West Country Water Resources Group

Environmental Destination

Annex A: Dorset Stour
pilot catchment plan to increase
future water supply and low
flow environmental resilience

Wood E & I UK Limited – August 2022

Report for

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Contents

1. Overview

This document is one of five technical annexes that lay out plans for holistic measures that may be implemented in five West Country Water Resources (WCWR) pilot catchments to increase water supply and environmental low flow resilience. 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).

1.1 This pilot catchment plan

This pilot catchment plan sets out the measures best suited to achieve future water resources resilience and environmental improvement in the **Dorset Stour Catchment**, in response to the challenge to meet environmental flow objectives, even as flows are expected to fall due to climate change.

Full details of the project context, scope, data sources and stakeholder engagement are given in the main report.

1.2 Contents of this annex

After this introduction,

- **Section 2** provides a summary of the catchment and the pressures on it.
- **Section 3** details the Environment Agency-suggested Environmental Ambition abstraction reductions that may be needed to improve river flows. It also provides an indication of how the flow regime is projected to change as the climate shifts into the future.
- **Section 4** describes the current projects underway in the catchment and summarises the strategic action plan of water company measures that could be implemented in a phased approach to increase water supply resilience. Projects currently focused on land management, habitat creation, restoration, re-wilding and diffuse water quality improvements are also included because these should improve ecological resilience through droughts, even though they will not make much difference to the flow regime.
- References are given in **Section 5.**

Figures are provided as a slide pack and at the back of this Annex in **Section 6.**

2. Catchment summary

The largely rural Dorset Stour catchment is underlain by a mixture of Jurassic low permeability clays (upper catchment), the Chalk aquifer (middle catchment), and the London Clay (lower catchment) (**Figure A2.1**). The Chalk is strategically important both for public water supply and also for the aquatic ecology it supports within a number of tributary rivers and winterbourne streams. This section describes the catchment as it is now - the rivers that drain it, the interaction of surface water with groundwater, the pressures from abstraction as well as from diffuse and point sources of pollution.

2.1 Why the Dorset Stour pilot?

For the **Dorset Stour catchment**, the Environment Agency's Environmental Ambition calculations suggest that there are reaches of the middle river where flows are likely to fall below environmental targets, and that these deficits will get worse as the climate changes. The catchment does not contain nationally or internationally prioritised SSSI riverine sites impacted by water abstraction – unlike the neighbouring European-designated Hampshire Avon Special Area of Conservation (SAC). But it is important to focus on the Stour partly because this will be affected by the desire to significantly reduce low flow summer abstraction from the more highly protected lower Avon. Options to support low flows in the Avon itself (e.g. through relocated water recycling centre discharges) are prohibited by the 'natural functioning' objectives set by Natural England for SSSI rivers.

So *increased* summer pumping from the Lower Stour will probably be needed to maintain supplies to Bournemouth whilst improving river flows in the Lower Avon. A long-term strategy has been outlined with phased measures to raise low flows in the Lower Stour in order to support more abstraction.

The catchment is also home to a number of active stakeholder groups and there is good public access along the lower reaches around Bournemouth and Christchurch - so measures to improve river flows, habitats and water quality are viewed as potentially benefiting the local economy.

2.2 The current state of the catchment

Geography, geology, rivers and environmental designations

The River Stour flows southeast through Wiltshire and Dorset, discharging to the English Channel, together with the River Avon, through Christchurch Harbour (**Figure A2.1**). Its catchment is predominantly rural and agricultural in nature, with areas of urban development concentrated in the southeast along the coast associated with Bournemouth, Southbourne and Christchurch, and Blandford Forum in the middle reaches (**Figure A2.2**).

The headwaters of the Stour arise from springs that issue from the Upper Greensand at Stourhead. As the river flows south, it is joined by the River Cale and the River Lydden. The upper catchment here is predominantly underlain by impermeable clays and limestone belonging to a mixture of Jurassic geology, including the Oxford Clay, Corallian Limestone, Great Oolite Group and Kimmeridge Clay (**Figure A2.1**).

As the Stour flows across the Dorset Downs, it passes onto the Chalk outcrop at Blandford Forum. Chalk tributary rivers and winterbourne streams join the Middle Stour in this section, including the Tarrant, North Winterbourne and River Allen. Here the main channel also interacts with the Chalk whilst retaining a flashier runoff and sediment-loaded character derived from the upper catchment. It supports diverse ecological assemblages including small numbers of salmon and sea trout, partly associated with accretion of clear, cool, good quality groundwater-dominated baseflow.

In the Lower Stour, the Chalk is overlain and confined by the Tertiary sands, gravels and clays of the Thames Group and Bracklesham Group and the river becomes disconnected from the Chalk aquifer at depth. It is joined by the Moors River (River Crane in its upper part) northwest of Christchurch, which drains the east part of the catchment, flowing southwards from its source at Cranbourne on the edge of the Chalk outcrop.

The Middle and Lower Stour, and also the tributaries of the Moors River System, have been in some sections significantly modified by historical dredging and removal of gravel from the river bed, by channel re-alignment and widening, the installation of weir structures, impoundments, and by weed cutting and tree removal. Little semi-natural wetland vegetation remains in the floodplain and the extent of a diverse riparian buffer zone has been restricted due to the agricultural land uses and grazing that now surround the Stour (Environment Agency, 2019a). In the urban and suburban southern part of the catchment close to the coast, former wetland areas have been drained, and measures to reduce flooding risks have also disconnected the main channel from the floodplain.

Detailed river restoration plans for the Middle and Lower Stour, and for the Moors River System have been published by the Environment Agency in 2019 (discussed further in **Section 4**).

Designated sites in the catchment include Special Areas of Conservation (SAC), Special Sites of Scientific Interest (SSSI) and Ramsar sites (**Figure A2.2**), although these do not include the riparian habitats of the Stour itself. Of particular note are the Dorset Heaths SAC in the southern catchment, designated for its dry and wet heath habitats, and peat bog pools (JNCC[1]). The Moors River System is designated a riverine SSSI for its exceptional chalk stream diversity of aquatic and wetland plants, and species of conservation importance (Natural England, 1999), but is not under any significant pressure from water abstraction.

Abstraction pressures

There is an extensive history of abstraction development and impact investigation in this catchment. Most of the 'consumptive' pumping is for public water supply which returns re-cycled water to the catchment downstream of towns and villages after treatment (**Figure 2.3**). There are also large abstraction licences for non-consumptive agricultural purposes such as fish farms and water cress beds – typically supported by springs or boreholes which return the water locally to the catchment and have little impact on downstream resource availability. Non-public water supply

[1] https://sac.jncc.gov.uk/site/UK0019857

water users in the agricultural, industrial or private supply sectors therefore represent a relatively small component of consumptive water demand. However, they still need to be aware of the changes in resource availability expected due to climate change, as set out in **Section 3** - so that they can plan and adapt.

Groundwater abstraction is dominantly from the Chalk, the majority of which is licensed to Wessex Water with the largest sources located near the Middle Stour at Black Lane, Sturminster Marshall and Corfe Mullen (**Figures A2.3** and **A2.4b**). In addition, there is a large Bournemouth Water (i.e. South West Water) intake from the lower reaches of river at Longham (**Figures 2.3 and 2.4a**) used to supply the city together with surface water intakes on the neighbouring River Avon at Matchams and Knapp Mill. Bournemouth Water also operate the Stanbridge Mill groundwater source and river support schemes on the River Allen, together with an unused licence at Wimborne. The River Allen tributary has been the focus of measures to improve low flow resilience for more than 40 years. This has reduced pumping from Stanbridge with associated abstraction relocation downstream to Longham. Three groundwater to river support schemes have also been developed (at Wyke Down, Gussage and Crichel – **Figure A2.3**) which are operated during most summers to maintain low flows alongside public supplies.

Groundwater abstraction intercepts flow in the aquifer that would otherwise contribute to river baseflow and therefore directly affects surface water flows, particularly in the Middle Stour. Lowered groundwater levels can also affect springs and winterbourne tributaries - extending dry periods, particularly under drought conditions, although the impacts of abstractions which draw on groundwater storage are partly delayed until the next recharge season when the aquifer is re-filling and flows are higher. Wessex Water has previously investigated the environmental impact of abstraction on headwater river flows in Shreen Water and Ashfield Water at Mere, and on the River Tarrant[2], Pimperne and Iwerne tributaries

The Wessex Basin regional groundwater and river flow model has been built by the Environment Agency and Wessex Water covering the Stour, Avon and Poole Harbour catchments. This has been extensively used by both water companies and the regulator to inform abstraction licence decision making for over 10 years.

The latest 2020 Dorset abstraction licensing strategy assesses groundwater availability across the catchment as 'Restricted water available' noting that there is very little scope for any additional consumptive abstraction in low flow summer months (Environment Agency, 2020a).

Drinking water safeguard zones have been designated associated with Wessex Water's Black Lane, Shapwick and Sturminster Marshall public water supply sources in the Middle Stour, all associated with nitrate pressures (**Figure A2.2**). These have been delineated using the Wessex Basin groundwater model which has also helped focus Catchment Sensitive Farming efforts to reduce diffuse pollution inputs of nutrients into the aquifer in order to protect public supply source water quality and ameliorate environmental eutrophication risks.

ARUP are also conducting a study to enhance the understanding of the current and future needs of non-PWS abstractions for agriculture, private water supplies, and mineral abstraction. As part of this assessment, ARUP have calculated the non-public water supply demands of the catchment, including generating figures for the number of animals in the catchment which have water

[2] https://www.wessexwater.co.uk/environment/protecting-and-enhancing-the-environment/investigations

demands. The preliminary results from the ARUP 2022 study are shown in **Figure A2.4a** and indicates non-public water supply demands from the catchment are approximately 15 Ml/d.

Water resource availability

Environment Agency published maps of river water body water resource availability at a range of historical climate flow conditions are shown in **Figure A2.5** (Environment Agency 2021[3]).

At high flows above Q30 (i.e. the flow exceeded for 30% of the time), water is assessed as being available across the entire catchment (that is, when flows are high, there is more water than is required to meet nationally consistent environmental river flow objectives, even if abstraction increased to Fully Licensed rates).

At moderate (Q50) and low flows (Q70 and Q95) this picture changes, with flows falling below the Environmental Flow Indicator (EFI) in the upper River Allen and also in the Stour headwaters, such that no water is available at any time for licensing. In the remainder of the middle and lower catchment, flows fall below the Environmental Flow Indicators (EFI) for around 30% of the time (i.e. below Q70 conditions) such that restricted water would be available for licensing – subject to low flow constraints.

It is also important to note that although the Lower Stour water body is mapped green on **Figure A2.5** – i.e. as having more water available for licencing - there is a local lower flow reach within it at the Throop gauging station. This is just downstream of the Longham abstraction intake and upstream of discharges from wastewater treatment works which return water from Bournemouth to the river before it flows into Christchurch Harbour.

Flood risks

The Stour catchment has a history of flood risk, from surface water flooding, groundwater flooding and tidal flooding. The sources of flood risk vary across the catchment but are mostly associated with the areally extensive lower permeability upper catchment which generates flashy peaky surface runoff affecting the whole of the main river channel downstream. A smoother hydrological response is characteristic of the middle catchment due to the buffering of Chalk groundwater storage between recharge and river baseflow. However, prolonged groundwater flooding is an issue in some places following heavy rainfall during times of high antecedent groundwater levels. Where the lower river flows onto clays, sands, and gravels, a more mixed response is typical and the river channel has been locally modified to reduce urban flooding risks through Bournemouth. Tidal flooding up to Iford has been documented (Environment Agency, 2012).

Waste water treatment works discharges and water quality pressures

Wessex Water operates the waste water treatment works which return mains water to the rivers across the catchment. There are treatment works for many small villages and towns (e.g. Wincanton, Shaftesbury, Blandford, Wimborne, Corfe Mullen), with the largest discharges returned from Bournemouth to the bottom reaches of the river. The larger works which discharge into the lower Stour before it flows into Christchurch Harbour are labelled on **Figure A2.3**, together with the Poole and Christchurch works in neighbouring catchments because these all

[3] https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/WaterResourceAvailabilityAndAbstractionReliabilityCycle2&Mode=spatial

represent potential opportunities for re-cycling or re-use to reduce the loss of reliable flows to the sea.

These discharges are consented and regulated by the Environment Agency. Considerable improvements in discharge water quality have been achieved over the past 30 years and investment is ongoing as clean-up standards continue to be tightened. As the sewer systems often combine household effluent with urban drainage runoff, occasional storm overflow of untreated water remains a focus for improvement.

Intensive agricultural land use in the catchment also results in diffuse pollution due to the application of nutrient fertilizers (phosphates and nitrates) and herbicides, sometimes associated with bare soil loss and sediment runoff into water courses. This is particularly an issue in the less permeable, flashier runoff upper Stour, which has been designated a priority catchment under DEFRA's Catchment Sensitive Farming Programme. Phosphorous from both wastewater treatment works and diffuse agricultural sources contributes to eutrophication of river sources with the risks of algal blooms and low dissolved oxygen increasing during dry summers when temperatures are high and flows are low.

Nitrate concentrations are also rising in the Chalk which increase treatment and blending costs for public supplies and cause particular ecological problems in the transitional waters of Christchurch Harbour.

Urban pollution risks in the areas around Bournemouth also affect the river water quality in the Lower Stour.

Future population pressures

In the Stour catchment, future population growth is forecast particularly in the urban and suburban areas, including the areas around Bournemouth, Blandford, Sturminster and Gillingham. BCP and Dorset Council are planning for a 20% increase in population in Stour by 2035 (Keith Calder, *pers comm*, 2021).

Water Framework Directive (WFD) status

A map of the overall WFD (Cycle 2, 2019) status of water bodies across the catchment is shown on **Figure A2.6**. This combines both the chemical and ecological status reported by the Environment Agency for the water bodies. The recent recognition of new types of pervasive pollutants which affect many rivers across the country is tending to dominate overall WFD status. So when focusing on water resources, abstractions and river flows it is more helpful to consider ecological status.

River flow and morphological condition (i.e. the naturalness of channel profiles, the existence of weirs and barriers etc.) are considered as supporting elements in the assessment of ecological status - which is primarily based on monitoring the health, diversity and abundance of plants, insects and fish in rivers, lakes and estuaries. The WFD water body ecological status of Dorset Stour water bodies (Cycle 2, 2019) is mapped on **Figure A2.7.**

There are several key reasons for the failure to achieve good status mapped in both Figures A2.6 and A2.7 which have nothing to do with abstraction pressures:

- In the upper Stour, Cale, Lydden and Lodden the main WFD issue is with Phosphorus related to diffuse agricultural runoff.

- In the middle Stour WFD a key issue is the impact of physical modifications of the main channel including barriers on fish migration, ecological habitat and connection with floodplain habitats.
- Rising nitrate pollution of groundwater associated with land management practices is an issue across the Chalk.
- In the lower Stour contaminated urban runoff and physical modifications of the channel also affect fish and other aquatic life.

Environment Agency catchment data[4] are summarised in **Table 2.1** for selected water bodies of particular interest to this plan which is focused on future water resource and environmental low flow resilience. In these water bodies the Environment Agency's Environmental Ambition modelling has predicted river flows could fall below regulatory thresholds by 2050 unless the impacts of public water supply abstraction are reduced. These calculations incorporate projections of future changes in river flows expected due to climate change, plus the potential impacts of fully licensed abstraction, as discussed further in **Section 3**). These focus water body locations are labelled on **Figures A2.6** and **A2.7.**

Table 2.1 2019 (Cycle 2) EA Catchment Data for selected water bodies of particular water resources interest in the catchment[4]

Water body	Ecological status	Biological quality	Physico-chemical quality	Hydrological Regime	Chemical substances	RNAG
1 Stour (Headwaters) **GB108043022490**	Poor ecological status	Poor	Moderate (Phosphate poor)	Does not support good	Fail (Mercury & PBDE)	Point/diffuse sources (Phosphate, Macrophytes and Phytobenthos Combined)
2 Shreen Water (including Ashfield Water) **GB108043022450**	Poor ecological status	Poor	Moderate (Phosphate poor)	Does not support good	Fail (Mercury & PBDE)	Flow (Hydrological Regime – suspected due to GW abstraction); Point/diffuse sources (Phosphate, Macrophytes and Phytobenthos Combined, Fish)
3 Allen (Headwaters) **GB108043015790**	Good ecological status	Good	High	Supports good	Fail (Mercury & PBDE)	Flow (Hydrological Regime - suspected due to GW abstraction)
4 Allen (Lower) **GB108043011090**	Good ecological status	High	Good	Supports good	Fail (Mercury & PBDE)	NA

[4] https://environment.data.gov.uk/catchment-planning/OperationalCatchment/3140 accessed 09/11/21

Water body	Ecological status	Biological quality	Physico-chemical quality	Hydrological Regime	Chemical substances	RNAG
5 Stour (Middle d/s Pimperne Brook) **GB108043016052**	Poor ecological status	Poor	Moderate (Phosphate poor)	Supports good	Fail (Mercury & PBDE)	Point/diffuse sources (Phosphate, Macrophytes and Phytobenthos)

RNAG Reasons for not achieving good, PDBE Polybrominated diphenyl ethers

In addition to these water bodies which are a concern based on current public water supply abstraction licences, there is a potential need to re-locate around 70Ml/d of summer abstraction from Matchams and Knapp Mill to Longham in order to raise Avon low flows into Christchurch Harbour. The SSSI and SAC designations of the River Avon are associated with 'close to natural functioning objectives' which are driving the need to reduce abstraction pressures on the bottom reach of the river. This means that the lower Stour also becomes a key focus in this plan for future water resources support to allow increased pumping from Longham.

Existing environmental low flow deficits at Throop are relatively small and short lived, in comparison with higher flow surpluses (**Figure A2.8**). This means that there is already a need for more low flow support during dry summers which will grow and become more frequent in order to reduce pressures on the lower Avon. It also indicates the potential benefits of options which develop storage to store winter water for summer supply. A phased plan is summarised in **Section 4** including smarter conjunctive use to draw on groundwater storage in the River Allen, the potential development of an Aquifer Storage and Recovery scheme at Longham, the relocation of Poole WwTW discharge to the Stour, and exploration of options for new surface reservoir storage in the upper catchment.

2.3 Existing water company water resource management planning (WRMP) options in the Dorset Stour

Wessex Water's previously published strategy centres on demand management, focused on reductions in per capita consumption rates, as presented in the Water Resource Management Plan (Wessex Water, 2019). This includes the management of leakage (15% reduction in 5 years), enhancing metering and providing water efficiency services.

South West Water (i.e. Bournemouth Water) also has a particular focus on the management of demand and leakage (15% reduction in 5 years) (South West Water Bournemouth Water, 2019).

Preferred options for both companies are detailed in **Table 2.2**.

Table 2.2 Preferred options in the 2019 WRMP, relevant to the Dorset Stour catchment (from Wessex Water, 2019 and South West Water Bournemouth Water, 2019)

Option	Code	Type of option	Preferred (Y/N)	Earliest potential start date	WAFU Ml/d	Detail
Wessex Water						
Final Planning Scenario - 15% leakage reduction by 2025	ALY	Other leakage control	Y	2020-21	18.6	Infrastructure renewal, active leakage control, pressure management, improved data analysis, and DMA improvements
Met uplift optional	M1a	Metering optants	Y	2020-21	0.4	Enhanced metering
Home Check	WE1	Household water audit	Y	2020-21	3.7	Home advice and device fitting visits
Dashboard	WE2	Customer education / awareness	Y	2020-21	1.3	Customer engagement dashboard
South West Water – Bournemouth Water Resource Zone						
Innovation Bournemouth WRZ	LB1-LB4	Schemes supporting Active Leakage Control - reduction in leakage by 15% by 2025	Y		4.4	A raft of measures including selective use of pressure management in key areas of the distribution network

WAFU – water available for use

A number of feasible supply-side options have also been explored by the water companies for this catchment, including the construction of desalination plants, bringing back mothballed sources into supply and exploring innovative licence changes. None of these have been taken forward as preferred options at this stage, as detailed in **Table 2.3**.

Feasible demand-side options have also been explored by the water companies for this catchment, including options to reduce leakage and options to reduce demand for water. None of these have been taken forward as preferred options at this stage, as detailed in **Table 2.4**.

Table 2.3 Supply-side options reviewed (but not preferred) in the development of the 2019 WRMP, relevant to the Dorset Stour catchment (from Wessex Water, 2019 and South West Water Bournemouth Water, 2019)

Option	Code	Type of option	Preferred (Y/N)	Earliest potential start date	WAFU Ml/d	Detail
Wessex Water						
Desalination (30 Ml/d)	R1a	Desalination	N	2025-26	30	A large desalination development on the south coast with the water transferred across the Wessex Water supply system
Desalination (10 Ml/d)	R1b	Desalination	N	2025-26	10	Small desalination development on the south coast with water used locally
Mothballed sources refurbished and brought back into supply - South	R5a	GW enhancement	N	2022-23	2.6	Treatment processes upgraded enabling groundwater and spring sources in the south to be brought back into use that have been mothballed.
South West Water – Bournemouth Water Resource Zone						
Re-introduce Wimborne	BW1	Production management	N	2024	4.1	Re-introduce a currently unused (but licensed) source near Wimborne
Potential increases in WAFU e.g. innovative licence changes	BW2	Resource Scheme	N	2027	10	Exploring options to make the current weekly licence constraint more flexible

WAFU – water available for use

Table 2.4 Demand-side options reviewed (but not preferred) in the development of the 2019 WRMP across water company supply zones (from Wessex Water, 2019 and South West Water Bournemouth Water, 2019)

Option	Code	Type of option	Preferred (Y/N)	Earliest potential start date	WAFU Ml/d	Detail
Wessex Water						

Option	Code	Type of option	Preferred (Y/N)	Earliest potential start date	WAFU Ml/d	Detail
Options to reduce distribution losses (leakage)	-	10 further options to manage and control leakage	N	2020-21	32.5	Active leakage management, mains replacement (not trunk mains), pressure management etc
Options to reduce the demand for water	-	3 metering options	N	2020-21	19.8	Reduction in demand through improved metering
South West Water						
Options to reduce the demand for water	-	22 options identified	N	2020-21	24.3	Metering, leaky loos fix, incentives, WWTW final effluent re-use

It is important to note that leakage from the public water supply system represents a return of water to the catchment. This is often associated with household connections rather than large leakage events from main supply pipes which are readily identified and quickly fixed. Leakage rates tend to be higher in winter when pressures are higher and temperatures lower than in summer. Where housing density is high such as in Bournemouth, rates of leakage are accounted for in the Wessex Basin groundwater and river flow model because much of the water is expected to end up in either the lower Stour or Avon. It follows that reductions in leakage, whilst reducing the rates of abstraction required for supply, may make less difference to river flows downstream of urban areas like Blandford and Bournemouth, particularly during summer months. Similarly, reductions in per capita consumption will be more difficult to realise during warmer summers when demand usually increases, rather than during winter periods. And if demand reductions are achieved, they could be associated with lower rates of treated wastewater discharge which would reduce low flow resilience downstream of cities and towns.

2.4 Environment Agency Catchment Strategy for the Dorset Stour

The Environment Agency's Keith Calder[5] is drafting a holistic Catchment Strategy for the Dorset Stour in parallel with this 'Environmental Destination' plan. Much of the summary of the catchment and broader environmental initiatives underway has been drawn from the developing Strategy. However, this plan also provides a more water resources focused overview of the phased measures which may be needed to improve supply and river low flow resilience in the Stour whilst also enabling reductions in summer abstraction from the lower Hampshire Avon.

[5] Dorset Stour Catchment Strategy: under development and consultation by Keith Calder

3. Environmental Ambition challenge

This section summarises the predicted 2050 flow deficits and surpluses in the catchment and the potential future reductions in public water supply abstraction impacts highlighted by the Environment Agency's Environmental Ambition screening modelling, as set out in the National Framework for Water Resources (March 2020).

The Environment Agency's modelling indicates the additional water that may be needed by 2050 to meet:

- Environmental river flow targets based on existing (Business as Usual, BAU) or enhanced (ENH) thresholds; and
- Predicted future predicted (FP) demands for public water supply and other water uses, and also worst-case, fully licensed (FL) demand assumptions,
- in the context of natural Q95 low flow conditions which have been simply factored down from current estimates for 2050 based on a climate change projection.

The Environment Agency provided the WCWRG with WFD river water body scale National Framework estimates of 2050 environmental flow surpluses or deficits to highlight the water bodies of concern (as summarised in **Section 2** and presented in more detail below). An indication of the individual abstraction reductions which might be needed to meet the 2050 existing or enhanced environmental flows was also tabulated for the regional water resources groups and water companies to consider.

Whilst the main theme of the Environmental Ambition challenge is therefore framed in terms of 'potential abstraction reductions needed to meet river flow targets' and improve environmental low flow resilience, this implies that alternative sources of water will need to be found from elsewhere to maintain public supply resilience. At the same time, water companies must demonstrate that their demand suppression and supply systems are robust enough for a 1 in 500 year drought event. So smarter management options for the Dorset Stour which allow existing drought-resilient abstractions to continue (such as the Chalk groundwater sources in the middle catchment) and also provide support to increase pumping at Longham, must also be on the table.

Section 3.1 presents mapped and tabulated summaries of the water bodies with Environment Agency projected flow deficits. The climate change assumptions made in these projections are reviewed based on the latest suite of UKCP18 modelling data in **Section 3.2** which suggests that significant low and median flow reductions should be expected throughout the century. The potential licence reductions being scrutinised according to the Environment Agency's analysis are listed in **Section 3.3**, and compared with published water company WRMP options in **Section 3.4.**

3.1 Predicted 2050 flow deficits and surpluses

Environmental Flow Indicator (EFI) targets are defined by the Environment Agency to indicate the river flow required to support Good Ecological Status under the EU Water Framework Directive

(WFD). The EFI allows a percentage deviation from natural flows at a specific location, defined based on the Abstraction Sensitivity Band (ASB) of the site – a nationally consistent abstraction pressure screening approach intended to highlight areas where further ecological impact investigations should be carried out.

The predicted fully licensed 2050 flow surpluses and flow deficits for Stour catchment water bodies under Q95 low flow conditions are mapped in **Figure A3.1**, under the EA's **enhanced** 2050 scenario, which is 'worst case' for planning purposes.

In the enhanced scenario, increased environmental protection (i.e. a more stringent flow target) is assigned to protected areas, principal salmon and chalk rivers, and catchments with SSSI rivers and wetlands.

- For the Dorset Stour catchment, a significant portion of the middle and lower Stour and its tributaries including the River Allen have been assumed to be Chalk streams so the EFI high sensitivity **ASB3** threshold has been applied. The local flow assessment point at the Throop gauging station where combined abstraction risks are highest is already ASB3 under Business as Usual assumptions (see Figure A2.8), so the enhanced standards make no difference to the deficits predicted at that point.
- In addition, the River Crane/Moors River catchment, which contains the Dorset Heaths SAC, has been designated as a more sensitive Common Standards Monitoring Guidelines (**CSMG)** catchment ('river' **ASB4**). However, this does not contain public water supply abstraction or other significant abstraction pressures so is not considered further in this plan.

It can be seen from **Figure A3.1** that for the majority of the water bodies within the Stour catchment, flow surpluses or flows close to the enhanced environmental flow target are predicted (mapped in green with Q95 flow surpluses labelled in Ml/d).

However, 2050 Q95 flow deficits are predicted by the Environment Agency modelling for five water bodies, relating to both non-PWS and PWS abstraction:

- Stour (Headwaters);
- Shreen Water (including Ashfield Water) (near the **Mere** PWS abstraction);
- Allen (Headwaters) (near the **Stanbridge Mill** PWS abstraction);
- Allen (Lower) (also downstream of **Stanbridge** but including the potential risks associated with the unused **Wimborne** licence);
- Stour (Middle d/s Pimperne Brook) (associated with the **Corfe Mullen, Shapwick** and **Sturminster** PWS abstractions).

It is important to note that in water bodies with existing groundwater to river low flow support schemes (i.e. the River Allen – **Figure A2.3**), the deficits may be over-estimated because the Environment Agency's Water Resources GIS projection calculations have not allowed for the increased frequency and duration of support which would be triggered as the climate shifts.

Further detail regarding those water body flow deficits linked to PWS abstraction is given in **Table** 3.1 below and a summary of their current ecological status catchment data has been presented in **Table 2.1**.

This provides the surpluses and deficits at different flow percentiles, and also compares with the same outputs for the less stringent '**Business as Usual'** (BAU) scenario - where the regulatory approach remains the same, such that EFI ASB2 would apply for some Chalk water bodies (e.g. allowing impacts up to 15% of QN95 rather than the 10% allowed for ASB3).

Table 3.1 Dorset Stour Predicted Fully Licensed 2050 Environmental Flow Surplus or Deficit (Water body outflow, Ml/d), for water bodies where potential PWS abstraction reductions are highlighted by the Environment Agency

	Shreen Water (including Ashfield Water) GB108043022450		**Stour (Middle d/s Pimperne Brook) GB108043016052**		**Allen (Headwaters) GB108043015790**	
Flow condition	**BAU (Ml/d)**	**ENH (Ml/d)**	**BAU (Ml/d)**	**ENH (Ml/d)**	**BAU (Ml/d)**	**ENH (Ml/d)**
Q30	2.49	1.64	214.15	193.71	10.85	10.85
Q50	-4.31	-4.96	62.06	43.40	-2.64	-2.64
Q70	-5.93	-6.41	3.47	-9.28	-2.50	-2.50
Q95	-6.12	-6.48	-22.09	-29.83	-1.64	-1.64

*BAU - Business as Usual; ENH – Enhanced Scenario
Waterbody Surplus or Deficit numbers are Ml/d based on EA natural flow, abstraction and environmental flow target assumptions for 2050

Figure A3.1 also maps the largest Fully Licensed 2050 Q95 environmental flow deficit for the lower Avon river water body (in red). It is important to note that the water body sub-catchments are coloured according to the deficits estimated at their outflow points. So the lower Avon deficit actually only affects just over 1km at the bottom of the river downstream of Knapp Mill before it flows into Christchurch Harbour. Actual summer abstraction from Knapp Mill is currently around 70 Ml/d and the SSSI and SAC designation flow objective for the Avon require this to be moved elsewhere under lower flow conditions. **Section 4** sets out a phased short, medium and long term plan for enhancing flow support to the Longham source on the lower Stour which should result in flow improvements for the middle Stour and the Allen, as well as delivering objectives for the Avon, and maintaining public supply resilience. Hence the local low flow reach downstream of Longham at Throop is noted on **Figure A3.1** as another focus for the plan.

3.2 How do the Environment Agency's estimates of flow reductions due to climate change compare with updated UKCP18 for the Dorset Stour?

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', 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. In January 2022[6], CEH and a consortium of associates working with the Meteorological Office have delivered the UKCP18 successor to the Future Flows data which includes 12 possible projections of river flows and groundwater levels from 1982 to 2080 using a variety of alternative modelling approaches. These Enhanced future Flows and Groundwater (eFlaG) data are available online[7] and have been used to compare against the Environment Agency's assumptions for the Dorset Stour and provide stakeholders with a clear picture of how flows are expected to change to 2050 and beyond.

Figures A3.2 and A3.3 plot rolling 18 year flow percentile statistics in Ml/d derived from modelled daily flow projections for Throop on the lower Stour. Plots are included to show how high (Q1 'floods'), median (Q50), low (Q95) and very low (Q99 'droughts') flows are predicted to change through the 21st century. There are lines for each of the 12 possible UKCP18 regional climate models (RCM) provided from eFlaG compared with the projection for the same location from UKCP09 Future Flows, as included in the Environment Agency's calculations.

On the right of each percentile time series, an area plot indicates how many of the 12 UKCP218 eFlaG models show increases or decreases in flow, how big that projected change is relative to the start of the century (2000), and how the differences evolve past 2050 and on to 2080.

These plots indicate that highest flood event flows (Q1 and above) are expected to be steady or perhaps increase with time according to most of the projection models. These increases are modest – perhaps over 10% by 2050, but this still represents a very large increase in highest flood flows. It indicates that flooding risks in the Stour are expected to get worse, but also emphasises the value of surface or groundwater storage options designed to capture high flows to support drier period supplies.

Figure A3.2 flow predictions are based on the most reliable of the eFlaG gauge-calibrated river flow models (the Probability Density Model, PDM) and indicate how flows calibrated against the historical gauged record (i.e. including the influence of upstream abstractions and discharges) may change due to climate shifts in rainfall and potential evaporation. Projected falls in median (Q50), low (Q95) and very low(Q99) flows are similar to or greater than the UKCP09 afixK dashed black line. i.e. the Future Flows scenario which was considered worst case now appears reasonable or perhaps even optimistic compared with the updated UKCP18 projections. By 2050, most of the eFlaG models are predicting more than 10% reductions in median flows, with falls of 20 or even 30% predicted by several models under drier conditions.

The **Figure A3.3** plots are based on the natural flow projections of the national 'Grid to Grid' (G2G) model using the same RCM climate inputs, but no gauged record calibration. Although less well adapted to the gauged local flow responses and probably less reliable, these projections are included for comparative purposes because they ignore any abstraction or discharge influences on

[6] https://www.ceh.ac.uk/our-science/projects/eflag-enhanced-future-flows-and-groundwater
[7] https://eidc.ac.uk/

the gauged record, Highest flood flow projected changes are similar, but median and lower flow falls are much steeper.

In order to more confidently understand future flow shifts in all the water bodies across the Dorset Stour it is recommended that the UKCP18 climate projections are run through the Wessex Basin groundwater and river flow model – to distinguish the different hydrological responses in the upper, middle and lower urbanised catchments. However, **Figures A3.2 and A3.3** confirm that low flows are expected to fall significantly to 2050. The Environment Agency will therefore need to allow EFI regulatory flow thresholds to evolve downwards with time, and the proportion allowed for abstraction will be squeezed.

This forward look adds real urgency to the need to consider options which will boost storage and low flows support on the supply side, beyond the current demand-side and leakage focus of WRMP options. It also highlights the need for riverine and wetland habitat restoration and active management to enhance ecological refuge resilience to dry periods which are becoming and will continue to become more frequent and longer. Broader re-wilding, soil and environmentally sensitive farm land management initiatives are also vital to improve water quality but they will not change the projected decline in low flows. As the climate warms, the higher temperatures will result in more evapotranspiration and less water in our rivers regardless of any 'nature-based solutions' implemented upstream.

3.3 Licences highlighted by the Environment Agency for potential abstraction reductions (or other low flow support)

If it is required to fully address the flow deficits identified in the Environment Agency's 2050 Environmental Ambition projections, licence reductions may be required for four Wessex Water groundwater licences and one South West Water groundwater licence. Alternatively, other options to support low flows can be considered – which may also enable abstraction at Longham to increase in order to deliver low flow recovery at the bottom of the Avon.

Licence details for these abstractions which are 'at risk' are given in **Table 3.2.** South West Water's unused Wimborne licence could be added to this table but is likely to be transferred down to Longham at the conclusion of an ongoing WINEP deterioration risk investigation.

Table 3.2 Details of PWS abstractions for which potential abstraction impact reductions have been flagged by the EA

Abstraction Information	Mere Boreholes	Shapwick Boreholes	Sturminster Marshall	Corfe Mullen	Stanbridge Mill
Licence Number	13/43/000/G/001	13/43/034/G/216	13/43/034/G/229	13/43/034/G/149	13/43/035/G/109
Water company	Wessex Water	Wessex Water	Wessex Water	Wessex Water	South West Water
Fully Licensed Ml/d	9.09	8	15.95	22.79	12.5
Recent Actual Ml/d	6.44	4.98	15.23	16.58	10.4

Abstraction Information	Mere Boreholes	Shapwick Boreholes	Sturminster Marshall	Corfe Mullen	Stanbridge Mill
Surface water/ Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
WFD Waterbody	GB108043022450	GB108043016052	GB108043016052	GB108043016052	GB108043015790
Previous Investigations	AMP4: not significant – no licence change	AMP4: not significant – no change required, AMP6: Investigation ongoing: monitoring of flows and ecology to understand impact. Potential reduction in licence at Stubhampton of 0.5-1 Ml/d			40 years of low flow recovery and stream support

These sources are all located close to headwater springs or the main river such that their impacts on river flows are fairly direct – there is little development of groundwater storage which might redistribute impacts to winter higher flow periods or spread drawdown impacts more widely if they were located further from the river. If the water body deficits were to be completely recovered (by sharing losses across all these abstractions), the reductions could be as follows:

- **Mere abstraction (Stour headwaters): 60% reduction in licence.** This would address the projected flow deficit in the Shreen Water which is present until flows above the Q50 (see **Table 3.1**). There is a small surplus at high flows so if a storage solution were possible (e.g. a small reservoir in the less permeable catchment just downstream) then summer compensation releases could offset this reduction.
- **Shapwick, Sturminster Marshall and Corfe Mullen abstractions (middle-lower Stour): 60% reduction OR 60% FL quantity as stream support at low flows**. This deficit is only present at low flows but the deficit is too large to fix using a groundwater – river augmentation scheme which would not be effective for the main channel., If wholescale reduction in abstraction from these reliable drought sources is to be avoided, another source of low flow support will be required. This could be either the relocation of the Poole WWTW discharge (if this can be feasibly sited at or upstream of Corfe Mullen), and/or summer flow support from new headwater reservoirs developed in the longer term – both options intended to allow Longham to be pumped harder. It is noted that all three of these sources have ongoing AMP6 investigations and so an appropriate solution may be suggested by that programme.
- **Stanbridge Mill abstractions (River Allen): 20% reduction in licence**. This reduction would address the flow deficit in the River Allen (see **Table 3.1**). However, smarter conjunctive switching of low flow abstraction down to Longham and then back up to Stanbridge when flows are higher, operated in association with the existing groundwater support schemes, and the downstream relocation of the Wimborne licence could also deliver low flow improvements whilst allowing total abstraction rates to be maintained or even increased.

The total groundwater licence reductions across the catchment flagged by the Environment Agency therefore potentially amount to:

- **Wessex Water ~34 Ml/d**
- **South West Water ~3 Ml/d**

In addition, South West Water would need to find alternative sources to replace the loss of around 70 Ml/d summer abstraction from the lower Avon – hence the additional focus on Longham and the lower Stour.

3.4 Potential 2050 supply loss compared to published WRMP options

Options explored in the water company WRMPs include demand reductions and leakage savings to reduce the future supply required (see **Section 2.3**). In this catchment, no options were being taken forward to boost supply in the previously published WRMP.

Table 3.3 puts into context the scale and magnitude of the potential 2050 abstraction reductions against the current licensed and recent actual abstraction from the catchment, and WRMP options.

If the EA's 2050 abstraction reductions were implemented, then, even taking into account the WRMP 2045 demand reductions and leakage savings, this would represent:

- **62% of Wessex Water's abstraction from the Dorset Stour catchment (30.6 M/d)**
- **21% of South West Water's abstraction from the Dorset Stour catchment (1.9 Ml/d) (not including the loss of Knapp Mill on the Avon ~ 70 Ml/d for ~half the time).**

It is clear that these are huge Environmental Ambition challenges which demand measures well beyond the options published in existing WRMPs. Potential solutions will be associated with large financial and carbon costs and will take around 25 years to complete. The Environmental Destination plan needs to be phased so that incremental benefits can be realised along the way – as set out in **Section 4**.

Table 3.3 Dorset Stour catchment: context of potential 2050 supply losses

	Wessex Water	South West Water*	Unit
Annual PWS licensed abstraction (catchment total)	64.1	18.4	Ml/d
Annual PWS RA abstraction (catchment total)	49.4	9.3	Ml/d
WRMP baseline water company total water into supply (WAFU) Base Year 2017/18	408.9	709.4	Ml/d
WRMP baseline WAFU 2045	384.3	692.5	Ml/d
Catchment PWS RA as % of water company WAFU (Base Year 2017-18)	12.1%	1.3%	%
Total WRMP projected 2045 demand-side and leakage savings	23.8	43.3	Ml/d

	Wessex Water	South West Water*	Unit
2045 demand reductions and leakage savings as % of current total water into supply	5.8%	6.1%	%
WRMP preferred additional supply-side options (catchment total)	0.0	0.0	Ml/d
EA 2050 potential abstraction reductions (catchment total)	-33.5	-2.5	Ml/d
Potential 2050 catchment supply loss, reduced by the effect of proportional 2045 demand reductions and leakage savings	**-30.6**	**-1.9**	**Ml/d**
Potential 2050 catchment supply loss (% of abstraction)	**-62.0%**	**-20.9%**	**%**

*South West Water also need to consider options to reduce summer abstraction from the neighbouring lower Avon by around 70 Ml/d.
Data sources:
Wessex Water (2019). Final water resources management plan.
South West Water Bournemouth Water (2019). Final Water Resources Management Plan.

4. Environmental Destination catchment plan to increase future water supply and low flow environmental resilience

The Environmental Ambition challenge has highlighted the potential constraints to water resource availability in the 2050s. Adapting to the future twin pressures of climate change and population growth will require holistic approaches to deliver sustainable resilience for both public supplies and low flow habitats.

This section sets the context of the relevant projects already underway or soon to be implemented in the Dorset Stour catchment, that include measures which will improve the resilience of the water resource for both public supplies and the environment. It also summarises wider catchment soil, land management, drainage restoration and nature-based initiatives which are important for the real biodiversity and water quality benefits they can deliver, but are not expected to significantly change the decline in river low flows as temperatures warm.

A catchment plan then sets out and prioritises the water company measures best suited to achieve future flow and supply resilience as part of improving biodiversity outcomes in the catchment.

4.1 Current projects in the catchment

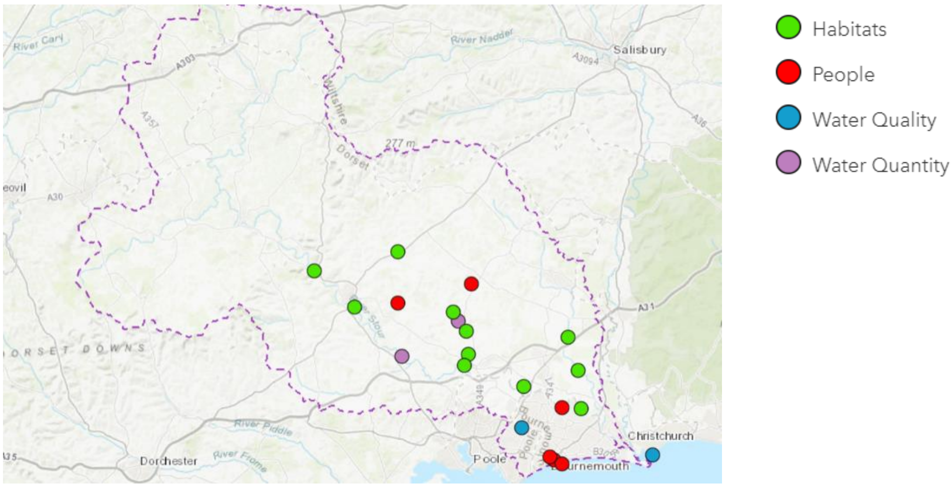
The Dorset catchment partnerships set up to promote the catchment-based approach (CaBA) include the **Stour Catchment Initiative[8] (SCI)**, which has been co-hosted by Wessex Water and Dorset Wildlife Trust since 2013.

The SCI is a collaborative partnership of a range of groups, aiming to use a catchment-based approach to improve the water environment of the Stour. Members also include South West Water, Natural England, Environment Agency, Dorset Council, BCP Council, National Trust, RSPB Wessex Rivers Trust, National Farmers Union, FWAG SW and other local farms and groups. Project locations to date are shown on **Graphic 4.1**.

The Poole Harbour and Dorset Stour Catchment Strategy 2022-2027[9] presents the Dorset catchment partnerships five year plans and priorities for these catchments.

[8] https://www.wessexwater.co.uk/stour
[9] https://www.dorsetcatchments.co.uk/media/zwvnctei/dorset-catchment-strategy-22-27.pdf

Graphic 4.1 Stour Catchment Initiative projects[10]



Projects currently being implemented, or recently completed in the Dorset Stour catchment include:

- **Stour Headwaters Project**[11]. Ongoing Environment Agency/Dorset Catchment Partnership project being implemented by FWAG. Working with farmers on a one-to-one basis aiming to improve water quality, reduce flood risk, increase biodiversity and improve farming efficiency. The focus is particularly in reducing sediment and pollution runoff in the higher topography headwaters, mainly via NFM measures but also including restoration, for example, recontouring for leaky dams, daylighting culverts.
- **Moors River Restoration.** Current Environment Agency-led project to undertake chalk stream restoration according to the Moors River Restoration Plan[12] (Environment Agency 2019a). This work is being undertaken in various reaches of the river to achieve WDF Good Ecological Status, including floodplain reconnection schemes to hold water back, and revegetation.
- The Wessex **'Stage Zero' floodplain reconnection** opportunity mapping project[13] has recently been completed (EA and Dorset Wildlife Trust, 2021). This has included mapping of the Frome, Piddle, Stour and Corfe to define the unconstrained bottom of the valley floor including areas outside the current floodplain, of importance in designing future Natural Flood Management (NFM) measures in the catchment.

4.2 Future planned projects

A **draft Dorset Stour Catchment Strategy** is currently under production by the Environment Agency to holistically bring together and align planned future work in the catchment (Keith Calder, *pers. comm*). This includes:

[10] Based on interactive project map at https://gis-services.wessexwater.co.uk/Storymaps/Environment/Stour/
[11] https://www.dorsetcatchments.co.uk/projects/dorset-wild-rivers/stour-headwaters/
[12] https://www.wessexwater.co.uk/-/media/files/wessexwater/environment/catchments/stour/moors-river-system-restoration-action-plan.pdf
[13] https://www.wessexwater.co.uk/-/media/files/wessexwater/environment/catchments/catchment-partnership-newsletter-autumn-2020-final.pdf

- Expansion of the Environment Agency Stour Headwaters Project to include neighbouring Wessex headwater catchments as part of a wider strategic initiative to regenerate and improve biodiversity, water quality, water resources, soil health, reduce soil loss and reduce pollution in the '**Heart of Wessex**'. This key programme includes the headwaters of the Stour, Hampshire Avon, Brue and Somerset Frome.
- Further **chalk stream restoration** across the Chalk outcrop in line with the Chalk Stream Restoration Strategy[14] (CaBA, 2021). To include the **Middle and Lower Stour** as per the Middle and Lower Stour Restoration Strategy[15] (Environment Agency, 2019b), which will address various reaches of the river to achieve WDF Good Ecological Status, including floodplain reconnection schemes to hold water back, and revegetation. Also, the **Tarrant Valley** which is a priority target for restoration to remove physical concrete structures, which currently lead to upstream ponding that results in the need for fish rescue. Chalk stream restoration in the Stour catchment is being put forward for future WINEP work as part of the PR24 process.
- **Biodiversity projects** in the lower catchment. Including creation of the **Stour Valley Park**, a proposed park and trail along the Lower Stour river corridor between Kingston Lacy and Hengistbury Head (led by Dorset Council and BCP Council). This would be a valuable eco-corridor that would include riparian habitat restoration and habitat links, with predicted improvements in water quality, flood alleviation, biodiversity and increase in carbon capture.
- **Local projects** to improve and re-connect the riparian area along the Stour where local landowners are interested in more positive environmental outcomes, which may include National Trust Kingston Lacy and Deans Court, Wimborne.
- The **Lower Stour flood project** to manage flooding in the lower Stour catchment, a key area of focus for the Environment Agency. This may include delivery of high flows to Poole Harbour. Surveys and investigations have been undertaken, although a strategy is yet to be agreed and implemented.
- Potential development of an **Upper Stour flood strategy** by the Environment Agency.
- The Environment Agency also has interest in future local **peatland and mire restoration** in Dorset and is currently looking at funding research to steer future investigations in this area.

Other future work of relevance in the Dorset Stour catchment also includes:

- The potential future **beaver reintroduction** and management in England, which was under consultation by Defra in 2021, with beavers now proposed to become a protected species. An ongoing trial in the Poole Harbour catchment led by the Dorset Wildlife Trust[16] has shown overall benefits in terms of their role as 'ecosystem engineers', where dam building and burrowing can redirect water flows, reconnect river systems, attenuate high flows, create wetland habitats and improve low flow resilience. Although no projects are as yet

[14] https://catchmentbasedapproach.org/learn/chalk-stream-strategy/
[15] https://www.wessexwater.co.uk/-/media/middle-and-lower-stour-river-restoration-action-plan.pdf
[16] https://www.dorsetcatchments.co.uk/media/zwvnctei/dorset-catchment-strategy-22-27.pdf

planned, it is possible that beavers will be re-introduced to or migrate to the Stour in the near future.

- Future plans by EnTrade (supported by Wessex Water & FWAG) to operate **Catchment Markets** in the Stour (as they currently do in Somerset) to improve water quality and biodiversity through on-farm nature-based projects. Including cover crops, planting of hedgerows and woodland, livestock watercourse exclusion fencing, wetland creation, buffer strips and arable reversion to species rich grassland.
- Investigations by Wessex Water of options for the Poole WwTW discharge including the potential for **moving Poole WwTW to the River Stour** to improve low flows in the Stour, provide opportunities for wetland creation with improved discharge water quality, as well as supporting Longham.

4.3 CaBA opportunity mapping: a resource for future projects

CaBA's opportunity maps from the '**Working with Natural Processes - Evidence Base'** project[17] identify the types of measure that may be effective in flood and coastal risk management (FCRM) and wider ecosystem service benefits (Environment Agency, 2018). These maps can be used to inform and prioritise future catchment measures.

Figure A4.1 shows the opportunity mapping across the Dorset Stour catchment for:

- Floodplain reconnection (for example, in the headwaters of the River Cale and along winterbournes on the Chalk).
- Tree planting in riparian areas (identified everywhere along the river network).
- Countryside stewardship options (for example, buffer strips, wildlife strips, regeneration of habitats, livestock fencing, coppicing of bankside trees, hedgerows).
- Priority habitat creation projects (at individual locations to create or restore habitats, for example the Dorset Ponds project in the headwaters of the upper Stour).

Wider scale implementation of these CaBA opportunities will help to deliver biodiversity, water resource and water quality benefits. Local channel, drainage and floodplain habitat restoration projects will also provide a vital role in improving the ecological resilience to droughts and dry periods. However, neither catchment-wide nor local habitat initiatives are expected to make much difference to river low flows, or to change the projected environmental flow deficits in the water bodies with abstraction pressures highlighted by the Environmental Ambition challenge.

4.4 WCWR Dorset Stour catchment action plan

Good work is clearly already underway and planned by catchment stakeholders in the Dorset Stour to improve its biodiversity resilience from multiple angles.

The Chalk winterbourne nature of many of the upper reaches in the Dorset Stour catchment means that there will be times of the year that these will dry naturally, even if abstraction is reduced.

[17] https://catchmentbasedapproach.org/learn/working-with-natural-processes-evidence-base/

Therefore, future water company measures should focus on actions to tackle low flows further downstream and increase available storage.

Consultation with WCWR during this project has contributed to the development of a **strategic action plan of water company measures that could be implemented in a phased approach,** tabulated in **If the** plan sketched out is realised, it should avoid a significant shift in the balance between the volumes of Chalk groundwater and surface water currently put into the supply network. However, if a more fundamental switch away from groundwater to other sources is required, the consequences for drinking water quality and the integrity of the supply network and service pipes could be significant, particularly if there is seasonal variability in the sources of supply.

Alongside the need to improve river water quality and explore options to boost low flow support, river and floodplain habitat restoration and creation works should be targeted at improving ecological resilience to the longer periods of lower groundwater levels, lower flows and higher temperatures expected with climate change. Stakeholders and river restoration hydro-ecologists need to collaborate to create habitats with built-in low flow refuges and a variety of shaded and open connected river reaches, side channels, pools and floodplain wetlands which are designed to cope better during hotter drier summers.

It is also anticipated that as the climate shifts, patterns of agricultural land management and water use will change as farmers adapt, regardless of anything set out in this plan. As water becomes scarcer in the summer months (and probably more expensive), crop and livestock practices may change and efforts to conserve, store and use water more carefully will be ramped up. This will not in itself free-up more water for others to use, but will be increasingly important for farming to thrive. This climate challenge should also combine with recent changes to the targeting of farming grants to generate opportunities for nature-based re-wilding and land stewardship which creates broader-scale biodiversity benefits.

Table 4.1**.** This plan has been sketched out to add supply-side options to the existing preferred demand management and leakage reduction measures in order to support *increased* abstraction by up to 70Ml/d from the lower Stour in order to reduce summer pressures on the neighbouring lower Avon. However, these water resources measures would also work in synergy and holistically with the wider catchment projects, all building resilience for the Dorset Stour itself. A phased implementation should deliver incremental benefits along the way and would require step-wise changes in abstraction regulation.

Schematic maps in **Figures A4.2** to **A4.4** show how the large-scale water company measures may be implemented over the short, medium, and long term. They also show how these link to the different environmental issues in the headwaters, main Chalk outcrop and lower catchment, and also how measures may contribute to improvements in the areas of potential 2050 flow deficits identified by the Environment Agency's Environmental Ambition modelling. Beyond the broader scale plan for the middle and lower catchment local investigations should also consider how to reduce abstraction pressures in the headwater catchment downstream of the Mere groundwater source. Local support options should be explored to reduce the additional carbon and financial costs of importing replacement supplies from distant sources. However, if abstraction reductions were required at Mere, licensed quantities could be transferred downstream to Longham (as is planned for the Wimborne licence) in order to avoid further loss of broader scale public supply resilience.

If the plan sketched out is realised, it should avoid a significant shift in the balance between the volumes of Chalk groundwater and surface water currently put into the supply network. However, if a more fundamental switch away from groundwater to other sources is required, the consequences for drinking water quality and the integrity of the supply network and service pipes could be significant, particularly if there is seasonal variability in the sources of supply.

Alongside the need to improve river water quality and explore options to boost low flow support, river and floodplain habitat restoration and creation works should be targeted at improving ecological resilience to the longer periods of lower groundwater levels, lower flows and higher temperatures expected with climate change. Stakeholders and river restoration hydro-ecologists need to collaborate to create habitats with built-in low flow refuges and a variety of shaded and open connected river reaches, side channels, pools and floodplain wetlands which are designed to cope better during hotter drier summers.

It is also anticipated that as the climate shifts, patterns of agricultural land management and water use will change as farmers adapt, regardless of anything set out in this plan. As water becomes scarcer in the summer months (and probably more expensive), crop and livestock practices may change and efforts to conserve, store and use water more carefully will be ramped up. This will not in itself free-up more water for others to use, but will be increasingly important for farming to thrive. This climate challenge should also combine with recent changes to the targeting of farming grants to generate opportunities for nature-based re-wilding and land stewardship which creates broader-scale biodiversity benefits.

Table 4.1 Phased water resources resilience action plan to 2050 for the Dorset Stour (and lower River Avon)

Category	Option category	Measure	Additional supply (to relieve the lower Avon)	Location	Issues being targeted	Short term	Medium term	Long term
AMP7/8 Investments	Planned water treatment works enhancements WINEP studies	Optimise existing and new phosphorus removal plants Catchment interventions to reduce P Updated river water quality modelling. Migrate Wimborne licence to Longham	NA	Upper headwaters	Water quality (Phosphate) Reduce River Allen flow risks			
Enhancing existing/new infrastructure	Reduce Avon abstraction; Smarter use of Stour sources; Infrastructure improvements	Conjunctive use between Stanbridge, River Allen GW support schemes and Longham to deliver low flow benefit **No regrets investments**	6 Ml/d (at higher flows)	River Allen	Improved low flow resilience of the River Allen. Also allow more abstraction of better quality winter water at higher flows (Stanbridge).			
Local sources of water	Effluent recycling of Poole WwTW	Relocation of the Poole WwTW discharge to the River Stour – ideally at Corfe Mullen or further upstream to offset middle Stour deficits as well as supporting Longham.	30Ml/d all the time?	River Stour	Improved low flows in the River Stour, improved water quality of discharge. Also opportunity for wetland creation in the flood plain.			
	Aquifer Storage Recovery (ASR) at Longham	Increase dry period supply through storage of high Chalk flows in confined aquifer for use in dry periods	10 Ml/d during summer?	Longham	Increased storage, use excess winter chalk water from Matchams			
Regional solutions	New storage reservoir(s) in upper catchments	Capture higher flows to mitigate some flood risks and increase dry period low flow support to the middle and lower reaches of the Stour	30 Ml/d during summer?	Upper Stour	Support low flows in the Stour downstream, flood risk reduction, create lake and wetland habitats			
	(Desalination	Not preferred: cost, carbon, siting)						

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6. Figures

wood.