Assessment of Hunter Water's and Sydney Water's Customer Willingness to Pay Surveys

Prepared for the

Independent Pricing and Regulatory Tribunal

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Table of Contents

Summary

Hunter Water's Pricing Proposal included willingness to pay (WTP) studies for the following two discretionary projects:

- Bankwork and landscaping of Hunter Water's open stormwater drains; and
- Increasing Hunter Water's wastewater recycling for irrigation of public open spaces.

Sydney Water's Pricing Proposal included WTP studies for the following two discretionary projects:

- Wastewater ocean outfalls; and
- Waterway health improvement program (WHIP).

Two distinct types of willingness to pay (WTP) studies are reported in the Hunter Water and Sydney Water Pricing Proposals:

- Economic, non-market valuation studies designed to estimate customers' benefits arising from proposed investments. They elicit the maximum WTP of customers for defined environmental, social or cultural outcomes. We refer to these as 'economic WTP' studies. Only one economic WTP was undertaken - a contingent valuation method (CVM) study for wastewater ocean outfalls; and

- Market research based studies designed to estimate the proportion of customers who would be WTP a price that would cover the costs of different levels of a proposed investment. We refer to these as 'market research WTP' studies. These were undertaken for all four discretionary projects.

The focus on market research WTP studies appears to be to meet IPART's requirement for proposals to demonstrate "that customers have both the capacity and willingness to pay more to realise the higher standard." However, this appears to be a misinterpretation of IPART's requirements, which when considered in conjunction with IPART's *Best practice principles for demonstrating willingness-to-pay using a contingent valuation approach to stated preference surveys*, is referring to an economic approach to assessment of WTP.

Economic WTP methods, such as the CVM and choice modelling (CM), are guided by a range of best-practice application principles that have been established from the international literature to ensure respondent preferences are estimated as accurately as possible. No such protocol governs market research WTP studies, although similar principles, such as specific definition of the environment outcome being considered, should apply if reliance is to be given to the proportion of customers who indicate they would be WTP a price to cover the costs of the proposed investment.

All the WTP studies provided in the submissions, including the single economic WTP study, deviated significantly from best practice principles for conducting economic WTP studies. Importantly, even the single economic WTP study, which followed many of the best practice principles, did not adequately specify the hypothetical good being valued.

Justification of an investment program on economic efficiency grounds requires a cost benefit analysis (CBA) to establish if the benefits of the program, including those enjoyed by customers, exceed all the costs, including costs to any third parties. Only economic WTP studies, which use either the CVM or CM, produce results that are appropriate for inclusion in CBA studies of investment programs. Neither Hunter

Water' or Sydney Water's Pricing Proposal included a CBA of the proposed discretionary programs to establish that these programs would produce an improvement in the community' well-being.

Table ES1 summarises the Hunter Water and Sydney Water market research and economic WTP studies, including an assessment against a modified version of IPART's best practice principles provided in full in Section 5.

Table ES1 - Evaluation of Willingness to Pay Studies Against Updated IPART Best Practice Principles

	Hunter Water		Sydney Water	
	Naturalisation of Stormwater Drains	**Wastewater Recycling for Irrigation**	**Ocean Outfalls**	**Waterway Health Improvement Program**
Type of WTP Study in Submission				
Economic i.e. contingent valuation or choice modelling	No	No	Yes	No
Market research	Yes	Yes	Yes	Yes
Cost Benefit Analysis of Program	No	No	No	No
Best Practice Principles for Demonstrating WTP using the Contingent Valuation Approach				
Consequentiality	Yes	Yes	Yes	Yes
Provision rule	Weak	Weak	No	No
Credible payment mechanism	Yes	Yes	Yes	Yes
Specific payment amount and time	No - range only	No - range only	Yes	Yes
Good specified in terms of final outcomes	Yes	No	No	Yes
Level of good to be provided is specific	No - range only	No - range only	No	Yes
Alignment between program and level of good that will be provided	Yes	No as good not specified	No as good not specified	Yes
Information provided is clear, relevant, easy to understand and objective	Yes	Yes	Yes	Yes
Respondents encouraged to consider broader context	Yes	Yes	Yes	No
WTP questions uses the dichotomous choice method	No	No	Yes	No
Following questions to detect potential sources of bias and levels of understanding	Yes	Yes	Yes	Yes
Representative sampling and sufficient sample size	Yes*	Yes	Yes	Yes
WTP estimates using appropriate methods e.g. logit regression, Turnbull estimator	No	No	Yes	No
WTP estimates supplemented with confidence intervals	No	No	No	No
Aggregation of household estimates to the population accounts for nonresponse and includes sensitivity testing	No	No	NA	No

Note: For ocean outfalls, where both economic and market research methods are used, it is the economic method that is evaluated.

* All sample sizes are considered reasonable and attempts were made to make samples representative. Hunter Water drew samples from an online panel and a database of customers. Tests between samples are not reported.

1. Introduction

The Independent Pricing and Regulatory Tribunal (IPART) is conducting reviews of Hunter Water and Sydney Water's maximum prices, to apply from 1 July 2020 for a period up to five years (the 2020 Determination).

Both Hunter Water and Sydney Water's Pricing Proposals included discretionary investments in liveability and environmental services to achieve standards higher than those mandated by Parliament and/or government. To allow Hunter Water and Sydney Water to make these discretionary expenditures, IPART requires evidence that the utilities' customers are willing to pay (WTP) for these discretionary expenditures. Best practice principles identified by IPART for demonstrating customer WTP relate to economic WTP methods, specifically the contingent valuation method (CVM), although many of principles also apply to other economic WTP methods such as choice modelling (CM).

The results of Hunter Water's and Sydney Water's customer WTP assessments of proposed discretionary liveability and environmental expenditures are included in the respective Pricing Proposals. Specifically, this is in:

- Technical Paper 1 in the Hunter Water Pricing Proposal; and
- Appendix 3A-3E in the Sydney Water Pricing Proposal.

The IPART Issues Papers have set out best practice principles for demonstrating economic WTP (see Box 1).

Gillespie Economics, in association with Professor Jeff Bennett, was engaged by IPART to assess the technical veracity/validity/quality of Hunter Water and Sydney Water's evidence for customer WTP for discretionary expenditure. For Hunter Water, the discretionary projects that form part of the pricing proposal and hence focus of the review are:

- Bankwork and landscaping of Hunter Water's open stormwater drains; and
- Increasing Hunter Water's wastewater recycling for irrigation of public open spaces.

For Sydney Water, the WTP evidence for review is limited to two discretionary projects:

- Wastewater ocean outfalls; and
- Waterway health improvement program (WHIP).

Before providing a high level review of the relevant WTP studies, some background is provided on WTP estimation methods, economic justification for a program and payments for programs.

Box 1 Best practice principles for demonstrating willingness-to-pay using a contingent valuation approach to stated preference surveys

- Participants are given the impression that their answers are consequential and that they may be compelled to pay any amount they commit to in the survey. The payment mechanism by which people would financially contribute is specific and credible (eg, annual change in water or wastewater bills).
- The non-market outcomes (external benefits) in the survey are expressed in terms of outcomes that people directly value. (eg, people should be asked about willingness-to-pay for the environmental improvements brought about by increases in water recycling, rather than for increases in water recycling in and of itself).
- There is alignment between the external benefits being valued and the likely investment outcomes. The survey should not reflect an overly optimistic view about what benefits the scheme would achieve, and major uncertainties made clear.
- The information provided to participants is clear, relevant, easy to understand and objective. For example, this can be tested with the use of focus groups and pilot surveys, consultation with stakeholders, and inclusion of appropriate maps and diagrams.
- Participants are encouraged to consider the context of their decisions, including the broader context of expected or proposed changes in prices for other services, as well as alternative approaches to achieving the external benefits.
- The valuation questions require participants to make discrete choices (such as 'yes/no' or selecting options), and include a 'no-answer' option to identify participants that are indifferent.
- Follow-up questions are used to detect potential sources of bias, such as cases where participants did not understand the valuation question(s) or the information provided.
- The sample of people surveyed is representative of the broader customer base and large enough to permit robust data analysis. The study should clearly set out how customers were selected for the survey, the number of participants and the response rate.
- Estimates of average willingness-to-pay are supplemented with confidence intervals to indicate the precision of the estimates.
- Population-wide estimates of willingness-to-pay for external benefits are calculated in a transparent and appropriate way. Potential reasons for non-response to the survey should be identified. Sensitivity analysis should be used to demonstrate how aggregate estimates change depending on assumptions about the values held by non-respondents and the extent of the population affected by the investment.
- Survey questions are designed and analysed using appropriate statistical techniques. For example, payment levels need to cover the likely range of amounts that customers might be willing to pay, no option should clearly dominate the others, and participants should not be burdened with too many choices.

Source: IPART (2019), Review of prices for Hunter Water Corporation from 1 July 2020, p. 61; IPART (2019) Prices for Sydney Water from 1 July 2020 - Issues Paper, p. 45, Based on Productivity Commissions, Environmental Policy Analysis: A Guide to Non-Market Valuation, January 2014, pp. 44-47.

2. Economic Background

2.1 Estimation of Consumer Willingness to Pay

Economic Approach to Estimating Willingness to Pay

A number of economic methods have been developed for valuing the non-market environmental, social and cultural impacts (benefits and costs) of proposed investments. These comprise revealed preference methods and stated preference methods. Revealed preference methods rely on observing the actual behaviour of consumers in markets that are specifically related to the nonmarket value under consideration to infer value estimates. Stated preference methods rely on surveys of individuals to elicit values for a hypothetical environmental, social or cultural change.

All of these methods aim to estimate the change in well-being (or utility) experienced by people exposed to the environmental, social or cultural change. When the change in well-being is positive it is measured by the amount of money people would be WTP to achieve the change. In this context, WTP refers to the extent of the benefit or increase in consumer surplus that accrues to respondents. The WTP of respondents are aggregated to determine the extent of aggregate benefits (change in consumer surplus) to the community. As a measure of change in well-being, WTP is consistent with the principles of welfare economics and appropriate for use in a cost benefit analysis (CBA) of the proposed change.

The main stated preference methods used by economists are the contingent valuation method (CVM) and choice modelling (CM).

The CVM establishes a hypothetical market for an environmental good or service and uses a survey questionnaire to elicit people's WTP for a well-defined change in the quantity or quality of the good or service. The preferred WTP elicitation method is 'dichotomous choice', where different cost amounts for the same good are presented to random sub-samples of the impacted population. Respondents are asked whether they would agree to pay these pre-assigned cost amounts for the specified good. The cost levels are specified with the aim that most respondents will be unwilling to pay the highest bid level. Dichotomous choice data are analysed using probabilistic econometric techniques such as logit estimation under a random utility model, with WTP estimated from these models or other approaches such as the Turnbull distribution-free estimator. The probability of a respondent agreeing to pay – which is expected to decrease as the cost amount is increased - is modelled as a binary logit function of the cost amounts used in the sub-samples. The area under the estimated logit function is the aggregate WTP for the change being proposed. It is this area that estimates the increase in well-being enjoyed by respondents because of the proposed change. As such it is suited for use as an element in a CBA of the proposal.

CM involves asking survey respondents to make a sequence of five or more choices, where each choice involves a status quo option and (normally) two alternatives. The status quo and each alternative are outcomes of a proposed change that are described in terms of a number of attributes including a cost attribute. Each choice is different because the attributes take on different levels in the alternatives made available. Similar to the CVM the levels for the cost attributed are specified with the aim that most respondents will be unwilling to pay the highest bid level. Through statistical means (multinomial, nested, random parameter logit) choice models produce estimates of the value of changes in the levels of individual attributes, known as implicit prices. These implicit prices are estimates of the change in respondent well-being resulting from a unit change in each attribute. Because they are monetary equivalents of the change in each attribute, they are referred to as respondents' WTP. Again, the WTP estimates are consistent with the conceptual requirements for use in a CBA of a proposed change that impacts the attributes.

An important element of both the CVM and CM is that the good being hypothetically 'purchased' is described as specifically as possible and in terms of the final outcome of investment programs, not the intermediate outcome. For example, it is not a reduction in stormwater discharges *per se* that is relevant but the ultimate outcome of changes in stormwater discharges that are of value to people e.g. increase in fish abundance, swimmability of waterway etc.

IPART's best practice principles for estimating willingness-to-pay referred to in Box 1 are relevant to the economic approach to estimating WTP, and specifically focus on the CVM although these principles also apply to other economic WTP methods such as CM.

Market Research Approach to Estimating Willingness to Pay

A different definition of willingness-to-pay is evident in the market research type of studies used to inform the Hunter Water and Sydney Water pricing submissions. In those studies, WTP refers to the proportion of customers who agree to pay the specific price increase required to fund a proposed investment. The method involves a sequence of different price rises reflecting different levels of investment being presented to each respondent of a questionnaire. The respondents are asked if they would be WTP each amount. This approach is not aimed at estimating the increase in economic well-being i.e. improvement in consumer surplus, from a program but rather provides information on the proportion of respondents who would be WTP the different levels of a price rise that reflects the cost of different levels of a program. An average willingness to pay across all respondents (calculated as the sum of the price rises (for different levels of a program) multiplied by the percentages of respondents who agree to pay) is then presented. This provides a weighted average of what respondents are WTP "generally" for a program area (but not related to a specific level of program provision), which is then equated to program cost to determine the level of proposed program provision. No change in consumer surplus is estimated. The WTP amount obtained from the market research approach cannot even be interpreted as a minimum (economic) WTP, as the market research WTP estimates did not relate to the outcomes of a single level of program but multiple levels of the program.

This market research approach is different in its structure and analytical requirements to the economic approach that estimates well-being changes. Both involve asking survey respondents hypothetical questions and so need to be guided by the same best practice principles for applying stated preference studies such as the CVM, in order to generate accurate and reliable answers. However, the analysis is different and the use of the two different concepts of WTP is also different. This market research approach appears to be specifically provided to address IPART's requirement for proposals to demonstrate "that customers have both the capacity and willingness to pay more to realise the higher standard" (IPART 2019, Review of Prices for Hunter Water Corporation, Box 5.1; IPART,2019, Review of prices for Sydney Water Corporation, pl 43). However, it appears to be a misinterpretation of IPART's requirements which when considered in conjunction with IPART's *Best practice principles for demonstrating willingness-to-pay using a contingent valuation approach to stated preference surveys*, is referring to an economic approach to assessment WTP. The market research WTP estimates are unsuitable for inclusion in CBA as they do not reflect well-being changes, and are not consistent with best practice economic WTP methods and practice.

2.2 Use of WTP for Economic Justification of a Program or Policy

From an economic efficiency perspective, it is not sufficient to just demonstrate customer WTP for a program. A program is justified if all the benefits of that program to the specified community are greater than the costs in present value terms i.e. there is an economic surplus to the community. The method used

to make this assessment is CBA. Costs and benefits of a program may be more than just the program costs to Hunter Water or Sydney Water and the benefits to customers as expressed by the (economic) WTP of the community. A CBA is required to justify a program on economic efficiency grounds, before consideration is given to how to finance that program or policy. A CBA would normally be a requirement of major projects, though a gateway assessment process, or a business case justifying the relevant expenditure. This type of analysis would also examine issues such as alternative options, risks and deliverability. The market research-WTP is not suitable to be used directly in these types of assessments.

2.3 Payment for Programs

If the benefits of a program exceeds the costs then there is some justification for recouping the **cost** of the program from the impactors or beneficiaries i.e. impactor pays or beneficiary pays principles. However, beneficiaries may be more than just the customer base of Hunter Water and Sydney Water and there may be other benefits not measured by economic WTP studies of the customer base. There may also be other costs of programs not borne by Hunter Water and Sydney Water. All the costs and benefits of a program impact the consideration of the appropriate pricing policy and hence consideration of the full CBA of a program is required, not just the results of an economic WTP study.

Where economic WTP studies are used to establish the price that customers are WTP (and there are no other benefits or costs to third parties), it is the full marginal cost of the program, not the economic WTP estimate, that is the relevant indicator for pricing policies. This ensures some net benefit accrues to the customers from the program. If the agency increases prices to the full extent of what consumers say they would be willing to pay then the agency would capture the economic surplus of the program and consumers would be no better off.

It is against this context, that the two types of consumer WTP studies carried out for the pricing proposals are reviewed.

3. Hunter Water Willingness to Pay Studies

3.1 Introduction

In a single questionnaire, Hunter Water surveyed a sample of customers to gauge if they would be WTP the price increase needed to fund new investments. The seven investments that were the focus of the survey were to:

- increase bankwork and landscaping of Hunter Water's open stormwater drains;
- reduce Hunter Water's carbon footprint;
- increase the amount of Hunter Water's stormwater harvesting;
- increase Hunter Water's wastewater recycling for business and industry;
- increase Hunter Water's wastewater recycling for irrigation;
- increase Hunter Water's water conservation programs; and
- reduce flooding at Wallsend.

The total amount that the respondents agreed to pay for all programs was then provided to respondents, allowing them to make adjustments to their previous answers.

For each of the seven areas of investment, respondents were provided with some background information, including pictures, and were then presented with a status quo option (with no price rise) and alternatives describing the quantum of outcome that the options would achieve and the additional cost to their water bill. The choice options for the two components that are the subject of this review are provided below.

Figure 1 - WTP Question - Bankwork and Landscaping of Hunter Water's Open Stormwater Drains

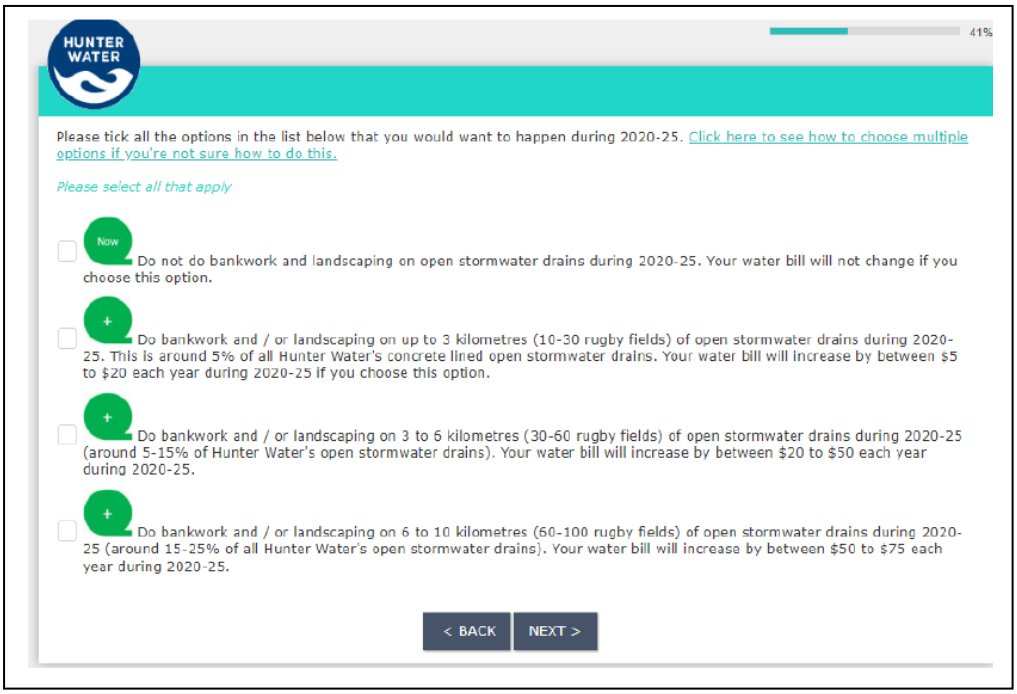
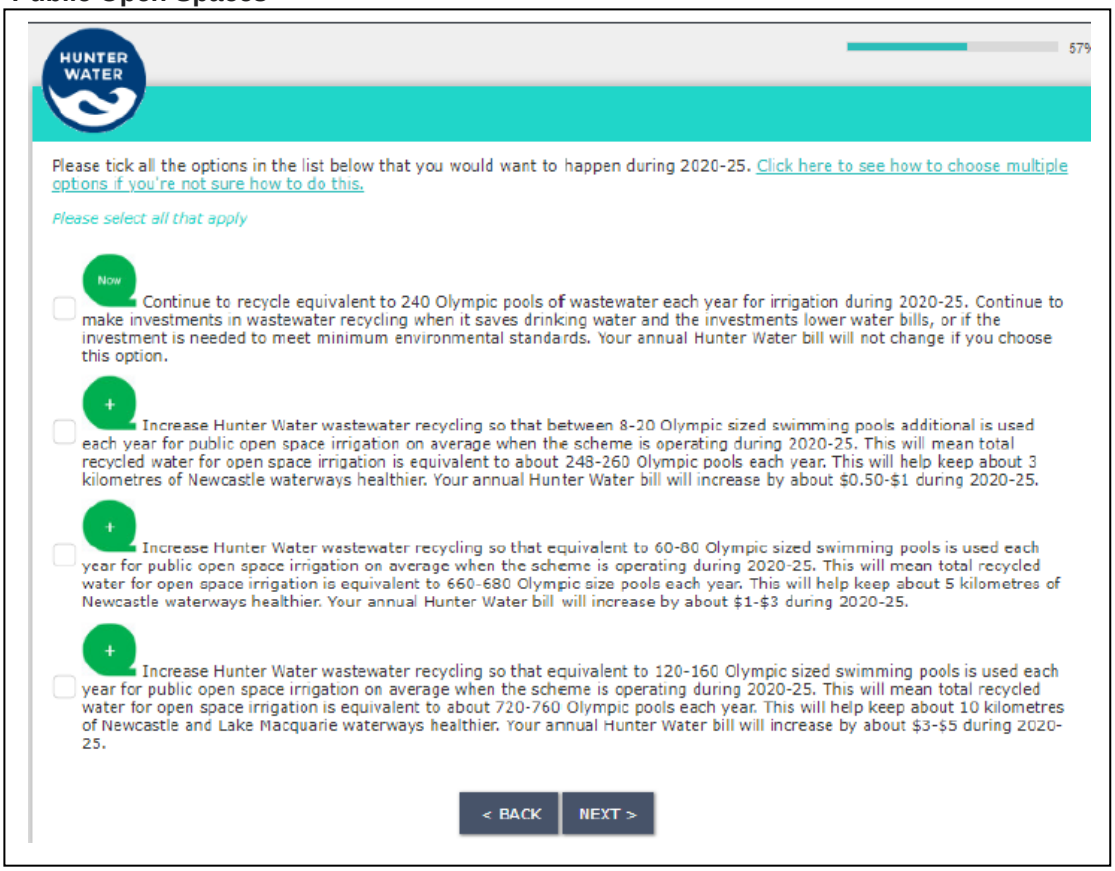


Figure 2 - WTP Question - Increasing Hunter Water's Wastewater Recycling for Irrigation of Public Open Spaces



3.2 Comments on the Hunter Water Customer Willingness to Pay Surveys

Type of Stated Preference Study

While the study reported in the Hunter Water submission is referred to as a customer WTP survey and a stated preference survey, it is neither a CVM study nor a CM study. Rather it is a market research study that more closely resembles a CVM study than a CM study (as respondents are asked whether they would be WTP for a specific good at a specific price).

However, the method does not follow the recommended dichotomous choice (DC) format of the CVM. In DC CVM different cost amounts for the same good, and level of good, are presented to random sub-samples of the impacted population (the upper bound of the cost amounts reflecting the respondent population's likely maximum WTP). In the Hunter Water study, a number of price rise levels (each one reflecting the cost of producing a different level of provision) are given to each respondent. Respondents are then asked which of these increased price/increased investment options they would accept. From this approach, it is not possible to determine respondents' average WTP (as a change in well-being measure) for inclusion in a CBA of a program to determine whether there is an economic surplus from that program. Instead, the study is only capable of producing estimates of the proportion of the customer base that is WTP additional costs associated with each levels of service provision.

Consequentiality and the Provision Rule

The WTP questionnaire stated the consequentiality of the responses for Hunter Water investments. However, the provision rule included in the questionnaire i.e. "we will consider making these investments if we have sufficient evidence customers are willing to pay for them" could be considered 'weak'. A stronger provision rule would state the proportion of respondents that must agree before the program is adopted. The literature has shown that answers to stated preference questions are 'incentive compatible' (i.e. they give respondents the incentive to answer accurately) only when a 'majority voting' provision rule is used in the DC version of the CVM. For example, 'the investment will be made only if 50% of respondents agree to pay the stated amount'.

Specification of the Good Being Purchased

For the question relating to bankwork and landscaping of stormwater drains, the good being valued is a length i.e. km and area (rugby fields), of stormwater drain naturalised by bankwork and landscaping. This is considered to be a suitable description of the final outcome of the investment and uses an appropriate metric. However, the quantum of the good being purchase is not specified: Alternatives are described by overlapping ranges of lengths of waterway treated i.e. up to 3km, 3-6km or 6-10km. The potential impact of overlapping options is discussed further below. The background information provided for this good also refers to potential improvements in property value which may confound the perception of the good being considered i.e. are respondents including in their decision-making the probability that works will occur near them that will increase their property value. Alternatively, respondents may only have thought about the general amenity, wherever it may occur, from proposed works. The lack of a tight definition of outcome levels means that individual respondents will assume the missing detail. Different respondents will make different assumptions and so their responses will relate to different goods. This confounds the interpretation of the results.

For wastewater recycling for irrigation, the good being purchased is defined in the questionnaire as a volume of wastewater recycled and used each year for public open space irrigation AND the length of Newcastle waterways that are going to be healthier. However, the first component of this good is a 'causally prior' attribute rather than a final good/outcome. What does this volume of wastewater being recycled do for public open space? How many hectares per annum would be brown under the base case and green because of the options? Or how often would sporting fields be open instead of closed because of the irrigation etc. It is left to each respondent to infer what they think they would get with the purchase of the specified quantum of recycling investment. The second component of the good being purchased i.e. length of Newcastle waterways that are 'healthier' is a final good, but there is little detail about which waterways will be impacted and what 'healthier' means. Again, it is left to respondents to infer this. Different respondents are likely to interpret the descriptors differently and hence be valuing different things.

The precise quantum of wastewater recycled is also not specific but a range e.g. 8-20, 60-80, and 120-160 Olympic sized swimming pools.

For wastewater recycling there is an imprecisely defined and contradictory status quo option: 'Hunter Water would continue to make investments in wastewater recycling when it saves drinking water and the investments would lower water bills'. Even though the status quo option may lower water bills it is stated that "Your annual Hunter Water bill will not change if you choose this option." This is contradictory.

Specification of Bill Increases

While components of the goods being considered by respondents are specified as a range, so too are the potential costs that respondents would face.

For stormwater drains, the price increase provided to each respondent for each level of good provision is an overlapping range, rather than a point estimate e.g. $5-$20, $20-$50, $50-$75 in annual water bill. For wastewater recycling for irrigation the price level for each level of good provision is $0.5-$1, $1-$3 and $3-$5.

This makes interpretation of results difficult because respondents may have been responding to the lower or the upper value in the range. For example, a respondent may have agreed to pay the first price rise increment on the assumption that the price rise is $5 and not $20. Another respondent may have assumed the $20 figure was the appropriate one.

Combining ranges for the level of a good and ranges of the level of bid level makes interpretation of results even more difficult because respondents may have been responding to the lower or upper values of both categories. For instance, the third and fourth choices for the stormwater channel naturalisation are:

- Option 3 - $20-$50 for 3-6km of channel naturalisation; or
- Option 4 - $50-$75 for 6-10 km of channel naturalisation.

Under Option 4 a respondent may interpret that under the best case scenario they may get 10km (the upper range in outcome) for $50 (the lowest bid level in the range) compared to under option 3 where in the worst case scenario they may only get 3km (the lower range outcome) for $50 (the highest bid level).

Willingness to Pay Calculation

An average WTP for each program area was estimated using a weighted average approach, where the percentage of respondents agreeing to each bid level range was applied to the **upper** value in that range and then summed.

Two issues emerge. First, the technique used is not appropriate for the estimation of an average WTP that represents a well-being change estimate. This confuses the approach with what the economic CVM/CM methods are able to do: estimate the change in well-being resulting from the proposed investment. All the technique used by Hunter Water is suited to doing is providing an estimate of the proportion of the customer base that is willing to pay a price that would be sufficient to fund each proposed investment level. Notwithstanding this limitation, the way the average WTP is calculated is incorrect. Because a range was presented to respondents rather than a specific price it is not known which amount within the range the respondent considered to be what they would have to pay. If the average WTP results are to be used, conservatively the weighted average approach should use the lowest value in each range. This has a significant effect on the estimated average WTP. For bankwork and landscaping for stormwater channels, the average WTP would reduce from the reported $33.87[1] to $15.85 pa per household. For wastewater recycling and irrigation, average WTP would reduce from the reported $2.68 to $1.45 pa per household. However, it must be stressed that these estimates of WTP are NOT estimates of the increase in well-being enjoyed by the average Hunter Water customer from the proposed investment.

[1] The report mistakenly uses upper range bid levels of $25, $50 and $75, rather than $20, $50 and $70 used in the survey. Hence, even using the upper bounds to calculate the bid level, average WTP would be $31.10 rather than $33.87.

Aggregation of Average Household WTP

Estimates of average WTP values were aggregated to all the households serviced by Hunter Water i.e. 220,000. While it is advised that the use of the average WTP figures is NOT an appropriate use of the technique's results, it should be noted that this process of aggregation may overstate aggregate WTP as it assumes that non-respondents and survey drop-outs had the same WTP (on average) as those that completed the questionnaire. General practice in the aggregation of sample WTP values from economic studies is to assume that survey results can only be aggregated to some proportion of the population. This allows for the fact that only some of the non-respondents to the survey may hold values similar to those who responded to the survey. Other non-respondents to the survey may have zero WTP.

Context for Respondent Choices

The non-market valuation literature clearly shows that the context within which respondents are asked to make choices matters. Different contexts can cause different estimates of value. Respondents in the Hunter Water survey were asked to make choices across seven program areas. However, only respondent market research WTP for two of the program areas have been carried forward into Hunter Water's pricing proposal. Because the choices made by respondents regarding the individual services are contextual (i.e. dependent on the other services being provided) the results of the study are likely to be different if only two services were detailed. This is consistent with respondents making choices within a fixed income constraint. Specifically, it would be expected that the proportion of respondents willing to pay for these two program areas would have been different (likely greater) if they were only presented with choices across these two program areas.

Cost Benefit Analysis

As identified in Section 2.2, it is not just program costs and customer benefits as estimated by (economic) WTP studies that is relevant to determining whether a program improves economic efficiency (unless these are the only categories of costs and benefits of a program). Programs may have a range of other cost and benefits, including those to third parties. No CBA of programs has been provided to demonstrate that the all benefits of programs exceed all the costs. In this respect, the market research WTP approach used, only sought to determine if respondents were WTP the direct cost of a program level not what their total change in well-being for program outcomes would be.

Use of Willingness to Pay Estimates in Pricing Proposal

Based on the approach used by Hunter Water to estimate WTP, it determined that customers were WTP:

- $7.5M pa i.e. $37.5M over 5 years, for 3-6Km of additional bank work and landscaping of HW open stormwater drains. The proposal is $12M (over 5 years) for one km. This accords with the reported WTP values (not accounting for concerns over its calculation and aggregation).
- $600,000 pa i.e. $3M over 5 years, for 150 to 200ML additional recycled wastewater for open space by 2025. However, the proposal is for $6M (over 5 years). It is unclear how this was arrived at and the quantity of wastewater to be recycled for irrigation.

Presentation of these 'aggregate WTP' estimates is misleading as they give the impression that they are measures of change in well-being i.e. the results of an economic WTP study. It should be stressed that these estimates of aggregate WTP are NOT consistent with the principles of welfare economics and are not appropriate for use in a CBA of the proposals. Because of other concerns regarding the questionnaire

design e.g. weak provision rule, imprecise definition of the good being valued, loose specification of levels of payments and goods to be provided, method for calculation of average WTP etc, the market research WTP values are not considered suitable for demonstrating customer WTP.

4. Sydney Water Willingness to Pay Studies

4.1 Introduction

For Sydney Water, the WTP evidence within the scope of this consultancy is for two discretionary projects:

- wastewater ocean outfalls; and
- Waterway Health Improvement Program (WHIP).

The WTP for wastewater ocean outfalls was estimated from an economic WTP questionnaire (using the CVM) that sought to estimate the changes in well-being resulting from investments in ocean outfalls and water pressure (CIPA Phase 2 Willingness to Pay Report).

A separate market research questionnaire that focused on water interruptions, wastewater overflows, inspecting pipes, digital meters, untreated wastewater ocean outfalls and chronic low water pressure and the WHIP was also used to estimate market research WTP' (CIPA Phase 3 Report). In addition, reference was made to a separate CM study not provided in the pricing proposal.

Sydney Water identifies that the targeted studies in Phase 2 measured customers' WTP as defined in economics literature and that "t**hese estimates were used to place monetary values on the benefits of service improvement in cost-benefit analysis of options from a community standpoint**." Sydney Water identify that Phase 3 of the program aimed to validated and triangulate these results by presenting options to customers that set out the impacts on their water bill to be expected as a result of each option being implemented. Customers were permitted to compare the potential increase in their bill against other options and their total bill. This study measued the proportion of customers in favour of each option i.e. this part of the work was market research.

4.2 Ocean Outfalls

Type of Stated Preference Study

The CIPA Phase 2 Willingness to Pay Report uses the recommended DC CVM with rotating one-off bid levels of $1, $3, $5, $7, $10, $15, $25, $35 and $50 for sub-samples of households and different rotating bids for sub-samples of businesses.

These bid amounts were correctly set at levels unrelated to program costs but aimed to elicit maximum WTP of respondents.

The CIPA Phase 3 Report presented a single alternative option to respondents with a price of $2.30 per year, presumably related to the cost of the proposed program. See Figure 4 below. This is a market research study. From this approach, it is not possible to determine respondents' average WTP (as a well-being measure) for inclusion in a CBA of the program and determination of whether there is an economic surplus from the program. Instead, the study is designed to estimate the proportion of the customer base that is willing to pay this amount for the specified service provision.

Consequentiality and Provision Rule

The consequentiality statements in the CIPA Phase 2 economic questionnaire could be considered to be "weak" i.e. "We wish to reassure you that this is genuine market research and as always your individual survey responses will remain confidential and anonymous at all times" "Your answer to the next question will affect the decision about how much raw wastewater is released into the ocean and also the size of you water bill. Please answer that question as if you were really facing this decision".

No provision rule was included in the CIPA Phase 2 economic questionnaire.

The CIPA Phase 3 market research questionnaire also has a 'weak' consequentiality statement i.e. "We wish to reassure you that this is genuine market research and as always your individual survey responses will remain confidential and anonymous at all times". It did not contain a provision rule.

Specification of the Good being Purchased

Both the CIPA Phase 2 and CIPA Phase 3 reports provide a description of status quo activity and status quo impacts at the outfalls. Impacts of the status quo i.e. four Olympic swimming pools worth of raw wastewater being discharged into the ocean every day, along with 203 wheelie bins worth of plastics and hygiene products are identified as causing:

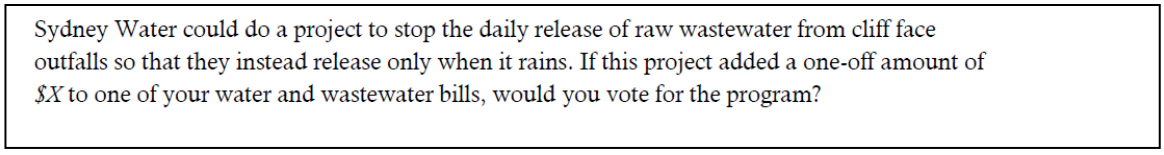
- public health risks to around 2,000 people who visit the affected areas each year for spear fishing, rock fishing and swimming and 300 people who have direct contact with pollutants through organised swim and paddle events;

- ecosystem impacts close to the outfall sites - degraded ocean floor habitat, with barren areas and 'brown fuzz'; increased growth of algae; more opportunistic species in the area; floating rubbish, which can harm sea creatures by swallowing or becoming tangled; a bad smell, including on cliff tops; visible 'plume' in the water 75% of the time, including oil and grease on top of the water.

This base case description lacks some specificity e.g. what is the public health risk? - 10% chance of diarrhea, how large is the degraded ocean floor habitat, which sea creatures would get harmed and how often, what is the frequency of bad smells and visible plume etc. Furthermore, the status quo context features a statement that the EPA is regularly conducting water quality tests at the site of the outfall and the results indicate ‘good water quality’. This would appear contradictory to the rest of the status quo context description.

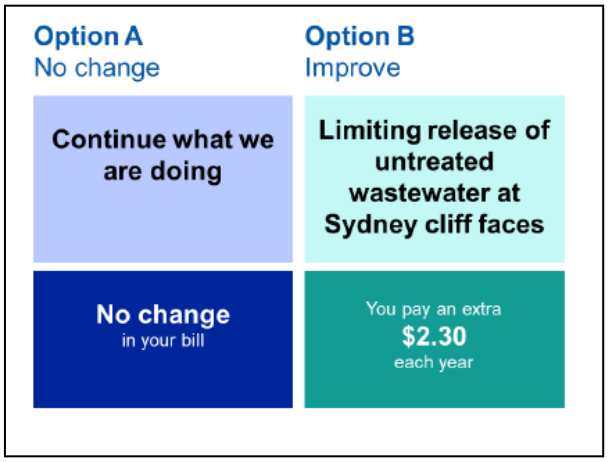
Compounding this lack of specificity of the status quo, the good that people are asked if they want to buy, is entirely unspecified. In the CIPA Phase 2 Report, respondents are only presented with the project i.e. the release of wastewater from the cliff face only when it rains. See Figure 3.

Figure 3 - WTP Question CIPA Phase 2 - Wastewater Ocean Outfalls



In the CIPA Phase 3 Report, the good being valued is "Limiting release of untreated wastewater at Sydney cliff faces. See Figure 4.

Figure 4 - WTP Question CIPA Phase 3 - Wastewater Ocean Outfalls



But the outcome of this for public health risks and ecosystem impacts is not stated. It is left to respondents to infer the outcome. Each respondent will likely infer a different outcome leaving the interpretation of the results compromised. In addition, no information is provided to respondents about how the project to stop the daily release of raw wastewater from the cliff face would still result in raw sewage being released into the ocean further from shore.

There are also questions over the relevance of inclusion of information on the public health risk, as any public health risk from the outfalls would only accrue to individuals who currently or potentially visit the area to swim or fish. If health risk were an issue for these users of the area, they could presumably go somewhere else to swim or fish. At the very least some statement as to the effect that there are many alternatives locations for these activities would warrant inclusion.

The final concern with specification of the good being valued is that no information is given on the location of outfalls. It is normal practice to provide information to respondents on the geographic context as well as other elements that may impact on preferences. The omission of this information could be expected to impact results, notwithstanding the other issues with the study.

Willingness to Pay Calculation

In the CIPA Phase 2 Report, the mean WTP of $18 one-off payment was estimated using the non-parametric Turnbull estimator and a conservative threshold for whether respondents would agree to the bid price. This is considered a reasonable approach. This is an economic measure of WTP aimed at measuring improvement in well-being resulting from the investment (albeit given the doubts cast on the description of the investment outcome outlined above).

In the CIPA Phase 3 Report it is reported that 65% of the online respondents preferred Option B - Limiting release of untreated wastewater at Sydney cliff faces, at a cost of $2.30 per annum.

The CIPA Phase 3 Report makes a comparison between the mean WTP from CIPA Phase 2 Report and the $2.30 amount that 65% of online respondents preferred in the CIPA Phase 3 Report. However, this

comparison is invalid because the WTP values reported are not measuring the same thing: one is measuring mean economic WTP and the other is measuring the proportion WTP the specified amount per household of the program.

Because of concerns regarding the questionnaire design e.g. weak or absent provision rule, imprecise definition of the good being valued etc, WTP values from both the economic WTP study and market research WTP study are not considered suitable for demonstrating customer WTP.

Context for Respondents' Choices

Respondents in the ocean outfalls economic WTP questionnaire were asked WTP questions in relation to both ocean outfalls and water interruptions. However, it would appear that there are no pricing changes sought with respect to the latter. As identified above, because the choices made by respondents regarding the individual services are contextual (i.e. dependent on the other services being provided) the results of the study are likely to be different (likely greater) if respondents were only presented with choices across one program area.

Cost Benefit Analysis

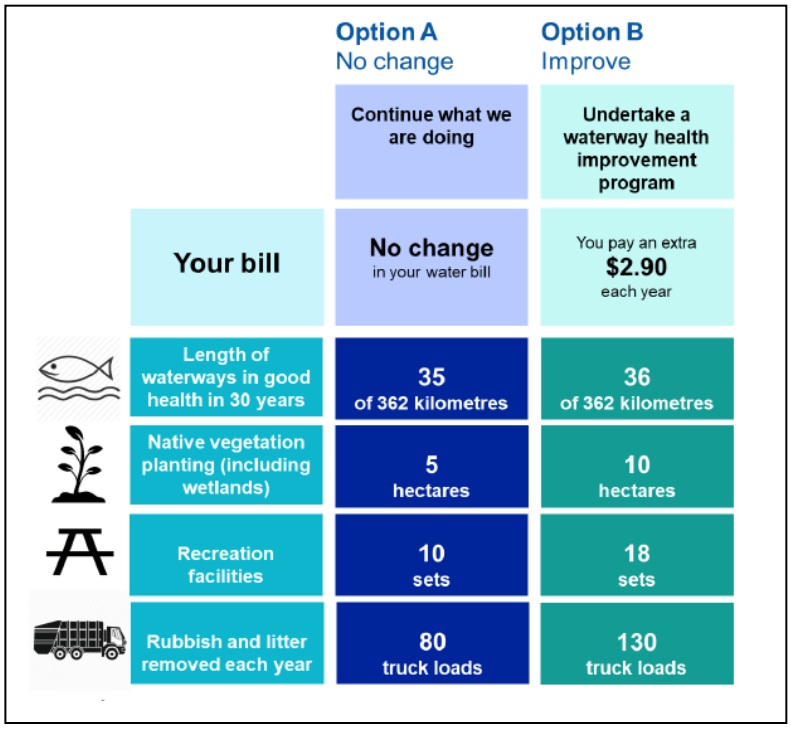
The CIPA Phase 3 Report notes that Phase 2 measured customers' willingness to pay estimates **"were used to place monetary values on the benefits of service improvement in cost-benefit analysis of options from a community standpoint**." This a correct use of these values (albeit with the caveat around the specification of the good being valued) and an important component of a justification for such a program. However, the results of the CBA do not seem to be provided as part of the pricing proposal.

4.2 Waterway Health Improvement Program

Type of Stated Preference Study

The CIPA Phase 3 Report reports the results of a survey to see if customers would be WTP for a specified price rise, presumably related to the cost of the proposed program. See Figure 5 below. This is a market research approach.

Figure 5 - Waterway Health Improvement Program WTP Question



Consequentiality and Provision Rule

The CIPA Phase 3 noneconomic questionnaire also has a 'weak' consequentiality statement i.e. "We wish to reassure you that this is genuine market research and as always you individual survey responses will remain confidential and anonymous at all times". No provision rule is included.

Specification of the Good being Purchased

The CIPA Phase 3 report provides a specific description of the good being valued in terms of changing levels of four final outcome attributes i.e. length of waterway in good health, native vegetation planting (including wetlands), recreation facilities and rubbish and litter removed each year. Waterway in good health was defined as the amount of river length that supports healthy populations of fish and birds.

Willingness to Pay Calculation

In the CIPA Phase 3 Report it is reported that 67% of the online respondents preferred Option B - Undertake a waterway health improvement program, at a price to them of $2.90 each year.

It is stated that this result is consistent with other research undertaken by Sydney Water, however, this is not demonstrated. Given that the study referred to, used CM to estimate well-being changes based on respondent maximum WTP, and the market research approach was based on the proportion of respondents WTP the cost of the program, the comparison made is between two different concepts.

Because of concerns with the market research approach to estimating WTP, it is considered that Sydney Water would be better placed relying on the previously prepared economic WTP (CM) study to demonstrate customer WTP for the WHIP.

Context for Respondent Choices

Respondents in the WHIP market research WTP questionnaire, were asked WTP questions in relation to seven different programs. However, it would appear that only some of these enter into pricing proposals. As identified above, because the choices made by respondents regarding the individual services are contextual (i.e. dependent on the other services being provided) the results of the study are likely to be different if only a subset of these outcomes were provided to respondents.

Cost Benefit Analysis

No CBA analysis results for the WHIP are provided in the pricing proposal.

5. Comments on Best Practice Principles

Economic WTP studies, using well established methods such as the CVM and CM, are essential for estimating the benefits of the outcomes of discretionary programs. They provide important inputs to CBA to determine the economic desirability of programs. Economic WTP methods are also associated with well established, best practice principles from the international literature that provide a systematic approach to community engagement aimed at ensuring respondents understand the outcomes of programs and minimise bias in responses.

The IPART *Best practice principles for estimating economic WTP using a CVM approach to stated preference surveys*, includes some elements that are more related to CM. While there are many similarities between the two methods, there is also a number of differences. It is therefore recommended that separate principles be developed for CM.

Suggested revised best practice principles for CVM principles are provided below. This provides some more specific guidance in relation to the CVM.

Box 2 Proposed best practice principles for demonstrating willingness-to-pay using a contingent valuation method approach to stated preference surveys

- Participants are convinced that their answers are consequential and subject to a provision rule - preferable a majority voting rule: If they agree to pay in the survey, they will have to pay AND the works they are being asked to pay for will be provided.
- The payment mechanism by which people would financially contribute is credible (eg, annual change in water or wastewater bills) and specific i.e. amount to be paid and time frame over which it would be paid (e.g. one-off, annual for 5 years etc).
- The non-market outcomes (external benefits) in the survey are expressed in terms of final outcomes that people directly value (eg, people should be asked about willingness-to-pay for the environmental improvements brought about by increases in water recycling, rather than for increases in water recycling in and of itself).
- The specific level of the non-market outcomes being provided should be made clear.
- There is alignment between the external benefits being valued and the likely investment outcomes i.e. what is being valued should reflect what can actually be achieved from the investment. The survey should not reflect an overly optimistic view about what benefits the scheme would achieve, and major uncertainties made clear.
- The information provided to participants is clear, relevant, easy to understand and objective. Information should include appropriate photos, maps and diagrams. Appropriateness of the information provided can be tested with the use of focus groups, pilot surveys and consultation with stakeholders.
- Participants are encouraged to consider the context of their decisions, including their incomes, the broader context of expected or proposed changes in prices for other services (both marketed and non-marketed), as well as alternative approaches to achieving the external benefits.
- The willingness to pay question should use the dichotomous choice method. The cost ($) ranges should reflect the likely maximum WTP range, rather than the cost of the program. This can be determined from focus groups etc. The highest cost value should reduce the proportion of respondents agreeing to pay to a minimal fraction of the sub-sample.
- Follow-up questions are used to detect potential sources of bias, such as cases where participants did not understand the valuation question(s) or the information provided.
- The sample of people surveyed is representative of the broader customer base and large enough to permit robust data analysis. The study should clearly set out how customers were selected for the survey, the number of participants and the response rate.
- Average willingness to pay should be estimated using appropriate methods such as logit regression and the Turnbull estimator.
- Estimates of average willingness-to-pay are supplemented with confidence intervals to indicate the precision of the estimates.
- Population-wide estimates of willingness-to-pay for external benefits are calculated in a transparent and appropriate way. Potential reasons for non-response to the survey should be identified. Protesting respondents should be identified and estimation sensitivity to their exclusion from the data base explored. Sensitivity analysis should be used to demonstrate how aggregate estimates change depending on assumptions about the values held by non-respondents and the extent of the population affected by the investment.
- Testing for sensitivity to the scale of the investment is advisable.