Catchment report
2016

www.wessexwater.co.uk

Wessex Water
a YTL company

Introduction

Welcome to the second edition of our annual catchment report giving an overview of our environmental work, catchment by catchment. We hope you find it informative and look forward to any feedback.

Our work is about delivering benefits for society and the environment. These include basic public services such as drinking water and sanitation, improvements to the water environment from source to sea, decarbonisation of energy and resilience in the face of climate change.

Some of our goals are very well established, representing universal services protected by regulation. However, our remit is growing and the range of options at our disposal is widening. We are increasingly seen as an organisation central to improving river catchments and water more widely – we can do this by promoting certain types of land management as well as investing in 'hard' infrastructure. We are also trialling market based measures that can help reconcile environmental goals with economic development.

Some of these approaches, such as nitrogen offsetting in the Poole Harbour catchment, online nitrogen trading, and catchment permitting in the Bristol Avon are innovative for the UK water sector. We are only able to proceed with these trials thanks to the co-operative relationships we have with environmental regulators, farmers and local authorities in our region.

Furthermore, these newer approaches to environmental stewardship can rarely be delivered by single bodies; instead, we are showing how new types of public-private partnership can produce benefits for all involved.

We are now looking ahead to the 2019 price review which will determine our work programme during 2020-25. We can already say that the business plan we submit in three years' time will be making the following points:

- working to a set of agreed environmental outcomes encourages a more diverse and flexible portfolio of delivery options
- there is good evidence that greater investment in catchments can help substantially in improving the environment in cost effective ways, although there are higher risks for attaining and maintaining such environmental outcomes, particularly during extreme weather events
- where more sustainable approaches that have this blend of lower cost but higher risk are adopted, we will look for recognition of this by our regulators. From Ofwat we will seek adjusted financial incentives and rewards; and from the Environment Agency we will look for proportionate regulatory enforcement if environmental outcomes are hampered by factors beyond our control.

David Elliott

Group Director of Strategy and New Markets

Foreword

In its Catchment Report 2015, Wessex Water reported on 25 years of significant improvements to the rich and diverse water environments within its area. It also set out its improvement plans for 2015-2020.

It is, therefore, most welcome to see the progress made over the past year set out in this Catchment Report 2016.

Improvements continue to flow from the still sizable capital investment programme, and there has been an increased focus on gaining wider benefits for the environment, more cost effectively, through land management in partnership with others. An extensive programme of investigations is also helping to determine the most sustainable solutions for future investment.

Over the past year, the catchment panel has reviewed the progress made against performance targets; several topics provoked lively, robust, but always constructive discussion.

The panel welcomed the success of the online nitrogen trading system (EnTrade) in encouraging farmers to reduce their nitrate use, and urged its wider application. Discussions regarding reductions in phosphate discharges led to serious questions to regulators over the 'correct' targets to achieve good ecological status and, out in the catchment, what 'good' actually looks like – an ongoing debate that highlights the importance of continuing research and investigation.

Much of the progress over the past 25 years has been driven by European directives, and future drivers are less certain following the Brexit vote. What is certain though is the importance of a healthy and resilient environment for the wellbeing of people and wildlife. Defra is currently drawing up its 25-year plan for the environment. We must take the opportunity to build on what has already been achieved, and further develop the partnerships with farmers, landowners and other organisations to ensure a healthy environment is an integral part of a healthy economy.

This report gives an excellent snapshot of what can be achieved.

Dr Richard Cresswell MBE

Chair, Wessex Water Catchment Panel

2015-16 activity

Capital investment

The last year has been the first of our five-year investment programme covering 2015 to 2020. While the first year is usually dominated by planning and design, some schemes were completed.

Our integrated water grid scheme is an eight-year project that will deliver improvements to river flows as well as improving the overall resilience of our water supply system. Elements completed during 2015-16 include new storage tanks at Summerslade, Littledown and Snowsdown and pumping stations at Monkton Deverill and Sturminster Marshall.

We delivered schemes related to the revised Bathing Waters Directive involving three sewage pumping stations in Burnham-on-Sea, Highbridge and Bridgwater. We continued to install monitors on environmentally sensitive combined sewer overflows with 46% of the total now monitored. By the end of 2019-20, monitors will be installed at all these overflows. During the current investment period we will also make improvements to 70 unique waterbodies under the National Environment Programme. While there were no targets for improvements during 2015-16, the programme is progressing well to achieve the target by the end of 2019-20.

Catchment management

Our work with farmers and landowners continues in the catchment areas around 15 groundwater sources and five surface reservoirs to tackle contamination by pesticides and nutrients. The task is to improve raw water quality without having to install additional treatment. Our experience is that farmers are willing to engage with our advisers in the majority of cases and the advisers' reputation within the wider agricultural community is very high.

However, nitrate concentrations rose last winter and blending was required at our highest risk sites, Deans Farm and Fonthill Bishop, to maintain compliance with drinking water standards. Nevertheless, nitrate concentrations were not as high as previous winters and improvements in nitrate trends at many sites have continued. There were no pesticide failures at any of our high risk reservoirs and catchment work continues to secure and maintain these improvements. Indeed, in the case of metaldehyde, the voluntary no use approach that we have championed appears to be the only way to successfully avoid it reaching rivers and reservoirs.

Environmental investigations

While it is evident that water abstraction and effluent discharges can affect the environment, it is important that we quantify these impacts so that they can be addressed in the most appropriate way.

During 2015-20 we are conducting 40 environmental investigations covering a range of issues. These include the occurrence and removal of hazardous and emerging substances from sewage effluent; new, sustainable treatment solutions for phosphorus removal; the ecological impact of our reservoirs and abstractions and the impact of our sewage treatment works on the nutrient levels within rivers, compared to other sources, at a catchment scale.

These investigations will support our proposals for investment during 2020-25 and help us to determine the most cost effective and sustainable solutions for our customers, with the best environmental results.

Among the investigations there are a number of leading edge projects, some of which are industry firsts. These include:

- two UK first trials of new methods for removing phosphorus from wastewater as part of a water industry-wide research project: BioMag, which employs magnetite to improve sedimentation and a high-rate algal pond in conjunction with the University of Bath
- vibrating wire piezometers located in a borehole to provide better detail about groundwater flows
- controlled release of spate flows downstream of Durleigh reservoir to remobilise phytoplankton that have had an adverse ecological effect on the stream.

More details are provided on a catchment by catchment basis in the rest of this report.

Our integrated grid scheme will deliver improvements to river flows and improve the overall resilience of our water supply system

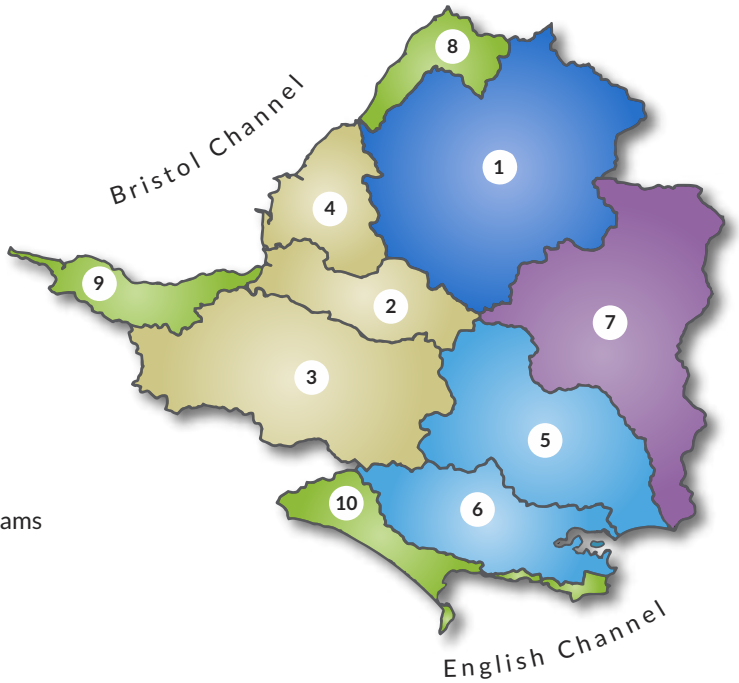
2015-16 targets and performance

The 2014 price review saw a shift in regulation to one that emphasises the achievement of social and environmental outcomes, rather than a defined set of activities and schemes. We consulted with our customers and other stakeholders to develop nine outcomes and 32 associated performance commitments, with targets defined for each year of the 2015-20 period. The table below shows our performance commitments that are primarily of environmental interest.

	2015-16 target	2015-16 actual	2019-20 target	More info
Environment Agency's annual environmental performance assessment	Industry leading	Industry leading	Industry leading	
Compliance with abstraction licences (%)	100%	100%	100%	
Water abstraction from Mere exported away from the local catchment (Ml/yr)	100	172	100	page 10
Per capita water consumption (l/person/day)	135	138	131	
Volume of water saved by water efficiency promotion (l/person/day)	0.57	0.68	3.26	
Bathing water compliance (%)	100%	98%	100%	page 8
Improved bathing waters – schemes delivered (%)	100%	100%	100%	page 8
Waterbodies improved	0	0	70	page 2
Monitoring of sewer overflows that present a risk to the environment (%)	40%	46%	100%	page 2
Wessex Water land actively managed for biodiversity (%)	60%	60%	100%	page 16
Greenhouse gas emissions (kt CO_2e)	133	138	119	page 18
Proportion of energy self-generated (%)	21%	25%	24%	page 18

Catchments

1 Bristol Avon
2 Brue
3 Parrett and Tone
4 Axe and North Somerset streams
5 Dorset Stour
6 Poole Harbour
7 Hampshire Avon
8 South Gloucestershire streams
9 West Somerset streams
10 Smaller catchments



Focus on natural capital

In the late 1990s, when we first committed ourselves to becoming a sustainable water company, we looked for a framework that would help us communicate our aims. We chose the 'capitals' model, which describes the resources that society needs to keep in a healthy state in order to thrive in the long term. We used this model first for our annual sustainability reporting and subsequently for our sustainability vision, in which we describe what a genuinely sustainable water company would look like and what we need to do to move in the right direction.

Natural capital encompasses the goods and services provided freely by nature that are either used by humans, or are needed for ecosystems to function and for our environment to be liveable. For example:

- photosynthesis by plants and trees that provide food, fibres and timber, while capturing carbon dioxide and producing oxygen
- water purification through wetlands, soil and rock
- pollination by insects
- decomposition of dead matter by microbes and scavenging animals
- pest control by insect eating birds
- pharmaceuticals derived from plant species
- the cyclical movement of carbon, oxygen and nutrients through the atmosphere, land, vegetation and water.

All economic activity is linked in some way to resources provided by the environment. However, humans have tended to use natural resources at an unsustainable rate in the pursuit of short-term gains. In effect, natural capital is generally being liquidated across the planet.

Although the concept of natural capital was first coined in the early 1970s, it has been in the ascendency in recent years as environmentalists and policy makers try to increase the case for environmental protection, in part by demonstrating the value of functioning natural systems – sometimes in monetary terms. In the UK, natural capital is starting to inform policy and business in more explicit ways. Leading bodies include:

- the Natural Capital Committee: an independent body set up in 2012 that advises the UK government on the sustainable use of natural capital and on the benefits we derive from natural assets, such as food, recreation, clean water, hazard protection and clean air. In its second term, from 2016 to 2020, the committee will focus primarily on helping the government develop its 25-year environment plan
- the Natural Capital Initiative: a partnership of four leading scientific organisations that aims to support decision making that results in the sustainable management of natural capital, by encouraging dialogue between different interests and communicating the evidence base
- the Natural Capital Coalition: a multi-stakeholder collaboration (headquartered in the UK) that brings together global initiatives and organisations to harmonise approaches to natural capital. Among its initiatives is the Natural Capital Protocol – a framework for business designed to help generate trusted, credible and actionable information about their interactions with natural and environmental resources.

As a company that provides environmentally-focused services, the concept of natural capital has a good fit with our activities. We invest to reduce our impacts on the water environment, to lower our greenhouse gas emissions and reduce our waste footprint. Increasingly, we are looking at ways to protect aspects of natural capital such as aquifers, rather than relying on additional equipment and energy to treat water to high standards.

We recently carried out a natural capital valuation of our landholding with environmental consultants Eunomia, focusing on the carbon capture properties of different types of land cover – the results of this are shown in the data given for each catchment in the pages that follow. We are working with the West of England Nature Partnership to identify opportunities to improve ecosystem services. And we have been innovative in how we report on our activities, such as the monetary estimate of our environmental impacts that we first published 14 years ago.

We will keep looking for ways to show that our work can have multiple benefits. For example, demonstrating how society and the environment benefit in multiple ways from joined up management of water catchments, as well as it simply being cost effective.

Focus on phosphorus

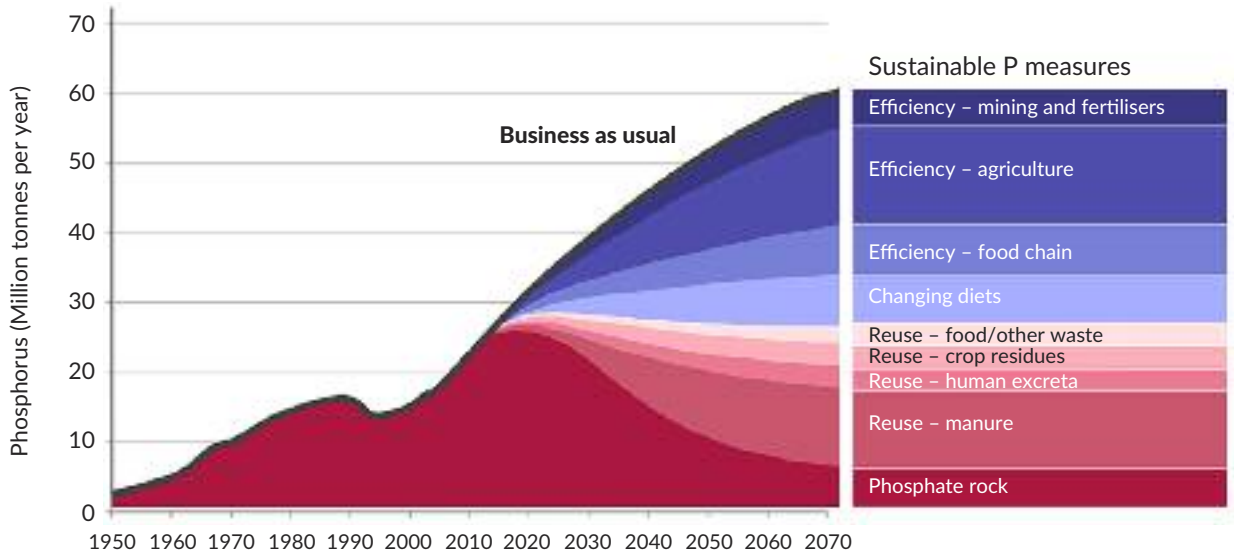
A major focus of recent effort to improve the water environment has been on the need to reduce nutrient levels. In warm conditions, high levels of phosphorus and nitrogen can lead to algal blooms, which in turn deplete oxygen levels and reduce aquatic and marine biodiversity. The nutrients can come from point sources such as sewage treatment works or from diffuse sources such as agricultural runoff.

Just under half the 3,000 tonnes of phosphorus that arrives annually at our sewage treatment works is removed with normal treatment methods. However, many treatment works near freshwater rivers and streams are required to remove more. Typically, we do this using coagulant chemicals such as ferric sulphate, removing more than 300 additional tonnes of phosphorus each year. This means that 83% of the phosphorus that arrives at these locations is extracted.

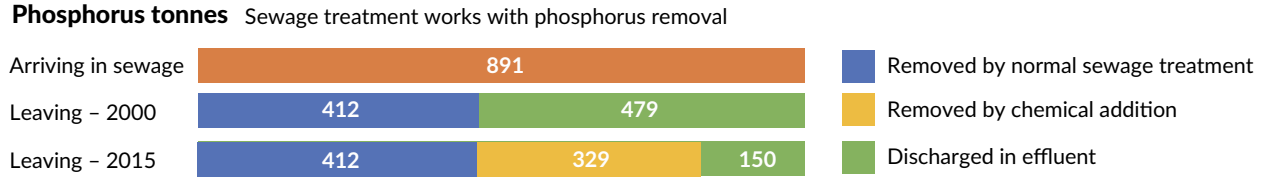
Meanwhile, the Environment Agency's National Environment Programme includes trials of novel processes for meeting more stringent concentrations required by the EU Water Framework Directive. For our part we are running four trials, including a magnetite assisted settlement process (BioMag), absorptive media (steel slag reed beds) and stretching existing chemical dosing performance on tertiary sand filters and activated sludge plants. We are also working with the University of Bath to develop an engineered pond for the removal of phosphorus from sewage effluent, using a species of algae found at one of our sewage treatment works, that shows promise in terms of its ability to remove phosphorus and then rapidly settle out so that the cleaned water can be decanted effectively.

As explained elsewhere in this report, we are working on other more innovative methods. These include catchment based sewage treatment permits in the. Bristol Avon; an online auction for helpful land management methods around Poole Harbour (albeit focused on nitrates rather than phosphorus); and a study of the background level of phosphorus in the upper Hampshire Avon from natural geological sources.

This issue is likely to intensify in the future as rock phosphate from easier to access, high concentration sources is expected to become more scarce over time. This means that the value of phosphorus will increase overall, which in turn will create more impetus to recover phosphorus from different sources. As the graph below shows, a mix of demand and supply side measures will be needed for food to continue being produced affordably and in sufficient quantities.



Cordell, D. & White, S., 2013. Sustainable Phosphorus Measures: Strategies and Technologies for Achieving Phosphorus Security. Agronomy, 3(1), pp.86–116



Bristol Avon

Catchment partnership

The Bristol Avon is our flagship catchment for demonstrating new technologies and approaches. This includes trialling new technologies for phosphorus removal, exploring new regulatory opportunities and working in partnership.

As many of the challenges within the catchment cannot be solved by Wessex Water alone, good partnerships are crucial to us. We believe there are many opportunities for different organisations to work together more efficiently to address flooding, drought, water and environmental quality, and other aspects of the area's resilience. In turn, this should help enable development and economic growth while enhancing the natural environment.

The Bristol Avon catchment partnership is hosted by Wessex Water and comprises a range of organisations including local authorities, wildlife trusts, environmental NGOs, Natural England and the Environment Agency. The partners are committed to delivering action across the catchment that will deliver multiple benefits and work towards achieving European Union Water Framework Directive and Biodiversity 2020 targets.

A key requirement is to ensure that decisions are based on sound science and evidence. The partnership has been using a method known as 'participatory ecosystem services visualisation', that has been applied in more than 30 other catchments in England to date. Developed by the Westcountry Rivers Trust, Defra and the Rivers Trust, this enables stakeholders and technical specialists to work together to evaluate all the relevant data and evidence relating to the environment and the ecosystem services found within a catchment. More than 70 maps have been produced indicating risks and opportunities for improvement; for example, erosion and diffuse pollution risk maps which show where efforts would have the greatest potential to reduce soil and nutrient losses.

Adaptation and resilience framework

Alongside, a framework is being developed with local authorities and utility providers that aims to create an attractive and sustainable area for future generations. This would involve a strong regional economy and enduring infrastructure supported by sustainable agriculture and resilient natural capital. One part of this project is to identify opportunities for climate change adaptation measures which could be achieved by improving natural capital in specific locations. Doing this with investment from a range of sources has the potential to bring about many different benefits at once.

Through this project we are also looking to help create more liveable cities and help in the delivery of the area's housing requirements, in accordance with the joint spatial plan for the West of England.

Land area: Wessex Water land and total catchment	**0.6 / 223,000 ha**
Environmental expenditure by Wessex Water during 2010-15	**£11m**
Regulated environmental schemes 2010-15, combined sewer overflows / other schemes	**69 / 6**
Wessex Water contributions to rivers not achieving good status (2015)	**35 sections**
Phosphorus tonnes at sewage treatment works with phosphorus limits: removed / discharged (2015)	**385 / 90**
Natural capital value of our landholding	**£6.7m**
Catchment management agreements with farmers / landowners	**0**

Case study: catchment permitting trial

We are working with the Environment Agency to develop an innovative approach to setting permits for the amount of phosphorus we can discharge in effluent from our sewage treatment works in the Bristol Avon river catchment. This is a catchment wide form of permitting which should lead to more improvements to the water environment at a lower overall cost. While doing this we and the Environment Agency can rethink our approach to environmental risk and regulation.

The permit works by grouping together the 66 sewage treatment works in the catchment and calculating their total loading of phosphorus into watercourses, identifying the locations where phosphorus reductions are most needed by the environment and also most cost effective. This means that phosphorus removal will be installed at 24 sewage treatment works by 2020, reducing our overall discharge of phosphorus by 46 tonnes to 216 tonnes per year across the catchment. Having agreed this approach with the Environment Agency we have started monitoring work.

If we had not advocated this novel approach, there would have been significantly less phosphorus removal in the Bristol Avon catchment during 2015-20, as it was deemed not to be cost beneficial at many sites according to the criteria for investment to comply with the Water Framework Directive.

Depending on the success of this trial, we believe this approach could be applied on a much wider scale and potentially combined with other methods such as nutrient trading (see page 11).

Bristol and Avon catchment partnership

Axe, Brue, Parrett and Tone

Bathing waters

Prior to the revised Bathing Water Directive taking effect in 2015, we identified Burnham Jetty as the only bathing water in our region that was likely to fail the Directive's 'sufficient' standard due to a change of classification and tightening of standards. The subsequent failure that occurred there was a result of this, rather than any underlying deterioration in water quality. It was also the reason for the reported drop to 98% of bathing water beaches passing EU standards in 2015, compared with our performance commitment target of 100%.

Otherwise, we achieved our target of delivering 100% of the schemes identified in the area in the National Environmental Programme. These include:

- screening an overflow at East Quay in Bridgwater
- installation of 77 monitors that record the duration of spills from sewer overflows
- building an ultraviolet disinfection plant to treat overflows from our storm tanks at Highbridge.

Catchment management

Our catchment management team works with farmers around our surface water reservoirs to reduce the levels of phosphorus, soils and problematic pesticides such as metaldehyde leaching into them. In the Durleigh reservoir catchment we have engaged with the landowners and tenants covering the entire area, offering advice, assistance with land management and funding. Eight of these have introduced at least one change to management practice, for example using alternatives to metaldehyde and leaving buffer strips at field margins.

These measures have led to almost complete removal of metaldehyde from the catchment, with only one exceedance of metaldehyde over the past two years, which was due to pumping water in from the Taunton-Bridgwater canal. We have also funded the planting of buffer strips to reduce nutrient rich runoff from high risk fields, undertaken fertiliser sprayer calibration and appointed a biodiversity adviser to work with farmers to identify ways to achieve the biggest benefits for water quality and biodiversity.

Environmental investigations

Investigations during 2010 and 2015 showed that Durleigh reservoir has an impact on flow, silt and water quality in Durleigh brook downstream. The brook's ecology was found to be imbalanced with an excess of invertebrates that feed on settled phytoplankton from the compensation flow from the reservoir, but few other species that would be expected in a stream in this area. As a possible remedy, we are trialling different flow rates including a simulation of a brook in spate following summer rain storms. Subsequent monitoring should tell us if this successfully flushes sediment from the brook and whether its water quality and ecology improve as a result.

Land area: Wessex Water land and total catchment	**1.4 / 273,000 ha**
Environmental expenditure during 2010-15	**£20m**
Regulated environmental schemes 2010-15, combined sewer overflows / other schemes	**10 / 21**
Wessex Water contributions to rivers not achieving good status (2015)	**36 sections**
Phosphorus tonnes at sewage treatment works with phosphorus limits: removed / discharged (2015)	**112 / 31 t/yr**
Natural capital value of our landholding	**£11.1m**
Catchment management agreements with farmers / landowners	**21**

Case study: surface water management

We are active participants in a multi-agency group in this part of the region comprising the Environment Agency, Sedgemoor District Council, Somerset internal drainage board, the catchment sensitive farming team and others to ensure that all parties are co-ordinated to deliver water quality improvements together. As part of this we are supporting a coastal engagement officer who is working in Burnham-on-Sea to raise awareness of water quality and increase local people's sense of ownership of their beach. This includes campaigns on sewer misuse, dog fouling and beach litter. A first phase of this project was to understand more about the local community and issues, with a survey conducted to help highlight the areas and activities that need the greatest attention.

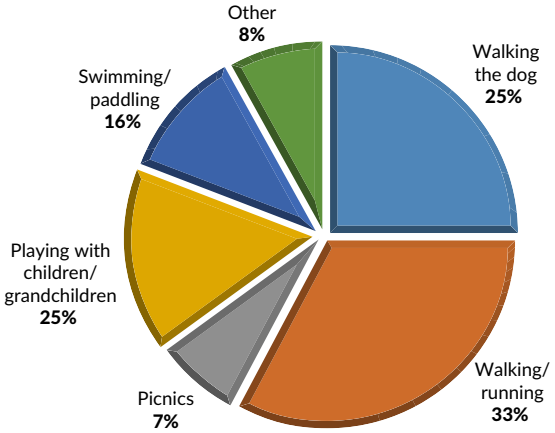
Twenty miles to the north, Tickenham, Nailsea and Kenn Moors are part of the Severn levels and moors, an area of low lying agricultural land to the north of the Mendip Hills. The levels and moors have been designated a Site of Special Scientific Interest (SSSI) because of the presence of an exceptionally rich plant community which supports a number of rare invertebrate species, such as the silver water beetle. The area is drained by a network of rhynes which criss-cross the area. Wessex Water owns a surface water overflow which provides drainage for the roads and hard-standing areas within Nailsea – this discharges into the SSSI.

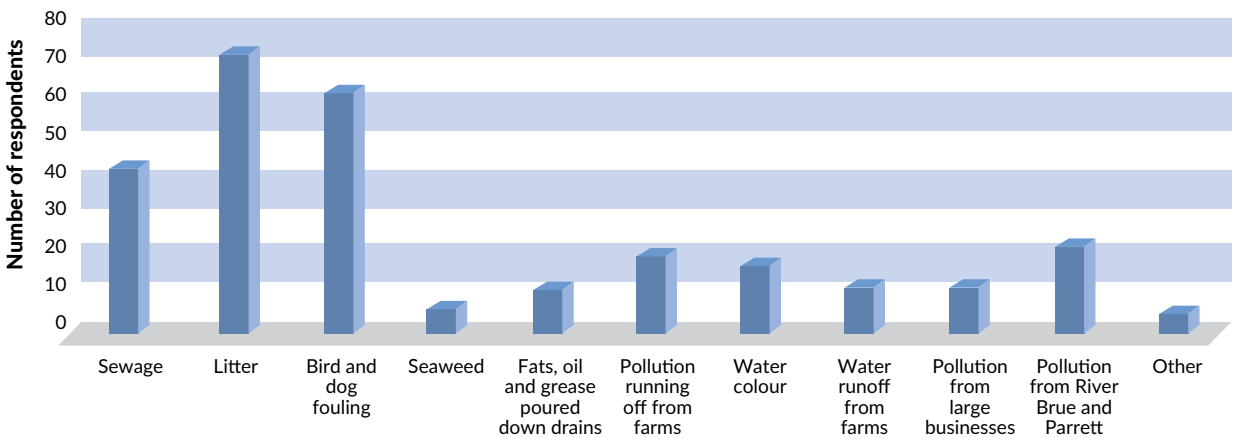
Natural England has raised concerns that this discharge may be negatively affecting the status of the SSSI. As part of this investigation we are collecting water quality samples from the outfall and rhyne network, particularly following rainfall events. We have also installed some flow monitoring on the outfall, having undertaken some Streamclean work identifying misconnections, and assessing the ecology within the rhynes.

As a result, we have identified a number of misconnections which have been dealt with by the relevant parties, and unblocked a number of sewers where there was an impact on the surface water system. This has led to a reduction in the phosphorus concentration discharged from the overflow.

The next stage is to undertake an options appraisal study to identify lasting solutions. This is quite sensitive as Wessex Water has no responsibility for the quality of the water which is discharged from the overflow – this arises from Nailsea. Options may include tackling some of the other high sources of phosphorus that have been identified, such as agriculture and Bristol Water, and working with the local community to raise awareness of how their actions can affect the SSSI.

Activities most commonly undertaken by the community





The issues the community thinks are affecting the bathing water

Stour, Frome and Piddle, Poole Harbour

Water abstraction

Abstraction from our Mere water source has caused local concern in the past, especially during dry conditions when there have been low flows in two streams fed by groundwater in the area. We have already taken a number of measures to reduce the amount of water produced for public water supply from the site. Consequently, the Mere source is now only used as a backup when others are unavailable or when we cannot otherwise meet public water demand.

While we abstracted 172 megalitres from Mere during 2015-16, compared with our performance measure target of 100 megalitres per year, we anticipate this figure will reduce later in the next four years once our integrated water supply grid is completed.

Environmental investigations

In this catchment we are currently investigating the effects of our sewage treatment works on the ecology and chemistry of the Moors River site of special scientific interest (SSSI) and on Christchurch Harbour. In the Moors River we are using a mobile water quality monitoring unit located at the bottom of the catchment to analyse phosphorus, nitrate, ammonia and turbidity at 30-minute intervals. This will demonstrate any seasonal variations in water quality and help us understand the relative influence of our effluent discharges. We are also trialling 'P-Pods'; these are novel online phosphorus analysers which can be deployed anywhere using solar panels and batteries for short-term intensive water quality monitoring.

Catchment management

Our catchment delivery team are very active in Dorset. In the vicinity of the Poole Harbour catchment one of the main aims is to influence use of fertiliser on farmland to the extent that more expensive nitrogen removal at Dorchester sewage treatment works can be deferred. In 2015-16 alone we calculate that our work with farmers focusing on land management has already reduced nitrogen leaching across the target area by approximately 20 tonnes, compared with a target of achieving a 40-tonne reduction by 2020.

We also host the catchment partnerships in the Stour catchment and Poole Harbour and have recently extended these to include all of the sub-catchments within Dorset. With a focus on the delivery of on the ground action, recognising the different farming practices and challenges across the county, activities this year included farmer led demonstration events and an algae harvesting workshop.

Land area: Wessex Water land and total catchment	**0.4 / 210,000 ha**
Environmental expenditure during 2010-15	**£41m**
Regulated environmental schemes 2010-15, combined sewer overflows / other schemes	**13 / 10**
Wessex Water contributions to rivers not achieving good status	**31 sections**
Phosphorus tonnes at sewage treatment works with phosphorus limits: removed / discharged (2015)	**44 / 5 t/yr**
Natural capital value of our landholding	**£2.8m**
Catchment management agreements with farmers / landowners	**34**

Case study: nitrogen trading and tonnage reductions

Poole Harbour is a notable waterbody and recognised by numerous environmental designations: it's a site of special scientific interest (SSSI), a special protection area under the EU birds directive and a Ramsar wetland. It also contains locations that are national nature reserves and the surrounding heathlands have been designated as a Special Area of Conservation under the EU Habitats Directive. One of the main concerns about the harbour is the level of nutrients in the water; this can promote the growth of algae under certain conditions which in turn can adversely affect biodiversity. To improve conditions there is a need for reduced inputs of nutrient – particularly nitrogen – into the harbour.

In 2008 we installed nitrogen removal at Poole sewage treatment works. This had the effect of reducing our discharge of nitrogen into the harbour by 927 tonnes every year, which means that our contribution has fallen to 15% of the annual inflow of nitrogen. This came at an upfront cost of £12 million, annual running costs of £0.5m and an estimated 1.5% addition to our operational carbon footprint.

But there is a desire to go further. The business as usual approach would be to pursue nitrogen removal from point sources in the river catchments upstream of the harbour. One such candidate is Dorchester sewage treatment works, where 40 tonnes of nitrogen could be removed each year but would cost an estimated £6m to install and around £0.4m each year to operate. This amounts to an annualised cost of around £1,700 per tonne of nitrogen removed.

Given these figures, we have gained the agreement of environmental regulators and others to try out alternative approaches before we implement this standard end-of-pipe treatment option.

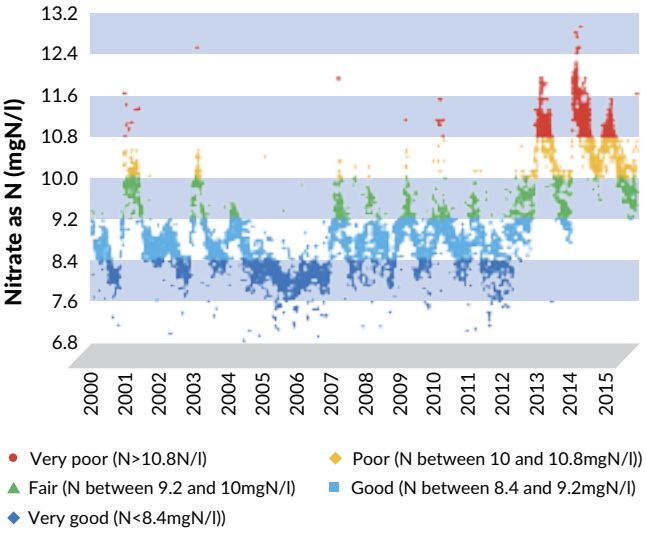
Consequently, our catchment delivery team has been extending its work with farmers in the area. To begin with we estimate that 15 tonnes of nitrogen leaching was avoided during 2015-16 simply by calibrating 18 fertiliser sprayers that operate across a 2,200 hectare area.

We are also encouraging farmers to plant cover crops such as oil radish that absorb nitrogen from the topsoil and can reduce leaching, especially during the wetter winter months. One way that we are doing this is through a new nutrient trading system that we have devised, called EnTrade. This works as an online reverse auction whereby farmers place bids for payment to grow cover crops for the following winter. The initial results of a proof of concept trial during summer 2016 were promising and we will document progress in future editions of this catchment report.

Hampshire Avon

Catchment management

We abstract water at several points from the chalk aquifer in the upper part of this catchment and have good relationships with farmers in the area. We work most closely with farmers in locations where only a small number are responsible for the land near our sources. An example is our Deans Farm water source near Salisbury, where we are working with farmers to reduce nitrate levels in the groundwater. High risk areas have been identified through an intensive monitoring programme using porous pots to capture leachate from just below the crop root zone. The resulting data has led to changes in cultivation techniques; relocation of cattle from fields during the winter to newly built housing; allowing weeds and self-seeding plants to become established or sowing cover crops in order to minimise bare soil; more accurate spreading of inorganic nitrogen fertiliser, and improved slurry storage facilities.



Nitrate concentration at Deans Farm raw water borehole

Environmental investigations

For a long time we have been investigating the effects of water abstractions on the unique chalk stream ecology of this catchment – in particular, how the ecosystem responds to less water being abstracted from groundwater near locations where the river flows all year round. This investigation is working at the level of mesohabitats – these are distinct types of habitat such as river gravel, ranunculus, silt or marginal plants. These surveys are being continued to see if long-term species records and flow data together reveal hydro-ecological relationships which can be used to calculate the result of reduced water abstraction.

This is another river catchment where we are investigating the discharge of nutrients from our sewage treatment. To date, we have invested more than £50m in phosphorus removal in this catchment, using the addition of metal salts such as ferric sulphate. To go further would require more innovative approaches which could be more or less sustainable than current practice. Firstly though, we are quantifying our phosphorus and nitrogen discharges relative to other sources. The data is fed into models that help identify the most cost effective measures to further improve the water quality. This might include land management, constructed wetlands, more advanced sewage treatment or improvements to private sewerage and unsewered areas.

Land area: Wessex Water land and total catchment	**0.2 / 174,000 ha**
Environmental expenditure during 2010-15	**£17m**
Regulated environmental schemes 2010-15, combined sewer overflows / other schemes	**1 / 10**
Wessex Water contributions to rivers not achieving good status	**11 sections**
Phosphorus tonnes at sewage treatment works with phosphorus limits: removed / discharged (2015)	**199 / 24 t/yr**
Natural capital value of our landholding	**£1.3**
Catchment management agreements with farmers / landowners	**22**

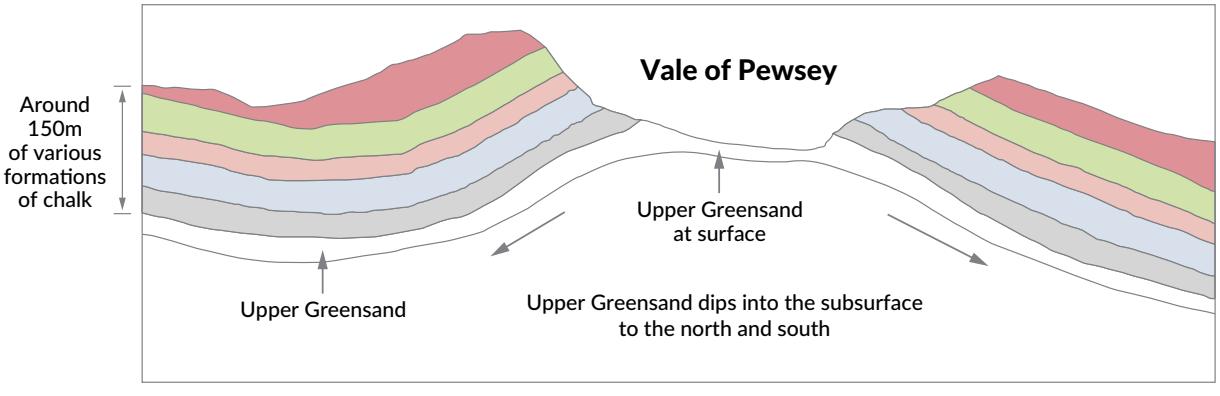
Case study: natural phosphorus contribution from the Upper Greensand

Some rivers and streams in the Hampshire Avon catchment contain high concentrations of phosphorus, which is an important pollutant contributing to adverse ecological impacts in its streams and rivers. While we have phosphorus removal at the majority of sewage treatment works in the catchment, we wish to identify other potential sources so that any further investment we make is well targeted and proportionate.

It is well known that phosphorus can reach the river from farming and other land-based activity, either via runoff or from leaching into the ground and eventually to watercourses. However, it is also possible that there are natural sources linked to the geology of a river's catchment area. In the case of the Hampshire Avon, most of the water in the Upper Avon (which flows from north to south towards Salisbury) comes from the Upper Greensand aquifer in Pewsey Vale and from the surrounding lower chalk aquifer. Phosphorus can be released naturally in an Upper Greensand aquifer through the weathering of a mineral called apatite contained within the rock. Apatite largely comprises calcium phosphate and is itself used in the production of fertiliser. However, secondary apatite can also be formed within the aquifer. This is not formed naturally but comes from human sources of phosphorus such as fertiliser and septic tanks.

To understand this better we are supporting a PhD study with Bristol University, British Geological Society and Natural England, that will try to distinguish between the different sources of phosphorus in the upper catchment: primary apatite, secondary apatite and phosphorus leaching directly from land use and other human activity. If the natural background concentration of phosphorus in the Hampshire Avon can be quantified, there will be a better basis for setting long-term targets for reducing other forms, whether through investment at sewage treatment works or through enhanced land management.

Most of the water in the Upper Avon... comes from the Upper Greensand aquifer in Pewsey Vale



Smaller catchments

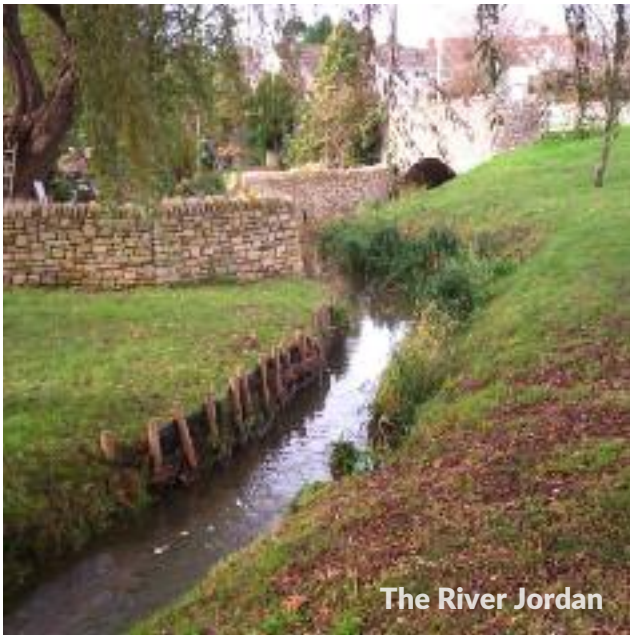
The smaller catchments in our region include many small coastal streams which flow into bathing waters and the sea. Bacteriological levels can be higher in some locations due to rural land practices and settlements that are not connected to mains sewerage but mainly have private septic tanks and sewage treatment works that we do not maintain. Locally, these can make a significant contribution to contamination of the water environment. These catchments can also have rapid responses to rainfall, leading to high levels of runoff into bathing waters and shellfisheries.

Our projects in these areas include the following:

- development of a constructed wetland at Cromhall in South Gloucestershire, to reduce phosphorus discharges to the Tortworth Brook. This is currently in the design phase

The Fleet estuary

- an investigation of the impacts of our discharges into The Fleet (behind Chesil Beach). This is specifically looking at bacteriological impacts on the shellfishery
- surveys to assess the extent to which Nutscale reservoir dam near Porlock acts as a barrier to European eel migration



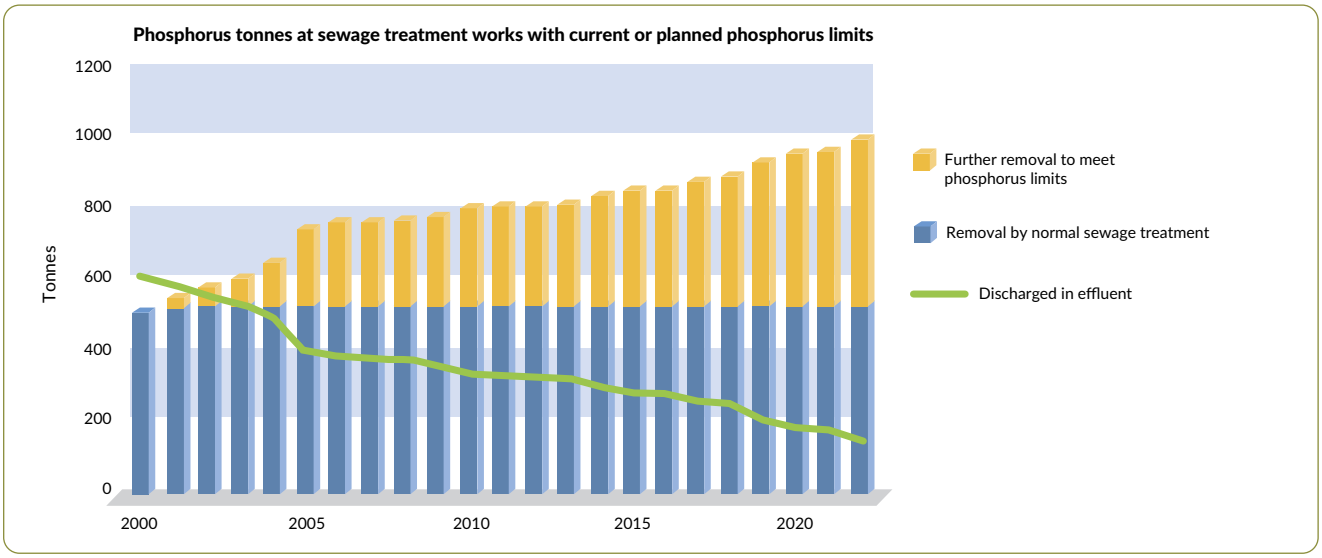
The River Jordan

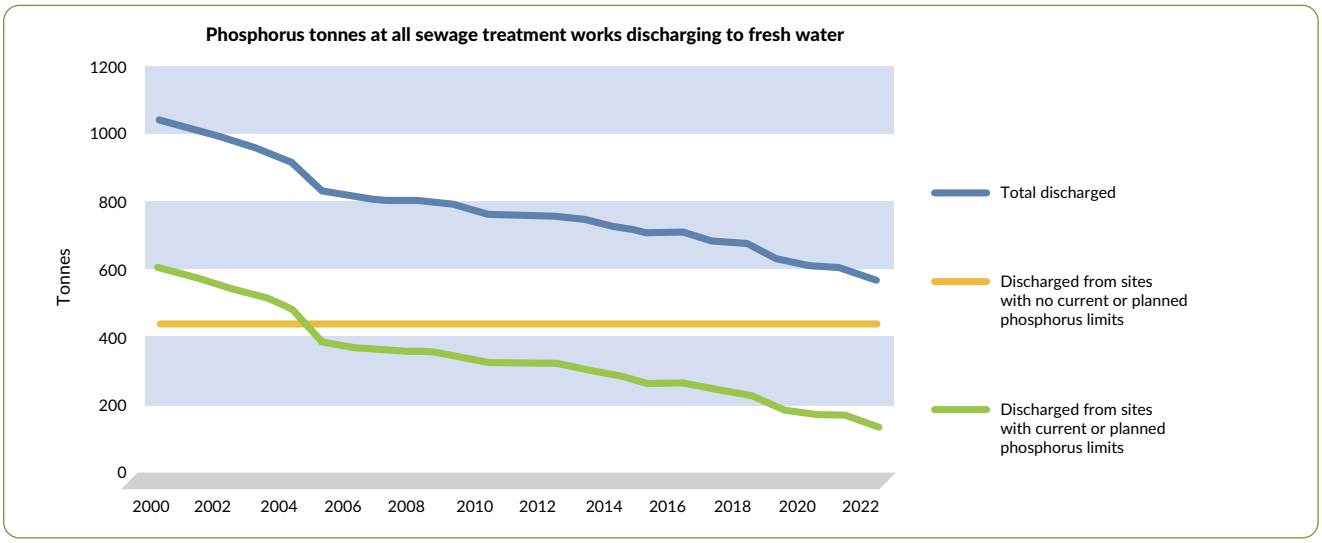
- a study of the effects of our groundwater abstractions on the River Jordan, which flows into Weymouth Bay
- support for an innovative project by the South Gloucestershire Biodiversity Action Group to restore populations of adder's tongue spearwort and tassel stonewort on Inglestone and Hawkesbury Commons.

Land area: Wessex Water land and total catchment	**0.2 / 110,000 ha**
Environmental expenditure during 2010-15	**£6m**
Regulated environmental schemes 2010-15, combined sewer overflows / other schemes	**24 / 5**
Wessex Water contributions to rivers not achieving good status	**4 sections**
Phosphorus tonnes at sewage treatment works with phosphorus limits: removed / discharged (2015)	**1 / <1 t/yr**
Natural capital value of our landholding	**£1.7m**
Catchment management agreements with farmers / landowners	**10**

Catchment data

	Bristol Avon	Brue, Parrett, Tone & Axe	Stour, Frome, Piddle and Poole Harbour	Hampshire Avon	Smaller catchments
Land area: Wessex Water land and total catchment ('000ha)	0.6 / 223	1.4 / 273	0.4 / 210	0.2 / 174	0.2 / 110
Environmental expenditure during 2010-15 (£m)	11	20	41	17	6
Regulated environmental schemes (2010-15); combined sewer overflows / other	69 / 6	10 / 21	13 / 10	1 / 10	24 / 5
Wessex Water contributions to rivers not achieving good status (sections)	35	36	31	11	4
Phosphorus at sewage treatment works with phosphorus limits: removed / discharged (2015) (t/yr)	385 / 90	112 / 31	44 / 5	199 / 24	1 / <1
Natural capital value of our landholding (£m)	6.7	11.1	2.8	1.3	1.7
Catchment management agreements with farmers / landowners	0	21	34	22	10





Biodiversity

Our work to protect the biodiversity of our region includes management of our own land, actions related to capital projects and partnerships with wildlife organisations.

Our landholdings

We have changed the management of our key conservation sites over the last five years as a result of extensive surveys. We are working towards the target of assessing 100% of our landholding for biodiversity and have so far surveyed most of the sites above 10 hectares. This amounts to just over 60% of our land area which meant we met our performance commitment for 2015-16.

Nearly 300 hectares of our land are designated as sites of special scientific interest. Our management of these vital habitats ensures that their condition exceeds government targets; currently, the status of 99.5% of our SSSIs is assessed as favourable or unfavourable but recovering (and mostly the former).

In 2015, we appointed a conservation, access and recreation officer to help improve our sites for the benefit of wildlife and people. The officer coordinates numerous projects at sites that have a lot of visitors or are particularly important for wildlife and heritage. So far these have included:

- woodland management on Clatworthy hill fort, a scheduled ancient monument, to prevent damage to archaeological features
- an assessment and improvement plan for the children's play area and visitor toilet facilities at Sutton Bingham reservoir
- access improvements at Tucking Mill Lake to secure the disabled angling facilities and maintain a peaceful and secure facility
- design of a new bird hide at Bleadon Levels nature reserve
- review of all known bat roosts on Wessex Water land and development of a monitoring protocol
- assessment and management of trees to maintain public access and safety at Backwell Lake, Durleigh reservoir and Tucking Mill
- extended car parking at Hawkridge reservoir to improve access for disabled visitors and anglers.

Our management of the SSSIs in our region ensures that their condition exceeds government targets

Partners Programme

During 2015-20 we are allocating up to £80,000 a year through our Biodiversity Action Plan Partners Programme across four major wildlife projects, with good progress made during 2015-16.

The Dorset Wild Rivers project run by Dorset Wildlife Trust involved 15 farm management plans being drawn up to tackle diffuse pollution; 6.5 hectares of habitat creation or buffering along streams and 3km of river restoration or enhancement.

Wiltshire Wildlife Trust's Wessex Chalk Streams project included 3.4km of river restoration; 7.5ha of land being identified for floodplain reconnection; guided walks and talks for the public; an ERASMUS student studying the benefits to invertebrates from river restoration; and training 19 volunteer river fly monitors.

The South Wiltshire Farmland Conservation project, run by Cranborne Chase Area of Outstanding Natural Beauty (AONB) successfully initiated a 'farmer cluster' in the Chalke valley. This provide an opportunity for farmer led, landscape scale conservation work. This cluster's activity included selection of priority species, detailed mapping and an application for Countryside Stewardship Facilitation funding. The project also won the Bowland award from the National Association of AONBs for the most outstanding contribution to an AONB.

Avon Wildlife Trust's restoring coastal and floodplain grazing marsh project in the North Somerset Levels brought together a local delivery partnership for the area. It identified target areas and priority activities and worked with Natural England on new Countryside Stewardship agreements in these target areas.

We have also launched a small grants scheme providing funding for practical, smaller scale conservation or research projects.

In the Bristol Avon catchment we supported two projects delivered by Bristol Avon Rivers Trust. The Sherston river improvement project resulted in 240m of river enhancement and 65m of bankside woodland management, while the Magnificent Marden project delivered approximately 200m of river improvements and significant engagement with the local community.

In the Parrett catchment we helped Somerset Wildlife Trust to improve Rewe Mead nature reserve, including 240m of fencing; laying 60m of roadside hedge and the surfacing of access across streams to allow cattle grazing while reducing siltation. South Gloucestershire Biodiversity Action Group used our funding to reintroduce adder's tongue spearwort – a member of the buttercup family – which is only found in two places in the UK, including Inglestone Common.

Carbon

One of our long-term sustainability goals is to be carbon neutral in our operations. To do this we need to avoid energy use where possible, improve efficiency and increase renewable energy generation. While electricity use increased between 1990 and 2010, mainly due to tighter sewage treatment standards, we have now halted this trend, largely through concerted energy efficiency work. This is supported by detailed consumption information, analysed through our energy data hub, that reveals sites using too much electricity, and in turn helps focus corrective measures.

This year we trialled Open Energi's dynamic demand system at Ham sewage treatment works which involves instantaneous, temporary adjustment of the site's energy use to maintain a balance on the local electricity grid. We completed installation of advanced anaerobic digestion and associated electricity generation at Trowbridge sewage treatment works. This facility is expected to generate just under seven gigawatt hours of renewable electricity per annum.

Meanwhile, we have installed a 250 kilowatt solar photovoltaic array on the roof of our Bath operations centre which is forecast to supply around 12% of the building's annual electricity demand. Overall, we exceeded the target of 21% of our energy provided by self generation.

Our operating division GENeco was a category winner in several awards during the year for schemes such as food waste digestion, gas to grid and the Bio-Bus. These included the Guardian Sustainable Business awards, the UK AD and Biogas Industry awards, the National Recycling awards, the Energy awards, the Low Carbon Vehicle Champion awards, the National Sustainable City awards, the CIWM awards, and the South West Built Environment awards.

Our net greenhouse gas emissions fell to 138 kilotonnes carbon dioxide equivalent in 2015-16 – our lowest since 1999-2000 but still higher than our target. Our emissions are highly sensitive to the carbon intensity of grid electricity; if they remained at the level forecast in the business plan, our emissions would be better than the target for the year. This reflects the combined effect of the work set out above and the lower carbon dioxide intensity of UK grid electricity compared with 2014-15.

Overall we exceeded the target of 21% of our energy provided by self generation.

Waste management

By 2020 we aim to divert from landfill 100% of the waste generated from our activities.

Our approach to waste management

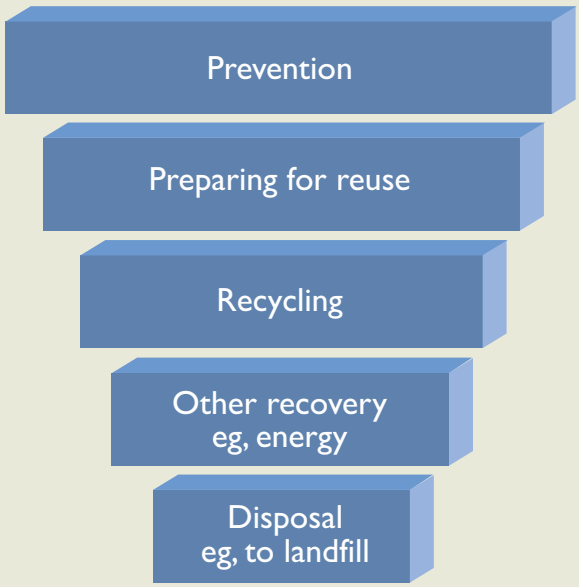
By 2020 we aim to divert from landfill 100% of the waste generated from our activities. Currently we are the only company that has made this commitment.

With landfill tax at £80 a tonne it makes economic sense to aim for these high recycling rates, as well as the environmental benefits. We fully embrace the waste hierarchy, reducing the generation of waste wherever possible and then reusing and recycling in preference to incineration and landfilling. We have already achieved 98% diversion from landfill (including 100% of our office waste), with the remaining 2% accounted for by items such as contaminated soil and construction wastes that are difficult to reuse or recycle.

Recent work

We are implementing the zero waste strategy in our day-to-day operations. One process involves plastic, rags, paper and sanitary material that are screened out from sewage treatment works, as well as grit from the road falling into sewers. Instead of sending them to landfill, we compost these materials at Bristol sewage treatment works. In addition, we have a programme of training staff in how to adopt a zero waste approach to work at the company. More than 200 staff have now attended this training, with another 100 scheduled to attend this year.

The waste hierarchy



We have already achieved 98% diversion from landfill

Postscript

Resilient, healthy catchments give fantastic benefits to people, the economy and wildlife. Thinking about the catchment as a whole system, that can be managed to deliver multiple benefits with every action, is daunting. But the prize available from this mindset– more efficient and effective use of scarce resources – is worthwhile.

A catchment – the area of land through which water flows – is used for many purposes. Sometimes it can feel as if there is conflict between one use and another, or that spending on one catchment goal makes it harder to achieve another goal.

Every year, large amounts of money and effort are spent managing the environmental quality of England's catchments or enhancing the water services provided by catchments – such as drainage, flood protection, navigation and water supply. Wessex Water recently sponsored a review by Indepen of all this spending and who spends it. The table below summarises some of the results.

The total of £13.4 billion is a lot of money – considerably more than the 2015 GDP of UK farming, which was £8.5 billion. Yet despite this spending, the average annual damage cost of flood events in England is more than £1 billion, only 20% of England's waters meet their environmental standards and there are more than 500 events each year which result in risks to drinking water safety.

One of the reasons these gaps remain is the sheer number of organisations – at least 50 per catchment – that control the spending, and the narrow focus of the objectives they are asked to meet. Bringing these organisations together to deliver higher level outcomes that everyone shares is a huge challenge. It is great to see Wessex Water rise to that challenge and to see the positive responses from other organisations. Long may it continue!

David Baxter

Bath resident and catchment panel member

Annual spending on England's catchments (£m) – by sector

Sector	Total England (£m)	Total Wessex Water region (£m)
Pollution control and enhancing natural capital of land		
Government – central control	477	40
Government – local control	824	46
Industry, services and infrastructure	1,771	107
Rural land management	2,704	187
Water companies	1,877	116
Subtotal	7,653	496
Flooding, drainage and raw water for supply		
Government – central control	719	39
Government – local control	924	56
Industry, services and infrastructure	1,377	77
Rural land management	95	3
Water companies	2,584	112
Subtotal	5,699	287
Grand total	13,353 783	783

THE QUEEN'S AWARDS
FOR ENTERPRISE
SUSTAINABLE DEVELOPMENT
2013

CUSTOMER
SERVICE
EXCELLENCE
CSE

5253 Designed by Wessex Water design services
November 2016 Printed on recycled paper

Wessex Water
a YTL company

YTL
SINCE 1955

Registered office: Wessex Water, Claverton Down, Bath BA2 7WW
Telephone: 01225 526 000 Fax: 01225 528 000
Registered in England No 2366648

www.wessexwater.co.uk