Dŵr Cymru Welsh Water
PR19 Willingness to Pay Research

Final Report
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EXECUTIVE SUMMARY

Introduction

DCWW commissioned Accent and PJM economics to conduct a programme of research exploring customers' WTP for a range of possible service level changes, and to support the application of the WTP values in cost benefit analysis (CBA). The results from the CBA will ultimately inform the development of the company's 2020-25 business plan and support its legitimacy to the regulators and other stakeholders.

The objectives of the study were to identify, through the use of stated preference (SP) surveys or other appropriate methods, which areas of service were most important to DCWW customers, and to estimate the value that customers place on different levels of service across DCWW's service measure framework.

This is our final report on the study.

Survey design and development

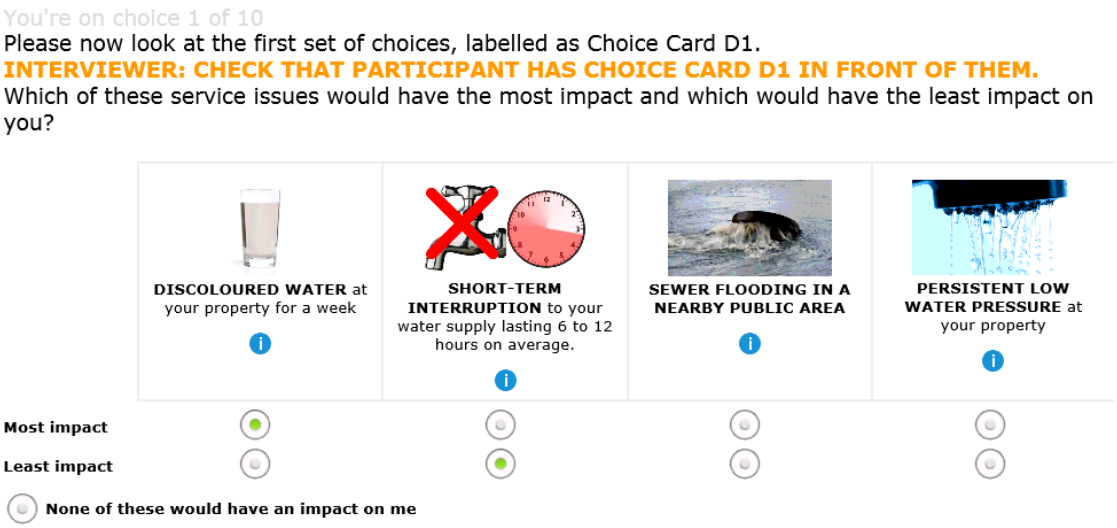
The SP survey research conducted for this study was designed and implemented in the context of several sources of focussed guidance, including the UKWIR (2011) report – "Carrying out WTP surveys". Following PR14, however, a number of issues concerning the UKWIR (2011) WTP methodology were raised in industry reviews and discussion papers. Echoing these concerns, Ofwat's Water 2020 consultation[1] proposed that companies consider how SP WTP evidence could be improved and explore what alternative and complementary tools are available to understand their customers' needs and requirements. Overall, it was evident at the outset of the present study that the approach to WTP evidence collection for PR19 would need to evolve from, rather than merely replicate, the PR14 approach.

In developing the design for the present study, we proposed an approach that sought, as far as possible, to remove the need for participants to trade off small risk reductions, which we believed to be the key source of complexity in the PR14 approach. This was achieved by imposing a degree of rationality on the structure of customers' preferences with respect to risk. By so doing, the choices customers were asked to make were much more straightforward and consequently, in our view, more likely to accurately capture their true preferences in a form that can validly be used for DCWW's investment appraisals.

Our design was constructed around two linked exercises: a 'MaxDiff' exercise containing questions of the kind shown in Figure 2 below; and a 'Package' exercise containing questions requiring participants to trade off packages of service change and bill changes.

[1] Ofwat (2015) "Water 2020: Regulatory framework for wholesale markets and the 2019 price review", December 2015

Figure 1 Example choice card form the MaxDiff exercise



The MaxDiff exercise obtained estimates of the relative impact that each type of service issue would have on customers. Table 1 below lists the service issues that were selected for the study. This list was arrived at via a process of consultation with DCWW.

Table 1: Service issues and descriptions

Service issue
DISCOLOURED WATER at your property for a week
WATER TASTE & SMELL NOT IDEAL at your property for a few days
SHORT-TERM INTERRUPTION to your water supply lasting 3 to 6 hours on average.
SHORT-TERM INTERRUPTION to your water supply lasting 6 to 12 hours on average.
LONG-TERM INTERRUPTION to your water supply lasting 24-48 hours.
LONG-TERM INTERRUPTION to your water supply lasting 7 days
PERSISTENT LOW WATER PRESSURE at your property
TEMPORARY USE BAN from May to September.
SEWER FLOODING INSIDE YOUR PROPERTY- Extensive flooding, making it uninhabitable.
SEWER FLOODING INSIDE YOUR PROPERTY- Minor flooding, causing no lasting damage
SEWER FLOODING OUTSIDE YOUR PROPERTY
SEWER FLOODING IN A NEARBY PUBLIC AREA
ODOUR FROM SEWAGE WORKS affects your property once or twice per year, for a few days each time
ODOUR FROM SEWAGE WORKS affects your property several times a year, for a week or two each time
SIGNIFICANT POLLUTION INCIDENT in your local area caused by Welsh Water operations
MINOR POLLUTION INCIDENT in your local area caused by Welsh Water operations
RIVER WATER QUALITY in your local area fails to achieve Good status due to the impact of Welsh Water operations.
COASTAL BATHING WATER QUALITY in your local area achieves Good quality but not Excellent due to the impact of Welsh Water operations.
COASTAL BATHING WATER QUALITY in your local area achieves Sufficient quality but not Good or Excellent due to the impact of Welsh Water operations.

The Package exercise was included in order to obtained evidence on customers' willingness to trade off money for service level changes at the package level.

For the purpose our analysis, four different packages of service levels were defined as follows:

- -1: all service measures deteriorate. The bill is lower than the SQ package.
- SQ: all service measures at current levels, with the bill either maintained (in real terms), or slightly decreased or increased.
- +1: all service measures improve, and the bill is higher than the SQ package.
- +2: all service measures further improve; the bill is higher than in the +1 package.

Customers were asked to make a sequence of choices between these packages, and the data from this exercise could be used to estimate their WTP for whole packages of service change.

The design approach put forward for this study was new to DCWW, and to the water sector more widely, and so an extensive programme of testing was designed and implemented to refine the design and provide assurance that the instrument was working effectively. This included four phases of pre-testing of the survey instrument with DCWW customers.

The first phase of pre-testing consisted of 8 pre-tasked focus groups and 24 pre-tasked telephone depth interviews. This qualitative work explored customers' response to different sets of show material and ways of presenting the various exercises.

The second phase consisted of 16 cognitive interviews (11 with household customers and 5 with non-household customers), in which participants were encouraged to "think aloud" and give feedback on the questionnaires and showcards as they worked their way through them.

The third phase of pre-testing with DCWW customers consisted of a pilot stated preference study of 200 interviews with household customers for each of the PR14 and PR19-style surveys. As for non-household customers, 192 interviews were conducted for the PR14-style survey, and 121 for the PR19-style survey.

Based on the findings from the analysis of the pilot data from the third phase, the design of the PR19-style survey was further refined. The fourth pre-testing phase tested this new survey tool by means of a second round of pilot interviews conducted with 249 household and 68 non-household customers.

The findings from each stage were presented in full in our Pilot report for the study.

An expert in the field of non-market valuation, Prof. Ken Willis, was engaged as a peer reviewer for this study by DCWW. His review of the pilot report was supportive of its validity for use as an instrument for measuring customers' WTP for PR19.

Methodology

The main survey comprised computer-assisted telephone interviewing (CATI) interviews with 1,000 dual-service households, 50 wastewater only households (from Dee Valley supply area) and 500 dual-service non-households.

For households, weighting was applied to SEG, age and gender variables to achieve a representative sample based on Census 2011 data for Wales.

Non-household data was weighted by number of employees, based on data for Wales from the BEIS (2016) Business Population Estimates 2016[2]..

Valuation results

The results from the MaxDiff analysis showed, as expected, that sewer flooding inside the customer's property was the highest-impact service issue overall. Moreover, the results on the impacts attributable to each of the different service issues all varied in line with expectation, with longer duration incidents, for example, found to have higher impacts than shorter duration incidents, and more severe types of sewer flooding found to have higher impacts than less severe types.

Our analysis of the Package exercise data found that participants were not willing, on average, to accept any service deteriorations in exchange for bill reductions. In fact, in the context of a decreasing bill, in real terms, participants would be unwilling to accept any deterioration in service, and would rather see any amount of service improvement than no service improvement. Once the bill change is in the positive range, however, participants become cost sensitive. This finding mirrors the same result found at PR14 for DCWW.

With respect to improvement packages, we found that Dual service households were willing to pay up to a total of £50.37 per year, on average, for an intermediate improvement package. This represents a substantial increase in WTP over the findings for PR14 where the corresponding WTP figure was £16.05. We found strong evidence of diminishing marginal WTP, with the same customers willing to pay only an additional £19.21 for the stretch improvement package on average.

Amongst the service improvements offered in the intermediate 'SQ to +1' package, the improvements to river water quality and bathing water quality were estimated to have the highest value. This was driven by the fact that improvements in these areas affected a large number of customers. Thus, despite the fact that the impact of service changes in these areas was less than for other service issues -sewer flooding, for example -the overall derived WTP for these improvements was very substantial.

Our analysis also calculated 'unit values', which are a standardised measure of WTP for a service measure that can be compared across surveys even where the packages of service change offered were different. In comparison with results obtained at PR14, the

[2] https://www.gov.uk/government/statistics/business-population-estimates-2016

results suggest that there are higher values for river water quality and bathing water quality, and lower values for sewer flooding and persistent low pressure.

Although the differences between PR14 and PR19 will, in part, reflect genuine changes in preferences, there are also methodological features of the change in design approach that are also likely to be playing a part. In particular, the findings can be explained by the hypothesis that customers previously over-weighted service measures where the risk change was very small (low pressure and sewer flooding), and correspondingly under-weighted the service measures where the chance of being impacted was relatively large (environmental improvements). By imposing proportionality with respect to the chance of being impacted, these effects will have been reversed.

Conclusions

Overall, the valuation estimates presented can be considered to be meaningful measures of DCWW customers' values for the range of services, and service levels, contained within the survey, and we recommend them for use in cost benefit analysis of proposed service changes for PR19.

Confidence in the results reported here can be gained from the following:

- The design of the questionnaire was peer reviewed, and fully tested via cognitive interviews and pilot tests with households and businesses.
- A clear majority of responses were assessed as valid, taking into account participants` and interviewers feedback
- Results for the impact scores describing the perceived disutility of each attribute were logically consistent and within expectations.

1 INTRODUCTION

1.1 Background

Dŵr Cymru Welsh Water (DCWW) provides water and sewerage services to 1.4 million households and businesses. DCWW's primary responsibility is to operate, maintain and upgrade its large network of assets to ensure a safe and reliable drinking water supply and to deal effectively with wastewater to protect the environment.

DCWW formally reviews its investment requirements every five years in response to a review of prices initiated by OFWAT the company's economic regulator. As part of its periodic review submission for the 2019 price review (PR19) DCWW must engage with its customers to explore and understand their priorities and willingness to pay (WTP) for improvements in service, or willingness to accept (WTA) lower service levels in exchange for lower bills.

DCWW commissioned Accent and PJM economics to conduct a programme of research exploring customers' WTP for a range of possible service level changes, and to support the application of the WTP values in cost benefit analysis (CBA). The results from the CBA will ultimately inform the development of the company's 2020-25 business plan and support its legitimacy to the regulators and other stakeholders.

The present research is undertaken in the context of the following sources of guidance:

- Ofwat's customer engagement policy for PR19
- UKWIR reports on "Customer involvement in price-setting", "Review of CBA and benefits valuation", and "Carrying out WTP surveys"
- Experience and best practice from other sectors; and
- the wider academic literature on CBA and benefits valuation.

1.2 Objectives

The objectives of the study were to identify, through the use of stated preference (SP) surveys, or other appropriate methods, which areas of service are most important to DCWW customers, and to estimate the value that customers place on different levels of service across DCWW's service measure framework.

The customer surveys were to be designed to assess customers' preferences and their valuations for marginal changes in service levels measured by their reaction to associated changes in water bills.

The contractor was expected to provide the economic analysis to take the raw survey results and translate them into numbers that can be used in the cost benefit analysis.

The required outputs included the following:

- Customers' WTP / WTA for marginal changes in each level of the service levels detailed in an agreed format compatible for inclusion in DCWW's Investment Manager which is part of its Asset Investment System (AIS)

- Survey database and results to be provided in an agreed format

- Copies of all survey material used, discussion guides, questionnaires (master copies) and show cards

- An evaluation report on how benefit valuations are affected by socio-economic characteristics and attitudinal variables for all levels of service.

- Provide relevant information, as and when required, to allow a peer review to be carried out for all relevant phases of the Contract.

- A review / report on the changes and amendments required to be undertaken to align our long term vision with Customer requirements from 2016 onwards.

- Reports detailing the key customer engagement findings and survey methodologies used to underpin those outcomes. This may also include copies of video, audio and presentation materials used in the process.

- Presentations of key customer research and engagement findings to internal and external stakeholders such as the Customer Challenge Group, PR19 Group and Board

1.3 Structure of Report

This document is our final report on the WTP study. It provides a full description and explanation of the survey design and methodology as well as detailed results from the survey including a full analysis of DCWW customers' WTP / WTA for service level changes and how preferences vary across the customer base.

The remainder of this report is structured as follows:

- Section 2 describes the survey designs and development of the survey instrument

- Section 3 describes the methodology, size and characteristics of the achieved samples.

- Section 4 presents our main findings

- Section 5 draws conclusions.

The appendices to this report contain the full questionnaire (for dual-service households), a detailed report on the econometric analysis undertaken which includes the detailed segmentation results, and a report on a small follow-on research study undertaken to complement the main results.

2 SURVEY DESIGN AND DEVELOPMENT

2.1 Introduction

The SP survey research conducted for this study was designed and implemented in the context of several sources of focussed guidance, including the UKWIR (2011) report – "Carrying out WTP surveys". Following PR14, however, a number of issues concerning the UKWIR (2011) WTP methodology were raised in industry reviews and discussion papers. Echoing these concerns, Ofwat's Water 2020 consultation[3] proposed that companies consider how SP WTP evidence could be improved and explore what alternative and complementary tools are available to understand their customers' needs and requirements. Overall, it was evident at the outset of the present study that the approach to WTP evidence collection for PR19 would need to evolve from, rather than merely replicate, the PR14 approach.

The key concerns raised with respect to the PR14 approach to WTP measurement included that:

- The choices that customers were asked to make were too complex for them to answer meaningfully
- WTP numbers were too variable across companies to be valid
- WTP measures didn't take account of comparative performance
- WTP measures weren't consistent with how they were applied in ODIs

With regard to the first of these, the fundamental source of complexity was the need for customers to consider trade-offs between very small risk levels of different types of service issue occurring. It is well known in the academic literature that most people have severe difficulties in evaluating small risks on a consistent basis across similar tasks. As a consequence, values derived via trade-offs involving risk reductions tend to be highly sensitive to features of the study design, and can hence vary very substantially across studies without there necessarily being any difference in underlying preferences between study samples.

In developing the design for the present study, we proposed an approach that sought, as far as possible, to remove the need for participants to trade off risk reductions. This was achieved by imposing a degree of rationality on the structure of customers' preferences with respect to risk. By so doing, the choices customers were asked to make were much more straightforward and, consequently, more likely to accurately capture their true preferences in a form that can validly be used for DCWW's investment appraisals.

In the remainder of this section, we describe the survey design approach taken in full, before then moving on to detail the process of development undertaken to obtain the final research instrument used in the main survey.

[3] Ofwat (2015) "Water 2020: Regulatory framework for wholesale markets and the 2019 price review", December 2015

2.2 Survey Design

Questionnaire structure

The survey questionnaire was designed around two interlinked exercises: (1) a 'MaxDiff' exercise focussed on which types of service issue would have the most, and least, impact on participants if they were to be affected by them; and (2) a 'Package' exercise focussed on high level trade-offs between service improvements or deteriorations and changes in the level of the bill.

The questionnaire was structured as follows:

1) Screening and recruitment
2) Introduction to main survey
3) Usage, experience and attitude questions
4) Background information, including service measure definitions
5) MaxDiff exercise:
6) Follow-up questions on ability to make comparisons between the service measures
7) Package exercise:
8) Follow-up questions, including reasons for choices, ability to choose, perceived realism of the service levels shown, and understanding of the service measures
9) Demographics

This structure is typical for SP questionnaires, and is consistent with UKWIR (2011) guidelines. Next, we describe in more detail the designs of the MaxDiff and Package exercises.

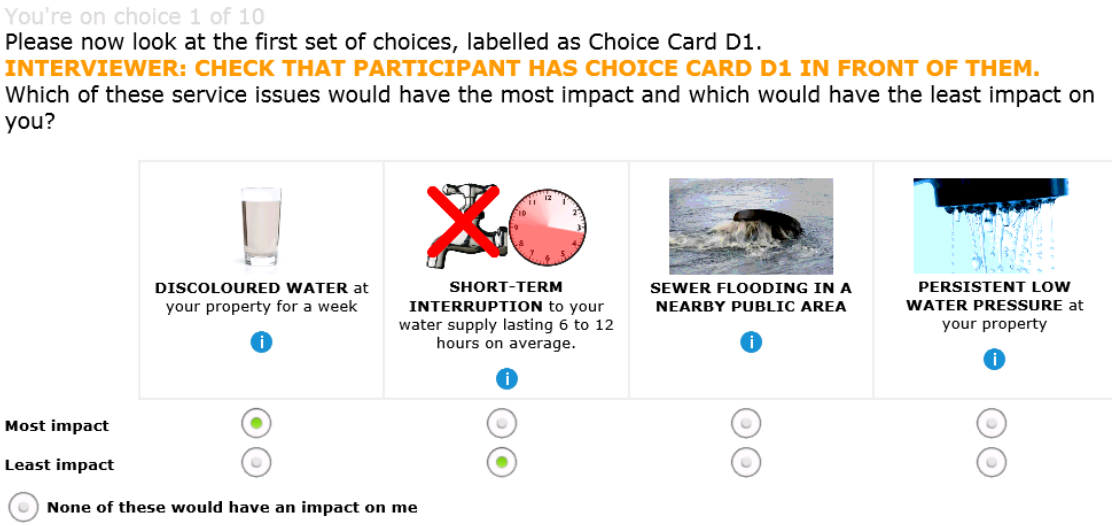
MaxDiff exercise (SP1)

The MaxDiff exercise presented participants with a sequence of choice cards in which they had to choose the service issue that would have most impact on them and the service issue that would have the least impact on them out of a total of four presented to them each time.

On each card, the service issues shown included an (i) button that the participant could click on to see further information about the service issue in question.

An example MaxDiff choice card is found in Figure 1.

Figure 2 Example choice card form the MaxDiff exercise



Overall, around 20-30 attributes could potentially be included robustly within a design of this kind.

Table 1 below lists the service issue definitions and descriptions that were selected for the study. This list was arrived at via a process of consultation with DCWW. The descriptions shown are the final ones used in the survey following the development work described in Section 2.3.

Table 2: Service issues and descriptions

Service issue	Description
DISCOLOURED WATER at your property for a week	On rare occasions, your water may be discoloured because of harmless deposits that accumulate over time in water mains, but the water is safe to drink. Even if you run your tap for several minutes, the water would still be brown/discoloured. This would typically last for a few hours at a time.
WATER TASTE & SMELL NOT IDEAL at your property for a few days	Water taste and smell can be less than ideal at your property for a few days at a time because of dissolved minerals and gases, but the water is safe to drink.
SHORT-TERM INTERRUPTION to your water supply lasting 3 to 6 hours on average.	
SHORT-TERM INTERRUPTION to your water supply lasting 6 to 12 hours on average.	
LONG-TERM INTERRUPTION to your water supply lasting 24-48 hours.	
LONG-TERM INTERRUPTION to your water supply lasting 7 days	
PERSISTENT LOW WATER PRESSURE at your property	Low water pressure means it takes longer to fill the bath or kettle than you would like, and may affect how well a combi boiler works. Persistent means the property is affected every day, though the problem may come and go during the day. It is usually caused by the age, condition and size of the water company's pipes. Properties at the tops of hills and the end of lines are most at risk.

TEMPORARY USE BAN from May to September.	As a result of drought conditions, Wessex Water can impose a ban on using a hosepipe at your property that would typically last from May to September (5 months). For this period, you would not be allowed to use a hosepipe to water a garden or clean a private car or van, and you would not be allowed to fill a swimming or paddling pool if you have one.
SEWER FLOODING INSIDE YOUR PROPERTY- Extensive flooding, making it uninhabitable.	Flooding from the sewer gets inside properties, causing damage to property and possible illness. The effects of internal sewer flooding include a foul smell, floors and walls would need to be sanitised, flooring and carpets would need replacing and some people may develop diarrhoea, vomiting or skin infections.
SEWER FLOODING INSIDE YOUR PROPERTY- Minor flooding, causing no lasting damage	
SEWER FLOODING OUTSIDE YOUR PROPERTY	Flooding from the sewer gets close to other people's properties, or gets into their gardens.
SEWER FLOODING IN A NEARBY PUBLIC AREA	Flooding from the sewer gets into public places like parks, footpaths and roads in your area.
ODOUR FROM SEWAGE WORKS affects your property once or twice per year, for a few days each time	
ODOUR FROM SEWAGE WORKS affects your property several times a year, for a week or two each time	
SIGNIFICANT POLLUTION INCIDENT in your local area caused by Welsh Water operations	
MINOR POLLUTION INCIDENT in your local area caused by Welsh Water operations	
RIVER WATER QUALITY in your local area fails to achieve Good status due to the impact of Welsh Water operations.	The cleanliness and quality of coastal bathing water and beaches in your area is classified according to the chances of getting an infection such as an upset stomach, an ear infection or a sore throat after bathing in the sea. There are three classification levels – "Excellent", "Good" and "Sufficient".
COASTAL BATHING WATER QUALITY in your local area achieves Good quality but not Excellent due to the impact of Welsh Water operations.	
COASTAL BATHING WATER QUALITY in your local area achieves Sufficient quality but not Good or Excellent due to the impact of Welsh Water operations.	

The experimental design for this research was generated using an algorithm which sought to maximise the statistical precision of the estimates, whilst avoiding choice pairs where one option dominated the other one (e.g. two or more identical attributes, or two or more attributes of the same nature but different intensities such as supply interruptions of different durations). A total of 200 choice cards were generated and grouped in 20 blocks of 10 cards each. Thus, each participant was administered choice cards from a randomly selected block answering 10 MaxDiff choice cards.

The MaxDiff exercise would generate a quantitative measure of 'impact' that can be interpreted as equivalent to disutility, for each of the attributes included in the design for the customer population or sub-populations. This measure provides a means of

understanding how bad each type of service failure would be relative to a chosen benchmark.

The use of an 'impact' scale to measure disutility was chosen carefully. We initially considered the alternative question: 'which of these service issues would be worst for you, and which would be least bad?'. However, focus group testing of this form of wording revealed that participants found the concept of 'least bad' confusing, and so the question 'which of these service issues would have the most impact on you, and which would have the least impact?' was chosen instead.

Importantly, in order to avoid bias towards service issues that affect the customer personally, at the expense of those that affect the environment, the following text was included at the start of the choice exercise.

Some of the service failures shown would affect your own property whereas others would affect your local area. When comparing the impact that each would have on you, please consider how you would feel generally about the service failure happening, including any concerns you may have about your local area and the environment.

The intention for customers was therefore that they consider 'impact' in the widest sense, as everything they care about. By so doing, we aimed to arrive at a good approximation for the concept of disutility without use of this unfamiliar concept (amongst the general public) in the survey itself.

Package exercise (SP2)

In order to generate value estimates per avoided service failure an additional exercise was needed. This is because the MaxDiff questions would only generate relative measures of utility; these must be scaled to a money metric using evidence on customers' willingness to trade off money for service level changes at the package level.

For the purpose our analysis, four different packages of service levels were defined as follows.

- -1: all service measures in this option deteriorate to '-1' levels. The bill is lower than in SQ.
- SQ all service measures are maintained at their current levels, with the yearly bill either maintained at its current level (in real terms), or slightly decreased or increased.
- +1: all service measures improve to +1 levels, and the bill is higher than in SQ.
- +2: all service measures further improve to +2 levels; the bill is higher than in +1.

These options were presented to participants in the survey in a series of four pairwise package comparisons.

1. SQ vs. +1 – Yields WTP estimate for a status quo (SQ) to +1 improvement
2. SQ vs. +2- Yields WTP estimate for an SQ to +2 improvement

3. +1 vs. +2 - Yields WTP estimate for a +1 to +2 improvement
4. SQ vs. -1 - Yields WTA estimate for an SQ to -1 deterioration

An example package choice card from this survey version is shown in Figure 2. This format was intended to make it simpler for the participant to make choices that reflect their true WTP/WTA than presenting all four options together.

Figure 3 Example PR19-style Package choice card

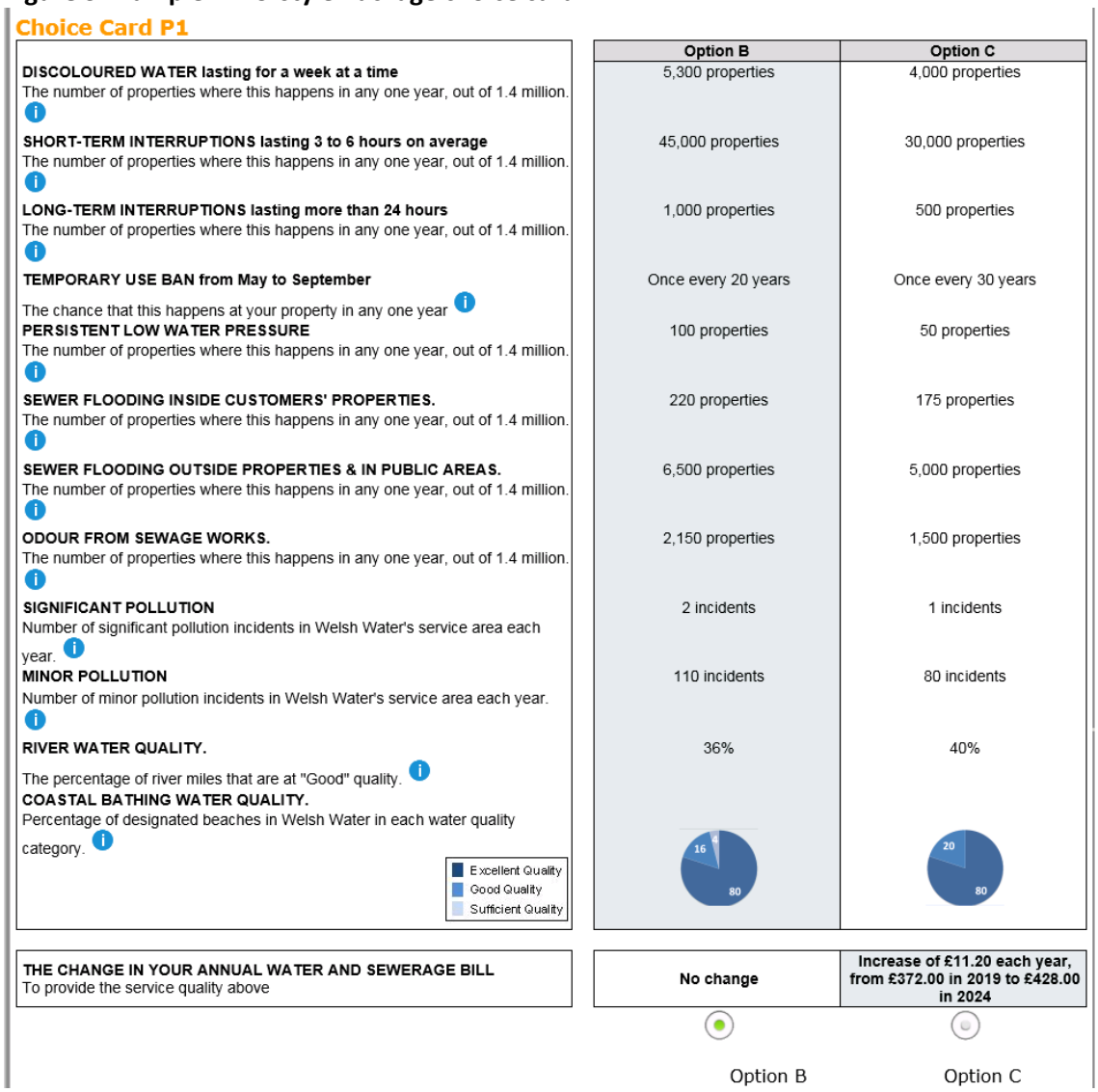


Table 2 shows the possible bill changes for each of the four option. The bill changes attached to the presented option were drawn as percentages from the levels shown and translated into monetary bill changes for households by multiplying by the current bill. For non-households, percentage changes were shown, in line with UKWIR (2011) guidance.

Table 3 PR19 Package % bill change levels

Package	Definition	Level		
		1	2	3
-1	% change over and above SQ bill change from 2020 to 2024	-10%	-5%	-1%
SQ	% change of SQ bill from 2020 to 2024	-2.5%	0%	2.5%
+1	% change over SQ bill change from 2020 to 2024	1%	7.5%	15%
+2	% change over and above SQ plus +1 bill changes from 2020 to 2024	1%	5%	10%

2.3 Testing and Refinement

The design approach put forward for this study was new to DCWW, and to the water sector more widely, and so an extensive programme of testing was designed and implemented to refine the design and provide assurance that the instrument was working effectively. This included four phases of pre-testing of the survey instrument with DCWW customers.

The first phase of pre-testing consisted of 8 pre-tasked focus groups and 24 pre-tasked telephone depth interviews. This qualitative work explored customers' response to different sets of show material and ways of presenting the various exercises.

The second phase consisted of 16 cognitive interviews (11 with household customers and 5 with non-household customers), in which participants were encouraged to "think aloud" and give feedback on the questionnaires and showcards as they worked their way through them.

The third phase of pre-testing with DCWW customers consisted of a pilot stated preference study of 200 interviews with household customers for each of the PR14 and PR19-style surveys. As for non-household customers, 192 interviews were conducted for the PR14-style survey, and 121 for the PR19-style survey.

Based on the findings from the analysis of the pilot data from the third phase, the design of the PR19-style survey was further refined. The fourth pre-testing phase tested this new survey tool by means of a second round of pilot interviews conducted with 249 household and 68 non-household customers.

The findings from each stage were presented in full in our Pilot report for the study.

Peer Review

An expert in the field of non-market valuation, Prof. Ken Willis, was engaged as a peer reviewer for this study by DCWW. His review of the pilot report was supportive of its validity for use as an instrument for measuring customers' WTP for PR19.

3 METHODOLOGY

3.1 Survey Mode and Segmentation

The overall main stage comprised a total of 1,550 interviews with DCWW's household and non-household customers. All interviews were conducted using a computer-assisted telephone interviewing (CATI) method, more specifically a phone–post/email–phone approach. All fieldwork was undertaken by Accent's Telephone Unit in Edinburgh.

The breakdown of achieved interviews by customer type and supply area was as follows:

- **1,050 x household (HH)** interviews
    - 1,000 x with dual supply customers
    - 50 x with sewerage-only customers in Dee Valley area
- **500 x non-household (NHH)** interviews
    - All with dual supply customers

3.2 Sampling and Recruitment Method

Non-household sample was provided by DCWW; household sample was purchased from Accent's sample partner. Customers' postcodes were checked against a lookup list to confirm their supply area.

To achieve 1,050 completed interviews with household customers, 1,904 customers were recruited. In the non-household survey, 856 customers were recruited for 500 interviews.

All customers were given the option to be interviewed in Welsh. Ten customers in total expressed interest; two of them were in scope for the survey and completed the full interview in Welsh.

3.3 Interview Length

The average interview length for all three surveys is shown in Table 3 below.

Table 4: Average interview length

	Dual supply		Sewerage only
	Household	Non-household	Household
Average interview length	36 minutes	25 minutes	34 minutes

3.4 Sample Characteristics and Weighting

Households

Weighting was applied to SEG, age and gender variables to achieve a representative sample; targets were based on Census 2011 data for Wales. Breakdown of all household interviews by these three variables – SEG, age and gender – is shown in Table 4 below.

Table 5: Frequency of household interviews by key demographics

Variable		Unweighted (%)	Weighted (%)
SEG	AB	35	**23**
	C1	26	**27**
	C2	14	**19**
	DE	25	**31**
Age	18-34	6	**17**
	35-54	28	**36**
	55+	66	**47**
Gender	Female	53	**59**
	Male	47	**41**
Total interviews		1,050	**1,050**

Table 5 shows the weighted breakdown of all household interviews by working status, highest level of qualifications, benefits and property type.

Table 6: Frequency of household interviews by other indicators

Characteristic	Value	Percentage of total %
Water meter status	Metered	40
	No meter	60
Working status	Working full-time (30+ h/week)	40
	Working part-time (8-29 h/ week)	10
	Not working; looking for work	2
	Not working; not looking for work	5
	Retired	32
	Retired unpaid voluntary work	2
	Looking after family/home	4
	Self employed	1
	Disabled	2
	Other	1
Highest level of qualifications[4]	No qualifications	9
	Level 1	11
	Level 2	18
	Apprenticeship	2
	Level 3	18
	Level 4 and above	36
	Other qualifications	5
	Refused	1
Benefits	Attendance allowance	2
	Carer's allowance	6
	Child tax credit	14
	Council tax benefit	13
	Disability living allowance	11
	Housing benefit	10
	Income support (or similar)	7
	Jobseeker's allowance	3
	Pension credit	5
	Working tax credit	6
	None of these	66
	Refused	1
Property type	Flat	7
	Terraced house	26
	Semi-detached house	35
	Detached house	22
	Bungalow	11
Total number of interviews		**1,050**

**Based on weighted data*

[4] **Level 1:** 1-4 O Levels/CSE/GCSEs (any grades), Entry Level, Foundation Diploma, NVQ Level 1, Foundation GNVQ, Basic/Essential Skills;
Level 2: 5+ O Level (Passes)/CSEs (Grade 1)/GCSEs (Grades A*-C), School Certificate, 1 A Level/ 2-3 AS Levels/VCEs, Intermediate/Higher Diploma, Welsh Baccalaureate Intermediate Diploma, NVQ level 2, Intermediate GNVQ, City and Guilds Craft, BTEC First/General Diploma, RSA Diploma;
Level 3: 2+ A Levels/VCEs, 4+ AS Levels, Higher School Certificate, Progression/Advanced Diploma, Welsh Baccalaureate Advanced Diploma, NVQ Level 3; Advanced GNVQ, City and Guilds Advanced Craft, ONC, OND, BTEC National, RSA Advanced Diploma;
Level 4 and above: Degree (for example BA, BSc), Higher Degree (for example MA, PhD, PGCE), NVQ Level 4-5, HNC, HND, RSA Higher Diploma, BTEC Higher level, Foundation degree (NI), Professional qualifications (for example teaching, nursing, accountancy);
Other qualifications: Vocational/Work-related Qualifications, Foreign Qualifications (not stated/level unknown)

Non-households

Non-household data was weighted by number of employees. Target profile for Wales was obtained from the Department for Business, Energy & Industrial Strategy's Business Population Estimates 2016[5]. Table 6 shows the comparison between weighted and unweighted data.

Table 7: Frequency of non-household interviews by number of employees

Variable		Unweighted (%)	Weighted (%)
Number of employees	Sole trader	12	**26**
	Less than 4	21	**9**
	4 to 49	49	**22**
	50 to 249	10	**23**
	250 +	9	**20**
Total interviews		**500**	**500**

A breakdown of non-household interviews by bill size, annual water consumption, number of sites operated from, business sector and water meter status is provided in Table 7.

[5] https://www.gov.uk/government/statistics/business-population-estimates-2016

Table 8: Frequency of non-household interviews by other characteristics

Characteristic	Value	Percentage of total %
Annual water and sewerage bill	Small (less than £1,000)	46
	Medium (£1,000-19,999)	40
	Large (£20,000 and over)	14
Annual water consumption	<5 megalitres	63
	5< megalitres	5
	Don't know	32
Number of sites	1	61
	2	6
	3	6
	4+	27
Business sector	Agriculture, forestry and fishing	2
	Manufacturing	10
	Construction	4
	Wholesale and retail trade (incl motor vehicles repair)	15
	Hotels and catering	
	Finance and insurance activities	10
	Business services	4
	Government, health & education	7
	Arts, entertainment and recreation	21
	Other service activities	9
	Other	6
		13
Water Meter Status	Water meter	76
	No water meter	16
	Don't know	9
	Total number of interviews	**500**

**Based on weighted data*

3.5 Participant Feedback

Survey Enjoyment

All participants were asked to rate their enjoyment in completing the survey using a scale of 1 to 10 where 1 means 'low enjoyment' and 10 means 'high enjoyment'. Table 8 shows mean ratings given by participants by customer type[6].

Table 9: Survey enjoyment ratings

Survey enjoyment	Household	Non-household
Mean rating	7.7	6.3
Base size	1,050	500

SP Follow-up Feedback

Table 9 summarises the statistics concerning difficulties in completing the questionnaire. Thus, a clear majority of households and non-households confirmed they

[6] Unweighted data

were able to make a clear choice between the options presented to them both for the MaxDiff exercise as well as the package exercise. Among the few issues that were raised was the conflict between attributes with personal impact and environmental attributes affecting the whole society; however, the percentage of participants mentioning that issue was small.

Table 10: Participant feedback to SP exercises

Feedback	DualHH	Waste HH	Dual NHH
MaxDiff exercise			
Did you generally feel able to make comparisons between the options I presented to you?	90.7%	78.0%	92.4%
Package exercise			
Did you generally feel able to make comparisons between the options I presented to you?	92.8%	92.0%	94.6%
Did you find each of the levels of service we described easy to understand?	93.8%	94.0%	95.6%
Were any of the service levels so low or so high that they were implausible?	12.7%	18.0%	15.4%

Bases: Dual HH=1000, Waste HH=50, Dual NHH=500

Overall, the above results are supportive of the face validity of the survey instrument as a means of measuring WTP amongst household and non-household DCWW customers.

4 VALUATION RESULTS

4.1 Introduction

Our approach to estimating WTP involved extensive use of econometric analysis. This analysis is presented in detail in Appendix B. In summary, our methodology involved the following steps:

- First, impact scores were estimated, via econometric modelling of responses to the MaxDiff exercise. (See 4.2.)

- These impact scores were then adjusted to take account of further research which indicated that the impact scores for three of the attributes were likely to have been overstated due to misinterpreting the service issues shown. (Discussed further in 4.3 below.)

- Next, 'package values' were estimated via econometric modelling of responses to the Package exercise. These represented values for the full range of service change for each package valued: status quo (SQ) to +1, +1 to +2 and the deterioration package SQ to -1. (See 4.4.)

- Individual service measure weights were then derived for each package level change (e.g. SQ to +1) by multiplying the adjusted impact scores by the change in the chance that the service issue in question would happen given the package level change in service, and scaling to sum to 100% over service measures.

  This stage involved imposing an assumption on the chance of being affected by the environmental service issues. The assumptions are discussed in 4.5 below.

- Each package value was then divided between each service measure change in proportion to the service measure weights to derive our main WTP/WTA estimates for changes in individual service levels. (See 4.6.)

- Unit values (£WTP per unit of change, e.g. per avoided supply interruption) were then calculated by dividing service measure values through by the number of units of change each one represented. These values allow for comparisons with PR14 WTP estimates for DCWW and other companies as the unit of improvement is standardised in this case. (See 4.7.)

Additionally, we have conducted an analysis of variation in customers' preferences for households and non-households. This included traditional segmentation analysis with respect to demographic variables plus, in addition, an exploration of the impact of experience and attitudes on preferences. (See 4.8.)

The remainder of this section is structured as following. First, we provide the overall raw impact scores (4.2); the next part then describes the adjustment that was performed on these impact scores, and reports the adjusted impact scores; presents package level WTP estimates (4.3); then, we describe how package service changes are

mapped onto MaxDiff units of measure (4.5); these results then feed into the next part which presents WTP estimates for individual service level changes (4.6); following this we present unit values (4.7); and finally, we summarise the key findings from the segmentation analysis (4.8).

4.2 Raw Impact Scores

Our initial, pre-adjustment, estimates of the relative impact of each of the different types of service issue are shown in Table 11 for dual-service households and non-households, and in Table 12 for wastewater only households. The results have been scaled to sum to 100 across the full range of service issues, and have been ordered in the table in order of impact, within water and wastewater service groups. The data in these tables are also shown in Figure 4 and Figure 5 for dual-service and wastewater only customers respectively.

The results in Table 11 show that amongst water services, both households and non-households assigned the highest impact to long-term supply interruptions. Taste and smell problems were considered to be more impactful than discoloured water issues for both households and non-households, and temporary/non-essential use bans were considered to be the least impactful again for both households and non-households.

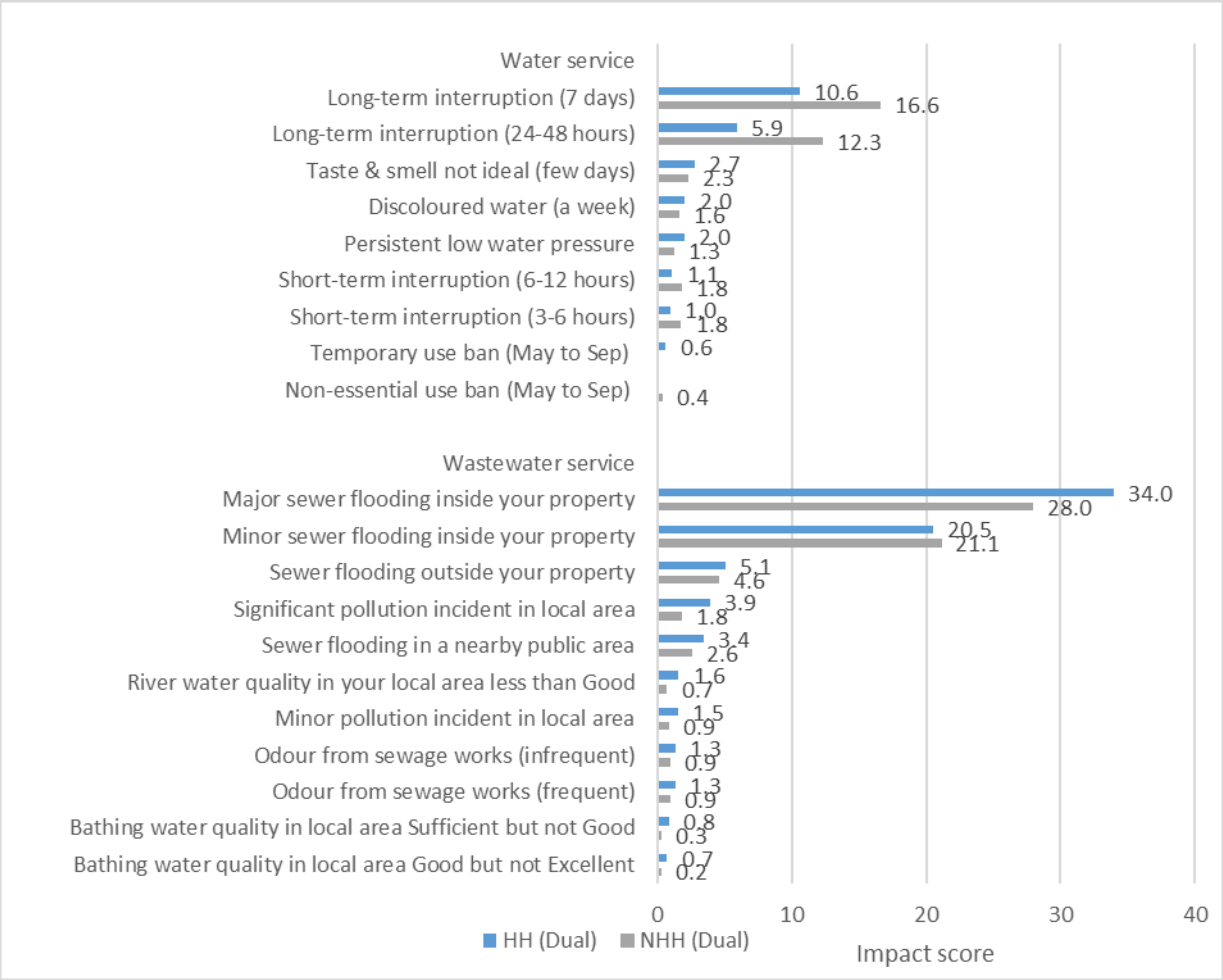
Amongst wastewater issues, sewer flooding issues were considered much more impactful than environmental issues, although we would emphasise that when they occur, the environmental issues will affect many more properties at a time than sewer flooding incidents. (See 4.5 for details on this issue.)

In general, the order and relative magnitudes of all the results shown are as expected. Longer duration and more severe incidents are estimated to have higher relative impacts than the shorter and less severe incidents. The one exception to this is in the case of odour from sewage works, where we found almost identical results for frequent as for infrequent odour problems. This finding suggests that customers either may not have adequately been able to distinguish between the two types of service issue, or they may simply not have considered frequent odour issues to be any more impactful than infrequent odour.

Table 11: Raw impact scores for dual-service households and non-households

Service issue	Raw impact score	
	HH (Dual)	NHH (Dual)
Water service		
Long-term interruption (7 days)	10.6	16.6
Long-term interruption (24-48 hours)	5.9	12.3
Taste & smell not ideal (few days)	2.7	2.3
Discoloured water (a week)	2.0	1.6
Persistent low water pressure	2.0	1.3
Short-term interruption (6-12 hours)	1.1	1.8
Short-term interruption (3-6 hours)	1.0	1.8
Temporary use ban (May to Sep)	0.6	
Non-essential use ban (May to Sep)		0.4
Wastewater service		
Major sewer flooding inside your property	34.0	28.0
Minor sewer flooding inside your property	20.5	21.1
Sewer flooding outside your property	5.1	4.6
Significant pollution incident in local area	3.9	1.8
Sewer flooding in a nearby public area	3.4	2.6
River water quality in your local area less than Good	1.6	0.7
Minor pollution incident in local area	1.5	0.9
Odour from sewage works (infrequent)	1.3	0.9
Odour from sewage works (frequent)	1.3	0.9
Bathing water quality in local area Sufficient but not Good	0.8	0.3
Bathing water quality in local area Good but not Excellent	0.7	0.2

Figure 4: Raw impact scores for dual service households and non-households



Raw impact scores are scaled to sum to 100 over service issues.

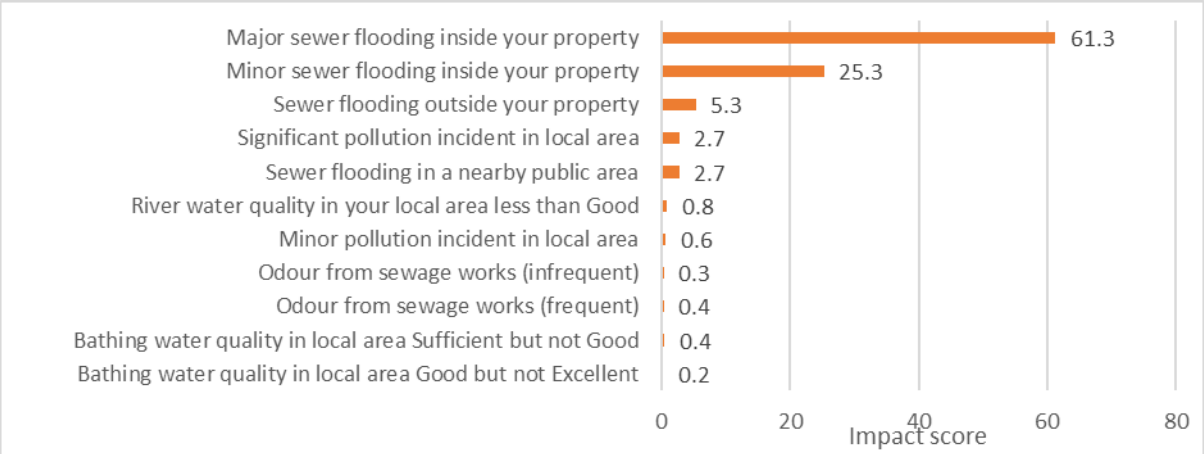
A similar set of findings is observed in Table 12 and Figure 5 for wastewater only households. Internal sewer flooding incidents were considered by far to be the most impactful of the service issues shown, with bathing water quality problems being the least impactful at the individual level.

Table 12: Raw impact scores for wastewater only households

Service issue	Raw impact score HH (Waste only)
Major sewer flooding inside your property	61.3
Minor sewer flooding inside your property	25.3
Sewer flooding outside your property	5.3
Significant pollution incident in local area	2.7
Sewer flooding in a nearby public area	2.7
River water quality in your local area less than Good	0.8
Minor pollution incident in local area	0.6
Odour from sewage works (infrequent)	0.3
Odour from sewage works (frequent)	0.4
Bathing water quality in local area Sufficient but not Good	0.4
Bathing water quality in local area Good but not Excellent	0.2

Raw impact scores are scaled to sum to 100 over service issues.

Figure 5: Raw impact scores for wastewater only households



Raw impact scores are scaled to sum to 100 over service issues.

4.3 Adjustment to Impact Scores

Overview

The peer review of the draft version of this report by Prof. Willis included the observation that the values for bathing water quality improvements seemed high in relation to previous research. In reflecting on this finding, we considered that the reported results could potentially have been overstated due to a potential discrepancy between how participants construed the language defining river and bathing water quality service issues in the survey, and how they are primarily to be used in appraisals.

In the MaxDiff exercise, the river and bathing water quality service issues were described as follows:

"RIVER WATER QUALITY in your local area fails to achieve Good status due to the impact of Welsh Water operations".

"COASTAL BATHING WATER QUALITY in your local area achieves Good quality but not Excellent due to the impact of Welsh Water operations",

"COASTAL BATHING WATER QUALITY in your local area achieves Sufficient quality but not Good or Excellent due to the impact of Welsh Water operations".

One possible reason why impacts for these service issues might have been overstated was that participants may potentially have interpreted the service issues as deteriorations in quality rather than, as intended, as states of affairs that could potentially be improved upon. This matters because we would expect a deterioration interpretation to lead participants to perceive a higher impact than would a 'worse-than-ideal current level' interpretation; and yet the results are to be used primarily for valuing potential improvements rather than the avoidance of deteriorations.

Evidence for our expectation of a higher impact comes from a fairly large academic literature on gain/loss, or WTP/WTA, disparities. A recent meta-study of the factors

driving WTA/WTP discrepancies by Tunçel and Hammitt (2014) found that for environmental goods (as in the case of river and bathing water quality), the average WTA/WTP ratio was 6.23. This means that we would expect people, on average, to require 6.23 times as much money in the form of a lower bill to accept a river or bathing water quality deterioration as they would be prepared to pay in the form of a higher bill for the corresponding improvement from the worse level to the better level.

Since the values obtained from this research are primarily to be used to evaluate WTP for potential improvements, they will be overstated if participants interpreted the river and bathing water quality service issues as deteriorations to the current level. The extent to which they did so was an empirical question that we explored further via a series of further customer survey interviews. (See Appendix C for the full report on this research.)

Further Interviews

We explored the extent to which participants might have interpreted the river and bathing water quality service issues in different ways via a series of 20 15-minute telephone interviews. Four different MaxDiff choice cards were presented, each including at least one of the coastal or river water quality issues. Following the choice exercise, participants were asked a series of questions about how easy they found the choice exercise, how they made their decision regarding the choice exercise and whether they interpreted the service issue as a deterioration in quality of describing the current situation.

The findings of these interviews (included in an appendix to this report) indicated that the majority of participants interpreted the wording of the river and coastal water quality service issues as describing the current situation in their local area, and therefore a service level that could potentially be improved, rather than one which has suffered a deterioration. On this basis, we concluded that the original WTP values for river and bathing water quality are unlikely to be as overstated as they potentially could be under our initial hypothesis.

We derived the following weights from the further interviews to be applied in the adjustment to impact scores as follows:

Coastal bathing water quality	0.92 for the original (WTP) interpretation, and 0.08 for the alternative (WTA) interpretation
River water quality	0.82 for the original (WTP) interpretation, and 0.18 for the alternative (WTA) interpretation.

Application of Weights

The weights above have been applied as follows.

- We divided the coastal bathing water quality impact scores by (0.92 + 0.08*6.23), where 6.23 was the value drawn from the literature on the WTA/WTP disparity.

- We likewise divided the river water quality MaxDiff impact score by (0.82 + 0.18*6.23).

- We then rescaled all the impact scores so that the revised total also added up to 100. This had the effect of inflating all the other service issues' impact scores slightly.

Adjusted Impact Scores

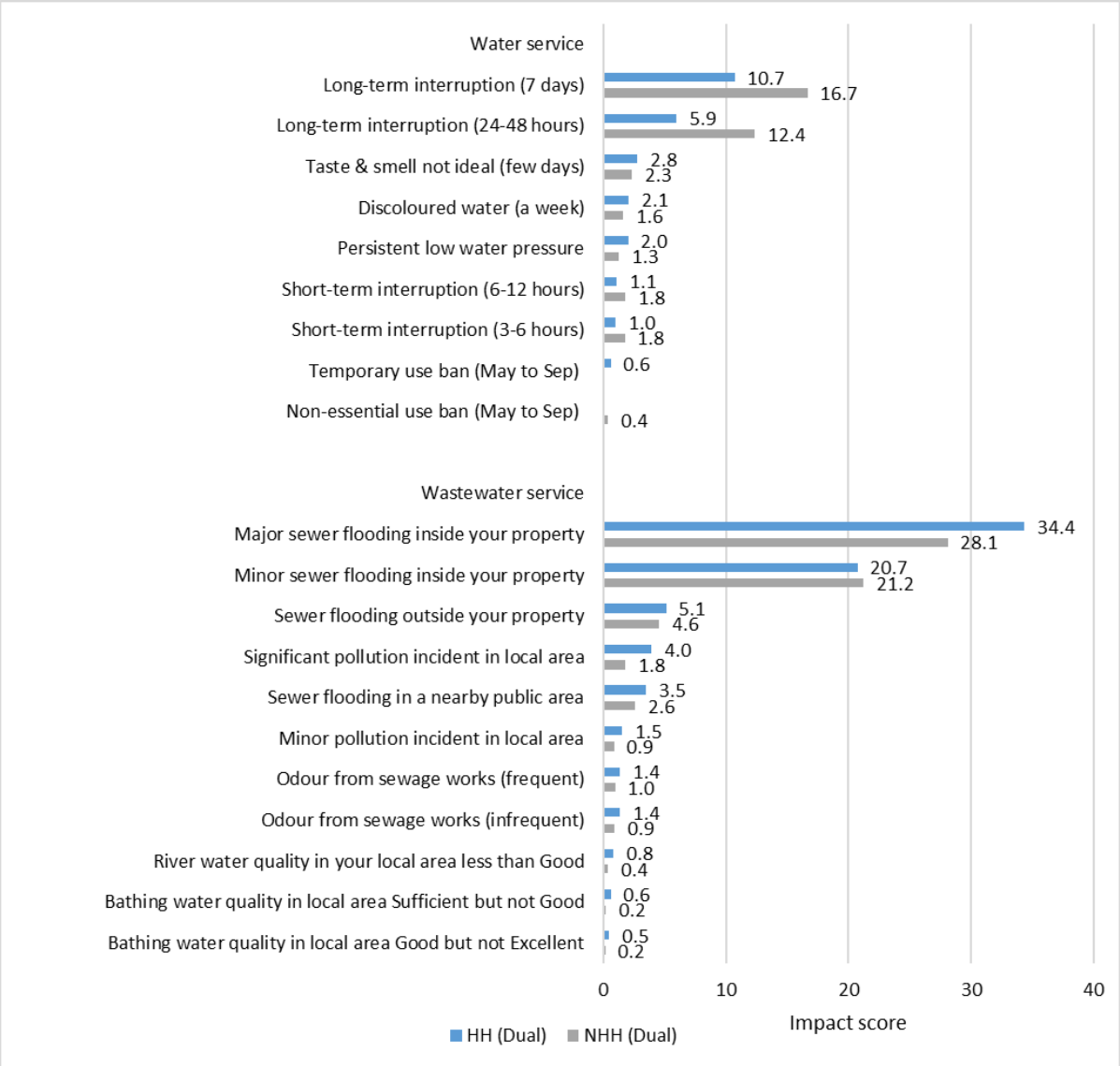
Our final, post-adjustment, estimates of the relative impact of each of the different types of service issue are shown in Table 13 for dual-service households and non-households, and in Table 14 for wastewater only households. The data in these tables are also shown in Figure 6 and Figure 7 for dual-service and wastewater only customers respectively.

The results in Table 13 are very close to those previously shown Table 11 for all service issues except for river water quality and bathing water quality. In the case of river water quality, the value has lowered from 1.6 to 0.8 for dual-service households, while for coastal bathing water quality, the two values for dual-service households have lowered from 0.8 and 0.7 to 0.6 and 0.5 for 'Sufficient but not Good', and 'Good but not Excellent' respectively.

Table 13: Adjusted impact scores for dual-service households and non-households

	Raw impact score	
Service issue	**HH (Dual)**	**NHH (Dual)**
Water service		
Long-term interruption (7 days)	10.7	16.7
Long-term interruption (24-48 hours)	5.9	12.4
Taste & smell not ideal (few days)	2.8	2.3
Discoloured water (a week)	2.1	1.6
Persistent low water pressure	2.0	1.3
Short-term interruption (6-12 hours)	1.1	1.8
Short-term interruption (3-6 hours)	1.0	1.8
Temporary use ban (May to Sep)	0.6	
Non-essential use ban (May to Sep)		0.4
Wastewater service		
Major sewer flooding inside your property	34.4	28.1
Minor sewer flooding inside your property	20.7	21.2
Sewer flooding outside your property	5.1	4.6
Significant pollution incident in local area	4.0	1.8
Sewer flooding in a nearby public area	3.5	2.6
Minor pollution incident in local area	1.5	0.9
Odour from sewage works (frequent)	1.4	1.0
Odour from sewage works (infrequent)	1.4	0.9
River water quality in your local area less than Good	0.8	0.4
Bathing water quality in local area Sufficient but not Good	0.6	0.2
Bathing water quality in local area Good but not Excellent	0.5	0.2

Figure 6: Adjusted impact scores for dual service households and non-households



Adjusted impact scores are scaled to sum to 100 over service issues.

A similar set of findings is observed in Table 14 and Figure 7 for wastewater only households. In comparison with Table 12, the results are very close for all service issues except for river water quality and bathing water quality. In the case of river water quality, the value has lowered from 0.8 to 0.4 for dual-service households, while for coastal bathing water quality, the two values for dual-service households have lowered from 0.4 and 0.2 to 0.3 and 0.1 for 'Sufficient but not Good', and 'Good but not Excellent' respectively.

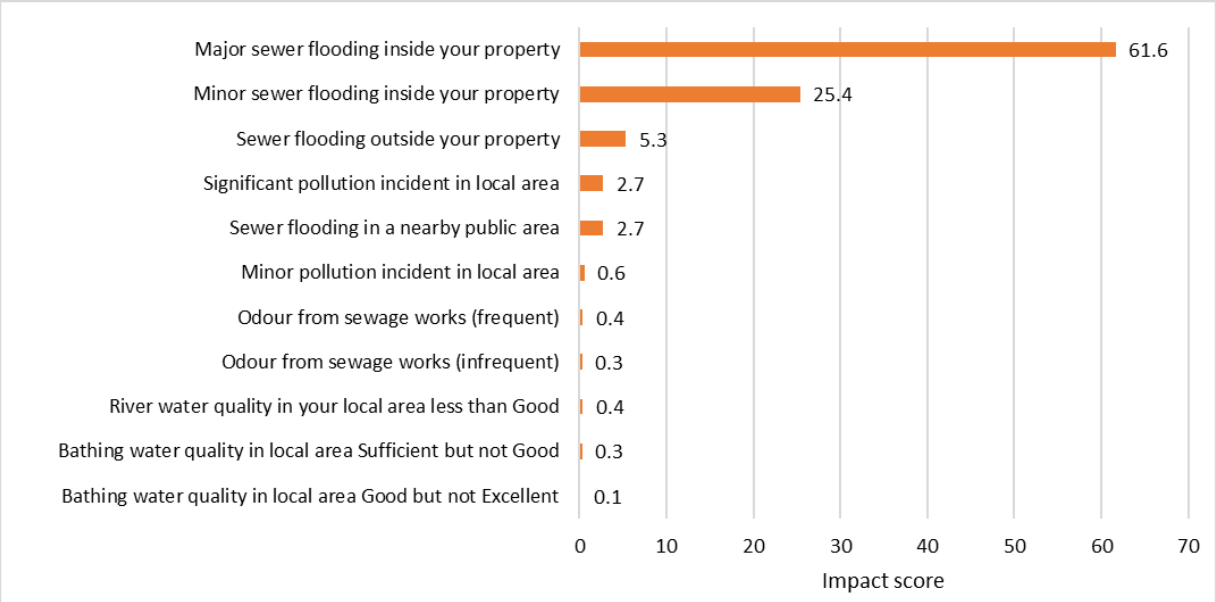
Internal sewer flooding incidents were considered by far to be the most impactful of the service issues shown, with bathing water quality problems being the least impactful at the individual level.

Table 14: Adjusted impact scores for wastewater only households

Service issue	Adjusted impact score HH (Waste only)
Major sewer flooding inside your property	61.6
Minor sewer flooding inside your property	25.4
Sewer flooding outside your property	5.3
Significant pollution incident in local area	2.7
Sewer flooding in a nearby public area	2.7
Minor pollution incident in local area	0.6
Odour from sewage works (frequent)	0.4
Odour from sewage works (infrequent)	0.3
River water quality in your local area less than Good	0.4
Bathing water quality in local area Sufficient but not Good	0.3
Bathing water quality in local area Good but not Excellent	0.1

Adjusted impact scores are scaled to sum to 100 over service issues.

Figure 7: Adjusted impact scores for wastewater only households



Adjusted impact scores are scaled to sum to 100 over service issues.

4.4 Package Valuations

Key Finding from Modelling: Customers Averse to Bill Reductions

In our econometric modelling of the package choice responses, we allowed participants' sensitivity to bill changes to vary between bill increases and bill decreases. This approach was to take account of the fact that people tend to be more sensitive to bill increases generally than they are to bill decreases.

Results from our initial model showed a positive coefficient for bill reductions, implying that participants preferred a smaller bill decrease over a larger bill decrease. This is highly counterintuitive, and not sensible for a final model as it would imply that customers would prefer bills to stay the same rather than see a bill reduction even if the service stays exactly the same. This incongruity was overcome by restricting the sensitivity to bill reductions to be zero.

This is a key finding from our analysis, and is consistent with findings we have observed elsewhere at PR19 and at PR14 to the extent that we consider it to be a stylised fact of WTP research in the water sector. The evidence here suggests that customers are averse to bill reductions, at least insofar as they respond to the choices put to them in this WTP survey, and hence would not accept any deterioration in service levels in exchange for a lower bill. Moreover, the implication is that customers would prefer any degree of improvement rather than a bill reduction.

Our findings thus showed very clearly that customers, on average, did not want to see reduced bills. As a consequence, no realistic bill reduction would lead households or businesses to choose a widespread service deterioration.

WTP for Improvement Packages

The values for each package for dual-service households and non-households, and wastewater only households are displayed below in Table 15. With respect to the improvement packages 'SQ to +1' and '+1 to +2', the findings show that WTP is diminishing for each customer group, as expected, with significantly lower values for the '+1 to +2' than for the 'SQ to +1' improvement in each case.

In comparison with PR14 WTP values, there appears to have been a substantial increase in WTP. For comparison, at PR14 :

- 'SQ to +1' was £16.05 for households and £43.78 for non-households
- 'SQ to +2' was £28.42 for households and £78.23 for non-households

The results obtained are still within the range reported by companies across the sector at PR14, however, where this range was £4.00 to £59.90 for an 'SQ to +1' improvement (PJM-Accent, 2014)[7]).

Table 15: Package WTP values by customer group

Package	WTP (£/customer/year)		
	Dual Households	Dual Non-Households	Waste only Households
SQ to +1	£50.37	£87.02	£30.89
+1 to +2	£19.21	£8.49	£22.25
SQ to +2	£69.58	£95.51	£53.14
SQ to -1	-	-	-

WTP values are presented in 2017 prices. No values are reported for 'SQ to -1' because the modelling found that no amount of compensation in the form of lower bills could persuade people to accept the service deterioration package.

Overall, the evidence suggests that customers have a greater willingness to pay for improvements than was observed at PR14.

Candidate explanations for why WTP might be higher this time around potentially include changes in design methodology, scope of improvement, presentation of inflation, sample composition, analysis methodology, or underlying attitudes.

[7] Accent-PJM (2014) Comparative review of WTP results, Final report for a club of water companies, p.8.

We do not believe the changes made to the design methodology would lead to an increase in value. This is primarily because we have made similar changes in research for other companies where the WTP value has fallen from PR14 to PR19.

The scope of improvement is somewhat greater in the 'Base to +1' improvement package at PR19 than it was at PR14. Using PR14 unit values to value the PR19 change in service offered, we would expect to obtain a Package value that was approximately 34% higher than the value obtained at PR14. This increase in scope may therefore explain some of the increase in Package value, but far from the full increase.

The presentation of inflation differed between PR14 and PR19 only insofar as participants were given a monetary example of the impact that inflation would have at PR19 whereas at PR14 they were simply told that inflation would be added. The example they were given at PR19 was as follows: '*To give you an example of the impact that inflation would have, if inflation was 2% per year the average Welsh Water bill would increase by £48 from £464 in 2019 to £512 in 2024*.'

We would not expect the inclusion of this text to lead to an increase in Package WTP.

The sample composition was weighted to the population of Wales using the same 2011 Census targets for age, gender and SEG. With respect to these variables, there would therefore be no difference in the weighted data between PR14 and PR19.

The analysis methodology differed between PR14 and PR19 only minimally to reflect the differences in design. We do not expect that any differences in methodology here would have caused the increase in valuation observed.

This leaves underlying attitudes as the remaining explanation from our candidate set, and we believe this to be the most likely explanation for the bulk of the increase. In both PR14 and PR19 surveys we asked customers whether they felt their current bill was (far) too little, about right, or (far/slightly) too much. At PR14, 28% said 'Slightly too much' and 18% said 'Far too much'; at PR19, 21% said 'Slightly too much' and 11% said 'Far too much'. These differences are significant, and also known to drive WTP differences as we have shown in our reports at both PR14 and PR19.

Further evidence of the difference in attitudes comes from the question included in both PR19 and PR14 surveys regarding altruism: '*In any of the choices that you have just made, would you be willing to pay a higher bill so that better service levels would be provided to other customers' properties?*' At PR14,19% said 'yes' while at PR19 40% said yes.

We therefore believe that the dominant explanation for the increase in observed WTP is that underlying attitudes have changed, leading to a greater desire to pay for improvements in 2017 in comparison to 2013.

4.5 Mapping Packages to MaxDiff Units

Following the approach outlined in 4.1, we required a mapping from the service change represented in the Package exercise to units of service issues as presented in the MaxDiff exercise in order to apportion the package values into amounts corresponding to each service measure. Essentially, the proportion of the package value that gets assigned to an individual service level change is the product of two components: the change in the chance that an individual is affected by the corresponding MaxDiff service issue(s) and the relative impact of that/those service issue(s) if they were to occur. Here we are focussed on the first part: mapping the package service level changes in units of change in the chances that MaxDiff service issues occur.

For the majority of the service measures explored, the mapping from Package unit to Maxdiff unit(s) is straightforward. In the simplest case – temporary use bans and non-essential use bans – the mapping is one-to-one because the Package unit is already expressed as the chance that an average property will be affected.

Additionally, in many cases the Package service measures are in units of 'properties affected'. In this case, the mapping to MaxDiff units is simply to divide the number of package units by the number of customers in the corresponding service area (water or wastewater). By so doing, a 1 property reduction in the Package service measure is translated into a 1/N change in the risk of an average individual experiencing the MaxDiff service issue in question.

For three of these cases: sewer flooding inside, sewer flooding and odour from sewage works, there were two different severity levels included in the MaxDiff exercise for each. For example, the Package measure 'Sewer flooding inside properties' included 44.4% of cases that could be characterised as 'Major' and 55.6% that could be characterised as 'Minor'. In these cases, our mapping simply took a weighted average of the different severity cases, so that a 1 property reduction in the Package service measure is translated into a p_{major}/N change in the risk of the 'Major' type of service issue and a p_{minor}/N change in the risk of the 'Minor' type of service issue, where $(p_{major}+p_{minor})=1$.

In other cases the mapping required an assumption to be made. This includes the two pollution incidents measures, the river water quality measure and the bathing water quality measure.

With respect to pollution incidents, the scaling factor used to map the Package measures to the chance of experiencing the corresponding MaxDiff service issue was based on two assumptions:

i) that pollution incidents affect 1km of river on average, and
ii) that 1% of the river is considered local by 1% of customers, or equivalently that an improvement to 1% of the river network benefits 1% of customers.

The first of these assumptions is based on FWR descriptions of Category 2 and Category 3 pollution incidents, as shown below. Clearly pollution incidents vary in length, but 1km was considered to be a reasonable average figure to use in the absence of hard data.

Cat 2	Significant but normally localised effect on water quality which has a significant impact on the quality or use of that water. § For surface waters, examples of Category 2 impacts include silt or soil, low dissolved oxygen or high ammonia levels along an extensive stretch of a water body. Impacts may be up to a couple of hundred metres in a larger water body or effects over several kilometres (such as a heavy rainbow coloured oil film).
Cat 3	Limited and localised effect on water quality which has a minimal impact on the quality or use of that water. § For surface waters, impacts are normally localised around the point of discharge, but could include an impact extending over a few kilometres of a stream (such as a thin oil sheen).

Source: Foundation for Water Research (http://www.fwr.org/WQreg/Appendices/Common_incident_classification_system_04_01.pdf)

With regard to the second assumption, that 1% of the river is considered local by 1% of customers, or equivalently that an improvement to 1% of the river network benefits 1% of customers, the basis for this is that it is a simple linear interpolation from the end-points that no improvement will affect no-one, and a 100% improvement will affect everyone. Although it is possible that over any particular range of improvement there may be a more than proportional number of customers affected, overall this assumption again seems as accurate as possible in the absence of further data or research.

Similar considerations to the above were the basis for our assumptions concerning river water quality and bathing water quality. In these cases, the mapping to MaxDiff units was based on the assumption that an improvement to 1% of the river network/set of bathing waters in the DCWW wastewater supply area benefits 1% of customers in this area; hence the chance of experiencing 'Less than Good' locally falls by 1% given a 1% reduction in the proportion of rivers/bathing waters at Less than Good status.

The full list of Package service measures and how they are mapped to MaxDiff service issues is shown in Table 13.

The mapping approach shown here was necessary to ascertain the change in the chance of experiencing a service issue given a service level improvement in the corresponding area. These values were then used in conjunction with the impact scores corresponding to each of the service issues to apportion each of the package values into WTP for individual service level changes. The following section presents the results obtained via this decomposition approach.

Table 16: Mapping from Package measures to MaxDiff units

Package service measure	Package unit	MaxDiff service issue	Scaling factor
Water service			
Discoloured water	Props.	Discoloured water (a week)	1/N_Water(1)
Short-term interruptions	Props.	Unexpected interruption (3-6h)	1/N_Water(1)
Long-term interruptions	Props.	Unexpected interruption (24-48h)	1/N_Water(1)
Temporary use ban	Chance	Temporary use ban (May-Sep)	1(2)
Non-essential use ban		Non-essential use ban (May-Sep)	1(2)
Persistent low pressure	Props.	Persistent low pressure	1/N_Water(1)
Wastewater service			
Sewer flooding inside properties	Props.	0.444*(Major sewer flooding inside your property)+0.556*(Minor sewer flooding inside your property)	1/N_Waste(3)
Sewer flooding outside properties	Props.	0.712*(Sewer flooding outside your property)+0.288*(Sewer flooding in a nearby public area)	1/N_Waste(3)
Odour from sewage works	Props.	0.406*(Odour from sewage works (frequent))+0.594*(Odour from sewage works (infrequent))	1/N_Waste(3)
Significant pollution	Incidents	Significant pollution	1/riverkm(4)
Minor pollution	Incidents	Minor pollution	1/riverkm(4)
River water quality	% Good	River water quality	1(5)
Bathing water quality	%Exc %Suff	-Bathing water quality in local area Good but not Excellent Bathing water quality in local area Sufficient but not Good	1(6)

(1) `N_Water' represents the number of water customers, hence 1/N_Water represents the change in the chance of a water customer being affected by a service issue if there are 1 fewer properties affected overall. (2) The Package unit is already the chance of being affected so the mapping is 1:1 in this case. (3) 'N_Waste' represents the number of wastewater customers, hence 1/N_Waste represents the change in the chance of a wastewater customer being affected by a service issue if there are 1 fewer properties affected overall; (4) 'riverkm' represents the length of river in DCWW's wastewater supply area. This scaling factor is based on two assumptions: i) that pollution incidents affect 1km of river, and hence that (1/riverkm) represents the proportion of the river network affected per pollution incident; and ii) that 1% of the river is considered local by 1% of customers, or equivalently that an improvement to 1% of the river network benefits 1% of customers. (5) As above, this is based on the assumption that an improvement to 1% of the river network benefits 1% of customers; hence the chance of experiencing the service issue falls by 1%. (6) As with rivers, this is based on the assumption that an improvement to 1% of coastal bathing waters affects 1% of customers, and hence that the chance of experiencing the service issue falls by 1%.

4.6 WTP for Service Level Changes

The estimated WTP values for 'SQ to +1' and '+1 to +2' improvements are presented in full for dual-service households, dual-service non-households and wastewater only households in Table 14. The following two figures present extracts from this full table.

First, Figure 5 presents 'SQ to +1' WTP values for water services for dual-service household and non-household customers. This figure shows that the highest values were found amongst both households and non-households for the short-term interruptions service improvement. Households were willing to pay £4.15 per year on

average, as an addition to their current bill, to see the 'SQ to +1' service improvement to this measure, while non-households were willing to pay £22.78 on average for the same improvement. The lowest values were found for persistent low pressure improvements amongst both households and non-households.

Figure 8: WTP for 'SQ to +1' water service level changes

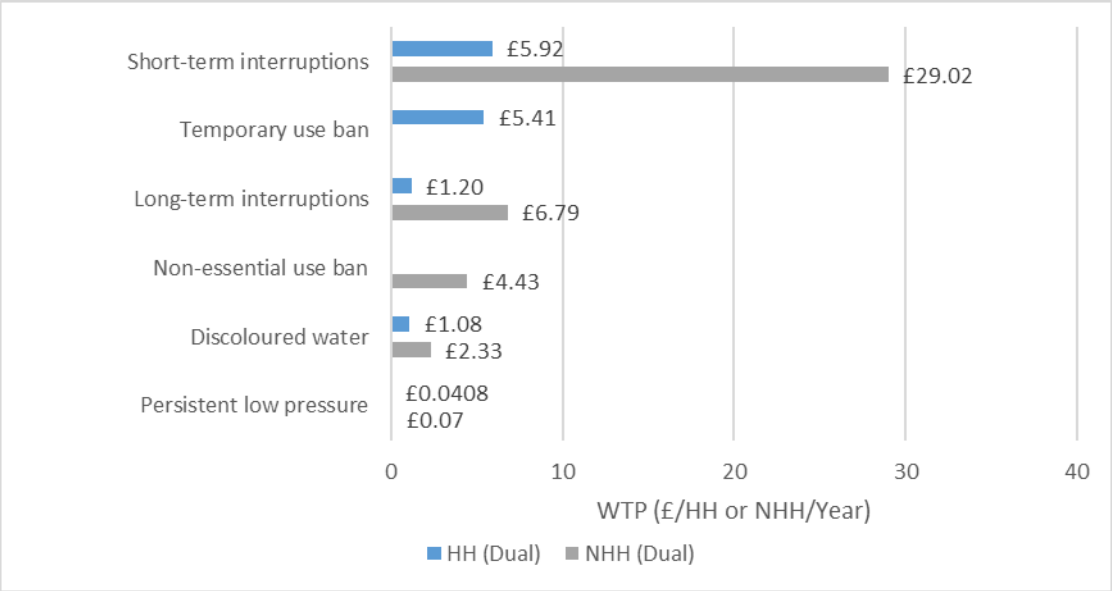
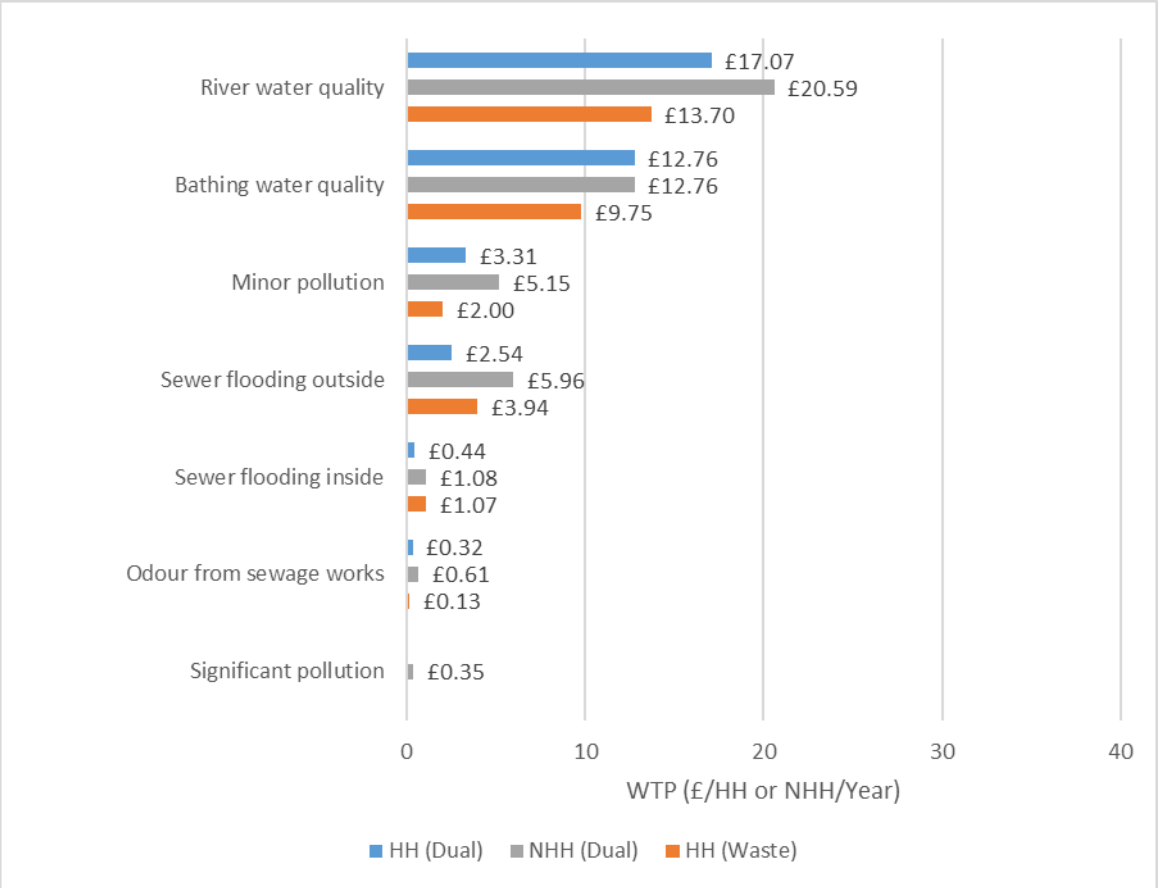


Figure 6 shows a similar set of results for wastewater service measures. Here, there are also very similar results across customer groups. The most valued service improvements (within the 'SQ to +1' package) are estimated to be river water quality and bathing water quality improvements. These results suggest there is a high value to making improvements in these areas.

By contrast, low values are estimated for the 'SQ to +1' improvements to sewer flooding insider customers' properties, odour from sewage works, and significant pollution.

Figure 9: WTP for 'SQ to +1' wastewater service level changes



The following table expands on the above results by including the full set of estimated WTP values for both 'SQ to +1' and '+1 to +2' improvement packages, alongside the service levels themselves at 'SQ', '+1' and '+2' levels. Results are presented for dual-service households, dual-service non-households and wastewater only households.

The results presented in this table are highly pertinent for DCWW in that they are based on carefully considered and realistic potential improvements in service levels for each measure. However, they are not directly comparable against findings from PR14, for DCWW or for other companies, because the values depend on the service level changes being valued and these vary across survey instruments. To compare WTP results on a similar basis it is necessary to standardise the values in the form of 'Unit values (£WTP per unit of change, e.g. per avoided supply interruption). These values are reported next.

Table 17: WTP for service level changes

Service measure		Level of Service			WTP (£ per HH/NHH per year)					
					HH (Dual)		HH (Waste)		NHH (Dual)	
		SQ	+1	+2	SQ to +1	+1 to +2	SQ to +1	+1 to +2	SQ to +1	+1 to +2
Water service										
Short-term interruptions	Props.	45,000	30,000	20,000	£5.92	£1.21			£29.02	£1.80
Temporary use ban	Chance	1 in 20	1 in 30	1 in 40	£5.41	£0.83				
Long-term interruptions	Props.	1,000	500	240	£1.20	£0.19			£6.79	£0.33
Non-essential use ban		1 in 40	1 in 60	1 in 80					£4.43	£0.21
Discoloured water	Props.	5,300	4,000	2,500	£1.08	£0.38			£2.33	£0.25
Persistent low pressure	Props.	100	50	0	£0.0408	£0.0125			£0.07	£0.01
Wastewater service										
River water quality	% Good	36	40	45	£17.07	£6.55	£13.70	£11.12	£20.59	£2.40
Bathing water quality	% Exc/Good/Suff.	80/16/4	80/20/0	90/10/0	£12.76	£8.00	£9.75	£6.62	£12.76	£8.00
Minor pollution	Incidents	110	80	50	£3.31	£1.02	£2.00	£1.30	£5.15	£0.48
Sewer flooding outside	Props.	6,500	5,000	3,500	£2.54	£0.78	£3.94	£2.56	£5.96	£0.55
Sewer flooding inside	Props.	220	175	150	£0.44	£0.07	£1.07	£0.39	£1.08	£0.06
Odour from sewage works	Props.	2,150	1,500	1,000	£0.32	£0.08	£0.13	£0.06	£0.61	£0.04
Significant pollution	Incidents	2	1	0	£0.28	£0.09	£0.31	£0.20	£0.35	£0.03

4.7 Unit Values

The unit values presented in the following were derived by dividing the WTP values for service level changes from 4.6 by the change in the number of units corresponding to the 'SQ to +1' and '+1 to +2' packages of service change and summing over the number of customers of each type (dual-service households and non-households, and wastewater only households). They represent the value of a 1 unit change in the level affecting one property of each service measure; for example, the value of one short-term interruption or one discoloured water incident avoided at one property.

Unit values are reported for both the 'SQ to +1' and '+1 to +2' packages of service improvement in Table 18. Suggested ranges are reported in each case, where these are based on 95% confidence intervals incorporating sampling error in both the main survey and the follow-on survey used to derive weights for the adjustments to impact scores as described in section 4.3.

Table 18: Unit values

		Total WTP (£/unit)			
		SQ to +1		+1 to +2	
Service issue	Unit	Central	Range	Central	Range
Water service					
Long-term interruption (7 days)	prop.	£6,743	(£5,691 , £7,772)	£1,762	(£1,090 , £2,433)
Long-term interruption (24-48 hours)	prop.	£4,009	(£3,348 , £4,656)	£1,002	(£571 , £1,433)
Taste & smell not ideal (few days)	prop.	£1,567	(£1,345 , £1,784)	£438	(£302 , £574)
Discoloured water (a week)	prop.	£1,162	(£998 , £1,322)	£327	(£227 , £426)
Persistent low water pressure	prop.	£1,110	(£958 , £1,258)	£317	(£225 , £408)
Short-term interruption (6-12 hours)	prop.	£702	(£591 , £810)	£182	(£110 , £253)
Short-term interruption (3-6 hours)	prop.	£636	(£534 , £735)	£163	(£97 , £228)
Temporary use ban (May to Sep)	prop.	£305	(£268 , £341)	£94	(£73 , £114)
Non-essential use ban (May to Sep)	prop.	£32	(£23 , £41)	£3	-(£4 , £10)
Wastewater service					
Major sewer flooding inside property	prop.	£22,470	(£17,115 , £28,512)	£7,986	(£5,212 , £10,754)
Minor sewer flooding inside property	prop.	£13,024	(£10,224 , £16,094)	£4,268	(£2,745 , £5,788)
Sewer flooding outside property	prop.	£3,090	(£2,457 , £3,778)	£1,003	(£658 , £1,348)
Sewer flooding in a public area	prop.	£1,979	(£1,603 , £2,382)	£631	(£424 , £838)
Odour from sewage works (freq.)	prop.	£713	(£600 , £828)	£210	(£145 , £275)
Odour from sewage works (infreq.)	prop.	£712	(£600 , £825)	£211	(£145 , £276)
Significant pollution incident	local prop.	£2,128	(£1,746 , £2,537)	£691	(£484 , £898)
	incident	£397,225	(£325,624 , £473,678)	£128,622	(£89,750 , £167,321)
Minor pollution incident	local prop.	£805	(£674 , £941)	£246	(£172 , £320)
	incident	£150,459	(£125,822 , £175,906)	£45,834	(£31,816 , £59,788)
River water quality less than Good to Good	local prop.	£424	(£242 , £954)	£134	(£65 , £332)
	%	£5,374,271	(£3,095,025 ,£11,991,580)	£1,790,252	(£918,108 , £4,272,109)
	km	£73,439	(£42,293 , £163,864)	£24,464	(£12,546 , £58,378)
Bathing water quality Sufficient to Good	local prop.	£309	(£182 , £505)		
	%	£3,994,362	(£2,373,328 , £6,497,713)		
	site	£3,916,041	(£2,326,792 , £6,370,306)		
Bathing water quality Good to Excellent	local prop.			£75	(£39 , £134)
	%			£1,005,929	(£540,696 , £1,733,693)
	site			£986,205	(£530,094 , £1,699,699)

** Ranges based on 95% confidence intervals.*

The figures in Table 18 are to be interpreted as in the following examples.

- the total value to DCWW customers of a reduction by 1 in the number of properties expected to suffer from a long-term interruption lasting 7 days was £6,743 per year for improvements up to the +1 level of service, and £1,762 per year per property for improvements between the +1 and +2 levels of service.

  Similar interpretations apply to all other unit values with 'prop.' as the unit of measure.

- In the case of significant pollution incidents, there are two units of measure shown in Table 18. The first, 'local prop.', can be applied when the number of properties local to the pollution incident can be identified. Alternatively, the per incident value of £397,225 (for the SQ to +1 range of improvement) is the expected value to be used which will be valid on average for all significant pollution incidents.

- Multiple units are also shown for river water quality and bathing water quality attributes. Here again, values per local property are shown, which can be used when the number of properties local to the river or beach can be identified. There are also average values per percentage of river/bathing water in the DCWW wastewater supply area, and values per km, in the case of rivers, and per site in the case of bathing waters.

Table 19 below shows unit values pertaining to dual-service households for those service measures where comparisons are possible against PR14 reported values, for DCWW and for the industry as a whole. This table suggests that the values are below the PR14 industry range for persistent low pressure and sewer flooding service issues, and above this range for temporary use bans and bathing water quality.

In comparison to the DCWW PR14 numbers, the PR19 values show the following key differences:

- PR19 values are higher than at PR14 for short interruptions, TUBs, and river and bathing water quality
- PR19 values are lower than at PR14 values for long interruptions, low pressure and sewer flooding

These differences are not unexpected as they can be explained as a consequence of the change in design approach. The PR19 approach is much more sensitive to the scale of service change, by construction, due to the fact that the relative values assigned to different service improvements are now derived as impact-weighted sums of the numbers of customers affected, rather than directly obtained from customers trading them off against one another.

As a result, we believe the PR14 approach probably over-valued attributes with small risk reductions (e.g. long interruptions, low pressure and sewer flooding), and under-valued attributes affecting lots of customers (e.g. short interruptions, environmental attributes and TUBs). Accordingly, we believe the PR19 numbers are a more valid and reliable measure of value overall.

Table 19: Comparison of PR19 and PR14 Unit Values (Dual-service households)

Service issue	Unit	Unit value (£/unit)		
		PR19	PR14 (DCWW)	PR14 (Industry range)
Water service				
Discoloured water (for a week)	Prop.	£1,087	£1,525	[£586, £3,060]
Short-term interruption (3–6h)	Prop.	£515	£50	[£50, £1,670]
Long-term interruption (7 days)	Prop.	£5,646	£13,662	[£277, £13,662]
Long-term interruption (24–48h)	Prop.	£3,131		
Temporary use ban (May-Sep)	Prop.	£325	£34	[£0, £123]
Persistent low pressure	Prop.	£1,000	£22,345	[£1,408, £28,462]
Wastewater service				
Major sewer flooding inside property	Prop.	£20,048	£97,984	[£22,530, £367,291]
Minor sewer flooding inside property	Prop.	£11,193		
Sewer flooding outside your property	Prop.	£2,695	£3,397	[£2,869, £162,570]
Sewer flooding in a nearby public area	Prop.	£1,755		
Odour from sewage works (frequent)	Prop.	£631	£1,536	[£166, £11,820]
Odour from sewage works(infrequent)	Prop.	£631		
Significant pollution	Incident(1)	£366,555	£1,119,639	[£22,200, £54,100,000]
Minor pollution	Incident(1)	£135,530	£42,669	
River water quality (Good)	km(2)	£73,071	£4,017	[£4,017, £256,889]
Bathing water quality (Suff.)	site(3)	£3,902,383	£202,921	[£79,080, £959,575]

Source for PR14 values: Accent-PJM (2014) Comparative review of WTP results. Values in red are those lying above the PR14 industry range; those in blue lie below the PR14 industry range.

4.8 Further Analysis

As a means of exploring the variation in results across the customer base, a suite of additional models has been estimated, including an analysis of how preferences vary by demographic characteristics, an analysis of the impact of experience of a service issue on impact scores assigned to that service issue, and an analysis of how willingness to pay varies with attitudes to the current bill level. The findings from this analysis are reported in detail in Appendix B.

The results from this analysis are supportive of the consistency of the results with expectation. In summary, we have found:

- Customers who stated in the questionnaire that their current bill is "too high" show a much higher price sensitivity in the package exercise leaning largely towards the cheaper option presented.

- Customers with higher incomes had higher WTP than those with lower incomes, and those not receiving social benefits had higher WTP than those that did receive social benefits.

- For several service failures, the perceived severity was found to be dependent on the participants' experience. A connection between the level of the impact score and previous experience was found for
    - Unexpected interruption (3 - 6 hours)

- Unexpected interruption (6 - 12 hours)
- Unexpected interruption (up to 7 days)
- Persistent low water pressure
- River water quality in your local area is less than "Good"
- Coastal bathing water quality in your local area is sufficient but not good

Overall, the results from the explanatory models are supportive of the validity of the main findings obtained.

5 CONCLUSIONS

This study has sought to estimate DCWW customers' WTP for service improvements and their WTA for service deteriorations. The research covered dual-service households and non-households, and wastewater only household customers.

The design approach implemented for this study was novel to DCWW, and the water sector generally, in that it sought to avoid, as far as possible, the need for customers to make trade-offs between small risk reductions. This was done by deriving estimates of WTP for whole packages of service level changes, and then apportioning these values to the various component service measure changes via an impact-weighted measure of the service change included in the package.

The key advantage of the new design approach is that it was simpler for participants, and thereby able to obtain more meaningful expressions of preference for customers. Additional advantages include that it was able to accommodate a greater number of service measures than the previous PR14 approach, and that fewer SP exercises were needed within the survey to obtain the required data.

The results from the MaxDiff analysis showed, as expected, that sewer flooding inside the customer's property was the highest-impact service issue overall. Moreover, the results on the impacts attributable to each of the different service issues all varied in line with expectation, with longer duration incidents, for example, found to have higher impacts than shorter duration incidents, and more severe types of sewer flooding found to have higher impacts than less severe types.

Our analysis of the Package exercise data found that participants were not willing, on average, to accept any service deteriorations in exchange for bill reductions. In fact, in the context of a decreasing bill, in real terms, participants would be unwilling to accept any deterioration in service, and would rather see any amount of service improvement than no service improvement. Once the bill change is in the positive range, however, participants become cost sensitive. This finding mirrors the same result found at PR14 for DCWW.

With respect to improvement packages, we found that Dual service households were willing to pay up to a total of £50.37 per year, on average, for an intermediate improvement package. This represents a substantial increase in WTP over the findings for PR14. We found strong evidence of diminishing marginal WTP, with the same customers willing to pay only an additional £19.21 for the stretch improvement package on average.

Amongst the service improvements offered in the intermediate 'SQ to +1' package, the improvements to river water quality and bathing water quality were estimated to have the highest value. This was driven by the fact that improvements in these areas affected a large number of customers. Thus, despite the fact that the impact of service changes in these areas was less than for other service issues -sewer flooding, for example -the overall derived WTP for these improvements was very substantial.

Our analysis also calculated 'unit values', which are a standardised measure of WTP for a service measure that can be compared across surveys even where the packages of service change offered were different. In comparison with results obtained at PR14, the results suggest that there are substantially higher values for river water quality and bathing water quality, and lower values for sewer flooding and persistent low pressure.

Although the differences between PR14 and PR19 will, in part, reflect genuine changes in preferences, there are also methodological features of the change in design approach that are also likely to be playing a part. In particular, the findings can be explained by the hypothesis that customers previously over-weighted service measures where the risk change was very small (low pressure and sewer flooding), and correspondingly under-weighted the service measures where the chance of being impacted was relatively large (environmental improvements). By imposing proportionality with respect to the chance of being impacted, these effects will have been reversed.

Confidence in the results reported here can be gained from the following:

- The design of the questionnaire was peer reviewed, and fully tested via cognitive interviews and pilot tests with households and businesses.
- A clear majority of responses were assessed as valid, taking into account participants' feedback
- Results for the impact scores describing the perceived disutility of each attribute were logically consistent and in line with expectations.
- Results from our further analysis showed that WTP varied in line with expectation. For example, WTP was higher for higher income groups and those not in receipt of benefits, and was lower for those who stated that their current bill was too much.

Overall, the valuation estimates presented can be considered meaningful measures of DCWW customers' values for the range of services, and service levels, contained within the survey. As such, we recommend them as a key source of evidence for use within the triangulation exercise that DCWW intends to conduct to assimilate findings from a wide range of sources for PR19 business planning.

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APPENDIX A: QUESTIONNAIRE

SYSTEM INFORMATION:
Interviewer number
Interviewer name
Date:
Time interview started:

Introduction

Good morning/afternoon/evening. My name is ..... from Accent and I am carrying out research on behalf of Welsh Water into customers' views on them, specifically what areas you think they should improve on in the future. We are talking to people about options for water and waste water services in your area from 2019 to 2024, and the impact on customers' bills.

Please may I speak to whoever is responsible – either jointly or solely – for paying your household's water bills? **WHEN SPEAKING TO APPROPRIATE CONTACT CONTINUE WITH EXPLANATION**

This is a *bona fide* market research exercise. It is being conducted under the Market Research Society Code of Conduct which means that any answers you give will be treated in confidence. This call may be recorded for quality control purposes.

The interview will take about 25 minutes, depending on your answers. Can I just ask you a couple of questions to check that you are eligible to take part in this research? Those who are eligible, and who then go on to conduct the full interview, will be given a £5 voucher as a thank you for their time.

Scoping questions

Q1. Do you or any of your close family work or have worked in the past in market research or the water industry (including working for Welsh Water)?

1. Yes **THANK & CLOSE**
2. No

Q2. Please can I confirm that you are responsible – either solely or jointly – for your household's water and waste bill?

1. Yes
2. No **THANK & CLOSE**

Q3. Does your property have a septic tank or cesspit?

IF REQUIRED: If you do have one, this would mean that your property is not connected to the main sewer and you would periodically arrange to have the septic tank emptied.

1. Yes **THANK & CLOSE**
2. No
3. Don't know

Q4. We need to check that we are speaking to residents in specific parts of the Welsh Water area. Please can you tell me the first part of your postcode. For example if your full postcode is CF2 2EN, please just tell me the first part ie CF2.

DO NOT READ - INTERVIEWER INSTRUCTION: Select area part of postcode from drop down list, then add district number. Please check carefully as we are matching to a look-up table. Use phonetic alphabet to clarify letters.

DP: Please create a drop down look up for postcode check using postcodes shown in column B sheet 'DLOOKUP' of ..\..\DP\Postcode Lookup files\DLOOKUP.xlsx. DO NOT CREATE BOX FOR 2nd HALF OF POSTCODE

Prefer not to answer — **THANK AND CLOSE – NOT WITH ANY OTHER CODE**

None of the above letters — **THANK AND CLOSE – NOT WITH ANY OTHER CODE**

FOR INTERVIEWER INFORMATION: PHONETIC ALPHABET

A	Alpha	J	Juliett	S	Sierra
B	Bravo	K	Kilo	T	Tango
C	Charlie	L	Lima	U	Uniform
D	Delta	M	Mike	V	Victor
E	Echo	N	November	W	Whiskey
F	Foxtrot	O	Oscar	X	X Ray
G	Golf	P	Papa	Y	Yankee
H	Hotel	Q	Quebec	Z	Zulu
I	India	R	Romeo		

DP: CHECK AGAINST THE LIST OF POSTCODES in column B sheet 'LOOKUP' of ..\..\DP\Postcode Lookup files\LOOKUP.xlsx AND CONFIRM.

Q5. Just to check, this makes your postcode **[DP: insert drop down PC area and PC district from Q4]**. Is this correct?

DO NOT READ - INTERVIEWER INSTRUCTION: Please check carefully as we are matching to a look-up table. Use phonetic alphabet to clarify letters.

1. Yes
2. No **GO BACK TO Q4** GO BACK TO PREVIOUS QUESTION AND AMEND

FOR INTERVIEWER INFORMATION: PHONETIC ALPHABET

A	Alpha	J	Juliett	S	Sierra
B	Bravo	K	Kilo	T	Tango
C	Charlie	L	Lima	U	Uniform
D	Delta	M	Mike	V	Victor
E	Echo	N	November	W	Whiskey
F	Foxtrot	O	Oscar	X	X Ray
G	Golf	P	Papa	Y	Yankee
H	Hotel	Q	Quebec	Z	Zulu
I	India	R	Romeo		

Q6. **ASK IF CONFIRMED POSTCODE MATCHES LOOK UP:** According to our records, both your water and waste water services are provided by Welsh Water. Is that correct?

1. Yes
2. No **THANK & CLOSE**
3. Don't know **THANK & CLOSE**

Q7. **ASK IF CONFIRMED POSTCODE DOES NOT MATCH LOOK UP:** Can you tell me who supplies your water and sewerage services?

1. Welsh Water supplies both my water and sewerage services
2. Welsh Water supplies sewerage only, another company supplies my water – **THANK AND CLOSE**
3. Welsh Water supplies my water services only, another company supplies my sewerage – **THANK AND CLOSE**
4. Other supplier for both water and sewerage service – **THANK AND CLOSE**
5. Don't know **THANK AND CLOSE**

Q8. Which of the following best describes your household? **READ OUT**

1. Owner Occupier (with or without mortgage) HOMEOWNER
2. Shared Ownership or Keyworker HOMEOWNER
3. Private Rented TENANT
4. Social Housing rented (Council Housing, Housing Association or similar) TENANT
5. Refused / N/A **DO NOT READ OUT** **THANK & CLOSE**

Q9. **IF Q8=3 OR 4 (TENANT) ASK, OTHERS GO TO Q10:** Is your water bill included in your rental payment, or do you pay directly to Welsh Water?

1. Included in rent **THANK & CLOSE**
2. Pay directly to Welsh Water
3. Don't know **DO NOT READ OUT.** **THANK & CLOSE**

Q10. Do you currently have any on-going complaints or issues with Welsh Water?

1. Yes
2. No **GO TO Q12**

Q11. What is the nature of your complaint? **TYPE IN**

Q12. How would you describe the occupation type of the chief income earner in your household? **READ OUT**

1. Senior managerial or professional
2. Intermediate managerial, administrative or professional
3. Supervisor; clerical; junior managerial, administrative or professional
4. Manual worker (with industry qualifications)
5. Manual worker (with no qualifications)
6. Unemployed
7. Retired
8. Student
9. Refused **DO NOT READ OUT** **SKIP TO SEG**

Q13. **IF Q12=7 (RETIRED), ASK else SKIP** Does the chief income earner have a state pension, a private pension or both?

1. State only
2. Private only
3. Both

4. Refused DO NOT READ OUT **SKIP TO SEG**

Q14. **IF Q13 = PRIVATE OR BOTH, ASK else SKIP** How would you describe the chief income earner's occupation type before retirement? **READ OUT**

1. Senior managerial or professional
2. Intermediate managerial, administrative or professional
3. Supervisor; clerical; junior managerial, administrative or professional
4. Manual worker (with industry qualifications)
5. Manual worker (with no qualifications)
6. None of these

SEG CODE AS FOLLOWS:

IF **Q12** = 1 or 2; SEG = AB
IF **Q12** = 3 or 4; SEG = C1/C2
IF **Q12** = 5; SEG = DE
IF **Q12** = 6; SEG = DE
IF **Q12** = 8; SEG = C1/C2

IF **Q12** = 7 and **Q13** = State only; SEG = DE

IF **Q12** = 7 and **Q13** = Private only OR Both and **Q14** = 1; SEG = AB
IF **Q12** = 7 and **Q13** = Private only OR Both and **Q14** = 2; SEG = AB
IF **Q12** = 7 and **Q13** = Private only OR Both and **Q14** = 3; SEG = C1/C2
IF **Q12** = 7 and **Q13** = Private only OR Both and **Q14** = 4; SEG = C1/C2
IF **Q12** = 7 and **Q13** = Private only OR Both and **Q14** = 5; SEG = DE
IF **Q12** = 7 and **Q13** = Private only OR Both and **Q14** = 6; SEG = DE

IF **Q12** = 9 OR **Q13**=4; SEG = Not stated

CHECK QUOTA

Q15. Which of the following age groups do you fall into?

1. 18-24
2. 25-34
3. 35-44
4. 45-54
5. 55-64
6. 65-74
7. 75 or older
8. Refused DO NOT READ OUT

CHECK QUOTA

Q16. **DO NOT ASK: INTERVIEWER RECORD GENDER**

1. Male
2. Female

Q17. Do you have a water meter?

1. Yes
2. No
3. Don't Know DO NOT READ OUT

Q18. How much is your annual bill from Welsh Water? You can give this as either a weekly, monthly or annual figure, whichever is easier for you. If you do not know exactly, please try and give your best estimate.

1. £ per week
2. £ per month
3. £ per year

Don't know

Q19. **Hidden question: Calculate annual bill from Q18**

£ per year
If DK, code as £437

Q20. **SKIP IF Q18=4 (DK), ELSE ASK:** Please say if that is an estimate or not?

1. Estimate
2. Exact amount

RECRUITMENT Thank you, I can confirm you are in scope for the survey. As I mentioned, we are carrying out an important research study for Welsh Water looking at areas you think they should improve on in the future. I would be very grateful if you could spare another 25 minutes – either now or at a more convenient time – to run through some questions with me. This is your opportunity to influence the company's future plans. You do need to have some materials in front of you which I can either email to you now and we can carry on or I can email or post them to you and we can make an arrangement to talk at a convenient time for you. Those completing this full interview will become eligible for a £5 Boots, Amazon, or M&S voucher (or can have £5 donated to the charity "WaterAid").

INTERVIEWER: Completing the interview in real time must be your preferred option at all times.

email, now **SEND EMAIL THEN PROCEED**
cannot continue with interview now **SEND EMAIL THEN RECORD APPOINTMENT ON NEXT SCREEN**
do not have access to email **BRING UP APPOINTMENT/ADDRESS BOX**
no **ATTEMPT TO REASSURE & PERSUADE; IF STILL NO, THANK & CLOSE**
continue without sending email (practice/design/completes)

Date:.....Time:.....

Name:.....

Address:

Email Address:

Tel No.

Main Survey

Thank you for agreeing to take part in this survey. As I said previously, we are conducting research for Welsh Water looking at areas you think they should improve on in the future. The questionnaire will take about 25

minutes. You do not have to answer questions you do not wish to and you can terminate the interview at any point.

Can I check that you have your materials ready to refer to? These will have either been sent in the post or by email.

1. Yes, have materials– **PROCEED**
2. No – **GO TO APPOINTMENTS SCREEN AND RE-SCHEDULE, RE-SENDING MATERIALS**

Background Questions

We'd like to start by asking you some questions about how you use water in your home on a day to day basis – both clean water coming into your home and dirty water that's taken away from your home.

Q21. What do you typically use **water** for on a daily basis? Please think about all of the areas in your life where you use water or where waste water is taken away from your home. **MULTICODE**

1. Cleaning teeth
2. Preparing food
3. Cooking food
4. Making a hot drink
5. Taking a bath
6. Taking a shower
7. Drinking water
8. Drinking water for pets
9. Cleaning
10. Using washing machine
11. Using dishwasher
12. Gardening
13. Cleaning car
14. Flushing the toilet
15. Other **SPECIFY**

Q22. What would be the impact of not having access to **clean water** for a day? **RECORD VERBATIM**

Q23. What would be the impact of **waste water** not being collected for a day? **RECORD VERBATIM**

Q24. **IF Q18= 4 (DON'T KNOW):** The average annual household water and sewerage bill in your area is £437.

ELSE: Previously you told me that your annual bill from Welsh Water is **[INPUT FROM Q18; please include per week/per month/per year]. IF Q18=1 OR 2 ADD:** This calculates as **[INPUT FROM Q19]** per year.

ASK ALL: How do you feel about the amount that you pay for water services? Is it**:**

1. Far too little
2. Too little
3. About right
4. Slightly too much
5. Far too much
6. Don't know **DO NOT READ OUT**

Impact of Service Changes

You are now going to be shown information about service levels that you could experience from Dŵr Cymru Welsh Water. We would then like you to consider which areas you would like to see improvements in.

Please now look at Show Card C (Service Measures). **INTERVIEWER CHECK THAT PARTICIPANTHAS SHOW CARD C IN FRONT OF THEM**

This is about various types of water and sewerage service failures and some environmental measures attached to them. We'll now look at each of these in a little more detail.

We will first look at possible problems with your water supply. Please turn to Show Card D1, labelled "**Discoloured Water at Your Property for a Week**". This tells you about possible discolouration of your tap water; please take a moment to read through this.

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

The next service failure on Show Card D2 is "**Water Taste and Smell Not Ideal**." Again, please read through this information.

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

Please now turn to the next two Show Cards, D3 and D3.1, which tell you about possible interruptions to your water supply.

IF REQUIRED: D3 is labelled **"When Your Water Supply is Interrupted"**; D3.1 is labelled **"Interruptions to Your Water Supply for a Short Period of Time"** and **"Interruptions to Your Water Supply for a Long Period of Time"**.

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

Next, Show Card D4 tells you about persistent low water pressure. Please let me know when you've finished reading this information.

IF REQUIRED: It is labelled "**Persistent Low Water Pressure**".

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

And the last water supply failure is on Show Card D5, labelled "**Temporary Use Bans**".

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

Q25. To your knowledge, have you or any of your relatives or close friends experienced, noticed or been aware of any of these problems? If so, was that in the past year or more than a year ago? **READ OUT**

INTERVIEWER: FOR EACH SERVICE AREA, THERE IS A HOVER BUTTON WITH A BRIEF DESCRIPTION. IF A PARTICIPANT HAS ANY QUESTIONS OR IS UNSURE ABOUT WHAT ANY OF THE SERVICE FAILURES REFER TO, PLEASE USE THESE TO EXPLAIN.

	Within past year	More than a year ago	Never	Don't know
Discoloured water				
Water taste & smell not ideal				
Short-term interruptions				
Long-term interruptions				
Persistent low water pressure				
Temporary use bans				

DP: PLEASE ADD HOVER BUTTONS; TEXT BELOW:

Discoloured water: On rare occasions, the water may be discoloured. Welsh Water wouldn't expect anyone to drink it when it looks unpleasant. Even if you run your tap for several minutes, the water would still be brown/discoloured.

Water taste & smell not ideal: Welsh Water makes water safe to drink by adding small amounts of one or two chemicals as part of its treatment process. Some customers may find the taste and smell of these strong depending on the levels in the water and their sensitivity to it. If a jug of tap water is left in the fridge for a couple of hours any smell or taste will disappear. Water taste and smell problems typically last for a few days at a time.

Short-term interruptions: Sometimes your water supply can be interrupted. This means that you may have no water for a period of time, or your supply could be intermittent. Some interruptions to your water supply that are unexpected last for a short period of time, for example between 3-6 hours.

Long-term interruptions: Sometimes your water supply can be interrupted. This means that you may have no water for a period of time, or your supply could be intermittent. Sometimes customers are left without water for a long period of time – for more than 24 hours. If this happens unexpectedly, Welsh Water will get an alternative supply of water to customers such as mobile water tanks, or for certain high risk customers, they may supply bottled water.

Persistent low water pressure: Customers with persistent low water pressure due to Welsh Water service failures experience problems daily with filling sinks and baths. In the most extreme cases water just trickles

out of the tap and in some cases normal shower systems will not work properly. Customers who suffer from this problem receive a £25 rebate off their water bill.

Temporary use bans: Temporary use bans are used by water companies to conserve water following very dry spells. They typically last for 5 months, beginning in May and ending in September. You would not be able to use a hosepipe to water your garden, wash a car or fill/maintain a swimming or paddling pool.

[NEXT SCREEN]

We will now talk about your sewerage service. First, please look at Show Card D6 which tells you about sewer flooding and the possible causes.

IF REQUIRED: It is labelled **"Sewer Flooding"**.

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

The next two show cards, D6.1 and D6.2, tell you how your property may be affected by sewer flooding. Please take a moment to read through this information.

IF REQUIRED: D6.1 is labelled "**Sewer Flooding Inside a Property**" and D6.2 is "**Sewer Flooding Outside Properties and in Public Areas**".

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

Next, Show Card D7 tells you about possible odour from sewage treatment works.

IF REQUIRED: It is labelled "**Odour From Treatment Works**".

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

And finally, we will look at three different environmental measures. Please turn to Show Card D8 which is about possible environmental pollution.

IF REQUIRED: It is labelled "**Environmental Pollution**".

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

Next, Show Card D9 tells you about the quality of river water and Show Card D9.1 illustrates the four quality levels.

IF REQUIRED: They are labelled "**River Water Quality**".

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

And finally, Show Card D10 is about the quality of coastal bathing water.

IF REQUIRED: It is labelled "**Coastal Bathing Water Quality**".

INTERVIEWER: CHECK IF PARTICIPANT NEEDS MORE TIME BEFORE PROCEEDING.

[NEXT SCREEN]

Q26. And to your knowledge, have you or any of your relatives or close friends experienced, noticed or been aware of any of these problems? If so, was that in the past year or more than a year ago? **READ OUT**

INTERVIEWER: FOR EACH SERVICE AREA, THERE IS A HOVER BUTTON WITH A BRIEF DESCRIPTION. IF A PARTICIPANT HAS ANY QUESTIONS OR IS UNSURE ABOUT WHAT ANY OF THE SERVICE FAILURES REFER TO, PLEASE USE THESE TO EXPLAIN.

	Within past year	More than a year ago	Never	Don't know
Sewer flooding inside a property				
Sewer flooding outside a property or in a public area				
Odour from sewage treatment works				
Minor pollution in rivers and coastal waters				
Significant pollution in rivers and coastal waters				
Poor river water quality				
Poor coastal bathing water quality				

DP: PLEASE ADD HOVER BUTTONS; TEXT BELOW:

Sewer flooding inside a property: If sewage enters a building, home, integral garage or outbuildings, this is known as "internal flooding". The flooding may cause damage to floors, carpets, furniture and belongings, and the occupant may have to make an insurance claim for any repairs or for the replacement of damaged items. When this happens, Welsh Water pays customers compensation equal to their annual wastewater bill (between £50 and £1,000).

Sewer flooding outside a property or in a public area: "External flooding" is where:

- people cannot access their home without stepping through sewage flooding or their garden is extensively flooded and cannot be used by family and pets or their outbuildings or garages (other than integral) are flooded inside
- public spaces are affected including roads and fields

Odour from sewage treatment works: People who live near to a treatment works may experience sewage odour on certain days or at certain times of the year. There are two different types of odour problem:

- Sewage odour affecting your property once or twice per year, for a few days each time
- Sewage odour affecting your property several times a year, for a week or two each time

Minor pollution in rivers and coastal waters: Minor pollution would cause fewer than 10 fish to die, and would affect agricultural or commercial activities in some way.

Significant pollution in rivers and coastal waters: Significant pollution would cause the death of 10-99 fish and/or would significantly affect agricultural or commercial activities.

Poor river water quality: The quality of river water is affected by the volume and quality of the treated waste that is put back into rivers. Wastewater from homes and businesses mixes with rainwater from draining from roads and pavements, before entering the public sewer. All this water is then treated at one of Welsh Water's sewage treatment works before being released back into rivers or the sea.

Poor coastal bathing water quality: Welsh Water puts treated wastewater back into rivers and the sea. Along with other users such as farming and industry, its activities therefore affect coastal bathing water quality. Coastal bathing waters are classified in order of cleanliness as either 'Poor', 'Sufficient', 'Good' or 'Excellent' in accordance with European Union standards, with 'Sufficient' being the minimum that is required for bathing water.

Q27. On the next page, you will find Show Card C which we looked at before. Which of these service areas, if any, would you like to see improved in the future? **MULTICODE. DP: ADD HOVER BUTTONS.**

1. Discoloured water
2. Water taste & smell not ideal
3. Short-term interruptions
4. Long-term interruptions
5. Temporary use bans
6. Persistent low water pressure
7. Sewer flooding inside a property
8. Sewer flooding outside a property or in a public area
9. Odour from sewage treatment works
10. Minor pollution in rivers and coastal waters
11. Significant pollution in rivers and coastal waters
12. Poor river water quality
13. Poor coastal bathing water quality
14. None **DO NOT READ OUT** **NOT WITH ANY OTHER CODE**
15. Don't know/not sure **DO NOT READ OUT** **NOT WITH ANY OTHER CODE**

Q28. In any of the choices that you have just made, would you be willing to pay a higher bill so that better service levels would be provided to other customers' properties?

INTERVIEWER: IF QUERIED, SAY: Some people are willing to pay a higher bill to improve service at other properties because they think no property should have especially poor service, or because they think some other people cannot or will not pay enough to get the service they should have.

1. Yes
2. No
3. Don't know **GO TO NEXT SECTION**

Q29. **Q28=1, ELSE SKIP:** What was your main reason for this? **DO NOT READ OUT. CODE MAIN REASON BELOW. PROBE IF NECESSARY**.

1. No property should experience sewer flooding inside the property
2. No property should experience sewer flooding in the garden or close by
3. I thought the effect might happen at my property
4. I thought the effect could happen where I move to next
5. I want to contribute when other people cannot pay
6. I want to contribute when other people will not pay
7. I want the people at the affected properties to be happier due to better service
8. I know someone in an affected property and want to help them
9. I am not sure the people in the affected properties understand the service or would make good choices about it
10. Other **SPECIFY**

Q30. **ASK IF Q28=2, ELSE SKIP:** Why would you not be willing to pay a higher bill? **RECORD VERBATIM**

Impact of Service Failures

Please now turn to Show Card X1, "Instructions for the first choice exercise". For the next ten questions you will be shown four service failures, presented like the example shown here.

For each I would like you to select **one** service failure that would have the **most impact** and **one** service failure would have the **least impact** on you.

Some of the service failures shown would affect your own property whereas others would affect your local area. When comparing the impact that each would have on you, please consider how you would feel generally about the service failure happening, including any concerns you may have about your local area and the environment.

DP: ADD HOVER BUTTONS IN CHOICE SETS.

Q31. **Max/diff 1:** Please now look at the first set of choices, labelled as Choice Card D1. **INTERVIEWER: CHECK THAT PARTICIPANT HAS CHOICE CARD D1 IN FRONT OF THEM.**

Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

Q32. **Max/diff 2:** Now turn to Choice Card D2. Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

Q33. **Max/diff 3:** Now turn to Choice Card D3. Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

Q34. **Max/diff 4:** Now turn to Choice Card D4. Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

Q35. **Max/diff 5:** Now turn to Choice Card D5. Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

Q36. **Max/diff 6:** Now turn to Choice Card D6. Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

Q37. **Max/diff 7:** Now turn to Choice Card D7. Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

Q38. **Max/diff 8:** Now turn to Choice Card D8. Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

Q39. **Max/diff 9:** Now turn to Choice Card D9. Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

Q40. **Max/diff 10:** Now turn to Choice Card D10. Which of these service issues would have the most impact and which would have the least impact on you?

Most impact
Least impact
None of these would have an impact on me

I would now like to ask you about the choices you have just made.

Q41. Did you generally feel able to make comparisons between the options I presented to you?

1. Yes
2. No

Q42. **ASK IF Q41=2, ELSE SKIP:** Why weren't you able to make the comparisons in the choices? **RECORD VERBATIM**

Changes to Service and Bill Levels

In the next exercise I would like you to consider the service areas that I have shown you in the previous exercise, but this time you will also see the associated change in your annual water bill from Welsh Water from 2019 to 2024.

Q43. **ASK IF SCHEDULED APPOINTMENT, ELSE GO TO Q45:** Show Cards E1 to E4 explain how the choice sets are formatted. Did you look at these before the interview?

IF REQUIRED: They are labelled "Instructions for the second choice exercise"

1. Yes
2. No **GO TO Q45**

Q44. Was anything about the instructions unclear?

1. Yes
2. No **GO TO Q45**

Q45. **SHOW IF SCHEDULED APPOINTMENT: INTERVIEWER: IF THEY HAVE A SPECIFIC QUESTION WHICH YOU ARE ABLE TO ANSWER, PLEASE DO SO. IF NOT, TALK PARTICIPANT THROUGH SHOW CARDS E1 TO E4 BY USING THE FOLLOWING TEXT.**

SHOW IF STRAIGHT OFF INTERVIEW: INTERVIEWER: TALK PARTICIPANT THROUGH SHOW CARDS E1 TO E4 BY USING THE FOLLOWING TEXT.

Please look at Show Card E1, "Instructions for the second choice exercise". This explains the next exercise, and the choices you will be asked to make. I will go through these with you now.

Welsh Water can invest your money to improve service levels across all the areas shown. Alternatively, by spending less in some areas, Welsh Water will be able to spend more in others, or reduce bills.

The next four questions will each ask you to choose between different service levels. The aim of this exercise is to encourage you to consider your preferences carefully and decide which option is best for you. You may like some parts more and some parts less but please decide overall which one you would prefer.

There are 12 different service areas in total. In addition we will show the associated change in your annual water and waste bill. **SAY IF Q18=4 (DK):** For this, I will assume that your bill is equal to the current average household bill in your area which is £437.

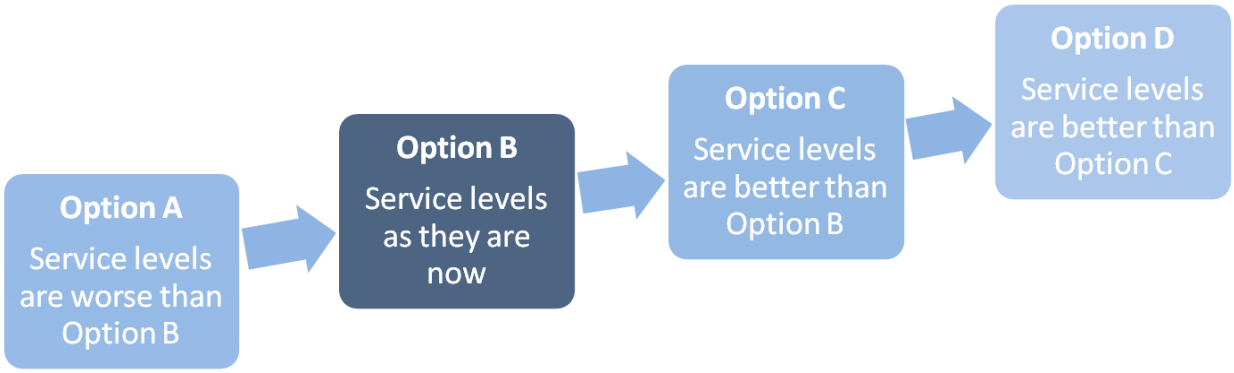
[NEXT SCREEN]

- Now look at the next show card, E2. This shows the format the options will be presented in. Please take a moment to review this. **INTERVIEWER: CHECK IF THEY HAVE ANY QUESTIONS ABOUT THIS BEFORE PROCEEDING.**

[NEXT SCREEN]

The example you've just looked at showed two options: B and C. Please now turn to Show Card E3 which explains all of the options you will be shown.

There are four options in total but you will only be asked to choose between two options at a time. In each option the level of service you receive will differ as outlined in the diagram below:



DP INSERT: ..\..\..\..\DP\Screen grabs\Main WTP\Package intro.png

The level of service you would receive in each option will affect your bill as follows:

- In **Option B** there would be **[DP SHOW AS APPLICABLE: "no change in your bill"/"a bill decrease of £[INSERT] by 2024"/"a bill increase of £[INSERT] by 2024"]**
- In **Option A** your bill would be **lower** than in Option B.
- In **Option C** your bill would be **higher** than in Option B.
- Finally, in **Option D** your bill would be **higher** than in Option C.

[NEXT SCREEN]

And finally, turn to Show Card E4.

When making your choices between the different options please bear in mind the following:

- that your bill would also increase by the rate of inflation each year. To give you an example of the impact that inflation would have, if inflation was 2% per year the average Welsh Water bill would increase by £48 from £464 in 2019 to £512 in 2024.
- that any money you would pay for better service levels here will not be available for you to spend on other things, and
- that the new bill level will gradually adjust over five years and stay the same after that. To maintain the service levels, your Welsh Water bill will not drop back to the level it was prior to changes in service levels.

DP: ADD HOVER BUTTONS IN CHOICE SETS.

Q46. Please look at Choice Card P1, the first set of options. Here, Option B represents current service levels with a bill [INSERT BILL LEVEL FROM OPTION B FROM PARTICIPANT SHOW CARD AS PER THE INTRODUCTION IE: DECREASE OF £1.00 BY 2024] and Option C represents an improvement in every area with a bill [INSERT BILL LEVEL FROM OPTION C FROM PARTICIPANT SHOW CARD AS PER THE INTRODUCTION IE: DECREASE OF £1.00 BY 2024]. Which option do you prefer, B or C?

B
C

Q47. Why did you choose the option you did? RECORD VERBATIM

Q48. Did you understand that for the option you selected [your annual bill would increase by £X each and every year for five years. This would mean at the end of that five years your annual bill would be £xx more than your current bill] OR [Your annual bill would decrease by £X each and every year for five years. This would mean at the end of the five years your annual bill would be £XX less than your current bill] OR [this would mean no change to your bill between 2019 and 2024]

Yes
No GO TO Q46 AND ASK AGAIN
Don't know/Not sure GO TO Q46 AND ASK AGAIN

Q49. Now turn to Choice Card P2. Here Option B represents current service levels with a bill [INSERT BILL LEVEL FROM OPTION B FROM PARTICIPANT SHOW CARD AS PER THE INTRODUCTION IE: DECREASE OF £1.00 BY 2024] and Option A represents a reduction in service levels and would allow for a bill [INSERT BILL LEVEL FROM OPTION A FROM PARTICIPANT SHOW CARD AS PER THE INTRODUCTION IE: DECREASE OF £1.00 BY 2024]. Which option do you prefer, B or A?

B
A

Q50. Now turn to Choice Card P3. In this question, Options C and D are as previously shown. Both represent an improvement over current service levels, and Option D represents the greater of the two improvements. In Option C, there would be a bill [INSERT BILL LEVEL FROM OPTION C FROM PARTICIPANT SHOW CARD AS PER THE INTRODUCTION IE: DECREASE OF £1.00 BY 2024] and in Option D, a bill [INSERT BILL LEVEL FROM OPTION D FROM PARTICIPANT SHOW CARD AS PER THE INTRODUCTION IE: INCREASE OF £1.00 BY 2024]. Which option do you prefer, C or D?

C
D

Q51. Now turn to Choice Card P4.In this final set of options, Option B represents current service levels again with a bill [INSERT BILL LEVEL FROM OPTION B FROM PARTICIPANT SHOW CARD AS PER THE INTRODUCTION IE: DECREASE OF £1.00 BY 2024] and Option D represents a greater improvement in every area with a bill [INSERT BILL LEVEL FROM OPTION D FROM PARTICIPANT SHOW CARD AS PER THE INTRODUCTION IE: INCREASE OF £1.00 BY 2024]. Which option do you prefer, B or D?

B
D

Follow-up Questions

I would now like to ask you a few questions about the choices you have just made.

Q52. Did you generally feel able to make comparisons between the options I presented to you?

1. Yes GO TO Q54
2. No

Q53. Why weren't you able to make the comparisons in the choices? RECORD VERBATIM

Q54. Did you find each of the levels of service we described easy to understand?

1. Yes GO TO Q56
2. No

Q55. Which levels did you feel were not easy to understand? RECORD VERBATIM

Q56. Were any of the service levels so low or so high that they were implausible?

1. Yes
2. No GO TO Q58

Q57. Which levels did you feel were not plausible? RECORD VERBATIM

Classification Questions

I now need to ask you a few questions about you and your household. These will only be used to ensure we have spoken to a wide range of customers. All responses you give will be kept strictly confidential.

Q58. First of all, could you please tell me what your employment status is?

1. Working full-time (30+ hours a week)
2. Working part-time (8-29 hours a week)
3. Not working – looking for work

4. Not working – not looking for work
5. Full-time student
6. Part-time student
7. Retired
8. Retired unpaid voluntary work
9. Looking after family/home
10. Other SPECIFY
11. Refused DO NOT READ OUT

Q59. Please look at Show Card R, labelled "Highest Level of Qualifications". Which of these best describes the highest level of education that you have completed?

1. No qualifications
2. **Level 1:** 1-4 O Levels/CSE/GCSEs (any grades), Entry Level, Foundation Diploma, NVQ Level 1, Foundation GNVQ, Basic/Essential Skills;
3. **Level 2:** 5+ O Level (Passes)/CSEs (Grade 1)/GCSEs (Grades A*-C), School Certificate, 1 A Level/ 2-3 AS Levels/VCEs, Intermediate/Higher Diploma, Welsh Baccalaureate Intermediate Diploma, NVQ level 2, Intermediate GNVQ, City and Guilds Craft, BTEC First/General Diploma, RSA Diploma;
4. Apprenticeship
5. **Level 3:** 2+ A Levels/VCEs, 4+ AS Levels, Higher School Certificate, Progression/Advanced Diploma, Welsh Baccalaureate Advanced Diploma, NVQ Level 3; Advanced GNVQ, City and Guilds Advanced Craft, ONC, OND, BTEC National, RSA Advanced Diploma;
6. **Level 4** and above: Degree (for example BA, BSc), Higher Degree (for example MA, PhD, PGCE), NVQ Level 4-5, HNC, HND, RSA Higher Diploma, BTEC Higher level, Foundation degree (NI), Professional qualifications (for example teaching, nursing, accountancy);
7. **Other qualifications:** Vocational/Work-related Qualifications, Foreign Qualifications (not stated/level unknown)
8. Refused DO NOT READ OUT

Q60. To help us analyse your responses, can you tell me which of the following bands best describes the total annual income of your household, before tax and other deductions? Please interrupt me when I read out the most relevant option. READ OUT

1. Up to £300 (Per Week) / Under £15,600 (Per Year)
2. £301-£1000 (Per Week) / £15,601 - £52,000 (Per Year)
3. £1001+ (Per Week) / £52,001+ (Per Year)
4. Don't know/Prefer not to say DO NOT READ OUT

Q61. Do you receive any of the following benefits? MULTICODE READ OUT

INTERVIEWER: If they say they don't receive any benefits before you finish reading out the list, stop reading and code as "None of these"

1. Attendance Allowance
2. Carer's Allowance
3. Child Tax Credit
4. Council Tax Benefit
5. Disability Living Allowance
6. Housing Benefit
7. Income Support (or similar)
8. Jobseeker's Allowance
9. Pension Credit
10. Universal Credit
11. Working tax credit
12. None of these NOT WITH ANY OTHER CODE
13. Refused NOT WITH ANY OTHER CODE DO NOT READ OUT

Q62. To which of these ethnic groups do you consider you belong to?

WHITE
1. British
2. Irish
3. Any other White background

MIXED
4. White and Black Caribbean
5. White and Black African
6. White and Asian
7. Any other Mixed background

ASIAN OR ASIAN BRITISH
8. Indian
9. Pakistani
10. Bangladeshi
11. Any other Asian background

BLACK OR BLACK BRITISH
12. Caribbean
13. African
14. Any other Black background

CHINESE OR OTHER ETHNIC GROUP
15. Chinese
16. Any other ethnic group

17. Prefer not to say DO NOT READ OUT

Q63. Thinking about all the people in your household, including yourself, how many people live here for each of these age groups: SINGLE CODE

Up to 5 years	0	1	2	3	4	5+
6 to 15 years	0	1	2	3	4	5+
16 to 65 years	0	1	2	3	4	5+
Over 65 years	0	1	2	3	4	5+

Prefer not to say DO NOT READ OUT

Q64. And finally, what type of property do you live in? SINGLE CODE

1. Flat
2. Terraced house
3. Semi-detached house
4. Detached house
5. Bungalow

Q65. We mentioned that there would be a £5 incentive for completing this survey. This could be an Amazon, M&S or Boots voucher, or it can be donated to Water Aid. Which would you prefer?

1. Amazon voucher – via email
2. M&S voucher – via email
3. M&S voucher – via post
4. Boots vouchers – via post
5. Water Aid Donation

Q66. ASK IF Q65=1 or 2, ELSE SKIP: What email address would you like us to send the voucher to?

TYPE IN

Please note, we send all incentives at the end of the fieldwork so this will take a few weeks to get to you. If you have any queries about your incentive please contact us on 0131 220 8770.

Q67. ASK IF Q65=3 or 4, ELSE SKIP: What address would you like us to send the voucher to?

DP: INSERT ADDRESS SCREEN

Please note, we send all incentives at the end of the fieldwork so this will take a few weeks to get to you. If you have any queries about your incentive please contact us on 0131 220 8770.

Q68. How would you rate your enjoyment in completing this survey? Please use a scale of 1 to 10 where 1 means 'low level of enjoyment' and 10 means 'high level of enjoyment'.

DP: ADD HORIZONTAL GRID LIKE BELOW

Low level of enjoyment	1	2	3	4	5	67	8	9	10	High level of enjoyment

Q69. We really appreciate the time that you have given us today. Would you be willing to be contacted again for clarification purposes or be invited to take part in other research for Welsh Water?

1. Yes, for both clarification and further research
2. Yes, for clarification only
3. Yes, for further research only
4. No

Thank you. This research was conducted under the terms of the MRS code of conduct and is completely confidential. If you would like to confirm my credentials or those of Accent please call the MRS free on 0500 396999.

Please can I take a note of your name and where we can contact you for quality control purposes?

Participant name: [CATI: DP, IMPORT FROM ID]

Telephone: [CATI: DP, IMPORT FROM TELNUMBER]

Interviewer Confirmation

I confirm that this interview was conducted under the terms of the MRS code of conduct and is completely confidential

Yes
No

INTERNAL USE ONLY: **Click here**

Online only ☐
CATI only ☒ (DP: add QAX)
CAPI/Tablet ☐ (BCQs:) QQAZ2Q Paper showcard? Y ☒ N ☐
CATI recruit for online/field ☐ (BCQs:) Q63
Field recruit for online/CATI ☐ (BCQs:) Q67
Recruit only (ie for qual) ☐

APPENDIX B: ECONOMETRIC ANALYSIS

Introduction

The main valuation estimates presented in this report are derived by combining estimates from econometric models based on the MaxDiff ranking exercise, with estimates from a separate econometric model based on responses to the Package exercise, along with data on the customer base to aggregate to the population. This appendix describes in full how these estimates are obtained and, in addition, presents supplementary detailed results to support the findings reported in the main body of this report.

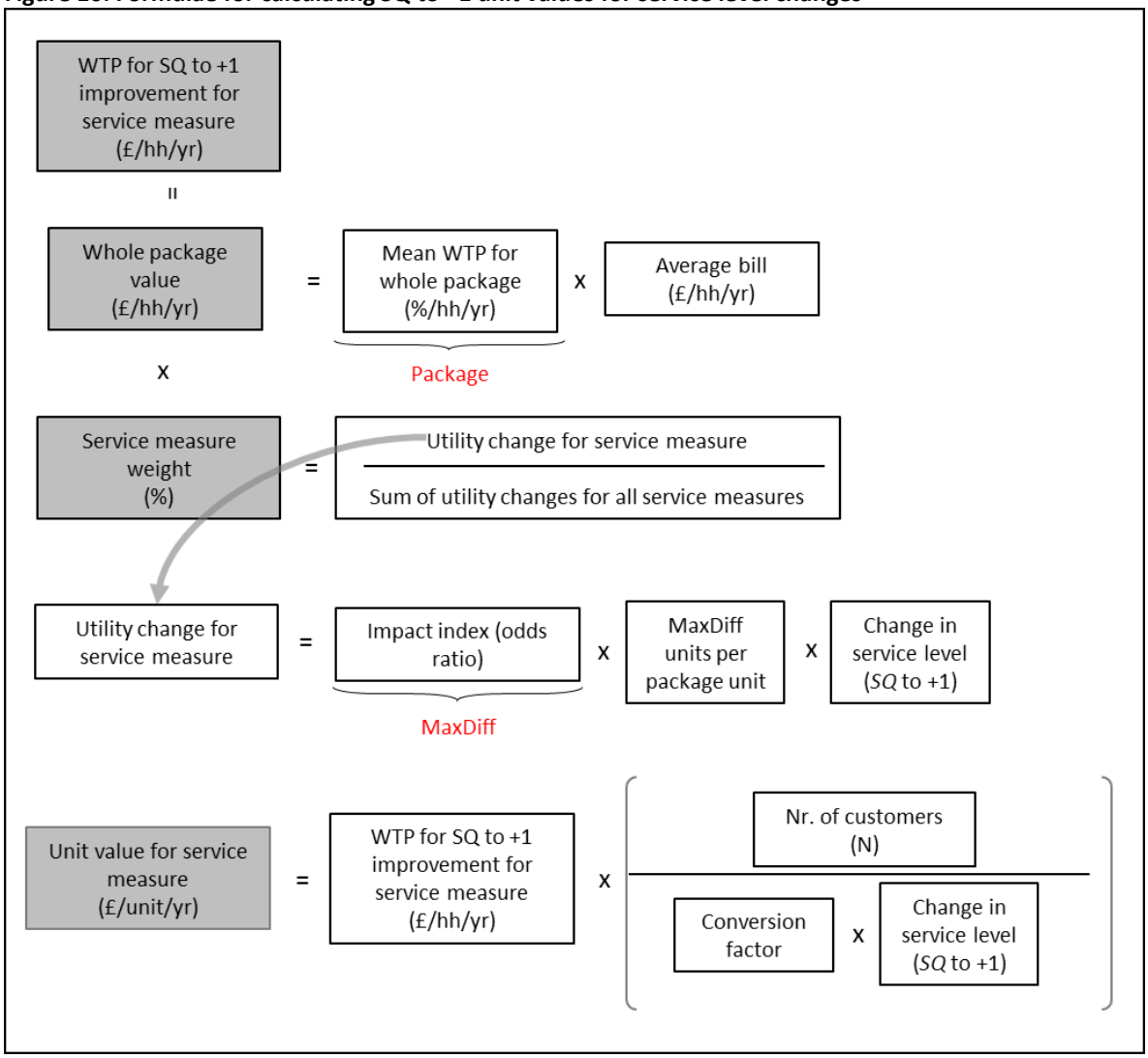
Methodology for Obtaining Core Valuation Estimates

The PR19-style survey was constructed around two linked exercises. The first 'MaxDiff' exercise required participants to choose which of the service issues shown to them would have the most impact on them and which would have the least impact. From this exercise we obtained a quantitative index of 'Impact', which we interpret as 'disutility' for the purposes of cost-benefit analysis. For example, we obtain estimates of how much a sewer flooding incident would impact a customer in relation to coastal bathing water quality being "Sufficient" but not "Good".

The second exercise was a Package exercise, which required participants to choose their preferred package of service levels and bill change. This exercise included all the same service measures as in the PR14-style survey but, importantly, was made easier to answer by virtue of the fact that all service levels moved together across the options. Thus, in one option all services were at SQ level, in another they were all at Level +1, and so on. The outcome from the Package exercise analysis was a set of Package WTP values for, e.g. an improvement in all services from status quo (SQ) to the '+1' level.

Figure 7 illustrates the way in which the components of our analysis are combined to obtain WTP values for *SQ* to +1 improvements (or indeed any other level changes) as well as unit values.

Figure 10: Formulae for calculating *SQ* to +1 unit values for service level changes



From the Package exercise analysis, we obtained estimates of customers' WTP for each service level change when all service measures moved together. The next part of the analysis involved apportioning the customer WTP value for the SQ to +1 package (or the WTP for any other level change) using the Impact index derived from analysis of the MaxDiff exercise.

The first step towards this required developing a mapping between the units of the MaxDiff exercise and the units of the Package exercise. For several of the service measures the mapping was one-to-one. This included all the cases where the Package service measure was defined in terms of the number of properties affected by a given type of incident. In other cases, however, including all of the environmental measures, a conversion factor was needed to capture the number of MaxDiff-measured incidents per Package-measured unit of service change.

The input values and assumptions underlying the conversion factors were all provided by and agreed with DCWW. They include:

- Proportion of odour incidents over 7 day (averaged over 2014-2016): 0.406

- Proportion of internal sewer flooding incidents classified as high or medium severity: 0.444

- Proportion of external sewer flooding incidents directly outside the property: 0.7125

- Number of household customers billed:
    - For water: 1,226,286
    - For waste water only: 133,236

- Assumption: 1 significant pollution incident affects 1km of river, and 1% of river length is considered local by 1% of customers. (Implies 175 properties affected per incident)

- Assumption: 1 minor pollution incident affects 1km of river, and 1% of river length is considered local by 1% of customers. (Implies 175 properties affected per incident)

- Assumption: 1% of river corresponds to the local area of 1% of customers (same as for pollution incidents)

- Assumption: 1% of bathing waters corresponds to the local area of 1% of customers

Given the MaxDiff units per Package units, we then calculated the change in the number of MaxDiff units corresponding to the SQ to +1 service level change for each MaxDiff attribute.

These units were then multiplied by the Impact index from the MaxDiff econometric analysis to derive a measure of the utility change associated with each SQ to +1 service level change for each MaxDiff attribute.

Given these utility values, MaxDiff attribute weights were calculated equal to the utility change for the attribute in question divided by the total utility change for the SQ to +1 service change over all MaxDiff attributes.

The Package SQ to +1 value was multiplied by each of the MaxDiff attribute weights to derive our main WTP estimates for the SQ to +1 service change for each MaxDiff attribute.

Finally, the unit values for service measures were obtained by multiplying the Package SQ to +1 value by the number of customers and dividing by the MaxDiff units to Package unit and the change in service level.

MaxDiff Analysis

The MaxDiff data were analysed using rank-ordered logit models. The modelling methodology for the MaxDiff analysis required that one attribute was omitted to be treated as the base category. We chose the 'Coastal bathing water quality sufficient but not good' attribute for this purpose. For the remaining attributes, impact scores are presented. As described earlier, the impact score for a given attribute is the perceived disutility of a service failure in ratio to the chosen benchmark; a higher impact score signifies therefore a higher importance of the attribute. Thus, impact scores can therefore can be used as weights to apportion package WTPs to individual attributes.

The below results in Table 18 and Table 19 are satisfactory for all three samples with high pseudo r^2 statistics and most coefficients being highly significant. Furthermore, the magnitudes of the coefficients correspond to expectations. In particular, we find:

- Increasing impact scores for the four interruptions attributes with the duration of the interruption

- Extensive sewer flooding has a higher impact score than minor sewer flooding which in turn has a higher impact score than external sewer flooding attributes.

- Extensive internal sewer flooding stands out as the dominant attributes in all three samples

- Significant pollution incidents have a higher impact score than minor pollution incidents.

The only result that goes counter expectation is the seemingly indifference between frequently and infrequently experienced odour from waste water works.

Overall, the results confirm that the MaxDiff exercise has returned plausible and statistically precise results, and is suitable for this research.

Table 20. MaxDiff Rank-ordered Logit Results for Dual Customers

Variable	Impact score	
	Household	Non-household
Discoloured water (a week)	2.20 ***	6.63 ***
Taste & smell not ideal (a few days)	2.97 ***	9.41 ***
Short-term interruption (3 to 6 hours)	1.05	6.96 ***
Short-term interruption (6 to 12 hours)	1.18	7.33 ***
Long-term interruption (24-48 hours)	6.42 ***	49.00 ***
Long-term interruption (7 days)	11.87 ***	66.29 ***
Persistent low water pressure	2.16 ***	4.91 ***
TUB / NEUB (May to September)	0.68 ***	1.56 ***
Sewer flooding inside your property-Severe	37.79 ***	110.57 ***
Sewer flooding inside your property-Minor	22.82 ***	85.42 ***
Sewer flooding outside your property	5.64 ***	18.48 ***
Sewer flooding in a nearby public area	3.75 ***	10.32 ***
Odour from sewage works-Minor	1.45 ***	3.66 ***
Odour from sewage works-Severe	1.45 ***	3.72 ***
Significant pollution incident	4.52 ***	6.76 ***
Minor pollution incident	1.61 ***	3.30 ***
River water quality less than Good locally	1.79 ***	2.73 ***
Bathing water quality less than Excellent locally	0.76 ***	0.94
Bathing water quality less than Good locally	*1.00*	*1.00*
Pseudo R-squared	0.239	0.339
Participants	998	498

** significant at 10%; ** significant at 5%; *** significant at 1%;*

Table 21: MaxDiff Rank-ordered Logit Results for Dee Valley Customers

Variable	Impact score
	Household
Sewer flooding inside your property-Severe	166.52 ***
Sewer flooding inside your property-Minor	67.98 ***
Sewer flooding outside your property	14.51 ***
Sewer flooding in a nearby public area	7.27 ***
Odour from sewage works-Minor	0.92
Odour from sewage works-Severe	0.94
Significant pollution incident	7.60 ***
Minor pollution incident	1.69
River water quality less than Good locally	2.08 **
Bathing water quality less than Excellent locally	0.55
Bathing water quality less than Good locally (omitted)	1.00
Pseudo R-squared	0.457
Participants	50

** significant at 10%; ** significant at 5%; *** significant at 1%;*

Package Exercise Analysis

The Package exercise data was analysed by means of conditional logit (CL) models. A first CL model estimated (dis)utility coefficients for 2 alternative-specific constants (ASC): (1) A '-1' ASC representing the deterioration option, and (2) a +1 or +2 ASC pooling together the +1 and +2 improvements, assuming there is no additional WTP for the +2 package beyond the WTP for the +1 package (and hence both packages would have the

same total WTP relative to the *status quo*). The reason for the restriction in (2) was a recurring problem for the +2 improvement package that was lower than for +1, if not negative altogether. This suggested, against expectations, that the +1 option is preferred to the +2 option.

In order to derive +1 to +2 utility and WTP values, we estimated a second binary logit model on the restricted sample of participants that excluded those who previously chose the SQ package in the 'SQ vs. +1' scenario, on the grounds that they would in large part fail to evaluate the +2 package in the following '+1 vs. +2' scenario even if offered at a relatively small premium. We therefore estimated the '+1 vs. +2' model for each of the water companies on a restricted-sample model in which choice data pertaining only to '+1 choosers' in the 'SQ vs. +1' scenario were considered. This model was used to derive the '+1 to +2' WTP that was scaled by the proportion of '+1 choosers' out of the whole sample.

Moreover, models were also fitted with a linear spline for bill change coefficients, such that different coefficients were estimated for bill change depending on whether it was in the positive or negative domain. This accommodates discrepancies in marginal willingness to pay (WTP) for improvements (+1 and +2) and willingness to accept compensation (WTA) for deterioration (-1).

Results for Dual Service customers (households and non-households) are presented in Table 20 and Table 22 followed by results for Dee Valley customers in Table 21 and Table 23. All three samples were examined as unrestricted model allowing for a separate bill effects for decreases and increases and as restricted model that that treats them as having the same effect.

The review of the unrestricted model reveals logically consistent as well as counter-intuitive findings. As anticipated, households and non-households both show strong aversion against a potential deterioration of the offered service level signified by the large negative coefficient for "Package –1" in Table 20. Equally expected, "Package +1" is measured with a positive coefficient for both samples (though only significant for households). The difference between "Package +1" and "Package +2", however, is trivial for household and even in reversed order for non-households. This is problematic as it suggests that customers rather have a smaller service improvement implemented even without any corresponding increase in bills. Likewise, the positive bill coefficients measured for a bill decrease implies that customers would prefer smaller bill reductions to larger bill reductions all else equal.

The issues are addressed in the restricted model confining the participants' choice to either a lower service level "Package –1" or a service improvement "Package +1 or Package +2" while suppressing the effect of a bill decrease. Evidently, the restricted model proves more appropriate producing all coefficients with the expected prefix for households and non-households most of which pass for statistical significance at 1% level. The issue of a positive bill coefficient is not inherent in the sample for Dee Valley households though the model also suffers from the same seemingly ignored benefit of "Package +2" over "Package +1". Again, the restricted model comes out as more appropriate producing logically consistent results with higher statistical significance.

Table 22: Package Exercise Conditional Logit Results – Dual Customers

	Coefficients			
	Households		Non-Households	
Variable	Unrestricted	Restricted	Unrestricted	Restricted
Package -1	-1.513**	-1.536***	-1.454	-1.569***
Package SQ (base)	omitted	omitted	omitted	
Package +1	0.825***		0.508	
Package +2	0.820***		-0.246	
Package +1 or Package +2		0.826***		.564***
Bill (%) * Bill reduction	0.426		2.232	
Bill (%)* Bill increase	-7.168***	-7.195***	-7.983	-12.247
Observations	7,992	7,992	3,992	3,992
Pseudo-R2	0.113	0.113	0.217	0.194

** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 23: Package Exercise Conditional Logit Results – Dee Valley Households

	Coefficients	
Variable	Unrestricted	Restricted
Package -1	-3.487**	-2.553***
Package SQ (base)	Omitted	
Package +1	0.650**	
Package +2	0.601	
Package +1 or Package +2		0.658***
Bill (%) * Bill reduction	-13.878	
Bill (%)* Bill increase	-8.234*	-7.195***
Observations	400	400
Pseudo-R2	0.191	0. 188

** significant at 10%; ** significant at 5%; *** significant at 1%*

The apparent indifference between "Package +1" and "Package +2" is investigated further by analysing the answers of participants who previously chose "Package +1" over the current package and those who rather remain with the current service level. Here, we found that participants who preferred the existing service level over the "Package +1" had an aversion to the +2 service package. Conversely, participants who chose "Package +1" over "Package SQ" showed positive WTP for the higher service improvement as indicated by the positive (and in the case of households highly significant) coefficient for "Package +2".

Table 24: Package Exercise '+2' Conditional Logit Results – Dual Customers

	Coefficients			
	Households		Non-Households	
Variable	Chose +1 over SQ	Chose SQ over +1	Chose +1 over SQ	Chose SQ over +1
Package +2	0.933***	-0.879***	.177	-1.939***
Bill (%)* Bill increase	-11.997***	-12.861***	-16.8054***	-11.778*
Observations	1,124	874	426	572
Pseudo-R2	0.053	0.351	0.123	0.632

** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 25: Package Exercise '+2' Conditional Logit Results – Dee Valley Households

Variable	Coefficients	
	Chose +1 over SQ	Chose SQ over +1
Package +2	2.282**	-2.130
Bill (%)* Bill increase	-26.118**	-2.14
Observations	58	42
Pseudo-R2	0.161	0.547

** significant at 10%; ** significant at 5%; *** significant at 1%*

In summary, our analysis of the Package exercise participants suggests the following conclusions. Firstly, there appear to be a substantial number of customers who are willing to pay for an intermediate '+1' package of improvements, but who are highly averse to the stretch '+2' improvement package to such an extent that their choices indicate a preference for remaining at the '+1' level even at the same bill level.

The choice between the 'SQ' and '+1' package has proved to be a good segmentation of the customer base in this regard, in that we estimate a positive WTP for the improvement from '+1' to '+2' amongst those who chose '+1' in this first question, and a negative WTP for the improvement from '+1' to '+2' amongst those who chose '+1' in this first question.

Since we have strong theoretical grounds for rejecting the idea that anyone would genuinely prefer the '+2' package to the '+1' package, all else equal, our approach to using these results is to restrict that group having negative WTP to zero, and thus take as our estimate of population WTP the product of the WTP estimate for the group with positive WTP and the proportion of the population that this group represents. Thus the population estimate is a weighed average of zero and the positive WTP estimate for the group that chose '+1' over 'SQ' in the first package question.

Willingness to pay calculation

The mean WTP to move from *SQ* for any improved package *i* (either +1 or +2) was derived as follows:

$$WTP_i\ (\%/hh/year) = -\frac{\alpha_i}{\beta_{positive}}$$

Where α_i is the coefficient for the improvement package, and $\beta_{positive}$ to bill coefficient over the positive bill change domain. Similarly, the WTA for deterioration is derived as follows:

$$WTA_i\ (\%/hh/year) = -\frac{\alpha_i}{\beta_{negative}}$$

Where $\beta_{positive}$ is the bill coefficient over the negative bill change domain. Standard errors allowing for hypothesis testing were then derived using the Delta method.

Segmentation Analysis

The following tables present segmentation results for household and non-household dual-service customers. Household segmentations include age, gender and SEG; non-household segmentations include water consumption, number of employees, number of branches, and industry sector. The number of participants in each segment is included at the foot of each table. We would advise caution against any inferences based on sample sizes below 50.

The results from the segmentation analysis of the impact scores are first presented for households. In all cases, impact scores are scaled to sum to 100 for each segment. This approach helps to ensure that comparisons between segments are not influenced by the arbitrary choice of which service issue to treat as a benchmark.

Results for all samples and segments are displayed in Table 24 to Table 30.

Households

The results for gender show very similar impact scores across all service issues. The sole statistically significant difference in this table relates to persistent low pressure, whereby male participants were found to assign a higher impact than females.

Table 26: Impact scores by gender – dual households

	Impact Score	
Service Issue	**Female**	**Male**
Discoloured water (a week)	1.8	1.9
Taste & smell not ideal (a few days)	2.5	2.6
Short-term interruption (3 to 6 hours)	0.8	0.9
Short-term interruption (6 to 12 hours)	0.9	1.0
Long-term interruption (24-48 hours)	5.2	6.1
Long-term interruption (7 days)	9.3	11.4
Persistent low water pressure(1)	1.6	2.4
TUB (May to September)	0.6	0.6
Sewer flooding inside your property-Severe	36.5	33.4
Sewer flooding inside your property-Minor	21.7	21.0
Sewer flooding outside your property	5.7	5.0
Sewer flooding in a nearby public area	3.4	3.2
Odour from sewage works-Minor	1.2	1.1
Odour from sewage works-Severe	1.3	1.1
Significant pollution incident	3.5	4.1
Minor pollution incident	1.3	1.2
River water quality less than Good locally	1.3	1.5
Bathing water quality less than Excellent locally	0.7	0.6
Bathing water quality less than Good locally	0.8	0.8
Participants	**524**	**474**

The segmentation according to participants' SEG score (dual households) shows a substantially larger variation, with many statistically significant differences observed. The AB group assigned a higher impact to severe internal sewer flooding than either

C1C2 or DE groups, and correspondingly had significantly smaller impact scores for most of the other service issues.

Table 27: Impact scores by SEG – dual households

	Impact Score		
Service Issue	**AB**	**C1C2**	**DE**
Discoloured water (a week)	1.3	1.6	3.1
Taste & smell not ideal (a few days)	1.3	2.2	4.6
Short-term interruption (3 to 6 hours)	0.5	0.8	1.0
Short-term interruption (6 to 12 hours)	0.5	0.8	1.3
Long-term interruption (24-48 hours)	4.7	4.8	7.3
Long-term interruption (7 days)	8.5	9.1	10.1
Persistent low water pressure	1.5	1.8	2.2
TUB (May to September)	0.3	0.5	0.8
Sewer flooding inside your property-Severe	45.4	35.4	27.8
Sewer flooding inside your property-Minor	23.6	23.0	20.3
Sewer flooding outside your property	4.3	5.8	4.8
Sewer flooding in a nearby public area	1.9	3.6	3.1
Odour from sewage works-Minor	0.6	1.0	2.0
Odour from sewage works-Severe	0.6	1.1	1.5
Significant pollution incident	2.7	4.0	4.6
Minor pollution incident	0.6	1.6	1.7
River water quality less than Good locally	0.8	1.5	1.9
Bathing water quality less than Excellent locally	0.4	0.6	0.9
Bathing water quality less than Good locally	0.4	0.9	1.0
Participants	**217**	**270**	**126**

The segmentation by age shows significant differences for 'Short-term interruptions (3-6 hours)', where the 16-34 group had higher impact scores than other age groups. Additionally, both the 16-34 and over 65 age groups had significantly higher impact scores for TUB, 'Odour from sewage works-Minor', 'Odour from sewage works-Severe', 'River water quality less than Good locally' and both bathing water quality service issues in comparison with the 35-64 age group. The over 65 group also had higher impact scores for 'Sewer flooding in a nearby public area'.

Table 28: Impact scores by age– dual households

Service Issue	Impact score		
	16-34	35-64	65 plus
Discoloured water (a week)	2.4	1.8	1.9
Taste & smell not ideal (a few days)	2.5	2.3	2.9
Short-term interruption (3 to 6 hours)	1.7	0.7	1.0
Short-term interruption (6 to 12 hours)	1.2	0.8	1.2
Long-term interruption (24-48 hours)	7.0	5.2	5.8
Long-term interruption (7 days)	14.5	8.9	11.3
Persistent low water pressure	2.2	1.8	2.1
TUB (May to September)	0.7	0.4	0.9
Sewer flooding inside your property-Severe	28.9	37.0	33.4
Sewer flooding inside your property-Minor	17.0	23.7	19.3
Sewer flooding outside your property	4.5	5.3	5.5
Sewer flooding in a nearby public area	3.1	2.9	3.8
Odour from sewage works-Minor	1.6	1.0	1.5
Odour from sewage works-Severe	1.6	1.0	1.5
Significant pollution incident	4.7	3.6	3.7
Minor pollution incident	2.5	1.1	1.2
River water quality less than Good locally	1.9	1.3	1.5
Bathing water quality less than Excellent locally	0.8	0.6	0.7
Bathing water quality less than Good locally	1.2	0.7	0.9
Participants	**59**	**554**	**385**

Non-Households

Table 27 shows the variation in non-household impact scores by number of employees. The largest customers had significantly lower scores for discoloured water, taste & smell not ideal, persistent low pressure, NEUB, external sewer flooding, odour and all the environmental attributes. Conversely, both 2-49 and 50plus groups had significantly higher impact scores for most of the interruptions measures than the sole trader group.

When comparing by the number of branches operated, Table 28 shows that those with 2-3 branches had significantly higher impact score for discoloured water and a significantly lower impact score for NEUB, river water quality and bathing water quality. Those with 4 or more branches had a lower impact score for persistent low pressure.

Comparing across water consumption groups, statistically significant differences in impact scores are observed for most service issues. This includes discoloured water, taste & smell not ideal, persistent low pressure, NEUB, both external sewer flooding measures, minor odour, and all the environmental attributes.

Table 29: Impact scores by number of employees – dual non-households

Service issue	Impact score		
	Sole Trader	2 - 49	50 or more
Discoloured water (a week)	1.5	1.8	1.1
Taste & smell not ideal (a few days)	1.5	2.7	1.3
Short-term interruption (3 to 6 hours)	0.7	2.0	1.5
Short-term interruption (6 to 12 hours)	1.0	2.0	1.6
Long-term interruption (24-48 hours)	8.3	12.8	11.3
Long-term interruption (7 days)	8.3	17.4	22.1
Persistent low water pressure	1.1	1.3	0.7
NEUB (May to September)	0.5	0.4	0.2
Sewer flooding inside your property-Severe	39.5	24.9	33.0
Sewer flooding inside your property-Minor	23.8	20.9	20.1
Sewer flooding outside your property	5.4	4.9	2.6
Sewer flooding in a nearby public area	2.7	3.0	1.1
Odour from sewage works-Minor	0.7	1.0	0.5
Odour from sewage works-Severe	1.0	0.9	0.6
Significant pollution incident	1.7	1.8	1.0
Minor pollution incident	1.3	0.8	0.7
River water quality less than Good locally	0.5	0.8	0.3
Bathing water quality less than Excellent locally	0.3	0.2	0.1
Bathing water quality less than Good locally	0.2	0.3	0.1
Participants	**58**	**347**	**93**

Table 30: Impact scores by number of branches – dual non-households

Service Issue	Impact Score		
	1	2 - 3	4 plus
Discoloured water (a week)	1.7	2.1	1.2
Taste & smell not ideal (a few days)	2.5	1.9	2.0
Short-term interruption (3 to 6 hours)	1.7	1.5	1.7
Short-term interruption (6 to 12 hours)	1.9	1.3	1.6
Long-term interruption (24-48 hours)	14.7	8.5	6.8
Long-term interruption (7 days)	16.3	15.9	17.3
Persistent low water pressure	1.2	1.4	0.8
NEUB (May to September)	0.4	0.3	0.4
Sewer flooding inside your property-Severe	25.0	35.0	38.2
Sewer flooding inside your property-Minor	21.5	21.1	18.5
Sewer flooding outside your property	5.1	3.3	3.2
Sewer flooding in a nearby public area	2.7	2.1	2.4
Odour from sewage works-Minor	0.9	1.0	0.9
Odour from sewage works-Severe	0.9	1.0	1.0
Significant pollution incident	1.6	1.7	1.9
Minor pollution incident	0.8	0.8	1.1
River water quality less than Good locally	0.7	0.6	0.6
Bathing water quality less than Excellent locally	0.2	0.2	0.2
Bathing water quality less than Good locally	0.2	0.2	0.3
Participants	**361**	**67**	**70**

Table 31: Impact scores by water consumption – dual non-households

Service Issue	Impact Score	
	Low Water Consumption	High Water Consumption
Discoloured water (a week)	1.7	1.5
Taste & smell not ideal (a few days)	2.6	1.8
Short-term interruption (3 to 6 hours)	1.6	1.9
Short-term interruption (6 to 12 hours)	1.8	1.8
Long-term interruption (24-48 hours)	11.9	12.6
Long-term interruption (7 days)	14.7	22.4
Persistent low water pressure	1.3	1.1
NEUB (May to September)	0.4	0.3
Sewer flooding inside your property-Severe	28.3	26.2
Sewer flooding inside your property-Minor	21.5	20.5
Sewer flooding outside your property	5.6	3.1
Sewer flooding in a nearby public area	2.8	2.1
Odour from sewage works-Minor	0.9	1.0
Odour from sewage works-Severe	0.9	0.9
Significant pollution incident	1.9	1.3
Minor pollution incident	1.0	0.6
River water quality less than Good locally	0.7	0.5
Bathing water quality less than Excellent locally	0.3	0.2
Bathing water quality less than Good locally	0.3	0.2
Participants	**333**	**165**

Table 32: Impact scores by industry sector– dual non-households

Service Issue	Impact Score									
	Manuf.	Constr.	Wholes.	Hotel	Finance	Bus. Serv.	Gov.	Arts	Oth. Serv.	Others
Discoloured water (a week)	1.5	2.2	1.3	2.8	1.1	1.0	1.1	1.7	1.4	1.6
Taste & smell not ideal (a few days)	1.8	1.2	2.7	5.0	3.9	1.2	1.9	2.0	1.5	1.5
Short-term interruption (3 to 6 hours)	2.9	1.3	2.4	1.6	1.2	0.9	1.7	1.1	0.6	1.4
Short-term interruption (6 to 12 hours)	2.8	1.7	1.6	2.6	1.2	0.4	2.0	1.4	1.3	1.8
Long-term interruption (24-48 hours)	21.5	10.6	8.7	18.6	11.0	6.8	8.8	15.0	12.2	12.1
Long-term interruption (7 days)	15.8	13.8	12.9	20.4	13.8	8.5	17.9	12.5	13.0	22.3
Persistent low water pressure	1.5	1.0	1.5	1.6	1.0	0.4	0.7	1.1	0.9	1.1
NEUB (May to September)	0.3	0.5	0.7	0.2	0.6	0.2	0.3	0.3	0.3	0.3
Sewer flooding inside your property-Severe	23.3	16.0	34.6	20.1	28.3	45.9	34.0	39.9	19.0	20.0
Sewer flooding inside your property-Minor	17.0	39.5	15.0	17.7	23.0	29.4	22.7	13.8	36.4	25.4
Sewer flooding outside your property	6.6	2.2	7.0	3.4	5.4	1.6	2.8	5.4	6.3	3.5
Sewer flooding in a nearby public area	1.7	4.3	4.3	1.6	3.4	1.2	1.7	1.9	1.6	3.2
Odour from sewage works-Minor	0.5	1.0	1.2	1.1	0.5	0.4	0.6	0.7	1.0	1.1
Odour from sewage works-Severe	0.6	0.5	1.4	0.7	0.9	0.5	0.8	0.7	1.0	0.9
Significant pollution incident	0.8	1.7	2.0	1.5	2.4	0.7	1.6	1.3	1.2	1.9
Minor pollution incident	0.7	1.0	0.9	0.4	1.0	0.5	0.6	0.5	1.2	0.8
River water quality less than Good locally	0.6	0.9	1.1	0.4	0.5	0.2	0.5	0.3	0.6	0.8
Bathing water quality less than Excellent locally	0.1	0.3	0.3	0.2	0.4	0.0	0.2	0.2	0.2	0.2
Bathing water quality less than Good locally	0.1	0.3	0.3	0.2	0.2	0.1	0.2	0.2	0.4	0.3
Participants	**54**	**23**	**89**	**53**	**24**	**35**	**79**	**43**	**20**	**78**

Analysis of the Effects of Experience of Service Issues

Our analysis of the effects of having experienced a service issue focuses on the effect of participants' experience of service failure on the relative impact they assigned to the corresponding service issue in comparison to the others, as captured by the MaxDiff models. To this end, an indicator variable was constructed for each service issue that equalled 1 if the participant experienced a failure in it any time in the past, and 0 otherwise. These indicator variables were interacted with their corresponding MaxDiff service issues in order to identify the effect in question. The rank-ordered logit model was therefore extended to estimate for each service measure a base coefficient representing relative impact under no experience, and an interaction term representing the change in relative impact with experience.

Interaction effects were detected for seven types of service issue, as shown in Table 31. For most of these service issues, experience of the issue had the effect of increasing the impact score assigned to it. However, in the case of discoloured water, the opposite effect was observed. For all other service issues not shown in this table there were no significant effects of experience observed.

Table 33: Interaction effect between service failures and previous experience – Dual Households

Service issue	No Experience	Experience	Significance of experience effect
Discoloured water (a week)	2.4	1.9	**
Taste & smell not ideal (few days)	3.3	2.6	**
Short-term interruption (3 - 6 hours)	1.1	2.3	**
Short-term interruption (6 - 12 hours)	1.3	0.8	***
Long-term interruption (up to 7 days)	12.9	21.6	***
River water quality less than Good locally	1.8	2.7	***
Bathing water quality less than Good locally	0.8	1.4	***

** significant at 10%; ** significant at 5%; *** significant at 1%*

Analysis of the Effect of Attitude to Water Bill

Willingness to pay for service improvements is expected to be sensitive to participants' attitudes towards their current bill level. We expect that WTP will be lower if the amount currently paid is deemed too high by the participant.

To test for this hypothesis, we created a dummy variable that equalled 1 if participants thought the amount they paid for their water and wastewater services was 'slightly too much' or 'far too much', and 0 if 'about right', 'slightly too little' or 'far too little'. Re-examining the restricted model, this indicator variable was then interacted with the bill variable to assess whether the bill coefficient decreased further.

The results in Table 34 confirm that participants who stated that their current bill was too high were, on average, more price sensitive, and hence had lower WTP. This is

evidenced by the negative coefficients on the *Bill increase*"Bill_too_high"* variable in each of the three models, with statistically significant coefficients in two of the three.

Table 34: The effect of bill attitude on WTP

Variable	Coefficients		
	Dual Households	Dual Non-households	Waste Households
Package -1	-1.536***	-1.495***	-2.553***
Package SQ (base)	Omitted	Omitted	Omitted
Package +1 or Package +2	0.838***	0.663***	0.683**
Bill (%)* Bill increase	-5.565***	-11.338***	-6.963**
Bill increase*"Bill_too_high"	-6.528***	-9.669***	-6.797
Observations	**7,992**	**3,992**	**400**
Pseudo-R2	**0.125**	**0.206**	**0.196**

** significant at 10%; ** significant at 5%; *** significant at 1%*

Package WTP Segmentation by Income and Receipt of Social Benefits

We have examined the Package exercise responses by income group and whether or not the participant received social benefits to measure if there are differences in overall WTP between these customer groups. We expected that those with higher incomes would have higher WTP than those on lower incomes. We further expected that those not receiving social benefits would have higher WTP than those that do receive social benefits.

Income groups were defined as follows:

Low income: All participants with a reported annual household income of less than £15,600

Medium income: All respondents with a reported annual household income between £15,600 and £52,000

High income: All respondents with a reported annual household income of more than £52,000 per year

Customers were further allocated in groups of 'Receiver of social benefits' and 'Non-receiver of social benefits'. The latter group included all respondents that do not receive any of the following benefits or allowances:

- Attendance Allowance
- Carer's Allowance
- Child Tax Credit
- Council Tax Benefit
- Disability Living Allowance
- Housing Benefit
- Income Support
- Jobseeker's Allowance
- Pension Credit
- Working Tax Credit

The number of respondents per group are summarised in Table 35.

Table 35: Package WTP segment sizes

Segment	Number of Respondents
Low Income	228
Medium Income	535
High Income	146
Receives Social Benefits	720
No Social Benefits received	271

Unlike for the analysis of the main sample, the data for each segment was not weighted to the Wales population as they represent distinct sub-samples rather than reflecting the image of the total customer base. Likewise, the sample average bill for each segment was used for the conversion of the econometric results into the package WTP value rather than the population average DCWW bill. In all other respects, the analysis methodology was the same as for the full sample core analysis.

The estimated WTP results for each segment are shown in Table 36 and Table 37.

Comparing the total package values across the different income groups, the results in Table 36 show, as expected, that customers in higher income groups had higher WTP for the improvement packages.

Similarly, the results in Table 37 show that WTP was lower for those in receipt of social benefits than those who were not. This result is again as expected.

Table 36: Package WTP values by different income groups

	WTP (£/customer/year)		
Package	Low Income	Medium Income	High Income
SQ to +1	25.84	65.23	111.43
+1 to +2	12.13	22.54	49.37
SQ to +2	37.97	87.77	160.80

Table 37: Package WTP values by receiver and non-receiver of social benefits

	WTP (£/customer/year)	
Package	No Benefits	Benefits
SQ to +1	59.22	40.41
+1 to +2	22.76	17.60
SQ to +2	81.98	58.01

Overall these segmentation results are further supportive of the validity of the study as they show that WTP varies in line with expectation.

APPENDIX C: FOLLOW-UP RESEARCH INTO WTP SURVEY PARTICIPANTS' INTERPRETATION OF RIVER AND BATHING WATER SERVICE MEASURES

INTRODUCTION

Background

The draft final report from the present study was peer reviewed by Professor Ken Willis. Professor Willis was highly supportive overall of the methodology, but raised an issue that the values for bathing water quality improvements seemed high in relation to previous research for PR14.

In reflecting on this finding, we hypothesised that the reported results could potentially have been overstated as a result of a discrepancy between how respondents construed the language defining river and bathing water quality service issues in the survey, and how they are primarily to be used in appraisals. Participants may potentially have interpreted the service issues as deteriorations in quality rather than, as intended, as states of affairs that could potentially be improved upon. This matters because we would expect a deterioration interpretation to lead respondents to perceive a higher impact than would a 'worse-than-ideal current level' interpretation; and yet the results are to be used primarily for valuing potential improvements rather than the avoidance of deteriorations.

This is an empirical question, which was to be addressed by a follow-on study. The intention of the follow-on study was that the results could be used to provide an enhanced understanding of the value of river and bathing water quality, and concomitantly an enhanced understanding of the value of all other service measures valued in the main WTP survey.

Objectives

The research needed to explore how survey participants interpreted the choice exercises used to derive WTP values for bathing and water quality service issues. The research aimed to understand whether participants interpreted the bathing and river water quality service issues presented in the choice exercise as deteriorations in quality or if they interpreted them as describing a current situation that was lower quality than it could have been.

Report Structure

The remainder of this appendix sets out our methodology, reports the findings and draws conclusions.

METHODOLOGY

Research was conducted with Welsh Water customers via 20 15-minute telephone interviews. A telephone approach was used to replicate the process used in the original survey fieldwork, and to ensure Welsh Water customers from a range of localities could

be included in the research (for instance, closer to and further away from different stretches of coastline).

Loose quotas were set on age, social grade and region to achieve a sample including a range of people across these characteristics.

The interview was a quantitative exercise, but included open questions to provide an understanding of the reasons behind customer's responses, thereby revealing their interpretation of the survey wording.

Interviews repeated the introductory part of the main WTP questionnaire, including the presentation of information about service issues, before repeating a shortened version of the MaxDiff choice exercise also from the main WTP questionnaire. This replicated the stages up to and including the choice exercise used in the main survey fieldwork as closely as possible.

Four different choice cards were presented, each including at least one of the coastal or river water quality issues. Following the choice exercise, participants were asked a series of questions about how easy they found the choice exercise, how they made their decision regarding the choice exercise and whether they interpreted the service issue as a deterioration in quality of describing the current situation.

All information relating to service issues, including the choice cards, were sent to participants via email or post, as was the case in the main fieldwork.

In the choice exercise, the river and bathing water quality service issues were described as follows:

- "*RIVER WATER QUALITY in your local area fails to achieve Good status due to the impact of Welsh Water operations*"

- "*COASTAL BATHING WATER QUALITY in your local area achieves Good quality but not Excellent due to the impact of Welsh Water operations*"

- "*COASTAL BATHING WATER QUALITY in your local area achieves Sufficient quality but not Good or Excellent due to the impact of Welsh Water operations*"

All participants were incentivised for their involvement with an incentive of £10 per participant.

FINDINGS

Ease of Responding to Choice Exercises

Overall, participants did not find it difficult to select the service issues which would have the most and least impact on them. Only one participant found this task difficult, finding it complex to assess how long term the impacts of the service issues, and therefore what the potential impact on them personally, might be.

Q19. *Did you generally feel able to make comparisons between the options I presented to you?*

	Frequency
Yes	19
No	1

This replicates the findings from the main WTP research, wherein we also found over 90% reporting positively to this question.

Coastal Bathing Water Quality

Responses indicate that the majority of participants (12 of 20) interpreted the wording of the coastal bathing water quality service issue presented in the choice exercises as describing the existing situation in their local area, and therefore a situation that could potentially be improved by Welsh Water. This was as we had intended when designing the survey.

Only one participant (1 of 20) understood this as a deterioration of the water quality in their local area.

The remainder (7 of 20) interpreted the service issue in some other way, either making a decision on gut instinct, stating that water was actually improving, or focusing on the other service issues felt to be more relevant to them personally.

Q23. *When thinking about this last service issue: "COASTAL BATHING WATER QUALITY in your local area achieves Sufficient quality but not Good or Excellent due to the impact of Welsh Water operations". Would you say this was describing a situation where coastal bathing water quality in your local area was getting worse, or describing things as they are now, or something else?*

	n.
Describing things as they are now	12
Getting worse	1
Other[8]	7

The 'other' responses included the following reasons:

> *I think it depends on weather conditions to be perfectly honest because we have high tides where we are.*
>
> *Improving no question about it.*
>
> *I didn't think of that at all, whether it's good, bad or excellent, as a non-user of coastal bathing water, I'm indifferent to the quality.*

[8] Any responses given of 'Something else' were followed up with an open question asking for an explanation of what the participant thought the wording described. Verbatim responses to this were analysed and re-coded, where possible, to one of the other codes (as now / getting worse) as appropriate. 1 response for each of coastal and river water quality were re-coded.

I can't answer that because I don't do any swimming. from what I hear, it seems okay. the young people I spoke to are quite happy with it.

Improving

I don't actually know what the water quality is at the moment, so I can't actually say.

I would hope it was just a temporary thing because, perhaps, the water was washing the sewage out.

From these results, we infer the following weights for our sensitivity analysis with respect to coastal bathing water quality: 0.92 (12 out of 13) for the original interpretation that the attribute was describing a current situation that could be better; and 0.08 (1/13) for the alternative interpretation that it was describing a situation that was getting worse.

River Water Quality

Responses again indicated that the majority of participants (14 of 20) interpreted the wording of the river water quality service issue presented in the choice exercises as describing the existing situation, and therefore a situation that could potentially be improved by Welsh Water. This was again as we had intended when designing the survey.

Just three participants (3 of 20) understood this as a deterioration of the water quality in their local area.

The remainder (3 of 20) interpreted the issue in a different way, as shown below.

Q25. *And when thinking about this service issue [RIVER WATER QUALITY in your local area fails to achieve Good status due to the impact of Welsh Water operations], would you say this was describing a situation where river water quality in your local area was getting worse, or describing things as they are now, or something else?*

	n.
Describing things as they are now	14
Getting worse	3
Other	3

The three 'other' response included the following reasons:

Better now

improving

I suppose my experience with water around here is pretty clean, so if there was a water quality issue it would be because something has happened.

From these results, we infer the following weights for our sensitivity analysis with respect to river water quality: 0.82 (14 out of 17) for the original interpretation that the attribute was describing a current situation that could be better; and 0.18 (3/17) for the alternative interpretation that it was describing a situation that was getting worse.

CONCLUSIONS AND RECOMMENDATIONS

The findings of these interviews indicate that the majority of participants interpreted the wording of the river and coastal water quality service issues as describing the current situation in their local area, and therefore a service level that could potentially be improved, rather than one which has suffered a deterioration. On this basis, we conclude that the original WTP values for river and bathing water quality are unlikely to be as overstated as they potentially could be under our initial hypothesis.

We derived weights to be applied in the sensitivity analysis as follows:

Coastal bathing water quality	0.92 for the original (WTP) interpretation, and 0.08 for the alternative (WTA) interpretation
River water quality	0.82 for the original (WTP) interpretation, and 0.18 for the alternative (WTA) interpretation.

However, because the sample is small the confidence limits for these results are not insignificant. The standard error for the sample proportion is 0.06 for bathing water, and 0.09 for river water; so at the 95% level of probability the true weight could lie between 0.80 and 1.00 for bathing water quality, and between 0.64 and 1.00 for river water quality.

Based on these findings, we recommend that as a next step, the main WTP research report is revised to include details of this follow-up study, and to use the weights and confidence ranges around them as shown above to provide further insight into the results.

***POSTSCRIPT: The above recommendation was implemented in the main body of this report, as described in section 4.3.*