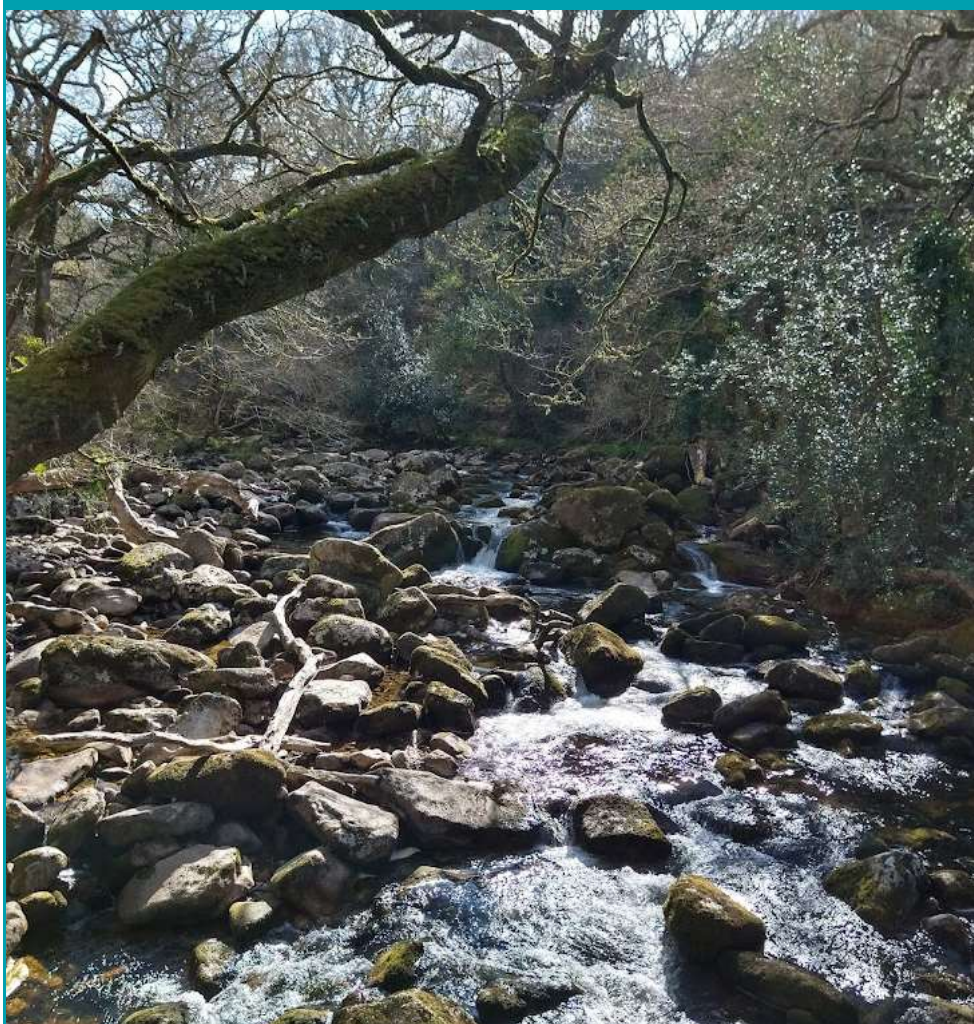
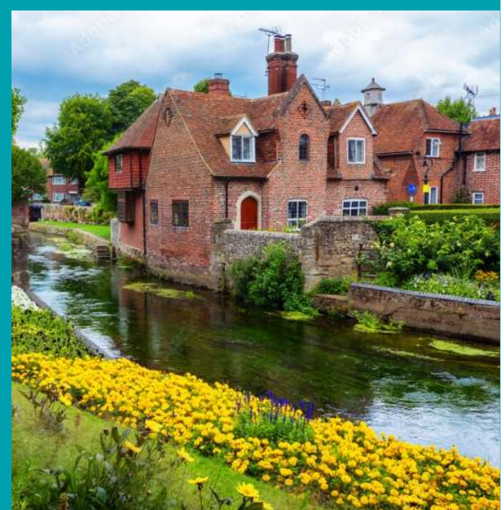
West Country Water Resources Group

# Environmental Destination

Pilot catchment plans to increase future water supply and low flow environmental resilience in the West Country





Wood Group UK Limited – February 2022

wood.

## Report for

Report for
Paul Merchant – Supply Demand Manager
FAO: West Country Water Resources Group
South West Water
Peninsula House
Rydon Lane
Exeter
EX2 7HR

## Main contributors

Katy James
Liz Buchanan
Rob Soley
Nancy Stone

## Issued by

.................................................................................
Liz Buchanan

## Approved by

.................................................................................
Rob Soley

## Wood Group UK Limited

Shinfield Park
Shinfield
Reading RG2 9FW
United Kingdom
Tel +44 (0)118 913 1234

Doc Ref.

https://woodplc.sharepoint.com/teams/environmentalambition-wood/shared documents/wood/trial catchments/deliver/reporting/draft/wcwr trial catchment plans_draft v2.0.docx

## Draft report disclaimer

This report has been prepared in a working draft form and has not been finalised or formally reviewed. As such it should be taken as an indication only of the material and conclusions that will form the final report. Any calculations or findings presented here may be changed or altered and should not be taken to reflect Wood's opinions or conclusions.

## Copyright and non-disclosure notice



## Third party disclaimer

Any disclosure of this report to a third party is subject to this disclaimer. The report was prepared by Wood at the instruction of, and for use by, our client named on the front of the report. It does not in any way constitute advice to any third party who is able to access it by any means. Wood excludes to the fullest extent lawfully permitted all liability whatsoever for any loss or damage howsoever arising from reliance on the contents of this report. We do not however exclude our liability (if any) for personal injury or death resulting from our negligence, for fraud or any other matter in relation to which we cannot legally exclude liability.

## Management systems

This document has been produced by Wood Group UK Limited in full compliance with our management systems, which have been certified to ISO 9001, ISO 14001 and ISO 45001 by Lloyd's Register.

## Document revisions

| No. | Details | Date |
|---|---|---|
| i1 | Draft for review | February 2022 |
| I2 | Final | March 2022 |
| | | |

# Contents

# 1. Introduction

## 1.1 The purpose of this document

This document has been produced to set out measures that may be implemented in five West Country Water Resources (WCWR) pilot catchments to increase water supply and environmental low flow resilience. The pilot plans are described in more detail in **Section 2**. These set out steps towards an Environmental Destination for 2050 in each catchment, in response to the water resources-related 'Environmental Ambition' challenge set by the Environment Agency as part of its National Framework for Water Resources (March 2020). The National Framework looks at the potential for climate change and tightened environmental river flow protections to reduce the water available for abstraction by the 2050s. This is described further in **Section 3**.

**Section 4** summarises conclusions and recommendations and the plans for each of the pilot catchments are collated as five **Annexes** at the back of this overview report.

## 1.2 Climate change and water supply in the 2050s

The future for public water supply is complex, in large part due to the uncertainty as to how climate change will impact rainfall and evaporation patterns, river flows and groundwater storage and how the dependant environment will react to (and recover from) low flow events which will become more frequent and prolonged into the future. The potential for adapting supply systems and habitats to improve resilience is the focus of these environmental destination plans.

What is certain is that climate projections are showing overwhelmingly that the climate is changing. UKCP09, and the emerging processing of UKCP18 data (**Section 3**), show that our catchments will experience reductions in river flow (either for all or part of the year) and groundwater recharge patterns will be affected. We will see increased extreme events including flooding (posing a risk to water supply and wastewater assets), droughts (with water shortages potentially leading to service failures) and heatwaves (leading to increased demand and also heightened risk of river, lake and estuary eutrophication events). As a result, the future water environment will face increasing pressure and water availability will be adversely affected, impairing our ability to ensure enough water for people, agriculture, businesses and the environment.

The Environment Agency's second adaption[1] report in 2016 highlighted that **without appropriate long-term planning, the demand for water will exceed supply throughout much of the UK by the 2050s**. Notable risks are highlighted in terms of:

- The availability of sufficient water to support healthy aquatic ecosystems.
- The ability of water companies to deliver a secure public water supply.
- The availability of water to support economic activity and not present a barrier to growth.

[1] https://www.gov.uk/government/publications/climate-adaptation-reporting-second-round-environment-agency

- Agricultural productivity, since farmers will increasingly need water to irrigate their crops and provide water for their livestock, especially during warmer weather.
- Ensuring that water management infrastructure is resilient and continues to function effectively as the climate changes.

Though a changing climate is our reality, the impact (in yield) on our water resources and the reaction of our water dependant environment is much harder to quantify. There are difficult questions for the next 30 years around environmental protection:

- what can and should be protected, where should the "natural" baseline be allowed to evolve to recognise the changing environment?
- Is it wise to abandon groundwater abstraction access to resilient aquifer storage on a large scale in order to meet environmental river flow targets?
- how do we guarantee sustainability of supply in a changing climate?
- who pays for the measures needed to guarantee resilient catchments and sustainable water supplies?

An adaptive, integrated, financed, pragmatic and robust approach is needed to ensure our catchments and water supply networks are in the best state possible to secure supplies for domestic and business use whist safeguarding our water dependant environments.

## 1.3 Structure of this report

This main report gives the overall context for this work and the catchment pilot plans are presented as **Annexes A-E**. The remainder of this report is structured as follows:

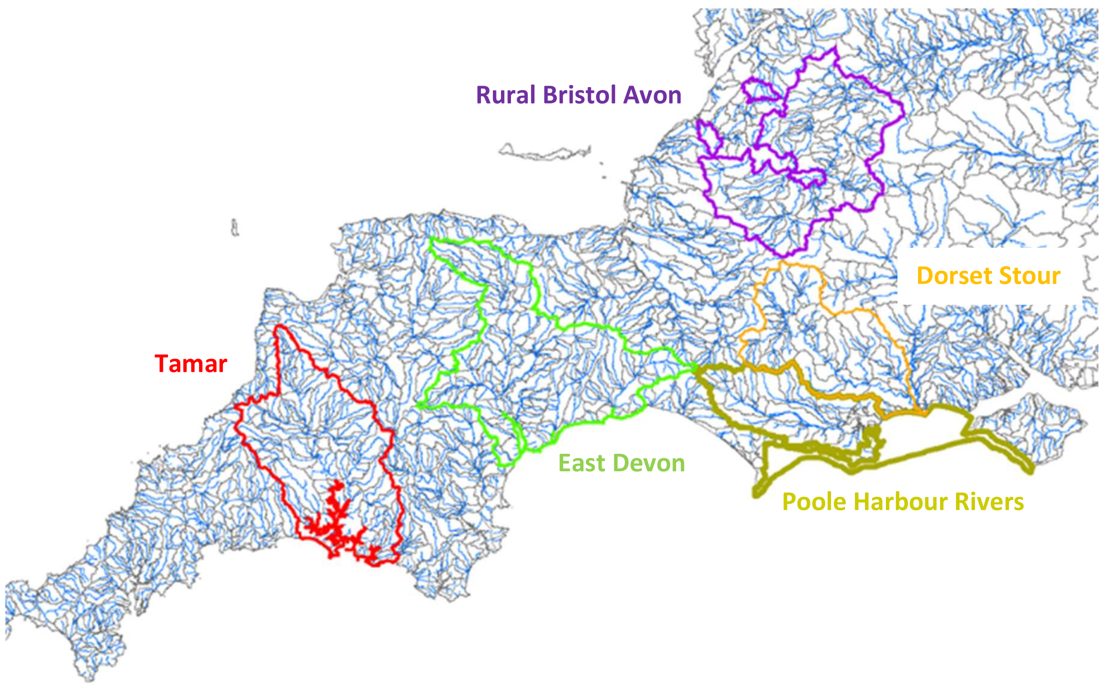
- **Section 2** provides further information on the **structure and focus of the pilot catchment plans**
- **Section 3** discusses the **application of the Environment Agency's National Framework modelling to the West Country**
- **Section 4** provides **conclusions and recommended next steps** from this work.

# 2. Development of pilot catchment plans

## 2.1 Overview

The catchments chosen for the development of pilot plans (**Figure 1.1**) are the Dorset Stour (**Annex A**), Poole Harbour Rivers (**Annex B**), Rural Bristol Avon (**Annex C**), Tamar (**Annex D**) and East Devon (**Annex E**). These catchments were chosen by the WCWR Steering Group (WSWRSG) to give a distribution across catchment types and the three water companies who are partnered in the Regional Water Resources Group (Wessex Water, South West Water and Bristol Water), together with the Environment Agency and Natural England.

Figure 2.1 Location of West Country Water Resources trial catchments




It is important to note that the plans produced here are not intended to replace or compete with other plans and strategies being developed. These documents have been produced within the context of the Regional Water Resources Planning process to illustrate how the challenge of the National Framework could be met on a catchment basis.

The purpose of these documents is to do the following for each catchment:

- **Summarise** the following information:
  - The **Environmental Destination challenge**, with respect to the catchment-wide flow changes predicted as the climate warms, the location of abstraction-related pressures on river flows and the potential associated need for abstraction impact reduction.

  - The work which is ongoing, planned or possible **to improve the condition of the water environment within the catchments**. This has been done in consultation with local catchment stakeholders and includes initiatives targeted to include water quality and ecological resilience, even if these will not make much difference to future low flows.
  - The **possible water company options** currently under consideration for the catchments.
- And then use this information to produce a **phased catchment plan to the 2050s**, looking at short, medium and long term measures which could be implemented to improve water supply and environmental resilience and meet the challenges posed by the National Framework.

## 2.2 The wider context – delivering resilient catchments and sustainable water supply networks

The environmental destination plans discuss both **nature-based solutions** and **water infrastructure and demand reduction measures**, which should work together to form the components of a resilient catchment. As noted above these catchment plans are being constructed in a **wider context of multiple, overlapping catchment and water resources plans**. It is important that this work is viewed within that wider context, and particularly the relevant Catchment Partnerships for each area (which seek to draw together multiple stakeholders into one cohesive unit aiming to deliver the best environmental outcome for the catchment). These trial catchment plans present in part a synthesis of ongoing and planned initiatives and in part a gap analysis of what could be done to **deliver more resilient catchments** which meet the challenges of **increased aspirations for environmental protection, population growth and climate change**.

**Integration with other planning processes and delivery mechanisms** will be key to the efficient delivery of resilient catchments and water supply networks. This includes the emerging Regional Water Resources Plan, individual water company Water Resource Management Plans (WRMPs), focused environmental impact and risk investigations (WINEP), the 3rd River Basin Management Plans (RBMPs), Flood Risk management strategies, environmental land management schemes (ELMS), drainage and wastewater plans and local authority spatial plans. In addition, changes to land management practices – including more resilient habitat creation and carbon sequestration should also be considered as a part of delivering sustainable and adaptive catchments.

In this work focus has been on catchment measures that improve the resilience of the water resource – i.e., the **quantity of available water** – within catchments, year-round. Some measures also provide more holistic benefits, for example in terms of improvements to **water quality** or **reduction in flood or eutrophication risk**, even if these will not improve low flow water resources resilience.

Within the plans a **hierarchy of measures** has been used to categorise into **short** (c.2030), **medium** (c.2040) and **long** (c.2050) term **planning horizons**. This categorisation reflects the prioritisation of the no regret/low hanging fruit to shorter time horizons (often catchment management measures) and the longer term horizons associated with the implementation of more structured solutions for water resources supply which will be needed alongside the existing focus on leakage and demand reduction measures. This approach also acknowledges the need to retain flexibility in the face of increasing uncertainty of the impact of future changes, and the effectiveness of measures.

## Nature based solutions and water resources resilience

There is a good (and increasing) understanding of how nature-based solutions benefit the environment – enhancing the overall natural capital, with interventions often delivering multiple benefits around water quality improvement, flood management, ecological diversification and resilience and carbon sequestration.  The move towards restoration to "Stage 0" rivers[2] is of particular interest in moving towards a model where the river environment is operating to its full potential with respect to natural capital.  However, there is much less certainty around the ability of nature-based solutions to deliver any significant (in public water supply terms) increased water supply. Interventions in catchment headwaters (such as the Upstream Thinking[3] project) and work to improve the condition of spring sources (as is happening in the Bristol Avon[4]) may provide some improved baseflow resilience, but quantification is currently hard and is likely to be lost in the broader scale flow changes predicted as the climate shifts.

In the plans, measures are set out that promote the infiltration of rainfall recharge and reduce rapid runoff (including tree planting, promotion of farming methods to reduce soil compaction, contour ploughing, modification to the aspect/slope of fields, use of riparian buffer strips); and measures to hold surface water back in the upper catchments, in out-of-bank storage and slow its movement towards areas of discharge (for example, through river restoration, wetland restoration/creation, floodplain re-connection, better deployment of riparian woodland zones, in channel water weed management to slow flow, maintenance of ditch systems, promotion of wet grassland rather than crops within floodplains).

Catchment management measures such as these will:

- Assist in rapid recovery from droughts (through creating a resilient environment which can withstand environmental extremes);
- Reduce the local impacts of flooding (through reducing peak flood flows);
- Lead to improvements in raw water quality (through reduced rates of sediment entrained runoff and leaching from soil);
- Reduce the impacts from run-off;
- Lead to improvements in the resilience of the in-channel aquatic environment (e.g. through keeping rivers cooler through riverbank planting or by improving habitat connection with the floodplain);
- Allow habitat creation and carbon sequestration through changes to land management practises.

## Supply and demand side measures

[2] https://www.therrc.co.uk/blog/what-stage-zero-approach-river-restoration
[3] https://www.southwestwater.co.uk/environment/working-in-the-environment/upstream-thinking/
[4] Insert reference

It is recognised that there is currently no practical way of quantifying the improved water resource availability brought about by purely catchment improvements, therefore supply and demand side measures are still essential to meet future water supply challenges. These measures will be set out in detail both in the Regional Plan and in the respective WRMPs for each water company. A brief discussion of these measures is included below, and the applicable measures for each pilot area have been discussed in the relevant catchment plan.

## Demand management and water efficiency

There is ongoing work by water companies to reduce the water put into the mains network, including tackling leakage and reducing water consumption demands. However, the development of new sources of storage and water supply will also be needed alongside measures to reduce demand in order to deliver resilience in the face of climate change, particularly if closer to natural river flow targets are also set.

Realising the aspiration for significant reductions in demand (e.g. per capita consumption reduced by around ??% to 110 litres per person per day) will require a huge collective change in thinking and practice across society. The Environment Agency highlights how everyone will need to change at least some their practices around water with both household and non-household users to reduce water dependency not just in water stressed areas, but across the UK. There have been various national campaigns to encourage consumers to save water with organisations such as Waterwise and Water UK undertaking public awareness campaigns to educate and encourage people to reduce their water consumption[5]. Even with engineering innovations to improve the water efficiency of domestic and commercial appliances, widespread smart metering, and unpopular increases in price, there is no guarantee that these demand reductions can be met, particularly as the climate warms. All demand management and water efficiency measures will need to be applied to across the range of domestic, industrial and agricultural settings

Aside from a reduction in consumer demand, ongoing water company projects required by government to reduce leakage would also reduce the water which needs to be put into supply.

However, it is important to acknowledge that reductions in both per capita consumption and mains leakage will also reduce the volumes of water returned to the environment and contributing to low flow resilience downstream of large towns and cities.

## Supply side measures

The need to find new sources of supply is driven in large part by the *replacement* of existing abstractions which are being flagged for closure in order to meet future environmental river flow targets. Many of these are groundwater abstractions which provide drought-resilient supplies from major aquifers like the sandstones of the Otter Valley in East Devon, and the Chalk baseflow dominated Wessex rivers (i.e. the Hampshire Avon, Stour and Poole Harbour catchments).

Supply side measures vary from the optimisation of the sources within water supply networks to more strategic options, such as those being championed by the Regulators' Alliance for Progressing Infrastructure Development (RAPID). Source optimisation could include:

[5] Water supply resilience and climate change, POST, May 2021 https://post.parliament.uk/research-briefings/post-pb-0040/

- Establishment of new sources in catchments where there is an environmental flow surplus, and the relocation or dynamic conjunctive movement of abstraction around catchments to maximise the use of these surpluses.
- Use of abstraction controls (such as stepped HOFs) with associated enhanced storage to maximise the available resource during wet periods while protecting the environment when flows are lower.
- Low flow support to abstraction-impacted streams. This could take the form of borehole support or support from a network of small upstream reservoirs (which also provide habitat creation ecological benefits). Natural England's 'natural functioning' objectives for SSSI rivers such as the Hampshire Avon, Frome and Camel means that such low flow support options are not preferred – reduction in abstraction is prioritised in these protected habitats.
- More intelligent reuse of waste water from treatment works and/or the relocation of treatment works discharges to abstraction depleted releases (as is proposed for the lower Dorset Stour).
- Improvements in water quality to reduce treatment requirements (e.g. Nitrate mixing).

For the West Country some of the more strategic options being discussed include:

- Cheddar 2 reservoir
- Roadford scheme
- Poole Effluent Reuse
- Mendip Quarries reservoir
- Severn to Thames Transfer

At the moment desalination is not being proposed as a serious option through the WRMP process, in large part due to the cost – both financial and carbon.

# 3. The National Framework application to the West Country

## 3.1 Current understanding of future water available for abstraction - the Environment Agency's National Framework modelling

This section discusses the Environment Agency's National Framework modelling and how it has been interpretated to give a picture of potential future deficits in the West Country.

The National Framework modelling[6] undertaken by the Environment Agency in 2020 identified water bodies in which there could be **potential further constraints to water resource availability into the 2050s**. This modelling took into account sectoral increases in abstraction demand, decreased flows from climate change and potentially increased levels of environmental protection for protected features. The modelling platform used was the Environment Agency's national Water Resources GIS (WRGIS) system which compiles the abstraction, discharge, reservoir and natural flow data sets taken from the CAMS (Catchment Abstraction Management Strategy) Ledgers, which are also used to inform Abstraction Licensing Strategies[7] (ALS). The CAMS Ledgers model all flow duration curve conditions at a catchment level for regulatory Assessment Points, whereas the WRGIS produces results at only four flow snapshots percentiles for water bodies at a national (England) level, these are the Q95, Q70, Q50 and Q30.

The following sections discuss how **increased environmental protection** and **climate change impacts on natural flow**s have been applied in the National Framework modelling for the West Country. It is important to note that the National Framework review extended across the whole of the west country so that implications for abstractions everywhere can be considered in the water resources planning process– it was not limited to the pilot catchments for which the resilience plans appended to this report have been drafted.

### Increased Environmental Protection

In the WRGIS each waterbody is assigned one of three Abstraction Sensitivity Bands (ASBs), these are based on a view of the sensitivity of the watercourse to abstraction and are a result of national processing of expected invertebrate, fisheries and physical datasets as well as local refinement. Each ASB (1,2,3) has been assigned a target Environmental Flow Indicator (EFI) which is defined as the permitted deviation from natural for flows to allow for the supporting of Good Status[8] ecology. The National Framework modelling added an additional three bands, taken from Natural England's Common Standards Monitoring Guidance[9] (CSMG) flow targets. The Bands used in the National Framework modelling can be seen in **Table 2.1**.

[6] Appendix 4: Long Term Environmental Water Needs, listed here https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources
[7] https://www.gov.uk/government/collections/water-abstraction-licensing-strategies-cams-process
[8] This is Good Status as currently defined under the Water Framework Directive
[9] https://data.jncc.gov.uk/data/1b15dd18-48e3-4479-a168-79789216bc3d/CSM-Rivers-2016-r.pdf

Table 3.1 Water available for abstraction as a percentage of natural flow as applied to waterbodies in the National Framework modelling

| Type | Q30 | Q50 | Q70 | Q95 |
|---|---|---|---|---|
| **CSMG – WFD high hydrology (ASB6)** | 10% | 10% | 10% | 5% |
| **CSMG – Headwater (ASB5)** | 15% | 15% | 10% | 5% |
| **CSMG – River (ASB4)** | 10% | 20% | 15% | 10% |
| **ENHANCED Salmon/ Chalk /GWDTE water bodies AND WRGIS ASB3 rivers** | 24% | 20% | 15% | 10% |
| **WRGIS ASB2 rivers** | 26% | 24% | 20% | 15% |
| **WRGIS ASB1 rivers** | 30% | 26% | 24% | 20% |

The water available for abstraction is presented as a proportion of the total available flow. This means that **if natural flows were to change in the future the total volume available for abstractors and the environment would change**, but their proportion of the available resource would remain the same. This means that **if flows were to change in the future, keeping the same EFI targets will mean less water available to support both abstraction and water dependant ecology**. This suggests, for example, that if a Hands-Off Flow condition has been set appropriately to an abstraction to protect the EFI now, it may need to be lowered if low flows fall in the future.

It is important to note (from **Table 2.1**) that the application of CSMG river/ASB4 targets will only have a substantive impact on ASB1 and 2 waterbodies as there is only a difference in application at the Q30 between the application of the ASB3 and CSMG River/ASB4 river reaches. The application of the ASB3 enhanced target to ASB1 and 2 waterbodies will be more substantive across the whole flow range in terms of the reduction of water available for abstraction

Furthermore, it should be noted that the CSMG targets have been simplified for the National Framework modelling in the WRGIS. The CSMG is intended to apply to all flow conditions on a daily time series. However, the National Framework modelling has been limited by the WRGIS structure, which only contains four flow percentiles (Q30, Q50, Q70 and Q95). The flow allowances applied at the Q30 in the WRGIS are actually specified for "high flows" in the CSMG, which are typically above Q10 (see **Figure 2.1** as quoted in Table 3 of the CSMG for Rivers). In the National Framework these have been applied to the Q30 as the highest flow percentile that the modelling has access to. This does mean that Q30 results from the National Framework modelling should be treated cautiously as the potential flow deficits flagged will not be a "correct" representation of the reality of the CSMG targets.

Figure 3.1 CSMG flow targets[10] taken from the CSMG for Rivers, 2016 (JNCC)

**Table 3. Flow targets in relation to river size and discharge**

| River size | < $Qn_{95}$ (Low flows) | $Qn_{50-95}$ (Low-moderate flows) | $Qn_{10-50}$ (Moderate-high flows) | > $Qn_{10}$ (High flows) |
|---|---|---|---|---|
| Headwater | 5 | 10 | 15 | 15 |
| River | 10 | 15 | 20 | 10 |
| Large river | 15 | 20 | 20 | 20 |

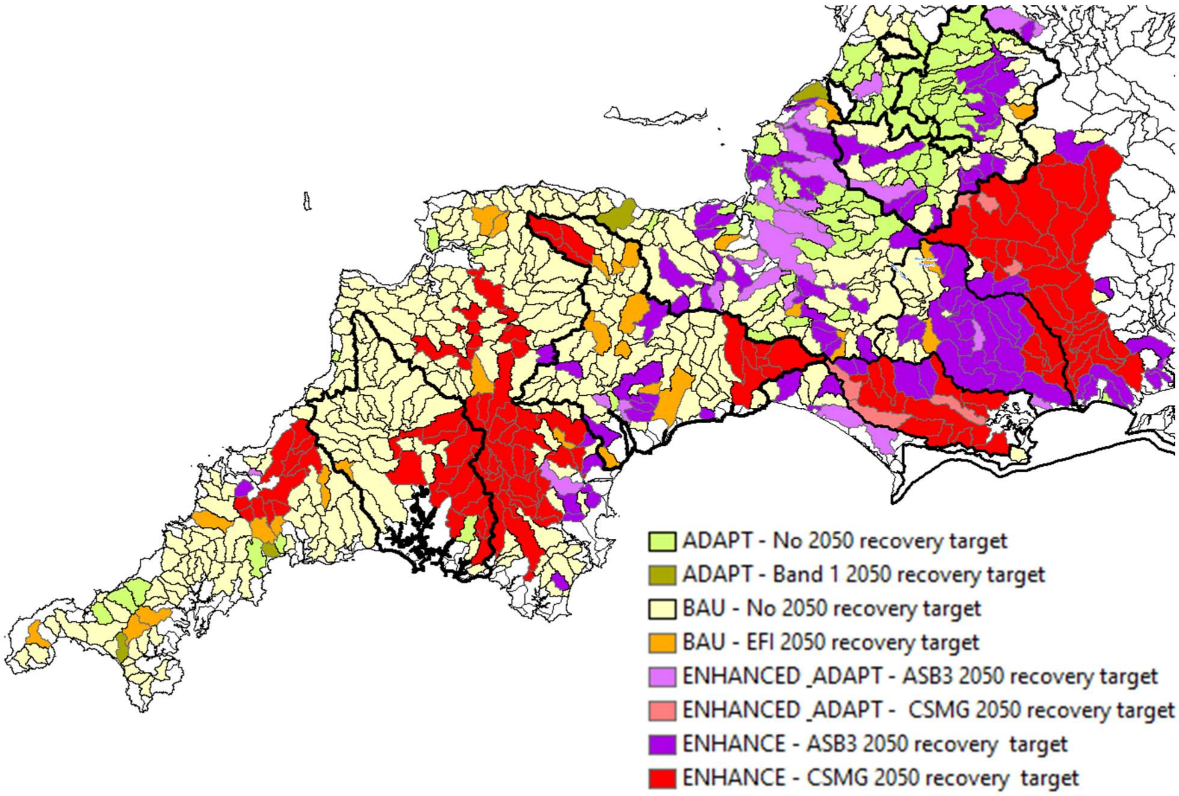
The National Framework modelling looked at three environmental scenario's – Business As Usual (BAU), Adapt and Enhanced (ENH). The WRGIS was used to ascertain whether there was a risk of failure against EFIs (i.e. an environmental deficit) in the 2050s. These are defined in some detail in the information released with the modelling, but can be summarised as follows:

- The **BAU** scenario represents no changes to environmental protection from the current day, and the focus in the scenario is on the impacts of climate change flows. Some assumptions were also made around the ability of ongoing WINEP schemes to address known issues.
- The **ADAPT** scenario acknowledged that in a few waterbodies an EFI target was infeasible, and so the environmental flow compliance target is 'Band 1 non-compliant' which is a less stringent than meeting the EFI and completely resolving the deficit.
- The **ENHANCED** scenario identified waterbodies where an enhanced level of environmental projection could be required. These fell into two categories:
  - Assigning an ASB of 3 to waterbodies which were perceived as having sensitive fisheries, chalk stream reaches or groundwater dependant terrestrial ecosystems.
  - Assigning the CSMG targets to waterbodies which impact Natura 2000 sites.

**Figure 2.2** shows the distribution of environmental flow targets across the WCWR catchments. Where water bodies were designated as Enhanced and Adapt through the National Framework screening the modelling took the more precautionary route and assigned these as Enhanced catchments.

[10] https://data.jncc.gov.uk/data/1b15dd18-48e3-4479-a168-79789216bc3d/CSM-Rivers-2016-r.pdf

Figure 3.2 The Environment Agency's increased environmental protection ambition across the West Country




From **Figure 2.2** it can be seen that:

- CSMG targets have been applied around the designated sites which has a significant impact on river flow targets across the area. In the east (Dorset/Hampshire/Wiltshire) this includes the Hampshire Avon, Lymington River (New Forest), Frome and Piddle; in Devon it includes stretches of the Tavy, Dart, Taw, Axe as well as other surrounding watercourses; and in Cornwall it includes stretches of the Camel, lower Tamar and surrounding watercourses. Somerset is largely absent of CSMG targets, with the exception of streams around Exmoor SAC. Most CSMG enhanced water bodies require application of the river/ASB4 target (**Table 2.1**). There are only a small handful of more sensitive headwater streams designated with tighter ASB5 sensitivity across the whole of the West Country (e.g. headwaters of the Camel and Hampshire Avon).
- Enhanced (ASB3) targets have been applied widely across the Chalk in the Dorset Stour (although the lower Stour where abstraction pressures are greatest was already ASB3 in the BAU scenario), and other scattered waterbodies, where they predominately associated with assumed 'Groundwater Dependent Terrestrial Ecosystems' (GWDTEs) Sites of Special Scientific Interest (SSSIs).

It is acknowledged in the National Framework reporting that the modelling was intended to be reviewed as an initial screening so that some assumptions have been made which could require further refinement in future models.

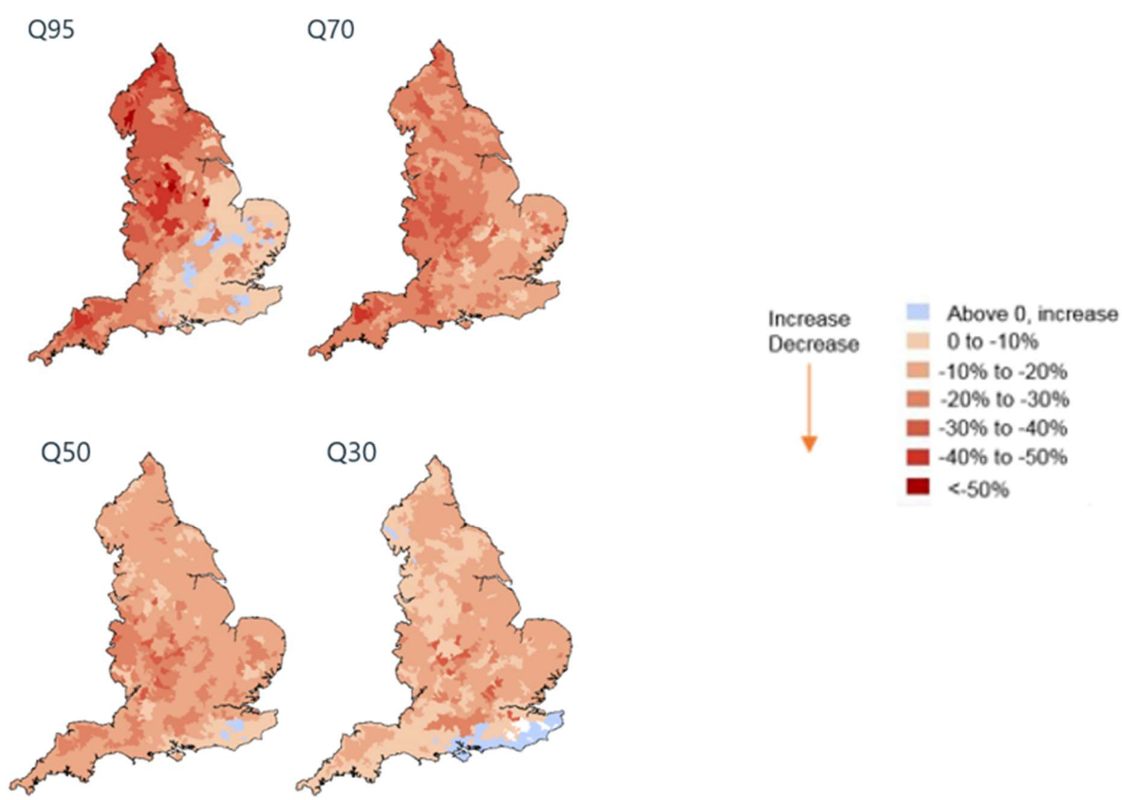
Key assumptions are:

- The connection between GWDTEs and rivers. The presence of a GWDTE in a waterbody has been used to assign the ASB3 sensitivity band to the river flow targets. However there are some waterbodies where the GWDTE is distant from the main watercourse, or may not be very 'groundwater dependent', and so further screening work is required to judge whether this is appropriate. The processing of the National Framework data undertaken for WCWR as a part of this work looked at these areas and noted where this could potentially be an issue.
- The spatial application of CSMG targets. CSMG targets have been applied across waterbodies which are connected to Natura 2000 sites, however there are some emerging questions about the detail of this across the West Country. Local Environment Agency staff have indicated that this may not be appropriate for all watercourses which flow from Dartmoor, for example.

## Application of climate change impacts to natural flows

The Environment Agency's National Framework predictions of natural flows for 2050 were based on one of the eleven UKCP09 Future Flows projections known as 'afixK' (**Figure 2.3**), as available at the time. This projected relatively more marked falls in flow over time compared with the remaining 10 'equally likely' suite of UKCP09 models.

Figure 3.3 Impact of the UKCP09 afixK scenario on flows at four flow percentiles (Q95, Q70, Q50, Q30)



As can be seen in **Figure 2.3** the afixK scenario does predict a marked decrease in mid to low flows in the West Country which is generally harder hit by climate change than other parts of England. Impacts can be seen to be increasing in the more westerly areas, with Devon and Cornwall particularly vulnerable to reductions in flow, partly because of the lack of significant groundwater storage and buffering.

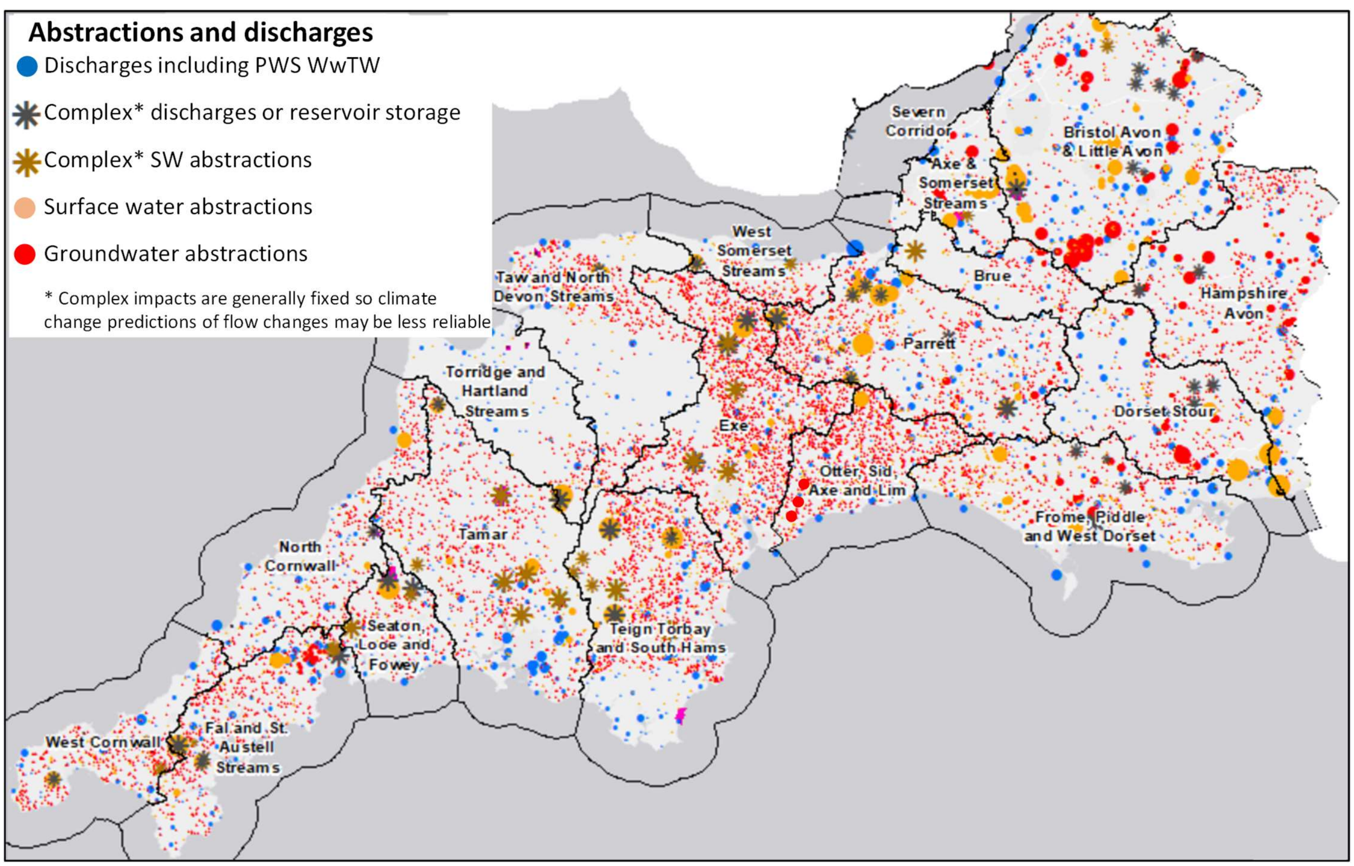
The National Framework modelling applied these percentage reductions to the natural flow statistics in the WRGIS. These revised natural flows have been used as the basis for the 2050 screening for environmental flow surplus or deficit against BAU or ENH EFIs.

## Abstractions, discharges, reservoir and water transfer assumptions in the Environment Agency's Water Resources GIS

The Environment Agency's National Framework predictions of water resource availability also depend on the abstraction, discharge, reservoir and water transfer assumptions in the WRGIS. The most critical deficits are associated with the precautionary 'Fully Licensed' scenario (licensed abstractions with WwTW discharges held at Recent Actual rates) with a 'Future Predicted' scenario also calculated as a more likely projection of abstractions and discharge rates in 2050.

**Figure 2.4** maps the locations of water Resources GIS abstractions, discharges and reservoir storage.

Figure 3.4 West Country catchments, abstractions, discharges and complex impact distributions in the Environment Agency's Water Resources GIS



The National Framework modelling provided two abstraction and discharge scenarios with associated deficits:

The **Future Predicted** scenario, in which recent actual abstraction (representative of abstraction use in ~ last six years) was upscaled based on sectoral growth factors, but not capped at current licence limits. This scenario is useful to give an indication of the potential for abstraction growth to impact river flows, however it is very complex to disaggregate to understand what is happening on an individual licence basis. Growth factors will vary across sector and water company, and complex abstractions (such as reservoir abstractions or licences with complicated HOFs) may not have had the growth factors applied in a consistent way due to the complexity of their representation in the WRGIS datasets.

The **Fully Licensed** scenario which represented flow impacts if all abstractions were to use their full licence capacity, but with WwTW discharges held at Recent Actual rates. In reality, this precautionary scenario would never occur as the nature of abstraction use, and the management of water company abstraction supply/demand balance across water resources zones means that not all abstractions will use their maximum capacity all of the time. However, this scenario is useful for understanding the potential deterioration risks and the scale reductions in total licensed quantity which could be required to meet environmental flows and, unlike the future predicted scenario above, it is clear which licence volumes have been used in the modelling.

As well as the larger reservoir, river and groundwater abstractions mapped on **Figure 2.4**, it is important to note that, whilst much of the public water supply is returned to the river network at inland WwTW, there are also many large coastal or estuarine WwTW outfalls around the west country. The larger coastal wastewater sites are highlighted in each of the pilot catchment Annexes because they represent a wasted loss of treated freshwater to the sea. Reviewing the potential re-use or relocation of these discharges to promote more water recycling is a common option to be considered in most of the pilot catchment Annexes - to improve future water supply resilience as low flows fall with climate change.

## Limitations of the National Framework modelling

### Fixed Complex impacts do not respond to climate change

The impacts of surface water abstractions with Hands Off Flow (HoF) conditions in the Water Resources GIS will change if the natural flow regime context changes. So if low flows fall, the HoF constraint may apply more frequently and for longer durations, limiting the impacts of the abstraction. However, across the south west, many of the larger reservoir and complex run of river abstractions for supply, storage, refill or power generation are represented as fixed flow duration curve complex impacts.

These Water Resources GIS influences types do NOT respond to climate shifts in natural flows. They are flow duration curve impact summaries which will not reflect changes in the frequency, duration or magnitude of, for example, flow regulating releases from reservoirs or groundwater augmentation schemes designed to support downstream abstraction, or complex HoF constraints.

**Figure 2.4** shows there are many influences of this type in the WCWRG catchments – including within the pilot catchments. This means that water resource deficit predictions may be too pessimistic. Better characterisation of such impacts and the deficits associated with them will need to come from time series modelling through Water Resources codes like Aquator or MISER, and through the regional groundwater models which cover the Hampshire Avon, Stour, Poole Harbour and Otter catchments, and the upper Malmesbury Avon.

### Protected groundwater dependent sites

As noted above the National Framework modelling provides a helpful screening for where abstraction impact may result in a failure of environmental flows in the 2050s when combined with the impacts of climate change and the local aspirations for higher levels of environmental protection. The modelling is focused on run-of-river impacts and does not provide a screening of how climate change and abstraction impact could affect water dependant designated sites which are not "on-line" within watercourses (e.g. offline groundwater dependent terrestrial ecosystems (GWDTEs) or other water dependant sites which depend on complex interactions between rivers and their flood plains, such as the Somerset Levels). The nature of the impact (and associated potential effects on abstraction) is not fully reflected in the Water Resources GIS or National Framework modelling screening and would need to be the subject of a more detailed investigation for these specific sites.

In some cases it also appears that the location of a SSSI designated GWDTE somewhere within the catchment has been used to justify an enhancement of the river flow standards, even if the protected site is actually not dependent on the river flow in any way.

### Application of Enhanced Q10 targets to Q30 Water Resources GIS flows

For rivers with protected migratory fish designations the enhanced river flow standards include a significant tightening of allowable high flow impacts. These are based on CSMG standards which should only apply above Q10 conditions. However, the highest flow condition calculated in the Water Resources GIS is Q30 – to which the Q10 constraints have been applied – a precautionary assumption influencing the Q30 resource availability maps presented in the next section.

## Environment Agency projected 2050 water resources surplus and deficit maps

It has not been possible to overcome the limitations flagged above in the National Framework projections, so the worst case Fully Licensed Enhanced environmental ambition water resources availability maps presented in **Figures 2.5 and 2.6** are as provided by the Environment Agency, with no adjustments. They should therefore be treated with some caution.

**Figure 2.5** shows the 2050 Fully Licensed surplus or deficit predicted for all west country river water bodies in relation to the Enhanced environmental flow target for higher flow Q30 conditions (top map) and low flow Q95 conditions (bottom map). At higher flows, the green and blue colours should how surplus water available builds going downstream in many catchments and blue labels indicate availability at the downstream end of the larger rivers. There are some high flow deficits in headwater catchments related to reservoir capture of winter water, as well as in the lower Hampshire Avon, Somerset Axe, Piddle and Tamar catchment rivers where the deficit relates to a combination of over-tightened Q30 flow standards and the impacts of some very high licensed hydroelectric power and public supply sources well beyond actual pumping rates. Under low flow conditions, projected deficits are mapped much more widely, although there is still significant water availability predicted in the Lower Bristol Avon (35 Ml/d), Exe (18 Ml/d), Fal (25 Ml/d) and in some north Devon catchments.

Figure 3.5 Local water resource availability from the Environment Agency National Framework indicating the local potential for environmental impacts or abstraction increases: 2050 local surplus or deficit in Ml/d for the Enhanced environmental ambition Fully Licensed scenario

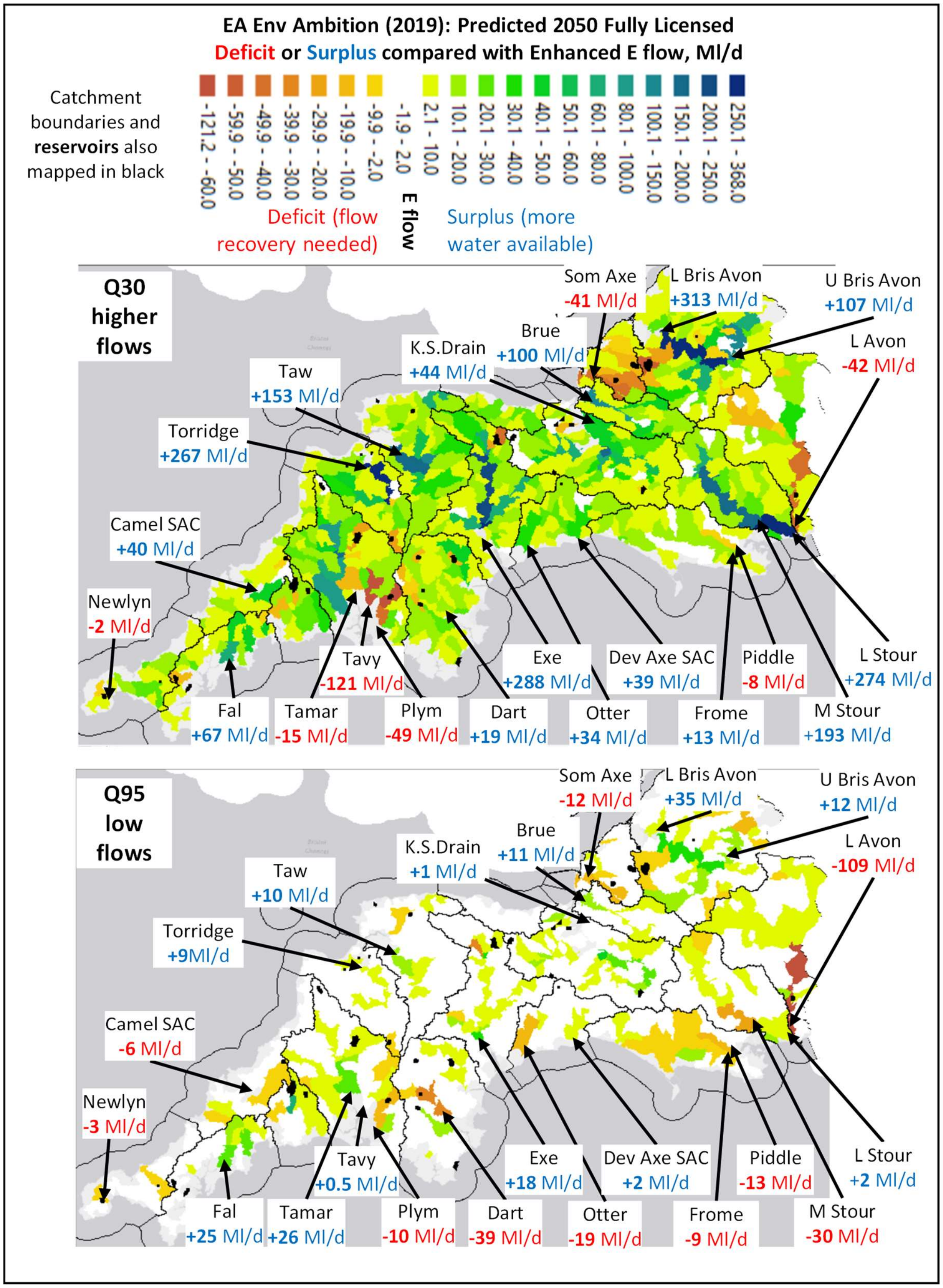



**Figure 2.6** re-maps the surplus and deficits on **Figure 2.5** by colouring according to the minimum downstream resource availability. The labels at the bottom of the catchments remain the same.

Figure 3.6 Downstream water resource availability from the Environment Agency National Framework indicating the need for downstream flow support: 2050 downstream minimum surplus or deficit in Ml/d for the Enhanced environmental ambition Fully Licensed scenario

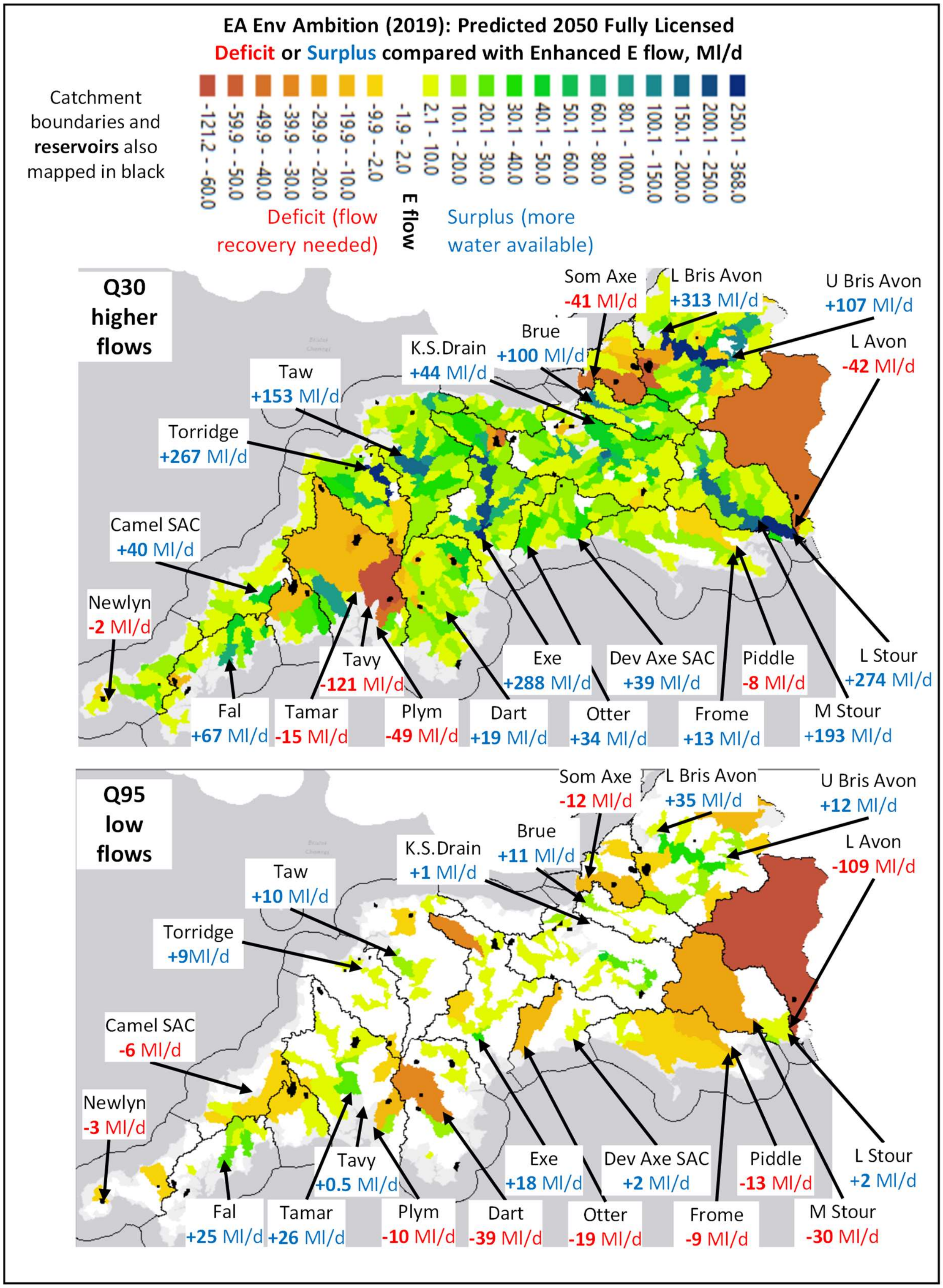



**Figure 2.6** shows that downstream abstraction impacts and deficits constrain upstream local resource availability – e.g. in the Avon, Stour, Otter, Frome, Piddle, Dart, Plym and Camel.

The largest low flow deficit in the Hampshire Avon (which is a protected SAC river), is due to public supply abstraction for Bournemouth just before the river flows into Christchurch Harbour. Raising flows in the Lower Avon whilst also realising improvements in the neighbouring Dorset Stour is one of the greatest environmental destination river flow-related challenges in the region, particularly involving both South West Water and Wessex Water – as presented in the Dorset Stour plan (Annex A).

Low flow recovery options for the Frome and Piddle are discussed in the Poole Harbour catchment plan (Annex B), the Tavy, Tamar and Plym are considered in Annex D (Tamar plan), and the Otter in Annex E (East Devon plan). The rural headwater catchments of the upper Bristol Avon include a number of water bodies with smaller deficits to consider, but there is significant resource available in the main river downstream. The largest new resource option for the region – development of a new reservoir in a Mendips quarry – is located within the Rural Bristol Avon catchment (Annex C).

Beyond the pilot catchments, **Figures 2.5 and 2.6** show that environmental river flow deficits are also predicted elsewhere across the region. The River Camel, for example, is of particular importance because of its protected SAC designation. And together with other labelled deficits for the Newlyn and Somerset Axe catchments, the Environment Agency's projections suggest there could be smaller deficits in many other headwater rivers. In parallel with the development of the pilot catchment plans, it was therefore important to carry out a high-level analysis all of the information provided by the Environment Agency in order to understand what broad scale of abstraction impact reductions may be required so that these can be considered in water company resource planning. The approach taken is described below.

### Use and interpretation of Environment Agency modelling information to inform potential abstraction reductions across the West Country

The Environment Agency's modelling projections have been processed to give an indication of the potential requirement for abstraction reduction to meet these deficits under fully licensed conditions in all river water bodies. To calculate the potential reductions water company abstraction locations were compared against the location of predicted flow deficits against EFIs, as mapped in Figure 2.5. This was done on a catchment basis, starting at the top of catchments to avoid any double counting of the potential flow recovery required. In calculating the recovery, the following rules have been applied:

- For **surface water abstractions from rivers** it has been assumed that a HOF constraint could be used to limit surface water abstraction to the required amount under each flow condition (in this case, the four WRGIS flow percentiles), and therefore only the deficit has been recovered. In reality this may be impractical or too complex, but the HOF approach was considered appropriate for this screening exercise to avoid a significant over estimation of surface water abstraction reductions needed at higher flows. However, more detailed scrutiny may subsequently show that smarter solutions are possible. In some cases implausibly large fully licensed risks which would never in reality materialise could be reduced by simply aggregating separately licensed abstractions together (e.g. in the Tamar and Tavy catchments – see Annex D). Elsewhere the relocation or recycling of treated wastewater may support low flows and allow abstractions to continue without tighter constraints (e.g. in the Dorset Stour – see Annex A).

- For **groundwater abstractions** the WRGIS groundwater impact factor has been used to give an indication of the ratio of lowest flow impacts to average abstraction rate. The impact factor varies between 0 and 2. Abstractions with an impact factor of 1 have the same impact on flows under all flow conditions, those with a higher impact factor have their impact biased towards lower flows and those with a lower impact factor towards higher flows. The vast majority of groundwater abstractions in the West Country have an impact factor of 1. Groundwater abstraction impact reduction requirements have therefore been assumed to fix the greatest deficit, which is usually at low flows. This means that proportionally much more groundwater abstraction has been lost because it is not possible to "safeguard" higher flow abstraction i.e. the disconnection between groundwater pumping and river flow impact means that HOF constraints are rarely effective in headwater catchments so the abstractions have to be switched off completely to realise low flow benefits. Groundwater abstractions assigned a lower impact factor in WRGIS have been left out of the list of sources where reductions might be required to fix low flow deficits because they will not have a significant impact at low flows. More detailed scrutiny may subsequently suggest that smarter options for low flow recovery are available to avoid the loss of drought resilient groundwater supplies – for example through the operation of existing or new groundwater to river support schemes, as in the Stour, Poole Harbour rivers and Otter catchments (Annexes A, B and E respectively).

- There are significant deficits shown in **water resources heavily modified waterbodies (WR HMWBs)**. In the west country these are generally reservoirs where changes to the natural flow means that the compensation flow arrangements may no longer be sufficient. There is a question around the application of EFIs to these water bodies and their immediate downstream reaches because the abstraction impact forms a key part of the reason for designation of a water body for which WFD Good Status targets are no applicable. The deficit recovery calculated for these waterbodies, however, should be treated with a significant amount of caution, both because it may not be necessary to recover the deficit, and because the nature of the national framework modelling means that the results in these catchments are particularly uncertain. WRGIS impacts for reservoirs and some public water supply river abstractions are fixed as 'COMPLEX' patterns across the flow duration curve – usually based on time series analysis of flows as they are now. These assumptions remained fixed in the National Framework projections which is not appropriate in the context of a shifting climate which may include both increased flood flows and reductions in mid and low range flows. The application of the CSMG targets to these waterbodies or downstream catchment could also cause a particular issue as the National Framework modelling results in a higher apparent deficit (or lower surplus) at the Q30 than would be the reality under the "correct" Q10 application of these targets.

The potential need for abstraction reductions to meet the flow targets has been shared with the relevant water companies and the Environment Agency across the whole West Country – in parallel with the more focused Pilot catchment plans in **Annexes A-E**. It is important to note that the abstraction impact reduction estimates are **indicative** only. The assumptions made in the modelling mean that care should be taken in placing too much emphasis on specific volumes. The reduction estimates provide a helpful basis for the understanding of future action planning but **should not drive specific licence reductions at this stage**. They should rather be taken as

**providing the impetus for further focus, investigation and modelling – as set out in the Annexes A-E pilot catchment examples**.

## 3.2 Updated climate understanding – UKCP18 and further work

In January 2022[11] CEH and a consortium of associates working with the Meteorological Office have delivered the UKCP18 successor to the Future Flows data which includes 12 'equally likely' projections of river flows and groundwater levels from 1982 to 2080 using a variety of alternative modelling approaches based on the 8.5 Regional Climate Models (including relatively high carbon emissions). These Enhanced future Flows and Groundwater (eFlaG) data are available online[12] and have been used in the pilot catchment plans to compare against the Environment Agency's assumptions for the five trial catchments. This processing has indicated that the UKCP18 results broadly support the future projections represented in the UKCP09 afixK scenario used for the Environment Agency's National Framework analysis. In some cases the updated eFlaG projections presented in **Annexes A to E** suggest greater low flow reductions and less marked higher winter flow increases than had been previously predicted.

The implication of this is that the pattern of deficits shown in the National Framework modelling is supported by more recent climate modelling, and may, in some areas be an underestimate of what is to come. **Given the scale of potential reductions in flow, this is a sobering picture for the future of water availability both for abstraction and the environment across the West Country**.

The eFLaG project[13] datasets will assist in a better translation of climate change impacts to river flows and other initiatives. For example, work proposed under the Climate services for a Net Zero resilient world (CS-N0W)[14] programme (2021-25) will seek to develop further detail on climate impact on river flows (incorporating anthropogenic influences such as abstractions and discharges). Projects like these, as well as the Environment Agency's review of their National Framework (to be complete in 2025) will help develop the understanding of future water resource availability squeeze in the next round of WRMPs and Regional Water Resources Plans.

[11] https://www.ceh.ac.uk/our-science/projects/eflag-enhanced-future-flows-and-groundwater
[12] https://eidc.ac.uk/
[13] https://www.ceh.ac.uk/our-science/projects/eflag-enhanced-future-flows-and-groundwater
[14] https://www.gov.uk/government/publications/climate-services-for-a-net-zero-resilient-world/cs-n0w-overview

# 4. Conclusions and recommendations

## 4.1 Catchment pilots

The conclusions from each of the pilot catchment plans have been summarised in **Table 4.1**, as set out in more detail in **Annexes A-E**.

Table 4.1 Conclusions of the catchment pilots

| Catchment | Key Conclusions |
|---|---|
| **Dorset Stour (Annex A)** | • Some of the water bodies have been classed as Enhanced (ASB3) in the national framework modelling due the presence of chalk streams in the middle catchment.<br>• Work is ongoing and is proposed aiming to improve the catchment condition with respect to soils, sediment and diffuse pollution management. Further productive work could be undertaken to understand what other options there could be to slow flood responses and improve water quality in the less permeable upper catchment – using the Environment Agency's opportunity mapping as a starting point.<br>• Further groundwater abstraction reduction might be required across the Lower Stour and River Allen to ensure environmental objectives are met in the 2050s, unless smarter management options are implemented over the short, medium and long term.<br>• These options include: 1. the migration of the Wimborne licence downstream, the conjunctive management of the Stanbridge, Longham and Allen support schemes to raise low flows, 2. the relocation of Pool WwTW to enable more abstraction from the Stour so that pressures on the neighbouring Lower Avon can be reduced, 3. other possibilities for non-potable effluent re-use, 4. a potential Aquifer Storage and Recovery (ASR) scheme at Longham, and 5. low flow support from new small reservoirs in the upper catchment or from the larger Mendips quarry reservoir strategic resource option. |
| **Poole Harbour Rivers (Annex B)** | • Nutrient reduction to reduce eutrophication risks in Poole Harbour will continue to be a priority. Improved Phosphate and Nitrate removal is being implemented in the short term alongside the Entrade platform to incentivise nutrient reduction on farms.<br>• The planned re-location of the Poole WwTW discharge to the Stour should further reduce pollution of the Harbour whilst supporting low flow and abstraction resilience in the Stour.<br>• Hooke springs will develop a catchment resilience plan as part of the Chalk streams work<br>• Large reductions in groundwater abstraction will be required to met enhanced Chalk streams targets unless smarter solutions can be found.<br>• The operation of existing low flow groundwater augmentation schemes will be reviewed and may be extended to improve low flow resilience in the headwater catchments of the Piddle and Devils Brook. Other schemes for the Bere Stream, South Winterbourne and River Win might also be considered<br>• The feasibility of previously investigated ASR scheme in the confined aquifer at Wareham should be reconsidered, as should the potential for a new offline storage reservoir refilled from Tadnoll Brook spring flow, and opportunities for re-cycling the Weymouth WwTW water currently discharged to the sea. |
| **Rural Bristol Avon (Annex C)** | • Potential flow impacts are scattered throughout the catchment with a focus on small headwater catchments generally EA modelling indicated relatively small deficits. The EA modelling predicts deficits in a number of headwater catchments where no |

| Catchment | Key Conclusions |
|---|---|
| | further flow recovery has been required, this is due to the presence of groundwater support schemes and active WINEP schemes which will deliver the hydrological regime which will support future change.<br>• A considerable amount of work is already underway or under consideration by catchment stakeholders in the Rural Bristol Avon Rivers catchment. There are a number of nature-based solution proposed across the headwater catchment which may deliver small-scale improvements to low flow availability as well as providing water quality and biodiversity resilience, but they are unlikely to significantly improve low flow resilience in the face of climate change.<br>• There are also some larger strategic options provided in the form of the Mendip Quarry Reservoir site and Cheddar 2 which would increase the available supply in the area.<br>• Both Wessex and Bristol Water are currently looking to deliver abstraction reductions through demand management but have considered a range of options that will impact the Rural Bristol Avon Rivers catchment but are currently not on their preferred list. Some of these options, may need to be reconsidered in the medium and long term. The total volume of potential demand management recovery is greater than the current 2050 deficit anticipated by EA modelling. |
| **Tamar (Annex D)** | • The Tamar has a strong track record in the application of the Upstream Thinking initiative and implementation of Natural Flood Measures should be progressed to slow the flow and improve water quality in this very flashy runoff-dominated catchment. The formation of a 'Nature Partnership' should be encouraged.<br>• In the absence of significant groundwater storage, climate change projections suggest that low flows could fall markedly as the climate warms. Whilst some increase in the severity of flood events is also expected, typical winter flows will also probably fall.<br>• This means that it will be important to improve the resilience of options to refill reservoirs – particularly Roadford and its associated treatment works at Northcombe as these are vital for supply to North Devon. Options for the development of new pumped storage from Gatherley should be developed and licensed in aggregate with existing River Lyd pumped storage and downstream Gunnislake abstractions.<br>• Existing low flow constraints on Tamar abstraction licences should provide reasonable protection into the future (i.e. environmental surpluses will be maintained). Projected higher flow (Q30) deficits are over-stated because the tighter CSMG standards for >Q10 flows should not be have been applied at Q30 in the Environment Agency's modelling, and the time series operations of the reservoirs and river abstractions represented as fixed complex impacts have not been recalculated in the future climate context.<br>• Options to aggregate together the Abbey Weir hydroelectric power and Lopwell public supply licences should also be considered. These are large licences which combine to result in very large deficits but are, in reality unlikely to be used together during low flow periods.<br>• The results of the Burrator reservoir compensation release and adaptive management trials should result in improved resilience in that catchment.<br>• Significant volumes of WwTW effluent from Plymouth are currently discharged into the Sound from four main works. Options for re-using or recycling this water for industrial non-potable purposes, or possibly upstream relocation to support a new intake on the Lower Plym should be explored. |
| **East Devon (Annex E)** | • The existing Nature Partnership should continue together with the catchment management, Upstream Thinking and Natural Flood Measures work so slow the flow, improve water quality and build-in more ecological resilience during low flow periods. |

| Catchment | Key Conclusions |
|---|---|
| | • There are small deficits on the Middle Creedy, Lower Barle and upper Axe water bodies where abstraction reduction options may need to be explored<br>• The largest projected deficits are associated with low flows in the Lower Otter associated with the impacts of sandstone groundwater abstractions for public supply. These have been the subject of WINEP investigation and options are available for increased use of river support associated with abstraction reduction and an AIM scheme to shift pressure downstream in dry years.<br>• In the longer term, options for relocating the discharge from the Exmouth or Sidmouth WwTW to upstream of Dotton instead of the sea could provide the low flow resilience needed to offset abstraction impacts so that the river support pumping is no longer needed.<br>• The Wimbleball reservoir resource is already resilient, shared by Wessex Water and South West Water and can be refilled from pumped storage. There may be more resource available now and in the future from the Lower Exe.<br>• The development of the Brampford Speke and Stoke Canon BHs to provide support to the Exe just upstream of the North Bridge intake should be explored as this will reduce the compensation release required from Wimbleball which will be good for low flows (there is concern that these are too high because of regulation) and good for retaining storage in the reservoir. |

## 4.2 Reflections and next steps

### Reflections on the future challenges for water supply planning

Climate change represents a significant challenge to maintenance of the balance between a secure water supply and a healthy and sustainable water dependant environment. Should the future represented in the climate projections come to pass in the West Country **the region will switch from a water surplus to a potential deficit, stretching the capacity of water supply networks and the environment which supports them**.

**Strategic water supply solutions** (as being promoted by RAPID through the WRMP process) **will form an important part of any solution** – making sure we make the best use of the water that is collected in our rivers, reservoirs and aquifers, as will other measures such as water re-use and a significant increased emphasis on demand management. However, **more is needed** to deliver a future which works for both our environment and water supply networks across the West Country. This should include **broader measures which are focused on improving the resilience of the catchment and local riverine habitats** to provide low flow refuges, help ecosystems recover quickly from droughts and floods, reduce diffuse water pollution at source and create better quality water habitat for dependant ecology. Resilient catchments allow for the maximisation of their freshwater abstraction potential but will not prevent the low flow reductions expected with climate change.

There needs to be **robust national and local conversations about how flows and habitats could change with as the climate shifts** – and understand how the ecological baseline is likely to evolve. Prioritisation of habitats for protection will continue to be important. This should include dialogue around how to classify an event which triggers drought measures if the climatic baseline changes. The representation of the Environmental Flow Indicator or CSMG standards as a proportion of natural flow, rather than a fixed volume of flow, has already dialled in the expectation that our environment and flow targets will evolve with a changing climate. If the scenarios we see in UKCP09 and UKCP18 are realised it will not be possible to achieve the environment that we would currently view as "good status" in all our rivers and water dependant sites – flow patterns, recharge volumes and the nature of weather events will change too much to support this. This does not mean that our environment will completely shift, but that there needs to be clear-sightedness in investment. **Doing what we can now to ensure our catchments are the best they can be is an important part of preparing them to adapt to change.**

Resilient catchments are only a part of the challenge to provide supply sustainability in the future. **Demand management is a cornerstone of future water resources planning** – this will require significant shifts in behaviour and usage which need to be co-ordinated at national and local level. The implications of demand management for the water supply system also need to be understood – a reduction in water use could result in less water coming through treatment plants which may be currently supporting low flows downstream.

**How we use groundwater storage and resources is an important part of the solution**. There is a proposed move away from Chalk and Sandstone groundwater abstraction at the moment, to meet river flow targets at assessment points which are being moved further upstream into headwater catchments. If full aspirations for demand reductions cannot be realised, this move away from existing resilient groundwater supplies will require the large scale construction of reservoir storage, water transfer and effluent re-cycling schemes. This may be the right answer for some catchments, but groundwater as a resource represents a local, low cost, low carbon solution to water storage, often with less impacts on river flows than equivalent surface water abstractions. So groundwater must continue to form a key part of future water supplies in the face of a drying climate.

In the West Country, **significant volumes of treated wastewater are also discharged into estuaries or the sea.** There have been great improvements in the treatment standards of these discharges driven by the need to improve the quality of bathing waters but they still represent a potentially wasteful loss of water which might be better re-used. It may be possible to re-locate the discharges upstream of a river intake in order to improve low flow resilience by recycling (as in the Dorset Stour), or there may be a local industrial or cooling needs for grey water which could be supplied from these works in order to reduce demands on higher quality water for drinking.

The fundamental question of **who pays for catchment improvements and the potential need to re-configure public supplies** still needs to be addressed. Currently catchment work is funded through a mosaic of governmental and private sector (mainly water company) schemes. How much money is needed and who pays will have a significant impact on what can be done and where improvements to water supply and catchment low flow resilience can be realised.

The **challenges of water quality treatment** are continuing to grow. Diffuse pollution (mainly from agriculture) and the long-term release of ubiquitous substances into our environment (such as PFAS and mercury) raise new and ongoing challenges for the treatment of water to safe drinking standards. Climate change could exacerbate these challenges by reducing the dilution potential of our rivers, increasing eutrophication risks as temperatures rise and raising the costs of treatment.

These challenges are set against a background of some national policy change. The Environment Act 2021[15] sets the groundwork for new interventions - of particular relevance are:

- The Environment Agency has the power to remove unused licence headroom which is judged to have the potential to cause environmental harm.
- Environmental Improvement Plans (EIPs) will be issued on a 5 yearly cycle, of which Defra's 25 year Environment Plan represented the first one. Future plans will have more details on expected environmental targets and the degree to which these are being met.

The narrative around the recently proposed Brexit Freedoms Bill[16] highlights that 80% of the UKs environmental law comes from the EU and it is the government's intention to review and reform "to ensure it is rational, cohesive and fit for the UK's unique economy and natural environment"[17]. This is positive phrasing but raises the challenge of **potential changes to targets and planning cycles** which needs to be carefully integrated to ensure that progress in meeting targets continues and doesn't stagnate while new processes are adapted to.

## Next steps for the catchment pilots and the application of the National Framework in the West Country

The work undertaken to process the National Framework modelling information and develop the catchment pilots indicates that there are significant future challenges to establishing appropriate river flow targets and sustainable water supplies in the West Country. This information is a useful first step in screening where more intervention may be required, above and beyond that already captured in WINEP and through previous WRMP cycles. Further work is required to better understand these future challenges:

- There should be a review of the Environment Agency technical assumptions in the 2050 Environmental Ambition modelling as a part of the revision of the National Framework., which is understood to be in progress within the Environment Agency. A reproduction of the results would be helpful, ideally incorporating more local modelling through the use of groundwater or water resources models and involving local Environment Agency and water company staff on the critical path for the review and prioritisation of outcomes.
- The Catchment Partnerships offer an excellent vehicle into the local stakeholder community. There should be closer integration of the water resources function of water companies into these groups to facilitate conversations around the protection of catchments used for water supply and future strategic option planning.
- Climate change adaptation should be a focus of the integrated catchment partnership work, to facilitate coherent and catchment wide conversations around adaptation and prioritisation of measures. Building more resilient refuges and better connectivity into riverine habitats will be essential for protecting dependent ecosystems from the longer periods of lower flows expected as the climate warms.

[15] https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
[16] https://www.gov.uk/government/news/prime-minister-pledges-brexit-freedoms-bill-to-cut-eu-red-tape
[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1051323/benefits-of-brexit.pdf

# Annex A
# Dorset Stour Pilot Catchment Plan

# Annex B
# Poole Harbour Rivers Pilot Catchment Plan

# Annex C
# Rural Bristol Avon Pilot Catchment Plan

# Annex D
# Tamar Pilot Catchment Plan

wood.

# Annex E
# East Devon Pilot Catchment Plan