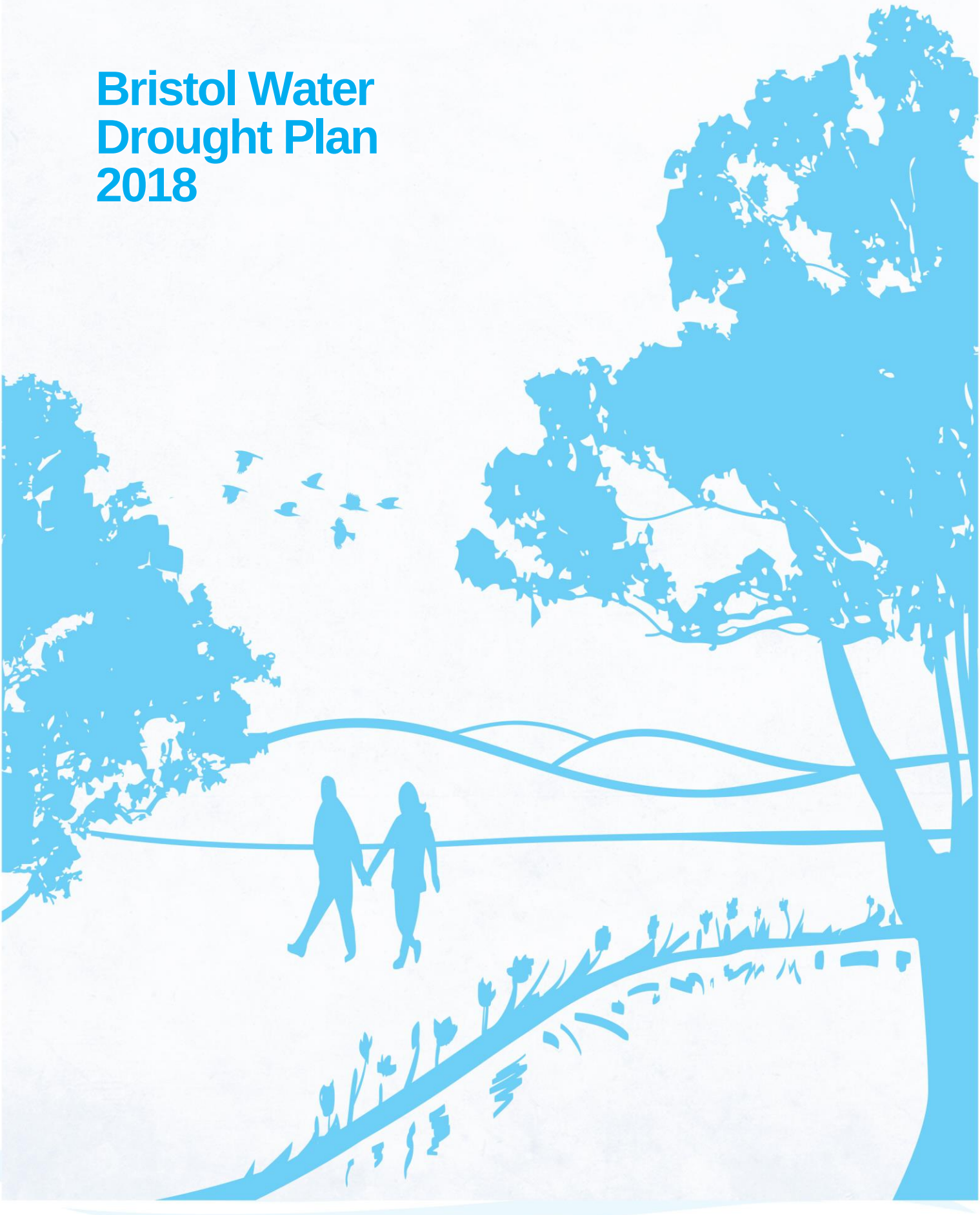
BRISTOL WATER

June 2018

Bristol Water Drought Plan 2018



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Executive Summary

This Drought Plan explains Bristol Water's operational approach to the management of water resources during periods of drought. It has been produced in consultation with a wide range of external stakeholders and is not a strategic document, but outlines the framework that Bristol Water would use for managing a drought if it were to occur under present circumstances and with existing infrastructure. The Plan includes information on the following:

- How Bristol Water defines a drought - the thresholds the company will use to define whether a drought has begun, the severity of the drought event, and when the drought can be considered to have ended
- The operational management structure to be used during drought events
- Measures the company will take to manage demand for water during a drought
- Temporary measures the company may take to obtain additional water supplies and the environmental investigations associated with these options
- Stakeholder communication and consultation the company will undertake during a drought, including working with neighbouring water companies
- How we will learn from any drought events

Our response to drought set out in this drought plan reflects operation under our current company levels of service as set out below:

Bristol Water Level of Service

Drought Action	Level of service
Temporary use ban (TUBs)	1 in 15 years on average
Drought Order – Non-essential use ban	1 in 33 years on average
Emergency Drought Order - Partial supply or rota-cuts	1 in 100 years

The Plan is designed to meet the needs of customers and to protect the environment. It follows a range of guidance and legislation, including the Environment Agency's Drought Plan Guidance (2015) and the requirements of the Water Industry Act 1991 (as amended by the Water Act 2003). The Plan is consistent with the company levels of service set out in Bristol Water's Water Resources Management Plan (2014) (WRMP14), a strategic plan which sets out the company's 25-year strategy for the management of water resources. The WRMP is updated every five years and is currently being updated; a draft of the WRMP will be available for public consultation during 2018, with final publication planned for 2019.

About Bristol Water

Bristol Water provides drinking water supply to a population of over 1.18 million people across an area of approximately 2500 square kilometres, centred on Bristol and extending from Glastonbury to Tetbury. The company normally provides between one quarter and one third of a billion litres of drinking water each day, with some minor non-potable water use by business customers.

Most of the water supplied by the company comes from surface water sources, with a fairly small proportion (about 15%) coming from underground sources such as wells, springs and boreholes. The company operates four major reservoirs - Chew Valley Lake, Blagdon Lake, Cheddar and Barrow, with additional direct surface water abstraction from rivers and canals. Reservoir and river sources each supply between 35% and 50% of the company's total water supply.

Reservoir storage is used in order to ensure that sufficient water is available during the drier summer months and peak demand periods, so a dry winter period that inhibits reservoir refill can lead to an increased vulnerability to drought.

Resilience to drought

Bristol Water has worked for many years to create a water supply system that is resilient to drought, water pollution and other operational issues. Works undertaken include reinforcement and interconnection within the company's potable mains network, flood protection, and improved water treatment systems.

Detailed technical modelling of a broad range of drought types has now identified that the company is resilient under current operation and water demand to all the droughts that have occurred during the historic record retained by the company. This includes the severe drought of 1933/1934 and our technical modelling has shown that the company is also resilient to a very severe summer drought if its reservoirs have refilled during the winter period. We have however identified that the company is less resilient to some specific drought types that have not occurred during the historic record, specifically where a long-duration drought occurs or if there is a very severe drought that begins in early winter. If the company is unable to mitigate the impact of drought as set out in this report, it would as a last resort need to seek emergency drought orders to operate area rota cuts to supply. At current levels of water demand, it is anticipated that the need for this measure would occur not more than once in one hundred years.

This Plan provides information on the measures that can be taken to manage drought at present, using all existing resources available to Bristol Water. WRMP19 considers whether our current system and measures will be resilient in the longer term and, if they would not be sufficient in the long-term the additional measures that we would take.

Changes and improvements since the last Drought Plan

Following the 2010-12 dry period, Bristol Water has re-evaluated its drought management options. Improvements since the 2012 plan include a new management and communications strategy, with use of social media; consideration of the impact of River Severn drought orders imposed by EA; an appraisal of how Bristol Water's supply system would perform against worse droughts than those which appear in the historic record; and the inclusion of a broader range of options for additional sources of supply. More information has also been included on the drought indicators that the company will use to define a drought.

The key change since the 2012 Drought Plan is the inclusion of an option for the use of drought permits to reduce the releases of water we are required to make from our reservoirs at Chew, Blagdon and Cheddar, into the downstream rivers (referred to as compensation releases). This Plan includes a preliminary environmental assessment of the impacts of this compensation reduction.

How Bristol Water defines a drought

Resource availability is monitored continuously by Bristol Water and a large data set is available that provides the company with good insight into the trends in available water. Factors considered in resource management include rainfall, reservoir storage volumes, groundwater levels, river flows and customer demand for water.

The most significant of the factors considered in drought management is the availability of stored water, where reservoir storage curves are used as the primary criteria against which drought management is planned. Because Bristol Water's supply system is highly interconnected, the reservoirs used by the company are considered for the purposes of drought planning as a single storage system with a capacity of 38,515 million litres; and reservoir levels are managed accordingly with control curves that vary seasonally, ranging from a "normal operation" approach where ample water is available and the primary operational driver is cost optimisation, to "severe drought" where emergency drought orders may be required.

Summary of the actions Bristol Water will take in a drought

A full breakdown of the actions the company will take in order to manage a drought event is included in this Plan.

These actions will begin in all drought circumstances with an increased management focus on water resources, and then as a drought progresses this will extend to actions taken to reduce demand. These actions will range from public communication and engagement events, water efficiency programmes and education; to temporary use bans on garden watering, or more stringent restrictions in the event of severe drought. Actions to increase available supply will range from temporary variations to bulk supply arrangements, to reduction in compensation flows from reservoirs.

The actions involved in drought management are highly detailed and technical and further detail can be found in the main body of this report.

Contents

1 Introduction

1.1 Overview

This report is Bristol Water's draft Drought Plan, which has been prepared as per the Environment Agency's Drought Plan Guidance (2015). Water companies were first required to submit statutory drought plans in 2006. However, Bristol Water has been producing them since 2000, and this drought plan builds upon our previous drought plans.

The Drought Plan is an operational plan identifying how we intend to manage a future drought, what trigger levels can be used to identify when action is required, and what measures are available to support supplies when levels of service are compromised. The Drought Plan sets out how the effects of a drought and associated drought actions will be communicated to our customers, and also takes account of the need to undertake environmental monitoring at any sites which could potentially be affected by implementation of our drought actions.

1.1.1 Changes and improvements since the last plan

Several changes and improvements have been made to our drought plan since its last update in 2012. These changes have been made to reflect the latest Defra and Environment Agency drought planning guidance (July 2015), and to take account of the lessons learned by the water industry from the drought that occurred between April 2010 and March 2012. In addition, there have been a number of national research projects on drought and water resources (Environment Agency, December 2015; and Water UK, September 2016) which we have taken account of in updating our plan.

Changes made to the Drought Plan include:

- Reviewing our assumptions in light of the 2010-12 drought experience
- Updating our management and communications strategy to reflect recent organisational changes, and any changes within external organisations that we liaise with during a drought situation
- Updating the methods used to communicate with customers, to reflect the use of social media for instant messaging
- Reflecting changes made to the Environment Agency's River Severn Drought Order proposals relevant to our source from the Gloucester & Sharpness canal
- Using the tools and techniques developed through national research projects, to understand the risk drought presents to Bristol Water and our customers. This includes testing our drought plan against droughts worse than those experienced in our historic record to better understand the resilience of our water supply system
- Providing more information on the use of drought indicators and triggers
- Reviewing and updating the drought options available to reflect changes to our understanding of the water available, and likely environmental effects of such options

1.1.2 Regulatory Framework

Water undertakers in England and Wales are required to prepare and maintain Drought Plans under Section 39B and 39C of the Water Industry Act 1991, as amended by the Water Act 2003. When producing this drought plan, reference has been made to the following guidance and legislation;

- How to write and publish a drought plan (Defra & Environment Agency, 2015)
- Water Industry Act 1991
- Water Act 2003 where s.63 inserts new sections 39B & 39C into the Water Industry Act 1991 and s.62 inserts new sections 37B-D into the Water Industry Act 1991
- Water Act 2014 where s. 28(4) inserts an amendment to s. 39B into the Water Industry Act 1991, and s. 28(5) inserts a new section 39D into the Water Industry Act 1991
- The Drought Plan (England) Direction 2016
- The Drought Plan Regulations 2005
- The Drought Direction 2011
- Flood and Water Management Act 2010 where s. 36 amends the Water Industry Act 1991 by substituting a new s.76
- Water Use (Temporary Bans) Order 2010
- Environmental Assessment of Plans and Programmes Regulations 2004
- Conservation of Habitats and Species Regulations 2010
- Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act 2000, Section 28G

This drought plan is consistent with the assumptions and company levels of service set out in our Water Resources Management Plan (2014) (WRMP14). The WRMP14 is a strategic plan which sets out our 25-year strategy for ensuring that we have enough water resources to meet forecast demand, identifying any requirements for additional supply demand solutions should there be a risk of demand exceeding our supply capability over the planning period. The WRMP is updated every 5 years. We are currently working on the next update of our WRMP, which will be available for public consultation during 2018, with final publication before June 2019. If there are material changes to our assumptions and company levels of service as a result of the WRMP update, we will review and update our drought plan to reflect this.

1.1.3 Consultation Process

Pre-consultation & preliminary discussions

Defra and Environment Agency Guidance (July 2015) sets out the requirements for carrying out preliminary discussions and public consultation on the draft drought plan.

Bristol Water recognises the value of early communication with the many stakeholders potentially affected by and involved in the drought management process. We therefore carried out a pre-consultation process and preliminary discussions with both statutory consultees and other interested parties.

Who we consulted:

We consulted a range of stakeholders as part of the pre-consultation process before preparing the draft drought plan, including statutory consultees, non-statutory consultees that may have an interest in the drought plan and/or could be affected by actions within the plan, and neighbouring water companies.

The following organisations and companies were contacted in August 2016, setting out what the focus of our draft drought plan update will be and requesting any recommendations or considerations that they would like us to take into account in the review process:

- Defra
- Environment Agency
- Ofwat
- DWI
- Natural England
- Severn Trent Water
- South West Water
- Wessex Water
- Consumer Council for Water
- Bristol Water Challenge Panel (BWCP)
- Avon Wildlife Trust
- Canal & River Trust
- Horticultural Trades Association

During the pre-consultation period, we also had a preliminary discussions meeting with the Environment Agency on the 8th August 2016, and a drought plan options review workshop with the Environment Agency on 26th September 2016.

Feedback received and how this has influenced our draft Drought Plan:

Responses were received from the Environment Agency, Natural England and the Bristol Water Challenge Panel. Table 1 overleaf summarises the comments received and where we have addressed them in this plan.

Table 1: Comments from organisations responding to our pre-consultation process

Organisation	Summary of comments	Comments addressed in section
Environment Agency	• Sequencing of the drought actions proposed • Plan should reflect that some abstraction licences have been revoked since 2012 • Communications plan should include effective engagement with customers and stakeholders with a focus on avoiding confusion with activities of neighbouring water companies • Consider the effect the drought plan may have Water Framework Directive (WFD) status or potential • Consider the effects the drought plan may have on River Basin Management Plan objectives • Ensure common understanding between neighbouring water companies and that operational assumptions are reflected in both company drought plans • Consider the potential effects of the River Severn Drought Order on our supply • Include any lessons learned from operational experience since the 2012 drought plan	• Section 3.3 • Section 4.3 and Appendix A • Section 6.2 & section 6.2.7 • Section 5.7 • Section 5.6 • • Section 4.3.1 & section 6.2.7 • Section 3.2.2 • • Section 4.1
Natural England	• Assess vulnerabilities of SSSI interest features to effects of reservoir drawdown (ref: Blagdon Lake) • Any new drought measures should be considered against the appropriate legislative requirements • Consideration of any in-combination effects with other water company plans on the River Severn if this is being proposed as a drought option within the plan	• Section 5.6 • Section 5.6 & section 5.5 • Drought Plan SEA (if relevant)
Bristol Water Challenge Panel	• Ensure we get feedback directly from customers on their willingness to save water during a drought	• Section 1.1.3

Draft drought plan public consultation

The statutory process requires us to publish our draft drought plan for pubic consultation. This process provides customers and stakeholders an opportunity to consider the proposals we have set out in our draft drought plan in terms of our operational response to drought under our current levels of service, and how this may affect our customers, and provide us with any feedback and comments.

We published our draft Drought Plan (along with its Appendices, a draft Strategic Environmental Assessment (SEA), a draft Habitats Regulations Assessment (HRA), and a Non-Technical Summary) for an eight week public consultation period that ran from 27th March to 21st May 2017.

As part of the Draft Drought Plan public consultation process we;

- Published our draft Drought Plan and supporting documents on our website
- Wrote to 58 consultee organisations directly (as well as members of the press, MPs and MEPs) informing them of the consultation and inviting them to respond.
- Implemented an online feedback questionnaire to support the drought plan consultation and encourage direct feedback from customers.
- Included five questions in our regular 'Let Us Know' online panel questionnaire
- Raised awareness of our consultation via Bristol Water's Twitter page; through the Bristol Water Challenge Panel; and by notifying Bristol Water Non-Household Retail Customers

A list of the respondents who made representation on the draft Drought Plan, SEA and HRA is provided on Table 2 below:

Table 2: Representations received on our draft Drought Plan

Name	Stakeholder Group
Environment Agency	Regulator
Natural England	Regulator
Historic England	Regulator
Canal & River Trust	Stakeholder
Horticultural Trades Association	Stakeholder
Drought Plan online feedback questionnaire (28 individual responses)	Customers

The Drought Plan (England) Direction 2016 requires us to publish a statement of response to the representations received as a result of the public consultation within 15 weeks of the publication date of the draft drought plan. We therefore prepared and published our Statement of Response on 7th July 2017. The Statement of Response provides a summary of the responses received, sets out our view on them, and identified where changes have been made to the drought plan. All responses received verbatim, and our responses to these are tabulated and appended to the Statement of Response report for reference.

We value the feedback we have received from our regulators, stakeholders and customers and would like to thank them for their input and contribution to the consultation process.

On 12 April 2018 Defra wrote to us and requested that additional considerations be made in the report but that the recommendation had been made to the Secretary of State that the plan should be published as a final plan if Bristol Water commit to the changes outlined in the letter, which are as follows:

1) Environmental Monitoring:
Commit to a timetable of work to develop environmental monitoring plans to ensure they have a fit-for-purpose drought permit options available for all events planned in the drought plan. The drought permits in drought plan are unlikely to be granted without such information.

2) Bulk supply Agreement:
The operation of a bulk supply with Wessex Water is being negotiated, a commitment should be made in the final plan to update any associated drought actions once the operation of the bulk supply has been agreed with Wessex Water.

We have highlighted clarifications such as those listed above by using yellow fill to show where we have made changes to our draft final plan. We have also made some minor changes such as updating dates and replacing the words ‘draft final’ with the word ‘final’ simply removing them. We have not highlighted the minor changes.

2 Background Information

2.1 Supply area and water resource zone

Bristol Water's supply area covers 2,400 square kilometres (1,000 square miles) and includes a population of over 1.18 million[1] people. Our supply area ranges from Thornbury and Tetbury in the north to Street and Glastonbury in the south, and from Weston-Super-Mare in the west to Frome in the east.

Water resource planning is undertaken at water resource zone (WRZ) level. A WRZ is defined as the largest possible area in which all resources, including external transfers, can be shared and hence the zone is which all customers experience the same risk of supply failure from a resource shortfall. Due to the integrated nature of Bristol Water's sources, we plan on the basis of operating the company area as a single WRZ. This means that all water resources within the company area are capable of being shared within the zone. Bristol Water uses the same WRZ for operational management, water resource planning and drought planning.

Our supply area and the key features of our WRZ are illustrated in the map in Figure 1.

2.2 Baseline water resource situation

Our baseline water resource situation is set out in our Water Resources Management Plan (WRMP) 2014.

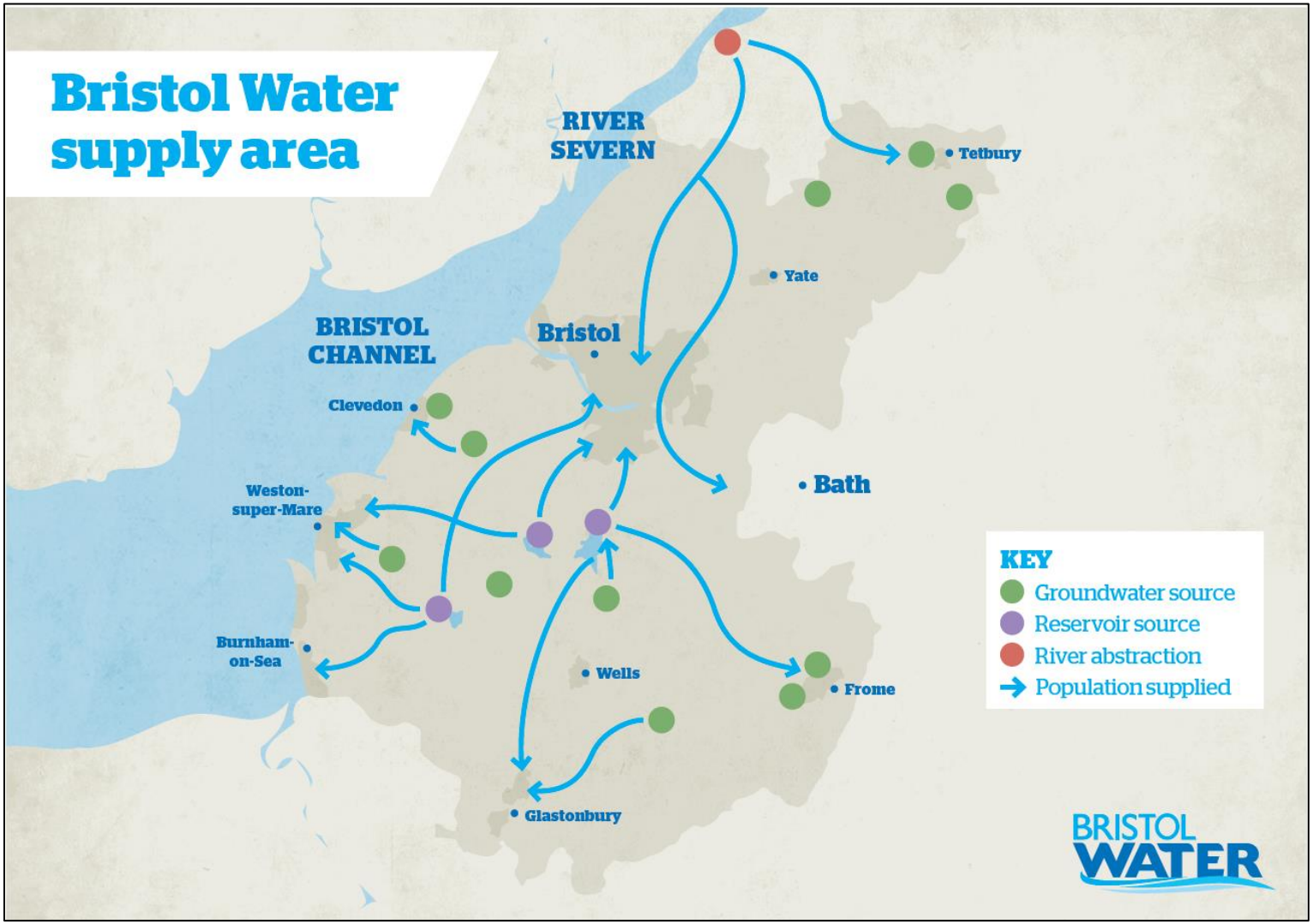
Only around half of the water supplied within the Bristol Water supply area is sourced from within it, with the rest being transferred into the zone from outside the area. This water is sourced from the Gloucester & Sharpness canal to supply our largest northern treatment works. This source accounts for approximately 46% of our licensed resource. The Gloucester & Sharpness canal is owned and operated by the Canal & River Trust and is supplied by the River Severn and other local rivers, the Cam and the Frome. In dry periods, use of this source is maximised to conserve the water stored in our reservoirs.

The intrinsic water resources within the WRZ include our Mendip Reservoirs and associated surface water abstractions, which account for approximately 42% of our available licensed resource.

The remaining water sourced from within the water resource zone is derived from groundwater and accounts for approximately 12% of our available licensed resource. These sources are operated at their optimum output to meet the base-load demand for water.

[1] As reported in the Bristol Water WRMP Annual Review submission (July 2016)

Figure 1: Bristol Water, water resource zone and associated infrastructure



2.3 Levels of service & resilience

2.3.1 Levels of service

Expectations about the frequency with which restrictions are implemented are known as 'levels of service'. We are required by our regulators to both specify and report our levels of service, or frequency at which customers can expect to experience restrictions on water use and what types of restrictions these would be.

During extended period of dry weather, it may be necessary to encourage increased customer water efficiency and to restrict customer demand, to ensure that water supplies are maintained. Initial demand management actions therefore include encouraging customer restraint on water use through media campaigns.

As dry weather continues into drought conditions and the risk to water supply increases, more formal water use restrictions may be required such as temporary use bans (TUBs). In extreme drought conditions, drought orders may be needed to further restrict water use for commercial purposes.

It is not feasible to plan for a level of service that would guarantee there would never be any customer demand restrictions because this would require significant investment in additional water resource assets, which would be used very infrequently, and result in unacceptably high water bills for customers. Our current levels of service are set out in our WRMP 2014 and are set out below in Table 3. These levels of service will be reviewed are part of the update of our next Water Resources Management Plan (WRMP19).

Table 3: Bristol Water levels of service and frequency of restrictions

Drought Action	Level of service
Temporary use ban (TUBs)	1 in 15 years on average
Drought Order – Non-essential use ban	1 in 33 years on average
Emergency Drought Order - Partial supply or rota-cuts	1 in 100 years

2.3.2 Resilience

The Environment Agency updated guidance, *How to write and publish a drought plan* (Defra & Environment Agency, 2015), specifies that water companies should at least plan to be able to provide supplies through a repeat of the historic droughts in their company records, and strongly encourages companies to plan for drought events that are of longer duration and lower rainfall than those in the historic record.

In response to this new guidance, since the publication of our last drought plan we have carried out some detailed work on the development of synthetic droughts for our supply system and testing our system against these (HR Wallingford, July 2016). This work used the same principles as used in the Environment Agency's work on *Understanding the performance of water supply systems during mild to extreme droughts* (Environment Agency, December 2015).

We are resilient to the droughts experienced within our historic record, under our current dry weather demand and within our stated levels of service. This is demonstrated through the scenario assessments documented in section 3.3. The additional analysis carried out using the drought library has further evidenced that our supply system is able to cope with a summer drought, commencing in early springtime (April), of very severe impacts without any adverse water supply impacts as long as the system received at least 80% of the long term average (LTA) winter rainfall during the preceding winter, allowing the system to fully recover. However, as drought duration increases beyond a single year, and beyond anything ever experienced in the historic record, the system is then shown to experience accumulated multi-year drought impacts because it is sensitive to the subsequent winter recovery period. This results in a step change in the system performance, with it operating successfully for droughts with up to 85% LTA rainfall, but performing less adequately during droughts of 80% LTA rainfall and below. In the context of our historic record, this work demonstrates that the performance of our system could have deteriorated quickly if the worst historic droughts had been more severe or continued for longer, particularly during the winter recovery period. It should be noted however, that this analysis is testing our water resource system against something that has never happened, and although it highlights potential vulnerabilities within our system, interpretation of this output requires a clear understanding of the context in which the assessments have been done.

3 Drought indicators, triggers and scenarios

We monitor the water resource situation throughout the year and across our operating area as part of our day to day operations. As well as providing the resource information required to manage our operations, this monitoring also ensures that we are aware of the onset of drought and provides the opportunity for timely action. We monitor the status of water resources in terms of key indicators, such as rainfall, reservoir storage, groundwater levels etc. These indicators not only provide a measure of relative 'dryness' but also the amount of water that is available for supply. This is based upon volumes of water in storage and the state of the river catchments, measured via a network of river gauging stations (mostly owned by the Environment Agency) and rain gauges. A further indicator and consequence of prolonged dry weather is a sustained level of high demand.

Once an indicator trigger level is approached (as outlined in section 3.2) we give consideration to implementing appropriate drought measures (Section 4) once the triggers are breached.

3.1 Resource monitoring and drought indicators

There are a number of indicators that a drought is developing. Drought indicators that historically have been of the greatest value in Bristol Water's WRZ are rainfall, reservoir storage, groundwater levels, river flows, weather forecasts and demand. These are the indicators that are used within this drought plan to identify and measure the onset of drought in our operating area.

The regional water situation is monitored on a daily basis. Reports on the situation are circulated widely within Bristol Water and weekly reports are shared with the Environment Agency. Routine monitoring is also carried out by the Environment Agency, and any relevant data and information shared with Bristol Water. The Environment Agency water situation reports and associated data give an indication of whether an environmental drought is likely and this data is also used to monitor the onset of a water resource drought. The results of the routine monitoring are used to track water resource availability throughout the year, and this position is monitored against specific drought triggers (Section 3.2).

3.1.1 Rainfall

Rainfall is the primary indicator of drought severity, and one of the earliest indicators of the possible onset of drought. It has a direct effect on the other hydrological parameters (river flows, soil moisture deficit and groundwater recharge) and therefore affects the quantities of water available for abstraction.

Rainfall is measured at rain gauges throughout the UK, and is independently recorded by Bristol Water at the following sites:

Table 4: Bristol Water rain gauges

Rain gauge location	Period of record	
	Storage gauge	Tipping bucket gauge
Chew Stoke PS	1984 – 2017	1996 – 2017
Barrow	1960 – 2017	2014 – 2017
Litton	1909 – 2017	2014 – 2017
Pucklechurch	2007 – 2017	n/a
Purton	1996 – 2017	2014 – 2017
Shipton Moyne	1985 – 2017	2014 - 2017
Cheddar	1984 - 2017	n/a

The data is available on Bristol Water's telemetry system and is reported as a daily total. Under normal conditions the data is reviewed on a monthly basis in the context of the long term average rainfall record. In a drought the rainfall will be closely monitored either weekly or daily depending on the severity of the situation.

Monthly rainfall is also provided by the Environment Agency within their 'Monthly Water Situation Reports' for both the Wessex Area and the Midlands Area. The Wessex Area covers the catchments affecting our Mendip Reservoir sources, and the Midlands Area covers the catchments affecting our supply from the River Severn via the Gloucester & Sharpness canal. Monthly rainfall totals are reported and compared to the 1961 to 1990 long term average for each hydrological area.

In addition, the Environment Agency also produces a weekly rainfall and river flow summary on a national level. This covers the whole of England, reporting rainfall for the south-west, and river flows for the Bristol Avon. This information supplements the site specific rainfall data recorded at Bristol Water's rain gauges.

3.1.2 River Flow

The Environment Agency monitors river flows across England via a network of river gauging stations, and reports monthly data in their 'Monthly Water Situation Reports'. As well as monthly mean flow, data is also presented as a percentage of long term average for the reporting month, and given a classification on a scale from Exceptionally Low to Exceptionally High. Reviewing this data enables us to quickly identify if river flows are receding in response to low rainfall and the onset of potential drought conditions.

If the river flows in the Environment Agency monthly report indicate the potential for drought conditions (reporting flows as 'below normal' or 'notably low'), we would put in place more frequent data requests to enable us to closely monitor the conditions within the river catchments we have an interest in. The frequency of the data requests would be agreed with the Environment Agency at the time, and would reflect the needs of the potential drought situation.

Table 5 lists the gauging stations that we use to monitor the response of the river catchments:

Table 5: River gauging stations used by Bristol Water

Gauging station name	Gauging station number	River	Associated Bristol Water source	Period of record
Bewdley	54001	Severn	Gloucester & Sharpness canal at Purton	1921 to present day
Deerhurst	54110	Severn	Gloucester & Sharpness canal at Purton	1995 – present day
Iwood	52017	Congresbury Yeo	Blagdon Reservoir	1973 – present day
Compton Dando	53004	Chew	Chew Valley Lake	1958 – present day
Wookey	52001	Axe	River Axe & Cheddar Reservoir	1958 – present day

3.1.3 Groundwater

Our groundwater sources are all in shallow unconfined aquifers, hydraulically connected to the local rivers. They are therefore quick to respond to rainfall, or lack of it. We monitor the water levels at our groundwater sources via our telemetry network. Levels are monitored every 15 minutes. The location these groundwater sources is indicated on the map in Figure 1.

The Environment Agency provides groundwater levels for a number of indicator sites for the major aquifers. The groundwater levels are ranked in the context of the historic data set for the specific site. These are reported in the Environment Agency's 'Monthly Water Situation Reports'. Reviewing this data enables us to identify if groundwater levels are receding in the wider aquifers in response to low rainfall and the onset of potential drought conditions.

3.1.4 Reservoir Storage

Bristol Water has four major reservoirs, Chew Valley Lake, Blagdon, Cheddar and Barrow, which are supplied from river basins in the Mendip Hills. Reservoir storage information is a critical

element of monitoring the resources in the Bristol Water system and forms the basis of the drought control curves and triggers referred to in Section 3.2.

Reservoir storage in the Bristol Water system is monitored through the telemetry system and reported on a daily basis within the Company. This information is circulated on a weekly basis to the Environment Agency.

Bristol Water's reservoirs are managed by reservoir operating control lines that indicate when storage levels are below normal for the time of year. These are used each year to trigger normal operational changes in order to optimise the use of stored water and to balance reservoir storage. Under normal water resource conditions and reservoir operation, the amount of water in storage in our reservoirs declines during the summer months and recovers again over the winter period.

3.1.5 Weather Forecasts

Weather forecasts provide an indication of the weather conditions likely to be experienced, and can be used to inform decision making on the management of water resources over the short term. We regularly review the weather forecast as part of our normal operations. In the event of the onset of drought conditions the frequency of weather forecast reviews will be increased, with a range of both short and long range weather forecasts being utilised.

3.1.6 Abstraction and demand

During dry weather conditions, customer demand increases. As demand increases, so does the pressure on our water resources. Abstraction and demand can therefore be used to indicate when our resources are being stretched.

In accordance with our abstraction licence conditions, Bristol Water record the volume of water abstracted from each of our sources. In addition we also continuously monitor the demand from our water treatment works and report this data on a daily basis using our telemetry network. During normal operation this information is assessed on a monthly basis and a monthly forecast of the expected water into supply is produced to inform the management of our resources under normal operational conditions. During a drought the frequency of this analysis and forecasting would be increased.

3.2 Drought triggers

Drought management decisions should always be based on sound planning and judgement and it is important to establish when action should be taken during a drought to protect supply to customers. During a drought the water availability and demand will be reviewed on a regular basis. Bristol Water has developed drought triggers to identify when we should consider implementing specific drought actions to reduce demand and, if necessary, obtain additional water supply. These triggers are used as one of the decision making tools to inform the overall drought

management framework in terms of deciding whether to implement drought actions. In a drought situation, professional judgement, drought scenario modelling and available data and information in the form of the drought indicators described in section 3.1, will also be used to inform the drought management decision making process.

Drought triggers have been developed to identify when the water resource situation is moving into a drought. Increasing levels of drought severity have been defined, aligned with the Environment Agency's 'drought stages' set out in their Drought Action Plan (January 2016), to ensure that the drought actions are proportionate to the level of drought risk being experienced. Our drought triggers are based on 6 drought management zones as set out in Table 6.

Table 6: Drought management zones

Zone	EA Drought Stage	**Actions** (see section 4 for further details)	**Associated level of service (if applicable)**
1	Normal	Normal operation	
2	Normal	Normal operation but implement dry weather system management	
3	Developing drought	Drought actions: – appeal for restraint, – enhanced demand management, – reduce bulk supplies to third parties – enhanced leakage management	
4	Drought	Drought actions: – temporary use bans	1 in 15 years on average
5	Drought	Drought actions: – non-essential use bans – supply side drought permits	1 in 33 years on average
6	Severe drought	Emergency drought orders	1 in 100 years

3.2.1 Reservoir triggers

Due to the integrated nature of the Bristol Water system, the combined volume of water stored within our reservoirs informs the management decisions relating to the use of water resources across the water resource zone as a whole. Reservoir triggers have been developed in the form of drought control curves for the combined storage of our 4 major reservoirs; Chew Valley Lake, Blagdon, Cheddar and Barrow. These define the drought zones within which specific drought actions may be implemented. The combined reservoir control curves are indicated in Figure 2. The shape of the curves reflects the expected drawdown of the reservoirs during the drier summer months when natural inflow into the reservoirs is less than the volume being abstracted to meet customer demand. Refill commences in the autumn when natural inflow to the reservoirs exceeds the volume being abstracted to meet customer demand.

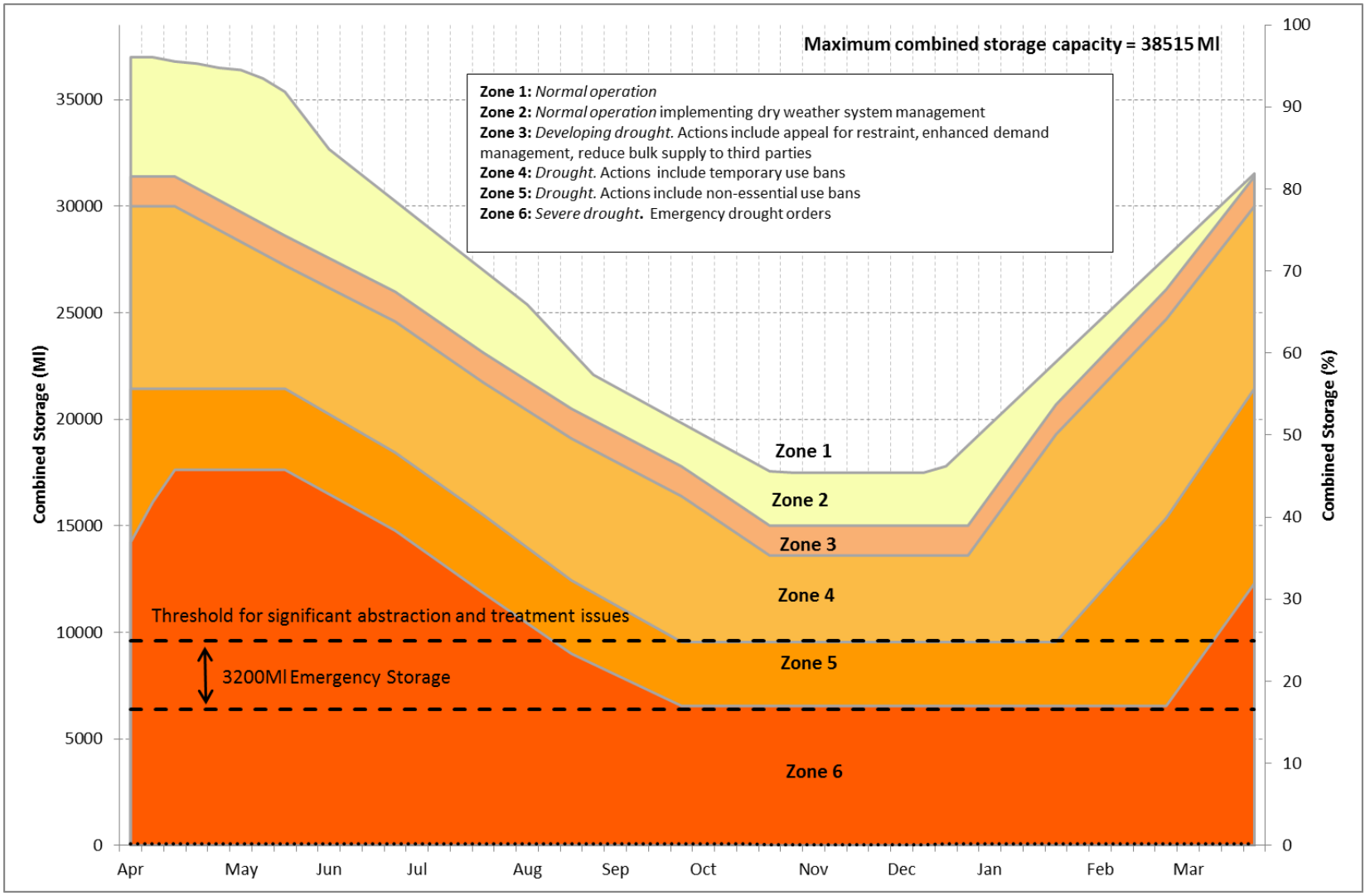
The combined storage approach reflects how the Bristol Water system is managed in practice, and that the whole water resource zone is at the same level of risk in terms of restrictions on water use, if a drought occurs.

The areas between the control curves define the discrete zones which indicate which of the drought measures should be considered for implementation. These zones have been aligned with the Environment Agency's 'drought stages' and are summarised in Table 6. If combined reservoir storage remains within zone 1, then we are not considered to be within a drought situation and our system will be operated as normal, optimising resources across the water resource zone in order to minimise cost. If reservoir storage drops into zone 2, then our 'dry weather' system management processes would be implemented (if they have not been already), optimising our system on a resource basis. This is still within the realms of normal operation, as dry weather is to be expected as part of annual variability.

The remaining zones, 3, 4, 5, and 6 are for the progressive implementation of drought actions, with the severity of the actions increasing as the combined reservoir storage declines. The details of our proposed drought actions are set out in section 4.

Scenario testing has been used to test these reservoir control curves and associated drought management zones and demonstrate their validity and how they would be used in a drought situation. Details of this analysis are presented and discussed in section 3.3.

Figure 2: Combined reservoir control curves and drought zones



3.2.2 River Severn drought order triggers

The Environment Agency is the responsible authority which regulates the flow in the River Severn, and has a legal responsibility to maintain the flow as measured at Bewdley gauging station near Kiddiminster, to an agreed level. The river flows are supported by releasing water from the upstream reservoirs Clywedog and Vyrnwy and from the Shropshire Groundwater Scheme (SGS).

Clywedog Reservoir is the main source of supply for river regulation and its control curves are used as the indicators for drought actions, including the application for a River Severn Drought Order. Details of the River Severn Drought Order control curves are set out in the Environment Agency's Shropshire, Herefordshire, Worcestershire and Gloucestershire (SHWG) Drought Plan.

The Clywedog Reservoir control curves define the discrete storage zones which indicate when the River Severn Drought Order needs to be implemented. These zones and the associated actions that may affect Bristol Water's supply from the Gloucester & Sharpness canal are set out in Table 7.

Table 7: River Severn Drought Order storage zones[2]

Clywedog Reservoir Storage zone description	Actions involving/affecting Bristol Water
Normal operation	None
Drought alert	Environment Agency forms the River Severn Drought Management Group and Bristol Water is represented on it
Apply for drought order (Environment Agency application)	Bristol Water will review the likely impacts of the application being made and make a formal representation on the specific effects the drought order is likely to have on our operations. We will work closely with the Canal & River Trust during this process.
Drought order in force	Canal & River Trust abstraction reductions enforced at Gloucester & Sharpness canal – possibly in to order of a maximum abstraction of 300Ml/d into the canal at Gloucester when the flow in the River Severn at Hay Bridge is 1200Ml/d or less.[3]

[2] Source - Environment Agency (June 2016): *Shropshire, Herefordshire, Worcestershire and Gloucestershire Drought Action Plan (draft v2).*

[3] The abstraction at Gloucester is currently not subject to abstraction licensing, due to the exemption provided by s.26 Water Resources Act 1991.

3.3 Drought scenarios

The latest Defra and Environment Agency drought planning guidance (July 2015) required us to test our drought triggers to prove that they are appropriate to a range of droughts using scenario analysis. This scenario testing should be used to;

- Demonstrate how well the drought triggers work under different drought scenarios
- Demonstrate what actions we would take in different scenarios
- Assess what the effects of past droughts would be if they occurred today and what actions would be taken if they occurred today

The scenarios used should cover short-term, one-season droughts (6 – 12 months), medium-term, multi-season droughts (1 – 2 years including 2 dry summers and a dry winter), and long-term droughts (lasting more than 2 years).

In line with this guidance, we have carried out drought scenario analysis to test our reservoir triggers. This has been done using both historic data and data from our 'drought library' to test the system beyond the droughts experienced in the historic record.

The scenario testing has been carried out using the mass balance spreadsheet model of our water resource zone that reflects the current system set up in terms of reservoir storage and licence constraints. This model uses river flow records for inflow into the Mendip Reservoirs, to simulate the operation of our current water resource zone if it experienced those river flows again today.

3.3.1 Historic drought assessment

The first stage of our scenario modelling assessed the likely effects of known historic drought events on the current water supply system. The historic flow record available for the Bristol Water system covers a period from 1910 to 2009. The early part of this inflow record was derived using Hysim rainfall runoff modelling from 1910 to 1960, with recorded flows being used from 1961 onwards. This period of record covers a wide range of historic drought events including 6 to 12 month droughts (1921-22), and 1 to 2 year droughts (1933/34, 1943/44 and 1975/76, 1991/92). The worst drought within the historic record is the 1933/34 drought. There are no longer term droughts within the historic record that last more than 2 years. This type of drought was assessed using the drought library (Section 3.5).

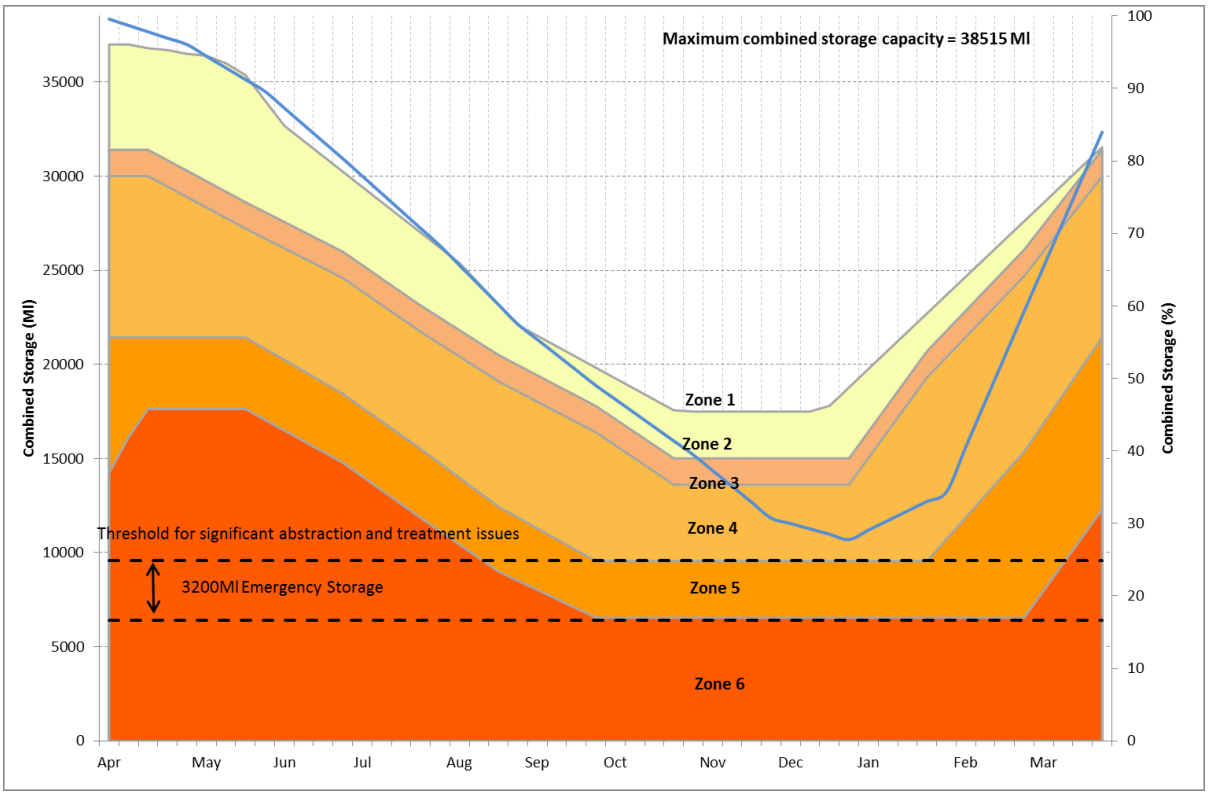
The analysis of our modelling assessment has focused on the performance of the water resource zone in the context of the combined storage of the Mendip Reservoirs against the drought management zones defined by the combined reservoir control curves.

Short-term, 12 month Historic Drought

The **1921-22 drought** is an example of a drought lasting up to 12 months. The graph in Figure 3 shows the response of the combined storage of the Mendip Reservoirs to this drought as a result

of the scenario assessment. The storage drops into drought management zone 4 (Drought) in November 1921. No demand management measures are implemented in this scenario because the major effects of the drought occur over the winter period (from November to March). It takes 2 weeks to enter drought management zone 4 (drought) after entering developing drought (zone 3).

Figure 3: Short-term 12 month historic drought – 2021/22

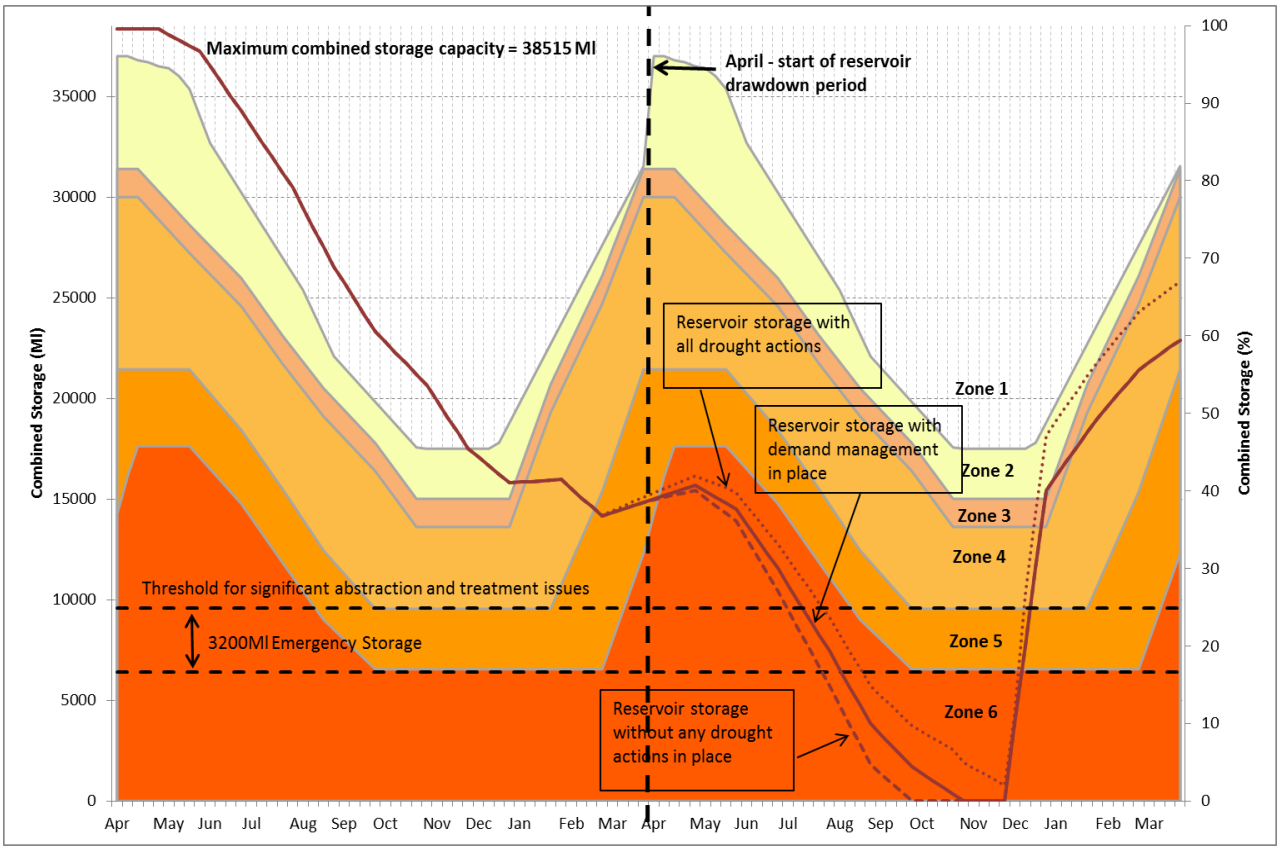


Medium-term, 2 year Historic Droughts

The **1933/34 drought** is the most severe drought in the historic record, consisting of a dry winter, followed by a dry summer. The graph in Figure 4 shows the response of the combined storage of the Mendip Reservoirs to this drought as a result of the scenario assessment. The storage enters drought management zone 4 (drought) in January 1934, after a reasonably normal summer drawdown pattern, until November 1933, when the reservoirs do not receive the usual winter recharge inflows. This lack of winter refill results in the reservoir storage rapidly dropping through the drought control curves, moving from what appears to be a normal situation at the end of October/beginning of November 1933, to a drought situation by the end of January 1934, and a severe drought by April 1934. Demand management measures (TUBs) would be implemented from April onwards, throughout the period they are most effective. The Honeyhurst & Rodney Stoke (well head) option would be commissioned and put into supply by the beginning of June when the reservoir is in drought management zone 6 (severe drought), after allowing for the 6 months needed to implement this option. The drought permit options for the reduction in reservoir

compensation releases would be implemented when the reservoir storage enters drought management zone 5, at the end of February 1934. This assumes that all the required permissions would have been prepared and permit applications made as a precautionary measure whilst the reservoirs were in drought management zone 4.

Figure 4: Medium-term, 2-year historic drought – 1933/34

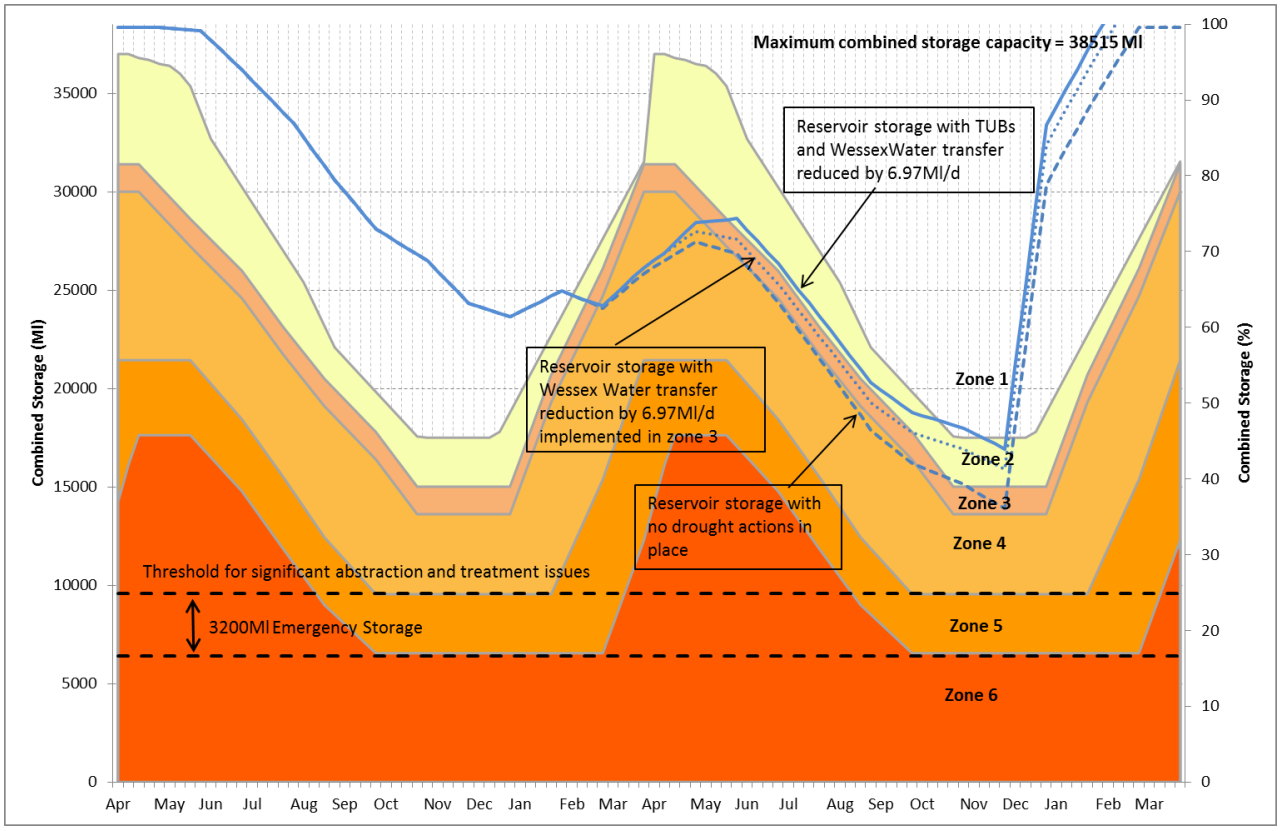


This scenario has been modelled using our current system deployable output[4] as the demand on the system, to demonstrate the timeframes within which the actions set out within our drought plan could be implemented in order to meet Environment Agency guidance. If we experienced a repeat of the 1933/34 drought today, under current customer demands, we believe we would be able to maintain supplies above the emergency storage level within our reservoirs because current customer demand is notably lower than our system deployable output. This is illustrated in the graph in Figure 5, which shows the modelled combined reservoir storage response if we experienced the 1933/34 drought today, with our current demand (adjusted to represent a dry year) plus a headroom allowance for uncertainty, as the demand on the Bristol Water system. We have included the effect of reducing our bulk supply to Wessex Water (as set out in section 4.3.1) when

[4] Deployable output is the maximum output of the sources within our water resource zone as constrained by licence, infrastructure capacity, and water resource. In our WRMP14 it was assessed against the water resources available in the 1943/44 drought. It is therefore the maximum demand that could be met under a repeat of the 1943/44 drought conditions.

we enter drought management zone 3 (developing drought) in this assessment to illustrate the effect this has on our resource position. This scenario illustrates that we are resilient to the worst drought in our historic record without the need to use emergency drought orders.

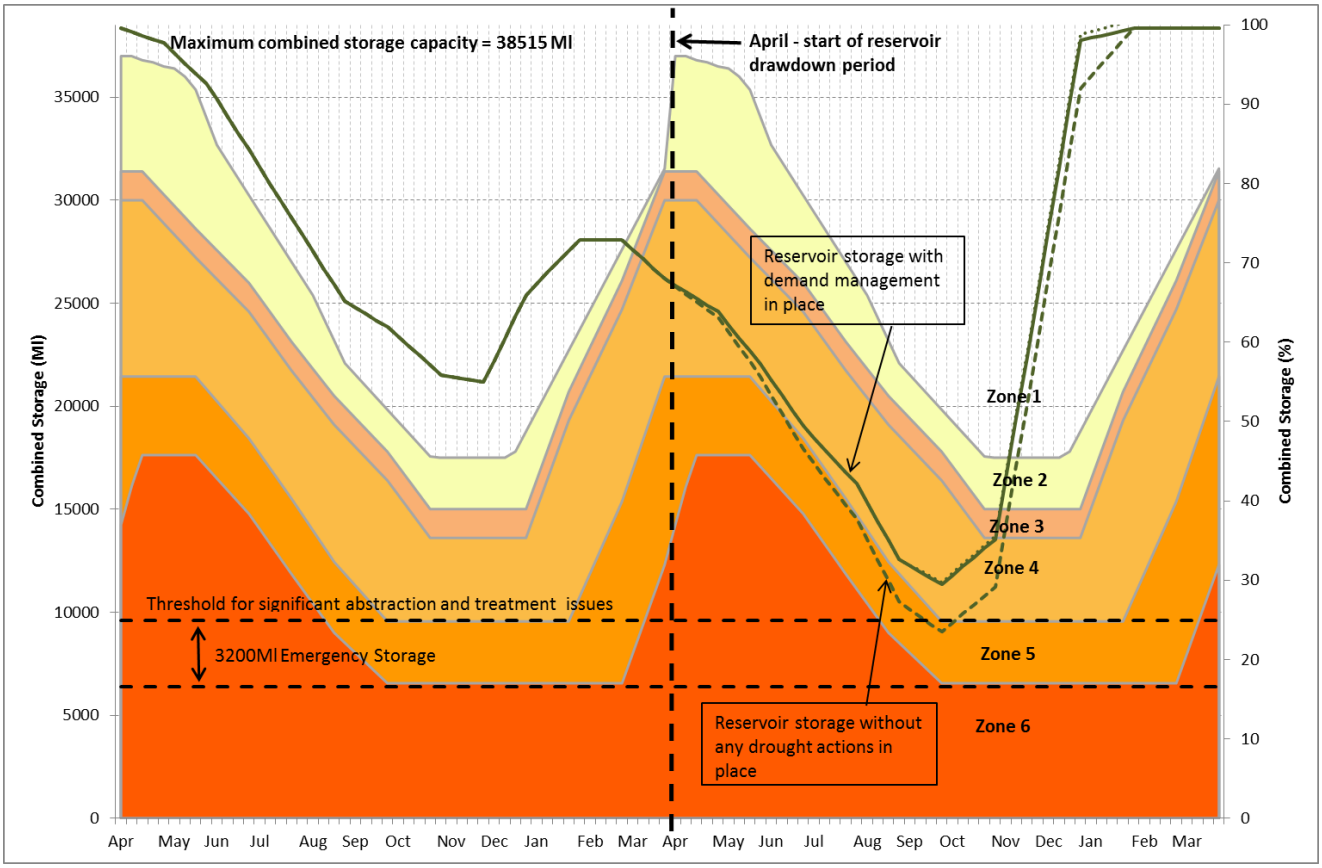
Figure 5: Medium-term, 2-year historic drought – 1933/34 under dry year demand plus headroom scenario



The **1943/44 drought** is the drought used to determine the Bristol Water system deployable output in the WRMP14. It is similar to the 1933/34 drought, in that it is a severe 2-season drought consisting of a dry winter followed by a dry summer. The graph in Figure 6 shows the response of the combined storage of the Mendip Reservoirs to this drought as a result of the scenario assessment. The storage enters drought management zone 4 (drought) in March 1943 after winter refill not being achieved and the combined reservoir storage only reaching just over 70% full before the start of the summer drawdown period. Demand management measures (TUBs) would be implemented from April onwards, throughout the period they are most effective.

The Honeyhurst & Rodney Stoke (well head) option would be commissioned and put into supply by the end of August when the reservoir storage is in drought management zone 4 (drought) after allowing for the 6 months needed to implement this option. The drought permit options for the reduction in reservoir compensation releases would not be required under this scenario as the demand management options and the Honeyhurst & Rodney Stoke (well head) options prevent the reservoir storage entering drought management zone 5. However, if this scenario were to be experienced it is likely that we would have prepared, and possibly submitted, permit applications as a precautionary measure whilst the reservoirs were in drought management zone 4.

Figure 6: Medium-term, 2-year historic drought – 1943/44



The 1975/76 drought and the 1991/92 drought are further examples of droughts spanning a dry winter period where reservoir refill would not have been achieved, followed by a dry summer period, resulting in reservoir drawdown into the drought management zones. The graphs in Figure 7 and Figure 8 show the output from the modelling assessments for these droughts. In both cases, demand management measures (TUBs) are implemented from April when the reservoirs are unable to refill before the start of the summer drawdown period. This demand management prevents the reservoirs entering drought management zone 5. The Honeyhurst & Rodney Stoke (well head) option would be commissioned and put into supply by August under both scenarios when the reservoir storage is in drought management zone 4 (drought) after allowing for the 6 months needed to implement this option. This is based on the decision to implement this option being made in February, when the reservoir storage first enters zone 4.

Figure 7: Medium-term, 2-year historic drought - 1975/76

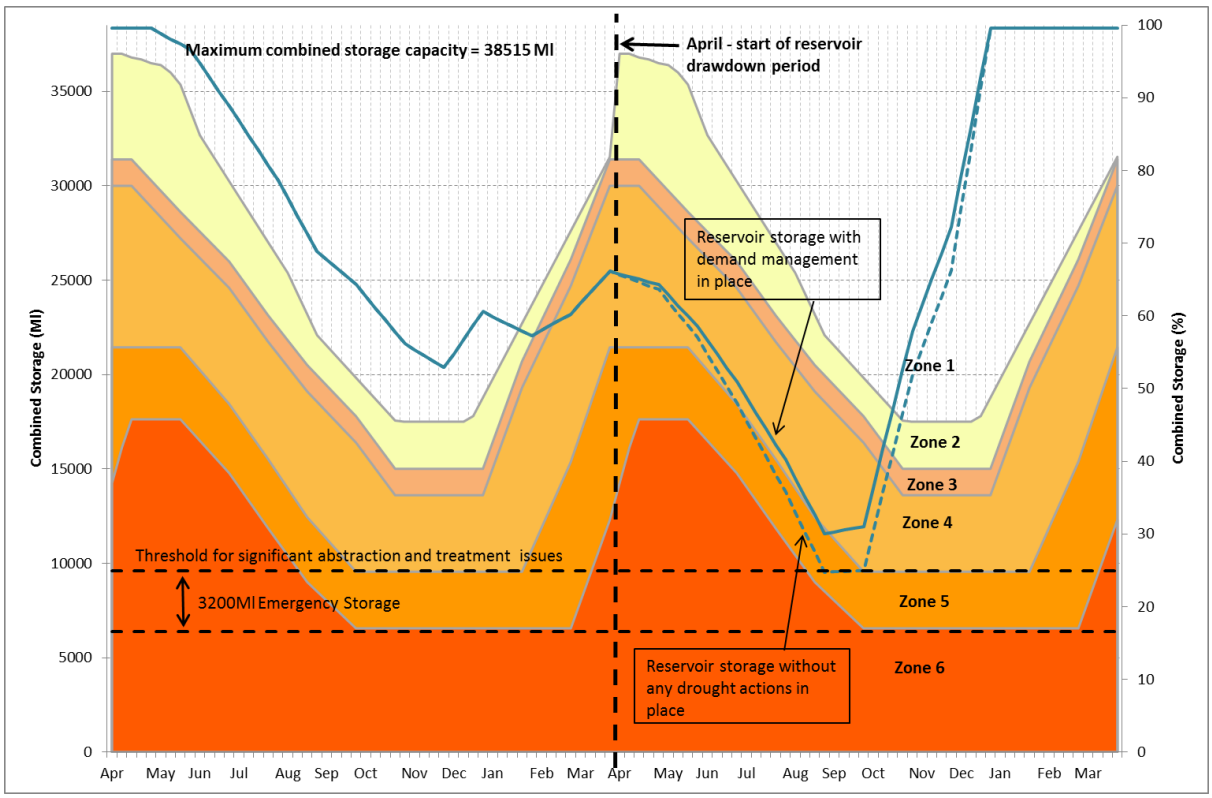
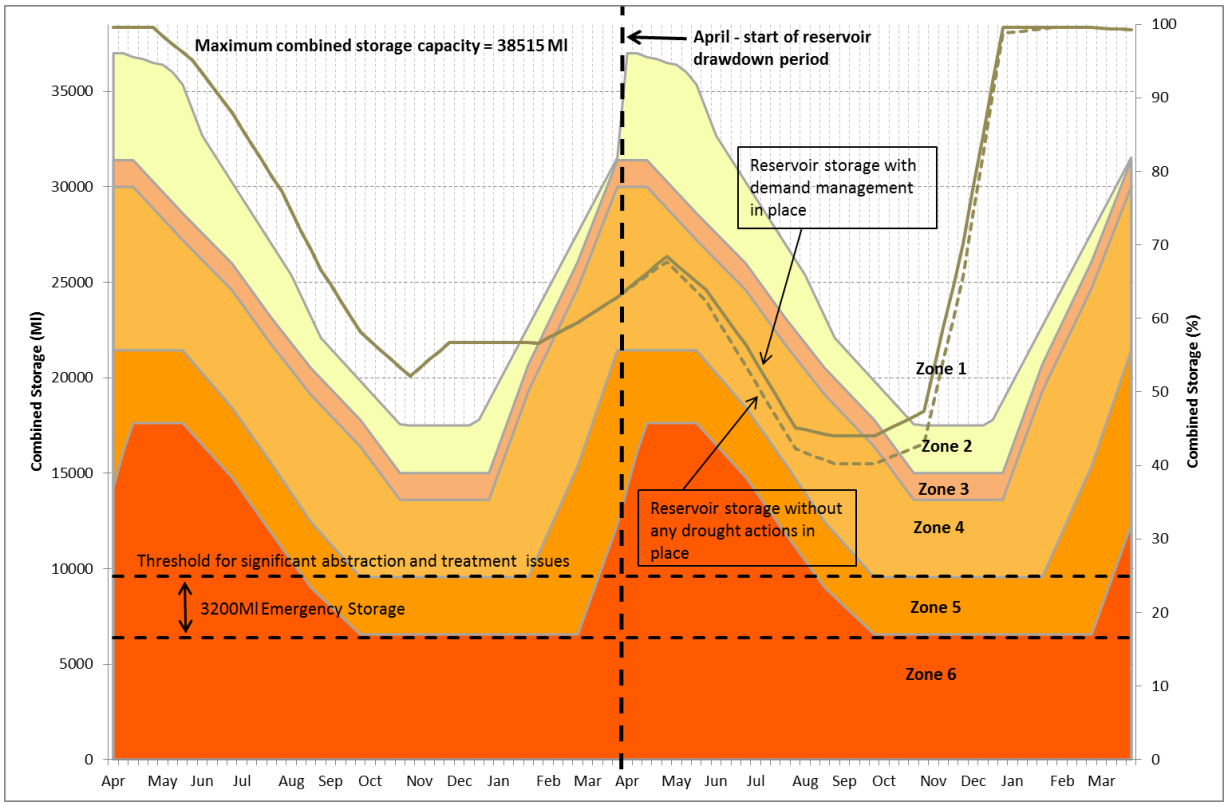


Figure 8: Medium-term, 2-year historic drought – 1991/92



3.4.1 Drought library assessment

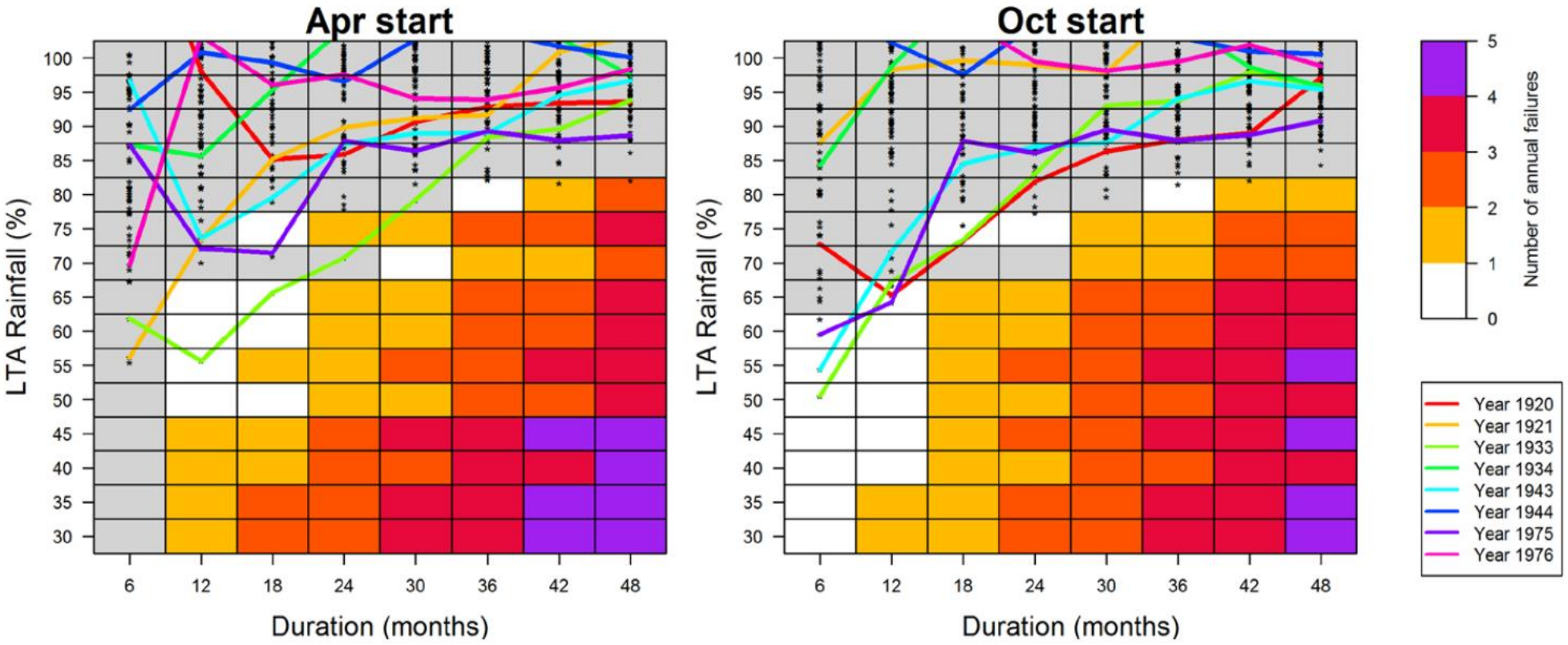
The drought library developed for Bristol Water by HR Wallingford provides a range of drought scenarios based on the starting month of the drought (April or October) and the rainfall deficit against the long term average (LTA). For the purposes of our drought plan scenario analysis, the drought library has been used to assess droughts that are worse than those experienced within the historic record, but are still plausible. In addition, because there are no long-term droughts within our historic inflow record, the drought library has also been used to test this scenario. This assessment has been completed to meet the requirements of the Environment Agency drought plan guideline as set out in section 3.3. Assessments of our water resource system against droughts worse than those in the historic record are also required as part of the update to our water resources management plan (WRMP19). We are therefore be carrying our further assessments as part of this work and to develop the understanding of the resilience of our water supply system. It should be noted, that this analysis is testing our water resource system against something that has never happened, and although it highlights potential vulnerabilities within our system, interpretation of this output should be done with caution and a clear understanding of the context in which the assessments have been done.

Three drought scenarios were assessed using the drought library inflow data. The selection of the scenarios used was informed by the drought response surface matrix developed by HR Wallingford in their synthetic drought assessment. The drought response surfaces are shown in Figure 9. The scenarios and their justification are summarised below

Table 8: Justification for drought library scenario selection

Drought scenario	Start month	Duration	Rainfall deficit (%LTA)	Scenario Justification
Short term	April	12 months	45%	Where the first annual failure is identified on the drought response surface matrix for a 12 month drought with an April start month
Medium term	October	24 months	65%	5% worse in terms of rainfall deficit than the 1933/34 drought
Long term	October	36 months	75%	Where the first annual failure is identified on the drought response surface matrix for a 36 month drought with an October start month

Figure 9: Drought response surface showing the number of annual failures (HR Wallingford 2016)



Short-term drought library scenario

The short-term drought library scenario represents the possible response of our water resource system to a 45% long term average rainfall deficit over a period of 12 months. This situation is significantly more severe than the worst historic drought in 1933/34. The analysis suggests that without the required inflow to the Mendip Reservoirs, our ability to supply water would be compromised. The output of this scenario is presented in Figure 10 for a demand set at our current system deployable output and in Figure 11 for our current demand (adjusted to represent a dry year) plus a headroom allowance for uncertainty, as the demand on the Bristol Water system. This assessment has been carried out as an exercise to test the response of our system to a drought worse than those within our historic record, as required under Environment Agency guidance.

Figure 10: Short term drought scenario – April start month, 12 months at 45% LTA rainfall (demand set at deployable output)

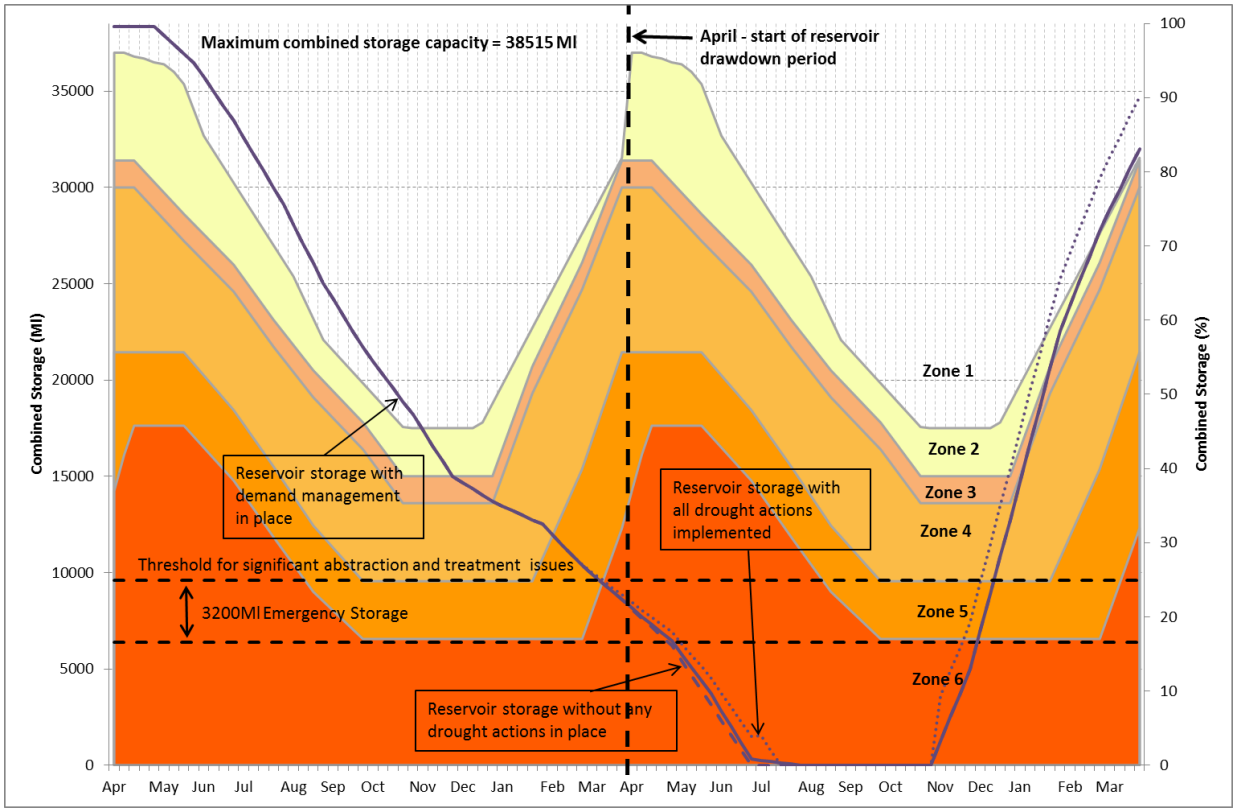
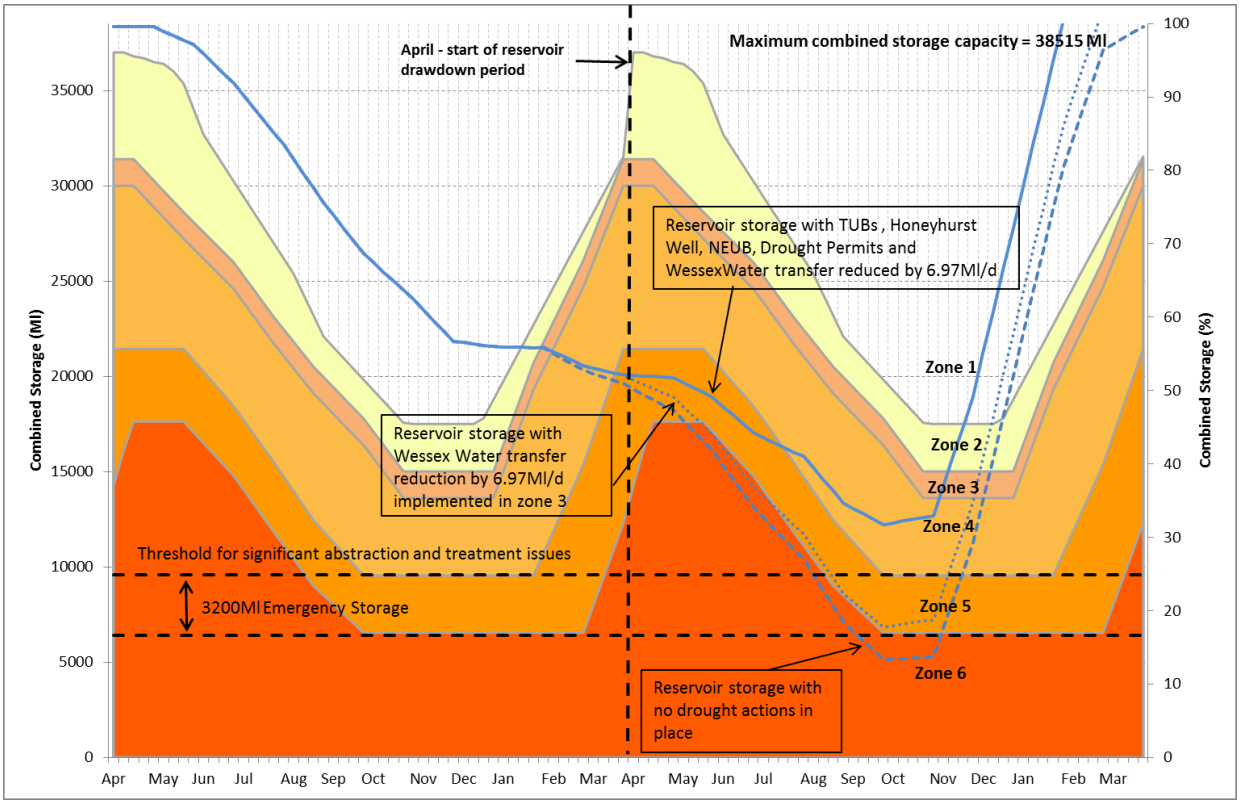


Figure 11: Short term drought scenario – April start month, 12 months at 45% LTA rainfall (dry year demand plus headroom)



Medium-term drought library scenario

The medium-term drought library scenario represents the possible response of our water resource system to a 65% long term average rainfall deficit over a period of 24 months, starting in October. This situation is 5% worse in terms of rainfall deficit than the 1933/34 drought. The analysis suggests that due to the very limited refill of the reservoirs after over 12 months of this level of rainfall deficit, our ability to supply water would be compromised. Figure 12 presents the scenario with demand set at our current system deployable output and Figure 13 presents the results for the scenario with our current demand (adjusted to represent a dry year) plus a headroom allowance for uncertainty, as the demand on the Bristol Water system. As with the preceding scenario this assessment has been carried out as an exercise to test the response of our system to a drought worse than those within our historic record, as required under Environment Agency guidance.

Figure 12: Medium-term scenario – October start month, 24 months at 65% LTA rainfall (demand set at deployable output)

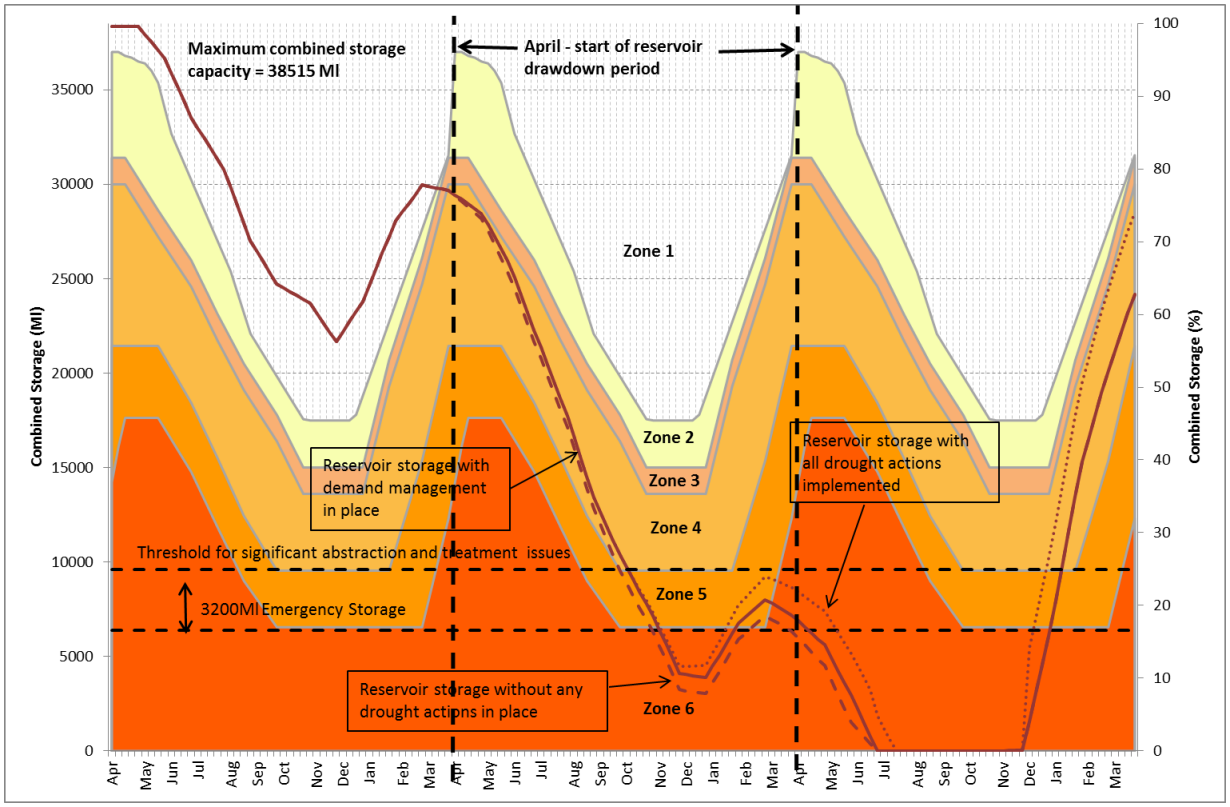
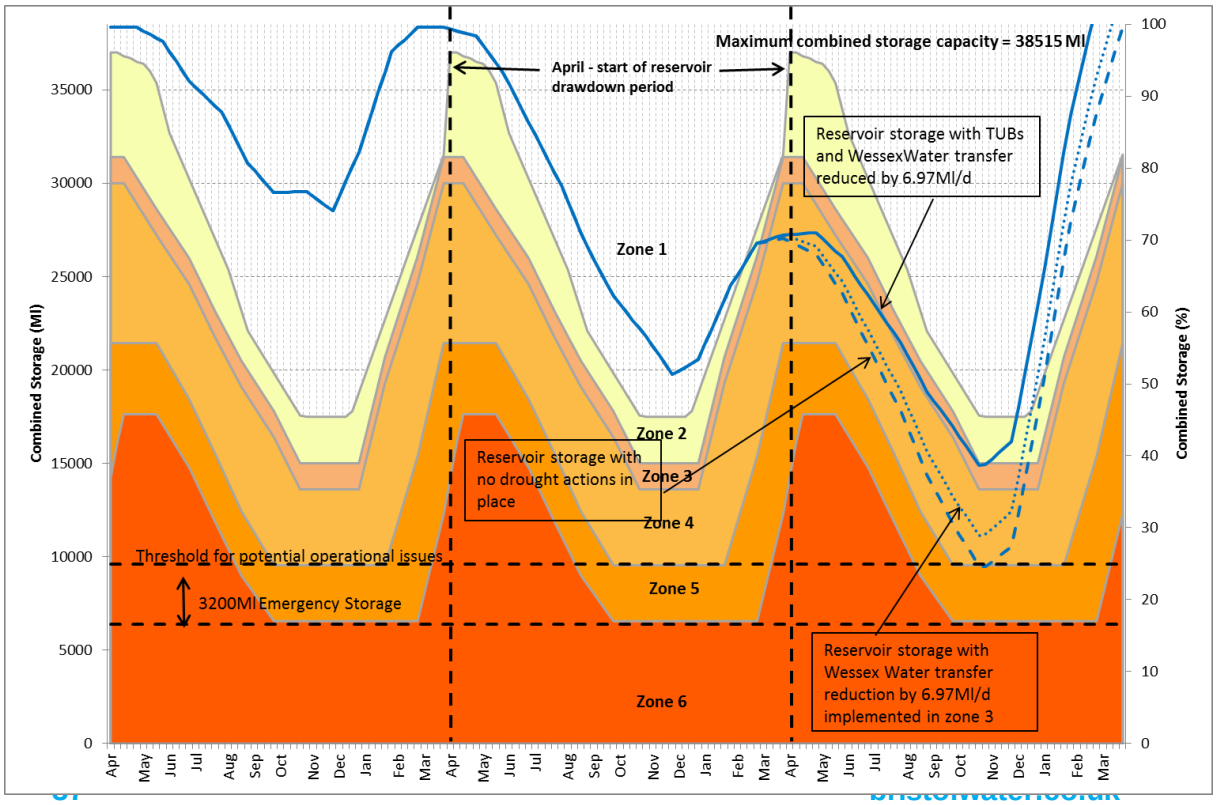


Figure 13: Medium-term scenario – October start month, 24 months at 65% LTA rainfall (dry year demand plus headroom)



Long-term drought library scenario

The long-term drought library scenario represents the possible response of our water resource system to a 75% long term average rainfall deficit over a period of 36 months, starting in October. This situation is over 10% worse in terms of rainfall deficit that any historic drought experienced, and would therefore be an unprecedented situation. The analysis suggests that after successive years when reservoir refill is not achieved, our ability to supply water would be compromised. Figure 14 presents the scenario with demand set at our current system deployable output and Figure 15 presents the results for the scenario with our current demand (adjusted to represent a dry year) plus a headroom allowance for uncertainty, as the demand on the Bristol Water system. Again, this assessment has been carried out as an exercise to test the response of our system to a drought worse than those within our historic record, as required under Environment Agency guidance.

Figure 14: Long-term scenario – October start month, 36 months at 75% LTA (demand set at deployable output)

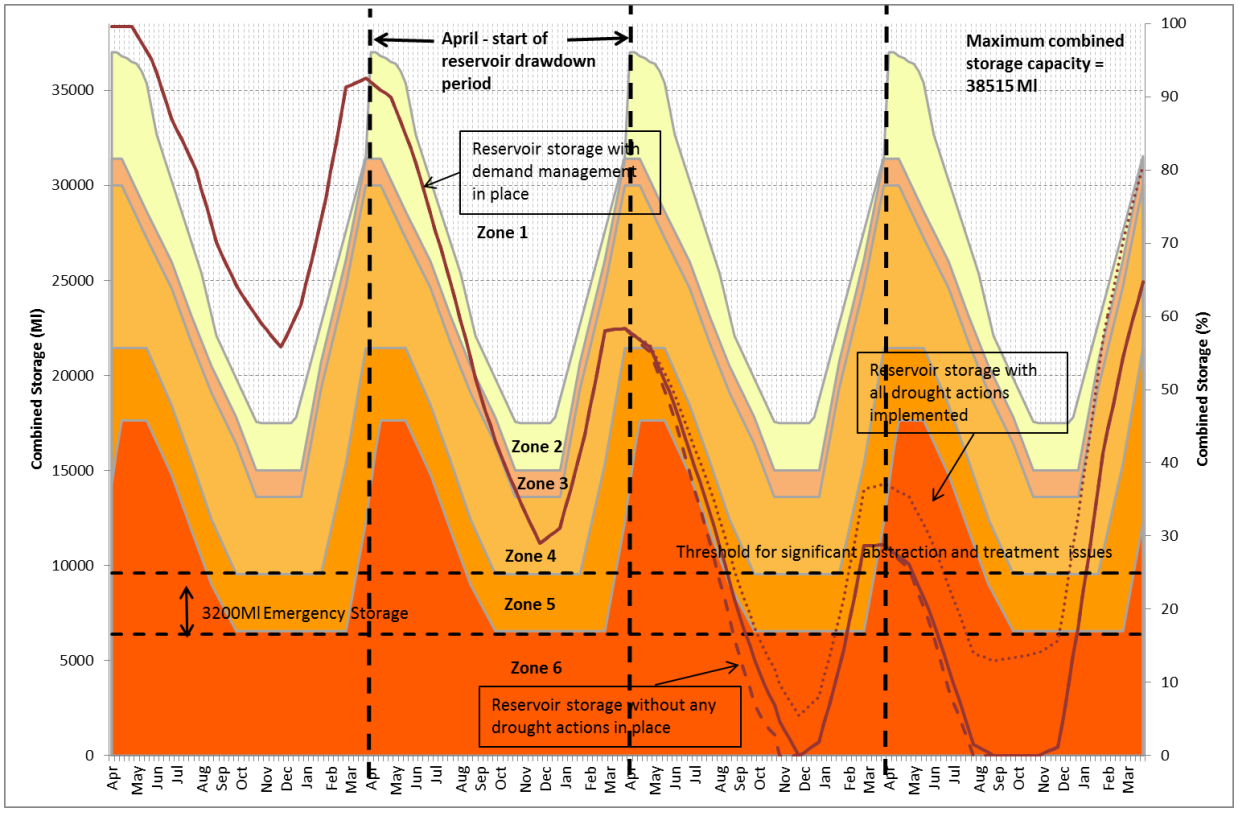
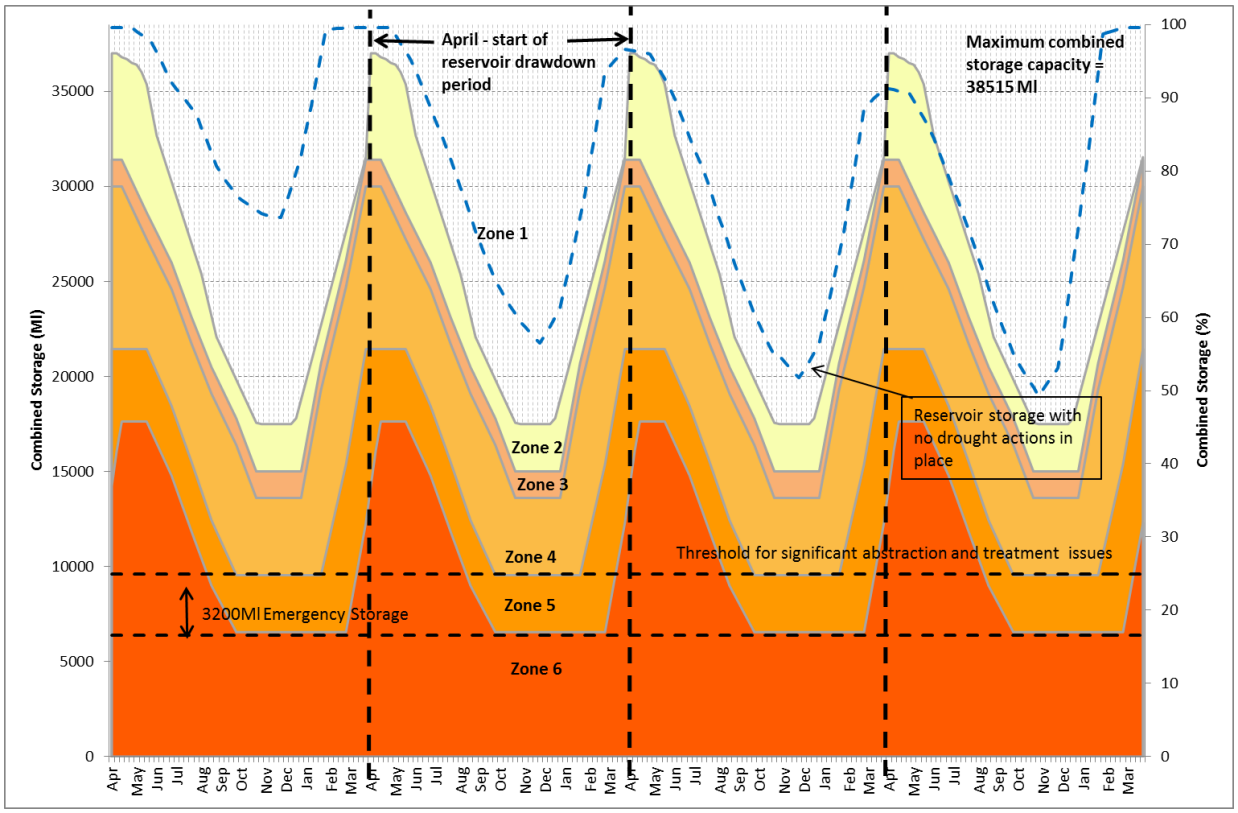


Figure 15: Long-term scenario – October start month, 36 months at 75% LTA (dry year demand plus headroom)



Summary of drought library assessment

This assessment has tested our water resource system using synthetically generated droughts that are beyond anything experienced within the historic record. Our water resource system is designed and operated to cope with historic droughts, and therefore it is not surprising that when tested beyond its capabilities it does not deliver the output we have historically anticipated. If we were to start to experience more frequent and more severe droughts as a result of climate change, we would respond accordingly by reviewing the operation and management of our system in the context of the relevant customer demand and levels of service.

4 Drought Management Actions

4.1 Overview

This section describes the drought measures/actions that Bristol Water would use to ensure that water supply is maintained in the event of a drought. Under normal conditions we monitor the water resource situation to inform our everyday operations and manage our water sources appropriately. If conditions start to become dry, we manage our operations to reflect this and initiate our 'dry weather' operations processes. Actions associated with this include, but are not limited to, the operation of the River Axe abstraction, re-zoning distribution areas to minimise use of the Mendip reservoirs, and increasing the output of our groundwater sources. These are considered to be part of the everyday management of our water resources and are therefore outside the scope of the drought plan. It should be noted however, that when a drought does occur, we will have already been monitoring the situation as part of our overall operational strategy planning.

As a drought develops, the decision will be made to form the Drought Management Group (see section 6.1). Drought measures will be implemented in an appropriate order as determined by the Drought Management Group, and ratified by the Management Team and Board as appropriate.

Section 3 has set out the way in which we identify and define the stages of drought in terms of the hydrological conditions and the resource availability within our reservoirs. Implementation of the drought measures will be influenced by the ambient hydrological conditions and our resource position against the trigger levels. However, every drought is different and the actions taken during a drought should be proportionate to the severity of a specific drought event. Bristol Water will therefore manage each drought with respect to the circumstances that emerge as the drought develops, and will always try to adopt the options with the least environmental effects first. This means that options that focus on demand management, such as water efficiency, media campaigns and enhanced leakage management will be implemented prior to using supply side measures that may require drought permits or orders. This section describes the order in which we will implement the drought actions associated with each drought management zone.

Since publishing our last drought plan in 2012, we have carried out a detailed review of our options from both an operational and regulatory perspective. This has included:

- Internal workshops and meetings with our operational and communications staff to review the feasibility of the existing options and identify any additional options
- A workshop with the Environment Agency to review our existing options and identify any additional options, with a specific focus on the likely environmental effects of options
- Implementation of our Strategic Environmental Assessment (SEA) of the drought plan.

As a result of this review a number of supply side options have been removed because they were considered to no longer be appropriate as drought management options. A list of these options and the reason for their removal from the drought plan is provided in Appendix A.

Similarly, following discussions with the Environment Agency, we have decided to re-introduce the supply side options relating to the reduction in compensation flows at our reservoirs. The likely environmental effect of these options has been assessed through the SEA process, further detail of the environmental assessments associated with these options is provided in section 5.

A summary of the demand and supply side options available to us and the order in which they would be likely to be implemented in the context of the drought management zones is set out in Table 9.

For each of the drought management options considered a Drought Options Summary form has been completed. The forms are located in Appendix B and contain both an option implementation assessment and an environmental assessment for each option. The environmental assessment section of the summary form has been largely populated using information from the Strategic Environmental Assessment and Habitats Regulations Assessment that accompany this drought plan.

Table 9: Drought actions available and their order of implementation

Drought management zone	Drought description	Demand side action	Supply side/ operational action	Stakeholder liaison/ communications
1	Normal	Weekly monitoring of rainfall, reservoir and demand levels Normal programme of leakage maintenance and water efficiency work	System operation optimised on both cost and maintaining resources within zone 1	
2	Normal	Enhanced publicity and awareness of water efficiency messaging through media campaigns as per the communications plan, including requests for voluntary restraint Water efficiency promotions	Increased monitoring and management of sources Minimise use of reservoir water and ensure balancing of reservoir drawdown Maximise River Severn and River Axe abstractions/transfers Maximise groundwater abstractions	Advise key stakeholders of situation (Environment Agency, Consumer Council for Water)
3	Developing drought	Full scale publicity and media campaign to appeal for restraint and raise awareness of the developing drought situation	Review availability of any mothballed/emergency sources and plan any mobilisation requirements	Implement increased Environment Agency liaison in line with Management and

Drought management zone	Drought description	Demand side action	Supply side/ operational action	Stakeholder liaison/ communications
		Increasing internal resources on leakage find and fix activities. Reduce the time taken to repair both visible leaks once reported and non-reported leaks once we are aware of them. Reduce pressure across as many network zones as feasible to preserve water and minimise loss from leaks. Implement enhanced customer communication campaigns to increase awareness and reporting of leaks. Promote the company “Leakline” service to encourage customers to report leaks Maximise “Leakstop” campaign publicity to encourage reporting of leaks Pre-planning and consultation on the implementation of Temporary Use Bans (TUBs)	Reduce bulk supplies to third parties where possible Minimise compensation releases within licence requirements Optimise treatment works to reduce/minimise losses Manage water treatment works to cope with reduced water quality issues	Communication plan

Drought management zone	Drought description	Demand side action	Supply side/ operational action	Stakeholder liaison/ communications
		Pre-planning for the implementation of Non Essential Use Bans (NEUBs)		
4	Drought	Continuation of preceding actions Introduction of TUBs Full media campaign with direct appeals for TUBs compliance as per the communications plan Apply for drought orders for NEUB Pre-planning for emergency drought order application	Implement environmental monitoring in line with Monitoring Plan Bring emergency/mothballed supply side options on line where practicable (constrained by scheme lead times and maintenance of wholesome water quality) Postpone planned maintenance where possible to reduce planned outage Prepare drought permit applications for supply side drought actions Apply for drought permits as drought management zone 5 is reached	Briefing and working with stakeholder groups
5	Drought	Continuation of preceding actions Full media campaign continues with updates messaging to reflect the ongoing severity of the situation as per the communications plan	Continue environmental monitoring in line with Monitoring Plan Once demand management options are in place, implement supply side	Briefing of Environment Agency, Consumer Council for Water, Defra and stakeholder groups

Drought management zone	Drought description	Demand side action	Supply side/ operational action	Stakeholder liaison/ communications
		Introduction of NEUBs Apply for emergency drought order (standpipes/rota cuts)	options that require drought permits	
6	Severe drought	Continuation of preceding actions Full media campaign continues with updates messaging to reflect the ongoing severity of the situation as per the communications plan Implementation of emergency drought orders (standpipes/ rota cuts)	Continue environmental monitoring in line with Monitoring Plan Bring any remaining emergency sources on line with customer notices in place if there is a risk of water quality issues Managing draw off from reservoirs at low volume	Planning supply security for vulnerable customers Increased frequency of briefing of Environment Agency, Consumer Council for Water, Defra and stakeholder groups

4.2 Demand Management Actions

4.2.1 Water efficiency campaign and appeals for restraint

Under normal water resource conditions we implement our on-going water efficiency campaign. This activity is designed to encourage our customers to use water wisely and our '*savewatersavemoney'* promotion encourages customers to cut both their water and their energy bills by being more water efficient. Through this campaign we offer a number of free water saving devices to our customers as well as the promotion of other water saving products.

During a period of extended dry weather and declining water resources, the profile of the water efficiency campaign would be increased. This would be done ahead of implementing any other drought management actions. The details of this option are set out in our Communications Plan presented in Section 6.2. Quantifying the likely additional demand reductions that would be associated with such a campaign is difficult; especially as Bristol Water have no recent experience of this. We have therefore based our assumptions on a reduction of approximately 1% of average household water demand. This may increase as the water resource situation deteriorates, and the media campaign becomes more high profile.

4.2.2 Enhanced leakage management

Bristol Water maintains a leadership position on leakage control with one of the lowest leakage levels in the industry. We have continually operated at or below our leakage target for the past 20 years. Our leakage management strategy is therefore well established. During a drought situation we will review our leakage activities and any scope for additional savings or improvements. This will include:

- Increasing internal resources on find and fix activities.
- Reducing the time taken to repair both visible leaks once reported and non-reported leaks once we are aware of them.
- Reduce pressure across as many network zones as feasible to preserve water and minimise loss from leaks.
- Implement enhanced customer communication campaigns to increase awareness and reporting of leaks.

These activities would be implemented on entering drought management zone 3 (developing drought) and be maintained throughout the drought situation. Table 9: Drought actions available and their order of implementationTable 9 shows where the implementation of leakage activities sits within our overall drought actions.

We will focus on our messaging to customer during a drought to emphasise our leakage activities and ask them to support us in these by promoting the company 'Leakline' service to encourage

customers to report leaks. We would also maximise our publicity for 'Leakstop' activity to reduce customer supply pipe leakage by offering a free repair service.

4.2.3 Temporary Water Use Restrictions

The Flood and Water Management Act (2010) gave new powers to water companies to implement a wider range of temporary water use restrictions during a drought, without the need for a drought order. The Water Use (Temporary Bans) Order 2010 and the Drought Direction 2011 supplement the Flood and Water Management Act and set out the categories of water use that companies can restrict with and without a Drought Order.

Bristol Water's proposals for implementing temporary use bans (TUBs) are aligned with the industry Code of Practice and Guidance on Water Use Restrictions (UKWIR 2013). We will implement the restrictions in one stage when we enter drought management zone 4. The activities that will be restricted are set out below:

- Cleaning a private leisure boat using a hosepipe
- Cleaning a private motor vehicle using a hosepipe
- Filling or maintaining and ornamental fountain
- Cleaning walls, or windows, of domestic premises using a hosepipe
- Cleaning paths or patios using a hosepipe
- Cleaning other artificial outdoor surfaces using a hosepipe
- Drawing water using a hosepipe, for domestic recreational use
- Filling or maintaining a domestic swimming or paddling pool
- Watering a garden using a hosepipe
- Watering plants on domestic or non-commercial premises using a hosepipe
- Filling or maintaining a domestic pond using a hosepipe

Bristol Water has signed up to the Code of Practice and Guidance for Water Companies on Water Use Restrictions (UKWIR 2013) and we will therefore honour the both the Statutory Exceptions[5] and the Discretionary Universal Exceptions[6] set out in the code. Customers do not need to make a formal representation to obtain permission for these exceptions.

Bristol Water would implement the temporary use ban over our whole supply area at the same time.

The demand saving associated with imposing restrictions on customer use is difficult to quantify. The legislation has only really been tested once since it has come into effect, during the 2011/12

[5] Statutory Exceptions – Activities/water uses specified in the legislation which are exempt from water use restrictions and for which customers do not need to make representation to obtain permission (UKWIR 2013).
[6] Discretionary Universal Exceptions – Activities/water uses not covered by a statutory exception but for which signatories to the Drought CoP have agreed to grant an exception for which customers do not need to make representation to obtain permission (UKWIR, 2013).

drought. However, in this case, the period of heavy rainfall that occurred shortly after the TUBs came into effect has made it difficult to clearly determine the effect of the restrictions on demand (Environment Agency, December 2013). Our assumptions for the likely demand savings to be made from the implementation of TUBs restrictions have therefore been based on the analysis of data collected during the 2003 drought (UKWIR, 2007), and the estimated savings set out in the industry Code of Practice and Guidance on Water Use Restrictions (2013). We estimate that our TUBs restrictions would save up to 9.5% of peak summer household demand.

Consultation prior to implementation of TUBs

We will follow the requirements set out in the legislation (Water Industry Act 1991 Section 76B (2) & (3) as amended by Section 36 of the Flood & Water Management Act) relating to the public consultation process on the implementation of temporary use bans.

We will give formal notice in 2 local newspapers and on our website of our intention to implement the TUB and provide the details of the restrictions we are proposing to apply. We will also use social media to raise awareness of the consultation. To promote consistency across the industry, we will use the example notifications for water use restrictions under a temporary use ban provided in Appendix C of the UKWIR (2013) *Code of Practice and Guidance*. Ongoing communications with customers will be used to inform them when the restrictions have come into effect.

We will allow a 14 day consultation period, within which customers would be able to make representations (including for Discretionary Concessional Exceptions[7]). We will also consult with our Bristol Water Challenge Panel to raise awareness and get feedback on the application of TUBS restrictions.

Both prior to implementation of TUBS and as part of the consultation process we will liaise with our neighbouring water companies to ensure there is appropriate consistency of messaging and approach to avoid confusion for customers. Further details of our approach to working with neighbouring water companies is provided in section 6.2.7.

The Water Resources Manager will be responsible for collating any representations received and presenting these to the Drought Management Group for review and consideration. We will consider all fully evidenced representation that indicate a particular water use ban would result in substantial and lasting damage to particular categories of business, or result in physical harm or damage to health. In such cases we may be willing to modify the restriction to avoid or limit damage.

[7] Discretionary Concessional Exceptions – Activities/water uses not covered by a statutory exceptions, but for which an individual water company offers an exception for which customers must first make representation to obtain permission (UKWIR, 2013).

4.2.4 Drought Order - Non-essential use bans (NEUBs)

If a drought situation continues to deteriorate, we will need to apply for a Drought Order to further restrict water use through the implementation of non-essential use bans (NEUBs) under the Drought Direction 2011. To introduce this level of restriction we are required to apply to the Secretary of State at the Department of the Environment, Food and Rural Affairs (Defra) for these powers.

In a similar manner to the implementation of TUBs, we will implement the restrictions in one stage. This will be when we enter drought management zone 5.

We anticipate that some of the categories of restrictions could potentially result in a business being affected financially, if operation had to be suspended. These restrictions would only be applied if we were experiencing a prolonged drought situation, with the potential for the use of Emergency Drought Orders (see section 4.5.2). The restrictions to be implemented are set out below:

- Watering outdoor plants on commercial premises
- Filling or maintaining a non-domestic swimming or paddling pool
- Filling or maintaining a pond
- Operating cisterns (in unoccupied premises)
- Cleaning industrial plant (except where required for health and hygiene)
- Suppressing dust (except where controlled by HSE regulations)
- Operating a mechanical vehicle-washer
- Cleaning a window of a non-domestic building
- Cleaning any vehicle, boat, aircraft or railway rolling stock
- Cleaning non-domestic premises

Bristol Water has signed up to the Code of Practice and Guidance for Water Companies on Water Use Restrictions (UKWIR 2013) and we will therefore honour the Statutory Exceptions[8] as per the Drought Direction 2011 and set out in the code for a NEUB drought order.

Bristol Water would implement the NEUB over our whole supply area at the same time.

It is very difficult to estimate the effect of this type of water use restriction on customer demand as very little data is available. The demand saving associated with imposing NEUB restrictions has been assessed using the UKWIR/EA methodology set out in the 2002 report *Evaluating the impact of demand restrictions*. We estimate that the NEUB restriction would save up to 2% of non-household demand. This would be applicable across the year, as non-household consumption shows little seasonal variation.

[8] Statutory Exceptions – Activities/water uses specified in the legislation which are exempt from water use restrictions and for which customers do not need to make representation to obtain permission (UKWIR 2013).

It is likely to take between 2 and 3 months to implement this option, to allow time for the drought order application and determination, including the publication of a notice of the Drought Order application in the press. The application process will be commenced at the same time as the TUBs restrictions are implemented (drought management zone 4) in order to ensure enough lead time before the restrictions are required.

The drought order can only be granted for a maximum of 6 months, and extended for up to a further 6 months via a further application to the Secretary of State.

4.2.5 Emergency Drought Orders

If the drought situation became significantly more severe than any drought in our historic record, we may not be able to maintain an uninterrupted supply of water for an extended duration. In such circumstances, intermittent supply cuts or supply via standpipes may be required. Although the probability of this occurring is very low, this remains a possibility if the drought management measures we have already implemented do not produce the required outcome. We have therefore included emergency drought orders within our drought plan in order to be prepared for the worst eventuality, but based on our historic record, under current demand conditions we would not have needed to implement this drought action. These restrictions would be applied to our whole supply area and are likely to take up to 3 months to implement.

4.2.6 Compensation

The compensation payments we make to customers for interruptions to their water supplies are as specified in the Bristol Water Bond, available from the following link:
https://www.bristolwater.co.uk/wp/wp-content/uploads/2016/02/Bristol-Water-Bond-15-161.pdf

This document outlines compensation to household customers. However, these commitments do not apply if we are prevented from meeting our standards as a result of severe weather. This includes drought conditions.

Anyone who is affected by the taking of water under a Drought Order may make a claim, which must be made within six months of the date of expiry of the order according to the rules which are set out in Schedule 9 of the Water Resources Act (WRA) 1991.

We are not required to pay compensation to customers if the circumstances are so exceptional that, in Ofwat's view, it would be unreasonable to expect the interruption to supply to be avoided and under the WRA 1991, customers are not entitles to compensation in respect of loss or damage sustained as a result of the implementation of Drought Permits/Orders.

Further information on the guaranteed standards scheme (GSS) payments is available from the Ofwat website: http://www.ofwat.gov.uk/wp-content/uploads/2015/10/gud_pro_gss08.pdf

4.3 Supply-side Actions

Under normal operating conditions we optimise our water resources to minimise the cost, operational risk and our carbon footprint, and to maintain our water resource position in the 'normal' operating zone. During drier conditions focus changes to our dry weather operating policy where we minimise the use of our reservoir water and maximise the use of our river sources from the Severn and the Axe.

Should drought conditions develop, and our water supplies become depleted, we will look to increase the volume of water available to us via a number of supply-side actions. These actions will supplement the demand management actions set out in section 4.2. Each drought is different, and we will aim to take a flexible approach to the timing and use of the supply-side actions in order to be able to respond appropriately to the specific drought conditions being experienced. In principle we will aim to use our licenced 'emergency' source(s) before submitting drought permit applications to make changes to our abstraction licence conditions in order to increase water available for supply.

As part of the drought plan update process we have reviewed our supply side actions and a number of them have been removed because they were considered to no longer be appropriate as drought management actions. A list of these options and the reason for their removal from the drought plan is provided in Appendix A.

The following drought measures have been identified as supply side actions to obtain additional water for the Bristol Water resource zone:

- Temporary variations to bulk supply agreements with Wessex Water
- Honeyhurst & Rodney Stoke (Well head)
- Reduction of Blagdon Reservoir compensation release (drought permit)
- Reduction of Chew Reservoir compensation release (drought permit)
- Reduction of Cheddar Ponds compensation release to Cheddar Yeo (drought permit)

Further details of these actions are set out in the sections below.

4.3.1 Temporary variations to bulk supply agreements

Bristol Water has a supply agreement with Wessex Water to provide up to 11.3Ml/d of water via a treated water pipeline to the city of Bath. In our water resource management plan (WRMP) 2014, we included an option to reduce this supply to 4.40Ml/d, thus providing us with an additional available resource of 6.97Ml/d. Wessex Water also included this bulk supply reduction within the assumptions used to develop their WRMP 2014. We are currently in discussions with Wessex Water on this the contract, but it has not yet been finalised. We have considered the terms of the current agreement and based on our interpretation of this we have proposed to Wessex Water that during a drought situation, on entering zone 3 (developing drought), we would reduce the bulk

supply to a maximum of 4.4Ml/d (reflecting the proposals set out in the WRMPs). On entering zone 4 (drought) we would consider the feasibility of reducing the supply still further, an approach which will include discussion with Wessex and EA to ensure the most efficient use of water within the region. This reduction would be maintained throughout zone 5 (drought). These actions are summarised in Table 10.

Table 10: Proposed reductions to bulk supply to Wessex Water at different stages of drought

Drought Management Zone	Bulk supply volume to Wessex Water (Bath) (Ml/d)	Additional yield available to Bristol Water (Ml/d)
Zone 2 – *Normal operation (dry weather management)*	11.37	0
Zone 3 – *Developing Drought*	4.4	6.97
Zone 4 – *Drought*	4.4 - 0	6.97 – 11.37
Zone 5 – *Drought*	4.4 - 0	6.97 – 11.37
Zone 6 – *Severe Drought*	0	11.37

Throughout the drought the operation of this bulk supply would then be under continual review as part of the ongoing water company liaison process as set out in our communication plan in section 6.2.

Every drought is different and we are likely to be affected by a drought in on a different timeframe to Wessex Water due to the differing nature of our resources and supply systems. The management of the transfer to Wessex Water would therefore be reflective of the specific drought conditions being experienced by both companies, and the need to implement the most efficient use of water resource across the region as a whole.

Once the contract negotiations are complete and a new bulk supply agreement is in place, any actions taken in a drought will reflect the terms of the new agreement and we will update drought actions so that any changes from the existing transfer contract will be reflected fully in our Drought Plan.

We also have some small imports of water from Wessex Water at the periphery of our system, typically no more than 1Ml/d. Wessex Water have not indicated a need to restrict these transfers during a drought. As these customers are within our supply area, they would be subject to any demand side measures implemented during a drought.

4.3.2 Honeyhurst & Rodney Stoke (well head)

Honeyhurst & Rodney Stoke (well head) is a licenced source that that has been retained for emergency use. It has an anticipated yield of 2.4 Ml/d, however, the water quality is relatively poor, and therefore is unable to be put into direct supply as was done in the past. This option would involve constructing a 4.2km pipeline to Cheddar Reservoir, and treating the water at

Cheddar water treatment works. Some pre-planning work has already been completed on this option because it is identified as a feasible option in our 2014 water resources management plan. It is anticipated that it would take at least 6 months to implement this option (subject to any environmental legislation requirements and engineering feasibility).

In implementing this option we would have to give regard to the 'no deterioration' principle set out in the Water Framework Directive when considering changes to the operation of the source because it has not been used for around 20 years. In addition it is also likely that a drinking water safety plan would be required to support this option. Full details of the option are provided in the option summary form in Appendix B.

The drought scenario assessment carried out (Section 3.3), identified that this option is only really effective for a multi-season drought due to the 6-month lead-in time required to put the source back into supply.

4.3.3 Reduction of Blagdon Reservoir compensation release

Bristol Water is required as part of its abstraction licence to make a compensation discharge of 8.638Ml/d into the Congresbury Yeo from Blagdon Reservoir. A reduction of this discharge would potentially conserve additional water for public water supply. Under this option we are proposing to reduce the compensation by 4.038Ml/d to 4.6Mld between 15th May and 30th November.

A drought permit from the Environment Agency would be required in order to implement this option. Full details of the option are provided in the option summary form in Appendix B.

4.3.4 Reduction of Chew Reservoir compensation release

Bristol Water is required as part of its abstraction licence to make a compensation discharge of 14.32 Ml/d (May to July) and 6.819Ml/d (Dec to April) into the River Chew. A reduction of this discharge would potentially conserve additional water for public water supply. Under this option we are proposing to reduce the compensation by 7.32 Ml/d to 7Ml/d between May and July, and by 3.419 Ml/d to 3.4 Ml/d between December and April.

A drought permit from the Environment Agency would be required in order to implement this option. Although Chew Reservoir is a European designated site (an Special Protection Area (SPA)) this option will not cause a negative effect to the designated features of the SPA, we have therefore determined that the application for this temporary licence change should be via a drought permit application to the Environment Agency, as opposed to a Drought Order application to the Secretary of State. Full details of the option are provided in the option summary form in Appendix B.

4.3.5 Reduction of Cheddar Ponds compensation release to Cheddar Yeo

Bristol Water is required as part of its abstraction licence to make a compensation discharge of 6.8 Ml/d to the Cheddar Yeo from Cheddar Ponds. A reduction of this discharge would potentially conserve additional water for public water supply. Under this option we are proposing to reduce the compensation by 50% to 3.4Mld between December and May.

A drought permit from the Environment Agency would be required in order to implement this option. Full details of the option are provided in the options summary form in Appendix B.

4.3.6 Demonstrating an exceptional shortage of rain

As part of the drought permit application process we will be required to provide evidence to demonstrate that we have experienced an 'exceptional shortage of rain'.

Each drought situation is unique; therefore it is not appropriate to specify a prescriptive approach to assessing the exceptional shortage of rain. However, it is likely that, based on the historic data and information we have available relating to our supply area (as set out in section 3.1), we would use the following forms of assessment to demonstrate and exceptional shortage of rain:

- Identification of rainfall deficits across our water resource zone as a percentage of the monthly long term average, in the context of our historic records. As set out in Table 4, our rainfall record at Litton goes back to 1909, and the record at Barrow goes back to 1960, thus providing a good historic data set to put any future drought into a comparative context.
- Calculation of the cumulative rainfall deficit over different time frames (e.g. 18 months, 12 months, 6 months), to demonstrate how long the low rainfall situation has been taking place and the ongoing severity of the situation in the context of previous droughts within the rainfall record.
- Ranking of rainfall deficits against other drought events in the historic record.

To support the rainfall assessment, we would also use the following secondary measures:

- Temperature: This has implications for the demand placed on our network, as well as the environmental impact associated with water temperatures and soil moisture deficits.
- River flows: low rainfall affecting runoff/river flows will have implications for reservoir storage, especially during the winter reservoir refill period.

We would also support the above analysis with a forecast to assess the risk of water resource position worsening under different rainfall scenarios over the subsequent 3 to 6 month period and how our water supply system would respond to this. This assessment would be put in the context of our resource position against our combined reservoir drought control curves.

5 Environmental Assessments

5.1 Background

Our drought plan has identified a number of supply side options that may need to be implemented during a drought, should our normal operations become resource constrained. In some cases these options involve us operating outside our normal abstraction licence conditions and will therefore require application to the Environment Agency for a drought permit in order to vary these conditions. Detailed descriptions of the options and their implementation are provided in Appendix B.

Although the drought permit options were not included within the 2012 drought plan, a significant amount of environmental assessment work was done to support these options prior to this, between 2006 and 2011. In re-introducing these options to our drought plan, we have used this data and information to inform our assessments of the likely environmental effect of these drought permit options.

5.2 Environmental Assessment

An assessment of the potential effects of each drought action has been undertaken. This was based on a review of existing environmental reports and the baseline monitoring data available. The details of this assessment are presented in the tables in Appendix B for each of the supply side drought options. A high level overview of the environmental assessment process is provided in sections 5.2 to 5.7, but should be read in conjunction with Appendix B. Further detail is also provided in the Strategic Environmental Assessment and Habitats Regulations Assessment that accompany this drought plan.

The environmental assessment has been carried out in the context of the overall risk and likelihood of use for each of the supply side drought options. Using the principles set out in Figure 2 in the Environment Agency *Drought plan guideline extra information* (May 2016), the drought permit options that involve the reduction of compensation flows from our reservoirs, have been identified as requiring a 'reduced' environmental assessment, because they are likely to cause 'moderate damage' (defined as impacts that a site could easily and quickly recover from), and will be used on an 'infrequent basis' (defined as not likely to reoccur within several decades). The drought permit options will not be implemented until combined reservoir storage enters drought action zone 5. In practice we have never needed to implement these drought permits.

Similarly, the Honeyhurst and Rodney Stoke (well head) option has also been identified as requiring a 'reduced' environmental assessment, because it is likely to cause 'moderate damage' mainly relating to construction activity, and will be used on an 'infrequent basis' because although it is identified as being implemented when combined reservoir storage enters drought actions zone

4, the 6 month lead-in time to commissioning the source means that unless the drought is continuing for 12 months or more, this options is unlikely to be implemented.

The environmental features which are potentially identified to be most at risk of damage from the proposed drought permit measures are identified as:

- Fish population: Brown trout, bullheads and coarse fish species
- Benthic macroinvertebrate communities
- Macrophytes

The maps in Figure 16 and Figure 17 show the location of the supply side drought options, including the drought permit sites, and the ecological sites within the vicinity of the drought options, including designated sites and sites of conservation importance.

Table 11 summarises the high level outcomes of the more detailed environmental assessments in Appendix B.

Figure 16: Location of supply side options and European designated sites

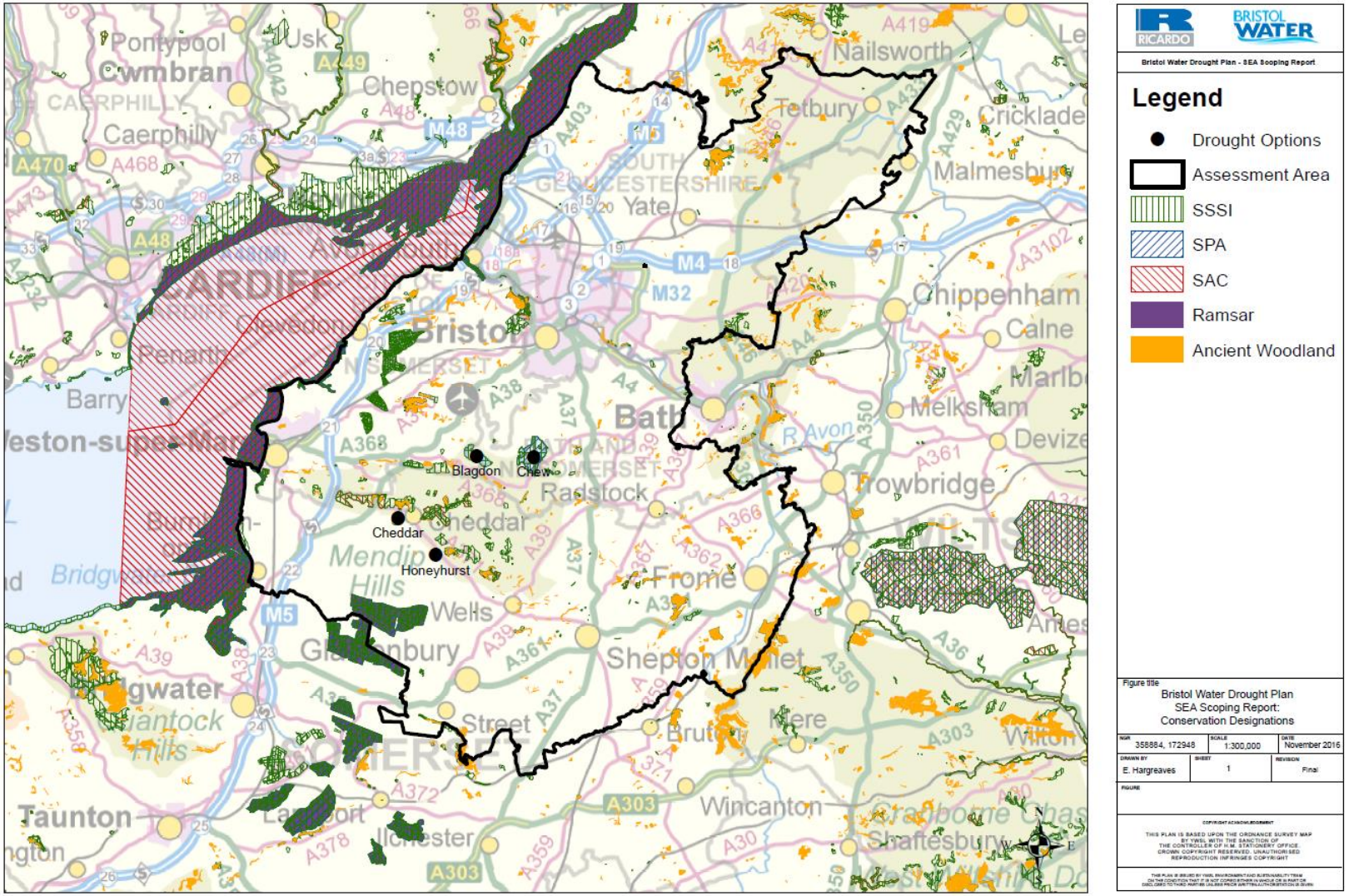


Figure 17: Location of supply side options and non-designated sites of conservation importance

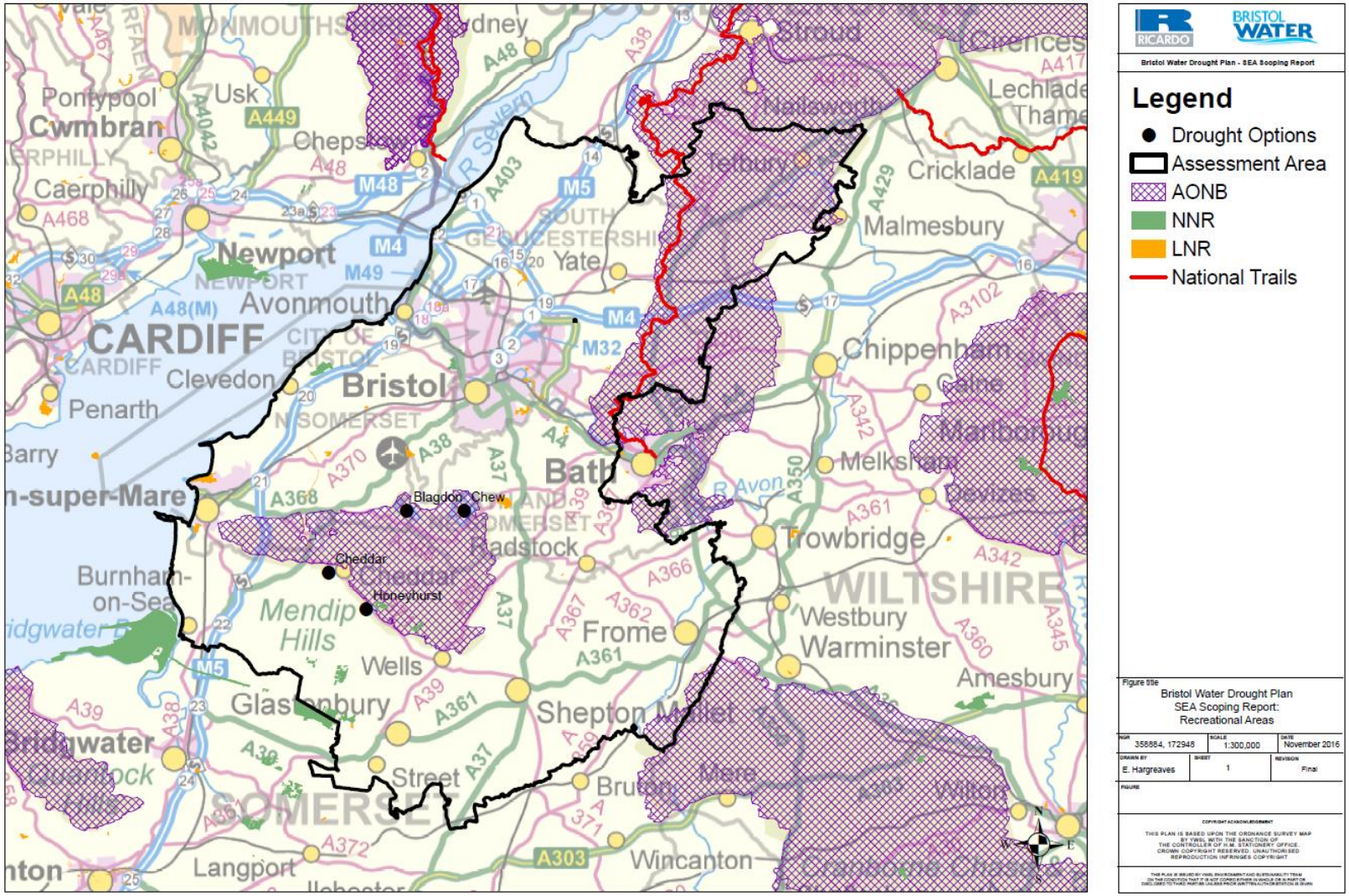


Table 11: Drought option environmental sensitivity summary

Drought Option	Permission Required	Existing EMP?	Existing Assessment Report?	Designation	Hydrological Impact (preliminary)	Environmental Sensitivity (preliminary)
Honeyhurst & Rodney Stoke (Well head)	None	No	No	None (post construction mitigation re: SSSI, SAC that are in proximity)	Minor	Minor during operation
Reduction of Blagdon Reservoir compensation release	Drought Permit	Yes	No	SSSI, SPA, SAC Ramsar	Moderate to Minor	Minor
Reduction of Chew Reservoir compensation release	Drought Permit	Yes	No	SLINC, SSSI, SPA	Moderate to Minor	Minor
Reduction of Cheddar Ponds compensation release to Cheddar Yeo	Drought Permit	Yes	No	SSSI, County Wildlife Site	Moderate to Minor	Minor

5.3 Environmental Monitoring

5.3.1 Background

Monitoring is required to identify any environmental effects of implementing the supply side drought options over and above the effects of natural drought conditions alone.

There is already a significant amount of information available to assess the likely environmental effects of our proposed supply side actions. In 2006 we carried out an environmental monitoring scoping exercise to identify the relevant environmental information available and where data gaps existed in the information required to determine the environmental effects of our proposed drought actions. In 2007 we produced environmental monitoring plans setting out the monitoring requirements to address the gaps in the baseline data and also identify the likely in-drought and post-drought monitoring requirements. A subsequent programme of monitoring was carried out in 2010 to gather the data required to address some of the data gaps. Bristol Water is developing an Environmental Monitoring Plan, informed by full Environmental Assessment Reports (EARs), in agreement with the Environment Agency and is committed to delivering said plan to ensure fit-for-purpose drought permit options for all the events covered in this Drought Plan. The EARs, EMP and timetable of work is described further below.

5.3.2 Environmental Assessment Reports

Going forward it is our intention to complete full EARs for our three drought permit options identified within our Drought Plan, in line with Defra and Environment Agency Guidance, taking full account of designated sites and in-combination effects with other options, and building on the studies we have already completed. Once complete, the EARs will be available for updating to support any application to the Environment Agency for a drought permit, should one be required in the future.

We have commissioned consultants Ricardo to support us in producing the EARs, and the programme of work to complete these reports is underway. The EARs were issued to the Environment Agency in November 2017, with revisions to the Final Draft EARs being undertaken in April 2018. Details of the programme and delivery dates are set out in Figure 18.

5.3.3 Environmental Monitoring Plans

We produced environmental monitoring plans for each of the drought permit options in 2007. These monitoring plans set out the proposed pre-drought, in-drought and post-drought monitoring requirements in detail. If we were to apply for one of the drought permits included within our current drought plan, the monitoring proposals set out in these reports would be used to inform the required in-drought and post-drought monitoring, in liaison with the Environment Agency and Natural England.

Subsequent to the programme of baseline monitoring carried out in 2010, a review and update of this work is required to identify the current baseline environmental data position. Due to the drought permit options not being included within the 2012 drought plan, there has been no on-going review of the baseline data position. The assessments undertaken in each EAR (described in section 5.3.2) will confirm the features requiring consideration for monitoring before, during and after the implementation of the drought permit and be able to inform an update of the EMPs for each drought permit option. The updated EMPs will include the following:

- The feature(s) to be monitored and the methods used
- The location of survey sites (including a map)
- The timing and frequency of monitoring
- Monitoring requirements linked to any specific mitigation actions
- Monitoring required for post-drought assessment of the sites.

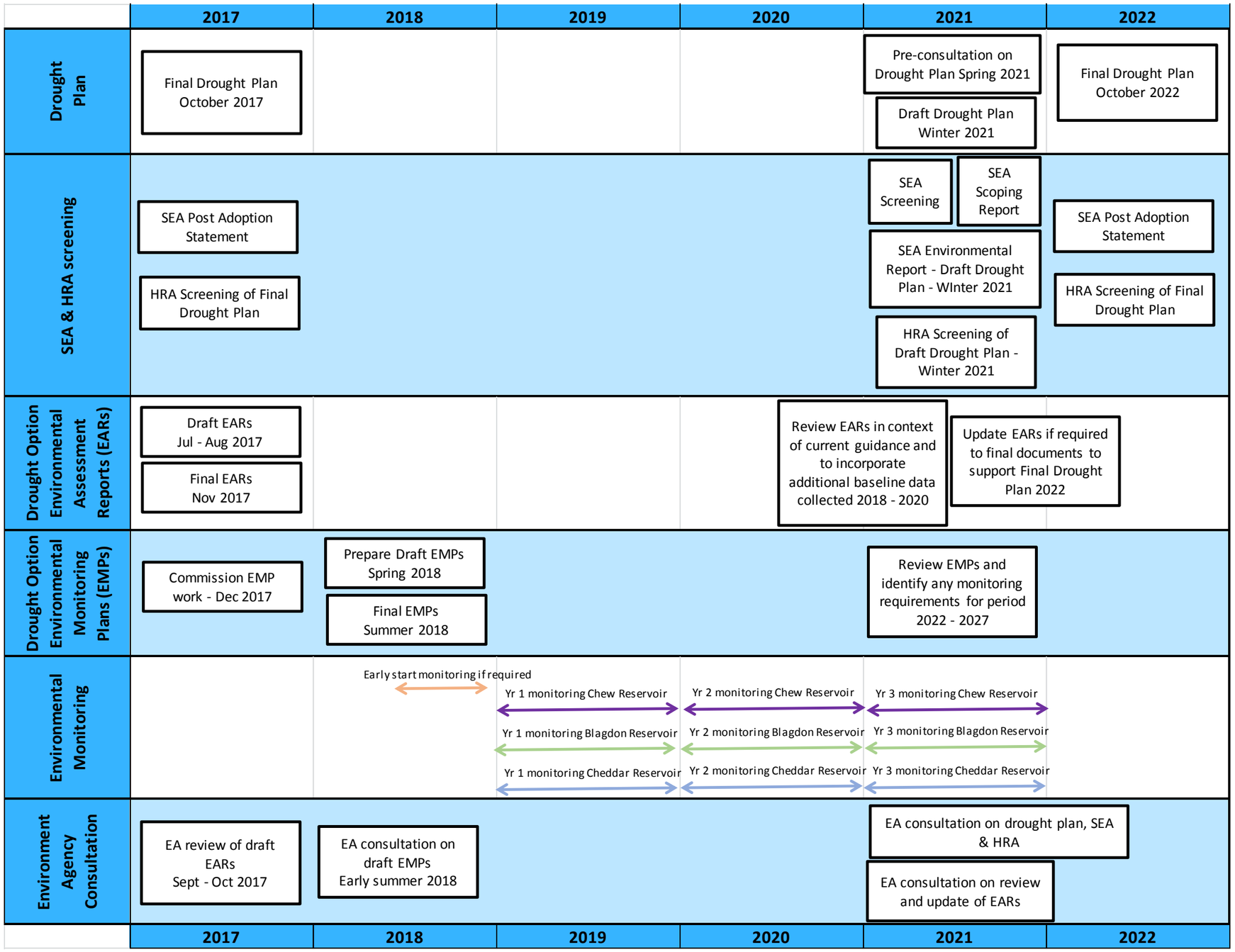
Moving forward, we are committed to ensuring that we have all the necessary data and information required to support a drought permit application should it be required. Therefore, once the EARs are completed, we will be in a position to identify the work required to update the EMPs and any additional monitoring requirements to fill data gaps.

Under the Environment Agency Water Resources Planning Guidance (May 2016) and supplementary supporting guidance *Drought Options* (November 2016), the Environment Agency has stated that all drought permit and orders are now considered to be water resource options within the water resource management plan process, and that they should be assessed consistently along with the other options needed to meet specified planning scenarios. We are currently reviewing and updating our Water Resources Management Plan, and are therefore assessing our drought permits and orders as part of the options appraisal process, in line with this new guidance. In addition we have also tested our draft drought plan via a drought exercise support both the drought plan development, and the understanding of the options to be included with the WRMP19 assessment

We finalised our draft WRMP19 in November 2017, at which point we will be able to confirm whether the drought permit options are to be maintained as the most appropriate options for drought management both in the short and long term. Figure 18 shows the programme and delivery dates for the EAR work that is already underway. It also includes an outline programme of work required to review and update the EMPs and implement any further environmental monitoring requirements that may be identified. This is the additional work required in order to achieve ‘permit ready’ status by the time we produce our next drought plan update in 2022. Once the EARs are completed, and the draft WRMP is finalised at the end of November 2017, we will implement the review, refine and update of the EMPs and the associated programme of environmental monitoring work, if required.

Should we need to apply for a supply side drought permit in the interim, we will use the existing monitoring plans, in consultation with the Environment Agency and Natural England, to ensure all environmental effects of implementation are assessed and mitigated where possible.

Figure 18: Programme for development of Drought Plan EARs, EMPs and Environmental Monitoring



5.4 Mitigation

Where likely adverse effects associated with our supply side drought options have been identified as part of the Environmental Monitoring Plan, details of likely mitigation measures have been identified. Mitigation measures will include, but not be limited to, the following actions;

- Development of a fisheries contingency plan in consultation with Environment Agency fisheries specialists and Natural England, including the identification of any consent applications required covering Section 28 (fish removal) and Section 30 (fish introduction) under the Salmon and Freshwater Fisheries Act, 1975
- Deployment of aeration equipment as appropriate to raise dissolved oxygen concentrations to prevent fish stress/kills
- Undertaking fish rescue (removal and transfer of fish to more suitable river reaches), where fish are seen to be in distress, and particularly if aeration cannot be deployed.
- Re-stocking of fish if fish mortality occurs

Post drought option assessment of the situation will be undertaken in liaison with the Environment Agency and Natural England in order to determine if additional remedial measures are required.

Mitigation actions will be agreed with the Environment Agency and Natural England prior to the implementation of supply side drought options/ drought permit application being made. The mitigation will be based on the level of understanding gained through the environmental monitoring data available and on any experience from previous droughts.

In order to implement some of the mitigation measures identified above, we will need to obtain some permits/ approvals in order to carry out this work. Based on the types of mitigation we have identified, the permits/ approvals required include:

- Environment Agency Section 27 authorisation under the *Salmon and Freshwater Fisheries Act 1975*.
- Application to the Environment Agency for a Site Permit under the *Keeping and Introduction of Fish Regulations 2015*.

The Environment Agency has confirmed that no permits are required to deploy aeration equipment.

As noted above, mitigation actions will be agreed with the Environment Agency and Natural England prior to the implementation of supply side drought options, and will be reflective of the specific circumstances of the drought. The list of required permits/ approvals is therefore indicative and not exhaustive, and will be reviewed in the context of the specific circumstances as a drought progresses.

5.5 Habitats Regulations Assessment

Under Regulation 61 of the Habitats Regulations, any plan or project which is likely to have a significant effect on a European site (either alone or in combination with other plans or projects) and is not directly connected with or necessary for the management of the site, must be subject to an assessment to determine the implications for the site in view of the site's conservation objectives.

Therefore, as the competent authority, Bristol Water is required to undertake a Habitats Regulations Assessment to assess the potential effects on European sites (also known as Natura 2000 sites) of implementing the Drought Plan. European sites include those sites designated as Special Areas of Conservation (SAC) under the EU Habitats Directive, Special Protection Areas (SPA) under the Birds Directive and Ramsar sites under the international Ramsar Convention.

The drought permit options re-introduced to this plan are located within or in close proximity to European sites, and therefore an HRA is required. An assessment has been undertaken to establish whether there may be any likely significant effects on designated features or species. The results of this assessment are presented in a separate report entitled *HRA of Bristol Water Draft Drought Plan 2017- Habitats Regulations Assessment Screening Report*. This report was included in the public consultation process for the draft Drought Plan alongside the Strategic Environmental Assessment.

The HRA screening of the Drought Plan shows that none of the measures included in the Plan are considered to have a likely significant effect on European sites, either alone or in combination with any other drought management measures in the plan. In addition, in-combination effects of the draft Drought Plan with our WRMP14, the Environment Agency's regional Drought Plan, the Severn River Basin District RBMP 2015, and other water company WRMPs and Drought Plans, are not considered likely to have significant adverse effects on any European sites. No in-combination effects with other plans or projects have been identified. On the basis of the screening results it was shown that an Appropriate Assessment of the draft Drought Plan was not required.

As part of our drought plan update we have considered the findings of the HRA screening to inform the priority and phasing of implementing the drought management options set out in the drought plan. The supply side drought options that are in close proximity to the European sites are implemented in the latter stages of the drought, with all demand management options being implemented as priority before taking additional water from the environment.

5.6 Strategic Environmental Assessment

We took a precautionary approach in relation to the SEA screening of the Drought Plan by considering that there could be a possible effect on Natura 2000 sites as a result of implementing some of the drought options included within the plan. On this basis, we undertook a Strategic

Environmental Assessment (SEA) of the Drought Plan which considered both the demand side and the supply side options. The SEA identified the social and environmental effects (beneficial or adverse) of implementing the Drought Plan in order to help inform the selection and phasing of drought measures. In addition this information will be used in prioritising drought actions during a drought.

The SEA Environmental Report (2018) presents an assessment of the likely social and environmental effects of the Drought Plan and identifies ways in which adverse effects can be avoided, minimised or mitigated and how positive effects can be enhanced.

It should be noted that SEA is an iterative process. The assessment has been based on information available at the time of publication. As further information becomes available and always prior to the implementation of a drought action, further review and assessment will be carried out.

The results of the SEA assessment are presented in the 'Drought Option Assessment Tables' located in the SEA Environmental Report Appendix F. Where appropriate, mitigation measures have been identified to prevent, reduce or offset significant adverse environmental effects. These mitigation measures have been taken into account in assessing the residual effects on the environment.

The SEA Environmental Report was included in the public consultation process for the draft Drought Plan.

5.7 Water Framework Directive Compliance Assessment

The Drought Plan Guideline (2015) requires that an assessment is provided of how the drought plan may affect WFD status or potential and how the drought plan might affect the environmental objectives and measures set out in River Basin Management Plans (RBMPs).

The 2015 RBMPs includes:

- 2015 classification results that form the baseline for assessing deterioration in water body status for the 6-year period December 2015 to 2021
- Updated water body status objectives
- Updated Protected Area objectives
- Programme of Measures required to help achieve the stated water body objectives

The Environmental Assessment for Water Company Drought Plans Guidance (2016) states that the WFD Articles most relevant to drought plans are:

- Article 4.1 Environmental objectives
- Article 4.6 Temporary deterioration in status
- Article 4.7 Defence against breach of WFD objectives

- Article 4.8 Impact on other water bodies
- Article 4.9 Level of protection

The 2016 Guidance specifically requires that the potential impacts of the drought plan measures on the following are considered:

- Impacts on the quality elements or features that are used to determine WFD surface water and groundwater body status and elements that could influence the status
- Impacts on measures to address priority substances, priority hazardous substances and other pollutants

In accordance with the above guidance, we have assessed the potential implications of supply-side measures on WFD objectives, both in isolation and in-combination. We have considered the following WFD objectives in relation to each of the four supply-side measures contained in our plan. Further details of our WFD assessment are provided as part of the accompanying Strategic Environmental Assessment.

WFD objectives:

- Objective 1: To prevent deterioration between status classes of any waterbody, including any temporary deterioration in status
- Objective 2: To prevent the introduction of impediments to the attainment of Good WFD status or potential for the waterbody
- Objective 3: To ensure that the planned Programme of Measures in the RBMP to help attain the WFD objectives for the waterbody (or the environmental objectives in the 2015 RBMPs) are not compromised
- Objective 4: To ensure the achievement of the WFD objectives in other waterbodies within the same catchment are not permanently excluded or compromised.
- Objective 5: To ensure no adverse effects on Protected Areas and WFD objectives for these Protected Areas
- Objective 6: To ensure no hindrance to measures to address priority substances, priority hazardous substances and other pollutants

It is important to note that the baseline for assessing drought plan measures is considered as the conditions anticipated in a natural drought and with all existing abstractions and discharges in operation under their normal regulatory conditions. In a drought, the environment and ecosystems will already be under stress prior to implementation of any Drought Plan measures. The WFD assessment of the Drought Plan only considers the impact of implementing the Drought Plan against the baseline of such drought conditions.

Table 12 shows the conclusions of the WFD assessment for each supply-side option, as well as in-combination. Each of the drought permit options has a benefit of maintaining water levels within the reservoirs during a period of drought and therefore no impact is expected on these WFD waterbodies. As a result, the potential impact on WFD objectives only relates to the downstream river water bodies that may be affected by the drought permits. The findings are considered

precautionary pending further evaluation as part of developing Environmental Assessment Reports for each drought permit option (if the WRMP process confirms that these options are required). The map in Figure 19 shows the current WFD status of the waterbodies within our supply are and the location of our drought options.

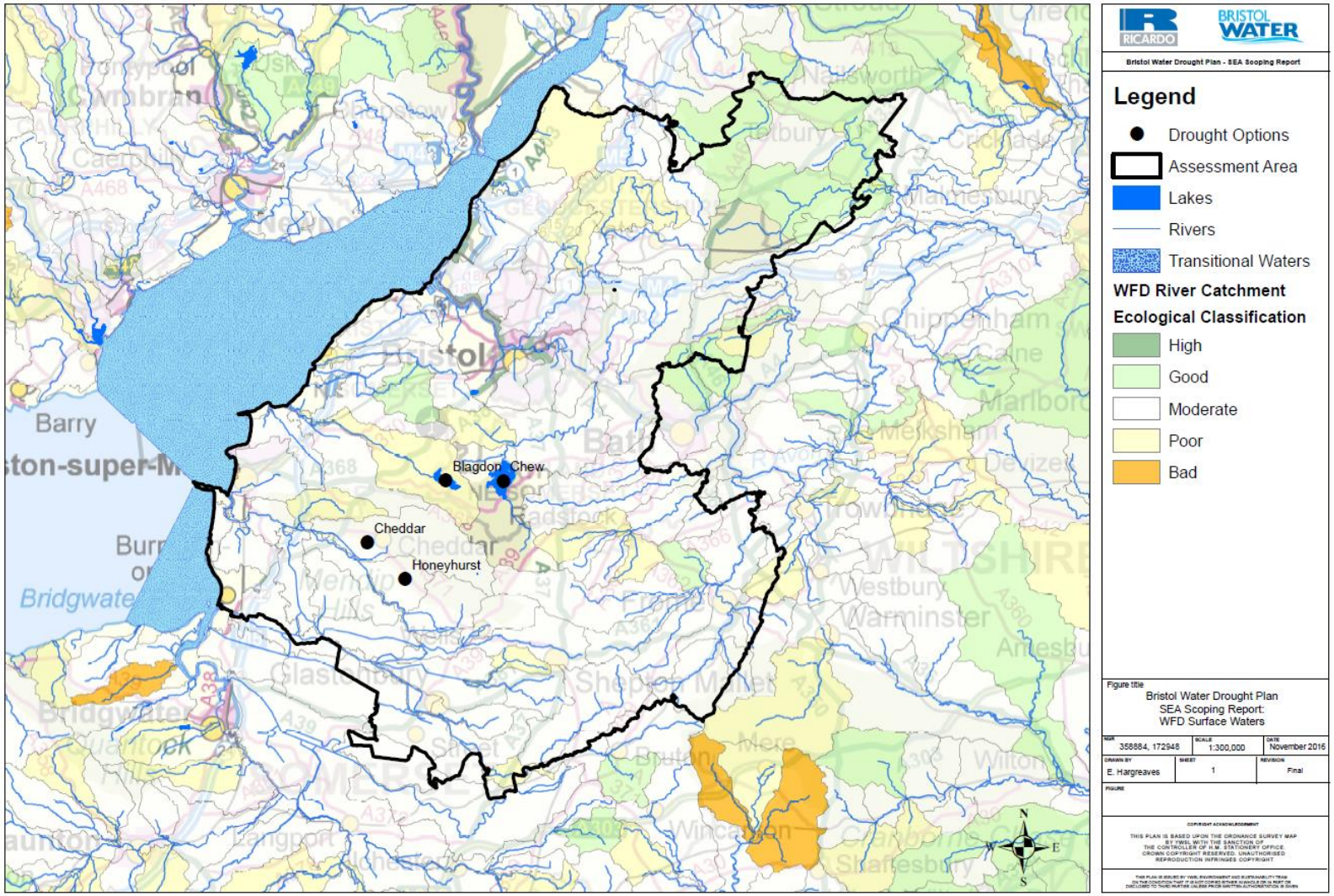
For the drought permit options, a low risk of temporary (not permanent) deterioration in WFD water body status between status class for one or more WFD elements in the downstream watercourse has been identified: note this is a risk, not a certainty and mitigation measures will be deployed to minimise this temporary risk. These mitigation measures will be considered further as part of the development of the Environmental Assessment Reports for each drought permit option (if the WRMP process confirms that these options are required for the future). No risk of permanent deterioration in WFD status class for any element is considered likely.

All the other WFD objectives are met provided that appropriate mitigation measures are deployed in relation to certain WFD Protected Areas (Objective 5).

Table 12: WFD Assessment Conclusions

Measure	WFD Objectives					
	Objective 1	**Objective 2**	**Objective 3**	**Objective 4**	**Objective 5**	**Objective 6**
Honeyhurst Well	Negligible risk of temporary deterioration in status	No likely adverse effects	No likely adverse effects	No likely adverse effects	No likely adverse effects with appropriate mitigation during construction activities	No likely adverse effects
Drought Permit at Blagdon Reservoir	Low risk of a temporary deterioration in status but risk will be mitigated as far as practicable	No likely adverse effects	No likely adverse effects	No likely adverse effects	No likely adverse effects with appropriate mitigation	No likely adverse effects
Drought Permit at Chew Reservoir	Low risk of a temporary deterioration in status but risk will be mitigated as far as practicable	No likely adverse effects	No likely adverse effects	No likely adverse effects	No likely adverse effects with appropriate mitigation	No likely adverse effects
Drought Permit at Cheddar Reservoir	Low risk of a temporary deterioration in status but risk will be mitigated as far as practicable	No likely adverse effects	No likely adverse effects	No likely adverse effects	No likely adverse effects with appropriate mitigation	No likely adverse effects

Figure 19: Location of supply side options and the WFD status of waterbodies within our supply area



6 Management and communications strategy

6.1 Management structure/roles and responsibilities

During normal conditions, each month Bristol Water has a high level water resources strategy meeting ('Sources') to review the water resources position and plan the operational strategy for the coming month and a 12-month management plan. This is done in the context of the water resources position, the anticipated customer demand at the time, any planned maintenance activity and consideration of any operational risks. In addition a longer term forecast is also presented to support the overall operational strategy. The on-going water resources situation is reported on a daily basis and circulated within Bristol Water and reported to the Environment Agency on a weekly basis.

The routine monitoring carried out by both Bristol Water and the Environment Agency enables any decline in the resource situation to be identified and responded to. If we experience a period of notably dry weather, or the long-range weather forecast indicates that this is reasonably likely, we implement the 'dry weather action/task force' as part of our normal operational response to dry weather conditions. If the water resource position starts to change and a developing drought (drought management zone 3) situation is indicated, then Bristol Water will form the 'Drought Management Group'. The decision to form the Drought Management Group will be agreed by those who attend the 'Sources' monthly meeting and the 'dry weather action/task force' which will have already been put in place.

The Drought Management Group will be formed from the relevant departments across the business that are able to provide the required expertise to support the drought management process. The departments that will be represented include Production, Network, Environment & Water Resources, Communications, Water Quality, Business Resilience, Customer Services. The Drought Management Group will be responsible for delivering the actions detailed within the drought plan.

The roles and areas of responsibility and/or expertise likely to form the Drought Management Group are set out in Table 13.

On formation of the Drought Management Group a Chairman and a Drought Co-Ordinator will be appointed. The Drought Co-Ordinator will provide administrative support and governance for the group. The minutes and action log from the Drought Management Group meetings will be widely circulated within the organisation. The frequency of the Drought Management Group Meetings will reflect the severity of the drought situation at the time. A summary of the proposed Drought Management Group process is set out in Table 14**.** When the drought management group is formed, deputies for each of the roles within the group will be identified in order to ensure business resilience to the overall management structure and process should any member of the group be absent for an extended period over the course of the drought.

In addition to the internal Drought Management Group, as drought conditions are encountered liaison will be increased with both the Environment Agency and our neighbouring water companies, including Wessex Water, Severn Trent Water, Thames Water, and South West Water. This process will provide the opportunity to implement consistency of messaging to customer/the public, and allow opportunities for joint working where appropriate.

Table 13: Proposed Bristol Water Drought Management Group

Area of Responsibility	Job Title	Department
Overall Management	Chief Executive Officer	Executive Team
Drought Management Responsibility	Head of Water Resources & Environment	Strategy & Regulation
Regulatory and Government liaison	Director of Strategy & Regulation	Strategy & Regulation
Water Production	Production Director	Production
Water Networks	Networks Director	Networks
Water Resources Planning and Resources/ Environmental Monitoring and Assessment	Water Resources Manager	Regulation & Strategy
Water Resources Strategy	Water Resources & Energy Manager	Production
Communication & Water Efficiency	Drought Communications Manager	Customer Services
Customer Contact	Operational Customer Services Manager	Customer Services
Legal Compliance	Solicitor	Legal & Compliance
Demand Forecasting	Head of Network Asset Planning	Asset Planning
Leakage	Leakage Technical Manager	Networks
Water quality issues	Head of Water Quality	Water Quality
Engineering schemes	Head of Network/Production Projects	Production/Network
Emergency Planning	Business Resilience Manager	Legal & Compliance
Administrative support and governance	Drought Co-Ordinator	Water Resources & Environment

Table 14: Drought Management Group actions

Water resources position:	Actions:
Normal	Routine monitoring and reporting of water resource situation
	Monthly 'Sources' meetings for resources and operational planning Dry Weather Action/Task Force put in place to implement dry weather operation
Developing Drought	Drought Management Group convened: • Initial meeting held and meeting frequency agreed (fortnightly recommended) • Communications plan put into effect as set out in Section 7.2 • Pre-planning for TUBs and NEUBs
	Meetings with adjoining water companies to understand wider situation
	Liaison meetings with Regulators (Environment Agency, Natural England, DWI and Ofwat). Frequency and format to be agreed
Drought	Drought Management Group meets weekly: • Forecast of future water resource and demand position presented and discussed • Management and tracking of drought actions (demand and supply), and their effect put in place • Agreement on drought actions to be progressed
	Meetings with adjoining water companies continue with aim of potentially co-ordinated response where appropriate
	Liaison meeting with Regulators continue, possibly increase in frequency
	In drought management zone 5 Water Resource Manager submits drought order application for NEUB if agreed by the Drought Management Group
	In drought management zone 6 Water Resource Manager submits supply side drought permit applications to Environment Agency and Emergency Drought Order application to Secretary of State if agreed by the Drought Management Group
Severe Drought	Drought Management Group meeting twice a week: • Water Resource/demand position and drought situation closely monitored and reported • Management and tracking of drought actions (demand and supply), and their effect
	Continued liaison and meetings with adjoining water companies, frequency may need increasing
	Close liaison with Regulators on the ongoing situation
Post Drought	Internal lessons learned workshop to discuss and record the drought experience and identify whether any elements of the drought plan need

Water resources position:	Actions:
	updating as a result of the recent drought. A 'lessons identified' report will be produced by the Water Resources Manager within 4 months of the end of the drought
	External joint lessons learned workshop with Regulators (and possibly neighbouring water companies) to discuss the drought experience and identify the effective joint working and opportunities for improvement
	If post drought environmental monitoring is required as a result of drought permit applications, this will continue

6.2 Communications Plan

6.2.1 Background

Our communications plan sets out clear guidance on what communications activities will be carried out by Bristol Water during a period of dry weather. Effective communications with customers, stakeholders and neighbouring water companies are an important part of drought management, to raise awareness of the developing resources position and ensure customer co-operation to help drive down demand and protect water resources.

The communications plan needs to remain flexible to reflect the individual nature of each drought and to deal with external influences such as media interest and other interested stakeholders (such as the Environment Agency, Natural England, Defra, Ofwat, DWI etc.).

6.2.2 Approach

The overarching principle behind the communications plan is to raise awareness of the drought situation and give timely and accurate information on the water resource situation, encouraging our customers to use water wisely.

On the formation of the Drought Management Group the Customer Services Director will appoint a Drought Communications Manager from the External Communications team. This will be a temporary role alongside the day job of that person. The Drought Communications Manager will be responsible for all external communication activity relating to the drought. Other members of the Communications team and Customer Services team will assist the Drought Communications Manager on an ad hoc basis.

6.2.3 Stakeholder groups

The effects of drought on society are far reaching. As a result there are a large number of stakeholders who will have an interest in the drought situation as it progresses. Table 15 summarises the key stakeholder groups that our communications actions will aim to target during a drought situation.

Table 15: Stakeholder groups for communications actions

Stakeholder Group	Name or Organisation
Customers	• Domestic • Commercial (Retailers operating in our area) • Bristol Water Challenge Panel
Regulators	• Defra • Environment Agency • Ofwat • Natural England • Drinking Water Inspectorate • Consumer Council for Water • Water UK • Historic England
Other Organisations	• Neighbouring water companies (Wessex Water, Severn Trent Water, Thames Water) • Canal & River Trust • Somerset Internal Drainage Board • Local Authorities • Avon & Somerset Local Resilience Forum • Gloucestershire Local Resilience Forum • Wiltshire & Swindon Local Resilience Forum • Horticultural Trades Association (HTA) • Fire Service • Political representatives e.g. MPs, MEPs, Bristol Mayor, Local Councillors. • Environmental organisations (including but not limited to Avon Wildlife Trust, Gloucestershire Wildlife Trust, Somerset Wildlife Trust, Bristol Avon Rivers Trust)
Staff	• Direct employees of Bristol Water • Contractors working for Bristol Water

6.2.4 Communication actions and techniques

Table 16 sets out our communications campaign that will be deployed and the specific actions we would take as part of our drought communications plan. This is a list of the techniques that can be used and how the messaging would change as the drought situation develops. The type and severity of the drought will ultimately dictate the details and specific timing of the media and communications campaign.

The following media spokespeople have been identified to support the media campaign during a drought; CEO, Director of Strategy & Regulation, Customer Services Director, Head of Water Resources & Environment, Water Resources Manager, and the Drought Communications Manager. The CEO would only be used during drought management zones 5 and 6. Directors will be used during zones 3 and 4. Head of Business and Managers will be used as appropriate throughout the drought situation

Table 16: Drought communications campaign

Water Resource Position	Communications Technique	Audience/ Stakeholder	Key Messages
Normal (Drought Management Zone 1)	Ongoing water efficiency programme across the year: • Schools programme • Compulsory metering programme • Public events • UWE student village project • "Save Water Save Money" products • Publications / newsletters		
Normal (Drought Management Zone 2)	Increase prominence of website homepage Social media targeted adverts and video/animation for social media and/or website Press release/ radio interviews to explain the current position	Visitors to the website Domestic customers – can target audience based on demographics	Our water resources are slightly below normal, we are managing our operations to address this. Please remember to use water wisely. The dry weather means our reservoirs are low. Help us save water.

Water Resource Position	Communications Technique	Audience/ Stakeholder	Key Messages
Developing Drought (Drought Management Zone 3)	Fix to homepage of website Increase social media messaging Press release and radio/TV interviews with coverage across the supply area, including reporting of developing drought situation on the local weather forecast Maximise 'Leakstop' campaign via website and social media Key messages OCS, Bristol & Wessex Billing Services (BWBSL) and retailers Information for retailers to provide to their customers Water efficiency messaging on bills (subject to the time of year) Radio and press adverts highlighting the situation trying to avoid Temporary Use Bans Public roadshow – visit events/garden centres/supermarkets and train stations across the supply area to raise awareness of the situation. Link with UWE drought team who do similar events Stakeholder/online panel consultation regarding TUBS to gauge public reaction to possible water use bans. Formal 14 day consultation on implementation of TUBs	All visitors to website Domestic customers Domestic customers & Non-household retailers Non-household customers via retailers Domestic customers Domestic customers Understanding of public support	Please support us in our increased leakage detection campaign by reporting any leaks you see. We are aware of the environmental stress the current dry period is causing. At this stage it does not affect our ability to supply water to our customers. We are monitoring the situation carefully and working with the Environment Agency on this developing situation. We encourage our customers to use water wisely. If the water resource situation continues to deteriorate we may have to implement a Temporary Use Ban (TUB) on our customers. Water is a precious resource.

Water Resource Position	Communications Technique	Audience/ Stakeholder	Key Messages
Drought (Drought Management Zones 4 & 5)	Website – as above with messaging tailored to reflect ongoing situation Social media messaging to reflect current drought situation with daily updates and real time information Press release across supply area with direct appeals for TUBS compliance. TV/radio interviews and phone-in sessions Radio adverts (Heart/Smooth/SamFM/ BCFM/ Ujima) & TV adverts highlighting the drought situation and the customer restrictions in place High impact posters and adverts (Buses, train stations, bill boards) Public meetings and speaker programme for schools, clubs, local groups etc. Targeted SMS messages to high demand areas Targeted messages to our 'Customer Care Plus' priority customers regarding TUBs restrictions	All visitors to website All customers across the supply area Commuters Household customers Priority customers	To protect supplies we have now introduced a temporary use restriction. These restrictions are essential to ensuring that supplies can continue to be maintained to customers in your area. We have introduced a NEUB restriction. These restrictions are essential to ensuring that supplies can continue to be maintained to customers in the Bristol Water area. We are continuing with our enhanced leakage campaign and would like customers to report any leaks they see. If the drought continues we may have to implement an Emergency Drought Order.

Water Resource Position	Communications Technique	Audience/ Stakeholder	Key Messages
Severe Drought (Drought Management Zone 6)	Media interviews with Directors/CEO on mainstream news during primetime Website – as above Press releases – as above with appropriate messaging keeping customers up to date with the ongoing situation Social media messaging – continue with the relevant campaign messages High impact posters and adverts to reflect ongoing severity of the situation Public meetings and roadshows	All customers across the supply area All visitors to the website All customers across the supply area Commuters	Thank customers for their support and communicate the demand savings achieved. Reiterate that these restrictions remain in place. Water resources are now exceptionally low and we are unlikely to be able to sustain supplies to all users in the short term.
End of Drought	Press release – announcing the end of the drought. Coordinated with Environment Agency messaging on this Social media messaging to announce the end of the drought and the lifting of TUBs and NEUB restrictions Ongoing water efficiency campaign to maintain the water efficiency culture developed during the drought	All customers across the supply area	Thank you for your support during the drought period. Our water resources position has improved and we are now able to remove the restrictions on water use.

6.2.5 Communication with customers on temporary use restrictions (TUBs)

Customers and interested parties will be given the opportunity to make representations prior to any temporary use ban being implemented. We will give formal notice in 2 local newspapers and on our website of our intention to implement the TUB and provide the details of the restrictions we are proposing to apply. We will also use social media to raise awareness of the consultation. We will allow a 14 day consultation period, within which customers would be able to make representations. By this stage of the drought the implementation of TUBs will not be unexpected to our customers due to the ongoing communications campaign and awareness raising that would have been taking place for a number of weeks, if not months, prior to the advertisement of the TUB.

To promote consistency across the industry, we will use the example notifications for water use restrictions under a temporary use ban provided in Appendix C of the UKWIR (2013) *Code of Practice and Guidance*.

The Water Resources Manager will be responsible for collating any representations received and presenting these to the Drought Management Group for review and consideration. We will consider all fully evidenced representation that indicate a particular water use ban would result in substantial and lasting damage to particular categories of business, or result in physical harm or damage to health. In such cases we may be willing to modify the restriction to avoid or limit damage.

6.2.6 Priority Services

Our 'Customer Care Plus' programme provides services to our customers requiring additional assistance. As part of this service we maintain a register of customers who require extra care. This includes a range of special services such as the haemodialysis register, and support to customers who are blind or partially sighted or who have difficulties reading to ensure that messaging about supply interruptions is received and understood. During a drought we will use the 'Customer Case Plus' register to target appropriate information and messaging to our priority customers. Details of the scheme and how to register are available on our web site:
https://www.bristolwater.co.uk/wp/wp-content/uploads/2016/02/CustomerCarePlus-May-2014-1.pdf

6.2.7 Cooperation with neighbouring water companies

Analysis and reporting on the 2012 drought highlighted the success and importance of the joint working between water companies and cooperation between the South East water companies during the drought campaign (Waterwise, July 2013). Our operating area adjoins the operating areas of 3 other water companies, Wessex Water, Severn Trent Water and Thames Water. A drought situation affecting our supply area is likely to be also affecting some or all of these companies in a similar way. We will aim to work closely with these companies to understand their drought position, and where appropriate work jointly to ensure customers receive clear messaging, particularly with regard to the implementation of water use restrictions. This is particularly relevant to working with Wessex Water as they provide the waste water services to our customers.

To ensure the delivery of consistent communications messages across our customer base, we will also include CCWater and the Environment Agency in the co-ordination of a joint approach to water efficiency communications. Joint working could include:

- Joint press releases
- Joint press conferences
- Joint advertising campaigns
- Joint stakeholder briefings and newsletters

6.2.8 Communication and data exchange with the Environment Agency

During a drought the Environment Agency (EA) Area Drought Manager is the first point of contact for us to ensure that the appropriate liaison and lines of communication are put in place between ourselves and the EA. The EA National River Basin Management Service (NRBMS) also has close liaison with water companies, both before, during and after a drought. Both teams have a role to play in ensuring joined up messaging between EA and water companies, checking that our drought plan actions are being enacted, ensuring that any drought permit applications are dealt with efficiently, and reporting to Government.

In the initial stages of a developing drought situation there will be regular liaison between Bristol Water and the Environment Agency. When our Drought Management Group is convened, we will inform the Environment Agency and agree the appropriate level of liaison for the drought position. It is likely that the EA NRBM account manager will liaise with the Head of Water Resources & Environment at Bristol Water throughout the drought situation, but additional technical support and input may be required as the drought situation develops.

In addition, once the EA has moved to 'Drought' status as defined within their Wessex Drought Action Plan (Final Draft Jan 2016), an Area Communications & Engagement Manager (ACEM) will be appointed. Our Drought Communications Manager will liaise closely with the EA ACEM to ensure a consistent and joined up approach to drought related communications.

Data and information exchange with the Environment Agency occurs regularly under normal operating conditions. It is anticipated that this will increase as the drought situation develops and we will make available any relevant drought related information requested by the EA as queries arise.

If the drought situation continues to deteriorate we may have to consider implementing TUBs, NEUBs and applying for drought permits. We will maintain close liaison with the Environment Agency on the implementation of any of these restrictions and permits.

At a national level we will work with the National Drought Group, chaired by the Environment Agency, via Water UK, to contribute to the national picture of the developing drought situation.

Details of this group and its purpose and structure are set out in the Environment Agency's report *Drought response: our framework for England* (June 2015).

6.2.9 Communication with Canal & River Trust

Bristol Water's supply of water from the Gloucester & Sharpness canal is implemented under agreement with the owners of the canal and the abstraction licence, the Canal & River Trust. Due to the importance of this supply as part of Bristol Water's overall operations, we consult with the Canal & River Trust on a regular basis to discuss issues such as maintenance, outage, River Severn flows and forecasts of canal abstractions. During a drought we would increase the frequency of our discussions to ensure there are no operational or resource issues arising.

The regulation of the River Severn is managed by the Environment Agency. Routine communication occurs between Bristol Water and the Environment Agency regarding the operation of the River Severn regulation across the year. As discussed in Section 3.2.2, the River Severn Drought Order will limit the volume of water available for abstraction by the Canal & River Trust from the River Severn to the Gloucester & Sharpness canal. During a drought, if the need for the River Severn Drought Order was triggered, then the Environment Agency will form the River Severn Drought Management Group to discuss the developing drought situation and implications on the River Severn and wider river catchments. Both Bristol Water and the Canal & River Trust will be represented on this group and will both look to ensure that the impact of any drought restrictions on the operation of the Gloucester & Sharpness canal is carefully managed and minimised where possible.

6.2.10 Communication with Retailers

From April 2017, Non-Household customers will be able to choose their retailers for water supply. During a drought situation Bristol Water will communicate with non-household customers regarding the on-going situation and any temporary use bans. This communication would normally be via the retailers.

Large businesses currently account for approximately 30% of our daily non-household demand for potable water. During a drought we would work closely with the retailers to keep their customers informed of the drought situation and any drought restrictions that may affect their customers, such as TUBs or NEUBs. We will look for opportunities to encourage retailers to raise awareness with their customers of water efficiency and what they can do to save water.

6.2.11 Communication with other organisations

Horticultural Trades Association (HTA)

We will work closely with the HTA as the drought develops to establish links to local members. These links will be used to raise awareness of the drought situation and identify opportunities for partnership working that will help to delay the need to implement TUBs restrictions. This work will

aim to mitigate the potentially damaging economic effect of water use restrictions on nurseries and garden centres. Targeted communications at the appropriate time via this route is likely to influence, or significantly reduce, water used for garden watering by the public.

Local Resilience Forums

The Local Resilience Forums communication networks will be used to communicate the current drought position to a wide group of stakeholders that will have an important role should the drought escalate into a critical situation. Ongoing updates on the drought situation will be communicated out via this network. Local Resilience Forums within our supply area include; Avon & Somerset, Gloucestershire, and Wiltshire & Swindon.

6.2.12 Employee information programme

Throughout a drought regular briefings and updates on the on-going situation will be provided to our employees. This is especially important for all customer facing employees, but also for those who are not directly customer facing. This is an important part of achieving consistent messaging from the company on the water resource situation. We will keep staff informed through a number of communication channels already in place:

- 'Inflow' Intranet homepage
- Internal e-briefings
- Team briefings

In response to the drought situation, all staff will be given a targeted briefing note, setting out the current situation and any direct effects to customers such as demand restrictions. This will be aligned with the key messages going out as part of our wider communications campaign.

7 Post Drought Actions

7.1 Drought Recovery

An ongoing improvement in the water resource situation, triggered by an extended period of good rainfall could indicate the end of the drought. The combined volume of water stored in our reservoirs relative to the drought management zones will be used to confirm our position and inform the decision to cease any drought actions that are being imposed/implemented.

The recovering water resource position will be monitored by the Water Resource & Environment Team and the Drought Management Group. The decision to end any drought management actions and the timing of this will be based on expert knowledge and experience of our water resources system and an assessment of any ongoing risks to customers' security of supply. We will also engage with our neighbouring water companies and the Environment Agency in advance of the decision to lift drought restrictions in order to understand the wider water resource and environmental situation and explore possible opportunities for coordinating any messages to reflect the changing circumstances. The process for lifting drought management actions and how this will be communicated to customer is set out in Table 16.

Throughout the post-drought stage as conditions recover, post-drought environmental monitoring will be undertaken as required by any drought permits implemented, and set out in Section 5.3.

7.2 Post Drought Review

Once the drought has ended and we have returned to operating under 'normal' conditions, a post drought review will be implemented. The review will provide an opportunity for those involved with the drought to identify any lessons learned and any potential improvements that could be made as a result to the drought plan and/or the overall drought management strategy. This will include identifying any particular vulnerabilities that became apparent during the drought, and the investment that may be required to mitigate these and build resilience into the water resource system.

The outcomes of the post drought review will be documented in a 'lessons learned' report. This report is likely to include information on:

- The suitability of the hydrological indicators and triggers used to identify the developing drought situation and whether they are still considered appropriate
- Customer responses to the drought measures imposed, the effectiveness of restrictions in reducing demand, and whether assumed reductions in demand associated with demand restriction were comparable to those experienced during the drought
- The actual yield achieved from the supply side measures implemented and identification of any operational difficulties that may have arisen during implementation
- The management decisions made during the drought relating to the timing and implementation of the drought measures

- Any environmental monitoring data collected during the drought and comparisons with the baseline situation prior to the onset of drought and implementation of any supply side drought actions
- The effectiveness of any mitigation measures carried out relating to supply side drought actions
- The effectiveness of cooperation between key stakeholders such as the Environment Agency and other water companies. We will work directly with the stakeholders to assess this.
- Whether the drought has any implications for our customer levels of service

We would aim to complete the post drought review and prepare the lessons learned report within approximately 6 months of the drought ending. The post drought review process will be led by the Water Resources & Environment Team, under the direction of the Head of Water Resources & Environment.

7.3 Revision of Drought Plan

Any recommendations from the post drought review would be included within the appropriate operational programmes and/or incorporated into the statutory planning process via updates to the drought plan and/or the water resources management plan as appropriate.

7.4 Testing our Drought Plan – Drought Exercise

On 15th May 2017, whilst the draft Drought Plan was out for public consultation, we carried out an internal drought exercise. The exercise was developed and facilitated by external consultants HR Wallingford. The aim of the exercise was to test the draft Drought Plan, specifically the management structure and communications strategy. The exercise also was used to raise awareness of the drought plan and processes across the business. The lessons learned from the exercise have helped inform our final Drought Plan. The exercise focused on the key decisions that would need to be made during the development of a drought, and the mechanisms for making these decisions. It did not focus on the detailed operational issues that may occur during a drought.

Ideas and suggestions for the drought plan were recorded as lessons learned from the exercise. A summary of those that have influenced our Drought Plan are provided below:

- On formation of the Drought Management Group, clear succession planning for each role needs to be put in place to improve resilience of the overall management structure and process.
- The need to consider the environmental monitoring requirements associated with the drought permit applications, and the risk associated with not having adequate baseline information available to support these applications.
- The two phased approach to implementing both TUBs restrictions and NEUBs was shown through the exercise to be confusing, particularly relating to communicating the process to

customers. It was recommended that all TUBs restrictions should be implemented at the same time in drought management zone 4 and NEUBs should be implemented in zone 5.

- The Bristol Water Challenge Panel should be included in the list of stakeholders to engage with during a drought.

8 Future Improvements

Bristol Water is committed to progress and develop our drought planning methodologies and drought management processes in order to continually improve our understanding of our water supply system and the environmental effects of our actions, ensuring that any risk to customer supply is minimised during a drought situation. It is important to us that we follow any industry methodologies and ensure that the assumptions we use to assess drought risk and management are based on the most up to date information available. Details of the areas we aim to develop and improve before we publish our next drought plan in 2022 are set out in the table below:

	Development / Improvement Plan
Reservoir drought control curves	Our current drought control curves have been used to successfully manage our water supplies under drought conditions since their first publication in the 2008 Drought Plan. Since 2008 there have been a number of changes to the environmental regulations and legislation that may have implications for reservoir operation under drought conditions. We will therefore review and update our reservoir drought control curves to support the development of our next drought plan update in 2022.
Environmental monitoring	As set out in section 5.3 we are in the process producing our Environmental Assessment Reports and subsequent Environmental Monitoring Plans to support the supply side drought permit options identified within our drought plan. The environmental monitoring plans will inform a programme of baseline monitoring work that will support the drought permit options, and where appropriate, we are committed to ensuring that we develop a supporting baseline of monitoring data and information that will inform the assessment of these options in the 2022 update of our drought plan, enabling us to become 'permit ready'.
Links to our Water Resource Management Plan (WRMP)	Our supply side drought options will be assessed via the WRMP19 options appraisal process to ensure that they are the best value options for managing our water resources for our customers and the environment. The outcome of this assessment will identify whether the existing supply options should stay in the drought plan, or whether alternative options are better in the context of drought management and resilience. If necessary, once this assessment is complete we will reflect the outcome within our drought plan.

9 Drought Plan Security Statement

This plan has been reviewed by the Company Security Manager to confirm it does not contain potentially sensitive information, in accordance with the requirements of Advice Note 11 edition 5 'The Control of Sensitive Water Company Security Information' dated February 2016, and the 'Guidance to Water Companies on the release of security sensitive information' dated May 2012, both as issued by Defra. Therefore no information has been redacted from this document and its associated appendices.

10 References

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UKWIR (2013): *Managing Through Drought: Code of Practice and Guidance for Water Companies on Water Use Restrictions (incorporating lessons from the 2011-12 drought)*

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