vector > Geoprocessing tools > Clip). This allows us to compare an urban centre to its context and potentially account for any residual bias remaining from the standardisation of NDVI values across the country.

Tree canopy coverage

To estimate tree canopy coverage in the urban centres, we used the land classification algorithm tool i-Tree Canopy [40], which has been used in previous urban greenspace studies [41–43]. The urban centre boundaries were loaded into i-Tree Canopy. This web-based tool enabled random sampling points (at least 300 points per boundary) and selection of tree canopy cover metrics, which is overlaid with Landsat 8 2020 satellite imagery. The i-Tree Canopy tool provides a graphical and map output with land cover classification metrics, including % cover and area (ha) with standard error. For city-level assessments such as our urban centre boundaries, 300 random points with a standard error of <2% are recommended [34]. These conditions were met for each of the 68 urban boundaries in this study.

Greenspace attributes

To determine greenspace presence, type, number of greenspaces, and area in each GB urban centre, we downloaded and imported the OS Open Greenspace dataset (data version April 2020) [44]. This dataset contains data for publicly accessible urban greenspaces in GB. Before analysis, we removed all greenspaces classified as sports/leisure facilities due to the high level of grey space (e.g. buildings such as leisure centres and carparks) and a low level of greenspace. See S1 Table for a full breakdown of OS Greenspaces in each urban centre. Using vector geoprocessing tools and the field calculator within QGIS, we calculated metrics on the abundance and area (m^2) of publicly accessible OS Greenspaces that occurred within each of the 68 urban centre boundary layers. Specifically, we used the Intersection Tool with both layers as input layers. This resulted in a layer which contains every polygon inside the urban centre boundary, and the attribute table contains all attributes from both input layers, including a number of polygons. Using the field calculator, the '$area' operator was used to calculate the area of each urban centre boundary.

Relative deprivation

To assess whether relative deprivation was associated with the level of green attributes in urban centres, a measure of deprivation was generated for each urban area using the 2019 local authority district summaries Index of Multiple Deprivation (IMD; [45]). Three urban centres

fell across multiple local authority districts. In these cases, weighting of deprivation was undertaken based on the area of the district. Area, as opposed to population, was used for the weight as the focus of this work—urban centres—are inherently a blend of both populated and non-populated geographic areas. The IMD provides an output of relative deprivation based on a multivariate analysis of demographic data such as crime risk, health, economics, living environment, and education. Deprivation could only be tied to the 60 English urban centres as different incompatible data exist for the other countries of Great Britain.

Ranking and statistical analysis

Statistical analysis was carried out in R and SPSS, with supplementary software including Microsoft Excel (for.csv file processing and constructing the parallel coordinate plot). To assess potential relationships between the green attributes (tree cover, greenness, OS Greenspaces) with population size, deprivation and urban centre area, we used the non-parametric Spearman's Rank Correlation Coefficient test in R. This was because the data were non-normally distributed––which was confirmed using histograms and Quantile-Quantile probability plots. Correlation tests were conducted using the cor.test function in R, and ggplot2 was used to create scatterplots.

To determine the ranks for urban centre green attributes, principal component analysis (PCA) was used to combine the three different measures of greenness (NDVI, tree cover, and OS Greenspaces) into a single measure for comparison across urban centres. Analysis was undertaken within SPSS (version 26). To test the robustness of the PCA approach—comparisons were made with a standard Z-score approach. To do this, we obtained the mean and standard deviation values for each variable and used the mutate function in R to generate Z-scores. This was carried out using the tidyverse package dplyr (version 4.0.2; [46]). Ranks for each urban centre were generated using Z-scores for individual green attributes (tree cover, greenness, OS Greenspaces), and summed ranks were generated to provide an index of overall scores. Spearman's Rank correlation was used, which identified a very strong association between the PCA single greenness measure and Z-score output (df = 64, $R_s = 0.99$, $P = <0.01$). The PCA was chosen as the preferred method as it accounts for the degree of interrelationship between variables (particularly evident between the NDVI and tree cover measures and which could lead to double counting certain components within the Z-score approach).

The following flowchart (Fig 2) summarises the workflow for the experimental design including data collection parameters, decision making and analysis.

Results

Overall urban centre ranking for green attributes

The PCA identified a single factor with an eigenvalue above 1.0, accounting for just over 70% of the variance in the three input greenness measures. The loadings were: Urban centre μ NDVI 0.94; Tree cover (%) 0.87; and OSGS (%) 0.68. This demonstrated a strong correlation between variables, particularly between the NDVI and tree cover measures. Based on the results of the PCA rankings for each of the green attributes (tree cover, greenness, OS Greenspace), the urban centre of Exeter in Devon, England, was the greenest (out of 68), with a mean NDVI of 0.15 (ranked 1 overall), a tree coverage of 11.67% (ranked 2 overall), and an OS Greenspace coverage of 0.05% (ranked 3 overall) (Fig 3).

The values for each of the green attributes for each urban centre are listed below in Table 1. It is interesting to note that at least the top 5 ranked urban centres are all located in the south of England, and the bottom 5 ranked urban centres all relate to ex-industrial areas in the north of Great Britain.

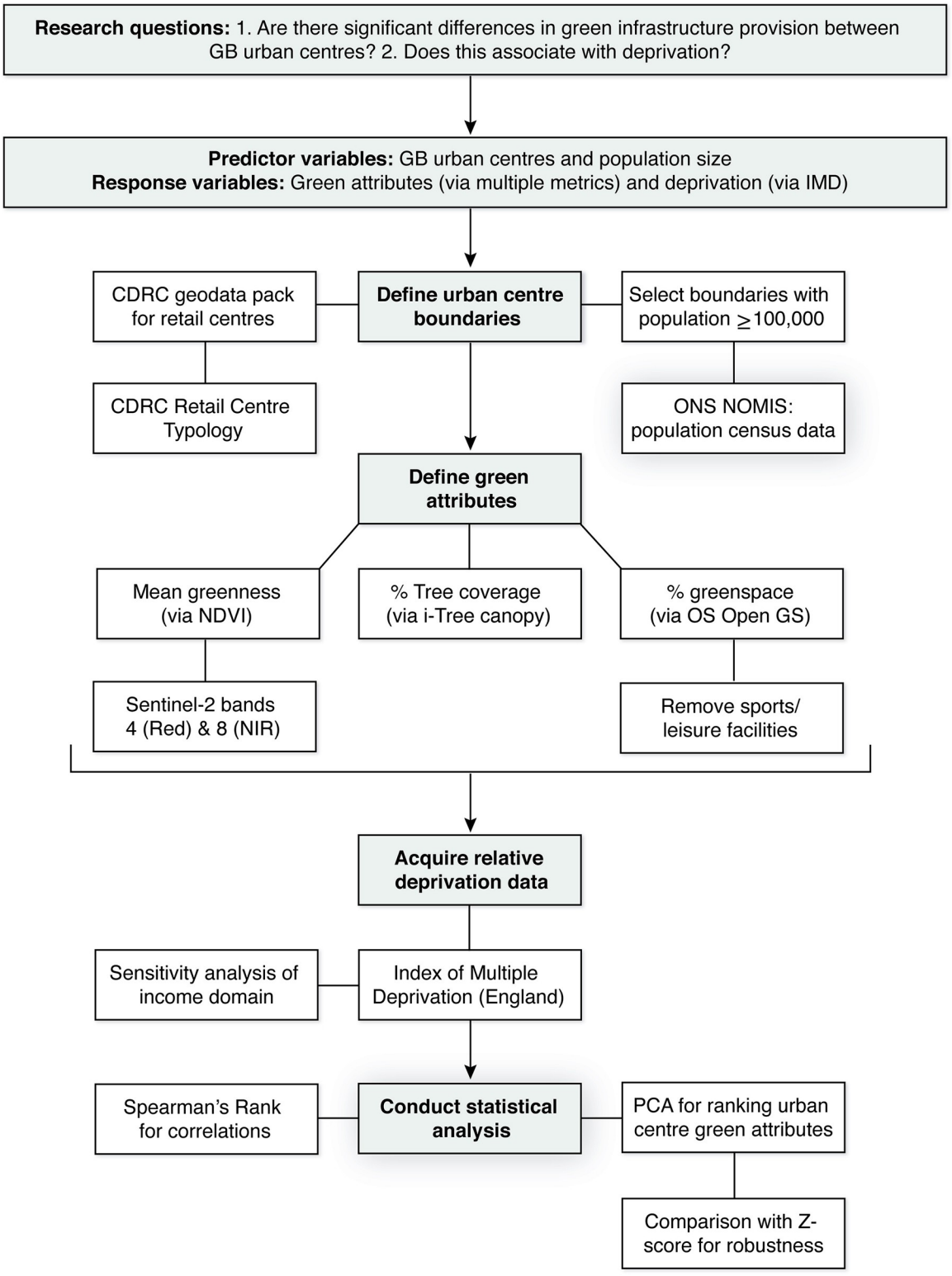

Fig 2. Project workflow.

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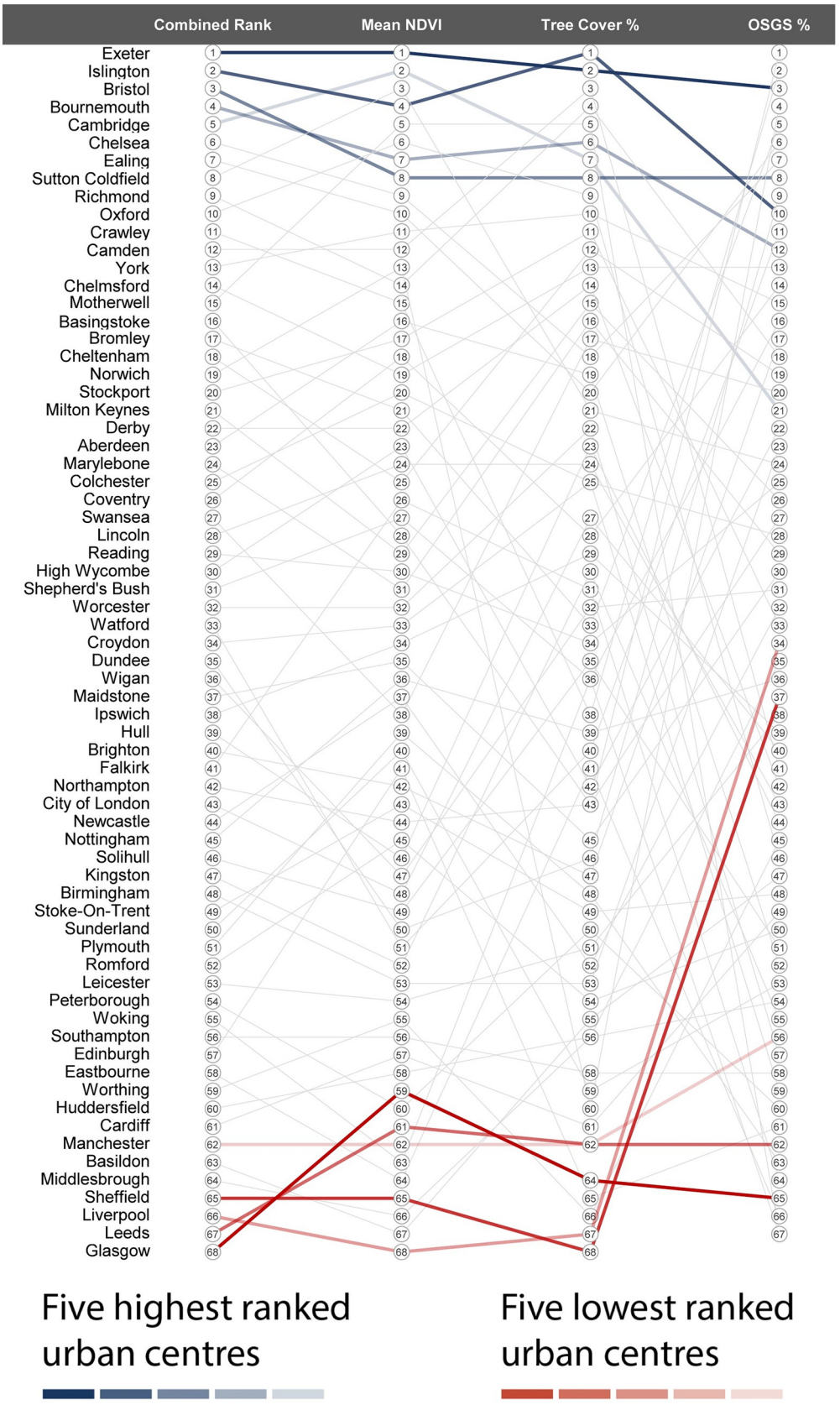
Combined Rank
Mean NDVI
Tree Cover %
OSGS %
Exeter
Islington
Bristol
Bournemouth
Cambridge
Chelsea
Ealing
Sutton Coldfield
Richmond
Oxford
Crawley
Camden
York
Chelmsford
Motherwell
Basingstoke
Bromley
Cheltenham
Norwich
Stockport
Milton Keynes
Derby
Aberdeen
Marylebone
Colchester
Coventry
Swansea
Lincoln
Reading
High Wycombe
Shepherd's Bush
Worcester
Watford
Croydon
Dundee
Wigan
Maidstone
Ipswich
Hull
Brighton
Falkirk
Northampton
City of London
Newcastle
Nottingham
Solihull
Kingston
Birmingham
Stoke-On-Trent
Sunderland
Plymouth
Romford
Leicester
Peterborough
Woking
Southampton
Edinburgh
Eastbourne
Worthing
Huddersfield
Cardiff
Manchester
Basildon
Middlesbrough
Sheffield
Liverpool
Leeds
Glasgow
Five highest ranked urban centres
Five lowest ranked urban centres

Fig 3. Parallel coordinate plot showing all the selected GB urban centres in descending order of their combined green attribute ranking (based on the PCA)–with Exeter in the top position. The chart also highlights the top 5 ranking urban centres (in blue), the bottom five ranking urban centres (in red), and the ranks for individual green attributes. OSGS = OS Greenspace.

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Comparing greenness (NDVI) in urban centres with the wider urban area (1 km radius)

As mentioned, one objective was to determine whether the level of greenness within urban centres is reflected across the wider urban area (1 km radius). Our results show a moderate positive correlation between the level of greenness within urban centres and that of the 1 km wider urban area (df = 64, R_s = 0.49, P = <0.01). Fig 4 highlights the five most green and five least green urban centres. Fig 5 shows a quadrat scatter plot, which indicates the distribution of the correlation data points. It also provides a visual output to comparatively assess the differences within and between urban centres. For example, Liverpool ranked relatively low on both NDVI values for the urban centre and the 1 km radius (μ NDVI = 0.01 and 0.12, respectively) thus Liverpool is in the bottom left quadrat. This quadrat indicates below mean NDVI values for both urban centre and 1 km radius. Whereas Sutton Coldfield ranked highly on both NDVI values for the urban centre and 1 km radius (μ NDVI = 0.15 and 0.69, respectively), thus, Sutton Coldfield falls in the top right quadrat. Woking ranked highly for NDVI values for a 1 km radius but low for an urban centre (μ NDVI = 0.02 and 0.60, respectively); thus, Woking is in the top left quadrat. Whereas Bristol ranked highly as an urban centre but relatively low for 1 km radius (μ NDVI = 0.13 and 0.30, respectively), thus, Bristol falls in the bottom right quadrat.

The mean urban centre NDVI was strongly associated with % tree coverage (df = 64, R_s = 0.80, P = <0.01) (S1 Fig).

Urban centre size (population and area) and level of green attributes

Our results show a relationship between the urban centre population size and level of greenness and tree coverage, but not between population size and publicly accessible greenspaces. There was a moderate negative correlation between population size with three of our different greenspace measures: level of greenness within urban centres (df = 64, R_s = -0.28, P = 0.02); greenness of the wider urban area (1 km radius) (df = 64, R_s = -0.39, P = <0.01); and tree coverage (df = 64, R_s = -0.34, P = <0.01). However, there was no association between population size and area of OS Greenspace (df = 64, R_s = -0.12, P = 0.30) (Fig 6).

Our results reveal no relationship between the urban centre area and level of urban centre greenness (df = 64, R_s = -0.20, P = 0.10), 1 km greenness (df = 64, R_s = -0.05, P = 0.65), and tree coverage (df = 64, R_s = -0.15, P = 0.20), but do show a relationship between urban centre size and publicly accessible greenspaces. There was a moderate negative correlation between urban centre area (m^2) and area of OS Greenspace (df = 64, R_s = -0.35, P = <0.01) (Fig 7). The influence of a small number of data points on this relationship, however, should be noted.

Relative deprivation and level of green attributes

For English urban centres, the correlation between the PCA greenness measure and index of multiple deprivation showed a weak to moderate negative relationship (df = 58, R_s = -0.36, P = <0.01)–whereby more deprived urban centres were found to be generally less green (Fig 8).

In order to explore any potential effects of intercorrelation (due to the IMD measure including measures related to accessibility), sensitivity analysis was undertaken using the

Table 1. GB urban centres and their green attribute scores in alphabetical order.

Urban Centre	Urban centre μ NDVI	Urban centre NDVI (Z-score)	1 km μ NDVI	1 km NDVI (Z-score)	Tree cover (%)	Tree cover (Z-score)	OSGS (%)	OSGS (Z-score)	PCA greenness
Aberdeen	0.09	0.66	0.33	-0.18	8.48	1.87	0.01	2.68	0.45
Basildon	0.01	-1.31	0.44	0.74	2.67	2.77	0.01	1.07	-1.21
Basingstoke	0.07	0.10	0.49	1.16	4.32	1.38	0.06	1.33	0.91
Birmingham	0.03	-0.83	0.21	-1.19	2.88	1.45	0.02	0.89	-0.71
Bournemouth	0.13	1.59	0.57	1.83	10.37	1.41	0.03	0.24	1.64
Brighton	0.05	-0.50	0.22	-1.11	3.91	0.92	0.02	1.51	-0.35
Bristol	0.13	1.56	0.30	-0.43	10.15	0.73	0.04	1.63	1.86
Bromley	0.09	0.50	0.54	1.58	5.53	-0.25	0.04	2.70	0.80
Cambridge	0.15	2.22	0.50	1.24	10.25	1.74	0.02	0.30	1.61
Camden	0.11	1.09	0.34	-0.10	11.49	1.19	0.01	0.46	1.07
Cardiff	0.02	-1.06	0.17	-1.53	2.05	-0.46	0.01	3.28	-1.18
Chelmsford	0.09	0.56	0.42	0.57	9.00	0.48	0.03	0.12	1.01
Chelsea	0.12	1.38	0.22	-1.10	8.68	1.33	0.04	-0.49	1.56
Cheltenham	0.08	0.30	0.48	1.10	9.07	1.81	0.02	-0.44	0.66
City of London	0.04	-0.72	0.16	-1.61	6.06	1.02	0.01	0.82	-0.43
Colchester	0.09	0.56	0.42	0.57	6.15	-0.08	0.02	1.90	0.39
Coventry	0.09	0.57	0.30	-0.43	6.05	1.52	0.02	-1.32	0.38
Crawley	0.10	0.77	0.56	1.75	5.00	-1.17	0.05	1.97	1.10
Croydon	0.06	-0.25	0.38	0.23	6.15	1.04	0.01	0.30	-0.19
Derby	0.09	0.50	0.31	-0.35	8.97	1.06	0.01	-0.25	0.51
Dundee	0.04	-0.72	0.21	-1.19	4.00	0.08	0.03	0.52	-0.20
Ealing	0.12	1.28	0.44	0.74	8.09	0.99	0.04	0.08	1.48
Eastbourne	0.02	-1.22	0.35	-0.01	4.48	1.01	0.00	-0.47	-1.11
Edinburgh	0.05	-0.49	0.33	-0.18	1.94	0.94	0.00	0.29	-1.10
Exeter	0.15	2.28	0.42	0.57	11.67	0.94	0.05	-0.05	2.54
Falkirk	0.07	0.23	0.40	0.40	5.57	0.85	0.00	-0.70	-0.40
Glasgow	0.02	-1.08	0.27	-0.68	1.95	0.11	0.00	0.04	-1.44
High Wycombe	0.08	0.38	0.50	1.24	4.44	-0.20	0.02	0.46	0.05
Huddersfield	0.02	-1.07	0.41	0.49	2.50	0.28	0.01	-0.49	-1.12
Hull	0.04	-0.65	0.20	-1.27	6.74	-0.42	0.01	0.15	-0.34
Ipswich	0.05	-0.29	0.42	0.57	6.00	-0.09	0.01	0.12	-0.32
Islington	0.14	1.80	0.29	-0.52	14.52	-0.56	0.03	1.27	2.30
Kingston	0.03	-0.81	0.33	-0.18	5.79	-0.41	0.01	0.91	-0.57
Leeds	0.02	-1.09	0.21	-1.19	2.00	0.33	0.00	-0.80	-1.43
Leicester	0.03	-0.84	0.24	-0.94	3.16	0.06	0.01	-0.40	-0.92
Lincoln	0.08	0.37	0.32	-0.26	6.67	-0.59	0.01	0.30	0.10
Liverpool	0.01	-1.47	0.12	-1.95	1.06	0.30	0.01	-0.49	-1.42
Maidstone	0.05	-0.30	0.40	0.40	4.24	-0.06	0.02	-1.02	-0.30
Manchester	0.02	-1.14	0.19	-1.36	2.00	-0.49	0.01	-0.11	-1.18
Marylebone	0.06	-0.03	0.28	-0.60	8.76	-0.07	0.02	-0.16	0.39
Middlesbrough	0.01	-1.30	0.21	-1.19	2.50	-0.46	0.01	0.04	-1.23
Milton Keynes	0.07	0.03	0.51	1.33	8.92	-0.32	0.02	-0.29	0.53
Motherwell	0.13	1.75	0.38	0.23	10.58	0.11	0.00	-0.92	0.93
Newcastle	0.05	-0.36	0.37	0.15	3.06	0.08	0.02	-0.44	-0.46
Northampton	0.04	-0.54	0.30	-0.43	4.32	-0.86	0.02	-0.18	-0.41
Norwich	0.11	1.09	0.38	0.23	2.10	-0.10	0.04	-0.64	0.58

(*Continued*)

Table 1. (Continued)

Urban Centre	Urban centre μ NDVI	Urban centre NDVI (Z-score)	1 km μ NDVI	1 km NDVI (Z-score)	Tree cover (%)	Tree cover (Z-score)	OSGS (%)	OSGS (Z-score)	PCA greenness
Nottingham	0.05	-0.36	0.37	0.15	4.75	-0.92	0.01	0.13	-0.48
Oxford	0.13	1.64	0.41	0.49	10.00	0.00	0.01	-0.80	1.10
Peterborough	0.02	-1.09	0.35	-0.01	3.51	-0.68	0.01	-0.58	-0.99
Plymouth	0.05	-0.38	0.25	-0.85	3.83	-0.62	0.00	-1.02	-0.85
Reading	0.07	-0.01	0.33	-0.18	5.50	-0.83	0.02	-0.39	0.08
Richmond	0.10	0.88	0.43	0.65	11.29	-0.95	0.02	-0.63	1.18
Romford	0.04	-0.55	0.37	0.15	2.78	-1.13	0.01	-0.74	-0.86
Sheffield	0.02	-1.28	0.33	-0.18	0.33	-1.04	0.01	-0.28	-1.40
Shepherd's bush	0.07	0.14	0.26	-0.77	5.14	-1.30	0.02	-0.49	0.03
Solihull	0.04	-0.72	0.63	2.34	5.45	-1.22	0.01	-0.95	-0.51
Southampton	0.03	-0.95	0.18	-1.44	2.22	-0.20	0.01	-1.32	-1.04
Stockport	0.09	0.59	0.31	-0.35	9.14	-0.72	0.01	-0.95	0.53
Stoke-on-Trent	0.04	-0.53	0.32	-0.26	3.62	-0.98	0.01	-0.51	-0.75
Sunderland	0.05	-0.38	0.25	-0.86	2.21	-1.20	0.01	-0.61	-0.82
Sutton Coldfield	0.15	2.18	0.69	2.85	7.30	-1.10	0.02	-0.83	1.22
Swansea	0.05	-0.36	0.29	-0.52	8.75	-0.41	0.02	-.132	0.28
Watford	0.04	-0.75	0.37	0.15	4.50	-1.04	0.03	-0.77	-0.13
Wigan	0.04	-0.70	0.31	-0.35	5.56	-1.20	0.02	-0.80	-0.24
Woking	0.02	-1.16	0.60	2.08	5.14	-1.50	0.00	-0.27	-1.02
Worcester	0.06	-0.06	0.41	0.49	6.84	-1.20	0.01	-0.97	-0.10
Worthing	0.03	-0.84	0.27	-0.68	1.67	-1.73	0.01	-0.31	-1.11
York	0.11	1.26	0.35	-0.01	9.56	-1.22	0.02	-1.25	1.06

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Income domain component of the IMD. This analysis supported the previous findings, identifying a similar correlation between PCA greenness and deprivation (df = 58, Rs = -0.32, P = <0.01).

Discussion

In this study, we conducted the first comparative assessment of the green attributes of GB urban centres. This is important because most research in this area has focused on suburban green infrastructure. Understanding potential disparities in green infrastructure provision in urban centres is vital to producing strategies that promote socio-ecological equity.

We ranked urban centres in GB based on their level of greenness, tree coverage and publicly accessible greenspaces. Our results highlight significant disparities in urban centre green attributes across GB. We reveal a significant positive association between urban centre greenness and greenness of the wider urban area (1 km radius) and a significant negative association between population size and urban greenness and tree coverage. We also found a significant weak to moderate negative association between IMD scores (a measure of deprivation) and overall greenness. A deeper exploration of these trends in a socioeconomic, health, and biodiversity context is warranted, as disparities in urban semi-natural environments play an important role in ecological justice––the equal and fair distribution of environmental resources and benefits.

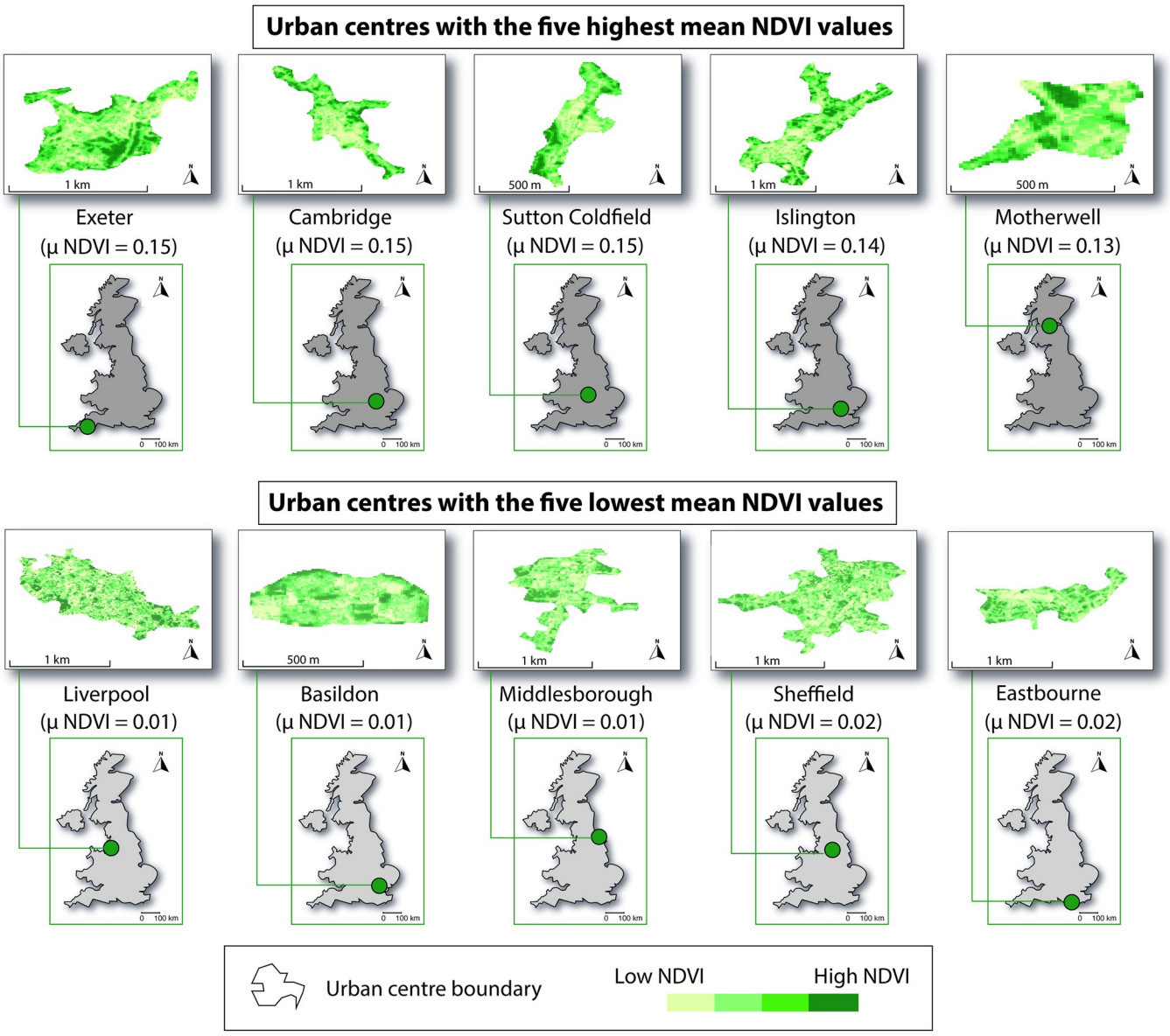

Fig 4. Urban centres with the five highest and five lowest NDVI values. The inset maps show the location of the corresponding urban centre in Great Britain. Map boundaries for the NDVI plots were generated in QGIS using the CDRC national-level geodata packs [32]. The figure is licensed under a CC BY 4.0 License.

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Urban centre green attribute ranking

The green attribute ranking process provides important baseline information. These data can help relevant stakeholders to monitor greening interventions in GB urban centres. They may also provide an incentive (particularly to the lower-ranked urban centres) to develop such interventions. Additionally, this process highlighted potential disparities in the presence/abundance of green attributes in urban centres across GB. This has important socioecological equity and justice implications, as green infrastructure is essential to human health and wellbeing. For example, spending time engaging with urban biodiversity is linked to reductions in stress and anxiety [39, 47, 48], improvements in positive affect [13], and immune regulation via

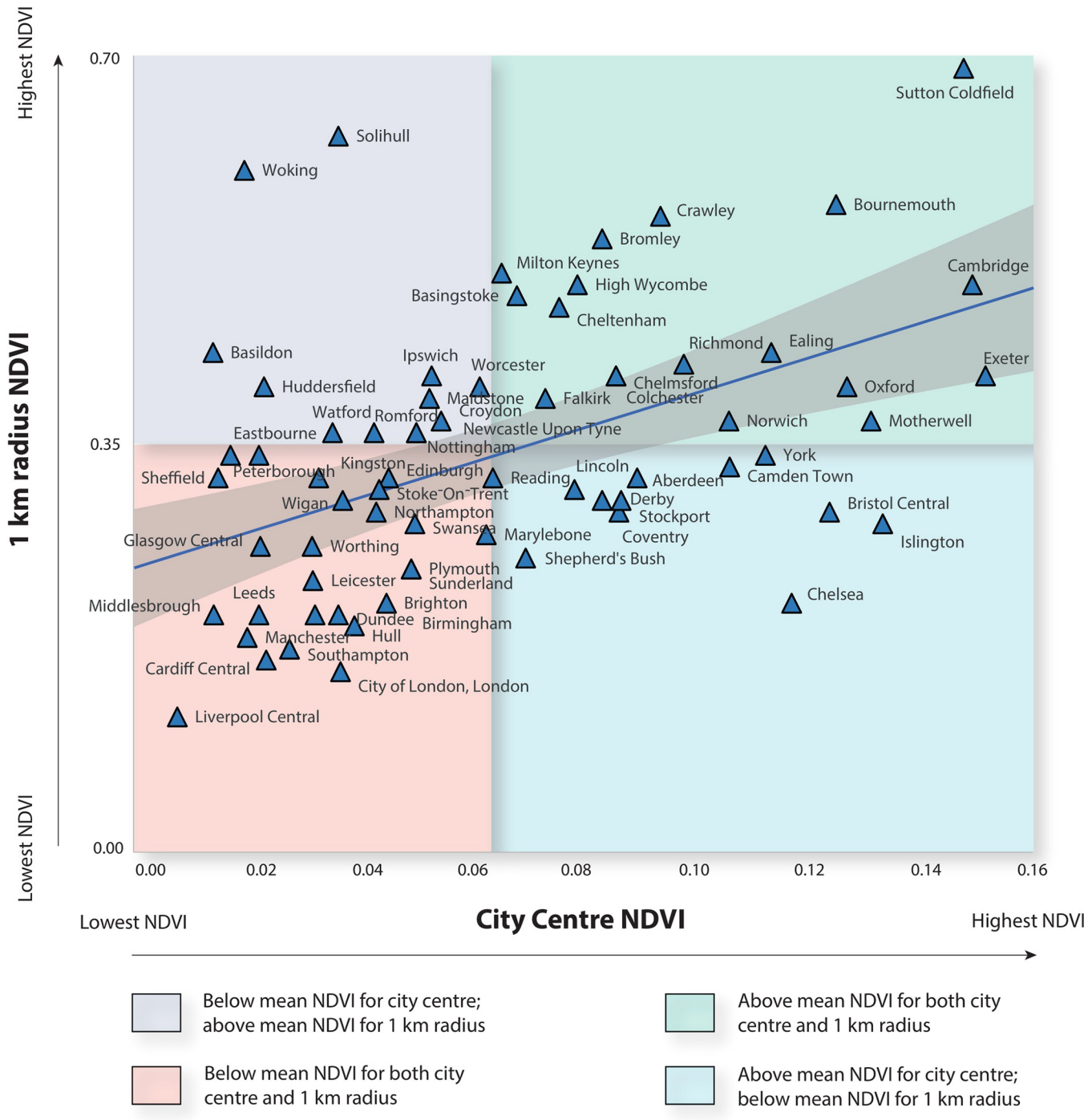

Fig 5. Quadrat scatterplot showing the correlation datapoints, highlighting the within and between urban centre differences in mean NDVI values for both urban centres and the 1 km radii.

https://doi.org/10.1371/journal.pone.0276962.g005

microbial exposure [14]. Moreover, green infrastructure provides vital ecosystem services such as stormwater attenuation [49], urban cooling and climate change mitigation [9, 50], and buffering against pollution [51]. Additionally, disparities in these semi-natural habitats have important implications for biodiversity conservation efforts. We live in an epoch characterised

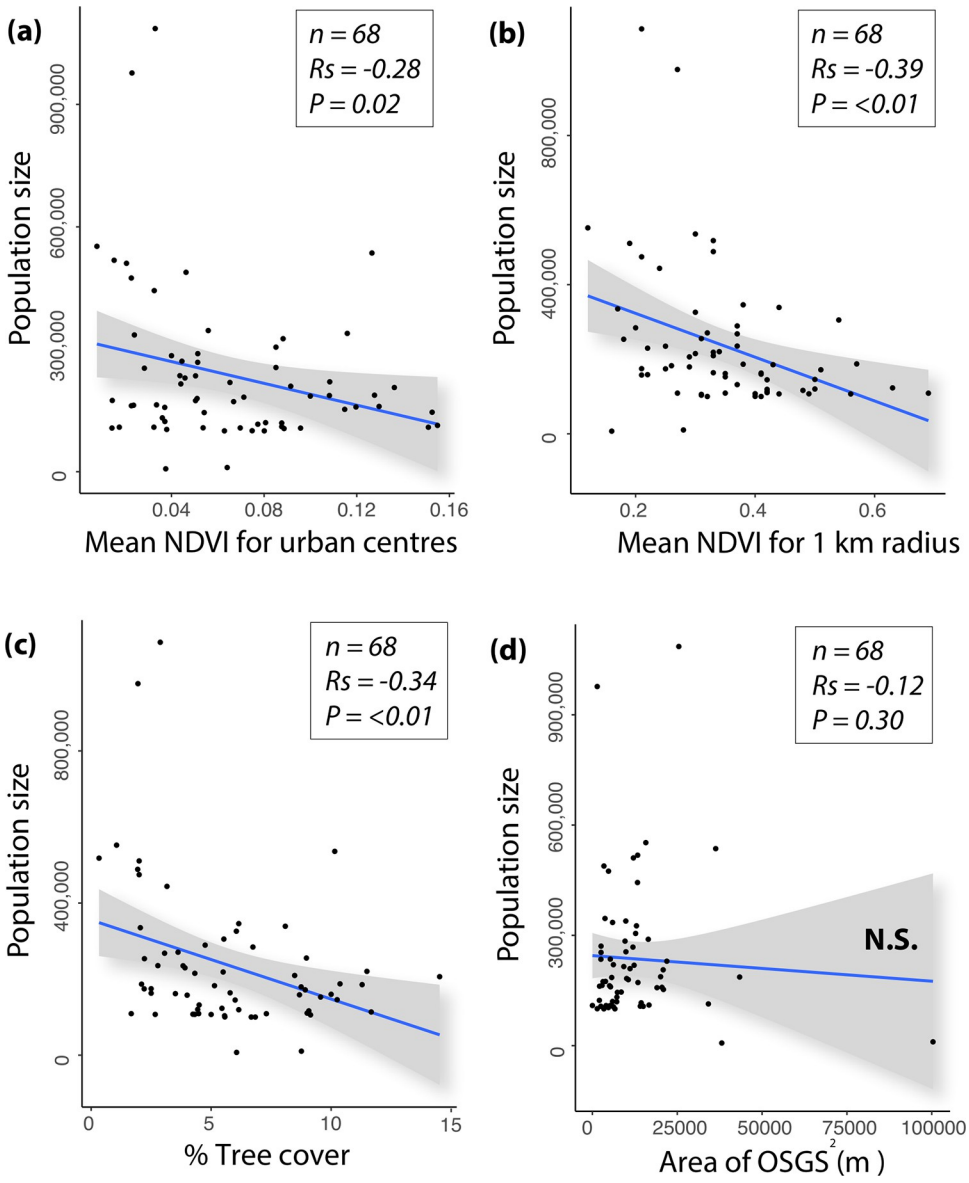

Fig 6. Correlation scatter plots for (a) population size and mean NDVI for urban centres; (b) population size and mean NDVI for 1 km radius; (c) population size and tree coverage; and (d) population size and area of OS Greenspace (OSGS). N.S. = not significant.

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by a biodiversity crisis, partly due to habitat loss, landscape fragmentation [52, 53], and other factors associated with urbanisation such as air and light pollution [54]. Therefore, biodiversity needs enhanced and contiguous ecological, infrastructural, and societal support across the landscape including in urban centres, which can be neglected as our study shows.

Although not formally part of the analysis in this study, it is interesting to note that at least the five highest-ranked urban centres (for combined green attributes) are situated in the south of England, and the five lowest-ranked urban centres are in the north of England. Although further research is needed, other reports have demonstrated a north-south divide in terms of the abundance of trees in the wider landscape [55] along with significant socioeconomic and health status disparities. For example, Buchan et al. (2017) examined data on all deaths in

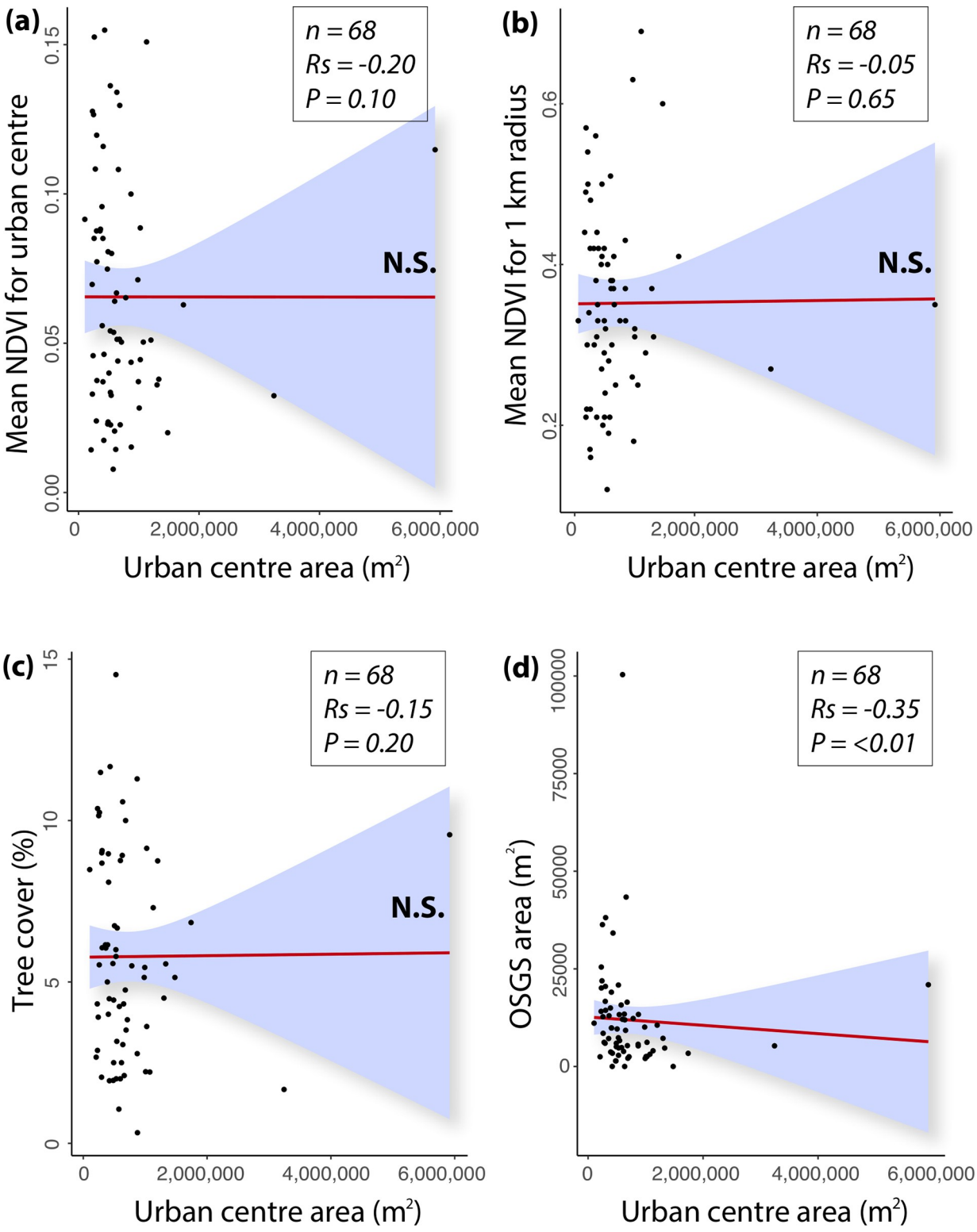

Fig 7. Correlation scatter plots for (a) urban centre area (m^2) and mean NDVI for urban centres; (b) urban centre area and mean NDVI for 1 km radius; (c) urban centre area and tree coverage, and (d) urban centre area and area of OS Greenspace (OSGS). N.S. = not significant.

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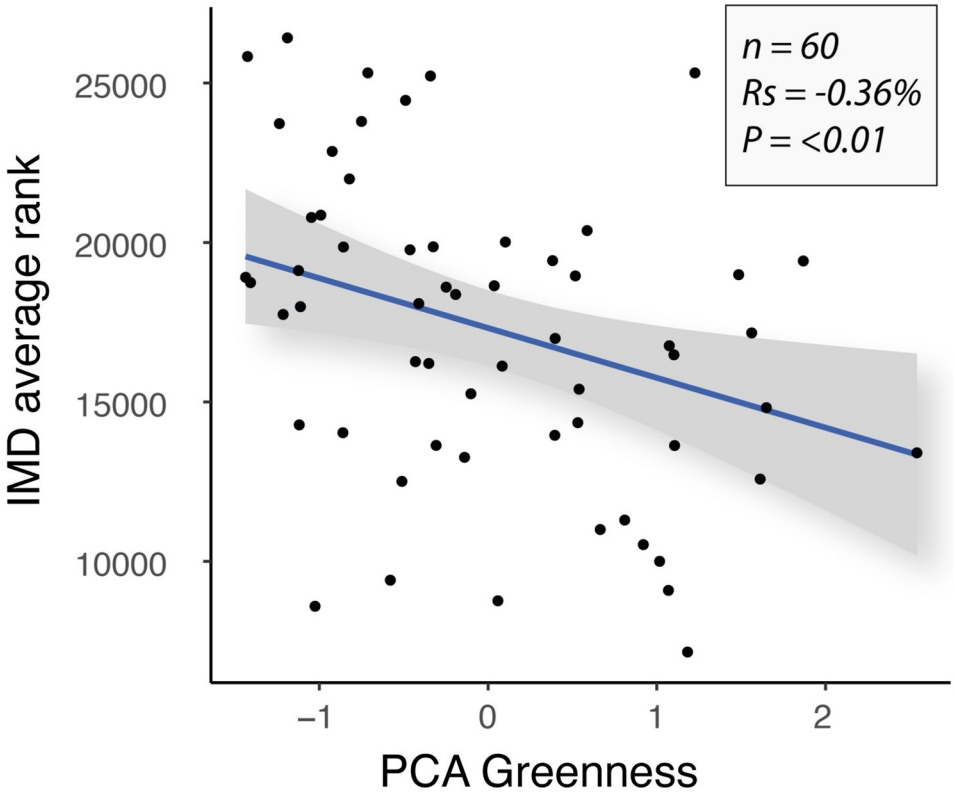

Fig 8. Correlation scatter plot for IMD average rank and PCA greenness (combined green attribute scores) for English urban centres only.

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England between 1965–2015 [56] and discovered a 20% higher risk of dying aged <75 in the north of England. Given that green infrastructure is important for human health, this potential disparity is worth investigating further.

Urban centres in Great Britain are changing, and retail outlets are closing, mainly due to the evolution of digital shopping technologies. This has been accentuated by the COVID-19 pandemic, which has devasted the traditional retail property sector [57], resulting in the popularisation of the term 'end of the high street'. New parks, habitat corridors, nature-rich recreational facilities, and vertical farms––which bring immense value to humans, wildlife, and climate change mitigation––could potentially replace certain disused retail properties and vacant lots. As Albert Einstein purportedly said, "*in the middle of difficulty lies opportunity*" [58]. The high street crisis certainly presents a difficulty. Re-envisioning and re-developing urban centres to include enhancements in green infrastructure and biodiversity presents a potentially important opportunity. Indeed, although this is pertinent across the board, our study reveals that some urban centres are significantly lacking in health-promoting and biodiversity-supporting green attributes compared to others. Therefore, from an urban centre perspective, we provide an important indication of where greening support is most needed in GB. This information can potentially be used by the UK government and/or city-level authorities to reduce socio-ecological inequity. For instance, Members of Parliament, urban planners, and campaigners in the lower-ranked urban areas can use our study as an impetus to improve the quality of urban centres in these areas, particularly in the light of the levelling up agenda of the current UK government. The study can also be used as a platform by international researchers to explore potential disparities in urban centre green attributes in other countries.

Urban centre and 1 km radius greenness (based on NDVI analysis)

We compared the results in the urban centres with 1 km radius to see if the greenness values were representative of the wider urban area. This provides additional valuable information on the distribution and potential disparities in green infrastructure provision across urban areas. For instance, it could indicate where planners/authorities should focus their greening efforts, and potentially central authorities could learn from the broader regions if disparities are recorded. It may also further emphasise the need to include urban centres in the bigger picture–as many studies focus on suburban areas (where people live) as opposed to the core (where many people spend much of their daily lives).

Our results show a moderate positive correlation between the level of greenness within urban centres and that of the wider urban area (1 km radius). This supports the hypothesis that greener urban centres, more broadly, may invest comparably more in the green attributes of their urban centres, whilst less green urban centres, more broadly, may invest relatively less. Yet it is likely that multiple drivers are leading to different levels of green attributes. Urban planning policy/strategy, policy implementation, supply-side constraints, political leadership, and other socioecological factors are likely important determinants of urban green infrastructure [59–61]. Future work should identify the multiple factors that impact urban centre greenness. This will provide foundational context to help understand how to improve and sustain the green attributes of lower-ranked urban centres. It could also be valuable to draw upon historical data to explore why some urban centres invested in parks and tree-lined avenues in the past. For example, in 19th century Britain, city planners often incorporated street trees. These decisions were influenced by the admiration of continental European boulevards and recognising the well-being benefits of 'garden cities' and 'spa towns' [62]. However, industry and war efforts contributed to urban sprawl and reduced natural features in certain urban centres, particularly in the North of Britain. Understanding both the historical and cultural context and community needs in the past and present, will likely be important to the success of future greening strategies. As Rotherham (2018, p.193) said:

> "*To really appreciate the importance of these trees [and other green attributes] and to understand how they should be managed, we need to recognise their historical and cultural significance*" [63].

With specific reference to NDVI greenness as a proxy for vegetation cover, the top 5 most green urban centres in this study were Exeter (Devon, England), Cambridge (Cambridgeshire, England), Sutton Coldfield (Birmingham, England), Islington (London, England), and Motherwell (Lanarkshire, Scotland). With the exception of Motherwell, these urban centres are considered to be relatively affluent [64], although deprivation may vary across wider geographic boundaries. Research has shown that the quality of greenspaces is higher in less socioeconomically deprived areas [18], which is consistent with these results. The urban centres with the lowest NDVI greenness in this study were Liverpool (Merseyside, England), Basildon (Essex, England), Middlesbrough (North Yorkshire, England), Sheffield (South Yorkshire, England), and Eastbourne (East Sussex, England). These urban centres have moderate to high levels of deprivation (although intra-urban centre variation occurs) [65, 66], which is also consistent with the above socioeconomic hypothesis.

Providing equitable access to health-promoting, biodiverse green infrastructure is vital to ensure we have flourishing, resilient communities. Populations from otherwise socioeconomically disparate areas spend considerable time in urban centres gathering and mingling for work, shopping, and recreation. Therefore, enhanced greening interventions in urban centres

may also reduce the inequality of opportunity for diverse populations in terms of nature-based, health-promoting pathways and impacts.

On a final note, perhaps expectedly, the mean urban centre NDVI scores strongly (and positively) associated with % tree coverage (S1 Fig). This suggests that trees are the predominant green features in urban centres in Great Britain. Future research could replicate the work, with additional analysis, for example, by using NDVI thresholds to identify green areas rather than applying mean NDVI values.

Urban size (population and area) and green attributes

Our results show a moderate negative correlation between population size and level of greenness within urban centres and between population size and greenness of the wider urban area (1 km radius). This finding is potentially important because it indicates that per capita, health-promoting (and biodiversity-supporting) green attributes may reduce as population increases, thereby highlighting another socioecological justice issue. By 2050, it is expected that 70% of the world's population will be urbanised [67]. Indeed, 84% of the UK's (GB including Northern Ireland) population already lives in towns and cities [68], and the population size of these urban centres increases year upon year, with a current 2015–2025 growth rate projection of 7.6% [69]. It will be important for local authorities and urban planners to ensure the levels of urban centre green attributes do not decrease or remain inert as population size increases because they are important for human health and wellbeing. Furthermore, as population size increases, the pressures on biodiversity are also likely to increase due to expanding grey space and anthropogenic stressors (e.g. pollution) [70]. Therefore, it will be imperative to ensure urban centre green attributes play their role in sustaining biodiversity and enhancing habitat corridors across the city and into rural areas. There was also a moderate negative correlation between population size and tree coverage but no association between population size and area of OS Greenspace.

Regarding urban centre area (m^2) and green attributes, our results revealed no relationship between the size of urban centres and the extent of urban centre greenness, 1 km greenness, and tree coverage. However, they show a relationship between urban centre size and publicly accessible greenspaces in that urban centre area was negatively associated with the proportion of greenspace. This relationship (Fig 6D) is heavily influenced by a small number of data points and requires further work to support these findings. The lack of a correlation between urban centre size and greenness/tree cover is another potentially significant finding in the context of disparities between urban centres. For example, one may expect green attributes to increase proportionally to the size of the urban centre. In contrast, the non-correlative pattern observed in our results shows that many smaller urban centres had a relatively high level of green attributes, and many had a relatively low level of green attributes. Moreover, many larger urban centres had a relatively high level of green attributes, and many had a relatively low level of green attributes (as indicated in Fig 6). This result suggests inter-urban centre disparities in the level of green attributes (not based on size per se), which could again indicate socioecological injustice on a GB-wide scale.

Relative deprivation

Our results show a weak to moderate significant negative association between deprivation and the overall greenness of urban centres. Whilst not a universal rule and requiring further research to confirm the relationship, generally speaking, in this study, more deprived urban centres were more likely to be less green than less deprived counterparts. Given the known associations between health, wellbeing and greenspace [13, 14, 23, 39, 48, 71], this has

important implications for current government policy and the desire for levelling up existing social inequalities. This is especially pertinent because disparities in quality living environments are critical drivers of health inequities [72, 73]. For example, people living in areas of higher deprivation are more likely to be exposed to poor air quality [74, 75] and poor quality greenspaces [18]. Therefore, the health impacts of exposure to these poor environmental conditions–and lack of access to better quality conditions––are also unequally spread across the socioeconomic spectrum, representing a major socio-ecological justice issue. These disparities demonstrate that transdisciplinary solutions are needed to promote equitable access to healthy living environments (e.g. accessible, safe, biodiverse greenspaces with clean air), along with policy changes that enforce monitoring and regulation of environmental conditions.

Limitations

The study has several limitations. For instance, the satellite data used within the study was a composite dataset provided through the EDINA Digimap Service. It is therefore possible that geographic disparities may be present, for example, different data timeframes. Such limitations are outside of the control of this exploratory study. Some data were not available, for instance, IMD for all countries and green metrics for Northern Ireland (hence being omitted). Other vegetation indices (such as the EVI) could also provide different results in urban areas and should be considered in future studies. The restricted scope of our study (e.g., focusing on GB and sampling urban areas with >100,000 population) means the results should be extrapolated with caution.

Conclusion

This is the first known study to comparatively define and rank urban centres in Great Britain based on multiple green attributes. The results suggest significant differences in the proportion of green attributes between urban centres. The finding that population size is negatively associated with greenness and tree coverage within urban centres suggests a relative diminishment of health-promoting and biodiversity-supporting resources as population increases. Furthermore, urban centre greenness and relative deprivation were also negatively associated. These disparities in green infrastructure across the country, along with the population and deprivation-associated trends, are important in the realms of socioecological and equity justice. For example, the current non-communicable disease crisis and the biodiversity crisis highlight the need to ensure the presence of, and equitable access to, quality green spaces across our landscapes. Ecologically conscious greening interventions in urban centres could play a vital role in supporting both human health (and reducing inequality of opportunity by reaching diverse populations) and biodiversity. The need to re-imagine and re-develop our urban/city centres due to digital shopping technologies and societal changes provides an important opportunity to explicitly consider the enhancement of urban centre biodiversity. This study provides a baseline and stimulus to help local authorities and urban planners create and monitor greening interventions in urban centres.

Supporting information

S1 Fig. Scatterplot showing mean urban centre NDVI and tree cover (%) positive association.
(TIF)

S1 Table. List of urban centres and their greenspaces as defined by the OS Greenspace (OSGS) dataset.
(PDF)

S1 Data.
(ZIP)

Acknowledgments

For the purpose of open access, the authors have applied a Creative Commons Attribution (CC BY) licence* to any Author Accepted Manuscript version arising. **Data access statement:** This study brought together existing research data obtained through a combination of Open Data (Index of Multiple Deprivation; Ordnance Survey Open Greenspace; Consumer Data Research Centre retail centre boundaries), data within Open-Source software (Landsat satellite imagery within i-Tree) and the Digimap educational data repository (Sentinal-2 satellite imagery). Digimap is an online service that provides maps and mapping data to UK colleges and universities and licence restrictions apply. The data have been deposited on Dryad: DOI https://doi.org/10.5061/dryad.p2ngf1vtj.

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Investigation: Jake M. Robinson, Paul Brindley.

Methodology: Jake M. Robinson, Paul Brindley.

Project administration: Jake M. Robinson.

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Supervision: Paul Brindley.

Validation: Jake M. Robinson.

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Writing – original draft: Jake M. Robinson, Suzanne Mavoa, Paul Brindley.

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News story

Surface water: The biggest flood risk of all

Speech by Sir James Bevan KCMG, Chief Executive, Environment Agency, CIWEM Surface Water Management Conference, 17 October 2018

From:
Environment Agency (/government/organisations/environment-agency)

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Introduction

I used to be a diplomat. I don't think I was a very good diplomat, because I kept telling people exactly what I thought. And I will do the same for you today. But one thing I did learn during my previous career was that if you want to understand any issue in foreign policy, you only need to know two things: history and the map. And I would suggest that the history, and the map, are equally good guides if you want to understand flooding – and in particular surface water flooding.

What surface water flooding is

I suspect that very few of you signed up to attend this conference on surface water management in order to find out what surface water flooding is. But I'm pretty sure that most the people outside this hall, the general public to whom this speech is also directed, won't. So for them, surface water flooding is what happens when there is too much rain for the drains and the streets fill with water. This doesn't sound that threatening. Gene Kelly danced through a minor surface water flood in Singing In The Rain. Who doesn't love that?

Why it matters: surface water flooding is a real and growing threat

But the reality of surface water flooding is not nearly as cheerful as the movie. It is a real and growing threat – to life, to property, to the economy, to the country.

Surface water flooding is a risk because of its reach. Of all the flood risks to which our rainy island is subject - from coasts, rivers, groundwater, sewers and surface water – it is surface water flooding which threatens more people and properties than any other form of flood risk. Over 3 million properties in England are at risk of surface water flooding, even more than those at risk from rivers and the sea (2.7 million). Surface water flooding is a risk because of its effect. It hits not just individual homes and businesses, but the whole infrastructure – road, rail, utilities etc – of a town or city, disrupting pretty much all aspects of modern life.

Surface water flooding is a risk because people don't know it is a risk. If you don't live near a river or the sea, it's not wholly unreasonable to think that you are not at risk of flooding. But reasonableness isn't the point. Leon Trotsky once said: "you may not be interested in war, but war is interested in you". Well, you may not be interested in surface water flooding, but it is interested in you. And people who don't know they are at risk are less well prepared to cope when the risk materialises.

Surface water flooding is a risk that tends to fall particularly on communities that can least afford it. Urban areas are more susceptible, because they have more concrete. Poor urban areas with high density housing are the most susceptible of all, because there are a lot of people and a lot of paved drives and parking spaces which don't absorb the rainwater, not big surburban lawns which do.

Surface water flooding is a risk which doesn't just affect our own country. The flash flood in Majorca last week, which tragically killed two British nationals, was a surface water event. The Dutch, who have been so successful in fighting sea flooding and are rightly regarded as world leaders in the field, are themselves struggling to manage a serious surface water risk building behind their mighty sea walls.

Most important of all, surface water flooding is a risk which is growing. An increasing population means more people are at risk. An increasingly urban population means more people are in cities, where the effects are starker. Development means more concrete, which means fewer places for rainwater to drain safely away. And the more frequent and intense rainfall which climate change is bringing will make flash flooding and overloading of the sewer network more likely and more frequent. That is why the government decided for the first time in 2016 to include surface water flooding on the national risk register.

Imagine this. It's another beautiful hot summer day in the South East. Gradually it turns humid, with thunderclouds building up over central London. Then the clouds burst with astonishing intensity. Within minutes water is overwhelming the drainage system. The underpasses start to fill up and the roads become impassable. The Tube stops running as parts of it flood. The city starts to grind to a halt. Then the power goes out. It's dark, and water starts coming into thousands of homes. It is inches not feet in most places. But in parts of the city it pours into basements, where it's several feet deep, and people start to drown.

This nightmare could happen. London is prone to high intensity thunderstorms and has an ageing Victorian sewer system. A smaller version did happen, in Hampstead in 1975 when in a localised thunderstorm it got more than three months of rain in three hours. Four of London's main-line railway stations were flooded and closed. Much of the Underground was brought to a standstill as tunnels were inundated and the electrics failed. 250 people were made homeless. One day, a much bigger rainfall event than that will happen somewhere in this country. We need to be ready.

The story so far: Pitt and after

The 2007 summer floods were a wake up call for all of us. They left 13 people dead, 44,600 homes flooded and £3bn damage. The rescue effort was the biggest in peacetime Britain. That event led to the 2008 Pitt Review, which concluded that much of the flooding had arisen not from rivers over-topping but from surface water pouring off the land.

The Pitt review led to the Flood and Water Management Act (2010), which provided clarity on the roles and responsibilities of the Environment Agency, local authorities, water and sewerage companies and others who manage flood risks. It gave the EA responsibility for the strategic overview of flood and coastal erosion in England and powers to manage that risk, which we exercise with our direct responsibility for managing the risk of coastal and main river flooding. And it

established Lead Local Flood Authorities (the unitary authority or county council), responsible for managing flood risk from surface water, groundwater, and ordinary watercourses in their areas.

The Environment Agency has made many changes in the light of the Pitt review:

We now give people better information so they can see whether they are at risk. In 2008, we produced the first map of areas at higher risk from surface water flooding. In 2013 we produced the Risk of Flooding from Surface Water maps. Check out whether your own house is at risk online.
We have improved how we forecast flooding. In 2009 the Environment Agency and Met Office jointly established the Flood Forecasting Centre. It provides a 24/7 flood forecasting service to the Environment Agency, the Government and the emergency responders.

We have completely overhauled how we warn and inform people of an imminent flood risk. Over 1.4 million people can now receive direct warnings from our flood warning service. We automatically register properties with landlines and mobile operators.

We've upgraded how we respond when flooding threatens, to deploy more people more quickly to more places to help. We've invested in new kit, including 40km of temporary flood barriers, 250 high volume pumps, and 4 incident response vehicles. We now have 6,500 staff trained to respond to incidents. And we regularly exercise with the military to ensure that we can call on their support when required. And by the way, in responding to a flooding incident we don't distinguish between surface water flooding (the local authorities' responsibility) and river flooding (ours). To the public it is all water, and there is anyway often a mix of both kinds of flooding when it rains. So we will turn out to help local authorities with significant surface water flooding if they need us.

We are making record levels of investment in flood defence construction projects: £2.6 billion to better protect 300,000 homes by 2021.

We've changed how we deliver those flood defence projects. We now work in partnership with local authorities, businesses, the water companies, and local people to design and deliver the schemes that work for those local communities.

That includes schemes which reduce surface water flood risk. For example, the £14m Willerby and Derringham Flood Alleviation Scheme completed in 2016, led by East Riding of Yorkshire Council and Hull City Council. It better protects approximately 8,000 homes and 200 businesses from surface water flooding through a series of lagoons for rainwater storage. These lagoons resemble flat pasture and for the majority of the time will remain dry, only to be filled during severe wet weather.

We've also taken up the Pitt Review recommendation that we improve the way we work with natural processes. Using nature to help manage flood risk, and adopting greener approaches to engineering, can help us to achieve better reduction of

flood risk and create better habitats for wildlife and greater beauty for people.

The future: the challenges and how to meet them

So things are better than they were. But we cannot afford complacency. Because as all of us seek to improve our performance, the future challenges are growing. The challenge of climate change, which will bring more extreme rainfall. The challenge of development, which requires us to build more houses, all of which have potential to increase the risk of surface water flooding. The challenge of constructing modern infrastructure which does not increase the risk of surface water flooding and is more resilient to it when it happens. How do we meet those challenges? By pressing all the buttons that are available to us, and by doing it together.

Pressing all the buttons means several things:

It means improving how we manage surface water now. Defra's Surface Water Management Action Plan (published in July 2018) seeks to strengthen the current arrangements by improving our collective understanding of the risks and helping those responsible to manage them effectively. It promotes better partnership working across all the flood risk management authorities, better risk assessments, better data sharing, and better guidance. We in the Environment Agency will help take this forward by leading work to produce a national picture of skills and capability in our risk management authorities, by giving guidance on asset registers, and by putting in place mechanisms to allow better sharing of data and communication of forecasts.

It means thinking about how we should manage surface water flood risk in future. Michael Gove recently commissioned a review of the Multi Agency Flood Plans produced by the Local Resilience Forums. Major General Tim Cross led that review and reported this summer. He underlined the need for the Environment Agency, the local authorities and the emergency responders to work even more closely together in the Local Resilience Forums to plan for and respond to surface water flooding and other local flood events. We in the EA agree with that, and will redouble our efforts over the coming months.

It means improving our forecasting, so that communities get more accurate and earlier warning when flooding threatens. Our flood forecasting is now much better than it was even a few years ago. We can usually predict coastal flooding like an East Coast storm surge 2-5 days before it arrives; and river flooding 12-48 hours before. But surface water flooding is the hardest of all to predict, and at present is sometimes just not possible at all. We can predict that there will be thunderstorms in a particular area. But precisely where the rain will fall, the duration and the effect on the ground often can't be predicted until it's happened. Getting better at this is a huge technical challenge. But we are working with our partners to make progress.
It means designing resilience into our towns and cities. Part of this is about Sustainable Drainage Systems, which can make communities more resilient to surface water flooding and deliver a host of other benefits – public spaces with

more green and blue; more beautiful surroundings in which people can live, work and play; enhanced habitat for wildlife, greater biodiversity, improved water quality, and so on. The EA is working with developers, local authorities and the water companies to support the integration of SUDs into as many locations as possible, and I have seen some great examples.

One of my favourites is Slough Salthill Park SUDS, a project which the EA supported with the local school, the local authority and Thames Water. Together we turned part of an inner city school's playing field into a sustainable drainage lake, filled with plants and animals. It was a win for everyone. It reduced flood risk to Slough. It helped Thames Water: like other water companies, they don't want any more water than necessary going into the main drains, because that risks flooding and/or sewage contamination. Most of all, it gave those schoolchildren a first hand and now permanent experience of nature.

But designing in resilience is about a lot more than SUDs. It means starting far upstream in the planning process so that new developments are themselves laid out in ways which reduce surface water and other risks. Milton Keynes is a good example – a city that was planned to be decentralised, without high concentrations of concrete in one centre with the attendant risks, with green and blue spaces designed in where they already existed and new ones created where not. All over the country now we are working with developers and local authorities to seek to emulate that.

It means innovation and new technology. Engineers, inventors, housebuilders, the construction companies, those who design utilities and all the other things which contribute to or can suffer from surface water flooding, all have a part to play.

It means recognising that some of the causes of surface water flooding are neither urban nor to do with concrete. The wrong kind of farming in the wrong place can cause significant surface water flooding. Example: Maize. There has been a dramatic increase in maize production over the last few years, primarily to feed Anaerobic Digestion plants. The problem with maize is that it's harvested in late autumn, when the ground is wet. This, combined with the use of heavy harvesting machinery, tends to compact the soil. And compacted soil can't absorb rainwater, which causes surface water runoff, which in turn can cause local flooding and pollute watercourses.

It means mitigating climate change. There is a direct connection between chaos on the streets of Birmingham or Newcastle, both of which have been affected by major surface water flooding events in recent years, and man-made climate change. This is not a speech about climate change. (That was last month, if you are interested). But the more we can stop the activities that cause climate change, the easier we will make it to tackle the greater flood risk it will otherwise generate.

Finally, there is one more button we need to press if we are to tackle the surface water flooding issue: public awareness. If people know they are at risk they are more likely to do something about it, whether that means ensuring they put in property level protection in their own house, or encouraging their local council to

ensure that the risks are mitigated. So just talking about surface water flooding, letting people know it exists and has consequences, as we are doing today, is an important part of the mitigation.

Conclusion

A wise environmentalist once said to me: “The thing about water is that it gets everywhere“. This is a simple but profound truth. Water does get everywhere, and when it gets where it’s going there are always consequences, good or bad.

So if there is somewhere you don’t want water to be, like people’s houses or the local supermarket, a community centre, a power station, a railway line, an underpass or a road, you’d better make sure that you have the right measures to stop it going where it wants to go.

Today’s event, and the debate I’m sure it will launch, is an important step in thinking through together how we can ensure water only goes where we want it. I wish you all well in your deliberations. Because this really, really matters.

Related content

Prepare your property for flooding (/government/publications/prepare-your-property-for-flooding)

Reservoir flood maps: when and how to use them (/guidance/reservoir-flood-maps-when-and-how-to-use-them)

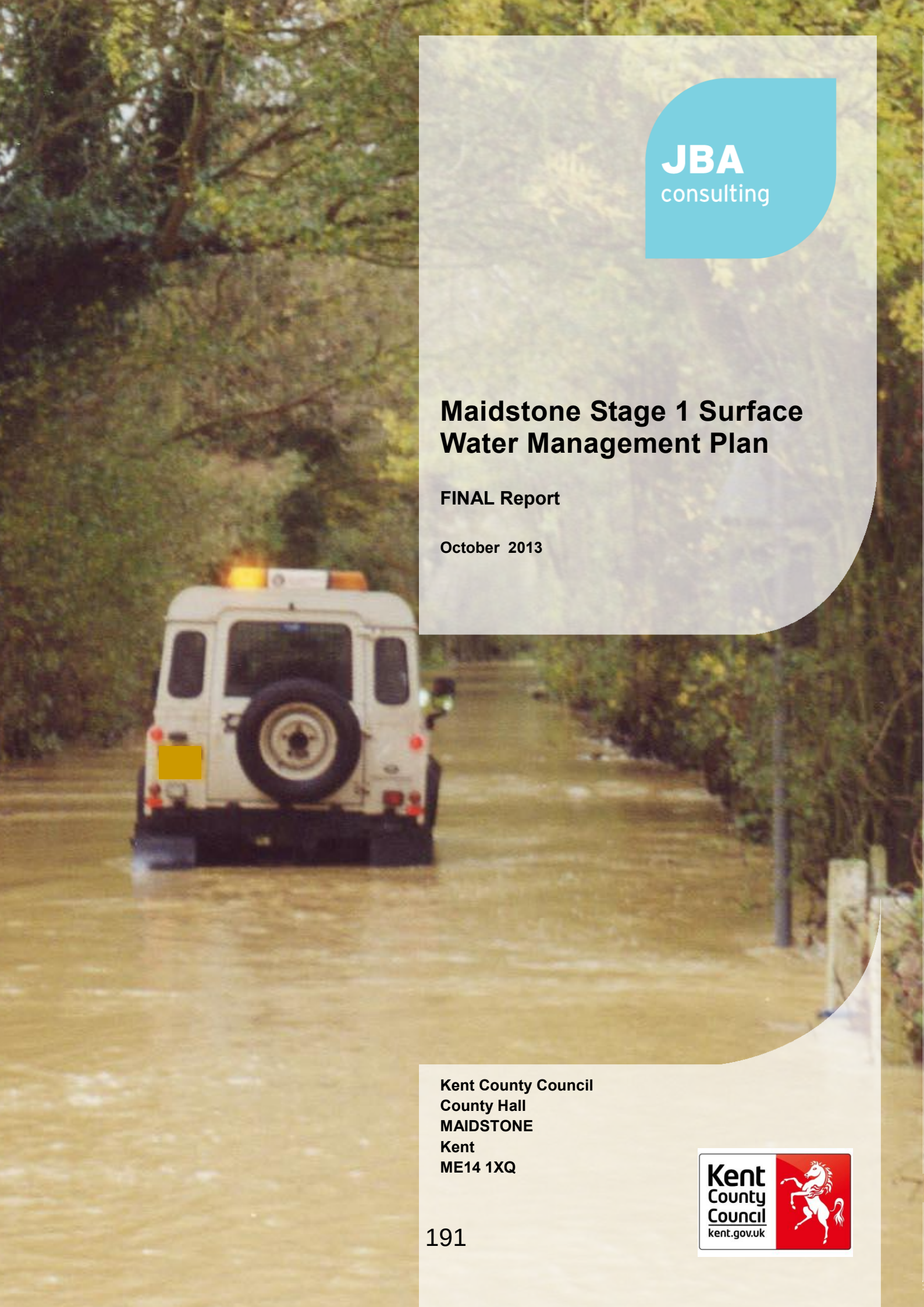
Flood plan guidance for communities and groups (/government/publications/flood-plan-guidance-for-communities-and-groups)

Humber River Basin District: flood risk map for reservoirs (/government/publications/humber-river-basin-district-flood-risk-map-for-reservoirs)

South West River Basin District: flood risk maps for reservoirs (/government/publications/south-west-river-basin-district-flood-risk-maps-for-reservoirs)

Explore the topic

Flooding and coastal change (/topic/environmental-management/flooding-coastal-change)



Maidstone Stage 1 Surface Water Management Plan

FINAL Report

October 2013

Kent County Council
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Final Report, v1 / October 2013		**Max Tant (Kent County Council)**

Contract

This report describes work commissioned by Kent County Council, under commission reference LL048. Kent County Councils' representative for the contract was Max Tant of Kent County Council. Margaret Moran and Rachel Huitson-Little of JBA Consulting carried out this work.

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Purpose

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Abbreviations and Glossary of Terms

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

SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SW	Southern Water
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
UMIDB	Upper Medway Internal Drainage Board

1 Introduction

1.1 What is a Surface Water Management Plan

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

SWMPs are led by the Lead Local Flood Authority (Kent County Council) in partnership with other flood risk management authorities. In relation to the Stage 1 SWMP, risk management authorities include Kent County Council, Local Authority, Environment Agency, Internal Drainage Boards (IDBs), Southern Water and other relevant authorities. The purpose of a SWMP is to identify what the local flood risk issues are, the effect they have and what options there may be to manage them. These options are presented in an Action Plan which lists the partners who are responsible for taking the options forward. Although the SWMP provides a full flood history for the study area which may include coastal and fluvial flood sources, the action plan only proposes measures to manage local flooding. The Action Plan is agreed by partners and reviewed periodically.

This SWMP is being undertaken by Kent County Council (KCC) to investigate the local flood risks in Maidstone as part of their remit for strategic oversight of local flood risk management in Kent, conferred on them by the Flood and Water Management Act 2010. Maidstone has been identified as an area potentially at risk of local flooding in the Preliminary Flood Risk Assessment[1], which KCC undertook in 2011 for the whole county of Kent. This SWMP will determine whether there are any local flood risks and what further work may be needed. To find out more about KCC's role and other SWMPs they are undertaking, please visit their website:

www.kent.gov.uk/flooding

1.2 Summary of aims and objectives

The main aims and objectives of the Maidstone Stage 1 SWMP are detailed below:

1. The establishment of a local partnership;
2. The collation of a comprehensive flood history for all relevant local flood risk sources;
3. The identification, collation and mapping of all available flood data and its availability for future use including an assessment of the reliability of the data;
4. The identification, where possible from the available data, of flood prone areas;
5. The identification of areas where existing data may be missing or unreliable, as a consequence of inappropriate local assumptions, additional local features or any other reason, and options to improve our understanding;
6. The identification of areas where the risks are from a combination of sources;
7. Identification of any proposed or allocated development sites and any impacts they may have on local flood risks (where sites are made available)*;
8. The preparation of source pathway receptor models for all the risks and sources that are identified;
9. The identification of any easy win opportunities that are apparent without further work, which may include planning policies or simple flood defence measures; and
10. A clear plan for further work, which may include:
    a. What needs to be achieved to reduce flood risk, including next steps;
    b. The owner of the actions;
    c. The timeframe for undertaking them; and
    d. Indicative costs.

* Note at the time of writing the Stage 1 SWMP the allocations sites were not available[2].

[1] Kent County Council (2011) Preliminary Flood Risk Assessment available at http://publications.environment-agency.gov.uk/PDF/FLHO1211BVSJ-E-E.pdf

[2] Maidstone Borough Council Local Plan Progress

1.3 Study area

The SWMP study area is the Maidstone borough boundary. Figure 1.1 describes the extent of the study area.

Location	Maidstone Borough (excluding Maidstone town)
Catchment Flood Management Plan (CFMP)	River Stour, North Kent Rivers and River Medway
Local Authority	Maidstone Borough Council

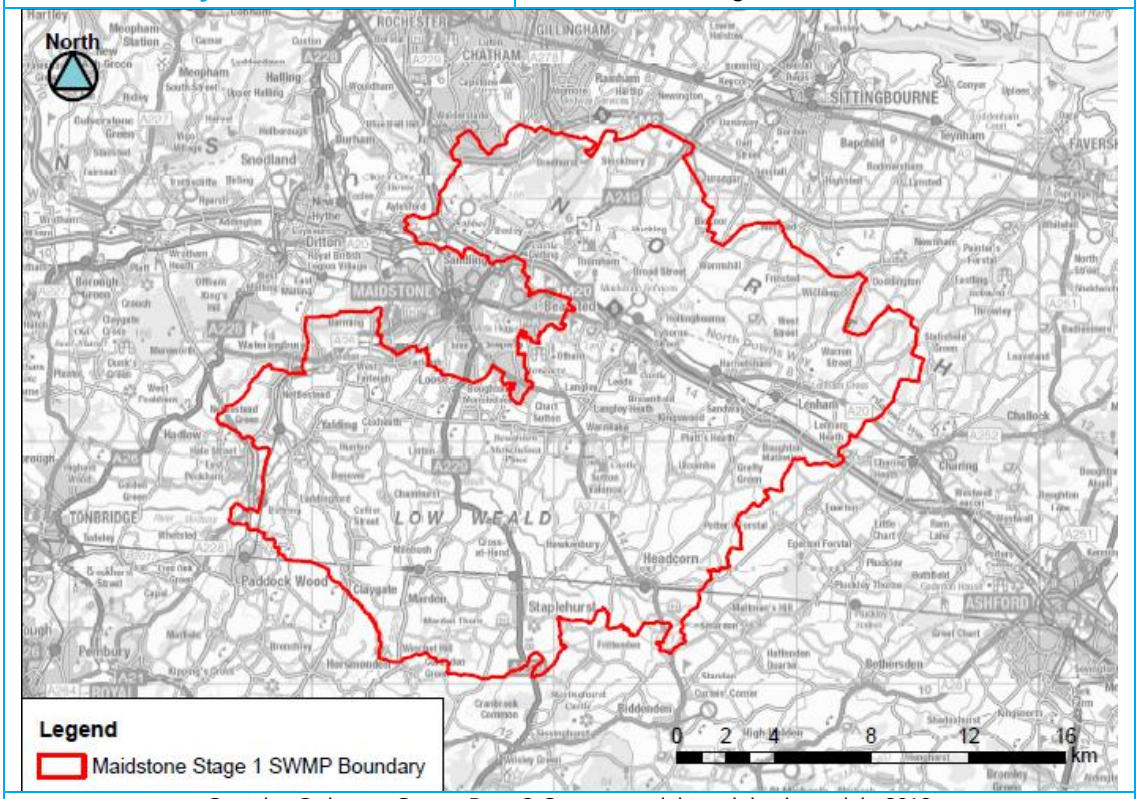

Figure 1.1 Study Area

1.3.1 Catchment Flood Management Plan (CFMP)

Catchment Flood Management Plans give an overview of the flood risk across each river catchment. They recommend ways of managing those risks now and over the next 50-100 years.
They consider all types of inland flooding, and take into account the likely impacts of climate change, the effects of how land is used and managed. Their development involves wide and prolonged consultation.

Maidstone borough falls within three river catchments and, as such, three CFMP's as illustrated in Figure 1.2. It is important that work undertaken within the borough is mindful of the flood risk management policies set by these high level strategic plans.

1. River Stour CFMP
2. North Kent Rivers CFMP
3. River Medway CFMP

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 in the catchment that can be applied to different locations. Within any CFMP six standard flood risk management policies has been applied to a policy unit. Figure 1.2 illustrates which policy has been applied to each policy unit:

- Policy 1 – No active intervention (including flood warning and maintenance). Continue to monitor and advice.
- Policy 2 – Reduce existing flood risk management actions (accepting that flood risk will increase over time).

- Policy 3 – Continue with existing or alternative actions to manage flood risk at the current level.
- Policy 4 – Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).
- Policy 5 – Take further action to reduce flood risk.
- Policy 6 – Take action to increase the frequency of flooding to deliver benefits locally or elsewhere (which may constitute an overall flood risk reduction, e.g. for habitat inundation).

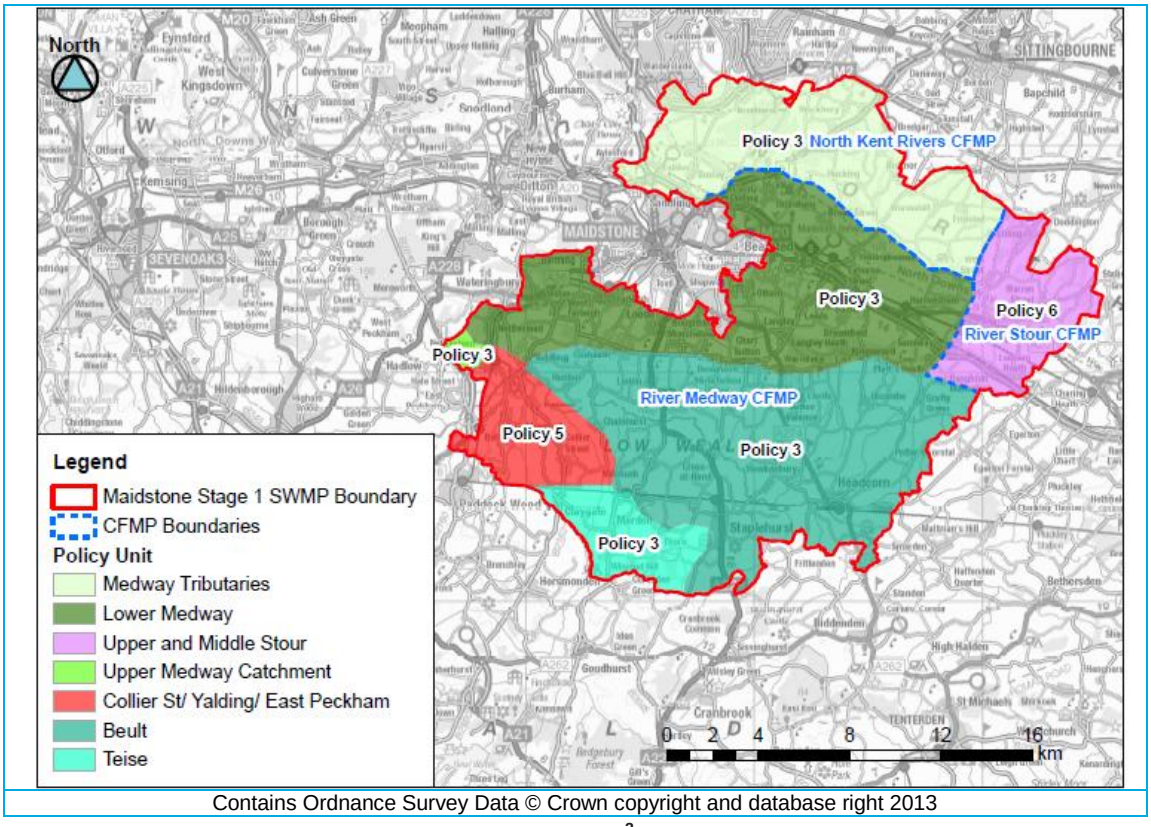

Figure 1.2 CFMP Policy Units and Applicable Policies[3]

1.3.2 Surface Water

Surface water presents a risk throughout Maidstone. When there are instances of heavy rainfall and water fails to infiltrate to the ground or enter the drainage system there is an increased risk of surface water flooding. Ponding generally occurs at low points in the topography. Historically there have been events attributed to surface water; however the likelihood of flooding is dependent on not only the rate of runoff but also the condition of the surface water drainage (surface water sewers, KCC Highways drains and gullies, open channels, ordinary watercourses and SuDS). There are two sources of information available from the Environment Agency, relating to the identification of potential surface water flood risk in Maidstone. These are:

- Areas Susceptible to Surface Water Flooding (AStSWF) - Since July 2009, these maps have been available to Local Resilience Forums and Local Planning Authorities, and provided a starting point in understanding the broad areas where surface water flooding is likely to cause problems
- Flood Maps for Surface Water (FMfSW) - these followed on from the AStSWF maps and provide a more realistic representation than the AStSWF maps in many circumstances. The Environment Agency considers this to be the national source of information[4].

[3] **Please note:** the boundaries of the CFMP Policy Units have been digitised approximately from the relevant CFMP available from http://www.environment-agency.gov.uk/research/planning/33586.aspx

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

It should be noted that the Environment Agency are currently updating national surface water mapping and will soon be releasing the Updated Flood Map for Surface Water (UFMfSW). The UFMfSW aims to provide an improvement on the representation of surface water flood risk across England and Wales. The UFMfSW are due to be released by the end of 2013. Therefore, for the purposes of this report the FMfSW datasets have been used.

1.3.3 Watercourses

Main Rivers

'Main River' is a legal term used to classify watercourses that have the potential to cause significant flooding. The Environment Agency has permissive powers to carry out maintenance and improvement works on these rivers. The Stage 1 SWMP makes reference to Main Rivers throughout the report. However, it is important to note the focus of the study is local flooding issues relating to surface water and / or a combination of flooding sources. Table 1-1 describes the list of Main Rivers, which are managed by the Environment Agency within Maidstone.

Table 1-1 List of Main Rivers

Catchment	Watercourse
Medway	River Beult
	Lesser Teise
	River Medway
	Loose Stream
	River Len
	River Teise
	Coult Stream
Stour	Great Stour

Ordinary Watercourse

Ordinary watercourses are watercourses that are not designated as Main Rivers, and are usually the smaller tributaries of them. KCC, Maidstone Borough Council and Internal Drainage Boards[5] have permissive powers to carry out works on ordinary watercourses and also have responsibilities in relation to consenting and enforcement. Figure 1.3 illustrates that there is one Internal Drainage Boards within Maidstone:

1. Upper Medway IDB (dealing with upland water and fluvial flooding in the catchment of the River Medway upstream of Allington).

The flooding mechanism for ordinary watercourses is similar to flooding from rivers. Due to the small nature of ordinary watercourses and the sometimes complex drainage mechanisms they may have (such as sluice gates, weirs and pumps), the risk can be difficult to assess. However, ordinary watercourses are generally considered to be low risk systems that do not pose a flood risk on the same scale as main rivers; however they still pose a local flood risk.

There is a high concentration of ordinary watercourses within Maidstone, specifically in the mid and southern reaches. Drainage is complex and one severe rainfall event can cause flooding on a number of ordinary watercourses simultaneously. A flood event can be exacerbated especially if it is combined with high levels on Main Rivers.

Riparian Owners

If you own land adjoining a watercourse, you have certain rights and responsibilities, and in legal terms you are a 'riparian owner'. Some of your responsibilities include:

- Maintaining river beds and banks;
- Allowing the flow of water to pass without obstruction; and
- Controlling invasive alien species such as Japanese knotweed.

Riparian owners should read the Environment Agency publication 'Living on the Edge' (2012) to find out more information about their responsibilities[6].

[5] An Internal Drainage Board's permissive powers pertain to those ordinary watercourses within their boundaries.

[6] **Environment Agency (2012) Living on the Edge**

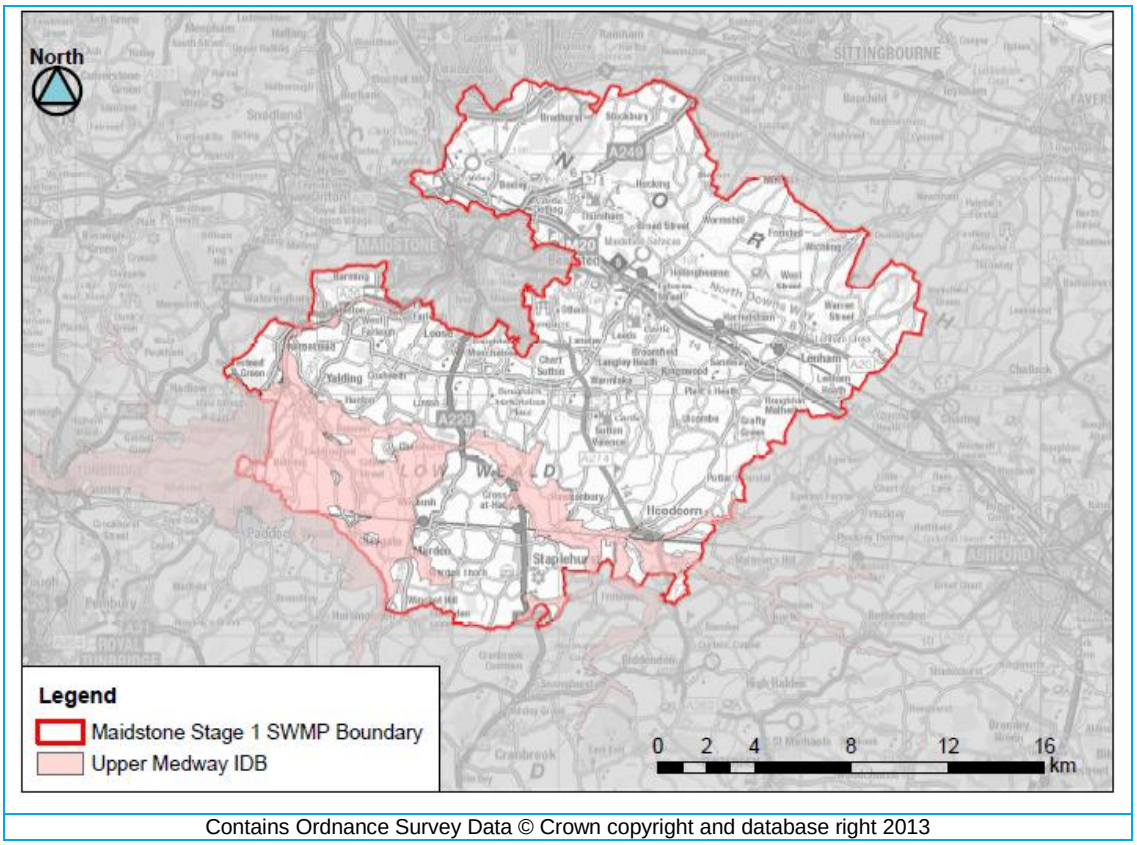

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Figure 1.3 Location of IDBs within Maidstone

1.3.4 Sewers

Southern Water is responsible for the sewers in this area. Data provided shows that there are a various sewer types located within the Maidstone SWMP study area, these include:

- Foul
- Surface Water
- Treated effluent

Sewer networks are mostly located in urbanised areas such as Marden, Staplehurst and Headcorn. Foul sewers are the predominant sewer type, with some surface water sewers located in Loose, Yalding, Marden, Staplehurst and Headcorn.

There are sewer models available from Southern Water for Maidstone borough. The location data was requested but it was not available at the time of writing this report.

1.4 Using this report

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

Table 1-2 Report layout

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

Section	Description of contents
Appendix A - Data Review	Provides a list of the data provided by the key partners for use in this project and its applicability to the Stage 1 SWMP.
Appendix B - Detailed Summary Sheets and Mapping	The summary sheets give a brief description of the source pathway receptor model within individual drainage areas. The mapping illustrates historical flooding.
Appendix C - Flood History Table	A table recording flood history data provided by the key partners, describing : - Receptor - Date (Month/ Year) - of the flood event, if provided - Location (Area/Road/ Street etc) - Source - perceived source of flooding - No. of properties affected - Source supplied data (organisation) - Source supplied data (report) - Comments - any additional comments provided within the data or through discussion at workshops.
Addendum 1	KCC Highways Issues - A table of historic records highlighted during the analysis of data received from the key partners that for the most part solely related to KCC Highways. This Addendum is to be included within the report at the discretion of KCC.
Addendum 2	Southern Water Issues - A table of historic records that require further investigation from Southern Water. This Addendum is to be included within the report at the discretion of KCC and Southern Water.

2 Preparation

2.1 Partnership Approach

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

2.1.1 Key Partners

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

- Maidstone Borough Council
- Kent County Council
- Kent County Council - Highways
- Upper Medway IDB
- Environment Agency
- Southern Water

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

- Data gathering exercise and one to one meetings with each of the key partners
- Action plan workshop

2.2 Data Collation and Review

JBA Consulting met with each key partner to discuss their knowledge and experience in relation to all sources of flooding across the study area. Data was collected from all key partners and the quality of the data was assessed and uncertainty or perceived weakness described and discussed with the key partners. A table summarising the data collected is located in Appendix A. A vast array of information was made available to inform the SWMP, including:

- The Environment Agency historical flood maps, FMfSW and LIDAR were used to delineate the individual drainage areas and define the receptive receptors within Maidstone.
- Records of historic flooding from KCC, KCC Highways, MBC, IDB's and Southern Water (were used to identify areas where actions are required within Maidstone). It should be noted that many of the historic records, specifically from KCC Highways only went back as far as 2008.
- Bedrock geology and superficial soils were informative when delineating individual drainage areas and also used to determine the applicability of SuDS type within Maidstone borough.
- The National Receptor Database (NRD) was used and was found to be informative when quantifying risk and prioritising potential measures and actions. The NRD was not used to determine numbers potentially affected by flooding but rather to indicate the critical infrastructure that may be impacted by local flooding.

- Other data which was used included the Maidstone Level 2 SFRA (2008)[7], Maidstone Local Multi Agency Flood Plan and anecdotal information collected while meeting with the key partners.

2.3 Historical Flooding

Each Risk Management Authority (RMA) provided data on incidents of historical flooding. The records begin in 1927 (Tidal Medway) to the present; there are a number of records that do not have a date specified. Historical flooding maps are displayed in Appendix B and the flood history tables are located in Appendix C. These have been compiled to provide further details on each recorded event received from all RMAs.

Historical flooding from Main Rivers has been described within the flood history table and displayed on the historical flooding maps, where key partners have provided records. It should be noted that Main River flooding has been included within this report to determine where a combination of issues (surface water, sewer, and groundwater) require an action. However, if an issue is solely related to Main River flooding, an action has not been prescribed as this is outside the remit of the Stage 1 SWMP. Actions to address flood risk from Main Rivers are considered within the Catchment Flood Management Plans (CFMPs).

A summary of historical flooding is noted below. Although the sources of flooding have been segregated into fluvial, surface water and sewers the issues highlighted within the summary may have originated from a number of sources.

Fluvial

The Environment Agency has provided data of historic events, from the Medway the Teise the Lesser Teise and the River Beult (Main Rivers). Flooding has been recorded from these rivers on a number of occasions, notably in 1927, 1960, 1963, 1968, 1969 and 2000.

Key Partners explained that Collier Street and Yalding are particularly vulnerable to flooding as they are situated at the confluence of the Medway, the River Beult, River Teise and the Lesser Teise (Main Rivers). Haviker Street, Collier Street, in particular, has been described as area prone to flooding from Main Rivers. Residents built flood walls around their properties to prevent the ingress of flood waters[8].

Records of flooding on ordinary watercourses have been provided by KCC Highways, the Environment Agency and UMIDB. Common factors described in these records report the perceived causes of flooding to be attributed to one or all of the following:

- Poor maintenance of watercourses
- Blocked infrastructure, such as culverts
- Insufficient channel capacity
- High water levels in watercourses impeding the discharge of flows from their associated tributaries. .

Headcorn is an example of an area where records describe all of the above as contributing factors to flooding in the past. It should be noted that within the data provided by key partners, possible knock on effects to sewer networks was evident. There have been reports of repeated fluvial/ sewer events at Clappers Lane, Clappers Farm. Forstal Road backs onto the River Medway (Main River), which at this point is partly tidal. The Environment Agency explained that previous events may have been exacerbated by tide locking of outfalls preventing drains and gullies from discharging to the River Medway (Main River).

Surface Water

The historical records are dispersed throughout the borough. It should be noted that records from KCC Highways are from the period of June 2008 to January 2013. There are limited records of older events from other key partners, the majority of records were provided from Kent County Council Highways. A number of surface water records were also extracted from the Maidstone SFRA, specifically for Harrietsham, Lenham, Marden, Headcorn and Staplehurst.

7 Maidstone Borough Council Level 2 Strategy Flood Risk Assessment (2008) available at *http://www.maidstone.gov.uk/pdf/090407_Strategic%20Flood%20Risk%20Assessment%20-%20amend%20mbc%20addr.pdf.*

8 Meeting minutes Upper Medway IDB – data gathering (22/01/2013)

For the most part surface water flooding could be attributed to heavy rainfall overloading carriageways, drains/ gullies. In other instances, the cause of flooding was perceived to be from blocked drains/ gullies, which in some circumstances, was a result of receiving watercourses impeding free discharge from surface water drains and gullies.

Repeated incidents were highlighted within Harrietsham on Ashford Road, KCC Highways report shows that the gullies here need regular cleansing; otherwise, the whole carriageway floods.

Reports describe Marden as experiencing flooding in the past. The perceived causes recorded included poor drainage, blocked drains and local topography. Staplehurst and Headcorn have regular incidents of flooding due to inefficient drainage systems during heavy rainfall or as a result of blockages in the drainage system. The main receptors are described in the MBC SFRA as being residential areas and highways.

Sewer

Southern Water provided records of historical flooding within Maidstone Borough from 2008 - 2012. The data presented the number of events that occurred within a particular post code. An indication was given within the records as to whether the event flooded properties internally, externally or whether it was within the curtilage of a property. Flooding was described predominantly as hydraulic overload of sewer or an overloaded pumping station. Sewer flooding records were also extracted from the Maidstone SFRA.

In general, records highlighted that in locations where there were fluvial events, these also have coincides with hydraulic overload. In 2009, sewer flooding at Clapper Lane and Clappers Farm coincided with a fluvial event. The curtilage of three properties was affected.

Maidstone SFRA describes sewer flooding events in Lenham, Marden, Headcorn and Staplehurst; property was recorded as being affected.

Southern Water recorded recent events in 2012, on Moat Road, Headcorn, where the curtilage of five properties was described as flooded, internal flooding was not reported. This is potentially where a combination of sources may exacerbate sewer flooding.

Where further information was provided upon discussion with the key partners, this was added to the comments within the Flood History Table in Appendix C. Southern Water has been made aware of any specific locations where historic records indicate that a combination of sources may affect sewer flooding.

Other

KCC Highways records describe that Water Lane, Harrietsham, was affected by a local spring. However, it should be noted from the data provided and following consultation with the key partners, it is difficult to ascertain if a source of flooding is from groundwater. This is because flood risk may be as a result of a combination of sources, or a culverted watercourse may have been mistaken for a spring or underground stream.

There was also a record of burst water mains causing issues in Harrietsham and on King's Road, Headcorn.

2.4 Source Pathway Receptor

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

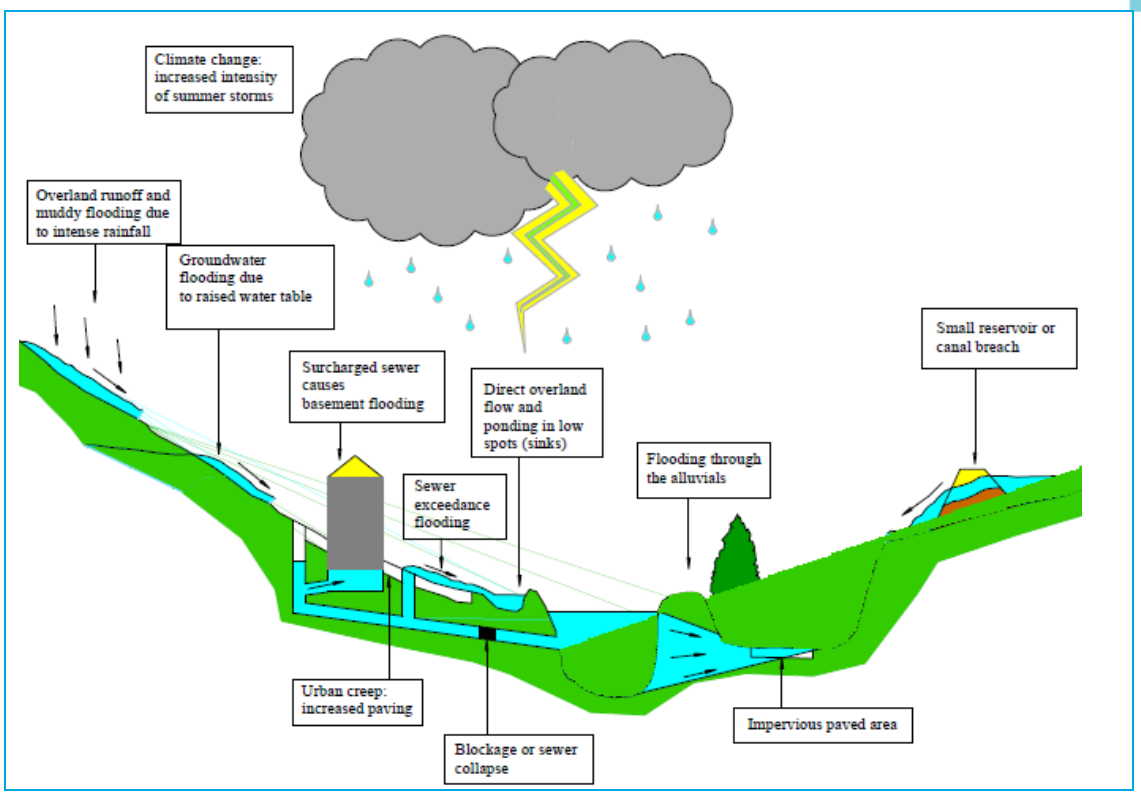

Figure 2.1 Source-Pathway-Receptor

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

- Heavy rainfall resulting in surface water runoff and overloaded sewers
- Surface water (blocked drains / gullies)
- Rivers - overtopping of river banks
- Groundwater [9]

The pathways for flooding are the sewer networks, drains and gullies, highways/ roads and river networks within Maidstone borough. Further detail on pathways is located in the summary sheets in Appendix B (see section 2.5 for discussion on summary sheets).

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

[9] It should be noted from the data provided and following consultation with the key partners, it is difficult to ascertain if a source of flooding is from groundwater. This is because flood risk may as a result of a combination of sources, or a culverted watercourse may have been mistaken for a spring or underground stream.

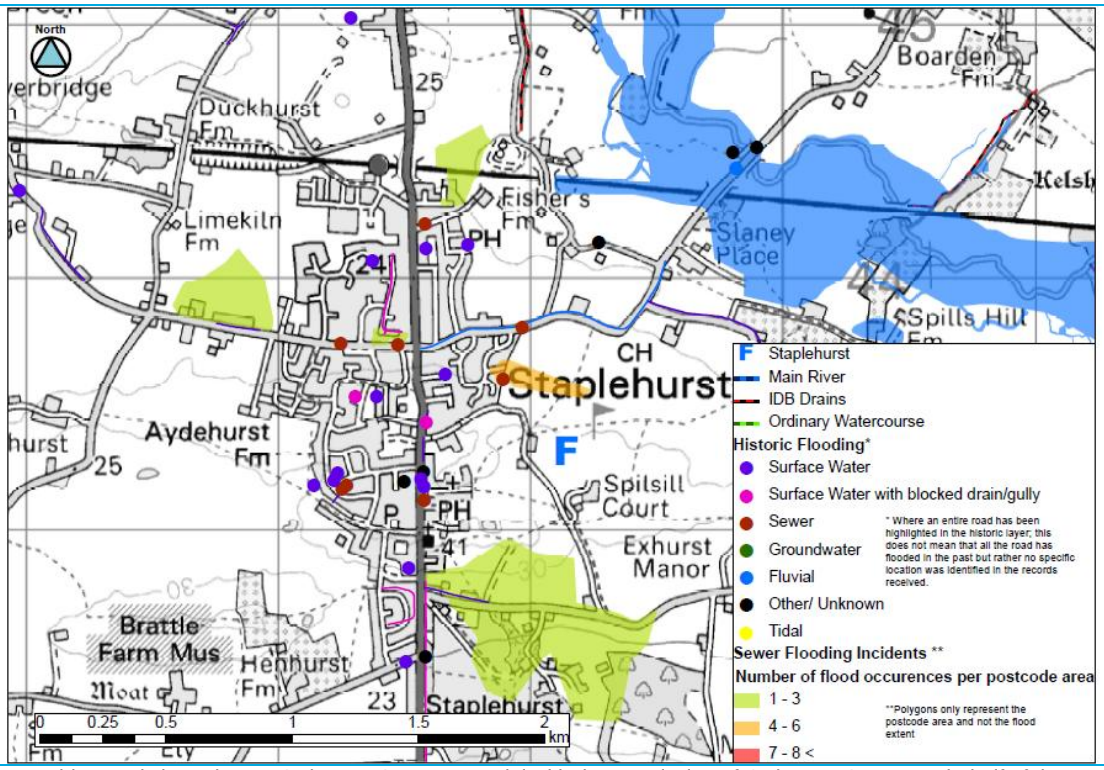

Figure 2.2 Example of a Maidstone SWMP Receptor

2.5 Communicating and mapping the risk

In order to consider the study area in more detail and enable partners and other interested parties to be able to focus in on certain areas of interest (aside from the whole SWMP area), Maidstone borough has been split into drainage areas, see Table 2-1 and Figure 2.3. The drainage areas have been split using the topography of the landscape, historic events, mapped outlines and the Flood Maps for Surface Water (1 in 200-year, deep). In addition to historical records of flooding and the FMfSW, IDB boundaries (which are catchment based) and geological boundaries have also been used. Where appropriate these drainage areas have been used to influence KCCs Local Flood Risk Management Strategy policy units.

Table 2-1 Maidstone Drainage Areas

Drainage Area	Location
DA01	Maidstone Rural North
DA02	Maidstone Rural Mid
DA03	Maidstone Rural West
DA04	Maidstone Rural East

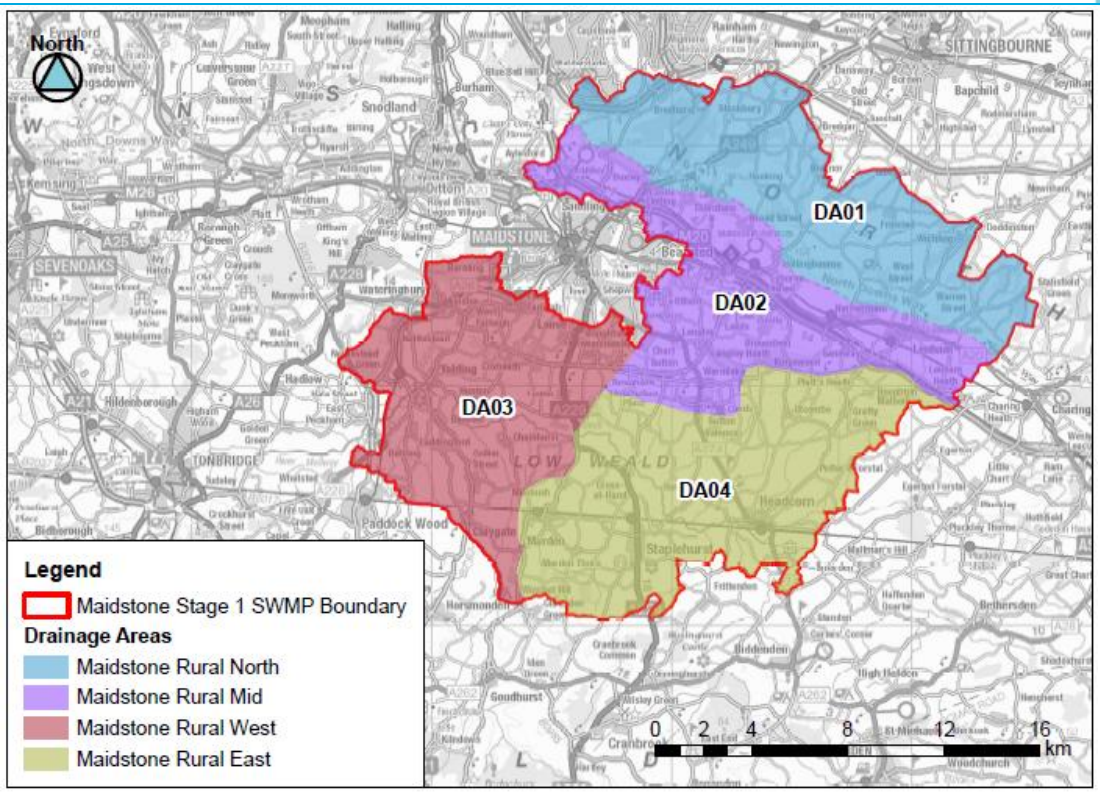

Figure 2.3 Maidstone Drainage Areas

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

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

A historic flooding map is provided for each drainage area to accompany the summary sheet. This map details the location of the historic flood data as provided by the key partners and illustrates the location of the IDB boundaries within Maidstone borough.

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

- Year of the incident;
- General location;
- Perceived source as per the data provided;
- Whether property was recorded as being affected
- Any additional comments provided within the historic datasets.

3 Sustainable Drainage Systems

3.1.1 Feasibility of SuDS in Maidstone

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

When considering infiltration options, groundwater source protection zones must also be considered. The Environment Agency's website provides a web based resource in order to check the Groundwater Source Protection Zone in their "What's in my backyard" section[10]. Zone I - Inner protection Zones, Zone II - Outer Protection Zones and Zone III Total Catchment are within the Maidstone study area, see Figure 3.1. The Environment Agency have defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk, Figure 3.1 shows three main zones (inner, outer and total catchment).[11] If a discharge is proposed within a source protection zone then additional information may be required to demonstrate that there is not an unacceptable risk to groundwater and to the surrounding environment. Additional information and advice can be found on the website www.environment-agency.gov.uk and within the document Groundwater protection: Principles and practice (GP3)[12].

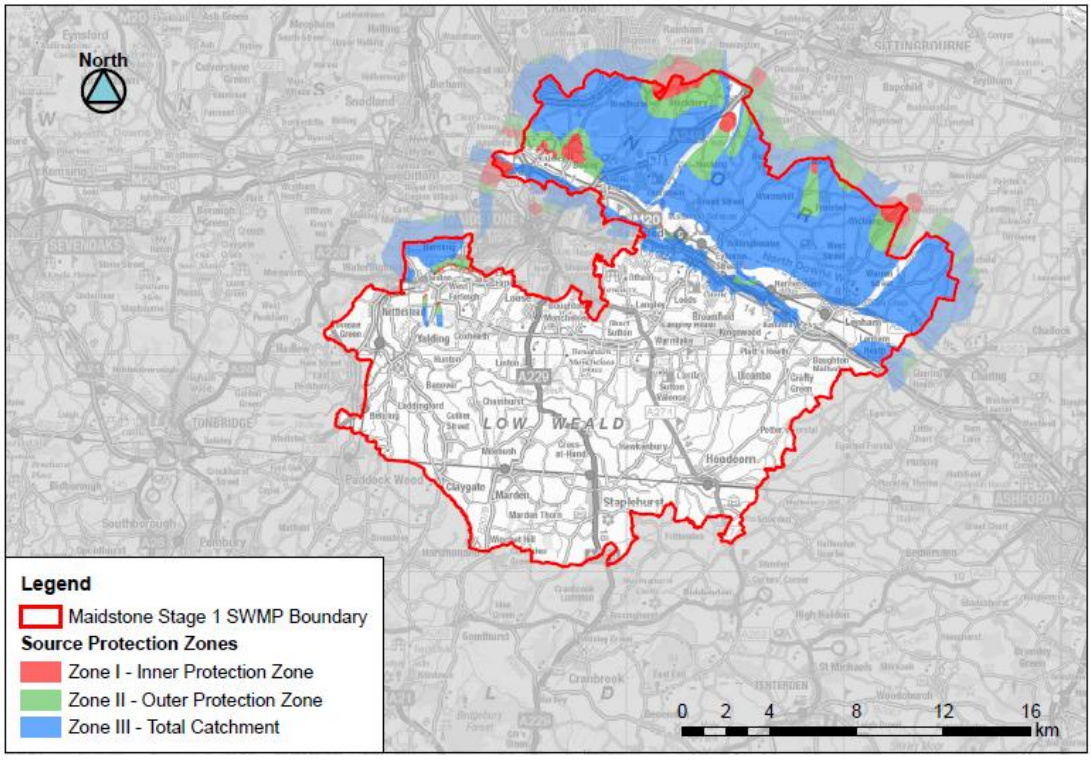

Figure 3.1 Groundwater Source Protection Zone

New development should also seek to incorporate SuDS, for example through green roofs and walls, rainwater recycling, permeable paving and soft landscaping to reduce surface water runoff where feasible and appropriate to the size and scale of the development. The hierarchy of surface water disposal is as follows

[11] http://www.environment-agency.gov.uk/homeandleisure/37833.aspx

[12] Environment Agency (2013) Groundwater protection: principles and practice (GP3)

1. The use of SuDS techniques, appropriate to the location, size and type of development; further details can be found in the SuDS Manual C697 (2007) published by CIRIA.
2. Discharge to watercourse.
3. Discharge to surface water sewer
4. Discharge to combined sewer.

SuDS Developers should consider and have regard for the Kent Design Guide[13]. This document includes a technical appendix on 'Water Efficient Homes" which refers to SuDS. The establishment of a SuDS Approving Body (SAB) is to be set up in county, borough or unitary local authorities. Kent County Council is designated the SuDS approving body (SAB) for Maidstone Borough Council. It should be noted that a clear timetable for implementation of the new responsibilities for SABs is still pending [14]. The duties of the SAB will be to approve drainage systems for new and redeveloped sites before construction can commence. Additionally the SAB will ensure that proposed drainage systems will meet the new National Standards for design, construction, operation and maintenance. The SAB will then be responsible for approving, adopting and maintaining drainage plans and SuDS schemes that meet the National Standards.

[13] The Kent Design Guide

[14] **Please note** a clear timetable for implementation of the new responsibilities for SABs is still pending. https://www.gov.uk/government/policies/reducing-the-threats-of-flooding-and-coastal-change

4 SWMP Action Plan

4.1 Introduction

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

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

4.2 Generic Action Plan

Table 4-1 describes the generic actions to be applied throughout all drainage areas (DA01- DA04).

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Table 4-1 Generic Action Plan

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

Ref	Applicable Drainage Areas	Action/Option (What?)	Priority Actions (How?)	Lead Action Owner	Supporting Action Owner(s)*	Priority (When?) **	Indicative Relative Cost
			4. Communicate coordinated maintenance activities to the public to manage expectations.	KCC	EA MBC, SW and UMIDB	Medium Term	Low
2	All Drainage Areas	Raise awareness within the LLFA, partner organisations, developers and the general public regarding the policies for surface water management, specifically SuDS, within existing evidence base documents[15]: Maidstone Level 2 SFRA (2008) Maidstone Borough - Local Plan and supporting documents[16] Environment Agency Flood Risk Standing Advice[17]	1. Key partners to ensure new developments incorporate SuDS in accordance with the NPPF and the requirements of the SuDS Approving Body (SAB) 2. Key partners to liaise with one another regarding opportunities for surface water management, i.e. green infrastructure, where feasible.	EA MBC, SW and UMIDB		Quick win	High
			3. Key partners who play a part in the planning process for Maidstone Borough Council are to ensure new developments do not increase the risk surcharging of sewer networks within their catchment. 4. Key partners should consider stakeholder engagement to inform the public about the benefits of rainwater and recycling and the consequences of connecting illegally to sewer networks.	EA MBC SW and UMIDB		Quick win	High
3.	All Drainage Areas	Improve the understanding within Maidstone Borough and key partners of the natural and manmade drainage systems.	Develop and implement a strategy for effective land and drainage management in co-operation with key partners, for example, where IDBs can help/ co- ordinate management of watercourses/ drains with the EA/ KCC Highways.	KCC, EA, UMIDB &	MBC	Long Term	Medium
4.	All Drainage Areas	Raise awareness within the borough of the issue caused by inappropriate land management	Stakeholder engagement to inform the public about appropriate land management in vulnerable areas	KCC, MBC EA	, UMIDB, Parish Councils	Long Term	High

[15] Maidstone Borough Council Local Plan
[16] http://www.maidstone.gov.uk/residents/planning/local-plan
[17] http://www.environment-agency.gov.uk/research/planning/93498.aspx

Ref	Applicable Drainage Areas	Action/Option (What?)	Priority Actions (How?)	Lead Action Owner	Supporting Action Owner(s)*	Priority (When?) **	Indicative Relative Cost
5.	All Drainage Areas	Raise awareness within Maidstone Borough of the rights and responsibilities of a 'riparian owner'.	Stakeholder engagement to inform the public about 'riparian owner' rights and responsibilities.	KCC, MBC EA, UMIDB	, Parish Councils	Long Term	High
6.	All Drainage Areas	Consider Critical Ordinary Watercourse that may benefit from demaining and / or assigning responsibility to the IDBs.	Liaise with key partners to consider which watercourse would benefit from IDB maintenance. It should be noted that any change in maintenance regime should be supported by evidence.	EA, UMIDB,	KCC, MBC	Medium Term	Medium
7.	All Drainage Areas	Southern Water should endeavour to inform key partners about their sewer models.	Liaise with key partners to determine a method to disseminate information regarding sewer models completed.	SW, KCC	EA	Long Term	Low
8.	All Drainage Areas	Raise awareness within the borough regarding catchment sensitive farming and its benefits to minimise soil erosion and diffuse pollution.	Liaise with all key partners about best methods to share information regarding sensitive farming and its benefits.	KCC, EA	UMIDB, MBC	Long Term	Low
9	All Drainage areas	Regulation 17 of the water environment (Water Framework Directive) (England and Wales) Regulations 2003 requires all public bodies, when exercising their functions so far as affecting a river basin district, to have regard to that district's river basin management plan and to any supplementary plans.	All key partners are to be mindful of their obligations under the Regulation 17 of the water environment (Water Framework Directive) (England and Wales) Regulations 2003 and environmental objectives as specified in the relevant River Basin Management Plans when carrying out locations specific actions.	EA MBC SW and UMIDB		Long Term	Low

Priority: Quick win = within 12 months. Short Term = up to 2 years. Medium Term = up to 5 years. Long Term = open ended/indefinite.

4.3 Location Specific Action Plan

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

It should be noted; generally where issues have been solely related to either KCC Highways or Southern Water these have been noted in a separate record/ addendum and passed to the relevant body to investigate and follow up with an action should it be required. Where KCC Highways or Southern Water issues have been discussed with key partners during the Data Validation and Action Plan Workshop and an action has been decided these have been highlighted below within the Location Specific Action Plan.

Table 4-2 Location Specific Action Plans

DA01 Maidstone Rural North

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
DA01	Waterditch Lane	Waterditch Lane	*This location was highlighted as a drainage hotspot, KCC are aware of the flooding issues at this location; however, at this stage they are not sure as to what type of scheme is to be implemented.* **A scheme is planned for 2013/2014.**		Work has been included into schedule for 2013/2014	KCC			

DA02 Maidstone Rural Mid

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
		Forstal Road	*In 2009 (February and November), Forstal Road was flooded. In November 2009, records describe the perceived cause was a blocked culvert of an ordinary watercourse. EA records also suggest commercial properties have been flooded in the past.*						
			Monitor the situation and should future flooding occur action should be taken.		Include study within future schedule of works	KCC, SW, MBC	EA	Long Term	Up to £50k
DA02	Detling (B)	Water Lane	*In 2012, KCC Highways were asked to provide a combo to remove flood water and cleanse gullies. Anecdotal evidence suggests that recent resurfacing works covered and damaged the drainage system. KCC Highways are aware of issues here but are unsure what the scheme may be, however, work has been programmed in for 2013-2014.*						
			Undertake study / investigation to resolve recurring flooding issues.	***Improve conditions along Water Lane***	***Work programmed for 2013-2014***	***KCC***	***n/a***	***Short term***	***Up to £50k***

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
DA02	Eyhorne Street and Hollingbourne (C)	Eyhorne Street, Hollingbourne	*MBC explained that there is a small ditch that flows through Eyhorne Street which has caused issues in the past, especially to the highway. In 2008, flooding was recorded at this location. The EA explained that the channels here are spring fed and are prone to blockage and require maintenance.*						
			Communicate with the landowners and inform them of their riparian duties.		Include study within future schedule of works	KCC, and MBC	SW, EA	Long Term	Up to £50k
			Monitor the situation and should future flooding occur; action/ enforcement should be taken.		Include study within future schedule of works	KCC, SW, EA, MBC		Long Term	Up to £50k
DA02	Harrietsham (D)	Harrietsham	*The EA described watercourses are being spring fed and easily blocked (undersized culverts). A number of events were reported in the historical flood data relating to the following areas of Harrietsham;* *- Church Road* *- East Street* *- Rectory Lane* *- Fairbourne Lane* *- Goddington Lane* *- Holm Mill Lane* *- Lakelands*						
			Complete an integrated asset management survey of the culverts, bridges and soakaways in Harrietsham to determine the condition of the infrastructure in the area.	Identify the origin/s of the issues	Engage with relevant key partners to organise date and include within future schedule of works	KCC, MBC,	SW, Parish Council, EA	Medium Term	Up to £50k

DA03 Maidstone Rural West

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
DA03	Nettlestead Green (D)	Hampstead Lane	*Repeated records of localised flooding at this location. The EA suggested at the Data and Validation workshop that a flap valve be fitted where the drain meets the River Medway to help to alleviate localised flooding*						
			Complete an investigation to consider this measure and its potential benefits		Include study within future schedule of works	KCC,	SW, MBC EA	Long Term	Up to £50k

DA04 Maidstone Rural East

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
DA04	Marden (D)	Marden	*Numerous issues identified within Marden from varying sources*						
			Consider completing a integrated catchment model for Marden		Include study within future schedule of works	KCC	EA, SW, MBC	Short Term	Up to £50k
DA04	Marden (D)	Pattenden	*This location was highlighted as a drainage hotspot. Sewer flooding was recorded in 2008. EA described this road suffers from surface water flooding due to surface water being unable to discharge to the watercourse and the presence of hard standing. EA described traffic on the road can create a bow wave during an event which increases flood risk to properties.* *In 2012, KCC were requested to clear flood water and cleanse and jet gullies to prevent further flooding.*						
			Investigate the methods of surface water drainage and consider routing drainage into existing watercourse in the future		Include study within future schedule of works	KCC	, SW, MBC	Long Term	Up to £50k

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
DA04	Clapper Farm (E)	Clapper Lane	*Records of flooding from numerous sources, Sewer flooding in 2009 affecting the curtilage of three properties. Fluvial flooding from an unnamed drain and an IDB Drain.* *MBC included this area within their "Planned Maintenance Schedule"*						
			Consider completing an investigation in collaboration with key partners into the methods of drainage at Clappers Lane.		Include study within future works	KCC, UMIDB, MBC, , SW		Short Term	Up to £50k
DA04	Staplehurst (F)	Staplehurst	*Numerous issues identified within Staplehurst from varying sources*						
			Consider completing an integrated catchment model for Staplehurst.		Include study within future schedule of works	KCC	EA, SW, UMIDB, MBC	Short Term	Up to £50k
			Consider a partnership approach with EA and IDB to continue to maintain watercourse and assets in the area. It should be noted that any change in maintenance regime should be supported by evidence.			EA UMIDB	KCC, SW	Medium Term	Up to £50k
DA04	Headcorn (G)	Headcorn	*Key partners have identified that there are issues as a result of unmaintained drains and channels with insufficient capacity. There have also been repeated incidents of sewer flooding. There are a number of records of surface water flooding from overloaded drains and gullies and from blockages. Therefore the following action should be considered.*						

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
			Consider completing an integrated catchment model for Headcorn.		Include study within future schedule of works	KCC,	EA, SW, UMIDB, MBC	Short Term	Up to £50k

**** Priority: Quick win = within 12 months. Short Term = up to 2 years. Medium Term = up to 5 years. Long Term = open ended/indefinite.***

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

4.4 Review Timeframe and Responsibilities

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

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

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

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

4.5 Sources of funding

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

- Defra (Flood Defence Grant in Aid)
- Industrial estate owners and businesses
- Kent County Council (highways)
- Maidstone Borough Council
- IDBs
- Local communities
- Network Rail
- New developments (directly through the developer or through CIL)
- Southern Water
- Local Levy from the southern region Regional Flood & Coastal Committees (RFCC)

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

4.6 Ongoing Monitoring

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

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

There may be circumstances which might trigger a review and/or an update of the action plan in the interim, for example:

- Occurrence of a surface water flood event;

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

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

4.7 Way Forward

Kent County Council has prepared a Local Flood Risk Management Strategy (the Local Strategy), which sets objectives and priorities for the management of local flood risks across the county. The Local Strategy includes an action plan of investigations and works to achieve the objectives and indicates which risk management authority should lead this work. The action plan is updated annually with progress on previous actions and new actions that have been identified. The action plan uses information from studies like this and other sources from across the county to prioritise where further works are needed to help achieve the objectives, this is balanced with the available sources of funding and resources to deliver these actions. The Local Strategy can be found here:

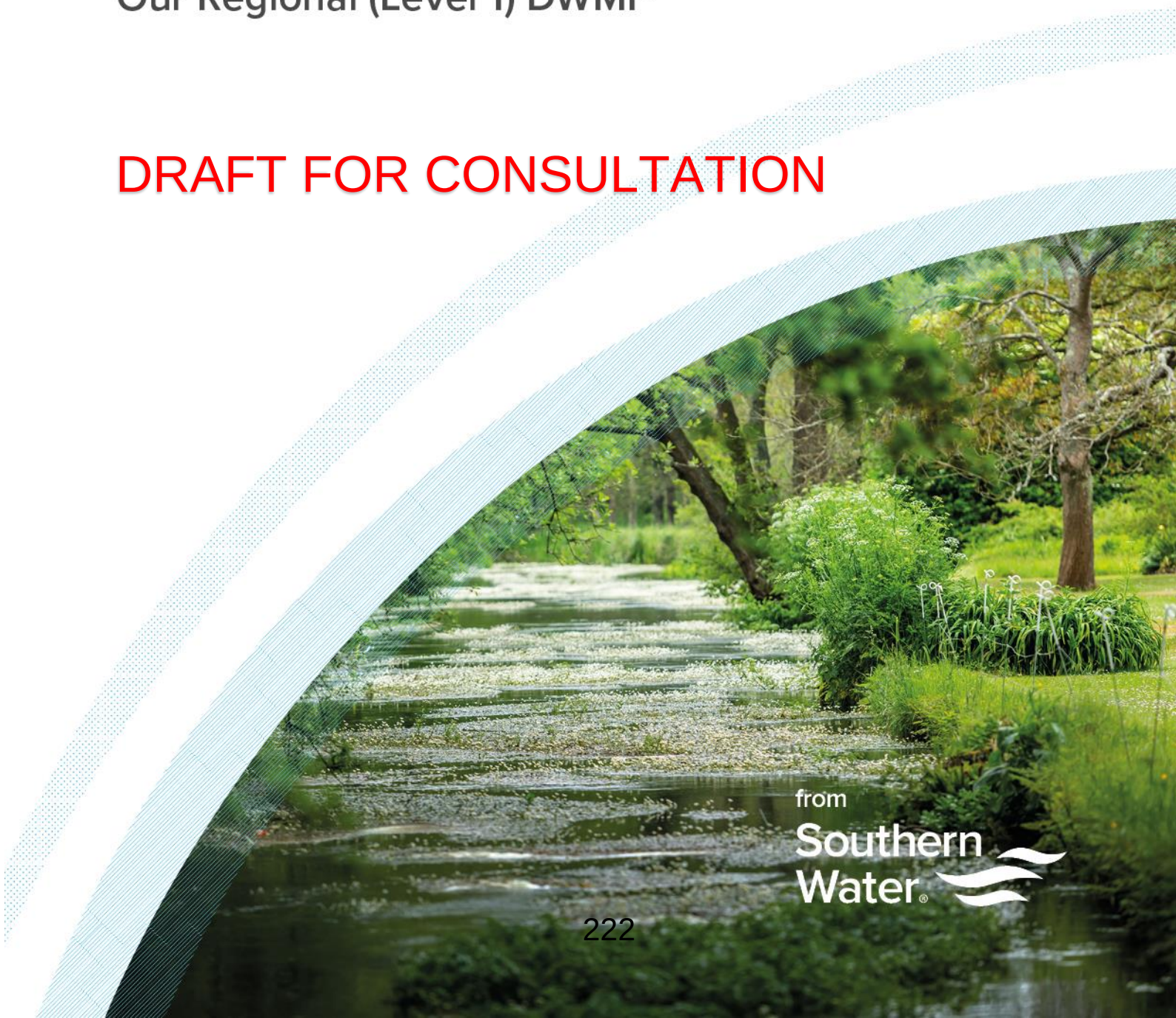
www.kent.gov.uk/local_flood_strategy

This SWMP and any new information about local flooding in Maidstone borough that comes to light will be used as part of the evidence base when setting the Local Strategy action plan annually. Any actions identified to be delivered from this SWMP will be overseen by the SWMP Partnership.

Drainage and Wastewater Management Plan (DWMP)

Our Regional (Level 1) DWMP

DRAFT FOR CONSULTATION



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Foreword

It's time to change

Water is our most precious resource, but it is one we often take for granted. We all turn on our taps and clean, safe water comes out of them. We drink it, wash ourselves and our property with it and water our crops with it. We use it to support our businesses and industrial processes. We simply expect it to be there for our use - whenever we need it - as well as depending on it to sustain a thriving natural environment to enrich our lives. At the same time, we don't spend much time thinking about what happens to our used water, we just expect it to be taken away and recycled so it can be released safely back into rivers or the sea. As a water company, these are the services our customers rightly expect of us, as we provide our communities with water for life.

Times have changed and we have to change too, recognising;

- the climate emergency, particularly in the South East, means there are droughts and storms at a scale we haven't faced before, but now see regularly
- there are significant pressures from growth across our region to provide homes for a rapidly expanding population and
- the need to protect and improve the environment and the wildlife that depends on it are now greater than ever.

Our role is to plan and manage for this change and, at the same time, enhance health and wellbeing, protect and improve the environment and sustain the economy.

Faced with these challenges, keeping our rivers, lakes and coasts clean is challenging. It is encouraging to see that our the 84 bathing waters in our region scored their highest ever quality ratings in 2021, although we must keep working to improve them further. Inland waters are however a significant concern with only 14% judged to be in Good Ecological Status by the Environment Agency.

The pressures on the quality of water in the environment come from many sectors and industries, including highways, agriculture, land use planning, developers, industry, pleasure and commercial waterway users. These issues and the risks to the water and natural environment are at the core of drainage and wastewater management. Likewise our operations, and the effluent we discharge into the environment, affect the health and sustainability of the natural environment and we must continue to improve the efficiency and quality of our service.

However no one single entity or sector can solve water quality problems on their own. By working together with other organisations, we can collaboratively create and implement innovative measures and solutions to get the outcomes we all want – a healthy, clean water environment that supports a wealth of habitats and wildlife. This will ensure that our communities have a water resilient future and the public value they deserve.

There is still much we need to know and do. We must share data and information on the health of our waters and biodiversity to understand what is causing the biggest impact. The interrelationship between our sewers and surface water is complex. We need to know how and where we can

separate or slow the flow of rainwater entering our systems to prevent discharges from storm overflows that potentially pollute rivers and the sea, and flooding from sewers that devastates homes and businesses. These issues, and many others, have to be tackled holistically. By working together across river basin catchments and multiple sectors, we can create cleaner, greener urban environments that are better for the health and wellbeing of our customers and communities, and we can most definitely create a more sustainable and hospitable environment in which our wildlife can flourish.

In essence, this is what our first Drainage and Wastewater Management Plan is. It is the culmination of over 80 engagement events with 75 organisations. It is our collaborative view of where we should focus our collective attention in delivering against these ambitions. At its core is a demonstration of how we want to live our company values by succeeding together, doing the right thing and always improving. We want to catalyse the concerted and collaborative action needed to develop and deliver solutions to the challenges ahead, working across the wider water and environmental systems.

Ian McAulay
Chief Executive Southern Water

Executive Summary

Every day our 39,835 kilometres of sewers and 3,444 pumping stations transport on average 758 million litres of wastewater and rainwater from our 4.7 million customers' homes and businesses, and from the drains outside. This water is carefully recycled by screening, filtering and treating at our 367 treatment works, meeting strict environmental standards before being returned to the environment.

Our Drainage and Wastewater Management Plan (DWMP) tells us one overarching thing: that we need to work with multiple organisations and stakeholders to create sustainable and resilient drainage and wastewater systems that keep wastewater services affordable while enhancing the environment, supporting tourism and enabling economic growth in the South East.

Our Plan provides an important step towards integrated and cross sector water management planning that drives long term investment and greater use of nature based solutions and sustainable drainage systems. It's a plan to avoid the potentially significant environmental and economic impacts from population growth, creeping urbanisation and climate change.

Our DWMP is about long-term planning. It sets out the investment needs for the next Price Review period from 2025 to 2030, known as Asset Management Plan 8 (AMP8), and starts to build a picture of the future investment needs for the following four AMP periods through to 2050. Thinking and planning for 25 years enables us to identify investment needs that meet the needs of our existing and future customers using more sustainable approaches to tackling drainage and wastewater issues.

The key challenges our Plan sets out to address include:

- Protecting public health
- Adapting to climate change
- Sustaining population growth
- Enhancing and protecting the environment
- Supporting tourism and economic growth
- Ensuring our ageing assets are resilient.

Our Plan is about collaborating and working with others. We have worked with 75 other organisations across the South-East who also have responsibilities for drainage, flooding, land use planning and protection of the environment to develop our first DWMP. Collaborative working creates the opportunity to take a wider view of what needs to be done to meet the future challenges, and enables our plans and investment to be aligned with and alongside those of organisations. Our customers, communities and local businesses will see greater collaboration in the future between ourselves and other water management organisations and environmental groups. Co-operation and partnerships will make the cross sector funding for water and the environment go further and enable us all to do more to protect the environment.

Our DWMP includes five Investment Plans that set out the investment needs to ensure our drainage and wastewater services are resilient to the future challenges. We estimate that the investment needed over the next 25 years for 61 of our 381 wastewater system is around £2 billion. It could be as much as £20 billion for all of our 381 wastewater systems. Our DWMP therefore sets the direction for a long term approach to ensure drainage and wastewater services remain resilient, sustainable and affordable into the future.

Introduction

This Drainage and Wastewater Management Plan (DWMP) is our wastewater plan for people and the environment across the South-East of England. It is for our customers across Kent, Sussex, Hampshire and on the Isle of Wight who rely upon us to provide an essential service to protect public health and enhance the environment across the region. This Plan is intended to set out the investment needs to provide resilient drainage and wastewater services for the South-East over the next 25 years.

DWMPs are new long-term strategic plans being produced by all water companies providing wastewater services in England and Wales. These plans will soon become a statutory requirement under the Environment Act 2021, and water companies will need to publish an update to their plan in the same way that the Water Resources Management Plan is updated every five years.

A national framework[1] for DWMPs has been developed by Water UK in collaboration with Defra, the Welsh Government, Ofwat, the Environment Agency (EA), Natural Resources Wales, the Consumer Council for Water, ADEPT and the Blueprint for Water. It is a risk-based approach to planning that means using data, evidence and modelling to understand the risks to customers and the environment from the performance of drainage and wastewater systems. Options are then identified to manage and reduce those risks so we can identify the future investment needs. We have followed this national framework to develop our DWMP.

The DWMP must set out how a water company will manage and develop its wastewater systems over the next 25 years. The aim is to ensure these systems are resilient, have the ability to meet the challenges of climate change and population growth, and enable us to protect and enhance the natural environment. The plan must also show the associated costs and the timescale for implementing the measures that are needed to deliver the level of performance that is expected by our customers and our regulators.

We work with many other organisations who also have responsibilities for water and the environment to deliver our drainage and wastewater services. We have worked together to develop our DWMP. It has involved three levels of planning:

(i) Level 1: Our operating region

(ii) Level 2: The 11 river basin catchments in our region, and

(iii) Level 3: Our 381 wastewater systems.

This document is our regional (level 1) DWMP and it is supported by five Investment Plans on:

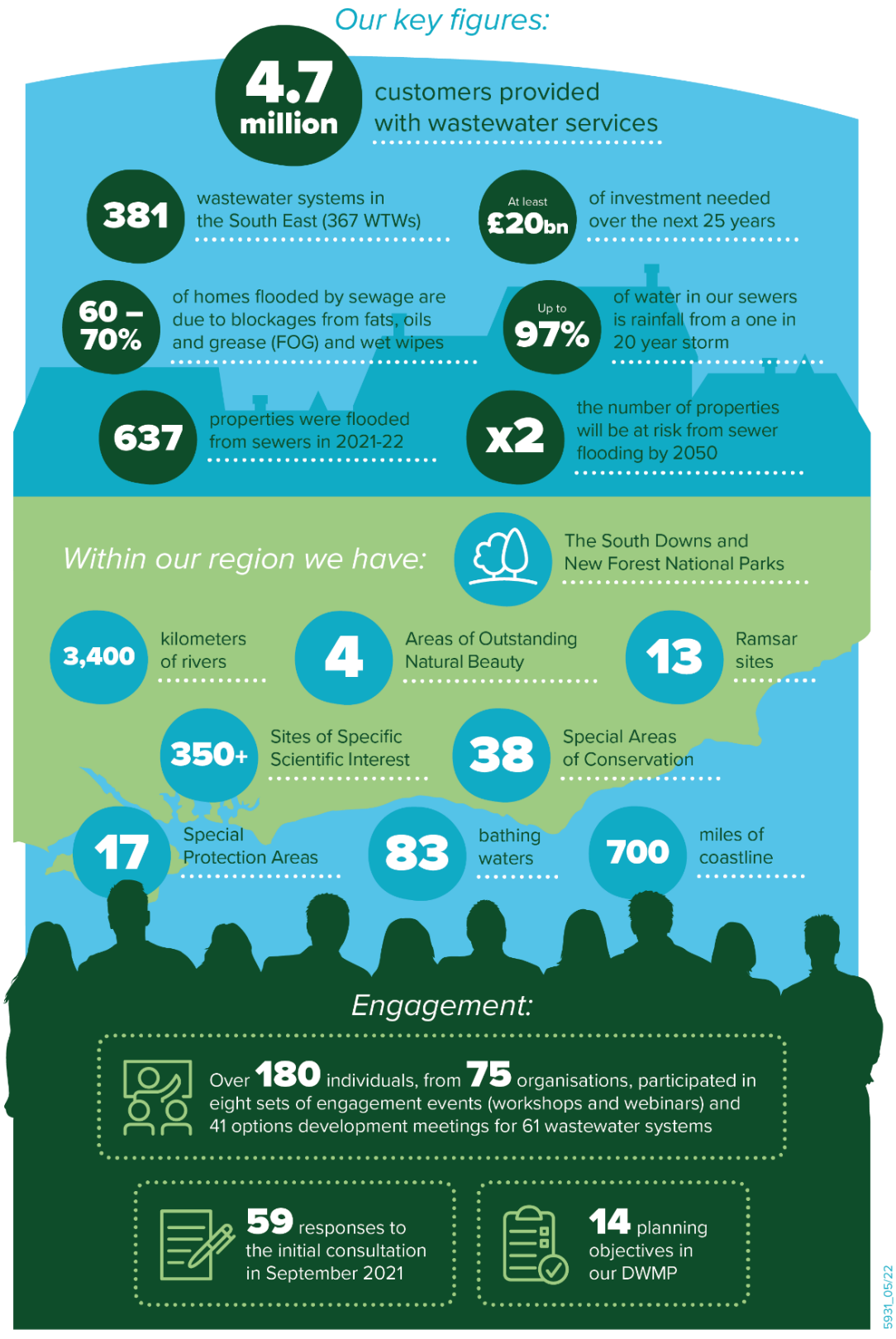
- Wastewater Compliance and Pollution
- Sewer Condition and Groundwater Pollution

[1] https://www.water.org.uk/policy-topics/managing-sewage-and-drainage/drainage-and-wastewater-management-plans/

- Storm Overflows
- Sewer Flooding
- Enhancing the Environment.

Overall our DWMP consists of this Regional Level 1 Plan, the 5 supporting Investment Plans and all the information contained on our website which sets out our plan for each wastewater system, and how those investment plans come together to manage water within each river basin catchment. Technical summaries provide information on the process that we have followed in developing our Plan and the methodologies we have developed for each stage of the planning process. The data, evidence and results from our DWMP are shown in tables and maps, including regional risk maps for each of the planning objectives. Our DWMP website is: www.southernwater.co.uk/dwmp. This document should be read in the context of the information available on our website.

Our Plan at a glance



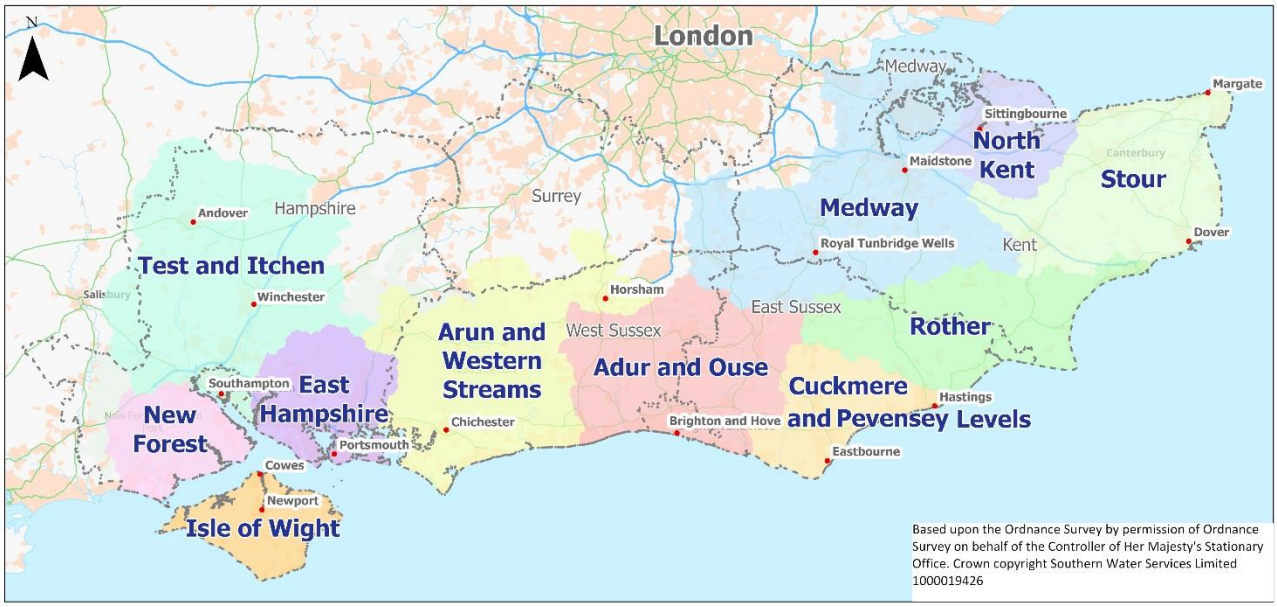
Our Drainage and Wastewater Services

Our drainage and wastewater systems serve around 4.7 million customers across Kent, Sussex, Hampshire and the Isle of Wight. Every day our 39,835 kilometres of sewers and 3,444 pumping stations transport on average 758 million litres of wastewater and rainwater from our customers' homes and businesses, and from the drains outside. This water is carefully recycled by screening, filtering and treating at our 367 treatment works, meeting strict environmental standards before being returned to the environment.

We operate our wastewater systems to protect a wealth of water dependent natural beauty and habitats, including over 700 miles of coastline, 83 designated bathing waters, 3,400 km of rivers, four Areas of Outstanding Natural Beauty (AONB), the South Downs and New Forest National Parks. There are more than 350 Sites of Specific Scientific Interest; 38 Special Areas of Conservation; 17 Special Protection Areas and 13 Ramsar sites within our region

Figure 1 shows our operating area and highlights the 11 River Basin Catchments (RBCs) within it. Across the region, our 381 wastewater systems provide services to customers in urban centres including cities, towns and many villages. We cover approximately 17% of the geographical area and provide wastewater services to around 99% of the population. Smaller villages and remote properties use alternative arrangements for wastewater removal, such as septic tanks and local private systems.

Figure 1: Map of our Operating Area



Planning for the Future

The UK Parliament declared a national climate emergency in 2019 to drive adaptation to climate change and reduce carbon emission by 80% by 2050. Our DWMP is a long-term plan for investment in drainage and wastewater services is to support the adaptation of communities so they have the critical infrastructure they need for existing customers and for future generations. It sets out the investment needs for the short, medium and long term to meet our customers' expectations, provide the necessary capacity and create resilient wastewater systems.

We need to start investing now for the future. Wastewater services are an essential service so they need to be affordable to protect and enhance the environment, to support tourism and enable economic growth. We cannot delay investment if we want to protect our children and grandchildren from the prospect of unaffordable water and wastewater services bills in the future.

Our DWMP provides an important step towards integrated water cycle planning and management – where planning across drainage, agriculture, land use, highways, environment is co-ordinated to ensure the availability of high quality water for people, industry and the environment. It's a plan for the future to avoid the potentially significant environmental and economic impacts from population growth, creeping urbanisation and climate change.

The changing climate will significantly increase pressures on our drainage and wastewater systems and, without a change of approach, we will be facing significantly increasing costs and unacceptable impacts on the environment and our customers. There are 12 significant challenges ahead which are the focus for us, our customers and partner organisations as we prepare to address very real external and operational pressures. These include:

1. **Climate change**. This is already affecting our weather patterns and many Councils across the South-East of England have declared a climate emergency. The past seven years have been the warmest seven years on record[2]. The climate predictions are for less overall annual rainfall in the South East, but we can expect periods of exceptionally heavy summer storms, warmer wetter winters, and longer periods of drought. These extremes of weather will create operational challenges to ensure our customers and the environment are not affected by flooding or pollution.
2. **Population growth**. The increasing population results in additional homes connecting into existing sewerage systems and the development of new towns that require new drainage and wastewater infrastructure. The rate of growth is increasing and a further 800,000 people are forecast to need homes in our region by 2040[3]. Urban development of roads and infrastructure is resulting in fewer green spaces and trees to absorb rainfall and reduce runoff, which is likely

[2] State of the Global Climate 2021 (WMO-No. 1290) Report, published by World Meteorological Organisation, 18 May 2022. https://library.wmo.int/index.php?lvl=notice_display&id=22080
[3] See our Technical Summary on Population Growth: https://www.southernwater.co.uk/media/5257/technical-summary-growth-and-creep-final.pdf

to lead to more frequent overwhelming of our sewer systems and an increase the risk of flooding.

3. **Tightening environmental permits**. These will be needed to ensure important habitats are protected into the future and remain resilient to environmental pressures. Over 24% of our wastewater treatment works (WTW) already have challenging quality permits and we are using the best available technology on some sites to achieve these. But we expect that the Environment Agency will need to tighten permits further so they become more stringent to protect the environment for the future.
4. **Nutrient enrichment**. There are urgent concerns regarding nutrients enriching our coastal and inland waters and affecting the ecology of the natural environment. We are already deploying the best available technologies at many of our larger Wastewater Treatment Works (WTWs), and expect further investments to be needed in the future to help restore internationally designated Habitat sites to favourable condition where we have identified the need for improvement
5. **Keeping rivers, lakes, reservoirs and coasts healthy and clean**. High quality open waterbodies are fundamental in supporting local tourism, shell fisheries and recreation. The Water Environment (Water Framework) (England and Wales) Regulations 2017 is the primary legislation that protects our rivers and lakes, estuaries, coastal waters and groundwater, and drives the need to ensure all aquatic ecosystems meet 'good status' by 2027. Only 14% of rivers in England are currently classed by the Environment Agency (EA) as being in good ecological status[4].
6. **Persistent and biologically active chemicals / pharmaceuticals**. These have the potential to disrupt hormones systems in both humans and wildlife. They are entering the drainage network from homes and businesses, but also in rainwater draining from farmland and roads.
7. **Public health**. The rise in popularity of wild open water swimming and recreational pursuits means there is a concern for public health due to the bacteria in rivers and coastal waters. It is also becoming apparent that the quality of our groundwater drinking water supplies are being gradually degraded by poorly maintained sewers and septic tanks, and from discharges direct to ground in areas that are not connected to our mains sewerage networks.
8. **Plastics and micro-plastics**. There are a growing number of products that could have a significant but as yet not fully understood impact on people and the environment if allowed to flow unchecked through the water cycle.
9. **Carbon**. Our industry has a large carbon footprint from the operational requirements for treating drinking water, processing wastewater, and pumping large volumes of sewage around extensive networks.
10. **Ageing assets and infrastructure**. Much of our sewer network is in excess of 50 years old and is not built with the capacity to cope with the current levels of storm water. Much of it is deteriorating over time which can cause collapses, blockages or sewage leaks. This can affect

[4] https://www.gov.uk/government/publications/state-of-the-water-environment-indicator-b3-supporting-evidence/state-of-the-water-environment-indicator-b3-supporting-evidence

the surrounding groundwater or infiltrate and inundate the network by either rising levels of groundwater or flooding.

11. **Water recycling and repurposing**. We expect droughts to happen more often as our climate changes. To ensure we have enough water supplies to meet the needs of our customers, industry and the environment, we need to change how we look at and use wastewater. Treated wastewater that is currently released out to sea is a valuable resource which could instead be recycled and used again to provide additional drinking water supplies. Our draft Water Resources Management Plan has a number of schemes that will recycle treated wastewater. In some areas, this will be into rivers where we can abstract it again and in others it will be into a storage facility such as a reservoir where it will mix with other sources of water. Doing this means we can store the water until we need it, and it helps to protect the environment as we are not impacting on the flow or quality of the river.
12. **Affordability**. The current cost of living crisis is placing greater financial pressure on our customers. We need to carefully consider the costs of how we manage the future challenges and achieve our environmental ambitions. The rate of investment will need to increase in order to keep pace with these challenges and prevent us passing costs onto future generations, but we want our water bills to be affordable for all, especially the vulnerable.

We realise the scale of the challenges and recognise that a radical step change is needed to ensure we have the right level of investment now and into the future to provide resilient wastewater systems. More of the same is not an option – we have to change. Together, we need to think and act differently, and collaborate in responding to these challenges.

Our DWMP sets out the ways we can protect and enhance the environment and provide resilient drainage and wastewater services now and into the future.

Working with Others

The DWMP provides an opportunity for more collaborative and integrated planning. Ofwat, Defra and the EA expect water companies to lead the development of the DWMP, although not all drainage systems are owned and operated by water companies. There are many other organisations that have responsibilities and interests in drainage, flooding and protection of the environment. Collaborative engagement is therefore essential between these organisations in order to develop and deliver our DWMP.

We adopted a 'Working with Others' approach to co-create our plan with experts from across our business and with partner organisations. This approach enabled our Plan to reflect and incorporate partners' issues and concerns as well as our own. Working in partnership has meant transparently sharing data and benefitting from the knowledge and expertise within all partner organisations to build a better plan.

Our DWMP is about collaborating to align plans and investment in drainage and wastewater management. This approach means that we can explore and co-create more sustainable and resilient options together that protect against future shocks and stresses that will come from, for example, climate and population growth. The process has enabled us to work closer together with other organisations to identify opportunities for future partnership projects that provide mutual benefits for the customers and communities we serve, and for the environment. As the process develops further it will lead to the co-creation of many schemes, and the establishment of partnerships to co-deliver projects.

We worked with various partner organisations during the development of our DWMP. At a regional scale, we engaged groups such as our Strategic Environment Panel and the Southern Region Flood and Coastal Committee (RFCC). However, the principle geographical area for planning and engagement was the 11 river basin catchments across our operating area. This enabled us to engage with the existing groups and organisations including:

- The Flood Risk Management Authorities (RMAs) such as the Environment Agency, Internal Drainage Boards and Lead Local Flood Authorities (County Councils and Unitary Authorities)
- The Local Planning Authorities that have to meet government housing targets
- Neighbouring water companies and those providing water supply services within our region
- Organisations that are charged with protecting and enhancing the environment such as Natural England, the National Park Authorities, Catchment Partnerships, and River and Wildlife Trusts.

Working with these partner organisations has meant our DWMP considers and incorporates a much wider range of socio-economic and environmentally-based outcomes than the core set of planning objectives set out in the national guidance. For example, our DWMP incorporates planning objectives on achieving Good Ecological Status under the Water Framework Directive

(WFD), securing nutrient neutrality[5], preventing groundwater pollution and protecting drinking water sources, improving surface water drainage and improving and protecting bathing and shellfish waters, see Box 1. Our website explains these planning objectives and the methodology to assess the risks of not achieving them due to the performance of our wastewater systems. We believe our DWMP is a significantly improved plan as a result of working with others, and the environment and communities we serve will benefit from this.

Planning objectives

Box 1

Our DWMP has 14 planning objectives developed with partner organisations and our colleagues to build in the things they care about and know are important in relation to the performance of our drainage and wastewater systems. These objectives are:

- **PO1:** Internal sewer flooding risk
- **PO2:** Pollution risk
- **PO3:** Sewer collapse risk
- **PO4:** Risk of sewer flooding in a one in 50 year storm
- **PO5:** Storm overflow performance
- **PO6:** Risk of WTW compliance failure
- **PO7:** Risk of flooding due to hydraulic overload
- **PO8:** Dry weather flow compliance
- **PO9:** Achieve good ecological status/potential
- **PO10:** Improve surface water management
- **PO11:** Secure nutrient neutrality
- **PO12:** Reduce groundwater pollution
- **PO13:** Improve bathing waters
- **PO14:** Improve shellfish waters

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We have collaborated with over 180 individuals from 75 organisations, and experts from across our business, to develop our Plan. We ran eight sets of engagement workshops and webinars as well as hosting 41 meetings to identify the unconstrained options for 61 wastewater systems. Full details of our approach and activities to work with others during the development of our DWMP are set out in the 'Who we're working with' page on our website.

We collated the concerns, comments, challenges and expectations raised by internal colleagues and external partners in our Register of Stakeholder Comments. This is published on our website

[5] https://www.gov.uk/government/publications/nutrient-pollution-reducing-the-impact-on-protected-sites/nutrient-pollution-reducing-the-impact-on-protected-sites

and should be viewed alongside our DWMP to see how we have addressed, or intend to address, the issues raised.

Working with others is increasingly important as we adapt to climate change and its impacts. As an industry, water companies cannot deliver high-quality and sustainable drainage and wastewater solutions by ourselves. We will continue to collaborate with partner organisations to share data and information and understand the wider issues and risks associated with drainage, water quality and the environment. Wherever possible, we will co-create and co-deliver solutions.

Our approach has enabled us to identify and consider links and relationships with other plans, including Local Plans, Water Resources Management Plan, Flood Risk Management Plans and the River Basin Management Plans. As a result, our customers, communities and local businesses will see greater collaboration between ourselves, other water management organisations and environmental groups. Our plans and investment programmes will be more aligned and deliver better outcomes for people and the environment, as well as developing better management of water across the whole river basin.

We see the DWMP as a shared Plan but recognise that, in this first cycle, we can only represent the investment needs specific to Southern Water. We will use the DWMP as we prepare our Business Plan for submission as part of the Ofwat Price Review 2024 (PR24), and to support the development of the Water Industry National Environment Programme (WINEP) for 2025-2030. At the same time, the partnership process means that our plan has emerging links with the plans of the other Risk Management Authorities. It is our ambition that as the DWMP and the collaborations evolve through time, these plans are further integrated into an overall strategic plan for drainage and wastewater management across our region in a similar way to how water resources planning has evolved through Water Resources South East.

Customer Engagement

We have focused on working with partner organisations in developing our DWMP, but keeping our customers informed of our developing plans is important to us. We have shared our work on our DWMP with customers on our website as we've developed the plan.

We used our customer focus groups to gain early insight on our DWMP website and the information provided to ensure we are explaining complex issues relating to drainage and wastewater in a way that is easy for customers to understand. The insight gained from these customer focus groups was that they:

- Welcome the consideration of macro factors like urban creep, people behaviours and climate change when planning for wastewater management
- Find it reassuring that multiple organisations are talking to each other about the DWMP to ensure there is a cohesive strategy to manage wastewater and limit environmental damage
- Think a 25-year view reviewed every 5 years feels forward looking, comprehensive and with the capacity to evolve over time
- Are pleased to have a wider picture of the issues for the whole of the South East of England
- Are reassured to know about the DWMP, but the granular detail is too much information for them to engage with
- Feel that it isn't always particularly customer facing and is jargon heavy, word heavy and lacking explanation for example, on the risk assessment results

- Think it is sufficient to know that there is a DWMP and to leave the detail to Southern Water and relevant agencies.

We are using this feedback to inform the development of our DWMP and how we share information with customers via our website.

We consulted our customers on our developing DWMP in September and October 2021. The purpose of this consultation was to gain feedback on:

(a) Our Strategic Environmental Assessment Scoping Report, which set out how we planned to consider the environment in our decision making

(b) Our selection of wastewater systems to take forward into the Options Development and Appraisal stage of the DWMP in the first cycle, and

(c) Our developing plans on each of the 11 river basin catchments.

We also wanted to understand if we could improve the process and way we communicate information about the DWMP. The Report on the 2021 DWMP Stakeholder Consultation is on our website.

We will be consulting on this draft regional DWMP in the public consultation in the summer of 2022. Customer and partner organisation feedback will enable us to finalise the plan and publish it before 31 March 2023.

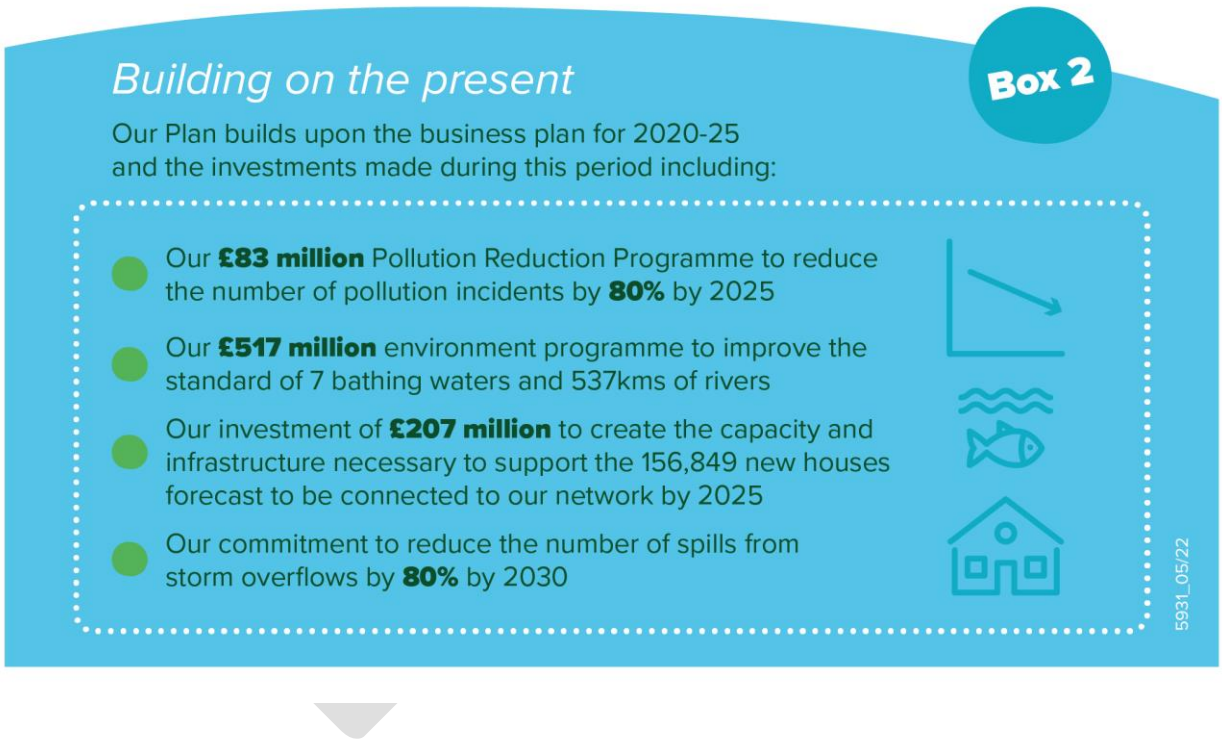
We will continue to engage customers in plans that directly affect them and their local area as we progress with the implementation of our DWMP.

Our Drainage and Wastewater Management Plan

Our DWMP is a long-term plan for drainage and wastewater management. It sets out the investment needs for the next Price Review period from 2025 to 2030, known as AMP8, and starts to build a picture of the future investment needs for the following four AMP periods through to 2050.

The DWMP forms the basis for planning activities in drainage and wastewater to address multiple future pressures such as population growth, urban creep, new development and climate change. It makes an explicit link to the current and future performance of our wastewater systems, and provides the long term focus which will drive co-ordinated, timely and sustainable investment decisions across our business. We hope our external partners can use the information provided in our DWMP to help shape their own plans and align with ours so that, collectively, we can begin to address the multiple shared challenges ahead.

Our DWMP builds upon the significant investment that we are already making during the current AMP7 investment period, see Box 2.



Our Plan has been developed in accordance with the national DWMP framework guidance using a structured, evidence driven, risk-based approach. The main steps in the process to develop a DWMP are:

(a) Strategic Context

(b) Risk Based Catchment Screening

(c) Baseline Risk and Vulnerability Assessments (BRAVA)

(d) Problem Characterisation

(e) Options Development and Appraisal

(f) Programme Appraisal.

The DWMP uses risk assessments to understand the probability and impact of the current and future performance of our wastewater systems on our customers and the environment, see Box 3. The national guidance requires all water companies to set the base year as 2020 and to use incident data for the period 2017 to 2019 inclusive for the risk assessments. Identifying the risks to our customers and the environment has meant we can develop the right options to reduce the risks and to put a cost to the investment needs. A regional map showing the 2020 results of our risk assessment for the planning objective on storm overflow risks is shown in Figure 2. The maps showing the risk assessment results for all 14 planning objectives are on our website.

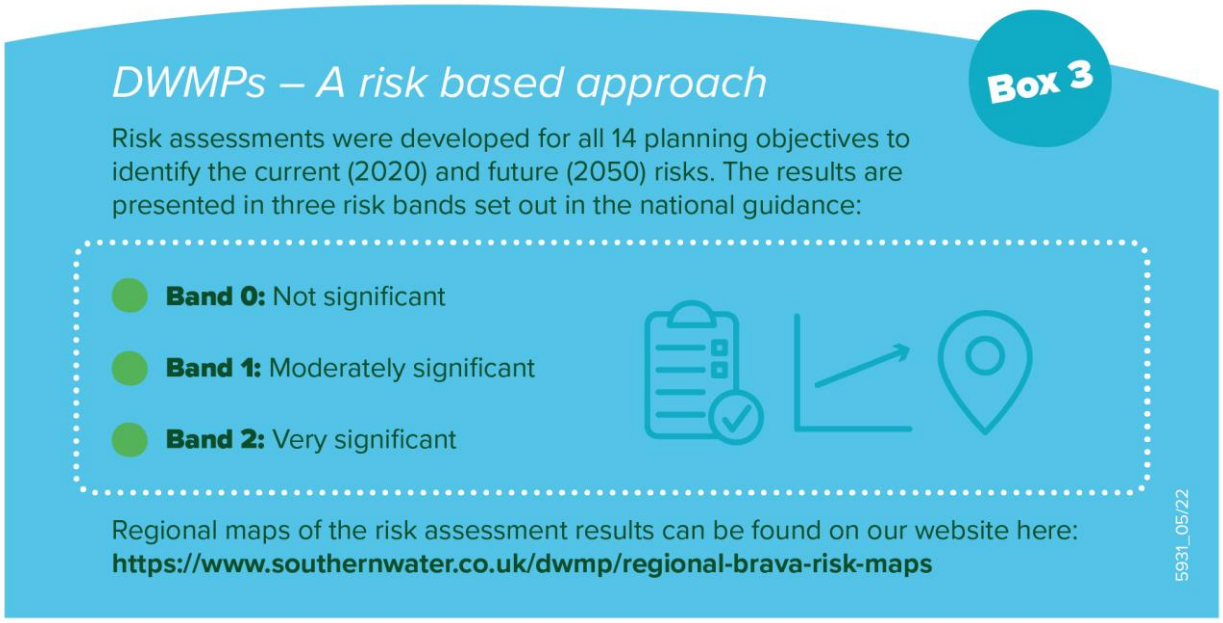
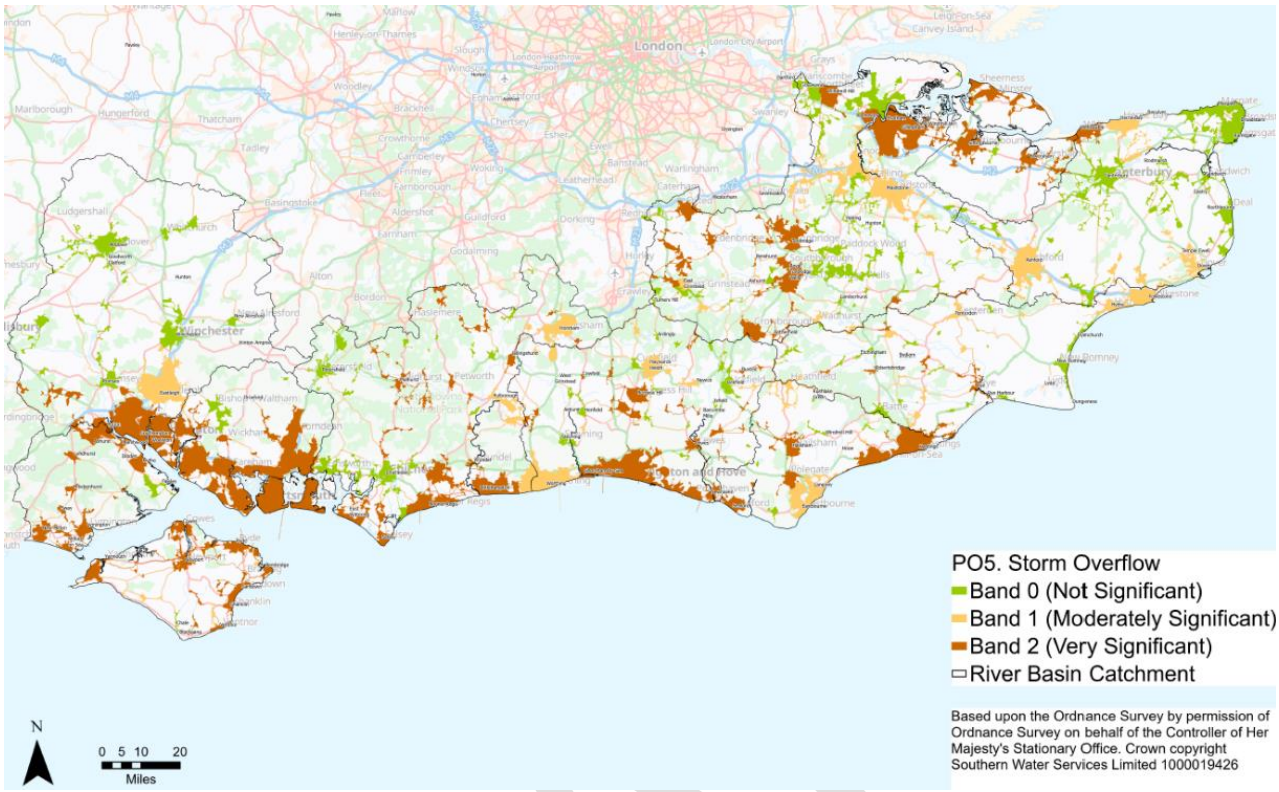


Figure 2: Risk Assessment Results for Storm Overflows in 2020



Developing a long-term plan for drainage and wastewater has enabled us to look more strategically at the options for managing the risks into the future. We adopted the industry wide Source-Pathway-Receptor (S-P-R) model for our DWMP. This model helps us to consider and identify opportunities to tackle and reduce the risks 'at source' as well as by investing in our infrastructure assets (the pathway), and also whether, perhaps as a last resort, we can mitigate the impacts on customers and the environment in the 'receptor' (the receiving waterbody for any discharges or customer homes). Figure 3 shows how we have applied the S-P-R model in the Options Development and Appraisal (ODA) stage of the Plan. This approach enables the most sustainable and effective options for the long term to be evaluated during the development of our plan. Examples of the types of generic options are provided in the table, including, for example, sustainable drainage systems (SuDS). Further details of our approach are provided in our technical summary on Options Development and Appraisal.

Figure 3: The application of the Source-Pathway-Receptor Model in our DWMP

Type of Measures	Generic Option Categories	Icon	Examples of Generic Options
Source (Demand) Measures (to reduce likelihood)	Control / Reduce surface water run-off		Natural Flood Management; rural land management and catchment management; SuDS including blue and green infrastructure; storm management
	Reduce groundwater levels		Reduce leakage from water supply pipes; pump away schemes to locally lower groundwater near sewer network
	Improve **quality** of wastewater		Domestic and business customer education; incentives and behaviour change (reduce Fats, Oils & Grease, wet wipes etc.); monitoring trade waste at source; on-site black water and/or greywater pre-treatment
	Reduce the **quantity** / demand		Water efficient appliances; water efficient measures; blackwater and/or greywater re-use; treatment at source
Pathway (Supply) Measures (to reduce likelihood)	Improve Sewer Network		Asset optimisation; additional network capacity; storage; separate flows; operational improvements; structural repairs; re-line sewer pipe and manholes; smart networks.
	Improve Treatment Quality		Increase treatment capacity; rationalisation of treatment works (centralisation / de-centralisation); install tertiary plant; UV plant or disinfection facilities; innovation; improve Technical Achievable Limits; new WTWs
	Wastewater Transfer to treatment elsewhere		Transfer flow to other network or treatment sites; transport sewage by tanker to other sites
Receptor Measures (to reduce consequences)	Mitigate impacts on Air Quality		Carbon offsetting; noise suppression /filtering; odour control and treatments
	Improve Land and Soils		Sludge soil enhancement
	Mitigate impacts on receiving waters		River enhancement, aeration
	Reduce impact on properties		Property flood resilience; non-return valves; flood guards / doors; air brick covers
Other	Study / Investigation		Additional data required; hydraulic model development; WQ monitoring and modelling

This document is our level 1 regional DWMP. It brings together the planning for the 11 river basin catchments (level 2) and our 381 wastewater systems (level 3).

Our Level 1 Plan sets out our future direction, policies and strategy for drainage and wastewater, and the investment needed to reduce risks to our customers and the environment. It considers the issues that we will need to address to deliver long-term, sustainable and affordable approaches to drainage and wastewater management. It explains the issues and potential solutions identified through working with partner organisations during the development of the DWMP, and the overall investment needs.

We have published on our website the data and information used for our level 2 and level 3 planning for each river basin catchment and wastewater system respectively. This information includes:

Level 2 Planning: River Basin Catchments

(a) The strategic context for the DWMP in each river basin catchment

(b) Who we worked with to develop the plan for the river basin catchment
(c) The results of the Risk Based Catchment Screening (RBCS)
(d) The methodologies developed for the Baseline Risk and Vulnerability Assessment (BRAVA)
(e) The results of BRAVA, including regional risk maps
(f) The Problem Characterisation for each river basin catchment to explain the current and future risks
(g) The Options Development and Appraisal (ODA) approach and which wastewater systems can been taken through this stage in our first DWMP
(h) Programme appraisal setting out the investment needs across the river basin catchment.

Level 3 Planning: Wastewater Systems

(a) Map of the wastewater system, with the risk assessment results
(b) Problem Characterisation – a narrative of the causes of the risks in each wastewater system
(c) Generic Options – our assessment of the generic options that were considered to reduce the identified risks in the wastewater system
(d) Investment Needs – a table of our most likely options and indicative costs for each wastewater system.
(e) A map of the location of where investment is needed to reduce the risks.

The level 3 planning covers 61 selected wastewater systems for our first cycle of DWMP. These are the largest and most complex systems, plus those that our partner organisations asked us to include in the first cycle of the DWMP. We will develop the level 3 plans for other wastewater systems as we embed the DWMP into the business before the next cycle.

We have also published technical summaries of the processes developed for delivering our DWMP including for specific issues such as growth and climate change.

Creating Resilient Wastewater Systems

Our vision is to create a resilient water future for our customers in the South East. To deliver on our vision we need to ensure as a minimum that our systems are (a) not causing unacceptable risks to customers and the environment, and (b) are resilient to threats and hazards both now and in the future to avoid loss or disruption to services.

Our DWMP focuses on the risks associated with the performance of our drainage and wastewater systems to identify the investment needs which can reduce the risks to the lowest risk band (Band 0). Our DWMP includes an assessment of a range of shocks and stresses that our wastewater systems could face now and into the future to test the resilience of these systems. Actions to improve the resilience of our assets and systems have been taken forward as part of our Resilience Action Plan[6].

This document is our Regional (Level 1) DWMP and brings together the plans for our wastewater systems and for the 11 river basin catchments across our operating area. This part of our Plan considers the risks and challenges in five main areas:

- Wastewater Compliance and Pollution
- Sewer Condition and Groundwater Pollution
- Storm Overflows
- Sewer Flooding
- Enhancing the Environment.

These are discussed in the sections below.

[6] https://www.southernwater.co.uk/media/2746/resilience-action-plan-final-publication.pdf

Wastewater Compliance and Pollution

We know we have let our customers down when it comes to pollution. In July 2021, we were fined by the Environment Agency for pollution offences over the period 2010 to 2015. What happened during this time was completely unacceptable and we pleaded guilty to the charges in recognition of that fact. We did not meet our customer expectations and we failed to protect the precious environment in the South-East of England. We recognise the importance of our actions to demonstrate our commitment to our customers and the environment.

We have a duty to protect and improve the environment in which we operate, and we recognise that causing it no harm through pollution incidents is the minimum our customers should expect from us.

The performance of our wastewater treatment works (WTWs), wastewater pumping stations (WPS) and storm overflows is a significant factor in preventing pollution of the environment. The EA sets limits on the quality and quantity of treated effluent from WTWs in permits based on the nature and sensitivity of the local environment and the receiving water body to prevent harm.

We routinely build sufficient capacity into our WTW to enable us to remain compliant with our permits, although problems do occasionally occur that lead to a pollution incident. The examples of the challenges that occur at wastewater sites across our region are a sudden drop in ambient temperature during winter freeze events adversely affecting our biological treatment processes, network, or operational issues such as high groundwater infiltrating the sewerage system during flooding periods, power outages in extreme weather events, sustained increases in domestic foul flows due to changes in customer behaviour (as an example the shift in home working during the pandemic), or even as significant as an inadvertent spillage of toxic chemicals into the sewer from say a road accident. Our focus is to proactively manage our assets and systems to prevent issues occurring that could lead to harm to the environment.

Risk of Wastewater Treatment Compliance: Quality (PO6) & Dry Weather Flow (PO8)

Our DWMP included the national Planning Objective 6 (PO6) on the risk of Wastewater Treatment Works (WTW) compliance with permits for the quality of discharges to the environment. We used this objective to assess our current and future risk of breaching the permitted treated effluent quality standards for each of our 295 WTW with prescribed quality standards.

We added a Planning Objective 8 (PO8) in our DWMP to assess the risk of compliance with the Dry Weather Flow (DWF) permit conditions. DWF is the average daily flow that we expect to reach our WTW during a period without rain. DWF has four main components; domestic wastewater, trade effluent, cess imports and infiltration. We have 308 WTW sites with DWF permits. PO8 assessed our current and future risk of exceeding these permitted flow rates.

The risks associated with DWF compliance are linked to Planning Objective 3 (PO3) on Sewer Collapse and Planning Objective 12 (PO12) on Groundwater Pollution. This is because infiltration of groundwater and intrusion of coastal saline water occurs in several of our wastewater systems meaning the flow in the sewers is higher than the expected dry weather flow from customers' homes and businesses. These additional flows vary according to the depth of sewer, the level of the groundwater below the surface, and the condition of the sewer. More infiltration occurs when the groundwater is higher than the level of the sewers and the sewer is in poor condition.

There is also a link to the planning objective on treatment quality (PO6) as an increase in DWF may require treatment improvements to maintain effluent standards on discharges. Infiltration is a significant issue in many parts of our operating area. Rising groundwater levels are increasing infiltration into the sewer network. This places greater pressure on the capacity of wastewater treatment works to meet our DWF permits. Keeping groundwater out of sewers means there is more capacity to provide for the current and future housing needs in the South-East.

The future risks for these two planning objectives have been forecasted by estimating the growth in population to 2050 using long term population growth forecasts and best estimates provided by Local Planning Authorities. Details of the growth projections are in our technical summary on growth. There is a need to continue to work closely with local planning authorities to build a greater understanding of growth risks and needs in the medium to long term by increasing our understanding of how local plans may develop. This should enable the use of adaptive planning techniques in our DWMP so options are developed for future investment needs to ensure our wastewater systems are resilient to long-term changes in population.

Future domestic flows are dependent on the future per capita potable water consumption rates. Currently, it is estimated that individuals use on average 133 litres of potable water per head per day, with 92.5% of this ending up in the sewer. We estimate that this will reduce to 125 litres per head per day by 2050. However, our ambitious “Target 100” programme works with our customers to reduce domestic potable water consumption down to 100 litres per head per day by 2040, or even less in some areas due to water neutrality issues. This is an important initiative, and a good example of integrated water management, to reduce the demand for scarce natural water resources for water supply and reduce the quantities of wastewater that will subsequently need treatment.

We will reduce the flows requiring treatment at our WTW as well as the flows in our sewers by reducing domestic water consumption. However, we will monitor this carefully to ensure that reducing flow in sewers does not cause an increase in the risk of sewer blockages (see PO1 and PO2). A sufficient base flow is needed to flush solids through the system and ensure the sewers remain self-cleansing as originally designed. We are installing over 20,000 digital water level monitors in our sewer networks during the current investment period to enable us to monitor the performance of sewers and protect against pollution and flooding incidents.

DWMP allows us to look across multiple risks into the future. But our risk assessments do not currently assess the need for tighter permit conditions at WTWs. We think this is a pivotal planning tool to be able to deliver more resilient catchment based solutions to these challenges when they materialise. For example, we expect regulations regarding nutrients to become more stringent and hence the nutrient permits at WTWs to become stricter – we need to be able to forecast when this will occur so we can plan for the investment needed and the catchment and nature based solutions that may take longer to deliver than traditional ‘end of pipe’ engineering solutions. This approach will enable the creation of more resilient wastewater systems and enable us to manage our own levels of resilience, rather than existing resilience being lost through changes in permits.

We are already working with the EA to develop the DWMP and would like to extend this to align the DWMP with the long-term strategic planning of future discharge quality permit standards for the next 25 years. Looking to the future in this way will enable the next cycles of the DWMP to consider if we will need to plan to fundamentally ‘change’ our wastewater system in the future, for example because a particular works has reached the maximum technically achievable limits to protect designated Habitat sites. This information will facilitate adaptive planning and enable us to identify major investment that will be needed to protect the environment from wastewater

operations. It will enable consideration of where effluent discharges may need to be taken elsewhere or further treated to put back into water supply.

Our Water Resources Management Plan is exploring greater re-use of recycled wastewater. Our discussions with partner organisations during the development of our DWMP supported the need for greater re-use of recycled water in the future. The South East is a water stressed region facing a climate emergency. The potential to reduce, reuse and recycle water is significant in helping us to face future water shortages. We are already working with others to place greater emphasis to:

- **Reduce:** We are working with customers to reduce water usage to 100 litres/person/day – an initiative known as Target 100.
- **Re-Use and Recycle:** We are supporting planning authorities and developers to capture and re-use water, known as rainwater harvesting and grey water re-use, in new developments, and we are trialling the re-use of effluent by putting it back into water supply via a reservoir. We aim to recycle every drop of water so it can be discharged safely back to the environment.
- **Offset:** To achieve water neutrality by offsetting any residual demand by making savings in the existing local community. Importantly, these savings must be made within the same water resource zone.

The water scarcity in the South East means that we need to consider that the discharge of treated effluent out to sea as a lost resource. Whilst it can be abstracted back from the sea for consumption, the process of desalination is hugely expensive in energy and carbon. Our customer insight has told us that it is not seen as a favourable solution and that water recycling is the preferred option. To minimise our reliance on groundwater resources or surface water abstraction, we need to consider and promote treated wastewater as a raw water source for our potable water supplies. The treated WTW effluent standards required for this purpose will be dependent on the details of any water reuse schemes proposed. We will continue discussions with Defra, the EA, Drinking Water Inspectorate (DWI) and our customers to find a way forward for effluent re-use as a source for supply.

Our Plan for wastewater compliance is to:

- Be fully compliant with our all permits
- Work with the EA to understand and plan for long-term future permits changes so the next cycle of the DWMP can set out adaptive pathways for future investment in our WTWs, including the relocation of assets or investment in new technology to meet tighter environmental permits.
- Further align with water resources and wastewater strategic planning to explore additional opportunities for greater recycling and re-use of water in the South-East.

Infiltration from Groundwater and coastal saline waters

Infiltration occurs when the water in the ground rises to a level where our sewers are surrounded by water. This groundwater can then leak into our sewers (known as infiltration) and disrupt the functions of the sewer. In coastal areas, the groundwater can be predominantly saline in nature, which causes specific problems with water recycling at our treatment works. Other sources of saline in our sewers can be sea water inundating combined surface water drains and misconnected tidally influenced surface water drains. However, these are usually transient in nature.

Infiltration entering the sewers can occupy a high proportion of the sewer system capacity and prevent sewage from customers' properties from being conveyed to the treatment works. During these conditions, some customers suffer restriction in use of their bathroom, toilet and kitchen facilities. Internal flooding and discharges from storm overflows can also occur as a result of this additional water entering into the sewer system.

Infiltration is an issue across our region especially within areas such as East Kent, the South Downs, and across north Hampshire. The areas in Hampshire most affected by groundwater infiltration into the sewer network are the villages in the Pillhill Valley, to the west and east of Andover. We maintain services for customers by a programme of investigation, repair, maintenance, and mitigation. The mitigation may include the short-term use of tankers and over-pumping to remove excess water from the sewer system.

The EA requires wastewater companies to submit their plans for managing groundwater infiltration of the sewers. These are known as Infiltration Reduction Plans (IRPs). We publish our IRPs on our website and we continually review them to take account of, for example, our extensive continuing programme of surveying and sealing the sewers to improve their performance.

Our DWMP has identified where there are infiltration issues within a wastewater system through the risk assessment on Dry Weather Flow (DWF) compliance. This means we can proactively target infiltration where we have flow issues into our sites. The dry weather flow permits for our wastewater treatment works are based on the average expected flow from the size of the population served by the wastewater system. Infiltration and saline ingress are likely causes where the flows are far in excess of the expected DWF.

The investment needs to reduce infiltration are included within the DWMP under PO8 on Dry Weather Flow.

Risk of Pollution (PO2)

Sewage can discharge from our sewerage network when there is a blockage or problem in the pipes and pumping stations that we use to carry the wastewater to our WTW. These discharges may cause pollution where untreated wastewater is diverted to watercourses via storm overflows, the storm tanks at our WTWs or emergency overflows. Pollution may also occur when wastewater rises out of the sewer network through manholes to cause flooding on the ground surface, which then runs overland into watercourses. These are pollution incidents. They are categorised by the severity of their impact using the EA's Common Incident Classification Scheme (CICS)[7]. We report pollution incidents to the EA.

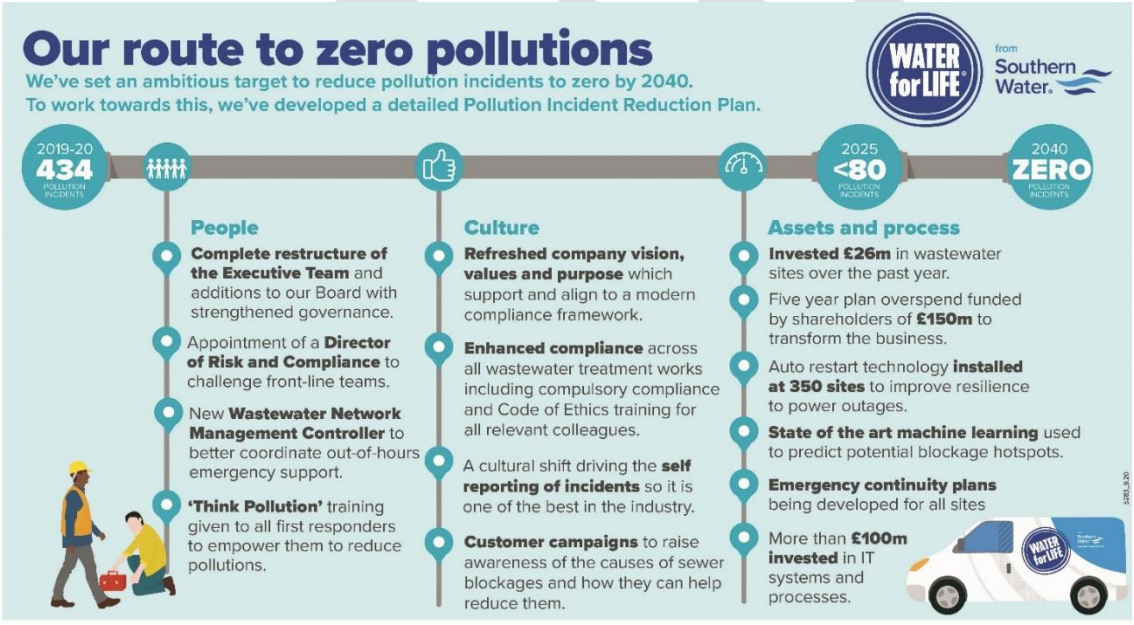
[7] https://www.ofwat.gov.uk/wp-content/uploads/2017/12/20171129-Incidents-and-their-classification-the-Common-Incident-Classification-Scheme-CICS-23.09.16.pdf

We have a duty to protect and improve the environment in which we operate. We have set out our policy[8] to eliminate serious pollution. We have ambitious targets to achieve zero pollution incidents by 2040, reducing to less than 80 by 2025, as published in our Business Plan for the current investment period, AMP7.

We have a dedicated Pollution Incident Reduction Plan[9] (PIRP) to deliver this commitment. The PIRP is supported by an £83 million investment programme to reduce risks and significantly increase monitoring of our networks across the region. This includes £60 million on strategic projects to deliver improvements in network digitisation, logistics and asset maintenance. This is a detailed programme of activities focused on exploring all mechanisms to reduce the risk of pollution of the environment. This programme is making significant improvements to our wastewater systems to reduce the number of incidents. As a result, the total number of pollution incidents fell by 10 per cent, and serious pollution incidents halved, in 2020 compared to 2019, with those at WTWs being reduced by approximately 40%. Our route to zero pollutions is shown in Figure 4.

The DWMP takes our pollution aspirations and builds on the PIRP to give us a long-term strategy to deliver zero pollution.

Figure 4: Our Route to Zero Pollution incidents

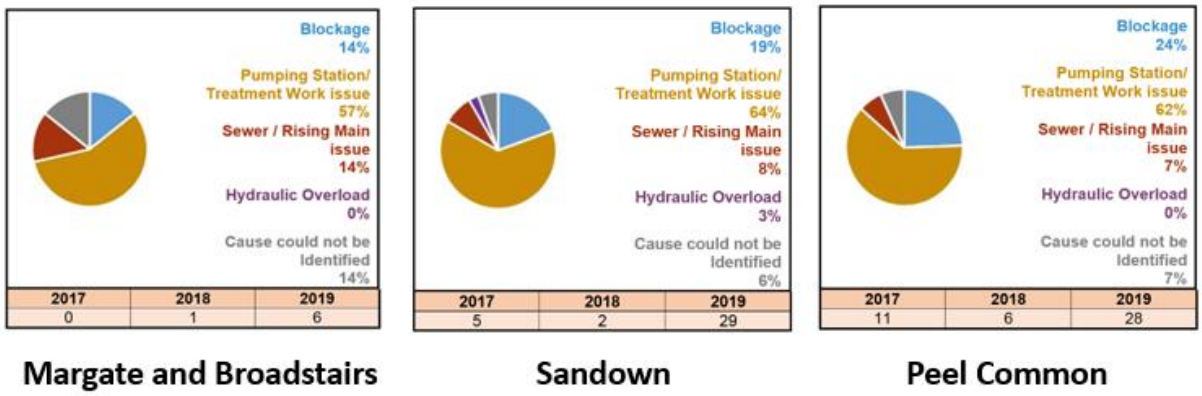


[8] https://www.southernwater.co.uk/media/4871/environment-policy-final-v10-approved-april-2021.pdf

[9] https://www.southernwater.co.uk/our-performance/reports/pollution-reduction-programme

Our DWMP explored the risk of pollution from the performance of our wastewater systems under the national Planning Objective 2 (PO2). Our analysis identified the risk in each of our wastewater systems and the root causes of pollution incidents during the period 2017-2019, see Figure 5 for three examples.

Figure 5: Root causes of pollution incidents at Margate, Sandown and Peel Common



Our analysis confirmed that the root causes of pollution incidents tend to be due to four main reasons:

(a) Blockage in our network

(b) Rising Mains (sewers where water is pumped to a higher elevation)

(c) Electrical and mechanical breakdowns

(d) Other operational type breakdowns.

This understanding enables us to focus and target our management of these assets and to define the future investment needs to reduce the risks.

The proactive and dynamic nature of our PIRP means that many of the baseline 2020 risks identified in our DWMP have been or are being tackled in our current AMP7 investment period. This has involved investing in our assets to improve resilience to, for example, power failures in the electricity network, as well as our operational activities.

We will achieve our pollution reduction targets by enhancing the resilience of our assets though our ongoing PIRP, and implementing our DWMP. We will:

(a) Fully comply with the EA permits for our sites, including WTW, WPS and Storm Overflows

(b) Review operational procedures to improve reliability of plant and equipment

(c) Replace assets at, or near, end of life to reduce risks of asset breakdowns

(d) Enhance our customer education programmes to reduce blockages

(e) Extend our programme of proactive jetting to clear debris before blockages occur

(f) Invest in smart technology to monitor, in real time, the performance of the sewer network and identify blockages before pollution or flooding occurs

(g) Deliver an effective and timely emergency response to clear blockages and rectify equipment breakdowns.

We also have a number of strategic improvement projects to improve resilience of our assets and systems to reduce pollution risks, including asset maintenance improvements, digitalisation and control programme, and improved logistics.

The identified investment needs for PO2, 6 and 8 are set out in our DWMP Investment Plan for Wastewater Compliance and Pollution.

Sewer Condition and Groundwater Pollution

Risk of Sewer Collapse (PO3)

The planning objective relating to the condition of sewers is PO3 on sewer collapse. A sewer collapse is defined by Ofwat as "*where a collapse has not been identified proactively and it causes an impact on service to customers or the environment*".

We report annually to Ofwat on the number of sewer collapses per thousand kilometres of all public sewers. We report collapses on public sewers, rising mains, pipe bridges and failures on the infrastructure network including inputs into the inlet of treatment works and terminal pumping station rising mains. We are not required to report collapses in private sewers. This national reporting on the number of collapses only provides an indication of the general asset health of the sewer network. It does not measure the level of service disruption, damage to customer's homes or businesses, the cost of a repair or the impacts on the environment.

The DWMP risk assessment is based on historic data and provides an indication of the overall condition of the sewer network. The definition of sewer includes rising mains, which are sewers where wastewater is pumped under pressure to a high point in the sewer network. The planning objective on sewer collapse includes both sewer collapses and rising mains bursts.

Poor condition sewers can lead to several risks, including increase risk of blockage, collapse, infiltration and exfiltration. Blockages can result in flooding of homes and business and pollution of the environment. Collapses can have the same impacts. Leaky sewers can enable sewage to escape and seep into the ground, potentially impacting on the groundwater quality. They can also allow groundwater into sewers, which increases the flow to the WTW, and can even cause wastewater to be released automatically from storm overflows.

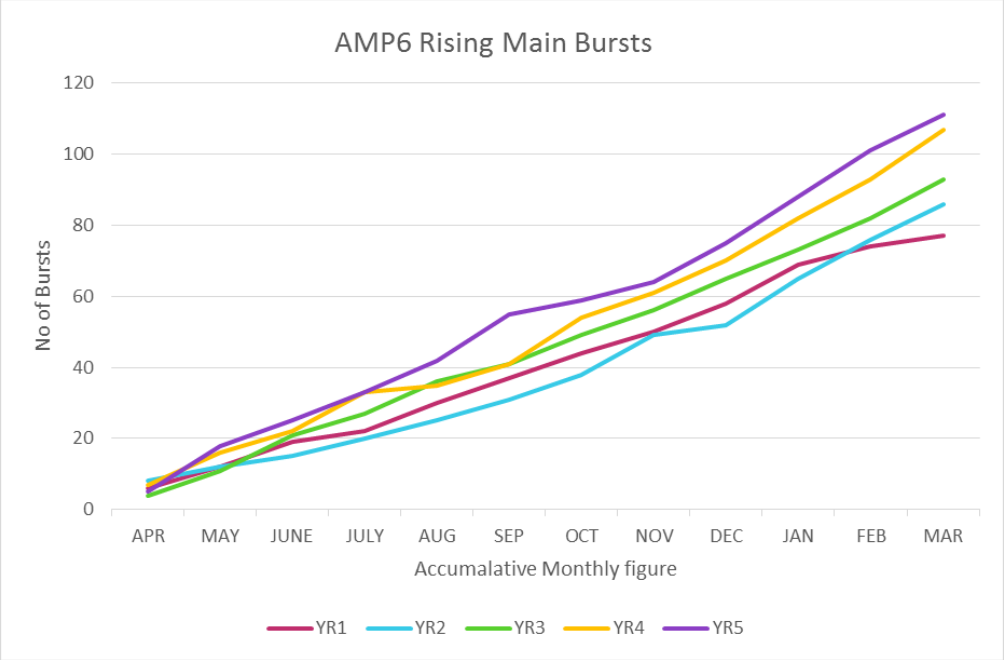
Critical sewers are those which are either costly or difficult to repair, and/or are important to the performance of the network. They are large diameter, very deep, pass under major roads or railways, and include rising mains. We consider that the risks associated with critical sewers is important to understand and that the sewer collapse risk assessment in our future DWMPs should take this into account. We also need to utilise other datasets that we have developed such as the proximity of our sewers and assets to environmentally sensitive or designated sites which could potentially be affected by sewage if a collapse or rising main burst were to occur. Hence the definition of critical sewers needs to be expanded to those that would most significantly impact a protected area, for example, a Drinking Water Protected Area, a shellfish or bathing water, or a Habitats directive site.

Our analysis of bursts by diameter and material show consistently that cast iron, spun iron and PVC are the materials responsible for 50% or more of our bursts. Rising mains made of these materials are the highest risk of bursts. They also represent a higher proportion of our rising main assets. Rising mains up to 150 millimetres in diameter account for more than 50% of all bursts. The main reason behind this is age. As assets age their failure rate can increase. We are seeing a greater increase in bursts from these assets for a variety of reasons, including deterioration of materials, ground movements and more extreme temperature changes. Further, wetter winters and increasing populations are placing a greater operational demand on these ageing assets.

Our findings indicate that a small number of rising mains can significantly influence the total number of bursts. As an example, in 2016-2017, 44 rising main bursts out of the total of 117 for the year occurred as repeat events on just 16 rising mains which is 37% of the total. This information enables us to target our investment in sewers.

We invested £8.4 million during AMP6 (2015-2020) on planned maintenance to replace 15km of rising mains. Figure 6 shows that this level of investment is not preventing an upward trend in bursts. We are now roughly 100% above the level in AMP4. In AMP7 we expect to deliver roughly 8 km of rising main replacement alongside a major investment covering 3.5km at Military Road in Thanet. At the same time, we have invested in our incident response capabilities, including improvements in our operational control centre, to mitigate the risk of impact from sewer collapses and bursts.

Figure 6: Annual Cumulative Number of Rising Mains Burst (2015-2020)



Our plan to tackle sewer condition is to focus on proactive maintenance on critical sewers involving condition surveys at appropriate intervals as defined by the Sewer Rehabilitation Manual[10] and proactive targeted rehabilitation and repairs prior to collapse. We are increasing inspections of high risk sewers and the associated investment so we proactively intervene before a failure can impact customers or the environment. This, in turn, will help reduce the cost of repairing sewers and the significant disruption to our customers. For non-critical sewers, we will react quickly and efficiently to repair and replace sewer collapses. Our investment into smart networks will better enable real time detection of sewer blockages and collapses.

We have 165 kilometres of critical sewers and 29.5 kilometres of critical rising mains which are in a condition where replacement is required in the next 5 years. We estimate the cost to repair these critical assets is in the order of £80 million so we need to drive new lower cost replacement and repair approaches to reduce the costs. We will work through our partners and innovation team,

[10] http://srm.wrcplc.co.uk/the-srm-approach-1.aspx

Bluewave, to deliver this. But we will need a sustained level of funding over several investment periods to ensure we keep pace with asset deterioration.

We will further develop the risk assessment for sewer collapse to factor in the consequences of collapse by utilising the designation of critical sewers and other important data in cycle 2 of the DWMP, subject to any revisions to the national DWMP guidance.

We will:

- Continue to implement and develop our sewerage management plans and extend the consideration of consequences of the impacts and prioritisation - this will give greater weighting to the risk of groundwater pollution, including the potential risks and impacts to groundwater sources relied on for water supply
- Implement a sustained programme of surveys, monitoring and rehabilitation of critical sewers - this is to reduce collapses and bursts and the subsequent disruption and economic impacts to customers through road closures and diversions, flooding of farmlands, and pollution of the environment
- Extend the use of technology to create smarter networks and enable faults to be notified and rectified before the customer is aware of an issue
- Respond to collapses of non-critical sewers on a reactive basis, through a rapid response team to reduce the risks of pollution and internal flooding
- Take action to remove rainwater from our foul and combined systems to reduce the likelihood of flooding homes or causing pollution in the event of a collapsed sewer
- Report to Ofwat on sewer collapses (a measure of the overall condition of our sewers)
- Implement any forthcoming new powers to inspect, repair and replace private sewers to prevent infiltration of groundwater, and to prevent exfiltration that could lead to groundwater pollution
- Further develop the risk assessment for sewer collapse for cycle 2 of the DWMP – this will help to factor in the consequences of the impacts of collapse by utilising the designation of critical sewers and other important data, subject to any revisions to the national DWMP guidance.

Groundwater Pollution (PO12)

We included an additional Planning Objective 12 (PO12) on groundwater pollution in our DWMP as a result of working with partner organisations including the EA and neighbouring water supply companies. The purpose of this planning objective is to enable us to target investment in the repair and replacement of sewers. By doing so we can safeguard the quality of groundwater for future generations, as well as protect the environment and the drinking water supplies for our customers and adjacent water companies. This risk assessment will also ensure we consider how groundwater feeds rivers and wetlands and, in turn, our coastal areas. The condition of sewers is an important factor to determine the risk of groundwater pollution.

Pollution from nitrate is the single biggest groundwater quality issue. Within England there is a widespread rise in nitrate concentrations in groundwater[11]. This is a particular concern in the South-East of England as our water supplies are predominantly reliant on underground sources, with some 70% of our water coming from the chalk aquifers across parts of Kent, Sussex, Hampshire and the Isle of Wight.

Nitrate contamination of groundwater is an important public health issue. The majority of nitrate in groundwater in the UK is derived from diffuse pollution from agriculture (livestock and fertilisers), atmospheric deposition, and point sources (such as discharges from WTWs). Nitrate also comes from leaking sewers. The post-1945 agricultural intensification and slow rates of filtration into the underlying aquifers means that much of the nitrate we see in water abstracted today is a result of this intensive use of nitrate fertilisers during the post-war era working its way through the chalk aquifer. In addition to this, present day sources of nitrate are also a risk to water quality both now and into the future.

Groundwater nitrate concentrations in some locations are now approaching, or have already exceeded, statutory limits for drinking water. We ensure the quality of water supplied to customers by treating it to remove the nitrate and thereby meet strict standards set out by the Drinking Water Inspectorate. However, this comes at a cost to our customers and so, to ensure underground sources do not deteriorate in water quality, it is vital that all sources of nitrate are investigated and reduced to protect the important drinking water supplies now and for future generations. This includes nitrate contamination from leaking wastewater sewers.

The condition of sewers is a key risk factor so investing in good asset management for the sewer network is important to reduce the risks. Some catchments, often the more urban ones, are at greater risk from leaking sewers because there are more sewers. We will focus on these sewer systems especially where these are increasing nitrate trends.

We have detected potential elevated nitrate levels in the chalk aquifers in parts of our operating area which may be coming from wastewater. Table 1 lists the groundwater source zones where we are most concerned about the potential pollution from leaking sewers. We have undertaken catchment monitoring and groundwater modelling to underpin our investigations but, moving forwards, further investigations will be needed before we can gain a full understanding of which parts of the sewer network need to be looked at.

We are already taking action to address these risks where the sources are known. In Thanet, we have invested over £60million to repair and line the old adits (underground tunnels containing sewers) to prevent the escape of sewage into the chalk aquifer. We are also working extensively with farmers to protect groundwater from nitrate pollution with key schemes through our strategic water resources planning process in our Water Resources Management Plan (WRMP), and through the Water Industry National Environment Programme (WINEP). The risk from leaking

11 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291473/scho0605bjcs-e-e.pdf

sewers is included in our DWMP so that we can identify the long-term investment needs to address the risks from our drainage and wastewater systems.

Table 1: Groundwater Sources at risk from Wastewater

Groundwater Source	Priority based on		Wastewater system
	Nitrate source apportionment	Pathogenic virus risk	
Northbrook	Yes	Yes	East Worthing
Sompting	Yes		East Worthing
Broadwater		Yes	East Worthing
Stanhope Lodge	Yes		East Worthing & Clapham
Andover		Yes	Fullerton
Windmill Hill	Yes		Gravesend
Hazells	Yes		Gravesend & Northfleet
Lower Bush Cuxton		Yes	Ham Hill
Lord of the Manor	Yes		Margate Broadstairs & Weatherlees
Otterbourne		Yes	Morestead Road Winchester & Chickenhall Eastleigh
Twyford		Yes	Morestead Road Winchester & Chickenhall Eastleigh
Luton	Yes	Yes	Motney Hill
Snodhurst	Yes		Motney Hill
Strood	Yes	Yes	Motney Hill
Nashenden	Yes		Motney Hill
Capstone Chalk	Yes		Motney Hill
Gore	Yes		Motney Hill
Southover	Yes	Yes	Newhaven East
Surrenden	Yes		Peacehaven
Balsdean	Yes	Yes	Peacehaven
Falmer	Yes	Yes	Peacehaven
Patcham		Yes	Peacehaven
Lewes Road	Yes		Peacehaven
Goldstone	Yes	Yes	Peacehaven & Shoreham
Carisbrooke		Yes	Sandown
Ventnor	Yes		Sandown & Wroxall
Shoreham	Yes		Shoreham
Mossy Bottom	Yes		Shoreham
Mile Oak	Yes		Shoreham
Lodsworth		Yes	South Ambersham

Our powers and responsibilities do not extend to private sewers, such as the pipes connecting individual homes to the public sewer, so leakage from these sewers will not be addressed though our current investment plans. We are pleased that the government is considering giving water companies the right and legal powers to repair defective drains on private property. The total length of privately owned drains is greater than that owned by water companies. Many of these private drains are old or poorly maintained and probably constructed and laid to lower standards than public sewers.

There are many small communities that are not connected to our wastewater systems, and there are concerns about the suitability of arrangements for wastewater disposal, especially for new developments. Our wastewater systems serve approximately two million homes and businesses across our region, mainly located in urbanised areas. The majority of the geographic area, more than 70%, is rural with many villages, settlements and farms without a mains wastewater drainage system. An emerging concern is the risk of pollution of groundwater in Source Protection Zones (SPZs) due to routine discharges from non-networked settlements and/or private leaking sewers and poorly maintained septic tanks.

The First Time Sewerage scheme is the existing mechanism for customers to apply to us to extend our wastewater systems to cover more villages. Our findings in the DWMP suggested that the process for first time sewerage schemes is too difficult and complex, such that the wastewater

systems are not being extended with the pace necessary to keep up with growth in these villages and the increasing risk of groundwater pollution. Where recent schemes have been provided by us, some customers are choosing not to connect as they would then be liable for wastewater service charges. A change in government policy and legislation is required for the provision of first-time sewerage schemes and, further, the costs and benefit assessment should take account of the downstream costs of these discharges on drinking water treatment, as well as the environmental impacts which can actually be quantified as part of the assessment.

The inclusion of PO12 on groundwater pollution in our DWMP will enable us to assess the risks to the environment and subsequently to our own water sources and that of adjacent water supply companies, from our wastewater systems and identify the future investment needs to enable us to continue to reduce these risks. We worked with the EA to develop the risk assessment for groundwater pollution for our first DWMP. Together we have identified other factors and data to include in the future DWMP groundwater pollution risk assessment such as the need to use:

a) Groundwater Capture Zones: these are modelled areas using hydrogeological models and can include additional areas where groundwater can be impacted outside of the Groundwater Safeguard Zones (SGZ)

b) Hydrogeology data: using the flow apportionment from our groundwater models to identify output areas of the groundwater source catchment that contribute more to abstracted water. This “flow apportionment” modelling can help target risk identification and prioritisation of investment in sewer rehabilitation

c) Wastewater asset risk: age and material, pipe diameters and flows, structural issues, infiltration risk data and other information from our asset risk registers

d) Discharges of effluent directly to groundwater from private effluent treatment systems. Although not our responsibility or under our control, these can impact on groundwater sources so need to be considered in the DWMP

e) Inadequate / poorly maintained private effluent treatment plants. We will need to work with the EA to explore what data is available to include in the risk assessment

f) Discharges of effluent to ground via septic tanks. We know the condition or capacity of septic tanks may not be adequate but there is no incentive for owners to replace them.

Our Plan is to take action to reduce the risks of groundwater pollution. We will:

- Prioritise and manage the integrity and rehabilitation of our sewer networks where they overlie SPZs and Groundwater Capture Zones (GCZs)
- Provide advice to developers on appropriate arrangements for wastewater management where no wastewater system currently exists. This may mean the developer bearing the cost of building the connection to the nearest wastewater system or develop, in association with us, a new discrete system and local wastewater treatment works
- Work with the EA, Water UK and Government to enhance the arrangements, mechanisms, legislation and funding for the provision of first time sewerage schemes
- Work with local councils, the EA and other water companies to actively look for and pursue first time sewerage schemes in areas where groundwater sources are being polluted due to the lack of a mains drainage sewerage system.

The investment needs for PO3 and PO12 are set out in our DWMP Investment Plan for Sewer Condition and Groundwater Pollution.

Storm Overflows

Storm overflows have recently attracted a lot of public and media attention due to the concern about discharges of untreated sewage. This is partly due to the increasing popularity of open water swimming and growing public concerns about the environment during the 2020-2021 pandemic. The government has responded by committing to a step change in action to protect public health and the environment from storm overflow discharges. These discharges are also known as spills or releases of sewage.

Government statement on Storm Overflows, Defra[12], March 2022

"*Storm overflows are safety valves built into the combined sewer system to discharge excess sewage to rivers, lakes, or the sea when rainfall exceeds capacity. This protects properties from flooding and prevents sewage backing up into streets and homes during heavy storm events. A growing population, an increase in hard surfaces and more frequent and heavier storms because of climate change have increased pressure on the system, bringing the frequency of discharges to an unacceptable level*."

Storm overflows were designed into drainage and wastewater systems such that a level of dilution is achieved in the system or the waterbody before they automatically discharge into local rivers. The EA issues permits to water companies to govern when storm overflows are allowed to discharge into the environment. The permits for discharges from wastewater treatment works and storm overflows are based on limiting pollutant concentrations to "that which would not cause harm to the receiving waterbody". The greater the dilution the less harm caused. The benchmark for storm overflow discharges was a dilution ratio of eight, meaning that the flow in the river in dry weather must be eight times greater than any flow of water from the wastewater system. Where this is achieved, the water released from storm overflows are of a similar dilution as treated effluent.

The other factor is the frequency of discharges. Storm overflows were designed into wastewater systems to discharge about 40 times a year, as this would not harm the river providing the dilution is achieved in the river. The exception to this is for bathing and shellfish waters. Storm overflows constructed or upgraded since the EU Directives on Bathing and Shellfish waters have been designed so that the frequency of discharges would not exceed thresholds of 10 per annum for shellfish waters and 3 discharges during the bathing water season for bathing waters (as an average over 10 years). We used these criteria in our risk assessments for bathing water quality and shellfish water quality.

Storm overflows release diluted sewage into the environment mainly as a result of rainwater draining from roofs, roads and other areas of land into the sewer system. Sewers are only capable

[12] Defra Storm Overflow Discharge Reduction Plan. https://consult.defra.gov.uk/water-industry/storm-overflows-discharge-reduction-plan/

of conveying flows up to their design capacity. Any flows greater than this discharge automatically through storm overflows to a local river or the sea to reduce the risk of flooding of homes and businesses with sewage. Figure 7 illustrates how combined sewers and storm overflows work. Storm overflows are permitted by the EA to ensure that the discharges from our wastewater systems do not cause harm to the environment.

Figure 7: How do combined sewers and overflows work?

Our wastewater treatment works are also often fitted with storm tanks to capture excess flows arriving at the works for treatment. These are designed to initially store excess flows, however they can release storm discharges to receiving watercourses when the capacity is exceeded during storm conditions. Storm overflows at the WTW tend to have the highest frequency of discharges so we are investing to enlarge the capacity of the storm tanks at several WTWs.

Some releases of sewage are caused by equipment breakdowns or operational issues. We report as pollution incidents where they are non-compliant with permits from the EA.

Climate change, new development and urban creep has placed even greater pressure on our drainage and wastewater systems meaning that, if we do not invest further in our systems, more flooding and discharges from storm overflows can be expected.

We have around 1,000 storm overflows across our network of 39,886 kilometres of sewers and at our 3,339 wastewater pumping stations and 367 wastewater treatment works. In 2020, these discharged on 20,313 occasions, totalling over 201,003 hours. Many of which comply with current discharge permits. Any releases of sewage that do not comply with the permits from the EA are reported as pollution incidents, and these risks are considered in our DWMP under planning objective 2 (PO2). We recognise that any release of untreated sewage from the wastewater system is not be acceptable to our customers. We are already taking action to reduce releases that do not comply with the EA permits through our Pollution Incident Reduction Plan.

The Government formed the Storm Overflows Taskforce in August 2020 to tackle the issue of storm overflows. This led to the inclusion of a series of actions to reduce discharges from storm overflows being included with the Environment Act published in November 2021. These include five new duties on water companies to:

(a) Secure a progressive reduction in the adverse impact of discharges from storm overflows

(b) Publish data on storm overflow operation on an annual basis

(c) Publish near real time information on the operation of storm overflows

(d) Monitor the water quality upstream and downstream of storm overflows and sewage disposal works

(e) Produce comprehensive statutory Drainage and Sewerage Management Plans (also known as Drainage and Wastewater Management Plans) setting out how they will manage and develop their drainage and sewer system over a minimum 25-year planning horizon, including how storm overflows will be addressed through these plans.

There are also three new duties/powers for government to:

(a) Produce a statutory plan to reduce discharges from storm overflows and their adverse impact, and report to Parliament on progress

(b) Produce a report setting out the actions that would be needed to eliminate discharges from storm overflows in England, and the costs and benefits of those actions (both publications are required by 1 September 2022)

(c) Direct water companies in relation to the actions in Drainage and Sewerage Management Plans.

Defra's Storm Overflow Discharge Reduction Plan[13] forms the Government's plan to reduce discharges from storm overflows and their adverse impact. It proposes three storm overflow reduction policy scenarios to eliminate harm from storm overflows. These are set out by Defra as:

(i) ***Protecting the environment**: Water companies shall only be permitted to discharge from a storm overflow where they can demonstrate that there is no local adverse ecological impact. The target is to be achieved for 75% or more of storm overflows discharging in or close to high priority sites by 2035, for 100% of overflows discharging in or close to high priority sites by 2045, and for all remaining storm overflow sites by 2050.*

This target will mean that no waterbody in England will fail to achieve good ecological status due to storm overflow discharges […] and protect biodiversity at both a local and national scale. It will result in the complete elimination of ecological harm from storm overflows.

(ii) ***Protecting public health in designated bathing waters**: Water companies must significantly reduce or eliminate pathogens harmful to human health being discharged by storm overflows*

[13] https://consult.defra.gov.uk/water-industry/storm-overflows-discharge-reduction-plan/supporting_documents/Final%20Consultation%20Document%20PDF.pdf

discharging into and near designated bathing waters. This can be done by either applying disinfection, such as with ultraviolet radiation, or reducing the frequency of discharges. This is expected to reduce discharges from overflows close to designated bathing waters by over 70% during the bathing season and lead to rivers being designated as bathing waters for recreation and leisure.

(iii) ***Ensuring storm overflows operate only in unusually heavy rainfall events****: Storm overflows must not discharge above an average of 10 rainfall events per year by 2050 and have screening controls to limit the discharge of persistent inorganic material. This target is key in protecting public health, wellbeing and the environment in areas which are not designated bathing waters*.

We explored in our DWMP the proposed Defra scenarios and costs for reducing the risks from storm overflows. Using the most recent data on storm overflows for 2021, which was a wet year with more discharges from storm overflows than usual, 491 of our storm overflows discharged more than 10 times during the year (which equates to about 3 discharges per overflow during the bathing water season). 80 of these storm overflows are linked to bathing waters, and the remainder to inland waterbodies. This means that in order to achieve Defra's three policy scenarios we need to tackle the following number of storm overflows:

- Scenario 1: Protecting the Environment = 411 storm overflows
- Scenario 2: Bathing Waters = 80 storm overflows
- Scenario 3: Operate only in unusually heavy rainfall = 491 storm overflows.

Typically the water industry has invested to reduce the number of discharges from storm overflows by targeting a specific storm overflow that may be causing harm to the environment, and delivering a solution within a 5 year investment plan period. This piece meal approach has favoured increasing the capacity of the network or wastewater treatment works through engineering, as it provides a robust, defined solution that can be designed to provide the necessary volume of storage and certainty in outcome to achieve the regulatory targets within the investment period.

Delivering a significant reduction in the number of discharges from so many storm overflows needs a different approach. Tackling the risk of storm overflows as close to the source as possible would be the most effective and sustainable option, rather than heavily engineered 'end of pipe' solutions. This means keeping rainwater out, and keeping more wastewater in our systems.

We established a Southern Water Storm Overflows Task Force in 2021 to investigate how we could tackle the problem in a different way. We set ourselves an aim to reduce the number of discharges from storm overflows by 80% from 2020 levels by 2030. Our task force created five pathfinder projects with the purpose of working with partner organisations to test, explore and deliver solutions to reduce the number of discharges from storm overflows. The five pilot locations are Deal, Margate, Swalecliffe (Whitstable), Sandown on the Isle of Wight, and the pan-parishes around Andover.

The focus of our Task Force is to drive changes and more sustainable approaches that will stand the test of time and continue to perform into the future even with the changes in our climate. There are broadly 3 main types of intervention to reduce the risk of flooding and storm overflow use:

- Upstream source control (removing and slowing the flow of rain water)
  - Rainwater harvesting
  - Permeable paving
  - Green roofs
  - Soakaways (includes tree pits)

  - Rain garden (swales)
  - Planters

- System optimisation (making better use of the existing infrastructure)
  - Optimisation, tweaking of connected systems and interfaces
  - Different mechanical and electrical equipment (e.g. pumps)
  - Improvements in pumping station and storm tank use and control
  - Smart network control with increased digitalisation

- Infrastructure enhancements (building larger infrastructure)
  - Larger sewers, storm tanks and/or treatment works.

All five pilots are exploring different solutions to do this using nature based solutions such as wetlands, swales and tree pits. These solutions help keep surface water out of our sewer systems and deliver wider environmental and social outcomes such as increased biodiversity, improved air quality, access to nature for the local community and lower carbon costs. Learning from these pilots is being used to evaluate the natural and social capital benefits provided through this approach. This will inform the wider roll out of our new approach to reducing discharges from storm overflows and improving surface water management.

Looking across the whole drainage system provides the opportunity to work with other organisations and customers to reduce the amount of rainwater entering the foul sewer network. There is real potential for the Pathfinder projects to change the way we think about water and wastewater systems. This is discussed further in the section on rainwater separation below.

Our Storm Overflows Task Force will be reporting in Summer 2022 so we can update our DWMP before the final publication in March 2023.

We followed the national DWMP framework on storm overflows by assessing the risks under planning objective 5 (PO5). We then explored the causes of the risks and developed options to reduce the risks to Band 0. Our options have been derived from:

(a) Previous Drainage Area Plans (DAPs)

(b) Results from hydraulic modelling – where the quantity of additional storage has been determined for a storm overflow; and

(c) Estimation of average costs to achieve Band 0 level of performance.

The Investment Needs identified in our DWMP to reduce the risks from storm overflows (PO5) are set out in our Investment Plan for Storm Overflows. The total scale of investment needed, and the cost of the Defra scenarios, are discussed in the Investment Needs section below.

The growing population, increasing paved areas, and more frequent and heavier storms are all increasing the demand on drainage and wastewater systems. Simply shutting off storm overflows will cause more widespread flooding of customer homes and businesses during storms, so we need to consider sewer flooding too, in order to solve the issues relating to storm overflows.

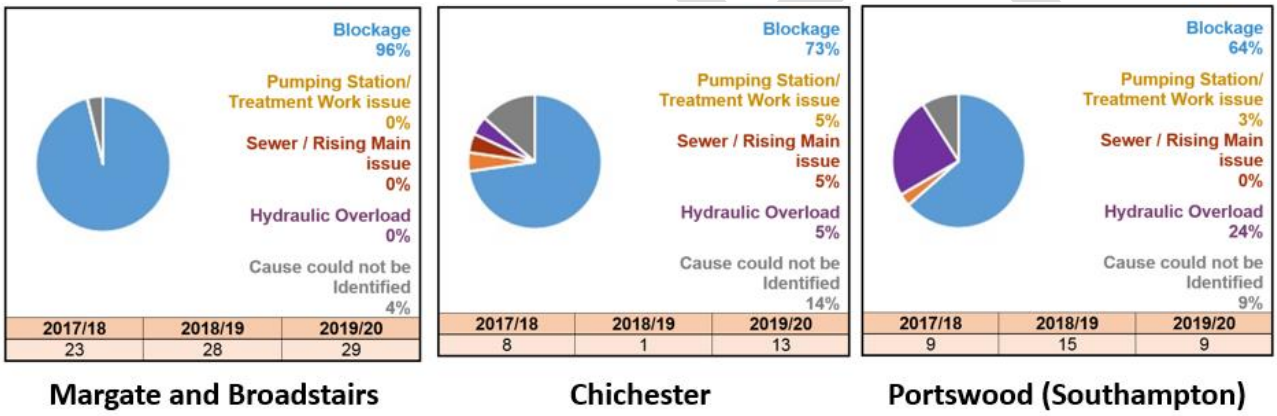
Sewer Flooding

Risk of Internal Sewer Flooding (PO1)

PO1 is one of the six national planning objectives which all water companies need to include in their DWMP. Internal flooding is defined as the flooding of customer's homes and business from sewers, either within the property or causing restricted access to and from the property. This is potentially damaging, disrupting and a health hazard, and can be deeply upsetting and distressing for anyone affected. We are committed to reducing the number of customers' homes and businesses from being flooded, despite the pressures on our systems from growth, urban creep and climate change.

Blockages of sewers account for approximately 70% of internal flooding incidents. In total, we recorded 1,547 internal flooding incidents over the three year period, 2017 to 2019, which is an average of 515 per year. Our action and investment has already reduced this to 394 incidents in the 2020-21 reporting year. Figure 8 shows the typical causes of internal flooding for three of our wastewater systems.

Figure 8: Examples of the Causes of Internal Flooding



Our experience and data across all our wastewater systems shows that the main cause of blockages is the inappropriate use or mis-use of toilets and sinks for the disposal of fats, oils and grease (FOG), as well as 'unflushable' items such as wet wipes, plastics, sanitary products and nappies. This is an industry wide issue and we, as well as other water companies, run customer education campaigns to inform and change customer behaviour.

The House of Commons Environmental Audit Committee made recommendations on FOG and unflushables in their report on water quality in rivers published in January 2022, including better product labelling, tighter producer responsibilities, and legislation on grease management systems. We welcome these recommendations.

The Environmental Audit Committee's report into Water Quality in Rivers (January 2022), which concluded:

"*Fats, oils and greases and cleaning and hygiene products containing plastic are causing huge problems for drainage systems when they are poured away in sinks or flushed down the toilet. The disposal of FOG by takeaways and other food service establishments is currently unregulated. Grease management solutions exist, but awareness appears to be low. The food service industry needs clear guidance and standards to be established, failing which firmer regulation is likely to be required, to ensure it begins to take responsibility for addressing an issue which is costly for water company customers and detrimental to sewerage systems and the environment. There could be potential circular economy benefits for businesses that can utilise these harmful waste products as biofuels. (Paragraph 262)*

The water and grease management industry must develop standards for the sectors which use FOG routinely to collect and dispose of such responsibly without it entering the drainage network. The Committee further recommend that Ministers work with the water industry to consider whether fats, oils and greases should be classed as a trade effluent and all takeaways and food outlets required to install grease management systems. (Paragraph 263)

Wet wipes and other 'unflushables' are a major constituent of sewer blockages. Many householders are unaware that flushing anything other than the '3Ps' ('pee, poo and paper') risks blocking sewers and could lead to a pollution incident. Better product labelling, introducing producer responsibility schemes and the use of behavioural science by water companies all have the potential to reduce blockages and the costs of clearing them. (Paragraph 264)

Single use plastic sanitary products, often coated with chemicals that can harm aquatic life, are clogging up drains and sewage works and creating 'wet wipe reefs' in rivers. Revolting 'fatbergs' as big as blue whales are being removed from sewers, costing companies and their customers in the region of £100 million a year.

The use of plastic in single use sanitary products should be prohibited, with exemptions only provided for medical requirements. The Committee urge the Government to adopt the measures outlined in the Plastics (Wet Wipes) Bill to prohibit the manufacture and sale of single use cleaning and hygiene products containing plastic. The Government should further incentivise the reduction of waste and recoup costs by using new powers in the Environment Act to extend Extended Producer Responsibility schemes to cover single use cleaning and hygiene products that cause blockages. (Paragraph 265)".

Customer Education

Our award-winning and pioneering FOG and Unflushables team have a region-wide programme of customer education. This includes media campaigns targeted in blockage hot spot areas, working with food service establishments on grease management, proactive surveys along with door-knocking to talk directly with customers on the doorstep, and speaking at schools and community group events and roadshows. The team works closely with our operational field service teams to optimise the sewer cleaning programme and with Environmental Health teams at local councils. Specific campaigns also include targeting food establishments to reduce FOG and to advise on proper disposal methods and equipment.

Our DWMP identifies specific locations where there are clusters of properties flooded internally as a result of FOG and unflushables related blockages, especially where there are repeat flooding incidents. For these locations, a localised customer education campaign has been identified as an enhanced activity over and above the region wide customer education programme. This approach

enables the FOG and Unflushables team to design and implement a very specific and targeted campaign based upon the customer demographic to be targeted by adopting a range of tools and techniques to influence and change behaviour, such as MINDSPACE[14]. This may be a one-off campaign or a sustained programme lasting several months or years to bring about and maintain the necessary behaviour change.

The most cost effective way to reduce blockages is to tackle the problem at source by influencing and changing customer behaviour. However, calculating the cost effectiveness of customer education is difficult. For the DWMP we have assumed that only 25% of incidents per year are reduced forever through a specific customer education campaign. Feedback from partner organisations has been positive about our customer education programme and several have suggested working with them to expand the messages to engage customers on other aspects of water. The messages could cover issues such as the need for surface water separation to reduce flooding and releases from storm overflows, and to reduce chemicals entering the wastewater system.

Flooding reduction and response

We have a long history of recording, investigating and rectifying incidents of sewer flooding in customers' homes. These incidents are recorded on a 'DG5' register which is a register of properties that have flooded as a result of the public sewer network not having enough capacity to hold and drain the flows when there is significant rainfall. The national reporting method is to count all properties flooded regardless of the severity of flooding, whether it's seepage from a manhole in a basement, backup into a bath or shower tray, flooding surrounding the property restricting access, or the complete internal flooding of the ground floor of a property. Our DG5 register currently holds details of about 350 property addresses that are at risk of internal flooding and another 8,350 properties at risk from external flooding. Our aim is to make flooding of homes an exception by 2040, but we recognise that preventing flooding can be technically challenging and cost more than our customers are willing for us to pay to resolve them.

Our Flooding Reduction Programme has been running for the last four years with an overriding deliverable to provide a significant reduction in flooding incidents through:

- Improving the resilience of our assets, especially reliability
- Fast and effective alarm handling in our Regional Control Centre
- Improving our emergency response to incidents
- Implementing a flood data dashboard showing leading indicators to track causes
- Identification of clearly defined hot spot / high consequence areas for targeted interventions
- Up-skilling site teams and contractors.

[14] Published by the Cabinet Office and Institute of Government, 1 January 2010. Available here: Going with the grain: influencing behaviour through public policy (instituteforgovernment.org.uk)

We are currently investing £35 million throughout AMP7 (2020 – 2025) to create smarter sewer networks through a digitisation programme and installing around 20,000 sewer level monitors. This will provide information to enable pre-emptive actions and maintenance that will reduce the number of flooding incidents by approximately 60 per annum. Our smart network will be a major step forward for a UK water company in monitoring across its drainage network. We see this as a key building block in moving to a much more proactive environment, where network performance drives proactive maintenance, protects homes and identifies emerging risk to prevent pollution.

Other ongoing activities to reduce the risks of internal flooding include tree root ingress surveys and clearance, and condition surveys – both of which together should reduce the number of floods by 30 incidents per year.

With our continued operational focus on preventing internal floods and the investments in smarter technologies, we expect that we can reduce the number of internal floods to between 186 and 279 properties, dependent upon dry versus wet years in terms of rainfall, by 2024 - 25.

Our DWMP recognises the importance of this work and makes recommendations for further investment in the Investment Plan on Sewer Flooding.

Risk of Flooding in a Storm (PO4 and PO7)

Planning Objective 4 (PO4) on the risk of sewer flooding in a 1 in 50 year storm is one of the six planning objectives set out in the national DWMP guidance for all water companies to use in their DWMP. It was included as a resilience metric to enable water companies to demonstrate the scale of the risks from sewer flooding now and into the future, with the aim to reduce the number of properties at risk over time.

Our DWMP includes an additional planning objective (PO7) on annualised flood risk. This planning objective looks at the risk of flooding from other storms from an annual event through to a 1 in 30 year storm and expresses this risk as an 'annualised flood risk' - or the risk of flooding in any year from a range of storms. It enables us, and our partner organisations, to assess the consequences of more frequent storms than a 1 in 50 year event, and how sewer flooding may combine with surface water flooding to cause disruption to customers.

Planning Objective 4 and Planning Objective 7 both measure the risk of internal and external flooding to properties as a result of rainwater exceeding the capacity of the sewer network during storms.

Most modern wastewater systems built since the 1980s were designed with some capacity to convey rainwater, often for a 1 in 30 year storm based on the historic rainfall records available at the time. Older sewers were laid at a predefined gradient and pipe diameter. These coped well for many years but with our changing climate they are now put under increasing pressure from the rainfall patterns of today. This means that sewer flooding and discharges from storm overflows can be expected more often, especially during heavy and extreme storms, such as a 1 in 50 year storm.

The sewer systems in many of our historic urban areas were built as 'combined' systems to drain both wastewater from homes and businesses and rainwater from roofs, paved areas such as roads and car parks, and permeable areas such as fields and parks. Flows from significant rainfall events can exceed the capacity of the sewer networks, and cause flooding in low lying areas. This is known as hydraulic overload. The likelihood of hydraulic overload is increasing due to climate changes, but also as a result of urban creep. This is where more paved areas, hard standings and

the roofs of house extensions are connected into the foul or combined drainage system and increase the demand on the sewer system during storms.

The risk assessment for these planning objectives used hydraulic models to predict where water would escape from the sewer system and the area of land at risk from flooding. The assessment counted the number of properties that are in the area at risk from flooding. The method of modelling to estimate the number of properties in areas at risk from flooding is very basic. It does not take into account the local topography or surface features or infrastructure that affects where water flows in a storm. This method has led to large numbers of properties being identified as currently at risk and the number obtained from this assessment does not correlate with our last 30 years' of flood records. For example, this method has led to 1484 properties identified as at risk in Portswood in Southampton, and yet the DG5 database has only 5 records of properties being at risk of flooding from hydraulic overload following reported flooding.

The difference in the number of properties identified in areas at risk by the modelling means there is significant uncertainty in the options and investment needs proposed in our DWMP to address the risk of flooding in a 1 in 50 year storm (PO4). Therefore our strategy for now is to focus investment on tackling the real risk and impacts to customers where flooding has occurred and remains a high risk, not just where there is a theoretical risk. We also need to further develop our hydraulic models to take into account the flow of water on the ground and better define the properties that are at risk from flooding. This will significantly reduce the level of uncertainty and enable us to refine the investment needs in future cycles of the DWMP.

Drainage Area Plans (DAPs)

We invested over £6 million during AMP6 (2015 – 2020) to plan future investment in our wastewater systems to reduce the risk of flooding. We developed Drainage Action Plans (DAPs) for 103 of our wastewater systems. The DAPs identified options to reduce flood risks to properties on our DG5 register. This has put us in a good position in terms of knowing the location and preferred options for many internal flooding problems across our operating region. We have imported these options, where they are yet to be funded and delivered, into our DWMP. Some of the DAP options are for wastewater systems in Band 0. This is because DAP options are based on our records of internal sewer flooding over the last 30 years, not just the records for 2017 – 2019 as used in our DWMP. We consider that a longer record of incidents should be used in the risk assessments for future DWMPs to support the validation of predicted flood risks and targeting of investment.

The DAP options were developed for specific properties, or clusters of properties, that have been flooded once or several times. The solutions are generally for traditional storage solutions and pipe upsizing because they provide greater certainty in terms of costs and outcomes. However these options tend to only benefit the properties previously flooded and the localised area. Benefits across the whole of the wastewater system are limited by the capacity and flow in the pipes away from the location and diminish the further away from improvements made. Alternative solutions such as rainwater separation can provide wider, multiple and more sustainable benefits. Removing or preventing a significant volume of rainwater from entering the sewer system at source will reduce the risks from storm overflows and flooding elsewhere within the wastewater system. Further, it could significantly reduce electricity and carbon pumping costs, asset deterioration, and treatment costs. We will investigate the causes of all flooding incidents to identify what action can be taken.

Our approach to reducing flood risks is three-fold:

- **Operational Solutions**: take action in the short term to address any operational issues that may have caused internal flooding, for example, improving the resilience of pumping stations, increased sewer cleansing targeted in hotspot areas.
- **Traditional Solutions**:
  - Deliver property level resilience measures to reduce the risk of a repeat flooding for specific properties
  - Increase the capacity of storm tanks at WTWs, increase network storage (e.g. underground concrete tanks) or upsizing of the network. Deliver this using an adaptive approach on a no regrets basis, such that future storage needs may be met through more sustainable solutions.
- **Sustainable Solutions**: work with local councils and other organisations such as developers, Catchment Partnerships and community groups to separate rainwater from the foul and combined sewer systems, using nature based and Sustainable Drainage Solutions (SuDS).

These solutions can be used in combination depending on the situation, the severity of the issue and the expected levels of growth and urban creep.

Planning objectives 1, 4 and 7 on sewer flooding are included in the DWMP to understand where sewage escapes from the system and causes flooding within customer's homes and businesses in storms of different levels of severity. Our discussions with partner organisations including the Lead Local Flood Authorities (LLFAs) and the EA flood teams led to our inclusion of an additional planning objective on Surface Water Management (PO10).

Surface Water Management (PO10)

We included PO10 on surface water management to consider two issues:

- where rainfall cannot drain away because of the lack of capacity of the sewer and drainage network during a storm, and
- where flooding occurs due to the interaction between our surface water drainage systems and other systems, for example, where they discharge into culverts, rivers and the coast.

PO10 enables us to gain a better understanding of where there is a risk of flooding from both our drainage systems and the systems owned and managed by other organisations. The risk assessment identifies the locations where we need to work with the LLFAs, other councils, internal drainage boards (IDBs) and the EA to improve the management of surface water and to reduce the impact of localised flooding on our customers.

The risk from surface water flooding was identified through discussions with these partner organisations, reviews of the EA's Risk of Flooding from Surface Water maps, historical flood incident data attributed to hydraulic overload and also the properties predicted to flood in PO4 and PO7. The analysis identified that the catchments that are likely to be impacted are those with insufficient capacity in combined sewer systems as well as separate surface water drainage systems where they exist. Our risk assessment for PO10 identified 36 wastewater catchments (out of 381) as Band 1 or 2 that require further investigation to understand the risks and investment needs.

Combined flooding from roofs, roads, rivers, drainage systems and sewers can be complex and difficult to resolve. A good understanding of the causes and flood mechanisms is needed. Further hydraulic modelling of surface water sewers and their interactions with other drainage systems will be necessary in order to develop options to tackle the flooding issues in areas affected by multiple sources of flooding. It may be necessary to improve models to:

- Map and replicate the topography of the natural and built environment in the hydraulic model to understand how rainwater flows across the catchment
- Include analysis of the interaction of rainwater runoff with combined and surface water sewer network in areas where flooding is reported and predicted
- Further data collection such as manhole and flow surveys to ensure that the models are of sufficient accuracy to replicate the performance of surface water system at key locations. This may require the representation of non-Southern Water assets such as culverted watercourses
- A review of the potential surface water management options which could include increasing capacity, attenuation measures or flood management.

Joint working will facilitate discussions and enable us to explore opportunities to tackle the problem at source by separating rainwater from wastewater drainage systems and maximising the use of all surface water drainage systems such as drainage channels, ditches, streams and rivers.

Rainwater Separation

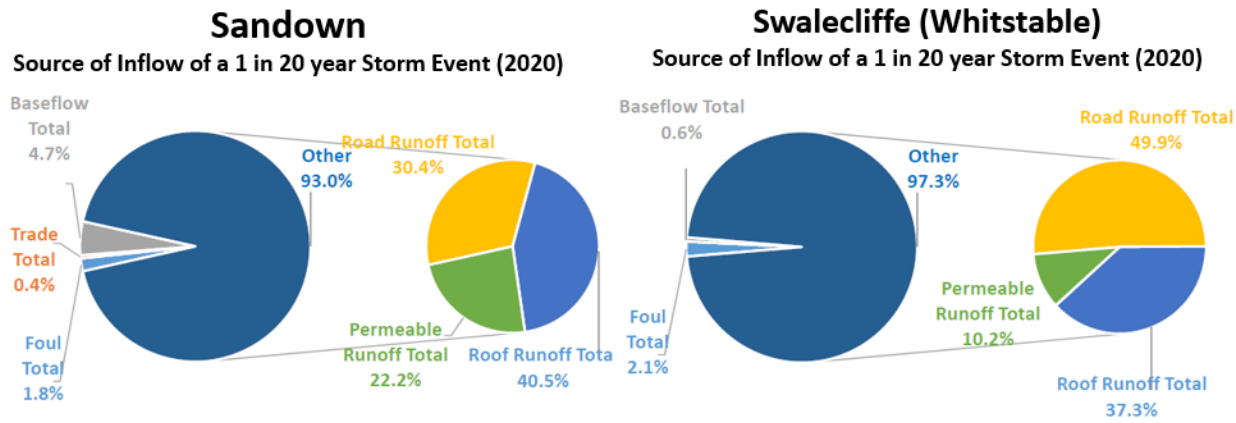
Climate change will bring less rainfall in the future but the intensity of summer storms will increase meaning that more rain will fall in shorter periods of time which will overwhelm many existing drainage systems and cause localised flooding. It means that we will all need to get used to seeing more damage from flooding in urban areas in the future unless we take action now.

We have a choice: to either invest significantly in upgrading thousands of kilometres of sewers to cope with the increasing demand from changing rainfall patterns and building more and more storm tanks, or to safely attenuate the rainfall on the surface enabling the existing systems to drain the water away over time. The latter is the more sustainable and affordable option, so we need to find ways to safely hold back and temporarily store water on the surface in areas where no harm is caused. An example is encouraging customers to capture and store more rainwater, which could have added benefit in making that water available for sustaining gardens, which in turn would reduce reliance on potable water for watering gardens during the drier summer months.

If we approach this in the right way, we can create more accessible green spaces, wetlands and natural environments such as urban woodlands, as well as supporting the long-term climate adaptation of communities.

Our DWMP highlighted the significant amount of rainwater that is within combined sewers during a storm. Figure 9 shows the sources and percentages for two of our larger wastewater systems. In both examples, the other water in the sewers is rainfall - up to 97% of the total flow in our sewer in a 1 in 20 year storm.

Figure 9: Sources of flow in sewers in a 1 in 20 year Storm



The majority of this rainwater is runoff from roofs and paved areas, such as roads, pavements and car parks. Permeable areas are parks and green spaces which become saturated in a storm, which means, once waterlogged, that any additional rainfall will run off rather than infiltrating into the ground.

Across our entire region, data shows that, on average, 79% of all flow in our sewers during a storm is rainwater, with 45% coming from roads, 34% from roofs and 14% from permeable areas. The actual foul wastewater component in a storm event can be as little as 1% of the flow in the system.

Excess rainwater in our sewers leads to:

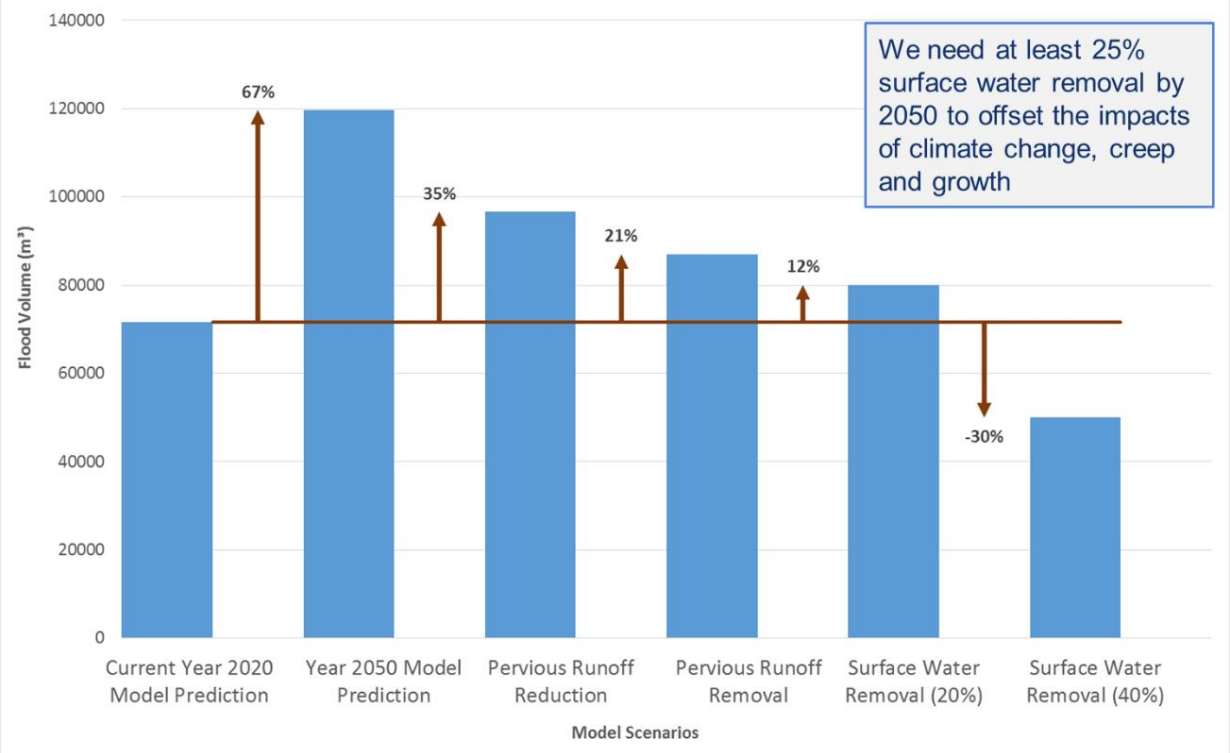
- flooding in customer's homes and businesses
- localised flooding in gardens and streets when water escapes from the sewer network
- wider flooding when rainwater is unable to get into the combined system
- storm overflows discharging diluted sewage into the environment
- pressure on the sewer network creating capacity issues and potentially to rising main failure, sewer collapse and asset deterioration
- increased energy and carbon costs of pumping the water significant distances to our wastewater treatment works and then treating it
- a reduction in the effectiveness of wastewater treatment processes at our wastewater treatment works due to the dilution of the sewage arriving at the works.

Our most significant concern relates to our legacy combined sewer systems where wastewater from homes and businesses is combined with rainwater from roofs and roads. The large proportion of rainwater in our sewers is the main cause of discharges from storm overflows to the environment. Our sewers are only capable of conveying flows up to their design capacity. Any flows greater than this will automatically overflow to reduce the risk of sewer flooding of homes and businesses.

Our modelling has indicated that climate change, growth and urban creep could increase sewer flood volumes by up to 67% by 2050, see Figure 10. This data is for our largest wastewater system, Budds Farm, in East Hampshire. Overall, climate change could lead to a doubling of the number of homes at risk from sewer flooding by 2050 compared to 2020.

Separating rainwater is not an easy option, especially where there is a need to retrofit SuDS or provide new surface water drainage systems within existing developments. But solutions that result in separation of rainwater provides greater climate resilience in the long term and also enables multiple benefits to be delivered by, for example, greening cities and urban areas. Figure 10 shows that reducing the runoff of rainwater from pervious areas (green spaces) could reduce the volume of flood water in 2050 from 67% down to 35% increase from 2020. Removing this runoff completely reduces the increase in flood volume to 21%. It's only by separating 40% of rainwater (surface water) that we see a 30% reduction in the volume of flood water in 2050 compared to 2020. Our modelling indicates that overall, we will need to separate at least 25% of paved areas (e.g. roads) and roofs in an area to offset the impacts of climate change, creep and growth.

Figure 10: Comparison of generic options for Budds Farm System in Hampshire



We believe that rainwater separation is the most sustainable long-term option for tackling the issues of storm overflows and flooding. Our pathfinder projects are leading the way in demonstrating that there are different solutions to do this, using the natural environment to help keep surface water out of our sewer systems by constructing swales and wetlands that will also benefit wildlife, provide access to nature for local communities, and help improve air quality and lower carbon costs. These blue green solutions and customer actions to remove rainwater at source will all help deliver wider multiple benefits, and slow the flow of rainwater into foul sewers. The benefits of this approach are likely to include:

(i) Significant reductions in sewer flooding from water escaping from the sewer network

(ii) Reductions from wider flooding when rainwater cannot get into the sewer network as it is already full

(iii) Fewer storm overflows discharging heavily diluted sewage into the environment

(iv) Greater focus on catchment management and nature based solutions

(v) Reduced energy and carbon costs as a result of pumping less water significant distances to our wastewater treatment works

(vi) Creating capacity at our wastewater treatment works so that part of the system can be shut down for maintenance, for example, taking a filtration tank offline without this disrupting our service

(vii) More effective and efficient removal of nitrate at our wastewater treatment works due to reduced dilation of the influent sewage arriving at the works

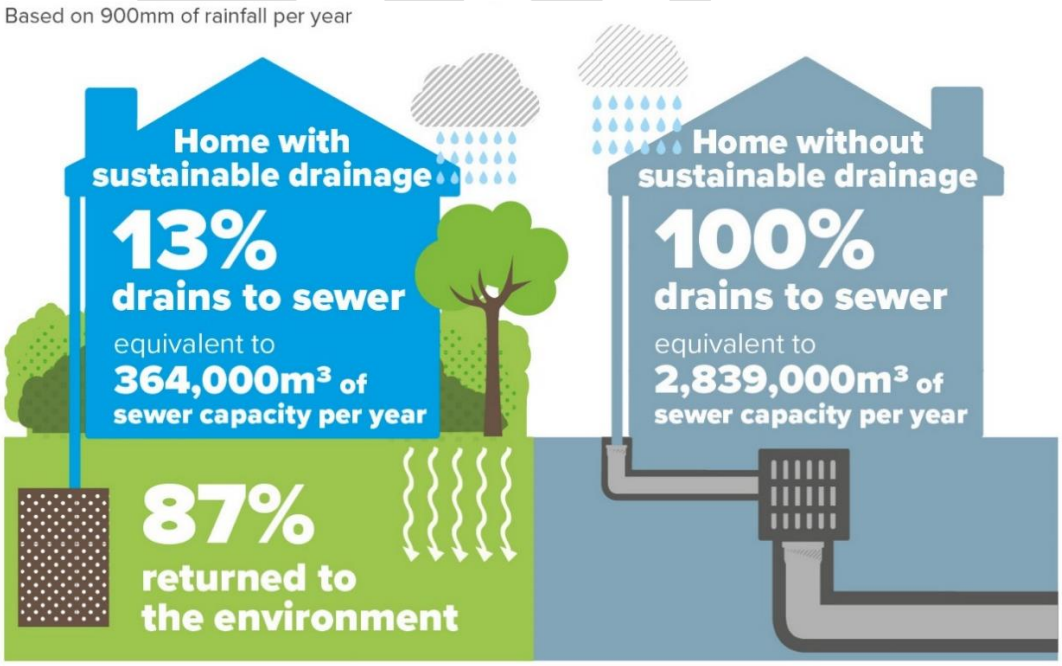
(viii) Improved water quality in the environment, including in rivers, bathing waters and shellfish waters

(ix) Greater opportunities to work with local councils to adapt communities for future climates and greener cities to create healthier and happier places to live

(x) Reducing future investment needs and customer bills.

SuDS provide many benefits in terms of biodiversity and amenity values as well as separating or holding back storm flows from inundating the sewer systems. Figure 11 shows that the rainwater runoff from a home with sustainable drainage could be as little as 13% compared to a home without SuDS. We have contributed towards the development of a benefits estimation tool, called B£ST, by the Construction Industry Research and Information Association (CIRIA). This is a free tool available to support the delivery of SuDS.

Figure 11: Water runoff for a development of 10,000 homes

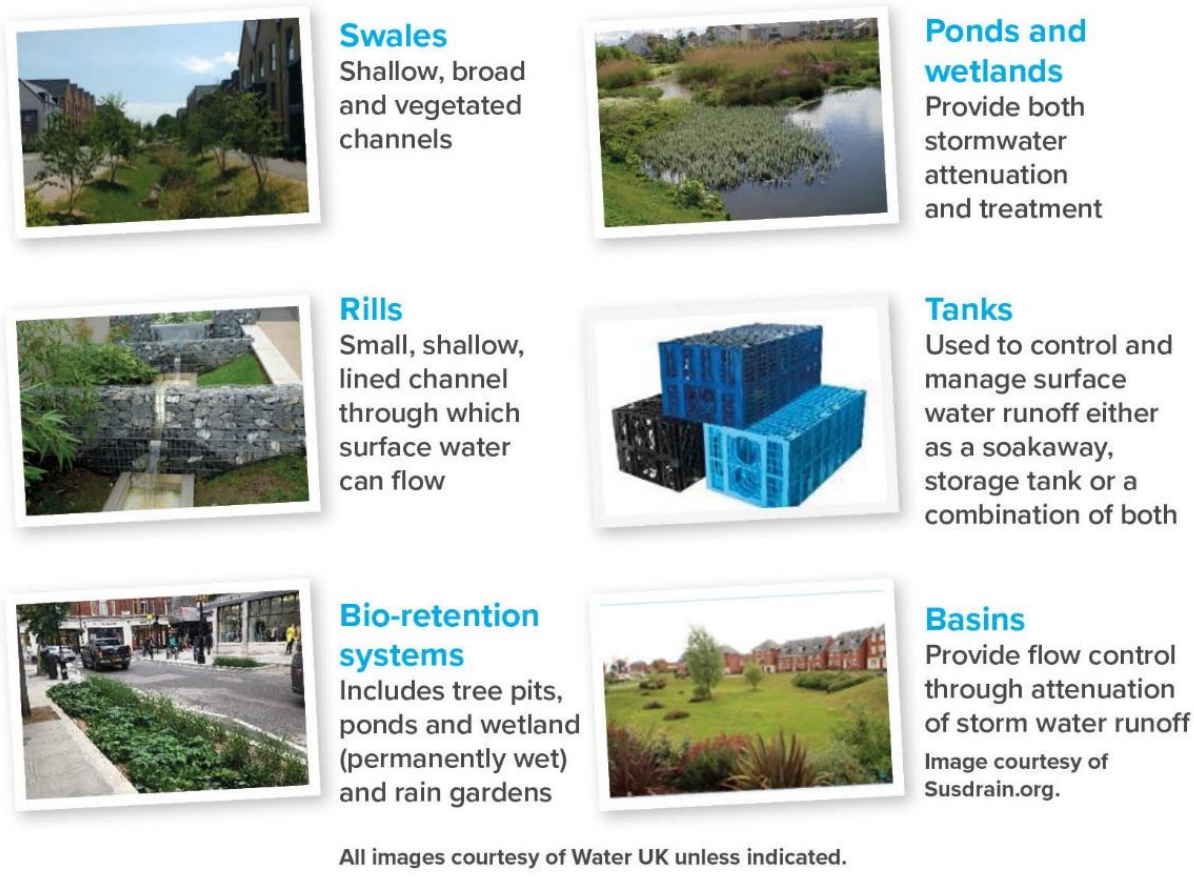


There are already many types of SuDS in widespread use, such as:

- Wetlands and attenuation ponds
- Swales
- Green roofs
- Tree planting / tree pits
- Rain gardens
- Permeable paving
- Waterbutts (including Smart Waterbutts).

Figure 12 shows some of the types of SuDS that water companies can now adopt.

Figure 12: Example of Sustainable Drainage Systems (SuDS) that we can adopt

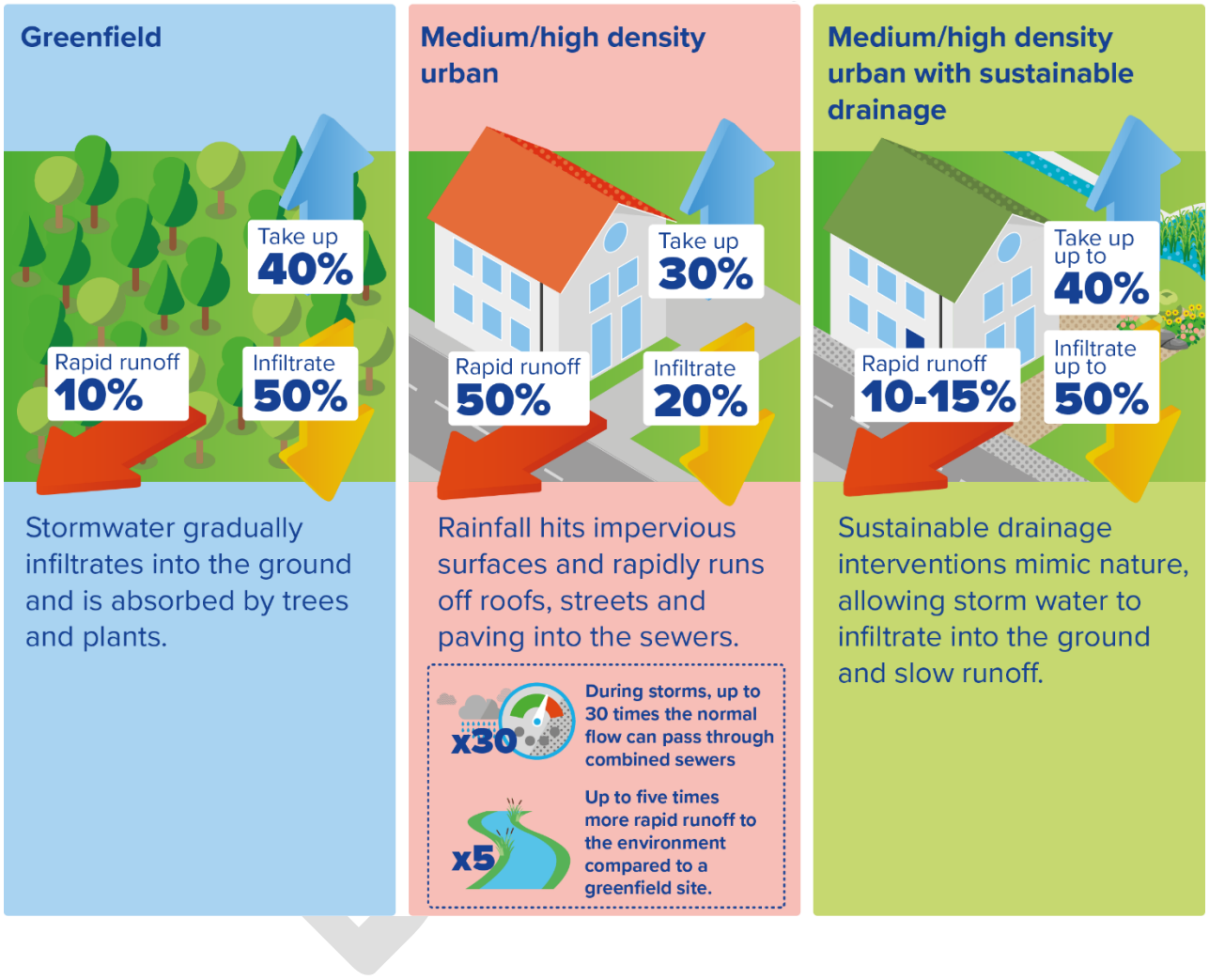


Separation of rainfall will require modifications to the existing drainage systems. Retrofitting new drainage systems within urban areas can be difficult, disruptive and expensive. Careful consideration needs to be given to how this could be done, where it can be implemented, the

volume of rainwater that needs to be removed from the sewers and the discharge points to which it can be channelled. It is vital that the current challenges are not simply displaced elsewhere.

Figure 13 illustrates the differences in storm water runoff from greenfields and urban areas, without and with sustainable drainage. It illustrates that by using sustainable drainage it is possible to reduce the runoff of rainwater to near to the level of greenfield sites.

Figure 13: Storm water runoff comparison (based on a 200m^2 area)



We cannot deliver rainwater separation on our own. Collaborations with the EA, Councils, Planning Authorities, Highways Agencies and local communities are needed to co-create the solutions. Our DWMP is a long-term plan and, by working together, the issue can be tackled, step by step. Every separation scheme is progress towards this long-term goal.

We know that the existing housing stock and infrastructure is the problem. Future development should not be. Local Planning Authorities are already working with developers on new developments to ensure rainwater is appropriately managed, following a drainage hierarchy to prevent rainwater being discharged to foul or combined sewers. We work closely with planning

authorities and provide advice to support new developments. We have recently updated our sustainable development policy, which includes the following expectations on developers:

(i) Sewer connections – Connections from new developments to foul or combined sewers for surface water runoff will not be accepted unless all options to separate surface water have been applied

(ii) Sustainable drainage – designs must include features to slow the flow of surface water runoff as close to the source as possible, for example, green roofs, permeable paving, rain gardens and water butts

(iii) Water recycling – incorporate rainwater capture and grey water recycling systems into designs, linking it to blue-green infrastructure and joining or establishing partnerships where practical to eliminate rainwater from drains

(iv) Nutrient Neutrality – to mitigate the expected increase in nitrogen and phosphorus from a new development so that they can become nutrient neutral. Specific developments in the Stodmarsh area in Kent and parts of South Hampshire and Chichester are required to demonstrate Nutrient Neutrality.

(v) Water neutrality – developments in Sussex North must demonstrate Water Neutrality for any new development with designs meeting 85 litres per person per day, which will require water capture and re-use, and off-setting, to achieve.

Collectively, we must take each and every opportunity to proactively separate surface water from our foul and combined systems. The organisations we have been working with to develop the DWMP have already shown that there is substantial and widespread backing for separation of rainwater at source, and express strong support to work together to implement this approach.

Our DWMP sets out a bold, innovative and sustainable approach to reducing the risks of sewer flooding and discharges from storm overflows by:

- **Storm Overflows Task Force**. Continue to develop the pathfinder projects through our Storm Overflows Task Force to demonstrate how to significantly reduce storm overflow discharges
- **Regulatory Compliance**. Fully comply with regulatory obligations and duties, including the environmental permits for storm overflows as issued by the EA
- **Asset Optimisation**. Make sure our wastewater systems, assets and networks are mapped and working as intended. Invest in technology to create smart networks to maximise the use and capacity of existing drainage systems
- **Rainwater Separation**. Prioritise the removal of existing surface water connections from the combined sewer network above building additional storage, and achieve year on year reductions in the amount of rainwater that is connected to the combined sewer
- **Sustainable Solutions**. Develop effective long-term solutions that deliver a natural capital approach, consider carbon reduction and biodiversity net gain, as well as catchment-level and nature-based solutions
- **Eliminate Harm**. Eliminate public harm from storm overflows
- **Deliver Wider Benefits**. Maximise co-benefits to address multiple issues and deliver wider environmental or societal value as well as storm overflow performance
- **Work in Partnership**. Actively seek opportunities to work in partnership with others to provide ‘green’ infrastructure such as trees, hedgerows, parks, fields and forests and ‘blue’

infrastructure including rivers, canals, ponds, wetlands, reservoirs and floodplains within existing communities

- **Separate existing systems**. Take the opportunity to separate combined sewers and lay new separate surface water systems when replacing and upgrading sewers
- **Advise New Developments**. Strengthen our advice to planning authorities to ensure new build properties and developments only connect foul drainage to our sewers
- **Adopt SuDS**. We are able to adopt SuDS constructed by developers as part of new developments where they meet the industry standards and the criteria for adoption
- **Retrofit SuDS**. Retrofitting is challenging, but essential in urban areas. Work with local councils and industry to identify opportunities to encourage property owners to install SuDS to existing buildings
- **Tackle road run-off**. We will work with the highway authorities to support and encourage them to improve surface water management and reduce pollution from the road network
- **Target customers with education campaigns**. We will extend our FOG and unflushables awareness campaigns to reduce blockages. We will include messages on sustainable drainage. We will work with our partner organisations to develop and implement our campaigns
- **Re-Classify storm overflows**. Where existing storm overflows are necessary for emergency use, we will work with the EA to re-designate and consent them as Emergency Overflows (EO's) where the risk of discharges during storms has been eliminated.

We are developing a Future Growth Strategy to strengthen the way information about development plans is captured within our region to improve the connection between Local Plan decision-making and the commitments of our DWMP. Local Planning Authorities have told us that this will be valuable to support and influence the growth and development related policies in Local Plans. However, this is not a statutory requirement and the water industry is not a statutory consultee so we are not able to influence planning applications, neither can we currently refuse applications for connections to our mains drainage.

Our Investment Plan for Sewer Flooding contains the investment needs identified to reduce flooding under PO1, 4, 7 and 10.

Enhancing the Environment

Our region has a wealth of beautiful coastal and natural environments that are not only fundamental to supporting the wildlife, biodiversity and ecosystems that thrive here, but also to the economic and social vitality of our region. They attract many thousands of visitors annually, provide the resources to underpin local shell fisheries and angling interests, and sustain recreational and wellbeing pursuits. The quality of the water in the environment is fundamental to supporting all of this.

We recognise the important role we play in protecting the environment. We also know how important it is to go further to improve and enhance the environment in managing drainage and wastewater services.

The way our business positively or negatively influences the environment is a vital element of our DWMP. The quality of the effluent that is discharged from our wastewater treatment works, as well sewer overflow discharges, affects the quality of the waters that receive it. In turn, this affects the water related habitats that ecosystems depend on, and impacts our customers, communities and the visitors to our region economically and socially when bathing and shellfish waters are not of the highest quality.

The natural environment is important for our customers and the local economy. The services it provides that benefit people are known as ecosystem services. These services directly and indirectly affect human wellbeing, such as food production, fuel provision, the regulation of the climate, the purification of air and water, flood protection, soil formation, nutrient cycling, and recreation. We are developing a common methodology for the valuation of ecosystem services that can be used across all our plans to consider the impact of our actions on the environment. The benefits will be to shift the emphasis from a focus mainly on valuing environmental damage caused to highlighting the value of changes in the services provided by the natural environment. For now, in our first DWMP, we have focused on the environment through our Strategic Environmental Assessment and a multi-criteria appraisal of benefits covering social, economic and environmental criteria. Further detail can be found in our Technical Summary on Options Development and Appraisal.

Receiving waters may be rivers and streams, ponds, wetlands or coastal waters, many of which have national and international designations. These include SSSIs (Sites of Special Scientific Interest), SACs (Special Areas of Conservation), SPAs (Special Protection Areas) or Ramsar, MPAs (Marine Protected Areas), MCZs (Marine Conservation Zones) or are part of a National Park, LNR (Local Nature Reserve) or an AONB (Area of Outstanding Natural Beauty). There are 38 internationally designated habitats in our region, and 84 designated coastal bathing waters. In addition, there are numerous shellfish waters around the Solent and Southampton Harbours and such as Chichester, Emsworth, Thornham, Portsmouth, Langstone, Spithead and Stokes Bay, as well as the Swale and Isles' of Wight and Sheppey.

Protecting and enhancing these vitally important regional assets is central to our work and the outcomes we, working with our partner organisations, want to deliver through the DWMP. This is why we included eight Planning Objectives (POs) over and above the six national planning objectives. Of the eight, four of these additional objectives are about the quality of surface waters in rivers and the sea:

(a) PO9: Achieving Good Ecological Status / Good Ecological Potential (GES / GEP)

(b) PO11: Securing Nutrient Neutrality (NN)

(c) PO13: Improving Bathing Water Quality

(d) PO14: Protecting Shellfish Waters.

We cannot work alone to achieve these objectives. We have been directly working throughout the development of the DWMP with partner organisations that have statutory responsibilities for the environment and for planning future development. These organisations include member organisations of the Catchment Partnerships that have nature conservation, enhancement and enjoyment as core goals.

Many of our planning objectives are interlinked. Addressing the risks from flooding, pollution, storm overflows and surface water management will help achieve the outcomes we need to sustain and enhance the lives of our customers, communities, businesses and wildlife now and into the future. Understanding the outcomes on the environment caused by our drainage and wastewater systems is a vital element of our DWMP. This is also important for our water resources planning, to ensure that there is sufficient good quality water in the environment for the ecosystems and for public water supply. We have aligned our DWMP with our Water Resource Management Plan (WRMP), and used common planning assumptions and data, for example on growth and climate change. Together these plans form a strong foundation for integrated management of water in the environment.

Good Ecological Status / Good Ecological Potential (PO9)

Good Ecological Status / Good Ecological Potential (GES/GEP) is the need enshrined in the Water Framework Directive (WFD) to implement "*necessary measures to prevent deterioration of the status of all water bodies".*

The ecological status of a stream, river, lake, estuary, lagoon or coastal water is an index of the quality of the water itself and the variety and quantity of plant and animal species it supports. By comparing the observed ecological status against the theoretical status it would have in a completely natural state, unaffected by human activity, one of five status classifications can be assigned to a waterbody: High, Good, Moderate, Poor and Bad. Good is the target condition for all waterbodies.

GEP applies to all "artificial" or "Heavily Modified" waterbodies (HMWBs). These will include waterbodies that have been modified for flood protection, navigation, recreation or water storage. It is accepted that, through the physical modifications made, GES can never be achieved for the HMWBs so the target is to achieve GEP - the best ecological condition possible under these alternative uses and conditions.

There are many potential sources of risk that affect the status of waterbodies. These include our drainage and wastewater systems as well as other sources such as industrial input and road and agricultural runoff. It is our intention to play our part by working with others to help all waterbodies in our region reach GES/GEP by removing our activities as a reason for a waterbody not achieving good ecological status or potential.

In the first cycle of the DWMP we are focusing on understanding our role in achieving GES or GEP and on collaborating with others to understand where future investment may be needed. We will focus investment in our wastewater systems where the EA has confirmed that one of the reasons for not achieving GES or GEP is due to our operations. By doing so we will improve our wastewater systems and support more waterbodies in achieving GES or GEP in the case of heavily modified waterbodies. We will work with the EA to ensure that the priority actions are included within the statutory Water Industry National Environment Programme (WINEP) so the funding can be secured from our customers and shareholders to deliver these actions.

Nutrient Neutrality (PO11)

Evidence from studies over the last few decades are showing that water dependent habitats and ecosystems are in significant decline, with many internationally important habitats sites being in declining condition. There are many issues causing this, one of which is the impact of nutrients and other pollutants which come from a variety of sources including recycled wastewater, agricultural and urban run-off and other point sources, for example, from industry.

Significant discharges to the environment are permitted by the EA. The permits in place for our wastewater treatment works set the concentrations we need to achieve in the treated water before it is discharged to the environment in order to prevent harm. However, all the contributions of pollutants from different sectors add up to increasing pressure on habitats and ecosystems and this is further compounded by population growth with associated housing development adding additional nutrient burden. To this end, targets for nutrient neutrality have been set to help ensure the most important habitats are afforded proper protection into the future.

We explored the risks of nutrients from our wastewater systems impacting on the 38 internationally designated habitats across our operating region in our risk assessment on nutrient neutrality (PO11).

The Conservation of Habitats and Species Regulations, 2017, as amended (Habitats Regulations) is the legislative basis for protecting Habitats sites. Natural England (NE) is the statutory conservation body in England providing advice on the conservation of Habitats sites. The internationally designated Habitat sites covered by the regulations are:

- Special Areas of Conservation (SACs) including marine and offshore sites
- Special Protection Areas (SPAs) including marine and offshore sites
- Ramsar Sites – these are wetlands of international importance designated under the Ramsar Convention[15].

The Habitats Regulations expect all designated sites to meet or be restored to 'Favourable Conservation Status' (FCS). FCS is assessed on the condition of the site itself and the flora and fauna it supports, rather than the water quality. Although some habitats have supporting water quality attributes that, if failed, are considered to undermine favourable conservation status.

Increased levels of nutrients, especially nitrogen and phosphorus, can speed up the growth of certain plants, disrupting natural processes and impacting wildlife. Algal blooms and excessive vegetation growth can kill fish and prevent birds from feeding.

[15] The Convention on Wetlands of International Importance especially as Waterfowl Habitat ('Ramsar Convention' or 'Wetlands Convention') was adopted in Ramsar, Iran in February 1971 and came into force in December 1975. Ref: https://jncc.gov.uk/our-work/ramsar-convention/?msclkid=2acdba90d0a411ec840d6cfd5561f0ad

There must be 'no deterioration' in the conservation status of these designated sites and no disturbance of the wild birds or flora or fauna. Where sites are already failing their conservation objectives, the ability to provide additional permissions such as for new housing that add to an existing impact on, for example water quality, is "necessarily limited" by case law.

This means that wastewater from new developments that drain to Habitats sites that are not at favourable conservation status need to be certain to not add to the existing nutrient burden to further undermine the conservation status. NE and the Government have provided advice and support to help 42 local planning authorities (LPAs) ensure that the development their areas require can progress without adding pollution to internationally designated 'Habitats sites'. The approach is to adopt a neutral approach to nutrients, called Nutrient Neutrality.

One way that developments can reach the certainty required by planning is to require the affected catchment to demonstrate that all surface water runoff and wastewater nutrients (nitrogen and/or phosphorus) generated by new proposals must be less than or equal to the load that the existing land use and wastewater generates.

Securing Nutrient Neutrality is crucial to enabling the continued growth and development across the South-East. Local planning authorities have responded quickly to NE's guidance on assessing how planning proposals can mitigate the expected increase in nitrogen and phosphorus from a new development so that they can become nutrient neutral, especially for the Solent in Hampshire and Stodmarsh in Kent. In the Solent, a Government-sponsored nutrient trading platform and partnership working between LPAs, Government, NE and the EA, with the engagement of landowners, has already delivered over 3000 nutrient neutral homes.

NE has also developed tools such as bespoke catchment calculators to help assess the Habitat's current nutrient status and the likely impact of any new development. We will use these tools to identify the level of mitigation required to cancel out the additional nutrient pollution expected from our projects and how we can reduce nutrient loading of these Habitats through our investment plans.

Many mitigation measures for nutrients will involve the creation of new wetlands, woodland or grasslands - providing new spaces for nature and recreation in the process - or installing environmentally-friendly SuDS. Of course, these could have much wider benefits for sewer flooding, storm overflows, bathing waters, shellfish waters and other waterbodies.

It is essential that we fully understand both the sources and sustainable levels of the nutrients affecting these habitats in order to facilitate sustainable growth in our region. We will work with partner organisations to understand the sources of nutrients that are impacting on these habitats and seek to establish appropriate nutrient budgets for each of the designated Habitat sites in our region. We may not be able to totally eliminate nutrients from all sources, but we will play our part in alleviating the pressures associated with nutrients from our operations and support the journey towards Nutrient Neutrality. One example where we are already working with planning authorities to tackle the challenges of nutrient neutrality is for Stodmarsh in Kent. We are monitoring and modelling water quality in the environment to better understand the risks to the vital habitats and species present from both our wastewater assets and the surrounding catchment. This study will set out any actions required on wastewater assets, as well as catchment and nature based solutions in the broader catchment, to protect water quality under different growth scenarios.

The solution to the increasing risks from nutrients relies on action on multiple fronts by working to mitigate current nutrient contributions arising from different sectors to the habitat sites. We need to

also ensure that development can continue to accommodate projected growth without adding additional nutrient loading via wastewater systems.

We all have a part to play in the solution. It requires collective action between different organisations, including ourselves, planners, housebuilders, developers, local authorities and others. Coordinated action is needed to bring about long term protection to water quality and important habitats.

Solutions need to be identified that reduce nutrients but also provide wider benefits. For example the use of nature based solutions such as wetlands to treat effluent can provide biodiversity habitats, reduce flooding and support carbon capture that an engineering solution alone cannot provide.

An example of where we are already working on nutrient neutrality is in Chichester Harbour where we are:

- Undertaking wastewater planning to resolve existing infrastructure issues whilst accommodating future growth projections
- Investigating the potential for nature based solutions in urban settings to capture surface water run-off and prevent it from entering the sewers and then reaching the harbours through storm overflows
- Working with farmers to reduce nitrate application and run-off from farmland around the harbours
- Working with other local and environmental organisations to build beneficial habitats such as hedgerows, reedbeds and wetlands that can capture overland runoff from roads and farmland and remove any excess nutrients prior to entering the harbours. These nature based solutions will help improve water quality whilst also providing beneficial habitats, improving the landscape, helping to manage flooding and capture carbon
- Collaborating with others through convening the Harbours Summit, comprising of different local organisations, with the aim to understand the local issues and constraints, and to develop a long term strategy to protect water quality and the important habitats of the harbours.

Reducing Nutrients from our Assets

Our WTWs remove nutrients from wastewater as part of the recycling process before discharging it back into the environment. The two main nutrients of concern are nitrate and phosphate – both of these are contained in domestic and industrial sewage.

The EA sets permits for concentrations of nitrate and phosphate in our discharges to prevent harm. The permits need regular review to ensure no harm is caused to the environment, particularly where new development is increasing the demands on our wastewater systems. Permit changes are an important element to securing the funding through the Water Industry National Environment Programme (WINEP) to enable the technology and supporting infrastructure, including constructed wetlands, to be installed at the relevant wastewater treatment systems.

For phosphate, we can normally achieve 80% of the permit level irrespective of what is arriving at the works and are able to achieve even more by dosing with ferric and adding tertiary solids removal. We have invested over £25 million in recent years at our two wastewater treatment works

in Hailsham to remove phosphate to much lower levels by using water treatment technology. Achieving these levels of phosphate removal has involved using best available technology which is high cost, high carbon and requires the use of chemicals. We are keen to find sustainable solutions that help achieve a range of environmental targets, including net zero carbon, whilst keeping costs to our customers low.

Some manufacturers of detergents are making changes to the formula of their detergents which potentially means less phosphate in domestic wastewater. This is a great example of tackling the cause of the risk at the source, and reducing the need for 'end of pipe' solutions.

For nitrate, removal is dependent on the type of process and also the strength of the crude sewage. If the sewage is concentrated, we are able to remove more nitrate. This tends to be site specific depending on the size of the anoxic tanks and the presence of an oxidation ditch.

Separation of rain water from the sewage system is advantageous for nutrient removal, as a greater percentage of removal can be achieved when the sewage is more concentrated. A reduction of the percentage of solids in the sewage also makes it harder for the removal of the residual nitrate at the works. However, a reduced nutrient load arriving at a wastewater treatment works only provides a benefit where the works does not have a nutrient removal process.

Many of our wastewater systems, but not all, are already using the best available technology so, currently, we cannot strip further nutrients from discharges at these WTWs. However, innovations in technology are ongoing and will be deployed to address the issues if the necessary funding is secured.

Ultimately, addressing nutrients effectively through our investment and collaborative working is the route to achieve the outcomes needed for the benefit of our customers, communities and the environment.

To reduce the risks to PO9 and PO11 we will:

- Continue to work with other authorities to develop a long term strategy to protect water quality and the important habitats of Chichester, Langstone and Pagham Harbours
- Continue to work with the planning authorities in Kent to achieve nutrient neutrality in Stodmarsh and unlock new development
- Provide advice and support to local planning authorities and developers to find sustainable, best-value solutions that enable Habitats to be restored to favourable condition whilst supporting the necessary growth and economic development in the South-East
- Work with NE, the EA and other partners across river basin catchments to deliver the Environment Act 2021 targets of reducing nutrient pollution in water by reducing phosphorus loading from treated wastewater by 80 per cent by 2037
- Actively support the Government's target to reduce nitrogen, phosphorous and sediment from agriculture to the water environment by 40 per cent by 2037
- Work with Water UK and government to explore mechanisms to reduce sources of phosphate in consumer products.

Bathing Waters (PO13) and Shellfish Waters (PO14)

The 700 miles of coastline in our operating area in the South-East and the 84 designated beaches attract thousands of visitors a year. The quality of the bathing and shellfish waters is vital to supporting thriving local economies. The designated coastal bathing waters and numerous shellfish waters are located around the Solent and Southampton Harbours and such as Chichester, Emsworth, Thornham, Portsmouth, Langstone, Spithead and Stokes Bay, as well as the Swale and Isles of Wight and Sheppey.

The shellfish harvesting waters in our region are of real economic importance and the shellfish must be suitable for human consumption, free from harmful bacteria and protected from any deterioration. The Shellfish Waters Directive is designed to protect the designated aquatic habitats of bivalve and gastropod molluscs, which include oysters, mussels, cockles, scallops and clams in order to support shellfish life and growth. It sets physical, chemical and microbiological requirements that designated shellfish waters must either comply with or, where this is not the case, improve so that it is compliant.

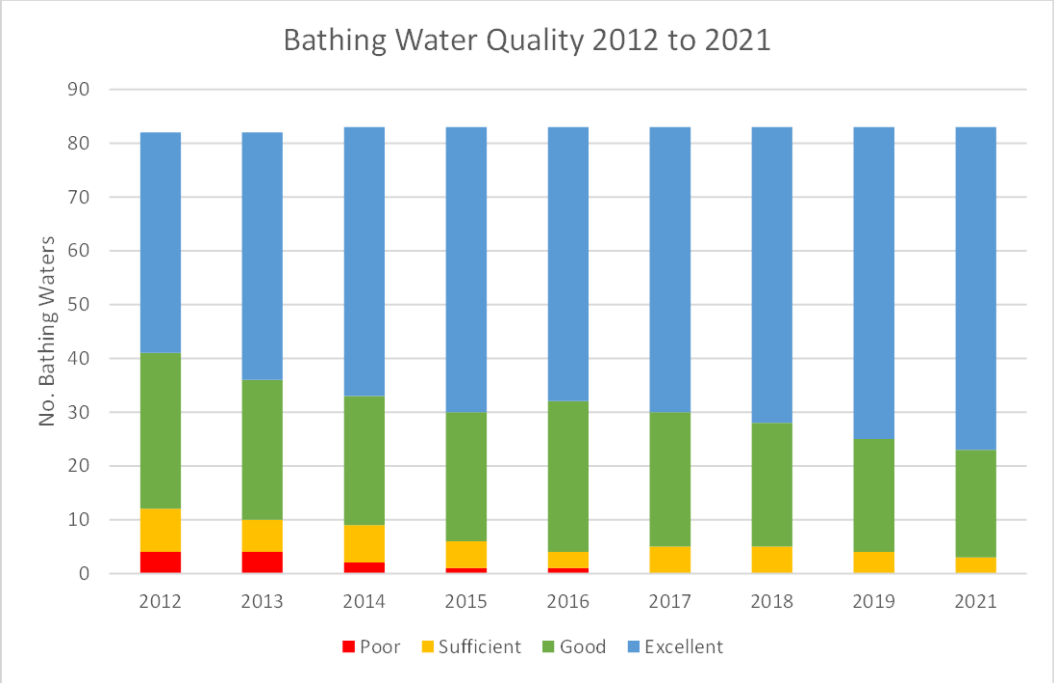
Shellfish waters are monitored for various parameters based on water quality standards including suspended solids, salinity, dissolved oxygen (DO), organo-halogenated substances such as polychlorinated biphenyls (PCBs) and organochlorine pesticides, metals and guideline values for coliforms in shellfish flesh. For each of these substances, the Directive specifies the minimum number of samples to be taken, the water quality standards to be met and the percentage of samples that must meet these standards. The standards are either a numeric limit or a descriptive standard.

Our AMP7 (2020 – 2025) company commitments are to maintain 57 bathing waters at “excellent” and to improve two more to achieve excellent status and at least five from “sufficient” to “good” by 2024 / 25. We aim to improve all 84 bathing waters to excellent classification by 2040[16]. We are fully committed to ensuring our wastewater discharges do not negatively impact the designated shellfish waters in our region.

In recent years, we have invested millions in our wastewater systems to reduce our impact on bathing and shellfish water quality. Figure 14 illustrates the improvements in bathing water quality as a result of this investment. Our improvement programme has included the creation of an in-house Misconnections Team to trace and find where foul wastewater from homes is misconnected into surface water sewers. These misconnections result in sewage from homes and businesses is directly discharged into rivers and the sea without any treatment. We work with local authorities to ensure that property owners take corrective actions to their private drainage systems so they do not pollute the local beaches.

[16] Our DWMP has considered the investment needs for 83 bathing waters. One additional bathing water was added to the list of designated bathing waters in April 2022.

Figure 14: Bathing Water Quality Results from 2012 to 2021



Bathing and shellfish waters are also affected by a range of other sources of pollution such as contaminated rainwater running off roads and agricultural land, wastewater from privately-owned treatment works, boats and animals on the beach such as dogs and seabirds. We are working closely with our Local Authority partners to continue to improve the quality of the coastal waters so our customers, communities and visitors to our region can enjoy them safely.

In May 2021 we launched an updated version of our Beachbuoy service; an online map that shows when and where storm discharges have occurred so people can make an informed decision before entering the water. Unlike anything in our industry, the map shows all our region's designated bathing waters and two non-designated recreation harbours, along with more detail about each release of untreated sewage. We have linked Beachbuoy directly to our new reporting system, Aspire, so updates on releases to the environment show on the map in near real-time. The Beachbuoy service is available on our website and it is now widely used. Many of our employees live in the region because they are passionate about the sea and regularly use Beachbuoy in their sports and recreation.

We included two additional planning objectives in our DWMP to assess the risks to bathing waters (PO13) and shellfish waters (PO14) from the performance of our wastewater systems. The risk assessment methodologies for each of these identify the wastewater systems that are hydrologically connected to or that could influence the quality of these waters. For example, there are 15 wastewater systems that are hydrologically connected to shellfish waters where our operations could potentially have an impact.

We will:

- Minimise pollution incidents from our systems to reduce the risks to bathing and shellfish water

- Continue to work with the EA to ensure our treatment works are treating wastewater to appropriate standards
- Continue with our bathing water enhancement programme, investing in sewer misconnections and other activities with partner local authorities, to ensure that the performance of the sewerage system does not prevent the delivery of excellent classification of all 84 bathing waters across our operating area.
- Ensure that shellfish waters are protected from contamination from human pathogens through disinfecting sewage discharges to comply with, or exceed, the requirements.

Inland Bathing Waters

Our customers and visitors are increasingly using inland waterbodies and rivers for recreational activities and as bathing waters. There are known locations across our area where customers use local parks and rivers for bathing. One such location is at Riverside Park in the Upper Itchen. We need to ensure these waters are safe for recreational uses.

The government is actively encouraging water companies to designate at least one widely used stretch of river for bathing by 2025, and Defra is going to revise its existing guidance on the application criteria for a new bathing water designation to make it easier for communities to apply. We will develop information on our website to help local authorities and community groups discuss their ambitions with us to begin the process.

We will work with the EA so we can support customers' wishes to be able to use our rivers for inland bathing through our investments in wastewater assets. It is expected that these inland waters will need to be formally designated as bathing waters by the EA to facilitate the investment to improve water quality in these locations.

Our Investment Plan for the Environment sets out the investment needs for PO9, 11, 13 and 14.

Investment Needs

Our DWMP highlighted the significant risks to our customers and the environment from the performance of our wastewater systems. We have 228 wastewater systems (59.84%) where there is at least one very significant risk in 2020 identified in our DWMP. These risks will increase due to climate change urban creep, growth and asset deterioration unless we continue to invest in our wastewater systems.

Our modelling indicated that the number of properties at risk from sewer flooding could double by 2050, when compared to 2020 level, as a result of climate change. The rate of investment will need to increase in order to keep pace with these challenges and prevent us passing costs onto future generations. However, we need to adopt a new approach as well as new technology to reduce future investment needs to ensure they remain affordable for future customers.

Our focus is on investing now to create resilient wastewater systems for the future. The DWMP is a risk-based plan to support planning for the uncertainties of the future, identifying the most likely future investment needs. We know that growth and climate change will place greater pressures on the critical infrastructure and essential services that we provide to our customers. The risk assessments for 2050 start to define what the future may hold. We used the risk assessments to assign Investment Strategies to each of our wastewater systems, see Figure 15 and Figure 16. These Investment Strategies underpin our approach to adaptive planning so we know when and where future investment may be needed in our wastewater systems.

Figure 15: Determining our Investment Strategies

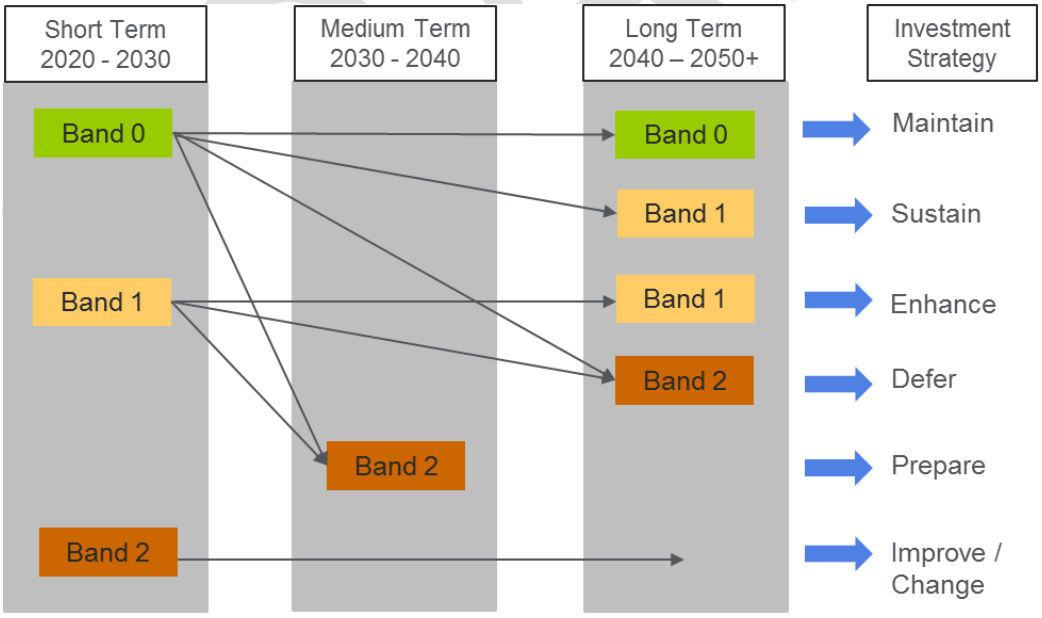


Figure 16: DWMP Investment Strategies

Adaptive planning is a process to support planning for future uncertainties. We can explore and test what the future may look like through scenario planning and developing adaptation strategies. This is completed at two spatial scales, firstly at the wastewater system scale to understand how our systems may need to change in the future, and secondly for our whole operational area as part of the business planning process to consider the financing and affordability of investment.

We use deterioration modelling to forecast the need for future investment in our assets and systems. The DWMP has added a range of future risk assessments to forecast when risks will

occur, thus enabling future investment strategies to be developed around the need for our system to adapt and respond to the future risks to remain resilient.

Examples may include:

(a) If environmental or technical constraints are forecast to restrict new development from being connected to an existing wastewater system then plans can be made to transfer wastewater to an alternative site for treatment

(b) If sea level rise places too greater risks to a coastal treatment works in, say, 20 years' time, then a decision may be needed within the next 10 years on whether to plan to relocate the treatment works away from the risk

(c) If flooding and discharges from storm overflows in a community is forecast to be very significant risk in 2040, then do we incrementally build additional network storage to keep pace with growth and climate change, or invest in providing a new separate surface water system.

Our core investment strategy is to 'maintain'. This means we will invest, on a no regrets basis, in our 381 wastewater systems to ensure they work and perform as designed to keep risks to customers and the environment in band 0. Where our wastewater systems are not already in band 0 across all 14 risk assessments, then we have assigned one of the other investment strategies, for example, Sustain through to Change, depending upon the scale and nature of the risk and when it occurs. The preferred options for each wastewater system set out the investment needs to implement our investment strategy, and becomes our adaptation pathway for the system once funding is secured.

Our adaptation pathways at the regional scale for drainage and wastewater are established as part of our 5 yearly business planning process to secure funding. The pathways balance the rate of risk (current and future) reduction with the level of investment thus providing choices in terms of customer willingness to pay and affordability. The affordability of investment for our customers and the willingness to pay are concerns which we discuss with our customers and Ofwat as part of the 5 yearly business planning process.

The DWMP supports and drives adaptive and scenario planning, although we would like to see the national DWMP framework expanded to enhance the scenario and adaptive planning for inclusion within future cycles of the DWMP. It would be helpful to incorporate Ofwat's common reference scenarios that cover key uncertainties that could impact water company activities in the future into future cycles of the DWMP. These would expand the current DWMP scenario planning beyond climate change and growth to cover wider issues of developments in technology, environmental limits, changes in demand for water and wastewater services, and levels of future water recycling.

The Problem Characterisation stage within the DWMP has enabled us to explore the causes of risks. This stage of the DWMP identified the wastewater systems with the highest level of concern which have the most planning objectives in each risk band and where the risks were likely to be the most complex and difficult to resolve, see Figure 17. Sandown, Swalecliffe and Weatherlees Hill are the three wastewater systems with the highest number of planning objectives – all with seven of the 14 planning objectives in Band 2.

Figure 17: Wastewater System with the highest level of concern

River Basin Catchment	System Ref	Wastewater System	No. of planning objectives in Band 2 (2020)
Isle of Wight	SAND	SANDOWN	7
Stour	WEAT	WEATHERLEES HILL	7
Stour	SWAL	SWALECLIFFE	7
East Hampshire	BUDD	BUDDS FARM HAVANT	6
North Kent	QUEE	QUEENBOROUGH	6
East Hampshire	PEEL	PEEL COMMON	5
Cuckmere & Pevensey Levels	EALP	EASTBOURNE	5
Test and Itchen	WOOL	WOOLSTON	5
New Forest	SLOW	SLOWHILL COPSE MARCHWOOD	5
Stour	HERN	MAY STREET HERNE BAY	5
Medway	TUWS	TUNBRIDGE WELLS SOUTH	5
Stour	CHAR	CHARTHAM	5
Rother	RYEW	RYE	5

We used this analysis to group the wastewater systems into 3 categories according to the level of concern – high, medium and low. We progressed all the systems with a high and medium level of concern through the Options Development and Appraisal (ODA) stage of the DWMP, with a selection of systems with a low level of concern following discussions with, and requested by, our staff and partner organisations. In total, we took 61 systems, serving 78% of our customers, through the ODA process to develop the Investment Needs for each of these systems. Further information on our risk assessment, the problem characterisation and the ODA stages of our DWMP can be found on our website.

The Investment Needs for each of the 61 wastewater systems consist of the current preferred options for managing and reducing the risks that we consider will represent the best value for our customers. We developed and tested a process for evaluating the multiple benefits as part of the ODA process, covering social, economic and environmental criteria. An initial list of generic options set out the types of intervention that could be used to address identified risks and problems in the wastewater systems. When these generic options were applied to the 61 wastewater systems, over 2000 unconstrained options were identified. These were screened through the appraisal of benefits to over 1000 preferred options for our Plan. The draft Investment Needs for each wastewater system and river basin catchment were shared and discussed with experts across our business and external partner organisations through a series of workshops in March 2022. Our technical summary on ODA is on our website.

Our Strategic Environmental Assessment reviewed these options and the benefits assessment to consider the cumulative and in-combination effects of our plan. Further information on our Strategic Environmental Assessment is available on our website.

We collated the preferred options during the Programme Appraisal stage of the DWMP to set out the total investment needs. This allowed us to describe the Investment Needs for the region (Level 1 planning area) and each river basin catchment (Level 2 planning area). We prioritised the investment needs and listed them against each planning objective. Many of these investment options deliver benefits under more than one planning objective, hence they can appear in the investment need for each of those planning objectives. The Investment Plans for each planning objective identify the investment that could be required to achieve the improved level of performance, or risk, under each planning objective. The prioritisation and optimisation process is iterative. Following public consultation, the investment needs will be reviewed, and the prioritisation adjusted as to reflect customer, stakeholder and regulatory needs. As part of our next price review, PR24, we will then look at the phasing and integration of these investments against our long term plan and core (no regrets) pathway.

The Investment Needs for each planning objective are listed in the Investment Plans on our website.

The advantage of optimising the investment needs across our operating area is that the total breadth of investment needs can be understood and the priorities for investment identified. Our aim in providing this information is to create opportunities to work with partner organisations in water and environmental management. Working in partnership will create alternative delivery models and mechanisms, allow pooling of resources and expertise, and unlock opportunities to deliver wider, multiple benefits.

The prioritised Investment Needs will inform our business planning for AMP8 (2025 – 2030) and the associated Southern Water Long Term Delivery Strategy (LTDS). The LTDS will establish the base investment needed to maintain our core pathway, and various adaptive pathways to reduce risks balancing the risk appetite of our customers, or the rate of risk reduction they expect, and the affordability. The triggers and monitoring that will be needed to identify when to adopt a different pathway will be set out in our LTDS. These adaptive pathway triggers will be established as core business metrics and will be routinely monitored to ensure our current pathway produces a resilient wastewater service that represents best value for our customers.

Total Investment Needs

We have used the information and costs from the Investment Needs for the 61 wastewater systems considered in our DWMP to extrapolate the Investment Needs across all 381 of our wastewater systems. This extrapolation process is covered in detail in the Programme Appraisal technical summary. It used the BRAVA results and the average cost to reduce a risk band for each planning objective. Not all the planning objectives had a 2050 risk assessment, so we know that the figures below are an under-estimate of the future investment that will be needed. The figures will be refined and improve as the DWMP planning process matures and more information becomes available.

The total Investment Needs across our region to 2050 are reported in our DWMP in two elements. These are:

(a) Planning Objectives 1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13 and 14

(b) Planning Objectives 4 and 7 on sewer flooding.

The planning objectives 4 and 7 on sewer flooding are reported separately as there is significant uncertainty in the figures. This is due to the national approach to modelling for PO4, which

specifies a simplistic method for predicting the number of properties at risk from sewer flooding. The modelling method is considered to over-predict the number of properties at risk, and hence the level of investment identified in our DWMP to protect these properties from flooding is an over-estimate. But it is important to include the Investment Needs for sewer flooding in our DWMP. The risk of sewer flooding could double by 2050 so we need to continue to invest in protecting customer's homes and businesses, whilst improving our hydraulic models to reduce the levels of uncertainty.

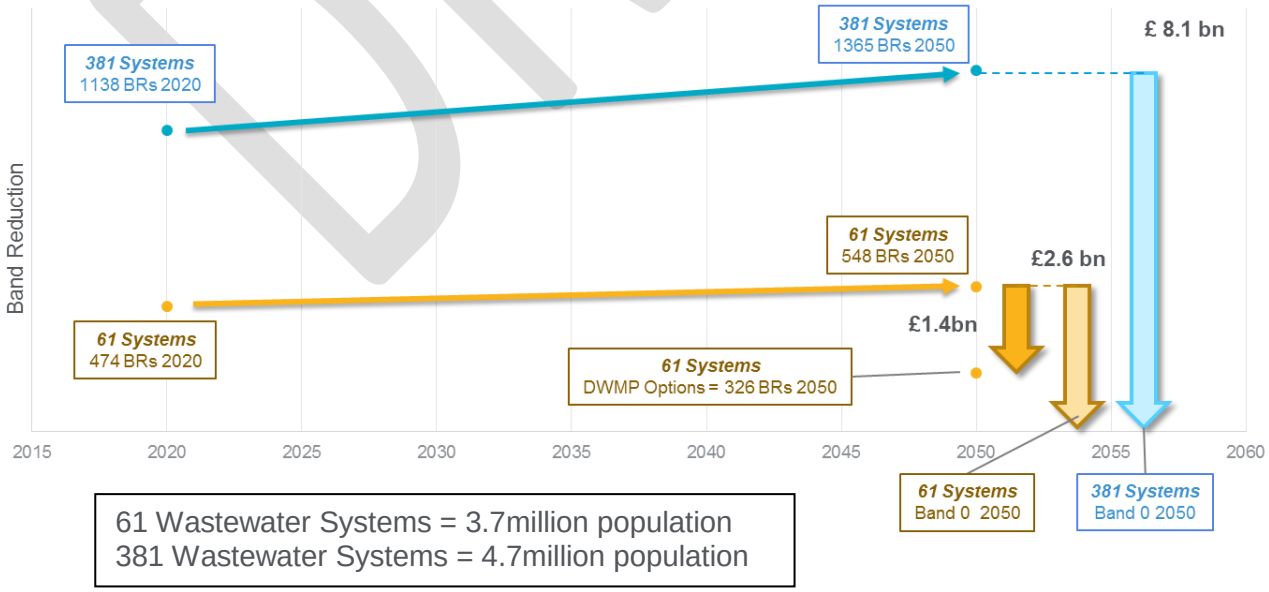
The total Investment Needs are shown in Figure 18. Our DWMP indicates that in order to reduce the risks for all 14 planning objectives across 381 wastewater systems to Band 0 by 2050, a total investment in the order of £20 billion will be needed. With the above uncertainties, our best estimate is that the total investment needed between now and 2050 is within the range of £8 billion to £20 billion.

Figure 18: Total investment needs identified in our first DWMP

Investment Needs for next 25 years to 2050	Planning Objectives (except 4 & 7)	Planning Objectives 4 and 7 only	Total All Planning Objectives
Options for 61 Wastewater Systems	£1.4 billion	£0.8 billion	£2.2 billion
61 Wastewater Systems to Band 0	£2.6 billion	£8.0 billion	£10.6 billion
381 Wastewater Systems to Band 0	£8.1 billion	£11.5 billion	£19.6 billion

Figure 19 illustrates how the costs for options in the 61 wastewater systems were extrapolated to identify the total investment need to reduce the risks to Band 0 for all 381 wastewater systems. A similar process was used for PO4 and PO7.

Figure 19: Total Investment Needs to Reduce Risks to Band 0



61 Wastewater Systems = 3.7million population
381 Wastewater Systems = 4.7million population

The scale of the investment need to achieve band 0 is significant. Using a rough estimation based on our number of customers, we can provide an indication of the impact of this investment on customer bills. If we assume that the £8.1 billion is additional investment above our core investment pathway of maintaining current systems, then this scale of investment could mean an increase of customer bills in the order of £160 per annum for the next 25 years. This rises to £392 per annum if customers expect no sewer flooding to occur in a 1 in 50 year storm. We therefore need to understand our customers, partner organisations and government's expectations for the levels of acceptable risk, and hence the threshold for Band 0 in our future risk assessments.

The prioritised list of investment needs for each river basin catchment and for the region as a whole are available under the appropriate section on our website. We have also prioritised the investment needs for each planning objective. These are contained within the Investment Plans on our website. The total of the investment needs for each planning objective are shown in Figure 20.

Figure 20: Total Investment Need to achieve band 0 for each planning objective

No.	Planning Objective Description	Total Projected Cost (£)
PO1	Internal Flooding	£82,000,000
PO2	Pollution Risk	£439,000,000
PO3	Sewer Collapse	£159,000,000
PO4	1 in 50 year Storm	£10,844,000,000
PO5	Storm Overflows	£701,000,000
PO6	WTW Compliance	£3,523,000,000
PO7	Hydraulic Overload	£10,102,000,000
PO8	DWF Compliance	£307,000,000
PO9	Good Ecological Status / Potential	£1,436,000,000
PO10	Surface Water Management	n/a
PO11	Nutrient Neutrality	£663,000,000
PO12	Groundwater Pollution	£525,000,000
PO13	Bathing Waters	£135,000,000
PO14	Shellfish Waters	£158,000,000

The total costs in this table sum to more than the totals in figure 18 as several of the options identified are beneficial to more than one planning objective. For example, investing to reduce discharges from storm overflows could also reduce flooding and risks to Good Ecological Status, Bathing Water and Shellfish Waters – so, where this is the case, these options would be listed under those planning objectives too.

Investing to Reduce Discharges from Storm Overflows

We will make the case for significant investment in storm overflows in our Business Plan for 2025 – 2030 for submission to Ofwat as part of the 2024 Price Review. This will be supported by the evidence provided by the DWMP and our Storm Overflows Task Force, especially that gained from the Pathfinder projects currently in progress.

The options for reducing the risks from storm overflows in our DWMP can be categorised into three types:

(a) Calculated Storage Volume (37 options) – an estimated storage volume was calculated from our hydraulic models, and a construction cost calculated. The average cost per storm overflow was £2.1 million.

(b) Drainage Area Plan (DAP) Options (19 options) – the DAP options were used where available. Most of our DAPs were updated between 2016 and 2019 and are targeted to address historical flood locations. DAP options occasionally included storage solutions to address any detriment to the performance of storm overflows that are associated with planned growth within catchment. The average cost for these storm overflows was £1.7M.

(c) Storage and Surface Water Separation (124 options) – in the absence of a hydraulic model or DAP, we adopted an average cost of £1 million per storm overflow.

Our DWMP options are based on achieving a risk level of Band 0 in line with the national DWMP guidance. This means we consider the investment needed to limit discharges to inland waters to no more than 20 per year, for bathing water to less than 10 per bathing water season and for shellfish waters to less than 10 per annum. Some of our options, particularly those brought in from previous plans, are traditional constructed storage solutions within the network. We therefore have an indication of the cost to tackle the problem, although our preferred approach would be to utilise that scale of funding to deliver the outcome through alternative, more sustainable approaches, for example, by reducing the amount of rainwater entering the foul sewer system at source.

There is significant uncertainty on the average cost for tackling storm overflows. The estimates in our DWMP to get to Band 0 range from £1 million to £2.1 million. The total estimated cost to achieve this is across all our wastewater systems is approximately £700 million over the next 25 years.

Band 0 threshold for inland waters is less than 20 discharges in a year, so additional rainwater storage or separation will be required to reduce the number of discharges to meet the Defra scenarios. Reducing the number of discharges per annum even further, to 10 or less, will cost more. Our Task Force estimates the cost could be approximately £3.4 million per storm overflow.

We have used this cost estimate to explore the potential scale of investment needed to deliver the three Defra scenarios being considered to reduce the discharges from storm overflows (as described earlier) in our area. Our cost estimates are as follows:

- **Protecting the environment -** No local adverse ecological impact (inland rivers):

  Target for 2035: 93 storm overflows @ £3.4 million each = £316 million

  Target for 2045: 31 storm overflows @ £3.4 million each = £ 105 million

  Target for 2050: 287 storm overflows @ £3.4 million each = £976 million

  Total cost over 25 years = £1,397 million

  Potential additional cost to customers = £28 per annum per household.

- **Protecting public health in our 84 designated coastal bathing waters**:

  80 storm overflows @ £3.4 million = £272 million

  Potential additional cost to customers = £6 per annum per household.

- **Ensuring storm overflows operate only in unusually heavy rainfall events** – which means they must not discharge above an average of 10 rainfall events per year by 2050.

  Number of CSOs discharging at 10 or more per annum = 491

  Total cost to reduce the average to 10 or less by 2050 = £1,700 million.

  Potential additional cost to customers = £34 per annum per household.

An independent report from the Storm Overflows Evidence Project published by Defra in November 2021 suggested that the cost of reducing the number of discharges from storm overflows could be much higher. The findings were (Defra, 2021):

- A policy limit of 40 spills on average per year, reduced to 10 spills for sensitive catchments would cost between £18 billion and £110 billion. The impact on annual household bills could be between £30 and £208 per year
- A policy focused on achieving 10 spills per year on average in sensitive rivers (such as chalk streams) would cost between £16bn and £82bn. The impact on annual household bills could be between £26 and £150 respectively
- A policy focused on achieving 10 spills per year on average in rivers where storm overflows are observed to be the reason for not achieving good ecological status would cost between £13bn and £59bn. The impact on annual household bills could be between £22 and £108 respectively
- A policy focused on improving rivers known to be used for bathing to achieve an average spill frequency of five per year would cost between £8bn and £26bn. The impact on annual household bills could be between £13 and £48 respectively.

These costs were based on an analysis of 15,000 storm overflows in England. The difference between our indicative costs and the costs within this report shows the current level of uncertainty of how much such a significant change to existing wastewater systems would cost. We have commissioned an analysis specifically for our region to improve our understanding of the investment needed. This is due to report in summer 2022. We are continuing to develop and refine the costs based on data and analysis, and so the figures provided above will change later in 2022. We will update the forecast costs of reducing storm overflows once the Defra policy is announced in September 2022 for inclusion within our final DWMP.

We are keen to tackle storm overflows and play our part in enhancing the water quality in rivers and the sea. But we recognise our customers concerns about the affordability of water bills so we will work with the Government and our regulators to implement any new policy of storm overflows in the most sustainable and cost effective way.

Our DWMP maps out a different approach for tackling and reducing the risks of sewer flooding and storm overflows. In the short-term we accept that traditional end of pipe solutions will still feature, but there is a need to transition towards lower cost, lower carbon, more sustainable solutions. We need a long-term programme of climate adaptation that works with communities to provide sustainable drainage systems. Our calculations indicate that between 15% and 80% of rainwater will need to be removed to reduce sewer flooding to a non-significant Band 0 level by 2050. We know that this will not be easy.

Next Steps

Our DWMP is a risk based, evidence led plan that has involved external stakeholders and partner organisations from the outset. Our engagement with others has enabled us to understand wider drainage risks and environmental issues as well as where there is the potential for collaborations, co-creation and co-delivery of future, long-term sustainable solutions.

We are undertaking a Strategic Environmental Assessment (SEA) as we develop our DWMP to ensure we appropriately take into account the environment at all stages of our plan making. We also have a Habitats Regulation Assessment and Water Framework Assessment in progress. We consulted on our SEA Scoping Report in September and October 2021. Our draft DWMP is accompanied by a draft SEA Environmental Report, an indicative Habitats Regulation Assessment and a draft Water Framework Directive Assessment. We are seeking views and feedback on all these assessments as part of our public consultation in Summer 2022.

Our DWMP forms an important part of the wastewater services element of our business plan submission for the Ofwat 2024 Periodic Review (known as PR24) to set prices and investment levels for the five-year period between 2025 and 2030. The investment needs identified in the DWMP, and the prioritisation of these needs, will feed directly into the AMP8 business plan. However, the DWMP investment needs are only the first stage of the process and the identified costs are indicative based on the information available at this stage in the planning process. The costs may not transpose directly into PR24 and some will need to be taken forward into future funding cycles as part of a longer-term strategic programme of works.

The business planning process will progress the DWMP options to make the case to Ofwat and the EA to secure the funding for delivery.

Our first DWMP has enabled us to create a strong foundation for the future. We have captured our lessons to be learned from the first cycle and we look forward to working with Ofwat, Defra, EA, Water UK and other water companies on the national DWMP Implementation Group to review and enhance the guidance for future DWMPs.

We are embedding our DWMP planning processes into our business, so it becomes the way we plan for the future. We have already started to test new ways of delivering against the challenges that our plan sets out with our Pathfinder projects. Our risk assessments will be formally integrated into our risk management, catchment risk management assessments and business planning processes and systems. By doing so, the DWMP will enhance our data, GIS capabilities and systems so that it is improved for future reporting requirements. As a result, we will see our DWMP mature and improve quickly into the next cycle of development and reporting.

There are two aspects that we recognise need improvement:

(i) Risk Assessments: We would like to further develop the risks assessments for the next cycle of DWMP to build a better picture of the future risks. They need to consider both the probability and consequences of the impacts and risks, and enable future risk forecasting for various periods up to 25 years ahead. We see this a fundamental to the development of an improved and adaptive plan for future investment and decision making.

(ii) Resilience Assessment: The approach to the Resilience Assessment set out in the national guidance was basic and only covered four areas. We will link our future DWMP Resilience Assessment to our wider corporate approach, so a full range of hazards and threats are considered during the development of future DWMPs. This will include our ongoing work on considering the impacts of sea level rise and the vulnerability of our assets along the coast.

In doing so, we will assess the operational resilience of our infrastructure systems against a wider range of hazards and threats and take steps to improve resilience. The process means we also look at how the risks will change in the future under different scenarios. We will also consider how our systems are reliant upon other infrastructure systems (e.g. power supply, communications, transport), so that we can put in place options and actions to ensure resilient 'system of systems' into the future. This work will contribute towards the annual assessment of our resilience in the round consisting of operational, corporate and financial resilience.

We will continue to develop our DWMP, working with our partners, and update the baseline risk and vulnerability assessment to monitor changes in risk to reflect our investment outcomes and the external pressures on our systems.

Our DWMP and our Water Resources Management Plan (WRMP) together form the foundation stones of robust long-term planning for both water supply and drainage and wastewater. Our continued co-ordination between these plans will move us closer towards our goal of integrated water cycle management at a river basin scale.

Southern Water
9 June 2022
Version 1.10

Drainage and Wastewater Management Plan (DWMP)

Investment Plan for Sewer Flooding

Planning Objectives 1, 4, 7 and 10

DRAFT FOR CONSULTATION

June 2022

Introduction

This Investment Plan sets out the investment needs to reduce the risks from sewer flooding.

Our DWMP is a risk-based plan. It uses data and evidence to assess the risk of sewer flooding in 2020 (the base year) and, where possible, for future risks up to 2050. The future risk assessment takes into account the impacts of future development and growth, climate change, urban creep - which is the building of extensions and the paving over of gardens/driveways, and asset deterioration.

The options set out in this plan are the investment needs to reduce the risks from sewer flooding to Band 0 (not significant level of risk). The methodology for the risk assessments and the thresholds for the three risk bands are here: [https://www.southernwater.co.uk/dwmp/baseline-risk-and-vulnerability-assessment]. The thresholds between the risk bands may need to be reviewed and changed for future cycles of the DWMP to reflect customer feedback as well as changes in national guidance or legislation.

The options and investment needs are not committed funding but an identification of the needs for funding. We will include these options in our future business plans as part of the Ofwat periodic review of water company funding to secure the investment needed to implement these options. The question of affordability of these investment needs will be discussed with our customers as part of the business planning process.

Sewer Flooding

The risk of flooding from sewers has been considered within our DWMP under four planning objectives. These are:

PO1: Internal Sewer Flooding

PO4: Risk of Sewer Flooding in a 1 in 50 year storm

PO7: Annualised Flood Risk (Hydraulic Overload)

PO10: Surface water management.

PO1 on Internal Flooding uses a risk assessment based on the historic records of the number of incidents within a 3 year period (2017 to 2019). It is the main driver for future investment in protecting properties from sewer flooding as it is based on actual records of flooded properties.

The other three planning objectives for flooding use hydraulic modelling and asset data to predict sewer flooding. They enable a forward look to assess how the sewer flooding risks will change in the future under different climate scenarios, changes in urban development and asset deterioration, as well as the reductions in risk through our investment decisions.

Investment Needs

The Investment Needs for sewer flooding have been developed following an option development and appraisal process that is described in a technical summary on Options Development and Appraisal on our website: https://www.southernwater.co.uk/dwmp/technical-summaries.

Internal Flooding (Planning Objective 1)

The Investment Needs to reduce internal flooding of homes and businesses are shown in Annex A.

A review of flooding incidents between 2017 and 2019 shows that the majority of internal flooding is attributed sewer blockages or failures of assets within our systems. Our options development has shown that Band 0 status can be achieved by targeting and addressing these issues. The solutions to reduce the risks associated with PO1 include:

- Customer Education Programme – an allocation of £115,000 has been provided to develop a specific and targeted customer education programme within each catchment. The programme will adopt specific targeted customer education measures in areas affected by frequent flooding due to blockages. Funding is needed in the short term as blockages need to be addressed within the initial AMP8 cycle (2025 – 2030), although the cost may be needed to be invested over a longer period to sustain the required level of performance.

- Sewer Jetting – an allowance has been provided to include or increase the frequency of sewer cleaning activities for catchments with a high proportion of flood incidents attributed to sewers blockages. The estimated length for a programme of sewer jetting is based on 1km per historical flooding incident that has been attributed to blockages. The proposed investment for sewer jetting is over and above existing Maintenance Schedule Tasks (MST) and will be apportioned equally within the five cycles of the 25 year DWMP investment plan.

- Improvements to critical wastewater pumping stations (WPSs) and wastewater treatment works (WTWs). Analysis of our historical flood records have shown that a proportion of internal flooding incidents are due to a failure of these critical ancillary structures. A need for capital investment of £235,000 has been provided to improve WPS resilience and a further £6,970,000 for addressing WTW needs that are causing flooding within each affected network following internal discussions with our catchment site operations teams.

The Investment Needs identified are based on our records of incidents in the three year period of 2017 to 2019 to determine the risk band. Implementation of the options will need to be refined through a review of longer term historical flood records, existing maintenance activities and schedules, followed with further liaison with operational staff.

The majority of options identified within the investment plan associated with PO1 are attributed to the short term to align with our aspirations to rapidly reduce the number of internal flooding incidents per annum.

The Investment Needs have been prioritised by:

- The cost per incident avoided (reduction in incidents delivered by the option)
- Risk Band Post Solution.

Risk of Flooding in a Storm (Planning Objectives 4 and 7)

The options identified to reduce the risk of flooding in a storm event consist of:

- Drainage Area Plan (DAP) options – generally these were derived between 2015 and 2020.
    - DAP options not including growth scenarios (285 options): The non-growth DAP options were specifically developed to address storage issues that would address historical flooding in properties and flood locations. The investment plan includes nine DAP options where surface water separation solutions were identified.
    - DAP options incorporating growth scenarios (207 options): The DAP growth options were developed to increase the capacity of the sewer network to accommodate planned growth and new development.
- Calculated Storage Volume (121 options). These have been calculated to estimate how much storage is needed in the sewer system to prevent flooding. The volumes can alternatively be used as an indication of how much rain water needs to be removed from the sewer system to achieve the same effect.
    - Model simulations were undertaken to estimate flooding locations. This approach has been developed to provide an initial insight to the level of investment required to achieve Band 0 for PO4 and PO7.
    - Predicted flood volumes provided within model simulations for a 1 in 50 year storm (PO4) and annualised flood volume (PO7).
    - Storage volume calculated as a predicted flood volume multiplied by 1.5 to account for upgrading the localised ancillary pipework and infrastructure.

The sizing of the options are based on modelled outputs and may not have been validated against historical events. Further analysis should be undertaken prior to progressing the delivery of options derived using this methodology as our models may over or under predict the extent of the flooding.

Water companies have set their own thresholds for the risk bands so there is significant variability between companies. PO4 is a measure of resilience to flooding, so we set the threshold for Band 0 in our risk assessment for PO4 at less than 1.85% of properties in the wastewater catchment in areas predicted to flood during a 1 in 50 year storm. This means that in our largest wastewater system, Budds Farm, Band 0 (not significant) level of risk would be less than 7,000 properties at risk from flooding in a 1 in 50 year storm.

These options have been prioritised for PO4 and PO7 based on the:

- number of properties at risk
- risk band after the solutions for the 2020 baseline have been implemented
- risk band predicted once the 2050 long term solutions have been implemented.

The Investment Needs to reduce the risk of flooding in a storm are shown in Annex B. These options reduce flooding for both PO4 and PO7 and therefore are only listed once under PO7.

Surface Water Management (Planning Objective 10)

The options for surface water management are limited to improving our hydraulic models so they consider both sewer performance and surface water flooding. Improving the management of surface water flooding requires several organisations to work together to identify the mechanisms causing localised flooding. In discussions with partner organisations during the development of our DWMP, it was clear that our existing models need to be developed further to model both sewer flooding and surface water flooding.

These investment needs are prioritised on the highest risk locations where surface water separation would have the greatest impact on reducing the risk of sewer flooding and other risks across all planning objectives.

Additional costs have been attributed for updating all catchments which are Band 1 or 2 for PO10 to improve the representation of surface water system which influences surface water flood locations.

Further, we also need to share data and information across all organisations with responsibilities for, and interests in, reducing surface water flooding. We commit to this as part of our DWMP.

The Investment Needs to reduce the risk of surface water flooding (PO10) are shown in Annex C.

Southern Water
June 2022

DWMP Investment Plan for Sewer Flooding

Annex A : Internal Flooding (Planning Objective 1)

1. The options listed in the DWMP Investment Needs below are the preferred options in our DWMP. They will need further refinement as we implement the DWMP to confirm the exact location and scope of action needed, and the cost.

2. The costs are indicative costs for planning purposes only. The basis for the cost estimates, including assumptions and uncertainties, are explained in our DWMP Investment Plans.

3. The table of Investment Need provides an indicative cost so we know what level of funding is needed to reduce the risks. It is not a commitment to fund or deliver any option.

4. The Indicative Timescale is when the investment is needed. Short term means before 2030 (AMP8), medium term between 2030 and 2040 (AMP9 &10), and long term between 2040 and 2050 (AMP 11 & 12). Some options may take several investment periods to achieve the desired outcomes.

5. Potential Partners have been identified in the table of Investment Needs. This is to indicate where there may be opportunities for us to work with these partners when developing and delivering these options. It is not a commitment by any of the partners to work with us.

6. These options will inform our future business plans as part of the Ofwat periodic review process to secure the finance to implement these options.

7. The options listed are prioritised by the method stated in the Programme Appraisal Technical Summary.

Date : May 2022

Version : 1.0

Prioritised Investment Needs Summary Table Identified for Internal Flooding (PO1)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
BUDD.SC03.1	East Hampshire	Budds Farm Havant	1	Hotspot 1 - Baffins Hotspot 2 - Denmead Hotspot 3 - Fratton	Enhanced Customer Education Programme to prevent blockages	£115K	Short to Medium	22	£5K
WEHB.SC03.1	Stour	Margate And Broadstairs	2	Old Town and Margate Beach	Target customers with a campaign to reduce FOG (fats, oils & greases) and unflushables discharged into the sewer network.	£115K	Short to long	19	£6K
WEHB.PW01.1	Stour	Margate And Broadstairs	2	Old Town and Margate Beach	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£880K	Short to long	19	£46K
BRIG.SC03.1	Adur and Ouse	Peacehaven Brighton	1	The Lanes North Laine Church Road	Enhanced maintenance: Customer education	£115K	Short	18	£6K
BRIG.PW01.5	Adur and Ouse	Peacehaven Brighton	1	The Lanes North Laine Church Road	Enhanced maintenance: Proactive jetting	£810K	Short	18	£46K
MOTN.SC03.1	Medway	Motney Hill	1	High Street & A2 Rochester; Best Street & High Street Chatham; Jeffery Street, Canterbury Street & Barnsole Road Gillingham	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	17	£7K
MOTN.PW01.15	Medway	Motney Hill	1	Canterbury Street, Balmoral Road, King Street, High Street GILLINGHAM; High Street CHATHAM; A2 / High Street ROCHESTER; Luton Road LUTON	Enhanced sewer jetting programme to reduce blockages from FOG and unflushables in the sewer network.	£775K	Short to long	17	£46K
SAND.SC03.1	Isle of Wight	Sandown	1	Catchment wide	Enhanced customer education plan to reduce blockages within the catchment. We will be linking in with 'FOG' team.	£115K	Short	12	£9K
CANT.SC03.1	Stour	Canterbury	2	Ethelbert Road, St. Margarets Street, Downs Road, North Lane, Sun Street, Castle Street, St. Peters Street, Reed Avenue, Wincheap, Palace Street, Cockering Road, Cherry Garden Road, Tyler Hill Road, Mill Road, Orchard Street, Northgate, Dover Street, St. Georges Street, Park Farm Close, Knight Avenue, St. Dunstans Street, Penshurst Close	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short	12	£10K

Prioritised Investment Needs Summary Table Identified for Internal Flooding (PO1)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
CANT.PW01.9	Stour	Canterbury	2	Ethelbert Road, St. Margarets Street, Downs Road, North Lane, Sun Street, Castle Street, St. Peters Street, Reed Avenue, Wincheap, Palace Street, Cockering Road, Cherry Garden Road, Tyler Hill Road, Mill Road, Orchard Street, Northgate, Dover Street, St. Georges Street, Park Farm Close, Knight Avenue, St. Dunstans Street, Penshurst Close	Enhanced maintenance: proactive jetting	£525K	Short	12	£46K
WEAT.SC03.1	Stour	Weatherlees Hill	2	St. Andrews Road, Cattle Market, High Street, York Street, Harbour Parade, Queen Street, Broad Street, Sandown Lees, The Old Vicarage, The Street, Hereson Road, Denmark Road, Albion Road, Pysons Road, The Strand, Victoria Road, Campbell Road, Beach Street, Channel Lea, Richmond Road, The Fairway, West Cliff Road	Target customers with a campaign to reduce FOG (fats, oils & greases) and unflushables discharged into the sewer network.	£115K	Short to long	11	£10K
WEAT.PW01.9	Stour	Weatherlees Hill	2	St. Andrews Road, Cattle Market, High Street, York Street, Harbour Parade, Queen Street, Broad Street, Sandown Lees, The Old Vicarage, The Street, Hereson Road, Denmark Road, Albion Road, Pysons Road, The Strand, Victoria Road, Campbell Road, Beach Street, Channel Lea, Richmond Road, The Fairway, West Cliff Road	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£515K	Short to long	11	£46K
HABX.SC03.1	Cuckmere and Pevensey	Bexhill And Hastings	1	Warrior Square, St Leonards Marina, Old Town	Enhanced maintenance: Customer Education	£115K	Short	11	£10K
HABX.PW01.9	Cuckmere and Pevensey	Bexhill And Hastings	1	Warrior Square, St Leonards Marina, Old Town	Enhanced maintenance: Proactive Jetting	£505K	Short	11	£46K
PEEL.SC03.6	East Hampshire	Peel Common	1	Catchment Wide	Targeted Customer Education Programme to prevent blockages	£115K	Short	10	£12K
PEEL.PW01.16	East Hampshire	Peel Common	1	Catchment Wide	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capcity of the network for rainfall	£445K	Short	10	£45K
WOEA.SC03.1	Adur and Ouse	East Worthing	1	Catchment wide	Enhanced maintenance: Customer education	£115K	Short	9	£14K

Prioritised Investment Needs Summary Table Identified for Internal Flooding (PO1)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
BROM.SC03.1	Stour	Broomfield Bank	1	St. James Lane, The Bayle, Castle Street, London Street, Bench Street, Norman Street, Sandgate Road, Oswald Road, Snargate Street, Cheriton High Street, Vale View Road, London Road, Wallace Mews, Ross Way, Cannon Street, Godwyne Road, Guildhall Street, Tontine Street, Canterbury Road, Sandgate High Street, Biggin Street, Clifton Crescent, Valley Road	Target customers with a campaign to reduce FOG (fats, oils & greases) and unflushables discharged into the sewer network.	£115K	Short to long	9	£14K
BROM.PW01.7	Stour	Broomfield Bank	1	St. James Lane, The Bayle, Castle Street, London Street, Bench Street, Norman Street, Sandgate Road, Oswald Road, Snargate Street, Cheriton High Street, Vale View Road, London Road, Wallace Mews, Ross Way, Cannon Street, Godwyne Road, Guildhall Street, Tontine Street, Canterbury Road, Sandgate High Street, Biggin Street, Clifton Crescent, Valley Road	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£390K	Short to long	9	£46K
MILL.SC03.1	Test and Itchen	Millbrook	1	Freemantle	Enhanced Customer Education Programme to prevent blockages	£115K	Short to Medium	8	£14K
MILL.PW01.12	Test and Itchen	Millbrook	1	Mount Pleasant Road, The Dell, Northbrook Road, Bevois Valley Road, Oxford Street, South Western House, Blakeney Road, Tremona Road, Briton Street, Buttermere Close, Bernard Street, St. Marys Road, Lingwood Close, Palmerston Road, Waterloo Road, Cliff Road, Northam Road, Northumberland Road, The Avenue, Park Road, Shirley High Street, St. Mary Street, Clausentum Road, Seafield Road, Firgrove Road, Graham Road	Enhanced maintenance: Proactive Jetting	£375K	Short	8	£45K
EALP.SC03.1	Cuckmere and Pevensey	Eastbourne	1	Roselands, Langney, Westham	Enhanced maintenance: Customer Education	£115K	Short	7	£18K
EALP.PW01.7	Cuckmere and Pevensey	Eastbourne	1	Roselands, Langney, Westham	Enhanced maintenance: Proactive Jetting	£295K	Short	7	£45K

Prioritised Investment Needs Summary Table Identified for Internal Flooding (PO1)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
FORW.SC03.1	Arun and Western Streams	Ford	1	South Terrace, Sea Road, Queensway, Willow Brook, Hewarts Lane, Sea Lane, High Street, Lizard Head, Clun Road, Horsham Road, Tarrant Street, Chichester Road, Northway Road, Newtown Avenue, The Street, Pryors Green, London Road, South Strand	Enhanced maintenance: Customer Education	£115K	Short	6	£20K
FORW.PW01.4	Arun and Western Streams	Ford	1	South Terrace, Sea Road, Queensway, Willow Brook, Hewarts Lane, Sea Lane, High Street, Lizard Head, Clun Road, Horsham Road, Tarrant Street, Chichester Road, Northway Road, Newtown Avenue, The Street, Pryors Green, London Road, South Strand	Enhanced maintenance: Proactive Jetting	£265K	Short	6	£46K
POOD.SC03.4	Test and Itchen	Portswood	1	Need to identify Hotspots	Enhanced Customer Education Programme to prevent blockages	£115K	Short to Medium	5	£22K
POOD.PW01.18	Test and Itchen	Portswood	1	Need to identify Hotspots	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall.	£240K	Short	5	£45K
HABX.PW01.1	Cuckmere and Pevensey	Bexhill And Hastings	1	Coombs Hastings WPS, Galley Hill Bexhill WPS	Improve resilience of Coombs Hastings WPS and Galley Hill Bexhill WPS to reduce risk of flooding	£465K	Short	5	£93K
GRAV.PW01.2	Medway	Gravesend	1	Darney Road WPS, High Street WPS, Mark Lane WPS	Enhanced maintenance: proactive jetting	£235K	Short	5	£47K
CRRM.PW01.2	Medway	Redgate Mill Crowborough	2	The Farthings - Millbrook Road	Drainage Area Plan (DAP) Option: Pipe upsize of 450mm sewer; New manholes on new sewer	£355K	Short	5	£76K
QUEE.SC03.1	North Kent	Queenborough	1	Sheerness area	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	4	£27K
QUEE.SC03.2	North Kent	Queenborough	1	Sheerness area	Enhanced maintenance: proactive jetting	£195K	Short	4	£45K
CHIC.SC03.1	Arun and Western Streams	Chichester	2	St. Pancras, Winden Avenue, St. Martins Square, Southgate, North Street, Northgate, Cooper Street, Stockbridge Road, Peacock Close, St. James Road	Enhanced maintenance: Customer Education	£115K	Short	4	£29K
CHIC.PW01.6	Arun and Western Streams	Chichester	2	St. Pancras, Winden Avenue, St. Martins Square, Southgate, North Street, Northgate, Cooper Street, Stockbridge Road, Peacock Close, St. James Road	Enhanced maintenance: Proactive Jetting	£185K	Short	4	£46K

Prioritised Investment Needs Summary Table Identified for Internal Flooding (PO1)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
CANT.PW01.2	Stour	Canterbury	2	South Canterbury Road, Tyler Hill Road, and School Lane	Provide offline storage (volume TBC by modelling) or separate rainfall runoff at source to reduce internal flooding events	£1,000K	Short to Medium	4	£250K
EALP.PW01.1	Cuckmere and Pevensey	Eastbourne	1	Archery Eastbourne WPS	Improve resilience of Archery WPS in Eastbourne to reduce flooding	£235K	Short	4	£59K
HERN.SC03.1	Stour	May Street Herne Bay	1	Clarendon Street, William Street, Mortimer Street, Central Parade, High Street, Bank Street, St. Georges Avenue, Hogarth Close	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewer network	£115K	Short	4	£29K
CHEA.SC03.1	Test and Itchen	Chickenhall Eastleigh	1	Hotspot 1 - Hiltingbury / Chandler's Ford	Enhanced Customer Education Programme to prevent blockages	£115K	Short to Medium	4	£29K
SITT.SC03.1	North Kent	Sittingbourne	1	London Road, High Street, East Street, Staplehurst Road, Station Street	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	3	£38K
SITT.SC03.3	North Kent	Sittingbourne	1	London Road, High Street, East Street, Staplehurst Road, Station Street	Enhanced maintenance: proactive jetting	£135K	Short	3	£45K
WOOL.SC01.1	Test and Itchen	Woolston	1	Hotspot 1 - Itchen	Enhanced Customer Education Programme to prevent blockages	£115K	Short to Medium	3	£38K
WOOL.PW01.15	Test and Itchen	Woolston	1	Hotspot 1 - Itchen	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall, specifically by jetting known gravel issues in these sewers.	£135K	Short	3	£45K
RYEW.SC03.1	Rother	Rye	2	Catchment wide	Enhanced maintenance: Customer education	£115K	Short	3	£46K
RYEW.PW01.5	Rother	Rye	2	Catchment wide	Enhanced maintenance: Proactive jetting	£115K	Short	3	£46K
GRAV.SC03.1	Medway	Gravesend	1	Marling Way, Ifield Way, Cross Lane East, Medhurst Crescent, Vigilant Way, St. Francis Avenue, Old Road East, Prospect Place	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	3	£46K
SLOW.SC03.1	New Forest	Slowhill Copse Marchwood	1	Central Totton (Commercial Road, Osborne Road, Rumbridge Street) West Totton (Ethelred Gardens, Alfred Close, Calmore Road) Ashurst (Princess Road)	Enhanced Customer Education Programme to prevent blockages	£115K	Short	3	£46K

Prioritised Investment Needs Summary Table Identified for Internal Flooding (PO1)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
SLOW.PW01.6	New Forest	Slowhill Copse Marchwood	1	Central Totton (Commercial Road, Osborne Road, Rumbridge Street) West Totton (Ethelred Gardens, Alfred Close, Calmore Road) Ashurst (Princess Road)	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall	£115K	Short	3	£46K
MORE.SC03.1	Test and Itchen	Morestead Road Winchester	1	South Winchester (St. Cross Road)	Enhanced Customer Education Programme to prevent blockages	£115K	Short	2	£50K
MORE.PW01.3	Test and Itchen	Morestead Road Winchester	1	South Winchester (St. Cross Road)	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall.	£105K	Short	2	£46K
THOR.PW01.1	Arun and Western Streams	Thornham	2	Emsworth	Sewer CCTV surveys, integrity checks and re-lining / enforcement	£255K	Short	2	£128K
CANT.PW01.1	Stour	Canterbury	2	The Stade Folkstone WPS	Improve resilience of The Stade Folkstone WPS to reduce risk of Internal Flooding	£235K	Short to Medium	2	£118K
TUWS.PW02.1	Medway	Tunbridge Wells South	1	Tunbridge Wells South WTW	Enhanced maintenance to improve WTW resilience and reduce risk of flooding	£6,970K	Short	2	£3,485K
ROMS.SC03.1	Test and Itchen	Romsey	1	Central Romsey (Abbey Water, Tadburn Road, Chambers Avenue	Enhanced Customer Education Programme to prevent blockages	£115K	Short	2	£58K
ROMS.PW01.1	Test and Itchen	Romsey	1	Hotspot 1 - Central Romsey (Abbey Water, Tadburn Road, Chambers Avenue	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall.	£90K	Short	2	£45K
CRRM.SC03.1	Medway	Redgate Mill Crowborough	2	Tanners Way, High Street, London Road, Green Lane, Eridge Road, Church Road, Mill Lane, and Pellings Wood	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	2	£64K
THOR.SC03.1	Arun and Western Streams	Thornham	2	Watersedge Gardens, Victoria Road, Main Road, Harbour Way	Enhanced maintenance: Customer Education	£115K	Short	2	£77K
THOR.PW01.3	Arun and Western Streams	Thornham	2	Watersedge Gardens, Victoria Road, Main Road, Harbour Way	Enhanced maintenance: Proactive Jetting	£70K	Short	2	£47K
HABX.PW01.3	Cuckmere and Pevensey	Bexhill And Hastings	1	Warrior Square	Sewer CCTV surveys, integrity checks and re-lining/enforcement	£190K	Short	2	£127K
SWAL.SC03.1	Stour	Swalecliffe	1	High Street, West Cliff Whitstable, Marine Parade, Herne Bay Road, Lucerne Road	Target customers with a campaign to reduce FOG (fats, oils & greases) and unflushables discharged into the sewer network.	£115K	Short to long	2	£77K

Prioritised Investment Needs Summary Table Identified for Internal Flooding (PO1)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
TUWS.SC03.1	Medway	Tunbridge Wells South	1	Cambridge Gardens, Maryland Road, Church Road, High Street, Grosvenor Park	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	1	£88K
FAVE.SC03.1	North Kent	Faversham	2	Cross Lane, Whitstable Road, Church Hill & Forbes Road	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	1	£115K
FAVE.PW01.1	North Kent	Faversham	2	Quay Lane Wastewater Pumping Station (WPS)	Enhanced maintenance to improve WPS resilience and reduce flooding incidents	£235K	Short	1	£235K
FAVE.PW01.3	North Kent	Faversham	2	Cross Lane, Whitstable Road, Church Hill & Forbes Road	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£45K	Short	1	£45K
BAST.PW01.7	Test and Itchen	Barton Stacey	2	St Mary Bourne WPS	Improve resilience: Review operation and maintenance of St Mary Bourne pumping station to improve resilience	£235K	Short	1	£235K
HAIN.PW01.1	Cuckmere and Pevensey	Hailsham North	1	Gournay Road Hailsham WPS	Improve resilience of Gournay Road WPS in Hailsham to reduce risk of pollution	£235K	Short	1	£235K
POOD.PW01.7	Test and Itchen	Portswood	1	Portswood WTW	Improve resilience of Eastbourne WTW to reduce pollution risk	£6,970K	Short	1	£6,970K
BAST.SC03.1	Test and Itchen	Barton Stacey	2	Gangbridge Lane	Enhanced Customer Education Programme to prevent blockages	£115K	Short to Medium	1	£230K
BAST.PW01.5	Test and Itchen	Barton Stacey	2	Gangbridge Lane	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall.	£25K	Short to Medium	1	£50K
HAIN.SC03.1	Cuckmere and Pevensey	Hailsham North	1	Harebeating Crescent	Enhanced maintenance: Customer Education	£115K	Short	1	£230K
HAIN.PW01.7	Cuckmere and Pevensey	Hailsham North	1	Harebeating Crescent	Enhanced maintenance: Proactive Jetting	£25K	Short	1	£50K
TUWN.SC03.1	Medway	Tunbridge Wells North	1	Catchment Wide	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	1	£230K
DAMB.SC03.1	Stour	Dambridge Wingham	1	Catchment wide	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	1	£230K
DAMB.PW01.9	Stour	Dambridge Wingham	1	Larch Road, Hyde Place	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£25K	Short to long	1	£50K
STAP.SC03.1	Medway	Staplehurst	2	Marden Road	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	0	£383K
STAP.PW01.2	Medway	Staplehurst	2	Marden Road	Enhanced maintenance: proactive jetting	£10K	Short	0	£33K

Prioritised Investment Needs Summary Table Identified for Internal Flooding (PO1)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
STAP.OT01.1	Medway	Staplehurst	2	Marden Road	Further investigation to identify the cause of the internal flooding incidents, and possible hydraulic solution to Marden Road flooding	£230K	Short	0	-
CRRM.OT01.7	Medway	Redgate Mill Crowborough	2	Catchment Wide	Model Study: Surveys and verification to improve model confidence and accuracy of simulations	£150K	Short	0	-
FAVE.OT01.1	North Kent	Faversham	2	Preston Street, The Street & St. Johns Road	Study: Investigate the root cause of internal flooding incidents due to unknown reasons and verify the risk using the hydraulic model of the sewer network	£230K	Short	0	-
FAVE.OT01.8	North Kent	Faversham	2	Catchment wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£300K	Short	0	-
WEAT.OT01.8	Stour	Weatherlees Hill	2	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£400K	Short	0	-
WEAT.OT01.10	Stour	Weatherlees Hill	2	Ramsgate	Study and Investigation: Investigate the condition of existing 40,000 m3 storage tanks under Ramsgate town and remobilise to full storage capacity.	£100K	Short	0	-
WEAT.OT01.11	Stour	Weatherlees Hill	2	Deal	Study and Investigation: Investigate the condition of existing storage tanks in town centre and remobilise to full storage capacity.	£100K	Short	0	-
WEHB.OT02.3	Stour	Margate And Broadstairs	2	Catchment Wide	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations	£375K	Short	0	-
BUDD.OT01.1	East Hampshire	Budds Farm Havant	1	Hotspot 1 - Hilsea Hotspot 2 - Denmead Hotspot 3 - Fratton	Study / Investigation: Identify causes of internal flooding incidents (currently unknown)	£230K	Short to Medium	0	-
BUDD.OT01.6	East Hampshire	Budds Farm Havant	1	Catchment Wide	Study / Investigation: Update and re-verify the Budds Farm Havant Hydraulic Model to improve model confidence	£750K	Short to Medium	0	-
TUWN.OT01.1	Medway	Tunbridge Wells North	1	Catchment Wide	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations.	£200K	Short	0	-
TUWN.OT01.2	Medway	Tunbridge Wells North	1	Medway Road, Jackwood Way, St Johns Road, Newcomen Road	Further investigation to define hydraulic issues causing internal flooding	£230K	Short	0	-
TUWS.OT01.4	Medway	Tunbridge Wells South	1	Catchment Wide	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations.	£225K	Short	0	-
MOTN.OT01.6	Medway	Motney Hill	1	London Road, Windsor Road, Church Lane	Study: Investigate the root cause of internal flooding incidents due to unknown reasons and verify the risk using the hydraulic model of the sewer network	£645K	Short	0	-
GRAV.OT01.6	Medway	Gravesend	1	Catchment Wide	Hydraulic Model Improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£250K	Short	0	-

Prioritised Investment Needs Summary Table Identified for Internal Flooding (PO1)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
MOTN.OT01.7	Medway	Motney Hill	1	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£415K	Short	0	-
SLOW.OT01.4	New Forest	Slowhill Copse Marchwood	1	Catchment wide	Study / Investigation: Update and re-verify the Slowhill Copse Marchwood Hydraulic Model to improve model confidence	£225K	Short to Medium	0	-
QUEE.OT01.4	North Kent	Queenborough	1	Catchment wide	Model Study: model improvements, including flow survey to calibrate and verify the model	£150K	Short	0	-
SITT.OT01.6	North Kent	Sittingbourne	1	Catchment wide	Model Study: model improvements including flow surveys to calibrate and verify the model	£190K	Short	0	-
BROM.OT01.3	Stour	Broomfield Bank	1	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£375K	Short	0	-
SWAL.OT01.5	Stour	Swalecliffe	1	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£200K	Short	0	-
DAMB.OT01.5	Stour	Dambridge Wingham	1	Catchment Wide	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations	£200K	Short	0	-
HERN.OT01.6	Stour	May Street Herne Bay	1	Catchment Wide	Hydraulic Model Improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£150K	Short	0	-
ROMS.OT01.3	Test and Itchen	Romsey	1	Catchment Wide	Study / Investigation: Update and re-verify the Romsey Hydraulic Model to improve model confidence	£300K	Short to Medium	0	-

DWMP Investment Plan for Sewer Flooding

Annex B : Risk of Flooding in a Storm (Planning Objective 4 and 7)

1. The options listed in the DWMP Investment Needs below are the preferred options in our DWMP. They will need further refinement as we implement the DWMP to confirm the exact location and scope of action needed, and the cost.

2. The costs are indicative costs for planning purposes only. The basis for the cost estimates, including assumptions and uncertainties, are explained in our DWMP Investment Plans.

3. The table of Investment Need provides an indicative cost so we know what level of funding is needed to reduce the risks. It is not a commitment to fund or deliver any option.

4. The Indicative Timescale is when the investment is needed. Short term means before 2030 (AMP8), medium term between 2030 and 2040 (AMP9 &10), and long term between 2040 and 2050 (AMP 11 & 12). Some options may take several investment periods to achieve the desired outcomes.

5. Potential Partners have been identified in the table of Investment Needs. This is to indicate where there may be opportunities for us to work with these partners when developing and delivering these options. It is not a commitment by any of the partners to work with us.

6. These options will inform our future business plans as part of the Ofwat periodic review process to secure the finance to implement these options.

7. The options listed are prioritised by the method stated in the Programme Appraisal Technical Summary.

Date : May 2022

Version : 1.0

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
GRAV.SC01.1	Medway	Gravesend	2	2	River front	Surface water flooding	£TBC	Long	N/A
GRAV.SC01.2	Medway	Gravesend	2	2	Southern areas	Surface water flooding	£TBC	Long	N/A
QUEE.SC01.1	North Kent	Queenborough	2	2	Coastal areas	Work with local council to mitigate surface water flooding in coastal areas through implementation of SuDS	£TBC	Short	N/A
PAWD.OT01.3	Medway	Paddock Wood	2	2	Catchment wide/ Overflow Locations	Model Study: Hydraulic surveys and verification to improve model confidence and accuracy of network simulations	£190K	Short	N/A
TONB.OT01.2	Medway	Tonbridge	2	2	Catchment wide/ Overflow locations	Hydraulic model to be improved and upgraded	£150K	Short	N/A
STAP.OT01.2	Medway	Staplehurst	2	2	Catchment Wide / Overflow Locations	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations	£275K	Short	N/A
STAP.OT01.3	Medway	Staplehurst	2	2	Areas in the South	Study: Investigate infiltration and exfiltration to identify the causes and highest risk areas	£275K	Short	N/A
FAIR.OT01.2	Rother	Fairlight	2	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£125K	Short	N/A
HAIS.OT01.4	Cuckmere and Pevensey	Hailsham South	2	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£200K	Short	N/A
HAIN.OT01.5	Cuckmere and Pevensey	Hailsham North	2	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£300K	Short	N/A
WHIT.OT01.2	Test and Itchen	Whitchurch	2	2	Catchment Wide	Study / Investigation: Build and verify the Whitchurch Hydraulic Model to improve model confidence	£225K	Short	N/A
BAST.OT01.5	Test and Itchen	Barton Stacey	2	2	Catchment Wide	Study / Investigation: Build and verify the Barton Stacey Hydraulic Model to improve model confidence	£225K	Short	N/A
BAST.OT01.6	Test and Itchen	Barton Stacey	2	2	Catchment Wide	Study / Investigation: Identify locations of private lateral connections across the catchment, to better understand whose maintenance responsibility they are	£TBC	Short	N/A
CANT.OT01.6	Stour	Canterbury	2	2	Catchment Wide / Overflow Locations	Study Model improvements: 3 month flow survey to catch both storm and dry data and calibrate these against the model should be conducted	£265K	Short	N/A
CHAR.OT01.4	Stour	Chartham	2	2	Catchment wide	Model Study: Build a new hydraulic model, including flow surveys to calibrate and verify the model	£325K	Short	N/A

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
WBER.OT01.3	Stour	Westbere	2	2	Catchment wide	Model Study: Build a new hydraulic model, including flow surveys to calibrate and verify the model	£225K	Short	N/A
TUWS.OT01.4	Medway	Tunbridge Wells South	2	2	Catchment Wide	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations.	£225K	Short	N/A
GRAV.OT01.6	Medway	Gravesend	2	2	Catchment Wide	Hydraulic Model Improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£250K	Short	N/A
EALP.OT01.5	Cuckmere and Pevensey	Eastbourne	2	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£300K	Short	N/A
NEWE.OT01.5	Adur and Ouse	Newhaven East	2	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£340K	Short	N/A
WOEA.OT01.8	Adur and Ouse	East Worthing	2	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£450K	Short	N/A
PORT.OT01.3	Adur and Ouse	Shoreham	2	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£350K	Short	N/A
WOOL.OT01.6	Test and Itchen	Woolston	2	2	Catchment Wide	Study / Investigation: Update and re-verify the Woolston Hydraulic Model to improve model confidence	£190K	Short	N/A
WOOL.OT01.8	Test and Itchen	Woolston	2	2	Catchment Wide	Sutdy / Investigation: Sharing of flood data to ensure flooding locations identified by SWS and SCC match	£TBC	Short	N/A
WOOL.OT01.9	Test and Itchen	Woolston	2	2	Catchment Wide	Study / Investigation: Identify locations of misconnections, reducing the unknown sources of flow into the catchments sewer systems.	£TBC	Short	N/A
SWAL.OT01.5	Stour	Swalecliffe	2	2	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£200K	Short	N/A
BUDD.OT01.6	East Hampshire	Budds Farm Havant	2	1	Catchment Wide	Study / Investigation: Update and re-verify the Budds Farm Havant Hydraulic Model to improve model confidence	£750K	Short	N/A
HORS.OT01.1	Medway	Horsmonden	1	2	Catchment wide / Overflow locations	Model Study: Build a new hydraulic model, including flow surveys to calibrate and verify the model	£275K	Short	N/A
RYEW.OT01.5	Rother	Rye	1	2	Catchment wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£125K	Short	N/A

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
HONE.OT01.3	Arun and Western Streams	Horsham New	1	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£250K	Short	N/A
BRIG.OT01.4	Adur and Ouse	Peacehaven Brighton	1	2	Catchment wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£800K	Short	N/A
POOD.OT01.5	Test and Itchen	Portswood	1	2	Catchment Wide	Study / Investigation: Build and verify the Portswood Hydraulic Model to improve model confidence	£265K	Short	N/A
MORE.OT01.4	Test and Itchen	Morestead Road Winchester	1	2	Catchment Wide	Study / Investigation: Update and re-verify the Morestead Road Winchester Hydraulic Model to improve model confidence	£200K	Short	N/A
HERN.OT01.6	Stour	May Street Herne Bay	1	2	Catchment Wide	Hydraulic Model Improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£150K	Short	N/A
MOTN.OT01.5	Medway	Motney Hill	1	2	Luton Road & Capstone Road Luton	Study: Surface Water Flooding investigation in partnership with Medway Council (LLFA) to improve hydraulic model and refine storm water attenuation options	£645K	Short	N/A
MOTN.OT01.7	Medway	Motney Hill	1	2	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£415K	Short	N/A
BOSH.OT01.4	Arun and Western Streams	Bosham	1	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£175K	Short	N/A
LIDS.OT01.5	Arun and Western Streams	Lidsey	1	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration (potential for impermeable area surveys)	£200K	Short	N/A
THOR.OT01.3	Arun and Western Streams	Thornham	1	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£200K	Short	N/A
SIDL.OT01.5	Arun and Western Streams	Sidlesham	1	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£200K	Short	N/A
TANG.OT01.5	Arun and Western Streams	Tangmere	1	1	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£125K	Short	N/A
LAVA.OT01.4	Arun and Western Streams	Lavant	1	1	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£300K	Short	N/A

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
CHIC.OT01.5	Arun and Western Streams	Chichester	1	1	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£400K	Short	N/A
MILL.OT01.5	Test and Itchen	Millbrook	1	1	Catchment Wide	Study / Investigation: Build and verify the Millbrook Hydraulic Model to improve model confidence	£340K	Short	N/A
LYND.OT01.1	New Forest	Lyndhurst	1	1	Catchment Wide	Study / Investigation: Build and verify the Lyndhurst Hydraulic Model to improve model confidence	£325K	Short	N/A
KISO.OT01.2	Test and Itchen	Kings Somborne	1	1	Catchment Wide	Study / Investigation: Build and verify the Kings Somborne Hydraulic Model to improve model confidence	£300K	Short	N/A
CHEA.OT01.5	Test and Itchen	Chickenhall Eastleigh	1	1	Catchment Wide	Study / Investigation: Build and verify the Chickenhall Eastleigh Hydraulic Model to improve model confidence	£300K	Short	N/A
CHEA.OT01.7	Test and Itchen	Chickenhall Eastleigh	1	1	River Itchen	Study / Investigation: Identify suitable location/s for wetland construction along with River Itchen in partnership with the EA (update hydraulic model)	£TBC	Short	N/A
TUWN.OT01.1	Medway	Tunbridge Wells North	1	1	Catchment Wide	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations.	£200K	Short	N/A
DAMB.OT01.5	Stour	Dambridge Wingham	1	1	Catchment Wide	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations	£200K	Short	N/A
CRRM.OT01.7	Medway	Redgate Mill Crowborough	1	1	Catchment Wide	Model Study: Surveys and verification to improve model confidence and accuracy of simulations	£150K	Short	N/A
FAVE.OT01.8	North Kent	Faversham	1	1	Catchment wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£300K	Short	N/A
BUDD.PW01.25	East Hampshire	Budds Farm Havant	2	1	Station Road, Central Road, Drayton Lane, Salisbury Road, Mousehole Road, Newbolt Road, Allaway Avenue, Beverston Road	Flood Storage (11,575m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£8,505K	Long	1127
MOTN.PW01.1	Medway	Motney Hill	1	2	Canadian Road & Gillingham Road Chatham	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£9,445K	Long	787
EALP.PW01.9	Cuckmere and Pevensey	Eastbourne	2	2	Gilbert, Whitney, Firle Rd	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£8,580K	Long	565

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
BUDD.PW01.28	East Hampshire	Budds Farm Havant	2	1	Catherington Lane, London Road, Spring Vale, Portsmouth Road, Dorset Close etc.	Flood Storage (13,193m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£9,785K	Long	433
BUDD.PW01.15	East Hampshire	Budds Farm Havant	2	1	Bernards Estate agents LRD, India Arms and Portsmouth Finance Corporation LTD	Flood Storage (10,367m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£7,790K	Long	342
BUDD.PW01.27	East Hampshire	Budds Farm Havant	2	1	Priorsdean Crescent, Brookside Road, Maylands Road, Purbrook Way, Park Lane, New Road, Hulbert Road etc.	Flood Storage (9,834m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£7,415K	Long	254
WOOL.PW02.9	Test and Itchen	Woolston	2	2	Blacthorn Road, Peartree Avenue, and Merridale Road	Storage Solution	£1,465K	Medium	247
WOOL.PW02.4	Test and Itchen	Woolston	2	2	Canon Place and Napier Road	Storage Solution	£2,365K	Long	220
WOOL.PW02.5	Test and Itchen	Woolston	2	2	Butts Road and South East Road	Storage Solution	£2,155K	Long	180
TUWS.PW01.18	Medway	Tunbridge Wells South	2	2	The Pantiles, Warwick Park, Mt Pleasant Road, Norfolk Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach and will be developed as part of the solution with our partners.	£10,615K	Long	170
BUDD.PW01.16	East Hampshire	Budds Farm Havant	2	1	Twyford Avenue, Gruneisen Road, Penrose Close, Wilson Road, Winstanley Road, Wilson Road, London Road	Flood Storage (2,369m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£2,150K	Medium	161
WOOL.PW02.3	Test and Itchen	Woolston	2	2	Sunningdale Gardens and Somerset Avenue	Storage Solution	£2,215K	Long	155
WOOL.PW02.7	Test and Itchen	Woolston	2	2	Lawrence Grove, Swift Road, Obelisk Road	Storage Solution	£3,010K	Long	148

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
BUDD.PW01.18	East Hampshire	Budds Farm Havant	2	1	Marine Walk, Sea View Road and Elm Grove	Flood Storage (3,539m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£2,975K	Long	137
BRIG.PW01.12	Adur and Ouse	Peacehaven Brighton	1	2	Warmdene Road	DAP Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£8,755K	Long	134
PORT.PW01.12	Adur and Ouse	Shoreham	2	2	Trafalgar Road	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£3,015K	Medium	132
WOEA.PW01.20	Adur and Ouse	East Worthing	2	2	Alinora Crescent	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£4,195K	Medium	121
PORT.PW01.15	Adur and Ouse	Shoreham	2	2	Old Shoreham Road	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£825K	Medium	118
WOOL.PW02.6	Test and Itchen	Woolston	2	2	Squirrel Drive	Storage Solution	£2,780K	Long	105
NEWE.PW01.8	Adur and Ouse	Newhaven East	2	2	Riverside	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£2,455K	Long	104
BOSH.PW01.6	Arun and Western Streams	Bosham	1	2	Bosham Centre	Growth DAP: Drain all flows from the proposed developments to a new pumping station via a new gravity network to reduce risk of flooding.	£710K	Long	102
PORT.PW01.13	Adur and Ouse	Shoreham	2	2	Station Road	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£2,870K	Medium	96
PORT.PW01.11	Adur and Ouse	Shoreham	2	2	Albion Street	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£10,685K	Long	88

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
MOTN.PW01.2	Medway	Motney Hill	1	2	Maidstone Road Rainham	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach	£1,330K	Medium	85
WOOL.PW02.8	Test and Itchen	Woolston	2	2	Swift Road and Swift Gardens	Storage Solution	£820K	Medium	79
SWAL.PW01.15	Stour	Swalecliffe	2	2	Seasalter Lane	Flood Storage (4890m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach and will be developed as part of the solution with our partners.	£3,925K	Long	79
SWAL.PW01.17	Stour	Swalecliffe	2	2	Millstrood Road	Growth Drainage Area Plan (DAP): Construct new sewers and upsize sections of existing ones	£625K	Medium	79
BRIG.PW01.9	Adur and Ouse	Peacehaven Brighton	1	2	South Coast Road	DAP Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£2,280K	Long	78
BUDD.SC01.14	East Hampshire	Budds Farm Havant	2	1	Flat 8, Bayview Court, 85	Surface Water Separation (0.85 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (1493 m3)	£3,200K	Long	73
BUDD.PW01.22	East Hampshire	Budds Farm Havant	2	1	Flat 8, Bayview Court, 85	Flood Storage (1,552m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,575K	Medium	73
SWAL.PW01.13	Stour	Swalecliffe	2	2	Ham Shades Lane	Flood Storage (990m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach and will be developed as part of the solution with our partners.	£1,175K	Long	68
BRIG.PW01.7	Adur and Ouse	Peacehaven Brighton	1	2	The Ridgeway	DAP Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£6,735K	Long	64

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
HONE.PW01.16	Arun and Western Streams	Horsham New	1	2	Southwater	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£2,820K	Long	63
BUDD.PW01.33	East Hampshire	Budds Farm Havant	2	1	Serpentine Road, Shaftesbury Avenue, Geoffrey Avenue etc.	Flood Storage (3,615m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£3,030K	Long	61
MOTN.PW01.3	Medway	Motney Hill	1	2	Luton Road & Capstone Road Luton	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£2,325K	Long	60
FAVE.PW01.15	North Kent	Faversham	1	1	Davington Hill, West Street & Lower Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding (option priced based on storage but surface water separation is the preferred option)	£3,890K	Long	56
SWAL.PW01.14	Stour	Swalecliffe	2	2	Borstal Hill	Flood Storage (1760m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach and will be developed as part of the solution with our partners.	£1,720K	Long	54
BRIG.PW01.6	Adur and Ouse	Peacehaven Brighton	1	2	Middle Road	DAP Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£5,930K	Long	54
BUDD.SC01.23	East Hampshire	Budds Farm Havant	2	1	Anmore Road, Little Mead, Hambledon Road, School Lane etc.	Surface Water Separation (1.2 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (2007 m3)	£4,835K	Long	53
BUDD.PW01.31	East Hampshire	Budds Farm Havant	2	1	Anmore Road, Little Mead, Hambledon Road, School Lane etc.	Flood Storage (2,138m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,985K	Medium	53

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
LIDS.PW01.5	Arun and Western Streams	Lidsey	1	2	The Elmer Hard i	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option, although SuDS and soakaways unlikely due to high water table.)	£1,695K	Long	53
EALP.PW01.11	Cuckmere and Pevensey	Eastbourne	2	2	Wartling Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£7,885K	Long	50
WOEA.PW01.19	Adur and Ouse	East Worthing	2	2	Durington Lane	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£3,235K	Medium	49
LIDS.PW01.4	Arun and Western Streams	Lidsey	1	2	West Barnham	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option, although SuDS and soakaways unlikely due to high water table.)	£1,040K	Medium	49
WOEA.PW01.17	Adur and Ouse	East Worthing	2	2	Old Shoreman Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,855K	Medium	46
WOOL.PW02.2	Test and Itchen	Woolston	2	2	Dena Road and Pound Street	Storage Solution	£595K	Medium	42
BRIG.PW01.8	Adur and Ouse	Peacehaven Brighton	1	2	Tongdean Lane	DAP Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£3,310K	Long	42
TUWS.PW01.20	Medway	Tunbridge Wells South	2	2	Neville Gate, Upper Cumberland Road, Farmcombe Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach and will be developed as part of the solution with our partners.	£5,450K	Long	36
DAMB.SC01.3	Stour	Dambridge Wingham	1	1	High Street, Wingham and areas upstream	Surface Water Separation (0.31 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (538 m3)	£970K	Long	36

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
QUEE.PW01.10	North Kent	Queenborough	2	2	Oak Lane / Cliff Gardens	DAP Option: Abandon sewer connection in Chequers Road and sections of local sewer. Construct new flow diversion chamber and WPS with rising main. Upsize local sewers in Oak Avenue and Oak Lane.	£TBC	Long	35
QUEE.PW01.4	North Kent	Queenborough	2	2	The Broadway / The Leas / Southsea Avenue	Drainage Area Plan (DAP) Option: Local sewer upsizing and new rider sewer on Southsea Avenue, Seaside Avenue and The Leas. New flow diversion chamber, online storage tank and upsize local sewers in The Broadway.	£TBC	Long	33
QUEE.PW01.9	North Kent	Queenborough	2	2	Castlemere Avenue / Dumergue Avenue	DAP Option: Upsize and relay sections of local sewers and increase pumping capacity at Rushenden Road WPS. Transfer all pumped flows from Drove Road WPS directly to the inlet works at Queenborough WTW.	£TBC	Long	31
QUEE.PW01.8	North Kent	Queenborough	2	2	-	-	£TBC	Long	31
HONE.PW01.14	Arun and Western Streams	Horsham New	1	2	Billingshurst Road	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£1,780K	Medium	30
FAVE.PW01.16	North Kent	Faversham	1	1	Market Street & Roman Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding (option priced based on storage but surface water separation is the preferred option)	£1,530K	Long	30
HONE.PW01.15	Arun and Western Streams	Horsham New	1	2	Hurst Road	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£1,495K	Medium	29
BRIG.PW01.10	Adur and Ouse	Peacehaven Brighton	1	2	Preston / New England Rd	DAP Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,250K	Medium	27
QUEE.PW01.5	North Kent	Queenborough	2	2	-	-	£TBC	Long	26
QUEE.PW01.6	North Kent	Queenborough	2	2	Delamark Road / Broadway / High Street	DAP Option: Construct new storage tank, foul sewer and reconstruct existing manhole with a new weir	£TBC	Long	26
WOEA.PW01.18	Adur and Ouse	East Worthing	2	2	Ham Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£870K	Medium	26

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
SWAL.PW01.2	Stour	Swalecliffe	2	2	Seasalter Lane and Lurcene Drive	Drainage Area Plan (DAP): Option - Sewer Upsize and Offline Storage	£TBC	Long	26
NEWE.PW01.6	Adur and Ouse	Newhaven East	2	2	Blatchington Road i	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£1,865K	Long	24
THOR.PW01.14	Arun and Western Streams	Thornham	1	2	Woodlands Avenue	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£3,405K	Long	24
PAWD.PW01.9	Medway	Paddock Wood	2	2	Whetsted Road	Growth DAP Option: upsize surface water sewers; construct new surface water sewer	£TBC	Long	23
HAIS.PW01.14	Cuckmere and Pevensey	Hailsham South	2	2	Station Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,175K	Medium	21
MOTN.PW01.4	Medway	Motney Hill	1	2	Prince Charles Avenue Lords Wood	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach	£715K	Medium	21
HAIN.PW02.1	Cuckmere and Pevensey	Hailsham North	2	2	Hailsham North WTW	Increase capacity of Hailsham North WTW for future growth	£16,055K	Long	20
SWAL.PW01.3	Stour	Swalecliffe	2	2	Joy Lane, Essex Street and Belmont Road	Drainage Area Plan (DAP): Option - Sewer Upsize and Online Storage	£TBC	Long	20
HAIN.PW01.15	Cuckmere and Pevensey	Hailsham North	2	2	The Dicker	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£2,195K	Medium	19
BUDD.PW01.30	East Hampshire	Budds Farm Havant	2	1	Coralin Grove and Ramblers Way	Flood Storage (1,463m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,510K	Medium	18

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
SWAL.PW01.16	Stour	Swalecliffe	2	2	Lurcene Drive	Flood Storage (970m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach and will be developed as part of the solution with our partners.	£1,160K	Long	17
SWAL.PW01.18	Stour	Swalecliffe	2	2	Maydowns Road	Growth Drainage Area Plan (DAP): Upsize sections of existing local sewers	£625K	Medium	17
HONE.PW01.17	Arun and Western Streams	Horsham New	1	2	Worthing Road	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£920K	Medium	17
PORT.PW01.14	Adur and Ouse	Shoreham	2	2	Brighton Road	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£985K	Medium	14
DAMB.SC01.2	Stour	Dambridge Wingham	1	1	Pudding Lane, Ash and areas upstream	Surface Water Separation (0.48 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (721 m3)	£1,165K	Long	14
THOR.PW01.16	Arun and Western Streams	Thornham	1	2	Brook Gardens	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,955K	Medium	13
BRIG.PW01.11	Adur and Ouse	Peacehaven Brighton	1	2	Wilbury Crescent	DAP Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£735K	Medium	13
HAIN.PW01.11	Cuckmere and Pevensey	Hailsham North	2	2	Upper Dicker	Growth DAP: Upsize sections of local sewers in Upper Dicker to accommodate flows from future development	£975K	Medium	12
HAIN.PW01.12	Cuckmere and Pevensey	Hailsham North	2	2	Lower Horsebridge	Growth DAP: Upsize sections of local sewers in Lower Horsebridge to accommodate flows from future development	£975K	Medium	12
HAIN.PW01.13	Cuckmere and Pevensey	Hailsham North	2	2	Amberstone	Growth DAP: Upsize sections of local sewers in Amberstone to accommodate flows from future development	£975K	Medium	12

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Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
HAIN.PW01.14	Cuckmere and Pevensey	Hailsham North	2	2	Battle Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£855K	Medium	12
SWAL.PW01.11	Stour	Swalecliffe	2	2	Herne Bay Road / Burnan Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,245K	Long	10
BUDD.SC01.11	East Hampshire	Budds Farm Havant	2	1	St. Georges Road	Surface Water Separation (0.01 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (284 m3)	£1,070K	Medium	10
BUDD.PW01.19	East Hampshire	Budds Farm Havant	2	1	St. Georges Road	Flood Storage (303m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£690K	Medium	10
THOR.PW01.15	Arun and Western Streams	Thornham	1	2	Main Road, Nutbourne	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,010K	Medium	10
HAIN.PW01.9	Cuckmere and Pevensey	Hailsham North	2	2	Lower Horsebridge	DAP: Upsize sections of local sewers in Lower Horsebridge to accommodate flows from future development	£3,900K	Long	8
NEWE.PW01.9	Adur and Ouse	Newhaven East	2	2	Vale Road	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£585K	Medium	8
NEWE.PW01.11	Adur and Ouse	Newhaven East	2	2	Avis Way i	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£1,060K	Medium	8
BUDD.SC01.9	East Hampshire	Budds Farm Havant	2	1	Victory Green	Surface Water Separation (0.2 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (45 m3)	£580K	Medium	8
BUDD.SC01.15	East Hampshire	Budds Farm Havant	2	1	Eastoke Avenue, Haven Road	Surface Water Separation (0.63 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (1816 m3)	£4,480K	Long	8

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
BUDD.PW01.17	East Hampshire	Budds Farm Havant	2	1	Victory Green	Flood Storage (77m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£530K	Medium	8
BUDD.PW01.23	East Hampshire	Budds Farm Havant	2	1	Eastoke Avenue, Haven Road	Flood Storage (1,842m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£1,785K	Medium	8
BUDD.PW01.29	East Hampshire	Budds Farm Havant	2	1	Greenfield Crescent, Erica Close, Erica Way	Flood Storage (167m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£595K	Medium	7
POOD.PW01.20	Test and Itchen	Portswood	1	2	Glen Eyre Road	Upsize and offline storage	£7,005K	Long	7
POOD.PW01.21	Test and Itchen	Portswood	1	2	Meggeson Avenue	New sewer and manhole	£490K	Medium	7
POOD.PW01.22	Test and Itchen	Portswood	1	2	Portwood Cricket Ground	Online tank, new sewer and manhole	£4,450K	Long	7
POOD.PW01.24	Test and Itchen	Portswood	1	2	Burgess Road	Online storage	£325K	Medium	7
BRIG.PW01.20	Adur and Ouse	Peacehaven Brighton	1	2	Ovingdean Road	DAP Option: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£985K	Medium	7
QUEE.PW01.12	North Kent	Queenborough	2	2	Scrapsgate Road	Growth DAP Option: upsize local sewers on Scrapsgate Road	£2,685K	Long	6
QUEE.PW01.13	North Kent	Queenborough	2	2	Marine Avenue	Growth DAP Option: Upsize sections of local sewers and construct a box culvert in the field west of Marine Avenue	£2,685K	Long	6
QUEE.PW01.14	North Kent	Queenborough	2	2	Minster Road	Growth DAP Option: Upsize sections of local sewers on Minster Road	£2,685K	Long	6
QUEE.PW01.15	North Kent	Queenborough	2	2	Parish Road	Growth DAP Option: Upsize sewer on Parish Road and relay sewers on Dreadnought Avenue	£2,685K	Long	6
QUEE.PW01.16	North Kent	Queenborough	2	2	Thistle Hill Way	Growth DAP Option: Upsize sections of local sewers on Thistle Hill Way and Minster Road and relay smaller sewer on Thistle Hill Way	£2,685K	Long	6
QUEE.PW01.17	North Kent	Queenborough	2	2	Drove Road WPS transfer to WTW	Growth DAP Option: Transfer all pumped flow from Drove Road WPS directly to the inlet works at Queenborough WTW	£2,685K	Long	6

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
QUEE.PW01.18	North Kent	Queenborough	2	2	Queenborough Road	Growth DAP Option: Upsize sections of sewer on Queenborough Road	£2,685K	Long	6
QUEE.PW01.19	North Kent	Queenborough	2	2	West Street	Growth DAP Option: Upsize sections of sewer in West Street and Brielle Way and construct box culvert in West Street	£2,685K	Long	6
QUEE.PW01.20	North Kent	Queenborough	2	2	Marine Parade, Sheernes	Growth DAP Option: Construct birfucation manhole and tank sewer for excess storm flows from network.	£2,685K	Long	6
QUEE.PW02.2	North Kent	Queenborough	2	2	Queenborough WTW	Increase capacity of storm tanks at the treatment works – approximate upsize required of 4000m3 - or separate rainfall runoff at source to reduce storm discharges at Queenborough WTW	£9,530K	Long	6
WOOL.PW02.10	Test and Itchen	Woolston	2	2	Braeside Road	Storage Solution	£575K	Medium	6
BUDD.PW01.32	East Hampshire	Budds Farm Havant	2	1	Hatchmore Road and Inhams Lane	Flood Storage (266m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£665K	Medium	6
BUDD.SC01.24	East Hampshire	Budds Farm Havant	2	1	Hatchmore Road and Inhams Lane	Surface Water Separation (0.5 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (253 m3)	£1,130K	Medium	6
CHIC.PW01.16	Arun and Western Streams	Chichester	1	1	Salthill	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£885K	Long	6
QUEE.PW01.7	North Kent	Queenborough	2	2	Barton Hill Drive	DAP Option: Upsize sections of local sewers and construct new sewer and box culvert. Connect 12 properties in Lower Road and Barton Hill Drive to the new sewer in Barton Hill Drive.	£TBC	Long	5
PAWD.PW01.4	Medway	Paddock Wood	2	2	Church Farm	Growth Drainage Area Plan (DAP) Option: Upsize diameter of existing sewer	£1,430K	Long	5
PAWD.PW01.5	Medway	Paddock Wood	2	2	Mount Pleasant	Growth DAP Option: Upsize diameter of section of existing sewer; construct new sewer	£1,430K	Long	5
PAWD.PW01.6	Medway	Paddock Wood	2	2	Ringden Avenue	Growth DAP Option: Upsize diameter of exisiting sewer at flatter gradient	£1,430K	Long	5
PAWD.PW01.7	Medway	Paddock Wood	2	2	Near Eastwell	Growth DAP Option: Upsize diameter of exisiting sewer at flatter gradient	£1,430K	Long	5
PAWD.PW01.8	Medway	Paddock Wood	2	2	Near Eastwell	Growth DAP Option: Upsize existing sewer; construct new sewer	£1,430K	Long	5

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
PAWD.PW01.10	Medway	Paddock Wood	2	2	Badsell Road	Growth DAP Option: Upsize diameter of section of existing sewers; construct new sewers	£1,430K	Long	5
PAWD.OT01.4	Medway	Paddock Wood	2	2	Paddock Wood WTW	Growth DAP Option: Provide additional storage in the network or separate rainfall at source to reduce spills from the SSO at the Works (model improvements required)	£1,190K	Medium	5
PORT.PW01.4	Adur and Ouse	Shoreham	2	2	Old Shoreham Road	Growth DAP: Attenuate excess flows in sewer network using, upsizing sewer, storage tanks and creating new sewers to reduce risk of flooding.	£2,960K	Medium	5
PORT.PW01.5	Adur and Ouse	Shoreham	2	2	High Street/Brighton Road	Growth DAP: Attenuate excess flows in sewer network using, upsizing sewer, storage tanks and creating new sewers to reduce risk of flooding.	£2,960K	Medium	5
PORT.PW01.6	Adur and Ouse	Shoreham	2	2	Upper Shoreham Road	Growth DAP: Attenuate excess flows in sewer network using, upsizing sewer, storage tanks and creating new sewers to reduce risk of flooding.	£2,960K	Medium	5
PORT.PW01.7	Adur and Ouse	Shoreham	2	2	Dolphin Road	Growth DAP: Attenuate excess flows in sewer network using, upsizing sewer, storage tanks and creating new sewers to reduce risk of flooding.	£2,960K	Medium	5
PORT.PW01.8	Adur and Ouse	Shoreham	2	2	Kingstone Lane	Growth DAP: Attenuate excess flows in sewer network using, upsizing sewer, storage tanks and creating new sewers to reduce risk of flooding.	£2,960K	Medium	5
PORT.PW01.9	Adur and Ouse	Shoreham	2	2	Albion Street	Growth DAP: Attenuate excess flows in sewer network using, upsizing sewer, storage tanks and creating new sewers to reduce risk of flooding.	£2,960K	Medium	5
PORT.PW01.10	Adur and Ouse	Shoreham	2	2	Wellington Road	Growth DAP: Attenuate excess flows in sewer network using, upsizing sewer, storage tanks and creating new sewers to reduce risk of flooding.	£2,960K	Medium	5
BRIG.PW01.14	Adur and Ouse	Peacehaven Brighton	1	2	Clarendon Villas	DAP Option: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£1,470K	Medium	5
SITT.PW01.1	North Kent	Sittingbourne	1	2	Swanstree Avenue	Upsize 225mm diameter sewer on Swanstree Avenue	£630K	Medium	5

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
SITT.PW01.2	North Kent	Sittingbourne	1	2	Canterbury Road	Upsize 225mm diameter sewers on Canterbury Road	£630K	Medium	5
SITT.PW01.3	North Kent	Sittingbourne	1	2	Iwade area	Construct two new gravity sewers in Iwade area. Upsize three sections of existing sewer network.	£630K	Medium	5
SITT.PW01.4	North Kent	Sittingbourne	1	2	London Road i	Upsize sewers and construction of new gravity sewer on London Road.	£630K	Medium	5
SITT.PW01.5	North Kent	Sittingbourne	1	2	London Road ii	New Pumping Station (100m3 wet well) and new rising main.	£630K	Medium	5
SITT.PW01.6	North Kent	Sittingbourne	1	2	Swale Way	2 new gravity sewers for Kent Science Park, and 2 New Pumping Stations and rising mains.	£630K	Medium	5
SITT.PW01.7	North Kent	Sittingbourne	1	2	A249 i	New gravity sewer. New Pumping Station (PS) and rising main (RM).	£630K	Medium	5
SITT.PW01.8	North Kent	Sittingbourne	1	2	A249 ii	Upsize 150mm diameter sewer on Wises Lane to 375mm.	£630K	Medium	5
SITT.PW01.9	North Kent	Sittingbourne	1	2	Saffron Way	Upsize sewers on Saffron Way	£630K	Medium	5
SITT.PW01.10	North Kent	Sittingbourne	1	2	Newbridge Avenue	Upsize 225mm diameter sewer on Newbridge Avenue	£630K	Medium	5
SITT.PW01.11	North Kent	Sittingbourne	1	2	Grovehurst Road	Upsize sewer on Grovehurst Road	£630K	Medium	5
SITT.PW01.12	North Kent	Sittingbourne	1	2	Quinton Road	Construction of new gravity sewer on Quinton Road	£630K	Medium	5
SITT.PW01.13	North Kent	Sittingbourne	1	2	Sittingbourne WTW	Increase the pumping rate of Sittingbourne WTW Storm Pump. New rising main for WTW. Increase inlet penstocks openings .	£630K	Medium	5
DAMB.SC01.4	Stour	Dambridge Wingham	1	1	Burgess Road, Ayelsham and areas upstream	Surface Water Separation (1.23 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (44 m3)	£960K	Long	5
HAIS.PW01.7	Cuckmere and Pevensey	Hailsham South	2	2	Town Farm	DAP Growth Option: New pumping station to accommodate flows from future development.	£2,270K	Long	4
HAIS.PW01.8	Cuckmere and Pevensey	Hailsham South	2	2	Dittons Road	DAP Growth Option: Upsizing sewers and creating new sewers to accommodate flows from future development.	£2,270K	Long	4
HAIS.PW01.9	Cuckmere and Pevensey	Hailsham South	2	2	Golden Jubilee Way	DAP Growth Option: Upsizing sewers to accommodate flows from future development.	£2,270K	Long	4
HAIS.PW01.10	Cuckmere and Pevensey	Hailsham South	2	2	Bramley Road	DAP Growth Option: New sewers to accommodate flows from future development.	£2,270K	Long	4
HAIS.PW01.11	Cuckmere and Pevensey	Hailsham South	2	2	Polegate	DAP Growth Option: New sewers to accommodate flows from future development.	£2,270K	Long	4
HAIS.PW01.12	Cuckmere and Pevensey	Hailsham South	2	2	Dittons Road CSO	DAP Growth Option: Storage tanks to accommodate flows from future development.	£2,270K	Long	4

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Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
BRIG.PW01.17	Adur and Ouse	Peacehaven Brighton	1	2	Millyard Crescent	DAP Option: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£1,295K	Medium	4
BRIG.PW01.18	Adur and Ouse	Peacehaven Brighton	1	2	-	-	£TBC	Long	4
EALP.PW01.12	Cuckmere and Pevensey	Eastbourne	2	2	Rattle Road	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£595K	Medium	3
NEWE.PW01.7	Adur and Ouse	Newhaven East	2	2	Blatchington Road ii	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£1,395K	Long	3
BUDD.SC01.13	East Hampshire	Budds Farm Havant	2	1	Woodlands Lane, West Lane, Manor Road and Station Road	Surface Water Separation (0.16 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (375 m3)	£1,825K	Medium	3
BUDD.PW01.21	East Hampshire	Budds Farm Havant	2	1	Woodlands Lane, West Lane, Manor Road and Station Road	Flood Storage (404m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£765K	Medium	3
HONE.PW01.6	Arun and Western Streams	Horsham New	1	2	Land North of Horsham development	Growth DAP: Attenuate excess flows in sewer network creating new sewers to reduce risk of flooding.	£2,670K	Long	3
HONE.PW01.7	Arun and Western Streams	Horsham New	1	2	West of Southwater development	Growth DAP: Attenuate excess flows in sewer network creating new sewers and WPS to reduce risk of flooding.	£2,670K	Long	3
HONE.PW01.8	Arun and Western Streams	Horsham New	1	2	Land Off Mill Straight development	Growth DAP: Attenuate excess flows in sewer network creating new sewers to reduce risk of flooding.	£2,670K	Long	3
HONE.PW01.9	Arun and Western Streams	Horsham New	1	2	Novartis Pharmaceuticals UK Limited, Parsonage Road development	Growth DAP: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding.	£2,670K	Long	3
HONE.PW01.10	Arun and Western Streams	Horsham New	1	2	Forest Road	Growth DAP: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding.	£2,670K	Long	3

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Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
HONE.PW01.11	Arun and Western Streams	Horsham New	1	2	Land South of Athelstan Way	Growth DAP: Attenuate excess flows in sewer network creating new sewers and upsizing existing sewers to reduce risk of flooding.	£2,670K	Long	3
HONE.PW01.12	Arun and Western Streams	Horsham New	1	2	Holbrook Club North Heath Lane	Growth DAP: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding.	£2,670K	Long	3
HONE.PW01.13	Arun and Western Streams	Horsham New	1	2	Horsham New WTW	Growth DAP: Attenuate excess flows in sewer network by increasing the pump capacity and using storage tanks to the reduce risk of flooding.	£2,670K	Long	3
BRIG.PW01.31	Adur and Ouse	Peacehaven Brighton	1	2	Clarendon Villas	Growth DAP: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£2,385K	Long	3
BRIG.PW01.32	Adur and Ouse	Peacehaven Brighton	1	2	Woodland Drive	Growth DAP: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£2,385K	Long	3
BRIG.PW01.33	Adur and Ouse	Peacehaven Brighton	1	2	Preston Road	Growth DAP: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£2,385K	Long	3
BRIG.PW01.34	Adur and Ouse	Peacehaven Brighton	1	2	Preston Road	Growth DAP: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£2,385K	Long	3
BRIG.PW01.35	Adur and Ouse	Peacehaven Brighton	1	2	Preston Road	Growth DAP: Upsize sections of local sewers in Preston Road to accommodate flows from future development	£2,385K	Long	3
BRIG.PW01.36	Adur and Ouse	Peacehaven Brighton	1	2	Preston Road	Growth DAP: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£2,385K	Long	3
BRIG.PW01.37	Adur and Ouse	Peacehaven Brighton	1	2	Millyard Crescent and Ovingdean Road	Growth DAP: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£2,385K	Long	3
BRIG.PW01.38	Adur and Ouse	Peacehaven Brighton	1	2	Montreal Close	Growth DAP: Upsize sections of local sewers in Montreal Close to accommodate flows from future development	£2,385K	Long	3
BRIG.PW01.39	Adur and Ouse	Peacehaven Brighton	1	2	Brighton Marina	Growth DAP: Storage tanks in Brighton Marina to accommodate flows from future development	£2,385K	Long	3

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Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
CANT.PW01.12	Stour	Canterbury	2	2	Shalloak Road	Growth DAP Option: Construct new pumping station; Provide new rising main; Re-assign new development to the new wet well	£TBC	Long	2
CANT.PW01.13	Stour	Canterbury	2	2	Kingsmead Road	Growth DAP Option: additional stotage at Kingsmead Road Canterbury CSO	£TBC	Long	2
CANT.OT01.7	Stour	Canterbury	2	2	CANT FC05 Tyler Hill	Provide offline storage of approximately 51m3 or separate rainfall runoff at source to reduce spills from the EMO at Tyler Hill; storage volume needs to be confirmed due to discrepancies between DAP and model data	£265K	Long	2
CANT.OT01.8	Stour	Canterbury	2	2	CANT FC6 Canterbury WTW	Provide offline storage of approximately 331m3 or separate rainfall runoff at source to reduce spills from the SSO at Canterbury WTW; storage volume needs to be confirmed due to discrepancies between DAP and model data	£265K	Long	2
TUWS.PW01.6	Medway	Tunbridge Wells South	2	2	Ferrars Estate Hawkenbury WPS	Growth DAP Option: Increase WPS pump rate to accommodate additional flows from future development	£65K	Medium	2
TUWS.PW01.7	Medway	Tunbridge Wells South	2	2	Ferrars Estate Hawkenbury WPS	Growth DAP Option: Rising main extension to new ring sewer to provide capacity for additional flows from future developments	£65K	Medium	2
TUWS.PW01.8	Medway	Tunbridge Wells South	2	2	High Woods Lane	Growth DAP Option: New ring sewer and pumping station to provide capacity for additional flows from future developments	£65K	Medium	2
TUWS.PW01.9	Medway	Tunbridge Wells South	2	2	Tunbridge Wells South WTW	Growth DAP Option: New ring sewer to provide capacity for additional flows from future developments	£65K	Medium	2
TUWS.PW01.10	Medway	Tunbridge Wells South	2	2	Bayham Road and Benhall Mill Road	Growth DAP Option: New surface water sewer to provide capacity for additional flows from future developments	£65K	Medium	2
TUWS.PW01.11	Medway	Tunbridge Wells South	2	2	Culverden Down	Growth DAP Option: New surface water sewer to provide capacity for additional flows from future developments	£65K	Medium	2
TUWS.PW01.12	Medway	Tunbridge Wells South	2	2	Hurstwood Tunbridge Wells WPS	Growth DAP Option: Upsize sections of foul and surface water sewers to provide capacity for additional flows from future developments	£65K	Medium	2

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
TUWS.PW01.13	Medway	Tunbridge Wells South	2	2	Hurstwood Tunbridge Wells WPS	Growth DAP Option: Operational enhancements to Hurstwood Tunbridge Wells WPS	£65K	Medium	2
TUWS.PW01.14	Medway	Tunbridge Wells South	2	2	Lonsdale Gardens	Growth DAP Option: Upsize sections of local sewers to provide capacity for additional flows from future developments	£65K	Medium	2
TUWS.PW01.15	Medway	Tunbridge Wells South	2	2	Broadwater Lane	Growth DAP Option: Upsize sections of local sewers to provide capacity for additional flows from future developments	£65K	Medium	2
TUWS.PW01.16	Medway	Tunbridge Wells South	2	2	Tunbridge Wells South WTW	Construct storage tank to reduce spill frequency to freshwaters	£3,660K	Long	2
NEWE.PW01.12	Adur and Ouse	Newhaven East	2	2	Avis Way ii	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£590K	Medium	2
HAIS.PW01.13	Cuckmere and Pevensey	Hailsham South	2	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£230K	Short	2
CANT.PW01.11	Stour	Canterbury	2	2	CHAUCER CLOSE TO CANTERBURY WTW	Growth DAP Option: Construct new pumping station; provide new rising main; Re-assign new development to the new wet well; New ring sewers	£TBC	Long	2
BUDD.PW01.34	East Hampshire	Budds Farm Havant	2	1	Laburnum Road, Regency Gardens and London Road	Flood Storage (32m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£505K	Medium	2
MOTN.PW01.21	Medway	Motney Hill	1	2	Land off Forge Lane Upchurch development	Growth Drainage Area Plan (DAP): Construct new WPS at the Land off Forge Lane, Upchurch development and rising main	£1,915K	Long	2
MOTN.PW01.22	Medway	Motney Hill	1	2	Land Off London Road, Newington	Growth DAP: Construct new WPS and rising main	£1,915K	Long	2
MOTN.PW01.23	Medway	Motney Hill	1	2	Lordswood to Motney Hill WTW	Growth DAP: Construct 2 new WPSs and rising mains and upsize sections of local sewers	£1,915K	Long	2
MOTN.PW01.24	Medway	Motney Hill	1	2	Church Green, Frindsbury	Growth DAP: Upsize sections of local sewers in Church Green to accommodate flows from future development	£1,915K	Long	2
MOTN.PW01.25	Medway	Motney Hill	1	2	Waterfront Way, Chatham	Growth DAP: Upsize sections of local sewers	£1,915K	Long	2

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Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
MOTN.PW01.26	Medway	Motney Hill	1	2	Royal Mail Medway Centre	Growth DAP: Construct a new diversion chamber, offline storage tank, rising main and upsize sections of local sewers	£1,915K	Long	2
MOTN.PW01.27	Medway	Motney Hill	1	2	A231 Dock Road	Growth DAP: Upsize sections of local sewers in the A231 Dock Road	£1,915K	Long	2
MOTN.PW01.28	Medway	Motney Hill	1	2	A231 The Brook	Growth DAP: Construct a new diversion chamber and upsize sections of local sewers	£1,915K	Long	2
MOTN.PW01.29	Medway	Motney Hill	1	2	Pier Approach Road	Growth DAP: Construct new box culvert and flow control device	£1,915K	Long	2
MOTN.PW01.30	Medway	Motney Hill	1	2	A231 Dock Road	Growth DAP: Construct new box culvert	£1,915K	Long	2
MOTN.PW01.31	Medway	Motney Hill	1	2	Amherst Hill, Brompton development	Growth DAP: Construct new WPS and rising main	£1,915K	Long	2
MOTN.PW01.32	Medway	Motney Hill	1	2	Eastcourt Lane, Gillingham	Growth DAP: Upsize sections of local sewers in Eastcourt Lane	£1,915K	Long	2
MOTN.PW01.33	Medway	Motney Hill	1	2	Rochester Avenue	Growth DAP: Construct new diversion chamber and upsize sections of local sewers	£1,915K	Long	2
MOTN.PW01.34	Medway	Motney Hill	1	2	Rochester Airfield development	Growth DAP: Construct a new pumping station and rising main and new connections	£1,915K	Long	2
MOTN.PW01.35	Medway	Motney Hill	1	2	New Fire Station, Marconi Way development	Growth DAP: Construct a new pumping station and rising main and new connections	£1,915K	Long	2
MOTN.PW01.36	Medway	Motney Hill	1	2	Lower Twydall Lane	Growth DAP: Upsize sections of local sewers in Lower Twydall Lane to accommodate flows from future development	£1,915K	Long	2
MOTN.PW01.37	Medway	Motney Hill	1	2	Chatham Hill Outside No.425 CSO	Growth DAP: Construct additional storage to maintain spill performance	£1,915K	Long	2
MOTN.PW01.38	Medway	Motney Hill	1	2	Corporation Street Rochester No.2 CSO	Growth DAP: Construct additional storage in order to meet the Shellfish Waters consent	£1,915K	Long	2
MOTN.PW01.39	Medway	Motney Hill	1	2	Dock Road Gillingham CSO	Growth DAP: Construct additional storage in order to meet the Shellfish Waters consent	£1,915K	Long	2
MOTN.PW01.40	Medway	Motney Hill	1	2	Hawthorne Avenue Gillingham CSO	Growth DAP: Construct additional storage in order to meet the Shellfish Waters consent	£1,915K	Long	2
MOTN.PW01.41	Medway	Motney Hill	1	2	Magpie Hall Road Chatham Outside No.60 CSO	Growth DAP: Construct additional storage in order to meet the Shellfish Waters consent	£1,915K	Long	2
MOTN.PW01.42	Medway	Motney Hill	1	2	The Strand Gillingham CEO	Growth DAP: Construct additional storage in order to meet the Shellfish Waters consent	£1,915K	Long	2
MOTN.PW01.43	Medway	Motney Hill	1	2	William Street Rainham CSO	Growth DAP: Construct additional storage in order to meet the Shellfish Waters consent	£1,915K	Long	2
MOTN.OT01.8	Medway	Motney Hill	1	2	Growth DAP - Charles Street Strood CSO	Hydraulic investigations and model improvements to improve accuracy of predicted spills and solutions	£415K	Medium	2

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Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
MOTN.OT01.9	Medway	Motney Hill	1	2	Growth DAP - Second Avenue Chatham No.2 CSO	Hydraulic investigations and model improvements to improve accuracy of predicted spills and solutions	£415K	Medium	2
MOTN.OT01.10	Medway	Motney Hill	1	2	Growth DAP - Northgate Rochester CSO	Hydraulic investigations and model improvements to improve accuracy of predicted spills and solutions	£415K	Medium	2
MOTN.OT01.11	Medway	Motney Hill	1	2	Growth DAP - Pump Lane Gillingham Tank CSO	Hydraulic investigations and model improvements to improve accuracy of predicted spills and solutions	£415K	Medium	2
FAVE.PW01.9	North Kent	Faversham	1	1	Lakeside Avenue, The Street & Oare Road WPS	Growth Drainage Area Plan (DAP): Upsize sections of local sewers and increase pumping rate at Oare Road WPS to accommodate flows from future development	£TBC	Long	2
FAVE.PW01.10	North Kent	Faversham	1	1	Ospringe Street	Growth DAP: Upsize sections of local sewers on Ospringe Street to accommodate flows from future development	£TBC	Long	2
FAVE.PW01.11	North Kent	Faversham	1	1	Athelstan Road & The Mall	Growth DAP: Upsize and relay sections of local sewers to accommodate flows from future development	£TBC	Long	2
FAVE.PW01.12	North Kent	Faversham	1	1	Brent Road & Quay Lane WPS	Growth DAP: Upsize local sewers, lay new sewer and increase pumping rate at Quay Lane to accommodate flows from future development	£TBC	Long	2
GRAV.PW01.5	Medway	Gravesend	2	2	Three Daws PH, Town Pier	Drainage Area Plan (DAP) Option: new sewers; new bifurcation weir chamber; new storage tank; new storm return pumps and rising main	£TBC	Long	1
GRAV.PW01.6	Medway	Gravesend	2	2	The Ship & Lobster, Mark Lane	DAP Option: new bifurcation chamber; new sewer; new offline tank with pumped return to gravity system	£TBC	Long	1
GRAV.PW01.7	Medway	Gravesend	2	2	Upstream of High Street WPS	Growth DAP Option: sewers upsizing	£TBC	Long	1
GRAV.PW01.8	Medway	Gravesend	2	2	Canal Road WPS and Prospect Grove WPS	Growth DAP Option: upsizing of sections of sewer; uprate capacity of WPS; new rising main	£TBC	Long	1
GRAV.PW01.9	Medway	Gravesend	2	2	South East Catchment - Riverview Park Area	Growth DAP Option: new Pumping Station and 2x new rising mains	£TBC	Long	1
GRAV.PW01.10	Medway	Gravesend	2	2	South East Catchment - Riverview Park Area	Growth DAP Option: new section of sewer	£TBC	Long	1
GRAV.PW01.11	Medway	Gravesend	2	2	South East Catchment - Riverview Park Area	Growth DAP Option: new Pumping Station; 2x new rising mains	£TBC	Long	1
GRAV.PW01.12	Medway	Gravesend	2	2	Denton Wharf WPS (Ship & Lobster DG5)	Growth DAP Option: Upsizing / online storage	£TBC	Long	1
GRAV.PW01.13	Medway	Gravesend	2	2	St George's Cof E School playing field	Growth DAP Option: upsizing of 300mm sewer; increase the diameter of 225mm sewer	£TBC	Long	1

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Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
GRAV.PW01.14	Medway	Gravesend	2	2	Outfall to Milton Road CSO	Growth DAP Option: seal manhole TQ65743251	£TBC	Long	1
GRAV.PW01.17	Medway	Gravesend	2	2	Gravesend WTW	Growth DAP Option: new pumps duty/standby at WTW inlet pumping station	£TBC	Long	1
TONB.PW01.7	Medway	Tonbridge	2	2	North Tonbridge	Growth Drainage Area Plan (DAP) Option: Construct new sewer; Increase pump rate and wet well storage volume; Replace rising main	£2,900K	Medium	1
TONB.PW01.8	Medway	Tonbridge	2	2	Central Tonbridge	Growth DAP Option: Upsize, new sewer and flow transfer	£2,900K	Medium	1
TONB.PW01.9	Medway	Tonbridge	2	2	South Tonbridge	Growth DAP Option: Offline storage, new storm PS, upsize	£2,900K	Medium	1
TONB.PW01.10	Medway	Tonbridge	2	2	South West Tonbridge	Growth DAP Option: Construct a new sewers; Upsize existing sewers	£2,900K	Medium	1
TONB.PW01.11	Medway	Tonbridge	2	2	Power Mill WPS	Growth DAP Option: Increase pump rate	£2,900K	Medium	1
TONB.OT01.3	Medway	Tonbridge	2	2	Coldharbour Lane Hildenborough 30 CSO	Growth DAP Option: Additional storage of 50m3 (TBC, model improvements required)	£2,900K	Medium	1
TONB.OT01.4	Medway	Tonbridge	2	2	Ensfield Road Leigh CEO	Growth DAP Option: Additional storage of 90m3 (TBC, model improvements required)	£2,900K	Medium	1
TONB.OT01.5	Medway	Tonbridge	2	2	Tonbridge WTW	Growth DAP Option: Additional storage of 4340m3 (TBC)	£3,900K	Long	1
TONB.OT01.6	Medway	Tonbridge	2	2	Tonbridge WTW Storm Tanks	Growth DAP Option: Additional storage of 670m3 (TBC, model improvements required)	£2,900K	Medium	1
STAP.SC01.1	Medway	Staplehurst	2	2	South areas	Work with local council to mitigate surface water flooding in coastal areas through implementation of SuDS	£TBC	Long	1
STAP.SC01.2	Medway	Staplehurst	2	2	Northern / South-west areas	Surface water separation to provide a long term solution to reduce flooding in the town and storm overflow discharges	£TBC	Long	1
NEWE.PW01.10	Adur and Ouse	Newhaven East	2	2	Chyngton Gardens	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option)	£540K	Medium	1
SWAL.PW01.19	Stour	Swalecliffe	2	2	Area upstream of Whitebridge Farm WPS	Growth Drainage Area Plan (DAP): Upsize sections of existing local sewers	£625K	Medium	1
SWAL.PW01.20	Stour	Swalecliffe	2	2	Golden Hill	Growth Drainage Area Plan (DAP): Upsize sections of existing local sewers	£625K	Medium	1
SWAL.PW01.21	Stour	Swalecliffe	2	2	Area upstram of Golden Hill WPS	Growth Drainage Area Plan (DAP): Upsize sections of existing local sewers	£625K	Medium	1

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
SWAL.PW01.22	Stour	Swalecliffe	2	2	Grasmere Road	Growth Drainage Area Plan (DAP): Upsize sections of existing local sewers	£625K	Medium	1
SWAL.PW01.23	Stour	Swalecliffe	2	2	Clapham Hill	Growth Drainage Area Plan (DAP): Upsize sections of existing local sewers	£625K	Medium	1
SWAL.PW01.24	Stour	Swalecliffe	2	2	Thanet Way	Growth Drainage Area Plan (DAP): Construct new storage manhole, 107m of new 1800mm dia sewer and upsize sections of local sewers	£625K	Medium	1
SWAL.PW01.25	Stour	Swalecliffe	2	2	Diamond Road	Growth Drainage Area Plan (DAP): Upsize sections of existing local sewers	£625K	Medium	1
SWAL.PW01.26	Stour	Swalecliffe	2	2	Church Lane	Growth Drainage Area Plan (DAP): Upsize sections of existing local sewers	£625K	Medium	1
TONB.PW01.12	Medway	Tonbridge	2	2	Hilden Bridge	Growth DAP Option: Upsize existing sewers	£2,900K	Medium	1
BRIG.PW01.16	Adur and Ouse	Peacehaven Brighton	1	2	Godwin Road	DAP Option: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£450K	Medium	1
BRIG.PW01.21	Adur and Ouse	Peacehaven Brighton	1	2	Stanmer Villas	DAP Option: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£1,840K	Medium	1
BRIG.PW01.22	Adur and Ouse	Peacehaven Brighton	1	2	-	-	£TBC	Long	1
BRIG.PW01.23	Adur and Ouse	Peacehaven Brighton	1	2	Woodland Drive	DAP Option: Upsize sections of local sewers and storage tanks to accommodate flows from future development	£165K	Medium	1
BRIG.PW01.24	Adur and Ouse	Peacehaven Brighton	1	2	-	-	£TBC	Long	1
BRIG.PW01.25	Adur and Ouse	Peacehaven Brighton	1	2	Montreal Close	DAP Option: New sewers and storage tanks to accommodate flows from future development	£475K	Medium	1
MORE.PW01.5	Test and Itchen	Morestead Road Winchester	1	2	Middle Brook Street	Sewer Upsize Reduce storm sewer size	£TBC	Long	1
MORE.PW01.6	Test and Itchen	Morestead Road Winchester	1	2	The Broadway & Colebrooke Street	Sewer Upsize Reduce storm sewer size	£TBC	Long	1
MORE.PW01.7	Test and Itchen	Morestead Road Winchester	1	2	Romsey Road	Sewer Upsize Reduce storm sewer size	£TBC	Long	1
MORE.PW01.8	Test and Itchen	Morestead Road Winchester	1	2	Airlie Road	Sewer Upsize Reduce storm sewer size	£TBC	Long	1

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
MORE.PW01.9	Test and Itchen	Morestead Road Winchester	1	2	Garnier Road WPS	Sewer Upsize New Weir at Garnier WPS New storm sewer Install Storage of 956m3 Pump return	£1,155K	Long	1
MORE.PW01.10	Test and Itchen	Morestead Road Winchester	1	2	Upstream trunk sewer at Garnier Roas WPS	Sewer Upsize Reduce foul sewer size	£230K	Medium	1
MORE.PW01.11	Test and Itchen	Morestead Road Winchester	1	2	Pitt Manor, Romsey Road along Badger Farm Road to Garnier WPS	New PS at Pitt Manor and Bushfield Camp with new rising main New foul sewer	£975K	Long	1
MORE.PW01.12	Test and Itchen	Morestead Road Winchester	1	2	Morestead Road Winchester WTW	Install approximately 1750m3 of storage	£1,725K	Long	1
HERN.OC01.1	Stour	May Street Herne Bay	1	2	West Brook estuary	West Brook joins the sea as a large surface water sewer west of Hampton. There is a reasonable amount of open space to accommodate SuDS.	£TBC	Long	1
HERN.PW01.1	Stour	May Street Herne Bay	1	2	Parsonage Road	Growth Drainage Area Plan (DAP) Option: Sewer upsizing; Reduce the upstream invert level	£2,605K	Medium	1
HERN.PW01.2	Stour	May Street Herne Bay	1	2	Eddington Lane	Growth DAP Option: Eddington Lane WPS - Construction of new sewer line	£7,815K	Long	1
HERN.PW01.3	Stour	May Street Herne Bay	1	2	Sweechbridge Road	Growth DAP Option: Parallel storage off Sweechbridge Road; hydraulic control device to control return flows into the existing sewer network	£2,605K	Medium	1
HERN.PW01.4	Stour	May Street Herne Bay	1	2	Lower Herne Road	Growth DAP Option: Gravity sewer off Lower Herne Road; new diversion manhole; hydraulic control device to control return flows into the existing sewer network	£7,815K	Long	1
HERN.PW01.5	Stour	May Street Herne Bay	1	2	Land at Bullockstone Road, Herne Bay development	Growth DAP Option: New sewer from the Land at Bullockstone Road	£7,815K	Long	1
SITT.PW01.15	North Kent	Sittingbourne	1	2	Sittingbourne WTW	Storage or separation of surface water to reduce spill frequency below annual threshold at the Works SSO (volume / area of separation to be determined)	£1,000K	Long	1
SITT.OT01.4	North Kent	Sittingbourne	1	2	St Pauls Street Sittingbourne CSO	Storage or separation of surface water to reduce spill frequency below annual threshold at St Pauls Street CSO (volume / area of separation to be determined)	£1,100K	Long	1
SITT.OT01.5	North Kent	Sittingbourne	1	2	Crown Quay Lane CSO	Storage or separation of surface water to reduce spill frequency below annual threshold at Crown Quay Lane CSO (volume / area of separation to be determined)	£1,520K	Long	1

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
MOTN.PW01.19	Medway	Motney Hill	1	2	High Street & The Brooke Chatham	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£2,630K	Long	1
MOTN.PW01.20	Medway	Motney Hill	1	2	Dock Road Chatham	Flood Storage: Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£920K	Medium	1
HORS.SC01.1	Medway	Horsmonden	1	2	Catchment wide	Work with local council to disconnect surface water runoff from the combined system and direct it to watercourses throughout the catchment	£TBC	Long	1
LIDS.PW01.6	Arun and Western Streams	Lidsey	1	2	The Elmer Hard ii	Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. (Cost based on storage but surface water separation is the preferred option, although SuDS and soakaways unlikely due to high water table.)	£520K	Medium	1
SLOW.PW01.7	New Forest	Slowhill Copse Marchwood	1	1	Cooks Lane	DAP Option: Upsize 413m of 225mm to 525mm diameter sewer	£345K	Long	1
SLOW.PW01.8	New Forest	Slowhill Copse Marchwood	1	1	Ashurst Bridge WPS	DAP Option: Upsize 33m 800mm and 850mm to 1800mm diameter	£40K	Medium	1
SLOW.PW01.9	New Forest	Slowhill Copse Marchwood	1	1	Butts Ash Lane	DAP Option: Upsize 96m 150mm to 1050mm diameter	£155K	Long	1
SLOW.PW01.10	New Forest	Slowhill Copse Marchwood	1	1	Eling Lane	DAP Option: Upsize 128m 225mm to 675mm diameter	£155K	Long	1
SLOW.PW01.11	New Forest	Slowhill Copse Marchwood	1	1	North Dibden	DAP Option: Upsize 93m 750mm to 1350mm diameter	£150K	Medium	1
SLOW.PW01.12	New Forest	Slowhill Copse Marchwood	1	1	Mulberry Road	DAP Option: Upsize 100m 150mm to 450mm diameter	£85K	Medium	1
CRRM.PW01.11	Medway	Redgate Mill Crowborough	1	1	Maynards Gate	Growth DAP Option: Additional storage; further investigation into spill data accuracy is required	£1,145K	Long	1
TUWN.PW01.1	Medway	Tunbridge Wells North	1	1	Dowding Way	Growth DAP: Construct 225mm diameter ring sewer	£1,715K	Long	1
TUWN.PW01.2	Medway	Tunbridge Wells North	1	1	Dowding Way	Growth DAP: Upsize section of local sewer from 225mm to 450mm diameter in Dowding Way	£1,715K	Long	1
TUWN.PW01.3	Medway	Tunbridge Wells North	1	1	St John's Road	Growth DAP: Construct new 300mm diameter sewer on St John's Road	£1,715K	Long	1

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
TUWN.PW01.4	Medway	Tunbridge Wells North	1	1	Medway Road	Growth DAP: Upsize 4 manholes to 3m diameter chambers	£1,715K	Long	1
DAMB.SC01.1	Stour	Dambridge Wingham	1	1	The Forstal, Preston and areas upstream	Surface Water Separation (0.14 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (126 m3)	£620K	Medium	1
QUEE.SC01.2	North Kent	Queenborough	2	2	Northern and Southwest part of catchment	Surface water separation to provide a long term solution to reduce flooding in the town and storm overflow discharges	£1,000K	Medium	0
QUEE.OT01.3	North Kent	Queenborough	2	2	Wards Hill WPS	Storage or separation of surface water to reduce spill frequency below annual threshold at Wards Hill CSO (volume / area of separation to be determined)	£1,100K	Medium	0
SWAL.PW01.12	Stour	Swalecliffe	2	2	Chestfield Rd	Flood Storage : Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach and will be developed as part of the solution with our partners.	£765K	Medium	0
BUDD.SC01.18	East Hampshire	Budds Farm Havant	2	1	Raymond Road, Hamilton Road, Portsview Avenue	Surface Water Separation (0.7 Ha) and sustainable drainage systems (SuDS) to attenuate storm runoff (16 m3)	£750K	Medium	0
BUDD.PW01.26	East Hampshire	Budds Farm Havant	2	1	Raymond Road, Hamilton Road, Portsview Avenue	Flood Storage (32m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£500K	Medium	0
SLOW.OT01.4	New Forest	Slowhill Copse Marchwood	1	1	Catchment wide	Study / Investigation: Update and re-verify the Slowhill Copse Marchwood Hydraulic Model to improve model confidence	£225K	Short	0
ROMS.OT01.3	Test and Itchen	Romsey	1	1	Catchment Wide	Study / Investigation: Update and re-verify the Romsey Hydraulic Model to improve model confidence	£300K	Short	0
CRRM.PW01.2	Medway	Redgate Mill Crowborough	1	1	The Farthings - Millbrook Road	Drainage Area Plan (DAP) Option: Pipe upsize of 450mm sewer; New manholes on new sewer	£355K	Medium	0
CRRM.PW01.3	Medway	Redgate Mill Crowborough	1	1	Eridge Road	Growth DAP Option: Construct new gravity sewer and new Manholes	£355K	Medium	0
CRRM.PW01.4	Medway	Redgate Mill Crowborough	1	1	Millbrook Road	Growth DAP Option: Upsize the pipe diameter of a section of 450mm sewer	£355K	Medium	0

Prioritised Investment Needs Summary Table Identified for Annualised Flood Risk (PO7)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Properties at Risk
CRRM.PW01.5	Medway	Redgate Mill Crowborough	1	1	Green Lane	Growth DAP Option: Upsize the pipe diameter of a sections of the sewer; Construct new manholes; New offline storage tank	£355K	Medium	0
CRRM.PW01.6	Medway	Redgate Mill Crowborough	1	1	Tollwood Road	Growth DAP Option: Sewer upsizing	£355K	Medium	0
CRRM.PW01.7	Medway	Redgate Mill Crowborough	1	1	Walshes Road	Growth DAP Option: Pipe upsize; Construct new manholes	£355K	Medium	0
CRRM.PW01.9	Medway	Redgate Mill Crowborough	1	1	Crowborough Hill	Growth DAP Option: Upsize the pipe diameter; Construct new manholes	£355K	Medium	0
CRRM.PW01.10	Medway	Redgate Mill Crowborough	1	1	Sybron Way	Growth DAP Option: Upsize sections of 525mm sewer	£1,175K	Long	0
CRRM.OT01.4	Medway	Redgate Mill Crowborough	1	1	Maynards Mead Crowborough CSO	Growth DAP Option: additional storage (volume to be confirmed)	£1,645K	Long	0
CRRM.PW01.8	Medway	Redgate Mill Crowborough	1	1	Western Road	Growth DAP Option: Pipe upsize; Construction of new manholes	£355K	Medium	0
CRRM.OT01.3	Medway	Redgate Mill Crowborough	1	1	Pellings Wood Crowborough CSO	Growth DAP Option: additional storage (volume to be confirmed)	£1,150K	Long	0
PENN.PW01.9	New Forest	Pennington	0	1	Ashely Common Road	Upsize 455m of existing sewer to 375mm diameter	£380K	Medium	0
PENN.PW01.10	New Forest	Pennington	0	1	Beechwood Avenue and Marley Avenue	Upsize 728m of existing sewer to 525mm diameter	£605K	Long	0
PENN.PW01.11	New Forest	Pennington	0	1	Milford Road Pennington WTW	Flood Storage (256m3): Attenuate excess flows in sewer network using storage tanks to reduce risk of flooding. Option priced based on storage tanks but surface water separation is the preferred approach.	£660K	Long	0
PENN.PW01.8	New Forest	Pennington	0	1	School Lane and Lymore Valley	Upsize 67m of existing sewer to 675mm diameter sewer	£80K	Medium	0
PENN.OT01.9	New Forest	Pennington	0	1	Catchment wide	Study / Investigation: Update and re-verify the Pennington Hydraulic Model to improve model confidence	£225K	Short	0

DWMP Investment Plan for Sewer Flooding

Annex C : Surface Water Management (Planning Objective 10)

1. The options listed in the DWMP Investment Needs below are the preferred options in our DWMP. They will need further refinement as we implement the DWMP to confirm the exact location and scope of action needed, and the cost.

2. The costs are indicative costs for planning purposes only. The basis for the cost estimates, including assumptions and uncertainties, are explained in our DWMP Investment Plans.

3. The table of Investment Need provides an indicative cost so we know what level of funding is needed to reduce the risks. It is not a commitment to fund or deliver any option.

4. The Indicative Timescale is when the investment is needed. Short term means before 2030 (AMP8), medium term between 2030 and 2040 (AMP9 &10), and long term between 2040 and 2050 (AMP 11 & 12). Some options may take several investment periods to achieve the desired outcomes.

5. Potential Partners have been identified in the table of Investment Needs. This is to indicate where there may be opportunities for us to work with these partners when developing and delivering these options. It is not a commitment by any of the partners to work with us.

6. These options will inform our future business plans as part of the Ofwat periodic review process to secure the finance to implement these options.

7. The options listed are prioritised by the method stated in the Programme Appraisal Technical Summary.

Date : May 2022

Version : 1.0

Prioritised Investment Needs Summary Table Identified for Surface Water Management (PO10)

Reference	River Basin	Catchment	Risk Band	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
BUDD.OT01.6	East Hampshire	Budds Farm Havant	2	Catchment Wide	Study / Investigation: Update and re-verify the Budds Farm Havant Hydraulic Model to improve model confidence	£750K	Short to Medium	365,496
BRIG.OT01.4	Adur and Ouse	Peacehaven Brighton	2	Catchment wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£800K	Short	297,284
WOEA.OT01.8	Adur and Ouse	East Worthing	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£450K	Short	142,261
FORW.OT01.5	Arun and Western Streams	Ford	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£450K	Short	132,208
EALP.OT01.5	Cuckmere and Pevensey	Eastbourne	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£300K	Short	116,948
EALP.OT01.7	Cuckmere and Pevensey	Eastbourne	2	Eastbourne WTW	Study to identify and provide solution for Saline intrusion at Eastbourne WTW.	£TBC	Short	116,948
WEAT.OT01.8	Stour	Weatherlees Hill	2	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£400K	Short	91,319
WEAT.OT01.10	Stour	Weatherlees Hill	2	Ramsgate	Study and Investigation: Investigate the condition of existing 40,000 m3 storage tanks under Ramsgate town and remobilise to full storage capacity.	£100K	Short	91,319
WEAT.OT01.11	Stour	Weatherlees Hill	2	Deal	Study and Investigation: Investigate the condition of existing storage tanks in town centre and remobilise to full storage capacity.	£100K	Short	91,319
HONE.OT01.3	Arun and Western Streams	Horsham New	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£250K	Short	66,861
GRAV.OT01.6	Medway	Gravesend	2	Catchment wide	Model Study: model improvements including flow surveys to calibrate and verify the model	£250K	Short	63,731
PORT.OT01.3	Adur and Ouse	Shoreham	2	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£350K	Short	55,458
SWAL.OT01.5	Stour	Swalecliffe	2	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£200K	Short	37,104

Prioritised Investment Needs Summary Table Identified for Surface Water Management (PO10)

Reference	River Basin	Catchment	Risk Band	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
MOTN.OT01.7	Medway	Motney Hill	1	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£415K	Short	263,577
HABX.OT01.6	Cuckmere and Pevensey	Bexhill And Hastings	1	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£325K	Short	141,300
MILL.OT01.5	Test and Itchen	Millbrook	1	Catchment Wide	Study / Investigation: Build and verify the Millbrook Hydraulic Model to improve model confidence	£340K	Short to Medium	140,442
BROM.OT01.3	Stour	Broomfield Bank	1	Catchment Wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£375K	Short	114,249
CHEA.OT01.5	Test and Itchen	Chickenhall Eastleigh	1	Catchment Wide	Study / Investigation: Build and verify the Chickenhall Eastleigh Hydraulic Model to improve model confidence	£300K	Short to Medium	97,014
CHEA.OT01.7	Test and Itchen	Chickenhall Eastleigh	1	River Itchen	Study / Investigation: Identify suitable location/s for wetland construction along with River Itchen in partnership with the EA (update hydraulic model)	£TBC	Medium	97,014
WEHB.OT02.3	Stour	Margate And Broadstairs	1	Catchment Wide	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations	£375K	Short	92,788
POOD.OT01.5	Test and Itchen	Portswood	1	Catchment Wide	Study / Investigation: Build and verify the Portswood Hydraulic Model to improve model confidence	£265K	Short to Medium	79,637
WOOL.OT01.6	Test and Itchen	Woolston	1	Catchment Wide	Study / Investigation: Update and re-verify the Woolston Hydraulic Model to improve model confidence	£190K	Short to Medium	68,457
CANT.OT01.6	Stour	Canterbury	1	Catchment Wide / Overflow Locations	Study Model improvements: 3 month flow survey to catch both storm and dry data and calibrate these against the model should be conducted	£265K	Short	65,145
SITT.OT01.6	North Kent	Sittingbourne	1	Catchment wide	Model Study: model improvements including flow surveys to calibrate and verify the model	£190K	Short	59,931
NEWE.OT01.5	Adur and Ouse	Newhaven East	1	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£340K	Short	58,325
TONB.OT01.2	Medway	Tonbridge	1	Catchment wide/ Overflow locations	Hydraulic model to be improved and upgraded	£150K	Short	45,768
HERN.SC01.1	Stour	May Street Herne Bay	1	West Brook estuary	West Brook joins the sea as a large surface water sewer west of Hampton. There is a reasonable amount of open space to accommodate SuDS.	£TBC	Short to Medium	43,011

Prioritised Investment Needs Summary Table Identified for Surface Water Management (PO10)

Reference	River Basin	Catchment	Risk Band	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
HERN.PW02.1	Stour	May Street Herne Bay	1	New Thanet Way (A299)	Partnership opportunity: Work with local councils to mitigate runoff from A299, that could be captured, attenuated and treated in reed beds (or similar) along the side of the motorway as a more sustainable solution, before being treated at the Works	£TBC	Short to Medium	43,011
HERN.OT01.6	Stour	May Street Herne Bay	1	Catchment Wide	Hydraulic Model Improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£150K	Short	43,011
QUEE.SC01.1	North Kent	Queenborough	1	Coastal areas	Work with local council to mitigate surface water flooding in coastal areas through implementation of SuDS	£TBC	Medium to Long	38,684
QUEE.SC01.2	North Kent	Queenborough	1	Northern and Southwest part of catchment	Surface water separation to provide a long term solution to reduce flooding in the town and storm overflow discharges	£1,000K	Short to Medium	38,684
QUEE.PW01.4	North Kent	Queenborough	1	The Broadway / The Leas / Southsea Avenue	Drainage Area Plan (DAP) Option: Local sewer upsizing and new rider sewer on Southsea Avenue, Seaside Avenue and The Leas. New flow diversion chamber, online storage tank and upsize local sewers in The Broadway.	£TBC	Short	38,684
QUEE.PW01.6	North Kent	Queenborough	1	Delamark Road / Broadway / High Street	DAP Option: Construct new storage tank, foul sewer and reconstruct existing manhole with a new weir	£TBC	Short	38,684
QUEE.PW01.7	North Kent	Queenborough	1	Barton Hill Drive	DAP Option: Upsize sections of local sewers and construct new sewer and box culvert. Connect 12 properties in Lower Road and Barton Hill Drive to the new sewer in Barton Hill Drive.	£TBC	Short	38,684
QUEE.PW01.9	North Kent	Queenborough	1	Castlemere Avenue / Dumergue Avenue	DAP Option: Upsize and relay sections of local sewers and increase pumping capacity at Rushenden Road WPS. Transfer all pumped flows from Drove Road WPS directly to the inlet works at Queenborough WTW.	£TBC	Short	38,684
QUEE.PW01.10	North Kent	Queenborough	1	Oak Lane / Cliff Gardens	DAP Option: Abandon sewer connection in Chequers Road and sections of local sewer. Construct new flow diversion chamber and WPS with rising main. Upsize local sewers in Oak Avenue and Oak Lane.	£TBC	Short	38,684
QUEE.OT01.3	North Kent	Queenborough	1	Wards Hill WPS	Storage or separation of surface water to reduce spill frequency below annual threshold at Wards Hill CSO (volume / area of separation to be determined)	£1,100K	Short	38,684

Prioritised Investment Needs Summary Table Identified for Surface Water Management (PO10)

Reference	River Basin	Catchment	Risk Band	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
QUEE.OT01.4	North Kent	Queenborough	1	Catchment wide	Model Study: model improvements, including flow survey to calibrate and verify the model	£150K	Short	38,684
TUWS.OT01.4	Medway	Tunbridge Wells South	1	Catchment Wide	Model Study: Surveys and reverification to improve model confidence and accuracy of simulations.	£225K	Short	29,800
HAIS.OT01.4	Cuckmere and Pevensey	Hailsham South	1	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£200K	Short	29,543
FAVE.OT01.8	North Kent	Faversham	1	Catchment wide	Hydraulic Model improvements: Surveys and reverification to improve model confidence and accuracy of simulations.	£300K	Short	26,291
HAIN.OT01.5	Cuckmere and Pevensey	Hailsham North	1	Catchment Wide	Study: Model improvements, including flow surveys for storm and dry weather flow, and model calibration.	£300K	Short	12,023
PAWD.PW01.9	Medway	Paddock Wood	1	Whetsted Road	Growth DAP Option: upsize surface water sewers; construct new surface water sewer	£TBC	Long	10,038
PAWD.OT01.3	Medway	Paddock Wood	1	Catchment wide/ Overflow Locations	Model Study: Hydraulic surveys and verification to improve model confidence and accuracy of network simulations	£190K	Short	10,038

Drainage and Wastewater Management Plan

Investment Plan for Wastewater Compliance and Pollution

Planning Objectives 2, 6 and 8

DRAFT FOR CONSULTATION

June 2022

Introduction

This Investment Plan for compliance and pollution sets out the Investment Needs to reduce the risks of non-compliance with the permits for our wastewater treatment works that are issued by the EA and wider permits to reduce the risks of pollution.

Our DWMP is a risk-based plan. It uses data and evidence to assess the risk of non-compliance with permits and pollution incidents in 2020 (the base year) and, where possible, for future risks up to 2050. The future risk assessment takes into account the impacts of future development and growth, climate change, and urban creep - which is the building of extensions and the paving over of gardens/driveways and asset deterioration.

The options set out in this plan are the Investment Needs that are required to reduce the risks from compliance and pollution to Band 0 (not significant level of risk). The methodology for the risk assessments, including the thresholds for the three risk bands, can be found on our website. The thresholds may need to be reviewed and changed for future cycles of the DWMP to reflect customer feedback as well as changes in national guidance or legislation.

The options and investment needs are not committed funding but an identification of the needs for funding. We will include these options in our future business plans as part of the Ofwat periodic review of water company funding to secure the investment needed to implement these options. The question of affordability of these investment needs will be discussed with our customers as part of the business planning process.

Background

The Environment Agency (EA) sets limits on the quality and quantity of treated effluent from wastewater treatment works (WTWs) to ensure discharges do not cause an unacceptable impact on the environment. These are set in permits that are issued to us by the EA.

A consent or permit can be a prescriptive or a descriptive licence:

a) 295 of our WTWs have a prescriptive licence.

b) 72 of our WTWs, mainly our very small WTWs, have a descriptive licence.

The EA sets conditions in our permits based on the nature and sensitivity of the local environment and the receiving waterbody. A prescriptive permit sets limits on the pollutants that can be released to the environment so that they do not cause any harm. In the case of a descriptive permit, specific numerical conditions are not set.

Our DWMP identifies the investment needed to ensure we remain compliant with the permits for our 367 WTWs. The risk of non-compliance with our environmental permits as a result of the performance of our wastewater treatment works are considered under the following Planning Objectives:

- PO2 Risk of Pollution
- PO6 WTW Water Quality Compliance
- PO8 WTW Dry Weather Flow Compliance.

Risk of Pollution (PO2)

The national guidance requires us to look at our historical pollution incidents records from 2017 – 2019 to derive our baseline for 2020. Using these records, we identified that the root causes of pollution incidents tend to be due to four main reasons:

- Blockages in our wastewater system
- Rising main bursts
- Electrical and mechanical failure
- Other operational failures in our wastewater system.

The Investment Needs are based on the options to tackle these causes of risk.

Wastewater Treatment Works Water Quality Compliance (PO6)

The consent conditions set by the EA usually include details of the composition of our treated effluent and stipulates the effluent quality standards. The parameters include biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), pH, ammonia (NH3), Nitrate (NO3) and Phosphorus (P). We are also required to monitor metals at some of our sites and, in a few of our sites we also have UltraViolet (UV) treatment installed to disinfect effluent before it is discharged to the environment. This is particularly important when the effluent is hydrologically connected to Shellfish Waters and Bathing Waters where it could impact human health. The performance of the UV plants has not been assessed in this first cycle of the DWMP.

Our methodology for PO6 on Wastewater Treatment Works Compliance assessed our current and future risk of breaching the consented treated effluent quality standards for each of our 295 WTW with full licences. We assessed our current (2020) quality compliance risk by reviewing our historical effluent quality results along with our asset performance and condition records.

Future quality compliance risk was determined by estimating the 2050 population, taking into account any anticipated growth in the catchment as set out in our technical summary on growth, and used this to determine the theoretical capacity to treat the wastewater using the existing WTW infrastructure.

Wastewater Treatment Works Dry Weather Flow Compliance (PO8)

Dry Weather Flow (DWF) is the average daily flow that we expect to reach our WTW during a period without rain. DWF has four main components: domestic wastewater, trade effluent, cess imports and infiltration.

We have 308 WTW sites with DWF permits where our assets are permitted to have observed DWF flows up to the specified consented DWF flow rates. Our BRAVA methodology for PO8 assessed our current and future risk of breaching these flow rates.

For each WTW, we looked at our current (2020) DWF compliance risk by assessing the capacity in the treatment works to take additional flow. This was done by comparing our permitted DWF with the observed “baseline” DWF flow data for 2020.

Future DWF compliance risk was determined by estimating the 2050 population taking any anticipated growth in the catchment into account as set out in our technical summary on growth, and used this to determine the theoretical increase in DWF. We considered and updated the flow where more stringent targets are anticipated or confirmed for the current investment cycle (AMP7).

Investment Needs for Pollution Risk (PO2)

We found that many of the Investment Needs identified in our DWMP have already been addressed in our Pollution Incident Reduction Plan (PIRP). This is an ongoing operational programme that is focused on reducing pollution incidents. It is focused on addressing operational issues and processes to improve the resilience of our assets. This leads to a fast paced delivery programme that really protects the environment. Future cycles of the DWMP will need keep pace with operational programmes and aim to more up to date data in assessing the risks. Our DWMP takes our pollution aspirations and builds on the PIRP to give us a long term strategy to deliver zero pollution.

The investment needs associated with increasing our resilience and reducing pollution incidents are listed in Annex A. The process for developing and costing these options is explained in our Technical Summary on Options Development and Appraisal on our website.

The main solutions we have identified in the Investment Needs to address the risk of pollution are:

- Capital maintenance to improve the resilience of wastewater pumping stations (WPSs) and WTWs.
- Customer education campaigns to reduce the amount of un-flushables and FOG (fats, oils and grease) that cause blockages in the wastewater network.
- Enhanced maintenance to target sewer jetting in parts of the wastewater network susceptible to blockages.
- Sewer rehabilitation to repair burst rising mains.

The cost of investment needs to address has been estimated by considering the following elements:

- A £3 million allowance for baseline capital expenditure (Capex) to improve the resilience of WTWs attributed to pollution incidents.
- An assumption that a sewer jetting and customer education campaign would be 25% effective in reducing the number of pollution incidents attributed to blockages.
- An assumption that sewer rehabilitation would be 50% effective in reducing the number of pollution incidents attributed to rising main bursts.
- Implementing named schemes funded under our AMP7 business plan to improve resilience at WTWs. These would reduce the risk to Band 0.

The proposed options to address pollution risk (PO2) have been prioritised in accordance with the following criteria:

1. The number of incidents reduced by the proposed solution.
2. Risk of pollution is current (2020 baseline) and requires investment in the short term.

The timing of investments in the short term will reduce the existing risk of pollution to Band 0 and align with our commitment to tackling the legacy of pollution and protect the environment for future generations.

Investment Needs for WTW Water Quality (PO6) and DWF (PO8) Compliance

The Investment Needs in Annex B have been identified to mitigate the risks associated with PO6 through the risk assessment and options development and appraisal processes. The DWMP has drawn upon the knowledge and experience of our specialist Wastewater Process Engineers. We looked at the capacity of our existing WTW and identified and costed the additional scope of work required to mitigate the specific risks associated with PO6 at each WTW. These needs have been prioritised to reduce the current (2020) and future (2050) risks of non-compliance across our WTWs.

The investment needs in Annex C have been identified to mitigate the risks associated with PO8. These have been prioritised to either mitigate existing (2020) risks based on current hydraulic capacity issues, or future (2050) risks based on anticipated population growth. These needs are based on known risks, and best available technology. There are likely to be technological improvements in treatment which may in part offset future challenges from nitrate, phosphate and chemicals. Our plan needs to remain flexible and adapt to these future changes.

Our technical summary on Options Development and Appraisal on our website provides the details on how the options have been developed and costed for inclusion in the table below.

Our Investment Needs mitigate the risks associated with non-compliance with our consents. We will be fully compliant with all our permits and work with our partners, including the EA, to understand how our permits might need to develop in the future to meet our environmental and social obligations.

The following suite of options to address the risk of WTW Water Quality and Dry Weather Flow Compliance have been identified in the Investment Needs to:

- Increase wastewater treatment capacity.
- Reduce water consumption at point of distribution to a target of 100 litres per head per day using a regional water efficiency campaign.
- Reduce infiltration in the wastewater system by rehabilitating sewers in poor condition.

The cost of the Investment Needs to address PO6 and PO8 has been estimated by considering the following elements:

- Proposing specific improvements / upgrades to the following treatment process elements which would reduce the risk to Band 0:
    - Primary Settlement Tank (upgrade in diameter).
    - Final Settlement Tank / Humus Tank (upgrade in diameter).
    - Submerged Aerated Filter (upgrade in volume / capacity).

  - Activated Sludge Process (upgrade in volume / capacity).
  - Aeration Tank (upgrade in loading rate).
- Applying unit cost rates for treatment units using historical scheme data
- Proposing preferred options from our growth related Drainage Area Plan (DAP) studies to reinforce the wastewater system for future developments
- Implementing named schemes funded under our AMP7 business plan to address the risk of compliance failure at WTWs. These would reduce the risk to Band 0

The proposed solutions to address WTW compliance (PO6 and PO8) have been prioritised in accordance with the following criteria and order:

1. Risk of non-compliance is current (2020 baseline) and requires investment in the short term
2. Risk of non-compliance is forecast for the future (up to 2050) and requires investment in the short to medium term
3. Size of population equivalent served by the WTW

The timing of investments in the short term will aim to reduce the existing risk of non-compliance to Band 0.

Southern Water
June 2022

DWMP Investment Plan for Wastewater Compliance and Pollution

Annex A: Pollution Risk (Planning Objective 2)

1. The options listed in the DWMP Investment Needs below are the preferred options in our DWMP. They will need further refinement as we implement the DWMP to confirm the exact location and scope of action needed, and the cost.

2. The costs are indicative costs for planning purposes only. The basis for the cost estimates, including assumptions and uncertainties, are explained in our DWMP Investment Plans.

3. The table of Investment Need provides an indicative cost so we know what level of funding is needed to reduce the risks. It is not a commitment to fund or deliver any option.

4. The Indicative Timescale is when the investment is needed. Short term means before 2030 (AMP8), medium term between 2030 and 2040 (AMP9 &10), and long term between 2040 and 2050 (AMP 11 & 12). Some options may take several investment periods to achieve the desired outcomes.

5. Potential Partners have been identified in the table of Investment Needs. This is to indicate where there may be opportunities for us to work with these partners when developing and delivering these options. It is not a commitment by any of the partners to work with us.

6. These options will inform our future business plans as part of the Ofwat periodic review process to secure the finance to implement these options.

7. The options listed are prioritised by the method stated in the Programme Appraisal Technical Summary.

Date : May 2022

Version : 1.0

Prioritised Investment Needs Summary Table Identified for Pollution Risk (PO2)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
PEEL.PW01.13	East Hampshire	Peel Common	2	Catchment Wide	Improve resilience of WPS across the catchment to reduce risk of pollution	£3,725K	Short	24	£155K
SWAL.PW02.3	Stour	Swalecliffe	2	Swalecliffe WTW	Improved Resilience: Wastewater Treatment Works	£6,970K	Short	14	£498K
HABX.PW02.1	Cuckmere and Pevensey	Bexhill And Hastings	1	Bexhill & Hastings WTW	Improve resilience of Bexhill and Hastings WTW to reduce risk of pollution	£6,970K	Short- Medium	7	£996K
BROM.PW02.1	Stour	Broomfield Bank	2	BROOMFIELD BANK WTW	Enhanced maintenance to improve WTW resilience and reduce pollution incidents	£6,970K	Short	6	£1,162K
TONB.PW01.1	Medway	Tonbridge	2	Priory Mill, Hilden Park, Hildenborough	Improve resilience of Priory Mill WPS, Hilden Park WPS, Hildenborough WPS to reduce risk of pollution	£930K	Short to Medium	5	£186K
HABX.PW01.4	Cuckmere and Pevensey	Bexhill And Hastings	1	Galley Hill Bexhill WPS Rock A Nore Hastings WPS Chestnut Walk Bexhill WPS	Improve resilience of Galley Hill Bexhill WPS, Rock A Nore Hastings WPS and Chestnut Walk Bexhill WPS to reduce risk of pollution	£700K	Short	5	£140K
CHEA.PW01.3	Test and Itchen	Chickenhall Eastleigh	1	Botley Road Horton Heath WPS	Improve resilience: Review operation and maintenance of Botley Road Horton Heath WPS pumping station to improve resilience	£930K	Short	5	£186K
EALP.PW02.1	Cuckmere and Pevensey	Eastbourne	1	Eastbourne WTW	Improve resilience of Eastbourne WTW to reduce pollution risk	£6,970K	Short-Medium	5	£1,394K
TUWS.PW02.2	Medway	Tunbridge Wells South	2	Tunbridge Wells South WTW	Enhanced maintenance to improve WTW resilience and reduce risk of pollution	£6,970K	Short	4	£1,743K
STAP.PW02.1	Medway	Staplehurst	2	Staplehurst WTW	Improve resilience of Staplehurst WTW to reduce pollution incidents	£1,000K	Short to Medium	4	£250K
SLOW.PW02.1	New Forest	Slowhill Copse Marchwood	2	Slowhill Copse Marchwood WTW	Improve resilience: Identify potential locations across the catchment for suface water removal to enhance the efficacy of the existing tertiary treatment at the works and reducing storm spills	£695K	Short	4	£174K
PENN.PW01.12	New Forest	Pennington	1	Peters Lane New Milton WPS	Improve resilience: Review operation and maintenance of Peters Lane New Milton pumping station to improve resilience	£235K	Short	4	£59K
PENN.PW01.13	New Forest	Pennington	1	Holly Lane Ashely WPS	Improve resilience: Review operation and maintenance of Holly Lane Ashely pumping station to improve resilience	£235K	Short	4	£59K
BOSH.PW01.1	Arun and Western Streams	Bosham	2	Taylors Lane Bosham WPS	Improve Resilience: Wastewater Pumping Stations	£235K	Short	3	£78K
SLOW.PW01.2	New Forest	Slowhill Copse Marchwood	2	Downes Park Totton WPS	Improve resilience: Review operation and maintenance of Downes Park Totton pumping station to improve resilience	£465K	Short	3	£155K
HERN.PW01.7	Stour	May Street Herne Bay	2	Kings Hall Herne Bay WPS and Eddington Lane Herne Bay WPS	Improve resilience of Kings Hall Herne Bay WPS to reduce risk of pollution	£465K	Short to Medium	3	£155K

Prioritised Investment Needs Summary Table Identified for Pollution Risk (PO2)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
HERN.PW02.2	Stour	May Street Herne Bay	2	MAY STREET HERNE BAY WTW	Improve resilience of May Street Herne Bay WTW to reduce risk of pollution	£1,000K	AMP7	3	£333K
HAIN.PW01.3	Cuckmere and Pevensey	Hailsham North	2	Upper Dicker WPS	Improve resilience of Upper Dicker WPS to reduce risk of pollution	£235K	Short	3	£78K
TUWN.PW02.1	Medway	Tunbridge Wells North	2	Tunbridge Wells North WTW	Enhanced maintenance to improve WTW resilience and reduce pollution incidents	£6,970K	Short	3	£2,323K
WEHB.PW02.1	Stour	Margate And Broadstairs	1	Weatherlees Hill B WTW	Enhanced maintenance to improve WTW resilience and reduce pollution incidents	£6,970K	Short	3	£2,323K
WEAT.PW01.8	Stour	Weatherlees Hill	1	KING STREET, ALLENBY ROAD, TELHAM AVENUE, CANTERBURY ROAD WEST, FLORA ROAD & THE STRAND	Targeted CCTV or electroscan surveys and proactive sewer rehabilitation to reduce risk of pollution due to poor pipe condition	£2,535K	Short	3	£845K
PEEL.SC03.7	East Hampshire	Peel Common	2	Catchment Wide	Targeted Customer Education Programme to prevent blockages	£115K	Short	2.75	£42K
PEEL.PW01.17	East Hampshire	Peel Common	2	Catchment Wide	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capcity of the network for rainfall	£125K	Short	2.75	£45K
TUWS.PW01.3	Medway	Tunbridge Wells South	2	Florence Farm Groombridge WPS	Rehabilitation of rising main and components to reduce bursts and pollution incidents	£2,110K	Short	2.5	£844K
BROM.PW01.3	Stour	Broomfield Bank	2	Folkestone Junction WPS	Enhanced maintenance to improve WPS resilience and reduce pollution incidents	£465K	Short	2	£233K
BROM.PW01.4	Stour	Broomfield Bank	2	Elizabeth Street Dover WPS	Enhanced maintenance to improve WPS resilience and reduce pollution incidents	£465K	Short	2	£233K
FAVE.PW01.4	North Kent	Faversham	2	Abbeyfields WPS & Hazebrouk Road WPS	Enhanced maintenance to improve WPS resilience and reduce pollution incidents	£930K	Short	2	£465K
FULL.PW01.2	Test and Itchen	Fullerton	2	Furzedown Lane Amport WPS	Improve resilience: Review operation and maintenance of Furzedown Lane Amport pumping station to improve resilience	£235K	Short	2	£118K
HAIS.PW01.1	Cuckmere and Pevensey	Hailsham South	2	Bolney Wood Hailsham WPS Dittons Road No2 WPS	Improve resilience of Bolney Wood Hailsham WPS and Dittons Road No2 WPS to reduce the risk of pollution incidents	£465K	Short	2	£233K
BAST.PW01.6	Test and Itchen	Barton Stacey	2	St Mary Bourne WPS	Improve resilience: Review operation and maintenance of St Mary Bourne pumping station to improve resilience	£235K	Short	2	£118K
CANT.PW01.3	Stour	Canterbury	1	Tile Kiln Hill Blean WPS and North Honey Hill WPS	Improve resilience of Tile Kiln Hill Blean WPS and North Honey Hill WPS to reduce risk of pollution	£465K	Short to Medium	2	£233K
CANT.PW01.8	Stour	Canterbury	1	Catchment wide	Pipe rehabilitation programme: CCTV surveys, sewer integrity checks, re-lining and renewal of assets	£6,045K	Short to Long	2	£3,023K
NEWE.PW01.1	Adur and Ouse	Newhaven East	1	Ham Lane Lewes New WPS	Improved Resilience: Wastewater Pumping Station	£235K	Short	2	£118K

Prioritised Investment Needs Summary Table Identified for Pollution Risk (PO2)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
NEWE.PW02.1	Adur and Ouse	Newhaven East	1	Newhaven East WTW	Improved Resilience: Wastewater Treatment Works	£6,970K	Short - Medium	2	£3,485K
HONE.PW01.1	Arun and Western Streams	Horsham New	1	Five Oaks Road Broadbridge Heath Wps, Langhurstwood Road Horsham Wps	Improved Resilience: Wastewater Pumping Stations	£465K	Short	2	£233K
SAND.SC03.2	Isle of Wight	Sandown	2	Catchment wide	Enhanced customer education plan to reduce blockages within the catchment. We will be linking in with 'FOG' team.	£115K	Short	1.75	£66K
HORS.SC03.1	Medway	Horsmonden	2	Catchment wide	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	1.75	£66K
HORS.PW01.2	Medway	Horsmonden	2	Catchment wide	Enhanced maintenance: proactive jetting	£80K	Short to Long	1.75	£46K
POOD.SC03.5	Test and Itchen	Portswood	2	Bassett, Harefield, Townhill Park	Enhanced Customer Education Programme to prevent pollution incidents	£115K	Short to Medium	1.75	£66K
POOD.PW01.19	Test and Itchen	Portswood	2	Bassett, Harefield, Townhill Park	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall.	£80K	Short to Medium	1.75	£46K
MOTN.SC03.1	Medway	Motney Hill	1	High Street & A2 Rochester; Best Street & High Street Chatham; Jeffery Street, Canterbury Street & Barnsole Road Gillingham	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	1.5	£77K
MOTN.PW01.15	Medway	Motney Hill	1	Canterbury Street, Balmoral Road, King Street, High Street GILLINGHAM; High Street CHATHAM; A2 / High Street ROCHESTER; Luton Road LUTON	Enhanced sewer jetting programme to reduce blockages from FOG and unflushables in the sewer network.	£775K	Short to long	1.5	£517K
BROM.SC03.2	Stour	Broomfield Bank	2	Catchment Wide	Target customers with a campaign to reduce FOG (fats, oils & greases) and unflushables discharged into the sewer network.	£115K	Short to long	1.25	£92K
BROM.PW01.8	Stour	Broomfield Bank	2	BUCKLAND AVENUE DOVER, SHORT LANE ALKHAM, DARLINGHURST ROAD FOLKESTONE, ALKHAM ROAD TEMPLE EWELL	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£55K	Short to long	1.25	£44K
BUDD.SC03.2	East Hampshire	Budds Farm Havant	1	Hotspot 1 - BUDDs Farm WTW Hotspot 2 - Farlington Hotspot 3 - Havant	Enhanced Customer Education Programme to prevent blockages	£115K	Short to Medium	1.25	£92K
SWAL.PW01.27	Stour	Swalecliffe	2	WHITEBRIDGE FARM SEASALTER WPS	Improve resilience at WPS to reduce operational faults causing pollution incidents	£700K	Short	1	£700K
SWAL.PW01.28	Stour	Swalecliffe	2	STATION ROAD WHITSTABLE WPS	Improve resilience at WPS to reduce operational faults causing pollution incidents	£700K	Short	1	£700K

Prioritised Investment Needs Summary Table Identified for Pollution Risk (PO2)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
SWAL.PW01.29	Stour	Swalecliffe	2	BROOK ROAD SWALECLIFFE NEW WPS	Improve resilience at WPS to reduce operational faults causing pollution incidents	£700K	Short	1	£700K
SWAL.PW01.30	Stour	Swalecliffe	2	STATION ROAD WHITSTABLE WPS	Improve resilience at WPS to reduce operational faults causing pollution incidents	£700K	Short	1	£700K
TONB.SC03.1	Medway	Tonbridge	2	Catchment wide	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	1	£115K
TUWS.PW01.4	Medway	Tunbridge Wells South	2	Ferrars Estate Hawkenbury WPS	Enhanced maintenance to improve WPS resilience and reduce risk of pollution	£235K	Short	1	£235K
TONB.PW01.6	Medway	Tonbridge	2	Catchment wide	Enhanced maintenance: proactive jetting	£45K	Short	1	£45K
HORS.PW01.3	Medway	Horsmonden	2	Sovereigns Way Marden Old Works WPS	Improve resilience of Marden Old Works WPS to reduce pollution incidents	£235K	Short to Long	1	£235K
HORS.PW02.1	Medway	Horsmonden	2	HORSMONDEN WTW	Improve resilience of Horsmonden WTW to reduce pollution incidents	£1,000K	Short to Medium	1	£1,000K
STAP.PW01.1	Medway	Staplehurst	2	Staplehurst WTW, Bathurst Road Staplehurst WPS	Improve resilience of pumping stations to reduce pollution incidents due to operational failures	£235K	Short	1	£235K
FAVE.PW02.1	North Kent	Faversham	2	Faversham Wastewater Treatment Works (WTW)	Enhanced maintenance to improve WTW resilience and reduce pollution incidents	£6,970K	Short	1	£6,970K
HAIS.PW02.1	Cuckmere and Pevensey	Hailsham South	2	Hailsham South WTW	Improve resilience of Hailsham South WTW to reduce risk of pollution incidents	£6,970K	Short - Medium	1	£6,970K
QUEE.PW01.1	North Kent	Queenborough	2	Minster	Pipe rehabilitation programme: CCTV surveys, sewer integrity checks, re-lining and renewal of rising mains (including coastal areas to reduce infiltration of sea water)	£40K	Short to Medium	1	£40K
CHAR.PW01.1	Stour	Chartham	2	Chartham Green WPS	Improved resilience at Chartham Green WPS to reduce the risk of pollution.	£235K	Short	1	£235K
CHAR.PW01.2	Stour	Chartham	2	Horton Crossing WPS & Shalmsford Street Chartham WPS Rising Mains	Proactive rehabilitation of rising mains to improve WPS resilience	£845K	Short	1	£845K
DAMB.PW01.5	Stour	Dambridge Wingham	2	Grove Road Preston WPS	Enhanced maintenance to improve WPS resilience and reduce pollution incidents	£235K	Short	1	£235K
CRRM.PW02.1	Medway	Redgate Mill Crowborough	2	Redgate Mill Crowborough WTW	Improve resilience of the WTW to reduce pollution incidents	£6,970K	AMP7	1	£6,970K
HARE.PW02.1	Test and Itchen	Harestock	2	Harestock WTW	Improve resilience: Review operation and maintenance of Harestock WTW to improve resilience	£6,970K	Short	1	£6,970K
CHEA.PW02.1	Test and Itchen	Chickenhall Eastleigh	1	Chickenhall Eastleigh WTW	Improve resilience: Review operation and maintenance of Chickenhall Eastleigh WTW to improve resilience	£6,970K	Short	1	£6,970K
WEHB.PW01.2	Stour	Margate And Broadstairs	1	Margate WPS	Enhanced maintenance to improve WPS resilience and reduce pollution incidents	£235K	Short	1	£235K

Prioritised Investment Needs Summary Table Identified for Pollution Risk (PO2)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
MOTN.PW01.13	Medway	Motney Hill	1	Lower Rainham WPS	Improve resilience of Lower Rainham WPS to reduce pollution incidents	£465K	Short	1	£465K
MOTN.PW01.14	Medway	Motney Hill	1	The Strand Gillingham WPS	Improve resilience of the Strand WPS in Gillingham to reduce pollution incidents	£465K	Short	1	£465K
SIDL.PW02.1	Arun and Western Streams	Sidlesham	1	Sidlesham WTW	Improved Resilience: Treatment Works	£6,970K	Medium	1	£6,970K
RYEW.PW01.1	Rother	Rye	1	Wish Street Rye WPS	Improved Resilience: Wastewater Pumping Station	£235K	Short	1	£235K
MORE.PW01.2	Test and Itchen	Morestead Road Winchester	1	Garnier Road Winchester WPS	Improve resilience: Review operation and maintenance of Garnier Road Winchester WPS pumping station to improve resilience	£235K	Short	1	£235K
FAIR.SC03.1	Rother	Fairlight	2	Catchment Wide	Enhanced maintenance: Customer Education	£115K	Short	0.75	£153K
FAIR.PW01.2	Rother	Fairlight	2	Catchment Wide	Enhanced maintenance: Proactive Jetting	£35K	Short	0.75	£47K
CHEA.SC03.2	Test and Itchen	Chickenhall Eastleigh	1	Hotspot 1 - Hiltingbury	Enhanced Customer Education Programme to prevent blockages	£115K	Short to Medium	0.75	£153K
CHEA.PW01.9	Test and Itchen	Chickenhall Eastleigh	1	Hotspot 1 - Hiltingbury / Chandler's Ford	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall.	£35K	Short	0.75	£47K
WOOL.SC01.2	Test and Itchen	Woolston	1	Hotspot 1 - Harefield	Enhanced Customer Education Programme to prevent pollution incidents	£115K	Short to Medium	0.75	£153K
WOOL.PW01.20	Test and Itchen	Woolston	1	Hotspot 1 - Harefield	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall, specifically by jetting known gravel issues in these sewers.	£35K	Short	0.75	£47K
SIDL.SC03.2	Arun and Western Streams	Sidlesham	1	Street End	Enhanced maintenance: Customer Education	£115K	Short	0.75	£153K
SIDL.PW01.5	Arun and Western Streams	Sidlesham	1	Street End	Enhanced maintenance: Proactive Jetting	£35K	Short	0.75	£47K
SWAL.SC03.1	Stour	Swalecliffe	2	High Street, West Cliff Whitstable, Marine Parade, Herne Bay Road, Lucerne Road	Target customers with a campaign to reduce FOG (fats, oils & greases) and unflushables discharged into the sewer network.	£115K	Short to long	0.5	£230K
SWAL.PW01.31	Stour	Swalecliffe	2	THANET WAY CHESTFIELD WHITSTABLE & RADFALL CORNER CHESTFIELD WHITSTABLE	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£25K	Short to long	0.5	£50K

Prioritised Investment Needs Summary Table Identified for Pollution Risk (PO2)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
STAP.SC03.2	Medway	Staplehurst	2	Catchment Wide	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	0.5	£230K
STAP.PW01.3	Medway	Staplehurst	2	Catchment wide	Enhanced maintenance: proactive jetting	£25K	Short	0.5	£50K
POOD.PW01.17	Test and Itchen	Portswood	2	Harefield	Targeted CCTV/Electroscan surveys and proactive sewer rehabilitation to reduce pollution risk.	£65K	Short to Medium	0.5	£130K
BOSH.SC03.1	Arun and Western Streams	Bosham	2	Taylor Lane	Enhanced maintenance: Customer Education	£115K	Short	0.5	£230K
BOSH.PW01.5	Arun and Western Streams	Bosham	2	Taylor Lane	Enhanced maintenance: Proactive Jetting	£25K	Short	0.5	£50K
HERN.SC03.2	Stour	May Street Herne Bay	2	Park Place and Sea Street	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewer network	£115K	Short	0.5	£230K
HERN.PW01.10	Stour	May Street Herne Bay	2	Kings Hall Herne Bay WPS and Eddington Lane Herne Bay WPS areas	Enhanced maintenance: proactive jetting	£25K	Short	0.5	£50K
HAIS.PW01.4	Cuckmere and Pevensey	Hailsham South	2	Polegate	Sewer CCTV surveys, integrity checks and re-lining/enforcement	£65K	Short	0.5	£130K
TUWN.SC03.2	Medway	Tunbridge Wells North	2	Catchment Wide	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	0.5	£230K
QUEE.SC03.1	North Kent	Queenborough	2	Sheerness area	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	0.5	£230K
QUEE.SC03.2	North Kent	Queenborough	2	Sheerness area	Enhanced maintenance: proactive jetting	£195K	Short	0.5	£390K
PAWD.PW01.2	Medway	Paddock Wood	2	Catchment Wide	Pipe rehabilitation programme: CCTV surveys, sewer integrity checks, re-lining and renewal of sewers to reduce pollution events	£420K	Short to Medium	0.5	£840K
DAMB.PW01.8	Stour	Dambridge Wingham	2	Grove Road Preston WPS	Proactive sewer rehabilitation to reduce risk of rising main bursts	£420K	Short	0.5	£840K
BAST.PW01.8	Test and Itchen	Barton Stacey	2	Hurstbourne Park Estate (On Bourne Rivulet)	Targeted CCTV/Electroscan surveys and proactive sewer rehabilitation to reduce risk of pollution	£65K	Short	0.5	£130K
CRRM.SC03.2	Medway	Redgate Mill Crowborough	2	Catchment Wide	Enhanced maintenance: Customer education	£115K	Short	0.5	£230K
WOOL.PW01.16	Test and Itchen	Woolston	1	Woolston	Targeted CCTV/Electroscan surveys and proactive sewer rehabilitation to reduce pollution risk.	£65K	Short	0.5	£130K

Prioritised Investment Needs Summary Table Identified for Pollution Risk (PO2)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
RYEW.PW01.4	Rother	Rye	1	Old Town	Pipe rehabilitation programme: CCTV surveys, sewer integrity checks and re-lining to reduce infiltration and pollution incidents	£65K	Short	0.5	£130K
TUWS.SC03.2	Medway	Tunbridge Wells South	2	Coniston Avenue, Tunbridge Wells	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	0.25	£460K
HAIN.SC03.2	Cuckmere and Pevensey	Hailsham North	2	Upper Horsebridge	Enhanced maintenance: Customer Education	£115K	Short	0.25	£460K
HAIN.PW01.8	Cuckmere and Pevensey	Hailsham North	2	Upper Horsebridge	Enhanced maintenance: Proactive Jetting	£10K	Short	0.25	£40K
FAVE.SC03.2	North Kent	Faversham	2	Area upstream of Abbeyfields WPS	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	0.25	£460K
FAVE.PW01.5	North Kent	Faversham	2	Area upstream of Abbeyfields WPS	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£10K	Short	0.25	£40K
PAWD.SC03.1	Medway	Paddock Wood	2	High Street	Enhanced and targeted customer education campaign to reduce FOG and unflushable items in the sewers	£115K	Short	0.25	£460K
PAWD.PW01.3	Medway	Paddock Wood	2	Catchment Wide	Enhanced maintenance: proactive jetting	£10K	Short	0.25	£40K
DAMB.SC03.1	Stour	Dambridge Wingham	2	Catchment wide	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short to long	0.25	£460K
DAMB.PW01.6	Stour	Dambridge Wingham	2	Network upstream of Grove Road Preston WPS	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£10K	Short to long	0.25	£40K
LIDS.SC03.1	Arun and Western Streams	Lidsey	2	Barnham, Westergate	Enhanced maintenance: Customer Education	£115K	Short	0.25	£460K
LIDS.PW01.3	Arun and Western Streams	Lidsey	2	Barnham, Westergate	Enhanced maintenance: Proactive Jetting	£10K	Short	0.25	£40K
HARE.SC03.2	Test and Itchen	Harestock	2	Kings Worthy	Enhanced Customer Education Programme to prevent blockages	£115K	Short to Medium	0.25	£460K
HARE.PW01.3	Test and Itchen	Harestock	2	Kings Worthy	Enhanced Maintenance: Review and enhance jetting programme of the pipe network in this location to maximise the capacity of the network for rainfall.	£10K	Short	0.25	£40K
WEHB.SC03.2	Stour	Margate And Broadstairs	1	Harbour Street Broadstairs	Target customers with a campaign to reduce FOG (fats, oils & greases) and unflushables discharged into the sewer network.	£115K	Short to long	0.25	£460K

Prioritised Investment Needs Summary Table Identified for Pollution Risk (PO2)

Reference	River Basin	Catchment	Risk Band 2020	Location	Option	Indicative Cost	Indicative Timescales	Incident Reduction	Option Cost/ Incident
WEHB.PW01.1	Stour	Margate And Broadstairs	1	Old Town and Margate Beach	Improve frequency of sewer jetting to reduce FOG and unflushables discharged into the sewer network.	£880K	Short to long	0.25	£3,520K
CANT.SC03.2	Stour	Canterbury	1	Catchment	Target customers with a campaign to reduce FOG and unflushables discharged into the sewer network.	£115K	Short	0.25	£460K
CANT.PW01.9	Stour	Canterbury	1	Ethelbert Road, St. Margarets Street, Downs Road, North Lane, Sun Street, Castle Street, St. Peters Street, Reed Avenue, Wincheap, Palace Street, Cockering Road, Cherry Garden Road, Tyler Hill Road, Mill Road, Orchard Street, Northgate, Dover Street, St. Georges Street, Park Farm Close, Knight Avenue, St. Dunstans Street, Penshurst Close	Enhanced maintenance: proactive jetting	£525K	Short	0.25	£2,100K
SAND.OT01.6	Isle of Wight	Sandown	2	Catchment Wide	Study / Investigation: to further identify the causes of the pollution incidents.	£230K	Short	0	Required but no benefit
STAP.OT01.3	Medway	Staplehurst	2	Areas in the South	Study: Investigate infiltration and exfiltration to identify the causes and highest risk areas	£275K	Short	0	Required but no benefit
BAST.OT01.7	Test and Itchen	Barton Stacey	2	Catchment Wide	Study / Investigation: Understand and investigate the impact of trade effluents/H2S on the sewer system.	£TBC	Medium	0	Required but no benefit
HARE.OT01.1	Test and Itchen	Harestock	2	Easton	Study / Investigation: Identify causes of pollution incidents (currently unknown)	£230K	Short to Medium	0	Required but no benefit
BUDD.OT01.2	East Hampshire	Budds Farm Havant	1	Mainland Drayton WPS Hambledon Road, Waterlooville	Study / Investigation: Identify causes of pollution incidents (currently unknown)	£230K	Short to Medium	0	Required but no benefit

DWMP Investment Plan for Wastewater Compliance and Pollution

Annex B: WTW Quality Compliance (Planning Objective 6)

1. The options listed in the DWMP Investment Needs below are the preferred options in our DWMP. They will need further refinement as we implement the DWMP to confirm the exact location and scope of action needed, and the cost.

2. The costs are indicative costs for planning purposes only. The basis for the cost estimates, including assumptions and uncertainties, are explained in our DWMP Investment Plans.

3. The table of Investment Need provides an indicative cost so we know what level of funding is needed to reduce the risks. It is not a commitment to fund or deliver any option.

4. The Indicative Timescale is when the investment is needed. Short term means before 2030 (AMP8), medium term between 2030 and 2040 (AMP9 &10), and long term between 2040 and 2050 (AMP 11 & 12). Some options may take several investment periods to achieve the desired outcomes.

5. Potential Partners have been identified in the table of Investment Needs. This is to indicate where there may be opportunities for us to work with these partners when developing and delivering these options. It is not a commitment by any of the partners to work with us.

6. These options will inform our future business plans as part of the Ofwat periodic review process to secure the finance to implement these options.

7. The options listed are prioritised by the method stated in the Programme Appraisal Technical Summary.

Date : May 2022

Version : 1.0

Prioritised Investment Needs Summary Table Identified for WTW Compliance (PO6)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
BROM.PW02.2	Stour	Broomfield Bank	2	2	BROOMFIELD BANK WTW	WTW Assessment indicates there is sufficient or surplus treatment capacity in 2050	£TBC	-	114,249
TUWN.PW02.2	Medway	Tunbridge Wells North	2	2	Tunbridge Wells North WTW	Increase biological capacity at the Treatment Works	£4,170K	Short	31,414
POOD.PW02.1	Test and Itchen	Portswood	1	1	Portswood WTW	Increase capacity of the Wastewater Treatment Works to meet compliance.	£4,720K	Short to Medium	79,637
HONE.PW02.2	Arun and Western Streams	Horsham New	1	1	Horsham New WTW	Deliver associated works to increase capacity of the works.	£104,940K	Medium	66,861
TONB.PW02.1	Medway	Tonbridge	1	1	TONBRIDGE WTW	Increase biological capacity at Works	£71,790K	Medium to Long	45,768
HAIS.PW02.2	Cuckmere and Pevensey	Hailsham South	1	1	Hailsham South WTW	Deliver additional storage for Final Settlement Tanks and Submerged Aerated Filter to increase Hydraulic and Biological capacity of the works.	£1,010K	Short	29,543
STAP.PW02.2	Medway	Staplehurst	1	1	Staplehurst WTW	Increase biological process capacity at Staplehurst WTW	£745K	AMP7	5,866
SITT.PW02.1	North Kent	Sittingbourne	0	2	Sittingbourne WTW	Increase biological capacity at the Treatment Works	£100,400K	AMP7	59,931
ROMS.PW02.1	Test and Itchen	Romsey	0	2	Romsey WTW	Increase capacity of the Wastewater Treatment Works to meet compliance.	£2,010K	Medium to Long	19,056
WBER.PW02.1	Stour	Westbere	0	2	Westbere WTW	Improve WTW Treatment Capacity by increasing capacity of Final Settlement Tank	£740K	Short	6,479
WHIT.PW02.1	Test and Itchen	Whitchurch	0	2	Whitchurch WTW	Increase Capacity at the WTW.	£1,150K	Medium	4,934
FULL.PW02.1	Test and Itchen	Fullerton	0	1	Fullerton WTW	Increase capacity of the Wastewater Treatment Works to meet compliance.	£35,100K	Medium	55,810
CRRM.PW02.2	Medway	Redgate Mill Crowborough	0	1	Redgate Mill Crowborough WTW	Increase biological capacity at the Treatment Works	£35,445K	Medium to Long	22,757
THOR.PW02.1	Arun and Western Streams	Thornham	0	1	Thornham WTW	Deliver additional Primary Settlement Tank and Submerged Aerated Filter to increase Hydraulic and Biological capacity of the works.	£34,900K	Medium - Long	21,339
HAIN.PW02.1	Cuckmere and Pevensey	Hailsham North	0	1	Hailsham North WTW	Increase capacity of Hailsham North WTW for future growth	£16,055K	Medium-Long	12,023
PAWD.PW02.1	Medway	Paddock Wood	0	1	Paddock Wood WTW	Increase biological capacity at Treatment Works	£880K	AMP7	10,038
HORS.PW02.2	Medway	Horsmonden	0	1	HORSMONDEN WTW	Increase biological process capacity at Treatment Works	£1,135K	AMP7	7,766
RYEW.PW02.1	Rother	Rye	0	1	Rye WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works	£805K	Medium	5,556
TANG.PW02.1	Arun and Western Streams	Tangmere	0	1	Tangmere WTW	Deliever associated works to increase capacity of the works.	£625K	Medium - Long	5,045

Prioritised Investment Needs Summary Table Identified for WTW Compliance (PO6)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
BOSH.PW02.1	Arun and Western Streams	Bosham	0	1	Bosham WTW	Deliver additional Primary Settlement Tank and Submerged Aerated Filter to increase Hydraulic and Biological capacity of the works.	£5,665K	Medium	3,922
BAST.PW02.2	Test and Itchen	Barton Stacey	0	1	Barton Stacey WTW	Increase capacity of the Wastewater Treatment Works to meet compliance.	£730K	Medium	3,437
EALP.OT01.7	Cuckmere and Pevensey	Eastbourne	0	0	Eastbourne WTW	Study to identify and provide solution for Saline intrusion at Eastbourne WTW.	£TBC	Short	116,948

DWMP Investment Plan for Wastewater Compliance and Pollution

Annex C: WTW Dry Weather Flow Compliance (Planning Objective 8)

1. The options listed in the DWMP Investment Needs below are the preferred options in our DWMP. They will need further refinement as we implement the DWMP to confirm the exact location and scope of action needed, and the cost.

2. The costs are indicative costs for planning purposes only. The basis for the cost estimates, including assumptions and uncertainties, are explained in our DWMP Investment Plans.

3. The table of Investment Need provides an indicative cost so we know what level of funding is needed to reduce the risks. It is not a commitment to fund or deliver any option.

4. The Indicative Timescale is when the investment is needed. Short term means before 2030 (AMP8), medium term between 2030 and 2040 (AMP9 &10), and long term between 2040 and 2050 (AMP 11 & 12). Some options may take several investment periods to achieve the desired outcomes.

5. Potential Partners have been identified in the table of Investment Needs. This is to indicate where there may be opportunities for us to work with these partners when developing and delivering these options. It is not a commitment by any of the partners to work with us.

6. These options will inform our future business plans as part of the Ofwat periodic review process to secure the finance to implement these options.

7. The options listed are prioritised by the method stated in the Programme Appraisal Technical Summary.

Date : May 2022

Version : 1.0

Prioritised Investment Needs Summary Table Identified for DWF Compliance (PO8)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
SAND.PW02.2	Isle of Wight	Sandown	2	2	SANDOWN NEW WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for a DWF up to 47371m3 required due to growth in catchment (Permit Review Required)	£4,640K	Long	130,771
STOC.PW02.1	Test and Itchen	Stockbridge	2	2	Stockbridge WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the approximately extra 275m3/day DWF required due to growth in the catchment	£1,500K	Medium	824
MOTN.PW02.1	Medway	Motney Hill	1	2	Motney Hill WTW	Increase capacity of Primary and Final Settlement Tanks (review DWF permit for the WTW with the EA)	£3,850K	Short	263,577
PEEL.PW02.10	East Hampshire	Peel Common	1	2	Treatment Works	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the extra DWF required due to growth in the catchment (Permit Review required)	£4,450K	Medium	256,119
GRAV.PW02.1	Medway	Gravesend	1	2	Gravesend WTW	Increase capacity at the Works and review Dry Weather Flow permit to reduce risk of DWF compliance	£2,300K	Short to Medium	63,731
GRAV.OT01.1	Medway	Gravesend	1	2	Northen areas (River front)	Indentify areas where tidal infiltration is more significant (Infiltration validation by CCTV/electroscan surveys/flow monitors in hotspots)	£100K	Short	63,731
SITT.PW02.2	North Kent	Sittingbourne	1	2	Sittingbourne WTW	Increase capacity at the Works and review Dry Weather Flow permit to reduce risk to DWF compliance	£2,995K	Medium	59,931
FULL.PW02.2	Test and Itchen	Fullerton	1	2	Fullerton WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the approximately extra 5750m3 DWF required due to growth in catchment	£2,970K	Medium	55,810
HERN.PW02.3	Stour	May Street Herne Bay	1	2	MAY STREET HERNE BAY WTW	Increase capacity at the Treatment Works and review Dry Weather Flow permit to reduce risk of DWF compliance	£2,110K	Short to Medium	43,011
QUEE.PW02.3	North Kent	Queenborough	1	2	Queenborough WTW	Increase capacity at the Works and review Dry Weather Flow permit to reduce risk of DWF compliance	£2,490K	AMP7 & Medium	38,684
QUEE.OT01.1	North Kent	Queenborough	1	2	Seafront	Surveys to review asset condition and identify disjoints, manhole ingression and locations of saline intrusion along seafront	£100K	Short	38,684

Prioritised Investment Needs Summary Table Identified for DWF Compliance (PO8)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
TUWS.PW02.3	Medway	Tunbridge Wells South	1	2	Tunbridge Wells South WTW	Review DWF permit for the WTW with the EA, and increase capacity of Primary and Final Settlement Tanks: Link to AMP7 U_IMP5 Scheme - increase FFT from current 260 l/s to 360 l/s by 2035	£2,215K	Short	29,800
SIDL.PW02.2	Arun and Western Streams	Sidlesham	1	2	Sidlesham WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works.	£2,535K	Medium - Long	25,167
LIDS.PW02.1	Arun and Western Streams	Lidsey	1	2	Lidsey WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works.	£2,140K	Medium - Long	21,708
BUDD.PW02.2	East Hampshire	Budds Farm Havant	1	1	Budds Farm Havant WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the extra 2301m3 DWF required due to growth in catchment	£2,765K	Medium	365,496
PENN.PW02.6	New Forest	Pennington	1	1	Pennington WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the extra 3200m3 DWF required due to growth in catchment	£2,385K	Medium	50,697
SWAL.PW02.2	Stour	Swalecliffe	1	1	Swalecliffe WTW	Review DWF permit for the WTW with the EA, and increase capacity of Primary and Secondary Settlement Tanks	£1,980K	Short	37,104
THOR.PW02.2	Arun and Western Streams	Thornham	1	1	Thornham WTW	Review permit for the WTW with the EA, and deliver additional primary, secondary and tertiary treatment to increase DWF capacity of the works.	£2,205K	Medium	21,339
PAGM.PW02.1	Arun and Western Streams	Pagham	1	1	Summer land Pagham WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works.	£2,635K	Short - Medium	9,664
FAVE.PW02.4	North Kent	Faversham	0	2	Faversham WTW	Review DWF permit for the WTW with the EA, and increase capacity of Primary and Final Settlement Tanks	£2,090K	Short	26,291
DAMB.PW02.1	Stour	Dambridge Wingham	0	2	Dambridge Wingham WTW	Review DWF permit for the WTW with the EA, and increase capacity of Primary and Final Settlement Tanks	£1,540K	Short to medium	14,211
HAIN.PW02.2	Cuckmere and Pevensey	Hailsham North	0	2	Hailsham North WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works.	£1,705K	Medium-Long	12,023
WOEA.PW02.1	Adur and Ouse	East Worthing	0	1	East Worthing WTW	Review permit for the WTW with the EA, and deliver additional primary and secondary treatment to increase DWF capacity of the works.	£1,505K	Medium -Long	142,261

Prioritised Investment Needs Summary Table Identified for DWF Compliance (PO8)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
HABX.PW02.2	Cuckmere and Pevensey	Bexhill And Hastings	0	1	Bexhill & Hastings WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works.	£2,215K	Medium-Long	141,300
MILL.PW02.4	Test and Itchen	Millbrook	0	1	Millbrook WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the approximately extra 4000m3 DWF required due to growth in catchment	£2,555K	Medium	140,442
MILL.OT01.6	Test and Itchen	Millbrook	0	1	Millbrook WTW	Study / Investigation: Removal of silt at Millbrook WTW to increase capacity	£TBC	Medium	140,442
FORW.PW02.1	Arun and Western Streams	Ford	0	1	Ford WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works.	£2,165K	Medium - Long	132,208
EALP.PW02.2	Cuckmere and Pevensey	Eastbourne	0	1	Eastbourne WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works.	£1,445K	Medium -Long	116,948
CHEA.PW02.2	Test and Itchen	Chickenhall Eastleigh	0	1	Chickenhall Eastleigh WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the approximately extra 3600m3 DWF required due to growth in catchment	£2,570K	Medium	97,014
WEAT.PW02.1	Stour	Weatherlees Hill	0	1	WEATHERLEES HILL A WTW	Review DWF permit for the WTW with the EA, and increase capacity of Primary and Secondary Settlement Tanks	£2,745K	Medium to long	91,319
CANT.PW02.2	Stour	Canterbury	0	1	CANTERBURY WTW	Increase capacity at the Works and review Dry Weather Flow permit to reduce risk to DWF compliance	£2,065K	Medium to Long	65,145
CANT.OT01.2	Stour	Canterbury	0	1	Catchment Wide	Study/investigation required to indentify areas of high infiltration	£175K	Short	65,145
SLOW.PW02.2	New Forest	Slowhill Copse Marchwood	0	1	Slowhill Copse to Marchwood WTW	Incease capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the extra 2301m3 DWF required due to growth in catchment	£2,270K	Medium	63,155
NEWE.PW02.2	Adur and Ouse	Newhaven East	0	1	Newhaven East WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works.	£2,130K	Medium - Long	58,325
PORT.PW02.1	Adur and Ouse	Shoreham	0	1	Shoreham WTW	Review permit for the WTW with the EA, and deliver associated works to increase capacity of the works.	£1,755K	Medium -Long	55,458

Prioritised Investment Needs Summary Table Identified for DWF Compliance (PO8)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
TONB.PW02.2	Medway	Tonbridge	0	1	TONBRIDGE WTW	Increase capacity at the Works. Proposed permit: 12,891m3	£1,895K	Medium to Long	45,768
MORE.PW02.1	Test and Itchen	Morestead Road Winchester	0	1	Morestead Road WTW	Incease capacity of the wastewater treatment Works (WTW). Optimisation or extension of site to allow for the approximately extra 700m3 DWF required due to growth in catchment	£1,730K	Medium	39,351
CHIC.PW02.1	Arun and Western Streams	Chichester	0	1	Chichester WTW	Completion of wastewater transfer to Tangmere, June'22. Position Statement- future developments flow to remain the same as current site.	£1,535K	Short	34,623
TUWN.PW02.3	Medway	Tunbridge Wells North	0	1	Tunbridge Wells North WTW	Review DWF permit for the WTW with the EA, and increase capacity of Primary and Final Settlement Tanks	£4,300K	Short	31,414
HAIS.PW02.3	Cuckmere and Pevensey	Hailsham South	0	1	Hailsham South WTW	Review permit for the WTW with the EA, and deliver additional primary and secondary treatment to increase DWF capacity of the works.	£1,360K	Short	29,543
HARE.PW02.2	Test and Itchen	Harestock	0	1	Harestock WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the approximately extra 425m3 DWF required due to growth in catchment	£1,505K	Medium	18,094
PAWD.PW02.2	Medway	Paddock Wood	0	1	Paddock Wood WTW	Increase capacity at the Treatment Works and review Dry Weather Flow permit to reduce risk to DWF compliance	£1,585K	Long	10,038
PAWD.OT01.2	Medway	Paddock Wood	0	1	Catchment wide	Surveys to review asset condition and identify Infiltration hotspots for relining/improving structural grades of sewers	£55K	Short	10,038
CHAR.PW01.5	Stour	Chartham	0	1	Catchment Wide	Targeted CCTV / electroscan surveys and proactive sewer rehabilitation to reduce risk of contaminating aquifers (East Kent Chalk)	£9,180K	Short to medium	6,940
RYEW.PW02.2	Rother	Rye	0	1	Rye WTW	Deliver additional Final Settlement Tank treatment to increase capacity of the works	£1,270K	Medium	5,556
BOSH.PW02.2	Arun and Western Streams	Bosham	0	1	Bosham WTW	Review permit for the WTW with the EA, and deliver additional primary, secondary and tertiary treatment to increase DWF capacity of the works.	£1,135K	Medium	3,922

Prioritised Investment Needs Summary Table Identified for DWF Compliance (PO8)

Reference	River Basin	Catchment	Risk Band 2020	Risk Band 2050	Location	Option	Indicative Cost	Indicative Timescales	Population Equivalent
BROC.PW02.1	New Forest	Brockenhurst	0	1	Brockenhurst WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the extra 153m3/day DWF required due to growth in the catchment	£3,105K	Medium	3,783
BAST.PW02.3	Test and Itchen	Barton Stacey	0	1	Barton Stacey WTW	Increase capacity of the Wastewater Treatment Works (WTW). Optimisation or extension of site to allow for the approximately extra 250m3 DWF required due to the connection of Sutton Scotney services and growth in catchment	£1,545K	Medium	3,437

(https://www.gov.uk/government/organisations/environment-agency)

Policy paper

Medway flood action plan - year 4 report

Updated 1 June 2022

Contents

This publication is available at https://www.gov.uk/government/publications/the-river-medway-partnership-objectives-members-and-action-plan/medway-flood-action-plan-year-3-report

The Medway Flood Partnership

The Medway Flood Partnership was established in January 2017. It brings together:

- local partners
- national agencies
- non-governmental organisations
- community representatives

The partnership's aim is to:

- reduce flood risk within the Medway catchment
- create better places for people, properties and businesses

The partnership brings together senior representatives from the following organisations:

- Country Land and Business Association
- Environment Agency
- Forestry Commission
- Joint Parish Flood Group
- Kent Association of Local Councils
- Kent County Council
- Kent Flood Action Group Forum
- Maidstone Borough Council co
- National Farmers Union
- Natural England
- Sevenoaks District Council
- South East Rivers Trust
- Southern Water
- Tonbridge and Malling Borough Council
- Tunbridge Wells Borough Council
- Upper Medway Internal Drainage Board

Reducing the risk of flooding in the Medway catchment is a complex problem. It is best solved by working in partnership. During the December 2013 flood event, approximately 965 homes were flooded across the Medway catchment. This was devastating for people and livelihoods. Over 9,000 properties across the Medway catchment are at risk of river flooding. Even more are at risk from other sources such as surface water or sewer flooding.

The flood action plan was first published at the end of 2017. It sets out what partner organisations will do to reduce flood risk in the short term. This flood action plan is a significant milestone in addressing flood risk in the Medway catchment. But it is part of a longer journey with the partnership, communities and individuals to build awareness and preparedness for flooding. It will help to identify and develop more actions which can help to reduce flood levels. The partnership will continue to work with communities to develop this plan further and consider the 25 year vision and the pathway to getting there.

This action plan is a 'living document'. It will be regularly monitored and reviewed by the Medway Flood Partnership to make sure that actions are delivered. It will also ensure that new information and ideas are incorporated. All members are committed to its delivery and embedding an integrated approach to flood risk management into our organisations.

For more information see the Medway Flood Partnership: objectives, members and action plan page (https://www.gov.uk/government/publications/the-river-medway-partnership-objectives-members-and-action-plan).

Capital investment and maintenance

Actions include traditional, engineered flood defence projects. These help to reduce the risk of flooding to people, property and businesses.

It also includes maintenance of:

- flood risk assets, such as sluices, to ensure they are in good operational condition
- river channels, including ditch and highway gully clearance, weed cutting, tree and debris removal and desilting of river beds

Action 1: Coult Stream flood storage area

Carry out works to enable the Coult Stream flood storage area to be used more frequently. This will reduce the risk of flooding to homes in smaller events.

- where: River Medway at Leigh and Hildenborough
- owner: Environment Agency
- when: March 2018

Action completed in Year 1.

The Environment Agency has spent £7,500 on the Coult Stream flood storage area near Snoll Hatch and East Peckham. This ensures it protects 51 properties from a flood with a 1% probability of occurring in any year.

Action 2: East Peckham scheme

Carry out feasibility and funding investigations to develop and deliver (if applicable) a scheme to reduce risk to homes and businesses in East Peckham.

- where: East Peckham
- owner: Environment Agency
- when: 2017-2022
- supporting organisations: Tonbridge and Malling Borough Council, Kent County Council

Year 4 progress: action ongoing.

In 2021 the Environment Agency awarded the contract for installing Property Flood Resilience (PFR) measures in East Peckham to Watertight International. Pre- and post-installation surveys are being completed by RAB consulting. Watertight delivered the Middle Medway Flood Resilience Scheme. As a result they have an excellent understanding of the local geography and fluvial flood risk.

To date, the project team has carried out full surveys of 123 properties. So far, 96 homeowners have signed their agreements to have the measures installed. This is a great uptake and we expect this number to rise as homeowners review their agreements.

Installations started in September 2021 and will run through to October 2022. To date we have installed PFR measures to 18 properties, with some very positive feedback.

You can find more information and useful resources about PFR measures on the scheme webpage: https://www.eastpeckhampfr.com/ (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.eastpeckhampfr.com%2F&data=04%7C01%7Ckathy.aucott%40environment-agency.gov.uk%7Cf827f1ec6cfe4272e23608d9ab456f12%7C770a245002274c6290c74e38537f1102%7C0%7C0%7C637729136969752514%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=M6GlMj1ZyuHz8y79MNiwsaqPiVlTjmnFZVdmxklTovk%3D&reserved=0)

Action 3: Leigh expansion and Hildenborough embankment scheme

Reduce flood risk to 1,470 homes in Tonbridge and Hildenborough by enlarging the Leigh flood storage area (FSA) and building an embankment in Hildenborough.

- where: River Medway at Leigh and Hildenborough
- owner: Environment Agency
- when: 2019-2022
- supporting organisations: Kent County Council, South East Local Enterprise Partnership, Tonbridge and Malling Borough Council

Year 4 progress update: action ongoing.

The Environment Agency is proposing to increase the capacity of the Leigh flood storage area (FSA) by storing water to a greater depth.

The Secretary of State for the Department for Environment, Food and Rural Affairs (Defra) must give permission to increase the stored water level. This approval is essential for both the Leigh expansion and Hildenborough aspects of the scheme to progress.

In June 2020, the Environment Agency submitted an application to the Secretary of State to increase the stored water level in the Leigh FSA. Defra received 10 objections to the application. Unfortunately, the Environment Agency was unable to resolve these objections. As a result, an Inquiry took place between Monday 26 April and Friday 28 May 2021, to allow concerns to be heard.

The Inspector submitted her report and recommendations to the Minister in July. In September 2021, the Secretary of State confirmed that a compelling case in the public interest had been made. As a result, he accepted the Inspector's recommendation and approved the application to increase the stored water level without modification or conditions. The maximum stored water level during a flood will increase from 28.05 metres Above Ordnance Datum (AOD) to 28.6m AOD.

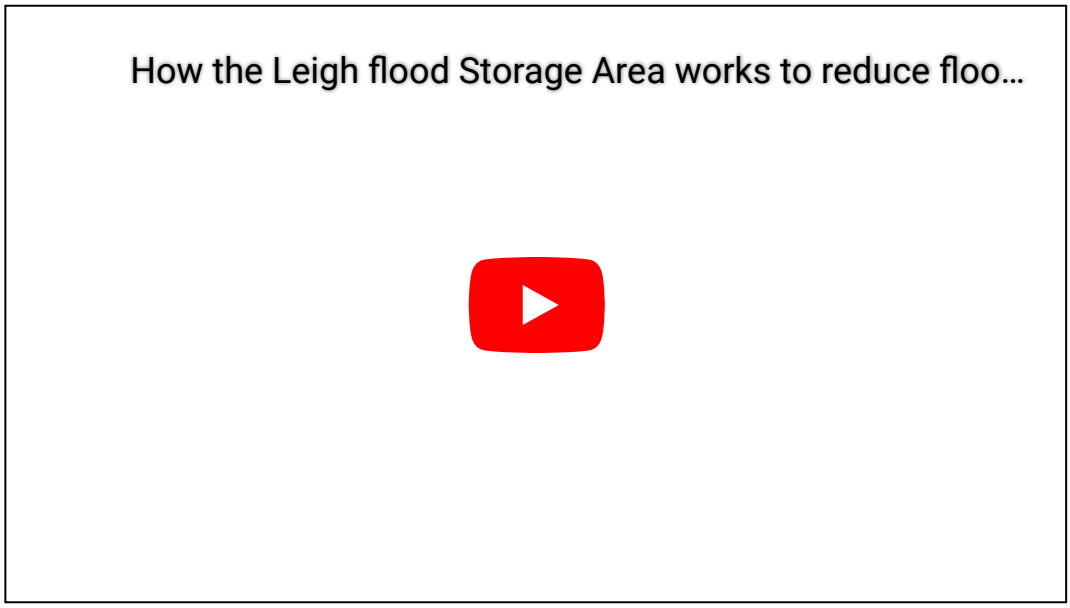
The decision means that the scheme to reduce flood risk to over 1,400 homes and businesses in Tonbridge and Hildenborough can proceed. The construction contract will be awarded in spring 2022, with construction expected to be complete in autumn 2025.

At Hildenborough, the Environment Agency has continued to work with residents on the final design of the embankment. A planning application for this aspect of the scheme will be submitted in February 2022. The construction programme for the Hildenborough part of the scheme is dependent on the planning decision.

More information about the Leigh FSA is available on the following web pages:

- Leigh flood storage area (https://www.gov.uk/government/publications/leigh-flood-storage-area)
- Leigh expansion and Hildenborough embankments scheme (https://www.gov.uk/government/publications/leigh-expansion-and-hildenborough-embankments-scheme)

You can find out how the Leigh FSA works to reduce downstream flood risk by viewing our You Tube animation below or search for ‘Leigh flood storage area’:



Action 4: Leigh flood storage area interim works

Carry out a 3-year programme of engineering works to keep the Leigh flood storage area in good operational condition.

- where: Leigh
- owner: Environment Agency
- when: ongoing to 2019

Action completed in Year 3.

The £1.2 million, 3-year programme of improvement works on the Leigh flood storage area (FSA) is now complete. These works keep the existing flood storage area operational and compliant with the Reservoirs Act until the works to expand the FSA are complete. These works were designed to complement the scheme to expand the Leigh FSA. They included:

- a 2-year project to refurbish the drains at the toe of the 1.3 kilometre main embankment
- refurbishing the lifting mechanism on the north gate
- replacing the original 1981 switchboard with a new one which will last for the next 50 years
- replacing the original 1981 ‘back-up’ generator with a new generator designed to last for the next 30 years. This generator supplies back up power so the structure can continue to operate if there is a power cut
- refurbishing the Powder Mill stream bridge. This provides access for maintenance, grass clearance and silt clearing
- installing new security measures to ensure the structure is safe and secure

New action 4b: Leigh gauging stations upgrade project

- where: upstream of the Leigh flood storage area
- owner: Environment Agency
- when: ongoing to 2023

Year 4 progress update: action ongoing.

Last year the Environment Agency added a new action about its plans to upgrade 8 gauging stations across the Medway catchment. The data from these sites is used to work out when and how to best to operate the Leigh flood storage area control structure in order to maximise the storage capacity available. The works include refurbishing the equipment that collects and records information about river flows and levels, and the buildings which house them.

2 of the 8 stations were upgraded this year (2021/22). 2 more are programmed to be upgraded in 2022/23.

The final 4 are planned to be upgraded 2023/24, though this is dependent on the funding allocated next year. The funding allocation for 2023/24 will be confirmed in spring 2023.

Over the next 3 years the Environment Agency will upgrade 8 gauging stations across the Medway catchment. The data from these sites informs decisions about when and how the Leigh flood storage area is used to maximise the storage capacity. The works will include refurbishing the equipment that collects and records the river flows and levels.

New action 4c: Leigh flood storage area Reservoir Act works

- where: upstream of the Leigh Flood Storage Area
- owner: Environment Agency
- when: ongoing to 2023

New action in Year 4

In 2021, the Environment Agency began essential works required to the Leigh flood storage area (FSA) under the Reservoirs Act 1975. The works will ensure the FSA continues to safely reduce flood risk to Tonbridge, Hildenborough and downstream communities into the future. The works to the embankment will take place over the next 3 years and will not affect the operation of the Leigh FSA to reduce the risk of flooding.

Laying the erosion matting at the first working area, summer 2021

These works will involve lifting the top soil of the existing 1.5-kilometre main embankment and laying reinforcing materials. This reinforced layer will be covered with a layer of soil then sown with grass to further stabilise the surface. Once these works are complete, the embankments will look very similar to how they look now.

Over spring/summer 2021 the team worked on the FSA embankment between A21 Bridge and southern tip of the FSA on Lower Haysden Lane. These works involved:

- removing the topsoil from the top and downstream side of the embankment
- carrying out works to raise the clay core in the centre of the embankment. This prevents water stored in the FSA from seeping through the embankment
- laying erosion protection matting on the downstream side of the embankment
- improving the drainage at the toe of the embankment so that water flows away more easily. This provides better bank stability

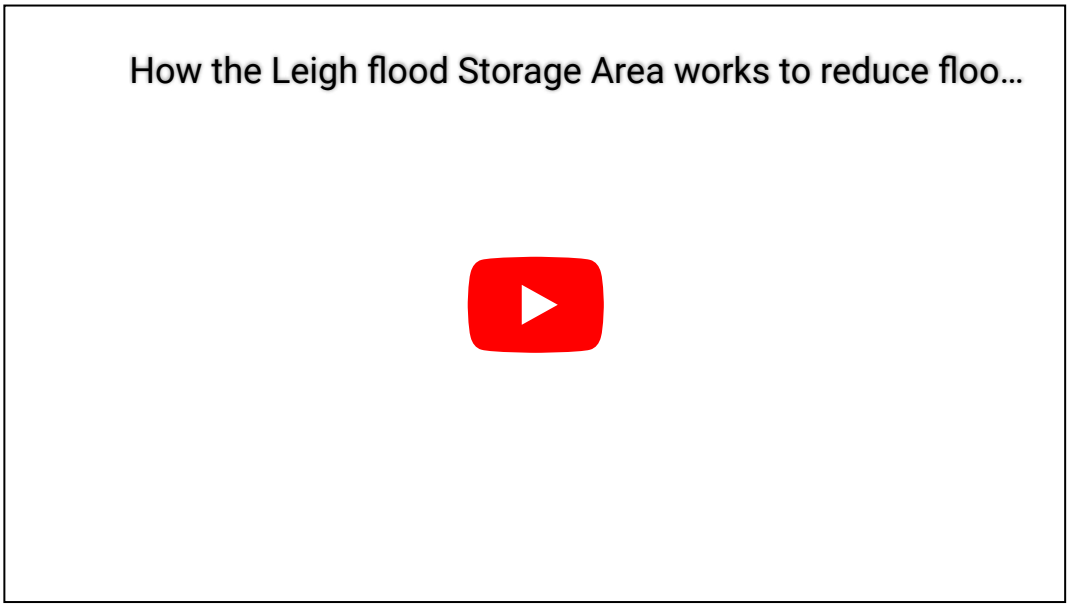
The erosion-protection matting on the downstream side of the embankment has been seeded and will soon be covered in grass

During autumn 2021, the team completed the works in the first working area. They then moved their operations to the second working area between the A21 and the main control structure at Leigh. Work at the second working area will take place during spring and summer 2022, with all work complete by autumn 2023.

More information about the Leigh FSA is available on the following web pages:

- Leigh flood storage area (https://www.gov.uk/government/publications/leigh-flood-storage-area)

- Leigh expansion and Hildenborough embankments scheme (https://www.gov.uk/government/publications/leigh-expansion-and-hildenborough-embankments-scheme)



Action 5: Middle Medway flood resilience scheme – Phase 1

Carry out surveys to understand which homes at greatest risk of flooding in the middle Medway area are suitable for property resistance measures. Where homeowners agree, install property resistance measures in suitable homes in the Middle Medway flood resilience scheme area.

- where: Yalding, Collier Street, Hunton, Marden, West Farleigh, East Farleigh, Wateringbury and Nettlestead
- owner: Environment Agency
- when: 2017-2019
- supporting organisations: Kent County Council, Maidstone Borough Council, Joint Parish Flood Group, Southern Regional Flood and Coastal Committee

Action completed in Year 3.

Phase 1 of the Middle Medway flood resilience scheme was completed in November 2020.

In total, the scheme installed Property Flood Resilience measures to 256 homes across the middle Medway villages. These measures include flood doors, flood gates and air brick covers.

The scheme has cost £1.54 million. This included government funding up to £7,500 per property through Flood Defence Grant in Aid. The Southern Regional Flood and Coastal Committee also provided an extra £195,000 to the project through local levy.

Read more about the Middle Medway flood resilience scheme (https://www.gov.uk/government/publications/middle-medway-flood-resilience-scheme).

Action 6: Middle Medway flood resilience Scheme – Phase 2

Investigate and implement community level resilience measures to reduce the impact of flooding in the Middle Medway flood resilience Scheme area. Do this with funding from Kent County Council, Maidstone Borough Council and the Southern Regional Flood and Coastal Committee. This includes localised flood defences to reduce risk to homes at greatest risk of flooding.

- where: Yalding, Collier Street, Hunton, Marden, West Farleigh, East Farleigh, Wateringbury and Nettlestead
- owner: Environment Agency, Kent County Council, Maidstone Borough Council
- when: 2018-2020
- supporting organisations: Joint Parish Flood Group, Southern Regional Flood and Coastal Committee

Action completed in Year 3.

A study has shown that in discrete locations, small community level resilience schemes could reduce flood risk to property. Unfortunately, none of these schemes meet the value for money criteria. This is mainly because the schemes proposed only assist a few properties. The details have been shared with the property owners involved so that they can take steps if they wish. If new community resilience measures become available they will be investigated and progressed, if appropriate.

Action 7: Environment Agency annual maintenance programme

Continue the Environment Agency's annual programme of maintenance work on Main Rivers across the catchment. This will maintain the flow of water and ensure flood risk assets are in good condition.

- where: catchment wide
- owner: Environment Agency
- when: ongoing

- supporting organisations: Kent County Council, Upper Medway Internal Drainage Board, Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council, Maidstone Borough Council

Year 4 progress update: action ongoing.

Each year the Environment Agency spends approximately £1 million maintaining rivers in the Medway catchment. These works help water to flow freely, and ensure that structures and defences are in good working order.

Alongside our planned maintenance work, our field teams also carry out a wide range of reactive work. This year our field teams cleared vegetation to enable the Reservoirs Act works at the Leigh flood storage area. They also cleared a number of large trees from rivers to keep them flowing. If you see an obstruction in a watercourse that may present a flood risk, please report it through the Environment Agency's 24/7 incident hotline: 0800 80 70 60.

Find out more about the Environment Agency's annual maintenance programme (https://environment.data.gov.uk/asset-management/index.html).

Action 8: Collated maintenance map

Collate the flood maintenance activities of risk management authorities across the catchment. Share this information with communities to raise awareness of ongoing work to manage flood risk. Also to encourage riparian landowners to carry out their own maintenance

- where: catchment wide
- owner: Environment Agency
- when: 2018/19 onwards
- supporting organisations: Kent County Council, Upper Medway Internal Drainage Board, Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council, Maidstone Borough Council

Year 4 progress update: action on hold.

There are many organisations that carry out maintenance work to waterways and drainage systems. Each of these organisations has its own programme. As a result, it can be difficult to find out which is planning to carry out maintenance when and where.

The partnership had hoped to be able to bring the maintenance programmes of each of the organisations together into one map. However, having investigated the systems and technicalities of doing this, we have run into difficulties. The Environment Agency's maintenance map is held on gov.uk and is live so it can be updated at any time. Unfortunately, we are not able to incorporate data from other organisations into the Environment Agency map.

This action remains an aspiration for the partnership, and it may be something we can pursue in the future as technology develops. In the meantime, you can find more information about the maintenance programmes of the Medway partners at the following locations:

- the Environment Agency carries out maintenance on main rivers. The national live maintenance map can be found here (https://www.gov.uk/government/publications/river-and-coastal-maintenance-programme).
- the Upper Medway Internal Drainage Board manages local drainage within its district. Its maintenance plan can be found here (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.medwayidb.co.uk%2Fwatercourses%2Fmaintenance%2F&data=04%7C01%7Ckathy.aucott%40environment-agency.gov.uk%7C10d83557f077440671ae08d9eb015500%7C770a245002274c6290c74e38537f1102%7C0%7C0%7C637799213211443216%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=QK%2FGgTpme6PiJ5j4oOPShE0zmBcXbBs4VVJxESX06%2FM%3D&reserved=0).
- Kent County Council's highways department maintains the drainage from local roads. You can find out more information about Kent County Council's maintenance of highway drainage here (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.kent.gov.uk%2Fenvironment-waste-and-planning%2Fflooding-and-drainage%2Fhighway-drainage-systems%23tab-4&data=04%7C01%7Ckathy.aucott%40environment-agency.gov.uk%7C10d83557f077440671ae08d9eb015500%7C770a245002274c6290c74e38537f1102%7C0%7C0%7C637799213211443216%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=%2FRFqR0t21yZPNBY1KrDiqJRtMsvCwftbU%2F5JHYIPWlk%3D&reserved=0).

Action 9: Maintenance group

Set up a Medway maintenance group to discuss and review the planned maintenance work of:

- Environment Agency
- Upper Medway Internal Drainage Board
- local councils

- Kent County Council Highways
- Southern Water

Involve local community representatives to promote a joined up approach and increase community involvement.

- where: catchment wide
- owner: Environment Agency
- when: ongoing
- supporting organisations: Kent County Council, Upper Medway Internal Drainage Board, Southern Water, Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council, Kent Association of Local Councils, Joint Parish Flood Group, Maidstone Borough Council

Year 4 progress update: action ongoing.

Organisations have continued to share information and coordinate activities. A particular success has been the use of the IDB funding to enable works to control invasive non-native species. This work is essential to raise awareness of, and control, invasive non-native species which thrive in our climate.

Many species use waterways to travel across the catchment. They often clog the rivers and streams with excessive growth which can increase local flood risk. They can also:

- reduce the availability of habitat for native species
- reduce biodiversity
- cause riverbank erosion
- increase siltation and flood risk
- cause physical harm
- damage infrastructure and recreation

So, the ongoing work to control them has wide-ranging benefits. You can find out more about Medway Valley Countryside Partnership's work to control invasive non-native species here (https://medwayvalley.org/invasive-non-native-species/).

Action 10: Culvert inspections

Carry out a rolling programme of work to inspect Environment Agency owned culverts across the catchment to ensure they continue to convey flows.

- where: catchment wide
- owner: Environment Agency

- when: annually

Year 4 progress update: action ongoing.

Over 2020, the Environment Agency team reviewed the data on all 196 culverts across the Medway catchment. They then developed a longer-term plan for CCTV culvert surveys.

In 2021 they began delivering this programme, including surveying culverts on the Gas Works Stream in Tonbridge and on the Paddock Wood stream. Over the next year the Environment Agency is planning to survey a further 40 culverts.

Action 11: Removal of old structures to reduce flood risk

Work with partners and communities to consider where removing old structures, like retention weirs and automatic sluices, may help to reduce flood risk. Where appropriate, work with partners and the community to carry out these works.

- where: Rivers Teise, Beult and Eden
- owner: Environment Agency
- when: 2018-2022
- supporting organisations: South East Rivers Trust

Year 4 progress update: action on hold.

Due to significant resource pressures this year, the Environment Agency has paused the project to remove the Darman's and Duddies auto sluices near Laddingford. At these sluices the Environment Agency is considering setting a permanent water level that works for all river users. These structures would then be welded in place to prevent them from failing.

The next step is to carry out modelling to test the effect of different water levels. We expect to resume this work once we have recruited more staff to the team. As noted in last year's report, the Darman's and Duddies auto sluices near Laddingford cannot continue to operate in the present manner. But as they do not reduce flood risk, they do not attract funding for maintenance.

At these sluices the Environment Agency is considering setting a permanent water level which works for all river users. These structures would then be welded in place to prevent them from failing. As noted in the Year 2 report, the next step is to carry out modelling to test the effect of different water levels. Covid-19 has delayed work on this project this year. But, we can confirm that we have now got funding to progress the modelling of different water levels and what effect they would have.

Once this is complete we will carry out further consultation with the local community to agree any actions.

Action 12: Watercourse maintenance

Carry out drainage works and maintenance works to Ordinary Watercourses on behalf of Maidstone Borough Council to maintain flow of water.

- where: Maidstone Borough
- owner: Kent County Council
- when: 2017-2020
- supporting organisations: Maidstone Borough Council

Year 4 progress update: action ongoing.

Action 13: River Grom trash screen, Tunbridge Wells

Improve the trash screen on the River Grom culvert entrance to prevent flooding due to blockage.

- where: Tunbridge Wells
- owner: Kent County Council
- when: 2017/18

Action completed in Year 1.

Kent County Council have invested £7,000 in installing a new trash screen across a culvert on the River Grom in Tunbridge Wells.

Action 14: Tunbridge Wells

Investigate ways to reduce risk of flooding at Neville Street and in the Warwick Park area of Tunbridge Wells. If feasible, develop funding plans and deliver flood risk management measures.

- where: Neville Street/Warwick Park, Tunbridge Wells
- owner: Kent County Council
- when: 2017/18

Year 4 progress update: action ongoing.

Action 15: Southern Water drainage maintenance

Continue to carry out Southern Water’s proactive programme of maintenance work. This is to maintain an effective system, including regular reviews to ensure appropriate maintenance is carried out.

- where: catchment wide

- owner: Southern Water
- when: rolling programme

Year 4 progress update: rolling programme under continual review.

Action 16: Southern Water asset surveys

Carry out a targeted programme of surveys of Southern Water assets. This will improve our understanding of their condition and inform our future Capital Maintenance plan.

- where: catchment wide
- owner: Southern Water
- when: rolling programme

Year 4 progress update: rolling programme under continual review.

Action 17: Drainage Area Plans

Update Drainage Area Plans for:

- Headcorn
- Horsmonden
- Staplehurst
- Ashford
- Redgate Mill Crowborough
- Aylesford
- Ham Hill
- Tonbridge
- Bidborough
- Biddenden
- Coxheath
- Edenbridge
- Luxfords Lane East Grinstead
- Eden Vale East Grinstead
- Felbridge
- Forest Row
- Godstone

- Hawkhurst South
- Leeds
- Lingfield
- Paddock Wood
- Tunbridge Wells North & South
- Copthorne
- Wateringbury

Use these to understand the impact of weather/climate change and growth on waste water systems. Identify how this impact can be managed to reduce flood risk from sewers to homes.

- where: catchment wide
- owner: Southern Water
- when: by March 2020
- supporting organisations: Kent County Council, Environment Agency, Borough and District Councils as required

Action completed in Year 2.

The Drainage Area Plans for 25 sewerage catchments within the Medway River Basin District have been updated. These plans will be used with the Lead Local Flood Authority Surface Water Management Plans to create strategic level plans for the River Basin District. These plans will feed into the Drainage and Wastewater Management Plan (DWMP).

Year 4 update: All water companies are preparing the first round of DWMPs. These are expected to be published in March 2023. These plans will set out future investment needs to inform Price Reviews.

Southern Water has set an ambition that, by 2040, flooding from sewers should be the exception. It plans to create resilience against more extreme weather using sustainable drainage approaches. The DWMPs will identify what action is needed, and where working in partnership will help to achieve these outcomes.

Action 18: IDB watercourse maintenance

Carry out annual maintenance work within Upper Medway Internal Drainage Board (IDB) district to maintain flow of water.

- where: catchment wide
- owner: Upper Medway Internal Drainage Board
- when: annually

Year 4 progress update: action ongoing.

The Upper Medway Internal Drainage Board adapted its maintenance approach in 2021 to better support wildlife and biodiversity. In the past, it had mowed both banks and cleared all weed from watercourses. While this helped reduce flood risk, it also significantly reduced the food and shelter for a variety of wildlife. Over 2021, the Board changed its approach to mow only one bank and cut 80% of the weed where possible. This has retained important habitats and food sources for wildlife. It has also enabled the Board to carry out maintenance on even more watercourses.

You can view the IDBs new biodiversity action plan (https://www.medwayidb.co.uk/watercourses/conservation/) here: Conservation – Medway IDB (https://www.medwayidb.co.uk/watercourses/conservation/)

Action 19: Community Infrastructure Levy

Support infrastructure projects which will reduce flood risk by considering valid bids for Community Infrastructure Levy (CIL) funding.

- where: Sevenoaks District
- owner: Sevenoaks District Council
- when: ongoing

Year 4 progress update: action ongoing.

Sevenoaks District Council's (SDC) has now held 4 meetings of the CIL Spending Board. The Board has awarded CIL to 23 separate infrastructure projects. Only 1 dealt with flood mitigation and was outside the Medway catchment.

No further bids have been submitted to SDCs CIL Spending Board to bring forward flood mitigation proposals at present. However, future bids may include flood mitigation projects. A guide is available for organisations wishing to submit bids. Anyone wishing to submit a bid can email cil@sevenoaks.gov.uk for a copy.

The interactive tool on the SDC website (https://app.powerbi.com/view?r=eyJrIjoiMTQxNWRlNGItNzQ4YS00YTc5LTg4NzQtYzc0NmMzMDVhZWFiIiwidCI6ImZjMDc5YWJkLWMyNjgtNGM1Ny1hZDY4LTU4YTFlOWU1NTk4OCJ9) provides:

- up to date information on how much CIL has been received by the council
- how much CIL income there has been from qualifying development in each parish
- how much CIL will be given to the relevant town parish/council

New action: Ightham property flood resilience measures

Carry out scoping surveys to understand which homes at greatest risk of flooding in Ightham are suitable for property resistance measures. Where homeowners agree, install property resistance measures in suitable homes.

- where: Ightham
- owner: Kent County Council
- when: 2018/19

Action completed in Year 2.

Kent County Council has installed property flood resilience measures to 12 properties in Ightham. This is after the flooding in 2016.

The council worked with the community's Flood Action Group to decide the best way to manage flood risk in the village. The outcome was to provide PFR for those properties that were eligible.

Flooding in Ightham can happen very quickly. As a result, the community does not benefit from a flood warning system. To manage this, most of the measures installed are passive. This means that they are always in place and so do not have to be deployed.

New action: Highway drainage pilot

Use innovative technology to manage highway drainage.

- where: Maidstone Borough
- owner: Kent County Council
- when: 2020-2021

Year 4 progress update: action ongoing.

New action: Mote Park Lake Reservoirs Act works

- where: Maidstone Borough
- owner: Maidstone Borough Council
- when: 2014-2021

New action in year 4: action complete

This year, Maidstone Council completed essential works to Mote Park Lake to keep it safe into the future. Due to its size, Mote Park Lake is regulated under the Reservoirs Act 1975. The lake had its mandatory 10-year review in 2014. The

review recommended works to increase the capacity of the spillway. This will reduce the risk of failure due to overtopping.

As a result, Maidstone Council has carried out works to:

- construct a new 50-metre wide secondary spillway
- install a new support of grass covered concrete blocks
- build a new wave wall.

The works have now been inspected and signed off by an All Reservoirs Panel engineer. This confirms that the structure is compliant with the Reservoirs Act 1975.

New action: Five Oak Green property flood resilience scheme

Install property resistance measures in suitable homes in Five Oak Green.

- where: Five Oak Green, Tunbridge Wells borough
- owner: Tunbridge Wells Borough Council and Environment Agency
- when: 2021-2022

The Environment Agency and Tunbridge Wells Borough Council are working in partnership to deliver Property Flood Resilience (PFR) measures to over 40 homes at very significant risk of flooding in Five Oak Green.

After the flooding from Storm Ciara in early 2020, residents were able to claim a flood resilience grant of £5,000 per property. The Environment Agency is able to count this as a partnership contribution which can be topped up with Flood Defence Grant in Aid (FDGiA) funding. In spring 2021 the Environment Agency developed a business case to request FDGiA funding. We are pleased to confirm that this was approved at the end of July 2021.

The Environment Agency has been able to add the Five Oak Green scheme onto the contract with the East Peckham scheme. This means we are able to deliver the scheme more cost efficiently and with less delay and disruption to residents.

PFR includes measures help to reduce the impact of flooding to homes. The measures include flood doors, flood barriers, and non-return valves on waste pipes. So far, 49 properties have received a full detailed survey. 26 properties have signed and returned a homeowner agreement to accept the measures.

We will begin installing measures to homes in early 2022.

Natural Flood Management

Actions in this theme of work look at how natural flood management techniques could work in combination with engineered solutions. This is with the purpose of helping to slow the flow of water and reduce the impacts of flooding.

There are a wide range of techniques including measures to help slow and/or reduce flows. These include:

- re-meandering rivers
- targeted woodland planting
- techniques to hold water temporarily on the land

As well as helping to reduce flood risk, natural flood management techniques can provide wider social and environmental benefits. This is done by improving our environment for people and wildlife to enjoy.

Action 20: Supporting NFM through annual maintenance programmes

Work with partners to consider how our annual maintenance work can support natural flood management measures where they help to reduce flood risk.

- where: catchment wide
- owner: Environment Agency
- when: annually
- supporting organisations: South East Rivers Trust, Natural England, Upper Medway Internal Drainage Board, Kent County Council, Southern Water, Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council, Joint Parish Flood Group, Kent Association of Local Councils, Maidstone Borough Council

Year 4 progress update: action ongoing.

The Environment Agency considers natural flood management plans through its annual maintenance programme.

The NFM steering group also plans to bring opportunities for further NFM projects to the Medway Catchment Partnership. This will widen the reach of these discussions to include other partners and organisations.

Action 21: Improving the River Beult SSSI for people and wildlife

Identify, investigate and agree options to improve the River Beult SSSI for people and wildlife by working with landowners, local partners and groups. This will include options to slow flood flows and use unoccupied areas of the floodplain to temporarily accept flood water.

- where: River Beult between Hadmans Bridge near Smarden and its confluence with the River Medway at Yalding
- owner: Environment Agency
- when: 2017/18
- supporting organisations: Natural England

Action completed in Year 1.

The Environment Agency published the Improving the River Beult SSSI for people and wildlife report (https://www.gov.uk/government/publications/the-river-medway-partnership-objectives-members-and-action-plan) on GOV.UK in August 2018.

The next step is to put the plan into action. This depends on the cooperation and support of local landowners. The Environment Agency and Natural England will use the plan to continue working with partners and local people to design and build the improvement measures. Further surveys and actions will be needed to inform the design stages. Partnership funding will also be needed and a wide variety of sources will be considered, many of which are detailed in the improvement plan.

Action 22: Mill Farm

Provide 12,500 cubic metres of flood storage at Mill Farm, Marden. Use this site to demonstrate the technique to build support for natural flood management measures.

- where: Mill Farm, Marden
- owner: Kent County Council
- when: 2017
- supporting organisations: Environment Agency, Mill Farm

Action completed in Year 1.

Kent County Council worked in partnership with a local landowner, to complete a 12,500 cubic metre flood storage area in Marden. The site will store peak flows from the drainage ditch network and River Teise which contribute to the flooding within the catchment.

Construction of the £40,000 project took place between November 2016 and December 2017. As well as storing water, the site provides additional habitat across this higher level stewardship farm. This supports a wide diversity of bird life. The site will be managed for wildlife and has no public access so will be an undisturbed haven for wildlife within the local area.

An opening event was held on 18 May 2018 to showcase the flood storage area to other local landowners. A number of follow-up meetings took place with other landowners interested in natural flood management measures.

Action 23: Paddock Wood

Investigate opportunities to use natural flood management techniques to reduce flood risk in Paddock Wood.

- where: Paddock Wood
- owner: Kent County Council
- when: 2017/18
- supporting organisations: Upper Medway Internal Drainage Board

Year 4 progress update: action ongoing.

Action 24: Ightham

Investigate opportunities to use natural flood management techniques to reduce flood risk around Ightham.

- where: Ightham
- owner: Kent County Council
- when: 2017/18
- supporting organisations: Environment Agency

Year 4 progress update: action ongoing.

Action 25: Catchment Sensitive Farming

Explore how we can use the Catchment Sensitive Farming approach to provide advice to farmers about managing water on-farm that promotes natural flood management measures.

- where: River Teise and River Beult catchments
- owner: Natural England
- when: 2016 to 2020

- supporting organisations: Southern Water (Beult) & South East Water (Teise)

Action completed in Year 3.

Natural England's Catchment Sensitive Farming (CSF) team has continued to advise farmers in the Medway catchment on measures to:

- reduce diffuse water pollution
- improve soils
- improve the natural flood management capacity of their land

Advice and approval has been provided to Countryside Stewardship Mid Tier and Higher Tier applications on water-related options and capital items. This is to protect and reduce farm-yard runoff.

Southern Water is funding the Upper Beult Farm Cluster in partnership with Kent Wildlife Trust. CSF advisors are continuing to work closely with water company partners in the Teise and Upper Beult catchments to provide advice to farmers.

New action 25b: Catchment Sensitive Farming

Continue to use the Catchment Sensitive Farming approach to provide advice to farmers about managing water on-farm that promotes natural flood management measures.

- where: River Teise and River Beult catchments
- owner: Natural England
- when: April 2021 to 2025

Year 4 progress update: action ongoing

As reported last year, the Catchment Sensitive Farming (CSF) work in the Medway catchment is continuing with funding from Defra. Over the past year, the focus expanded to high- and medium-priority water quality areas. It also began to address new themes such as air quality, flood risk and related sustainable farming practices.

The focus on CSF is helping us build relationships with landowners across large project areas in Marden, Shadoxhurst and Lamberhurst.

We now have many 65 Countryside Stewardship and 12 Higher Level Stewardship agreements in the Teise catchment area. We also have 75 Countryside Stewardship schemes and 23 Higher Level Stewardship schemes in the Beult. Our landowner agreements include techniques such as buffer strips, arable reversion and 'no input' options. This means they receive no fertilisers or agricultural chemicals.

These measures help:

- soil to hold more water
- store water on land
- reduce soil erosion
- prevent agricultural run-off into the watercourse

These measures are good for both the landowner and the environment, supporting both food production and flood risk.

Action 26: Ashdown Forest

Investigate the potential to hold floodwater in the upper catchment. Achieved by restoring areas of wet heathland in Ashdown Forest through the Countryside Stewardship Higher Tier Scheme.

- where: Ashdown Forest/River Medway headwaters
- owner: Natural England
- when: 2016-2021
- supporting organisations: Ashdown Forest Conservators

Action completed in Year 2.

Natural England has worked with landowners at Ashdown Forest to agree a Countryside Stewardship agreement which will fund the 7,500 cubic metre pond restoration work. The agreement was signed in January 2019 and the landowner has planned work to take place in autumn/winter 2019.

Action 27: West Kent Woods

Explore the potential for natural flood management techniques in the West Kent Woods ecological network around Sevenoaks, Hildenborough, Hadlow and Kings Hill. This will include the use of attenuation methods to slow the flow.

- where: River Bourne
- owner: Natural England
- when: 2017-2020
- supporting organisations: Kent County Council

Year 4 progress update: action ongoing.

The Natural England Condition Assessment team has visited Sites of Special Scientific Interest (SSSIs) in the area including:

- Scord’s Wood

- Oldbury
- One Tree Hill
- Knole Park.

At these visits the team provide advice to landowners on actions they can take to get the SSSIs into Favourable Condition (if they are not already.) This includes woodland management actions which could include or support natural flood management. These visits are part of a continuous process. We are planning to revisit sites on a rotational basis to continue to provide advice.

In 2021, 2 large Countryside Stewardship agreements were established along the river Bourne. These have led to the creation of ‘no input’ grassland habitats which will restore soil and improve water retention and run off.

Action 28: Countryside Stewardship

Invest in Countryside Stewardship agreements in the catchment. Include creation/restoration/maintenance of diverse habitats to improve water quality and reduce run-off/erosion.

- where: catchment wide
- owner: Natural England/Forestry Commission
- when: extended until 2029 when the last agreements may end
- supporting organisations: Southern Water, landowners and farmers

Year 4 progress update: action ongoing.

Through 2021, we have continued to work with landowners in 3 project areas in the Beult and Teise catchments. This work includes some large Higher Tier schemes, which will begin in 2022. The schemes will help reduce run off by converting arable fields into permanent grassland nature restoration areas.

This year, Countryside Stewardship funding has also delivered natural flood management in woodlands in Shadoxhurst. This included woody dams which complement another NFM project delivered by SERT in the same woods. These works were in the headwaters of the Beult so will help slow the flow of water in the upper catchment.

Action 29: Priority NFM sub-catchments

Through the FRAMES project, identify priority sub-catchments where natural flood management techniques will achieve greatest benefit in reducing flood risk in the catchment. Carry out modelling and identify the techniques to achieve this.

- where: catchment wide

- owner: South East Rivers Trust
- when: 2017/18
- supporting organisations: Environment Agency, Natural England, Forestry Commission, Kent County Council

Action completed in Year 2.

After wide consultation supported by a variety of evidence, the South East Rivers Trust (SERT) identified 2 flood-affected communities likely to benefit from natural flood management in the short term. These are Headcorn and Five Oak Green. In Headcorn around 20 properties are at risk of flooding from the ‘School Stream’. In Five Oak Green approximately 100 properties are at risk of flooding from the Alder Stream.

The nature of the headwaters and surrounding landscape make these catchments particularly suitable for this approach. Also, the small area of these sub-catchments means that natural flood management techniques are likely to have a greater effect. Much has been learnt through the process of identifying these catchments which can be applied elsewhere.

In the longer term it is hoped that interventions in more sub-catchments will have a cumulative effect, and help reduce flood risk further downstream.

Action 30: Delivering Natural Flood Management

Through the FRAMES project, work with local communities and landowners in priority sub catchments. Design and deliver natural flood management schemes which will test land-management techniques.

- where: catchment wide
- owner: South East Rivers Trust
- when: 2018-2021
- supporting organisations: Environment Agency, Natural England, Forestry Commission, Kent County Council, Maidstone Borough Council

Year 4 progress update: action complete.

Natural flood management (NFM) uses natural materials to slow the flow of water. It can reduce the chance of flash flooding, and increases water storage. In 2017, Defra assigned £15 million to the Environment Agency for pilot projects to build our understanding of:

- the effectiveness of NFM in reducing flood risk to homes
- the practicalities of installing and monitoring NFM measures across different types of catchments

- the wider benefits that NFM can provide.

Leaky woody structure in Pembury woods, in the Alder stream catchment

The Medway catchment was successful in gaining £364,000 of this £15-million pot. The South East Rivers Trust (SERT) was able to access match-funding of £149,000 from the European Union FRAMES project. Maidstone Borough Council also contributed £65,000 bringing the total funding available for this work to £580,000.

In total the project team selected 4 sites to demonstrate and test NFM. The team worked with 10 landowners to design a range of practical and effective measures. These included 200 Leaky Woody Structures (LWS) and 3,200-square metres of flood storage.

- Alder Stream: reducing flood risk to properties in Five Oak Green. Techniques included LWS and redirecting flood flows away from local homes.
- School Stream: reducing flood risk to properties in Headcorn. Techniques included LWS and an offline storage pond.

The project included 2 demonstrations sites at Bedgebury Forest and Sissinghurst Castle. We worked with partners to:

- trial and test techniques suitable for the Wealden landscape. These included LWSs, bunds to slow the flow and enhance wet woodlands, and meadow creation
- promote the concept of NFM at sites each of which receive over 200,000 visitors each year
- provide test locations for monitoring techniques
- create exemplar projects which demonstrate the wider benefits of NFM
- act as training hubs, where NFM techniques can be shared with contractors, communities and volunteers

In total, the project has:

- reduced flood risk to over 100 properties
- provided environmental benefits, including 200m2 of online wetland habitat and 5,750m2 of offline wetland habitat
- enhanced 2.3 hectares of lowland meadow and 11ha of ancient woodland
- established a new NFM delivery sector among local woodland and drainage contractors
- helped share understanding of NFM through display areas at Bedgebury Pinetum visitor centre and Sissinghurst Castle Gardens

Image shows water from a stream gushing and bubbling around the side of a dam made of horizontal logs

The project team has prepared case studies for each of the sites and these are available on SERT's website: https://www.southeastriverstrust.org/projects/natural-flood-management-in-the-medway/ (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.southeastriverstrust.org%2Fprojects%2Fnatural-flood-management-in-the-medway%2F&data=04%7C01%7Ckathy.aucott%40environment-agency.gov.uk%7C34747212f8e54d93c16408d9fc4307cb%7C770a245002274c6290c74e38537f1102%7C0%7C0%7C637818187121306475%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=rE78lPvxKz4UKkXmgy7avU%2B6PctkhfEFFXTImAHzsv8%3D&reserved=0)

Action 31: NFM funding strategy

Develop a funding strategy to identify and secure additional resources for natural flood management measures across the catchment. This will be a live document and reviewed regularly.

- where: catchment wide
- owner: South East Rivers Trust
- when: 2017/18 and reviewed regularly

- supporting organisations: Environment Agency, Natural England, Forestry Commission, Kent County Council, Southern Water, Maidstone Borough Council, Tonbridge and Malling Borough Council

Year 4 progress update: action ongoing.

SERT has carried out an initial scoping exercise to identify priority locations for future NFM. This will enable the Medway Flood Partnership to continue to build on the momentum from the Medway NFM project. SERT is now working with key partners across the Medway to discuss the scope for delivering more NFM in the future.

As part of these conversations, Kent County Council is funding SERT to carry out a feasibility study for a second phase of delivery in the Alder Stream catchment.

Action 32: Building NFM awareness and take-up

Through the FRAMES project, coordinate existing mechanisms and networks across the partnership. This is to build understanding of the wider benefits of natural flood management techniques. Encourage landowners and tenants to consider implementing them within their current practices.

- where: catchment wide
- owner: South East Rivers Trust
- when: 2018-2021
- supporting organisations: Natural England, National Farmers Union, Country Land and Business Association, Environment Agency, Kent County Council

Year 4 progress update: action complete.

SERT has promoted wider public understanding of NFM through articles on its website, webinars and social media. The demonstration sites at Bedgebury Forest and Sissinghurst Castle (see Action 30) are a valuable way of raising awareness of NFM:

- the sites attract hundreds of thousands of visitors each year
- interpretation boards explain NFM, and the range of benefits that the techniques can bring

SERT has produced a comprehensive report about the work done to create NFM. It has also created case study documents summarising the NFM conducted in the Medway. These case studies are available on SERT's website: https://www.southeastriverstrust.org/projects/natural-flood-management-in-the-medway (https://www.southeastriverstrust.org/projects/natural-flood-management-in-the-medway).

Although the FRAMES project is now complete, the Medway Flood Partnership's NFM steering group will continue the work to raise awareness and take up of NFM techniques. We are now investigating how we can build on the legacy of the Medway NFM project and install further NFM across the catchment.

Action 33: Develop and share NFM case studies

Identify and develop natural flood management case studies from across the country. Build a database of more local demonstration projects and sites suitable for potential walkovers/visits.

Build landowner support for techniques to slow the flow of flood water and other natural flood management techniques through targeted discussions in priority sub-catchments.

- where: catchment wide
- owner: South East Rivers Trust
- when: 2018-2021
- supporting organisations: Environment Agency, Natural England, Forestry Commission, Kent County Council

Year 4 progress update: action ongoing.

The final report of the EU FRAMES project (https://www.gov.uk/government/publications/the-river-medway-partnership-objectives-members-and-action-plan/northsearegion.eu/frames) includes sections on SERT's NFM pilot. It also includes work from Kent County Council and other partners on:

- community resilience
- the innovative 'Multi-level' approach to flooding across the North Sea region

SERT has worked with the Environment Agency to complete case study documents for each of the NFM projects. These have been shared with our partners and are available on the SERT website: https://www.southeastriverstrust.org/projects/natural-flood-management-in-the-medway/ (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.southeastriverstrust.org%2Fprojects%2Fnatural-flood-management-in-the-medway%2F&data=04%7C01%7Ckathy.aucott%40environment-agency.gov.uk%7C34747212f8e54d93c16408d9fc4307cb%7C770a245002274c6290c74e38537f1102%7C0%7C0%7C637818187121306475%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=rE78lPvxKz4UKkXmgy7avU%2B6PctkhfEFFXTImAHzsv8%3D&reserved=0)

The Medway NFM project has raised the profile of NFM in the area. The demonstration sites at Sissinghurst Castle and Bedgebury Forest continue to raise awareness of NFM to visitors. SERT are receiving enquiries from partners and

individuals interested in taking NFM forward on their land.

Leaky woody structure in Pembury woods, in the Alder stream catchment

Community resilience

Actions in this theme consider a broad range of activities to improve community resilience. They aim to reduce the impact of flooding on communities and help them to continue to function during a flood. This might be by ensuring that the power supply is uninterrupted or by managing traffic to prevent properties flooding from road wash.

The Medway Flood Partnership brings together a wide variety of organisations to:

- raise awareness of flood risk
- build individual preparedness
- develop emergency planning activities to ensure local communities are ready to respond
- identify community measures to reduce the impact of flooding

Action 34: Raising awareness of the Medway Flood Action Plan and developing it into the future

Run community drop in sessions and workshops to raise awareness of the Medway Flood Action Plan. Develop the plan further to build flood resilience across the catchment and identify next steps for the action plan.

- where: catchment wide
- owner: Environment Agency and Kent County Council
- when: 2018/19
- supporting organisations: Medway Flood Partnership

Year 4 progress update: action ongoing.

We are nearing the end of the first 5 years of the Medway Flood Partnership.

In May 2021, the Environment Agency published an action plan (https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england-action-plan) to support the National Flood and Coastal Erosion Risk Management Strategy (https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england--2). The Medway Flood Partnership is already working on some of the themes and objectives outlined in the Strategy. As such it would be well-placed to coordinate local actions to deliver the national ambitions.

The Strategy Group will meet in May 2022 to discuss how the partnership will proceed and our next steps.

Action 35: Raising awareness of flood risk to residents

Support local communities to help build residents' awareness of their individual flood risk and what they can do to prepare and respond.

- where: catchment wide
- owner: Kent Association of Local Councils
- when: ongoing
- supporting organisations: Kent County Council, Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council, Environment Agency, Kent Resilience Team, Maidstone Borough Council

Year 4 progress update: action ongoing.

Covid-19 limited face-to-face engagement again in 2021. But despite this, a lot of work has continued to build awareness of flood risk among communities within the Medway catchment. This work includes:

- further updating the Flood Warden training. It aims to empower wardens and communities to run local flood awareness campaigns. Materials to support this are available on the Kent Resilience Forum web pages
- supporting the Environment Agency's National Flood Action Campaign during the week of 22 November. Locally we included social media advertising targeting Maidstone. Media enquiries led to TV and radio coverage with Environment Agency staff and one of our Tonbridge Flood Wardens
- holding a virtual school visit to Ditton where over 100 homes are at risk. We talked about the risk of flooding and the dangers that flood water poses. We also used fun and interactive exercises to show how to prepare for flooding

Action 36: Extended Floodline Service

Raise awareness of the Extended Floodline Service and work with local councils to encourage them to register for this free service.

- where: catchment wide
- owner: Environment Agency
- when: ongoing
- supporting organisations: Kent Resilience Team

Action completed in Year 1.

The following councils have all signed up to the Extended Floodline Service:

- Maidstone Borough Council
- Tunbridge Wells Borough Council
- Tonbridge & Malling Borough Council
- Sevenoaks District Council

Through this service, Environment Agency Floodline call handlers can provide up-to-date and locally relevant flooding information direct to residents on behalf of the Council. This service is available 24 hours a day, 365 days a year.

Action 37: Build awareness of how structures work to reduce flood risk to homes and businesses

Build community understanding about how flood risk assets are operated to reduce flood risk to homes and businesses without increasing risk to others.

- where: catchment wide

- owner: Environment Agency
- when: ongoing
- supporting organisations: Kent County Council, Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council, Kent Association of Local Councils, Joint Parish Flood Group, Kent Resilience Team, Maidstone Borough Council

Year 4 progress update: action ongoing.

The Environment Agency has continued to raise awareness of how flood assets and structures help to reduce flood risk to properties across the Medway catchment:

- Tonbridge Flood Wardens and the University of the Third Age both received a presentation about the Leigh FSA expansion works at their virtual meetings in November 2021.
- the Leigh FSA animation (see above) continues to help people understand how the flood storage area works to reduce flood risk to Tonbridge. Since going up on YouTube in December 2019 it has received over 7,600 views

Action 38: Promoting flood awareness

Continue to promote flood awareness and preparedness and encourage parish councils and community groups to complete and test their own flood plans.

- where: catchment wide
- owner: Kent Resilience Team and Environment Agency
- when: ongoing
- supporting organisations: Kent Association of Local Councils

Year 4 progress update: action ongoing.

Work on this action continued through 2021. In January, the Environment Agency met virtually with the Tonbridge Flood Wardens to help them refine their Community Flood Plan.

The Environment Agency has again refreshed the gap analysis of community risk and preparedness.

The analysis showed that:

- currently there are 155 communities at risk of flooding across the county
- more than 500 trained Flood Wardens across Kent

- over 1,000 are needed across Kent
- the majority of communities don’t have Flood Wardens or flood plans in place

The partnership is using this data to encourage communities to create Community Flood Plans.

Action 39: Local flood forums

Support communities to establish local flood forums in Headcorn, Ightham and Hildenborough. Develop local resilience plans.

- where: Headcorn, Ightham, Hildenborough - further communities may be added as the project progresses
- owner: Kent County Council
- when: 2017-2019
- supporting organisations: National Flood Forum, Environment Agency

Year 4 progress update: action ongoing.

Through the National Flood Forum, Kent County Council is continuing to support Flood Action Groups in:

- Ightham
- Headcorn
- Hildenborough
- East Peckham
- Tunbridge Wells
- Collier Street

Support has also been offered to the flood committee run by the Parish Council in Five Oak Green.

The National Flood Forum has supported groups during the pandemic through virtual meetings. These groups help to raise questions and concerns about flood risk to the appropriate risk management authorities. They also help to improve communication between these authorities and flood-vulnerable communities.

The groups are discussing forming a countywide group of flood action groups, to offer mutual support and information sharing.

Action 40: Operational plan for Yalding and Collier Street

Work with partners to develop a jointly owned flood incident plan, including road closures. This is to support communities during flood events in Yalding and Collier Street.

If this pilot is successful, develop similar plans for other key communities in the catchment.

- where: Yalding and Collier Street
- owner: Environment Agency
- when: 2017 onwards
- supporting organisations: Kent County Council, Kent Resilience Team, Maidstone Borough Council, Yalding and Collier Street Parish Council

Year 4 progress update: action ongoing.

The Medway Confluence Operational Framework was used in winter 2020/21. Partners, including parish councillors, fed back that the Framework is a great measure in protecting the community. We have used the feedback received from partners to further improve the Framework for future use.

Action 41: Flood training

Run training for Parish Councillors and Clerks in at risk communities to build understanding of all aspects of flooding.

- where: county wide
- owner: Kent Association of Local Councils
- when: ongoing
- supporting organisations: Environment Agency, Kent Resilience Team

Year 4 progress update: action ongoing.

The Kent Association of Local Councils invited all parish councils to attend one of three Flood Warden training sessions. These were held in February, September and November 2021. Members from 9 parishes attended. However, more work is needed to improve understanding and engagement around the Flood Warden role at the parish council level.

To complement parish council training, Flood Warden training for borough and district council staff continued. This helps by:

- building understanding of the role of Flood Wardens to support the Council's planning for the wider response

- creating a pool of Flood Wardens who can be deployed to areas with no community Flood Wardens in place

This year we trained a 21 more staff from 4 different councils. To date, 126 staff from 8 councils across the county have been trained as Flood Wardens.

Action 42: Flood Wardens

Recruit, train and maintain engagement with new and existing volunteer flood wardens.

- where: Tonbridge, Hildenborough, Edenbridge, Yalding, Little Venice Country Park and Marina, Paddock Wood, East Peckham, East Farleigh, Collier Street. New communities on demand
- owner: Environment Agency
- when: ongoing, as required
- supporting organisations: Kent Resilience Team, Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council, Kent Association of Local Councils, Joint Parish Flood Group, Maidstone Borough Council

Year 4 progress update: action ongoing.

With Covid-19 and physical restrictions in place again in 2021, much of the community engagement work was online. The Environment Agency and Kent Resilience Forum continued to deliver the Flood Warden training as an e-training package. 3 virtual Flood Warden training sessions ran in 2021 resulting in 130 new wardens trained.

We held a new series of 1-hour ‘Bitesize’ events for our existing Flood Wardens between September and December. These enabled us to stay connected with our existing wardens, share learning and best practice as well as expand their training.

We had expert speakers for each of the 4 events held that covered:

- groundwater flooding (led by the EA)
- surface water flooding (led by KCC)
- how the Leigh Flood Storage area works and an update on the planned expansion works (led by the EA)
- how the Kent Voluntary Emergency Sector supports our response to flooding and links in with Flood Wardens (led by the KRF)

There was plenty of opportunity to interact and ask questions, and we received excellent feedback. You can find out more about becoming a Flood Warden here: www.kentprepared.org.uk/flood-warden (https://eur03.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.kentprepared.org.uk%2Fflood-wardens&data=04%7C01%7Ckathy.aucott%40environment-agency.gov.uk%7C2be10625097f4532d1b408d9c012542b%7C770a245002274c6290c74e38537f1102%7C0%7C0%7C637752007251365494%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=slrizAyYnbp%2Fw6XjUH%2B6HA2u4mppY4GrwK%2FX%2FKkyua0%3D&reserved=0)

Action 43: Emergency flood plans for rural businesses

Develop an emergency flood plan template for rural businesses to ensure they know what action to take in the event of a flood.

Use existing mechanisms to work with businesses and landowners to promote flood awareness and preparedness. Encourage them to complete their own plans.

- where: catchment wide
- owner: National Farmers Union
- when: ongoing
- supporting organisations: Environment Agency, Kent Resilience Team, Country Land and Business Association

Year 4 progress update: action ongoing.

Action 44: Kent Prepared

Use Kent Prepared website to raise awareness of flood risk to the business community.

- where: catchment wide
- owner: Kent Resilience Team
- when: ongoing
- supporting organisations: Environment Agency, Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council, Maidstone Borough Council

Year 4 progress update: action ongoing.

Action 45: Traffic management measures to reduce flood risk

Investigate and install traffic management measures as part of the Middle Medway flood resilience scheme. This is to reduce the risk of flooding to homes from road wash.

- where: Yalding, Collier Street and Hunton
- owner: Kent County Council
- when: 2017-2022
- supporting organisations: Yalding, Collier Street and Hunton Parish Councils, Maidstone Borough Council, Kent Resilience Team, other councils as necessary

Action completed in Year 3.

Kent County Council Highways have worked closely with the Parish Councils of Yalding, Collier Street and Hunton to plan temporary traffic management measures. These can be deployed when needed to reduce the risk of flooding from road wash. The kit was delivered in Year 1 and the protocol for use was finalised in Year 2.

The measures are part of the Medway Confluence Operational Framework (see Action 40).

They were used during the flood events of December 2019 and February/March 2020. The measures had some limited success. Learning was identified during the multi-agency debrief after the December flood event.

Action 46: Traffic management measures to reduce flood risk

Use learning from Middle Medway flood resilience scheme to consider other areas in the catchment where traffic management may help to increase resilience to flooding. Work with local businesses to raise their awareness of how they can help to reduce flood risk.

- where: Yalding, Collier Street and Hunton
- owner: Kent County Council
- when: 2017-2022
- supporting organisations: Yalding, Collier Street and Hunton Parish Councils, Maidstone Borough Council, Kent Resilience Team, other councils as necessary

Year 4 progress update: action ongoing.

Action 47: Asset resilience

Understand which Southern Water assets are key to community resilience during flood events. Work with partners to consider how to make these sites more resilient so that they can continue to support communities during flooding.

- where: catchment wide
- owner: Southern Water
- when: ongoing
- supporting organisations: Kent County Council, Environment Agency

Year 4 progress update: action ongoing.

Action 48: Testing community flood plans in the Middle Medway

Develop and deliver a rolling exercise programme to test community flood plans within the Middle Medway flood resilience scheme area. This will include any action needed for homes with property level resilience measures.

- where: Yalding, Collier Street, Hunton, Marden, West Farleigh, East Farleigh, Wateringbury and Nettlestead
- owner: Environment Agency
- when: Rolling programme from 2018
- supporting organisations: Maidstone Borough Council, Kent County Council, Kent Resilience Team, Joint Parish Flood Group

Year 4 progress update: action ongoing.

The Environment Agency is planning a Property Flood Resilience (PFR) community exercise for Aylesford next year. The aim is to build residents' confidence in installing their PFR measures. It will also raise understanding of where to go for maintenance and repairs.

We plan to use this exercise as a template which can be rolled out to other Medway communities with PFR installations. The template can then also be added into Community Flood Plans and exercised as part of flood plan testing.

Action 49: Testing community flood plans

Develop and deliver a rolling exercise programme to test community flood plans.

- where: catchment wide
- owner: Environment Agency

- when: ongoing
- supporting organisations: Kent Resilience Team, relevant Borough and District Councils

Year 4 progress update: action ongoing.

Communities can download scenarios to test their community plans from the Kent Prepared website (https://www.kentprepared.org.uk/). The Environment Agency are still offering to support communities to hold exercises virtually.

Action 50: Flood asset register

Compile a register of flood risk assets in Kent. Include high-risk culverts, watercourses and other drainage assets, structures and locations.

Share this flood risk asset information so that local communities understand where local assets are and who is responsible for them.

- where: County of Kent
- owner: Kent County Council
- when: 2017
- supporting organisations: all Risk Management Authorities

Year 4 progress update: action ongoing.

Action 51: Flood Risk to Communities documents

Develop and publish Flood Risk to Communities documents to explain:

- all sources of flood risk in an area
- who is responsible for managing different flood risks
- who will do what in an emergency and
- what is currently planned to manage flood risk in the area

These will apply to all Kent districts and boroughs.

- where: in each borough and district of Kent, including: Maidstone, Tonbridge and Malling, Tunbridge Wells, Sevenoaks
- owner: Kent County Council
- when: 2017
- supporting organisations: all Risk Management Authorities

Year 4 progress update: action ongoing.

Action 52: Using national planning policy to manage flood risk

Continue to apply national planning policy and local approaches to the practical design of development and sustainable drainage systems. This will ensure that planning for new development reduces the risk of flooding.

- where: catchment wide
- owner: Maidstone Borough Council, Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council
- when: ongoing
- supporting organisations: Kent County Council, Environment Agency

Year 4 progress update: action ongoing.

In November 2021, Tonbridge and Malling Borough Council withdrew the Local Plan they had submitted in January 2019. They plan to resubmit a new Local Plan with some amendments to meet the higher housing need. The Council is currently refreshing the Evidence Base, including the Strategic Flood Risk Assessment. A new Call for Sites exercise was open between December 2021 and February 2022. This invited landowners and those with an interest in land to promote sites for inclusion in the Plan. The new Plan is expected to be submitted in the first half of 2023, with adoption expected during 2024.

Maidstone Council has published a draft Local Plan to replace the current adopted 2017 Local Plan. Regulation 19 consultation on the draft ended in December 2021. It is anticipated that the new Local Plan will be adopted in January 2023. The draft Local Plan addresses flood risk in proposed new developments and requires that all new developments include sustainable drainage methods to manage surface water flooding.

Action 53: Managing flood risk in new developments

Continue to encourage developers to have pre-application discussions to ensure new development incorporates flood risk management best practice.

- where: catchment wide
- owner: Kent County Council and Environment Agency
- when: ongoing

Year 4 progress update: action ongoing.

The Environment Agency has continued to provide a pre-planning application advice service this year. This service allows developers to discuss their proposals and gain flood risk mitigation advice before submitting a planning application to the planning authority.

The Environment Agency has talked to developers about 6 sites within the Medway Flood Action Plan area this year. We have encouraged them to include best practice measures in their developments. For example, at one site we advised the applicant to carry out a topographic survey and improve their Flood Risk Assessment. This allowed us to remove our objection and the development was able to take place.

Kent County Council also offers pre-planning application advice where developers can discuss their drainage proposals prior to submitting an application.

Action 54: Neighbourhood plans

Encourage Town and Parish Councils who are preparing Neighbourhood Plans to consider sustainable drainage and flooding mitigation measures in their Plans where appropriate.

- where: catchment wide
- owner: Kent Association of Local Councils
- when: ongoing
- supporting organisations: Tonbridge and Malling Borough Council, Tunbridge Wells Borough Council, Sevenoaks District Council, Maidstone Borough Council, Kent County Council, Environment Agency

Year 4 progress update: action ongoing.

The Kent Association of Local Councils (KALC) held 2 Neighbourhood Planning workshops on 23 June 2021 and 1 July 2021.

KALC's introductory planning training will now include a section on climate change and sustainable drainage. KALC will also run training on Advanced Topics in Planning for Local Councils which will go into these areas in more depth.

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Appendix 1: Biodiversity and Climate Change Action Plan Implementation Status and RAG

The following table breaks down the status of each action in the Action Plan and details the responsible officer, the outputs and outcomes of the action and the previous status of the action in February 2022 with and updated status for October 2022. A RAG (Red-Amber-Green) ratings, also known as 'traffic lighting,' are used in the table below to summarise the status of specific actions, where **green denotes 'completed', amber as 'ongoing, being investigated' and red as 'delayed or incomplete'**. The following table details, by theme, each action in the Biodiversity and Climate Change Action Plan, its responsible officer, timescale, status and RAG.

Of a total of 68 Actions across the Biodiversity and Climate Change action plan, 29 actions are Red (delayed or incomplete), 33 are Amber (ongoing or being investigated), and 6 action are Green and have been completed. For full details of each action's status, including the February 2022 update, responsible officers, outputs and outcomes please see Appendix 1 with this report.

RAG Rating	Number of Actions
Red (Incomplete or delayed)	29
Amber (ongoing or being investigated)	33
Green (Complete)	6

Action		Outputs	Outcomes	Responsibility	Timescale	Previous Status February 2022	Current Status October 2022	RAG
Decarbonising and insulating homes and buildings								
1.1	Promote water efficiency to residents in partnership with South East Water	Engagement and education initiatives Indicator SA36: Water availability/consumption ratios[1]	Reduction in water wastage Increase in residents' knowledge of water conservation	Gemma Bailey James Wilderspin	2020-30	Started	Led by KCC and in partnership with South East Water a water saving campaign is underway with 110k postcards sent to lower income Maidstone residents on the 1st August to encourage them to order water saving devices for their homes to reduce water consumption and also increase awareness of the link between water usage and domestic energy consumption. As part of the engagement and information provided at the Go Green Information Centre, residents were able to directly discuss and take leaflets on water saving advice and were able to discuss options available including water butts, aerating taps, and reduced water flow showers.	Amber

[1] Maidstone Authority Monitoring Report (AMR) 2020-2021

Action		Outputs	Outcomes	Responsibility	Timescale	Previous Status February 2022	Current Status October 2022	RAG
Adapting to climate change								
2.1	Provide policy on climate change adaptation in Local Plan review, including consideration of flooding, heat and drought.	Indicator M36: Number of qualifying developments failing to provide BREEAM very good standards for water and energy credits Indicator SA27: Number of new residential developments where the energy/emissions standards in the Building Regulations Part L have been exceeded[2]	Flooding, heat and drought impacts of climate change integrated in to local plan, DPD and policy documents.	Mark Egerton James Wilderspin	2020-22	Started - As part of local plan review policy to ensure climate adaptation is now included: • POLICY LPRSP14(C) – CLIMATE CHANGE requires the integration of blue-green infrastructure into qualifying new development in order to mitigate urban heat islands, enhance urban biodiversity, and to contribute to reduced surface water runoff through the provision of SuDS. • POLICY LPRQ&D 1: SUSTAINABLE DESIGN is incorporated into the local plan review process to ensure new developments mitigate climate impacts in their design. This action is also integrated into the forthcoming Design and Sustainability DPD	The LPR is currently undergoing examination in public. LPR indicators are reported in the autumn. Work has stared on Design and Sustainability Development Plan Document which will build on LPR policies in relation to sustainable movement.	Red
2.2	Ensure Local Plan review considers level of current and future projected flood risk and that new developments are planned accordingly.	Indicator SA4: New development in the floodplain Indicator SA5: Development permitted contrary to advice by the Environment Agency on flood risk[3]	New developments are planned in projected flood resilient/resistant area	Mark Egerton	2020-22	Started - There have been 111 applications permitted within the floodplain during the monitoring year of 2020/21. Of this number 28 included a flood risk assessment as part of the application. A further 17 applications included flood mitigation conditions such as details regarding floor level, materials and the submission of a floor risk assessment. The remaining applications did not include any flood risk mitigation as the developments were considered suitable.	AMR monitoring reported in Autumn	Red

[2] Maidstone Authority Monitoring Report (AMR) 2020-2021

[3] Maidstone Authority Monitoring Report (AMR) 2020-2021

	Action	Outputs	Outcomes	Responsibility	Timescale	Previous Status February 2022	Current Status October 2022	RAG
2.3	Use Severe Weather Impacts Monitoring System (SWIMS) to understand impacts of severe weather in borough. Work with Kent County Council to implement actions from the Climate Change Risk and Impact Assessment in the borough.	Number of Major / Minor impacts recorded / detailed on SWIMS and back log of events also to be put up from 2020 Record of actions Implemented alongside KCC for Maidstone Borough	Use of past incidences to gather 'lessons learnt' and for future planning	Uche Olufemi James Wilderspin	2020-30	Started – SWIMS is in use at MBC, sever incidences are recorded and logged.	There has been little progress on this action because of other pressing priorities responding to Covid19, flooding and heatwave response. However, MBC have now recruited an Emergency Planning Officer who will be trained on SWIMS and take on the task of uploading impacts on SWIMS more regularly and with closer ties to KCC.	Red
2.4	Work with Medway Flood Partnership to identify and develop actions, including natural flood management (nature-based solutions and sustainable urban drainage), which can help to reduce flooding.	Utilise natural flood management and integrated with planning Indicator SA6: Percentage of developments implementing SUDs[4]	Flooding reduced across borough Surface run off reduced at new developments	Mark Green	2020-30	Started - Over 2021, the Partnership has been working hard to deliver the actions within the Medway Flood Action Plan. Action Plan End of Year 1 Report. While this flood action plan is a significant milestone in addressing flood risk in the Medway catchment, it is part of a longer journey with the partnership, communities and with individuals to build awareness and preparedness for flooding and identify and develop more actions which can help to reduce flood levels. In the coming years, the partnership will continue to work with communities to develop this plan further and consider the 25-year vision and the pathway to getting there.	South east rivers trust – schemes of	Amber
2.5	Work with Medway Flood Partnership to • Develop a funding strategy to identify and secure additional resources for natural flood management. • Build local communities' resilience to flooding	Support to parishes to develop plans	Increase in Parishes involved Increase in number of emergency plans implemented	Mark Green Uche Olufemi	2020-30	Started - Following the floods of winter 2013/14, extensive work was carried out to investigate the feasibility of large-scale engineering solutions to flood risk. The only large-scale capital scheme in the overall Medway Flood Partnership programme is the expansion of the Leigh Flood Storage Area in Tonbridge & Malling. Other capital investment and maintenance work has been on a smaller scale, focused on local flood	Officers have been in touch with local parishes to share the importance of creating community flood and emergency plans. Support has been offered to the parishes with templates and material shared to help kick start the process. Some parishes have effective plans which have been rehearsed multiple times because of incidents like flooding. We have now contacted the KALC chair and plan to work with the other parishes without community emergency plans to develop one for their communities, promote the plans and recruit volunteer flood wardens to support the response to incidents.	Amber

[4] Maidstone Authority Monitoring Report (AMR) 2020-2021

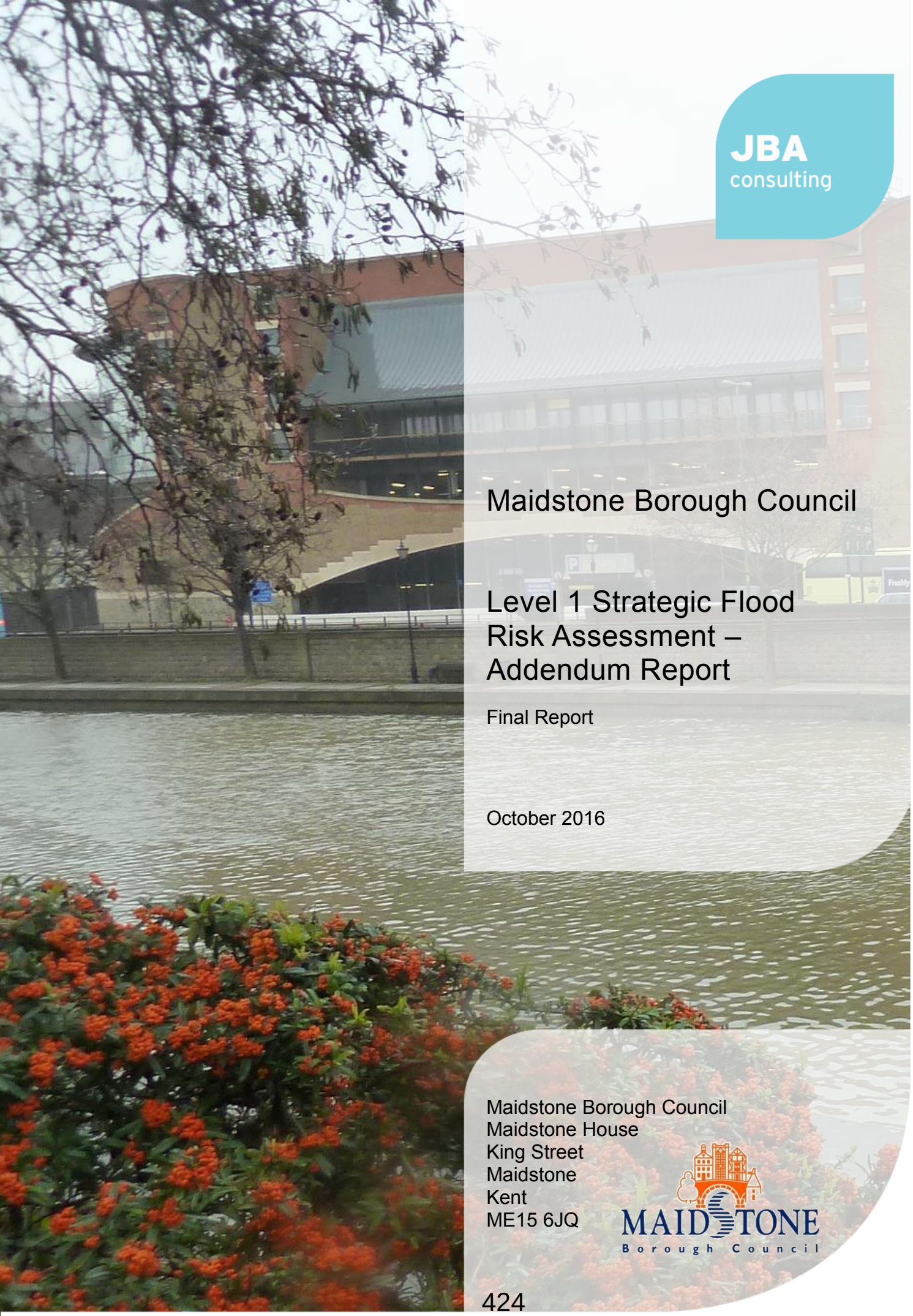
Action		Outputs	Outcomes	Responsibility	Timescale	Previous Status February 2022	Current Status October 2022	RAG
						risk. The two projects within Maidstone Council's capital programme are described below.		
2.6	Review our arrangements around our estate, parks and recreation facilities in severe weather situations as part of business continuity management	Develop plans for Parks & Open spaces and recreation facilities owned and operated by MBC	Reduction in recovery time following sever weather situation	Uche Olufemi Lucy Norman Andrew Williams	2021	Started – Plans in development.	Business Continuity Plans have been development for facilities owned and operated by MBC. The Business Continuity Plan's primary aim is to ensure that maintenance and management of Council properties continue if an emergency situation occurs. This plan is to be used in the event of a major incident affecting the provision of the Council's services and is to be used in conjunction with the full MBC Business Continuity Plan and may be used in conjunction with the Council's Emergency Plan.	Amber
2.7	Work with the Kent Resilience Forum, spatial planners and other partners to enhance adaptation and emergency planning contingencies for severe weather and other climate impacts. 'Strengthening' of power and water supply and other critical infrastructure should be a priority alongside ensuring more resilient settlements	Incorporate climate adaptation and emergency planning contingencies in to planning	Improved resilience of power and water supply and other critical infrastructure	Mark Egerton Uche Olufemi James Wilderspin	2020-30	Started	The Local Plan Review (LPR) is currently undergoing examination in public. Annual Monitoring Report indicators are reported in the autumn. Work has stared on Design and Sustainability Development Plan Document which will build on LPR policies in relation to sustainable movement.	Red
2.8	Support local businesses to be resilient to climate change including referring to Kent Prepared website	Signpost and support local businesses to make climate informed decisions and access to resilience information	Climate resilience and awareness increased for local businesses	Chris Inwood	2021	Not Started – this action is delayed to 2022. However, through the business newsletter local business have been supported through awareness raising and the option to contact the council for advice.	The Kent prepared website will be listed in the business green business support section of the new Maidstone in Business Website due to go live in Autumn 2022.	Red
Enhancing and increasing biodiversity								
2.9	Work with Environment Agency, South East Rivers Trust, Kent Wildlife Trust and Medway Valley Countryside Partnership to enhance and expand wetland coverage in Borough (including removal of dams and culverts, achieving improvements to water quality and restoration	Identify potential wetland area Facilitate partnerships on wetland projects	Increase in wetlands across borough Reduction in flooding and surface water run off Improvement in water quality	Rob Jarman James Wilderspin	2020-30	Started – Project opportunities are in the process of being scoped to expand wetlands in the borough. MBC supported development of a 2.2-hectare wetland on unproductive farmland that lies South of Carpenters Lane in Staplehurst. Total projected costs are £59,785 in partnership with The Environment Agency.	No additional update since February 2022	Red

Action		Outputs	Outcomes	Responsibility	Timescale	Previous Status February 2022	Current Status October 2022	RAG
	of ponds, lakes, marshes, wet woodland and bogs)							
2.10	Work with partners to develop and implement a Nature Recovery Strategy, linking habitat restoration and creation to improve flood protection and water quality	Create a Nature Recovery Strategy Indicator SA37: Ecological/chemical status of water bodies[5]	Improved flood protection and water quality	Rob Jarman James Wilderspin	2020-30	Started – KCC leading	Local Nature Recovery Strategy provides the opportunity to deliver an ecologically coherent and landscape scale, strategic approach to nature recovery in Kent and Medway – this is being led and implemented by Kent County Council. As spatial strategies, Local Nature Recovery Strategies are under development to establish priorities and map proposals for specific actions to drive nature's recovery and provide wider environmental benefits. Secondary legislation and statutory guidance, yet to be published.	Red
2.11	Work with local farms and landowners to deliver landscape scale biodiversity initiatives – including reconnection of fragmented natural habitats, floodplain restoration, reduced chemical inputs and reintroduction of lost key stone species	Form partnerships and collaboration with farmers and landowners	Landscape scale biodiversity improvements	Rob Jarman James Wilderspin	2020-30	Started – a partnership with the Kent Agricultural Society is being initiated to work with local farmers.	Monthly Marden Farm Cluster Blog to be distributed through MBC comms aimed at wider farmer community to encourage sustainable practices with farming community. Meetings have been held with Rochester Bridges Trust and Leeds Castle on Biodiversity and Climate actions and plans. Further collaboration is being sought with Leeds Castle. Other than resource sharing no landscape scale initiatives or partnerships have been formed yet for this action. Officers seeking collaboration through KWTs cluster system to create closer ties with famers and large-scale landowners.	Red
2.12	Contribute to the KCC aim to plant 1.5 million trees in Kent by 2050 to increase canopy cover by 2% increase to 19%, of which Maidstone's proportion is to increase canopy cover from 16% to 18%. With an emphasis on expanding ancient forests and reconnecting of existing woodland including urban woods, greening town	Seek partnership on land and tree planting Seek to purchase land for rewilding projects Partner with KCC on wider scale tree planting initiative	Borough tree canopy increased by 2%	James Wilderspin Rob Jarman Andrew Williams	2021 -2030	Started – MBC has launched the Call for Tree Planting Projects to seek partners for widescale tree planting. In collaboration with KCC Kent Plan Tree Partnership, large scale areas for tree planning and funding is being sought.	Following a call for tree planting sites on the MBC website campaigns page and comms outreach a total of 15 medium to large scale landowners submitted proposals to MBC of which only 6 tree planting projects we deemed viable and shortlisted. With a combined 12 hectares for planting owned by private landowners. However, Due to legal agreement requiring MBC ownership of trees, maintenance required, access needed and stipulation that the trees must adhere to DEFRA guidelines and be left to grow for a minimum of 30 years several private landowners dropped out of the MBC scheme. The	Amber

[5] Maidstone Authority Monitoring Report (AMR) 2020-2021

Action		Outputs	Outcomes	Responsibility	Timescale	Previous Status February 2022	Current Status October 2022	RAG
	centres, and where feasible increase tree cover on our estate land.						number of interested private landowners has now reduced to just two (totalling 3 hectares). Cost effectiveness of the MBC planting scheme will be considered on small scale projects and MBC is awaiting confirmation from the landowners on whether the terms are accepted to go ahead with planting in autumn 2022. One tree planting project funded by MBC is set to go ahead in October 2022 collaboration with Medway country Valley partnership and working with Maidstone Victory Angling Society (MVAS) to create a new community woodland on MVAS land adjacent to the River Medway between Yalding and Nettlestead. The proposed creation of this small community woodland on land at Grid Ref: TQ6864350752 is currently a mixture of neutral and improved grassland covering approx. 1.5 hectares. It has some wildflowers but is currently heavily affected by the presence of non-native invasive Himalayan balsam and largely inaccessibly. The site has no protected habitat designations. In the short term 1200 whips will be planted. We propose a site specific broadleaved mixed woodland with tree species such as oak, lime and alder (on the wetter parts of the site) plus ash and elm if ash die back and Dutch elm disease strains have been identified ahead of planting. Whilst the planting and activities we propose will be slightly further than 8m from the waterbody, the land in question is in Flood Zone 3. As such, MVCP have prepared a Flood Risk Assessment and Method Statement and will submit a Be-Spoke Permit Application to the Environment Agency and gain confirmation that the planting is supported by the E.A ahead of project start. No trees will be planted closer than 4m from the adjacent path. Trees will not be planted adjacent to the access gate which allows access to the site from across the railway line. A route for potential future machinery through the gate and across the site will be left to ensure the facilitation of future access. To ensure the success of the planting, MVCP will carry out Himalayan balsam removal activities with volunteers in the first year after planting. Whilst doing so we	

Action		Outputs	Outcomes	Responsibility	Timescale	Previous Status February 2022	Current Status October 2022	RAG
							will provide training to MVAS members and volunteers to ensure this activity continues. Additionally, Biodiversity and Climate officers are developing a business case for the purchase of land specifically for green projects including nutrient neutrality, SuDS and wetland creation, Biodiversity banks, offsetting schemes and tree planting.	



JBA consulting

Maidstone Borough Council

Level 1 Strategic Flood Risk Assessment – Addendum Report

Final Report

October 2016

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Revision History

Revision Ref / Date Issued	Amendments	Issued to
Draft v1 / June 2016	Draft addendum report, excluding updated climate change information	Cheryl Parks (Maidstone Borough Council)
Draft v2 / October 2016	Updates made following comments received from Cheryl Parks on 12 July 2016	Cheryl Parks (Maidstone Borough Council)
Draft v3 / October 2016	Updates made following draft comments raised by the Environment Agency and received from Maidstone Borough Council on 13 October 2016	Cheryl Parks and Adam Reynolds (Maidstone Borough Council)
Final v4 / October 2016	Updates made following final comments raised by the Environment Agency and received from Maidstone Borough Council on 19 October 2016	Cheryl Parks and Adam Reynolds (Maidstone Borough Council)

Contract

This report describes work commissioned by Maidstone Borough Council. The Council's representative for the contract was Cheryl Parks. Georgina Latus and Ben Gibson of JBA Consulting carried out this work.

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Purpose

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Executive Summary

Introduction

This Strategic Flood Risk Assessment (SFRA) 2016 addendum document updates elements of the Level 1 SFRA document prepared by Mott MacDonald for Maidstone Borough Council in May 2008. The addendum SFRA replaces sections of the 2008 issue and provides supporting evidence for the emerging Local Plan. The report indicates which sections and figures from the 2008 document are replaced or should be discarded.

Whilst sites allocated in the Local Plan have taken account of the National Planning Policy Framework (NPPF) (2012) and the National Planning Practice Guidance (NPPG), the 2016 SFRA addendum and 2008 SFRA will inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

SFRA objectives

The key objectives of this addendum document are:

- To take into account the latest flood risk policy following key changes to policy and guidance that have occurred since the previous SFRA was published.
- To take into account the latest flood risk information and available data since the previous SFRA.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as part of the evidence base for the Local Plan.

SFRA outputs

To meet the objectives, the outputs prepared as part of this SFRA addendum include the following:

- Appraisal of all potential sources of flooding, including Main River, Ordinary Watercourse, surface water and groundwater.
- Updated review of historical flooding incidents.
- Mapping of location and extent of functional floodplain.
- An assessment of the potential increase in flood risk due to climate change.
- Areas at risk from other sources of flooding, for example surface water or reservoirs.

Summary of Level 1 Assessment

The SFRA addendum has considered all sources of flooding within the borough. Fluvial flood risk has been analysed using the results from computer models supplied by the Environment Agency, as well as existing Environment Agency Flood Zone mapping. Surface water flood risk has been assessed using the updated Flood Map for Surface Water published online by the Environment Agency and recorded flood incidents supplied by various sources. A number of other data sources have been drawn upon as an evidence base, including data from Southern Water, National Inundation Reservoir Mapping from the Environment Agency, historic incidences of flooding from Kent County Council and various geology / groundwater products and datasets from the Environment Agency. Each of the sources of flood risk analysed is based upon updated data compared with that available since the publication of the 2008 SFRA. This includes; updated flood history information, more detailed modelling of fluvial flood risk across the borough, the updated Flood Map for Surface Water (uFMfSW), Areas Susceptible to Groundwater Flooding and Risk of Flooding from Reservoirs dataset.

Using this updated evidence base for flood risk, the Level 1 SFRA addendum concludes the following:

- Maidstone Borough has a history of documented flood events and flood records indicate that the main source of risk is from fluvial sources.
- The primary source of fluvial flood risk to the borough is the River Medway and its major tributaries, the River Beult and River Teise, which are of fluvial influence in the south and west of the borough. Updated Flood Zone information (2, 3a and 3b) for the borough

typically indicates increased extents compared with the information presented within the previous SFRA, reflecting changes in the understanding of risk in the borough. Additionally, updated climate change guidance now takes account of the vulnerability of development and provides greater definition on predicted changes to flows at various times through the lifetime of development. Generally, the change in peak river flows brought about by climate change are expected to increase compared with the previous guidance, indicating greater flood risk throughout the borough compared with the previous SFRA.

- The most significant flood events reported to have affected the borough occurred in 1927, 1963, 1968, 2000 and 2013/14, each of which included notable flooding from the River Medway. The December 2013/14 event ranked the largest flood event recorded in the River Medway catchment at East Farleigh gauging site (upstream of Maidstone), whilst elsewhere in the Maidstone Borough, the event ranked either 1st or 2nd largest.
- Maidstone Borough has also experienced a number of historic surface water / drainage related flood events, which have been attributed to a range of sources. The primary source of surface water flooding was attributed to heavy rainfall overloading highway carriageways and paved areas, drains and gullies, but other sources of flooding were perceived to be from blockages and high water levels impeding free discharge from surface water drains and gullies. The uFMfSW shows a number of surface water flow paths which predominantly follow topographical flow paths along existing watercourses or dry valleys with some isolated ponding located in low lying areas.
- Up to date data from the Sewer Incident Report Form data supplied by Southern Water indicates a total of 188 recorded flood incidents in Maidstone Borough within the last 5-year period. The more frequently flooded postcodes are TN12 9 (41), ME18 6 (28), TN12 0 (22) and TN27 9 (22). However, it is important to recognise that the information does not present whether flooding incidences were caused by general exceedance of the design sewer system, or by operational issues such as blockages.
- Historically, groundwater flood events have been recorded across the borough, but these have typically been isolated incidents (note: Boughton Monchelsea has a number of groundwater flood incident reports historically). The Areas Susceptible to Groundwater Flooding (AStGWF) mapping suggests that areas susceptible to groundwater flooding are primarily located in the central and southern sections of the borough. For the most part, susceptibility to groundwater flooding is considered to be low as less than 25% of the area within the 1km grid squares are considered to be susceptible to groundwater flooding. However, several areas are indicated to have higher susceptibility.
- The Risk of Flooding from Reservoirs mapping, not previously available for the 2008 SFRA, indicates that there are ten reservoirs within the borough and nine reservoirs outside of the borough that could affect the borough in the event of a breach. This includes Leigh Flood Storage Area and Weirwood Reservoir, located at the west of the borough, but most notably Bewl Bridge reservoir located south of the borough.

Site-specific FRAs should include assessment of mitigation measures required to safely manage flood risk along with promotion of Sustainable Drainage Systems (SuDS) to create a conceptual drainage strategy and safe access/egress at the development in the event of a flood.

Surface water flooding and the role of the Lead Local Flood Authority (LLFA) and the Local Planning Authority (LPA) in surface water management has been defined with guidance provided for the design and implementation of SuDS as part of the initial planning stage of all types of residential, commercial and industrial developments. The SFRA provides details of the types of SuDS available and when they should be used, and outlines the recommendations included in the relevant national, regional and local guidance documents.

Strategic flood risk solutions should be considered and understood when considering development within the borough. Developers should work with stakeholders to identify issues and provide suitable solutions.

Recommendations

Assessing Flood Risk and Developments

- The NPPF supports a risk-based and sequential approach to development and flood risk in England, so that development is located in the lowest flood risk areas where possible.

- A site-specific FRA is required for all developments which are located in the Environment Agency's Flood Zones 2 and 3, or developments greater than 1ha in size in Flood Zone 1. They are also required for developments less than 1ha in Flood Zone 1 where there is a change in use to a more vulnerable development where they could be affected by sources of flooding other than rivers and the sea (e.g. surface water drains, reservoirs). All developments located in areas of Flood Zone 1 highlighted as having critical drainage problems must also be accompanied by an FRA. The FRA should be proportionate to the degree of flood risk, as well as the scale, nature and location of the development.
- It is recommended that the impact of climate change to a proposed site is considered in FRAs and that the percentage increases which relate to the proposed lifetime of the development and the vulnerability classification of the development is identified and taken into account. The Environment Agency and LLFA should be consulted to confirm a suitable approach to climate change in light of the latest guidance.
- Opportunities to reduce flood risk to wider communities could be sought through the regeneration of Brownfield sites, through reductions in the amount of surface water runoff generated on a site.
- For areas of the Borough where specific surface runoff and drainage issues have been identified, it will normally be expected that development in these areas should contribute to the Community Infrastructure Levy, natural flood management, or local, targeted highways improvements to reduce the local flood risk in the area.
- The Local Planning Authority (LPA), Environment Agency and LLFA should be consulted to confirm the level of assessment required and to provide any information on any known local issues. The LLFA (Kent County Council) may also be able to provide guidance on water quality treatment train from new developments and developers should consult with the Kent County Council Flood & Drainage team as early as possible in the design process.
- When assessing sites not identified in the Local Plan (windfall sites), developers should use evidence provided in this SFRA to apply the Sequential Test as well as provide evidence to show that they have adequately considered other reasonably available sites.

Future Developments

Development types and their location mean that opportunities and constraints will vary on a site by site basis. However, developments should seek opportunities to reduce overall levels of flood risk at the site, for example by:

- Reducing volume and rate of surface water runoff based on Local Plan policy and LLFA Guidance
- Locating development to areas with lower flood risk
- Creating space for flooding.
- Integrating green infrastructure into mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.

The LPA should consult the NPPF and Environment Agency's 'Flood Risk Standing Advice (FRSA) for Local Planning Authorities', published in March 2014, when reviewing planning applications for proposed developments at risk of flooding.

At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances) inform development zoning within the site and prove, if required, whether the Exception Test can be passed.

Promotion of SuDS

Planners should be aware of the conditions set by the LLFA for surface water management and ensure development proposals and applications are compliant with the Council's policy.

- A detailed site-specific assessment of SuDS would be needed to incorporate SuDS successfully into the development proposals. New or re-development should adopt source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff.

- During the review of development applications, Maidstone Borough Council will consider the benefits of proposed SuDS systems at development sites, both in terms of flood reduction and other environmental enhancements, and advise on appropriate measures.
- For proposed developments, it is imperative that a site-specific infiltration test is conducted early on as part of the design of the development, to confirm whether the water table is low enough to allow for SuDS techniques that are designed to encourage infiltration.
- Where sites lie within or close to Groundwater Source Protection Zones or aquifers, there may be a requirement for a form of pre-treatment prior to infiltration. Further guidance can be found in the CIRIA SuDS manual on the level of water quality treatment required for drainage via infiltration. Further restrictions may still be applicable and guidance should be sought from the LLFA.
- Developers need to ensure that new development does not increase the surface water runoff rate from the site and should therefore contact the LLFA and other key stakeholders at an early stage to ensure surface water management is undertaken and that SuDS are promoted and implemented, designed to overcome site-specific constraints.
- The LPA will need to consider drainage schemes for major applications, but it is advised developers utilise the LLFA's Polices and Guidance to develop their drainage scheme for minor applications.

Infrastructure and Access

If a proposed development site is located with areas at flood risk, safe access and egress in times of flood will need to be demonstrated. Consideration of alternative access and egress routes should be made in the event that primary routes are inundated with flood water. Resilience measures will be required if buildings are situated in the flood risk area, and opportunities to enhance green infrastructure and reduce flood risk by making space for water should be sought.

Green Infrastructure and WFD

Opportunities to enhance green infrastructure and reduce flood risk by making space for water should be sought. In addition, opportunities where it may be possible to improve the WFD status of watercourses, for example by opening up culverts, weir removal, and river restoration, should be considered. Green infrastructure should be considered within the mitigation measures for surface water runoff from development.

Use of SFRA data and future updates

It is important to recognise that the SFRA addendum has been prepared using the best available information at the time of preparation.

The SFRA should be periodically updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by authorities including Maidstone Borough Council, Kent County Council (in its role as LLFA), the Highways Authority, Southern Water and the Environment Agency. It is recommended that the SFRA is reviewed internally on an annual basis, allowing a cycle of review, followed by checking with the above bodies for any new information to allow a periodic update.

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Using this document

Hyperlinks

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

Contents, list of figures, list of tables and references to other sections, figures and tables have also been hyperlinked to enable easy navigation around the report.

Abbreviations and Glossary of Terms

Term	Definition
AEP	Annual Exceedance Probability
AStGWF	Areas Susceptible to Groundwater Flooding
CFMP	Catchment Flood Management Plan - A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Defra	Department for Environment, Food and Rural Affairs
Designated Feature	A form of legal protection or status reserved for certain key structures or features that are privately owned and maintained, but which make a contribution to the flood or coastal erosion risk management of people and property at a particular location.
DG5 Register	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.
EA	Environment Agency
EU	European Union
FEH	Flood Estimation Handbook
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river
FRA	Flood Risk Assessment - A site specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FRM	Flood Risk Management
FWMA	Flood and Water Management Act
GI	Green Infrastructure – a network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and urban fringe
Ha	Hectare
Indicative Flood Risk Area	Nationally identified flood risk areas, based on the definition of ‘significant’ flood risk described by Defra and WAG.
JBA	Jeremy Benn Associates
LFRMS	Local Food Risk Management Strategy
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
m AOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
OS NGR	Ordnance Survey National Grid Reference
PFRA	Preliminary Flood Risk Assessment

Term	Definition
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
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.
PPG	National Planning Policy Guidance
PPS25	Planning and Policy Statement 25: Development and Flood Risk – superseded by the NPPF and PPG
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.
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.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
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.
uFMfSW	Updated Flood Map for Surface Water
WFD	Water Framework Directive

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

This Strategic Flood Risk Assessment (SFRA) 2016 addendum document updates elements of the Level 1 SFRA document prepared by Mott MacDonald for Maidstone Borough Council in May 2008. The addendum SFRA replaces sections of the 2008 issue and provides supporting evidence for the emerging Local Plan.

Sites allocated in the Local Plan have taken account of the National Planning Policy Framework (NPPF) (2012) and the National Planning Practice Guidance (NPPG). Maidstone Borough Council have used the Sequential Test or Exception Test in determining suitability of these sites. Where sites are shown to be at risk of flooding, these have been identified and recorded by Maidstone Borough Council to ensure the appropriate policy is put in place requiring a flood risk assessment.

Whilst NPPF requirements have been considered at allocation sites to date, the 2016 SFRA addendum provides an updated evidence base to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

The key objectives of the review performed during the preparation of the 2016 SFRA update were:

1. To take into account the latest flood risk policy

There is a need to ensure the assessment is up to date with reference to the following key changes to policy and guidance that have occurred since the existing SFRA was published in 2008:

- Changes to legislation, both relating to flood risk and planning policy, including the Flood Risk Regulations (2009), Flood and Water Management Act (2010), the National Planning Policy Framework (2012), the Localism Act (2011) and the Climate Change Act (2008); and new powers and responsibilities bestowed on Kent County Council as the Lead Local Flood Authority (LLFA) under the Flood and Water Management Act (2010) and their dependencies therefore with the Council's local development and forward planning roles.
- Recent guidance published in April 2015 regarding the role of LLFAs, Local Planning Authorities and the Environment Agency with regards to SuDS approval.
- Changes to technical guidance, for example the Consultation on SuDS Regulations and Standards (2011), Defra's Non-statutory technical standards for sustainable drainage systems (March 2015), and NPPF Planning Practice Guidance replacing PPS25 and PPG25, CIRIA SuDS Manual C753 (2015)
- Latest guidance on climate change allowances for flood risk assessments released by the Environment Agency in February 2016.

2. Take into account the latest flood risk information and available data

There have been a number of changes to available data that have occurred since the last SFRA was published in 2008:

- Availability of the Environment Agency's updated tidal flood risk modelling of the North Kent Coast, including the River Medway (2013)
- Availability of the Environment Agency's updated fluvial flood risk modelling of the River Len (2010) and River Medway, River Beult and River Teise (2015), including climate change modelling of the defended and undefended 1% AEP event with +35% and +70% flows (2016)
- Fluvial flood risk modelling for a small reach of the Loose Stream (completed to inform this SFRA update)
- Availability of the surface water flood risk dataset: updated Flood Map for Surface Water (uFMfSW)
- Kent County Council Local Flood Risk Management Strategy (2013)

- Maidstone & Malling Surface Water Management Plan (2012)
- Maidstone Surface Water Management Plan (2013)

3. To provide a comprehensive set of maps including, but not limited to
    - fluvial flood risk, including functional floodplain and climate change;
    - surface water risk;
    - groundwater risk; and
    - flood warning coverage.

1.2 SFRA objectives

The Planning Practice Guidance advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

- Level One: where flooding is not a major issue and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test.
- Level Two: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all the necessary development creating the need to apply the NPPF's Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

In order to provide a robust evidence base and support the Council's emerging Local Plan, the objectives of this SFRA 2016 document are to provide up to date information and replace sections of the existing Level 1 SFRA published in May 2008. This addendum report does not contain information that provide a complete replacement of the existing SFRA and some content from the 2008 version should still be used. The addendum SFRA only replaces selected sections of evidence from the previous document and the sections updated are discussed in section 1.3.

1.3 SFRA outputs

To meet the objectives of an SFRA, this document has been prepared as an addendum report to the existing SFRA. It serves to inform and update several key chapters of the 2008 SFRA document. The chapters which this report replaces are outlined in Table 1-1. Sections of the previous 2008 SFRA document that are out of date given availability of new data, and should therefore not be used, are recorded in Table 1-2. Figures within the 2008 SFRA document that are replaced by those within this document are recorded in Table 1-3. Where updates have not been made it is considered that the information provided in the 2008 Level 1 SFRA is relevant to Maidstone Borough and supports the emerging Local Plan.

Table 1-1: Sections of this SFRA addendum report which replace sections of the previous SFRA document (2008)

Chapter of this SFRA addendum	Chapter/sub-chapter of the 2008 SFRA document to be replaced	Updated information in this SFRA addendum
1. Introduction	Including, but not limited to: 2.5 Existing Hydraulic Modelling and Mapping Studies	Update on the most recent flood modelling and mapping studies carried out on the main watercourses within the borough
2. The Planning Framework and Flood Risk Policy	1.2 Government Advice on Flood Risk	Review and update of government advice of flood risk and changes to planning policies and legislation.

Chapter of this SFRA addendum	Chapter/sub-chapter of the 2008 SFRA document to be replaced	Updated information in this SFRA addendum
3. Understanding Flood Risk in Maidstone Borough	2.4 History of Flooding 4. Flooding from Surface Water, Sewer and Groundwater 5.3 Climate Change	Appraisal of all potential sources of flooding, including Main River, Ordinary Watercourse, surface water, groundwater, sewers and reservoirs. Including review of historic flood events. Discussion on updated climate change guidance.
4. Surface water management and SuDS	8.3 Sustainable Drainage Systems (SuDS)	Updated guidance on managing surface water run-off and flooding.

Table 1-2: Sections of the 2008 SFRA document which are no longer relevant given updated information

Chapter/sub-chapter of the 2008 SFRA document	Justification
6. Flood Risk Mapping of Specific Locations	Updated flood risk information is available the majority of the borough for fluvial, tidal/coastal, surface water, groundwater and reservoir flood risk sources. Updated flood history information is also available.

Table 1-3: Figures within the 2008 SFRA document replaced by figures within this addendum document (2016)

Figure within the 2008 SFRA document (Content)	Figure within this SFRA addendum (2016)	Reason for update
Figure 2.3 (Historical flood events)	Figure 3-1	Updated flood history information.
Figure 3.1 (Flood Defences and Flood Warning Areas)	Appendix F	Updated flood warning areas. No formal flood defences are present within the borough.
Figure 4.1 (Reported Flood Incidents)	Figure 3-2	Updated flood incident information.
Figure 5.1, Figure 5.2 and Figure 5.4 (Flood Zones 2, 3a and 3b)	Appendix B	Updated Flood Zone information.
Figure 5.3 (1 in 100-year plus climate change mapping)	Appendix C	Updated Climate Change mapping.
Figure 6.1 to Figure 6.14 (Various, indicating flood risk at several settlements)	Appendices B-E	Updated flood risk information is available the majority of the borough for fluvial, tidal/coastal, surface water, groundwater and reservoir flood risk sources. Updated flood history information is also available.

1.4 Approach

1.4.1 General assessment of flood risk

The flood risk management hierarchy underpins the risk-based approach and is the basis for making all decisions involving development and flood risk. When using the hierarchy, account should be taken of:

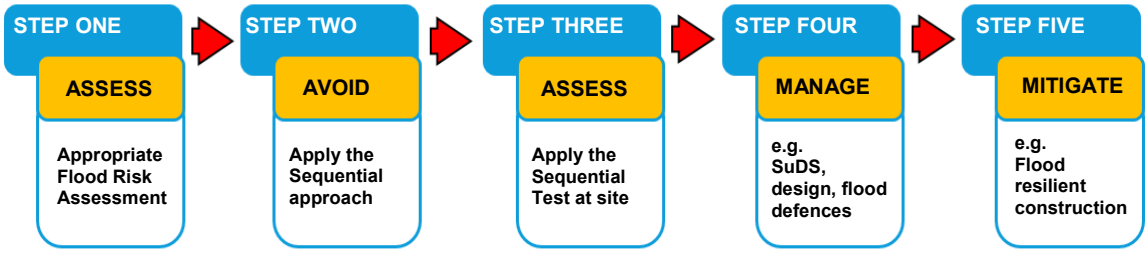
- the nature of the flood risk (the source of the flooding);
- the spatial distribution of the flood risk (the pathways and areas affected by flooding);
- climate change impacts; and
- the degree of vulnerability of different types of development (the receptors).

Future developments should reflect the application of the Sequential Test using the maps produced for this SFRA. The relevant information in this SFRA and the 2008 SFRA should be used as evidence and, where necessary, reference should also be made to relevant evidence in other documents referenced in this report. The Flood Zone maps and flood risk information on other sources of flooding contained in this SFRA should be used where appropriate to apply the Sequential Test.

Where other sustainability criteria outweigh flood risk issues, the decision making process should be transparent. Information from this SFRA should be used to justify decisions to allocate land in areas at high risk of flooding.

The flood risk management hierarchy is summarised in Figure 1-1.

Figure 1-1: Flood Risk Management Hierarchy



1.4.2 Technical assessment of flood hazards

Flood risk within the Maidstone Borough has been assessed using results from computer models supplied by the Environment Agency and existing Environment Agency Flood Zone mapping. The following models inform the flood risk information within the borough:

1. Environment Agency fluvial (river) models
    - River Medway (2015)
    - River Bourne and Coult Stream (2011)
    - Kent & East Sussex Flood Zone Improvements (2011)
    - Hilden Brook & Hawden Stream (2006)
    - National Flood Zone modelling
2. Fluvial model developed to support this SFRA
    - Loose Stream at River Medway confluence (2016)
3. Environment Agency tidal (costal) models
    - North Kent Coast modelling (2013) and updates (2015)
4. Environment Agency surface water (rainfall) models
    - Updated Flood Map for Surface Water (2013)

1.5 Consultation

The following parties (external to Maidstone Borough Council) have been consulted during the preparation of this version of the SFRA:

- Environment Agency
- Kent County Council (as Lead Local Flood Authority)
- Southern Water

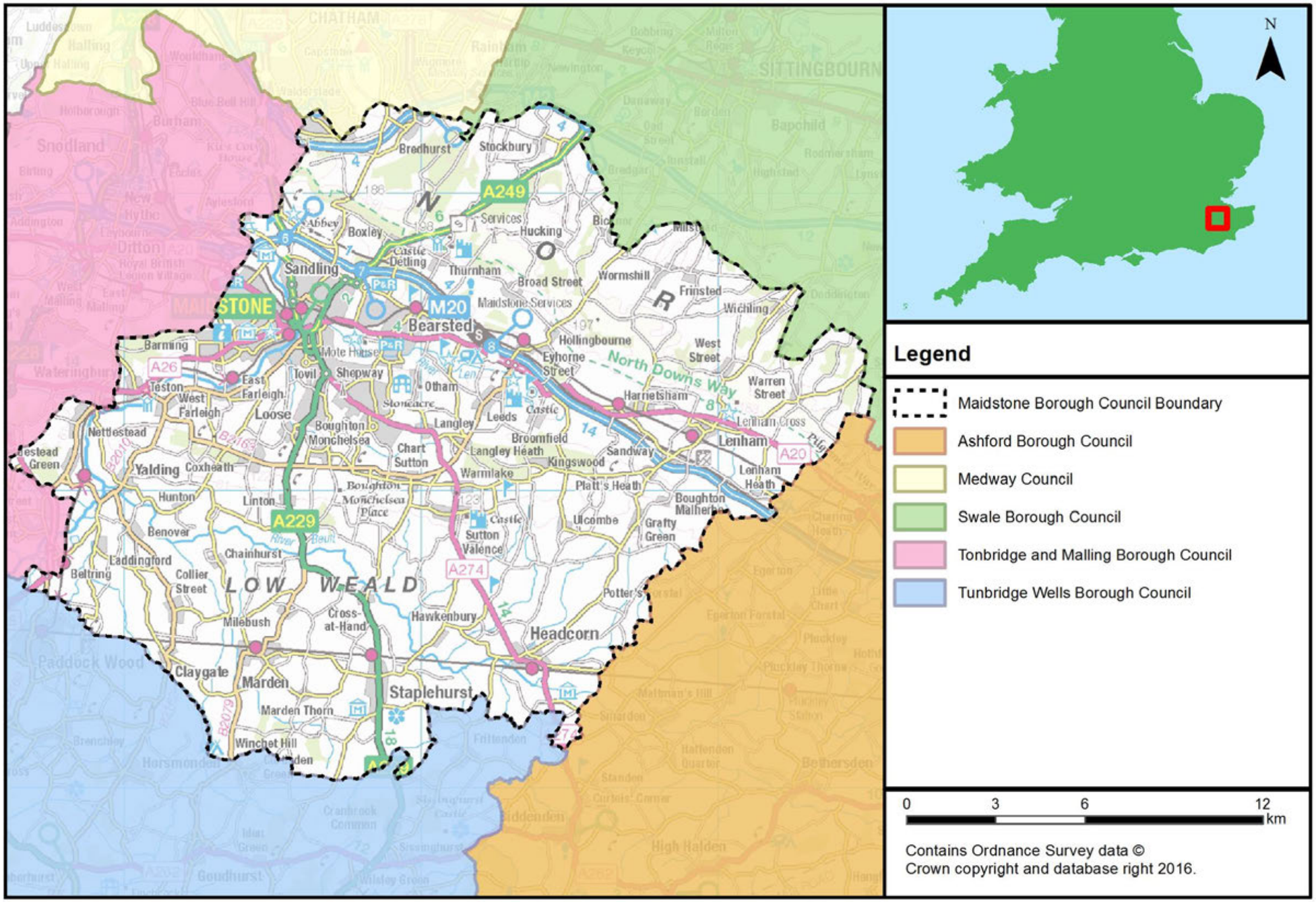
1.6 SFRA user guide

This SFRA 2016 document is an addendum report that serve to update the key chapters of the existing Level 1 SFRA published in 2008. The structure and contents of this addendum report are outlined in Table 1-4.

Table 1-4: SFRA update structure and contents

Chapter	Section	Contents
1	Introduction	Provides a background to the study, defines objectives, outlines the approach adopted and the consultations performed.
2	The Planning Framework and Flood Risk Policy	Includes information on the implications of recent changes to planning and flood risk policies and legislation.
3	Understanding flood risk in Maidstone Borough	Gives an introduction to the assessment of flood risk and provides an overview of the characteristics of flooding affecting the district. Provides a summary of responses that can be made to flood risk, together with policy and institutional issues that should be considered.
4	Surface water management and SuDS	Advice on managing surface water run-off and flooding. Important to incorporate updates as there have been many changes in regard to surface water management. This includes the latest guidance documents (e.g. Kent SuDS guidance and the Water. People. Places: a guide to master planning sustainable drainage into developments).
5	Summary	Reviews the Level 1 SFRA update and provides recommendations

Figure 1-2: Maidstone Borough Council and neighbouring authorities



2 The Planning Framework and Flood Risk Policy

2.1 Introduction

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is taken into account at every stage of the planning process. This section of the addendum SFRA provides an overview of the planning framework, flood risk policy and flood risk responsibilities. In preparing the subsequent sections of this SFRA, appropriate planning and policy amendments have been acknowledged and taken into account.

2.2 Flood Risk Regulations (2009) and Flood and Water Management Act (2010)

2.2.1 Flood Risk Regulations (2009)

The Flood Risk Regulations (2009) are intended to translate the current EU Floods Directive into UK law and place responsibility upon all Lead Local Flood Authorities (LLFAs) to manage localised flood risk. Under the Regulations, the responsibility for flooding from rivers, the sea and reservoirs lies with the Environment Agency. However, responsibility for local and all other sources of flooding rests with LLFAs. In the instance of this SFRA, the LLFA is Kent County Council.

Figure 2-1 illustrates the steps that have / are being taken to implement the requirements of the EU Directive in the UK via the Flood Risk Regulations.

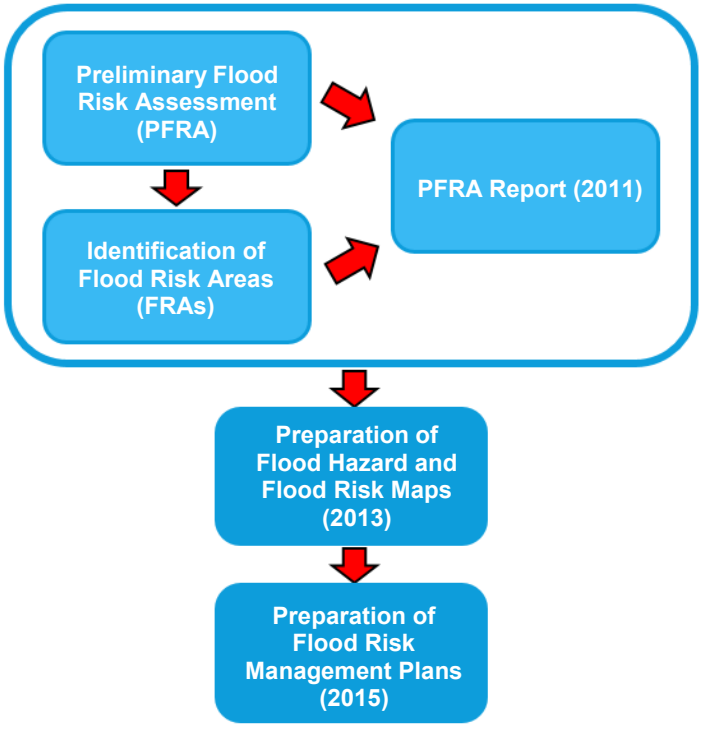


Figure 2-1: Flood Risk Regulation Requirements

Under this action plan and in accordance with the Regulations, LLFAs had the task of preparing a Preliminary Flood Risk Assessment (PFRA) report. The PFRA document that covers the borough was published by Kent County Council in 2011[1].

[1] Kent County Council PFRA (2011): http://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/flooding-and-drainage-policies/preliminary-flood-risk-assesment

Under the Regulations the Environment Agency exercised an 'Exception' and did not prepare a PFRA for risk from rivers, reservoirs and the sea. This then made it a requirement for the Environment Agency to prepare and publish a Flood Risk Management Plan (FRMP). The FRMP process adopts the same catchments as used in the preparation of River Basin Management Plans, in accordance with the Water Framework Directive. Accordingly, more detailed strategic information on proposed strategic measures and approaches can be found in the Thames River Basin District Flood Risk Management Plan - Parts A, B, C and D[2]. The FRMP draws on previous policies and actions identified in Catchment Flood Management Plans and also incorporates information from Local Flood Risk Management Strategies. The plan covers all of the London Boroughs and 17 contributing catchments covered by the Thames River Basin, including Maidstone Borough, which lies within the Medway catchment area. The FRMP summarises the flooding affecting the area and describes the measures to be taken to address the risk in accordance with the Flood Risk Regulations.

2.2.2 Flood and Water Management Act (2010)

The Flood and Water Management Act (2010)[3] aims to create a simpler and more effective means of managing both flood risk and coastal erosion and implements Sir Michael Pitt's recommendations following his review of the 2007 floods. The FWMA received Royal Assent in April 2010.

Kent County Council as LLFA has developed a Local Flood Risk Management Strategy (LFRMS) under the Act, in consultation with local partners. This is discussed further in section 2.2.5. This Strategy acts as the basis and discharge of duties and responsibilities for Flood Risk Management co-ordinated by Kent County Council. The final version of the strategy was published for June 2013.

Local authorities are responsible for flooding management relating to 'Ordinary Watercourses' (i.e. smaller ditches, brooks), groundwater and other sources of risk with the Environment Agency responsible for 'Main Rivers', the sea and reservoirs.

When considering planning applications, Local Planning Authorities should consult LLFAs on the management of surface water in order to satisfy that:

1. the proposed minimum standards of operation are appropriate
2. through the use of planning conditions or planning obligations, there are clear arrangements for on-going maintenance over the development's lifetime.

The FWMA will also update the Reservoirs Act 1975 by reducing the capacity of reservoir regulation from 25,000m^3 to 10,000m^3. Phase 1 was implemented in 2013 and requires large raised reservoirs to be registered to allow the Environment Agency to categorise whether they are 'high risk' or 'not high risk'.

2.2.3 Lead Local Flood Authorities

The FWMA established LLFAs. Kent County Council is the LLFA for the Maidstone Borough Council administrative area. Duties of LLFAs include:

- Local Flood Risk Management Strategy: LLFAs must develop, maintain, apply and monitor an LFRMS to outline how they will manage flood risk, identify areas vulnerable to flooding and target resources where they are needed most.
- Flood Investigations: When appropriate and necessary, LLFAs must investigate and report on flooding incidents (Section 19 investigations).
- Register of Flood Risk Features: LLFAs must establish and maintain a register of structures or features which, in their opinion, are likely to have a significant effect on flood risk in the LLFA area.
- Designation of Features: LLFAs 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.

[2] Environment Agency, Thames River Basin District Flood Risk Management Plan 2015-2021 Part C (March 2016). Available: https://www.gov.uk/government/publications/thames-river-basin-district-flood-risk-management-plan
[3] Flood and Water Management Act (2010): http://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf

- Consenting: When appropriate LLFAs will perform consenting of works on Ordinary Watercourses.

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, and 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, Kent County Council, will be required to provide technical advice 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; and
- 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.

2.2.4 Kent Preliminary Flood Risk Assessment (2011)

The Flood Risk Regulations required Kent County Council (as the LLFA) to prepare and publish a Preliminary Flood Risk Assessment (PFRA) on past and future flood risk from sources of flooding. The **PFRA** reports on significant past and future flooding from all sources except 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 Southern Water).

The PFRA is a high-level screening exercise and considers floods which have significant harmful consequences for human health, economic activity, the environment and cultural heritage. The Regulations require the LLFA to identify significant Flood Risk Areas. The threshold for designating significant Flood Risk Areas is defined by Defra and the PFRA is the process by which these locations can be identified. Of the ten national Indicative Flood Risk Areas that were identified by the Defra/Environment Agency, one was found to encroach on the administrative area of Maidstone Borough Council. However, given that the Flood Risk Area is primarily located in Chatham and Gillingham, the Flood Risk Area was amended to the Medway Council administrative boundary and does not include any parts of Kent County Council.

No Flood Risk Areas have been identified based on critical infrastructure/access routes, sewer/surface water problems and areas prone to significant ponding.

2.2.5 Kent Local Flood Risk Management Strategy (2013)[4]

Kent County Council is responsible for developing, maintaining, applying and monitoring a **LFRMS** for Kent, which covers the Maidstone Borough. The Strategy is used as a means by which the LLFA (Kent County Council) co-ordinates Flood Risk Management on a day to day basis. The Strategy also sets measures to manage local flood risk i.e. flood risk from surface water, groundwater and Ordinary Watercourses. The Environment Agency is responsible for managing flooding from main rivers and reservoirs, while the LLFA responsible for managing Ordinary Watercourses. The objectives of the Strategy are to:

1. Improve the understanding of the risks of flooding from surface runoff, groundwater and ordinary watercourses in Kent.
2. Reduce the risk of flooding for people and businesses in Kent.
3. Ensure that development in Kent takes account of flood risk issues and plans to effectively manage any impacts.

[4] http://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/flooding-and-drainage-policies/kent-flood-risk-management-plan

4. Provide clear information and guidance on the role of the public sector, private sector and individuals in flood risk management in Kent, how those roles will be delivered and how authorities will work together to manage flood risk.
5. Ensure that emergency plans and responses to flood incidents in Kent are effective, and that communities understand the risks and their role in an emergency.

The Strategy also sets out an action plan of how the LLFA intends to achieve these objectives. The action plan contains the following information:

- A description of the action.
- The objective the action relates to.
- The driver behind the action.
- The organisation with key accountability.
- Supporting organisations.
- The funding source.
- When the action was added.
- Timescale for completion or current status.

The Strategy should be updated regularly or when key triggers are activated. An example of a key trigger would be issues such as amendments to partner responsibilities, updates to legislation, alterations in the nature or understanding of flood risk or a significant flood event, may also require the update of the Strategy and action plan.

2.3 National Planning Policy Framework

The **National Planning Policy Framework** (NPPF)[5] was issued on 27 March 2012 to replace the previous documentation as part of reforms to, firstly, make the planning system less complex and more accessible, and, secondly, to protect the environment and promote sustainable growth. It replaces most of the Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs) that were referred to in the previous version of the SFRA. The NPPF is a source of guidance for local planning authorities to help them prepare Local Plans and for applicants preparing planning submissions.

Paragraph 100 of the NPPF:

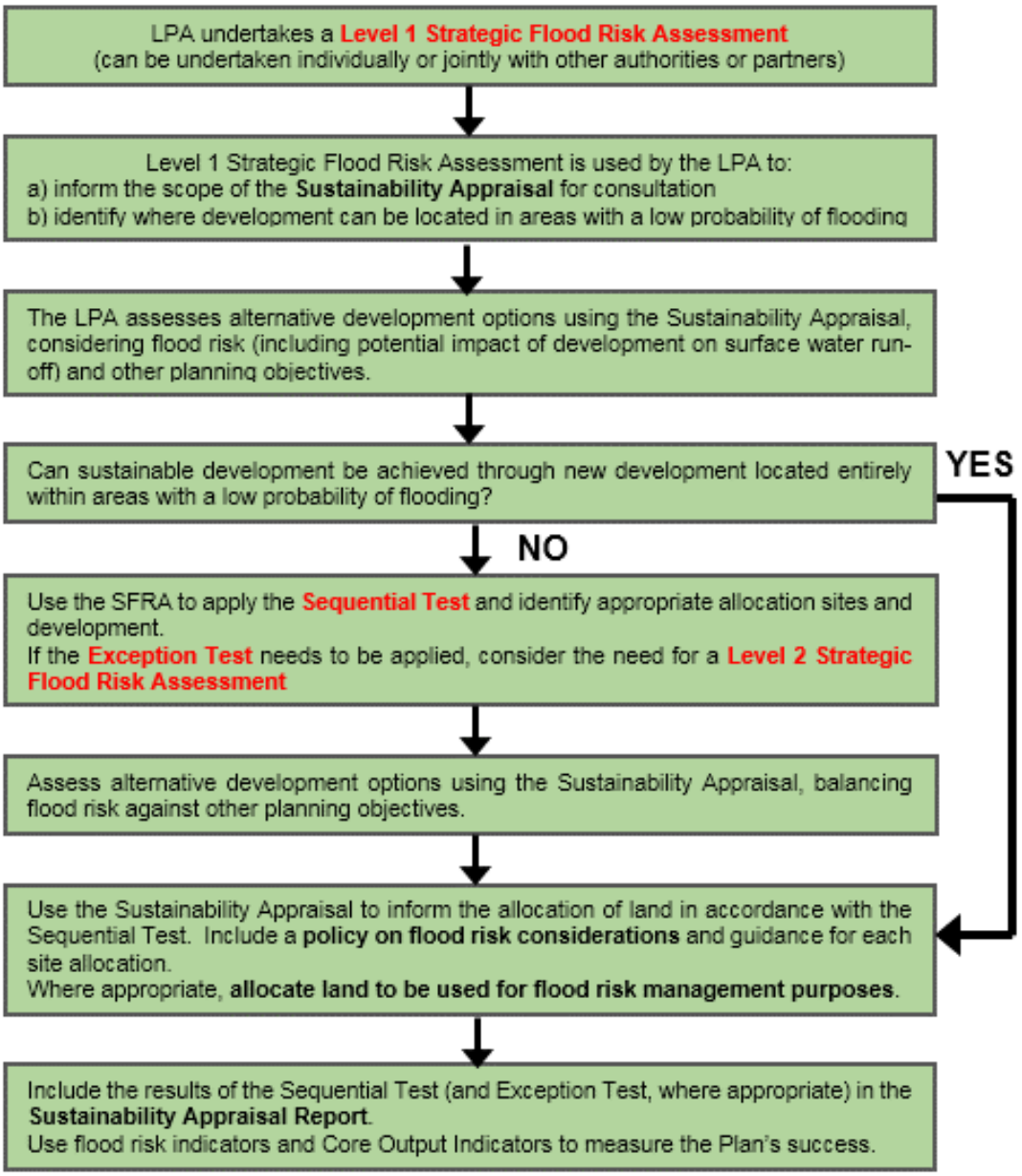
> ***"Local Plans should be supported by a strategic flood risk assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as Lead Local Flood Authorities and Internal Drainage Boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change".***

Planning Practice Guidance on flood risk was published in March 2014 and sets out how the policy should be implemented. NPPF sets out Flood Zones, the appropriate land uses for each zone, flood risk assessment requirements and the policy aims for developers and authorities regarding each Flood Zone.

A description of how flood risk should be taken into account in the preparation of Local Plans is outlined in Diagram 1 contained within the Planning Practice Guidance (Figure 2-2).

[5] National Planning Policy Framework (Department for Communities and Local Government, March 2012)

Figure 2-2: Flood risk and the preparation of Local Plans†



† Based on Diagram 1 of NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 004, Reference ID: 7-005-20140306) March 2014

2.4 Surface Water Management Plans

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. They are produced to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from surface runoff, groundwater, and ordinary watercourses. SWMPs 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 action plan from SWMPs should be reviewed and updated as a minimum every six years.

Surface Water Management Plans (SWMPs) applicable to Maidstone Borough are listed below, with links provided to these documents.

- **Maidstone Stage 1 SWMP[6] (2013)**
- **Maidstone and Malling Stage 1 SWMP[7] (2012)**

The outcomes and actions from each of these SWMPs should be considered in the context of proposed developments within the area of Maidstone Borough.

It should be noted that Stage 2 SWMPs for Marden, Staplehurst and Headcorn were commissioned in 2014 in order to provide a detailed understanding of the causes and consequences of surface water flooding and test the benefits and costs of proposed mitigation measures. Again, the outcomes and actions from each of these Stage 2 SWMPs should be considered in the context of proposed developments within these areas once these documents have been published by Kent County Council.

2.5 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are a high-level strategic plan 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 six national policies are:

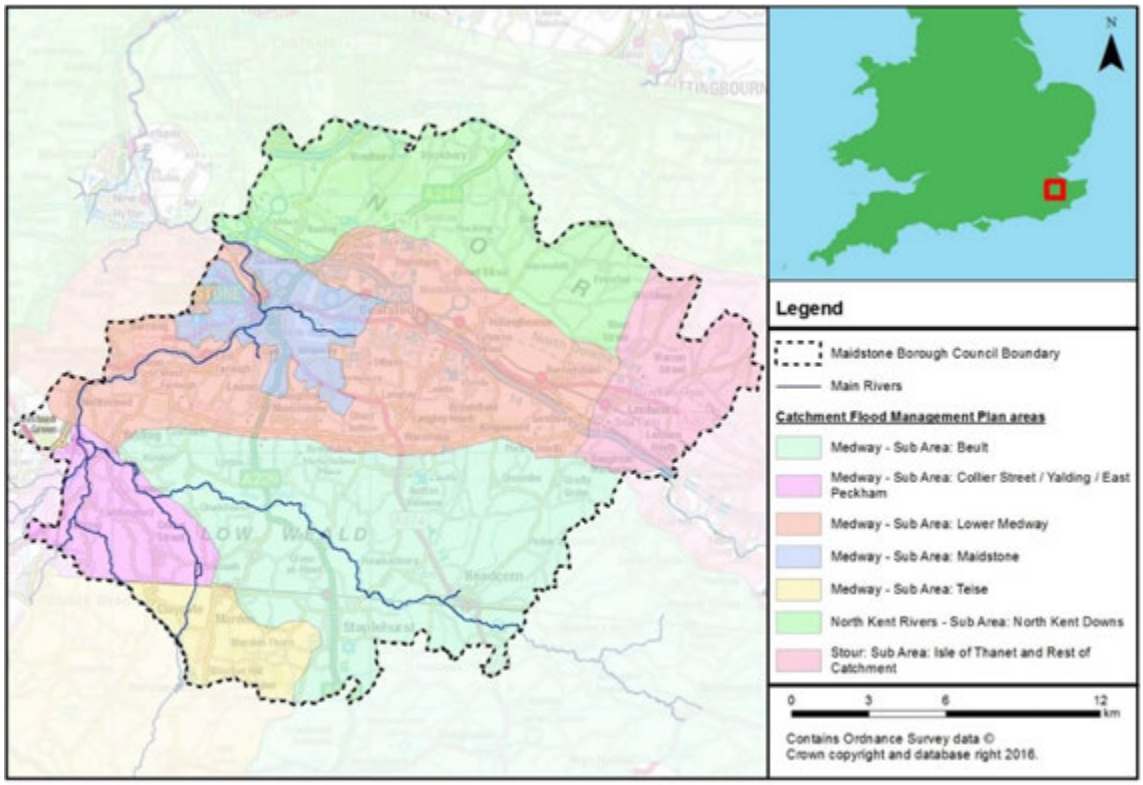
1. No active intervention (including flood warning and maintenance). Continue to monitor and advise.
2. Reducing existing flood risk management actions (accepting that flood risk will increase over time).
3. Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline).
4. Take further action to sustain the current level of flood risk (responding to the potential increases in risk from urban development, land use change and climate change).
5. take action to reduce flood risk (now and/or in the future)
6. Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.

CFMPs provide a starting point for measures being considered strategically to manage flood risk within their areas. To that end, an important consideration of the NPPF for Maidstone Borough relates to safeguarding land from development that is required for current and future flood management (paragraph 100).

The CFMPs covering Maidstone Borough and the relevant sub-areas with assigned national policies are shown in Figure 2-3.

[6] http://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/flooding-and-drainage-policies/surface-water-management-plans/maidstone-surface-water-management-plan
[7] http://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/flooding-and-drainage-policies/surface-water-management-plans/maidstone-and-malling-surface-water-management-plan

Figure 2-3: CFMPs policy units covering Maidstone Borough



2.5.1 River Medway CFMP (2009)

The majority of the borough is covered by the **River Medway CFMP**[8]. The primary policy units for Maidstone Borough are:

- Sub Area 5: Collier Street/Yalding/East Peckham – Policy Option 5
- Sub Area 6: Teise – Policy Option 3
- Sub Area 7: Beult – Policy Option 3
- Sub Area 8: Lower Medway – Policy Option 3
- Sub Area 9: Maidstone – Policy Option 5

Policy Option 3 is for areas of low to moderate flood risk where the Environment Agency are generally managing existing flood risk effectively.

Policy Option 5 is for areas of moderate to high flood risk where the Environment Agency can generally take further action to reduce flood risk.

The CFMP provides a starting point for measures being considered strategically to manage flood risk within its area. To that end, an important consideration of the NPPF for Maidstone Borough relates to safeguarding land from development that is required for current and future flood management (paragraph 100).

2.5.2 North Kent Rivers CFMP (2009)

The northern section of the borough is covered by the **North Kent Rivers CFMP**[9]. The primary policy unit for Maidstone Borough are:

- Sub Area 5: North Kent Downs – Policy Option 1

[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/293890/Medway_Catchment_Flood_Management_Plan.pdf
[9]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/293893/North_Kent_rivers_Catchment_Flood_Management_Plan.pdf

Policy Option 1 is for areas where there are very few properties at risk of flooding and the Environment Agency will continue to monitor and advise.

The CFMP notes that the sub-area covers the upper reaches of several watercourses in the North Kent Downs and that flood risk in this area is low as no flood damage was identified and no people or property were affected by flooding.

2.5.3 Stour CFMP (2009)

The eastern most section of the borough is covered by the **Stour CFMP[10].** The primary policy units for Maidstone Borough are:

- Sub Area 9: Isle of Thanet and Rest of Catchment – Policy Option 1

Policy Option 1 is for area where there are very few properties at risk of flooding and the Environment Agency will continue to monitor and advise.

The CFMP notes that there has been little or no risk of flooding from rivers, surface water or foul water flooding.

2.6 River Basin Management Plans

River Basin Management Plans (RBMPs) are prepared under the Water Framework Directive (WFD) and assesses the pressure facing the water environment in River Basin Districts. The WFD aims to achieve at least 'good' status for all water bodies by 2015. The Maidstone Borough Council area falls within the Thames River Basin District.

2.6.1 Thames River Basin Management Plan (2015)

The second cycle of **The Thames RBMP**[11] was published in February 2016, replacing the previous version published in 2009. The document provides information on the following:

- Current state of the water environment
- Pressures affecting the water environment
- Environmental objectives for protecting and improving waters
- Programme of measures. And actions needed to achieve the objectives
- Progress since the 2009 plan

The Thames RBMP identified a number of significant water management issues, including:

- Physical modifications
- Pollution from waste water
- Pollution from towns, cities and transport
- Changes to the natural flow and level of water
- Negative effects of invasive non-native species
- Pollution from rural areas

The RBMP describes how development planning needs to consider a number of issues relevant to the RBMP including housing locations, sewage treatment options, initiatives to reduce flow to sewage works, water efficiency measures and the reduction of nutrients from diffuse pollution.

The RBMP notes that 11% of water bodies in the Thames River Basin District currently have a 'good or better' overall status, which is expected to increase to 13% by 2021. However, this 'good or better' overall status is forecast to increase notably for the extended deadline of 2027 reported in the RBMP.

[10]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/293884/Stour_Catchment_Flood_Management_Plan.pdf

[11]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500548/Thames_RBD_Part_1_river_basin_management_plan.pdf

2.7 Water Cycle Studies

Future changes in climate and increases in new development are expected to exert greater pressure on the existing waste water supply and infrastructure. A large number of new homes for instance may cause the existing water supply infrastructure to be overwhelmed which would result in adverse effects on the environment both locally and in wider catchments. Planning for water management therefore has to take these potential challenges into account.

Water Cycle Studies (WCS) assist local authorities to select and develop sustainable development allocations so that there is minimal impact on the environment, water quality, water resources, infrastructure and flood risk. This can be achieved in areas where there may be conflict between any proposed development and requirements of the environment through the recommendation of potential sustainable solutions.

Maidstone Borough Council prepared a Water Cycle Study Outline Report[12] in June 2010 as part of their planning process following the borough's designation as a Growth Point for significant new development. The document highlights that there were some potential constraints to development, related to the capacity of the sewerage network in Maidstone Town. It is noted that if a solution is not found, the number of new homes that can be provided in and around Maidstone Town will be seriously restricted, particularly for potential sites in the south-east area adjacent to the town. Furthermore, it is considered that the limited capacity of the wastewater treatment plant at Headcorn will restrict the number of new homes that can be provided in the area, and similar restrictions may occur at Yalding and Harrietsham. The WCS should be consulted to understand and manage potential impacts of a proposed develop on the environment, water quality, water resources, infrastructure and flood risk.

2.8 Association of British Insurers Guidance on Insurance and Planning in Flood Risk Areas for Local Planning Authorities in England

The Association of British Insurers (ABI) and the National Flood Forum have published guidance for Local Authorities with regards to planning in flood risk areas[13]. The guidance aims to assist Local Authorities in England in producing local plans and dealing with planning applications in flood risk areas. The guidance complements the National Planning Policy Framework. The key recommendations from the guidance are:

- Ensure strong relationships with technical experts on flood risk.
- Consider flooding from all sources, taking account of climate change.
- Take potential impacts on drainage infrastructure seriously.
- Ensure that flood risk is mitigated to acceptable levels for proposed developments.
- Make sure Local Plans take account of all relevant costs and are regularly reviewed.

2.9 Implications for Maidstone Borough

The new and emerging responsibilities under the Flood and Water Management Act 2010 and the Flood Risk Regulations 2009 are summarised in Table 2-1.

[12] Halcrow group Limited, (June, 2010), Maidstone Borough Council Water Cycle Study – Outline Report
[13] Guidance on Insurance and Planning in Flood Risk Areas for Local Planning Authorities in England (Association of British Insurers and National Flood Forum, April 2012)

Table 2-1: Roles and responsibilities in Maidstone Borough

Risk Management Authority (RMA)	Strategic Level	Operational Level
Environment Agency	National Statutory Strategy Reporting and supervision (overview role)	• Preliminary Flood Risk Assessment (per River Basin District)* • Managing flooding from main rivers and reservoirs and communication flood risk warnings to the public, media and partner organisations. • Identifying Significant Flood Risk Area* • Preparation of Flood Risk and Hazard Maps • Preparation of Flood Risk Management Plan • Enforcement authority for Reservoirs Act 1975 • Managing RFCCs and supporting funding decisions, working with LLFAs and local communities. • Emergency planning and multi-agency flood plans, developed by local resilience forums
Lead Local Flood Authority (Kent County Council)	Input to National Strategy. Formulate and implement Local Flood Risk Management Strategy.	• Responsible for enforcing and consenting works for Ordinary Watercourses, risk assessing Ordinary Watercourses. • Managing local sources of flooding from surface water runoff and groundwater and carrying out practical works to manage flood risk from these sources where necessary. • Preparing and publishing a PFRA • Identifying Flood Risk Areas • Preparing Flood Hazard and Flood Risk Maps • Preparing Flood Risk Management Plans (where local flood risk is significant) • Investigating certain incidents of flooding in Section 19 Flood Investigations • Statutory roles in planning for surface water drainage. • Keeping asset registers of structures and features which have a significant effect on local flood risk. • Acting consistently with LFRMS in realising FRM activity and have due regard in the discharge of other functions of the strategy
Local Planning Authority (Maidstone Borough Council)	Input to National and Local Authority Plans and Strategy (e.g. Maidstone Local Plan – to develop a spatial strategy for growth within the area which accounts for flood risk)	• Preparation of a Local Plan to guide development. • The competent determining authority for planning applications and have the ultimate decision on the suitability of a site in relation to flood risk and management of surface water run-off. • Responsibilities for emergency planning as a responder to a flood event. • Own and manage public spaces which can potentially be used for flood risk management.

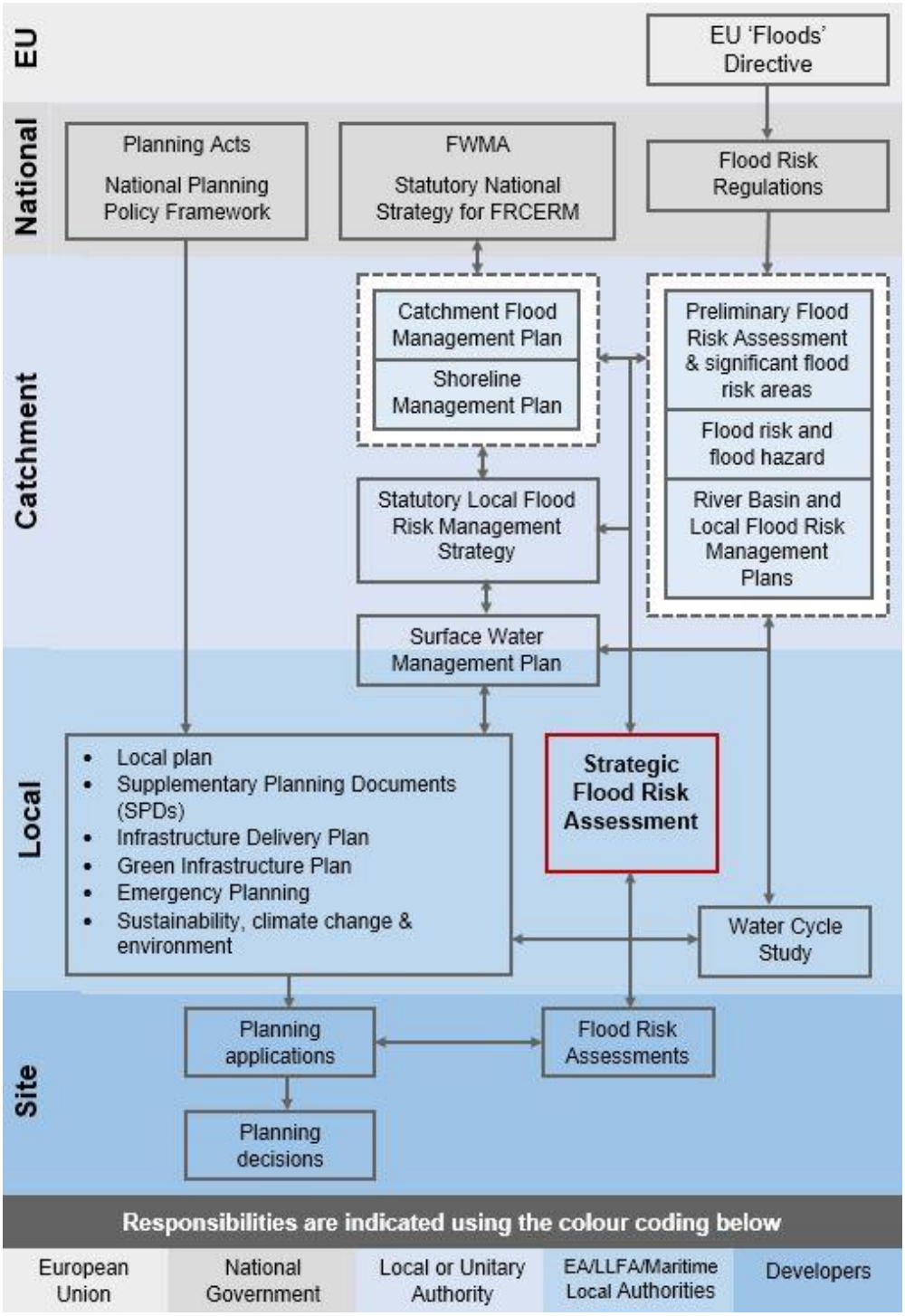
* Environment Agency did not prepare a PFRA; instead they exercised an exception permitted under the Regulations

Figure 2-4 outlines the key strategic planning links for flood risk management and associated documents. It shows how the Flood Risk Regulations and Flood and Water Management Act, in conjunction with the Localism Act's "duty to cooperate", introduce a wider requirement for the mutual exchange of information and the preparation of strategies and management plans.

SFRAs contain information that should be referred to in responding to the Flood Risk Regulations and the formulation of local flood risk management strategies and plans. SFRAs are also linked to the preparation of Catchment Flood Management Plans (CFMPs), Shoreline

Management Plans (SMPs), Surface Water Management Plans (SWMPs) and Water Cycle Strategies (WCSs).

Figure 2-4: Strategic planning links and key documents for flood risk



† See Table 2-1 for roles and responsibilities for preparation of information

3 Understanding flood risk in Maidstone Borough

3.1 Historical flooding

The Medway has been subject to a number of documented flood events, with the main cause being from 'fluvial' (river/watercourse networks) sources.

Historic flood events have been recorded from the River Medway, Teise, Lesser Teise and the River Beult. The most notable flood events recorded from these rivers occurred in 1927, 1960, 1963, 1968 and 2000, and caused widespread flooding across the borough. Data provided by the Environment Agency also indicates that significant flooding occurred within the borough during Winter 2013/2014 and included notable flooding from the River Medway.

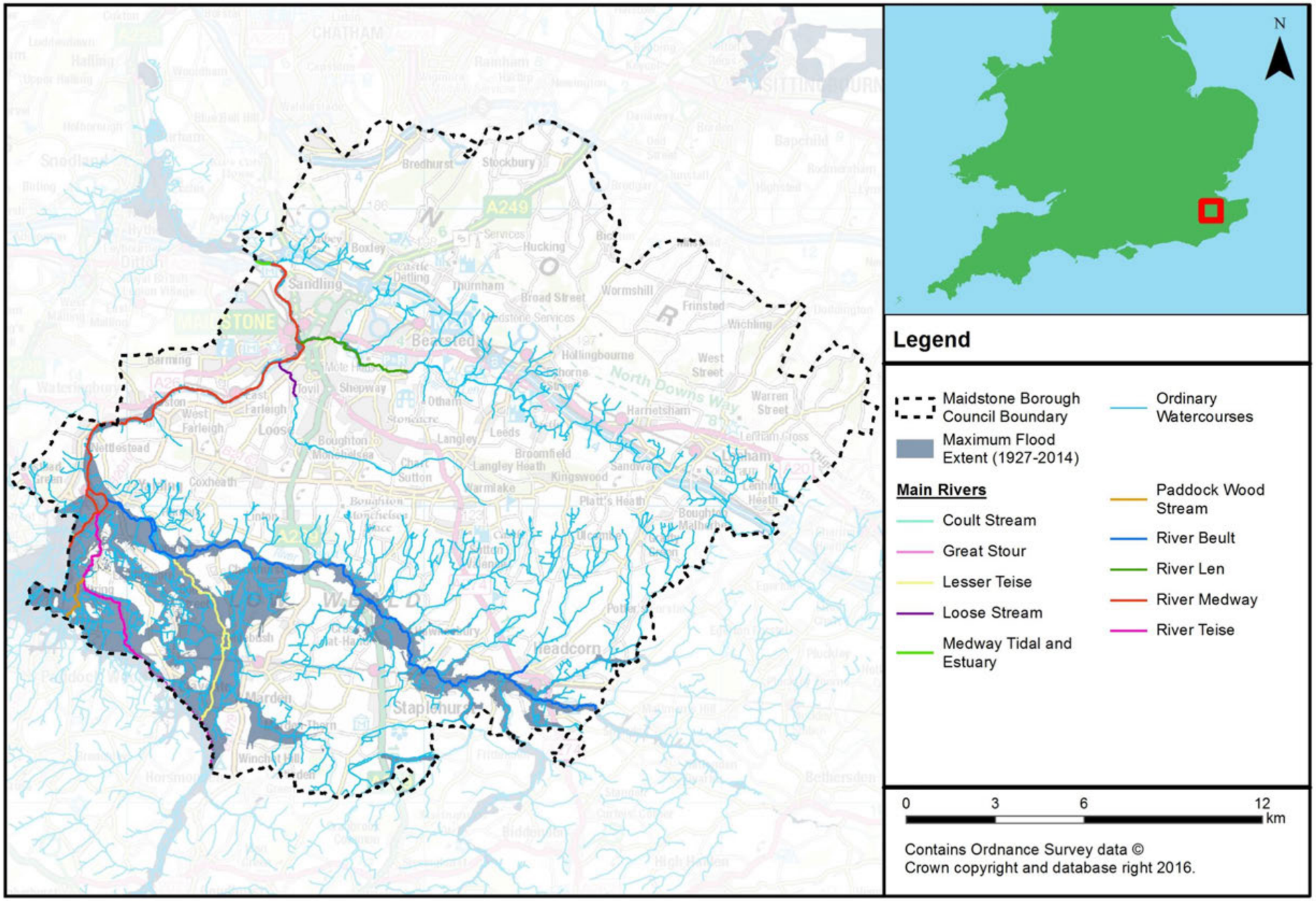
Historical flood records provided by the Environment Agency, Maidstone Borough Council and Kent County Council identify fluvial flood events to have occurred between 1927 and 2014. The south-west area of the borough is identified to have experienced extensive flooding between 1927 and 2014 and the following locations are noted to have been effected by at least one historical event during this time period:

- Maidstone
- Ringlestone
- Bearsted
- East Farleigh
- West Farleigh
- Teston
- Nettlestead
- Yalding
- Laddingford
- Beltring
- Benover
- Collier Street
- Chainhurst
- Claygate
- Marden
- Marden Thorn
- Staplehurst
- Cross-at-Hand
- Hawkenbury
- Headcorn

The maximum extent of flooding indicated by this historical data (all extents from these events combined) and locations of the Main Rivers across Maidstone are shown in Figure 3-1.

Whilst an account of historic flooding throughout the Borough is presented within this section, it should be noted that the majority of flooding occurrences are not reported. It is very likely that other areas of the Borough are at risk of flooding and have experienced flooding previously, but this might not have been recorded. Therefore, areas identified in this section should not be taken as definitive, but instead indicative of the distribution of flood risk within Maidstone Borough. Additional investigation into historic flooding which may have influenced proposed development sites should be conducted as site allocations are progressed.

Figure 3-1: Historical fluvial flooding extent within Maidstone Borough



Details of some of the significant flood events noted to have affected Maidstone Borough are summarised as follows:

- December 1927: heavy rain on the 25th December, which changed to snow and caused what is regarded as one of the worst snowstorms in the 20th century[14], resulted in flooding of the area surrounding Allington downstream of Allington Lock[15].
- November 1960: the July to November rainfall in 1960 was the greatest on record in England and Wales since 1927 and caused widespread flooding across much of England in early November 1960. Frequent and heavy rainfall caused the River Medway, River Len, River Beult and the River Teise to overtop their banks in early November which resulted in catchment-wide flooding throughout the borough, including the flooding of Maidstone Town Centre.
- September 1968: prolonged heavy rainfall associated with a slow-moving depression and thunderstorms caused severe flooding across the south east of England. Between the 14th and 15th of September, 150mm-200mm of rainfall was recorded across Kent[16,17] and caused the River Medway to exceed its channel capacity. The September 1968 flood event caused inundation along the River Medway through Maidstone and upstream of Teston[18].
- October 2000: the autumn of 2000 was the wettest on record since records began in 1766 and is noted to have caused the largest floods in recent history as many river catchments were subjected to multiple flood events. Much of Kent was affected and flooding was particular severe over the mid-Kent catchments of the River Medway, River Beult and the River Teise. The principle source of flooding in the Kent area was the sheer volume of rain that fell over relatively short periods onto already wet or saturated catchments. Within Maidstone Borough, Yalding and Collier Street are noted to have suffered from extensive flooding but flooding in Maidstone Town was relatively limited[19].
- December 2013: During the winter of 2013-14 a series of Atlantic depressions brought heavy rainfall and stormy conditions to much of England and Wales, including the River Medway catchment, where the largest flood of the period occurred on 23-25 December 2013. Flows seen in the Medway rivers were amongst the highest ever recorded, in several cases larger than the previous largest gauged event in 1968. Drivers for the notable events were the very wet antecedent conditions, combined with an intense storm on 23 December.

The Maidstone Stage 1 SWMP states that Collier Street and Yalding are particularly vulnerable to flooding as they are situated at the confluence of the Medway, the River Beult, River Teise and the Lesser Teise. In particular, Haviker Street, Collier Street, has been described as an area prone to flooding from Main Rivers and residents have built flood walls around their properties to prevent in the ingress of flood waters[20].

Historic flood records provided by a variety of data sources show a number of surface water flood incidents to have occurred across the borough. The historical records are somewhat dispersed throughout the borough and for the most part, surface water flooding could be attributed to heavy rainfall overloading carriageways, drains/gullies. A large number of surface

[14] Tonbridge Weather Notes 1900-1929 (1927: December)
[15] Mott Macdonald, (May, 2008), Maidstone Borough Council: Strategic Flood Risk Assessment: Final Report (Chapter 2.4 History of Flooding).
[16] Met office, (2011), Sunday 15 September 1968 (Southeast England Floods)
[17] Tonbridge Weather Notes Post 1929 (1968: 14 & 15th September)
[18] Mott Macdonald, (May, 2008), Maidstone Borough Council: Strategic Flood Risk Assessment: Final Report (Chapter 2.4 History of Flooding).
[19] Mott Macdonald, (May, 2008), Maidstone Borough Council: Strategic Flood Risk Assessment: Final Report (Chapter 2.4 History of Flooding).
[20] Maidstone Borough Council, (October, 2013), Maidstone Stage 1 Surface Water Management Plan (Chapter 2.3 Historical Flooding).

water flood incidents are noted to have occurred in Harrietsham, Marden, Staplehurst and Headcorn[21].

Other incidents of historical flood records provided by Maidstone Borough Council and Kent County Council are summarised as follows:

- Sewer flooding in areas surrounding Headcorn, Staplehurst, Marden, Yalding and Lenham. In particular, records indicate regular flooding east of Marden Thorn due to a broken surcharging sewer. Records do not specify any property flooding
- Flooding at Nettlestead Green, Chainhurst and Hunton due to the low-lying nature of the ground in these areas. Records do not specify any property flooding.
- Flooding from highway assets at Honey Lane, Church Lane and Lenham Road
- Flooding from unknown or other sources in several locations across the borough.

3.1.1 Winter 2013-2014 flooding

The most recent significant flood events to affect Maidstone occurred in the winter of 2013-2014. The Kent Severe Weather Impacts Monitoring System (SWIMS) recorded five successive weather events across Kent and Medway:

- The St Jude's storm (28 October 2013)
- Fluvial event (1 November 2013)
- East coast tidal surge (5-6 December 2013)
- Fluvial and Surface water floods (20 December 2013 – 28 March 2014)
- Groundwater floods (25 January 2014).

The SWIMS Event Summary Report for Kent & Medway states that Kent received 242% of the long-term average rainfall during the 2013-2014 winter. As part of the National Severe Weather Warning Service, 43 Yellow and 7 Amber weather warnings as well as 63 flood alerts were issued.

Of particular note is the storm of the 23rd-24th December 2013, which bought heavy rain (50-70mm) to southern England and caused significant widespread flooding[22]. Approximately 76mm of rain fell within 24 hours on the saturated Medway catchment, which caused the River Medway to rise significantly[23].

The Leigh Flood Storage Area Review states that the December 2013 flows in the Medway rivers were amongst the highest ever recorded and exceeded those of the September 1968 event in several places. Although the Leigh Flood Storage Area (FSA) held back over 5.5 million cubic meters of water between the 24th and 27th of December, the storage capacity at the FSA was insufficient to prevent all flooding from occurring. The communities affected by the flooding within Maidstone Borough were Laddingford, Yalding, Collier Street and Maidstone. The impacts from wider reports are summarised as follows:

- Over 900 homes and businesses in Tonbridge, Maidstone, Yalding, East Peckham and other smaller communities were flooded from the River Medway and its tributaries[24].
- A total of 262 properties were flooded in the Maidstone[25].
    - Specifically, 207 residential properties and 55 commercial properties were flooded. However, this is likely to be an underestimate as they mainly consist of properties known to have flooded by rivers, groundwater or groundwater-fed rivers. Information of surface water and sewer flooding is less certain. [26].

[21] Maidstone Borough Council, (October, 2013), Maidstone Stage 1 Surface Water Management Plan (Chapter 2.3 Historical Flooding).
[22] The Met Office: Winter Storms, December 2013 to January 2014 (July, 2014)
[23] The Environment Agency Press Release: New defence to reduce flood risk in Tonbridge (December, 2015)
[24] Environment Agency, (2015), River Medway Flood Storage Areas (FSAs) Project
[25] Thanet District Council: Christmas & New Year 2013-2014 Storms & Floods Final Report (Appendix 1)
[26] Thanet District Council: Christmas & New Year 2013-2014 Storms & Floods Final Report (Appendix 1)

- 197 properties were flooded when river levels peaked on 24 December 2013[27] and a total of 700 homes were reported to have flooded in Yalding alone[28].
- Two rest centres were opened in Maidstone with Kent County Council Family and Social Care staff on stand-by at all times to provide a 24-hour continuous response[29].

3.2 Fluvial flood risk

3.2.1 Watercourses

As noted in the existing Level 1 SFRA, there is approximately 70km of Main River in Maidstone Borough. The main watercourse flowing through the borough is the River Medway and major tributaries include the River Beult and the River Teise, which join the Medway at Yalding upstream of Maidstone Town. The main watercourses flowing through the borough are:

- River Medway
- River Beult
- River Teise
- River Len
- Lesser Teise
- Loose Stream
- Paddock Wood Stream
- Coult Stream
- Great Stour

Tributaries to the watercourses listed above include Ordinary Watercourses and man-made drains. A summary of each main watercourse is provided in Table 3-1.

The River Medway catchment (at Allington Lock: NGR 574850 158150) receives approximately 740mm of rain on average per year[30]. The average runoff from the Medway catchment through Allington is in excess of 400 million cubic meters. Flows are reported to vary widely, with winter and spring producing three times the average of the summer and autumn months[31].

3.2.2 Flood risk

The primary source of fluvial flood risk in the catchment is associated with the River Medway. The Main Rivers in Maidstone Borough are detailed in Table 3-1 and a figure of their location is provided in Appendix A.

Water levels in the River Medway are influenced by fluvial inflows for the majority of the borough. However, in the vicinity of Allington, water levels in the River Medway are also influenced by tidal/estuarine effects and it has been known for the backwater effect from tidal water to reach as far upstream as East Farleigh[32]. The Medway has been subject to many flood events, and, as a result, Maidstone has experienced severe flooding on several occasions. The most recent flood event to affect Maidstone occurred in Winter 2013/2014 when the river exceeded its capacity and caused the town centre as well as Laddingford, Yalding and Collier Street to flood.

Although flooding was worse than that experienced during 2000 for many areas, it is noted that in central Maidstone approximately 2.5ha of floodplain and banks alongside the River Len have been re-naturalised with woodland and wetland since 2002[33]. Therefore, the flood risk to the

[27] Thanet District Council: Christmas & New Year 2013-2014 Storms & Floods Final Report (Appendix 1)
[28] SWIMS Event Summary Report for Kent & Medway Winter 2013-2014 Full Report
[29] SWIMS Event Summary Report for Kent & Medway Winter 2013-2014 Full Report
[30] FEH CD-ROM v3.0 © NERC (CEH). © Crown copyright. © AA. (2009)
[31] Mott Macdonald, (May, 2008), Maidstone Borough Council: Strategic Flood Risk Assessment: Final Report (Chapter 2. Background)
[32] Mott Macdonald, (May, 2008), Maidstone Borough Council: Strategic Flood Risk Assessment: Final Report (Chapter 2. Background Information)
[33] Kent County Council (March, 2016), Flood Risk to Communities – Maidstone

area has been reduced and properties that were affected in 2000 were not flooded during Winter 2013/2014[34].

Other fluvial flood risk areas identified in the borough are from the main tributaries of the River Medway (River Beult, River Teise and the Lesser Teise) and the confluence of these tributaries with the River Medway. For example, the village of Yalding is located on the River Beult approximately 500m upstream of the confluence with the River Medway and flooding to property has occurred on numerous occasions in the past[35]. Moreover, complex flooding issues are experienced at Collier Street due to its location on the confluence of these watercourses, and residents now have their own property level protection scheme to prevent the ingress of flood water as a result[36].

Ordinary watercourses are reported to have contributed to past flooding in the borough. Common factors described in these records report the perceived causes of flooding to be attributed to one or all of the following:

- Poor maintenance of watercourses
- Blocked infrastructure, such as culverts
- Insufficient channel capacity
- High water levels in watercourses impeding the drainage of flows from their associated tributaries.

In addition to flood risk shown by the flood risk mapping, there are a number of small watercourses and field drains which may pose a risk to development. Generalised Flood Zone mapping (where more detailed modelling investigations are not available) is only available for watercourses with a catchment greater than 3km^2. Therefore, whilst these smaller watercourses may not be shown as having flood risk on the flood risk mapping, it does not necessarily mean that there is no flood risk. As part of a site-specific flood risk assessment it will be necessary to assess the risk from these smaller watercourses where these may influence the site.

Given the widespread flooding recorded historically within the borough (particularly along the River Medway floodplain and the area surrounding the confluence of the Medway with its main tributaries as evidenced in Figure 3-1) particular areas (e.g. roads and settlements) of the borough susceptible to fluvial flooding have not been listed here. Although there are no formal defences within Maidstone Borough, a number of structures (walls and embankments) and formal defences upstream (e.g. Leigh Flood Storage Area) and downstream (e.g. tidal flood walls) of Maidstone act to reduce flooding. This may be particularly important when considering the Functional Floodplain (Flood Zone 3b) for development proposals. For further information regarding the defences in Maidstone Borough, please refer to Chapter 3 (Flood Defence and Management) of the existing Level 1 SFRA.

The delineation of the Flood Zones and the areas of Maidstone Borough which are within these zones is displayed in Appendix B. Consideration of how climate change may influence the predicted Flood Zones in the future is indicated within mapping included in Appendix C.

[34] Kent County Council (March, 2016), Flood Risk to Communities – Maidstone
[35] Kent County Council (March, 2016), Flood Risk to Communities – Maidstone
[36] Kent County Council (March, 2016), Flood Risk to Communities – Maidstone

Table 3-1: Main River watercourses in Maidstone Borough

Watercourse name	Classification	Description
River Medway	Main River	The River Medway rises as a spring just above Turner's Hill to the south-west of East Grinstead in East Sussex. The river flows north-eastwards towards Penshurst where it is joined by the River Eden which rises above Oxted in Surrey. As the River Medway then flows through the Vale of Kent, it enters the borough east of East Peckham (NGR: TQ 68017 48626). It then generally flows in a north-eastern direction through the borough and converges with several tributaries including the Rivers Teise, Beult and Len. The River Medway then cuts though the Greensand Ridge beyond Yalding before reaching its tidal limit at the Allington Lock in Maidstone Town (NGR: TQ 74776 58105). It then flows north cutting through the chalk of the North Downs before the estuary widens out and Rochester and joins the sea at Sheerness.
River Beult	Main River	The reach of the River Beult that flows through the borough is designated as a Main River. The River enters the borough south-east of Headcorn (NGR: TQ and flows in a north-western direction through much of the southern section Maidstone Borough. The River bypasses the settlements of Staplehurst and Chainhurst before it is joined by the Lesser Teise near Hunton (NGR: TQ 71534 48263). The River then continues to flow north-west towards and through Yalding before converging with the River Medway (NGR: TQ 69282 50237).
River Teise	Main River	The River Teise enters Maidstone Borough at The Plantation approximately 1.04km north-west of Winchet Hill (NGR: TQ 72803 41193) and continues to flow north-west along the borough's boundary towards Claygate. The River then flows in a northern direction through the borough via Fowle Hall and Laddingford before converging with the River Medway at Hampstead Lane (B2162 road) (NGR: TQ 69051 49769). There are three radial gates situated on the River Teise: Duddies Sluice, Darman Sluice and Moors Farm Sluice).
Lesser Teise	Main River	The Lesser Teise splits from the River Teise approximately 1.25km east of Marden Beech (NGR: TQ 72501 42755) and continues to flow in a north-east direction by-passing Marden, Collier Street and Chainhurst. The River reaches its confluence with the River Beult at Benover (NGR: TQ 71535 48259).
Great Stour	Ordinary Watercourse / Main River	The Great Stour is primarily an Ordinary Watercourse within Maidstone Borough and is therefore under riparian ownership. The Great Stour flows from its source near Lenham in a southerly direction to the east of Lenham. South of Lenham Heath the River becomes a designated Main River (NGR: TQ 91207 49147) and flows along the Maidstone Borough boundary for approximately 0.35km before leaving the borough and flowing south towards Stonebridge Green (NGR: TQ 91503 49000).
River Len	Ordinary Watercourse / Main River	The River Len is a tributary of the River Medway and the entire reach of the River is located within Maidstone Borough. The River consists of several Ordinary Watercourses, which flow from Harrietsham in a north-west direction parallel to the M20. The watercourses converge at Otham Lane (NGR: TQ 79956 54804) to form the River Len, which then flows between Bearsted and Willington and through Maidstone Town. The River Len reaches its confluence with the River Medway in Maidstone Town Centre (NGR: TQ 75823 55487). There is one gauging station located along the River Len in the centre of Maidstone Town.
Loose Stream	Ordinary Watercourse / Main River	Similar to the River Len, the Loose Stream is a tributary of the River Medway and the entire reach of the Stream is located within Maidstone Borough. The Stream flows from its source near Sutton Valence as an Ordinary Watercourse in a north-west direction along the southern edge of Maidstone. At Tovil, the Stream becomes classified as a Main River (NGR: 75703 53661) and continues to flow north-west through Tovil before reaching its confluence with the River Medway near Maidstone Town Centre (NGR: TQ 75128 54836)
Coult Stream	Main River	A very small reach of the Coult Stream is located within the borough. The River enters the borough at the railway line between Beltring and Yalding approximately 0.5km east of Hale Street (NGR: TQ 68108 49062). The River then flows east for approximately 0.1km before reaching its confluence with the River Medway near Stoneham Lock (NGR: TQ 68203 49008).

Paddock Wood Stream	Main River	The Paddock Wood Stream is a tributary of the River Teise and is classified as a Main River. The Stream flows from its source on the southern edge of Paddock Wood in a northern direction before it enters the borough at Wagon Lane near High Lees Farm (NGR: TQ 67966 46283). The Stream continues to flow in a northern direction through mainly agricultural land before reaching its confluence with the River Teise south-west of Laddingford (NGR: TQ 68541 47558).
NOTE: This table is based on information extracted from the Environment Agency's Statutory (Sealed) Main Rivers database. Ordinary Watercourses within Maidstone Borough are not included within this table.		

3.3 Tidal flood risk

Tidal flood risk is assessed based on Extreme Still Water Sea Levels (ESWSL). An ESWSL is the level the sea is expected to reach during a storm event for a particular magnitude of flood event as a result of the combination of tides and surges. As these levels are based on 'still' water, the effect of short-term fluctuations in sea level associated with wind and swell waves are not included.

The tidal influence of the River Medway extends from the far north of the borough to beyond Allington Lock which is located within near the boundary of the borough. The tidal limit of the River Medway is at Allington Sluice. However, despite the presence of Sluice gates at Allington, tidal backwater effects can influence water level depths upstream during extreme events and it has been known for the backwater effect to reach as far upstream as East Farleigh[37]. Interrogation of the Environment Agency's recorded flood outline dataset[38] indicates the last known tidal flood event to flood areas of Maidstone Borough occurred in 1927 when the channel capacity was exceeded and there was no presence of raised flood defences. This flood event caused areas of Aylesford and Allington to flood as a result and the Maidstone Borough Stage 1 SWMP states that there are approximately 7 properties that may have been affected by flooding[39].

However, the dataset also indicates that that the most significant even recorded occurred in 1953 when defences lining this part of the River Medway were overtopped (outside of Maidstone Borough boundary). Areas within the settlements of Aylesford, Lunsford, New Hythe and Snodland flooded as a result. Although no areas within Maidstone Borough were flooded during this event, improvements to the costal and tidal defences following the 1953 event should be kept in mind when reviewing the dataset.

Tidal flooding is caused by extreme tide levels exceeding ground and/or defence levels. Flood Zones 1, 2 and 3 delineate areas at low risk, medium risk and high risk respectively from both tidal and fluvial flooding. Flood Zones do not take into account the effects of flood defences, and as such typically provide a worst-case assessment of flood risk. The delineation of the Flood Zones and the areas of Maidstone Borough which are within zones is displayed in Appendix B. Consideration of how climate change may influence the predicted Flood Zones in the future is indicated within mapping of Appendix C.

Flood Zones 2 and 3 represent the area that would be flooded in the 0.5% AEP and 0.1% AEP tidal events, respectively, in the absence of defences. In the context of the borough, tidal Flood Zone extents are small. Where tidal flooding is predicted Flood Zone 2 is larger in extent than Flood Zone 3a north of the M20, and Flood Zone 2 is also shown to extend upstream along the River Medway channel which Flood Zone 3a is not. It is expected that Flood Zone 3a should also extend upstream along the River Medway beyond Allington Lock, but flood risk modelling has not been completed to date to evidence this.

It has been identified that no formal defences are present within the borough. However, defences are located upstream (Leigh FSA and East Peckham FSA) and downstream (tidal flood walls/embankments) of the borough. The probability of failure of defences is reduced by the actions of the defence owners in maintaining these, but there remains a residual risk from flooding. Should defences form part of future development plans within the borough, it would be necessary that assessment of the 'residual' risk of defence failure (e.g. breach) be considered. It may also be important to understand how existing defences outside of the borough may influence flood risk at a future development site.

3.4 Surface water flooding

Flooding from surface water runoff (or 'pluvial' flooding) is usually caused by intense rainfall that may only last a few hours. Flooding usually occurs when rainfall fails to infiltrate to the ground or enter the drainage system. Ponding generally occurs at low points in the topography. The likelihood of flooding is dependent on not only the rate of runoff but also saturation of the

[37] Mott Macdonald, (May, 2008), Maidstone Borough Council: Strategic Flood Risk Assessment: Final Report (Chapter 2 Background Information)

[38] Environment Agency Historic Flood Map

[39] Maidstone Borough Council, (October, 2013), Maidstone Stage 1 Surface Water Management Plan (Appendix C2: DA02 – Maidstone Rural Mid).

receiving soils, the groundwater levels and the condition of the surface water drainage system (i.e. surface water sewers, highway authority drains and gullies, open channels, ordinary watercourses and SuDS). Surface water flooding problems are inextricably linked to issues of poor drainage, or drainage blockage by debris, and sewer flooding.

The updated Flood Map for Surface Water (uFMfSW) predominantly follows topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas. Mapping of the uFMfSW throughout the borough is provided in Appendix D.

Surface water flood records provided by a variety of data sources are shown in Figure 3-2. It should be noted that the records provided cover the period from 2008 to 2016 or do not have a date specified. Therefore, it is assumed that there have been at least 153 records of surface water flooding across the borough since 2008.

Although the Maidstone Borough Stage 1 SWMP states that historical records are relatively dispersed throughout the borough, several historical records are found to be located in clusters surrounding Marden, Staplehurst, Headcorn, Harrietsham and Bearsted (Figure 3-2). For the most part, surface water flooding was attributed to heavy rainfall overloading carriageways, drains and gullies. However, in other instances, the cause of flooding was perceived to be from blocked drains and gullies, which was the result of receiving watercourses impeding free discharge from surface water drains and gullies.

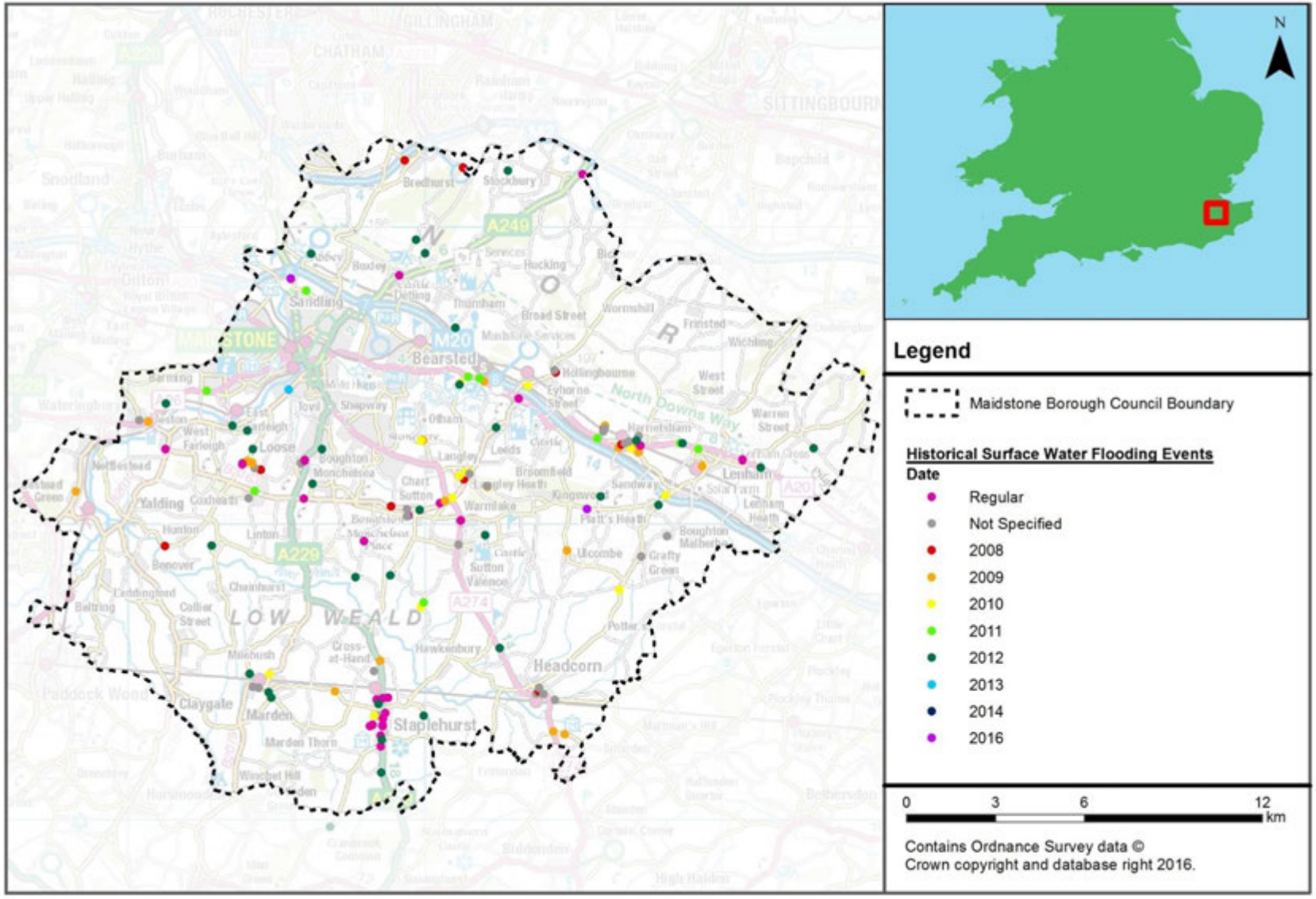
Repeated incidents have been highlighted within Harrietsham, Marden, Staplehurst and Headcorn. Specifically, it is noted that gullies located near Ashford Road, Harrietsham, require regular cleansing otherwise the whole carriageway floods. Furthermore, perceived causes of recorded flood events in the latter locations include local topography, inefficient drainage systems, or blockages in the drainage system. For areas of the Borough where specific surface runoff and drainage issues have been identified, it will normally be expected that development in these areas should contribute to the Community Infrastructure Levy, natural flood management, or local, targeted highways improvements to reduce the local flood risk in the area.

3.5 Groundwater flooding

Compared with other sources of flooding, the current understanding of the risks posed by groundwater flooding is limited and mapping of flood risk from groundwater sources is in its infancy. Under the Flood and Water Management Act (2010), LLFAs have powers to undertake risk management functions in relation to groundwater flood risk. Groundwater level monitoring records are available for areas on Major Aquifers. However, for low lying valley areas, which are typically associated with mudstones, clays and superficial alluvial deposits, very few records are available. In these areas, flooding from the ground may be more likely to result from prolonged periods of rainfall resulting in periods where water levels are perched near to the ground surface and potentially enhanced springflows. Additionally, there is increased risk of groundwater flooding where long reaches of watercourses are culverted due to elevated groundwater levels not being able to naturally pass into watercourses and be conveyed to less susceptible areas.

As part of the SFRA deliverables, mapping of the whole borough has been provided showing the Areas Susceptible to Groundwater Flooding (AStGWF). This information is provided in Appendix E. The AStGWF is a strategic-scale map showing groundwater flood areas on a 1km square grid. The data was produced to annotate indicative Flood Risk Areas for PFRA studies and allow the LLFAs to determine whether they may be at risk of flooding from groundwater. This data shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring, nor does it take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

Figure 3-2: Surface water flooding records



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The information indicates that the areas susceptible to groundwater flooding are primarily located in the central and southern sections of the borough. For the most part, susceptibility to groundwater flooding is considered to be low as less than 25% of the area within the 1km grid squares are considered to be susceptible to groundwater flooding.

However, the greatest susceptibility of groundwater flooding is focused in the following areas as greater than 25% of the area within the 1km grid squares are considered to be susceptible to groundwater flooding:

- Headcorn
- Staplehurst
- Marden
- Benover
- Hunton
- Yalding
- Harrietsham
- Bearsted
- Willington

This strongly links with the bedrock and superficial deposits in the borough. Harrietsham, Bearsted and Willington overly the Lower Greensand Group, which is an unconfined aquifer and the high permeability of these deposits are likely to contribute to groundwater flooding in these areas.

Although the clay in the Wealden Group beneath the southern section of the borough prohibits groundwater, the superficial geology (River Terrace and Alluvial deposits) underlying these areas may be a contributing factor to their susceptibility to groundwater flooding.

The AStGWF data should be used only in combination with other information, for example local or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist. It should be noted that although an area may be designated as susceptible to groundwater flooding, this does not mean that groundwater flooding will definitely be a problem within these areas, rather it provides an indication of the risk.

The 2008 Level 1 SFRA states that most of the reports of groundwater flooding are noted to be isolated singular incidents. However, a number of groundwater flooding incidents were reported in Boughton Monchelsea[40]. Boughton Monchelsea is a complex area for flood risk, and flood risk in the area is likely to be a combination of fluvial, groundwater and surface water flood sources. Proposed developments in this area and others will need to consider how these sources of risk, and possible interaction can be managed. Elsewhere, the Maidstone Stage 1 SWMP identified one recorded event of groundwater flooding at Water Lane, Harrietsham, due to the local springs affecting the highway[41].

It is noted that it can be difficult to ascertain if a source of flooding is from groundwater. This is because the flood risk may be the result of a combination of sources, or a culverted watercourse that may have been mistaken for a spring or an underground stream[42]. Nonetheless, developers planning to build within groundwater emergence zones should still investigate whether groundwater flooding is likely to be a problem locally.

3.6 Flooding from artificial sources

3.6.1 Flooding from sewers

Sewer flooding occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge freely into watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system. Infiltration, entry of soil or groundwater into sewer systems via faults within the fabric of the sewerage system, is another cause of sewer

[40] Mott Macdonald, (May, 2008), Maidstone Borough Council: Strategic Flood Risk Assessment: Final Report (Chapter 4 Flooding from Surface Water, Sewer and Groundwater)
[41] Maidstone Borough Council, (October, 2013), Maidstone Stage 1 Surface Water Management Plan (Chapter 2.3 Historical Flooding).
[42] Maidstone Borough Council, (October, 2013), Maidstone Stage 1 Surface Water Management Plan (Chapter 2.3 Historical Flooding).

flooding. Infiltration is often related to shallow groundwater, and may cause high flows for prolonged periods of time. The Maidstone Stage 1 SWMP identified that records of historical flooding were predominantly caused by hydraulic overload of sewers or an overloaded pumping station[43].

The existing Level 1 SFRA identifies that incidents of sewer flooding are more prominent in urban areas where there is a higher density of sewers and more water being discharged into the sewer system, although local incidents have been reported in more rural areas of the borough[44]. The majority of sewer flooding events are described to have occurred in the areas surrounding Maidstone, Staplehurst, Marden, Headcorn and Lenham.

Since 1980, the Sewers for Adoption[45] guidelines have meant that the majority of new surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30 chance of occurring in any given year. However, until recently this did not apply to smaller private systems. This therefore means that even where sewers are built to the current specification, they are likely to be overwhelmed by events of magnitude often considered when investigating the risk of river or surface water flooding (e.g. 1 in 100 chance of occurring in any given year). Existing sewers can also become overloaded due to new developments adding to their catchment or incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the borough.

Historical incidents of flooding are detailed by Southern Water in their DG5 register. This database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties experienced flooding. For confidentiality reasons, this data has been supplied on a postcode basis from the Sewer Incident Report Form (SIRF) hydraulic overload database. Data covers all reported incidence as of its export of 28 April 2016. The information from the SIRF database is shown in Table 3-2.

The SIRF hydraulic overload information indicates a total of 188 recorded flood incidents in Maidstone Borough within the last 5-year period. The more frequently flooded postcodes are TN12 9 (41), ME18 6 (28), TN12 0 (22) and TN27 9 (22). It is important to recognise that the information does not present whether flooding incidences were caused by general exceedance of the design sewer system, or by operational issues such as blockages. The information also represents a snap shot in time and may become outdated following future rainfall events.

Furthermore, risk in some areas may reduce in some locations by capital investment to increase of the capacity of the network. As such, the sewer flooding flood risk is not a comprehensive 'at risk register' and updated information should be sought to enhance understanding of flood risk from sewers at a given location.

Table 3-2: SIRF database for Maidstone Borough

Post Code	Number of Recorded Flood Incidents	Post Code	Number of Recorded Flood Incidents
ME14 2	9	ME17 1	4
ME14 3	1	ME17 2	4
ME14 4	4	ME17 3	3
ME14 5	3	ME17 4	3
ME15 0	5	ME18 5	5
ME15 6	4	ME18 6	28
ME15 7	8	TN12 0	22
ME15 8	9	TN12 5	1
ME15 9	2	TN126	2
ME16 0	2	TN12 9	41
ME16 8	4	TN27 9	22
ME16 9	2		
Total: 188 Note: based on information exported on 28/04/2016			

[43] Maidstone Borough Council, (October, 2013), Maidstone Stage 1 Surface Water Management Plan (Chapter 2.3 Historical Flooding).
[44] Mott Macdonald, (May, 2008), Maidstone Borough Council: Strategic Flood Risk Assessment: Final Report (Chapter 4 Flooding from Surface Water, Sewer and Groundwater)
[45] Sewers for Adoption 7th Edition - A Design & Construction Guide for Developer. WRc plc. September 2012.

3.6.2 Flooding from reservoirs

Reservoirs are artificial bodies of water, where water is collected and stored behind a man-made structure and released under control either to reduce the flow magnitudes in downstream channels or to meet a requirement when needed for purposes such as irrigation, municipal needs or hydroelectric power[46].

Flooding from reservoirs may occur following partial or complete failure of the control structure designed to retain water in the artificial storage area. It is estimated that although the risk of such failure is low and the occurrence of complete reservoir failure is exceptionally rare since the introduction of safety legislation in 1930. However, 1.1 million properties in England are in areas to be considered at risk of flooding from reservoir failure[47].

Reservoir flooding is very different from other forms of flooding. It may happen with little or no warning and evacuation will need to happen immediately. The likelihood of such flooding is very difficult to estimate, but it is less likely than flooding from rivers or surface water. It may not be possible to seek refuge from floodwaters upstairs as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure. The Environment Agency maps (available online at the Environment Agency **'What's in Your Backyard'** website[48] represent a credible worst case scenario. In these circumstances it is the time to inundation, the depth of inundation and the velocity of flood flows that will be most influential.

There are 10 reservoirs located within Maidstone Borough, the details of which are provided in Table 3-3. There are also 9 reservoirs located outside of the borough boundary that are indicated to inundate parts of the borough under breach failure. These are also listed in Table 3-3.

Outlines from the Risk of Flooding from Reservoirs dataset show the worst case inundation flood extents if these reservoirs were to breach or fail. As shown in Figure 3-3, reservoir breaches would primarily affect the south-west section of the borough, including the areas surrounding Marden, Collier Street, Chainhurst, Benover and Yalding, as well as Maidstone Town.

Most notably, the biggest risk of flooding from a reservoir breach is from the Bewl Bridge Reservoir, which is predicted to flood large parts of the River Teise and River Medway floodplains. Leigh FSA (formerly Leigh Barrier FSR) and Weirwood Reservoir are also predicted to flood parts of the River Medway floodplain, including the Yalding area. Although located approximately 6.2km south of the borough boundary near Wadhurst, a breach of this reservoir could have notable implications for the south-west area of the borough through to Maidstone Town.

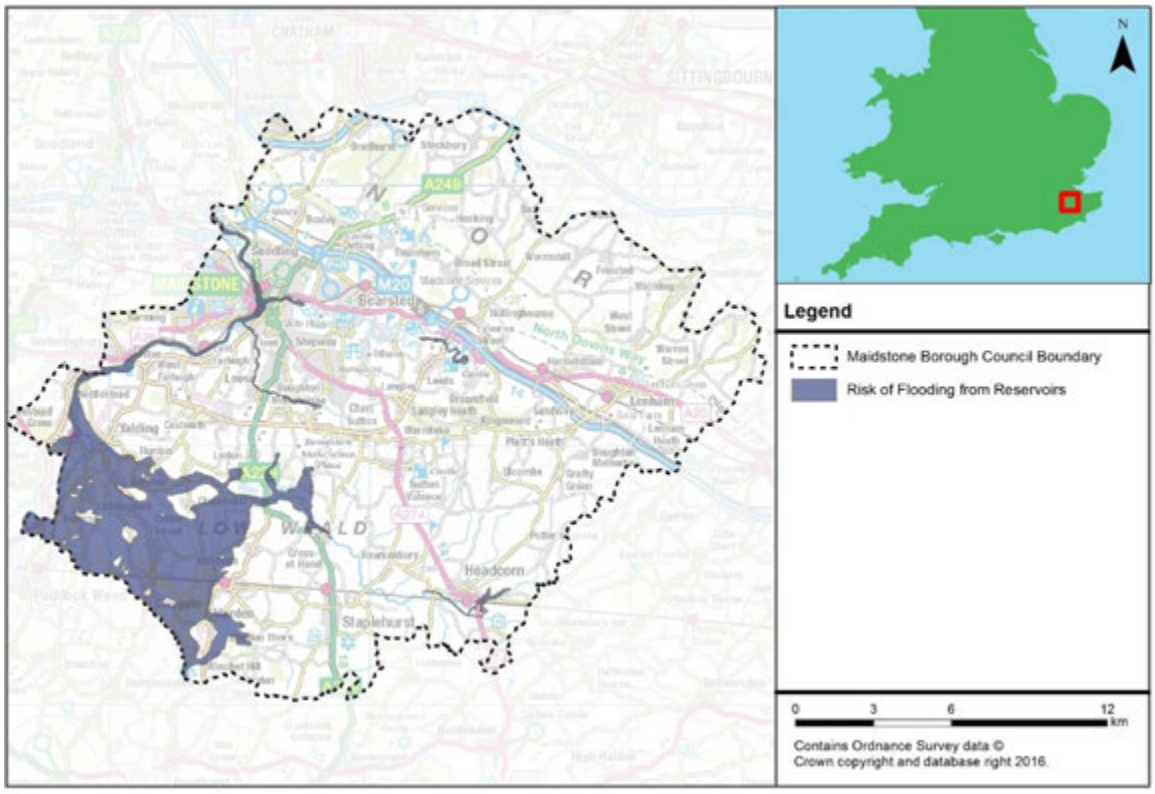
Table 3-3: Reservoirs that may potentially affect Maidstone Borough in the event of a breach

Reservoir	Location (grid reference)	Reservoir owner	Environment Agency area	Local Authority
Within Maidstone borough				
Cheveney Farm Upper Lake No 1	571465, 149587	Cheveney Farm	Kent and South London	Kent County Council
Dreamfields (ID370)	574704, 149087	Alan Firmin Ltd		
Leeds Castle Moat	583507, 153242	Leeds Castle Foundation		
Little London Reservoir	576427, 149697	Smith		
Mote Park Lake (ID398)	577417, 155375	Maidstone Borough Council		
Parkwood Farm Reservoir	578148, 151490	Boughton Monchelsea Parish Council		
Redwalls Lower Reservoir (ID283)	574885, 148981	Alam Firmin Ltd		
Redwalls Upper	575025, 149111	Alan Firmin Ltd		

[46] Defra – national flood and coastal erosion risk management strategy for England (2011): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228898/9780108510366.pdf
[47] DEFRA and the Environment Agency: The national flood and coastal erosion risk management strategy for England (September, 2011).
[48] http://apps.environment-agency.gov.uk/wiyby/default.aspx

Reservoir	Location (grid reference)	Reservoir owner	Environment Agency area	Local Authority
Reservoir (ID369)				
The Ringles Reservoir	584573, 144224	Ringles Ltd		
Weirton Hill	577658, 149089	Pavlovic		
Outside of Maidstone borough				
Bayham Lake	564315, 136595	Shchukina	Kent and South London	Kent County Council
Bedgebury Park Great Lake	572382, 134818	Bell Bedgebury International School		
Bewl Bridge Reservoir	568239, 133654	Southern Water Services Ltd		
Bough Beech Reservoir	549168, 147292	Sutton & East Surrey Water Company		
Churches Reservoir	566321, 153960	Hugh Lowe Farms Ltd		
Coult Stream Dam	565824, 149375	Environment Agency		
Leigh Barrier (Medway) FSR	556408, 146112	Environment Agency		
Style Place Farm	564326, 149164	Laurence J Betts Ltd		
Weirwood Reservoir	540713, 135333	Southern Water Services Ltd		East Sussex

Figure 3-3: Areas at risk of reservoir flooding following a breach or failure



The risk to development for reservoirs is residual but developers should consider reservoir flooding during the planning stage.

1. If influential to flood risk at the development site, developers should seek to contact the reservoir owner to obtain information which may include:
    a. Reservoir characteristics: type, dam height at outlet, area / volume, outflow location
    b. Operation: discharge rates / maximum discharge

c. Discharge during emergency drawdown

d. Inspection / maintenance regime

2. Developers should apply the sequential approach to locating development within the site. The following questions should be considered:

    a. Can risk be avoided through substituting less vulnerable uses or by amending the site layout?

    b. Can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted?

    c. Can layout be varied to reduce the number of people or flood risk vulnerability or building units located in higher risk parts of the site?

3. Developers should consult with relevant authorities regarding emergency plans in case of reservoir breach.

3.7 The impact of climate change

Flood Risk Assessments (FRAs) are required to demonstrate future implications of climate change have been considered, and risks managed where possible, for the lifetime of the proposed development. This may include for instance:

- Consideration of the vulnerability of the proposed development types or land use allocations to flooding and directing the more vulnerable away from areas at higher risk due to climate change.
- Use of 'built in' resilience measures. For example, raised floor levels.
- Capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

This latter point acknowledges that there may be instances where some flood risk management measures are not necessary needed now but may be in the future. This 'managed adaptive' approach may include for example setting a development away from a river so it is easier to improve flood defences in the future.

The latest guidance on climate change allowances for flood risk assessment released by the Environment Agency[49]provide predictions of anticipated change for

- peak river flow;
- peak rainfall intensity;
- sea level rise; and
- offshore wind speed and extreme wave height.

3.7.1 Fluvial flooding

Climate change mapping for Maidstone Borough has been provided in Appendix C.

To be supplied once the updated flood risk mapping information is available.

It is important to note that climate change does not just affect the extent of flooding. Even where flood extents do not significantly change; flooding is likely to become more frequent under a climate change scenario. The impact of an event with a given probability is also likely to become more severe. For example, as water depths, velocities and flood hazard increase, so will the risk to people and property. Although qualitative statements can be made as to whether extreme events are likely to increase or decrease over the UK in the future, there is still considerable uncertainty regarding the magnitude of localised impact of these changes. Further details regarding the uncertainties in predicting the impacts of climate change can be found in:

- **Environment Agency (2016) Flood Risk Assessments: Climate Change Allowances**

[49] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

- **UK Climate Projections (UKCP09)**

3.7.2 Tidal flooding

Climate change is predicted to influence the rate of sea level rise, in addition to offshore wind speed and extreme wave height. For Maidstone Borough, the influence of offshore wind speed and extreme wave height on predicted flooding is likely to be negligible given that the tidal Medway is some way inland. However, sea level rise will influence the tidal levels which propagate upstream along the Medway, thereby impacting flood risk. Guidance on required net sea level rise allowances (after adjustment for land movement changes) is presented within the updated guidance released by the Environment Agency. The adjustments to the allowances from previous guidance are less marked. However, the information presented within this SFRA document remains as per the previous guidance and it is expected that development applications use the updated guidance to inform their assessment of flood risk.

3.7.3 Surface Water flooding

Climate change is predicted to increase rainfall intensity in the future by up to 40%[50] under the new range of allowances published by the Environment Agency. This will increase the likelihood and frequency of surface water flooding, particularly in impermeable urban areas, and areas that are already susceptible. Changes to predicted rainfall should be incorporated into flood risk assessments and drainage and surface water attenuation schemes associated with developments.

3.7.4 Groundwater flooding

The effect of climate change on groundwater flooding problems, and those watercourses where groundwater has a large influence on winter flood flows, is more uncertain. The updated climate change guidance released February 2016 does not provide information on expected changes to groundwater flooding under future climate change. However, milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers could counteract this effect by drawing down groundwater levels to a greater extent during the summer months. Where groundwater flooding is expected to influence a development site, it will be expected that consideration of groundwater flooding under a changing climate is assessed and measures taken to mitigate any change in risk.

[50] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

4 Surface water management and SuDS

4.1 What is meant by Surface Water Flooding?

For the purposes of this SFRA, the definition of surface water flooding is that set out in the Defra SWMP guidance[51]. Surface water flooding describes flooding from sewers, drains, and ditches that occurs during heavy rainfall in urban areas.

Surface water flooding includes

- **pluvial flooding:** flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (overland surface runoff) before it either enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity;
- **sewer flooding:** flooding that occurs when the capacity of underground water conveyance systems is exceeded, resulting in flooding inside and outside of buildings. Normal discharge of sewers and drains through outfalls may be impeded by high water levels in receiving waters which may cause water to back up and flood on the urban surface. Sewer flooding can also arise from operational issues such as blockages or collapses of parts of the sewer network; and
- **overland flows entering the built up area from the rural/urban fringe:** includes overland flows originating from groundwater springs.

4.2 Role of the LLFA and Local Planning Authority in surface water management

From April 2015 local planning policies and decisions on planning applications relating to major development or major commercial development should make provision for sustainable drainage systems to manage run-off, where major development is 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; and
- 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 one hectare or more.

(The LLFA will also provide advice on minor development on a non-statutory basis).

The Local Planning Authority must satisfy themselves that clear arrangements are in place for future maintenance of the management arrangements and the LLFA (Kent County Council), as statutory consultee is required to review the drainage and Sustainable Urban Drainage (SuDS) proposals to confirm they are appropriate.

When considering planning applications, local planning authorities should seek advice from the relevant flood risk management bodies, principally the LLFA on the management of surface water (including what sort of SuDS they would consider to be reasonably practicable), satisfy themselves that the proposed minimum standards of operation are appropriate and ensure, through the use of planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the development's lifetime. Judgement on what SuDS system would be reasonably practicable should be through reference to Defra's technical standards and should take into account design and construction costs.

It is essential that the consideration of sustainable drainage takes place at an early stage of the development process – ideally at the master-planning stage. This will assist with the delivery of well designed, appropriate and effective SuDS. Proposals should also comply with the key SuDS principles regarding solutions that deliver multiple long-term benefits. These principles are:

- **Quantity:** should be able to cope with the quantity of water generated by the development at the agreed rate with due consideration for climate change via a micro-catchment based approach

[51] Defra, Surface Water Management Plan Technical Guidance (March 2010). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69342/pb13546-swmp-guidance-100319.pdf

- **Quality:** should utilise SuDS features in a "treatment train" that will have the effect of treating the water before infiltration or passing it on to a subsequent water body
- **Amenity/Biodiversity:** should be incorporated within "open space" or "green corridors" within the site and designed with a view to performing a multifunctional purpose

Kent County Council and Maidstone Borough Council should:

- promote the use of SuDS for the management of run off;
- ensure their policies and decisions on applications support and complement the Building Regulations on sustainable rainwater drainage, giving priority to infiltration over watercourses and then sewer conveyance;
- Incorporate locally distinctive favourable policies within development plans, where appropriate;
- adopt locally distinctive policies for incorporating SuDS requirements into Local Plans, where appropriate;
- encourage developers to utilise SuDS whenever practical, if necessary, through the use of appropriate planning conditions; and
- develop joint strategies with sewerage undertakers to further encourage the use of SuDS.

4.3 Level 1 and 2 Assessment of Surface Water Flood Risk

In assessing the surface water flood risk across the Maidstone administrative area, the Environment Agency's updated Flood Map for Surface Water (uFMfSW) has been used (Appendix D). These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the Environment Agency and any potential developers to focus their management of surface water flood risk.

The uFMfSW is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water (Table 4-1).

Table 4-1: uFMfSW risk categories

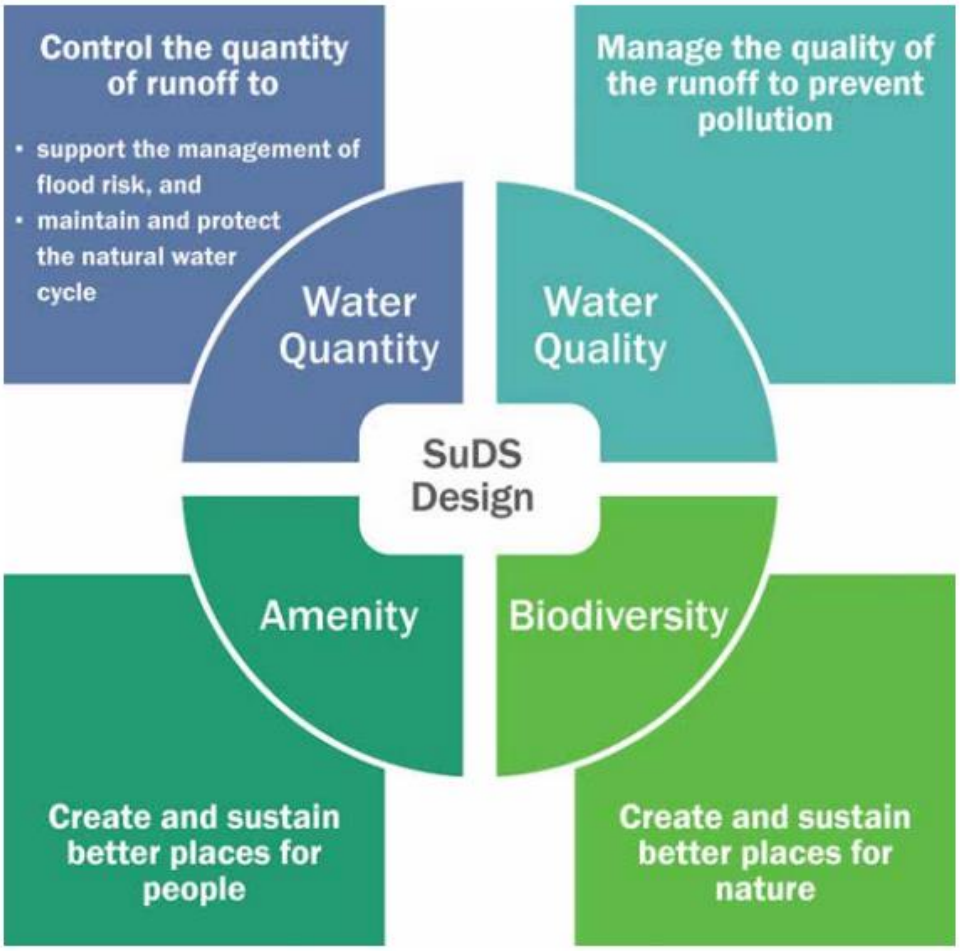
Category	Definition
High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%)
Medium	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year.
Low	Flooding occurring as a result of rainfall of between 1 in 1,000 (0.1%) and 1 in 100 (1%) chance in any given year.
Very Low	Flooding occurring as a result of rainfall with less than 1 in 1,000 (0.1%) chance in any given year.

Although the uFMfSW offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site specific scale. Such an assessment will use the uFMfSW in partnership with other sources of local flooding information to confirm the presence of a surface water risk at that particular location. This may include information within other strategy documents, such as the Kent Local Flood Risk Management Strategy (see section 2.2.5). It will be important for this to consider the potential impacts of climate change. Guidance relating to climate change allowances is made in section 3.7.

4.4 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems are water management practices which aim to enable surface water to be drained in a way that mimics (as closely as possible) the run-off and drainage prior to site development. The primary benefits of SuDS can be categorised under four distinct themes. These are highlighted in Figure 4-1 and are referred to as the four pillars of SuDS design.

Figure 4-1: Four pillars of SuDS design



Source: The SuDS Manual C753 (2015)

There are a number of ways in which SuDS can be designed to meet surface water quantity, water quality, biodiversity and amenity goals. Given this flexibility, SuDS are generally capable of overcoming or working alongside various constraints affecting a site, such as restrictions on infiltration, without detriment to achieving these goals.

The inclusion of SuDS within developments should also be seen as an opportunity to enhance ecological and amenity value as well as promote Green Infrastructure by incorporating above ground facilities into the landscape development strategy. SuDS must be considered at the outset and during preparation of the initial conceptual site layout to ensure that enough land is given to design spaces that will be an asset to the development as opposed to an ineffective afterthought. For SuDS trains to work effectively it needs to be ensured that appropriate techniques are selected based on the objectives for drainage and the site specific constraints. It is recommended that on all developments source control is implemented as the first stage of a management train allowing for improvements in water quality and reducing or eliminating runoff from smaller, more frequent, rainfall events.

Where practicable, all new major development proposals should ensure that sustainable drainage systems for management of run-off are put in place. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully

and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and existing drainage arrangements is essential.

4.5 Types of SuDS Systems

There are many different SuDS techniques that can be implemented in attempts to mimic pre-development drainage (Table 4-2). The suitability of the techniques will be dictated in part by the development proposal and site conditions. Advice on best practice is available from the Environment Agency and the Construction Industry Research and Information Association (CIRIA) e.g. the CIRIA SuDS Manual C753 (2015). During the review of development applications, Maidstone Borough Council will consider the benefits of proposed SuDS systems at development sites, both in terms of flood reduction and other environmental enhancements, and advise on appropriate measures.

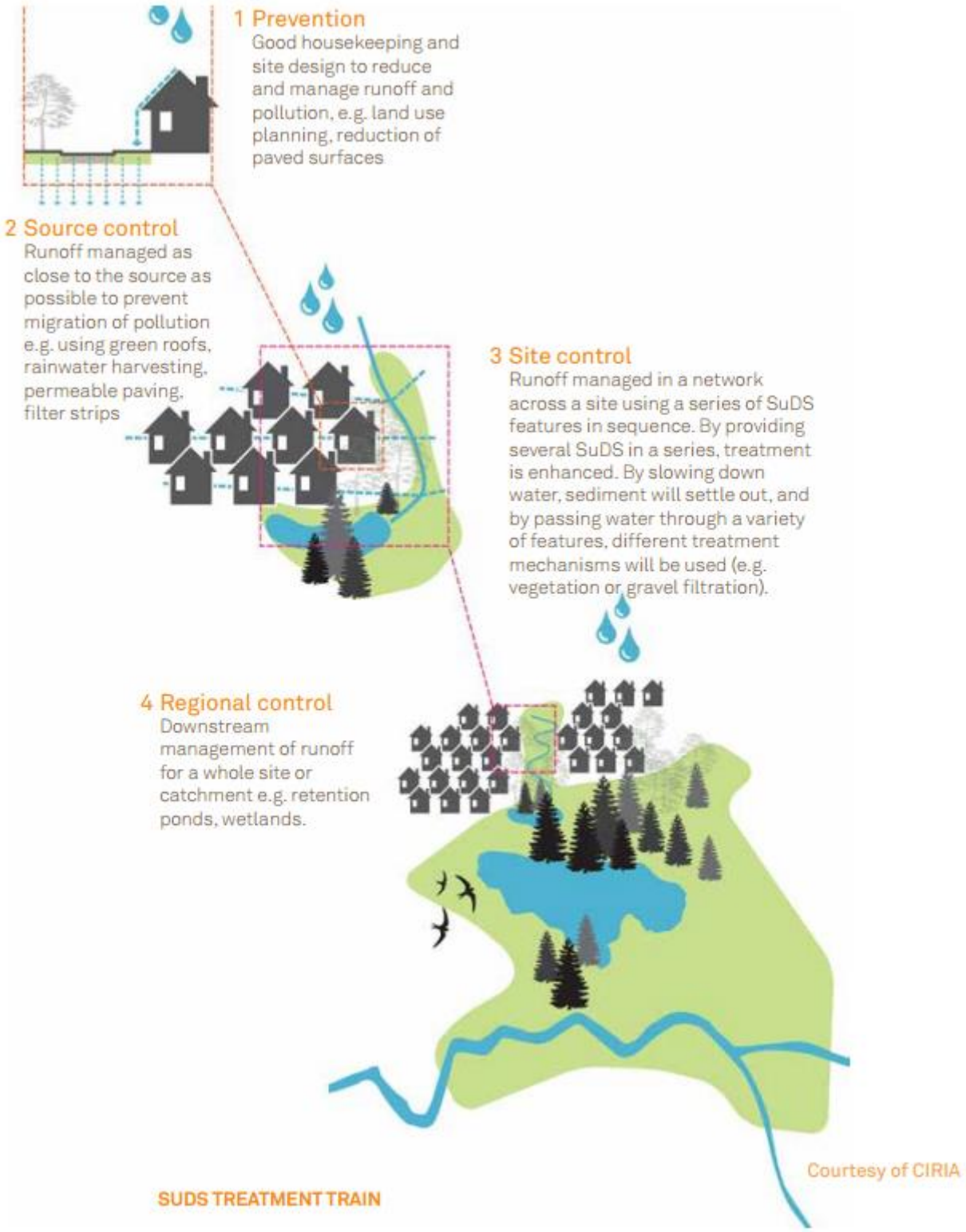
Table 4-2: Examples of SuDS techniques and potential benefits

SuDS Technique	Flood Reduction	Water Quality Treatment & Enhancement	Landscape and Wildlife Benefit
Living roofs	✓	✓	✓
Basins and ponds	✓	✓	✓
Constructed wetlands	✓	✓	✓
Balancing ponds	✓	✓	✓
Detention basins	✓	✓	✓
Retention ponds	✓	✓	✓
Filter strips and swales	✓	✓	✓
Infiltration devices	✓	✓	✓
Soakaways	✓	✓	✓
Infiltration trenches and basins	✓	✓	✓
Permeable surfaces and filter drains	✓	✓	
Gravelled areas	✓	✓	
Solid paving blocks	✓	✓	
Porous pavements	✓	✓	
Tanked systems	✓		
Over-sized pipes/tanks	✓		
Storm cells	✓		

4.5.1 SuDS Treatment Train

SuDS should not be used individually but as an interconnected system, designed to capture water at the source and convey it to a discharge location. This system is described as a SuDS Treatment Train (Figure 4-2). By using a number of SuDS features in series it is possible to reduce the flow and volume of runoff as it passes through the system, minimise the pollutants which may be generated by a development, and tailor surface water management to the local context.

Figure 4-2: SuDS Management Train



Source: Water. People. Places: A guide for master planning sustainable drainage into developments (2013)

4.5.2 Treatment

A key part of the four pillars of SuDS is to provide the maximum improvement to water quality through the use of the SuDS Treatment Train. To maximise the treatment within SuDS, CIRIA recommends the following good practice guide is implemented in the treatment process:

- **Manage surface water runoff close to source**: This makes treatment easier due to the slower velocities and also helps isolate incidents rather than transport pollutants over a large area.
- **Treat surface water runoff on the surface**: This allows treatment to be delivered by vegetation and the sources of pollution to be more easily identified. It helps with future maintenance work and identifying damaged or failed components of the treatment train.
- **Treat a range of contaminants**: SuDS should be chosen and designed to deal with the likely contaminants that may pose a risk to the receiving environment and be able to reduce them to acceptably low levels.
- **Minimise the risk of sediment remobilisation**: SuDS should be designed to prevent sediments being washed into receiving water bodies or systems during events greater than those for which the component may have been specifically designed.
- **Minimise the impact of a spill**: Designing SuDS to be able to trap spills close to the course, facilitate contamination management and removal. The selected SuDS should also provide robust treatment along several components in series.

The number of treatment stages required depends primarily on the source of the runoff. The C753 SuDS Manual advises a simple index approach to determining the number of treatment stages. This involves determining a pollutant hazard score for each pollutant type. An index is then used to determine the treatment potential of different SuDS features for different pollutant types. This is known as the mitigation index. The Total SuDS mitigation index should be equal or greater than the pollution hazard score to deliver adequate treatment.

4.6 Kent SuDS Guidance

Information and guidance regarding SuDS design and implementation is available from a number of sources published by Kent County Council and Maidstone Borough Council.

4.6.1 Water. People. Places: A guide for master planning sustainable drainage into developments[52]

The guide for master planning sustainable drainage into developments was published in 2013 by the LLFAs of the South East of England, of which Kent County Council is a part, to outline the process for integrating SuDS into the master planning of large and small developments. The South East LLFAs expect this guidance to be used as part of the initial planning and design plans for all types of residential, commercial and industrial development. The guidance complements existing guidance on SuDS design, maintenance and operation which should also be used to inform detailed design and delivery of SuDS.

Although SuDS can be applied to any site, there are a variety of conditions and constraints that could restrict the suitability of different types of SuDS or trigger the need for bespoke design. Therefore, consideration of the movement of water and its interaction with site-specific conditions at the earliest stage of design is crucial to the success of a SuDS scheme.

Section 4 of the 'Water. People. Places' document provides detailed SuDS design guidance for a range of commonly encountered site conditions. A summary of this guidance is provided in the SuDS Selection Matrix (Figure 4-3), whereby the suitability of each type of SuDS is presented for each common site condition.

It is noted in the guidance document that SuDS design should be fully integrated into a master plan as an essential part of land use and development planning, and considered in conjunction with other aspects of the design. Although there is no formal process for master planning, a typical design process for SuDS is outlined in Sections 5 and 6 of the guidance document. The process is designed to allow planners and designers to scope and embed opportunities for SuDS as land use and design ideas evolve.

[52] Water. People. Places: A guide for master planning sustainable drainage into developments. Prepared by the Lead Local Flood Authorities of the South East of England (AECOM, 2013)

Figure 4-3: SuDS selection matrix for site conditions

SUDS SELECTION MATRIX FOR SITE CONDITIONS

unsuitable

suitable

		Green Roof	Rainwater Harvesting	Soakaway	Permeable Paving	Filter Strip	Bioretention Area	Swale	Hardscape Storage	Pond	Wetland	Underground Storage
Flood Plain	Located in the floodplain?	●	●	●	●	●	●	●				
Groundwater	Groundwater less than 3 metres below ground surface?	●	●		● With liner and underdrain (no treatment)	●	● With liner and underdrain	● With liner	● If aboveground	● With liner	●	
Topography	Sited on a flat site (<5% gradient)?	● Source control	● Source control	● Source control	● Source control	● Source control	● With short kerb or rill length	● Careful to provide some gradient	●	● Try to keep flow above ground to	● Try to keep flow above ground to	●
	Sited on a steep slope (5-15% gradient)?	●	●		● If terraced		● If terraced	● If installed along contour	● If terraced		● If terraced	●
	Sited on a very steep slope (>15% gradient)?	●	●									●
Soils and Geology	Impermeable soil type (e.g. clay-based type)?	●	●		● With underdrain (no treatment)	●	●	●	●	●	●	●
Contaminated land	Are there contaminated soils on site?	●	●		● With underdrain (no treatment)	● With liner	● With liner and underdrain	● With liner	● With liner	● With liner	● With liner	● With liner
Existing Infrastructure	Are there underground utilities in the SuDS area?	●	●		● If possible relocated into a marked corridor for future maintenance	●	● Possible with structural grid in soil					●
Space constraints	Limited space for SuDS components?	●	●	●	●		●	● Rill or channel more suitable	●		● Micro-wetland	●
Runoff characteristics	Suitable for inclusion in high risk contamination areas?	● Source control	● Source control		● With liner and spill isolation		● With liner and spill isolation	● With liner and spill isolation	● With liner and spill isolation		● If designed for treatment of predicted wastes	● With liner and spill isolation
Protected species or habitat	Proximity to designated sites and priority habitats?	●	●	●	●	●	●	●	●	● If designed and maintained appropriately	● If designed and maintained appropriately	●
Ownership and Maintenance	Can the feature be designed for adoption?	● Dependant on design and local adoption policies										

Extract from the SuDS guidance document prepared by the Lead Local Flood Authorities of the South East of England: Water. People. Places: A guide for master planning sustainable drainage into developments (2013).

4.6.2 Maidstone Stage 1 SWMPs

Kent County Council state that the relevant SWMPs should also be referred to during the formulation of a SuDS scheme for a site. In this case SuDS developers should refer to the guidance provided in the following SWMPS:

- Maidstone and Malling Stage 1 SWMP (2012)
- Maidstone Stage 1 SWMP (2013)

These documents provide advice regarding the feasibility of SuDS across Maidstone Borough.

Again, it is noted that the choice of a SuDS technique is site-specific; depending on the nature of the proposed development and local conditions. The suitability of areas for different types of SuDS techniques if often determined by:

- Existing land use;
- Soil type;
- Underlying geology; and
- Groundwater conditions.

When considering infiltration options, Groundwater Source Protection Zones must also be considered. The Maidstone SWMP states that Zone I (Inner protection zones), Zone II (Outer protection zones) and Zone III (Total catchment) are within the borough (see Section 4.8). These zones show the risk of contamination from any activities that that may cause pollution. If discharge is proposed within a Source Protection Zone, then additional information may be required to demonstrate that there is not an unacceptable risk to groundwater and the surrounding environment. Additional information and advice can be found on the website and within the 'Groundwater protection: Principles and practice (GP3)[53]' document.

The SWMP also states that new development should seek to incorporate SuDS to reduce surface water runoff where feasible and appropriate to the size and scale of development. The hierarchy of surface water disposal is as follows:

- The use of SuDS techniques, appropriate to the location, size and type of the development.
- Discharge to the watercourse.
- Discharge to a surface sewer.
- Discharge to a combined sewer.

4.6.3 Further information and guidance

Other sources of information and guidance regarding SuDS can be found in the Kent Design Guide[54]. The guide updates the 'Kent Design – A Guide to Sustainable Development' originally published in 2000 and assists designers to achieve high standards of design and construction by promoting a common approach to the main principles that underlie the criteria for assessing planning applications.

The guide is also accompanied by a set of technical appendices that replace previous advice about the design of housing and industrial estates. The 'Making it Happen – Sustainability (Drainage Systems)'[55] document includes advice, guidance and information about the design and implementation of drainage systems, including SuDS for both residential and industrial developments.

Along with the guidance provided by the South East LLFAs and the Stage 1 SWMPs, development applications should have regard for and consider the above documents during the design and delivery of SuDS for all types of development.

[53] Groundwater protection: principles and practice (GP3), (Environment Agency, 2013).
[54] The Kent Design Guide
[55] Making It Happen – Sustainability (Drainage Systems) (Kent County Council, 2007)

4.7 Groundwater Vulnerability Zones

The Environment Agency published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise the underlying bedrock. The maps show the vulnerability of groundwater at a location based on the hydrological, hydrogeological and soil properties within a one-kilometre grid square.

Two maps are available:

- Basic groundwater vulnerability map: this shows the likelihood of a pollutant discharged at ground level (above the soil zone) reaching groundwater for superficial and bedrock aquifers and is expressed as high, medium and low vulnerability
- Combined groundwater vulnerability map: this map displays both the vulnerability and aquifer designation status (principal or secondary). The aquifer designation status is an indication of the importance of the aquifer for drinking water supply.

The groundwater vulnerability maps should be considered when designing SuDS.

4.8 Groundwater Source Protection Zones (GSPZ)

In addition to the Areas Susceptible to Ground Water Flooding (AStGWF) data the Environment Agency also defines Groundwater Source Protection Zones in the vicinity of groundwater abstraction points. These areas are defined to protect areas of groundwater that are used for potable supply, including public/private potable supply, (including mineral and bottled water) or for use in the production of commercial food and drinks. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. The definition of each zone is noted below:

- Zone 1 (Inner Protection Zone) – Most sensitive zone: defined as the 50-day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres
- Zone 2 (Outer Protection Zone) – Also sensitive to contamination: defined by a 400-day travel time from a point below the water table. This zone has a minimum radius around the source, depending on the size of the abstraction
- Zone 3 (Total Catchment) - Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. Individual source protection areas will still be assigned to assist operators in catchment management
- Zone 4 (Zone of special interest) – A fourth zone SPZ4 or 'Zone of Special Interest' usually represents a surface water catchment which drains into the aquifer feeding the groundwater supply (i.e. catchment draining to a disappearing stream). In the future this zone will be incorporated into one of the other zones, SPZ 1, 2 or 3, whichever is appropriate in the particular case, or become a safeguard zone

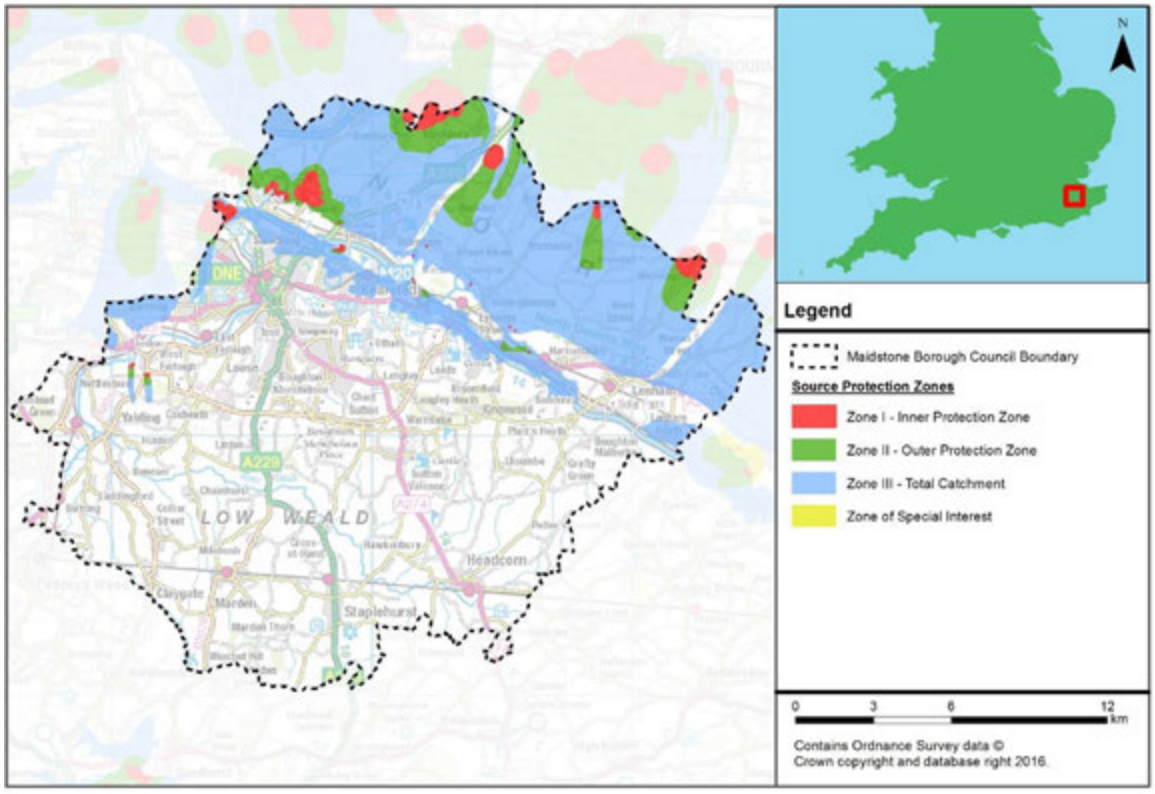
4.8.1 GSPZs in Maidstone Borough

- Unlike the rest of the borough, the north-eastern section of Maidstone Borough is characterised by several GSPZs of varying sizes. They are located in the following areas and have been displayed in Figure 4-4.
- West Farleigh
- Boxley
- Yelsted
- Wichling
- Cobtree Manor Park, Aylesford
- Horish Wood, Maidstone

- Crismill Lane, Maidstone
- Longham Wood, Maidstone
- Pilgrims Way, Maidstone
- Goddington Lane, Harrietsham
- Greenway Court Road, Hollingbourne
- Harple Lane, Detling
- Boarley Farm, Sandling
- Hayes Lane, Sittingbourne
- Trundle Wood, Sittingbourne

There are no Zones of Special Interest located within Maidstone Borough.

Figure 4-4: Groundwater Source Protection Zones



4.9 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies. The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process. The definition of each NVZ is as follows:

- Groundwater NVZ – an area of land where groundwater supplies are at risk from containing nitrate concentrations exceeding the 50 mg/l level dictated by the EU Council's Surface Water Abstraction Directive (1975)[56] and Nitrates Directive (1991)[57].
- Surface Water NVZ – an area of land where surface waters (in particular those used or

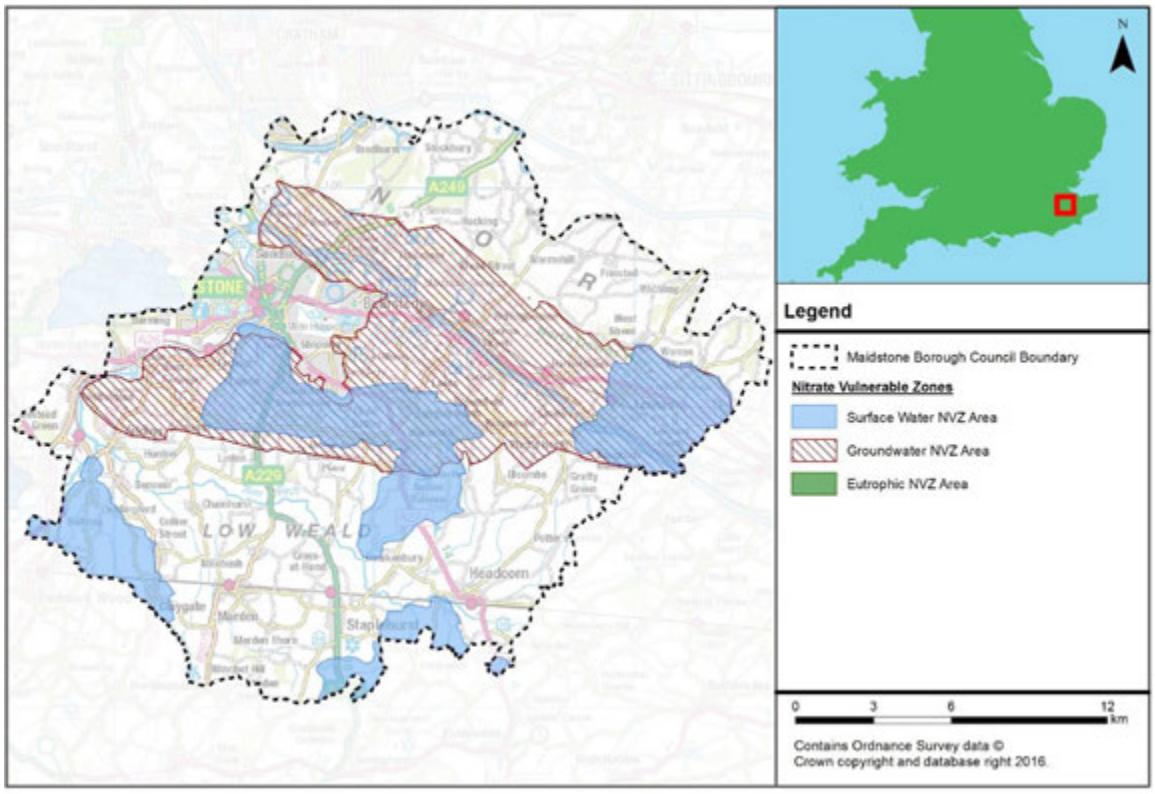
[56] The EU Council's Surface Water Abstraction Directive (Annex II, parameter 7*), June 1975
[57] The EU Council's Nitrates Directive (Annex I), December 1991

intended for the abstraction of drinking water) are at risk from containing nitrate concentrations exceeding the 50 mg/l level dictated by the EU Council's Surface Water Abstraction Directive (1975) and Nitrates Directive (1991).

- Eutrophic NVZ- an area of land where nitrate concentrations are such that they could/will trigger the eutrophication of freshwater bodies, estuaries, coastal waters and marine waters.

The location of NVZs within the Maidstone Borough are shown in Figure 4-5. As can be seen, the borough is primarily characterised by an extensive groundwater NVZ, and four significant areas are classed as surface water NVZs. There are no eutrophic NVZs located within the borough.

Figure 4-5: Nitrate Vulnerable Zones



5 Summary

This Strategic Flood Risk Assessment (SFRA) 2016 addendum document updates elements of the Level 1 SFRA document prepared in May 2008. The addendum SFRA replaces sections of the 2008 issue and provides supporting evidence for the emerging Local Plan.

5.1.1 Sources of flood risk

- Maidstone Borough has a history of documented flood events and flood records indicate that the main source of risk is from fluvial sources.
- The primary source of fluvial flood risk to the borough is the River Medway and its major tributaries, the River Beult and River Teise. The most significant flood events reported to have affected the borough occurred in 1927, 1963, 1968, 2000 and 2013/14, each of which included notable flooding from the River Medway.
- Maidstone Borough has also experienced a number of historic surface water / drainage related flood events, which have been attributed to a range of sources. The primary source of surface water flooding was attributed to heavy rainfall overloading highway carriageways and paved areas, drains and gullies, but other sources of flooding were associated with blockages and high water levels impeding free discharge from surface water drains and gullies. The updated Flood Map for Surface Water (uFMfSW) shows a number of surface water flow paths which predominantly follow topographical flow paths along existing watercourses or dry valleys with some isolated ponding located in low lying areas.
- Data from the Sewer Incident Report Form data supplied by Southern Water indicates a total of 188 recorded flood incidents in Maidstone Borough within the last 5-year period. The more frequently flooded postcodes are TN12 9 (41), ME18 6 (28), TN12 0 (22) and TN27 9 (22).
- Historically, groundwater flood events have been recorded across the borough, but these have typically been isolated incidents. The Areas Susceptible to Groundwater Flooding (AStGWF) mapping suggests that areas susceptible to groundwater flooding are primarily located in the central and southern sections of the borough, but for the most part, susceptibility to groundwater flooding is considered to be low as less than 25% of the area within the 1km grid squares are considered to be susceptible to groundwater flooding.
- National Reservoir Inundation Mapping indicates that there are ten reservoirs within the borough and nine reservoirs outside of the borough that could affect the borough in the event of a breach. This includes Leigh Flood Storage Area and Weirwood Reservoir, located at the west of the borough, but most notably Bewl Bridge reservoir located south of the borough.

5.1.2 Key Policies

There are a number of regional and local key policies which have been considered with the SFRA. The regional policies include the River Medway CFMP (2009), the River Thames Basin Management Plan (2009), the Medway Estuary and Swale SMP (2010) and the Thames River Basin District Flood Risk Management Plan (FRMP) - Parts A, B, C and D (March 2016).

Key local policies include the following:

- Thames River Basin District Flood Risk Management Plan (FRMP): within Part C identified priorities are to implement outcomes of the Middle Medway Strategy and improve flood warning.
- Kent County Council Preliminary Flood Risk Assessment (PFRA): The PFRA reports significant past and future flooding from all sources except Main Rivers, the Sea and Reservoirs, which are covered by the Environment Agency, and sub-standard performance of the adopted sewer network (covered under the remit of Southern Water). The Flood Risk Regulations (2009) require the Lead Local Flood Authority (LLFA) to identify significant Flood Risk Areas. No Flood Risk Areas have been identified in Maidstone Borough based on critical infrastructure/access routes, sewer/surface water problems and areas prone to significant ponding.

- Kent Local Flood Risk Management Strategy (2013): The Strategy is used as a means by which the LLFA co-ordinates Flood Risk Management on a day to day basis and sets out measures to manage local flood risk (i.e. flood risk from surface water, groundwater and Ordinary Watercourses). The Strategy also sets out an action plan of how the LLFA intends to achieve the high-level objectives proposed for managing flood risk.
- Surface Water Management Plans (SWMPs): SWMPs are produced to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from surface runoff, groundwater, and Ordinary Watercourses. Options to alleviate the risks are identified and presented as a long-term action plan to manage local flooding in a particular area. The published SWMPs relevant to Maidstone Borough that have been considered in this SFRA are the:
    - Maidstone Stage 1 SWMP (2013)
    - Maidstone and Malling Stage 1 SWMP (2012)
    - Other Stage 2 SWMPs which have been commissioned yet to be published are for Marden, Staplehurst and Headcorn.

5.1.3 Development and flood risk

The Sequential approach to development and flood risk has been defined with guidance provided for the application of the Sequential and Exception Tests for both the Local Plan and for detailed site-specific Flood Risk Assessments. Site-specific FRAs should include assessment of mitigation measures required to safely manage flood risk along with the promotion of Sustainable Drainage Systems (SuDS) to create a conceptual drainage strategy and safe access/egress at the development in the event of a flood.

Surface water flooding and the role of the LLFA and the Local Planning Authority (LPA) in surface water management has also been defined with guidance provided for the design and implementation of SuDS as part of the initial planning stage of all types of residential, commercial and industrial developments. The SFRA provides details of the types of SuDS available and when they should be used, and outlines the recommendations included in the relevant national, regional and local guidance documents.

The merits of strategic flood risk solutions should be identified and understood when considering development within the borough as these can involve measures that deliver wider strategic benefits and can be more easily and efficiently maintained than a myriad of individual smaller scale measures. Developers should work with stakeholders to identify issues and provide appropriate solutions.

5.1.4 Flood warning and emergency planning

Emergency planning considerations are reported in the 2008 SFRA document, but flood warning coverage has been indicated within the appendix mapping in this addendum SFRA.

5.2 Recommendations

5.2.1 Future Developments

Development types and their location mean that opportunities and constraints will vary on a site by site basis. However, developments should seek opportunities to reduce overall levels of flood risk at the site, for example by:

- Reducing volume and rate of surface water runoff based on Local Plan policy and LLFA Guidance
- Locating development to areas with lower flood risk
- Creating space for flooding.
- Integrating green infrastructure into mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.

The LPA should consult the NPPF and Environment Agency's 'Flood Risk Standing Advice (FRSA) for Local Planning Authorities', published in March 2014, when reviewing planning applications for proposed developments at risk of flooding.

At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances) inform development zoning within the site and prove, if required, whether the Exception Test can be passed.

5.2.2 Promotion of SuDS

Planners should be aware of the conditions set by the LLFA for surface water management and ensure development proposals and applications are compliant with the Council's policy.

- A detailed site-specific assessment of SuDS would be needed to incorporate SuDS successfully into the development proposals. New or re-development should adopt source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff.
- For proposed developments, it is imperative that a site-specific infiltration test is conducted early on as part of the design of the development, to confirm whether the water table is low enough to allow for SuDS techniques that are designed to encourage infiltration.
- Where sites lie within or close to Groundwater Source Protection Zones or aquifers, there may be a requirement for a form of pre-treatment prior to infiltration. Further guidance can be found in the CIRIA SuDS manual on the level of water quality treatment required for drainage via infiltration. Further restrictions may still be applicable and guidance should be sought from the LLFA.
- Developers need to ensure that new development does not increase the surface water runoff rate from the site and should therefore contact the LLFA and other key stakeholders at an early stage to ensure surface water management is undertaken and that SuDS are promoted and implemented, designed to overcome site-specific constraints.
- The LPA will need to consider drainage schemes for major applications, but it is advised developers utilise the LLFA's Polices and Guidance to develop their drainage scheme for minor applications.

5.2.3 Infrastructure and Access

Safe access and egress will need to be demonstrated at development sites. Consideration of alternative access and egress routes should be made in the event that primary routes are inundated with flood water. Resilience measures will be required if buildings are situated in the flood risk area, and opportunities to enhance green infrastructure and reduce flood risk by making space for water should be sought.

5.2.4 Green Infrastructure and WFD

Opportunities to enhance green infrastructure and reduce flood risk by making space for water should be sought. In addition, opportunities where it may be possible to improve the WFD status of watercourses, for example by opening up culverts, weir removal, and river restoration, should be considered. Green infrastructure should be considered within the mitigation measures for surface water runoff from development.

5.3 Use of SFRA data and future updates

It is important to recognise that the SFRA has been developed using the best available information at the time of preparation.

The SFRA should be periodically updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by authorities including Maidstone Borough Council, Kent County Council (in its role as LLFA), the Highways Authority, Southern Water and the Environment Agency. It is recommended that the SFRA is reviewed internally on an annual basis, allowing a cycle of review, followed by checking with the above bodies for any new information to allow a periodic update.

Appendices

A Watercourses in Maidstone Borough

B Flood Zone mapping

The flood zone maps show the extents of Flood Zones 1, 2, 3a and 3b in Maidstone Borough. The flood zones are defined as follows:

Zone 1: Comprised of land having a less than 1 in 1,000 annual probability of river or sea flooding in any year.

Zone 2: Comprised of land having between a 1 in 100 and a 1 in 1,000 annual probability of river flooding or 1 in 200 and 1 in 1,000 annual probability of sea flooding in any year.

Zone 3a: Comprised of land assessed as having a greater than 1 in 100 annual probability of river flooding or a greater than 1 in 200 annual probability of flooding from the sea in any year.

Zone 3b: Comprised of land where water has to flow or be stored in times of flood (the functional floodplain). The SFRA identified this Flood Zone as land which would flood with an annual probability of 1 in 20 years, where detailed hydraulic modelling exists. In the absence of detailed hydraulic model information, a precautionary approach was adopted with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site specific flood risk assessment to define the extent of Flood Zone 3b.

C Climate change mapping

Hydraulic modelling has been undertaken by the Environment Agency to provide updated climate change flood mapping for the River Medway catchment (including the River Beult and River Teise). Modelling has also been completed as part of this SFRA to prepare this information for Loose Stream close to its confluence with the River Medway. This modelling followed the latest guidance for climate change in FRAs/SFRAs released by the Environment Agency in February 2016 (and updated in April 2016).

Climate change for fluvial events has been prepared for the Higher Central and Upper End estimates for the 2080s epoch (2070-2115). Present day flood risk information is available for comparison. The River Medway catchment is within the Thames River Basin District and therefore allowances are:

- Higher Central (2080s) = +35% flows
- Upper End (2080s) = +70% flows

For tidal/coastal models, undefended case still water level simulations are available to inform future flood risk within the borough. Net sea level rise adjustments to 2115 were used within the climate change mapping for both +35% and +70% flows, meaning tidal/coastal flood extents are comparable in these events.

Flood Zone 2 information has also been displayed on the map. This is included to help identify potential sensitivity to climate change for watercourses where climate change modelling which follows the latest guidance is not available. This is expected to provide a conservative estimate of future Flood Zone 3a flood risk.

D Surface water mapping

The updated Flood Map for Surface Water (uFMfSW) maps show the flooding that takes place from the 'surface runoff' generated by rainwater (including snow and other precipitation) which: (a) is on the surface of the ground (whether or not it is moving), and (b) has not yet entered a watercourse, drainage system or public sewer.

The uFMfSW will pick out natural drainage channels, rivers, low areas in the floodplain and flow paths between buildings but it will only indicate flooding caused by local rainfall.

The uFMfSW shows predictions of flooded area but does not show whether individual properties will be affected by surface water flooding or have been affected in the past. The uFMfSW should not be used to predict if individual properties will flood.

E Groundwater mapping

The Areas Susceptible to Groundwater Flooding (AStGWF) maps are a set of strategic maps which show groundwater flood areas on a 1km square grid. The data was produced to annotate indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the Lead Local Flood Authorities (LLFAs) to determine whether there may be a risk of flooding from groundwater.

This data shows the proportion of each 1km grid square where geological and hydrogeological condition show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. It does not take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of ground water flooding.

The AStGWF data should only be used in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

F Flood warning coverage

Flood Warning coverage maps are displayed.

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. It is issued earlier than a flood warning, to give customers advance notice of the possibility of flooding, but before the Environment Agency are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding to property and encourage them to take action to protect themselves and their property.

Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office

South Barn
Broughton Hall
SKIPTON
North Yorkshire
BD23 3AE
United Kingdom

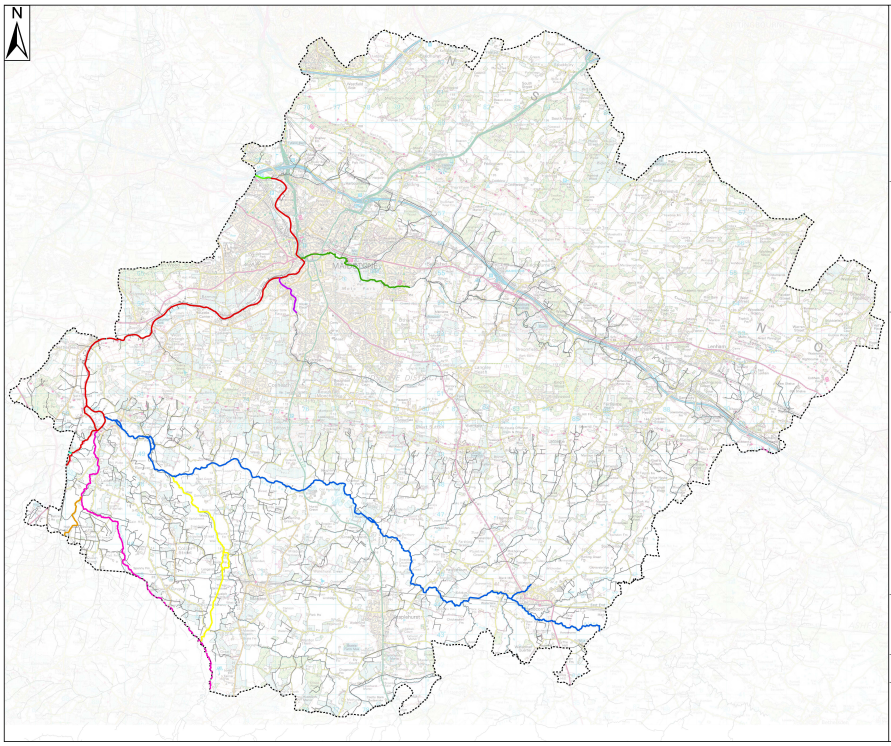
t:+44(0)1756 799919
e:info@jbaconsulting.com

Jeremy Benn Associates Ltd

Registered in England
3246693

Visit our website

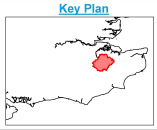
www.jbaconsulting.com



Notes

The information shown in this map has been derived from the Environment Agency's Statutory (Sealed) Main Rivers and Detailed River Network (DRN) datasetes.

Key Plan



Legend

- Maidstone Borough Council boundary

Main Rivers

- Caulk Stream
- Great Stour
- Lesser Teise
- Loose Stream
- Medway Tidal and Estuary
- Paddock Wood Stream
- River Beult
- River Len
- River Medway
- River Teise
- Ordinary Watercourses

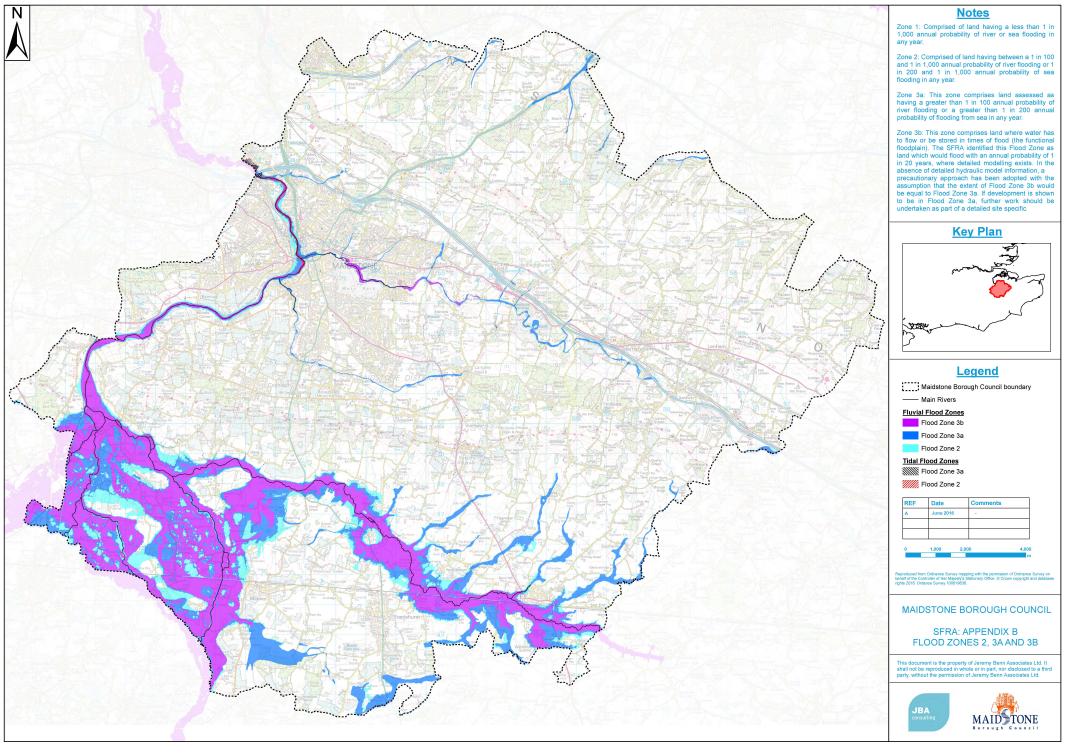
REF	Date	Comments
A	June 2016	-

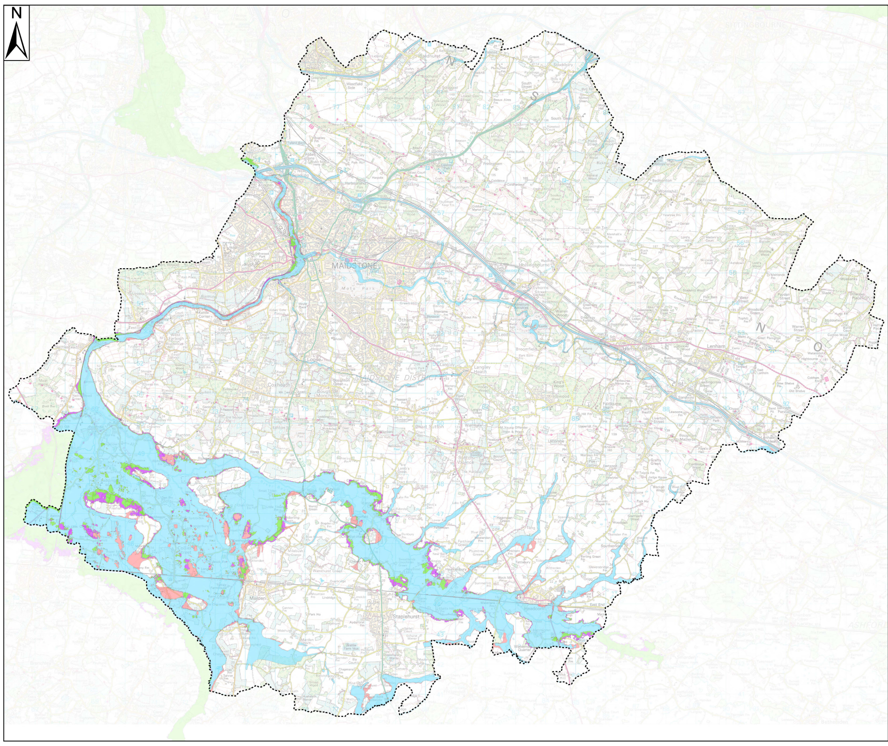
0 1,900 3,800 4,936 m

MAIDSTONE BOROUGH COUNCIL
SFRA: APPENDIX A
WATERCOURSES IN MAIDSTONE BOROUGH

JBA consulting

MAIDSTONE Borough Council


N
Notes
Zone 1: Comprised of land having a less than 1 in 1,000 annual probability of river or sea flooding in any year.
Zone 2: Comprised of land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding or 1 in 200 and 1 in 1,000 annual probability of sea flooding in any year.
Zone 3a: This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding or a greater than 1 in 200 annual probability of flooding from sea in any year.
Zone 3b: This zone comprises land where water has to flow or be stored in times of flood (the functional floodplain). The SFRA identified this Flood Zone as land which would flood with an annual probability of 1 in 20 years, where detailed modelling exists. In the absence of detailed hydraulic model information, a precautionary approach has been adopted with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site specific
Key Plan
Legend
Maidstone Borough Council boundary
Main Rivers
Fluvial Flood Zones
Flood Zone 3b
Flood Zone 3a
Flood Zone 2
Tidal Flood Zones
Flood Zone 3a
Flood Zone 2
REF
Date
Comments
A
June 2016
0
1,900
3,800
4,936
m
MAIDSTONE BOROUGH COUNCIL
SFRA: APPENDIX B
FLOOD ZONES 2, 3A AND 3B
JBA consulting
MAIDSTONE Borough Council



Notes

Hydraulic modelling has been undertaken by the Environment Agency to provide updated climate change flood mapping for the River Medway catchment (including the River Beult and River Teise). Modelling has also been completed as part of this SFRA to prepare this information for Loose Stream close to its confluence with the River Medway. This modelling followed the latest guidance for climate change in FRAs/SFRAs released by the Environment Agency in February 2016 (and updated in April 2016).
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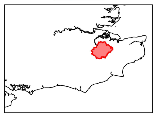
Flood Zone 2 information has also been displayed on the map. This is included to help identify potential sensitivity to climate change for watercourses where climate change modelling which follows the latest guidance is not available. This is expected to provide a conservative estimate of future Flood Zone 3a flood risk.

Key Plan



Legend

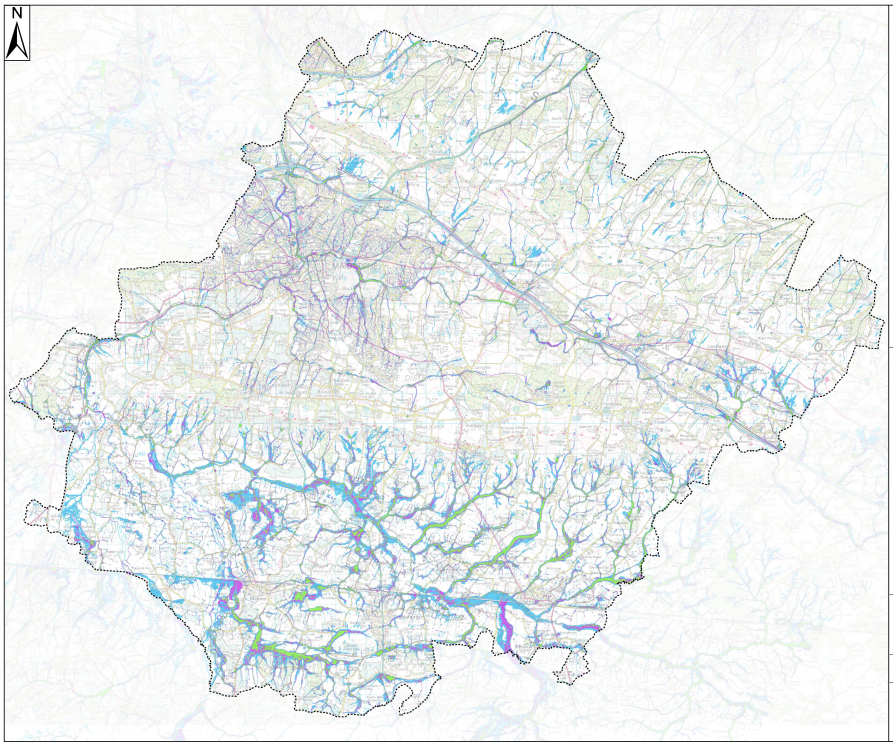
- Maidstone Borough Council boundary
- Present Flood Zone 3a
- Flood Zone 3a (+35% flows) (River Medway + lower part of Loose Stream only)
- Flood Zone 3a (+70% flows) (River Medway + lower part of Loose Stream only)
- Present Flood Zone 2

REF	Date	Comments
A	Oct 2016	-

0 1,000 2,000 4,000 m

MAIDSTONE BOROUGH COUNCIL

SFRA: APPENDIX C
CLIMATE CHANGE MAPPING



Notes

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(a) is on the surface of the ground (whether or not it is moving), and
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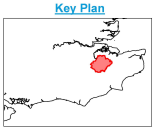
Note: The uFMfSW shows predictions of flooded areas but does not show whether individual properties will be affected by surface water flooding or have been affected in the past. The uFMfSW should not be used to predict if individual properties will flood.

Key Plan



Legend

Maidstone Borough Council boundary

Surface Water Flood Map

uFMfSW 30-year extent

uFMfSW 100-year extent

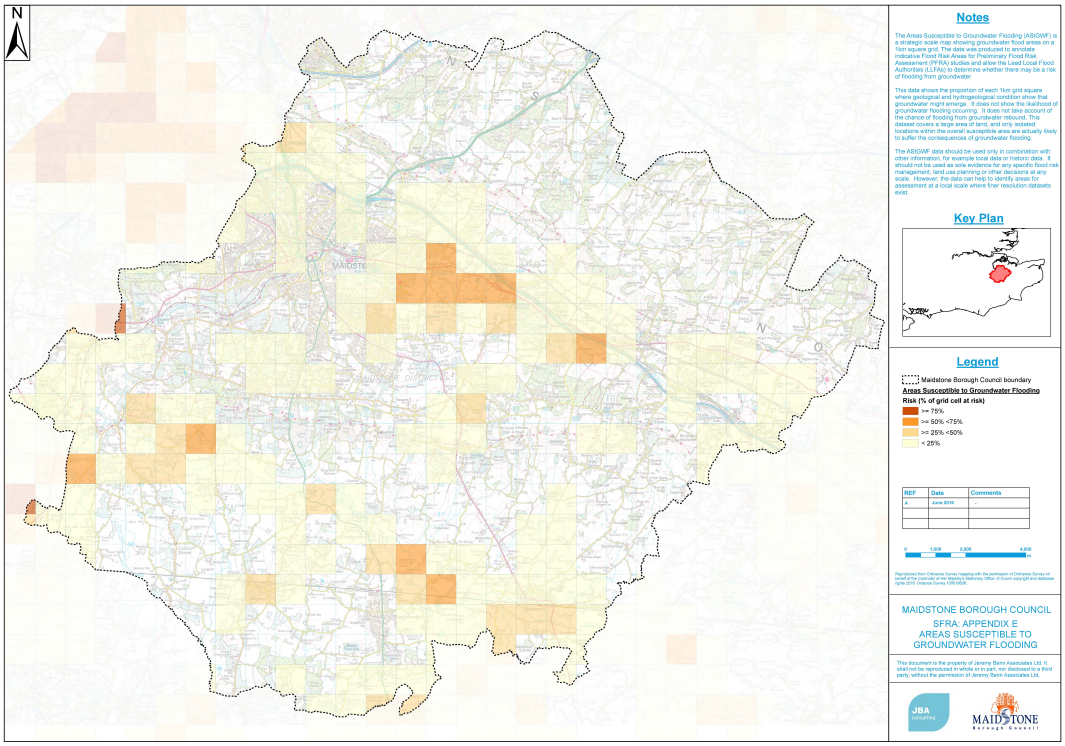
uFMfSW 1,000-year extent

REF	Date	Comments
A	June 2016	-

0 1,900 3,800 4,936 m

MAIDSTONE BOROUGH COUNCIL

SFRA: APPENDIX D
SURFACE WATER FLOOD RISK


N
MAIDSTONE
Notes
The Areas Susceptible to Groundwater Flooding (ABSGWF) is a strategic scale map showing groundwater flood areas on a 1km square grid. The data was produced to annotate indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the Lead Local Flood Authorities (LLFAs) to determine whether there may be a risk of flooding from groundwater.
This data shows the proportion of each 1km grid square where geological and hydrogeological condition show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. It does not take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.
The ABSGWF data should be used only in combination with other information, for example local data or historic data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.
Key Plan
Legend
Maidstone Borough Council boundary
Areas Susceptible to Groundwater Flooding
Risk (% of grid cell at risk)
>= 75%
>= 50% <75%
>= 25% <50%
< 25%
REF
Date
Comments
A
June 2016
-
0
1,900
3,800
4,936
m
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MAIDSTONE BOROUGH COUNCIL
SFRA: APPENDIX E
AREAS SUSCEPTIBLE TO
GROUNDWATER FLOODING
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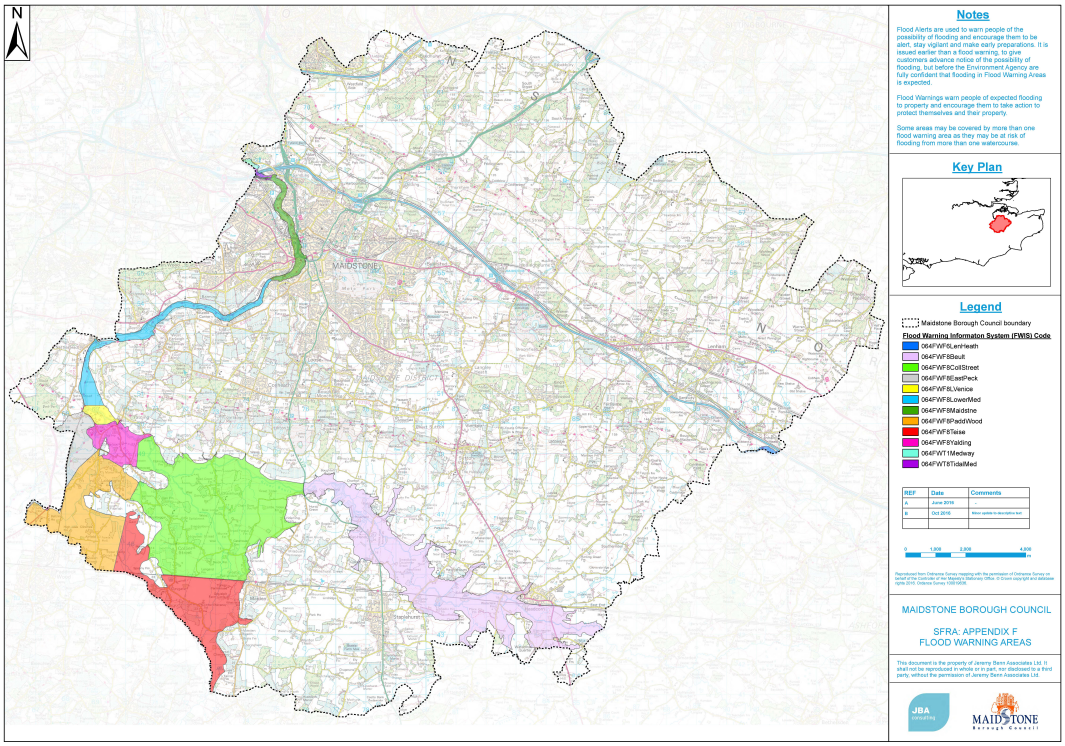
MAIDSTONE
Borough Council


N
MAIDSTONE
Notes
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Flood Warnings warn people of expected flooding to property and encourage them to take action to protect themselves and their property.
Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.
Key Plan
Legend
Maidstone Borough Council boundary
Flood Warning Information System (FWIS) Code
064FWF8LenHeath
064FWF8Beult
064FWF8CollStreet
064FWF8EastPeck
064FWF8LYenice
064FWF8LowerMed
064FWF8Maidstne
064FWF8PaddWood
064FWF8Teise
064FWF8Yalding
064FWT1Medway
064FWT8TidalMed
REF
Date
Comments
A
June 2016
-
B
Oct 2016
Minor update to descriptive text
0
1,900
3,800
4,936
m
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MAIDSTONE BOROUGH COUNCIL
SFRA: APPENDIX F
FLOOD WARNING AREAS
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JBA consulting
MAIDSTONE Borough Council

Water Management Cycle Working Group

Briefing Note on how flooding/sewage is considered as part of the planning application (Development Management) Process.

Flood Risk

There is national policy and much guidance on this topic but essentially it steers development away from the highest risk areas and requires Flood Risk Assessments (FRA) with planning applications.

All major planning applications and those in Flood Zones 2 and 3 (highest risk) must have a FRA to assess risks to and from the development and it must demonstrate flood risk is not increased elsewhere.

The objectives of a FRA are to establish:

- Whether a proposed development is likely to be affected by current or future flooding from any source;
- Whether it will increase flood risk elsewhere; and
- Whether the measures proposed to deal with these effects and risks are appropriate;

When a site is in Zones 2 or 3, development is only allowed if there is nowhere else that is reasonable available (Sequential Test). If this is cleared it must pass the 'Exception Test' and demonstrate that:

- The development will provide wider sustainability benefits to the community that outweigh flood risk; and
- The development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

This includes flood resistance and resilience; sustainable drainage systems; and safe access and escape routes.

Surface Water

This is also assessed and includes surface/rainwater runoff from the development (buildings and hard surfaces) and can be separate or part of the FRA and must demonstrate increased flood risk won't occur. Again, there is national policy and guidance.

To deal with this, national policy requires sustainable drainage systems (SUDs) for major developments which combine a mixture of built (e.g. attenuation tanks) and nature-based techniques (basins and swales) to mimic natural drainage as closely as possible. They must basically ensure that any water run off is no worse than the current situation but account for predicted increased rainfall from climate change.

Legally we must consult the Environment Agency on major development in Zones 2 and 3 and critical drainage areas re. flood risk, and the Lead Local Flood Authority (KCC) on major development re. surface water drainage.

Foul Drainage

Foul drainage is a consideration but we only need to be satisfied that capacity can be provided and Southern Water are usually consulted (but it's not statutory).

When they advise there isn't capacity they state it can be provided (as it their legal duty to do so) and this would be through the developer funding upgrades (e.g. increased pipe capacity or treatment works) via the Water Industry Act 1991.

Development Management should not get heavily involved as it's dealt with under separate legislation and we just need to be satisfied there is a potential solution.

Water Management Cycle Working Group – Other Information

As outlined in the (draft) working group report, the below information was also provided to the working group:

- KCC Land Enquiries Drainage Data
- MBC Sewage and Flooding Complaints Data
- Follow-Up Note on Project Feasibility
- Nature Based Solutions for Water Cycle Management Case Studies
- Southeast Rivers Trust Wish-list (to follow)
- Southern Water Documents (to follow)

Quarter											
Row Labels	**Blocked Drain/Gully**	**Carriageway Flooded**	**Ditch Problems**	**Flood Boards**	**Flooding Rural Areas**	**Manhole/Drain Cover Problem**	**Pavement Flooded**	**Property Damaged by Flood**	**Sandbag Issues**	**Subway Flooded**	**Grand Total**
Q4 2019-2020	249	7	5	4	17	4	2	3	1	1	293
Q1 2020-2021	110	2	5		7	1	1				126
Q2 2020-2021	123	1	9	1	6		5				145
Q3 2020-2021	291	5	16	1	10	4	10	1			338
Q4 2020-2021	269	7	8	1	12	5	2			1	305
Q1 2021-2022	107	2	4		8	2	2				125
Q2 2021-2022	322	5	8		9	3	6	2	3	1	359
Q3 2021-2022	181	9	5		6	6	4	1	3		215
Q4 2021-2022	113		4		4	2	3				126
Q1 2022-2023	135		5		2	3	1				146
Q2 2022-2023	102	1	1		3	2	7				116
Grand Total	**2002**	**39**	**70**	**7**	**84**	**32**	**43**	**7**	**7**	**3**	**2294**

Areas											
Row Labels	**Blocked Drain/Gully**	**Carriageway Flooded**	**Ditch Problems**	**Flood Boards**	**Flooding Rural Areas**	**Manhole/Drain Cover Problem**	**Pavement Flooded**	**Property Damaged by Flood**	**Sandbag Issues**	**Subway Flooded**	**Grand Total**
ALLINGTON	1										1
AYLESFORD	1										1
BARMING	18				2						20
BEARSTED	158	1	2	1	2	4	2	1	1		172
BICKNOR					1						1
BOUGHTON MALHERBE	4		2		5						11
BOUGHTON MONCHELSEA	53	1	1			1		1			57
BOXLEY	37		1		1						39
BREDHURST	15				1						16
BROOMFIELD	9					1					10
CHART SUTTON	21	2	1		2						26
CHATHAM	2										2
COXHEATH	17										17
DETLING	12				3	1					16
DOWNSWOOD	8										8
EAST FARLEIGH	59	2			3	3	1				68
EAST SUTTON	10										10
GRAFTY GREEN	6										6
HARRIETSHAM	83	1	3		4	2	1		1		95
HAWKENBURY	8	2	1								11
HEADCORN	77		6	3	6	1	1				94
HOLLINGBOURNE	47	1			1	2	1				52
HUCKING	1										1
HUNTON	38	1	3	1	2	1					46
KINGSWOOD	17	1					1				19
LADDINGFORD	10		2		2						14
LANGLEY	28					1	1				30
LEEDS	38				2	1					41
LENHAM	56		1		1						58
LENHAM HEATH	7	1	1			1	1				11
LIDSING	1										1
LINTON	32		7		4	1					44
LOOSE	61	2	1		2		1	1			68
LORDSWOOD	3										3
MAIDSTONE	474	13	2		2	8	20			2	521
MARDEN	45	1	9	1	4			1	1		62
NETTLESTEAD	11	1	2		2	2		1			19
OTHAM	8		1	1	1						11
PADDOCK WOOD	6		1				1			1	9
PENENDEN HEATH	13										13
PLATTS HEATH	32		2		2		1	1	3		41
SANDLING	24				2						26
SITTINGBOURNE	3										3
SOUTH GREEN					1						1
STAPLEHURST	85	1	5		4						95
STOCKBURY	22	3	1		4						30
SUTTON VALENCE	63	1	1		3						68
TESTON	13		2		3		1	1			20
THURNHAM	35				1		2				38
TONBRIDGE	5		1		1		1				8
TOVIL	17	1									18
ULCOMBE	47	1	5		3		1		1		58
WALDERSLADE	20	1	3				2				26
WATERINGBURY	8										8
WEAVERING	51				1		3				55
WEST FARLEIGH	21	1									22
WICHLING	4					1					5
WORMSHILL	3				1						4
YALDING	54		3		5	1	1				64
Grand Total	**2002**	**39**	**70**	**7**	**84**	**32**	**43**	**7**	**7**	**3**	**2294**

Date	Title / Description	Location	Complaint Stage
12/04/22	Sewage System at the Bentletts	Bentliffs	1 Complaint at Stage 1
20/12/19	Surface water - Hen and Duckhurst, Staplehurst	Staplehurst	4 Complaint to Ombudsman
31/08/21	Employee Conduct		1 Complaint at Stage 1
09/01/20	Clinical Waste collection charges		1 Complaint at Stage 1
04/06/21	Prior approval refusal at Still Water Farm	Still Water Farm	2 Pre-stage 2 Assessment
29/03/22	Complaint about Employee		1 Complaint at Stage 1
24/11/23	Council Tax - specifically the policy of empty property on 'uninhabitable' properties and council tax charge		1 Complaint at Stage 1
12/10/21	Planning Application comment		1 Complaint at Stage 1
16/05/22	Roundwell Park		1 Complaint at Stage 1

WATER MANAGEMENT CYCLE

FOLLOW UP NOTE ON PROJECT FEASIBILITY

In my evidence to the Working Group on 15th December I mentioned that one of the obstacles to delivery of effective flood resilience measures appeared to be a lack of resource for development of feasibility studies. I was tasked with bringing forward proposals on how to conduct the required feasibility studies.

The note covers the following areas:

- Objectives
- Skills and experience
- Resources

1. Objectives

Feasibility studies would need to respond to an agreed set of objectives. These might include some or all of the following:

- Ensure that places and infrastructure are resilient and can adapt to future flooding and coastal risks in a changing climate. Traditionally this has been quantified by assessing whether a scheme gives projection to (eg) a flood event likely to occur every 50 years.

- Support the Council's carbon and sustainability ambitions.

- Enhance the environment, eg by creating and improving habitat and rivers.

- Meet statutory requirements, eg complying with Reservoir Act duties.

It would be helpful if the Working Group could either indicate its preferred objectives or suggest a process for drawing up a set of objectives.

2. Skills and experience

Carrying out feasibility studies implies a pre-feasibility screening process that would identify catchment and sub-catchment areas within the borough that had the potential to offer opportunity for flood risk alleviation (assuming that this is the primary objective to be addressed). Of the agencies currently active locally, the Environment Agency is best placed to support this work, as they are likely to hold much of the contextual data and may have expert staff (geomorphologists) who could carry out the work. However, we know that the EA is financially stretched and would not easily be able to free up the necessary resources.

The South East Rivers Trust has some relevant experience and knowhow, but their ongoing core funding is limited. So any work would have to be carried out on a contract basis, probably commissioned by a public body like MBC.

KCC have staff in Max Tant's team who work on feasibility studies and they are working on a number at present. However, not many of these are in the Medway catchment and none are in Maidstone. KCC are still investigating floods in Yalding and Ulcombe, which are the only recent floods in Maidstone that fall within their purview.

In short, further discussions would be required with each of these organisations (EA, SERT and KCC) and maybe others to establish on what basis they would be able to carry out feasibility work.

3. Resources

Any such work would require some 'seedcorn' funding to carry out the feasibility studies, prior to identification of individual projects. The Working Group could request that MBC includes a financial bid for this purpose in its next annual budget round. Other organisations – the Upper Medway Internal Drainage Board, the Southern Region Flood and Coastal Committee – could also be approached for matching contributions.

MG/27.02.2023

Actions (15 December 2022 Meeting)

1. **Produce a proposals map, to identify which areas could benefit from schemes designed to improve aspects of the Water Management Cycle;**

   A proposals map is in early development, combining the KCC map of Maidstone surface water management plan and local flooding and development map of Maidstone. High impact areas, of pollution, flooding, drought will be highlighted on this map in consultation with the planning team and target areas for water management schemes will be identified.

2. **Continue to develop the ongoing business case, and that a scale of the land available for purchase starting with agricultural land as the most affordable, be included.**

   Development of a Business case is ongoing, combining water cycle management, Biodiversity Net Gain, SuDS schemes. Five non-operational MBC sites have been identified, and will be assessed with the planning team for viability of wetland, SuDS schemes. No other sites, land, or areas have yet been identified for land purchases or wider landscape schemes.

3. **Provide case studies types of projects underway elsewhere in the country relating to the Water Management Cycle.**

   Relevant Case Studies/Business Cases have been identified – See attached.

Nature Based Solutions for Water Cycle Management Case Studies

The following case studies have been gathered to give examples of the wide array of NBS schemes and projects that can alleviate water pollution, reduce surface water runoff, reduce flooding, and preserve and store water in the landscape, while enhancing biodiversity and human wellbeing. Some of the case studies are part of a business case that opens up potential new revenue streams and funding opportunities.

Nature-based solutions

Nature-based solutions (NBS) seek to protect or enhance nature in a way that helps tackle climate change and other challenges, while benefitting biodiversity and improving human wellbeing. NBS often involve elements from multiple disciplines, such as ecology, hydrology and soil science. Villages, towns and landscapes are having to contend with a surplus, or shortage, of water due to the impacts of climate change, and housing development. The depletion and degradation of pristine water resources is expected to affect human and environmental health. In addition, the increase of urban areas, resulting in a higher demand for water resources as well as disruption of the natural water cycle, accentuates the importance of sustainable and resilience-based water management.

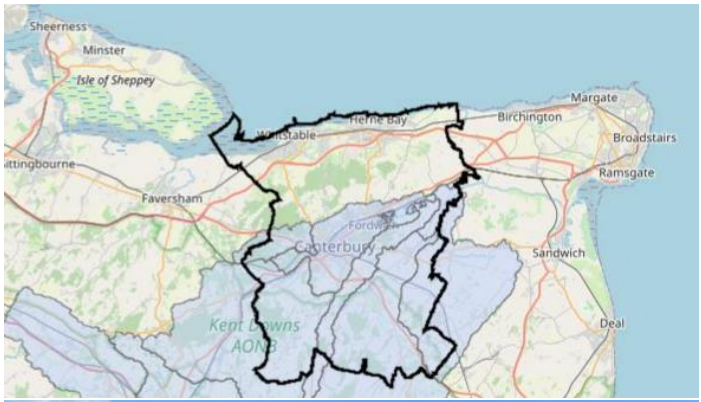
Land use decisions affect water supply and wastewater system designs and operation, as well as measures needed for managing stormwater runoff. As part of planning, NBS can be used to improve water quality by reducing nutrient and sediment run-off from agricultural land into water bodies through approaches such as riparian grasses, tree buffers, and vegetative waterways. As well as the multitude of cross benefits by improving biodiversity, carbon sequestration, catchment management, and soil management. Forests, wetlands and grasslands, as well as soils and crops, play important roles in regulating water quality by reducing sediment loadings, capturing and retaining pollutants, and recycling nutrients. Soils are important for infiltration, run-off, and storage.

Utilising green infrastructure approaches such as green roofs, pervious pavements, rain gardens and restoration of peri-urban wetlands to manage stormwater run-off, retaining some water for re-use are also important NBS tools. Both natural and constructed wetlands can mitigate flood risk, acting as natural sponges trapping rain and surface run-off, mitigating land erosion and the impact of storm surges. Wetlands can also act as a reservoir during drought, and resource management practices can improve or modify these functions.

Case Studies

Canterbury City Council investigating wetland creation for Nutrient Neutrality

Discharge from Wastewater Treatment Works contains Phosphorus and Nitrogen and then enters the River Stour. The River Stour feeds the Stodmarsh lakes, a Special Protection Area (SPA), a Ramsar site, a Special Area of Conservation (SAC), a Site of Special Scientific Interest (SSSI) and some parts are a National Nature Reserve (NNR). Canterbury City Council are currently investigating acquisition of land to mitigate the problem, Eg for the creation of wetlands or taking agricultural land out of use – with establishing or creating wetland being most efficient option. Please see Presentation for details. Overseen by Simon Thomas, Head of Planning. https://www.turley.co.uk/comment/nutrient-neutrality-stodmarsh-strategic-mitigation-solution



Financing Wetlands for the Stiffkey using Environmental Impact Bonds

Norfolk Rivers Trust has received £70,000 in grant funding to explore the application of an 'environmental impact bond' to reduce phosphates and other pollutants from entering the River Stiffkey, through the creation of nature-based solutions. The project, which is 1 of 27 schemes to benefit from the £10m Natural Environment Investment Readiness Fund (NEIRF), will model revenues from this intervention in the form of phosphate credits, and it will explore other ecosystem services for additional revenue sources. In addition, the work will build on the knowledge gained during a pioneering project between NRT, Anglian Water and the Environment Agency to improve water quality through the creation of an integrated constructed wetland on the River Ingol in 2018; the wetland naturally cleans treated outflow that is released from Ingoldisthorpe Water Recycling Centre (WRC), providing a final 'polish' to the effluent before it flows into the chalk-fed Ingol.

Developing an Environmental Impact Bond to reduce phosphates and other pollutants entering the River Stiffkey, reducing the harm to biodiversity. The project will model revenues from this intervention in the form of phosphate credits and it will explore other ecosystem services for additional revenue sources. https://norfolkriverstrust.org/project/financing-constructed-wetlands/

Ingol wetland creation (Credit: William Morfoot Ltd.) (Ingol wetland)

Wetland establishment

New Forest Net Zero: Investment Models for Nature Restoration

New Forest National Park Authority are mapping the restoration of arable and neutral grasslands to woodland and fens across three public and privately owned sites within the NPA in an area of high development pressure. The project will scope work needed to restore woodlands and wetlands, resulting in carbon sequestration, habitat creation and improvements in water quality. Revenues from these ecosystem services will then be modelled in the form of carbon, nutrient and biodiversity credits to demonstrate a case for private investors. Freshwater habitats polluted by agriculture are sources of greenhouse gas emissions. For example, manure from domestic livestock and nutrients from fertiliser enhance greenhouse gas production. Extensive wetland restoration work has been undertaken in the New Forest to tackle agricultural pollution run off into freshwater habitats and by continuing the work, the climate mitigation potential of these habitats can increase. https://www.newforestnpa.gov.uk/conservation/climate-and-nature-emergency/net-zero-with-nature/

Crystal Clear Clyst Bond

Defra and the Environment Agency have awarded £100k to East Devon District Council to drive private investment and tackle climate change. As part of the Council's ambitious plans for the Clyst Valley Regional Park, a new 'Crystal Clear Clyst Bond' will help to address the climate emergency and investigate schemes to improve the environment in the Park. The £100k fund, plus an additional

£10k from EDDC, will be used to set up an Environmental Impact Bond. East Devon District Council are seeking to convert farmland to woodland in an area experiencing a growth in development, via an Environmental Impact Bond. This is a council driven project and will lead to the conversion of agricultural land to woodland. It will monetise revenue generation from voluntary carbon credits, biodiversity credits from new habitat recreation and the Community Infrastructure Levy.

The Wildlife Trusts' Habitat Banking Investment Model

Berkshire, Buckinghamshire, Oxfordshire Wildlife Trust are developing a new habitat banking investment model to deliver biodiversity net gain at scale. The project is a consortium of Wildlife Trusts and will define habitat restoration and creation of grassland, wetland and woodland at three sites for carbon storage, improved flood resilience and visitor well-being. The project will monetise potential for revenue generation through biodiversity credits.
https://www.bbowt.org.uk/news/habitat-banking-investment-scheme-wins-government-funding

Wilder Carbon Standard

Kent Wildlife Trust are working with small clusters of landowners (including farmers in Maidstone) to create a finance facility to facilitate the restoration of nature at scale funded by carbon finance. The project will test and develop the ability to generate new revenue streams across multiple habitats. In particular, this project will develop a carbon standard which can be linked to wild habitats and generate revenues from biodiversity credits. https://www.wildercarbon.com/ and https://www.kentwildlifetrust.org.uk/blog/evan-bowen-jones/nature-based-solutions-more-trees-and-not-just-carbon

Gloucester Urban Greening Project

The project will be carried out over the next couple of years targeting approximately 62 hectares of urban green spaces throughout the city and neighbouring councils. It will be done in stages, with overall completion scheduled for Spring 2023. The project will aim to deliver benefits through a combination of methods including:

- changes to grass cutting regimes
- wildflower meadow creation
- planting of native species including trees and hedgerows
- river restoration and re-naturalisation
- creation of water features for habitat generation and flood risk benefits
- sustainable planting

The project will bring about benefits including:

- habitat creation
- increased biodiversity
- reduced flood risk
- improvements to water quality
- increasing target species
- engaging communities with the outdoors including ongoing monitoring of sites/citizen science projects
- improving urban air quality
- an improved, interconnected network of habitats
- enhancing sites as valuable public green space with broader biodiversity

- increasing amenity value of sites and ultimately well-being

Southeast Rivers Trust Wish-List

- **Projects**
  - Current Natural Flood Management opportunities - Loose Stream, School Stream & Ullcombe Stream. Identified as having potential for NFM, IDB interested, need funding for scoping and delivery;
  - Funding for NFM (rural) & SuDS (urban) co-coordinator role - fund for a year or two to kick start. Seed funding to get going, the role then becomes self-sustaining. Need to establish landowner relationships and identify opportunities and bring in funding for delivery. Lots of opportunities for SuDS funding - Water Companies re. DWMP deliverables, Department of Education, Climate change adaptation agenda etc.;
  - Holistic Water for Horticulture (HWH) - Investment to deliver on the ground measures (rainwater harvesting and storage) through the HWH project to increase the resilience of water supply of local horticulture sector, while delivering NFM, Biodiversity, Carbon benefits, supporting local businesses;
  - Beult SSSI - be partner in the restoration of the River Beult SSSI, bring together the existing EA channel restoration plan and catchment restoration measures;
  - River Len Chalk stream restoration strategy - develop an ambitious strategy for the restoration of this globally rare chalk stream in the heart of Maidstone;
  - Question? What evidence and outputs would Maidstone BC require to invest in a mixed funding investment model for NbS in Upper Beult for water retention, NFM, biodiversity and carbon storage? Who should we talk to in the council about this idea?

- **Policies**
  - Adopt Medway/North Kent/Stour Catchment Plans as supplementary planning guidance in MBC Local Plan:
    - river mentioned and acknowledged in the plan and its value to people and wildlife;
    - that developments should adhere to relevant Catchment Plan;
    - projects in the plan can be delivered as mitigation works for or within future developments.
  - Implement Nutrient and Water Neutrality measures for developments across the borough, regardless of their proximity to internationally designated sites;

- Requiring in development schemes, all road run-off and surface water is filtered before it discharges into a river, preferably by Nature Based Solutions (NbS);
- Ensure developments in the construction phase are sensitive to species and the river and wildlife, e.g. noise pollution during times of fish and bird migration;
- Make space for the river - don't allow development right next to any river, preferably 20m as a minimum of natural riparian buffer, including a no light zone on or near the river for the benefit of aquatic invertebrates. If lighting required for H&S, direct away from the river;
- Plastics - fit passive collectors in the river to collect and dispose of plastic waste and prevent it impacting downstream and the oceans;
- Work with Nature Based Solutions (NbS) as opposed to a purely engineering solution;
- Rivers should not be fenced off, rivers should be accessible to the public for their enjoyment and recreation;
- Work with other boroughs in the catchment, to implement these policies, so they are applied throughout the catchment;