

Upstream Thinking 2015-2020

An overview of progress contributing to 10 years
of Upstream Thinking in the South West

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Foreword

It gives me great pleasure to write the introduction to this report, which marks 10 successful years of Upstream Thinking and looks forward to great things ahead for 2020-2025 and beyond.

I joined South West Water in 2006, when we were working hard with all our partners and stakeholders to get our visionary ideas supported through the Price Review 2009 process.

They included our proposals for Upstream Thinking. Early pilots on Exmoor and in the Tamar were under way, but back then we could never have imagined it would become such a large programme and a fundamental part of our business.

Ten years later catchment management is universally accepted as best practice by virtually everyone, including the industry's economic regulator, Ofwat, and it formed a key part of all the water company submissions for the Price Review 2019.

The work that has been achieved over 10 years of the programme and, in particular, in the last five years, when it was extended to cover 10 catchments, has been remarkable.

We have invested over £20m in building the resilience of the drinking water supply in these catchments through Upstream Thinking, and this has been more than doubled by partnership match funding.

Over the last five years, we have engaged with farmers managing over 70,000 hectares, delivered over 864 farm plans and follow-up grants worth £1.72m, and restored 1,059 ha of peatland on Exmoor, Dartmoor and Bodmin moor.

The work we have done has made a significant difference to the quality of water in the rivers that we abstract from, for the benefit of not just our water treatment works but for all river life and users.

We must thank all the Upstream Thinking delivery partners in the River and Wildlife Trusts and National Park Authorities for this. The work they have done on the ground as ambassadors for the project has ensured its success.

When we set out on this journey, we were asked by Ofwat and the Environment Agency to measure and understand the impacts of Upstream Thinking. This we have done through our partnership with the University of Exeter and it is wonderful to see their findings after 10 years of monitoring and research in this report.

It is clear that catchment management is part of the Government's plans for the future of agriculture and the way it is supported and funded. The work begun by South West Water 10 years ago has flourished and has had a significant impact not just on the rivers of the South West and for South West Water as a business, but it has also been important for the support it has given to farm business and the regional economy.

Plans are already under way for the next five years and the extension of Upstream Thinking into a further four catchments, covering over 80% of our drinking water supply area.

As I prepare to step down from Pennon, I look forward to cleaner rivers in the South West with great pride in what has been achieved so far.



Chris Loughlin

Chief Executive for South West Water (2006-2016) and Pennon Group (2016-2020)

Upstream Thinking – a clear philosophy

Upstream Thinking (UST) is South West Water’s innovative and award-winning catchment management programme, focused on protecting surface and groundwater resources from detrimental landscape impacts and on developing the Natural Capital stock of their catchments.

This investment in Natural Capital increases the flow of Environmental Goods and Services (EGS), such as cleaner raw water and improved biodiversity, from catchments to deliver improved business performance and support our customer priorities of:

- Clean, safe and reliable supply of drinking water
- Reliable wastewater service
- Resilience
- Protecting the environment.

The range of pollutants reduced includes farming-derived nutrients, pesticides, faecal coliforms, sediment, dissolved organic carbon (DOC) and new emerging issues such as veterinary medicines and antibiotics. The benefits across the business include reliable clean water supplies, better wastewater dilution and natural flood management. We have consistently met and exceeded both our own environmental responsibilities and the requirements of the Environment Agency’s National Environment Programme (NEP) for the care of rivers, priority habitats and species in operational catchments.

South West Water (SWW) has always set ambitious objectives for our Upstream Thinking work, and are proud to have been the first water company to create a wider partnership project in 2010, following the success of our 2006-2010 pilots – Exmoor Mires, the Wimbleball project and Upper Tamar Lakes. We established a principle – with the water regulator, Ofwat – of working together with farmers and landowners through a third-party organisation, such as the Westcountry Rivers Trust, to deliver practical land management, at a catchment scale, capable of alleviating pressure on the rivers and our water treatment works.

Since our pioneering approach first began to yield tangible results, many other agencies and water companies throughout the country have followed our example. UST2, covering the period from 2015 to 2020, has taken this work to the next level, helping to secure a sustainable future for the environment, water treatment and our customers.

Upstream Thinking directly contributes to government targets as laid out in the Defra 25-year Environment Plan. More detail on this can be found in the South West Water Environment Plan to 2050 (available to download in pdf format from our website – www.southwestwater.co.uk).

The scope of the project extends beyond the remit of South West Water to also meet sustainability targets set by our parent group, Pennon, one of the largest environmental infrastructure groups in the UK.



Key achievements during UST1 (2010-2015)

£3.2m = 2,083 ha
invested in peatland restoration = 416,600 t
of carbon stored

+£2m
matched funding provided by farmers



7 project awards

Allocated **180** capital grants totalling **£2.2m**

1,700 farms visited

Increased UST farmers’ bottom line by up to **£20,000 a year**

Achieving objectives – redressing the balance

Working with the Environment Agency, we identified 10 catchments to host the UST2 projects that formed part of our NEP for 2015-2020. All the selected locations (nine surface water and one ground water catchment) fell within Drinking Water Protected Areas (DWPA) that were at risk of pesticide pollution, notably metaldehyde (slug pellets) and broadleaved weed herbicides. These substances are difficult and costly to remove when treating water.

The primary outcome of the schemes was the reduction of the pesticide risk in drinking water sources. Other positive consequences were recorded for water quality in relation to farm nutrients, ammonia, sediment, faecal coliforms, moorland organic carbon, quantity of flow and flood risk. The programme reduced risks to water treatment works, increased river biodiversity and met the criteria set within two Outcome Delivery Incentives (ODIs) that were pre-agreed with the water regulator Ofwat.

The progress accomplished in the five-year period – between 2015 and 2020 – allotted to our sixth Asset Management Plan (AMP6) has extended far beyond our original targets, providing a healthy head-start on our quest towards the goals set for AMP7 (2020–2025).

As an example, 164 additional farm plans (over and above the target of 700) were agreed with farmers. These cover land with a combined area of close to 10,000 ha that can be counted towards our biodiversity enhancement ODI for AMP7.

The following points offer a concise summary of the accomplishments during AMP6:

- All UST2 projects completed and ODIs exceeded
- 5,713 acres of restored or created habitat (46% above ODI target of 3,213 acres)
- 864 Farm Water and Environment Plans created (23% above ODI target of 700)
- Cumulative starting position on AMP7 ODI of 73,150 ha of active catchment management within the farm plan areas (15% above the Ofwat target of 63,209 ha). This was made possible as South West Water achieved fast track status from Ofwat for our 2020-2025 Business Plan, allowing us to get a headstart on our plans.

In addition to grant distribution, workshop organisation and event hosting by the UST Delivery Partners throughout AMP6, the work that contributed to the ODI achievements over the last five years has included:

- 2,721 acres of mire restoration on Exmoor, Dartmoor and Bodmin moor, supported by a £2m grant from Defra
- 1,114 acres of culm restoration by Devon Wildlife Trust
- 1,878 acres of other habitat managed, restored or created for biodiversity and water outcomes
- 246 farm improvement grants to farmers – worth £1.72m and doubled by their own match-funding contributions
- 24,461 trees planted; South West Water's first contribution towards the Water UK commitment to plant 11 million trees nationally.



Key achievements during UST2 (2015-2020)

5,713
acres of restored or created habitat
(46% above ODI target)

864
Farm Water and Environment Plans created
(23% above ODI target)

246
farm improvement grants – worth
£1.72m

24,461
trees planted



Challenges faced by South West Water

The South West, with its combined characteristics of low population density, high coastline to land area ratio and tourism-based seasonal flux on water demand, presents a unique set of challenges.

Of primary importance is the basic need to provide good-quality drinking water at an acceptable price point to all customers across the entire region. To ensure the delivery of this essential service, at an ecologically sustainable level, we instigated a comprehensive programme of mutually beneficial projects, uniting interested parties from the industrial, agricultural and environmental sectors; many players, one goal.

With many Areas of Outstanding Natural Beauty, the South West attracts millions of visitors each year, placing seasonal pressure on our resources and distribution networks. With much of its income generated by visitors, it is imperative that we all take steps to conserve the assets that continue to draw people towards our county borders.

Maintaining the aesthetic beauty of our unique coastal and rural landscapes whilst meeting the 21st century needs of both domestic and industrial consumers has required some innovative solutions. The following factors represent a sample of the many elements to be addressed:

- Contaminants from human and animal activity affecting water quality in our catchments (e.g. organic matter like soils and manures or chemical products including pesticides, fertilisers, slug pellets and veterinary products)
- Peatland erosion in the uplands which contributes organic colour and sediments
- Nutrients from the farmed landscape which cause algal growth and taste and odour issues
- The hilly nature of our region means our water pressure is among the highest in the industry, requiring careful management to minimise leaks, bursts and interruptions
- Bathing waters – SWW has 674 miles of coastline and 150 bathing beaches. Updating the treatment of wastewater around the coast and maintaining the infrastructure to keep these bathing waters clean is a major challenge, addressed through our Clean Sweep programme



2.2million
resident population equivalent
(over 1 million customers)
and **10million** visitors
to our region each year

- New challenges from climate changes such as sea level rise, salt water ingress into drinking water aquifers and wastewater drainage systems
- Changing rainfall patterns with greater summer storm intensity leading to erosion and flooding
- Hotter summers with less river flows leading to greater reservoir use for drinking water and the need for winter pump storage to refill.

Additional information that needs to be taken into consideration when formulating a universally acceptable set of guidelines for our future action plans include:

- Increased demand on available resources
- Abstraction and treatment reform proposals
- Degenerating water quality in raw water from catchments
- Economic and population growth
- Agricultural intensification and uncertainty
- Increased catchment risks due to demands on farmers and others
- Rising mechanisation and subsequent soil degradation causing compaction, increased run-off and flooding
- Overwhelming of drainage networks by catchment flows, resulting in Combined Sewer Overflow (CSO) discharges
- Constant assessment of the impact of new chemical products utilised in catchments
- Carbon neutral targets to reduce pumping and treatment carbon costs.



→ Region contains
34%
of all the
designated
bathing waters
in England

Surface sources
supply
93%
of water for
treatment works



Working with farmers and landowners

Land and water are intrinsically linked, and human impact over recent decades has had a detrimental effect on our peat bogs, wetlands, meadows, hedgerows, fields, woodlands and rivers.

The National Biodiversity Network, the UK's largest partnership for nature with more than 225 million wildlife records to draw upon, has been collecting and sharing biological data since 2000. In its State of Nature report for 2019, agricultural management, climate change, hydrological change, urbanisation, pollution, woodland management and invasive non-native species are identified as being among the most significant of pressures acting upon terrestrial and freshwater wildlife.

If the damage to these habitats is not reversed, raw water quality will also continue to decline, and the levels of treatment required to remedy the damage will rise. Ultimately, we need to provide customers with clean drinking water and environmental protection at affordable prices.

One of the fundamental findings of Upstream Thinking initiatives has been the intrinsic value of using nature-based solutions to build the Natural Capital stock and the resilience of catchments. Working with natural process in this way averts the need for future investment in more treatment plants to deal with degrading raw water quality. The additional immediate benefit is that cleaner raw water requires less energy and chemical use in treatment. Preventing water treatment works shutdowns due to untreatable contaminated raw water supplies also avoids future financial penalties being issued by the Drinking Water Inspectorate for unplanned interruptions in supply and reduces interruption of customer supply.

UST has identified new and progressive ways of working that have led to improved environmental outcomes. One such example is the NatureBid online auction platform originated by the Environment Agency and Sylva Foundation, redeveloped with Westcountry Rivers Trust. This was trialled in the Roadford reservoir catchment via their Channel Payments for Ecosystem Services (CPES) project operating alongside UST to enable farmers to bid for items or implement actions that promote ecologically beneficial practices, such as tree planting or improved soil management, on their land.



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The tailored NatureBid options were designed to target water quality improvements alongside wider environmental benefits. The Natural Capital investments were sponsored by a group of local business beneficiaries collectively supporting projects to effect positive change. The auction was managed by WRT with submitted bids contracted for delivery by the farmers and landowners.

Designed to encourage engagement, business activity and shared benefits, both economically and ecologically, amongst local farming communities, the NatureBid initiative perfectly embodies the spirit of Upstream Thinking.

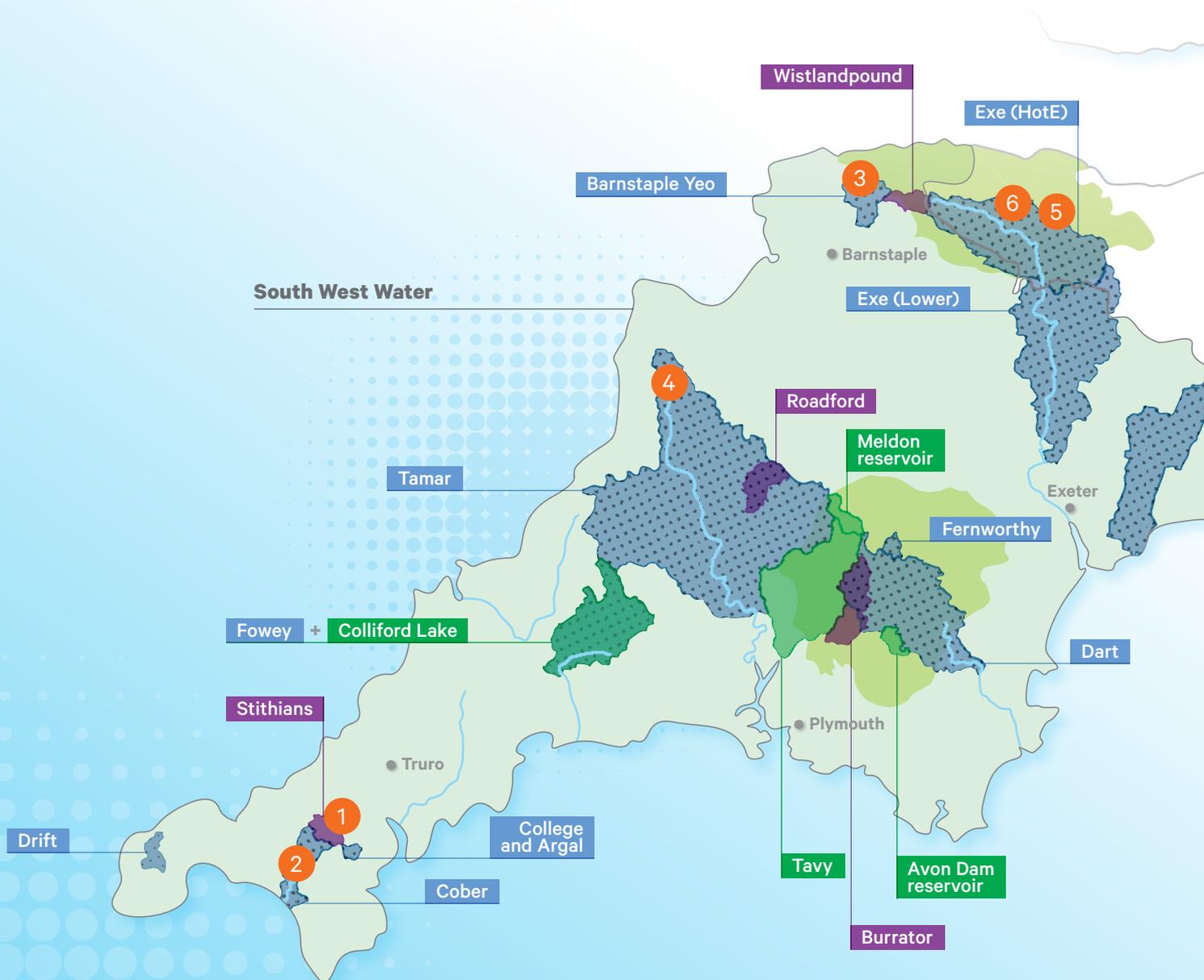
Society has never been more attuned to the consequences of human activity on the health of our planet and it is now more important than ever that we play our part in reducing the impact of creating clean drinking water on the wider environment. Working together, we can achieve that objective.



Case studies

Illustrating the variety and breadth of projects undertaken as part of Upstream Thinking, the following six case studies demonstrate how close collaboration with other agencies enables practical, sustainable and mutually beneficial outcomes for all parties.

Drawn from a range of environments, spread across the South West region, the success of each of the featured projects not only validates the UST programme, but also confirms the value of sharing knowledge, working together and building positive relationships to achieve common goals.



Case studies
continued

Project one
Releath Stream

in partnership with Cornwall Wildlife Trust

1

Project two
Diverse Leys

in partnership with Cornwall Wildlife Trust

2

Project three
River Yeo Catchment

in partnership with Devon Wildlife Trust

3

Project four
Upper Tamar Lakes

in partnership with Westcountry Rivers Trust

4

Project five
Rights of Way Repairs

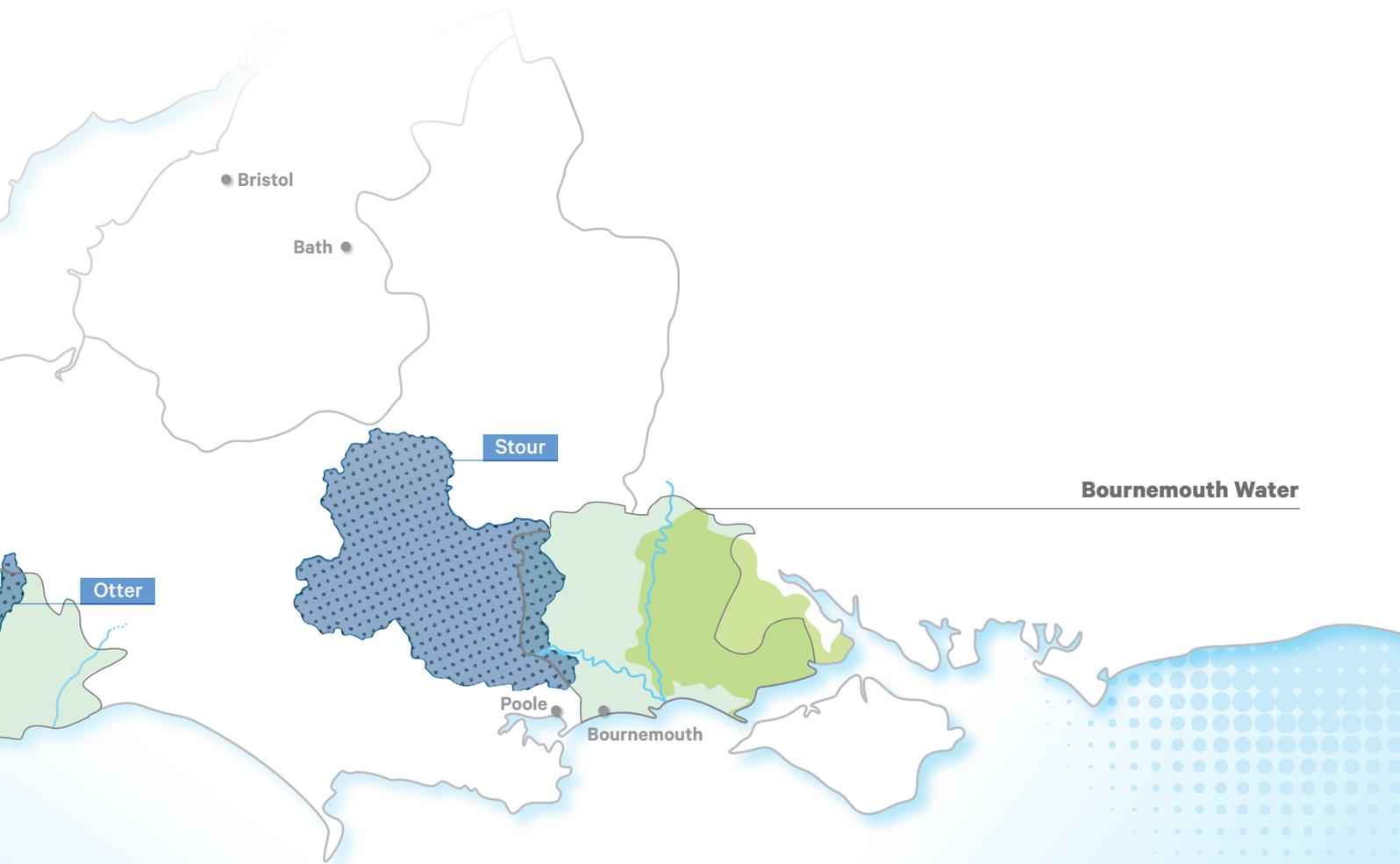
in partnership with Exmoor National Park

5

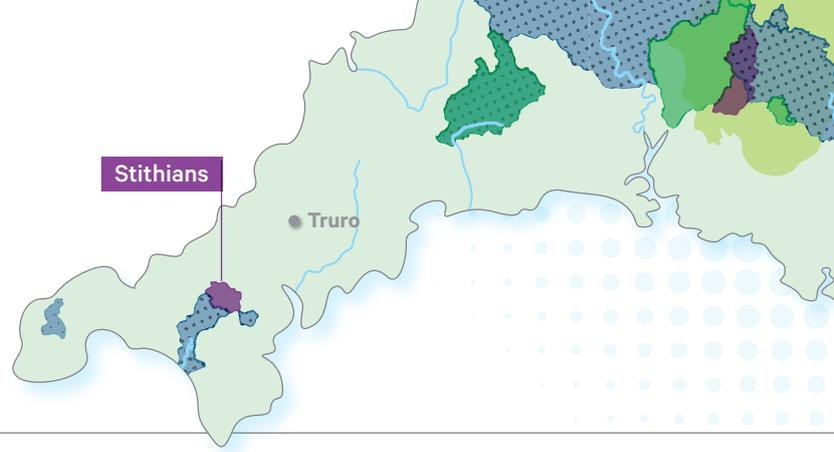
Project six
Shallow Peatland Restoration

in partnership with Exmoor Mires

6



Project one Releath Stream



In partnership with
Cornwall Wildlife Trust (CWT)

Location
Cornwall

River
Cober

Government targets



- Clean and plentiful water ✓
- Benefits to plants and wildlife ✓
- Ecological hazard reduction ✓
- Preservation of natural resources ✓
- Adaption to climate change ✓

Recognised issues

The Releath Stream (pictured below) is the western tributary of the upper River Cober, with its sub-catchment representing around 25% of the Drinking Water Protected Area. In 2008, the stream was diverted into a valve-controlled bypass channel, so it joined the Cober below the Trenear drinking water intake at Wendron. This was due to the water quality of the stream being so poor it was unsuitable for abstraction for drinking water treatment.

Water abstracted from the River Cober at Trenear is treated at Wendron Water Treatment Works. The abstraction licence states that the process can take place only if flow in the Cober is above the prescribed rate of 0.079m³/s, and only 50% of the volume of water above this rate can then be abstracted. Transfers from Stithians Reservoir to the River Cober can be made to augment the abstraction. Stithians Reservoir storage can also be supplemented by transfers from Kennall Vale. In both instances, the transfers are done by powered pumps.

Proposed solutions

Cornwall Wildlife Trust's Upstream Thinking advisors engaged with landowners across the Cober catchment, and provided both advisory services and capital grants to facilitate practical improvements; aimed at reducing a range of diffuse pollutions problems, such as dirty water run-off from farmyards (a source of ammonia and pathogens) and field run-off (a source of sediment, nutrients and pesticides).

To date, four grant-funded projects have been completed in the Releath sub-catchment (Figure 1), aided by £16,842 of match capital funding from the Environment Agency (EA). The projects, which included upgrades to livestock buildings and drainage, farm tracks, and livestock drinking facilities were designed to reduce the risk of a range of diffuse pollutants reaching the river via a variety of connecting drains and ditches. In addition, thanks to CWT's volunteer groups and Countryside Stewardship providing financial incentives for landowners to look after and improve the environment, management of land within the catchment has been modified to include new measures, such as planting tree buffers, erecting riverside fencing, roughland management and seasonal livestock removal, to address environmental issues.

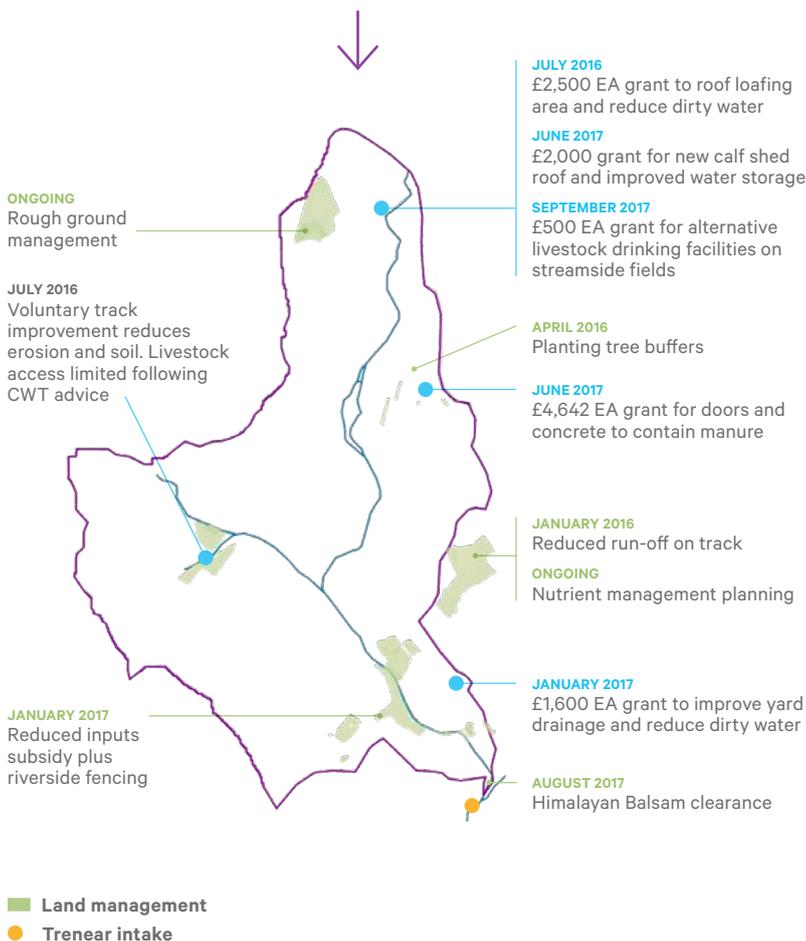
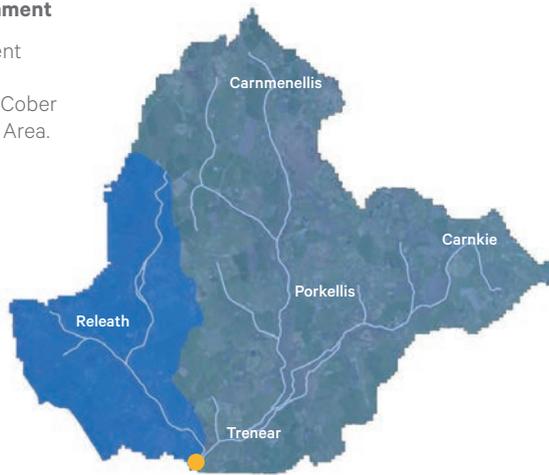
The Releath Stream near its confluence with the River Cober



Potential avoided cost
for South West Water
through AMP7
→ **£72,500**

Figure 1.
**Upstream Thinking projects
in the Releath sub-catchment**

The Releath sub-catchment (dark blue) accounts for approximately 25% of the Cober Drinking Water Protected Area.



Positive results

During the spring of 2017, our scientists assessed the water quality in the Releath Stream with a view to determining its suitability as a drinking water source. The results indicated that the Releath Stream could now be used as a drinking water source for Wendron Water Treatment Works (WTW). On 1 August 2017 the stream was re-diverted into the River Cober above the abstraction.

The calculated annual cost avoidance in reduced water transfers from Stithians to Cober and from Kennall Vale to Stithians in a range of flow types (wet year, dry year, typical year) was projected to be between £1,800 and £14,500 per year.

Restoring this resource brings the additional benefit of lowering reliance on supplemental provision of raw water from Stithians Reservoir, which, if over used, has to be pump filled in winter, increasing both cost and carbon.

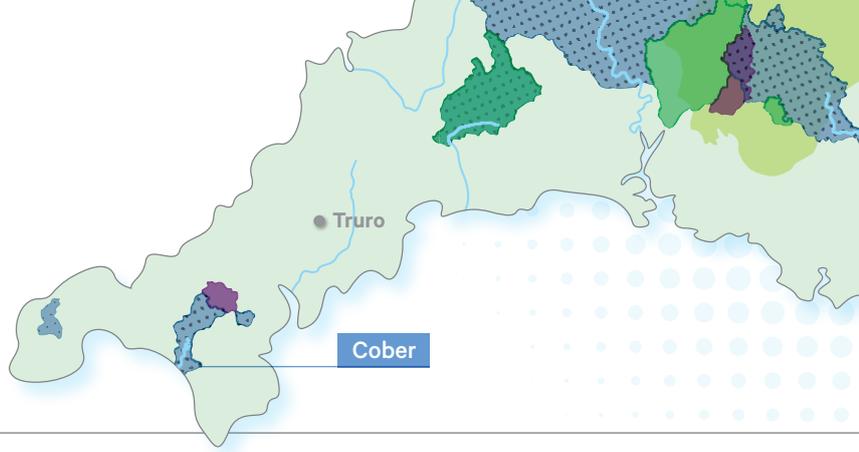
Continued work in the catchment and ongoing engagement with farmers will give long-term assurance that land use, infrastructure and water quality will not deteriorate. With continued investment and support, both the Cober and Releath catchments have the potential to further reduce polluting activities and increase the economic efficiency of Wendron WTW.



The presence of
water shrew and
brown trout suggests
**water quality
is improving**
in the Releath Stream



Project two Diverse Leys



In partnership with
Cornwall
Wildlife Trust

Location
Cornwall

River
Cober

Government targets



- Clean and plentiful water
- Benefits to plants and wildlife
- Ecological hazard reduction
- Preservation of natural resources
- Adaptation to climate change

Background history

Working with natural processes, the Cornwall Wildlife Trust UST team has been seeking solutions that not only improve water quality and lower water treatment costs but also improve, or create new wildlife habitat. Part of this work, in the River Cober drinking water catchment, involved a combined diffuse-pollution and crop-trial project on a farm in the upper catchment, adjacent to the Medlyn Stream tributary.

With project support, in spring 2018, the farmer altered two fields from conventional grass or fodder crop to a diverse legume and herb mix. The team were granted permission to then monitor the fields, which are also part of the GS4 'Legume & Herb-rich Swards' Mid-Tier Stewardship option as part of a larger farm agreement, adding value beyond that of the livestock fodder.

Two different seed mixes were trialled in two adjacent fields: a Herbal Grazing Ley (a four-year drought resistant ley) and a Resource Protection & Grassland mix (a legume and herb-rich sward). Both were sown in May 2018.

Preparing the land

Despite the exceptionally hot, dry weather that followed, and initial concerns that the seed would not take, these trial fields proved to be particularly resilient, and soon became well established.

Typically after spring-grazing with cattle, the two fields are shut off to allow the clovers, vetches, herbs and grasses to grow undisturbed, a period that also benefits pollinators by providing a range of nectar and pollen sources. They remained closed for at least five weeks before either being grazed again, or being cut and baled for winter livestock feed.

The resultant mass of growth was phenomenal, especially when taking the dry conditions into consideration. Subsequent regrowth was grazed again, when adjacent pastures had stopped growing, and was still being grazed at the end of the summer. This strong growth pattern continued into the second year despite no nutrients having been added since the seed-bed was initially mixed with farmyard manure prior to sowing.

Arid conditions in the early summer of 2018 caused some initial concerns



Deep-rooted chicory and plantain help improve soil structure, sequester carbon and provide food for pollinators





Digging deeper

By August 2019, the second-year growth had become heavily herb-dominated and information from leading strategic agricultural science agency, Rothamstead Research, suggests this could be a response to the plants having been established during a time of drought.

The fields now showed a blanket growth of around one metre high, with some chicory plants even reaching head height. The volume of buzzing from pollinating insects was also astonishing; far louder than you would experience in a conventional grass pasture, and exceeding the levels usually found in some semi-natural habitats.

For the second part of the trial, the CWT team invited an undergraduate student (from Camborne School of Mines) to base his dissertation on the experimental fields.

Electromagnetic induction was used to understand the soil properties beneath the surface, enabling a direct comparison of the moisture-holding capabilities of soil from the new deep-rooted herbal-leys with that of an adjacent, conventional grass-ley. The indications of the study were that deep-rooted pastures can store more water than their conventional counterparts, giving them a theoretically higher resistance to both flood and drought.

Positive results

The science provided solid evidence to back up the theory behind the project – that deep-rooted herbal-leys allow water to penetrate deeper into the improved soil structure. Water retention was maintained to a depth of at least 30cm, increasing catchment storage and resistance to drought through greater infiltration during rainfall and slower run-off rates. This supports higher river base flows during dry periods, extending abstraction times within the EA limits; an increasingly valuable advantage as climate change continues to cause drier summers.

Additional positive gains, courtesy of the trial fields, included the formation of low-input buffers between the farm complex and the river corridor, helping to intercept and nullify the identified run-off risk. The land now has a low nutrient input (receiving no bagged nitrogen), which has reduced nitrogen-leaching in the catchment above the Cober drinking-water intake at Wendron, and lowered greenhouse gas emissions. Boom-spraying of herbicides has also stopped, with only spot-treatment of a few thistles and docks now taking place.

Considering the multiple benefits to wildlife, the farming community and water catchment, these deep-rooted diverse herbal-leys are likely to become an increasingly common sight within our farmed landscapes.

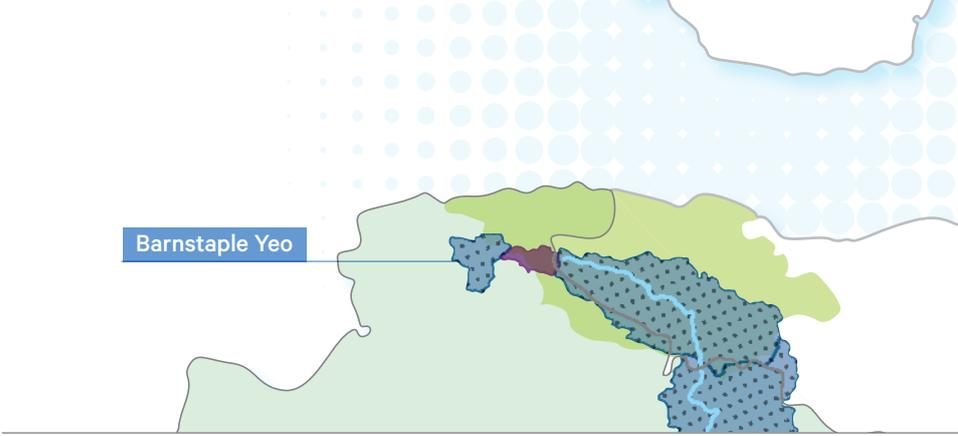
The improved soil structure via more organic matter and deeper and more complex roots will increase carbon sequestration, whilst the mix of various grasses, legumes and herbs provides good nutritional protein and medicinal benefits for the livestock. The plants grow well in drought conditions without irrigation, and the trials have offered practical information on the virtues of these diverse-leys. Sharing this knowledge with other local farmers and the wider agri-environment sector helped to promote the core message of the Upstream Thinking project to its primary participants.

Over the last 12 months, CWT has facilitated planting of 152 ha of herbal-leys across its three UST catchments.

Cornwall Wildlife Trust is also working with the agri-tech funded Toolbox of Multi-species Swards (TOMS) project to gather more data on the forage value, pollinator benefits and pollution prevention aspects, with the aim of promoting the introduction of similar leys in the near future. Three UST farms that are currently taking part in a TOMS trial are all reporting reductions in nitrogen leaching.

Project three River Yeo Catchment

Barnstaple Yeo



In partnership with
Devon Wildlife Trust

Location
Devon

Area
38km²

River
Yeo

Government targets



- Clean and plentiful water ✓
- Benefits to plants and wildlife ✓
- Ecological hazard reduction ✓
- Preservation of natural resources ✓
- Adaption to climate change ✓

About the catchment

The Yeo catchment is an area of steep valleys, hillsides with exposed tops and some significant areas of woodland, covering approximately 38km². The predominant industry in the area is agriculture, consisting mainly of dairy, beef and sheep farming with some small areas utilised as arable land. The majority of the ground consists of freely draining soils over shillet, which is prone to erosion and the release of fine grained sediments.

The headwaters begin within Exmoor National Park, a region well known for its high levels of rainfall; the Yeo receives between 1,200mm and 2,000mm rainfall a year. In drier periods, when levels in Wistlandpound reservoir are low, raw water is pumped from Loxhore to Bratton Fleming Water Treatment Works, and is an essential back-up supply.



A typical view of landscape within the Yeo catchment



Recognised issues

Historically, pesticides have posed a problem for South West Water in the Yeo. Acid herbicides (e.g. clopyralid, MCPA and mecoprop) are commonly detected at Loxhore raw water intake, with metazachlor (a neutral herbicide) and metaldehyde (found in slug pellets) also regularly detected in spot samples.

The water treatment works at Bratton Fleming is unable to cope with high volumes of turbidity, so soil erosion – to which the area is prone, due to its steepness and high levels of rainfall – is also a concern.

A large agricultural contractor, based near the top of the catchment, is responsible for applying around 90% of the chemical pesticides in the catchment, using many different products throughout each of the four seasons.

The contractor predominantly applies herbicides based on the recommendations of the individual farmer's agronomist. Sprayers used for work outside of the catchment are routinely cleaned at the contractor's yard, which can bring in pesticides that otherwise would not be found in the area.

Existing facilities at the site were not adequate to cope with the volumes of washout, with a high risk of pesticides reaching the watercourse, just 100 metres from the main site.

→ **£70,000**
grant funds
secured

14x ←
South West Water's
initial investment

Proposed solutions

A number of passive sampling devices, known commercially as Chemcatchers®, were deployed at Loxhore in 2016 and 2017 and detected a variety of pollutants present in the raw water, including acid herbicides and metaldehyde.



Chemcatcher® discs
(photo courtesy of WRT)

To combat these findings, the following measures were recommended to the pesticide provider:

- Investment in new sprayers
- Compulsory first rinse in field
- Training for drivers/sprayer operators with national expert
- Upgrade biobed material with new straw/soil/compost mix and replace torn lining
- Replace irrigation pipes over biobed and install additional irrigation pipe at its outflow
- Instigate new rinsing and storage system for used pesticide containers
- Apply for Countryside Stewardship to fund other yard improvement works for water quality
- Create a bund to divert yard water
- Apply for tree planting to buffer yard.

Positive results

Major investment by the contractor in new sprayers, biobed improvements and additional filtration have proved highly effective, with recorded levels of pesticides in the Yeo dropping considerably and the consequent improvement in water quality providing a reliable back-up raw water supply for Bratton Fleming Water Treatment Works.

Levels of metazachlor have fallen to practically zero, with no incidences recorded in 2017.

New trees, planted in 2017, now provide a natural buffer to the river, reducing the amount of run-off entering the flow during periods of heavy rain. The tree roots also stabilise the river's banks, helping to minimise the rate of bank erosion.

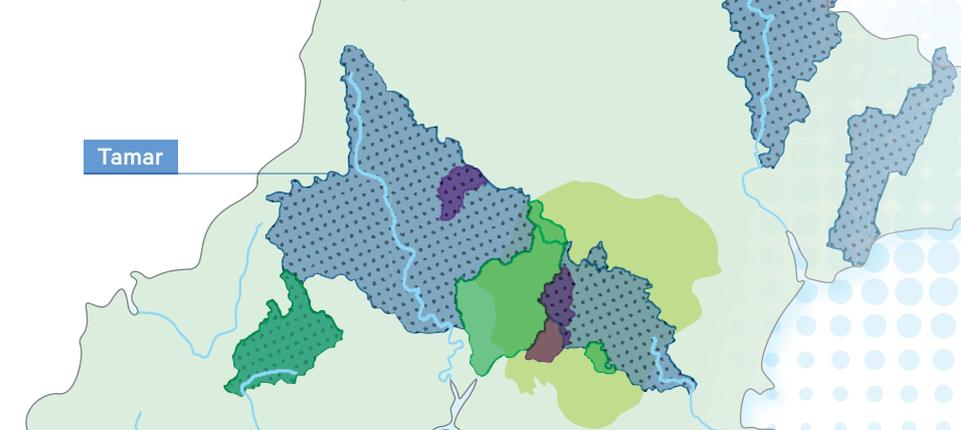
Match funding of approximately £65,000 from other sources, including a Countryside Stewardship grant of £52,000, has secured investment funding of £70,000 for an initial outlay of just £5,000, representing outstanding value for money.

**Outstanding
value for money**



**Improved biobed
with washout area
and chemical store**

Project four Upper Tamar Lakes



In partnership with

Westcountry Rivers Trust

Location

Devon & Cornwall

Area

Upper Tamar waterbody

River

Upper Tamar

Government targets

 Department for Environment Food & Rural Affairs

Clean and plentiful water 

Benefits to plants and wildlife 

Ecological hazard reduction 

Preservation of natural resources 

Adaption to climate change 

Background history

The Upper Tamar Lakes are strategic reservoirs for South West Water and were the starting place for our working relationship with Westcountry Rivers Trust (WRT). In 2002, annually recurring issues with cyanobacterial (algal) blooms triggered our mission to find a long-term solution to the problem.

Further consultation with WRT, the Environment Agency and Tamar Tributaries Fisheries Association confirmed the need for remedial action, resulting in the installation of aeration systems designed to prevent stratification and lock nitrates into the reservoir bed in order to reduce water discolouration.

Alongside this measure, the Tamar Links Catchment (TLC) management programme was initiated, the first phase of which ran from 2007 to 2009, with funding from the Tubney Charitable Trust.

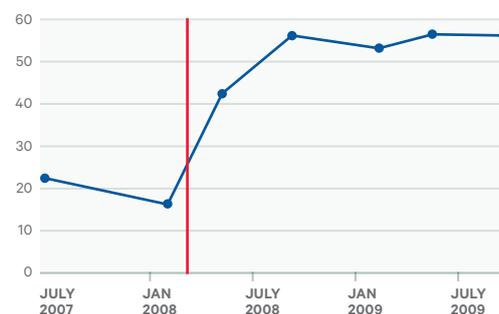
From a total of 17 farms within the catchment, 16 agreed to participate in the project, each receiving individually tailored Integrated River Basin Management Plan reports offering advice on the management of soils and nutrients, plus guidance on how to protect watercourses and their surrounding habitats.

Over its two-year lifespan, the TLC programme provided many benefits including:

- Over 200 soil tests
- Extensive nutrient budgeting advice
- Small grant assistance for 10km of watercourse fencing
- Management plans for five wetlands and four wet woodland buffer strips
- Assistance with six clean works initiatives.

Figure 2.

Grant investment: 98 hectares, 130-cow dairy farm (BMWP score)



Aquatic invertebrates were sampled downstream and upstream of an inappropriate slurry facility (A). Investment (B) in spring 2008 (red line) caused improvements in the BMWP invertebrate score.



Note: Invertebrate surveys are not designed for use in first order streams, but the results were used to demonstrate impact with the farmer.

→ **£17,300**
average grant value
47% ←
of total
investment

Widening horizons

Despite its undeniable success in tackling the algal imbalance, the parameters of the TLC project were restricted by its limited budget.

Having identified a lack of adequate infrastructure as the underlying cause of inappropriate practices at many of the farms within the catchment, levels of funding were increased considerably for phase one of our Upstream Thinking campaign.

Poor storage facilities for slurry and farmyard manure had led farmers to spread their stocks at the wrong time of year, compacting fields during wet weather and generating significant levels of diffuse pollution. The challenges created by these issues – plus several other recognised incidents of point-source pollution – were addressed by an extensive programme of remedial measures across UST1 and UST2.

For UST1 and UST2, grant funding of £121,698 coupled with farm contributions of £135,552 provided a total investment of £257,250 in the Tamar Lakes area.

Positive results

Currently, all farms in the Upper Tamar Lakes now have enough storage to house five months' supply of slurry, eliminating this source of propagation for diffuse pollution.

Project staff continue to work with landowners to alleviate the effects of historic compaction, which can still drive soil, nutrient and pesticide loss. Additionally, by improving soil structure and base flow the dilution of any remaining pollutants is increased, improving water resources over the summer period.

The Upper Tamar Lakes catchment has recently been designated as a Nitrate Vulnerable Zone which should help to attract further investment and ongoing improvements to land management.

Local impacts

1. South West Lakes Trust

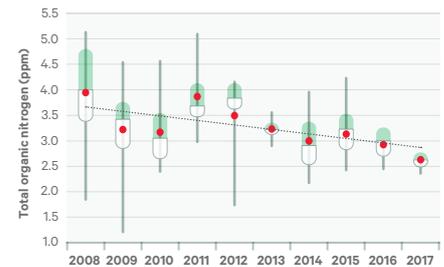
Since the initial catchment management project, and investment in aeration systems, there have been no significant algal blooms and South West Lakes Trust have not had to close their immersive sports facilities (which used to occur once or twice a year pre-2007). Additionally, South West Lakes Trust have reported a solid improvement in the visual appearance of the waters over the last five years, coinciding with the implementation of the catchment management initiative.

2. Environment Agency

The Environment Agency monitored water quality in the Upper Tamar Lakes between 2009 and 2016 as part of the Water Framework Directive (WFD). Results show an elemental improvement, with fish stocks moving from poor to moderate (likely due to improvement in spawning habitats) and levels of ammonia moving from moderate to low. This reduction in ammonia is a direct result of changes to land management practices.

Adding to the data gathered by WFD, the Environment Agency took samples at Buse's Bridge (at the inlet to the Upper Tamar Lakes) where, from 2008 to 2017, they measured for total oxidised nitrogen. In the same period, total nitrogen levels were also recorded at the surface of the lake. Both inlet and outlet nitrogen data show reductions since 2008 that again coincide with the implementation of the catchment management initiative.

Figure 3.
Upper Tamar Lakes: inlet

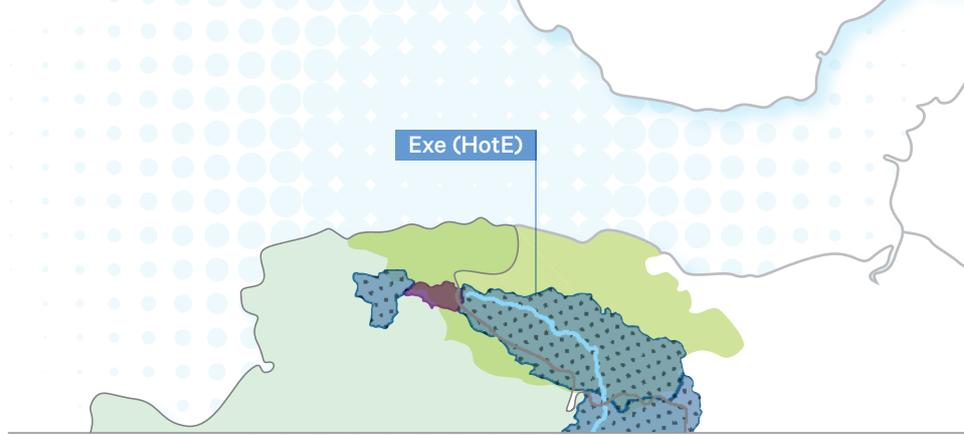


Upper Tamar Lakes: dam surface



The combination of farm project observations, Environment Agency catchment information, lake input and surface water data, and the feedback from South West Lakes Trust provides a body of evidence to support the conclusion that conditions within the Tamar Lakes have improved considerably over the length of the catchment management initiative. Furthermore, this is having a positive impact on immersive water sports, treatment costs for drinking water to North Cornwall, local biodiversity and water body ecological status. There are also significant benefits to the downstream ecological status of the main stem of the Tamar, the drinking water abstraction point at Gunnislake, the ecological status of the European Protected Sites and bathing waters in the Tamar Estuary and Plymouth Sound.

Project five Rights of Way Repairs



In partnership with

Exmoor National Park Authority (ENPA) & Farming and Wildlife Advisory Group (FWAG SW)

Location

Exmoor

Area

27,559 hectares

River

Barle, Quarme, Pulham, Haddeo and Exe

Government targets



- Clean and plentiful water
- Benefits to plants and wildlife
- Ecological hazard reduction
- Preservation of natural resources
- Adaptation to climate change

Background history

Launched at the beginning of UST2 in 2015, the Headwaters of the Exe catchment management programme focused on improving water quality and other ecosystem services in the upper part of the River Exe catchment, most of which lies within Exmoor National Park. The Upper Exe headwater catchment extends to 27,559 hectares and includes the Rivers Barle, Quarme, Pulham and Haddeo, as well as other smaller tributaries and Wimbleball Lake, which supplies Exeter and Devon by releasing water into the River Exe.

The Upper Exe catchment primarily comprises farmland and moorland areas, with woodlands along many of the watercourses. The main uses for land within the catchment are upland farming, forestry and game shoots. Recreation and access are also very important in this catchment.

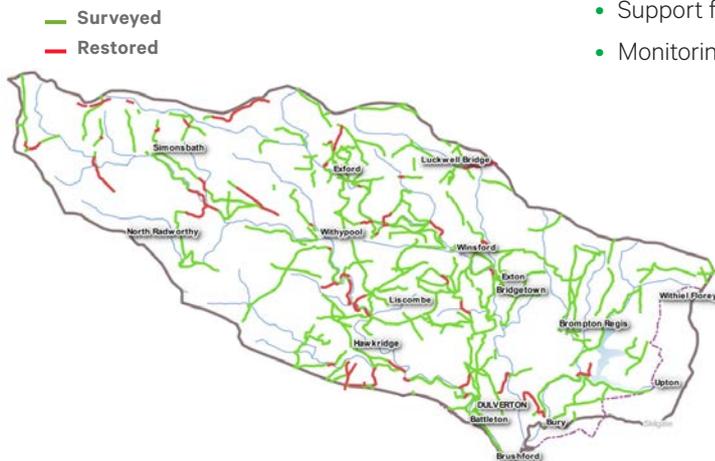
Assessing the issues

The first phase of the programme identified areas of highest priority for water quality within the catchment. This comprised a desk-based modelling exercise – subsequently ground-truthed through extensive wet weather field surveys – to establish flow paths and high risk areas (Westcountry Rivers Limited, 2016). Rights of way were found to have poor transport run-off and were a likely cause of river pollution.

Following completion of the prioritisation exercise, a sustainable catchment management programme was delivered by FWAG SW and ENPA, addressing key issues of concern for South West Water and the Environment Agency (EA), such as sediment loading and pesticides. The programme of work included:

- Advice to farmers, foresters and game shoot managers
- Capital grant funding to support implementation of necessary works and management
- Training events, site visits and demonstrations to promote good practice
- Rights of way maintenance to reduce erosion and run-off in high risk areas
- Support for invasive species control projects
- Monitoring of water quality.

Figure 4.
Rights of way



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Successful restoration of over
→ **23km**



The path to success

Being responsible for maintaining the rights of way network within the National Park, ENPA was the obvious choice to lead this programme of work and duly undertook an analysis of path condition, identifying areas where significant run-off was known to be leading to erosion and the pollution of watercourses.

This exercise was used to target restoration works to paths with the highest risk of erosion and pollutant run-off – usually those which run steeply downhill towards watercourses or those which run in close proximity and parallel to watercourses, with potential to wash sediments and other pollutants into rivers during times of flood. An additional assessment was carried out to identify any potential issues relating to landscape character, ecology and archaeology.

The goal for the first year of the project was to deliver 4.3km of rights of way repair. Following individual site visits and assessments the programme focused on surface regeneration and repairs to, or the addition of, drains to divert water off paths into surrounding land, particularly on steeper slopes that ran directly into a watercourse.

“The project has undoubtedly resulted in some great sediment reduction and erosion gains as well as improving the quality of the public path network so to my mind it has offered great value for money.”

Dan Barnett
Recreation Manager, ENPA

Positive results

Working closely with local contractors and Westcountry Rivers Limited, ENPA met and exceeded their initial target, successfully restoring 6km of continuous path, with overall improvements to rights of way extending over 17km.

Additional funding was subsequently secured to further the restoration programme. Exmoor was fortunate enough to be selected as one of the areas for the British Mountaineering Council’s (BMC) crowdfunding campaign, ‘Mend Our Mountains’, which drew in an extra £7,500. Added to £4,000 from ENPA, this extra funding enabled the restoration of a remote moorland site by commissioning a helicopter to transport stone to the isolated location. The helicopter was also used to transport stone to a number of other geographically challenging sites that had been prioritised for repair.

The nature of the land within the catchment meant that, on several other occasions, additional assistance was sought. In 2018, ENPA teamed up with the Commando Helicopter Force to move 60 tonnes of local stone needed for repair work along the Two Moors Way near Simonsbath. Two Merlin MK3 helicopters from 846 Naval Air Squadron collected the crushed stone in underslung bags from a nearby farm and delivered them to an eroded section of path near Wheal Eliza. The repairs improved the accessibility of the path, enabling more people to enjoy the beauty and tranquillity of the ancient Barle Valley, and also reduced sediment run-off into the River Barle. The operation, which was filmed for BBC Spotlight, was undertaken by the Royal Navy as a training exercise for pilots new to the Merlin, helping them to gain experience in real-life specialist manoeuvres and helicopter handling.



**Before & after –
footpath
restoration:
Two Moors Way
near Simonsbath**

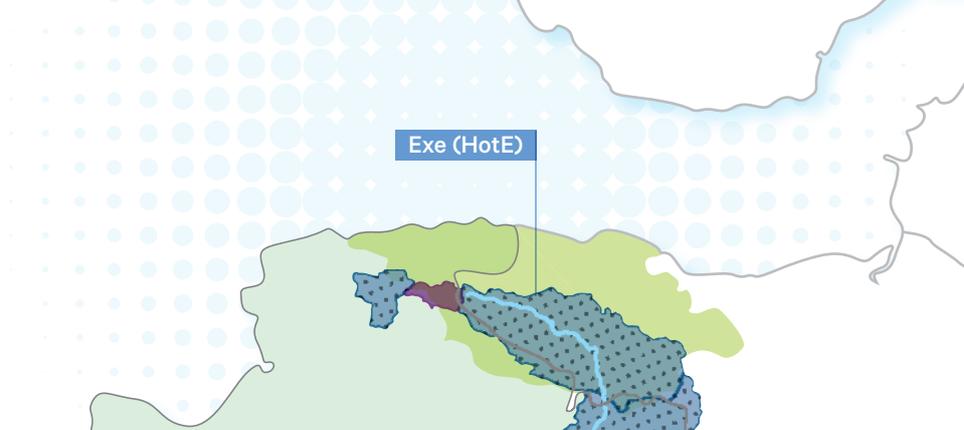


**Before & after –
section of path
adjacent to the
River Barle**

As well as achieving its primary aims of improving water quality and supply, the programme also delivered numerous other benefits which dovetail neatly with the outcomes of South West Water’s long-term business plan, including resource protection and wider ecosystem services.

The programme helped to build resilience to extreme conditions and climate change, particularly through addressing increased run-off and associated diffuse pollution arising from compaction and damage to tracks and rights of way. In wider terms, the project has also proved advantageous to the local community in terms of recreation and tourism, and creating volunteering opportunities.

Project six Shallow Peatland Restoration



In partnership with

Exmoor Mires
Partnership (EMP)

Location

Exmoor National Park

Area

28 sites

River

Exe

Government targets



Clean and
plentiful water ✓

Benefits to plants
and wildlife ✓

Ecological hazard
reduction ✓

Preservation of
natural resources ✓

Adaption to
climate change ✓

Background history

The Exmoor Mires Partnership was formed in 1998 with the aim of implementing sustainable hydrological management in Exmoor's upland river catchments.

Peatlands cover 11% of England's landscape, but provide an estimated 70% of our drinking water. They also store twenty times more carbon than all UK forests combined and are home to a wide range of wildlife and rare plant species.

Much of the peatland in the South West is currently in a degrading state, either fragile and eroding or dried out and dominated by purple moor grass (*Molinia caerulea*). The ongoing loss of peatlands causes significant ecological changes and a reduced water and carbon storage function.

Under the current Upstream Thinking programme of works the goal is to restore the hydrological function of the relatively shallow peatland covered headwaters of the River Exe and other catchments on Exmoor with multiple benefits to the upland environment and society.

Assessing the issues

Rivers draining peaty catchments tend to be enriched in carbon, giving the water a dark, tea-like appearance. Previous burning, peat-cutting and drainage practices have amplified this problem, leading to drying out of the peat mass and its degradation due to oxidation, causing:

- The loss of carbon – both to the atmosphere (as CO₂) and to rain fall run-off (as particulate and dissolved organic carbon)
- Negative effects on the biology within the stream
- The transfer downstream of metals, such as lead or copper, due to their binding with organic matter.

For water companies, discolouration is a problem. It has to be removed to meet drinking water standards.

Restoration of the peatland presents a long-term solution to the discolouration issue, with the added bonus of also delivering ecological benefits, including a greater proliferation of water-loving plants, such as bog cotton grass (*Eriophorum angustifolium*).



Peatlands
provide
an estimated
70%
of our drinking
water

Moorland at Spooners allotment, Exmoor, showing degraded vegetation with dense purple moor grass tussocks, due to past drainage, burning and peat cutting



A square metre of
40cm-deep peat
(about a wheelbarrow
load) holds

20kg
of carbon



Peatland covering
→ **1,059 ha**
restored
during UST2

Stemming the flow

Drainage ditches and erosional channels lower the peat's water table, increasing the depth to which oxygen can penetrate and promoting decay – leading to carbon loss. Over time, vegetation will adapt to the drier conditions with a reduction in *Sphagnum* moss and an increase in purple moor grass, further promoting decay and subsequent water discolouration.

Restorative measures involve the installation of 'blocks' within peat ditches to encourage water out of the ditch and across the moor, slowing the rate at which water leaves the moorland and increasing its storage capacity. These blocks are mostly made of peat, but wood is also used and new approaches using bales of live willow have been tried.

This increase in moisture retention prevents the acceleration of carbon degradation, which helps to preserve the clarity of water abstracted from the area.

Lanacombe after restoration



Positive results

Hydrological analysis has revealed that in the driest areas, where drainage had the greatest effect pre-restoration, water tables rose by as much as 4cm. Storm generated discharge was also reduced by up to 32% leading to more sustained and higher base flows during dry periods (the water still flows out of the peatlands, it just takes longer). Enhanced base flows benefit all river life, including fish, as they dilute other pollutants in the river as well as enabling SWW abstractions.

These factors could potentially increase river flows during dry periods and enable abstraction for water treatment, thus avoiding the need for compensation flows from Wimbleball reservoir, and associated pump storage costs in winter. Reduced peak flows also cut the net export of carbon in the water – as the majority of carbon leaves the moorland during these times – leading to cleaner, less acidic rivers.

Of great significance to sheep-farmers, population densities of the sheep tick (known to spread livestock diseases) are significantly lower in restored mires than in drier habitats on the same sites. A further agricultural benefit is that plants associated with blanket bog tend to have a higher value to grazing animals, especially in the late summer and autumn when purple moor grass has died back.

Sphagnum cover across all 28 sites for which appropriate data were available, showed a significant increase seven or more years after restoration. Breeding snipe have been observed at two restoration sites, representing a 25% increase in breeding locations recorded on Exmoor since 2011. Dunlin have also been recorded, potentially breeding for the first time in around 100 years.

In the process of peatland restoration, 300 previously unrecorded archaeological features and sites, ranging in date from around 6,000BC to the 20th century have been discovered. The new finds included prehistoric standing stones and cairns, Victorian mining works, disused roads and tracks and Second World War military training features.



Willow block
construction



Spreading the benefits – moor means more

2,780 ha
of peatland across
selected sites on both
Exmoor and Dartmoor
has been restored

Our six case studies provide a useful overview of the diverse range of activities covered by UST2, but the true measure of their worth is validated by the environmental changes initiated as a direct result. As an example, the impacts of peatland restoration have been closely studied by the Exmoor Mires Partnership in association with Exeter and other Universities.

Employing the same methods highlighted in the sixth of our featured case studies, projects instigated by the Upstream Thinking initiative have, since 2006, overseen the restoration of 2,780 ha of peatland across selected sites on both Exmoor and Dartmoor.

As the work expands, using natural solutions to remedy issues that have been exacerbated by long-term pressures on land use, so too does the volume of data gathered – and the impact knowledge gained through its careful analysis.

The following positive impacts illustrate the depth of research undertaken by the Mires teams and their collaborative partners:

In shallow peats

- Water table responses to restoration are complex. In the driest areas, where drainage had the greatest effect pre-restoration, water tables rose by as much as 4cm
- Restoration has not yet substantially changed water quality, suggesting that changes in the ecohydrological function of shallow peatlands take many years to achieve
- After seven years, (heterotrophic) respiration of the peat soil and methane fluxes remained largely unchanged, confirming the high level of intervention required to restore ecosystem functionality to badly degraded areas.

In deeper peats

- Restoration increased the permanent deep water storage in the soil by up to 7.3cm and increased average water tables by 2.45cm
- Raised water tables significantly reduced (heterotrophic) respiration of the peat store indicative of reduced emissions of CO₂ from the peat and a return to more natural functioning in the longer term.

Post-restoration

- Rainfall run-off regimes can be subject to considerable change; storm-generated discharge was reduced by up to 32% in shallow peatland catchments and by around 66% in gullies within deeper peat
- Quantities of dissolved organic carbon leaving selected study sites during storm events was approximately one third of the pre-restoration loads, due to a significant decrease in run-off.

Miscellaneous extras

- Population densities of the sheep tick, a vector of economically important livestock diseases, are significantly lower in wet mires than in drier habitats on the same sites
- Dartmoor National Park is estimated to house 158 (±101) km² (15,800 ha) of peat with a depth of more than 0.4 metres, which stores 13.1 megatonnes of carbon
- Functionally intact blanket bog covers a total area of just 3.6km² (360 ha) across Dartmoor, but it is fragmented and often surrounded by ecohydrologically degraded peat, which covers an area of 29km² (2,900 ha).

Left: Hydrological monitoring station, Exmoor – pre restoration

Below: Hydrological monitoring station, Flat Tor Pan, Dartmoor – post restoration



Spreading the benefits – for farmers, water and wildlife

One of the most gratifying aspects of the UST programme has been the benefits to farmers from the work completed under grant-funded schemes.

An example is found on a 65 ha dairy farm with 100 dairy cows and following young stock, reared on permanent grassland pasture and short-term silage lays. The farm had been housing the cows over the winter period in barns, using an open feeding yard.

The open yard was becoming problematic due to rainwater mixing with ground-based slurry and over-stocking the adjacent slurry pit. This additional volume reduced the pit's effective winter storage capacity, forcing the farmer to periodically spread some of his slurry stock out of season, especially following periods of heavy rainfall, in order to maintain sufficient free space.

Following consultations with representatives from Westcountry Rivers Trust, an appropriate solution was agreed and, with the help of a £20,000 grant (representing half of the total investment) a bespoke covered building was constructed on the site of the formerly open yard.

With clean rainwater now diverted via the new barn's guttered roof for redistribution (to cattle troughs, for example) volumes entering the slurry pit are now at a level well within the available storage capacity and, as a result, the collected slurry contains a higher concentration of valuable nutrients.

Maximising the value of farm-produced manures also reduces the need to purchase additional fertilisers, and removing the need to spread excess slurry alleviates soil compaction, the risk of associated soil loss and overall labour costs.

Covering an area of 600 m², the new barn collects around 900 m³ of clean rainwater in a single year, which, at a predicted cost of £41 per hectare to manually spread the equivalent volume of excess slurry, saves the farmer £2,700 per year. Coupled with a major annual reduction of around £218 per hectare in outlay for inorganic fertilisers, the project could see the farmer's investment repaid within five years.

The UST grant is protected over a 25-year period by a contract that includes a deed of covenant to ensure continuity in the event of the farm changing hands. Additionally, the contract includes a schedule that prevents any increase in stock numbers without joint agreement to create commensurate additional slurry storage capacity, ensuring a long-term commitment to environmental concerns.

As more natural nutrients are retained by the soil across the farm – and any excess run-off averted – the benefits literally trickle down to surrounding land and river corridors, and the wildlife they support.

“Adding to these factors the wealth of experience and goodwill developed through partnerships with other agencies and land users, it's easy to see how Upstream Thinking has made such a positive impact throughout the region.”

Dr. David Smith

Upstream Thinking Programme Manager, SWW



**Before & after –
Improved guttering on current
buildings, covering yard areas and
slurry pits and increasing slurry
storage allow farmers better slurry
and manure management**

Reactions to UST – thoughts from the farming community

The extent to which Upstream Thinking is achieving positive outcomes for the farming community is clearly illustrated by the wide-ranging response to a recent confidential farm user survey, distributed to farms within the UST catchments projects.

Here are a selection of quotes taken from completed surveys:

“Thank you for all your help with this project. I would like to say how helpful you have been throughout this project, being friendly and professional. The completed work is very well done and is bound to help with cleaner water in our nearby river.

Without your help, advice, and grant aid this wouldn't have been done – now for the foreseeable future the river will be protected from any pollution from our farm which is good for the community and makes me feel good too.”

“Really pleased to have the free soil tests. We didn't know we were so much over on the phosphate on our home fields. Applying less will save money.”

“Much advice on the management of all our ground, in particular areas bordering the river. This is ongoing as we intend to retain the riverside fields as a nature reserve, with assistance from the Trust.”

“Help from the Trust in cleaning ditches and helping to sort out run-off water from fields.”

“Most importantly though, as farmers we have as a result of this process really got our heads around looking at the farm from a run-off perspective, and are encouraged by the measures that are already working.”

“Dartmoor ponies brought on loan for grazing fields on two occasions.”

“Helped me with stream damming and hedge grant applications.”



University of Exeter – monitoring the impacts

The University of Exeter has been monitoring water quality across a number of test sites to identify the benefits gained from interventions. In catchments of different sizes, evaluating change in a wide range of contaminants requires the assessment of many different types of data and information. In turn, teasing out the appropriate information involves a number of different analytical techniques. Overall, the data used for this project included:

- Water quality samples collected during storm events from in situ monitoring locations
- Continuous data collected routinely by SWW at each of their assets
- Flow and climatic data collected by the Met Office and the Environment Agency.

The range of issues considered has included: colour and dissolved organic carbon, turbidity, nutrients input to reservoirs and eutrophication, and taste and odour compounds.

The main conclusions to draw from this work are:

Pesticide monitoring

The use of passive sampling (e.g. Chemcatchers®) throughout the project has been an invaluable way for SWW and our partners to gain an understanding of the extent of chemical usage in each catchment, as well as the levels being detected at water treatment works.

Additional targeted spot sampling in the feeder streams around reservoirs by CWT has shown a reduction of herbicides, fungicides, insecticides and metaldehyde (for controlling slugs) going into the reservoirs in recent years.

Overall, understanding the impact of spatial interventions on water quality over a relatively short period of time is a challenging task. Such work requires an integrated approach, combining a wide range of information, whilst also considering overlapping external factors, such as climate change, inter annual variability, model projections and data uncertainty. The completed work has contributed a great deal to our understanding of water quality changes – and enabled us to identify issues to be targeted – but has also highlighted the need to extend the monitoring programme in order to achieve long-term change.

Storm event data and nutrient loadings in feeder streams

Rainfall run-off events are critical times for water quality, as overland flow will wash contaminants down from the catchment, leading to increased diffuse pollution. The monitoring of feeder streams in several catchments has shown the differences between locations, highlighting where the practical work should be focused. For instance, efforts should be made to reduce phosphorus input as a priority in the Arenal catchment, as peaks are related to an increase in blue green algae – and therefore likely to be a driver for such blooms.

Continuous data

Perpetual measurements in the feeder stream to Upper Tamar Lake have shown a slight decrease in the turbidity reaching the lake at high flow (i.e. maximum 5% stream flow) between the hydrological years of 2016/17 and 2018/19. This positive change in turbidity at a small scale will contribute to cleaner water.



Top: Monitoring site on the River Exe
Above: Drift reservoir

Profile raised by the project

Throughout the five-year period of AMP6, South West Water's own communications team issued 19 UST related press releases, generating 41 printed articles across 17 publications.

Combining this coverage with a further 22 pieces broadcast on radio and television programmes and in excess of 100 items of online coverage, a conservative estimate of the total audience reached during the current phase of UST would suggest a figure of around 8.5 million.

On a more direct, interpersonal level, outstanding work has been accomplished by our partner organisations, sharing practical knowledge and expertise with landowners, service providers and farmers at ground level.

An evaluation of the Exmoor National Park Authority Headwaters of the Exe project, undertaken by Bea Davis in conjunction with specialist ecological survey consultants, Corylus Ecology, reveals the full extent to which local communities have embraced the ethos of UST.

Self-generating publicity

In addition to the quantifiable media coverage generated by the various promotional campaigns of both SWW and our partner organisations, a considerable percentage of the continued success of the UST programme must be attributed to the approval of its results amongst interested parties.

We are fortunate enough to be in the rare position of marketing a product for which the benefits far outweigh the costs, at all levels of participation. The positive outcomes continue to resonate with the farming communities. Our strongest allies remain those at the frontline of countryside stewardship.



→ **8.5 million**
estimate of the total audience reached



A small selection of publications in which Upstream Thinking has been featured



Staff working hard to get the message out



From the numerous examples of events designed to promote brand awareness that are listed in the Corylus findings, the following abridged excerpts provide a useful insight into the valuable relationship building developed by the UST team:

Programme of workshops and events

A series of events for land managers, agents and contractors was developed and delivered, some held on farms and woodlands within the catchment to encourage good practice and the sharing of knowledge and experience. Several visits to water treatment works were also undertaken, highlighting the processes involved in treating water following its abstraction from the River Exe.

Farm events were organised, covering a variety of topics including the safe use of agricultural pharmaceuticals in parasite control, sward management and rotational grazing. Woodland events were delivered to promote good practice in forestry management in relation to water quality. The annual joint meeting between Exmoor National Park Authority (ENPA) and Greater Exmoor Shoots Association (GESA) was used to discuss issues relating to management of game shoots and the protection of water quality.

The Headwaters of the Exe catchment management programme was formally launched by local resident and conservationist Stanley Johnson at a public event. Additional publicity included leaflet production and contributions to a South West Water film on UST.

Twenty-two events and workshops delivering over 50% more than the initial target of 14, for farmers, foresters and game shoot managers, including a project launch event in the first year, were attended by more than 300 people. Wider publicity and input to additional events reached an audience in excess of 700 people.

Many events publicised the work of the Headwaters of the Exe programme, with representatives also present at the National Parks' Big Picnic event, in July 2019, attended by HRH The Prince of Wales and The Duchess of Cornwall. Project work was also shown to the Minister for the Environment, Food and Rural Affairs, the Rt Hon. Michael Gove, during a visit to Exmoor in June 2018, during which he met several farmers who had participated in the programme as well as members of the advisory team.

Additional visits to see the work of the programme were carried out throughout the five-year period, with notable guests including: Julian Glover, author of the Glover Review of National Parks, 2019; Lord Gardiner, Parliamentary Under Secretary of State for Rural Affairs and Biosecurity; Ian Liddell-Grainger, MP for Bridgwater and West Somerset.



The project has been shown to many influential stakeholders

Financial overview

SWW investment increased from £7.3 to £10.5m across the two periods. With match funding the totals were £16.9m and £25.9m.

For both AMPs it shows how important SWW's core funding was in drawing additional targeted funding into the catchments and the local economy.

In both five-year periods the SWW funding was more than doubled by match funding at a ratio of roughly 40% SWW and 60% match funding.

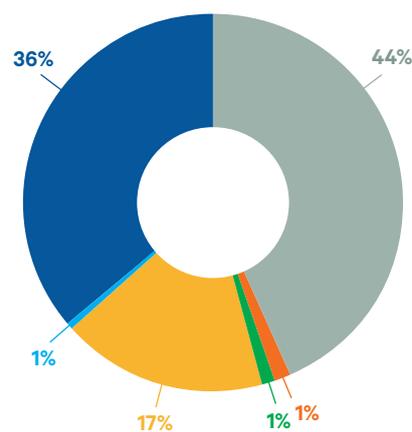
The targeting of this funding is also important, a big chunk of the additional funding for example was DWT securing Natural England's Countryside Stewardship agreements. With DWT's help these agreements were targeted at better water quality outcomes, which would not have happened without their support.

Exmoor Mires match funding in AMP6 was 10% of the total, this was due to grants from Defra for mire restoration capital works and additional EA and Natural England support.

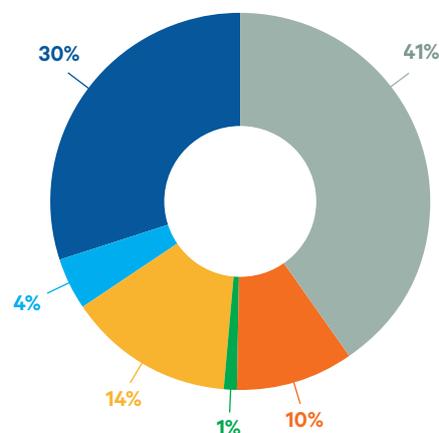
For AMP7 SWW have increased their ambition with a larger programme and we estimate with all the different funding routes together this should result in over £30m of new capital invested in catchments and healthier rivers by 2025.

Figure 5. South West Water funding and matched funding from partners

UST1



UST2



- South West Water
- Exmoor Mires
- Exmoor National Park Authority
- Westcountry Rivers Trust
- Cornwall Wildlife Trust
- Devon Wildlife Trust

The next step – 2020-2025 for AMP7

SWW's Upstream Thinking programme was one of the first catchment management schemes in the UK, setting the standard for innovation and incentivising good water quality outcomes. The central ethos of Upstream Thinking remains the promotion of constructive partnerships and a Stewardship of Natural Capital approach with new farmer behaviour incentives and cost-beneficial outcomes in UST3.

We plan to extend the management programme to 18 catchments for the period 2020-2025 – and have strategies in place for over 80% of the catchments within our operational boundaries – with the aim of improving raw water quality and long-term resilience of supply while simultaneously restoring landscapes.

As demand for water increases due to population rises, we are working with landowners and farmers to maintain sustainable catchment flows of high-quality raw water by improving farming practices and working with natural processes to provide solutions.

UST3 will:

- Support progressive and well-planned farm businesses
- Work with farmers to exploit new market opportunities
- Develop new ways of incentivising farmers to produce clean water outputs
- Encourage farmers to take a Natural Capital approach to their businesses
- Develop the role farmers could play in catchments in the management of natural flood risk and water storage for supply
- Look for new opportunities to develop catchment-wide nutrient management agreements with farmers.

This new five-year programme is a combination of new catchment management schemes and investigations, as specified by the EA Water Industry National Environment Programme (WINEP), and the continuation of AMP5/6 schemes in SWW and Bournemouth Water areas. Outcomes will contribute to:

- Improved raw water quality and supply and long-term business resilience
- The new Biodiversity Improvement Outcome Delivery Incentive (ODI) 'Hectares of new catchment management'
- The Pennon sustainability and Natural Capital commitments of year-on-year 3% improvement, from a 2020 baseline

The target is
→ **50,000 hectares**
of new catchment
management in the
next 5 years

- Water UK carbon mitigation commitments made to the Secretary of State for the Environment (peatland restoration and tree planting)
- Catchment investigations.

The extended programme is designed to combat deterioration in soil, nutrient and water management in the farmed landscape of catchments abstracted for drinking water supply. There are potential long-term resilience benefits including:

- New treatment investment deferment at treatment works
- Reduced power, chemicals, maintenance costs and carbon emissions
- Reduced risk of treatment works shutdowns and Drinking Water Inspectorate (DWI) penalties.

The engagement and support of delivery partners, environmental stakeholders in the South West region and associated match-funding contributions is a key aspect of the programme, as are the Natural Capital outcomes. These are aligned with Ofwat and EA expectations and SWW/Pennon ambitions to become a leading water company in environmental delivery.

Upstream Thinking for AMP7 comprises 16 schemes and five investigations in 18 catchments, as set out in SWW's Business Plan for 2020-2025. The programme is fully endorsed by our local quality regulators, the EA, DWI and Natural England, and is wholly aligned with the national guidance issued for 2015-2020 by Defra in the 'Statement of Obligations'.

Expenditure will be focused on exceeding the Biodiversity Improvement ODI 'Hectares of new catchment management'.

Delivery of the in-catchment schemes will be by the UST teams at Cornwall Wildlife Trust (CWT), Devon Wildlife Trust (DWT), FWAG SW and WRT. Funds allow the UST teams to engage farm managers to address the catchment pollution and flow problems, with a focus on the development of 'farm water management' plans and the roll out of grant funding for catchment improvement work.

The ongoing Defra funded mires work and the new WINEP mires work on Bodmin, Exmoor and Dartmoor will be delivered through the SW peatland partnership by SWW's own Peatland restoration team working with Dartmoor and Exmoor National Park Authorities and others.

Biodiversity commitments for UST3

UST is moving into a new exciting five-year programme with more river catchments than ever before included. We have also raised our ambitions for the programme beyond water quality and supply to include much broader Natural Capital and Biodiversity Net Gain outcomes. By shifting our focus to working with natural processes and actions that specifically benefit the Natural Capital Stocks of the catchment we will be creating better habitats and opportunities for wildlife in the catchments. This ambition to contribute to increasing the amount of wildlife in our catchments is known as Biodiversity Net Gain (BNG).

The SWW and Pennon commitments to BNG are set out in the table below. These are supported by our SWW Customer WaterShare Panel, who helped develop our plans for 2020-2025, with our regulators at the EA and Natural England and Ofwat. They are also in line with UK Government targets set out in the 25-year Environment Plan.

This is an amazing opportunity to increase the number of diverse wild flower meadows and deep herbal leys, restore more peatlands and culm grasslands, plant more trees, introduce more riparian buffer strips, create more farm wetlands and ponds and manage our productive farmland areas better for wildlife.

South West Water Biodiversity Performance commitment for UST3 – definition of our Outcome Delivery Incentive (ODI)

Performance commitment	Area of improvement for biodiversity
Biodiversity – Enhancement Enhance biodiversity through actions in addition to statutory requirements	Sustained catchment management – area (hectares) of catchments that are under active improved management for Natural Capital as a result of UST intervention

UST3 Contribution to South West Water Biodiversity annual reporting requirements

Length of river improved	<ul style="list-style-type: none"> • River bank planting and rejuvenation, buffer strips, riparian fencing • The length of river with cleaner water and more sustainable flows as a result of a catchment management scheme • River restoration – gravel augmentation and hatchery support.
Habitat restored or created	<ul style="list-style-type: none"> • Tree planting – SWW’s contribution to the Water UK 10-year national commitment to plant 11 million trees • Wetland creation – delivering sustainable cleaner flows and Natural Flood Management whilst supporting diverse wildlife • Priority habitat where applicable; e.g. blanket bog and culm grassland.
Protecting priority species	South West Water has many unique opportunities to deliver specific management plans to support the following species (this is not exhaustive and will be reviewed annually to identify new opportunities): <ul style="list-style-type: none"> • Fish – especially salmonids and eels • Mammals – especially bats, otter and dormice • Invertebrates – including dragonflies • Farmland birds.



Photo: Adrian Langdon

Photo: Linda Pitkin

Photo: Tom Marshall

Otters, dunlins, salmon and bats are just a few of the species that will benefit from our management plans

Pennon commitments to Biodiversity Net Gain – Healthy Places and Habitats

Our objective

- Proactively protect and enhance biodiversity in our operational and service areas through quality habitat creation, land management and restoration, good stewardship and environmental partnerships.

Our target 2019-2022

- Deliver measurable Biodiversity Net Gain on our relevant operational sites and projects.

We aim to protect and, where possible, enhance biodiversity and the natural environments in which we have influence.

There are significant areas rich in wildlife and biodiversity across and adjacent to Pennon's operational sites and projects, including a number protected by law. We are therefore committed to the protection, enhancement and sensitive management and stewardship of our landholdings and to contribute to the same across the landscapes and catchments in our operational areas, for the benefit of biodiversity and wildlife.

Pennon has created a Group-wide biodiversity strategy to provide a more cohesive approach across the Group and build on the excellent work already established within the businesses.

South West Water plays a critical role in protecting and enhancing the region's natural environment. The company's 'source to sea' approach to the management of water and wastewater favours innovation, the use of sustainable solutions and an emphasis on partnership working to deliver positive outcomes for the region's ecosystems and habitats. We are working to protect our environment by minimising our carbon footprint, improving raw water quality through our 'Upstream Thinking' catchment management initiative, and continuing to improve biodiversity through our environmental projects.

Pennon commitments to Natural Capital Stewardship

Our objective

- Develop our services and deliver innovative solutions for society that help to protect Natural Capital and resources.

Our target 2019-2022

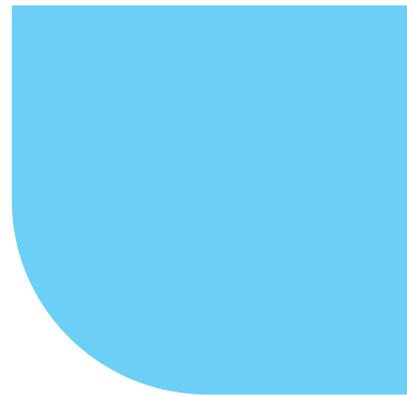
- Deliver measurable Natural Capital gain across our relevant operational areas and projects.

Our key performance indicator

- Evaluate relevant operational areas and projects for net Natural Capital gain (using defined methodology), demonstrating 3% year-on-year improvement from a 2019/20 baseline.

The sustainable use of Natural Capital, that is our natural assets including rivers, oceans, forests, resources, minerals and land, is fundamentally important to all of us. Delivering solutions for society is core to our strategy and helps to address the challenge of depleting natural resources.

Pennon plays an active role in the Accounting for Sustainability network (our Chief Executive Officer, Susan Davy, is part of their CFO Network), which has produced guidance on how to integrate sustainability into strategic planning, budgeting and forecasting strategic planning. Following this approach enables a value to be put on our natural and social capital and to use this in making informed business decisions. We have set a target to define leading practice methodology for Natural Capital assessment of operational areas and projects in 2020.



UST is managed by Dr. David Smith and Crawford Munro for SWW with support from Amber Willis and Maggie Lundh.

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- South West Water Upstream Thinking team, drinking water treatment and scientific teams, biodiversity and INNS managers, Mires team, communications team
- All our contractors on the UST and mires programmes
- And finally all our other enthusiastic project supporters who have worked with Upstream Thinking for a better future for our rivers.



**Cornwall
Wildlife Trust**



**Devon
Wildlife Trust**

