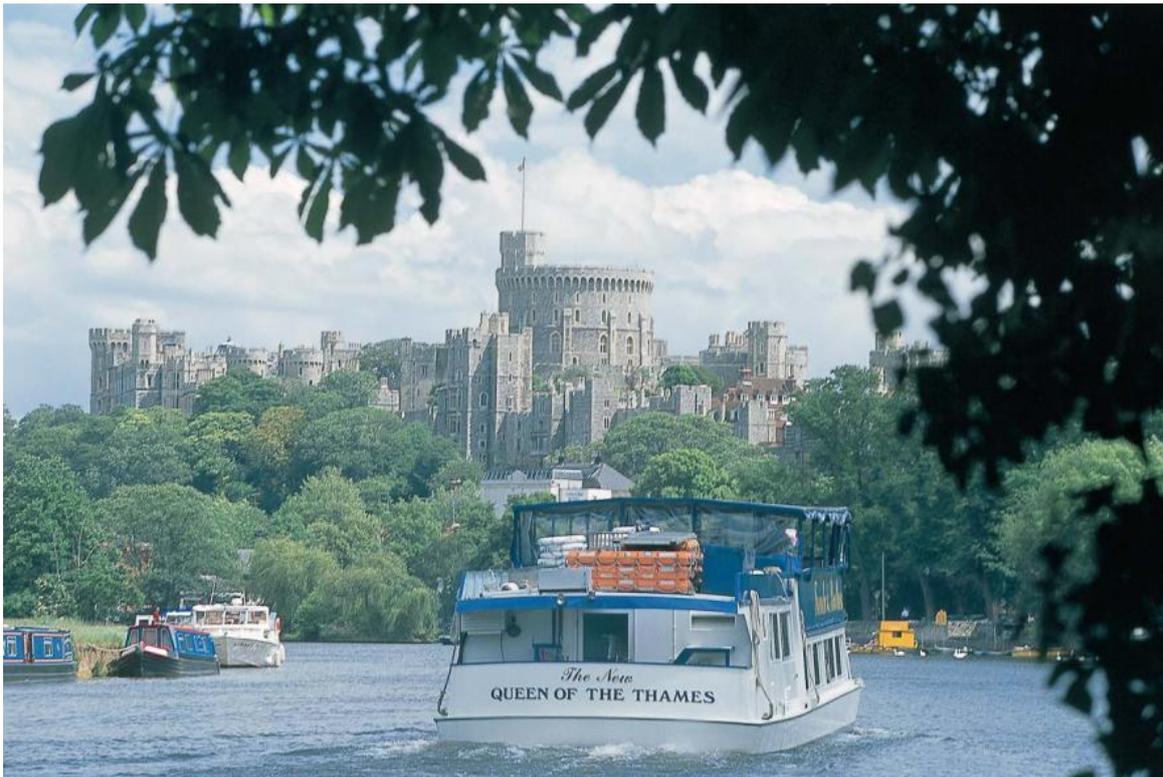




Water for life and livelihoods



Part 1: Thames river basin district River basin management plan

Updated: December 2015



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We are the Environment Agency. We protect and improve the environment and make it a better place for people and wildlife.

We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

Acting to reduce climate change and helping people and wildlife adapt to its consequences are at the heart of all that we do.

We cannot do this alone. We work closely with a wide range of partners including government, business, local councils, other agencies, civil society groups and the communities we serve.

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Further copies of this report are available on the [river basin management plan web pages](#) (<https://www.gov.uk/government/collections/river-basin-management-plans-2015>).

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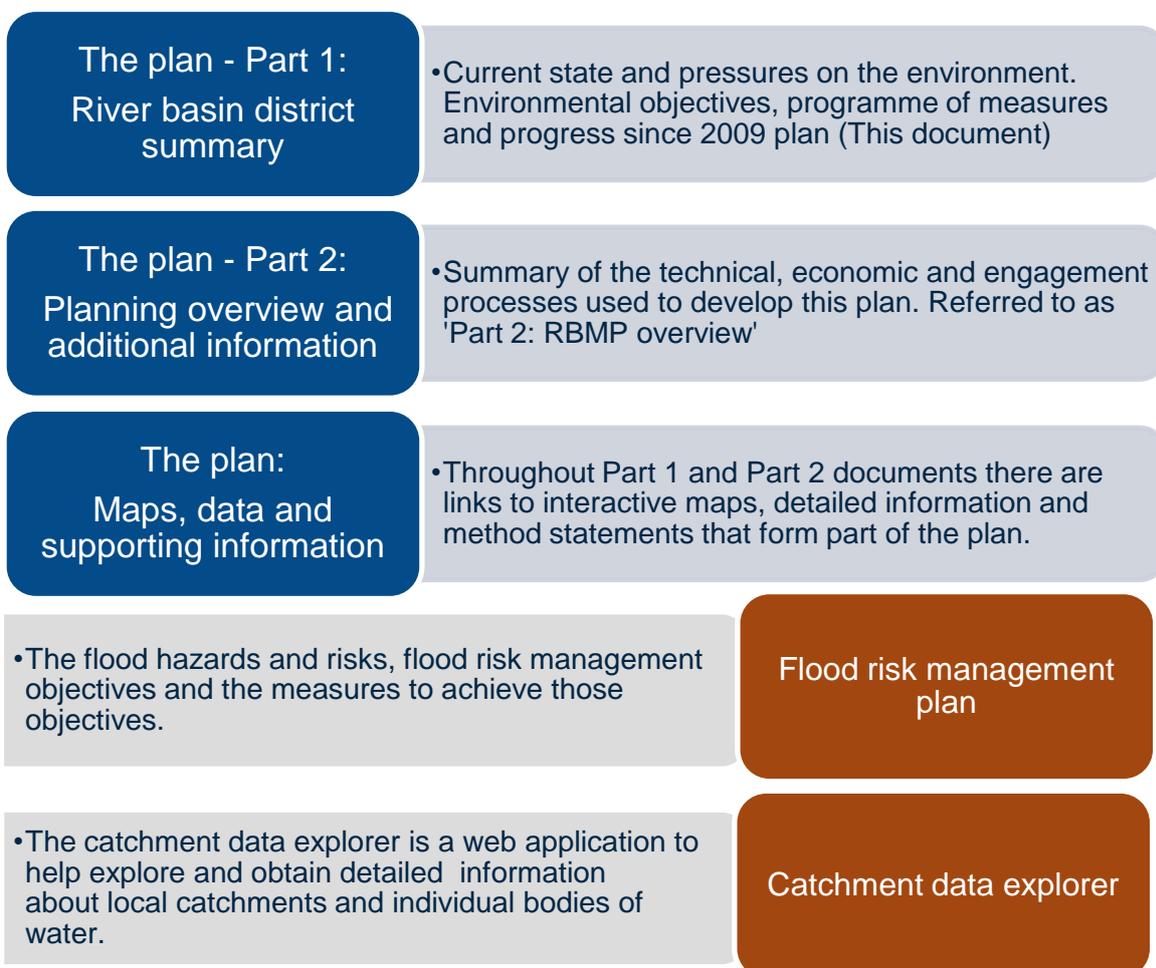
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Contents

Using the plan: accessing the most relevant information	4
1. Introduction.....	5
1.1. The purpose of a river basin management plan	6
1.2. Who is responsible for implementing this plan	7
1.3. The Thames River Basin District	9
1.4. Significant water management issues.....	11
1.5. Working with others	13
1.6. Links to other major plans affecting water management	16
1.7. Reporting progress on this plan	17
2. Current state of the environment, environmental objectives and outcomes.....	18
2.1. Current state of the environment	19
2.2. Environmental objectives	21
2.3. Preventing deterioration.....	22
2.4. Protected area compliance and objectives.....	23
2.5. Water body objectives	27
2.6. Reversal of trends	31
2.7. Progressive reduction of pollution of groundwater	31
2.8. Environmental outcomes for 2021	32
3. Measures to achieve the environmental objectives	35
3.1. Programme of measures: background.....	36
3.2. Measures to prevent deterioration	38
3.3. Main programmes of measures for 2021 outcomes	50
3.4. Local measures	61
3.5. Forward look at measures beyond 2021	89
3.6. Additional measures to achieve protected area objectives.....	94
4. Changes from 2009 to 2015.....	96
4.1. Improvements in evidence	97
4.2. Measures implemented	99
4.3. Progress towards achieving the environmental objectives in the 2009 plan	103
5. Summary statistics	107

Using the plan: accessing the most relevant information

The river basin management plan consists of a number of different documents, maps and datasets, of which this is just one. Below is a summary of the statutory components of the river basin management plan (in blue) along with associated documents and data sources outside of the official plan that support the plan (in brown):



Throughout this document there are light green boxes containing links to the further information relevant to each section.

Further information

- You can access the river basin management plan and associated documents through the river basin management [web pages](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).
- A guide to accessing river basin management data and supporting information is available on the river basin management [web pages](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).

1. Introduction

This section provides an explanation of the purpose of this plan, who it is for and how the river basin district is managed.

1.1. The purpose of a river basin management plan

Water is essential for life and livelihoods. It allows the natural environment to flourish, and businesses, agriculture and the economy to grow and prosper.

Rivers, lakes, estuaries, coastal areas, wetlands and water under the ground provide many different benefits to society; from supplying drinking water and supporting fisheries to providing an essential resource for business and agriculture, transport routes and a source of recreation that promotes wellbeing.

It is critical that this precious resource is managed properly to ensure that the needs of society, economy and wildlife can be met and maintained over the long-term.

The purpose of a river basin management plan is to provide a framework for protecting and enhancing the benefits provided by the water environment. To achieve this, and because water and land resources are closely linked, it also informs decisions on land-use planning.

This plan contains 4 sets of information that groups who manage land and water should pay particular attention to:

- **Baseline classification of water bodies** - One of the main purposes of this plan is to prevent water bodies deteriorating. The first step to preventing deterioration is to understand the baseline status for all the quality elements in each water body. Deterioration from the baseline is not permitted, except in very specific circumstances that are described in this plan. Preventing deterioration is one of the biggest challenges in managing the water environment.
- **Statutory objectives for protected areas** - This plan highlights the areas of land and bodies of water that have specific uses that need special protection. These include waters used for drinking water, bathing, commercial shellfish harvesting and those that sustain the most precious wildlife species and habitats. The plan ensures that these areas have the legally binding objectives in place that protect those uses from potentially harmful activities and new developments.
- **Statutory objectives for water bodies** - This plan sets out legally binding objectives for each quality element in every water body, including an objective for the water body as a whole. The default objective is good status. Less stringent objectives have been set in some cases where natural conditions, technical feasibility or disproportionate cost make improvement impractical. The default deadline for achieving objectives is 2021. However, extended deadlines of 2027 or beyond have been set in some cases where it would be more appropriate, have less impact on existing activities or where the environment will need more time to respond to the planned measures.
- **Summary programme of measures to achieve statutory objectives** - This plan provides a framework for action and future regulation. To do this it summarises the existing mechanisms, both statutory and voluntary, that are used to manage the quality of the water environment. It also summarises the types of action and who needs to do this, to achieve the statutory objectives. Although it is not a detailed action plan it provides a clear signal to those who use and affect water about what they can do to make sure there is enough good quality water for life and livelihoods in England.

The river basin management plan has been approved by the Secretary of State for the Environment, Food and Rural Affairs. It has been prepared in line with ministerial guidance and fulfils the requirements of the Water Framework Directive and contributes to the objectives of other EU directives. It is an update of and replaces the river basin management plan published in 2009 (referred to as the '2009 plan' in this document).

1.2. Who is responsible for implementing this plan

Many organisations are responsible for managing the water environment in the river basin district. These organisations are often grouped into sectors, such as water companies, agriculture and industry. Table 1 identifies these sectors and describes their role in managing the water environment.

The roles in managing the water environment are:

- **Regulator** - regulates and enforces the activities of operators
- **Operator** - undertakes activities that could potentially influence either directly or indirectly the quality of the water environment. Many of these activities are regulated.
- **Influencer** - educates, influences or advises others on how to reduce their impact on the water environment
- **Undertakes projects** - undertakes environmental improvement projects (for example, habitat restoration) to reduce the damage caused by others, usually in partnership with other groups

Table 1: Main sector groups involved in river basin management

Sector	Role in managing the water environment			
	Regulator	Operator	Influencer	Undertakes projects
Agriculture and rural land management - farming, forestry and horticulture		X	X	X
Government and agencies:				
Central government departments	X		X	
Environment Agency	X	X	X	X
Natural England	X	X	X	X
Forestry Commission		X	X	X
Marine Management Organisation	X		X	
Highways England		X	X	
Network Rail		X	X	
Industry, manufacturing and other business - including chemicals, construction, food and drink, power generation, paper, textiles and metals		X	X	
Internal drainage boards	X	X	X	X
Local government - includes local councils, national park authorities and Inshore Fisheries and Conservation Authorities	X	X	X	X
Mining and quarrying - coal mining, non coal mining and quarrying		X	X	

Sector	Role in managing the water environment			
	Regulator	Operator	Influencer	Undertakes projects
Navigation - inland waterways (Canal & River Trust), port and harbour authorities	X	X	X	X
Non-governmental organisations - user groups, catchment groups and environmental organisations (including local wildlife trusts and rivers trusts)		X	X	X
Waste treatment, transfer, storage and disposal - landfill, biowaste, waste treatment and transfer		X		
Water industry - water supply and sewage treatment activities	X	X	X	X

1.3. The Thames River Basin District

The Thames river basin district (Figure 1) covers over 16,200km². It encompasses all of Greater London and extends from north Oxfordshire southwards to Surrey and from Gloucester in the west to the Thames Estuary and parts of Kent in the east.

In total over 15 million people live in the Thames district with many entering daily to work or visit. In addition to Greater London, other urban centres in the river basin district include Luton, Reading and Guildford.

The Thames river basin district has a rich diversity of wildlife and habitats, supporting many species of global and national importance from chalk streams such as the River Kennet to the Thames Estuary and salt marshes.

There are 17 management catchments that make up the river basin district, which include many interconnected rivers, lakes, groundwater and coastal waters. These catchments range from chalk streams and aquifers to tidal and coastal marshes.

The river basin district is mostly rural to the west and very urban to the east where it is dominated by Greater London. Around 17% of the river basin district is urbanised and the rural land is mainly arable, grassland and woodland. The economy is dominated by Greater London and the finance sector.

To support economic growth and development, significant or large scale infrastructure projects will occasionally take place within the river basin district. These projects must take account of the environmental objectives within this river basin management plan. Similarly, the potential benefits and impacts of such projects will, where relevant, be considered during future reviews and updates of the plan, including updates to the environmental objectives.

Figure 1: Map of the Thames river basin district



1.4. Significant water management issues

The significant water management issues are the main issues that limit the uses and potential benefits of managing the water environment in the river basin district in a sustainable way. They have been identified based on the results of public consultation and assessments of the pressures caused by people now, in the past, and predicted in the future.

Many of these issues arise from current activities that provide a wide range of benefits. It may therefore not be possible or desirable to fully resolve the issues.

- **Physical modifications** - affecting 44% of water bodies in this river basin district

People have made many physical changes to rivers, lakes and estuaries, for example, flood defences and weirs, and changes to the size and shape of natural river channels for land drainage and navigation. These modifications alter natural flow levels, cause excessive build up of sediment in surface water bodies and the loss of habitats and recreational uses. In many cases the uses and associated physical modifications need to be maintained. In these circumstances it may not be possible to achieve good ecological status.

- **Pollution from waste water** – affecting 45% of water bodies in this river basin district

Waste water, or sewage, can contain large amounts of nutrients (such as phosphorus and nitrates), ammonia, bacteria, harmful chemicals and other damaging substances. It can enter water bodies where sewage treatment technology to remove enough of the phosphorus and harmful chemicals doesn't exist, from leakages from privately owned septic tanks and, in wet weather, storm overflows can discharge untreated sewage having a significant impact on bathing waters. Population growth and changes in rainfall patterns are increasing the pressure on the sewer network.

- **Pollution from towns, cities and transport** - affecting 17% of water bodies in this river basin district

Rainwater draining from roofs, roads and pavements carries pollutants, including grit, bacteria, oils, metals, vehicle emissions, detergent and road salt drains to surface water, including estuaries and coastal waters. Many homes and workplaces have 'misconnected' drains, meaning that dirty water often enters surface waters and groundwater rather than foul sewer drains.

- **Changes to the natural flow and level of water** - affecting 12% of water bodies in this river basin district

Reduced flow and water levels in rivers and groundwater caused by human activity (such as abstraction) or less rainfall than usual can mean that there is not enough water for people to use and wildlife might not be able to survive. Reduced flow affects the health of fish and exaggerates the impacts of barriers such as weirs. Climate change research shows that by 2050 England can expect significant seasonal variations, with higher winter and lower summer flows, and a reduction in flow overall. In the long term, there will be less water available to abstract for drinking, industry and irrigating crops.

- **Negative effects of invasive non-native species** - affecting 3% of water bodies in this river basin district

Non-native invasive species can have significant economic impacts. The cost of controlling invasive species to make sure that flood defences and the natural environment are not compromised is rising. American signal crayfish are becoming widespread and affect animals such as fish and invertebrates. Other species such as mitten crabs destroy habitats like reed beds and can cause banks to collapse by burrowing into them. Climate change is thought to drive certain species northwards, increasing their frequency and variety in the future and affecting the condition of water bodies.

- **Pollution from rural areas** - affecting 27% of water bodies in this river basin district

Some approaches to land management have increased the amount of soils and sediment that are being washed off the land carrying phosphorus into waters which can cause excessive algae growth called 'eutrophication'. A changing climate means that more intense rainfall is likely to occur, increasing the risk of impacts further. Nitrate from fertilisers has built up in groundwater over decades and will take a long time to reduce. Sedimentation from erosion, forestry practices, saturated and compacted fields and livestock trampling on river banks has affected river ecology by smothering fish spawning grounds. Other impacts include bacteriological contaminations from animal faeces, and inappropriately stored and applied livestock slurry being washed off the land and pesticides from farming, forestry, golf courses and parks. These contaminants pose a particular threat to bathing waters, shellfish waters and drinking water.

Taking account of climate change

The climate is changing as a result of greenhouse gas emissions caused by human activity. Latest UK climate projections show that temperatures will continue to rise, with increased winter rainfall and more rain falling in intense storms and continuing sea level rise. The impact on river flows, water quality and ecosystems is less clear. Studies to learn more about the effects of climate change on the river basin district are underway. In the meantime, it makes sense to implement measures that are flexible or increase resilience to extreme weather events and future warming.

Risk assessments

Risk assessments are used to help identify significant water management issues by identifying where pressures could change in the future, potentially leading to a deterioration or reducing the effectiveness of measures to meet their objectives. The Environment Agency has reviewed and updated, where necessary, the risk assessments since the 2009 plan.

The risk assessments forecast risk up to 2027. Because of the relatively short timescale, the specific risks from climate change have been considered mainly in the faecal indicator organisms risk assessment and the abstraction-flow risk assessment.

Further information in this document

- You can find a summary of the impacts of significant water management issues by sector in section 5.

Information elsewhere in the river basin management plan

- You can find GeoPDF maps, statistics and main findings for each risk assessment on the Environment Agency's [ShareFile service](https://ea.sharefile.com/d-s25aecb60c464ccd9) (<https://ea.sharefile.com/d-s25aecb60c464ccd9>).
- More detail on risk assessments and links to the method statements behind them can be found in section 4.4 of [Part 2:RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).
- The [Inventory of emissions, discharges and losses of priority and priority hazardous substances](https://ea.sharefile.com/d-sab675d1e4d74e5e8) (<https://ea.sharefile.com/d-sab675d1e4d74e5e8>) provides information on priority substances at the river basin district scale.
- You can find more detail on how the inventory has been compiled in section 4.4 of [Part 2: RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).

1.5. Working with others

River basin district liaison panel

The river basin district has a liaison panel. Members share their views as the representative of a sector that is responsible for implementing measures and carrying out projects.

The role of the liaison panel is to:

- contribute evidence to enable decision making and reporting on river basin management plans
- devise and track measures and projects as part of a programme of work to prevent deterioration and improve the environment
- work with members and their sectors to ensure a broad base for decision making and communication
- assist and champion the implementation of the catchment based approach

Catchment partnerships and the catchment based approach

Taking a catchment based approach helps to bridge the gap between strategic management planning at river basin district level and activity at the local water body scale. The catchment based approach aims to encourage groups to work together more effectively to deal with environmental problems locally.

Catchment partnerships are groups of organisations with an interest in improving the environment in their local area and are led by a catchment host organisation. They inform the river basin management planning process and help implement measures by:

- providing local evidence
- targeting and coordinating action
- identifying and accessing funding for improvements in the catchment
- incorporating river basin management planning into the wider environmental management of the catchment

Some of the partnerships will produce their own catchment or local plans.

The partnerships work on a wide range of issues including, but not restricted to, the water environment and river basin management. Catchment partnerships also cover coastal and marine waters.

Table 2 lists the partnerships in this river basin district. Some partnership groups are in the early stages of being set up, while others have been active for years. Members from some catchment partnerships also sit on the river basin district liaison panel.

Table 2: Catchments and partnership groups

Catchment	Partnership group host
Cherwell	Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT)
Colne	Groundwork South
Cotswold - Evenlode (Oxfordshire)	Wild Oxfordshire
Cotswold - Gloucestershire and the Vale - Upper Thames	Farming Wildlife and Advisory Group South West
Darent	North West Kent Countryside Partnership and South East Rivers Trust
Gloucestershire and the Vale - Ock	Freshwater Habitats Trust
Kennet & Pang	Action for the River Kennet
Loddon	Hampshire and Isle of Wight Wildlife Trust
London - Beverley Brook	South East Rivers Trust
London - Brent	Thames21
London - Crane	Green Corridor
London - Hogsmill	South East Rivers Trust
London - Lower Lea North	Hertfordshire and Middlesex Wildlife Trust
London - Lower Lea South	Thames 21
London - Marsh Dykes (Woolwich)	London Wildlife Trust and Thames21
London - Ravensbourne	Thames21
London - Wandle	The Wandle Trust
Maidenhead to Sunbury (Lower Thames)	Thames21
Medway	South East Rivers Trust and Kent Countryside management partnership
Mole	Surrey Wildlife Trust and South East Rivers Trust
North Kent	Medway Swale Estuary Partnership and South East Rivers Trust
Roding, Beam & Ingrebourne	Thames21
South Essex	Thames Chase Trust
Thame and South Chilterns - South Chilterns	Foundation for Water Research
Thame and South Chilterns - Thame	Freshwater Habitats Trust and River Thame Conservation Trust
Thames (tidal)	Thames Estuary Partnership, Thames21, Thames Landscape Strategy and Thames Strategy Kew to Chelsea
Upper Lea or Lee	Groundwork East
Wey	Surrey Wildlife Trust

Incorporating information from others in river basin management planning

Some organisations have asked for the opportunity to share their environmental data to help improve river basin management and catchment planning. For example, sharing data and information to improve local evidence on the cause of a problem, such as the reason for not achieving good status, or a new response to a problem. The Environment Agency is working with the Catchment Based Approach National Support Group and others to confirm data sharing priorities. To learn more about sharing your information contact your local catchment partnership, see further information box.

Further information in this document

- You can find a map showing the location and boundaries of the catchments in section 3.4.
- Contact details for the catchment partnerships as well as a summary of the measures they are carrying out can be found in section 3.4.

Information elsewhere in the river basin management plan

- You can find more information about the catchment based approach in section 3.4 of [Part 2: RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).

Supporting information

- You can find more information on the liaison panel and details about membership in the [Record of consultation and engagement](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).
- You can find examples on how the Environment Agency has used information from others in the [consultation response document](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).
- You can find more information on the catchment based approach on the catchment based approach [web pages](http://www.catchmentbasedapproach.org/) (<http://www.catchmentbasedapproach.org/>).

1.6. Links to other major plans affecting water management

This plan provides a long-term framework for managing the issues that affect the quality of the water environment in the river basin district. However, many water management issues are so significant or complex that they demand their own more detailed plans. The public bodies that prepare these plans are bound by the Water Environment (Water Framework Directive) Regulations 2003 to have regard to the river basin management plan when exercising their functions and in the case of many of the functions exercised by the Environment Agency and the Secretary of State for the Environment, Food and Rural Affairs to exercise those functions so as to secure compliance with the requirements of the WFD.

Table 3 summarises the important water management issues that have their own planning processes and plans.

Table 3: Other plans affecting water management

Issue	Plans	Primary responsible bodies in England
Flooding and coastal erosion	Flood risk management plans Local Flood Risk Management Strategies Shoreline management plan	Environment Agency Lead local flood authorities Coastal groups (risk management authority partnerships)
Climate change adaptation	UK National Climate Adaptation Strategy and Adaptation Plan	Government's Committee on Climate Change Public bodies and utility companies
Water supply	Water resources management plans Drought management plans	Water companies
Biodiversity	Biodiversity 2020: A strategy for England's wildlife and ecosystem services Natura 2000 site improvement plans	Defra Natural England
Invasive non-native species (INNS)	The Great Britain Invasive non-native species strategy and implementation plan	Defra's Great Britain invasive non-native species secretariat
Marine waters	Marine Strategy Framework Directive Marine plans	Defra Marine Management Organisation

Supporting information:

- More information about the flood risk management plans can be found on the flood risk management plan [web pages \(https://www.gov.uk/government/collections/flood-risk-management-plans-frmps-2015-to-2021\)](https://www.gov.uk/government/collections/flood-risk-management-plans-frmps-2015-to-2021).

1.7. Reporting progress on this plan

A formal assessment of progress with meeting the objectives in this plan will be reported in the 2021 update to this plan. An interim report on making measures operational will be produced and reported to the European Commission in 2018.

The Environment Agency and other organisations have extensive monitoring programmes to assess the state of the water environment. To help monitor progress with this plan and show how the quality of the water environment is changing, the Environment Agency will report on a range of quality indicators. These could include:

- status or risks facing protected areas: drinking water protected areas, Natura 2000 sites, bathing waters, shellfish waters, nutrient sensitive areas
- ecological status plus individual status of some quality elements: fish, macrophytes, invertebrates, diatoms, phosphorous, dissolved oxygen, ammonia, specific pollutants, acidity
- chemical status plus individual status of some quality elements
- the annual change in status of each of the individual ecological status elements

This will be used as an indicator of overall progress towards good ecological status.

As well as monitoring the state of the environment, the Environment Agency also plans to report on important activities that will eventually bring positive results. For example:

- numbers of fish passage improvements
- length of shoreline and river bank habitat enhancements
- area of priority habitat created or improved
- extent of new mitigation measures implemented on heavily modified and artificial water bodies

Those implementing measures should monitor and report their own progress. The following groups will be particularly important:

- catchment partnerships - progress on partnership projects, progress on securing additional funding and influencing others
- water companies - progress on implementing national environment programme schemes and other measures that relate to environmental performance agreed by the water company with their customer challenge group
- agriculture and rural land managers - progress on uptake of Countryside Stewardship schemes that benefit water and other sector related initiatives, for example, Campaign for the Farmed Environment
- local councils - opportunities taken to encourage growth by green infrastructure and habitat enhancement
- ports and navigation authorities - implementing mitigation measures
- Highways England - progress on environmental aspects of their £15 billion road investment strategy

The liaison panel, as a collective group representing the river basin district as a whole, provides an opportunity for monitoring progress against the plans, sharing best practice and helping catchment partnerships. As such, positive actions taken by partners to implement this plan can be reported and collated through the panels

2. Current state of the environment, environmental objectives and outcomes

This section describes the current state of the environment and the environmental objectives for the river basin district. It also describes the planned progress towards achieving those objectives by 2021.

2.1. Current state of the environment

The WFD indicator of the health of the water environment is whether a water body is at good status or potential. This is an assessment of a range of quality elements relating to the biology and chemical quality of surface waters and quantitative and chemical quality of groundwater. To achieve good ecological status or potential, good chemical status or good groundwater status every single element assessed must be at good status or better. If one element is below its threshold for good status, then the whole water body's status is classed as less than good.

Surface water bodies can be classed as high, good, moderate, poor or bad status. Table 4 gives a description of each of those status classes.

Table 4: Definition of status in the Water Framework Directive

Status	Definition
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.
Good	Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife.
Moderate	Moderate change from natural conditions as a result of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.
Poor	Major change from natural conditions as a result of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
Bad	Severe change from natural conditions as a result of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

Table 5 shows the number of water bodies in the river basin district. It shows whether these are natural, artificial (such as canals and reservoirs) or have been modified ('heavily modified') for particular uses.

Table 5: Number of water bodies in the river basin district

Water body categories	Natural	Artificial	Heavily modified	Total
Rivers, canals and surface water transfers	287	21	106	414
Lake	7	47	19	73
Coastal	0	0	1	1
Estuarine	1	4	5	10
Groundwater	47	0	0	47
Total	342	72	131	545

Tables 6 and 7 summarise the current status of surface and groundwater water bodies in the river basin district.

Table 6: Ecological and chemical 2015 classification for surface waters

No. of water bodies	Ecological status or potential					Chemical status	
	Bad	Poor	Mod	Good	High	Fail	Good
498	27	112	320	39	0	5	493

Table 7: Chemical and quantitative 2015 classification for groundwaters

No. of water bodies	Quantitative status		Chemical status	
	Poor	Good	Poor	Good
47	22	25	18	29

The 2015 water body classification is the baseline from which deterioration is not permitted unless certain and specific conditions apply.

A summary of the current state of protected areas is included in section 2.4.

Information elsewhere in the river basin management plan

- For more information on how the current status of the water environment is assessed see section 4 of [Part 2: RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).
- You can access GeoPDF maps showing the current status of water bodies on the Environment Agency's [ShareFile service](https://ea.sharefile.com/d-s25aecb60c464ccd9) (<https://ea.sharefile.com/d-s25aecb60c464ccd9>).
- To obtain the 2015 classification results for each water body, download the [water body spreadsheet](https://ea.sharefile.com/d-s0faa355450243538) (<https://ea.sharefile.com/d-s0faa355450243538>).

2.2. Environmental objectives

The environmental objectives of the WFD are:

- to prevent deterioration of the status of surface waters and groundwater
- to achieve objectives and standards for protected areas
- to aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status
- to reverse any significant and sustained upward trends in pollutant concentrations in groundwater
- the cessation of discharges, emissions and losses of priority hazardous substances into surface waters
- progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants

Environmental objectives have been set for each of the protected areas and water bodies in the river basin district. They were identified through a process involving technical and economic appraisals and formal public consultation. Achieving the objectives will optimise the benefits to society from using the water environment.

The environmental objectives summarised in this section are legally binding. All public bodies must have regard to these objectives when making decisions that could affect the quality of the water environment.

In certain specific circumstances, exemptions from some of these objectives may be applied. These exemptions are considered in the process used to set these objectives.

Information elsewhere in the river basin management plan

- You can find more information on the process of setting objectives in section 5 of [Part 2: RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).

2.3. Preventing deterioration

To protect the many uses and benefits the water environment provides it is essential to prevent it deteriorating. The water industry and many of the businesses essential to the economy have invested billions of pounds in infrastructure that rely on secure supplies of clean water. Preventing deterioration also protects wildlife and people's health and wellbeing.

The requirement to prevent deterioration was taken into account when setting the water body status objectives. Each water body status objective in this plan is set no lower than the 2015 classification result for the water body. This applies to a water body's overall status and to the status of each element used in classification.

Section 3 contains a summary of the programmes of measures to protect and improve the beneficial use of the water environment in the river basin district. Without these measures, the quality of the water environment would deteriorate with associated loss of benefits. It is estimated that without these controls, 32% of surface waters in the river basin district would deteriorate by 2027 due mainly to an increase in the unmitigated physical modification of rivers and the spread of invasive non-native species. The increase in physical modification is driven by climate change and population growth resulting in the need for increased flood protection, land drainage, and the spread of urban areas.

An assessment of whether deterioration has occurred from the 2015 classification baseline will be carried out in 2021.

Further information in this document

- You can find an assessment of whether deterioration in water body status occurred between 2009 and 2015 in section 4.3.

Information elsewhere in the river basin management plan

- You can find information on preventing deterioration in section 3.1 of [Part 2: RBMP overview \(www.gov.uk/government/collections/river-basin-management-plans-2015\)](http://www.gov.uk/government/collections/river-basin-management-plans-2015).

2.4. Protected area compliance and objectives

There are many areas where the water environment is especially valued. These areas include rare wildlife habitats, bathing waters and areas where drinking water is abstracted. These areas are known as ‘protected areas’ and their uses are given particular legal protection. Protected areas are a priority for action to make sure they achieve their objectives and protect the benefits they provide.

This section presents information on the extent to which protected areas are compliant with their current standards and objectives.

Drinking water protected areas

The objectives for drinking water protected areas are to ensure that:

- under the water treatment regime applied, the drinking water produced meets the standards of the Drinking Water Directive plus any UK requirements to make sure that drinking water is safe to drink
- the necessary protection to prevent deterioration in the water quality in the protected area in order to reduce the level of purification treatment required

These objectives are at risk when increasing pollution levels caused by human activity could lead to more treatment being needed in the future and where measures are needed to reduce pollution. For groundwater bodies only, not meeting these objectives may also mean the water body is classed as poor chemical status. Safeguard zones are non statutory areas identified for ‘at risk’ abstractions where land use management practices and other activities can affect the quality of the untreated water. Measures to prevent and reduce pollution are targeted within these zones.

Table 8: Drinking water protected areas current status and at risk

Water body type	Number of drinking water protected areas	Number ‘at risk’	Number at poor chemical status for drinking water protected area objectives
Surface water	46	14	Does not apply to surface waters
Groundwater	47	25	12

Economically significant species (shellfish waters)

Some areas of estuarine and coastal waters are designated as shellfish waters. Shellfish waters are areas requiring protection or improvement to support shellfish life and growth in order to contribute to the high quality of shellfish for people to eat.

Table 9: Shellfish water protected areas current status and objectives

Number of shellfish waters	Objective	Currently achieving objective	Achieving objective by 2015	Achieving objective by 2021	Achieving objective by 2027
2	<300 <i>E.coli</i> /100ml in the shellfish flesh and intravalvular fluid	1	1	0	1

Recreational waters (bathing waters)

Bathing waters are designated waters and beaches that large numbers of bathers use. The objective for bathing waters is to preserve, protect and improve the quality of the environment and to protect human health by meeting the 'sufficient' water quality standards of the Bathing Waters Directive and to take such realistic and proportionate measures considered appropriate with a view to increasing the number of bathing waters classified as 'excellent' or 'good'.

Table 10: Bathing water protected areas current status and objectives

Number of bathing waters	Objective	Number which met at least the sufficient classification in 2014*	Number expected to achieve at least sufficient in 2015	Number at risk of not achieving sufficient in 2015
18	At least sufficient classification	17	18	0

* This is the number that would have met at least the sufficient class if the new 2015 standards had been in force

Nutrient sensitive areas (Nitrate vulnerable zones)

The objective of the Nitrates Directive is to reduce water pollution caused by nitrates from agricultural sources and to prevent further such pollution occurring. Nitrate Vulnerable Zones (NVZs) are designated where nitrate concentrations in water bodies are high or increasing, or water bodies are, or may become, eutrophic due to agricultural nitrate pollution. Farmers within NVZs must comply with mandatory action programme measures to reduce agricultural nitrate losses. In addition, a code of good agricultural practice has been established for voluntary implementation by all farmers.

Table 11: Nitrate vulnerable zone protected areas extent

Reason for designation	Number of NVZs	Land area(ha) covered by NVZ type	% of RBD covered by NVZ type
High nitrate in surface water	66	899,125	57
High nitrate in groundwater	21	357,496	23
Eutrophication in lakes or reservoirs	1	200	<1
Eutrophication in estuaries or coastal waters	0	-	0

Nutrient sensitive areas (Urban Waste Water Treatment Directive)

The objective of the Urban Waste Water Treatment Directive is to protect the environment from the adverse effects of waste water discharges. Sensitive areas are designated for water bodies affected by eutrophication or where surface water abstraction is affected by elevated nitrate concentrations. Reductions or emission standards for nutrients in sewage effluent must be met within areas sensitive to nutrient pollution.

Table 12: Urban Waste Water Treatment Directive protected areas type and extent

Reason for designation	Number of sensitive areas	Length (km)/Area (km ²) designated
Eutrophication in rivers	9	483
Eutrophication in canals	N/A	N/A
Eutrophication in lakes / reservoirs	13	15.87
Eutrophication in estuaries or coastal waters	N/A	N/A
High nitrate in surface fresh water	N/A	N/A

Natura 2000 sites: Water dependent Special Areas of Conservation or Special Protection Areas

The overall objective of the Habitats Directive is to maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of community importance. The network of protected areas established under the Wild Birds and Habitats Directives is known as Natura 2000. Site conservation objectives are designed to maintain or restore Natura 2000 sites to favourable conservation status. The provisions of the WFD only relate to water dependent Natura 2000 sites or water dependent habitats and species on sites that combine wet and dry features. The objective is to protect and, where necessary, improve the water environment to achieve favourable conservation status for the water dependent features for which the site was designated as set out in the site's conservation objectives.

Natural England determines what favourable conservation status means in terms of the environmental conditions (targets) and ecology expected for designated habitats and species. The targets required are based on UK Common Standards Monitoring Guidance (CSMG), published by the Joint Nature Conservation Committee. Some of the conservation objectives for attributes of Natura 2000 sites are the same or equivalent to objectives for elements of water bodies. Natural England reports on compliance with these objectives. Where there are CSMG targets for flow and water quality elements, they have been taken into account when setting water body status objectives. Where the deadline for achieving Natura 2000 water body objectives (CSMG target) has been extended beyond 2021, the Environment Agency has agreed interim goals locally with Natural England.

Ramsar sites are wetland sites of international importance. For the purposes of river basin management planning, Ramsar sites are considered in the same way as Natura 2000 sites.

Table 13 contains a summary of the current condition and objectives for Natura 2000 protected areas.

Table 13: Natura 2000 water dependent protected areas current condition and objectives

Current condition			
Area of SSSI underpinning Natura 2000 sites (Ha)			
WFD - favourable	24708		
WFD - unfavourable recovering	7357		
WFD - unfavourable no change	227		
WFD - unfavourable declining	131		
WFD - destroyed/partially destroyed	0		
Total areas	28612		
Objective	Number of protected areas		
	By 2015	By 2021	By 2027
All measures complete to enable conservation objectives to be achieved	6	5	6

Further information in this document

- You can find a summary of the protected area action planning process and links to action plans for each protected area in section 3.6.

Information elsewhere in the river basin management plan

- For more information on all of the protected areas see section 4.2 of the [Part 2: RBMP overview \(www.gov.uk/government/collections/river-basin-management-plans-2015\)](http://www.gov.uk/government/collections/river-basin-management-plans-2015).
- For a list of all the protected areas, associated objectives and information see the [register of protected areas \(https://ea.sharefile.com/d-s487ae61bf2a4b4fb\)](https://ea.sharefile.com/d-s487ae61bf2a4b4fb).
- You can find detailed interactive maps of the different protected areas in the river basin district showing location, current status and monitoring points on the Environment Agency's [ShareFile service \(https://ea.sharefile.com/d-s25aecb60c464ccd9\)](https://ea.sharefile.com/d-s25aecb60c464ccd9).

Supporting information:

- The CSMG and interim progress goals for flow and water quality elements in Natura 2000 is available on the Environment Agency's [ShareFile service \(https://ea.sharefile.com/d-s25aecb60c464ccd9\)](https://ea.sharefile.com/d-s25aecb60c464ccd9)

2.5. Water body objectives

For surface waters, objectives are set for ecological and chemical status. For artificial or heavily modified water bodies, objectives are set for ecological potential and chemical status. For groundwater, objectives are set for quantitative and chemical status.

Water body objectives consist of 2 pieces of information: the status (for example, good) and the date by which that status is planned to be achieved (for example, by 2021).

The status part of an objective is based on a prediction of the future status that would be achieved if technically feasible measures are implemented and, when implemented, would produce more benefits than they cost. The objective also takes into account the requirement to prevent deterioration and achieving protected area objectives.

The date part of an objective is the year by which the future status is predicted to be achieved. The date is determined by considering whether the measures needed to achieve the planned status are currently affordable, and once implemented, the time taken for the ecology or the groundwater to recover.

Aiming to achieve good status or potential by 2021 is the default objective for this plan. Where certain and specific conditions apply, alternative objectives (to good status by 2021) have been set. These either involve taking an extended time period to reach the planned status (for example, good by 2027) or aiming to achieve a lower status (for example, moderate by 2015).

The water body objectives in this plan are:

- **‘x’ status by 2015:** 2015 status matches the predicted future status or potential. Here the predicted future status has already been achieved and no further improvement in status is expected. The main environmental objective is to prevent deterioration in status between 2015 and 2021.
- **‘x’ status by 2021:** there is confidence that, as a result of the programme of measures, the water body will improve from its 2015 status or potential to achieve the predicted future status by 2021.

The ‘by 2015’ date has been used to clearly distinguish water bodies and elements where the reported 2015 status matches the predicted future status (and so no further improvement is expected) from water bodies and elements where an improvement from the reported 2015 status is required to achieve the predicted future status by 2021.

- **‘x’ status by 2027:** the deadline for achieving the status or potential has been extended to 2027. Where the time extension is due to ecological or groundwater recovery time, there is confidence that the measures needed to achieve the improvement in status are already in place or will be in place by 2021. Where the time extension is due to practical constraints delaying implementation of the measures, there is confidence the process of implementing the measures will begin before 2021. For the remaining objectives with a 2027 date, there is currently not enough confidence that the improvement in status can be achieved by an earlier date.
- **‘x’ status by 2040 or ‘x’ status by 2050 or ‘x’ status by 2060:** the deadlines for achieving the planned status or potential have only been extended beyond 2027 where either ecological recovery time or groundwater recovery time will delay the achieving of the planned status. In these cases there is confidence that the measures needed to achieve the improvement in status are already in place or will be in place by 2021.

Where the status is less than good, this means that a less stringent objective has been set.

The following two tables summarise the status objectives for water bodies, indicating how many of these are alternative objectives.

Table 14 summarises the ecological and chemical status objectives that have been set for the 498 surface water bodies in the river basin district. It shows for instance, that:

- 289 water bodies have an objective of maintaining or aiming to achieve good ecological status between 2015 and 2027
- 143 water bodies have already achieved their objective of moderate ecological status (a less stringent objective)
- 29 water bodies have been set an objective of reaching moderate ecological status (a less stringent objective) by 2027 (an extended deadline)

Table 14: Summary of ecological status or potential and chemical status objectives for surface water bodies (number of water bodies) including those with less stringent objectives and extended deadlines (blue shaded cells)

	Ecological status or potential						Chemical status			
	Bad	Poor	Mod	Good	High	Total	Fail	Good	Total	
By 2015	7	27	143	39	0	216	2	493	495	
By 2021	0	0	1	11	0	12	0	0	0	
By 2027	0	2	29	239	0	270	0	3	3	Extended deadline
Beyond 2027	0	0	0	0	0	0	0	0	0	
Total	7	29	173	289	0	498	2	496	498	
	Less stringent						Less stringent			

Table 15 summarises the quantitative and chemical status objectives that have been set for the 47 groundwater water bodies in the river basin district. It shows for instance, that:

- 31 water bodies have an objective of maintaining or aiming to achieve good quantitative status between 2015 and 2027
- 45 water bodies have an objective of maintaining or aiming to achieve good chemical status between 2015 and 2027
- 16 water bodies have already achieved their objective of poor quantitative status (a less stringent objective)

Table 15: Summary of quantitative and chemical status objectives for groundwater (number of water bodies) including those with less stringent objectives and extended deadlines (blue shaded cells)

	Quantitative status			Chemical status			
	Poor	Good	Total	Poor	Good	Total	
By 2015	16	25	41	2	29	31	
By 2021	0	3	3	0	0	0	
By 2027	0	3	3	0	16	16	Extended deadline
Beyond 2027	0	0	0	0	0	0	
Total	16	31	47	2	45	47	
	Less stringent			Less stringent			

Although 42% of water bodies have a less stringent objective for ecological status or potential, only 11% of elements have a similar objective. The difference is because the overall objective's status is determined by the lowest of the element level objectives. Therefore for many of the water bodies with a less stringent objective, most of the elements still have an element level objective of good status.

Justification for alternative objectives

Table 16 shows how many times the different reasons for justifying the setting of alternative objectives (extended deadlines and less stringent objectives) were used across all water bodies (surface water and groundwater) in this river basin district. More than one reason may have been used to justify the alternative objective for any particular water body and therefore the numbers in the table do not equal the total number of water bodies.

The table also shows the reasons extended deadlines have been set for some shellfish waters and Natura 2000 protected areas.

Table 16: Summary of the justifications for alternative objectives for water bodies, shellfish waters and Natura 2000 protected areas

Alternative objective reason	Sub-reason	Number of water bodies or protected areas where reason has been used		
		Water bodies	Natura 2000	Shellfish waters
Technically infeasible	No known technical solution is available	149	4	0
	Cause of adverse impact unknown	148	3	0
	Practical constraints of a technical nature	0	1	1
	Number of water bodies or protected areas where technically infeasible has been used	263	6	1
Disproportionately expensive	Unfavourable balance of costs and benefits	105	0	0
	Disproportionate burdens	301	1	0
	Number of water bodies or protected areas where disproportionately expensive has been used	343	1	0
Natural conditions	Ecological recovery time	5	0	0
	Groundwater status recovery time	0	0	0
	Background conditions	5	0	0
	Number of water bodies or protected areas where natural conditions has been used	10	0	0
Total number of water bodies or protected areas with an alternative objective (extended deadline and/or less stringent status objective)		474	6	1

Information elsewhere in the river basin management plan

- More information on alternative objectives, including explanations of the justifications for alternative objectives can be found in section 5.4 and 5.5 of [Part 2: RBMP overview \(www.gov.uk/government/collections/river-basin-management-plans-2015\)](http://www.gov.uk/government/collections/river-basin-management-plans-2015).
- A GeoPDF map of the types, location, boundaries, monitoring sites and current status of water bodies in the river basin district is available on the Environment Agency's [ShareFile service \(https://ea.sharefile.com/d-s25aecb60c464ccd9\)](https://ea.sharefile.com/d-s25aecb60c464ccd9)
- The current status and objective for each water body is available in a spreadsheet on the Environment Agency's [ShareFile service \(https://ea.sharefile.com/d-s0faa355450243538\)](https://ea.sharefile.com/d-s0faa355450243538).

2.6. Reversal of trends

Actions to reverse any significant and sustained upward trends in pollutant concentrations in groundwater must be implemented as soon as a trend has been identified. It is not possible to propose an alternative that is less stringent or extend the deadline for this objective.

2.7. Progressive reduction of pollution of groundwater

Hazardous substances must be prevented from entry into groundwater and the entry into groundwater of all other pollutants must be limited to prevent pollution. Hazardous substances means substances or groups of substances that are toxic, persistent and liable to bioaccumulate, and other substances or groups of substances which give rise to an equivalent level of concern.

2.8. Environmental outcomes for 2021

To help determine the water body status objectives summarised earlier, a prediction was made about what the status of each element will be in 2021. Predicted improvements in status are based on measures where there is confidence that the:

- measures will happen by 2021
- location of the measures and the water bodies that will benefit are known
- change in element status will occur as a result of the measures

Confidence in this context means there is at least a reasonable expectation (more confident than not) that the measures will happen and the outcome will be met. Environmental processes are complex and investment plans of both public and private sectors change. Some of the predicted outcomes may therefore not be achieved. However, there will be opportunities to implement additional measures and potentially achieve further outcomes by 2021. These opportunities are discussed in section 3.5.

The water body status objective does not always show whether an improvement in status is predicted to occur by 2021. For example, an element or water body may require an extended deadline to reach good status and so have an objective of 'good by 2027'. However, it might be predicted to improve from poor to moderate status by 2021.

To help understand the improvements predicted to occur as a result of measures in this plan, the tables 17, 18 19 and 20 summarise the current status and the predicted status in 2021 for:

- surface water bodies (ecological and chemical status)
- groundwater (quantitative and chemical status)
- all elements for all surface water bodies in the river basin district
- selected elements that contribute to the ecological status of surface waters

Table 17: Current and predicted 2021 ecological and chemical status of surface water bodies (number of surface water bodies)

	Ecological status				Chemical status	
	Bad	Poor	Mod	Good or better	Fail	Good
Current status	27	112	320	39	5	493
Predicted 2021 status	22	109	317	50	5	493
Predicted change	-5	-3	-3	11	0	0

Table 18: Current and predicted 2021 quantitative and chemical status of groundwater bodies (number of groundwater bodies)

	Quantitative status		Chemical status	
	Poor	Good	Poor	Good
Current status	22	25	18	29
Predicted 2021 status	19	28	18	29
Predicted change	-3	3	0	0

Table 19: Current and predicted 2021 status of ecological elements and chemical elements (number of elements in surface water bodies)

	Ecological status				Chemical status	
	Bad	Poor	Mod	Good or better	Fail	
Current status	110	350	538	2670	5	1178
Predicted 2021 status	95	328	551	2691	5	1178
Predicted change	-15	-22	13	21	0	0

The predicted status in 2021 for all of the classified elements for each water body are available in a comprehensive data set that forms part of this plan. Table 20 summarises the current and predicted 2021 status for biological elements in surface waters.

Table 20: Current and predicted 2021 status for biological elements in rivers (number of times element assessed)

		Bad	Poor	Mod	Good or better
Fish	Current status	25	64	51	55
	Predicted 2021 status	21	64	51	59
	Predicted change	-4	0	0	4
Invertebrates	Current status	12	37	84	237
	Predicted 2021 status	10	38	83	239
	Predicted change	-2	1	-1	2
Plants (macrophytes and phytobenthos)	Current status	2	44	167	65
	Predicted 2021 status	1	44	162	68
	Predicted change	-1	0	-5	3

Further information in this document:

- Further summaries of current status, 2021 predicted outcomes and water body objectives are presented in section 5.

Information elsewhere in the river basin management plan:

- The 2021 predicted outcomes for each water body are available to download on the Environment Agency's [ShareFile service](https://ea.sharefile.com/d-s0faa355450243538): (<https://ea.sharefile.com/d-s0faa355450243538>).

Additional environmental outcomes for 2021

For some measures, although there is confidence that the measure will happen by 2021, there is not enough confidence about the location or the scale of improvement to be able to predict outcomes for specific elements in specific water bodies.

These additional 2021 outcomes, which are not included in the tables above, are:

- Improvements to protected areas such as the quality of raw water at 78 safeguard zones due to actions targeting pesticides, reduced nutrient pollution at 6 Natura 2000 protected areas and bathing and shellfish water quality as a result of 3 water company improvements to waste water discharges.
- Ecology is expected to improve in at least 30 water bodies as a result of habitat improvements, including over 388ha of wetland creation and over 28km of river improvements, as a result of flood risk management schemes. This ranges from small-scale restoration, for example, on the River Kennet to extensive habitat improvement work, for example, in the River Ver, Upper Lee and Thames Estuary areas, and new flood risk management schemes.
- Improvements in fish populations, including eels, are expected in over 25 water bodies as a result of fish passage and habitat improvement work, for example in the Middle Kennet and Lambourne.
- Several catchments will benefit from reductions in pollution from sediment, nutrients and chemicals as a result of projects focusing on agriculture and land management, road and urban run-off, misconnections and sewage treatment. For example, improvements to discharges from 2 sewage treatment works and, where adopted, Countryside Stewardship.
- Dissolved oxygen levels will improve in the River Lea as a result of water company investment.
- Improvements to the flow and level of water are expected in several catchments, for example, the River Misbourne due to reduced abstraction and more efficient use of water.

The environmental objectives in this plan will drive additional improvement in the water environment by 2021. Opportunities include the periodic review of water company price limits in 2019, government spending reviews, major infrastructure projects and the routine review of environmental permits.

Supporting information:

- To see a summary of the effects of this plan on the wider environment read the [strategic environmental assessment \(www.gov.uk/government/collections/river-basin-management-plans-2015\)](http://www.gov.uk/government/collections/river-basin-management-plans-2015).
- The impact assessment for the river basin management plans in England provides further information on the benefits this plan will achieve. It is available on the river basin management plan [web pages \(www.gov.uk/government/collections/river-basin-management-plans-2015\)](http://www.gov.uk/government/collections/river-basin-management-plans-2015).

3. Measures to achieve the environmental objectives

This section provides a summary of the programme of measures that are needed to manage the significant water management issues and achieve the objectives of this plan. The benefits of action and those involved are identified.

3.1. Programme of measures: background

This section provides a summary of the programmes of measures used to achieve the environmental objectives of this plan.

Table 21 provides an overview of the summary programmes of measures.

Table 21: Overview of the programme of measures

Measures to prevent deterioration		
<p>Summary of the programmes of measures to control the significant water management issues</p>	<p>These ongoing measures play a significant role in preventing deterioration.</p> <p>They protect all the current uses of the water environment and the benefits that society gets from it.</p> <p>The ongoing measures represent substantial investment and all sectors with an interest in the water environment have a role to play.</p> <p>These measures apply across the river basin district.</p>	<p>Section 3.2</p>
Measures to achieve outcomes by 2021		
<p>Main programmes of measures for 2021 outcomes (Summary of the programmes of measures that will improve the water environment by 2021)</p>	<p>The main programmes have discrete funding streams to deal with particular issues.</p> <p>These programmes will achieve the biggest improvements in the water environment by 2021.</p> <p>They include the measures predicted to improve specific water bodies by 2021 and additional measures where it has not been possible to predict the geographic extent and/or size of environmental change they will result in by 2021.</p> <p>These measures apply in either specific locations or across the river basin district.</p>	<p>Section 3.3</p>
<p>Local measures (Summary of the local measures identified by catchment partnerships)</p>	<p>Each catchment partnership has identified the measures they will implement by 2021.</p> <p>Some of the measures are reflected in water body specific outcomes by 2021.</p> <p>These measures apply within specific catchments.</p> <p>Catchment partnerships also identify what more they could achieve if additional resources could be realised in future.</p>	<p>Section 3.4</p>

Forward look at measures beyond 2021		
Summary of the programmes of measures to meet objectives for water bodies with extended deadlines	A summary of the additional measures needed to achieve objectives beyond 2021. These will be reviewed when the plans are next updated in 2021 These measures are not linked to predicted outcomes for 2021.	Section 3.5
Additional measures to achieve protected area objectives		
Summary and links to the action plans containing measures for protected areas	A summary of and links to the action plans to meet protected area objectives in specific locations.	Section 3.6

Many of these measures, for example, land-based controls on pollutants, will also lead to improvements in marine waters not covered by the WFD.

Information elsewhere in the river basin management plan

- You can find a summary of the process for identifying of measures, including how costs and benefits were assessed in section 5 of the [Part 2: RBMP overview \(www.gov.uk/government/collections/river-basin-management-plans-2015\)](http://www.gov.uk/government/collections/river-basin-management-plans-2015).
- More information about the mechanisms used to implement measures is available on the Environment Agency's [ShareFile service \(https://ea.sharefile.com/d-sabbd14301a44d5e9\)](https://ea.sharefile.com/d-sabbd14301a44d5e9).

3.2. Measures to prevent deterioration

This section summarises the ongoing measures that help prevent deterioration and protect the many uses of the water environment and the benefits it provides. Many of these measures also help improve the quality of the water environment.

The measures are presented for each of the significant water management issues described in section 1.4.

To identify which sectors are involved in implementing the measures, the main roles in managing the water environment (identified in section 1.2) are referred to below.

Physical modifications

Physical changes such as widening, deepening and straightening rivers, estuaries and coasts help to meet the needs of society and the economy. Physical modifications allow the water environment to be used and valued for many purposes, including for navigation, flood risk management, fishing and other recreational activities that improve people's wellbeing and quality of life. These changes have helped towns and cities to develop and the economy to grow, but this can sometimes be at the expense of the water environment.

There are benefits to controlling new modifications and reducing the impacts of existing ones. While many modifications are, and will continue to be important to society, their potentially harmful impacts can be reduced and the resilience of aquatic communities improved. Taking action to address the impacts of physical modifications can have benefits for protected areas, in particular Natura 2000 sites. There is increasing evidence that in some cases, addressing the impacts of modifications (for instance by using natural water retention measures such as wetland creation and coastal realignment) could help alleviate flooding by slowing flows and making more space for water.

How the issue is managed

Regulators and operators use and apply relevant legislation and policy:

- **Local government and internal drainage boards** grant land drainage consents under the Land Drainage Act 1991. **Government and agencies (Environment Agency)** grant flood defence consents under the Water Resources Act 1991. Subject to parliamentary approval, flood defence consents will be replaced with flood risk activity permits from April 2016. All these authorities assess applications for schemes or activities for their potential effect on local flood risk and the environment.
- **Government and agencies (Environment Agency)** make sure new abstraction and impoundment licences and environmental permits include protection for freshwater and migratory fish where relevant and use powers to ensure fish passes and screens are in place where appropriate.
- **Government and agencies (Marine Management Organisation)** use marine licensing controls under the Marine and Coastal Access Act 2009 for activities including construction, alteration or improvement works, dredging and removing substances or objects from the sea or sea bed.
- **All sectors** to consider the Marine Policy Statement and marine plans in decisions that affect marine and coastal environments. These plans set out the strategic framework for sustainable development of the sea.
- **Navigation (harbour authorities)** license dredging and works within harbour limits.

- **Government and agencies (Environment Agency)** work with partners and interested groups to identify appropriate mitigation measures to achieve WFD objectives in artificial and heavily modified water bodies. Mitigation measures are practicable steps that can be taken to mitigate adverse impacts from beneficial human activities such as impoundments for water resources, or structures that provide flood defence.
- **Local government** consider impact on hydromorphology when preparing spatial plans and local flood risk management plans, decisions on development management, new buildings and infrastructure.

Operators and project undertakers apply the following guidance:

- **Navigation (ports and harbours), industry, manufacturing and other business, non governmental organisations and central government** use the e-learning site for flood risk management to access expert information on mitigation measures.
- **All sectors** apply the Environment Agency's WFD compliance guidance, which covers a range of activities in estuaries and coasts.
- **Industry, manufacturing and other business** use the Environment Agency's 'Hydropower development: guidance for run-of-river hydropower'.
- **Navigation (ports and harbours), government and agencies (Environment Agency) and local government** use industry developed best practice guidance.

Influencers and regulators consider future management activities:

- **Local government, central government (Environment Agency)** refresh the strategic overview of sea flooding and coastal erosion to better manage environmental risk in the long term using shoreline management plans.
- **Government and agencies (Environment Agency)** to explore effectiveness of existing approach to planning guidance on development in flood plains and coastal erosion risk areas.
- **Government and agencies (Environment Agency)** to review flood defence design standards for WFD and Natura 2000 sites.
- **Government and agencies (Environment Agency)** to carry out feasibility studies and designs for flood storage areas for environmental benefits.

Further information in this document

- Section 3.3 includes further information on flood risk management investment.

Information elsewhere in the river basin management plan

- You can find more information about managing flooding and flood risk management plans in section 2 of the [Part 2: RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).

Supporting information

- More information on marine plans can be found on the gov.uk [webpages](https://www.gov.uk/government/collections/marine-planning-in-england) (<https://www.gov.uk/government/collections/marine-planning-in-england>).
- The Environment Agency's compliance guidance for activities in estuaries and coasts can be found on the gov.uk [webpages](https://www.gov.uk/government/publications/complying-with-the-water-framework-directive-marine-dredging) (<https://www.gov.uk/government/publications/complying-with-the-water-framework-directive-marine-dredging>).
- The Environment Agency's guidance for hydropower development can be found on the gov.uk [webpages](https://www.gov.uk/government/collections/hydropower-schemes-guidelines-and-applying-for-permission) (<https://www.gov.uk/government/collections/hydropower-schemes-guidelines-and-applying-for-permission>).

Managing pollution from waste water

Waste water, or sewage, can contain:

- nutrients such as phosphorus and nitrates
- harmful chemicals, including ammonia and metals and those used in homes and industry
- other harmful substances, including viruses and bacteria

Pollutants in waste water can affect the dissolved oxygen levels within the receiving waters and can impact on ecology. Nutrients can disturb the natural ecological balance of a water body and cause excessive growth of vegetation and algae, which may starve the water of oxygen. Other pollutants such as metals and everyday chemical used in products around the home which are discharged in sewage may be directly toxic to plants or animals. Humans can also be affected, for example, through chemicals that accumulate in food or bacteria and viruses in waste water affecting bathing waters

Reducing the impact of pollution from waste water will provide many benefits and help support a wide range of water uses that society values. These uses include drinking water supply, agriculture (including commercial shellfish harvesting), water sports, angling, conservation, and wider benefits such as tourism and quality of life. Addressing pollution from waste water will have benefits for a large number of protected areas including bathing waters, shellfish waters, Natura 2000 sites and sensitive areas under the Urban Waste Water Treatment Directive. It also benefits marine waters under the Marine Strategy Framework Directive.

How the issue is managed

Regulators, operators and influencers use and apply relevant legislation and policy:

- **Government and agencies (Environment Agency)** grant and review environmental permits under the Environmental Permitting Regulations (England and Wales) 2010 to the **water industry, manufacturing and other business and other sectors** to protect the environment from pollutants such as chemicals, nutrients, bacteria, viruses, ammonia and organic material in discharged effluent.
- **Government and agencies (Environment Agency)** work with the **water industry** to develop a long-term strategy for sewerage to prevent deterioration of permitted discharges (for example, combined sewer overflows), resulting from pressures such as climate change, growth and ageing infrastructure; and to develop a long term strategy to reduce and minimise risks to the water environment from misconnected sewerage (foul sewage wrongly connected to surface water).
- **Government and agencies (Environment Agency)** grant environmental permits for small sewage discharges in designated sensitive areas. In other areas, small sewage discharges (including septic tanks) are exempt from the need for a permit if they can meet a number of criteria.
- **Government (Environment Agency)** to carry out a review of areas sensitive to eutrophication, in relation to the Urban Waste Water Treatment Directive (UWWTD) and make recommendations to Defra.
- **Government and agencies (Environment Agency and Health and Safety Inspectorate)** enforce restrictions and bans on the use of certain chemicals

- **Local government** considers the impact on water quality in their preparation of spatial plans, decisions on spatial planning, development management, new buildings and infrastructure.
- **All sectors** to consider the Marine Policy Statement and marine plans in decisions that affect marine and coastal environments. These plans set out the strategic framework for sustainable development of the sea.

Further information in this document

- You can find more information on water company investment in section 3.3.

Information elsewhere in the river basin management plan

- You can find more information on the National Environment Programme in Section 2 of [Part 2: RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).

Managing pollution from towns, cities and transport

Rainwater draining from roads and pavements carries many pollutants. These include metals, vehicle emissions, silt, grit, bacteria from animal faeces and oil. Other issues arise from pollution from households and business, for example, misuse of the drainage network. Pollution can enter surface water sewers that discharge to rivers, estuaries and coastal waters, causing harm to animals and plants.

Dealing with pollution from towns, cities and transport is a complex task. Costs for the measures tend to be higher and ownership of the problem is less clear. Existing legal powers are designed to address specific sources of pollution rather than small-scale or cumulative impacts from many different sources. However, there are some ways in which the challenge can be addressed. Benefits from action include improved flood resilience, climate change adaptation, increased biodiversity and social cohesion. In addition, protected areas, particularly certain bathing waters and shellfish waters, can be improved when enough resources are targeted at a specific issue.

How the issue is managed

Regulators and operators use and apply relevant legislation and policy:

- **Local government** uses planning conditions, legal agreements and enforcement powers under the Town and Country Planning Act 1990 to prevent or stop pollution from developments, roads and other infrastructure.
- **Local government** makes sure that new developments address potential pollution problems by using sustainable drainage systems to manage surface water.
- **Local government** uses powers under the Building Act 1984 to rectify misconnected waste water pipe work, and statutory nuisance powers under the Environmental Protection Act 1990 to stop water pollution from unauthorised operations such as transient car wash operations.
- **Government and agencies (Environment Agency)** use anti-pollution works powers (including service of notices) under the Water Resources Act 1991 to prevent or clean up small scale pollution, for example, ensuring storage tanks are banded or repairing misconnections.
- **Industry, manufacturing and other business** comply with existing regulations (for example, the Environmental Permitting (England and Wales) Regulations 2010) to make sure that chemicals are properly managed and surface water drainage is appropriately used and maintained.

Operators take action, where appropriate:

- **Industry, manufacturing and other business (construction industry)** use sustainable drainage systems to remove silt and minimise other chemicals to prevent polluting run-off.
- **Local government** considers urban diffuse pollution pressures when developing spatial plans, determining planning applications and designing and constructing local council owned buildings, infrastructure and grounds. These should incorporate sustainable drainage schemes and water efficiency measures where practical and affordable.
- **Local government** incorporates green and blue infrastructure into regeneration schemes where possible.

- **Local government and industry, manufacturing and other business** reduce the impact of pesticides by using Amenity Assured registered weed control contractors under the Voluntary Initiative.

Regulators and operators plan and work together:

- **Government and agencies (Environment Agency) and Highways England** apply the memorandum of understanding agreement covering the strategic road network and remediation of high risk outfalls.
- **Government and agencies (Environment Agency) and urban and transport (Network Rail)** operate under the terms of a memorandum of understanding covering contaminated land, water discharge and use of pesticides.
- **Government and agencies (Environment Agency and water industry)** investigate and deal with misconnections, for example, through the National Misconnections Strategy group and in accordance with Defra's diffuse urban action plan.
- **All sectors** to consider the Marine Policy Statement and marine plans in decisions that affect marine and coastal environments. These plans set out the strategic framework for sustainable development of the sea.
- **Industry manufacturing and other business, local government, navigation and general public** follow codes of conduct and non-statutory estuary and coastal management plans to protect and improve the water environment in specific locations.
- **Local government** works with **industry, manufacturing and other business (Local Enterprise Partnerships), and non governmental organisations** (catchment partnerships and Local Nature Partnerships) to develop joint improvement programmes.
- **Industry, manufacturing and other business (Local Enterprise Partnerships)** work in partnership with **all sectors** to help identify where money from the European Growth Programme is invested to develop local economies and enhance the environment.

Further information in this document

- You can find more information on Highways England's environment fund in section 3.3.

Changes to natural flow and levels of water

Taking too much water from freshwater or tidal rivers, canals, lakes and groundwater damages the environment. Changes in the natural flow and level of water could affect some Natura 2000 sites; particularly water dependent Special Areas of Conservation. Improving the way water resources are managed will make sure that there is enough good quality water for a healthier water environment and secure supplies of water for people, businesses and agriculture. It will also provide more leisure opportunities and increase the amenity value of natural environments, leading to health benefits for people.

How the issue is managed

Regulators and operators use and apply relevant legislation and policy:

- **Government and agencies (Environment Agency)** grant licences under the Water Resources Act 1991 to regulate how much water is taken from rivers, lakes estuaries and groundwater. The Environment Agency reviews the sustainability of time-limited abstraction licences as they expire and the licence holders seek replacement licences. The Environment Agency will take action to curtail time-limited licences that are not sustainable. Replacement licences are granted on a sustainable basis in line with water body objectives.
- **Government and agencies (Environment Agency)** change or revoke permanent licences to protect the environment from actual or potential damage, including serious damage under the Water Resources Act 1991.
- **Government and agencies (Environment Agency)** work to bring a number of currently exempt abstraction activities into regulation following public consultation and formulation of government policy and legislation. This includes dewatering, transfers for inland navigation and previously exempt irrigation activities. Some reductions in currently exempt abstractions that are causing serious damage to the environment may be necessary. This may result in an improvement in groundwater and flow in affected water bodies.
- **All sectors** consider the Marine Policy Statement and marine plans in decisions that affect marine and coastal environments. These plans set out the strategic framework for sustainable development of the sea.

Regulators and operators take action:

- **Government and agencies (Environment Agency)** identify water resource pressures due to abstraction and restore sustainable flows and groundwater levels through changes to abstraction licences and physical changes to river channels to improve flows. New licences must be sustainable and prevent future impacts.
- **Government and agencies (Environment Agency)** implement the Restoring Sustainable Abstraction (RSA) programme. This programme identified, investigated and is solving environmental risks or problems caused by unsustainable licensed water abstraction. The Environment Agency takes action to curtail abstraction licences that have been identified as causing an environmental problem under the RSA programme. The Environment Agency aims to complete the programme by the end of March 2020.

Regulators and operators plan and work together:

- **Water industry** complete statutory Water Resource Management Plans, setting out how supplies and demand for water will be managed over a 25 year period, and takes action to restore sustainable groundwater and flows where impacts due to abstraction have been confirmed.
- **Water industry** produce drought plans to make sure that public water supplies are maintained while minimising the environmental impact of drought.
- **Government and agencies (Environment Agency)** produce abstraction licensing strategies to help ensure a consistent approach to managing water resources and balancing the needs of water users and the environment.
- **Government and agencies (Environment Agency)** revoke unused licences where the licence holder does not have a reasonable need for the water.
- **Water industry** carries out Adaptive Management trials, to determine the best measures for improving heavily modified water bodies used for water supply.

Regulators, operators, influencers and project undertakers make sure water is used efficiently:

- **All sectors** take up or encourage water efficiency measures, including water industry work on metering, leakage, audits, providing water efficient products, promoting water efficiency and education.
- **Local government** sets out local plan policies requiring new homes to meet the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010.
- **Industry manufacturing and other business** implement tighter levels of water efficiency, as proposed by changes to the Building Regulations.
- **Agriculture and rural land management** manage demand for water and use water more efficiently to have a sustainable water supply for the future.
- **Local government** commissions water cycle studies to inform spatial planning decisions around local water resources.

Further information in this document

- You can find more information on water resources sustainability measures and water company investment in section 3.3.

Information elsewhere in the river basin management plan

- You can find more information about the management of abstraction and flow in [Part 2: RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).

Managing invasive non-native species

Some non-native animals and plants are invasive and can have significant social, economic and environmental impacts. Where they lead to greater erosion some plants, such as Himalayan balsam, can increase flood risk. Others like American signal crayfish can decrease river bank stability and most have negative impacts on ecology and leisure activities such as angling and water sports. There are also significant costs in controlling and safely disposing of invasive species such as Japanese knotweed on development sites and managing species such as zebra mussels, which can block pipes, intakes and other structures.

Many invasive non-native species spread rapidly and once they are established control is often prohibitively expensive or technically infeasible and ultimately unsuccessful.

The approach to dealing with invasive non native species is set out in the GB Invasive Non-native Species Strategy. The strategy aims to minimise the risk posed by, and reduce the negative impacts of invasive non-native species. It adopts a hierarchical approach stressing prevention, followed by early detection and rapid response and finally long-term management and control.

The most effective and least expensive measure is to reduce the number of new species introduced and slow the spread of those that are already present by applying good biosecurity (measures which reduce the risk of spreading diseases and invasive non-native plants and animals) and promoting the 'Check, Clean Dry' and 'Be Plantwise' campaigns.

Natura 2000 protected areas can be vulnerable to certain invasive non-native species. Intensive and often expensive control measures may be required to actively manage or eradicate them in specific circumstances. For example, at sites designated for their wetland habitat interest, Himalayan balsam can dominate and reduce the habitat space available for native plant species. Controlling the Himalayan balsam by targeted and intensive hand pulling or cutting over a number of years can reduce the pressure from this species and prevent further deterioration of the habitat.

How the issue is managed

Regulators and operators use and apply relevant legislation and policy:

- **Government and agencies (Environment Agency and Natural England)** use the Keeping and Introduction of Fish Regulations 2015 and Wildlife and Countryside Act 1981 to control movements of invasive non-native species. A change in legislation, implemented in April 2014, introduced a ban on selling 5 high-risk plant species including water primrose and floating pennywort.
- **Agriculture and rural land management** is aware of the Wildlife and Countryside Act 1981 and does not allow certain species to escape into the wild.
- **Government and agencies (Marine Management Organisation)** use policies within emerging marine plans and marine policy statements to support controlling and mitigation against invasive non native species.
- **Government and agencies** implement EU Regulation 1143/2014 on Invasive Alien Species. Implementation of the regulation is gradual and will take place throughout the period of this plan.

Regulators, operators, influencers and project undertakers plan and work together:

- **Government and agencies (includes Environment Agency and Natural England), non governmental organisations (including angling, conservation and recreation)** implement the updated Great Britain strategy on invasive species, which includes species impact risk assessments, action plans and rapid response.
- **All sectors work together to develop and implement codes of practice** to reduce the spread of invasive non-native species.

Regulators, operators, influencers and project undertakers take action:

- **Government and agencies (includes Environment Agency and Defra), non governmental organisations (angling, conservation and recreation) and navigation** implement rapid responses to contain and eradicate new invasions where practicable. This measure is aided by the addition of powers to make Species Control Agreements and Orders in the Wildlife & Countryside Act 1981 as amended by the Infrastructure Act 2015.
- **Government and agencies (Natural England)** manage invasive non native species at selected protected sites as appropriate.
- **All sectors** can form Local Action Groups to deal with invasive non native species and raise awareness.

Regulators, operators, influencers and project undertakers build awareness and understanding:

- **Government and agencies (includes Environment Agency and Natural England), non-governmental organisations (including angling, conservation and recreation), local government and navigation** work in partnership to influence recreational users to slow the spread of invasive non native species by promoting 'Check, Clean, Dry' actions.
- **Government and agencies (Defra) and all sectors** raise public awareness of the risk of transferring non-native species accidentally and of preventative approaches.
- **Central government** helps the non-native species secretariat co-ordinate alert systems, species records and a central repository for information, including public online and smart phone submission of species records.

Information elsewhere in the river basin management plan

- You can find more information about the management of invasive non-native species in section 2 of [Part 2: RBMP overview \(www.gov.uk/government/collections/river-basin-management-plans-2015\)](http://www.gov.uk/government/collections/river-basin-management-plans-2015).

Supporting information

- The GB Invasive Non-native Species Strategy can be found on the GB non-native species secretariat [webpages \(http://www.nonnativespecies.org/index.cfm?sectionid=55\)](http://www.nonnativespecies.org/index.cfm?sectionid=55).

Manage pollution from rural areas

Pollution from rural areas comes from the combined effects of numerous sources, including agriculture, roads, recreational land use such as golf courses and forestry activities. It is mainly caused by nutrients, contaminants, chemicals such as pesticide and sediment entering water bodies as a result of land management activities.

Dealing with pollution from rural areas will help society reap the benefits of a healthy water environment. Farmers will benefit from making sure soil and nutrients are retained on the land rather than losing them, through run-off, to water. Controlling this run-off will help reduce localised flooding, reduce the sedimentation of lakes and harbours, improve fisheries and reduce the amount of harmful chemicals entering water bodies. Water companies will spend less money treating water for colour, pesticides and nitrate contamination. A reduction in nutrients will also benefit water quality and habitat in estuaries and coastal waters.

A wide range of protected areas will see benefits, including bathing water, shellfish waters, drinking water protected areas, Natura 2000 sites and nutrient sensitive areas designated as nitrate vulnerable zones.

How the issue is managed

Regulators and operators use and apply relevant legislation and policy:

- **Government and agencies (Environment Agency)** check and ensure compliance against environmental permits under the Environmental Permitting (England and Wales) Regulations 2010 and against requirements of a wide range of environmental legislation.
- **Agricultural and rural land management (farm businesses)** comply with permits granted under the Environmental Permitting (England and Wales) Regulations 2010. Permitted activities include some discharges to groundwater, spreading of waste to land for agricultural benefit, pig and poultry units over a certain size and safe recovery of agricultural waste.
- **Agricultural and rural land management (farm businesses)** comply with the action programme measures within the Nitrate Pollution Prevention Regulations 2015 in all nitrate vulnerable zones.
- **Agricultural and rural land management (farm businesses)** comply with the requirements of the Control of Pollution (Silage Slurry and Agricultural Fuel Oil) Regulations 2010 (SSAFO).
- **Agricultural and rural land management (farm businesses)** ensure that polluting matter is not present at a place where it has or is likely to enter controlled waters to avoid enforcement action under Water Resources Act 1991.
- **Government and agencies (Farming Advice Service)** advise farmers on general requirements of cross compliance and regulations required under the WFD.
- **Government and agencies (Environment Agency and Natural England)** provide site-level advice on the specific requirements of regulations.
- **Government and agencies (Natural England)** provide advice on the specific requirements of regulation that relate to designated sites, and can prevent or stop potentially damaging activities.
- **Government and agencies (Environment Agency and Natural England)** provide advice and training to farmers in some priority catchments through an approach such as Catchment Sensitive Farming.

- **Government and agencies (Environment Agency)** review the effectiveness of measures within catchments, and where there is sufficient need, consider whether further action should be proposed.
- **Government and agencies (Forestry Commission)** comply with the UK Forestry Standard, the government's approach to sustainable forestry.
- **Local government** uses planning conditions, legal agreements and enforcement powers under the Town and Country Planning Act 1990 to prevent or stop pollution from rural developments, roads and other rural infrastructure.
- **Local government** considers the impact of pollution when preparing spatial plans, minerals and waste plans and making decisions on development management, new rural buildings and rural infrastructure.

Operators, influencers and project undertakers take action:

- **Agricultural and rural land management (farm businesses)** meet cross compliance requirements of the Basic Payment scheme funded by the Common Agricultural Policy.
- **Agricultural and rural land management (farm businesses)** voluntarily participate in Countryside Stewardship and Countryside Productivity schemes to prevent deterioration, improve water quality and reduce flood risk.
- **Agricultural industry manufacturing and other business** participate in sector led approaches including farm assurance and the Campaign for the Farmed Environment schemes.
- **Water industry and rural land management** work together in drinking water safeguard zones to reduce the need for water treatment as a result of nutrients or pesticides to meet drinking water standards.
- **Government and agencies (Forestry Commission and Environment Agency)** use opportunity mapping to identify and promote locations where woodland creation can achieve multiple benefits for the environment.

Further information in this document

- You can find more information on Countryside Stewardship in section 3.3.

Information elsewhere in the river basin management plan

- You can find more information about the management of pollution from rural areas in section 2 of [Part 2: RBMP overview \(www.gov.uk/government/collections/river-basin-management-plans-2015\)](http://www.gov.uk/government/collections/river-basin-management-plans-2015).

3.3. Main programmes of measures for 2021 outcomes

This section provides a summary of the main programmes of measures, grouped by funding sources, which will improve the water environment by 2021. The outcomes of these measures fall into 2 categories:

- measures which the predicted improvements in the status of water bodies by 2021 are based upon
- measures which will happen by 2021 and achieve environmental outcomes, but there is not enough confidence (in location or scale of improvement) to predict specific outcomes

The main programmes are:

- water company investment programme
- Countryside Stewardship
- Highways England's environment fund
- flood risk management investment programme
- catchment level government funded improvements
- water resources sustainability measures

Supporting information

- You can find a list of the measures used to predict improvements in status by 2021 for specific elements in specific water bodies, and a summary of the measures expected to result in additional environmental outcomes for 2021 on the Environment Agency's [ShareFile service](https://ea.sharefile.com/d-sabbd14301a44d5e9) (<https://ea.sharefile.com/d-sabbd14301a44d5e9>).

Water company investment programme

Ofwat, the economic regulator of the water companies, reviews water industry investment plans every 5 years. As part of this process, known as the price review, the Environment Agency works with water companies, Ofwat and others to make sure that investment protects the water environment, increases resilience and secures long-term benefits for society and the economy. The Environment Agency sets out the environmental obligations, including work required to prevent deterioration and achieve protected area and water body status objectives.

Across England and Wales, water companies will be investing £3.5 billion in environmental improvements between 2015 and 2020. This equates to, when forecast over a 37-year period, a total of approximately £350 million being invested in this river basin district, plus additional investment specifically on the Thames Tideway and the Lee tunnel in London.

Significant investment will go into addressing point source impacts from sewage treatment works and discharges from the sewer network. This will reduce pollutants such as ammonia and nutrients that disturb the natural ecological balance of water bodies and cause excessive growth of vegetation and algae.

Further investment will deal with abstraction and flow pressures. This includes reducing the amount of water that can be taken or measures to enhance habitats to compensate for damage caused by abstraction.

Habitat improvement schemes are planned to reduce the impact of physical modifications caused by water company operations and action is planned to deal with invasive non-native species on water company land. Further measures will ensure compliance with the Eels Regulations, which require water intakes to be screened to prevent eels and other fish from being drawn out of the river into drinking water treatment works.

Climate change adaptation and mitigation is an integral part of water company planning and is an essential part of assessing scheme options. This is particularly important for water resources planning, where water companies must plan up to 25 years in advance to make sure that there is enough water to meet future demands.

Most of the measures are well-established engineering solutions that are proven to be effective. Changes are secured through amendments to environmental permits.

There are some catchment and habitat improvement schemes that are less well established, including measures to reduce pesticide pollution. Some of these schemes rely on voluntary behavioural change affecting agricultural practice. These can be less effective when compared to engineering solutions.

A 'fair share approach' is applied to the selection of measures, which assumes there is a proportional reduction in polluting load from each of the contributing sectors. For example, when identifying measures for phosphorus in a catchment, the amount coming from sewage treatment works and the amount from other sources, such as rural diffuse pollution was calculated. If the sewage works was responsible for 70% of the phosphorus load, then the measure identified is to achieve 70% of the required phosphorus reduction. In this situation achieving an improvement in status is reliant on other sectors putting additional measures in place.

Water company investment will directly contribute to predicted improvements in status by 2021 for specific elements in specific water bodies. A large proportion of this will be achieved by installing phosphate-stripping equipment at sewage treatment works. In addition, measures to reduce the amount of water taken out of the environment for public water supply will make sure that there is enough water left in rivers and lakes to support good ecological status. This will be achieved through changes to water company abstraction licences.

A wide range of measures will secure additional outcomes for the environment, but are not linked to specific improvements in element status by 2021 because there is insufficient confidence about the scale of improvement. This includes measures for eel passage, measures to protect drinking waters and improve bathing waters and measures to improve river habitat and flow regime where it is affected by impoundment for public water supply.

Water companies are also investing in the Chemicals Investigation Programme, a multi-million study to better understand the impacts of chemicals in treated sewage and to trial new treatment technologies and catchment measures to reduce these impacts. The results from the Chemicals Investigation Programme will be used to implement measures to reduce the impacts of chemicals discharged in sewage in the future.

Examples of these measures in the Thames river basin district

Water resources

The Affinity Water supply area within the Thames river basin district is home to a significant number of chalk streams flowing off the Chiltern Hills and North Downs. Affinity Water has agreed to help protect these rare chalk streams by reducing the amount of water that it abstracts from groundwater sources by 69.8 million litres a day by the end of asset management plan (AMP) 7 (2025). It will continue to meet demand for water by a number of planned initiatives, including its water saving programme that includes metering, leakage reduction and water efficiency. As well as reducing abstraction, the company will be carrying out river restoration and habitat enhancement work on 7 chalk streams together with the Environment Agency and catchment partnerships, to improve ecology and habitat diversity.

Affinity Water will also be carrying out a detailed programme of monitoring to assess the effectiveness of both in-channel works and abstraction reductions. With this significant reduction in abstraction, it is important to protect the water available for public water supply. There will be a comprehensive catchment management programme to support the abstraction reductions. The programme will investigate pollution risks and Affinity Water will work with local communities to address issues such as diffuse pollution from agriculture affecting raw water quality.

Water quality

The water quality concerns for the Thames Estuary centre on the impacts of storm discharges from the 5 major sewage works that serve London, and from the combined sewer network. These discharges to the estuary frequently result in low dissolved oxygen levels, pose a risk to health and kill fish. It is also aesthetically unsightly and detrimental to the image of the River Thames.

Improvements to the sewage treatment works along the tidal River Thames and the construction of the London Tideway tunnels are planned to be completed by Thames Water over the next 2 river basin cycles, with tunnelling beginning in 2017 and all work will be completed by 2023.

These major projects represent the main measures to address point source pollution from the sewerage system and are fundamental to achieving good status in this catchment.

The Thames Tideway tunnel will provide 1.6 million cubic metres of capacity via a 25 kilometre interception, storage and transfer tunnel that will run up to 65 metres below the River Thames. It will improve water quality, ecology and public health plus wider benefits in terms of creating new riverside open spaces.

The scheme will be implemented by a new infrastructure provider, Thames Tideway Tunnel Limited, and will cost £4.4 billion. Of this, £2.8 billion will be provided by Thames Tideway Tunnel Limited, with the remainder funded by Thames Water Utilities Limited. Thames Tideway Tunnel Limited will build, own, finance and maintain the project.

Countryside Stewardship

Countryside Stewardship is a new scheme that is open to all eligible farmers, woodland owners, foresters and other land managers through a competitive application process. It is entirely voluntary and is part of a wider investment of £3.5 billion in England under the Common Agricultural Policy for 2016 to 2020. It will contribute £900 million of new funds to enhance the natural environment, particularly the diversity of wildlife and water quality. Of this funding, about £400 million will be invested over a 5-year period to improve water quality and increase resilience against flooding.

By 2020, it is expected that 30% to 40% of rural England could be part of a Countryside Stewardship agreement. Countryside Stewardship supports the implementation of measures over and above legal requirements and good practice. It will address soil management and reduce the effect of nutrients, sediment and faecal contamination. This will reduce the impact of eutrophication and benefit bathing waters, shellfish waters and drinking water. This is achieved through measures categorised by the following groups:

- enhanced field management, including seasonal livestock exclusion, winter cover crops, buffer and riparian management strips next to watercourses and reduced nutrient applications from fertilisers
- land use change, including woodland and wetland creation or converting arable land to grassland which requires less fertiliser
- water and woodland capital grants, including sediment traps, fencing of watercourses and tree planting
- re-naturalising rivers and coast defences, including making space for water and coastal realignment

Countryside Stewardship will support climate change resilience, for example, by planting trees next to rivers and streams, which can reduce river temperature and the risk to salmonid fisheries. It will also reduce sedimentation of rivers, making rivers better able to store more flood water.

Individually these measures can be effective at a field scale but a number of land managers need to take up measures across the whole catchment for the measures to be really effective. As a result, improvements to the environment from Countryside Stewardship are not linked to specific improvements in water body element status by 2021. The uptake of measures is voluntary, with the first agreements commencing in January 2016.

The individual nature of catchments including soils, topography and rainfall make it difficult to quantify the benefits of these measures. Countryside Stewardship is expected to achieve additional environmental outcomes for 2021. Preliminary research suggests that for nutrients and sediment it may provide elemental improvements of approximately 2 to 10% from the current position where supported with advice. In some discreet locations an improvement of up to 18% may be achieved, but the precise locations will depend on the level of uptake of measures by farmers and the supporting advice provided. Further research is planned that will help to evaluate the likely benefits of Countryside Stewardship for water.

It is not yet possible to describe the detail of schemes or exact location of investment, however improvements are anticipated within the river basin district.

Highways England's environment fund

Highways England is the government company that manages motorways and major A roads. It manages around 6,500 miles of trunk roads that accommodate 33% of all road travel and 50% of lorry travel. Over the next 5 years, Highways England's environment fund will invest £300 million in the existing strategic road network for environmental improvements. A proportion of this will address pollution from highway run-off.

Highway run-off is waste that collects on roads made up of silt and grits mixed with contaminants, including metals from brake pads and oil from engines and vehicle emissions. During storms this is washed off the road and can reach rivers, lakes or groundwater without being treated. The metals, nutrients and sediments can harm the ecology of the water environment. This is made worse by the effects of physical modifications required by the road network, such as bridges and culverts.

Highways England take a risk based approach to decide how and where to invest, using modelling that looks at factors including road length drained and climatic conditions. The actual impact of a measure on the receiving water body can't be entirely predicted, although the standard techniques are relatively reliable and well understood.

Outfalls will generally be treated with sustainable drainage systems (SuDS), which is a broad term of measures from those that can trap pollutants at the side of the carriageway through a swale (shallow grassy ditch) to large balancing ponds that regulate flow quantity as well as allowing pollutants to settle out. To address physical modification pressures, techniques such as fish and eel passes are installed to allow fish migration.

SuDS are moderately resilient to climate change as they use natural processes and cope well with fluctuations, although prolonged drought may restrict their effectiveness. They can achieve a range of benefits, when used on the strategic road network these include water quality improvements, flood risk reduction and water availability.

Improvements to the environment from Highway England's investment programme are not linked to specific improvements in water body element status by 2021. Highways England has not yet announced the location of investment so improvements in specific locations cannot be predicted. Further detail is expected during 2016.

Implementing the programme will result in additional environmental outcomes for 2021. The pressure from sediment and chemical loadings will be reduced by an order of magnitude and there will be reductions in metals and nutrients alongside improvements in dissolved oxygen levels. Eel passes on culverts will allow upstream migration resulting in more sustainable eel populations.

It is not yet possible to describe the detail of schemes or exact location of investment, however improvements are anticipated within the river basin district by 2021.

Flood risk management investment

The Environment Agency's Flood and Coastal Erosion Risk Management capital investment programme aims to reduce the risks of flooding and erosion to people's homes and the economy over the next 6 years to 2021. Projects will focus on protecting people and avoiding other economic damage (including farming business). Some may also contribute towards improving the status of water bodies, protecting valuable wildlife sites and creating new habitats.

Flood and coastal erosion risk management is a legitimate use of many water bodies but has in some cases resulted in significant modification and alterations in hydromorphology. Activities to improve water body conveyance and reduce flood risk, such as construction and reinforcement of banks, channel re-sectioning and vegetation management often have a negative impact on the condition of water bodies.

The capital investment programme aims to reduce the impact of these activities by, where possible, working with natural processes. This includes using natural flood management measures to slow, store and filter floodwater. This will achieve more sustainable flood risk management schemes, often with significant additional environmental and social benefits. This approach is used together with traditionally constructed hard defences to increase the resilience of communities to extreme events, both floods and drought.

In identifying and designing schemes the impacts of climate change, such as more winter rainfall, more intense rainstorms and sea level rise are taken into account.

Meeting statutory obligations, improving the natural environment and mitigating climate change will be achieved through 'win-wins' at the same time as reducing flood and coastal erosion risk (for example, through natural flood management). Achieving environmental outcomes is integral to flood and coastal risk management, for example, where possible when improving defences opportunities to reduce any barriers to eel passage will also be sought.

Examples of these measures in the Thames river basin district

Oxford flood alleviation scheme

The Environment Agency are working with their project partners, local stakeholders and environmental groups to develop a scheme to reduce flood risk in Oxford. The scheme is in development with the project team gathering the evidence needed to gain government approval for the scheme. If the scheme is approved construction will begin in 2018.

Options include the construction of new channels or enlargement of existing channels in the western floodplain. A new channel would provide additional capacity and would work with the natural processes of the local watercourses and the flood plain to help manage the movement of water through Oxford. In addition to the scheme design, work is also being undertaken to influence land management in the upper Thames catchment. This work will help to reduce diffuse pollution and sediment entering our rivers, as well as reducing flood risk. Climate change predications have also been taken into account which, in the future may result in the creation of an upstream storage area, complimenting the flood relief channel and mitigating the increased risk of flooding.

This scheme presents an opportunity for Oxfordshire communities to create an inspiring new natural resource. The project team aim to ensure that any scheme would be as natural, wildlife-rich and attractive as possible. They aim to embed Water Framework Directive improvements in the development of the proposed flood alleviation scheme.

Wealdstone Brook project

The Wealdstone Brook is an urban river catchment in North London (Brent and Harrow) that responds very quickly to rainfall. There have been several flooding incidents over the last 30 years, particularly due to the foul sewerage system backing up as a consequence of being overloaded with surface water.

A computerised model of the wastewater, storm water and watercourse network in the Brent and Harrow catchment is currently being developed. Interested groups that are involved in the project will use this model to map out planned investment in the catchment and to work together on solutions. A sustainable urban drainage system in local parks is one of the solutions being considered in the Brent catchment to store surface water, alongside habitat enhancement works and, where possible, de-culverting the Wealdstone Brook.

Catchment level government funded improvements

As part of the commitment to the catchment based approach, Defra has made £10.1 million available during 2015 to 2016 for voluntary action to improve the water environment through the Catchment Partnership Action Fund (CPAF) and the Environment Agency's Environment Programme. The Environment Agency will invest £4.64 million through its Environment Programme, with more than 50% of this being specifically for partner-led projects.

CPAF will invest £5.1 million in 2015 to 2016. £1.3 million of this supports the role of catchment hosts with the remainder going to projects carried out by voluntary groups. Of the CPAF and Environment Programme funding, at least £2 million will be used for dealing with urban pollution issues.

A wide variety of measures are funded at a catchment level. This includes advisory and action based schemes to reduce the impact of pollution from rural and urban areas along with habitat improvement measures to increase biodiversity.

Natural England will continue to invest in protected areas measures. This will focus on safeguarding and, where necessary, improving the condition of Natura 2000 sites using measures such as river restoration, lake restoration, diffuse pollution, management of freshwater invasive species and habitat restoration on wetland sites.

The effectiveness of measures within this programme is variable. Measures such as removing barriers to fish migration are well established engineering solutions and are effective. However, there are some catchment and habitat improvement schemes that are less well established, including measures to reduce pesticide pollution or undertake wider river habitat enhancements. Some measures rely on behavioural change in agricultural practice, so may be less effective compared to engineering solutions.

Projects need to be resilient to a changing climate, performing under a variety of conditions and supporting the long-term health of the catchment. When developing its investment programme, the Environment Agency considers the contribution each action will make to reduce climate change risks and works with partners to manage these risks and help catchments adapt.

The outcomes of a number of projects will directly contribute to predicted improvements in status by 2021 for specific elements in specific water bodies. This includes habitat creation and fish passage actions. Other catchment level government funded improvements address a range of pressures and will secure a variety of improvements to the environment, but are not linked to outcomes for 2021 because of insufficient confidence about the scale of improvement.

Examples of these measures in the river basin district

Upper Lee sustainable urban drainage systems (SuDS)

Working with Luton Borough Council and Groundwork Luton, the local partnership will invest multi partner funding of approximately £200,000 to construct at least one SuDS in a greenspace, which will help reduce flood risk and improve habitat and water quality of the River Lea in Luton. The project will be complemented by £70,000 of funding from Thames Water for the development and support of a community engagement programme to connect people to the River Lea and to support volunteer environmental monitoring.

The Wey fish pass and wetland delivery project

This project has been developed collaboratively to provide the range of measures identified for the Water Framework Directive. The project is being led by Wey Landscape Partnership and carried out by the Environment Agency and Surrey Wildlife Trust, as well as maximising opportunities to collaborate with others on specific projects identified within the strategy. Over the next 6 years the project will result in multiple benefits along the 7 water bodies of the River Wey corridor. It will also link in with smaller projects on the tributaries in the wider catchment strategy.

Feasibility and design has already been undertaken and elements of the project are underway, with partners already involved and implementing initiatives on the ground. The project is also being aligned with the flood and coastal risk management programme. The total cost of the project is expected to be approximately £2 million over the next 6 years.

The project will prioritise efforts on protected areas, while providing improvements to river habitats, fish passage, reductions in urban and rural diffuse pollution, reduction in treatment costs for abstractions used for public drinking water supplies and some flood resilience benefits. The project will also provide wider benefits through increased access and recreational use of the river as well as greater partnership working with local communities and volunteer groups.

Water resources sustainability measures

Abstraction and other changes to river flows and groundwater levels are putting pressure on the water environment, and, in some cases, are causing environmental damage. Dealing with abstraction and flow pressures now will address damage that is already occurring and also help support sustainable supplies of water for the future.

Measures grouped within this programme are based on applying existing provisions under the Water Resources Act 1991. Current tools will be fully used to achieve environmental objectives ahead of abstraction reform which will create a system that has built in long-term flexibility to help deal with future challenges of changing climate, population and economic growth whilst protecting the environment and trying to ensure water is used efficiently.

Most measures will be applied through the current abstraction licensing system and involve the following types of action:

- constraint or refusal of applications to renew time limited licences
- changes to or revocation of abstraction licences necessary to protect the environment from serious damage
- working with licence holders to voluntarily apply to change licences to make them sustainable
- bringing previously exempt abstractions under regulation (new authorisations)
- implementing the Restoring Sustainable Abstractions (RSA) programme
- revoking unused licences

The existing abstraction licence charge scheme funds these measures. (Note water company actions are included in the section titled 'Water company investment programme').

Licence change measures are well established and proven to result in environmental benefits once the change becomes effective, and will achieve environmental outcomes. Some water bodies will respond quickly to changes in timing and volume of water abstracted. Surface water bodies suffering from serious damage will see flows increased, and the damage being caused will be stopped. However, for licence changes made to groundwater abstractions, benefits may take longer to take effect, and can be over many years. This is particularly true when considering groundwater recovery times within some major aquifers.

Climate change will affect the future demand for water as well as its availability and quality. Rivers and groundwater water bodies are already under pressure. Demand for water is increasing due to population growth, urban development and land-use change. Climate change is expected to alter the frequency and distribution of rainfall, increasing temperatures and increasing the frequency and severity of extreme weather events. Dealing with unsustainable abstraction and implementing water efficiency measures is essential to prepare and be able to adapt to climate change and increased water demand in future.

Not all of the measures can be linked to outcomes in specific water bodies by 2021 because there is insufficient confidence in the exact scale and timing of improvement. However, classification change may be seen in some, as yet unspecified, water bodies. All the measures will bring about additional environmental outcomes, these are described below:

- Through the RSA programme, the Environment Agency will take action to change or revoke abstraction licences that have already been identified as causing an environmental problem.
- The Environment Agency is using government guidance and evidence to take a prioritised approach to assessing whether licence changes are needed to protect the

environment from serious damage. All abstractors should anticipate changes to their licences in water bodies suffering from serious damage.

- Following public consultation and formulation of government policy, a number of currently exempt abstraction activities are expected to come under regulation. This will give greater ability to control the environment and prevent damage.

RSA is a programme of work that identifies, investigates and solves environmental risks or problems caused by unsustainable licensed water abstraction throughout England and Wales. RSA work is undertaken by the Environment Agency, water companies, local authorities, conservation bodies and site owners.

The Environment Agency works with abstractors to find solutions that will increase water levels in certain rivers, streams, lakes and other natural wetland habitats. It is an umbrella programme of work required under the European Habitats and Wild Birds Directive (HD), designated Sites of Special Scientific Interest (SSSI), Biodiversity Action Plans (BAP) and designated sites of local importance. It focuses on sites where plants and animals are dependent on good levels of water.

For all river basin districts there are 81 non-water company licences in the RSA programme.

Examples of these measures in the Thames river basin district

There are 2 non-water company licences in the Thames river basin district RSA programme. Both of these licences are for industrial, commercial and public services and are driven by the Biodiversity Action Plan. These will both be implemented by March 2020.

3.4. Local measures

Catchment partnerships are a major initiative to encourage local action to protect and enhance the water environment. The catchment based approach allows flexibility in the geographic scale at which catchment partnerships operate. Most catchment partnerships operate at the water 'management' catchment scale. Some operate at a smaller catchment scale. The partnerships consist of a wide range of stakeholders with an interest in the water environment. This includes, but is not limited to local government, angling interests, wildlife organisations, water companies, land managers, business representatives and government agencies. Figure 2 shows the management catchments in the river basin district.

Figure 2: Management catchments within the Thames river basin district



Each catchment partnership is committed to working collaboratively to share evidence, develop common priorities and carry out work on the ground. Many partnerships are producing catchment plans that will detail local actions related to the measures in this plan. Partnerships are at different levels of maturity, so while some may have a detailed plan for measures in their catchment, others may be newly formed and may not have such a detailed view at this stage.

The following section has been developed by the catchment partnerships (plus other interested groups) and reflects their views on current priorities and future ideas. It includes a summary of the main measures that partnerships are contributing to.

These ideas for local measures have been suggested by catchment partnerships and reflect local priorities which can often be around achieving 'multiple benefits' for shared outcomes through collaborative working. Such multiple benefits include improved water quality, habitat and biodiversity as well as contributing to some flood and climate resilience.

The catchment partnerships seek funding for these local measures from a range of sources including government, other national and international providers such as the Big Lottery or EU LIFE as well as local partners and stakeholders who have an interest. Normally, to secure funding, projects would need to be fully developed with all the necessary permissions secured in advance.

Each catchment summary page sets out measures that are linked to water body outcomes for 2021 and also measures which will improve the environment, but cannot be linked to water body outcomes for 2021 (for example, because the exact outcome or location is not confirmed). These measures are mainly funded through local funding streams and where this is not the case it is explained within the text.

This is followed by a description of some of the additional measures the partnerships would like to pursue if they were able to secure additional funding. They have presented their initial ideas of what they would do with £100,000 per year and with £1,000,000 per year to help to show local ambition in the short and longer term.

Supporting information

- More information on the location of water bodies and catchments, along with associated data, can be found on the [Catchment data explorer](http://environment.data.gov.uk/catchment-planning/) (<http://environment.data.gov.uk/catchment-planning/>).

Catchment partnership local measures

Measures in the Cherwell catchment

Catchment partnerships: The Cherwell and Ray catchment partnership is hosted by the Berks, Bucks and Oxon Wildlife Trust (BBOWT) and consists of the Environment Agency, Natural England, Cherwell District Council, Banbury Town Council, Thames Water, the RSPB, Upper Thames Fisheries Consultative, and the National Farmers' Union (NFU).

The priority river basin management issues to tackle in this catchment, affecting both surface water and groundwater, are diffuse pollution from agricultural run-off, pollution from waste-water (including from sewage treatment works) and heavily modified channels.

Contribution to environmental outcomes for 2021

- **Cherwell:** A project focusing on restoring a more natural river channel and fish passage through Spiceball Country Park in Banbury, a well-used public amenity, will result in improvements in the status of fish, invertebrates, macrophytes and sediment in the River Cherwell by 2021. It will also engage with local communities to raise awareness about sustainability, water quality and biodiversity.
- **Oxon Ray:** A project to implement measures described following a walkover survey will reduce diffuse pollution and sediment input from agriculture.

Future aims

Ideas for additional measures with £100,000 per year:

- **Cherwell:** Action on the River Cherwell to create more backwaters between Banbury and Oxford, involving landowners, BBOWT and community groups. This will re-naturalise the river corridor, attenuate water flow and provide habitat for fish and invertebrate species. (If £100,000, one backwater; if more funding available then more sites will become possible).
- **Oxon Ray:** Initiate landowner engagement and advisory programme similar to Catchment Sensitive Farming in the Ray catchment. This will reduce agricultural diffuse pollution and increase resilience to flooding events.
- **Cherwell:** Action on River Cherwell to monitor and quantify abstraction issues with the Oxford Canal.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- **Cherwell:** Major infiltration project in the catchment, with involvement of Thames Water and the NFU, involving landscape interventions designed to increase surface water infiltration, increase water storage capacity and attenuate overland flow during peak rainfall events (with potential benefits for some flood alleviation). This will help to resolve rural diffuse pollution and phosphate failures.
- **Oxon Ray:** Major restoration projects along the River Ray re-instating natural river features and riparian habitat. This will improve water quality and nutrient cycling, increase habitat for fish and invertebrates, provide some benefits for flood alleviation, ecosystem services and benefits for leisure, education and public access.

Further information on the partnership is available from: <mailto:info@bbowt.org.uk>.

Catchment partnership local measures

Measures in the Colne catchment

Catchment partnership: The Colne Catchment Action Network (ColneCAN) core group includes Affinity Water, Thames Water, Colne Valley Fisheries Consultative, Hertfordshire and Middlesex Wildlife Trust, Hertfordshire County Council, Buckinghamshire County Council, Chilterns Conservation Board, Colne Valley Park, River Chess Association and the Environment Agency. The ColneCAN is working with many others to address the challenges in the catchment, an area of serious water stress and significant growth demands.

Priority issues include changes to natural level and flow of water, pollution from waste water, transport infrastructure and rural areas, and the extent of physical modifications such as weirs and concrete channels.

Contribution to environmental outcomes for 2021

- To support ambitious abstraction reductions, Affinity Water will invest over £2,000,000 to improve river morphology and habitat, and undertake other improvements with local people and landowners. The work, together with Environment Agency investment of £190,000 in 2015/16 (raised from abstraction licence fees), will improve river function and resilience, which will secure public benefits and contribute to improved status of the Misbourne, Ver and Gade chalk rivers in Buckinghamshire and Hertfordshire.
- With a £10,000 contribution from the Box Moor Trust (the riparian landowner), the partnership is supporting a £54,000 project to restore and enhance connectivity, river function and provide some flood resilience benefits to a 1km stretch of the river Bulbourne in Hertfordshire.

Future aims

Ideas for additional measures with £100,000 per year:

- Devise and implement phase 2 of the river Bulbourne restoration project to achieve a further 1km of improved water body.
- Support a programme to produce or update flood modelling for priority water bodies in the catchment, in order to support and facilitate decision making for river restoration projects.
- Establish a new programme, 'Weir today Gone tomorrow' to focus on removal or adaptation of modifications. Addressing a minimum of 3 barriers per year and opening up a minimum of 2km of impacted river per year to contribute to status/element level improvements.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Lead 'Catching the Colne', a programme to increase engagement and enjoyment of key sites along the Colne Valley, (River Colne and tributaries) improve access for local communities, and implement a minimum of 10km of river and riparian improvement per year.
- Establish and co-lead a national chalk streams restoration and stewardship programme to build capability, encourage support and secure funding for additional improvements to UK chalk streams. Establish a chalk streams discovery centre on the River Chess to showcase and celebrate the water environment, and to secure interest and commitment towards chalk stream stewardship and improvement.

Further information on the partnership is available at: <http://www.colnecan.org.uk/>.

Catchment partnership local measures

Measures in the Cotswold catchment

Catchment partnerships:

Evenlode – hosted by Wild Oxfordshire with a group that includes the Environment Agency, Natural England, the Forestry Commission, West Oxfordshire District Council, Atkins, The Cotswolds Fly Fishers, Cotswolds Rivers Trust, Berks, Bucks and Oxon Wildlife Trust (BBOWT), Wychwood Project, Oxford University and the Sylva Foundation.

Windrush – hosted by BBOWT and consists of a similar mix of statutory organisations, non-government organisations, councils and local interest groups such as the Evenlode.

The priority river basin management issues to tackle in both catchments, affecting both surface water and groundwater, are diffuse pollution from agricultural run-off, point source pollution and poor habitat.

Contribution to environmental outcomes for 2021

- **Evenlode** - tackling rural diffuse pollution and impoundments to improve the status of fish, sediments and phosphate in the River Glyme. Engage in community-based actions to benefit water quality and biodiversity. 25% of the £100,000 project fund comes from government grant in aid. A Payment for Ecosystem Services scheme is being developed for a landscape-scale infiltration project.
- **Windrush** - preventing rural diffuse pollution at source (for example, cattle poaching) and repairing associated bankside damage in the upper catchment will result in improvements in the status of fish, sediments and phosphate. A landscape-scale river restoration project and a wetland creation project are being developed.

Future aims

Ideas for additional measures with £100,000 per year:

- **Evenlode** - to mitigate remaining impoundments and re-naturalise the Glyme from Stratford Bridge to Glympton involving the local authority, landowners and community groups. This will join up restored areas and tackle rural diffuse pollution.
- **Evenlode** - address barriers to fish passage and create in-channel habitat enhancements at Charlbury. This will help resolve failures in fish, invertebrate and macrophyte populations and improve amenity and recreational value.
- **Windrush** - a fish passage and wetland creation project at the confluence of Great Brook and Thames; this will create a backwater refuge for fish and invertebrates and provide some additional flood storage and resilience capacity.
- **Windrush** - further action to address rural diffuse pollution and channel damage.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- **Evenlode** - infiltration project, involving strategic woodland planting and other landscape interventions to attenuate overland flow during peak rainfall events (with potential benefits for flood alleviation and climate change resilience). It will tackle rural diffuse pollution and phosphate failures, and contribute to Biodiversity 2020 targets. It is part of a wider partnership project across the Upper Thames tributaries.
- **Windrush** - major project to restore degraded ecosystems along the river from the source of Thames to Oxford. It would target connectivity of riparian and aquatic habitats and contribute to improving flood management, water quality, soil quality and recreation. It would seek to establish more integrated environmental governance across the Upper Thames and promote further academic research.

Further information on the Windrush partnership is available at: <mailto:info@bbowt.org.uk> and for the Evenlode: <mailto:hilary@wildoxfordshire.org.uk>.

Catchment partnership local measures

Measures in the Darent catchment

Catchment partnership

The Darent and Cray are co-hosted by the North West Kent Countryside Partnership (NWKCP) and the South East Rivers Trust (SERT). There are 2 Catchment Improvement Partnerships, one for the Darent and one for the Cray. Members of these include, Dartford Borough Council, Sevenoaks District Council, the London Boroughs of Bexley and Bromley, Westerham Town Council, Farningham Parish Council, Kent Wildlife Trust, Thames21, the Environment Agency, Campaign for the Protection of Rural England, the National Farmers' Union, Kent Downs Area of Outstanding Natural Beauty, Darent River Preservation Society, Dartford and District Angling Preservation Society, Kent Fisheries Consultative Association, Darent Valley Consortium, Darent and Cray Valley Catchment Consultative, West Kent Cycle Touring Club, the Darent Valley Trout Fishery, the Kent Fisheries Consultative Association and the Darent and Cray Catchment Consultative.

The priority issues identified in the catchment are diffuse pollution, improve modified physical habitats, and invasive non-native species (INNS).

Contribution to environmental outcomes for 2021

- Thames21 River Keeper team will continue to provide community engagement and educational activities, which raise awareness of the importance of the Cray, its habitats and ecology. They will deliver habitat improvements within the river. Thames21 provides over £30,000 to the catchment per year.
- NWKCP and SERT are working together on a £41,000 project to improve fish passage on the upper Darent. The creation of a bypass channel around a large structure will reconnect over 1.5km of the river near Sundridge.
- Angling clubs will continue to provide habitat improvements to the river and lakes. Projects include reduction of shading, creation of low flow channels, pool and riffle features, artificial margins, and monitoring of invertebrates and water levels within the river. This voluntary work contributes over £20,000 to the catchment each year.

Future aims

Ideas for additional measures with £100,000 per year:

- Expansion of the INNS control programme focusing on both flora and fauna. Increasing the survey areas, treatments, provide training and develop a volunteer surveyor programme and providing an awareness raising campaign.
- Development of Ecosystems Services projects to improve aquifer recharge.
- Investigation and project development to reduce impacts of physical modifications such as the weirs at Hawley and Hall Place.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Improve opportunities for fish passage on large structures in the river and provision of extensive channel restoration.
- Implement the Marlborough Park Master Plan, which includes reinstating meanders of the River Shuttle, re-profiling of the river banks and removal of hard engineering.
- River restoration at Eynsford, working with local landowners to develop traditional grazing regimes and habitat management for the benefit of local wildlife and communities.

Further information on the partnership is available at: www.nwkcp.org/darent-and-cray-catchments.

Catchment partnership local measures

Measures in the Gloucestershire and the Vale catchment

Catchment partnerships:

Upper Thames: The partnership is hosted by the Farming and Wildlife Advisory Group and includes the Countryside and Community Research Institute (CCRI) and a broad and inclusive partnership made up of 210 members covering public, private and third sector organisations with an interest in the catchment.

Ock: The partnership is hosted by the Freshwater Habitats Trust and includes the Environment Agency, Natural England, the Forestry Commission, Vale of White Horse District Council, Berks, Bucks and Oxon Wildlife Trust, Abingdon Naturalist Society, Ock Valley Flood Group, South Abingdon Flood Action Group, Upper Thames Fisheries Consultative, Oxford University and 3 independent expert ecologists.

The priority river basin management issues to tackle in both catchments, affecting both surface water and groundwater, are rural diffuse pollution, point source pollution and poor habitat.

Contribution to environmental outcomes for 2021

- **Upper Thames:** The Water with Integrated Local Delivery (WILD - <http://www.fwagsw.org.uk/what-we-do/projects/>) project works with local communities, farmers and environmental groups to improve water quality, reduce flood risk and enhance biodiversity.
- **Ock:** A river restoration project to improve the status of invertebrates in the Sandford Brook by 2021. Located in the town of Abingdon, it will also increase public access, provide recreational benefits and engage the local community to take ownership of their water environment through environmental monitoring and practical river restoration days.

Future aims

Ideas for additional measures with £100,000 per year:

- **Upper Thames:** To continue to roll out the implementation of the Community Guide to the Water Environment (<http://www.acre.org.uk/cms/resources/comm-guides/communityguidewater.pdf>) to engage land managers and communities in delivering integrated water management, increase resilience and deliver multiple benefits for the water environment, improving water quality and reducing flood risk.
- **Ock:** Engage landowners to adjust land management through land use models to reduce flood risk, diffuse pollution, taking into account the effect of sewage treatment work (STW) improvements. Take an upstream to downstream approach and protect and build out from the freshwater, standing water and wetland 'hot-spot' locations.

Ideas for additional measures with £100,000 per year (as above plus the following):

- **Upper Thames:** To test and implement innovative solutions to pollution from STW and land management in order to reduce the impact of rural diffuse pollution and point source pollution. Prioritising coordinated action to enhance river habitats and increase the natural resilience (for example, non-native invasive species) across the whole river system.
- **Ock:** Extend downstream existing river 'hot-spot' sections, create water quality buffers around key freshwater and wetland sites, implement measures for species of conservation concern and install clean water ponds and wetlands across the catchment.

Further information on the partnership is available at:

Upper Thames: <http://www.fwagsw.org.uk/what-we-do/projects/esters-page/>

Ock: <http://www.freshwaterhabitats.org.uk/>

Catchment partnership local measures

Measures in the Kennet catchment

Catchment partnership: The Kennet catchment partnership is hosted by Action for the River Kennet and includes representatives from the local community, Atkins, the Canal and Rivers Trust, Centre for Ecology and Hydrology, the Environment Agency, the Kennet and Avon Canal Trust, the Kennet and Pang Fishery Action Plan Stakeholder Group, Kennet Valley Fishery Association, Natural England (NE), Reading and District Angling Association, Thames Water and West Berkshire District Council. The priority river basin management issues to tackle in this catchment are interrelated and are nutrients, sediments and algal growth; channel modification and degradation of habitats; and pressures from abstractions within the catchment.

Contribution to environmental outcomes for 2021

- Significant habitat restoration and fish passage projects are underway and planned in the Middle Kennet and Lambourn. These will improve fish populations and improve hydromorphology by reducing the impact of impoundments. Funded by combination of the Environment Agency, NE and private funds.
- Small scale restoration projects in the middle and lower Kennet with volunteer input are joining the gaps between significant scale habitat restoration works.
- Projects working with farmers to reduce nitrate and phosphate pollution are underway and planned in the Middle Kennet and tributaries with funding from NE and the Environment Agency bolstered by additional funding and 'in kind' assistance from partners.
- Public outreach projects (for example, Yellow Fish and 'You poo too') to reduce pollution from sewers and roads are underway for the entire catchment.
- Water efficiency projects 'Care for the Kennet' are helping households to use less water in the Upper and Middle Kennet.
- A cross catchment partnership project, funded by Defra, will improve understanding of the impact of septic tanks and develop ways to reduce pollution from them.
- Urban habitat restoration and fish easements to address low fish populations are planned for the Lower Kennet.
- Continue to work with Thames Water on abstraction issues in the Kennet, including the construction of pipeline from Axford to Swindon to be completed in 2016.

Future aims

Ideas for additional measures with £100,000 per year:

- complete the Upper Kennet Habitat Restoration Plan projects
- implement a Lower Kennet Habitat Restoration plan to bring the poorest water bodies to good status by resolving failures in fish, invertebrate and plant populations and improving amenity and recreational value
- improve understanding of the relationship between water quality and algal growth and implement a plan to reduce the problems of algae and its impact on plants
- agree a strategy for resolving the issue of the interaction between the Kennet and Avon canal and the River Kennet

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- improve water quality in Kennet and Avon canal to reduce its impact on the river
- take actions to improve treated waste water from small point source inputs
- review water management in the upper Kennet and improve water efficiency

For current information on the Kennet catchment partnership contact ARK: <mailto:info@riverkennet.org> and see the partnership website: www.kennetcatchment.org

Catchment partnership local measures

Measures in the Loddon catchment

Catchment partnership(s): The Loddon catchment partnership is formed of a steering group made up of Hampshire and Isle of Wight Wildlife Trust, the Environment Agency, the Loddon Fisheries and Conservation Consultative, the Loddon Basin Flood Action Group, Affinity Water (also representing Thames Water and South East Water), Natural England, Hampshire County Council, Wokingham Borough Council, the National Farmers' Union, Berkshire Buckinghamshire and Oxfordshire Wildlife Trust and the University of Reading.

The priority river basin management issues to tackle in this catchment are:

- habitat and biodiversity, including channel structure and function, barriers to fish passage, habitat management and flood plain connectivity
- water quality. in particular phosphorus, sediment and pesticides
- water quantity (flooding and abstraction)

Contribution to environmental outcomes for 2021

- The Loddon Farm Advice Project focuses on rural diffuse pollution across the catchment. The project aims to improve the status of phosphate and fish in 3 water bodies by 2021 as well as reducing the impacts of pesticides on public drinking water abstractions. Currently 80% of the funding comes from government grant although alternative funding streams are being investigated. The cost of the measures will be in the region of £200,000 over 6 years.
- Several projects currently in place include action to reduce the impact of invasive non-native species, raising awareness of riparian habitat management with landowners and holding an annual 'Rivers Week' to increase engagement with the public.
- The Loddon catchment partnership is also involved in a joint project with other nearby partnerships to raise awareness of the issues of phosphorus from domestic waste water inputs and to address problems associated with septic tanks and misconnections contributing to algal blooms in the rivers.

Future aims

Ideas for additional measures with £100,000 per year:

- Carry out a River Whitewater structures and habitat improvement project to improve the status for fish in the River Whitewater.
- Increase the scope of the Loddon Farm Advice Project to address rural diffuse pollution across the catchment to help protect public drinking water abstractions.
- Work with the Loddon Basin Flood Action Group to develop flood mitigation projects that also deliver river basin management objectives.
- Influence and encourage sustainable development for the water environment to aid climate change adaptation and mitigation.
- Engage with communities to take ownership of their local water environment and provide education and training opportunities.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Return water corridors in the Loddon catchment to a near natural state providing social, flood risk mitigation and biodiversity action plan habitat benefits.
- Identify and reduce pollution in water bodies across the catchment, with the University of Reading developing tools for evaluation and planning. These will be used in the Loddon catchment and could also be made available for use in other catchments.

Further information on the partnership please email: <mailto:Loddon.Catchment@hiwwt.org.uk>

Catchment partnership local measures

Measures in the London – Beverley Brook catchment

Catchment partnership

The Beverley Brook Catchment Partnership is hosted by the South East Rivers Trust. The Steering Group is made up of the Environment Agency, The Royal Parks, Wimbledon Common Conservators, Friends of Barnes Common, London Boroughs of Richmond, Wandsworth, Sutton and Merton, Royal Borough of Kingston, Wildfowl and Wetlands Trust, Thames21, London Wildlife Trust and Thames Water.

The priority river basin management issues to tackle in this catchment are:

- poor water quality due to diffuse pollution from road run-off and misconnected pipes
- high phosphate levels originating from effluent from the sewage treatment works
- physical modifications that have been made to the river leading to a uniform channel with poor hydromorphological and habitat diversity

Contribution to environmental outcomes for 2021

A project to enhance the Beverley Brook through Richmond Park has been funded by the Environment Agency's Environment Programme, the Catchment Partnership Action Fund, Friends of Richmond Park and other sources. This project will enhance river habitat throughout the park with the creation of a backwater, bank softening, 500m of in-channel improvements and measures to control the impacts from deer and dogs. The project also aims to improve water quality by working on outfalls to reduce silt and other contaminants entering the river.

Future aims

Ideas for additional measures with £100,000 per year:

- Habitat and hydromorphological enhancements throughout the Beverley Brook and its tributaries to support fish, plant and invertebrate populations as well as enhance natural processes ecosystem and flood resilience. Measures include removal of redundant bank reinforcements, bank softening, tree management, installation of woody material, backwater creation and habitat restoration. Key locations include Barnes Common, Vine Road Recreation Ground, Leaders Gardens, Palewell Common, Richmond Park (additional to the above), Wimbledon Common, Malden Park Golf Course, Beverley Park, Worcester Park, and Morden Cemetery as well as Motspur Park and Morden Park on the Pyl Brook tributary.
- Locally targeted campaigns to raise awareness among domestic properties and businesses about misconnections, only flushing water down sinks and drains, and promoting water efficiency measures.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Retrofitting of sustainable drainage systems (SuDS) and other water management measures throughout the catchment to improve water quality and reduce the flashy nature of the river due to high volumes of run-off.
- Control and reduce road run-off through the installation of sediment interceptors, such as hydrodynamic vortex chambers, on all surface water drains.
- Full river restoration through Richmond Park, Beverley Park and Barnes Common.
- Fish passage enhancement at Horne Way Weir through full removal with re-routing the sewer pipe or low flow fish passage enhancement measures.

Further information on the partnership is available at: [The South East Rivers Trust \(SERT\) | Part of the Wandle Trust: Reg. Charity No. 1091000w.](#)

Catchment partnership local measures

Measures in the London - Brent catchment

Catchment partnership: The Brent catchment partnership is an informal group of organisations committed to working together to improve the rivers, the Grand Union Canal and the Brent Reservoir in the Brent catchment in north and west London. The members include charities, community groups, borough councils, private businesses and government agencies.

The partnership's priority Water Framework Directive issues are reducing pollution, making rivers more natural, and tackling invasive non-native species.

Contribution to environmental outcomes for 2021

- A £500,000 project funded by the London Borough of Harrow and the Big Green Fund is creating wetlands as part of a flood storage and river restoration project at Stanmore Marsh, including mitigation measures and improvements to invertebrates, macrophytes and water quality elements in 1 water body.
- With £4,000 River and Wetland Community Day funding, Thames 21 is working with the London Borough of Ealing to engage volunteers in installing in-channel enhancements on the lower Brent through Ealing, contributing to putting mitigation measures in place and to improvements in fish and invertebrates in 1 water body.
- Two more improvement projects are planned. A backwater will be created and a weir will be notched at Greenford Island, while £50,000 of Section 106 funding will contribute to improving a reach of the Brent in Hendon. These mitigation measures will benefit fish and invertebrates in 2 water bodies.

Future aims

Ideas for additional measures with £100,000 per year:

- Catchment-wide engagement and training of community volunteers in invasive species management and removal techniques, with benefits for macrophytes and putting mitigation measures in place in 8 water bodies.
- Habitat projects across the catchment involving volunteers, removing timber bank reinforcement and enhancing banks and margins, with benefits for macrophytes, fish and invertebrates in 4 water bodies.
- Citizen science water quality monitoring and training to do 'walkovers', to record and report pollution incidents, to gather information on the state of the rivers and target further action to improve water quality elements.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Transforming up to 10 km of heavily modified river to a more natural condition, including restoration projects in Tokyngton Park and Queensbury Rec, managing invasive species and engaging and educating the community. This will result in improvements for fish, invertebrates and macrophytes in at least 2 water bodies, with benefits for flood storage and improved access along the river corridor.
- Install reed beds or other pollution interceptors at priority sites such as Coston's Brook, the Mutton Brook and the Crouch Brook, resulting in improvements in phosphate, dissolved oxygen and ammonia in 4 water bodies.
- Strategic review of barriers to fish, and implementation of fish passage at priority weirs. This will improve fish populations and angling opportunities in 3 water bodies.

Further information on the partnership is available at:

<http://www.brentcatchmentrivers.org.uk/>

Catchment partnership local measures

Measures in the London - Crane catchment

Catchment partnership: The Crane Valley Partnership is a collaboration between charities, community groups, private businesses, government agencies and the 5 borough councils that border the River Crane and Yeading Brook (Harrow, Hillingdon, Ealing, Hounslow and Richmond-upon-Thames).

Priority Water Framework Directive issues for the partnership are clean, clear water; monitoring to identify issues and evaluate projects; and an accessible, natural looking and functioning river, rich in habitats and wildlife.

Contribution to environmental outcomes for 2021

- 8 confirmed projects will create backwaters and wetlands at Crane Meadows, Donkey Wood, Mill Road and the middle River Crane; selective tree removal, appropriate aquatic planting and installation of woody debris berms at Cranebank and Gutteridge Woods; eel passage at Kidd's Mill and Mogden. Cost of measures is £350,000, contributing to improvements in the status of fish, invertebrates and macrophytes in 2 water bodies.
- Duke's River enhancements downstream of Kneller Gardens, supported by the Big Green Fund and Section106 funding, costing £420,000 - mainly improving access and amenity value, but will also put 50% of mitigation measures in place in 1 water body.
- 'Citizen Crane' community monitoring projects for phosphorus levels, invertebrates, and polluted outfalls, resulting in identification of pollution hotspots and incidents; improvements to Heathrow Airport's Eastern Balancing Pond. Action as a result will improve water quality elements in 3 water bodies.

Future aims

Ideas for additional measures with £100,000 per year:

- Ongoing, co-ordinated programme for the catchment-wide control of invasive species and planting of indigenous species to slow the spread of invasive plants and increase the abundance of indigenous marginal plants.
- Natural River Project along 4km of the River Crane and Yeading Brook: in-channel habitat enhancements, backwater creation, tree works and removal of wooden bank protection to put mitigation measures in place and resolve failures in fish, invertebrate and macrophyte populations; improve amenity and recreational value; and improve resilience during pollution incidents.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- 'Only Rain in Rivers' pollution awareness campaign throughout the Crane catchment to reduce the impact of pollution from misconnections and incidents.
- Strategic review of barriers to fish passage and implementation of fish passage at priority weirs. This will improve fish populations, with improved angling opportunities, in 3 water bodies.
- Lower Crane River Restoration: removal of 2km of concrete channel in public open spaces downstream of Mereway Road. This will improve fish, invertebrate and macrophyte populations in 1 water body, with benefits for flood storage, access and recreation, and education.

For further information on the Crane Valley Partnership see their website <http://www.cranevalley.org.uk/> or contact <mailto:ilse@greencorridor.org.uk>

Catchment partnership local measures

Measures in the London - Hogsmill catchment

Catchment partnership

The Hogsmill catchment partnership is hosted by the South East Rivers Trust. The Steering Group is made up of the Environment Agency, Royal Borough of Kingston Upon Thames, Epsom and Ewell Borough Council, Surrey County Council, Sutton and East Surrey Water, Thames Water, Kingston University, The Environment Trust, Kingston Environment Centre, the Zoological Society of London, Surrey Wildlife Trust, London Wildlife Trust, the Lower Mole Project and representation from Quadron, the Thames Angling Conservancy and the London Bat Group.

The priority river basin management issues to tackle in this catchment are:

- poor water quality due to diffuse pollution from road run-off, point source pollution from misconnected pipes, and phosphate from the Hogsmill sewage treatment works (STW)
- physical modifications such as reinforced bed and walls, the installation of weirs, channel straightening and disconnection from the flood plain
- poor hydromorphological and habitat diversity

Contribution to environmental outcomes for 2021

- A habitat enhancement project in the upper reaches of the Hogsmill in Ewell has been funded by the Catchment Partnership Action Fund. This project will enhance the habitat for fish, invertebrates and other wildlife.
- Volunteers will help to monitor the condition of the river through the Riverfly Monitoring Initiative and a pollution monitoring programme. Volunteers will also help deliver river and catchment based enhancements.
- Fish passage will be enabled past the weirs and concrete channel at the Hogsmill sewage treatment works through a project funded by Thames Water.

Future aims

Ideas for additional measures with £100,000 per year:

- Identify sources of pollutants and contaminants using citizen science such as phosphate upstream of STWs. Locally targeted campaigns to raise awareness with domestic properties and businesses about misconnections, what goes down drains, and promoting water efficiency measures.
- Begin tackling urban diffuse pollution through the installation of sediment interceptors, like hydrodynamic vortex chambers, on surface water drains.
- Habitat and hydromorphological enhancements throughout the Hogsmill to improve natural processes for fish, plant and invertebrate populations. Control of Himalayan balsam and Japanese knotweed to prevent sediment ingress.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Major river enhancement and restoration projects at Chamber Mead and Elmbridge Meadows. This could provide significant flood alleviation benefits.
- Retrofitting of sustainable urban drainage systems throughout the catchment to improve water quality. Design and delivery of collaborative projects to reduce flood risk by natural flood management.
- Replacement or modification of the Kingston Gauging weir to enhance fish passage and provide replacement gauging.

Further information on the partnership is available at: www.southeastriverstrust.org

Catchment partnership local measures

Measures in the Lower Lea North catchment

Catchment partnership

The Lower Lee catchment partnership comprises Hertfordshire and Middlesex Wildlife Trust, the Environment Agency, Affinity Water, Groundwork Hertfordshire, Herts County Council, Natural England, Lea Valley Regional Park, the Rt Honourable Charles Walker MP, Fishers Green Angling Consortium, Waltham Abbey AC, Rural Angling Society, Kings Weir Fishery, Cheshunt Natural History Society, Hoddesdon Society, London Anglers' Association, Kings Arms and Cheshunt and the Palmers Green Angling Societies and the Hertford Angling Club.

The priority issues in the catchment are poor water quality from waste water treatment, pollution incidents and misconnections, pollution and poor water quality from urban run-off and historic land use and physical modifications for urbanisation and flood protection.

Contribution to environmental outcomes for 2021

'Conserving Slimy Wrigglers' aims to address the specific issue of structures on the Lower Lea that prevent the movement of eels as many of the rivers in the catchment are failing to meet their ecological potential due to poor fish populations. This collaboration with the Upper Lea catchment partnership will aim to design, build and install features to ease eel movement on a maximum of 3 structures.

Future aims

Ideas for additional measures with £100,000 per year:

- Lea tributaries catchment walkover project would aim to improve knowledge and understanding of the tributaries and their importance to the River Lea by monitoring pH, nitrates, phosphates, flora, fauna, turbidity and siltation. This could then be used to identify problems and help develop further projects to improve the status of the water body.
- Establish a Lower Lea riverfly monitoring group to sample and identify a range of freshwater invertebrates on a monthly basis to build up a picture of the river's health, improve knowledge of the catchment, increase public engagement and participation, reduce the frequency and severity of pollution and improve the status of the water body.
- The River Lea fish shelter project would help to restore in-channel diversity, improve habitats and provide shelter for fish during high flows. It aims to reduce the need for restocking by making fish populations self-sustaining, improving the status of the water body.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Promote and encourage the use of sustainable drainage systems in new developments and retrofitting existing sites within the catchment to reduce the impacts of urban diffuse pollution on water quality and flood risk.
- River bank and channel enhancements in the catchment to reduce sediment input and improve wildlife habitat. Promoting the use of willow spiling, deflectors and coir rolls to improve the status for fish, invertebrates and macrophytes.
- Cornmill Stream restoration project to reinstate flow by removing silt and vegetation to improve the status for fish, macrophytes, invertebrates and recreational value.
- The Red House Fishery and the Barbel Spawning Beds projects aim to improve fish spawning habitats by removing silt and using in-channel features to provide areas of clean gravel to improve the status for fish, invertebrates, macrophytes and recreational value.

Further information is available at: <http://www.hertswildlifetrust.org.uk/contact-us> and <http://www.riverleacatchment.org.uk/>

Catchment partnership local measures

Measures in the Lower Lea South (London Lea) catchment

Catchment partnership: There is not currently a formal catchment partnership for the London Lea. As catchment host, environmental charity Thames21 is listening to the wishes and contributions of their Love the Lea campaign supporters and other organisations including the Greater London Authority, All London Green Grid, London Wildlife Trust, Lee Valley Park, Canal and River Trust, Environment Agency, Natural England, and the London boroughs of Enfield, Haringey, Tower Hamlets, Waltham Forest and Hackney. In time, these conversations will inform the development of the Catchment Management Plan.

The priority issues in the London Lea are: water quality, biodiversity, and raising awareness of the rivers of the catchment and how we impact them.

Contribution to environmental outcomes for 2021

- Working with the local community to install reed beds on the Lee Navigation and at Grovelands Park in the Salmon Brook Catchment. These projects will contribute to improvements in water quality elements.
- Installing 'Rain Planters' on schools and community buildings, contributing to improvements in water quality elements.
- Collating information on projects, news and events across the catchment and publicising them on the London Lea catchment website.

Future aims

Ideas for additional measures with £100,000 per year:

- Employ a full-time independent community Partnership Officer to further engage communities, provide volunteering opportunities, coordinate 'friends of' groups and river champions across the catchment in a community focused, 'grassroots' partnership.
- Develop and provide a 'skills through training' programme as part of Thames21's existing accredited training programme; to empower members of the community to effectively engage and raise issues with statutory bodies.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Reduce the frequency and severity of pollution, increasing surface water management at source, leading to improvements in water quality elements in all water bodies (including: 'Rain Planter' (mini SuDS) programme, downpipe disconnection programme, and large scale sustainable drainage projects)
- Restore an ecologically complex structure to the river channels, improving riverine and riparian habitat, river function and sustainability. This will improve macrophytes, invertebrate and fish populations in all water bodies.
- Engage people and communities by improving their knowledge and understanding of the catchment, and of the impact of their behaviour on the water environment. This will result in greater public engagement and participation in improving the catchment's ecology.

Further information on the London Lea is available at:

<http://www.riverleacatchment.org.uk/index.php/london-lea-home>

Catchment partnership local measures

Measures in the London Marsh Dykes catchment

Catchment partnership

The Thamesmead and Marsh Dykes catchment partnership is co-hosted by Thames 21 and the London Wildlife Trust. The steering group is made up of the Environment Agency, local angling groups, London Borough of Bexley, Royal Borough of Greenwich, Peabody Group (in particular Gallions Housing, Tilfen Land, and Trust Thamesmead), and Thames Water.

The priority river basin management issues to tackle in this catchment are:

- de-silting and physical modifications to the Thamesmead canal and lake system
- water quality improvement and community engagement to accrue social and economic benefits
- addressing diffuse pollution and litter

Contribution to environmental outcomes for 2021

- A project to enhance the habitat of the Waterfields Canal has been funded by the Catchment Partnership Action Fund and will be delivered by London Wildlife Trust and Thames 21. This project will enhance habitats for fish and help to improve flow in the canal.
- The Environment Agency's environment programme will provide additional funding for further enhancement works to the watercourses throughout 2015.

Future aims

Ideas for additional measures with £100,000 per year:

- Working in collaboration with the Peabody Group, Thames Water and local authorities complete a canal de-silting programme and introduce a silt prevention regime.
- Work in partnership with current projects to improve community access and engagement with watercourses in the catchment to include linking the Tump 53 and Crossness Nature Reserves.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Major lake and canal restoration projects to improve water quality, fish and invertebrate populations and deliver benefits for public amenity and education.
- Natural watercourse projects along the dykes in the east of the catchment to improve water vole habitat and promote natural habitat awareness among local communities.
- Development of the derelict ecology centre at Tump 52 and Crossway Canal.
- Development of a catchment streams restoration project to improve water bodies within Borstal Woods, and Bedens Stream at the outer areas of the catchment.

Further information on the partnership is available at: www.thames21.org.uk

Catchment partnership local measures

Measures in the London Ravensbourne catchment

Catchment partnership

The Ravensbourne catchment partnership is hosted by Thames21. The steering group is made up of Thames21, the Environment Agency, London boroughs of Lewisham, Bromley and Greenwich, the London Wildlife Trust and the Quaggy Waterways Action Group.

The priority river basin management issues to tackle in this catchment are the physical modifications made to the river, diffuse pollution from urban areas and point-source pollution of sewage.

Contribution to environmental outcomes for 2021

- Creating easier access for eels in the Ravensbourne by installing eel passes on weirs. This project is funded through the catchment partnership action fund.
- Reducing the flooding impact of heavy rain in this urbanised catchment along with improving water quality entering the river through the sustainable urban drainage (SuDS) project. This project was funded by the Environment Agency's environment programme.
- Identify suitable sites for SuDS throughout the catchment. This project has been funded by Patagonia and will be carried out within the 2015/16 financial year.
- Engage with user groups and the wider community for citizen science water-quality testing. This project was funded by the River and Wetland Community Days scheme. It was started during the 3 Rivers Clean Up 2015 and concluded in the autumn.

Future aims

Ideas for additional measures with £100,000 per year:

- Cator Park restoration. Project to include improvements to Cator Park, the Beck and Chaffinch Brook. The River Pool at Cator Park is presently fenced off from public view in a deep, linear concrete channel. This project will reconnect the river with Cator Park for the benefit of wildlife, recreation, aesthetic improvement and an enhanced level of flood protection. It will also include improvement to the river and a Site of Importance for Nature Conservation (SINC) by the removal of weirs and concrete, the reintroduction of meanders and in-stream enhancements and increased marginal vegetation.
- Catchment-wide interpretation boards. These will include a catchment map, an overview of the local biodiversity, links to local groups and volunteering opportunities. There will also be a hotline number to the Environment Agency and Thames Water for reporting pollution, misconnections and incidents.

Ideas for additional measures with £1,000,000 per year:

- Riverview Walk, Sydenham. The project would create a natural river by removing its concrete channel and introducing meanders. This would improve biodiversity, help flood alleviation and create links to the River Pool project.
- Weir removal or modification at Keston Common, Hayes Lane, Dainford Close, Ford Mill, Beckenham Hill at Homebase, Glassmill Lane, 'Steps' Croydon Road, Keston Mark, Padmall Wood and Lewisham to Ladywell. This will improve passage along the river for fish (including eels) and invertebrates.

Further information on the partnership is available at: www.thames21.org.uk

Catchment partnership local measures

Measures in the London Wandle catchment

Catchment partnership

The Wandle catchment partnership is hosted by the Wandle Trust, part of the South East Rivers Trust. The steering group is made up of the Environment Agency, the London boroughs of Sutton, Merton and Wandsworth, Thames Water, Sutton and East Surrey Water, London Wildlife Trust, the Wandle Valley Regional Park Trust, the National Trust and Beddington Farmlands.

The priority river basin management issues to tackle in this catchment are:

- physical modifications made to the river, including impoundments from weirs that prevent fish passage
- urban diffuse pollution, in particular contaminants from road run-off and misconnected pipes
- high nutrient levels due to phosphate introduced from Beddington sewage treatment works

Contribution to environmental outcomes for 2021

- Removal of the Half Tide Weir by the London Borough of Wandsworth, enhancing connectivity and tidal habitat at the confluence of the Wandle and Thames.
- The Trewint Street fish passage project, funded by Thames Water, the Environment Agency and the Catchment Partnership Action Fund, will enhance fish passage over the concrete aprons and structures at Trewint Street in Earlsfield, London.
- River habitat enhancements in Ravensbury Park and other locations as part of the Living Wandle Landscape Partnership Scheme funded by the Heritage Lottery Fund.
- Control and removal of invasive species (undertaken by several partners and a variety of funding sources) including those contributing sediment ingress.
- A sustainable urban drainage project has been funded by the Environment Agency environment programme. The scheme will improve water quality from urban run-off as well as provide flood alleviation benefits.

Future aims

Ideas for additional measures with £100,000 per year:

- removal of all remaining small weirs, such as the weir on the Croydon arm of the Wandle, wherever possible to enhance habitat and restore fish passage
- enhancement of in-stream channel diversity with bank re-grading and the creation of low flow channels and backwaters at multiple locations throughout the river
- a citizen science based water quality and pollution monitoring scheme as well as river enhancement monitoring to help inform the targeting of water quality improvement measures and effective design of river enhancements

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- removal of Shepley Mill, Watermeads, Goat Bridge, Topps Tiles and EDF weirs, with the installation of appropriate structures passable to fish, such as a rock ramp or stepped pool pass where water levels need to be maintained
- full river restoration through Beddington Park, including sustainable lake enhancement, and King George's Park
- installation of sediment traps, such as hydrodynamic vortex chambers, on all significant surface water drains discharging into the river and their incorporation into all new developments

Further information on the partnership is available at: www.wandletrust.org

Catchment partnership local measures

Measures in the Maidenhead to Sunbury catchment

Catchment partnership: The Lower Thames catchment (also known as the Maidenhead to Sunbury catchment) is made up of a steering group consisting of Thames21 (hosts), Thames Landscape Strategy, River Thames Alliance and British Canoeing, the Environment Agency. The wider partnership includes all local authorities from each of the boroughs in the catchment, River User Group 8, 3 angling groups, 10 local community organisations, 1 Local Nature Partnership, and Natural England.

The priority river basin management issues to tackle in this catchment are habitat and biodiversity (including channel structure and function, barriers to fish passage, habitat management), water quality (in particular phosphorus, sediment and pesticides) and collecting evidence.

Contribution to environmental outcomes for 2021

- Many member organisations are currently operating their own projects on the catchment, which implement river basin management mitigation measures and more, such as Thames21 community and volunteer engagement project funded by the Royal Bank of Canada, Thames Landscape Strategy - the Arcadian flood plain, and the River Thames Alliance - Waterways Plan. Opportunities to implement multiple benefit river basin management mitigation measures (e.g. reduce water quality and biodiversity impacts and flood risk) identified in partnership members' own projects will be shared and promoted.
- The Thames Landscape Strategy Project, which will improve connectivity from Home Park to the Thames via the installation of a sustainable urban drainage system (SuDS). This will also give an opportunity to local people to learn about their river and SuDS. This has been funded by a government grant.

Future aims

Ideas for additional measures with £100,000 per year:

- engagement and training of community volunteers in river restoration, invasive species management and putting mitigation measures in place
- small-scale habitat projects with consideration for cross catchment mutual gains involving volunteers to re-naturalise a river corridor and improve water quality, habitat, biodiversity and flood resilience by removing hard banking and planting with marginal native macrophytes, and installing a small scale SuDS reed bed on a priority surface water body

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- high media level promoting of the Lower Thames, for catchment-wide engagement of people and business
- citizen science and accredited training for community volunteers in the catchment area
- strategic review of barriers to fish, and back waters and scope implementation of new design fish passages at priority weirs (for example, Salthill stream and Roundmoor Ditch). This will improve fish populations and habitat for refuge

Further information on the partnership is available at: <http://www.thames21.org.uk/the-maidenhead-to-teddington-catchment/>

Catchment partnership local measures

Measures in the Medway catchment

Catchment partnerships

The Medway co-hosted by the South East Rivers Trust and the Kent Countryside Management Partnerships, with support from Kent Wildlife Trust in the Eden and Upper Medway.

The priority issues identified by the partnership are physical modifications to the river, water quality, and water flows and availability.

Contribution to environmental outcomes for 2021

- The partnership will implement a project to make Harper's Weir fish passable, improving fish passage in the Lesser Teise by linking 3.5km of the river which was previously disconnected.
- The Kent Wildlife Trust has secured funding to carry out restoration and creation of wetland habitats and provide landowner advice for the Eden operational catchment.
- Medway Valley Countryside Partnership (MVCP) has established an invasive non-native plant species (INNS) control and management programme across the Medway catchment.
- MVCP is leading a project to provide 2km of riparian habitat improvements to restore fish habitat and river function on the Hammer Stream in the Beult operational catchment.
- 4 schemes are proposed to remove artificial structures in the Eden, Teise and Beult operational catchments. These are barriers to fish movement and are contributing to problems with flow dynamics, resulting in a build up of fine sediment, pollutants and an impoverished habitat for aquatic life.

Future aims

Ideas for additional measures with £100,000 per year:

- Wetland habitat creation scheme and removal of retention boards along the River Eden. Kent Wildlife Trust working with local landowners and user groups will tackle diffuse pollution, fish passage and river habitat. This will lead to element status improvement in 2 water bodies. Weir removal along 4km of the Lesser Teise, removal of 3 fixed crest weirs, in-channel mitigation and habitat enhancement works. This will help to resolve failures in fish, invertebrate and macrophyte populations and improve water quality.
- Continuation of the control of INNS programme.
- Citizen Science projects to collect data, observations and early warnings. Funding will provide workshops and training events, walkover surveys, sampling, INNS.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Fish pass or removal of 5 structures (East Farleigh lock, Yalding, Leigh, Chafford auto sluice and Ashurst Weir), allowing migratory fish and eels to access 93km of the 112km length of the main river and opening up 14 tributaries for spawning.
- Improve the quality, quantity and connectivity of riparian habitats across key sites in the catchment. Element improvements to 12 water bodies would be possible.
- Maintaining a Healthy Catchment project aims to improve water quality by tackling aggravated erosion, river restoration to make low-flow river channels, which would allow the ecosystem to be more resilient, and improving species diversity by increasing the complexity of aquatic habitats. This will be delivered through education and training of river restoration to empower the community.

Further information on the partnership is available at: <http://www.medwayvalley.org>, <http://www.southeastriverstrust.org/>, <http://www.kentwildlifetrust.org.uk/>, <http://www.khwp.org.uk>.

Catchment partnership local measures

Measures in the Mole catchment

Catchment partnership

The River Mole partnership is jointly hosted by the Surrey Wildlife Trust and The South East Rivers Trust. The steering group includes the Environment Agency, Natural England, Surrey County Council, district councils, Countryside Partnerships, Thames Water, Sutton and East Surrey Water and Sussex Wildlife Trust. The wider partnership is made up of a number of interested organisations, local community groups and landowners.

The priority issues in the catchment are:

- man-made modifications in the river
- pollution from waste water
- diffuse pollution from farmland

Contribution to environmental outcomes for 2021

- Greater fish passage on the lower section of the Pipp Brook, a tributary of the Mole, funded by the Catchment Partnership Action Fund will improve the fish status of the water body.
- East Surrey Rivers Project includes a series of tasks on the Redhill Brook to improve fish passage and habitat. This is funded by the Environment Agency.
- Creation of wetland habitat at Ashted Rye Meadows to improve habitat diversity and flood protection.

Future aims

Ideas for additional measures with £100,000 per year:

- Modification of Horley Weir to allow fish passage into the upper reaches of the Mole.
- Diffuse Pollution and Sustainable Urban Drainage Advice Project to operate throughout the catchment. This would greatly extend a proven mechanism of reducing the impacts of rural and urban diffuse pollution, partially resolving catchment-wide phosphate failures.
- Develop a comprehensive strategy for tackling non-native invasive species.
- Mapping opportunity areas for natural flood management in the catchment to allow implementation of small-medium scale projects such as pond and hedge creation and grass margins.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

Catchment-wide projects with multiple benefits with principal aims to:

- Remove barriers that are impeding fish passage and contributing directly to the local recovery of populations of threatened priority fish species, such as brown trout, Atlantic salmon and European eel, with associated recreational and fisheries benefits.
- Restore natural morphology where man-made modifications exist with channel habitat creation, gravel reintroduction, tree works and back waters, allowing naturalised flow regimes and sediment transport and associated flood management benefits.
- Install fish bypass structures on the 5 weirs of the Lower Mole flood alleviation scheme.

Further information is available at: www.surreywildlifetrust.org/what-we-do/living-landscapes/partnership-and-advocacy

Catchment partnership local measures

Measures in the North Kent catchment

Catchment partnership

The North Kent Catchment Partnership is co-hosted by the Medway Swale Estuary Partnership and South East Rivers Trust. The members include the Environment Agency, Medway Council, Swale Borough Council, Kent County Council, Southern Water, Elmley Conservation Trust, Kent Wildlife Trust, the Royal Society for the Protection of Birds (RSPB), Peel Ports Medway, Faversham Creek Trust, the National Farmers' Union, Friends of the Westbrook Stream, Kent Wildfowling and Conservation Association, Farm for Wildlife, Kent and Essex Inshore Fisheries and Conservation Authority, Rochester Floating Oyster Fisheries and the Medway and Swale Boating Association.

The partnership has identified priority issues in the catchment as:

- water quality, in particular point source pollution from the water industry, rural diffuse pollution and urban diffuse pollution
- physical modifications to the river - changes to the shape and position of the rivers have dramatically altered the river habitat and have introduced barriers to fish movement
- invasive non-native species (INNS) - these have an adverse impact on plants, invertebrates and fish communities within the fresh water bodies and the estuary

Contribution to environmental outcomes for 2021

In order to address the priority issues, the partnership is:

- Carrying out a £41,000 project to start to tackle rural pollution and appraise options to deal with urban diffuse pollution from road run-off on the White Drain.
- Carrying out a project that enhances water vole habitat and reduce rural pollution.
- Liaising with the RSPB on its Seasalter Masterplan to ensure multiple benefits for the catchment. This project involves farm advice to target land management practices for the benefit of breeding birds.

Future aims

Ideas for additional measures with £100,000 per year:

- 4 projects have been identified on the White Drain to improve the aquatic habitat, reduce abstraction, create better fish and eel passage and improve pollution prevention
- land management project to improve water quality and habitat in a Site of Special Scientific Interest (SSSI) nature reserve, currently in unfavourable condition
- continued awareness raising and monitoring of marine non-native invasive species, working closely with local groups such as the RSPB, Kent Wildlife Trust and marina owners

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Catchment-wide wetland project, including the creation of new fresh and brackish wetlands. This will focus on improving biodiversity and creation of on-farm treatment of diffuse and point source pollution from farming activity.
- Saltmarsh creation in the Medway Estuary.
- Increase recreational opportunities like sailing and rowing as well as contributing to Biodiversity 2020 targets.

Further information is available at: www.msep.org.uk/your-estuary-catchment-improvement-plans/ and www.southeastriverstrust.org/

Catchment partnership local measures

Measures in the Roding, Beam and Ingrebourne catchment

Catchment partnership: The Roding, Beam and Ingrebourne catchment partnership includes Thames21, Thames Chase Trust, the Environment Agency, Thames Water, London boroughs of Havering, Redbridge and Barking and Dagenham, the Forestry Commission, Essex Wildlife Trust, London Wildlife Trust, Epping Forest District Council, the RSPB, Friends of the Ingrebourne Valley and Hornchurch Marshes and Brentwood Borough Council.

The priority issues in the catchment are pollution and poor water quality from urban and agricultural run-off and physical modifications for urbanisation and flood protection.

Contribution to environmental outcomes for 2021

The Ingrebourne Sustainable Drainage (SuDS) project focuses on an urban drainage outfall near Squadrons Approach in Hornchurch, impacting on the Ingrebourne marshes, which are a Site of Special Scientific Interest (SSSI). The project aims to reduce phosphates, ammonia, heavy metals and silt from urban run-off entering the SSSI marshes. This involves the creation of a network of pools and swales to slow the water flow, giving time for silt to drop out and enable planted vegetation to filter the water, removing pollutants prior to water entering the main river channel and the SSSI.

Future aims

Ideas for additional measures with £100,000 per year:

- Connecting Communities; encouraging communities to take ownership of water quality in their area. Practical conservation days, training events, misconnection awareness and littering prevention campaigns, water quality monitoring and an Ingrebourne Valley mobile app.
- Development and implementation of a water body wide invasive species identification, monitoring and eradication programme. Surveying for invasive non-native species (INNS) such as mink, Himalayan balsam, floating pennywort and Japanese knotweed.
- Promote and encourage the use of sustainable drainage systems (SuDS) in new developments and retrofitting to existing sites within the catchment to reduce the impacts of urban diffuse pollution and phosphate run-off from fertilisers and herbicides.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Implementation of the Havering Wildlife Project Ingrebourne Restoration Plan. Flood management using natural processes, climate change adaptation, reconnecting people to the environment, improved recreation access and enhanced habitats. This project will improve the status of fish, macrophytes and invertebrates and improve amenity and recreational value.
- Modelling and design proposals for the Harrow Lodge Park Restoration Plan on the Ravensbourne. Ultimately, this will improve the status of fish, invertebrate and macrophyte populations and amenity and recreational value.
- Development and implementation of a water body wide culvert awareness and removal programme. Promoting alternatives to culverting, influencing planning policy and encouraging sustainable development without culverts. This will resolve failures in fish and invertebrates, increase recreational opportunities and contribute to biodiversity.

Further information is available at: <http://www.catchmentbasedapproach.org/thames/roding-ingrebourne>

Catchment partnership local measures

Measures in the South Essex catchment

Catchment Partnership: The South Essex Catchment Partnership (SECP) includes: Thames Chase Trust, Environment Agency, Anglian Water, Essex & Suffolk Water Ltd, Thurrock Council, Essex Wildlife Trust, RSPB, Davy Down Trust, and local volunteers.

The priority issues to tackle in this catchment are: pollution; poor water quality from urban and agricultural run-off; and physical modification due to urbanisation and flood protection.

Contribution to environmental outcomes for 2021

The partnership has a master plan for restoration of the Lower Mardyke. Current funding will improve 1km of the Mardyke by:

- creating new berms to form a narrower river channel with faster flow exposing river gravels and creating new breaches/channels to enhance and restore 20 hectares of riparian habitat
- increasing habitat quality of the Mardyke Valley
- creating a raised viewing point
- raising awareness of issues affecting river catchments and river restoration by hosting public events in the Mardyke Valley
- increasing knowledge and awareness within Thurrock Open spaces staff and the wider public

£31,000 has been awarded by the Catchment Action Partnership Fund to deliver this project.

The SECP aim to enhance and restore a wider part of the lower Mardyke in the future.

Future aims

Ideas for additional measures with £100,000 per year:

- introduce more sustainable urban drainage systems e.g. to reduce the impact of misconnections, road run-off, urban drainage and rural diffuse pollution
- development and implementation of a water body wide invasive species identification, monitoring and eradication programme. Surveying for Invasive Non Native Species
- encourage communities to take ownership of water quality in their area. Practical conservation days, training events, misconnections and littering campaigns, water quality monitoring and a Mardyke Valley mobile app

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Flood management using natural processes, climate change adaptation, reconnecting people to the environment (possible creation of new paid Community Engagement Officer post), improved recreation access and enhanced habitats. This project will improve the status of plants and animals and improve amenity & recreational value.
- Development and implementation of a water body wide culvert awareness and removal programme. Promoting alternatives to culverting, influencing planning policy and encouraging sustainable development without culverts.
- Improve links to the RSPB Purfleet which is currently land-locked in terms of access up to the Mardyke Valley.

More information can be obtained from the Catchment Based Approach (CaBA) website <http://www.catchmentbasedapproach.org/thames/south-essex>

Catchment partnership local measures

Measures in Thame and South Chilterns catchment

Catchment partnerships: There are two partnerships in this management catchment. The Thame partnership is hosted by the Freshwater Habitats Trust and the River Thame Conservation Trust. The South Chilterns partnership is hosted by the Foundation for Water Research. The partnerships include the Environment Agency, Chilterns Chalk Stream Project, Revive the Wye and the Chiltern Society, West Berkshire Countryside Society, West Berkshire Farming and Countryside Project, Aylesbury Vale Council Natural England, Thames Water, Berks, Bucks and Oxon Wildlife Trust (BBOWT), the National Farmers' Union (NFU), Wycombe District Council, Thame Fisheries Consultative, the Royal Yachting Association, Withymead Nature Reserve, North Wessex Downs Area of Outstanding Natural Beauty, Thame Valley Fisheries Preservation Consultative, Cuttlebrook Conservation Volunteers, Save the River Thame and the Watlington Environment Group.

The priority river basin management issues to tackle in both catchments are diffuse pollution from both rural and urban sources; point source pollution and habitat degradation.

Contribution to environmental outcomes for 2021

- **South Chilterns:** Habitat improvement projects on the Wye and Pang, creating a significant number and range of new habitats for fish and invertebrates. The work will also help address poor riverine habitat caused by diffuse pollution from urban surface water drainage and rural diffuse pollution sources, and will reduce flood risk. To date, the projects have been mainly funded by government grants.
- **Thame:** Working with partners in the Lower Thame (including the Chalgrove Brook, the Holton Brook and Kingsey/Cuttle Brooks) to improve water quality and habitats by reducing impacts from point source and diffuse source pollution as well as providing habitat improvement, extending clean water ponds and increasing the amount of wetlands across the catchment. Funding for the project has been provided by government grants and Thames Water.

Future aims

Ideas for additional measures with £100,000 per year:

- **South Chilterns:** Development of recreational access on the Thames at Reading, providing social and economic benefits.
- **Thame:** Assisting the delivery of the overarching strategy for the Thames on this stretch of the river, in partnership with the Earth Trust, including reduction in flood risk.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- **South Chilterns:** The partnership would help Wycombe District Council implement the 'Remaking the Wye' project. An extensive project looking to rejuvenate the Wye and High Wycombe town centre, providing environmental, social and economic benefits.
- **Thame:** Work to remove fish barriers along the Thame river corridor. This will include coordinating improvements to the riverine habitat around Aylesbury and creating areas for biodiversity and community access.

Further information on the partnership is available at:

- **South Chilterns:** <http://www.fwr.org/Catchment/index.htm>
- **Thame:** <http://www.freshwaterhabitats.org.uk/or>
<http://www.riverthameconservation.org/>

Catchment partnership local measures

Measures in the Thames (tidal) catchment

Catchment partnership: The Your Tidal Thames partnership is made up of a Steering Group of catchment hosts, the Thames Estuary Partnership, Thames21, Thames Strategy Kew to Chelsea, and the Thames Landscape Strategy. The Environment Agency and the Port of London Authority also help to steer the partnership. The Steering Group supports a wider partnership, the Strategy Group, which involves many public, private and voluntary sector partners.

The priority river basin management issues to tackle in this catchment are

- the Water (including habitat enhancement, water quality, and flood risk)
- the human element (education, access, and public awareness)
- planning and economic development (including river traffic, commerce, fishing, and riverside redevelopment)

Contribution to environmental outcomes for 2021

- A misconnections project is being rolled out over 2015-16 targeting the issue of waste water going into the surface water network. The partnership will work with Thames Water to identify the polluted outflows in the Upper and Middle Tidal Thames water bodies. The partnership will engage with volunteers, schools and builders merchants to deliver sustainable drainage systems (SuDS).
- The partnership is liaising with the Environment Agency's Thames Estuary 2100 project to achieve greater public access and habitat restoration, particularly inter-tidal habitat in the estuary, from any capital works on flood defence.
- An EU Horizon 2020 bid, worth £0.5 million to the catchment, is in the second stage. It will focus on ecosystem services and suitable mitigation measures for estuaries. It will include intertidal habitat creation, opportunities for vertical or artificial foreshore, and retrofitting of existing structures. For an update on this project visit www.yourtidthames.org

Future aims

Ideas for additional measures with £100,000 per year:

- Develop the infrastructure needed to deliver and maintain community led projects within the tidal Thames. This will include maintaining the momentum and monitoring successes. Projects could involve ecologically functioning community gardens and SuDS.
- Work with the planning departments of all 17 riparian local authorities along the tidal Thames and the numerous community development organisations. Maximise sustainable development through innovative partnerships between developers, NGOs and local community groups and 'honest broker' support by the catchment partnership.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Major intertidal habitat restoration projects where large scale habitat creation opportunities exist. 37 hectares could be created, with sites at either end of the catchment, both estuary and tidal limit. These would include pre and post monitoring to ensure data is contributed to river basin management targets and to build a robust scientific database for the estuary with evidenced improvements.

Further information on the partnership is available at: <http://www.yourtidthames.org>

Catchment partnership local measures

Measures in the Upper Lee catchment

Catchment partnership: The Upper Lee catchment is home to a number of partnership groups. Membership varies, but at their core are landowners, angling groups, campaigning groups, and local interest organisations. Membership also includes Affinity Water, Thames Water, Groundwork Luton and Beds, Hertfordshire and Middlesex Wildlife Trust, Luton Borough Council, Hertfordshire County Council, Cranfield University, Luton Airport, Vauxhall and the Environment Agency. All have assisted a better understanding of problems and the health of the water environment in an area of serious water stress and significant growth expectations.

Priority issues include low flows in rivers, pollution from waste water and from rural and urban areas, and modifications, structures and changes to the natural form of rivers.

Contribution to environmental outcomes for 2021

- Affinity Water will invest over £1,000,000 to improve river morphology and undertake other improvements with landowners and local communities. Together with additional investment of £265,000 in 2015/16 (raised from abstraction licence fees), the work will improve river function and resilience, contributing to improved status of the Mimram and Beane chalk rivers in central Hertfordshire.
- Working with Luton Borough Council and Groundwork Luton, the local partnership will invest multi partner funding of around £200,000 to construct at least 1 sustainable drainage system (SuDS) in a public green space, which will help reduce flood risk and improve habitat and water quality of the River Lea in Luton. The project will be complemented by £70,000 of funding from Thames Water for the development and support of a community engagement programme to connect people to the River Lea, and to support volunteer environmental monitoring.

Future aims

Ideas for additional measures with £100,000 per year:

- Build further green space SuDS connecting to the Lea in Luton, to mitigate the impact of polluted urban run-off and improve the quality of water entering the Lea and its tributaries. Remove or adapt a minimum of 3 barriers/weirs per year, opening up a minimum of 2 km of impacted river per year.
- Support and develop a network of Living River Champions for every water body in the catchment to lead community level rivers groups. Harness local effort to shape a funding bid to achieve and monitor improvements on at least 1 water body, and engage more people with the health and history of their river.
- Support a programme to produce or update flood modelling for priority water bodies in the catchment, to support and facilitate timely and confident decision making for river restoration projects.

Ideas for additional measures with £1,000,000 per year (as above plus the following):

- Build a network of SuDS in a further 6 urban green spaces across the catchment to contribute to status improvement of at least 3 water bodies.
- Establish and co-lead a national chalk streams restoration and stewardship programme to improve understanding, build capability, encourage support and secure funding to achieve additional improvements to UK chalk streams. Secure improved protected status designation for all chalk streams in the catchment.

Further information on the partnerships is available at:

<http://www.riverleacatchment.org.uk/index.php/london-lea-home>

Catchment partnership local measures

Measures in the Wey catchment

Catchment partnership(s): The Wey Landscape Partnership is made up of the Environment Agency, Natural England, relevant local authorities and utilities, the Wey Valley Fisheries Consultative Association, Surrey and Hampshire Wildlife Trusts, the National Trust, River Wey Trust and Northern Wey Trust. The priority river basin management issues to tackle in this catchment are diffuse pollution from rural areas, barriers to natural fish movements and migration, and invasive non-native species.

Contribution to environmental outcomes for 2021

- Guildford Borough Council's Slyfield Area Regeneration project, incorporating re-location/upgrade of the local sewage treatment work and a major river restoration scheme at Burpham Court Farm on the Lower Wey (Shalford-Weybridge) water body, with significant improvements to multiple biodiversity elements as well as phosphate failures. Additional benefits include improved local flood alleviation and recreational opportunities.
Several ongoing cross-catchment advisory projects will continue to operate throughout this cycle, including Wey RiverSearch (a voluntary river wardening project using trusted citizen science data collection techniques to inform, prioritise and implement local riparian habitat enhancement measures); as well as the Wey Diffuse Advice Project (land-use diffuse pollution risk-analysis and follow-up land-owner engagement).

Future aims

Ideas for additional measures with £100,000 per year:

- Implement Lower Wey Oxbow Restoration Project to enhance and restore the main Wey river channel. This would enhance riparian habitats and restore river function on several heavily modified water bodies in the lower catchment, improving approximately 15 km of river.
- Wey Diffuse Advice Project throughout the catchment. This would greatly extend a proven mechanism of reducing the impacts of rural and urban diffuse pollution, thus helping resolve catchment-wide problems with high levels of pesticides, phosphates and sediments impacting on river life and public drinking water abstractions.

Ideas for additional measures with £1,000,000 million per year (as above plus the following):

- Major river restoration projects at Bishops Meadow and Snails Lynch on the North Wey in Farnham, and at Woking Palace on the Lower Wey. These would help improve fish, invertebrate and macrophyte communities; offer increased local flood alleviation; increase recreational opportunities; and contribute to local delivery of Biodiversity 2020 priority habitat restoration/creation targets and help tackle invasive non-native species.
- Fish passage mitigation projects on all key identified migratory barriers throughout the catchment, contributing directly to the local recovery of populations of threatened priority fish species, such as brown trout, Atlantic salmon and European eel, with associated recreational and fisheries provisioning benefits.

Further information on the partnership is available at: <http://www.surreywildlifetrust.org/what-we-do/living-landscapes/partnership-and-advocacy>

3.5. Forward look at measures beyond 2021

This section provides a summary of the measures which are envisaged as necessary for protected areas and water bodies to achieve their objectives for 2027 and beyond. It also describes opportunities which could enable additional measures to be implemented by 2021.

Measures to 2027

Table 22 contains a summary of the types of measures which are envisaged to be necessary to address each significant water management issue up to 2027. This is not exhaustive and will inevitably change. Change can occur for a variety of reasons including, new evidence, changes in water body status, funding availability, government policy changes, development impacts and climate change.

The measures in table 22 are required in addition to the measures to address the significant water management issues described in section 3.2.

The summary programmes of measures and environmental objectives in this plan will be reviewed and updated in 2021. The WFD does not generally allow the timescale for the achievement of environmental objectives to be extended beyond 2027. Therefore as part of the plan update in 2021, choices will have to be made about the appropriate use of less stringent objectives.

Table 22: Summary of types of measures envisaged as necessary to achieve objectives for each significant water management issue

Types of measures envisaged in the river basin district	Main sectors involved in implementing the measures
Measures to address physical modification	
<ul style="list-style-type: none"> • Improvement to condition of channel/bed and/or banks/shoreline • Improvement to condition of riparian zone and/or wetland habitats • Removal or easement of barriers to fish migration • Removal or modification of engineering structure • Vegetation management • Change to operations and maintenance 	<ul style="list-style-type: none"> • Government (central and local government) • Industry services and infrastructure (non governmental organisations, navigation, industry, manufacturing and other business) • Rural land management • Water industry

Types of measures envisaged in the river basin district	Main sectors involved in implementing the measures
Measures to address pollution from waste water	
<ul style="list-style-type: none"> • Mitigate/Remediate point source impacts on receptor • Reduce point source pollution at source • Reduce diffuse pollution at source • Reduce point source pathways (i.e. control entry to water environment) 	<ul style="list-style-type: none"> • Government (central and local government) • Industry services and infrastructure (urban and transport, industry, manufacturing and other business, waste treatment, transfer, storage and disposal) • Rural land management • Water industry
Measures to manage pollution from towns, cities and transport	
<ul style="list-style-type: none"> • Reduce diffuse pollution pathways (i.e. control entry to water environment) • Mitigate/Remediate diffuse pollution impacts on receptor • Reduce diffuse pollution at source 	<ul style="list-style-type: none"> • Government (central and local government) • Industry services and infrastructure (urban and transport, industry manufacturing and other business, non governmental organisations, navigation) • Rural land management • Water industry
Measures to address changes to natural flow and level of water	
<ul style="list-style-type: none"> • Improvement to condition of channel/bed and/or banks/shoreline • Control pattern/timing of abstraction • Water Demand Management • Use alternative source/relocate abstraction or discharge 	<ul style="list-style-type: none"> • Government (central and local government) • Industry services and infrastructure (non governmental organisations) • Rural land management • Water industry
Measures to address pollution from rural areas	
<ul style="list-style-type: none"> • Reduce diffuse pollution at source • Mitigate/Remediate diffuse pollution impacts on receptor 	<ul style="list-style-type: none"> • Government (central and local) • Industry services and infrastructure (urban and transport) • Rural land management • Water industry

Types of measures envisaged in the river basin district	Main sectors involved in implementing the measures
Measures to manage invasive non-native species	
<ul style="list-style-type: none"> • Mitigation, control and eradication (to reduce extent) • Building awareness and understanding (to slow the spread) • Early detection, monitoring and rapid response (to reduce the risk of establishment) 	<ul style="list-style-type: none"> • Government (central and local) • Industry services and infrastructure (non governmental organisations, navigation, industry, manufacturing and other business) • Rural land management • Water industry

Section 3.6 contains further information on measures to achieve protected area objectives, including those with extended deadlines.

The cost of programmes of measures provides a good indication of the scale and phasing of action. Table 23 shows the current assessment of the potential costs of measures to achieve the water body and protected area objectives in this plan. The costs of measures are broadly allocated to the sectors whose activities cause the problem in line with the 'polluter pays principle'. Beyond the known funding to 2021, no decision has been made on where the costs will fall. In some cases, the sectors may not pay their own costs. Note figures are rounded to the nearest £10 million.

Table 23 Summary of estimated costs and phasing of action

Sectors	Total cost of measures over 37 years (undiscounted) to achieve objectives (£m)	Phasing to 2021 (% of total cost envisaged to 2021)	Phasing post 2021 (% of total cost envisaged after 2021)
Government	1270	<10%	>90%
Rural land management	1350	<10%	>90%
Industry, services and infrastructure	130	<10%	>90%
Water industry	1990	10-20%	80-90%

The rural land management costs are based on a range due to different scenarios of cost allocation. The midpoint is presented here to be consistent with other costs.

Opportunities for additional measures

There will be greater certainty on the measures that will be required between 2021 and 2027 when this plan is updated in 2021. Before then, a number of strategic reviews and funding streams could enable additional measures to be confirmed and/or implemented before 2021. Some of these opportunities are described below.

External funding sources

The following funding sources could be used to implement measures.

- The LIFE Regulation, which was published on 20 December 2013, sets a budget for 2014 to 2020 of €3.4 billion for projects to invest in the environment and climate change. Calls for applications are annual, for priorities including nature, biodiversity, water, floods and drought.
- The Heritage Lottery Fund invests £375 million each year, a portion of this being available to environmental improvement projects through the 'Parks for People' (£100,000 - £5 million) and 'Landscape Partnerships' (£100,000 - £3 million) programmes. Calls for applications can be once or twice a year and are often a 2 stage process.
- The government has asked Local Enterprise Partnerships to prepare economic strategies to inform the allocation of domestic and European 'growth funds', for example, the Single Local Growth Fund and the European Structural and Investment Funds. The criteria for allocation of these funds include environmental protection and sustainable development, providing an opportunity for water infrastructure that supports efficient and sustainable use of water.

Review of Urban Waste Water Treatment Directive designations

The Urban Waste Treatment Directive aims to protect the water environment from the adverse effects of discharges of urban waste water and certain industrial discharges by specifying minimum treatment requirements as well as more stringent tertiary treatment when needed to protect designated sensitive receiving waters.

Sensitive area designations are currently reviewed every 4 years, the next review was completed in December 2015. The Environment Agency would like to see a move towards 6 yearly cycles to align with WFD but this would require changes to legislation.

EU Priority Substances Directive

The 2013 revisions to the Priority Substances Directive have been transposed into domestic legislation. To comply with the new requirements, by 22 December 2018, the Environment Agency will submit a supplementary monitoring programmes and a preliminary programme of measures to the European Commission, with the aim of achieving good chemical status by 2027. The required measures will need to be considered in water company investment plans, as part of the 2019 Price Review and will be finalised in the 2021 update of the river basin management plans. All of the required measures will be made operational by 2024.

Preliminary investigations of chemicals with new European standards indicate that they could have a significant impact on good status in future. Sewage may be a significant source of some of these chemicals. Whilst sewage treatment is generally effective at reducing inputs this may not always be sufficient. Some substances have restrictions or bans on usage but these may take many years to result in lower environmental concentrations.

Review of water company price limits

Ofwat is expected to review the prices that water companies can charge their customers in 2019. As part of this process, water companies will need to update their business plans to include (amongst other things) additional environmental improvements agreed with their customers and the Environment Agency.

Common Agricultural Policy

The current agreement for funding from the Common Agricultural Policy, including the basic payment scheme and rural development programme that encompasses Countryside Stewardship, ends in December 2020. Negotiations for continued funding for the period 2021 to 2027 have not yet begun.

Water resources management plans

Water companies will publish new plans in 2019. These plans set out how they will balance supply and demand for water over a 25 year period. The new plans will enable them to take account of expected changes in demand for water and in their available supply as a result of climate change and population growth as well as any new measures needed to deliver environmental objectives.

Review of nitrate vulnerable zones designations and action plans

Every 4 years, the UK is required to review the evidence in relation to the extent of nitrate vulnerable zones (NVZ) and the effectiveness of the action programme introduced by the Regulations and to implement changes where required. NVZs are a means of reducing or preventing water pollution caused by nitrates from agricultural sources. The next review is underway and any changes are expected to be implemented in January 2017.

Further information in this document

- You can find more information on the ongoing measures to prevent deterioration for each significant water management issue in section 3.2.

Information elsewhere in the river basin management plan

- You can find more information about the catchment economic appraisal in section 5.5 of [Part 2: RBMP overview](#) (www.gov.uk/government/collections/river-basin-management-plans-2015).

Supporting information

- You can find a list of the measures needed to achieve water body objectives for 2027 and beyond on the Environment Agency's [ShareFile service](https://ea.sharefile.com/d-sabbd14301a44d5e9) (<https://ea.sharefile.com/d-sabbd14301a44d5e9>).
- You can find the impact assessment on the river basin management plan [web pages](#) (www.gov.uk/government/collections/river-basin-management-plans-2015).

3.6. Additional measures to achieve protected area objectives

Measures have been developed for protected areas that are at risk of or do not currently meet their objectives. Table 24 summarises the action planning process.

Table 24: Summary of measures for protected areas

Protected area	Programme
Drinking water protected areas - surface water and groundwater	Safeguard zones have been established for water sources in drinking water protected areas where extra treatment is likely to be required in the future. Safeguard zone action plans have been developed including measures needed to manage activities that may threaten raw water quality for surface waters and ground waters.
Economically significant species (shellfish waters)	Shellfish water action plans have been produced for all designated shellfish waters, which include measures aiming to observe the microbial shellfish flesh standards.
Recreational waters (bathing waters)	Bathing water profiles have been produced for all designated sites. They include details of the measures needed to achieve compliance with the revised standards that came into force in 2015. Further information is available on the measures for those bathing waters at risk of not achieving sufficient in 2015 in the bathing water action plans (continuing at risk).
Nutrient sensitive areas (Urban Waste Water Treatment Directive)	Measures have been identified to make sure that all relevant discharges from waste water treatment plants within the sensitive area have appropriate phosphorus or nitrogen emission standards.
Nutrient sensitive areas (nitrate vulnerable zones)	The objective of the Nitrates Directive is to reduce water pollution caused by nitrates from agricultural sources and to prevent further such pollution occurring. Nitrate Vulnerable Zones (NVZs) are designated where nitrate concentrations in surface and/or groundwaters are high or increasing, or where waters are, or may become eutrophic, due to agricultural nitrate pollution. Farmers within NVZs must comply with mandatory action programme measures to reduce agricultural nitrate losses. In addition a code of good agricultural practice has been established, for voluntary implementation by all farmers.
Natura 2000: Water dependent Special Areas of Conservation (SACs) and Special Protection Areas for Wild Birds (SPAs)	Natural England has developed site improvement plans (SIPs) for water dependent sites. SIPs provide an overview of issues affecting the site condition; identify priority actions, timescales for implementation and potential funding sources. Natural England monitors, reviews and updates SIPs where appropriate.

Supporting information:

- You can find more information on the measures in protected areas at the following locations:
 - For drinking water protected areas for [surface water](https://ea.sharefile.com/d-scac3ff7da4a424eb) (<https://ea.sharefile.com/d-scac3ff7da4a424eb>) and for [groundwater](https://ea.sharefile.com/d-sa22fd79de304532a) (<https://ea.sharefile.com/d-sa22fd79de304532a>).
 - For [economically significant species](https://ea.sharefile.com/d-s84c5554e50947dbb) (<https://ea.sharefile.com/d-s84c5554e50947dbb>).
 - You can access more information on recreational waters on the [Bathing Water Explorer](http://environment.data.gov.uk/bwq/profiles/) (<http://environment.data.gov.uk/bwq/profiles/>) and in the bathing water action plans (continuing at risk) on the Environment Agency's [ShareFile service](https://ea.sharefile.com/d-s2c9919e38f04798b) (<https://ea.sharefile.com/d-s2c9919e38f04798b>).
 - For Nitrate vulnerable zones visit the [NVZ web pages](https://www.gov.uk/nitrate-vulnerable-zones) (<https://www.gov.uk/nitrate-vulnerable-zones>).
 - The Natura 2000 site improvement plans are available on Natural England's [website](http://publications.naturalengland.org.uk/category/4878851540779008) (<http://publications.naturalengland.org.uk/category/4878851540779008>).

4. Changes from 2009 to 2015

This section contains an assessment of what has been achieved and what has happened since the first river basin management plan was published in 2009.

It includes a summary of the improvements made to the evidence used in river basin management planning, a report on the implementation of measures, and a summary of progress towards achieving the environmental objectives in the 2009 plan and where progress has not been made.

4.1. Improvements in evidence

Over the last 6 years the Environment Agency has done much to improve the understanding of the water environment. The quantity and quality of the evidence available has grown because of significant investment.

- In England, an additional £4.7 million pounds has been invested in a new ecological monitoring programme for rivers and an additional £1.5 million pounds invested in chemical monitoring technology. This means that the number of classification element results in the river basin district has increased from 5,000 in 2009 to 5,956 in 2015.
- In the river basin district, more than 2,600 investigations have been carried out to identify the reasons (pressures, and the sources of the pressures) why good status and protected area objectives have not been achieved.
- The actions that would be needed to achieve good status and protected area objectives have been identified.
- Through detailed economic appraisal, there is an improved understanding of the benefits the water environment can provide and the cost of the measures needed to realise the benefits.
- The latest generation of environmental assessment criteria has been introduced in collaboration with a range of partners and leading scientists. These improvements to methods mean that the classification results are now a better interpretation of the general health of the water environment. These changes include:
 - new standards for additional chemical substances
 - updated standards for existing physico-chemical elements
 - new and improved biological assessment tools and new intercalibrated biological classification boundary values.
- Improvements have been made in mapping of the water body network.
- Improved risk assessments have been introduced to help target future monitoring programmes, and predict and help prevent potential deterioration in the water environment.

This new evidence was used in the review and update of the environmental objectives in the 2009 plan.

Further information in this document

- You can find summaries of the latest water body classification results and the reasons for not achieving good status in section 5.
- You can find more information on risk assessments in section 1.4.

Information elsewhere in the river basin management plan

- You can find more information in [Part 2: RBMP overview](#) available on the river basin management plan web pages (www.gov.uk/government/collections/river-basin-management-plans-2015) for:
 - the process used to review and update the environmental objectives in the 2009 plan, in section 5.2
 - measures identification in section 5.2
 - economic appraisals in section 5.3
 - review of the water body network in section 4.1
 - review and update of heavily modified water body designations in section 4.1
 - revised risk assessments in section 4.4
- GeoPDF maps showing the latest classification results can be found on the Environment Agency's [ShareFile service](#) (<https://ea.sharefile.com/d-s25aecb60c464ccd9>).
- You can find a spreadsheet containing the reasons for not achieving good status on the Environment Agency's [ShareFile service](#) (<https://ea.sharefile.com/d-s0faa355450243538>).

Supporting information

- You can find the full description of changes to environmental standards on the [UKTAG website](#) (<http://www.wfduk.org/>).
- The full description of changes to biological methods can be found on the [UKTAG website](#) (<http://www.wfduk.org/>).

4.2. Measures implemented

Planned measures implemented since 2009

Most of the measures (over 99%) summarised in the 2009 plans have been completed.

A few measures have not been completed in the river basin district for the following reasons:

- 2 measures have been reassessed and are no longer needed or considered effective
- 5 were not funded (funding withdrawn)

Additional measures implemented since 2009

As well as the measures in the 2009 plans, a significant number of other measures have been implemented. For instance in England, the government provided £90 million between 2010 and 2015 for additional measures to improve the physical water environment, reduce pollution, and reduce the impact of invasive non-native species.

It is estimated that the additional measures in the river basin district represent a further investment of at least £8.9million. Table 25 gives a summary of the issues addressed and an indication of the scale of additional measures.

Table 25 – Summary of additional measures in the river basin district

Significant water management issue	Number of measures	Cost (£Million)	Number of water bodies benefitting
Physical modifications	76	6.1	121
Pollution from rural areas	10	1.3	41
Pollution from town, cities and transport	12	0.8	26
Pollution from abandoned mines	0	0	0
Non-native invasive	3	0	4
Other	9	0.6	18
Total	110	8.8	210

Supporting information

- You can download a spreadsheet of the additional local measures implemented from 2009 from the Environment Agency's [ShareFile service](https://ea.sharefile.com/d-s13e5e39caef432d9) (<https://ea.sharefile.com/d-s13e5e39caef432d9>).

Effectiveness of measures implemented since 2009

Most of the measures implemented between 2009 and 2015 have resulted in improvements to the quality of the water environment, providing significant additional benefits. However, the scale of the improvements has not always been enough to fully secure compliance with WFD environmental objectives (protected area and water body status objectives) set in the 2009 plan. Section 4.3 identifies some of the reasons for this.

Table 26 contains a summary of how effective the measures implemented since 2009 were at achieving WFD environmental objectives. Measures are grouped by each significant water management issue. The assessment is based on the measures implemented across England and not just in this river basin district.

Table 26: Summary assessment of the effectiveness of measures for each significant water management issue (England level assessment)

Physical modifications
<p>Obstructions</p> <p>Removing or lowering weirs and building fish passes has generally been effective. In some cases, it has not been possible to fully remove the pressure because of the obstruction's historic value or the need to prevent erosion or mobilisation of contaminated sediments. In some cases full compliance with WFD environmental objectives has not yet been achieved because other barriers elsewhere in the catchment are still present.</p>
<p>Habitat improvement</p> <p>Habitat improvements, from large-scale river restoration to relatively minor schemes on small watercourses, have generally been effective. They have led to improvements in fish populations and other wildlife. The effectiveness of these schemes at achieving compliance with WFD environmental objectives will only become apparent once the new habitat and associated wildlife has matured. In some cases, it is expected that additional restoration elsewhere in the catchment will be required to support a fully functioning ecosystem.</p>
Pollution from waste water
<p>There were over 300 improvement schemes implemented at sewage treatment works since 2009. These have been effective at helping to achieve compliance with WFD environmental objectives.</p>
Pollution from rural areas
<p>Government advice</p> <p>Catchment Sensitive Farming was effective at encouraging farmers to take up measures to help achieve WFD environmental objectives (mainly for protected areas). In areas where Catchment Sensitive Farming was targeted, between 2006 and 2013, the estimated quantity of pollutant (including phosphorus, nitrate, sediment and faecal indicator organisms) released from agricultural sources reduced by between 4% and 12% (on average).</p>
<p>Regulation</p> <p>Regulation has reduced the impact of pollution incidents and helped to prevent deterioration. There is some evidence that action plans for nitrate vulnerable zones helped to reduce pollution from nutrients. The overall effectiveness can only be assessed over a longer period.</p>

Industry initiatives

A number of schemes have promoted voluntary action including, advice and grants through local catchment groups, advice through the Campaign for the Farmed Environment, and work lead by water companies to improve the quality of water they abstract for public water supply. Advice is effective at promoting good farming practice. Measures that go beyond good practice greatly increase where grants have been provided. Many of these schemes resulted in improvements to the local water environment.

Environmental stewardship (2006 to 2014)

There was good uptake of measures to protect the water environment. Measures were not always placed where most benefit could be gained or the uptake sufficiently concentrated within a catchment to reduce pressures enough to achieve compliance with WFD environmental objectives.

Cross compliance

Compliance with environmental conditions attached to the Single Farm Payment was high. The environmental conditions were strengthened in 2010 and 2015. The associated measures had a small impact on the quality of the water environment

Changes to the natural flow and level of water

Changes in abstraction licences

The national Restoring Sustainable Abstraction programme has been effective at improving habitat for fish and other wildlife. Voluntary and compulsory action has resulted in changes to over 200 abstraction licences (by the Environment Agency and government). As a result of this, 27 billion litres of water has been returned to the environment.

Nationally this programme has been effective at helping to achieve compliance with WFD environmental objectives, in particular those for Natura 2000 protected areas

Demand management

Demand management and water efficiency techniques have been implemented by many sectors including government, water industry, independent bodies and trade associations.

Local Development Plans / Frameworks have been introduced which set out local plan policies requiring new homes to meet the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010.

Water companies have reduced leakage from their supply networks and increased the number of homes with meters across water stressed areas.

Most of these have been effective at a local scale.

Pollution from towns, cities and transport

A variety of measures have been implemented to reduce pollution from urban areas. These include contaminated land restoration; installation of sustainable drainage systems for new and existing developments; treatments to remediate road run-off; regulatory action following pollution incidents; initiatives to resolve misconnected foul drainage systems; and pollution prevention advice to occupiers of industrial estates.

Most of these measures have been effective at the local scale. However, in some cases the effectiveness is low, as there needs to be more measures within an area if improvements are to be sustained over the long term. Given the scale, cost and complexity of this issue, the measures have not been effective at reducing the pressure enough to achieve compliance

with WFD environmental objectives.

Invasive non-native species

A variety of measures have been implemented to prevent the introduction and spread of invasive non-native species. These have been moderately effective and have slowed the deterioration in the biodiversity of affected waters and the spread to unaffected waters. Measures to remove invasive non-native species from affected waters are only effective for a minority of species where a rapid response to their presence is possible. Evidence gathered in cycle 1 has confirmed that it is technically infeasible to remove most species once they are established. At locations such as Natura 2000 sites, intensive (and ongoing) action can mitigate the pressure, but not remove it.

4.3. Progress towards achieving the environmental objectives in the 2009 plan

Preventing deterioration

To assess compliance with the WFD objective of preventing deterioration, 2015 classifications results (based on data up to the end of 2014) using the standards and classification tools used in 2009, were compared with the 2009 classification baseline. The assessment considered whether the water body had deteriorated from one status class in 2009 to a lower one in 2015. This was applied to a water body's overall status and to the status of each element used in classification.

The results of this assessment for water bodies in the river basin district are summarised in Table 27. Table 34 in section 5 provides a breakdown by elements.

Table 27: Water bodies that have deteriorated (at >75% confidence)

Water bodies	Number	Percentage
Surface water ecological status	27	5%
Surface water chemical status	2	<1%
Groundwater quantitative status	0	0%
Groundwater chemical status	0	0%

Where deterioration of status has occurred, the cause needs to be identified and measures to restore the water body to its previous status put in place as soon as possible.

In some cases, reported deterioration may be a result of changes to monitoring programmes or be an artefact of monitoring and assessment processes (sampling error). Distinguishing these changes from real deterioration in the quality of the environment that has been caused by a new activity or a change in an existing pressure in a catchment can be difficult.

Table 34 in section 5 contains a summary of the causes of deterioration that have already been identified. This summary is for each element by pressure and sector. You can also download a spreadsheet containing the water body elements that have deteriorated in status since 2009 (see further information box at the end of this section).

In certain and specific circumstances deterioration of status is permitted. These circumstances are described in Article 4.6 (temporary deterioration) and Article 4.7 (new modifications) of the WFD. No cases that meet these requirements have been identified in this river basin district.

Protected area objectives

Drinking water protected areas

The Drinking Water Inspectorate is the competent authority for the drinking water directive. They publish an annual report detailing compliance with the directive's water quality requirements.

The Environment Agency has established safeguard zones and produced associated action plans for all relevant drinking water protected areas to manage the risk of water quality deteriorating.

Following improvements in the knowledge of the pressures in catchments, improved monitoring programmes for chemicals and new abstractions which have come about, the number of drinking water protected areas classified as at risk of water quality deterioration or at poor chemical status (for groundwater only) has increased. Measures such as providing advice and guidance to stakeholders, capital grants for infrastructure improvements (for example biobeds) and payment for ecosystem services have been used to protect water quality in drinking water protected areas.

Economically significant species (freshwater fish)

The freshwater fish directive was repealed in December 2013. Environmental objectives for freshwater fish protected areas ceased to have effect from that date. An equivalent level of protection is provided by the water body objectives in this plan.

Economically significant species (shellfish waters)

The shellfish water directive was repealed in December 2013. Shellfish waters protected areas have been maintained and an equivalent level of protection is being provided by domestic legislation. Monitoring used to assess compliance with the shellfish flesh standards has significantly increased. Although there has been no significant change in the quality of the water environment in the protected areas, the improved monitoring has led to a reduction in reported compliance.

The current status of shellfish protected areas is summarised in section 2.4.

Recreational waters (bathing waters)

A revised bathing water directive introduced new water quality objectives for bathing water protected areas from 2015. Projected classification of bathing waters against the new standards is summarised in section 2.4. Compliance with the water quality standards of the old bathing water directive was assessed for the final time in 2014. These results are summarised in Table 28. This shows an increase in compliance since 2009.

Table 28: Bathing water compliance with old (1976) Bathing Water Directive objectives:

Year	Number of bathing waters	% compliant with mandatory standards	% compliant with guideline standards
2009	17	100	35
2014	18	100	61

Natura 2000 sites: Water dependent Special Areas of Conservation or Special Protection Areas

In 2009 17 Natura 2000 protected areas in the river basin district had an objective of maintaining or achieving their water dependent conservation objectives by 2015 (assessed on basis of measures being underway/complete, known pressures, anticipated measures and likely improvements in condition). Of these, 6 had all measures completed (i.e. no further intervention is required) to enable their water dependent objectives to be achieved by 2015, based on knowledge of current pressures on the sites.

Water body status objectives

As a result of the improvements in monitoring, standards and classification tools described in section 4.1, it is not possible to identify environmental change by simply comparing the 2009 and 2015 classification baselines. Instead, a set of 2015 classifications results (based on data up to the end of 2014) has been produced using the standards and classification tools used in 2009. This helps identify where they may have been an actual environmental change since 2009.

Table 29 shows the percentage of water bodies at good status for the:

- 2009 baseline
- predicted outcomes in 2015 envisaged in the 2009 plans
- 2015 classification results produced using the 2009 methods

Table 29: Comparison of 2009 baseline with 2015 predicted and actual results (using the standards and classification tools used in 2009)

Percentage of water bodies at good or better status	2009	2015 predicted	2015 actual
Surface water ecological status	23	25	14
Surface water chemical status	13	14	18
Groundwater quantitative status	35	35	57
Groundwater chemical status	43	46	63
Overall status	23	25	17

Although many of the measures completed over the last 6 years are providing benefits for the local environment, the comparison shows a slight reduction in the number of water bodies at good status. After 2009 the Environment Agency put additional biological monitoring in place and improved the design of the monitoring network. The new monitoring has revealed more symptoms of environmental issues. The change between 2009 and 2015 reported in the table above does not necessarily constitute a real environmental deterioration. Over this period 416 water body elements improved by one or more class.

The reasons why the predicted improvement in status has not yet been seen include:

- the measures have not been as effective at reducing pressures at the water body scale as expected
- the environmental standards which the measures were designed to achieve were not tight enough to fully protect the biological elements
- there are pressures acting on the water bodies that were not known in 2009
- improvements in the monitoring network identifying that pressures are having more impact than previously detected
- the pressure has been reduced but the biology has yet to fully improve
- some classification elements have improved in status, but no improvement in the status of the water body has been reported due to the use of the 'one out all out' classification rule

Further information in this document

- You can find a summary of the causes of deterioration that have already been identified in section 5.

Information elsewhere in the river basin management plan

- A more detailed explanation of the approach to preventing deterioration can be found in can be found in section 2.2 of [Part 2: RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).
- You can find detail on the circumstances in which deterioration may be permitted (temporary deterioration and new modifications) in section 3.1.4 of [Part 2: RBMP overview](http://www.gov.uk/government/collections/river-basin-management-plans-2015) (www.gov.uk/government/collections/river-basin-management-plans-2015).
- You can download spreadsheets containing:
 - a spreadsheet containing the 2009 classification baseline, predicted and actual results for 2015 using the standards and classification tools used in 2009
 - a map of the 2015 classification results using the standards and classification tools used in 2009
 - a spreadsheet containing the water body elements that have deteriorated in status since 2009from the Environment Agency's [ShareFile service](https://ea.sharefile.com/d-s13e5e39caef432d9) (<https://ea.sharefile.com/d-s13e5e39caef432d9>).

5. Summary statistics

This section provides a summary of the key statistics for the river basin district at water body and quality element level.

Summary statistics tables

The tables in this section provide a summary of the plan data for the river basin district and can be used for quick reference. To understand the purpose of the data and how it has been generated see the relevant sections earlier in this document. The detailed data behind the summaries can also be accessed by following the links in the relevant sections.

The following descriptions explain the content of the tables and the further information box shows where more information can be accessed.

- **Table 30: Summary statistics for the Thames river basin district: Water bodies:** shows the status, by percentage, of the different types of water bodies in the river basin district. It also shows the predicted outcome by 2021 and the objective.
- **Table 31: Summary statistics for the Thames river basin district: Elements:** shows the status, by percentage, of the water body elements in the river basin district. It also shows the predicted outcome by 2021 and the objective.
- **Table 32: Pressures preventing waters reaching good status and the sectors identified as contributing to the impact (reasons for not achieving good status):** shows the number of reasons for water bodies not achieving good status for each pressure and which sector is contributing to this. The table shows individual counts and there may be more than one reason in a single water body.
- **Table 33: Significant water management issues (SWMIs) preventing waters reaching good status and the sectors identified as contributing to the impact (reasons for not achieving good status):** shows the number of reasons for water bodies not achieving good status because of each significant water management issue and which sector is contributing to this. The table shows individual counts and there may be more than one reason in a single water body.
- **Table 34: Reasons for deterioration by one or more status class between 2009 and 2015 and the sectors identified as contributing to the impact:** shows the number of reasons for water body elements deteriorating by one of more status class, with 75% confidence, for that pressure and which sector is contributing to the deterioration. The table shows individual counts, if there is more than one element deteriorating in a water body, then there will be more than one reason assigned.

Further information in this document:

- You can access the detail behind Table 30 and Table 31 on the current status, predicted outcomes and objectives for water bodies and elements in section 2.
- The detail behind Table 33 on the significant water management issues can be found in section 1.4.
- You can find more information on Table 34 and the reasons for deterioration in section 4.3.

Table 30: Summary statistics for the Thames river basin district: Water bodies

	Rivers, Canals and SWTs*	Lakes	Estuaries	Coastal	Surface Waters Combined	Ground water	All Water Categories
% of water bodies at good or better ecological status/potential now	6%	15%	50%	0%	8%		
% of water bodies predicted to be at good ecological status/potential or better by 2021	8%	18%	50%	0%	10%		
% of water bodies with an objective of good ecological status/potential or better	56%	68%	60%	0%	58%		
% of water bodies at good chemical status now							
% of water bodies at good chemical status now	99%	100%	100%	100%	99%		
% of water bodies predicted to be at good chemical status by 2021	99%	100%	100%	100%	99%		
% of water bodies with an objective of good chemical status	>99%	100%	100%	100%	>99%		
% of water bodies at good chemical (groundwater) status now							
% of water bodies at good chemical (groundwater) status now						62%	
% of water bodies predicted to be at good chemical (groundwater) status by 2021						62%	
% of water bodies with an objective of good chemical (groundwater) status						96%	
% of water bodies at good quantitative status now							
% of water bodies at good quantitative status now						53%	
% of water bodies predicted to be at good quantitative status by 2021						60%	
% of water bodies with an objective of good quantitative status						66%	
% of water bodies at good or better overall status now							
% of water bodies at good or better overall status now	6%	15%	50%	0%	8%	40%	11%
% of water bodies predicted to be at good or better overall status by 2021	8%	18%	50%	0%	10%	45%	13%
% of water bodies with an objective of good or better overall status	56%	68%	60%	0%	58%	64%	59%

*SWTs are surface water transfers

Table 31: Summary statistics for the Thames river basin district: Elements

	Rivers, canals and SWTs*	Lakes	Estuaries	Coastal	Surface waters combined	Ground-water	All water categories
% of ecological elements at good or better status now (biological, physico-chemical and specific pollutants)	73%	60%	88%	67%	73%		
% of ecological elements predicted to be at good status or better by 2021 (biological, physico-chemical and specific pollutants)	74%	62%	88%	67%	73%		
% of ecological elements with an objective of good status or better (biological, physico-chemical and specific pollutants)	89%	80%	91%	67%	89%		
% of chemical elements at good status now							
% of chemical elements at good status now	>99%	100%	100%	0%	>99%		
% of chemical elements predicted to be at good status by 2021	>99%	100%	100%	0%	>99%		
% of chemical elements with an objective of good status	>99%	100%	100%	0%	>99%		
% of chemical (groundwater) elements at good status now							
% of chemical (groundwater) elements at good status now						89%	
% of chemical (groundwater) elements predicted to be at good status by 2021						89%	
% of chemical (groundwater) elements with an objective of good status						99%	
% of quantitative elements at good status now							
% of quantitative elements at good status now						81%	
% of quantitative elements predicted to be at good status by 2021						85%	
% of quantitative elements with an objective of good status						89%	
% of elements at good or better status now							
% of elements at good or better status now	79%	68%	95%	67%	79%	85%	80%
% of elements predicted to be at good or better status by 2021	80%	70%	95%	67%	80%	87%	80%
% of elements with an objective of good or better status	92%	84%	96%	67%	92%	95%	92%

*Surface water transfers

Table 32: Pressures preventing waters reaching good status and the sectors identified as contributing to the impact (reasons for not achieving good status) in the Thames river basin district

Pressure	Agriculture and rural land management	Industry	Mining and quarrying	Navigation	Urban and transport	Water Industry	Local & central government	Domestic general public	Recreation	Waste treatment and disposal	Other	No sector responsible	Sector under investigation	Total
Abstraction and flow	6	5	1	3	5	58	1	0	0	0	7	24	0	110
Chemicals	21	5	0	1	14	3	0	0	0	0	6	0	1	51
Biochemical oxygen demand	1	0	0	0	3	2	0	1	0	0	0	1	0	8
Dissolved oxygen	48	8	0	2	56	68	3	11	0	0	3	24	0	223
Ammonia	2	2	0	0	47	62	1	3	0	0	2	0	3	122
Fine sediment	59	2	2	1	28	6	2	0	1	0	3	4	2	110
Invasive non native species	0	0	0	0	0	0	0	0	0	0	0	18	0	18
Nitrate	2	0	0	0	0	2	0	0	0	0	0	0	3	7
Phosphate	166	6	0	0	151	352	0	32	0	1	26	10	13	757
Physical modification	54	3	1	23	196	41	95	2	54	0	46	3	9	527

Table 33: Significant water management issues preventing waters reaching good status and the sectors identified as contributing to the impact (reasons for not achieving good status) in the Thames river basin district

Significant water management issue	Agriculture and rural land management	Industry	Mining and quarrying	Navigation	Urban and transport	Water Industry	Local & central government	Domestic general public	Recreation	Waste treatment and disposal	Other	No sector responsible	Sector under investigation	Total
Physical modifications	79	4	0	24	237	43	116	3	56	0	55	0	14	631
Pollution from waste water	11	22	0	1	30	499	0	58	0	1	19	0	1	642
Pollution from towns, cities and transport	1	5	0	0	275	18	0	0	0	0	3	0	2	304
Changes to the natural flow and level of water	14	6	1	5	3	70	2	0	1	0	8	0	0	110
Invasive non-native species	0	0	0	0	0	0	0	0	0	0	0	21	0	21
Pollution from rural areas	297	0	0	0	0	0	0	0	0	0	6	0	0	303
Pollution from abandoned mines	0	0	2	0	0	0	0	0	0	0	0	0	0	2

Table 34: Reasons for deterioration from one or more status class between 2009 and 2015 and the sectors identified as contributing to the impact in the Thames river basin district

Pressure causing deterioration	Agriculture and rural land management	Industry	Mining and quarrying	Navigation	Urban and transport	Water Industry	Local & central government	Domestic general public	Recreation	Waste treatment and disposal	Other	No sector responsible	Sector under investigation	Total
Abstraction & Flow	1	0	0	0	0	1	0	0	0	0	0	0	0	2
Chemicals	0	0	0	0	0	1	0	0	0	0	0	1	0	2
Biochemical oxygen demand	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dissolved Oxygen	2	0	0	0	0	4	0	1	0	0	0	7	21	35
Ammonia	1	0	0	0	1	5	0	0	0	0	0	1	7	15
Fine sediment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Invasive non native species	0	0	0	0	0	0	0	0	0	0	0	2	0	2
Nitrate	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphate	0	0	0	0	0	0	0	0	0	0	0	0	5	5
Physical Modification	2	0	0	0	0	0	1	0	1	0	1	0	0	5

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