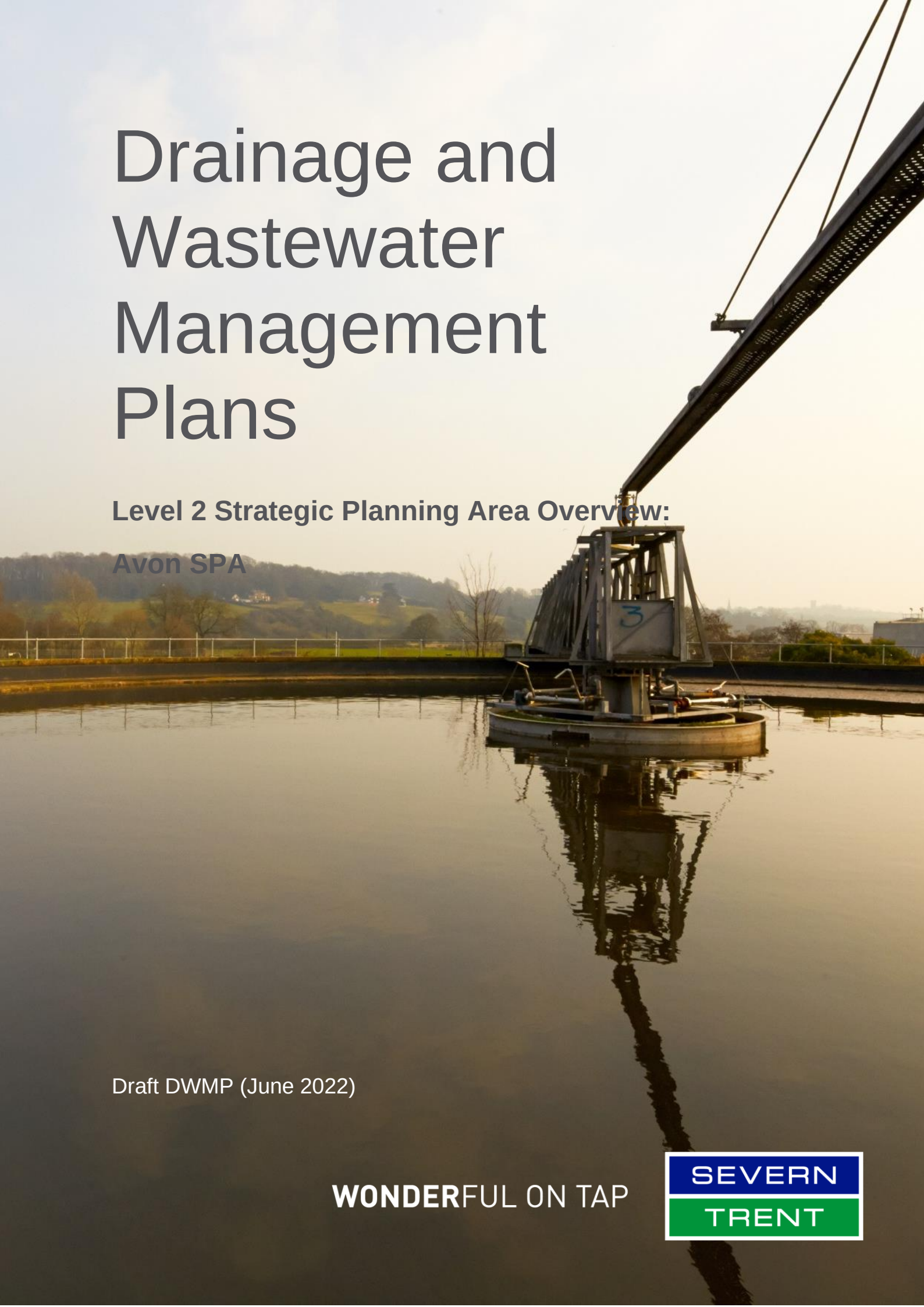
Drainage and Wastewater Management Plans

Level 2 Strategic Planning Area Overview:

Avon SPA



Draft DWMP (June 2022)

WONDERFUL ON TAP

SEVERN TRENT

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Background

For our Drainage and Wastewater Management Plan (DWMP) we have split our region into Strategic Planning Areas which closely align with the River Basin Management Catchments. The aim of this document is to share the outputs of our DWMP that specifically relate to the Avon Strategic Planning Area.

This document focusses on the Avon Strategic Planning Area (SPA) which is aligned to the Avon Warwickshire River Basin Management Catchment.

Within the Severn Trent Avon SPA there are 155 Wastewater Treatment Works (WwTW) catchments serving a residential population nearing 1,111,264 people and 478,761 properties. This makes it the 3rd largest SPA across Severn Trent region, serving 10.7% of the company's total population.

We completed Risk Based Catchment Screening (RBCS) as part of the DWMP assessment process, where all 155 catchments were assessed in line with the criteria set out in the Framework. The purpose of the RBCS was to assess each catchment against 17 metrics to determine the level of risk, to screen out lower risk catchments enabling us to focus our attention and more detailed assessment in areas with greater priority. This resulted in 96 catchments triggering progression to the next stage, known as BRAVA, where more detailed assessment and hydraulic modelling was undertaken. This resulted in 99% of the connected residential population of the Avon SPA undergoing more detailed assessment, with those not triggering at present being kept under review to ensure any new risks are taken into consideration in future RBCS refreshes.

Avon SPA

155
Wastewater Treatment Works

3rd
Largest SPA

1,111,264
People

478,761
Properties

10.7%
Of the company's population

96
Catchments triggering detailed assessment

99%
Connected population received detailed assessment

The map below shows the extent of the Avon SPA, with catchments coloured green if they have progressed to detailed assessment (known as Baseline Risk and Vulnerability Assessment, or BRAVA), with those catchments which have been screened out as part of RBCS shown in red.

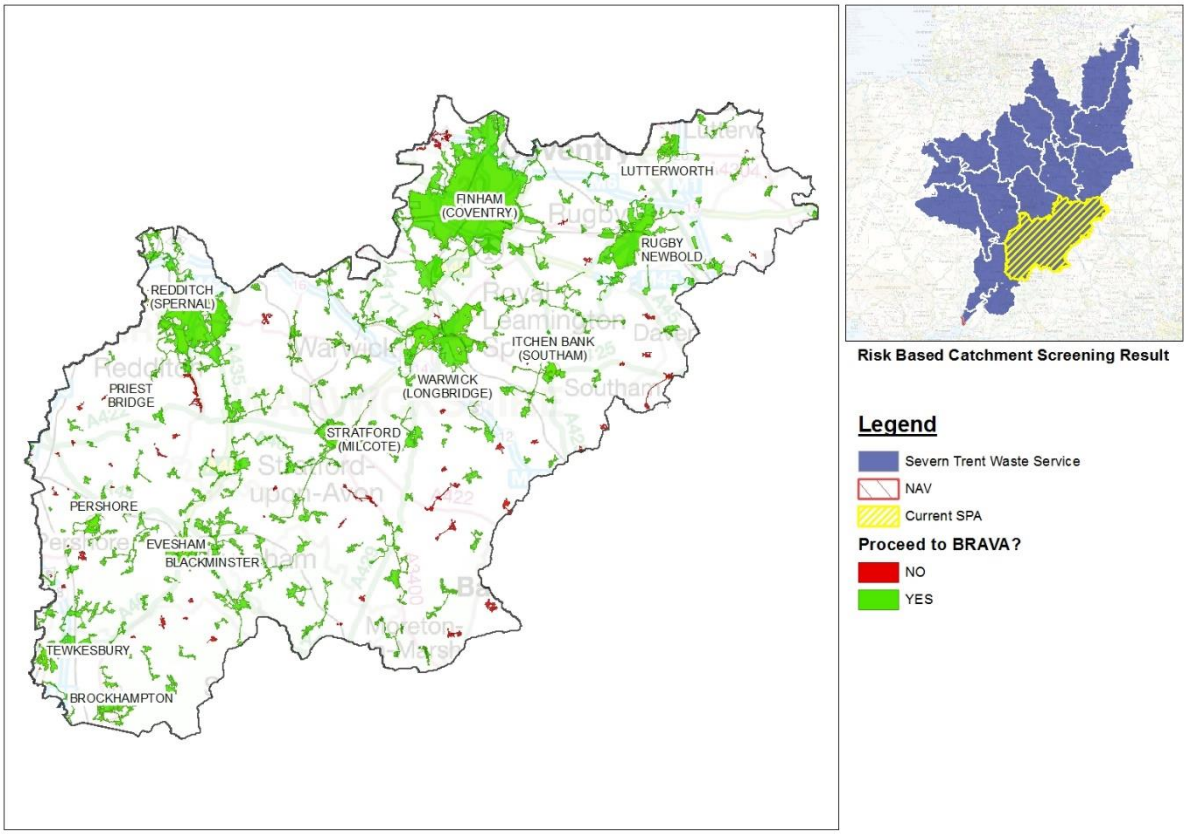

Figure 1. Map of the Avon SPA showing catchments which triggered BRAVA (green) and lower priority catchments (red)

Assessing Catchments

In terms of catchments, Table 1 lists all catchments within the SPA, identifying the size and whether they have proceeded to more detailed assessment or were screened out following the RBCS.

We have grouped each catchment into three categories based on their size, which reflects the strategic approach:

- **Large** - Catchments over 10,000 population are often complex with multiple interactions. They are likely to benefit from phased interventions to meet immediate needs which align with the overall long term catchment strategy.
- **Medium** - Catchments with populations between 2,000 and 10,000 are not expected to be overly complex hydraulically but may require mini strategies to address risks.
- **Small** – Catchments with populations less than 2000; this forms the majority of our catchments. Where risks need to be addressed, they are not usually complex hydraulically, however there are often more interactions with other drainage systems which require more in-depth local feasibility work to understand the root cause and identify potential interventions. Due to the often more rural nature, smaller catchments often have fewer physical constraints that could make a solution complex.

Where a catchment has not been assessed, this is because it did not trigger as part of the Risk Based Catchment Screening (RBCS) stage of the DWMP process. These catchments have been assessed as being lower risk but will be kept under review should changes in the catchment warrant further assessments.

Table 1. *Summary of the catchment size distribution and which catchments triggered a more detailed assessment (BRAVA)*

Assessed			Not Assessed
Large Sized Catchments >10,000 population	**Medium Sized Catchments** 10,000 - 2,000 population	**Smaller Catchments** <2,000 population	**Catchments which did not trigger more detailed assessment (BRAVA)**
ALVECHURCH (10152) BLACKMINSTER (10027) BROCKHAMPTON (10308) EVESHAM (10035) FINHAM (COVENTRY) (10451) ITCHEN BANK (SOUTHAM) (10434) LUTTERWORTH (11232) PERSHORE (10040) PRIEST BRIDGE (10163) REDDITCH (SPERNAL) (10168) RUGBY NEWBOLD (10429) STRATFORD (MILCOTE) (10348) TEWKESBURY (10313) WARWICK (LONGBRIDGE) (10354)	ALCESTER (10151) ASTWOOD BANK (10148) BEDWORTH (MARSTON LANE) (10454) BIDFORD-ON-AVON (10154) BREDON (10028) BROADWAY (10287) CHIPPING CAMPDEN (10330) CROPTHORNE HEATH (10030) DUNCHURCH (10402) FRANKTON (10403) HARVINGTON WORKS (10161) HONEYBOURNE (10051) KILSBY (10404) KINETON-STW (10430) SHIPSTON FELL MILL (10332) WELLESBOURNE (10355) WINCHCOMBE (10305) WOLSTON (10433) WOOTTON WAWEN (10378)	ALDERTON (10282) ASHTON-U-HILL (10265) BEARLEY (10318) BECKFORD (10285) BISHAMPTON (10026) BLOCKLEY (10329) BRAUNSTON (10401) BRINKLOW (10405) BUBBENHALL (10427) CHERINGTON (10350) CHURCH LAWFORD (10382) CHURCH LENCH (10156) CHURCHOVER (10383) CLAVERDON (10349) CROWLE (WORCESTER) (10097) DEFFORD VILLAGE (10032) ECKINGTON (10033) ETTINGTON (10321) FENNY COMPTON (10425) FLYFORD FLAVELL (10165) HANBURY (WORCESTERSHIRE) (17618) HARBOROUGH MAGNA (10385) HINTON-ON-THE-GREEN (10047) ILMINGTON (10340) INKBERROW (10166) KIMCOTE (11229) KINGTON (10167) LAVERTON (10312) LEEK WOOTTON (10351) LIGHTHORNE (10388) LIGHTHORNE HEATH (10389) LILBOURNE (10387) LITTLE COMBERTON WKS (10046) LONG COMPTON (10341) LOWER MOOR (10055) LOWER STRENSHAM (10052) MONKS KIRBY (10466) MORETON MORRELL (10390) MORETON PADDOX (10391) NAPTON WRW (10393) NASEBY WRW (10392) NETHERCOTE (10343) NORTHEND (10394) NORTON LINDSEY (10342) PEOPLETON (10039) ROWINGTON (10353) SEDGEBERROW (10022) SHAWELL (11235) SNITTERFIELD (10326) SOUTH KILWORTH (11248) STOKE ORCHARD (10278) SWINFORD (11239) TANWORTH-IN-ARDEN (10328) THROCKMORTON (10043) TODDINGTON (10302) TWYNING (10044) TYSOE (10345) UPTON SNODSBURY (10084) WADBOROUGH (10045) WELFORD (10398) WESTON-UNDER-WETHERLEY (10406) WOOLSTONE (10306) YELVERTOFT (10432)	ABBOTTS MORTON (10150) ADMINGTON (10338) ASHORNE (10380) ASTON MAGNA (10317) ASTON SOMERVILLE (10025) BASCOTE (10381) BIRLINGHAM (14761) BRETFORD (10428) BROCKHILL (17811) BROUGHTON HACKET (10068) BUTLERS MARSTON (10319) CHURCHOVER (COTON ROAD) (10423) COMBROOK (10335) CORLEY (10461) DEFFORD LODGE HILL (10056) DORSINGTON (10320) DUMBLETON (10280) DUNNINGTON (10149) EARLS COMMON (18128) FLECKNOE (15134) GAYDON (10384) GLEBE FARM (11222) GRANGE FARM (11223) GREAT WASHBOURNE (10269) KNIGHTCOTE (10386) LAWFORD HEATH (10424) LOWER SHUCKBURGH (10426) LOWER STRENSHAM (BAUGHTON LANE) (18005) NAUNTON BEAUCHAMP (10020) OLD MILVERTON (10322) OXHILL (10323) PEBWORTH MIDDLESEX (10059) PRESTON-ON-STOUR (10324) PRIORS HARDWICK (10395) RADWAY (10325) RIDGEWAY (10176) ROUS LENCH (10174) SALE GREEN (17926) SIBFORD FERRIS (10327) SNEACHILL (10083) SNOWDON LODGE (11237) STANTON (GLOUCESTERSHIRE) (10315) STAVERTON (10396) STOULTON (HAW BRIDGE) (10023) STOULTON (WINDMILL LANE) (10042) STRENSHAM INTAKE (14491) STRETTON-ON-FOSSE (10344) TARDEBIGGE (18649) TEWKESBURY (LINCOLN GREEN LANE) (18009) TILESFORD PARK (10024) ULLENHALL (10346) WELLESBOURNE - WALTON ROAD (STW) (19848) WHICHFORD (10347) WHITTINGTON (NEAR MOTORWAY) (10088) WHITTINGTON EAST (17817) WILLOUGHBY (10397) WINWICK (10399) WORMINGTON (10314) WORMLEIGHTON (10400)

To find out more about how the RBCS assessment was undertaken please refer to the RBCS Technical Summary and for detail relating to how catchments performed see the RBCS tables included within the supporting documentation.

Key Stakeholders

Working together with our stakeholders is key to the success of the DWMP, especially recognising that there are opportunities when working together to have wider benefits than just improvements to the wastewater system. Table 2 summarises the key stakeholders and organisations covering this SPA. As part of our ongoing process in developing the DWMP for this area we have undertaken a series of workshops with these stakeholders along with engaging with these authorities via our digital systems. This will continue over the Draft DWMP consultation period in 2022 to help develop our Final DWMP plan in 2023.

Table 2. *Summary of the key stakeholders and organisations we are working with*

Local Planning Authorities	Lead Local Flood Authorities	Other
Birmingham	Birmingham	Environment Agency
Bromsgrove	Coventry	Natural England
Cherwell	Gloucestershire	River Severn Partnership
Cotswold	Leicestershire	Severn Rivers Trust
Coventry	Northamptonshire	Warwickshire Avon CaBA Group
Daventry	Oxfordshire	Warwickshire Wildlife Trust
Harborough	Solihull	
North Warwickshire	Warwickshire	
Nuneaton and Bedworth	Worcestershire	
Redditch		
Rugby		
Solihull		
Stratford-on-Avon		
Tewkesbury		
Warwick		
Wychavon		

We've produced a lookup spreadsheet in the supporting documentation which will enable stakeholders to filter by SPA, Local Planning Authority or LLFA to determine which catchments are of particular interest within the operational area.

Collaborative working opportunities in the Avon SPA

As part of our normal day to day activities we work closely with other risk management authorities to support and develop collaborative working opportunities. This includes the reduction of the risk of fluvial flooding whereby the public sewerage system can get inundated by high river flows and where joint solutions to improve surface water management can deliver multiple source flood benefit. Our DWMP approach builds on existing practices we already have in place to engage with stakeholders and so we envisage the outputs of DWMP will help reinforce this, both as part of our ongoing AMP7 programme but also in readiness for AMP8. This activity is firstly aimed at supporting Environment Agency with the six-year Flood and Coastal Erosion Risk Management (FCERM) investment programme running from 1 April 2021 to 31 March 2027 to better protect 336,000 homes and non-residential properties. We also work with the Lead Local Flood Authorities, the Local Planning Authorities and other drainage body owners as part of our collaborative flood resilience approach.

With the six-year programme covering 2021 to 2027, the DWMP Cycle 1 planning horizon (2025-2050) will only overlap for the last two years of Flood and Coastal Erosion Risk Management (FCERM) schemes within this programme. However, as part of our ongoing engagement, we are working with the Environment Agency, Lead Local Flood Authorities and other Risk Management Authorities to support the development of (and where viable the delivery of) potential FCERM schemes and studies within the Avon SPA in various locations including:

- Bishops Cleeve, Gloucestershire
- Keresley, Coventry

- SuDS Retrofit in Coventry
- Upper Brookstray, Coventry
- Redditch Flood Risk Management Plan
- Withybrook, Warwickshire

In partnership with Coventry City Council, we are assessing the potential for SUDS retrofitting projects across Coventry to help manage the risks of climate change and increased extreme rainfall. We are liaising with other organisations working in or operating within the catchment with a view to taking a collaborative approach.

We are aware of or engaged in other catchment partnerships and initiatives in the Avon SPA. For instance, we are working with partners on the Avon adaptive pathway demonstrator project (Action on the Avon) as part of the River Severn Partnership. The Avon project is seeking to take a broader catchment-based approach to help manage water resources and flood risk whilst also enhancing biodiversity. It also aligns with our current bathing water Green Recovery project in the Avon catchment. We are also supporting the Sherbourne Valley Project, which seeks to rejuvenate the largely culverted River Sherbourne in Coventry.

We are part of the Severn Catchment Partnership which is a large multi-agency partnership with the following "To make the Severn Catchment Britain's most vibrant and resilient river network; where an exceptional quality of life, prosperous local economies and an outstanding natural environment is driven by a programme of innovation to reduce flood risk, secure future water resources and improve and deliver shared natural assets." We will continue to play our part in this partnership, and we will seek ways to align and collaborate on delivering ours as well as wider drainage and flood risk aspirations.

In the previous 6 year programme (2015 to 2021), we delivered a partnership scheme in the Holbooks area of Coventry to reduce flood risk to 14 properties. We worked with Coventry City Council on this scheme which used a mix of 'grey' and 'blue / green infrastructure i.e. SUDS' to manage the risk, and was co-funded by Flood Defence Grant in Aid (FDGIA), Local Levy, Coventry City Council and Severn Trent. We also contributed to the Environment Agency led flood risk management scheme in Broadway given the benefits the flood storage area provided in terms of increased resilience of the local sewer network.

We will continue to seek and develop opportunities to collaborate with other Risk Management Authorities to manage flood risk within the current 6-year programme. As part of the consultation period in 2022 and 2023, we will also work closely with stakeholders and partners to identify future opportunities to align plans and to co-create potential schemes for potential inclusion in future FCERM programmes.

The Avon SPA falls within the Severn Flood Risk Management Plan (FRMP) area. FRMPs are strategic statutory plans which have measures for high-risk Flood Risk Areas (FRAs). FRMPS have been developed by the Environment Agency, working together with Lead Local Flood Authorities and Risk Management Authorities (RMAs). The draft second cycle FRMP for the Severn River Basin District covering the period 2021 – 2027 has recently been produced and consulted on in October 2021. We contributed to this draft FRMP by developing and incorporating measures. We also worked with other Risk Management Authorities to support other measures and we fed back to the consultation.

Within the Avon SPA, there are 4 Flood Risk Areas (FRAs) in the FRMP, these are 'Birmingham FRA', 'Coventry FRA', 'Henley-in-Arden FRA', 'Redditch FRA' and 'West Midlands FRA'. The FRAs are catchment areas deemed to be at significant risk of flooding from surface water and/or rivers and the sea. Where Flood Risk Areas have been identified we are supporting the Environment Agency and Lead Local Flood Authorities to better understand and address the risk where applicable. We will seek opportunities to align FRMP activities with DWMP strategies in this current second cycle and future FRMP cycles.

Additionally, the Avon SPA is included within the Severn River Basin Management Plan (RBMP) area which sets out environmental objectives and the programme of measures for protecting and improving the water environment.

Water Framework Directive

The core aim of the Water Framework Directive (WFD) is to prevent deterioration of the water environment and improve water quality by managing water in river basin districts. Based on Environment Agency measures river health, waterbodies that have a classification status of less than 'Good' are classified based on their Reasons for Not Achieving Good Status (RNAGS).

As part of our River Pledge our aim is for our operations to not be the reason for unhealthy rivers by 2030 based on Environment Agency measures (RNAGS). Working together with the Environment Agency we are currently sharing information to support the development of our AMP8 Water Industry National Environmental Programme (WINEP) list. We will also continue to educate, advocate and use our convening powers to help others to address their issues too.

Across the Avon SPA there are 75 river water bodies. When looking at rivers reaching Good Ecological Status across the SPA, 13.7% of the problem is caused by Water Industry activity and 86.3% by other reasons. ***Figure 2*** shows the breakdown of RNAGS responsibility by sector.

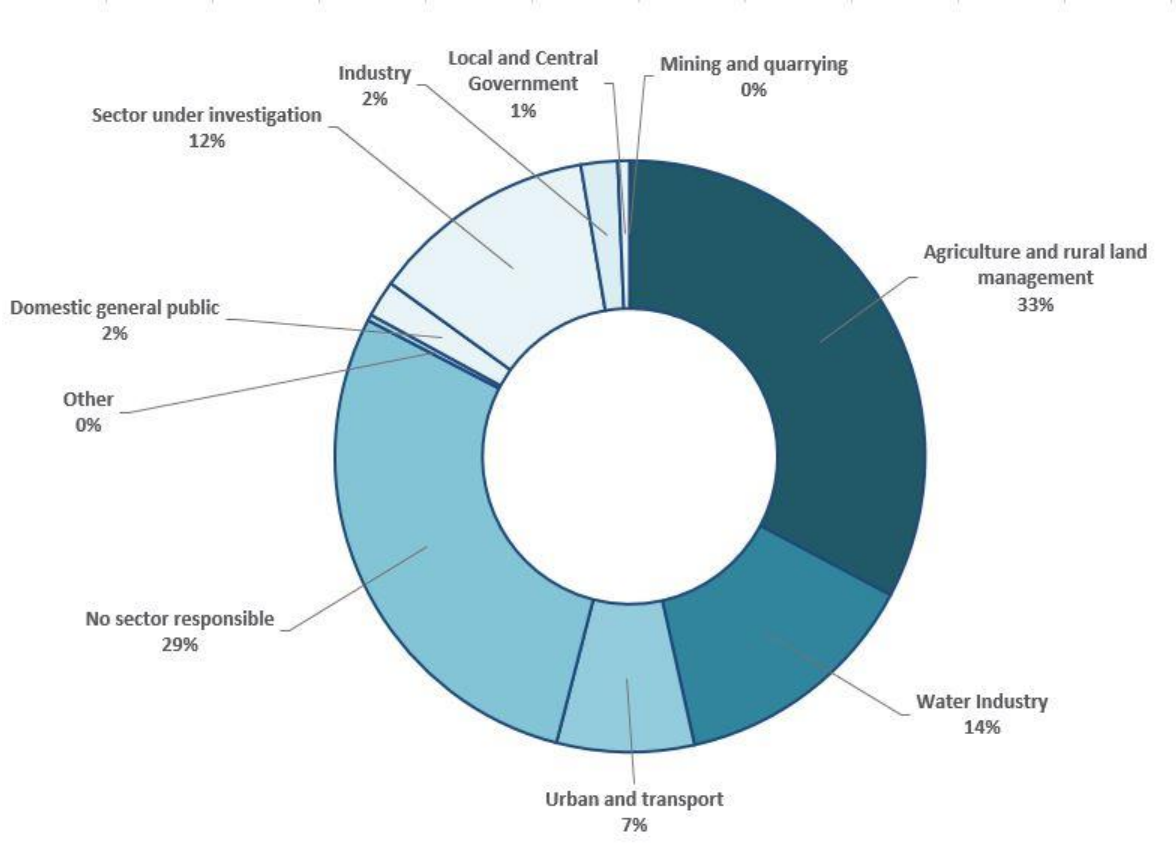

Figure 2. *Reasons for Not Achieving Good Ecological Status by Sector and Activity across the Avon SPA*

Assessment of SPA Catchment Needs

As part of our Baseline Risk and Vulnerability Assessments (BRAVA) we have assessed each catchment against six Common Planning Objectives and four Opportunity Indicators (Table 4). More detail about how these have been developed and measured can be found in our Technical Summaries Section. Our Planning Objectives have allowed us to understand what the priorities of our catchments within this SPA are and where our

strategies should be focussed to deliver a best plan for our customers and stakeholders. Each Planning Objective and Opportunity Indicator have been scored according to 3 priority risk bands (band 0/1/2) which are explained in Table 3. These scores are based on a no intervention scenario which gives us the scale of the problem that needs to be addressed by the DWMP and does not mean that our plan is to do nothing. We have collated the catchment level scores at SPA level, according to the DWMP Framework, so that we can share what the current and future needs are within the SPA to identify the high-level strategic direction needed to address these needs. A catchment Level detailed breakdown can be found in the supporting documentation.

Table 3a. Description of the priority risk bands for Common Planning Objectives

Band	Priority Level	Description
2	Short Term Priority	The needs of the catchment indicate that performance warrants more immediate investigation and is a short term priority to improve performance. The solution to remedy the need could be simple or complex which can be understood through Option Development and Appraisal stage of DWMP.
1	Medium Term Priority	The needs of the catchment indicate that performance appears to be borderline and therefore needs further investigation in the Options Development and Appraisal stage of DWMP.
0	Long Term Priority	The needs of the catchment indicate that performance is not triggering specific risk thresholds and current baseline performance (or projected 2050 performance) is not a significant issue or concern. This is a long-term priority to address sider strategic needs. Where there may localised needs there is the mechanism to address through 'business as usual' investment decisions.
N/A	Not Assessed	Where a planning objective has not been assessed due to not being able to project to 2050

Table 3b. *Description of the priority risk bands for Opportunity Indicators*

Band	Opportunity Level	Description
2	Good	This indicates the catchment is likely to offer good opportunities for DWMP interventions to benefit a particular indicator.
1	Reasonable	This suggests there are reasonable opportunities across a catchment to support an indicator.
0	Limited	Based on the characteristics of the catchment our assessment suggests there are limited opportunities to support an indicator, however there may still be some benefits which could still be gained.
N/A	Not Assessed	Where an opportunity indicator has not been assessed due to not being able to project to 2050.

Table 4. *Needs of the Avon SPA in relation to the Planning Objectives and Opportunity Indicators.*

Ref	Planning Objective	2020	2050	Comments
Common Planning Objectives				
CPO1	Internal Sewer Flooding Risk	0	N/A	Based on the average number of internal sewer flooding incidents reported over the 3 year period from 1st April 2018 to 31st March 2020.
CPO2	Pollution Risk	1	N/A	Based on the average number of pollution incidents reported over the 3 year period from 1st April 2018 to 31st March 2020.
CPO3	Sewer Collapse Risk	0	N/A	Based on the average number of sewer collapses reported over the 3 year period from 1st April 2018 to 31st March 2020.
CPO4	Risk of internal sewer flooding in a 1 in 50-year storm	0	1	Based on the Ofwat guidance for Risk of Sewer Flooding in a Storm Methodology and incorporating enhancements to align with the assessment of surface water and fluvial flood risks assessments used by Environment Agency/LLFAs.
CPO5	Storm Overflow Performance	0	0	Based on the Water UK 21st Century Drainage Capacity Assessment Framework to assess storm overflow performance.
CPO6	Risk of wastewater treatment works quality compliance failure	1	2	This considers pressures on flow and quality permit compliance at Wastewater Treatment Works, plus any technological limitations or physical site conditions which could limit available solutions.

Opportunity Indicators				
OI1	Risk of surface, fluvial and groundwater flooding	1	N/A	This indicator uses the Environment Agency surface water flood risk maps to identify properties at risk of surface water flooding which could potentially benefit from co-created drainage and wastewater solutions.
OI2	Sustainable accommodation of future growth	0	N/A	This indicator looks at how likely it is that new development would connect to a foul/combined sewer as no suitable surface water sewers are available or the ground conditions limit use of Sustainable Drainage Systems (SuDS).
OI3	Effective wastewater asset resilience	1	N/A	High level assessment of WwTW and major pumping station resilience against fluvial (river) flooding, electricity supply failures and communication outages.
OI4	Supporting Water Resource Management Plan strategies	2	N/A	This indicator assesses potential opportunities to integrate DWMP surface water management strategies to offset groundwater and river abstraction constraint within WRMP.

Developing Options

To help us develop a best value, long-term approach to managing the future risks within each catchment we have assessed each catchment against a series of interventions. This ensures a good understanding of what options may be viable to consider as part of our long-term plan. The DWMP Framework identifies a long list of 'generic options', which fall into three main themes; reduce demand, optimise existing capacity or increase supply of capacity (Figure 3). We have grouped these tactical interventions into Intervention Themes (Table 5), and a detailed explanation of these options and how we have considered them are included in the ODA Screening Technical Summary.

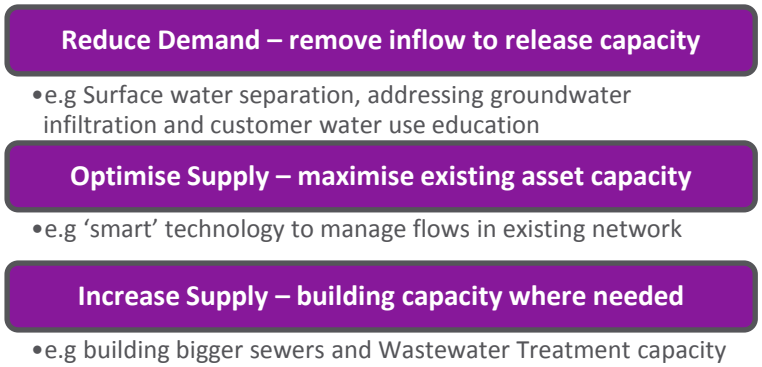

Figure 3. *Main categories of options addressed through the DWMP*

Table 5. *Summary of the Intervention Themes considered when developing options at catchment level*

Type		Intervention Theme	Aim of Intervention
Reduce		Domestic water Consumption Management	Working with customers to reduce inflow from domestic properties to reduce base flows.
		Trade Flow Demand Management	Working with non-household traders to identify opportunities to pre-treat flows on site to offset load issues at the WwTW.
		Customer Education	Customer awareness on the impact of sewer misuse, water consumption and increase of impermeable area creep. **This is a company level activity.**
		Surface Water Inflow Management	Managing surface water entering the sewer network through surface water separation and SuDS strategies.
		Infiltration Management	Sealing of pipes to reduce groundwater ingress due to changes in groundwater tables.
Optimise	Sewerage Network	Managing Exceedance Flow Paths	Mitigating sewer exceedance flood risk by managing flow paths. **This is a business-as-usual activity.**
		Sewer Flow Management to Optimise Headroom	Identify opportunities within the sewer network where alterations can be made to make better use of existing spare capacity.

Type		Intervention Theme	Aim of Intervention
		Storm Overflow Rationalisation	Identify opportunities to combine multiple Storm Overflows into a single asset designed to improved modern design standards.
		Active System Control	Using smart technology to dynamically manage flows in the wastewater system during heavy rainfall.
		Operational Performance Management	Maintenance of the network such as routine cleanse to reduce blockage risk. **This is a business-as-usual activity.**
	Wastewater Treatment	River Catchment Flexible Permitting	Use of river reach permitting to meet environmental objectives for the watercourse.
		WwTW Treatment Optimisation	Optimising existing treatment capacity by transferring flows to an alternative WwTW with spare headroom.
		Storm Overflow Effluent Treatment	Treatment of storm overflow effluent to improve the water quality before release into sensitive environments.
		Product Recovery	Using technology to extract products from the flows into the WwTW. This is a bespoke option rather than within strategic DMWP scope.
Build	Sewerage Network	Sewer Capacity Upgrades	Traditional capacity upgrades including building new sewers and attenuation tanks.
		Sewer rehabilitation	Repair of structural condition of sewers through replacement, sewer lining or patch repairs to reduce risk of collapse, burst or blockage. **This is a business-as-usual activity covered through capital maintenance plans.**
	Wastewater Treatment	WwTW Capacity Upgrades	Traditional capacity upgrades including building additional treatment capacity.
		WwTW Capital Maintenance	Repair and maintenance of existing assets at WwTW. This is a business-as-usual activity covered through capital maintenance plans.
Environmental		SuDS for Groundwater Recharge	SuDS Strategies to support groundwater recharge to support water availability objectives.
		Natural Flood Management	Use of Natural Flood Management to manage flood levels where they interact with and inundate the wastewater system.
Indirect Measures		Influencing Policy	Influencing policy on growth, planning, surface water connections to reduce inflow. **This is a company level activity.**
		Investigate and Monitor	Understand root cause and risk. **This is a company level activity.**
		Future Technology	To await or develop new technology to support with meeting objectives. **This is a company level activity.**

Each of the 96 WwTW catchments within the Avon SPA have been assessed against each of the intervention options. These have been assessed based on the individual characteristics of each catchment using in-depth knowledge of the catchment by our Technical Experts.

The intention of the assessment was to understand what solutions may be viable within a catchment, enabling the interventions to be married against the needs to determine which solutions may be viable. It is unlikely that a single intervention would be applicable to the entire catchment as some parts of a catchment may be amenable to an intervention which would not work elsewhere in the catchment. However, the purpose of this exercise is to understand what could comprise feasible interventions which should be assessed in more detail as part of Option Development and Appraisal.

The findings of the assessment of interventions are summarised for 96 catchments in this SPA in Figure 4, which indicates which options are the most feasible. Based on an assessment of catchment needs and characteristics, the larger text indicates which interventions are likely to be more viable across all catchments in the SPA. This does not mean the less viable interventions will be discounted altogether as once we get to the next phase of detailed optioneering there may be parts of a catchment where these interventions would be used, but our analysis indicates they are not primary interventions. Overall, this indicates that the main

interventions worth considering further are traditional interventions to increase supply of capacity within the wastewater network or look at options to reduce inflow into the sewerage system through improved surface water inflow management. The added benefit of the latter being this also provides opportunities to work with other flood risk management authorities to deliver wider flooding benefits.

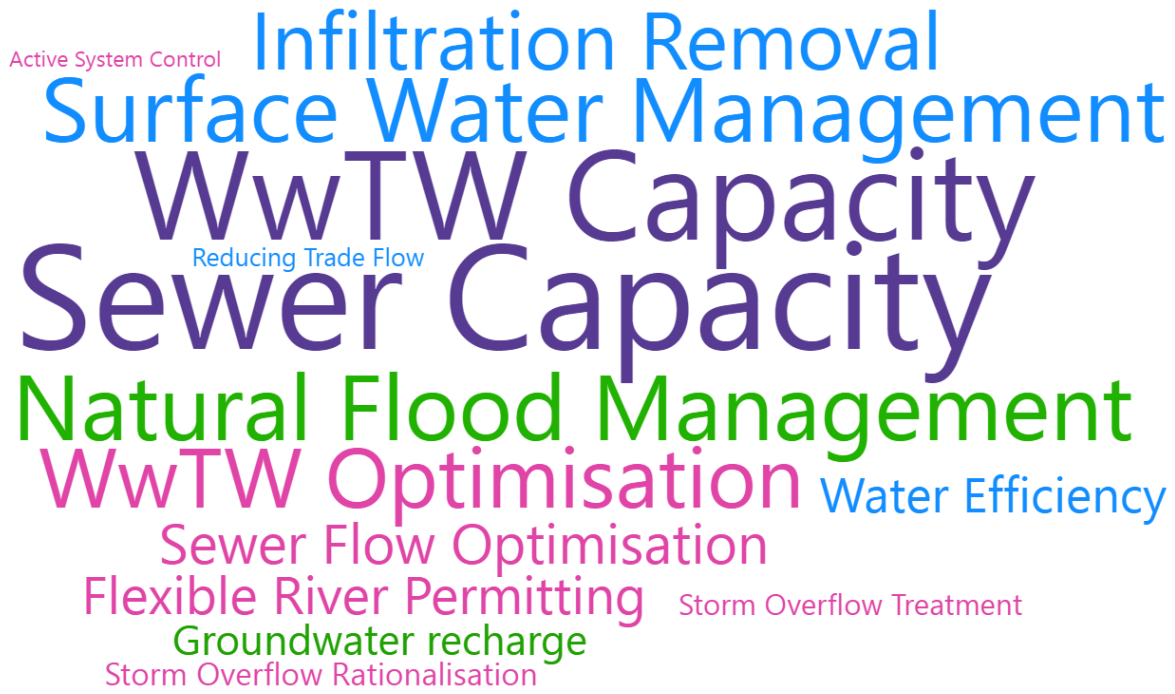

Figure 4. *Summary of the most viable options available within the Avon SPA*

Interventions

As part of our Option Development and Appraisal assessment we have focussed on traditional interventions to represent the 'supply' activities, and more nature-based surface water removal options to achieve 'demand' reduction. The assessments from the option viability will be used to inform project development during the future stages of our catchment management.

Internal sewer flooding in a 1 in 50 year storm

This aims to understand the level of risk across a catchment to internal sewer flooding in a 1 in 50 year storm to identify what interventions would be required to reduce the risk. A 1 in 50 year storm is a probabilistic means of indicating the likelihood of a heavy rainfall event causing flooding from the sewerage network. This is often shown as a 1 in 50 chance of occurring in a year, sometimes shown as a 2% annual probability. This does not mean an event will only occur every 50 years, it is purely an indication of its statistical annual probability. Internal Sewer flooding planning objective and how the strategic options and interventions were developed can be found in the Internal Sewer Flooding Technical Summary.

Figure 5 provides an overview of the level of risk across this SPA and how it is likely to deteriorate by 2050 due to the impacts of climate change, new development and urban creep. We have assessed this for both 2°C and 4°C global warming scenarios.

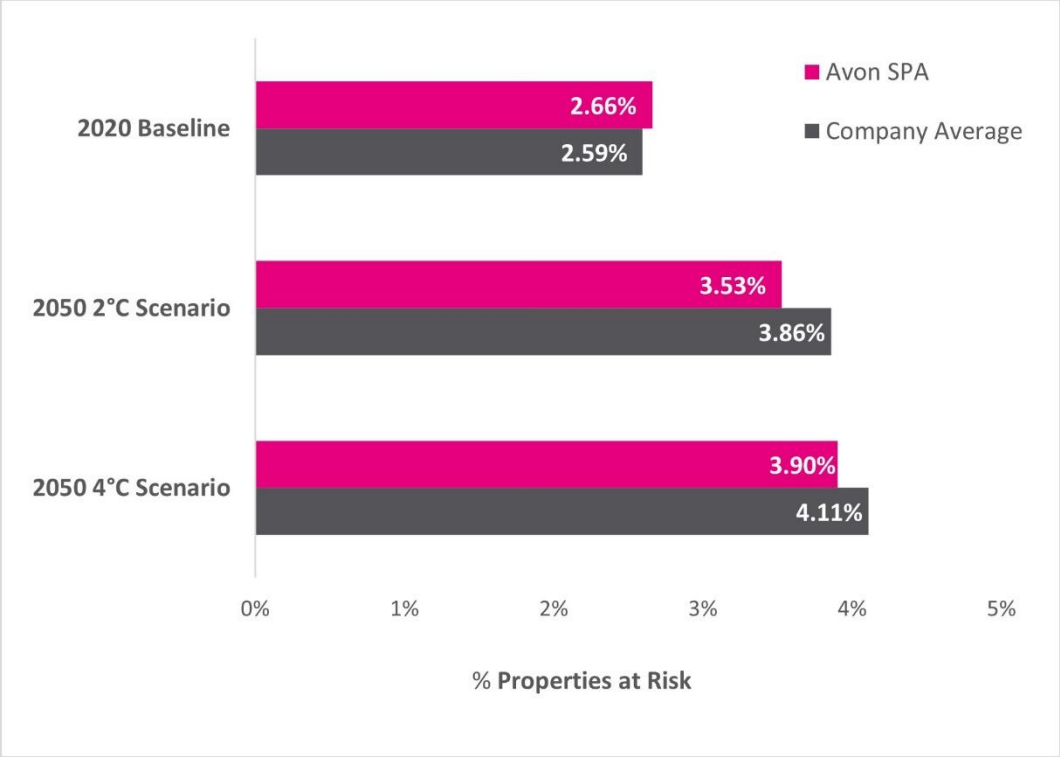

Figure 5. *Comparison of the risk of internal sewer flooding in a 1 in 50 year storm between Avon SPA and the Company as a whole for a range of scenarios.*

Within the Avon, the risk of internal flooding in a 1 in 50 year storm is below the company average across the different scenarios. Without intervention a further 4,221 properties are expected to become at risk across all the assessed catchments within this SPA, therefore our options need to ensure future pressures do not result in deterioration of current performance.

Table 6 summarises the current and future flood risks based on our assessment of priority risk level for a 2°C global warming scenario. Our immediate focus is to mitigate the risks associated with catchments forecast to fall within band 2 'Short Term priority' by 2035.

Table 6. *Assessment of risk of sewer flooding in a 1 in 50 year storm showing which catchments fall within which priority bands (NOTE: This table is listed in order of its population size)*

Ref	Catchment Name	Population	2020	2025	2030	2035	2050
10451	FINHAM (COVENTRY)	477,671	1	1	1	1	1
10354	WARWICK (LONGBRIDGE)	108,466	1	1	1	1	1
10429	RUGBY NEWBOLD	105,347	0	0	1	1	1
10348	STRATFORD (MILCOTE)	38,497	0	0	0	0	0
10313	TEWKESBURY	29,374	0	0	0	0	0
10035	EVESHAM	28,826	1	1	1	1	2
10308	BROCKHAMPTON	17,017	1	1	1	1	1
10027	BLACKMINSTER	16,231	0	0	0	0	0
10434	ITCHEN BANK (SOUTHAM)	14,883	1	1	1	1	1
10163	PRIEST BRIDGE	13,871	0	0	0	0	0
10040	PERSHORE	11,489	0	0	0	0	0
11232	LUTTERWORTH	11,320	1	1	1	1	2
10152	ALVECHURCH	10,023	0	0	0	0	0
10454	BEDWORTH (MARSTON LANE)	9,932	2	2	2	2	2
10151	ALCESTER	8,750	0	0	0	0	0
10154	BIDFORD-ON-AVON	7,994	0	0	0	0	0
10332	SHIPSTON FELL MILL	7,154	0	0	0	0	0
10355	WELLESBOURNE	6,875	0	0	0	0	0
10433	WOLSTON	5,887	0	0	0	0	0
10305	WINCHCOMBE	5,040	0	0	0	0	0
10051	HONEYBOURNE	4,867	0	0	0	0	0
10287	BROADWAY	3,822	0	0	0	0	0
10028	BREDON	3,641	0	0	0	0	0

Ref	Catchment Name	Population	2020	2025	2030	2035	2050
10378	WOOTTON WAWEN	3,580	0	0	0	0	0
10030	CROPTHORNE HEATH	2,742	0	0	0	0	0
10148	ASTWOOD BANK	2,708	0	0	0	0	0
10402	DUNCHURCH	2,548	0	0	0	0	0
10404	KILSBY	2,429	0	0	0	0	0
10161	HARVINGTON WORKS	2,408	0	0	0	0	0
10403	FRANKTON	2,324	0	0	0	0	0
10430	KINETON-STW	2,314	0	0	0	1	1
10330	CHIPPING CAMPDEN	2,284	0	0	0	0	0
10329	BLOCKLEY	1,913	0	0	0	0	0
10353	ROWINGTON	1,831	0	0	0	1	1
10401	BRAUNSTON	1,783	0	0	0	0	0
11229	KIMCOTE	1,739	0	0	0	1	1
10166	INKBERROW	1,716	0	0	0	0	0
10044	TWYNING	1,513	2	2	2	2	2
11248	SOUTH KILWORTH	1,389	1	1	1	1	1
10350	CHERINGTON	1,321	1	1	1	1	1
10282	ALDERTON	1,211	0	0	0	0	0
10306	WOOLSTONE	1,123	0	0	0	0	0
10033	ECKINGTON	1,122	0	0	0	1	1
10278	STOKE ORCHARD	1,122	0	0	0	0	0
10398	WELFORD	1,116	0	0	0	0	0
10466	MONKS KIRBY	1,100	2	2	2	2	2
10405	BRINKLOW	1,058	0	0	0	0	0
10326	SNITTERFIELD	1,049	0	0	0	0	1
10345	TYSOE	1,006	0	0	0	0	0
10321	ETTINGTON	986	0	0	0	0	0
10097	CROWLE (WORCESTER)	985	0	0	0	1	1
10461	CORLEY	966	NA	NA	NA	NA	NA
10176	RIDGEWAY	957	NA	NA	NA	NA	NA
10393	NAPTON WRW	937	0	0	0	0	1
10285	BECKFORD	885	0	0	0	0	0
10351	LEEK WOOTTON	864	0	0	0	0	0
10349	CLAVERDON	837	0	0	0	0	0
10022	SEDGEBERROW	828	0	0	0	0	0
10327	SIBFORD FERRIS	825	NA	NA	NA	NA	NA
10425	FENNY COMPTON	797	0	0	0	0	0
10341	LONG COMPTON	776	1	1	1	1	2
10389	LIGHTHORNE HEATH	758	0	0	0	0	0
10432	YELVERTOFT	756	0	0	0	0	0
10406	WESTON-UNDER-WETHERLEY	746	0	0	0	0	0
10055	LOWER MOOR	711	0	0	0	0	0
10340	ILMINGTON	711	2	2	2	2	2
10265	ASHTON-U-HILL	708	0	0	0	0	0
10392	NASEBY WRW	690	0	0	0	0	0
10026	BISHAMPTON	686	2	2	2	2	2
10318	BEARLEY	672	0	0	0	0	0
10427	BUBBENHALL	591	0	0	0	0	0
11239	SWINFORD	589	2	2	2	2	2
10319	BUTLERS MARSTON	582	NA	NA	NA	NA	NA
10343	NETHERCOTE	560	1	1	1	1	1
10324	PRESTON-ON-STOUR	559	NA	NA	NA	NA	NA
10342	NORTON LINDSEY	554	0	0	0	0	0
10396	STAVERTON	488	NA	NA	NA	NA	NA
10039	PEOPLETON	471	0	0	0	0	0
10390	MORETON MORRELL	457	0	0	0	0	0
10385	HARBOROUGH MAGNA	443	0	0	0	0	0
10323	OXHILL	435	NA	NA	NA	NA	NA
10156	CHURCH LENCH	423	0	0	0	0	0
10384	GAYDON	394	NA	NA	NA	NA	NA
10032	DEFFORD VILLAGE	386	0	0	0	0	0
10397	WILLOUGHBY	385	NA	NA	NA	NA	NA
10165	FLYFORD FLAVELL	373	0	0	0	0	0
10387	LILBOURNE	373	0	0	0	0	0
10394	NORTHEND	372	2	2	2	2	2
10344	STRETTON-ON-FOSSE	371	NA	NA	NA	NA	NA
10346	ULLENHALL	366	NA	NA	NA	NA	NA
10388	LIGHTHORNE	353	2	2	2	2	2
10382	CHURCH LAWFORD	340	1	1	2	2	2
17618	HANBURY (WORCESTERSHIRE)	326	2	2	2	2	2
10302	TODDINGTON	320	0	0	0	0	0
10280	DUMBLETON	305	NA	NA	NA	NA	NA
10328	TANWORTH-IN-ARDEN	305	0	0	0	0	0
10084	UPTON SNODSBURY	295	0	0	0	0	0
10347	WHICHFORD	292	NA	NA	NA	NA	NA

Ref	Catchment Name	Population	2020	2025	2030	2035	2050
10046	LITTLE COMBERTON WKS	286	0	0	0	0	0
10325	RADWAY	260	NA	NA	NA	NA	NA
10025	ASTON SOMERVILLE	228	NA	NA	NA	NA	NA
10047	HINTON-ON-THE-GREEN	215	0	0	0	0	0
10315	STANTON (GLOUCESTERSHIRE)	212	NA	NA	NA	NA	NA
10312	LAVERTON	207	0	0	0	0	0
10052	LOWER STRENSHAM	207	0	0	0	0	0
10383	CHURCHOVER	204	0	0	0	0	0
10317	ASTON MAGNA	203	NA	NA	NA	NA	NA
14761	BIRLINGHAM	203	NA	NA	NA	NA	NA
10023	STOULTON (HAW BRIDGE)	184	NA	NA	NA	NA	NA
15134	FLECKNOE	179	NA	NA	NA	NA	NA
10386	KNIGHTCOTE	179	NA	NA	NA	NA	NA
10167	KINGTON	172	0	0	0	0	0
10068	BROUGHTON HACKET	158	NA	NA	NA	NA	NA
10335	COMBROOK	158	NA	NA	NA	NA	NA
10424	LAWFORD HEATH	158	NA	NA	NA	NA	NA
10391	MORETON PADDOX	158	0	0	0	0	0
10395	PRIORS HARDWICK	154	NA	NA	NA	NA	NA
10380	ASHORNE	146	NA	NA	NA	NA	NA
10174	ROUS LENCH	135	NA	NA	NA	NA	NA
11235	SHAWELL	125	0	0	0	0	0
17926	SALE GREEN	123	NA	NA	NA	NA	NA
10314	WORMINGTON	110	NA	NA	NA	NA	NA
10428	BRETFORD	101	NA	NA	NA	NA	NA
10045	WADBOROUGH	101	1	1	1	1	1
10043	THROCKMORTON	100	0	0	0	0	0
10150	ABBOTTS MORTON	94	NA	NA	NA	NA	NA
10149	DUNNINGTON	91	0	0	0	0	0
10400	WORMLEIGHTON	89	NA	NA	NA	NA	NA
10338	ADMINGTON	88	NA	NA	NA	NA	NA
10088	WHITTINGTON (NEAR MOTORWAY)	88	NA	NA	NA	NA	NA
18128	EARLS COMMON	87	NA	NA	NA	NA	NA
10381	BASCOTE	81	NA	NA	NA	NA	NA
10083	SNEACHILL	81	NA	NA	NA	NA	NA
10024	TILESFORD PARK	76	NA	NA	NA	NA	NA
10426	LOWER SHUCKBURGH	65	NA	NA	NA	NA	NA
10320	DORSINGTON	62	NA	NA	NA	NA	NA
10269	GREAT WASHBOURNE	62	NA	NA	NA	NA	NA
10020	NAUNTON BEAUCHAMP	61	NA	NA	NA	NA	NA
10322	OLD MILVERTON	58	NA	NA	NA	NA	NA
10056	DEFFORD LODGE HILL	44	NA	NA	NA	NA	NA
17817	WHITTINGTON EAST	42	NA	NA	NA	NA	NA
10399	WINWICK	36	NA	NA	NA	NA	NA
10423	CHURCHOVER (COTON ROAD)	35	NA	NA	NA	NA	NA
10059	PEBWORTH MIDDLESEX	33	NA	NA	NA	NA	NA
10042	STOULTON (WINDMILL LANE)	32	NA	NA	NA	NA	NA
18009	TEWKESBURY (LINCOLN GREEN LANE)	21	NA	NA	NA	NA	NA
18005	LOWER STRENSHAM (BAUGHTON LN)	17	NA	NA	NA	NA	NA
14491	STRENSHAM INTAKE	17	NA	NA	NA	NA	NA
18649	TARDEBIGGE	5	NA	NA	NA	NA	NA
11237	SNOWDON LODGE	5	NA	NA	NA	NA	NA
11222	GLEBE FARM	4	NA	NA	NA	NA	NA
17811	BROCKHILL	2	NA	NA	NA	NA	NA
11223	GRANGE FARM	2	NA	NA	NA	NA	NA

When looking at intervention options, we have modelled three principal intervention themes:

- Traditional – building 'grey' sewer capacity interventions
- Surface water separation - assessing 3 scenarios: 10%, 30% and 50% separation of roads and footpaths
- Hybrid – a mix of traditional 'grey' and nature based 'green' solutions. Where surface water interventions on their own do not meet the desired level of performance, we have reinforced any shortfall with traditional sewer-based solutions.

Traditional

Figure 6 indicates the cost vs benefit for meeting different performance levels across the Avon SPA using traditional interventions. This shows the balance between percentage of properties at risk and indicative costs to 2050. For this SPA, reducing the risk from sewer flooding to zero has an indicative cost in the region of £ 793

million by 2050 (to alleviate current baseline risk and to mitigate future pressures from climate change, creep and new development). Whereas maintaining current performance against future pressures is indicated to require investment levels on the region of £ 134 million by 2050.

Risk of internal sewer flooding in a 1 in 50 Year Storm

2°C Climate Change Scenario

Investment Option	Indicative Cost (£m)	Properties at Risk
Maintain Current Risk	£134.2	2.5%
Basic Investment*	£ 33.5	3.4%
Enhanced Investment**	£193.3	2.3%
Aspirational: Zero Flooding	£793.3	0%

Risk of internal sewer flooding in a 1 in 50 Year Storm

4°C Climate Change Scenario

Investment Option	Indicative Cost (£m)	Properties at Risk
Maintain Current Risk	£184.6	2.6%
Basic Investment*	£ 52.9	3.6%
Enhanced Investment**	£247.9	2.3%
Aspirational: Zero Flooding	£871.3	0%

*Cost to ensure no catchments are within the highest flooding risk band
**Cost to ensure no catchments are within the medium flooding risk band

Figure 6. *Indicative cost of traditional 'grey' capacity increase interventions for a range of performance options. For each option, the resultant percentage of properties at risk is shown.*

In the figure above, strategic options are shown using the band 0/1/2 risk thresholds used for BRAVA. As part of Option Development and Appraisal we have assessed what level of interventions would be needed to ensure a catchments risk does not exceed a risk threshold. For some catchments this could see risk deteriorate as indicated by the Basic Investment option.

Surface Water Separation

Where catchment characteristics indicate catchment wide surface separation strategies are likely to be viable, we have also assessed options to remove surface water from the public sewerage system. The added benefit being that such solutions may also provide wider opportunities to support co-creation of projects with other Risk Management Authorities and reduce carbon use from our movement and processing of this rainfall induced flow. This could provide surface water flood risk benefits by working together to manage above ground flows before it would have otherwise entered the public sewerage network.

The findings of this analysis are summarised in Figure 7, with the indicative costs to reduce sewer flooding to zero being £845m - £865 million depending on the scale of viable surface water separation. The added benefit of this approach being that it provides potential opportunities to support reduction of wider flood risk benefits. Figure 7 shows the indicative costs of four different performance options for traditional 'grey' infrastructure capacity improvements against 10%, 30% and 50% surface water separation options.

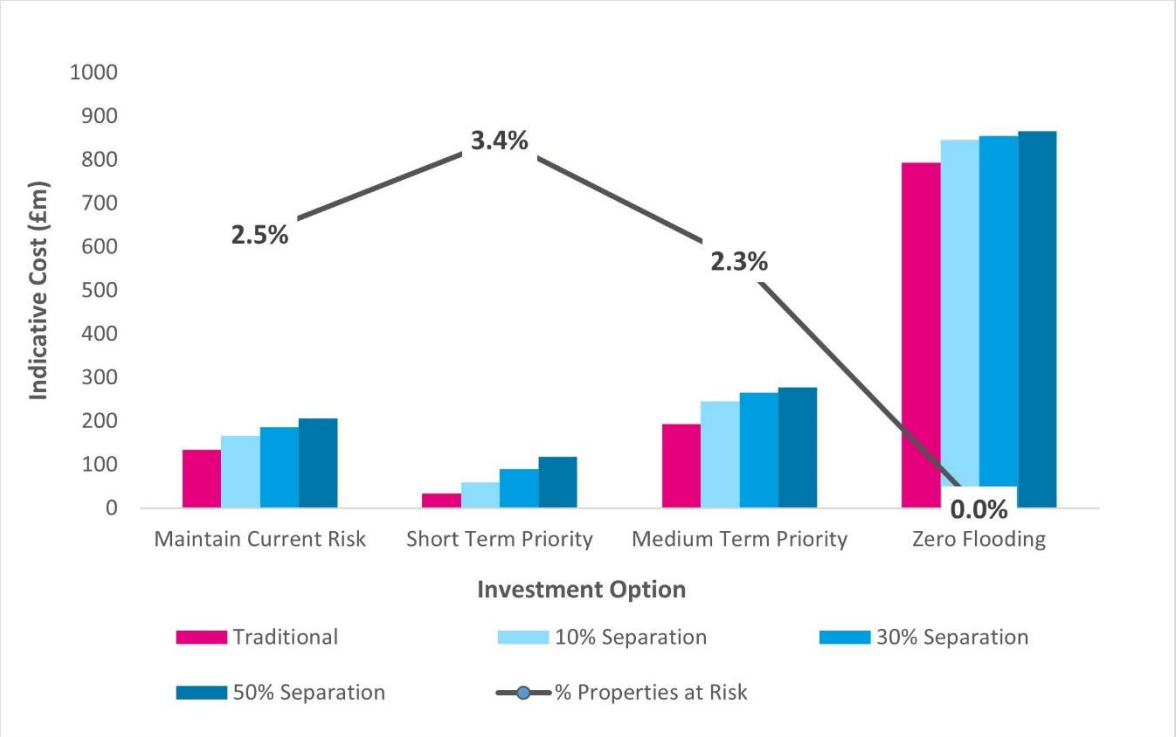

Figure 7. *Graph indicating costs vs risk options for Traditional vs 10%/30%/50% Separation scenarios.*

Storm Overflows

All our Storm Overflows are subject to permits issued by the Environment Agency which specify the standard which must be met before diluted effluent can be discharged into the environment during rainfall periods to help protect properties from flooding. We have assessed the performance of our storm overflows in line with the Common Planning Objective (CPO) which used the same scoring methodology as set out in the 2017 Capacity Assessment Framework (CAF). Using actual rainfall records over a recent 10-year period we have used our hydraulic sewer models to inform likely performance of our storm overflows in a 'typical year'. Note that these results will differ from reportable Event Duration Monitoring (EDM) as such spills are based on actual rainfall which fell across a catchment during a calendar year. Hence a wetter than average year is likely to be reflected in higher EDM spills, with lower spills in drier years. In line with the CPO/CAF, the intention of using typical year annual rainfall and best available hydraulic sewer modelling (developed in line with industry standard best practice) is to provide an indication of which catchments would benefit from more detailed investigations to confirm performance.

The findings of the assessment are summarised in Table 7. for the Avon SPA: within this table where we have outlined as 'No Overflows' this identifies that this planning objective is not relevant to the catchment, whereas 'Not Applicable' indicates that the catchment did not trigger more detailed BRAVA assessment.

Table 7. Results of the storm overflow risk assessment for the Avon SPA catchments.

Ref	Catchment Name	Population	2020	2025	2030	2035	2050
10451	FINHAM (COVENTRY)	477,671	0	0	0	0	0
10354	WARWICK (LONGBRIDGE)	108,466	1	1	1	1	1
10429	RUGBY NEWBOLD	105,347	0	0	0	0	0
10168	REDDITCH (SPERNAL)	80,096	0	0	0	0	0
10348	STRATFORD (MILCOTE)	38,497	0	0	0	0	0
10313	TEWKESBURY	29,374	0	0	0	1	2
10035	EVESHAM	28,826	1	1	1	1	1
10308	BROCKHAMPTON	17,017	2	2	2	2	2
10027	BLACKMINSTER	16,231	0	0	0	0	0
10434	ITCHEN BANK (SOUTHAM)	14,883	1	1	1	1	1
10163	PRIEST BRIDGE	13,871	0	0	0	0	0
10040	PERSHORE	11,489	0	0	0	0	0
11232	LUTTERWORTH	11,320	2	2	2	2	2
10152	ALVECHURCH	10,023	0	0	0	0	0
10454	BEDWORTH (MARSTON LANE)	9,932	0	0	0	0	0
10151	ALCESTER	8,750	1	1	1	1	0
10154	BIDFORD-ON-AVON	7,994	0	0	0	0	0
10332	SHIPSTON FELL MILL	7,154	0	0	0	0	0
10355	WELLESBOURNE	6,875	2	2	2	2	2
10433	WOLSTON	5,887	0	0	0	0	0
10305	WINCHCOMBE	5,040	1	1	1	1	0
10051	HONEYBOURNE	4,867	0	0	0	0	0
10287	BROADWAY	3,822	0	0	0	0	1
10028	BREDON	3,641	0	0	0	0	0
10378	WOOTTON WAWEN	3,580	0	0	0	0	0
10030	CROPTHORNE HEATH	2,742	0	0	0	0	0
10148	ASTWOOD BANK	2,708	0	0	0	0	0
10402	DUNCHURCH	2,548	0	0	0	0	0
10404	KILSBY	2,429	0	0	0	0	0
10161	HARVINGTON WORKS	2,408	0	0	0	0	0
10403	FRANKTON	2,324	0	0	0	0	0
10430	KINETON-STW	2,314	0	0	0	0	0
10330	CHIPPING CAMPDEN	2,284	0	0	0	0	0
10329	BLOCKLEY	1,913	0	0	0	0	0
10353	ROWINGTON	1,831	2	2	2	2	2
10401	BRAUNSTON	1,783	0	0	0	0	0
11229	KIMCOTE	1,739	2	2	2	2	2
10166	INKBERROW	1,716	0	0	0	0	0
10044	TWYNING	1,513	2	2	2	2	2
11248	SOUTH KILWORTH	1,389	2	2	2	2	2
10350	CHERINGTON	1,321	0	0	0	0	0
10282	ALDERTON	1,211	2	2	2	2	2
10306	WOOLSTONE	1,123	2	2	2	2	2
10033	ECKINGTON	1,122	0	0	0	0	0
10278	STOKE ORCHARD	1,122	0	0	0	0	0
10398	WELFORD	1,116	0	0	0	0	0
10466	MONKS KIRBY	1,100	2	2	2	2	2
10405	BRINKLOW	1,058	0	0	0	0	0
10326	SNITTERFIELD	1,049	0	0	0	0	0
10345	TYSOE	1,006	0	0	0	0	0
10321	ETTINGTON	986	0	0	0	0	0
10097	CROWLE (WORCESTER)	985	2	2	2	2	2
10461	CORLEY	966	NA	NA	NA	NA	NA
10176	RIDGEWAY	957	NA	NA	NA	NA	NA
10393	NAPTON WRW	937	2	2	2	2	2
10285	BECKFORD	885	0	0	0	0	0
10351	LEEK WOOTTON	864	NA	NA	NA	NA	NA
10349	CLAVERDON	837	0	0	0	0	0
10022	SEDGEBERROW	828	0	0	0	0	0
10327	SIBFORD FERRIS	825	NA	NA	NA	NA	NA
10425	FENNY COMPTON	797	0	0	0	0	1
10341	LONG COMPTON	776	0	0	0	0	0
10389	LIGHTHORNE HEATH	758	NA	NA	NA	NA	NA
10432	YELVERTOFT	756	0	0	0	0	0
10406	WESTON-UNDER-WETHERLEY	746	0	0	0	0	0
10055	LOWER MOOR	711	0	0	0	0	0
10340	ILMINGTON	711	2	2	2	2	2
10265	ASHTON-U-HILL	708	0	0	0	0	0
10392	NASEBY WRW	690	0	0	0	0	0
10026	BISHAMPTON	686	2	2	2	2	2
10318	BEARLEY	672	0	0	0	0	0

Ref	Catchment Name	Population	2020	2025	2030	2035	2050
10427	BUBBENHALL	591	0	0	0	0	0
11239	SWINFORD	589	2	2	2	2	2
10319	BUTLERS MARSTON	582	NA	NA	NA	NA	NA
10343	NETHERCOTE	560	NA	NA	NA	NA	NA
10324	PRESTON-ON-STOUR	559	NA	NA	NA	NA	NA
10342	NORTON LINDSEY	554	0	0	0	0	0
10396	STAVERTON	488	NA	NA	NA	NA	NA
10039	PEOPLETON	471	0	0	0	0	0
10390	MORETON MORRELL	457	0	0	0	0	0
10385	HARBOROUGH MAGNA	443	0	0	0	0	0
10323	OXHILL	435	NA	NA	NA	NA	NA
10156	CHURCH LENCH	423	0	0	0	0	0
10384	GAYDON	394	NA	NA	NA	NA	NA
10032	DEFFORD VILLAGE	386	0	0	0	0	0
10397	WILLOUGHBY	385	NA	NA	NA	NA	NA
10165	FLYFORD FLAVELL	373	0	0	0	0	0
10387	LILBOURNE	373	0	0	0	0	0
10394	NORTHEND	372	2	2	2	2	2
10344	STRETTON-ON-FOSSE	371	NA	NA	NA	NA	NA
10346	ULLENHALL	366	NA	NA	NA	NA	NA
10388	LIGHTHORNE	353	2	2	2	2	2
10382	CHURCH LAWFORD	340	NA	NA	NA	NA	NA
17618	HANBURY (WORCESTERSHIRE)	326	2	2	2	2	2
10302	TODDINGTON	320	2	2	2	2	2
10280	DUMBLETON	305	NA	NA	NA	NA	NA
10328	TANWORTH-IN-ARDEN	305	0	0	0	0	0
10084	UPTON SNODSBURY	295	0	0	0	0	0
10347	WHICHFORD	292	NA	NA	NA	NA	NA
10046	LITTLE COMBERTON WKS	286	0	0	0	0	0
10325	RADWAY	260	NA	NA	NA	NA	NA
10025	ASTON SOMERVILLE	228	NA	NA	NA	NA	NA
10047	HINTON-ON-THE-GREEN	215	0	0	0	0	0
10315	STANTON (GLOUCESTERSHIRE)	212	NA	NA	NA	NA	NA
10312	LAVERTON	207	2	2	2	2	2
10052	LOWER STRENSHAM	207	0	0	0	0	0
10383	CHURCHOVER	204	0	0	0	0	0
10317	ASTON MAGNA	203	NA	NA	NA	NA	NA
14761	BIRLINGHAM	203	NA	NA	NA	NA	NA
10023	STOULTON (HAW BRIDGE)	184	NA	NA	NA	NA	NA
15134	FLECKNOE	179	NA	NA	NA	NA	NA
10386	KNIGHTCOTE	179	NA	NA	NA	NA	NA
10167	KINGTON	172	NA	NA	NA	NA	NA
10068	BROUGHTON HACKET	158	NA	NA	NA	NA	NA
10335	COMBROOK	158	NA	NA	NA	NA	NA
10424	LAWFORD HEATH	158	NA	NA	NA	NA	NA
10391	MORETON PADDOX	158	0	0	0	0	0
10395	PRIORS HARDWICK	154	NA	NA	NA	NA	NA
10380	ASHORNE	146	NA	NA	NA	NA	NA
10174	ROUS LENCH	135	NA	NA	NA	NA	NA
11235	SHAWELL	125	2	2	2	2	2
17926	SALE GREEN	123	NA	NA	NA	NA	NA
10314	WORMINGTON	110	NA	NA	NA	NA	NA
10428	BRETFORD	101	NA	NA	NA	NA	NA
10045	WADBOROUGH	101	NA	NA	NA	NA	NA
10043	THROCKMORTON	100	NA	NA	NA	NA	NA
10150	ABBOTTS MORTON	94	NA	NA	NA	NA	NA
10149	DUNNINGTON	91	NA	NA	NA	NA	NA
10400	WORMLEIGHTON	89	NA	NA	NA	NA	NA
10338	ADMINGTON	88	NA	NA	NA	NA	NA
10088	WHITTINGTON (NEAR MOTORWAY)	88	NA	NA	NA	NA	NA
18128	EARLS COMMON	87	NA	NA	NA	NA	NA
10381	BASCOTE	81	NA	NA	NA	NA	NA
10083	SNEACHILL	81	NA	NA	NA	NA	NA
10024	TILESFORD PARK	76	NA	NA	NA	NA	NA
10426	LOWER SHUCKBURGH	65	NA	NA	NA	NA	NA
10320	DORSINGTON	62	NA	NA	NA	NA	NA
10269	GREAT WASHBOURNE	62	NA	NA	NA	NA	NA
10020	NAUNTON BEAUCHAMP	61	NA	NA	NA	NA	NA
10322	OLD MILVERTON	58	NA	NA	NA	NA	NA
10056	DEFFORD LODGE HILL	44	NA	NA	NA	NA	NA
17817	WHITTINGTON EAST	42	NA	NA	NA	NA	NA
10399	WINWICK	36	NA	NA	NA	NA	NA
10423	CHURCHOVER (COTON ROAD)	35	NA	NA	NA	NA	NA
10059	PEBWORTH MIDDLESEX	33	NA	NA	NA	NA	NA
10042	STOULTON (WINDMILL LANE)	32	NA	NA	NA	NA	NA

Ref	Catchment Name	Population	2020	2025	2030	2035	2050
18009	TEWKESBURY (LINCOLN GREEN LANE)	21	NA	NA	NA	NA	NA
18005	LOWER STRENSHAM (BAUGHTON LN)	17	NA	NA	NA	NA	NA
14491	STRENSHAM INTAKE	17	NA	NA	NA	NA	NA
18649	TARDEBIGGE	5	NA	NA	NA	NA	NA
11237	SNOWDON LODGE	5	NA	NA	NA	NA	NA
11222	GLEBE FARM	4	NA	NA	NA	NA	NA
17811	BROCKHILL	2	NA	NA	NA	NA	NA
11223	GRANGE FARM	2	NA	NA	NA	NA	NA

Figure 8 gives an indication of the levels of investment likely to be needed to reduce spill counts to different levels during an average typical year. For our Draft DWMP, these costs are based on spill count using the same EA 12/24 block spill counting methodology used for EDM spill reporting (the '12/24' spill count is explained in CIWEM Urban Drainage Group Good Practice Guide [1]), however this does not consider the potential to cause environmental harm. Further assessment will be undertaken ahead of the Final DWMP submission once government policy on future expectation of storm overflow performance is published in Autumn 2022.

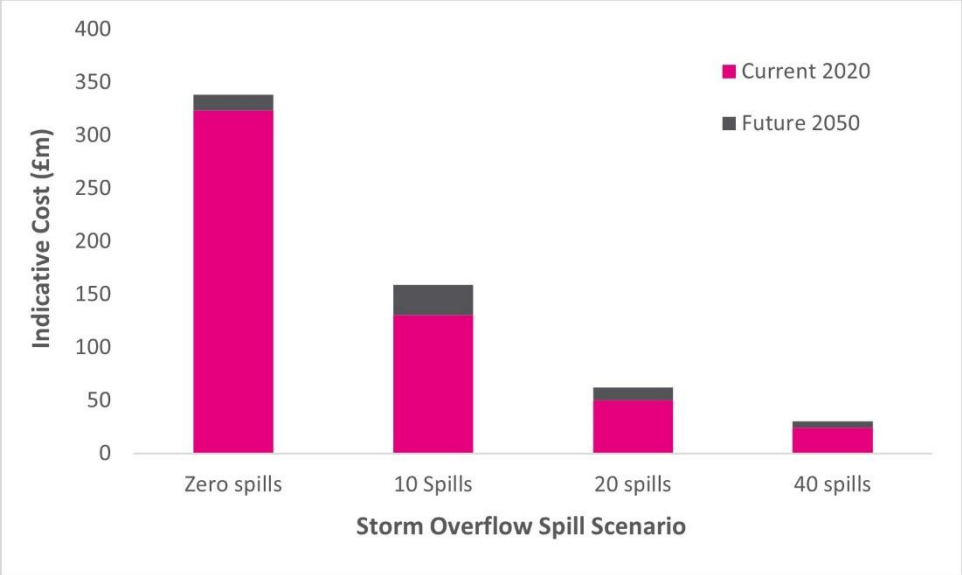

Figure 8. *Indicative investment needs to reduce storm overflow spill counts to different levels during an average typical year.*

Wastewater Treatment Works

All our Wastewater Treatment Works (WwTW) are subject to permits issued by the Environment Agency which specify the standard which must be met before treated effluent can be discharged into the environment. These standards consider the ability of the receiving waterbody to accommodate treated effluent and considers dilution and current water quality status. We are passionate about meeting our legal duty under Section 94 of the Water Industry Act in maintaining 100% permit compliance.

Many of our WwTW do not have large amounts of spare headroom built into their design just in case there is significant new development allocated within its catchment. Whilst we take account of foreseeable growth set out in local development plans when we upgrade our WwTW, we try to avoid building oversized, potentially expensive assets with underutilised capacity which can be inefficient and costly to operate. As a result, many WwTW could struggle to accommodate future pressures from climate change, growth, and urban creep by 2050 and still maintain permit compliance without investment.

[1] https://www.ciwem.org/assets/uploads/CIWEM_UDG_EDM_Good_Practice_Guide_2021_final.pdf

The method we have used to assess WwTW compliance can be found in the WwTW Capacity Technical Summary. As part of our DWMP optioneering we have assessed our treatment against four criteria (summarised in Table 8) to understand future challenges to maintain permit compliance and to inform what intervention options are available.

Table 8. *Summary of the WwTW capacity assessment criteria*

WwTW Assessment Criteria	Explanation
Flow Headroom	Assessment of the Q80 recorded flow (see glossary) compared to current permit. We use this to understand how many new homes could be accommodated before we need to apply for a revised discharge permit.
Process Treatment Headroom	Assessment of how current processes are meeting quality parameters.
Environmental Capacity	Assessment of the limitations of current best available treatment technologies which will constrain what is technical achievable to treat. It accounts for the cost of building, operating and maintaining high-tech processes in perpetuity and considers the impact of energy and chemical hungry processes on climate change. If current treatment processes are close to what is technically achievable to treat this could constrain future interventions and our ability to meet tighter permit standards to maintain environmental standards.
Site Constraints	Assesses the available land footprint available on a site which may limit possibilities to expand the site in the future. This includes physical constraints such as rivers, railways, roads or existing developments.

The results of our assessments for the WwTW within the Avon SPA are shown in Table 9.

Table 9. *Results from the WwTW capacity assessment, these highlights where existing improvement works are planned in the short term for AMP7 (2020-2025)*

Ref	Catchment Name	Population	2020	2025	2030	2035	2050	Subject to AMP7 scheme?
10451	FINHAM (COVENTRY)	477,671	2	2	2	2	2	
10354	WARWICK (LONGBRIDGE)	108,466	2	2	2	2	2	
10429	RUGBY NEWBOLD	105,347	0	0	2	2	2	
10168	REDDITCH (SPERNAL)	80,096	0	2	2	2	2	Yes
10348	STRATFORD (MILCOTE)	38,497	2	2	2	2	2	
10313	TEWKESBURY	29,374	2	2	2	2	2	
10035	EVESHAM	28,826	0	0	2	2	2	
10308	BROCKHAMPTON	17,017	0	2	2	2	2	
10027	BLACKMINSTER	16,231	0	2	2	2	2	Yes
10434	ITCHEN BANK (SOUTHAM)	14,883	0	2	2	2	2	Yes
10163	PRIEST BRIDGE	13,871	0	0	0	0	0	Yes
10040	PERSHORE	11,489	0	2	2	2	2	
11232	LUTTERWORTH	11,320	0	0	0	0	1	
10152	ALVECHURCH	10,023	0	0	0	0	0	Yes
10454	BEDWORTH (MARSTON LANE)	9,932	0	0	0	0	1	
10151	ALCESTER	8,750	0	2	2	2	2	Yes
10154	BIDFORD-ON-AVON	7,994	0	2	2	2	2	
10332	SHIPSTON FELL MILL	7,154	0	0	0	1	1	
10355	WELLESBOURNE	6,875	0	0	2	2	2	Yes
10433	WOLSTON	5,887	0	0	0	0	1	
10305	WINCHCOMBE	5,040	0	0	0	1	1	
10051	HONEYBOURNE	4,867	0	0	0	1	1	Yes
10287	BROADWAY	3,822	0	0	2	2	2	Yes
10028	BREDON	3,641	0	0	0	1	1	
10378	WOOTTON WAWEN	3,580	0	0	0	0	0	
10030	CROPTHORNE HEATH	2,742	2	2	2	2	2	
10148	ASTWOOD BANK	2,708	0	2	2	2	2	Yes
10402	DUNCHURCH	2,548	0	0	0	0	1	
10404	KILSBY	2,429	0	0	0	1	1	
10161	HARVINGTON WORKS	2,408	0	0	0	0	0	
10403	FRANKTON	2,324	0	0	0	0	1	
10430	KINETON-STW	2,314	0	0	0	1	1	Yes
10330	CHIPPING CAMPDEN	2,284	0	0	0	1	1	
10329	BLOCKLEY	1,913	0	0	0	1	1	
10353	ROWINGTON	1,831	0	0	0	0	1	
10401	BRAUNSTON	1,783	0	2	2	2	2	
11229	KIMCOTE	1,739	0	2	2	2	2	

Ref	Catchment Name	Population	2020	2025	2030	2035	2050	Subject to AMP7 scheme?
10166	INKBERROW	1,716	0	0	0	1	1	Yes
10044	TWYNING	1,513	0	2	2	2	2	
11248	SOUTH KILWORTH	1,389	0	0	0	0	1	
10350	CHERINGTON	1,321	2	2	2	2	2	
10282	ALDERTON	1,211	2	2	2	2	2	
10306	WOOLSTONE	1,123	0	0	0	1	1	
10033	ECKINGTON	1,122	0	0	0	1	1	
10278	STOKE ORCHARD	1,122	0	0	0	1	1	
10398	WELFORD	1,116	0	0	0	1	1	
10466	MONKS KIRBY	1,100	0	0	0	0	1	
10405	BRINKLOW	1,058	0	0	2	2	2	
10326	SNITTERFIELD	1,049	0	0	0	1	1	Yes
10345	TYSOE	1,006	0	2	2	2	2	Yes
10321	ETTINGTON	986	0	0	0	0	0	
10097	CROWLE (WORCESTER)	985	0	0	2	2	2	
10461	CORLEY	966	NA	NA	NA	NA	NA	
10176	RIDGEWAY	957	NA	NA	NA	NA	NA	
10393	NAPTON WRW	937	0	2	2	2	2	
10285	BECKFORD	885	2	2	2	2	2	
10351	LEEK WOOTTON	864	0	0	0	0	1	
10349	CLAVERDON	837	0	0	0	1	1	
10022	SEDGEBERROW	828	0	0	0	1	1	
10327	SIBFORD FERRIS	825	NA	NA	NA	NA	NA	
10425	FENNY COMPTON	797	0	0	0	1	1	
10341	LONG COMPTON	776	0	2	2	2	2	Yes
10389	LIGHTHORNE HEATH	758	0	0	0	1	1	Yes
10432	YELVERTOFT	756	0	0	0	1	1	
10406	WESTON-UNDER-WETHERLEY	746	0	0	0	0	1	
10055	LOWER MOOR	711	2	2	2	2	2	
10340	ILMINGTON	711	0	0	0	1	1	
10265	ASHTON-U-HILL	708	2	2	2	2	2	
10392	NASEBY WRW	690	0	0	0	1	1	
10026	BISHAMPTON	686	0	0	0	1	1	Yes
10318	BEARLEY	672	0	0	0	1	1	
10427	BUBBENHALL	591	0	0	0	0	1	
11239	SWINFORD	589	2	2	2	2	2	
10319	BUTLERS MARSTON	582	NA	NA	NA	NA	NA	
10343	NETHERCOTE	560	0	0	0	1	1	Yes
10324	PRESTON-ON-STOUR	559	NA	NA	NA	NA	NA	
10342	NORTON LINDSEY	554	0	0	2	2	2	Yes
10396	STAVERTON	488	NA	NA	NA	NA	NA	
10039	PEOPLETON	471	0	1	1	1	1	
10390	MORETON MORRELL	457	0	0	0	1	1	
10385	HARBOROUGH MAGNA	443	0	0	0	0	1	
10323	OXHILL	435	NA	NA	NA	NA	NA	Yes
10156	CHURCH LENCH	423	0	0	0	1	1	Yes
10384	GAYDON	394	NA	NA	NA	NA	NA	
10032	DEFFORD VILLAGE	386	0	0	0	1	1	
10397	WILLOUGHBY	385	NA	NA	NA	NA	NA	
10165	FLYFORD FLAVELL	373	0	0	0	1	1	
10387	LILBOURNE	373	0	0	0	1	1	
10394	NORTHEND	372	0	0	0	1	1	Yes
10344	STRETTON-ON-FOSSE	371	NA	NA	NA	NA	NA	
10346	ULLENHALL	366	NA	NA	NA	NA	NA	
10388	LIGHTHORNE	353	0	0	0	1	1	Yes
10382	CHURCH LAWFORD	340	0	0	2	2	2	
17618	HANBURY (WORCESTERSHIRE)	326	0	0	0	1	1	
10302	TODDINGTON	320	2	2	2	2	2	
10280	DUMBLETON	305	NA	NA	NA	NA	NA	
10328	TANWORTH-IN-ARDEN	305	0	2	2	2	2	
10084	UPTON SNODSBURY	295	0	0	0	1	1	
10347	WHICHFORD	292	NA	NA	NA	NA	NA	
10046	LITTLE COMBERTON WKS	286	0	0	0	1	1	
10325	RADWAY	260	NA	NA	NA	NA	NA	
10025	ASTON SOMERVILLE	228	NA	NA	NA	NA	NA	
10047	HINTON-ON-THE-GREEN	215	0	0	0	1	1	
10315	STANTON (GLOUCESTERSHIRE)	212	NA	NA	NA	NA	NA	
10312	LAVERTON	207	0	0	0	1	1	
10052	LOWER STRENSHAM	207	0	1	1	1	1	
10383	CHURCHOVER	204	0	0	0	0	1	
10317	ASTON MAGNA	203	NA	NA	NA	NA	NA	
14761	BIRLINGHAM	203	NA	NA	NA	NA	NA	
10023	STOULTON (HAW BRIDGE)	184	NA	NA	NA	NA	NA	

Ref	Catchment Name	Population	2020	2025	2030	2035	2050	Subject to AMP7 scheme?
15134	FLECKNOE	179	NA	NA	NA	NA	NA	
10386	KNIGHTCOTE	179	NA	NA	NA	NA	NA	
10167	KINGTON	172	0	2	2	2	2	
10068	BROUGHTON HACKET	158	NA	NA	NA	NA	NA	
10335	COMBROOK	158	NA	NA	NA	NA	NA	
10424	LAWFORD HEATH	158	NA	NA	NA	NA	NA	
10391	MORETON PADDOX	158	0	1	1	1	1	
10395	PRIORS HARDWICK	154	NA	NA	NA	NA	NA	
10380	ASHORNE	146	NA	NA	NA	NA	NA	
10174	ROUS LENCH	135	NA	NA	NA	NA	NA	
11235	SHAWELL	125	0	0	0	0	1	
17926	SALE GREEN	123	NA	NA	NA	NA	NA	
10314	WORMINGTON	110	NA	NA	NA	NA	NA	
10428	BRETFORD	101	NA	NA	NA	NA	NA	
10045	WADBOROUGH	101	0	0	0	0	0	
10043	THROCKMORTON	100	0	0	0	0	0	
10150	ABBOTTS MORTON	94	NA	NA	NA	NA	NA	
10149	DUNNINGTON	91	NA	NA	NA	NA	NA	
10400	WORMLEIGHTON	89	NA	NA	NA	NA	NA	
10338	ADMINGTON	88	NA	NA	NA	NA	NA	
10088	WHITTINGTON (NEAR MOTORWAY)	88	NA	NA	NA	NA	NA	
18128	EARLS COMMON	87	NA	NA	NA	NA	NA	
10381	BASCOTE	81	NA	NA	NA	NA	NA	
10083	SNEACHILL	81	NA	NA	NA	NA	NA	
10024	TILESFORD PARK	76	NA	NA	NA	NA	NA	
10426	LOWER SHUCKBURGH	65	NA	NA	NA	NA	NA	
10320	DORSINGTON	62	NA	NA	NA	NA	NA	
10269	GREAT WASHBOURNE	62	NA	NA	NA	NA	NA	
10020	NAUNTON BEAUCHAMP	61	NA	NA	NA	NA	NA	
10322	OLD MILVERTON	58	NA	NA	NA	NA	NA	
10056	DEFFORD LODGE HILL	44	NA	NA	NA	NA	NA	
17817	WHITTINGTON EAST	42	NA	NA	NA	NA	NA	
10399	WINWICK	36	NA	NA	NA	NA	NA	
10423	CHURCHOVER (COTON ROAD)	35	NA	NA	NA	NA	NA	
10059	PEBWORTH MIDDLESEX	33	NA	NA	NA	NA	NA	
10042	STOULTON (WINDMILL LANE)	32	NA	NA	NA	NA	NA	
18009	TEWKESBURY (LINCOLN GREEN LANE)	21	NA	NA	NA	NA	NA	
18005	LOWER STRENSHAM (BAUGHTON LN)	17	NA	NA	NA	NA	NA	
14491	STRENSHAM INTAKE	17	NA	NA	NA	NA	NA	
18649	TARDEBIGGE	5	NA	NA	NA	NA	NA	
11237	SNOWDON LODGE	5	NA	NA	NA	NA	NA	
11222	GLEBE FARM	4	NA	NA	NA	NA	NA	
17811	BROCKHILL	2	NA	NA	NA	NA	NA	
11223	GRANGE FARM	2	NA	NA	NA	NA	NA	

When it comes to intervention options, future interventions at WwTW are more complex due to a varied mix of different investment drivers that need to be considered. Investment needs at WwTW are driven by multiple drivers, namely capital maintenance (to deal with life expired assets), growth (to increase process capacity to accommodate new development) and effluent quality improvements where the Environment Agency request changes to permit requirements as set out in the Water Industry National Environmental Programme (WINEP). Due to the complex nature of WwTW processes, it is rare that investment deals with a single driver.

For our Draft DWMP, it is not possible to isolate capacity related investment needs on their own, as this is linked with ongoing discussions regarding the WINEP, and alignment to capital investment needs for PR24.

Summary of Programme Outputs

From the DWMP assessments this indicates the following needs for catchments within the Avon SPA:

First 5 years we will

- We will continue with our river pledge and ensure that we do not cause any RNAGS within our drainage area (overflow and treatment works)
- We will focus on the Defra priority areas (Sites of Special Scientific Interest (SSSI) and Special Areas of Conservation (SAC)) for removal of local ecological impact from our assets (overflows and treatment works)

- Ensure we have no high priority (band 2) catchments in regard to overflows by reducing spill frequency in these catchments by implementing a pragmatic balance of blue / green and grey engineering solutions.
- For all overflows invested in we will ensure that they have appropriate screening controls in place to reduce aesthetic impact on the watercourses
- We will start to implement interventions in our high priority (band 2) catchments in regard to flooding by implementing a pragmatic balance of blue / green and grey engineering solutions with our aim being to complete this work by 2035.
- Ensure there is no deterioration in our catchments in regard to overflows, flooding and treatment works
- We will continue with investigations in river quality including standard ecological, aesthetic and water quality chemical monitoring following the industry standards and incorporating new guidance from DEFRA, OFWAT and the EA. Where any issues are found, pragmatic operational remediation will be implemented with more complex interventions planned and actioned in the next 5 year programme period.

Over the next 5 to 10 years

- We will focus on the Defra priority areas (Eutrophic sensitive areas) for removal of local ecological impact from our assets (overflows and treatment works)
- Ensure we have no medium term priority (band 1) catchments in regard to overflow by reducing spill frequency in these catchments by implementing a pragmatic balance of blue / green and grey engineering solutions.
- For all overflows invested in we will ensure that they have appropriate screening controls in place to reduce aesthetic impact on the watercourses
- Ensure we will continue to reduce flood risk in our catchments by focusing on the medium term priority (band 1) catchments in regard to flooding by implementing a pragmatic balance of blue / green and grey engineering solutions.
- Ensure there is no deterioration in our catchments in regard to overflows, flooding and treatment works
- We will continue with investigations in river quality including standard ecological, aesthetic and water quality chemical monitoring following the industry standards and incorporating new guidance from DEFRA, OFWAT and the EA. Where any issues are found, pragmatic operational remediation will be implemented with more complex interventions planned and actioned in the next 5 year programme period.

Over the next 10 to 25 years

- Ensure we have no overflow spilling more than 10 times per average year by reducing spill frequency in these catchments by implementing a pragmatic balance of blue / green and grey engineering solutions.
- For all overflows in our system, we will ensure that they have appropriate screening controls in place to reduce aesthetic impact on the watercourses
- Ensure we will continue to reduce flood risk in our catchments by focusing on the medium and long term priority (band 1 and 0) catchments in regard to flooding by implementing a pragmatic balance of blue / green and grey engineering solutions.
- Ensure there is no deterioration in our catchments in regard to overflows, flooding and treatment works
- We will continue with investigations in river quality including standard ecological, aesthetic and water quality chemical monitoring following the industry standards and incorporating new guidance from DEFRA, OFWAT and the EA. Where any issues are found, pragmatic operational remediation will be implemented with more complex interventions planned and actioned in the next 5 year programme period.

What's next?

From our analysis undertaken so far, this has helped us better understand the performance of those catchments within this SPA which have proceeded through DWMP. This allows us to understand the expected long term investment needs across our catchments and this is already being used to support and inform the development of our PR24 Business Plan. The PR24 investment period covers 2025 to 2030 and so will help deliver the first five years of our first 25 year DWMP.

As the scope of DWMP is intended to inform the most appropriate high level direction for a catchment, we are not able to give more details as to what specific schemes are likely to be built. This level of detail will follow as part of our PR24 delivery, as we need to complete detailed scheme specific feasibility investigations to decide what actual schemes will look like. However, the schemes we build will be aligned to our long term DWMP strategies, with delivery optimised to ensure schemes are commissioned when required, and where necessary phased to manage any uncertainties.

Between now and the publication of our Final DWMP by 31st March 2023, we will be carrying out further evaluation on the more immediate intervention needs identified in our Draft DWMP and so we would welcome any comments in relation to this catchment, or our wider Draft DWMP content.