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Working with water

Bristol Water Risk Decision Making Framework, UKWIR Guidance & Risk Characterisation

Workshop record

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Executive summary

HR Wallingford ran a workshop for Bristol Water on the latest UKWIR Water Resource Management Planning (WRMP) Methods for 2019. The workshop focussed on the new Decision Making Methods and Risk Based Planning guidance published by UKWIR.

The aim of the workshop was to take representatives from across key parts of Bristol Water through the new guidance, identify the key issues affecting Bristol Water's WRMP19 process, support Bristol Water in developing their provisional Problem Characterisation assessment and identify the evidence required to underpin this. This report provides a summary of the outcomes from the workshop.

HR Wallingford provided a technical overview of the latest UKWIR guidance to the workshop participants. This presentation explained to representatives from different parts of the water company how the WRMP methods are changing and how this may affect Bristol Water's WRMP19. The second part of the workshop used a series of sessions to prompt discussion between Bristol Water attendees on each aspect of the "Problem Characterisation" assessment.

This workshop discussion indicated that Bristol Water considers their Strategic Needs to equate to a 'Small' scale of problem in the terms of the UKWIR guidance. The Complexity Factor was rated by Bristol Water as 'Medium'. These assessments result in Bristol Water's resource zone lying in the green area of the Problem Characterisation matrix which means that current EBSD decision making methods are likely to be appropriate for use in WRMP19, although 'Extended' methods may be used at Bristol Water's discretion. The outputs of the Problem Characterisation should also be considered when developing the inputs required for the decision-making process in accordance with the UKWIR Risk Based Guidance.

A key concern highlighted by Bristol Water during the workshop is that their system is relatively flashy and vulnerable to droughts that result in reduced refill to the Mendip reservoirs during the winter. Increasing demand remains an issue for the upcoming plan, however experience of recent population increases suggests that the associate demand impact is less severe than is suggested by the projections.

A number of areas were highlighted as having evidence gaps or low confidence in the existing evidence, including but not limited to:

- Asset performance;
- Water availability calculations and sustainability reductions, including climate change;
- Drought resilience;
- Monitoring data in relation to drought permits;
- Demand forecasts.

Supply-side complexity factors generally were considered to be more cause for concern than demand- or investment-side complexity factors. An area of particular interest, but considerable uncertainty in its practical implementation is the feasibility of water trading.

Suggested citation

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Contents

1. Introduction

HR Wallingford ran a workshop for Bristol Water on the latest UKWIR Water Resource Management Planning (WRMP) Methods for 2019. The workshop focussed on the new Decision Making Methods and Risk Based Planning guidance recently published by UKWIR (UKWIR 2016a, b). As part of this guidance a water company is required to undertake a risk assessment, named Problem Characterisation, which assesses the scale and complexity of water supply planning problem. The aim of the workshop was to take Bristol Water through the new guidance, help Bristol Water identify the key issues affecting their WRMP19, support Bristol Water in developing their draft score of the Problem Characterisation and identify the evidence which will be required to underpin this. This report provides a summary of the outcomes from the workshop.

2. Workshop Overview

The first part of the workshop was a presentation led by HR Wallingford, providing a technical overview of the latest UKWIR guidance to six participants from Bristol Water:

- Liz Cornwell – Water Resource Manager
- Rebekah Rice – Water Resources & Energy Manager
- Patric Bulmer – Head of Water Resources and Environment
- Wendy Staden – Head of Production Asset Planning
- Michelle Ashford – Head of Network Asset Planning
- Damien Staszek – PhD Researcher at Bristol Water.

This presentation explained to different parts of the water company how the WRMP methods are changing and how this may affect Bristol Water's WRMP19.

The second part of the workshop used a series of sessions to discuss the "Problem Characterisation" assessment in the UKWIR guidance. The aim of these discussion sessions was to highlight the key issues which will affect the Supply, Demand and Investment components of the WRMP process. These were recorded by using wall charts as shown in the photograph in Figure 2.1.

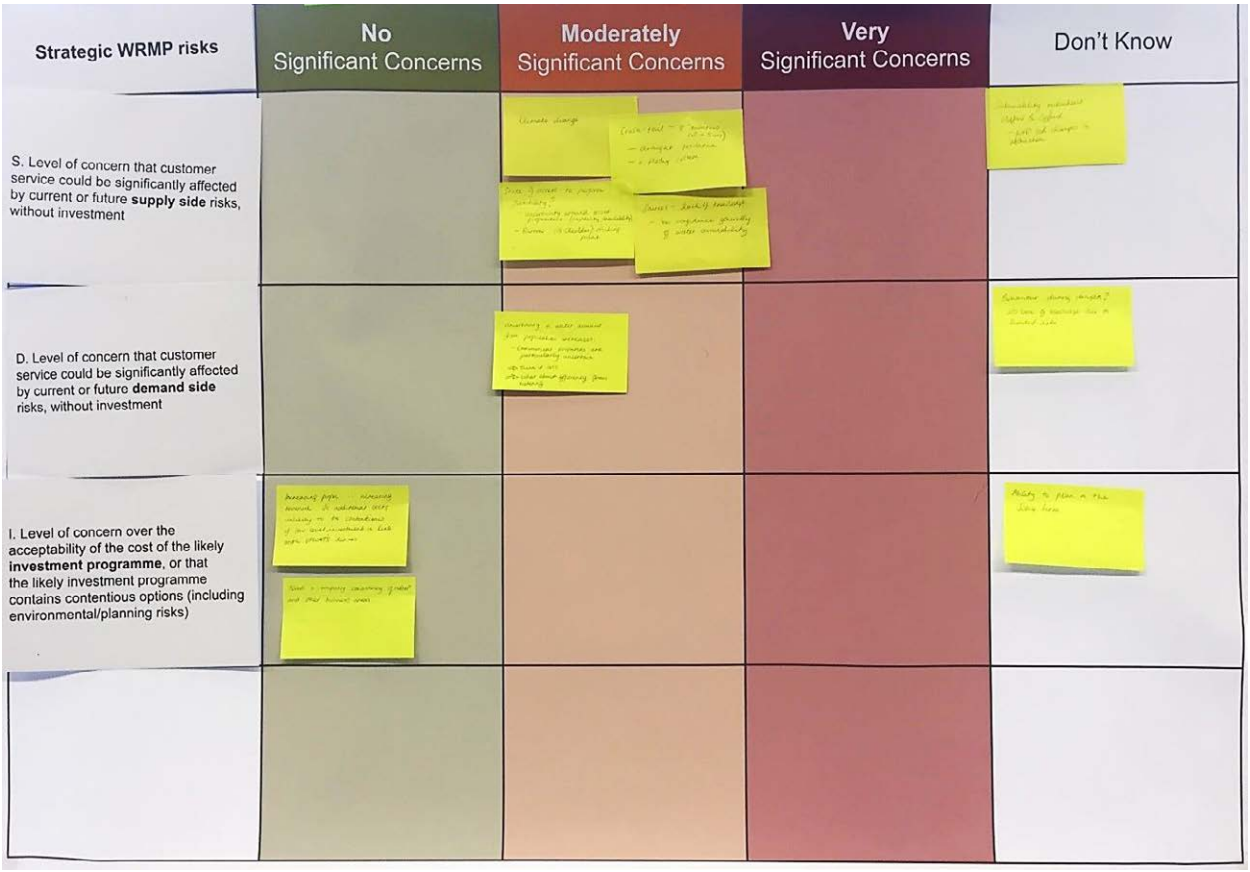

Figure 2.1: Example of Strategic Needs wall chart from breakout groups

At the end of each discussion session, the Bristol Water representatives agreed a score for each aspect of the Problem Characterisation tables.

At the end of the workshop each Problem Characterisation table had a first draft score and a record of the discussion of the evidence to underpin and justify this score. The evidence and scores obtained from the workshop are included in Section 3.

3. Problem Characterisation Evidence

This section provides a summary of the discussion to support each of the Problem Characterisation tables and a summary of the corresponding scores.

3.1. Strategic Needs

3.1.1. Key Issues Table

Table 3.1: Strategic Needs Table

Strategic WRMP risks	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
S. Level of concern that customer service could be significantly affected by current or future supply side risks, without investment			The BW system displays a sensitivity to drought; in particular eight dry months is likely to cause significant issues. There is a limited time-period between moving from an initial level of concern (e.g. Autumn and early winter rainfall is modest- which occurs regularly) to this developing into a potentially significant event. • The system is vulnerable to droughts where winter refill is reduced. • Climate change increases potential risks. • The current state of assets limits their ability to perform flexibly. • There is uncertainty around asset performance (in terms of capacity and availability). Barrow in particular (& Cheddar) are potential bottlenecks. • Drought permit risk; data is not currently available to support drought permit applications	There is a general concern that there is a lack of knowledge and low confidence in the information available on water availability. WFD led changes to abstraction are uncertain; although improvements have been made lately. Sustainability reductions would be more problematic at certain sources, e.g. the groundwater sources at Oldford and Egford.

Strategic WRMP risks	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
D. Level of concern that customer service could be significantly affected by current or future demand side risks, without investment		Consider that in the recent past population increases have not lead to the anticipated increases in demand (for domestic properties in particular). Expectation that better metering penetration would be required to manage demand.		Behaviour during a drought is highly uncertain; there is a lack of knowledge due to limited data on drought behaviour in modern society in Bristol. Uncertainty in the potential for changing demand in commercial properties.
I. Level of concern over the acceptability of the cost of the likely investment programme, or that the likely investment programme contains contentious options (including environmental/planning risks)	There is an increasing population and therefore increasing revenues. Additional costs unlikely to be contentious for low-level investment in line with regulatory requirements. Slight concerns regarding the cross-company consistency of investments for WRMP and other business areas.			Concern regarding long-term planning and how this will be dealt with in the future.

3.1.2. Scores Table

Table 3.2: Bristol Water's Strategic Needs Table

	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
S			✓	✓
D		✓		✓
I	✓			✓
Totals	0	1	2	

3.2. Supply Side Complexity Factors

3.2.1. Key Issues Table

Table 3.3: Supply Side Complexity Table

S	Supply side complexity factors	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
S(a)	Are there concerns about near term supply system performance, either because of recent Level of Service failures or because of poor understanding of system reliability /resilience under different or more severe droughts than those contained in the historic record? Is this exacerbated by uncertainties about the benefits of operational interventions contained in the Drought Plan?			Drought resilience knowledge is incomplete. Flashy system may not be resilient to certain type of events. Some doubts around potential yield that could be relied upon from Gloucester and Sharpness (GSC) during droughts due to the effects of the River Severn Drought Order and associated restrictions. Improving resilience may require supply-side changes that are not favourable to regulatory bodies. Drought permit options do not currently have significant monitoring data to support their application. Previous WRMP did not use the worst drought in the historic	

S	Supply side complexity factors	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
				record. There is uncertainty around the potential impacts from the worst historic drought and those that are more severe than this.	
S(b)	Are there concerns about future supply system performance, primarily due to uncertain impacts of climate change on vulnerable supply systems, including associated source deterioration (water quality, catchments etc.), or poor understanding?		Limited understanding but believe that this has been captured in headroom calculations		
S(c)	Are there concerns about the potential for 'stepped' changes in supply(e.g. sustainability reductions, bulk imports etc.) in the near or medium term that are currently very uncertain?	Recent discussions with the Environment Agency has reduced the uncertainty associated with sustainability reductions. However, depending on the source, the potential impact is variable.			
S(d)	Are there concerns that the 'DO' metric might fail to reflect resilience aspects that influence the choice of investment options (e.g. duration of failure), or are there conjunctive dependencies between new options(i.e. the amount of benefit from one option depends on the construction of another option). These can both be considered as non-linear problems.		Whilst there is some uncertainty in DO estimates for some sources and options, the DO metric is still considered the appropriate metric for assessing the choice of investment options and their combinations as part of WRMP 2019.		

3.2.2. Scores Table

Table 3.4: Bristol Water's Supply Side Complexity Table

	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
S (a)			✓	
S (b)		✓		
S (c)	✓	✓		
S (d)		✓		
Totals	**0**	**3**	**2**	

3.3. Demand Side Complexity Factors

3.3.1. Key Issues Table

Table 3.5: Demand Side Complexity Table

D	Demand side complexity factors	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
D(a)	Are there concerns about changes in current or near term demand, e.g. in terms of demand profile, total demand, or changes in economics/demographics or customer characteristics?	There are always societal and demographic changes with associated uncertainty. Concerns are not significant in the near-term though.			
D(b)	Does uncertainty associated with forecasts of demographic / economic / behavioural changes over the planning period cause concerns over the level of investment that may be required?	Demand increases as a results of recent population growth is not as significant as the projections initially suggested due to the type of development.	Power station development and water resource requirements is uncertain and will be considered as specific scenario in the planning process.		
D(c)	Are there concerns that a simple 'dry year/normal year' assessment of demand is not adequate, e.g. because of high sensitivity of demand to drought (so demand under severe events needs to be understood), or because demand versus drought timing is critical.		No recent evidence of customer behaviour and demand response during a drought to understand likely customer response.		

3.3.2. Scores Table

Table 3.6: Bristol Water's Demand Side Complexity Table

	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
D (a)	✓			
D (b)	✓	✓		
D (c)		✓		
Totals	**0**	**2**	**0**	

3.4. Investment Programme Complexity Factors

3.4.1. Key Issues Table

Table 3.7: Investment Programme Complexity Factors

I	Investment programme complexity factors	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
I(a)	Are there concerns that capex uncertainty (particularly in relation to new or untested technologies) could compromise the company's ability to select a 'best value' portfolio over the planning period?	No, this is standard practice for the company and BW is confident in its capex estimates.			
I(b)	Does the nature of feasible options mean that construction lead time or scheme promotability are a major driver of the choice of investment portfolio?	There is likely to be adequate time available to plan for any options required to be implemented based on the current supply demand position. Connection to other water companies is an area of slight uncertainty.			
I(c)	Are there concerns that trade-offs between costs and non-monetised 'best value' considerations (social, environment) are so complex that they require quantified analysis (beyond SEA) to justify final investment decisions.	No particularly complex options are anticipated in the forthcoming plan.			
I(d)	Is the investment programme sensitive to assumptions about the utilisation of new resources, mainly because of large differences in		There has been a focus on gaining a better understanding of OPEX		

I	Investment programme complexity factors	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
	variable opex between investment options?		recently and therefore the confidence in understanding this is significantly improved. Desalination does get put forward as an option, but so far has never been highlighted as feasible. Water trading sensitivities are poorly understood.		

3.4.2. Scores Table

Table 3.8: Bristol Water's Investment Programme Complexity Table

	No significant concerns (Score = 0)	Moderately significant concerns (Score = 1)	Very significant concerns (Score = 2)	Don't know
I (a)	✓			
I (b)	✓			
I (c)	✓	✓		
I (d)		✓		
Totals	**0**	**2**	**0**	

4. Problem Characterisation Results

The scores that were agreed by the participants at the workshop are presented in Table 4.1.

The Strategic Needs for Bristol Water was scored as 2 which equates to 'Small' scale of problem in the terms of the UKWIR guidance. The Complexity Factor was 8 overall, which equates to 'Medium'. An overview of these results is shown in Table 4.1 This mean that current EBSD decision making methods are likely to be appropriate, although 'Extended' methods may be used at Bristol Water's discretion and the approach to supply side risks may warrant further consideration in line with UKWIR's Risk Based Planning guidance

Table 4.1: Summary of Problem Characterisation Results. Note these are based on the most frequently recorded scores and not the average scores.

	Bristol Water's WRZ Score
Strategic Needs	**3**
Complexity Factor (CF)	**9**
A - Supply CF	5
B – Demand CF	2
C – Investment Programme CF	2

		Strategic Needs Score ("How big is the problem")			
		0-1 (None)	2-3 (Small)	4-5 (Medium)	6 (Large)
Complexity Factors Score ("How difficult is it to solve")	Low (<7)				
	Medium (7-11)		BW		
	High (11+)				

Figure 4.1: Problem Characterisation results

5. Recommendations

The workshop and this report provide a summary of the UKWIR Problem Characterisation for Bristol Water's WRZ. A wide range of issues have been highlighted through this process and it is now important for Bristol Water to determine the key issues and evidence which should underpin their Problem Characterisation assessment. The sections below provide a basis for starting this process based on the workshop outcomes and includes recommendations on the appropriate methods and approaches for use in WRMP19.

5.1. Workshop summary

The results of the Problem Characterisation in Figure 4.1 suggests that Bristol Water's resource zone is in the green area of 'Small' strategic needs (scale of the problem) and 'Medium' complexity scores.

Strategic needs – "How big is the problem"

The flashy nature of the system and associated drought resilience are the primary causes of concern in the Strategic needs but their potential impact on the planning process is assessed as 'Small' in the terms set-out in the UKWIR Decision Making Process guidance. Whilst increasing demand remains an issue, as per the last plan, experience of recent population increases suggests that the associate demand impact is less severe than is suggested by the projections. An increasing population means that revenues to Bristol Water are relatively secure and increasing. Therefore, concerns with respect to the acceptability of any investment decisions is low.

A number of areas were highlighted as having evidence gaps or low confidence in the existing evidence. There is considerable uncertainty with respect to asset performance and sustainability reductions; although in recent months the uncertainty surrounding sustainability reductions has reduced a little. The behaviour of the general public during a drought under a modern resource systems in Bristol is largely unknown as particularly severe historic droughts, such as during 1976 are no longer recent and the behaviour shown by that population cannot be considered to be representative of the current population. The usage anticipated from new commercial properties is also challenging to predict, as it is common for commercial organisations to agree a need for higher water use than they actually use. Future approaches to investment planning across Bristol Water as a whole, for the WRMP and other business areas was also an area of uncertainty to the workshop group.

Complexity factors – "How difficult is the problem to solve"

Incomplete knowledge of the drought resilience of their flashy system and low confidence in the actual Deployable Output that could be realised during a drought for some sources creates moderately significant concerns for Bristol Water in terms of supply side complexity. Cross-company understanding of drought permit options and their timeframes over which they could be implemented during a drought along with understanding of the methods used in previous WRMPs are also a source of concern. Understanding of impacts from climate change is also potentially significant although there is confidence that such uncertainty is captured appropriately in previous headroom calculations. The reduction in uncertainty with respect to sustainability reductions in recent months has reduced the level of concerns regarding the complexity of this factor.

Demand-side complexity factors mostly cause no significant concern. To-date increases in demand have not had as great an impact as projected and metering is known to manage demand well, historically. More significant concern is associated with behaviour during droughts, as up-to-date data is lacking.

Investment introduces little in the way of complexity factors; planning significant investment options, understanding capex uncertainty and non-monetary considerations is standard practice for Bristol Water. There are no immediate needs for substantial investment options and based on the current position there is likely to be adequate time for planning any options required to meet a supply shortfall or address resilience issues. Furthermore, improvements have been made in recent years in understanding opex, such that the uncertainty in these sensitivities is also reduced. One of the few areas where knowledge is still lacking is in the feasibility of water trading.

5.2. Evidence Gaps

Table 5.1 highlights the evidence gaps and issues with lack of knowledge or low confidence in existing evidence identified in the Risk Characterisation workshop.

Table 5.1: Evidence required to underpin key issues discovered in Problem Characterisation workshop.

Key Issue	Evidence gap / issue
Assets	• Asset performance: capacity and availability. • Current state of assets with respect to the ability to perform flexibly.
Water availability	• Uncertainty over assumptions used in WRMP14 DO assessment. Potential impact of sustainability reductions. • Impact of climate change on flashy system. • Water trading sensitivities are poorly understood.
Drought Resilience	• Customer behaviour during a drought is highly uncertain due to lack of data. • Adequacy of monitoring data to support drought permit applications. • Impact of worst historic drought and more severe droughts.
Demand	• Power station development and required water resource is uncertain but will be considered as a separate scenario. • New commercial demand challenging to manage planned usage versus actual usage.

5.3. WRMP Approach

The Water Resource Planner needs to decide upon a “System Modelling” approach using either an “Aggregate” or “System Simulation” approach. The Aggregate approach is the current convention where supply and demand are reduced to a single number each year as per water company planning tables. This approach is best suited to understanding the near-term scheduling of an Investment Programme and will be easier to adapt a water companies current methods and tools in the timeframes for WRMP19. A “System Simulation” approach only needs to be considered where there is a high inter-dependency between Options and/or existing sources and where the system is particularly vulnerable to droughts. Given the nature of the issues facing Bristol Water’s an Aggregate approach is most appropriate for WRMP19.

The initial score in the Problem Characterisation Process indicates that Bristol Water’s resource zone has a ‘Small’ strategic need and a ‘Medium’ level of complexity and therefore Bristol Water consider that an EBSD approach alone is sufficient for WRMP 2019 although some ‘extended’ methods may also be used for specific elements as appropriate.

6. References

UKWIR (2016a) WRMP 2019 Methods – Decision Making Process: Guidance. Report Ref. No. 16/WR/02/10.

UKWIR (2016b) WRMP 2019 Methods – Risk based planning: Guidance. Report Ref. No. 16/WR/02/11.

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