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Willingness to Pay for a Domestic Food Waste Diversion Policy Option in Regional Queensland, Australia

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Abstract

The cost of disposing domestic food waste (DFW) in open landfills is a significant financial expenditure for most Councils in regional Australia. However, there is little information about the extent that householders value the environmental goods and services that are impacted by DFW disposal. This paper presents non-market valuations for a hypothetical kerbside domestic food waste collection service from a household survey in two local government areas in the Central Queensland region. Choice modelling (CM) and contingent valuation method (CVM) were employed to elicit and estimate willingness to pay (WTP) of the community for a DFW collection service. In the CM exercise, latent class analysis results for the sub-groups supporting an improvement option revealed that the respondents' utility increased by \$4.13 for lifespan expansion of the local landfill. On the contrary, the group had \$3.05 and \$0.28 utility declines for a fortnightly DFW collection service and an increase in the rate of methane emission from DFW disposal, respectively. For the status quo group, utility increased by \$5.05 for a landfill lifespan extension but decreased by \$16.26 for potential odour from the collection bins. Under the CVM exercise, a Multilogit estimator model for the overall sample population showed a WTP of \$30.42 for the service, with 58% participation rate in the improvement option. This valuation study provides policy insights on the importance of full-cost accounting of environmental goods and services attributes, which is useful information for future implementation of voluntary or mandatory DFW diversion schemes.

Keywords: Domestic food waste; non-market valuation; stated preferences; choice experiments; contingent valuation

1. Introduction

In most industrialized nations including Australia, food accounts for the largest proportion of municipal waste, ranging from 40 to 50% of the composition in households' general waste (Australian Bureau of Statistics (ABS), 2007; Sustainability Victoria, 2015; Waste and Resources Action Program [WRAP], 2015). The discarded food is either disposed of at landfills or diverted and re-used if a suitable system exists. Kerbside collection schemes are one way of diverting domestic food waste (DFW) from disposal, and are common practice in some councils in Australia. Domestic food waste is of great concern for all three tiers of government—for local governments in terms of collection and disposal operations; for states/territories regarding regulations and managing waste volumes; and for the Commonwealth in terms of broader concerns such as economic feasibility and links to climate change. A range of technical and financial support has been provided to tackle food waste, including data collection on DFW, management strategy of pilot projects, and roll-out of bins for DFW diversion

programs (Commonwealth of Australia, 2017), yet more needs to be done to effectively tackle this issue in Australia.

In Australia, direct correlations have been reported between waste generation volumes and population growth, gross state product, per capita income and level of urbanization (Randell et al., 2014). The increase in waste generation drives subsequent needs for new or expanded disposal grounds. Related issues of concern include greenhouse gas (GHG) emissions, odour from organic matter decomposition, land and water contamination—all bearing financial and non-financial implications. These in turn impact the capacity of public service providers, especially local governments, in providing affordable, accessible and efficient services to local communities.

In kerbside recycling schemes, the values of recovered materials and avoided landfill costs can be estimated using market data (Gillespie & Bennett, 2012). However, some costs or benefits, such as avoiding air pollution, cannot be explicitly expressed in terms of market price. A purely market-based economy will tend to undervalue non-market goods or services compared to what would be socially optimal (Segerson, 2017). It is therefore, worthwhile for public agencies to correct the failure through mechanisms that factor in the implicit (e.g. pollution) costs. This has prompted economists to use non-market valuation techniques to inform policy makers about the relative economic values of policy options and their associated trade-offs. Economic value relates to human welfare, often revealed by people's preferences and can be measured through the notions of willingness to pay (WTP) for a good or service (Pearce, 1998, 2006).

Currently in Queensland, some Councils already collect residential garden (green) waste and the potential inclusion of DFW, mainly vegetables, in such collections is drawing more interest. According to a recycling and waste report by the Queensland Government (2017), only ten from a total of 77 local government Councils in Queensland currently provide a household-level green bin collection service. The report revealed that the number of green bin services has grown more than fivefold in the past 8 years, from seven services per thousand people in 2008–09, to 39 services per thousand people in 2016–17. Ipswich City is the only Council currently collecting DFW within Queensland.

The Rockhampton Regional Council (RRC) operates a residential kerbside waste collection program, with dual, 240 litre mobile plastic bins ('wheelie bins'), one for general waste and the other for commingled recyclables. The general waste is collected weekly by Council, and the recyclables fortnightly by a contractor. Close to 29,991 households are served with general waste and recycling wheelie bins (RRC, 2016) for which homeowners pay a combined rate of \$452 per property, per year (RRC, 2018). The Livingstone Shire Council (LSC) also manages two kerbside collection programs, with

general waste collected weekly and recyclable fortnightly. A contractor operates the collection of both bins. The Council provides 12,140 households with 240 litre bins for a combined annual service charge of \$419 per property (LSC, 2018). The households in the two Councils have similar socio-demographic characteristics such as household income, education, gender and family composition (Australian Bureau of Statistics (ABS), 2017a, 2017b).

The purpose of the research reported in this paper is to estimate the WTP of RRC and LSC residents to avert DFW. Assessing the non-market use values of DFW diversion from disposal should focus on the drivers of DFW, the context in which it is generated, and the behaviour complexities embedded in households. The experimental exercises were included in an online survey where respondents in the two Council areas completed Likert-type, food-related behavioural and attitudinal questions. The key objectives of this study were focused on identifying WTP for and the motivation to participate in the hypothetical DFW collection program. This also included predicting the type of household socio-demographic and attitudinal characteristics that are most likely to participate.

This paper is presented as follows: section 2 introduces the methods employed for data collection, the research questions and valuation techniques for WTP estimates. Section 3 presents the models generated and results of the estimates. Section 4 provides discussion of the results reported in section 3 and final concluding remarks and policy implications are presented in Section 5.

2. Methods

2.1 Considerations in Non-market Valuations

There are two types of non-market valuation methods commonly used to estimate welfare or utilities derived from environmental goods or services, namely revealed preference and stated preference techniques. Revealed preference methods use observations of purchasing decisions or behaviour to estimate values; whereas stated preference techniques assign values by asking people to make choices (usually in surveys) from a list of options containing monetary trade-offs (Adamowicz et al., 1994; Baker & Ruting, 2014; Champ et al., 2003). In assessing environmental trade-offs, two notable techniques used to estimate non-use values are the choice modelling (CM) and the contingent valuation method (CVM). The CVM involves a single trade-off scenario presented to respondents to gather information on the strength of their preferences (Boyle, 2017; Carson, 2012; Rolfe & Bennett, 2006). In the CM technique, survey respondents reveal their preferred values by making choices between several future resource uses or development options and a status quo option, each of which are described by key attributes (Bennett, 2011; Bennett & Blamey, 2001). The CM technique reveals

the importance of different factors that need to be simultaneously considered in decision making (Bennett, 2011; Rolfe & Bennett, 2006).

Numerous non-market valuation studies related to household waste have been conducted to assess the values of environmental attributes involved. For example, in a CM experiment (Gillespie & Bennett, 2012) based on a kerbside recycling program in the city of Brisbane, Australia, a WTP of AU\$18.30 was reported to increase the collection frequency from fortnightly to weekly. However, the utility declined by AU\$34.18 if general waste collection was to increase from weekly to twice a week. Factors that influenced the WTP included gender, interest in recycling, practicing recycling, higher household income, favouring the environmental health over development, and environmental group membership. A study by Karousakis and Birol (2008) examined households' preferences for kerbside recycling services in London using a conditional logit model. Among the values estimated for a range of materials (paper, textile etc.), a WTP of £1.20/month (approximately AU\$ 0.60) was reported for a collection of food and garden waste. Determinant factors for the WTP were education, income, environmental concern, proximity to drop-off site, cost of collection and the collection of dry materials compost and textile. Another non-market valuation study in Oklahoma tested households' preferences and WTP for additional kerbside recycling service (Boyer 2006). A WTP of US\$1.98/household/month was reported from a CM exercise and a WTP of US\$ 1.35/household/month from an embedded CV question. Females, higher income earning households, and existing recyclers were willing to pay for the service. In a residential waste disposal improvement study in South Korea, Ku et al. (2009) used multinomial logit and nested logit models to estimate WTP for three collection scenarios—clean food-waste collection facility; collection of small items like mobile phones; and convenience to buy stickers for large garbage from village offices and supermarkets. The combined average annual WTP from the two models were US\$ 0.74, US\$ 0.67, and US\$ 0.55 for the three scenarios respectively. Besides the three scenarios, a key factor that significantly influenced WTP was the cost of the service.

2.2 Research Problem

This study set out to examine household food waste reduction from a behavioural and motivation point of view. To assess this, an online survey (Appendix A) was designed and deployed to respondents who were 18 years of age or older. The survey included CM experiments, a CV question, and thematically structured Likert-type food-related behavioural and attitudinal questions.

2.3 Contingent Valuation Method

The CVM technique estimates non-use values as essential components of decision options involving environmental trade-offs (Rolfe, 2006b). This technique is often used for benefit transfer-based policy analysis in recreation, health, environmental quality and other public goods (Whitehead et al., 2015). The CVM often encourages policymaker's engagement in critically evaluating projects and choosing options with lower costs or greater benefits to the public (Carson, 2012; Whittington, 2002). The theoretical basis of valuation using CVM includes the definition of the value, statement for the conditions of the item(s) to be valued, statistical analysis of the responses, and clear interpretation of value estimates (Boyle, 2003). Despite criticisms of uncertainties in valuations (Champ, 2003), CVM offers more prospects for research innovation as well as control over experimental designs when compared with revealed preference methods (Adamowicz, 2004).

A key aspect in CVM is eliciting the respondents' value and a means by which payment will be made (payment vehicle) for the provision of the goods or services (Bateman et al., 2006). The willingness to pay (WTP) is estimated from the preferences respondents would state, or the monetary trade-offs they would make concerning the value of the goods or services (Carson, 2012). The CVM could take an open-ended bidding format where respondents assign a price of their choice, a dichotomous 'yes or no' choice to a set prices, or a payment ladder to select the most appealing from amongst a list of prices.

This research employed the open-ended bid format (Mitchell & Carson, 1989) to a single round hypothetical question which asked: *"if a kerbside FW collection service was started, and there are no changes to your other service, please indicate the maximum additional amount you would consider paying each year in your rates \$___."*

2.4 Choice Modelling Method

The CM method estimates environmental trade-offs using multiple scenarios that are described with a bundle of similar attributes across two or more alternatives that vary in levels (Hanley et al., 2006; Rolfe & Bennett, 2006). A typical CM technique involves attributes selection, levels assignment, experimental design, choice sets construction, preference measurement, and value estimation (Hanley et al., 2001). An important aspect characteristics of the CM is the discrete choice experiment, which is a key variant in preference measurements (Bateman et al., 2006; Scheufele & Bennett, 2013).

In the CM method, survey respondents are asked to make their most preferred choice from repeated multi-attribute policy proposals (improvement versus status quo) (Whitehead et al., 2015). Relative importance on the attributes in the choice sets, including how much respondents are willing to pay

for them, are revealed (Johnston et al., 2015). Value estimates are then derived from the trade-offs respondents make when choosing alternatives with cost attributes (Morrison et al., 2002). Evaluating all choice possibilities with too many available alternatives may involve complexity and cognitive bias; so to reduce the complexities, respondents may base their choices on rationality, heuristics and/or 'rules of thumb' (Schaafsma & Brouwer, 2013).

The management and operation of DFW collection services have cost implications, justifying the selection of a rates charge for the service as a payment vehicle for this study. The main question of interest was *"if three policy options were to be proposed by your Council to start the program, and Option A, B, and C were the only ones available, which one would you prefer the most?"* To answer this question, the values of attributes that were associated with the DFW collection program were measured. The full application of the CM technique in this case study is discussed in section 4.4.

2.5 Framing the Choice Attributes and the Experimental Design

Decisions about waste are difficult to understand due to multiple influences, and the CM method offers a way of presenting what are considered to be the most important ones in a controlled environment. In this case study, the CM method was beneficial because respondents had the chance to make trade-offs between alternative outcomes when making choices amongst variable options. This potentially reduced biases as the value of the attributes were already provided.

To carry out the valuation exercise, five attributes were selected: the cost of the DFW collection service, frequency of collection, methane reduction, odour from the collection bins, and extension of landfill lifespan (Table 1). Costs were expressed in terms of annual payments on local government rates notices. Collection timing was given by frequency, either weekly or fortnightly. A choice for percentage increase and decrease in methane was considered as contributing to either an increase or decrease in GHG emissions in waste landfills. Odour emission from collection bins was also given as either moderate or mild intensity. Extending the lifespan of landfills was also a given as a key attribute arising from DFW diversion.

Table 1. Choice set attributes, measurement units and levels

Option A and Option B			Option C (Base Scenario)
Attribute	Unit of measurement	Level	
DFW Collection	Frequency	Weekly (1), Fortnightly (2)	None
Cost	Annual fee on rates (AUD\$)	25, 50, 75, 100	0
Methane	Percentage	Decreased to 20, 30, 40	50 (current state)
Odour	Intensity	Mild (1), Moderate (2)	None
Landfill Lifespan	Year	1, 3, 5	0

A Bayesian experimental design (Atkinson et al., 1992) was employed to develop a representative sample of the alternative outcomes. A total of 24 choice sets were constructed using the five

environmental attributes, with six choice sets per respondent embedded in four blocks (versions) of the questionnaire (Figure 1). The respondents were randomly assigned to a survey version.

In each choice set, respondents could choose between the improvement options (Option A, Option B) or the status quo/business as usual option (Option C). The option of answering ‘Unsure’ was also provided to give respondents more flexibility. For the sake of simplicity, however, respondents who chose “Unsure” were combined and coded together with the respondents who chose Option C (the status quo) before the data were analysed.

Choice Set 1

Options	Frequency of Food Waste Collection (240 Litre bin)	Annual Rent on Your Rates Notice	Environmental Outcomes of Attributes		
			(a) Contribution of Household Food Waste to Methane Gas at Council Landfill (%)	(b) Level of Odour Concern from Collection Bins	(c) Extend the Life-span of the Current Landfill
OPTION A	Weekly	\$75	Decreased to 40%	Moderate	Extend by 1 year (to 2035)
OPTION B	Fortnightly	\$75	Decreased to 20%	Mild	Extend by 5 years (to 2039)
OPTION C	None	\$0	Current situation: 50%	Current situation: Not applicable	Current situation: Reaching full capacity in 2034

Q5.1: If three policy options were to be proposed by your Council to start the program, and Options A, B, and C were the only ones available, which one would you prefer the most?

OPTION A **OPTION B** **OPTION C** **UNSURE**

Figure 1. Example of a choice set

The data were analysed using LIMDEP® and NLOGIT® econometric and statistical analysis software. In the CVM, Tobit and a two-stage Multilogit Estimator were used to develop models and estimate the WTP. For the CM, a simpler Multinomial Logit (MNL) and an advanced latent class analysis (LCA) technique were used to develop models to assess the respondents’ preference of attributes and subsequent WTP. Behavioural factors (constructs) and socio-demographic variables (Table 2) were also used as key predictors in the valuation exercises. These variables were included to explore effects on the prediction of choice preferences of respondent characteristics and attitudinal variables.

Table 2 Predictor Variables Used for CVM and CM Data Analyses

Variable Code	Description
ASC	Alternative Specific Constant (1 = no improvement option [status quo])
FREQ	Frequency of FW collection (1 = weekly, 2 = fortnightly)
COST	Annual fee on rates (base = \$0) (\$25, \$50, \$75, \$100)
METHANE	Contribution of DFW collection to methane gas reduction (base = 50%) (20%, 30%, 40%)
ODOUR	Level of odour concern from DFW collection bins (base = 0) (1 = mild, 2 = moderate)
LIFESPA	Years extended in the life-span of the current landfill (base = 0) (1, 3, 5)
FAMILY	Family composition (1= family household)
RESBLOCK	Residential block (1 = two acre and above)
GENDER	Gender (1 = female)
EDUC	Highest level of education (1= higher education)

EMP	Current employment status (1= currently employed)
INCOME	Approximate combined household net income (\$000) (1 = \$60,000 & above)
FOODSPEND	Percentage of household monthly income spent on food (1= Above 30%)
FAC1	FW Focus Factor 'level of concern for unconsumed food'; 'interest to further reduce food waste'; 'consumption proportion of a weekly or fortnightly purchased food'; 'level of food waste in the general waste bin weekly'
FAC2	Environment and FW Collection Factor 'willingness to pay for kerbside food waste collection service'; 'environmental and social wellbeing obligations'; 'willingness to accept fortnight general waste collection'
FAC3	FW Handling Factor 'home/backyard composting policy option'; 'preferred way of handling wasted/unconsumed food at home'
FAC4	Reasons for FW Factor 'food is no longer fresh (intention to discard unconsumed/uncooked food)' ; 'bulk/loose fruits & vegetables (food items that go uneaten)'

2.6 Sampling and Data Collection Process

The Population and Research Laboratory at CQUniversity Australia administered the sample recruitment and data collection task across the RRC and LSC. A computerized sample drawing process was employed to achieve a geographically comparable sample using randomly generated landline phone numbers and postcode parameters. Participants who agreed to participate were contacted by e-mail and sent an online link to complete the survey. The survey was collected between October and November 2016. Overall, 587 completed survey responses were received, achieving a 68% response rate. Each respondent completed six choice sets, resulting in 3522 choice observations.

3. Results of Estimates

Preliminary analyses showed that for the respondents who were willing to pay for the program, the top three reasons for their decisions were environmental and social wellbeing obligations; potential to create local employment opportunities; and reduced feelings of guilt if/when wasting food. By contrast, the following opinions were identified from those who did not want to support or pay for the DFW collection program mainly due to the following broad categories of accounts:

- Perceptions that they were not wasting food at home or already have alternative options (backyard composting, feeding to pets etc.)
- Financial drivers (rates, subsidies, bin charges, etc.)
- Aesthetic or sanitation concerns (odours, vermin, etc.)
- Lack of interest for other reasons (disposal location, contamination)

Concerning DFW handling issues, 44% of the total sample population preferred disposal in GWB (32% male and 68% female) whilst 22% claimed to do composting (31% male and 69% female). If a DFW collection program was to be launched, the proportion of respondents who agreed and disagreed to a fortnightly general waste collection was 39% and 41% respectively. The remaining 20% comprised

those who were not sure and/or indifferent about the proposal. The majority of the respondents (75%) reported participating in some form of pro-environmental initiatives in the past or at present.

3.1 Contingent Valuation Method (CVM)

The 587 responses to the open-ended CVM question were not normally distributed but rather truncated at zero, with WTP values that ranged between zero and \$700. Prior to running the CVM analysis, a Stem-and-Leaf Plot was applied in SPSS. This helped to reduce the effect of extreme values by trimming the upper and lower limits for either the full data set ($N = 587$) or the data set with only non-zero responses ($N=420$). When the full data set was considered, 16 extreme cases were identified with values greater than \$150. When only the non-zero responses were considered, six cases with extreme values greater than \$250 were excluded.

Two tests were initially performed using a Tobit model to account for variations in respondents who were willing to pay (non-zero WTP) and those who were not willing to pay (zero WTP) for the service. Originally proposed by James Tobin (1958), a Tobit model is a form of linear regression that helps to examine the influence of independent variables (IVs) on non-zero WTP respondents. It estimates the probability that zero responses would change to positive bids when the IVs change (Halstead et al., 1991). The first Tobit model combined both zero and non-zero WTP responses¹ ('Tobit All'), i.e., the entire sample population. The second model considered those non-zero responses² ('Pay Only') applicable to those who were willing to pay for the service regardless of their decisions to participate in the program. A third test involving a two stage model, also known as Multilogit Estimator (MLE), was more relevant for this study than the two Tobit models. The two-stage exercise was applied for positive WTP respondents and considered as a slightly more accurate way of developing the CVM model. Details of the MLE model and test results are reported in the section below. The same list of attributes and variables described in Table 1 and Table 2 were used in the CVM models.

3.1.1 Two-stage Multilogit Estimator Model

The two-stage model considered the decision to participate (non-zero bid) and then the decision about WTP within one modelling framework, allowing differences in the IVs between the two decision processes. The analysis draws on Heckman's (1979) two-stage sample selection or sample bias reduction procedure. It involves a binary Probit analysis followed by a truncated regression analysis (ordinarily least square) to estimate maximum likelihoods. A positive response for the DV, i.e., WTP,

¹ 'Tobit All' model for $N=587$ showed mean WTP of \$30.00, with Log-likelihood value -3252. A trimmed mean WTP \$32.38 (95% confidence interval between \$25.15 and \$39.63) was obtained using Krinsky and Robb (1986) bootstrapping procedure from 1000 random draws.

² Tobit 'Pay only' model for $N=420$ (72% of the sample population) had estimated WTP \$61.13 with Log-likelihood value -2193. The trimmed mean WTP was \$63.23 (95% confidence interval between \$55.68 and \$70.80).

is observable only for a sub-sample of the population, who have already made the decision to participate in the service being offered—suggesting that participation and WTP should be treated as separate individual choices (Heckman, 1979; Jones, 1989).

Accordingly, two underlying models were first generated (Table 3), starting with a binomial Probit model (BPM) (decision 1), which analysed the decision ‘yes’ or ‘no’ to pay (participate). In a successive sample selection regression model (decision 2), the WTP was calculated using the Probit statistics for the sub-samples (yes respondents) in decision 1. Subsequently, a third Multilogit Estimator (MLE) model took the decision 2 model and iteratively ran maximum likelihood results by generating a joint corrected regression (Table 4) for the entire 587 sample population. Put simply, the MLE was calculated as the proportion of the positive WTP responses i.e., it was applied against the sub-sample of respondents who were willing to pay, in an effort to find a more valid WTP for the total sample population. Non-significant IVs were removed in the process of developing the final model. In focusing on the most useful IVs for the Councils, the RRC and LSC were separately entered in the model command but results showed the same statistical outputs. The model’s mean WTP is calculated for single observations of all responses using:

$$\text{Mean WTP (CS)} = \sum (\text{Constant} + \text{mean of IVs} \times \text{Coefficient of IVs}) \quad (1)$$

Table 3 Contingent Valuation Results for the underlying Binomial Probit Model (Decision Step) and Two step Ordinary Least Square Regression (Decision Step 2)

Variable	Decision Step 1 (BPM)	Decision Step 2 (OLS)
	Coefficient	Coefficient
Constant	0.858***	-16.185
EDUC	0.360**	20.378*
GENDER	-0.007	-12.551
INCOME (\$000s)	-0.001	0.092
FAC1	0.244***	18.877***
FAC2	1.164***	83.171***
FAC3	-0.235***	-17.561***
Summary Statistics		
Number of Observations	587	420
Log-Likelihood	-243	-
McFadden Pseudo R-squared	0.307	-
Adjusted R-squared	-	0.569
<i>Note: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively.</i>		

The two underlying individual models were significant ($p < 0.0001$) and the Probit constant was positive, signifying the propensity to choose an improvement option. The McFadden Pseudo R-square has a high value of 31% and the regression Adjusted R-squared scored 57% predictive power, confirming fitness of the underlying models for pooled analysis under the MLE model (Table 4).

Table 4 Contingent Valuation Results for Multilogit Estimates (MLE) of the Selection Model

Variable	Selection (Probit) Equation for Decision Step 1	Corrected Regression Regime
	Coefficient	Coefficient
Constant	0.485**	24.334***
EDUC	0.292	13.820**
GENDER	-0.299	-9.981*
INCOME (\$000s)	0.002	0.100*
FAC1	0.245**	9.649***
FAC2	1.083***	53.773***
FAC3	-0.259**	-11.666***
Summary Statistics		
Number of Observations	587	
Log-Likelihood	-2331	
Probability of Participation	0.58	
CI (95%) for participation	0.38-0.80	
Sample Population WTP (\$)	30.42	
CI (95%) for WTP (\$)	23.88-35.97	
<i>Note: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively.</i>		

The participation rate was calculated as the sum function of the mean for the IVs and their coefficients produced in the ‘selection (Probit) equation for decision step 1’ column. The WTP value for the entire sample population draws on the mean and coefficients of the IV (Formula 1) in the ‘corrected regression regime’ column. The overall sample population model predicted that the sample were willing to pay \$30.42 for a DFW kerbside collection service, and that 58% will participate in the improvement option.

Householders who were highly educated appeared to have the motivation to participate in and be willing to pay for the proposed DFW collection service. The model shows that education, income and gender were not significant in the Participation decision, but they were in the Payment decision, whereas the three behavioural factors were important in both decisions. Householders who cared about FW issues and also those concerned with environment and FW collection, were found to be prospective participants, willing to pay the estimated amount. On the contrary, neither participation in nor payment for the service seem to matter for households who had inclinations towards the FW handling behaviour.

3.2 Choice Modelling

3.2.1 Multinomial Logit Model

The focus here was to predict how the respondents’ choices related to the attributes of the choice sets and other IVs. The multinomial logit (MNL) is the simplest model used to explain observed choices;

it operates by regressing the logarithm of the probability that an alternative is chosen against the levels of the attributes in the alternative (Rolfe, 2006a). It is used to identify respondents' preferences using a utility function for each option, which is expressed as a function of the beta values for each levels of the choice attribute and the predictor variables. The underlying assumption is that respondents choose an alternative with the highest value or utility. An alternative specific constant (ASC), also known as 'intercept', is used to show the influence of unobserved attributes on the respondents' choice of alternatives, typically for an improvement or a status quo option (Morrison et al., 2002; Rolfe, 2006a).

The framework underpinning models of discrete choice among multiple alternative is a random utility model of choice, which is given by (Greene, 2012):

$$\begin{aligned} U(\text{choice } 1) &= f_1(\text{attributes of choice } 1, \text{characteristics of the chooser}, \varepsilon_1, \mathbf{v}, \mathbf{w}) \\ &\dots\dots\dots \\ U(\text{choice } J) &= f_J(\text{attributes of choice } J, \text{characteristics of the chooser}, \varepsilon_J, \mathbf{v}, \mathbf{w}) \end{aligned} \quad (2)$$

where $U(\text{choice } J)$ describes the utility or expression of satisfaction by an individual decision maker of J possible choices, as functions of the choice attributes, the SD characteristics of the chooser, random choice specific elements of preferences, ε_J , that may be known to the chooser but are unobserved by the analyst, and random elements $\mathbf{v}$ and $\mathbf{w}$, that will capture the unobservable heterogeneity across individuals. The underlying theory in Green's formula is the assumption of utility maximization i.e., the choice made is alternative j such that $U(\text{choice } j) > U(\text{choice } q)$ for all $q \neq j$.

A typical utility function of a choice behaviour in a CM is given by (Rolfe, 2006a):

$$\begin{aligned} \text{Log of probability that a particular} & \quad \text{Constant (ASC) + Beta values for attributes +} \\ \text{alternative will be chosen} & = \quad \text{Beta values for attitudinal and demographic variables} \end{aligned}$$

The utility function of the three alternatives for the DFW choice behaviour MNL model was given by:

$$\begin{aligned} U(\text{Alt A}) &= f(\text{ASC} + \text{frequency, cost, methane, odour, lifespan, factors, SD variables}) \\ U(\text{Alt B}) &= f(\text{ASC} + \text{frequency, cost, methane, odour, lifespan, factors, SD variables}) \\ U(\text{Alt C}) &= f(\text{frequency, cost, methane, odour, lifespan}) \end{aligned} \quad (3)$$

In this study, the ASC, attitudinal and socio-demographic variables were used to identify the respondents who preferred the improvement options (Option A and Option B) over those who chose the status quo (Option C).

Overall, 3,522 choice sets were answered (587 total respondents multiplied by six choice sets each). Of these respondents, 64% were in favour of either of the improvement option and 36% for status quo. Tests were run for the combined RRC and LSC dataset until a significant and interpretable model was obtained. The results of the MNL model are shown in Table 5 below:

Table 5. Choice Modelling Results with Multinomial Logit (MNL) Model

Variable	Coefficient	S.E.
ASC	0.010	0.196
FREQ	0.407***	0.045
COST	-0.015***	0.001
METHANE	0.002	0.003
ODOUR	-0.191***	0.046
LIFESPA	0.184***	0.015
INCOME (\$000s)	-0.002*	0.001
FAMILY	0.196*	0.115
GENDER	0.0167	0.087
RESBLOCK	0.151*	0.084
FAC1	-0.381***	0.044
FAC2	-1.285***	0.057
FAC3	0.222***	0.043
FAC4	0.120***	0.045
Number of Observations	3522	
Log-Likelihood	-3252	
AIC	1.855	
Adjusted R ²	0.156	
Participation Rate:		
Improvement option	64%	
Status quo	36%	
Note: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. S.E., standard error; AIC, Akaike Information Criteria		

The model indicated that significant predictions for the choice options came from all the attributes, with the exception of methane. Other significance contributors were income, family and residential block as well as all the four FW behaviour factors. Gender was not significant but was included in the analysis for its contribution in building the best model. The overall MNL model fit was statistically significant, with an adjusted R-square value 15.6% demonstrating strong predictive power for WTP.

The result showed the factors contributing to preferences for the improvement options, with support for the fortnightly DFW collection over the weekly service and extension of local landfills' lifespans. The negatives on cost and odour attributes imply that the higher the cost of collection and likelihood of odour emission from collection bins, the less the respondents will support the improvement options. Households with higher income, who were keen to see FW issues addressed, and have environment and FW collection concerns, represented the status quo group. On the other hand, those who valued FW handling factors, who conformed to reasoning for FW, and were family households living in bigger residential blocks, preferred either of the improvement options.

This MNL model presents aggregate characterization of respondents who wanted the improvement option as well as those choosing a status quo. Most importantly, the ASC is non-significant, meaning there could be more compelling reasons why respondent would choose the improvement options over the status quo or vice versa. The key limitation of the MNL model is that it assumes respondents

have homogenous preference structures. As this is unrealistic, it was important to identify diversity in preferences by applying the latent class model.

3.2.2 Latent Class Model

The LCM is a discrete distribution which identifies a respondent's behaviour from observable attributes and on latent heterogeneity that varies with factors which are not revealed to the analyst (Greene, 2012; Greene & Hensher, 2003). In latent class analysis (LCA), a mixture of probability distributions are used to identify the most likely model that describes the heterogeneity of a data as a fixed number of classes or sub-groups (Magidson & Vermunt, 2002). Greene and Hensher (2003) formulated the probability for the specific choice made by an individual as:

$$P_{it|q}(j) = \text{Prob}(y_{it} = j | \text{class} = q) \quad (3)$$

where J_i represent the alternatives, by individual i observed in T_i choice situations, for a specific choice y_{it} made, sorted into a set of Q classes.

As simulation studies of LCA suggest a sample size of 500 should be the threshold for application (Finch & Bronk, 2011), the sample size in this study of $N = 587$ met the criteria. Determining the number of latent classes to retain was an essential building block of the best model. For that, the Akaike Information Criterion (AIC) was considered as an important measure of the goodness-of-fit of models, which accounts for the number of parameters and number of observations. The model's AIC value of 1.507 was well below the expected average relative to the observed sample (Akaike, 1974; Dziak et al., 2014). The AIC 1.507 was a value the simulation resulted in subcategorising the sample size into three sub-classes hence the decision to choose three LCs for this analysis. The model fitness of the LCA, as shown in Table 6, was adequate given its statistical significance (chi-square statistics = 2493, $df = 32$, $p < 0.0001$) with a strong predictive power of McFadden's Pseudo R-squared statistics = 0.322.

Table 6 Choice Modelling Results with Latent Class Analysis (LCA)

Variable	Latent Class 1		Latent Class 2		Latent Class 3	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
ASC	0.220	0.997	-3.453***	0.961	0.802*	0.474
Frequency	0.701***	0.052	0.179	0.230	-0.165*	0.086
Cost	-0.002	0.005	-0.039***	0.005	-.0542***	0.003
METHANE	0.009**	0.004	-0.003	0.015	-0.015***	0.006
ODOUR	-0.191***	0.066	-0.631*	0.335	-0.098	0.113
LIFESPAN	0.200***	0.020	0.196**	0.090	0.224***	0.034
FAMILY	-0.728	0.902	-0.700**	0.320	-2.248***	0.313
GENDER	0.574	0.537	0.746**	0.291	1.120***	0.231
INCOME (\$000s)	0.004***	0.011	0.020***	0.003	0.033***	0.003
FACTOR 3	-0.594**	0.997	0.304**	0.127	-0.111	0.115
Proportion of sample	41%		31%		28%	

Number of observations	3522		
Log-Likelihood	-2622		
Chi-square statistics (32 degree of freedom)	2493		
AIC	1.507		
McFadden Pseudo R ²	0.322		
Part-worth:			
Frequency	NA	NS	-\$3.047
Methane	NA	NS	-\$0.284
Odour	NA	-\$16.255	NS
Lifespan	NA	\$5.052	\$4.128
ASC	NA	-\$88.996	\$14.808
<i>Note: ***, **, * indicate significance at 1%, 5%, and 10% levels respectively. S.E., standard error; AIC, Akaike Information Criteria; NA, Not Applicable; NS, Not Significant.</i>			

In LC1, despite the some significant predictors in support of the service, the ASC was not significant and the class members were not sensitive to price though income was a significant factor. These implied that the respondents were indifferent to both the improvement and status quo options.

The respondents in LC2, representing 31% of the total sample, had a larger and significant but negative ASC, which means that they were very unlikely to support the improvement options. They were opposed to the cost of the service and odour from collection bins but appeared to have interest in extending the lifespan of the landfill. This sub-class class represented females, higher income earning and smaller family size households who had high scores in the FW handling behaviour factor.

In LC3, which accounted for 28% of the total sample, a smaller but positive ASC was identified, meaning they were somewhat in favour of the improvement options. Females, smaller family size and higher income respondents were more likely to be represented in this class. However, the members were more likely to resist fees for DFW collection services. They lacked interest in methane reductions despite wanting increased landfill lifespans. In addition, there was a scenario for this class members where a total WTP value of \$30.28 was obtained for a fortnightly collection service, methane reduction by 40%, mild odour from the collection bins, and extension of landfill lifespan by one year.

The last step in the LCA was deriving the average WTP for the options under consideration. In CM experiments, this is expressed in terms of consumer surplus (CS) and is a measure of marginal satisfaction (utility) from consuming one more unit of a good or service that is being offered (McConnell, 1995) i.e., the trade-off between one more unit of an attribute and the WTP. The CS for changes in only one attribute is also known as part-worth, and is calculated by dividing an attribute's coefficient (β) with the negative of the coefficient for the monetary (cost) attribute (Rolfe et al., 2000):

$$\text{Part-worth (attribute)} = -1 \times \beta_{\text{attribute}} / \beta_{\text{cost}} \quad (4)$$

The part-worth calculations for LC1 could not be performed as 'cost' was not statistically significant. For LC2 status quo group, WTP declined by \$16.25 if the level of odour was to increase from mild to moderate and increased by \$5.05 for a landfill lifespan extension. The group also had an ASC part-worth amounting to -\$89, indicating the overall value of their disinclination to support the improvement option. For LC3, members had a value of \$4.13 for an improvement in landfill lifespan extension but their utility declined by \$3.05 for a fortnightly DFW collection, relative to the weekly service. Despite interest in landfill lifespan extension however, the group's WTP declined by \$0.28 for reductions in the rates of methane emission from DFW diversion. The overall value of the group's inclination to support the improvement option was \$14.81.

4. Discussion

The results offered a range of insights into the valuation of attributes and trade-offs to be made regarding choices and preferences in the DFW collection service. The observed participation rates and correlations between WTP and the predictor variables are potential indicators of householders' motivations towards the diversion initiative, if implemented. The research approach of progressing from simple CVM models, followed by a two-stage regression model and finally the CM models, provided key insights. These included identifying the proportion of respondents who were likely to support the proposed service; significant behavioural and SD factors that appeared to explain their support; how support and WTP were sensitive (or not) to different elements of the improvement options (the CM models); and how the support varied across different respondent sub-groups (the LCM results).

4.1 A synopsis on the structure of the models

The significant predictor variables (Figure 2) were found to be identical across the CVM models. The WTP estimates (\$30) and coefficient values between the initial Tobit 'all' model and the subsequent MLE model were almost identical. This confirms to insights of standard economic that WTP should be relatively stable across decision contexts (Samson, 2017). However, the coefficients for the initial Tobit 'pay only' model substantially differed from those estimated using the MLE model, perhaps because of differences in sample sizes. The MLE model results could be considered credible as estimations were done on a corrected sampling regression procedure.

Figure 2 Significant Socio-demographic and Behaviour Factors for WTP in the CVM Models.
(The red dashed borders indicate significant predictors driving lower WTP estimates)

In the LCM, cost, income, lifespan and gender (Figure 3) were variables of considerable significance across LC 2 and LC 3, either in support or against the proposed program. Despite cost appearing not significant for the indifferent LC 1 members, prospects for support could be foreseeable given observed significances in methane reduction and increase in landfill lifespan. For the status quo LC 2, all predictors, except for frequency and methane, were significant in influencing participants' choices and decisions towards the program. Their resistance for support might possibly be due in part to reduced utility (-\$16.25) of odour emission from collection bins. For the support seeking LC 3 members, all predictors were significant, except for odour and FW handling behaviours. These class members appeared to have diminished propensity (-\$0.28) to potential methane reduction from DFW diversion. The LCM provided better understanding of the sub-classes of respondents and their behaviour influencing factors are indicated in Table 6 and Figure 3 below.

Figure 3 Significant Choice Attributes, Socio-demographic, and Behaviour Factors for WTP in LCA
(The red dashed borders indicate significant predictors driving less WTP likelihoods or declining part-worth)

It was evident that there were similarities in the significant WTP predictors between the CM and CVM valuation techniques. Higher income groups preferred the improvement options, showing WTP in both the CVM (Multilogit Estimator) and LCM models. Apparent similarities were also observed such that the status quo group in LC 2 were more interested in FW handling and those who scored high in FW handling appeared less likely to show WTP under the CVM models. On the contrary, female respondents supported the improvement options in the LCMs while the opposite was true for the CVM models. This does not imply that the model estimates were unreliable, since the preferences questions were presented in two different ways in the two valuation techniques. Overall, the LCM was more useful than the MNL model in terms of informing the Councils about the scale of householders' preferences, their SD characteristics and heterogeneity. In the LCM, the sub-groups of residents, choosing different levels of the attributes, are distinctively shown in relation to both the improvement as well as the status quo options.

4.2 Key predictors influencing choice preferences and WTP

The importance of asking and valuating service-users' preference were found to be crucial in this study. What may be of even greater importance is understanding the underlying socio-demographic and behavioural contexts in which those choice preferences were made. Despite limited research on the non-market use value estimates of DFW collection programs, this study had some similar predictors as in previous WTP studies for kerbside waste collection services (Boyer, 2006; Gillespie & Bennett, 2012; Karousakis & Birol, 2008). For example, gender, household income, education, environmental concerns, existing recycling practices, and cost of services had appeared to be the significant factors influencing WTP in some similar and contrasting manner.

Despite higher income appearing as the enabling factor to pay for the improvement options, the issue of affordability was a concern as cost was the most significant WTP prohibitive factor. This might have surfaced mainly from the perception of low income or frugal households who thought the existing services were already high, thus lack the WTP for an additional collection service. This may not always be the case as higher income was a significant predictor for the status quo group, who could also be avoiding WTP for other latent reasons. This suggests that earning higher income does not stimulate agreeableness to bear the costs that come with collection services. Female respondents were simultaneously represented as supporters of the proposed program yet were apparently lacking the WTP for it. This could be the effect of females' higher inclination to GWB disposal of unconsumed food than males, thus supporting DFW collection; females were also reported as more involved in composting than males, perhaps also justifying a lack of WTP for the proposed service.

The issue of odour was a key negative factor for the status quo group, which may have discouraged their support and participation. The improvement-seeking members' preference for a weekly collection over a fortnightly, might also have influenced their insensitivity towards odour as more frequent collection is likely to reduce odour from the bins. As seen in the case of councils in North Eastern Victoria, participation and diversion rates proved successful when transitioning to weekly organic and fortnightly GW collections (Sustainability Victoria, 2018). Also important to note is that the improvement-seeking respondents could have been strategic in their selection of specific levels of a choice attribute(s). The resulting inconsistency in their declining utility for methane reduction but increasing utility for landfill lifespan extension was a case in point. Landfill lifespan extension was significant for all the LCs, possibly implying concerns the residents have over the impacts of DFW on the ecosystems.

The link between WTP and the FW focus predictor is believed to come from the predictor's association with concerns for and desires to reduce DFW as well as food purchasing, consumption and disposal behaviours. As identified in Table 2, the FW handling factor comprised respondents who practiced backyard composting and those who had other preferences to handle unconsumed food, GWB disposal being the most preferred (44%). This behavioural factor was positively significant in the status quo group (LS2), meaning the group was not interested in paying for a DFW diversion service but rather handle unconsumed food through composting or disposal. This factor was also negatively significant with respect to WTP in the CVM models as backyard composters might have made the influence on the preference outcome. The environment and FW collection factor was a construct of WTP for kerbside FW collection; acceptance of fortnightly GWB collection; and environmental and social wellbeing obligations. This was a plausible ground for the significant relationship between WTP and this predictor in the CVM models.

There could be possible explanations for the inconsistent or unexpected WTP-predictor relationships observed in LC 3, who supported the improvement option but were opposed to methane reduction. The respondents might be lacking awareness or were not convinced about the relationship between avoidance of DFW disposal at landfills and its possible effect in reducing methane emission. It could also be due to 'elimination by aspects' (Tversky, 1972); in choice probabilities, the interpretation and selection of a desired aspect often results in the dismissal of all other alternatives that do not contain the selected aspect. Correspondingly, the effect of 'less-is-better' or preference reversal could have influenced the respondents' judgement—a tendency to have exclusive focus on attributes that are easy to assess when evaluating things separately rather than jointly (Samson, 2017). As Yu & Abler (2010) noted, zero WTP does not imply zero marginal utility of environment quality; people could either believe that other agents such as governments and polluters should be responsible for

improvements in environmental quality. It could also be possible that energy production from methane was what they thought important than emissions reduction at the landfill sites.

Overall, the CVM model showed that approximately 58% of residents would support a DFW diversion option, although the estimated WTP of \$30.42 was low. An annual rate of only \$747,343 would be raised from the diversion program considering 58% participation of the total 42,131 households in the Council areas, paying \$30.42/year. In the LC models of the CM exercise, support was much more complicated than this – the different classes of respondents have varying levels of motivations and support, which probably means that there is currently no single option that the Councils could present to generate more than 50% support or a high enough WTP to justify and launch the service. Considering the scenario of a \$30.28 WTP for the improvement group, a total rate amount of \$357,203 per year would be raised if 28% of the respondents were to participate in the diversion program—an amount lower by more than half than that of the rate from the CVM. It should be noted that the respondents' scenarios are also subject to change over time as perceptions, information and attitudes of the residents change.

5. Conclusions and Implications

In this study, the non-market values of attributes linked to DFW generation and disposal were assessed, using a survey in regional Queensland. The analyses focused on DFW prevention attributes, the residents' food-related attitudes, and SD characteristics as key determinants of WTP using contingent valuation method and choice modelling exercises. The preferences and level of utilities revealed a range of sensitivities to the attributes. This substantiated the presence of measurable dispositions the residents have towards the role of environmental goods and services in their Council areas.

In the overall models, a range of important factors were identified to influence WTP for and participation in a DFW collection program. The factors included cost, odour, lifespan, income, gender, education, family composition, FW focus, FW handling, and environmental and FW collection. The choice preferences and the WTP estimates could have also been influenced by non-environmental attributes other than those presented in the study (e.g., respondents' sentiments about what the Councils do with recyclable items). Also important to note was that both intrinsic and extrinsic values towards the collection service were possibly provisional. If householders' circumstances (e.g., income) were to change, so will the stated preferences as changes essentially influence decision making.

Monetary disincentives such as fees and charges levied to discourage wastefulness could prove productive and/or counter-intuitive to behavioural changes. For example, in this study, zero, positive and negative WTP were observed. Under the CVM exercise, a two stage estimator for the overall

sample population showed a WTP of \$30.426, with 58% participation rate for the improvement option. In the CM exercise, LCA results showed that from the total 587 survey respondents, 41%, 31% and 28% were indifferent, status- quo and improvement seeking sub-class proportions respectively. The results revealed that cost was a highly significant factor across all WTP estimates. Even so, the improvement seeking group's part-worth showed a \$4.13 increase for an extension in the lifespan of the local landfills. However, the group's utility declined by \$3.047 if collection frequency was to become fortnightly instead of weekly. A peculiar relationship was also observed for the improvement group such that their utility declined by \$0.28 if the rate for methane reduction was to increase.

A comparison of model estimates in this study with results from other DFW behaviour studies was difficult due to differences in the sample characteristics and statistical tools used. Nevertheless, this valuation effort signified the role of accounting for householders' preferences, if DFW diversion could indeed be a viable policy option in the Councils. It is also hoped that the results and techniques employed will contribute to future larger scale research in the domains of DFW prevention, reduction or diversion initiatives.

References

- Adamowicz, W. (2004). What's it worth? An examination of historical trends and future directions in environmental valuation. *Australian Journal of Agricultural and Resource Economics*, 48(3), 419-443.
- Adamowicz, W., Louviere, J., & Williams, M. (1994). Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities. *Journal of Environmental Economics and Management*, 26(3), 271-292. doi:<https://doi.org/10.1006/jeem.1994.1017>
- Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, 19(6), 716-723. doi:10.1109/TAC.1974.1100705
- Atkinson, S. E., Crocker, T. D., & Shogren, J. F. (1992). Bayesian exchangeability, benefit transfer, and research efficiency. *Water Resources Research*, 28(3), 715-722.
- Australian Bureau of Statistics (ABS). (2007). *Australian social trends: household waste (1321–1781)*. Retrieved from [http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/51EE403E951E7FDACA25732F001CAC21/\\$File/41020_Australian%20Social%20Trends_2007_ADJUSTED.pdf](http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/51EE403E951E7FDACA25732F001CAC21/$File/41020_Australian%20Social%20Trends_2007_ADJUSTED.pdf)
- Australian Bureau of Statistics (ABS). (2017a). 2016 Census QuickStats, Livingstone. Retrieved from http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LG_A34530?opendocument, January 19, 2018.
- Australian Bureau of Statistics (ABS). (2017b). 2016 Census QuickStats, Rockhampton. Retrieved from http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LG_A36370?opendocument, January 19, 2018.
- Baker, R., & Ruting, B. (2014). *Environmental policy analysis: a guide to non-market valuation, Productivity Commission Staff Working Paper*. Retrieved from Canberra.: <http://www.pc.gov.au/research/supporting/non-market-valuation/non-market-valuation.pdf>

- Bateman, I. J., Day, B., Dupont, D., Georgiou, S., Matias, N., Morimoto, S., & Subramanian, L. (2006). Cost-benefit analysis and the prevention of eutrophication. In D. Pearce (Ed.), *Environmental Valuation in Developed Countries: Case Studies* (pp. 317-339). Cheltenham, UK: Edward Elgar
- Bateman, I. J., Day, B. H., Georgiou, S., & Lake, I. (2006). The aggregation of environmental benefit values: welfare measures, distance decay and total WTP. *Ecological Economics*, 60(2), 450-460.
- Bennett, J. (2011). Estimating the value of Australian environmental assets. *Australasian Journal of Environmental Management*, 18(1), 21-32.
- Bennett, J., & Blamey, R. (2001). *The choice modelling approach to environmental valuation*: Edward Elgar Publishing.
- Boyer, T. A. (2006). *Talking trash: valuing household preferences for garbage and recycling services bundles using a discrete choice experiment*. Paper presented at the 2006 Annual meeting, July 23-26, Long Beach, CA.
- Boyle, K. J. (2003). Contingent valuation in practice. In P. A. Champ, K. J. Boyle, & T. C. Brown (Eds.), *A Primer on Nonmarket Valuation* (pp. 111-169). The Netherlands: Springer.
- Boyle, K. J. (2017). Contingent Valuation in Practice. In P. A. Champ, K. J. Boyle, & T. C. Brown (Eds.), *A Primer on Nonmarket Valuation* (pp. 83-131). Dordrecht: Springer Netherlands.
- Carson, R. T. (2012). Contingent valuation: a practical alternative when prices aren't available. *Journal of Economic Perspectives*, 26(4), 27-42. doi:10.1257/jep.26.4.27
- Champ, P. A. (2003). A Primer on Non-market Valuation. In I. J. Bateman (Ed.), *A Primer on Nonmarket Valuation* (2nd ed. 2017 ed., Vol. 13). Dordrecht: Dordrecht: Springer Netherlands.
- Commonwealth of Australia. (2017). *National Food Waste Strategy: Halving Australia's Food Waste by 2030*. Canberra: Commonwealth of Australia.
- Dziak, J. J., Lanza, S. T., & Tan, X. (2014). Effect Size, Statistical Power, and Sample Size Requirements for the Bootstrap Likelihood Ratio Test in Latent Class Analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, 21(4), 1-19. doi:10.1080/10705511.2014.919819
- Finch, W. H., & Bronk, K. C. (2011). Conducting Confirmatory Latent Class Analysis Using M plus. *Structural Equation Modeling: A Multidisciplinary Journal*, 18(1), 132-151. doi:10.1080/10705511.2011.532732
- Gillespie, R., & Bennett, J. (2012). Willingness to pay for kerbside recycling in Brisbane, Australia. *Journal of Environmental Planning and Management*, 56(3), 362-377. doi:10.1080/09640568.2012.681033
- Greene, W. H. (2012). *NLOGIT 5 Reference Guide*. Econometric Software Inc., Plainview, NY
- Greene, W. H., & Hensher, D. A. (2003). A latent class model for discrete choice analysis: contrasts with mixed logit. *Transportation Research Part B: Methodological*, 37(8), 681-698. doi:[https://doi.org/10.1016/S0191-2615\(02\)00046-2](https://doi.org/10.1016/S0191-2615(02)00046-2)
- Halstead, J. M., Lindsay, B. E., & Brown, C. M. (1991). Use of the Tobit model in contingent valuation: experimental evidence from the Pemigewasset Wilderness Area. *Journal of Environmental Management*, 33(1), 79-89.
- Hanley, N., Mourato, S., & Wright, R. E. (2001). Choice modelling approaches: a superior alternative for environmental valuation? *Journal of Economic Surveys*, 15(3), 435-462. doi:10.1111/1467-6419.00145
- Hanley, N., Wright, R. E., & Alvarez-Farizo, B. (2006). Testing for Benefit Transfer Over Water Quality Benefits *Choice Modelling and the Transfer of Environmental Values* (pp. 97-111).
- Heckman, J. J. (1979). Sample Selection Bias as a Specification Error. *Econometrica*, 47(1), 153-161.
- Johnston, R. J., Rolfe, J., Rosenberger, R. S., & Brouwer, R. (2015). *Benefit transfer of environmental and resource values* Benefit Transfer of Environmental and Resource Values. A Guide for Researchers and Practitioners, Vol. 14. I. J. Bateman (Ed.)

- Jones, A. (1989). A double-hurdle model of cigarette consumption. *Journal of applied Econometrics*, 4(1), 23-40. doi:10.1002/jae.3950040103
- Karousakis, K., & Birol, E. (2008). Investigating household preferences for kerbside recycling services in London: A choice experiment approach. *Journal of Environmental Management*, 88(4), 1099-1108. doi:<https://doi.org/10.1016/j.jenvman.2007.05.015>
- Krinsky, I., & Robb, A. L. (1986). On approximating the statistical properties of elasticities. *The Review of Economics and Statistics*, 715-719.
- Ku, S.-J., Yoo, S.-H., & Kwak, S.-J. (2009). Willingness to pay for improving the residential waste disposal system in Korea: A choice experiment study. *Environmental Management*, 44(2), 278-287.
- Livingstone Shire Council (LSC). (2018). *Livingstone Shire Council Budget and Operational Plan 2018/19*. Retrieved from <https://www.livingstone.qld.gov.au/1479/2018---2019-Budget> August 28, 2019.
- Magidson, J., & Vermunt, J. K. (2002). Latent class models for clustering: A comparison with K-means. *Canadian Journal of Marketing Research*, 20(1), 36-43.
- McConnell, K. E. (1995). Consumer surplus from discrete choice models. *Journal of Environmental Economics and Management*, 29(3), 263-270.
- Mitchell, R. C., & Carson, R. T. (1989). *Using surveys to value public goods: the contingent valuation method*: Rff Press.
- Morrison, M., Bennett, J., Blamey, R., & Louviere, J. (2002). Choice modeling and tests of benefit transfer. *American journal of agricultural economics*, 84(1), 161-170.
- Pearce, D. (1998). Auditing the Earth: The Value of the World's Ecosystem Services and Natural Capital. *Environment: Science and Policy for Sustainable Development*, 40(2), 23-28. doi:10.1080/00139159809605092
- Pearce, D. (2006). *Environmental valuation in developed countries: case studies*: Edward Elgar Publishing.
- Queensland Government. (2017). *Recycling and Waste in Queensland*. Retrieved from <https://www.qld.gov.au/environment/pollution/management/waste/recovery/data-reports/recycling-waste> November 12, 2018.
- Randell, P., Pickin, J., & Grant, B. (2014). *Waste generation and resource recovery in Australia Reporting period 2010/11. Prepared for the Australian Government Department of Sustainability, Environment, Water, Population and Communities*. Retrieved from <http://www.environment.gov.au/system/files/resources/4b666638-1103-490e-bdef-480581a38d93/files/wgrra.pdf> July 12, 2018.
- Rockhampton Regional Council (RRC). (2016). *Waste Reduction and Recycling Plan. Rockhampton Regional Waste and Recycling*. Retrieved from <http://www.rockhamptonregion.qld.gov.au/CouncilServices/Rockhampton-Regional-Waste-and-Recycling> April 22, 2016.
- Rockhampton Regional Council (RRC). (2018). *Rockhampton Regional Council 2018/2019 Budget Report*. Retrieved from <https://www.rockhamptonregion.qld.gov.au/AboutCouncil/Finance-Rates-and-Budget/Budget> August 28, 2018.
- Rolfe, J. (2006a). A simple guide to choice modelling and benefit transfer. In J. Rolfe & J. Bennett (Eds.), *Choice Modelling and the Transfer of Environmental Values* (pp. 10-27). Cheltenham, UK: Edward Elgar.
- Rolfe, J. (2006b). Theoretical Issues in Using Choice Modelling Data for Benefit Transfer. In J. Rolfe & J. Bennett (Eds.), *Choice Modelling and the Transfer of Environmental Values* (pp. 28-53). Cheltenham, UK: Edward Elgar.
- Rolfe, J., & Bennett, J. (2006). *Choice modelling and the transfer of environmental values*. Cheltenham: Edward Elgar.
- Rolfe, J., Bennett, J., & Louviere, J. (2000). Choice modelling and its potential application to tropical rainforest preservation. *Ecological Economics*, 35(2), 289-302.

- Samson, A. (2017). *The Behavioral Economics Guide 2017 (with an introduction by Cass Sunstein)*. Retrieved from <http://www.behavioraleconomics.com> February 15, 2018.
- Schaafsma, M., & Brouwer, R. (2013). Testing geographical framing and substitution effects in spatial choice experiments. *Journal of Choice Modelling*, 8, 32-48.
- Scheufele, G., & Bennett, J. (2013). Effects of alternative elicitation formats in discrete choice experiments. *Australian Journal of Agricultural and Resource Economics*, 57(2), 214-233.
- Segerson, K. (2017). *Valuing Environmental Goods and Services: An Economic Perspective*. In: Champ P., Boyle K., Brown T. (eds) *A Primer on Nonmarket Valuation. The Economics of Non-Market Goods and Resources*. Vol. 13. Springer, Dordrecht.
- Sustainability Victoria. (2015). *Statewide waste and resource recovery infrastructure plan Victoria 2015-44*. Retrieved from <http://www.sustainability.vic.gov.au/our-priorities/statewide-waste-planning/2015-2020-priorities/statewide-waste-and-resource-recovery-infrastructure-plan> April 20, 2016.
- Sustainability Victoria. (2018). *Introducing a kerbside food and garden organics collection service*. Retrieved from <https://www.mwrrg.vic.gov.au> October 25, 2018.
- Tobin, J. (1958). Estimation of relationships for limited dependent variables. *Econometrica: Journal of the Econometric Society*, 24-36.
- Tversky, A. (1972). Elimination by aspects: a theory of choice. *Psychological Review*, 79(4), 281-299. doi:10.1037/h0032955
- Waste and Resources Action Program [WRAP]. (2015). *Household Food Waste in the UK*. Retrieved from <http://www.wrap.org.uk/sites/files/wrap/Household food waste in the UK 2015 Report.pdf> June 16, 2016.
- Whitehead, J. C., Morgan, O. A., & Huth, W. L. (2015). Benefit transfers with the contingent valuation method. In I. J. Bateman (Ed.), *Benefit Transfer of Environmental and Resource Values* (pp. 119-140). Dordrecht: Springer.
- Whittington, D. (2002). Improving the performance of contingent valuation studies in developing countries. *Environmental and Resource Economics*, 22(1-2), 323-367.
- Yu, X., & Abler, D. (2010). Incorporating zero and missing responses into CVM with open-ended bidding: willingness to pay for blue skies in Beijing. *Environment and Development Economics*, 15(5), 535-556. doi:10.1017/S1355770X10000197

**Assessing Behaviours and Policy Preferences relating to Domestic Food Waste Reduction:
A Central Queensland case study**

Thank you for your support of this important research study about managing food waste in your local area.

The research is aimed at understanding what factors influence your decisions and behaviours in relation to food utilization and management at home. It will also investigate food waste reduction options you might prefer to support and participate in. The survey should take you approximately 15-20 minutes to complete. All data from the survey will be reported in de-identified and/or aggregate format, meaning that no single individual is named in any material arising. The information you are going to provide will also be confidentially and securely maintained.

The result of the study will help inform government policies to improve current and future food waste management practices in the Central Queensland region.

If you have any questions, difficulties or concerns please feel free to contact:

Addis Benyam P:(07) 4923 2253 E:a.benyam@cqu.edu.au

In addition you can contact the CQU Office of Research Ethics and Compliance Officer (Tel: 07 4923 2607 or e-mail: ethics@cqu.edu.au) should there be any concerns about the nature and/or conduct of this research project.

Section 1: Household information

To begin we will ask a few details about your locality and household.

Q1.1: In which local government (Council) area do you currently reside?

Rockhampton Regional Council area

Livingstone Shire Council area

Other Council area (not eligible to take this survey)

Q1.2: Please enter your SUBURB name:

Q1.3: Is your household:

Single person

Family, adults only (18+)

Family with children (under 18) at home

Shared house, non-related residents

Shared accommodation (e.g. homestay, university residence, retirement home)

Other (please specify)

Section 2: Food shopping, consumption and storage

The next few questions ask about your usual grocery shopping habits and the ways in which food is used and stored in your household.

Q2.1: How often does your HOUSEHOLD shop for groceries?

- Twice a week or more
- Once a week
- Fortnightly
- Monthly or less
- Not applicable

Q2.2: How much of the household grocery shopping do YOU do?

- All
- Most
- Some
- A little
- None

Q2.3: How often do you eat out (away from home) or purchase take-out food?

- Twice a week or more
- Once a week
- Fortnightly
- Monthly or less
- Not applicable

Q2.4: How regularly do you check what is available at home and prepare a list before shopping for food?

- Never
- Rarely
- Sometimes
- Often
- Always
- Not applicable

Q2.5: My household's food is mostly obtained from:**(Please pick up to three options by numbering boxes 1, 2, 3, with 1 = most frequently)**

- Supermarkets
- Food Co-ops
- Community or farmers' market
- Grow my (our) own food (e.g. vegetables, chickens)
- Corner stores/speciality stores (e.g. fast food, deli)
- Food from guests, friends or family members
- Online shopping and home delivery
- Other (please specify)

Q2.6: How regularly do you check date labels before buying food?

- Never
- Rarely
- Sometimes
- Often
- Always
- Not applicable

Q2.7: Thinking about food items that you often buy but do not eat, what would be the most likely reasons for this happening?

(Please pick up to three options by numbering boxes 1, 2, 3, with 1 = most likely)

- Taste changed
- Food is no longer fresh
- Food is no longer fancied (e.g. I bought too much of one thing?)
- Health concern (e.g. becoming ill from contaminated foodstuffs)
- Plans change for the day or week
- Not sure how to cook or what ingredients to use
- Other (please specify)

Q2.8: Thinking about two statements below, what would be the most likely items in your household?
(Please pick up to three options for both A and B by numbering boxes 1, 2, 3, with 1 = most likely)

	(A) Which food items are most likely to go uneaten in your household?	(B) Which food items most regularly end up in the general waste bin?
Bulk/loose fruits & vegetables	<input type="text"/>	<input type="text"/>
Packaged & frozen fruits & vegetables	<input type="text"/>	<input type="text"/>
Dairy products	<input type="text"/>	<input type="text"/>
Poultry products	<input type="text"/>	<input type="text"/>
Canned vegetables	<input type="text"/>	<input type="text"/>
Canned meals (e.g. soup)	<input type="text"/>	<input type="text"/>
Baked food (e.g. bread, pastry)	<input type="text"/>	<input type="text"/>
Cooked & frozen food	<input type="text"/>	<input type="text"/>
Take-out food	<input type="text"/>	<input type="text"/>
Mixed food items (meal leftovers)	<input type="text"/>	<input type="text"/>
Ingredients (e.g. spices)	<input type="text"/>	<input type="text"/>
Others (please specify) <input type="text"/>	<input type="text"/>	<input type="text"/>
None	<input type="text"/>	<input type="text"/>

Q2.9: In my household, wasted food is most likely to end up:

In the general waste bin

In the recycling bin

Being fed to pets

Sink or drain disposal

Composted

Other (please specify)

Q2.10: How regularly do you end up having contamination by foodstuff in your recycling bin?

Never

Rarely

Sometimes

Often

Always

Not applicable

Q2.11: Of the food that is purchased in your household in a typical week or fortnight, what percentage do you think is consumed? (%)

Section 3: Food utilisation

The following questions will focus on knowledge, attitudes, awareness, perception and motivation related to food utilisation.

Q3.1: How regularly do you check for storage instructions on food labels if these are provided?

- Never
- Rarely
- Sometimes
- Often
- Always
- Not applicable

Q3.2: How concerned are you about the amount of food purchased but not consumed in your household?

- Not concerned
- Slightly concerned
- Moderately concerned
- Very concerned

Q3.3: In your household, what is the most important reason to avoid wasting food?
(Please pick up to three options by numbering boxes 1, 2, 3, with 1 = most important)

- ☐ Economic reason (personal saving)
- ☐ Environmental concerns (pollution prevention)
- ☐ Social reason (food shortage elsewhere)
- ☐ The desire to manage my home efficiently
- ☐ The desire to not feel guilty from wasting food
- ☐ Other (please specify)

Q3.4: To what extent would you be interested to reduce food waste further?

- Not at all
- Very little
- Somewhat
- To a great extent
- Not applicable - Do not waste any food

Section 4: Factors related to food waste

This section will ask your knowledge and preferences about environmental and socio-economic issues related to food waste.

Q4.1: In the last 5 years, have you or anyone in your household:

Been a member of environmental advocacy group(s)?

Participated in environmental campaigns?

Donated money to an environmental cause?

None of the above

Q4.2: Imagine that your Council was able to direct new money into one area of operation. Which of the following would you prefer this to be spent on?

(Please pick up to three options by numbering boxes 1, 2, 3, with 1 = most important)

- Parks, gardens & recreation areas
- Better waste management
- Road maintenance (e.g. fixing potholes)
- Improvements to the CBD
- Public library services
- Sport facilities (e.g. gym)
- Other (please specify)

Q4.3: Thinking about an average week, what percentage of your general waste bin is food waste?

- None
- Less than 10%
- About 10%
- About 20%
- About 30%
- About 40%
- More than 40%

Q4.4: Thinking about an average week, what percentage of your general waste bin is garden waste?

- None
- Less than 10%
- About 10%
- About 20%
- About 30%
- About 40%
- More than 40%

Q4.5: Please rank the following materials in terms of your preference that they be recycled instead of sent to Council landfill

(Please pick up to three options by numbering boxes 1, 2, 3, with 1 = most preferred)

- ☐ Household packaging & printed papers
- ☐ Beverage containers (cans and plastics)
- ☐ Organic waste (household food & garden waste)
- ☐ Single use plastic bags
- ☐ Electronic waste (old machines and appliances)
- ☐ Others (please specify)

Q4.6: Which of the following do you think are the most important reasons to avoid food waste going to Council landfill?
(Please pick up to three options by numbering boxes 1, 2, 3, with 1 = most important)

- ☐ Improve food availability
- ☐ Reduce organic contamination in the recycling bins
- ☐ Reduce harmful greenhouse gas emissions
- ☐ Extend the lifespan of the existing landfill
- ☐ Production of quality compost for home garden & public spaces
- ☐ Create local business opportunity for organic waste recyclers

Section 5: Your choices and preferences

The following questions will ask you to make (hypothetical) choices about food waste reductions and management policy options.

Q5: Suppose a policy is to be implemented to prohibit the disposal of food waste in your household's general waste bin and at the Council landfill. Which of the policy options below would you prefer be implemented to assist households in reducing their food waste?

Please pick up to three preferences from the following list of policy options by numbering boxes 1, 2, 3, with 1 = most preferred.

- Home/backyard composting
- Community composting
- Green bin residential food waste collection program
- Education to avoid over purchasing and over consumption
- I would not support any option
- I would like to suggest other option(s) (please specify)

IMPORTANT! The next 6 questions will present you with various options and ask you to choose which option you would most prefer. Before proceeding to these questions, please read the information provided below.

Statement of the Policy Options:

Suppose your Council was to offer a separate bin for food waste residential kerbside collection. This bin would be in addition to the general waste bin and recycling bin, if your household is currently being serviced by those bins.

If the policy is implemented, your Council could become the second Council in Queensland, next to Ipswich City Council (currently collecting green waste, fruits and vegetables), to take proactive measures in reducing, diverting and/or managing food waste.

How does the policy option affect you?

- Implementing the policy will involve kerbside collection and management costs. One viable way to accomplish that is for the local government to collect an annual service fee from rate payers.
- The amount of the rate and the environmental outcome of the program will depend on some important attributes of the policy options the local community would prefer to choose.
- The next 6 questions will show some combination of possible policy options. Answering these will help us to identify the most important factors for people in making the choices.

Box 5.1 below provides descriptions of environmental outcomes of the three attributes provided in the next 6 choice set questions. You are highly encouraged to complete the 6 questions even if your household is not currently being serviced by a kerbside bin collection. Please take some time to review this information before proceeding.

Box 5.1 Description of the Environmental Outcomes of the Policy Options

Attributes of Environmental Outcomes	Description
<p>a.</p> <p>Methane gas</p>	<ul style="list-style-type: none"> Decomposition of food in the absence of oxygen (anaerobic decomposition) generates and releases greenhouse gases like methane and carbon dioxide into the atmosphere. Methane is an odourless gas but very harmful to the environment and health of humans and animals. The collection and recycling/processing of food waste into a usable material (compost) reduces methane release and its harmful impacts.
<p>b.</p> <p>Odour</p>	<ul style="list-style-type: none"> Collecting food waste at a reasonable frequency reduces the level of odour to be emitted from odour creating gases at the source of generation (households) and landfilling or processing sites. Odour can be reduced in other ways, such as wrapping food waste in biodegradable bags when disposing.
<p>c.</p> <p>Landfill lifespan</p>	<ul style="list-style-type: none"> Disposal of high volume of household food waste at landfills quickly takes up valuable space. Diverting food waste from landfill saves space and extends landfill lifespan.

When you have finished reviewing this information, click the next arrow to begin answering the first of 6 choice sets.

Carefully consider the choices provided below.

Choice Set 1

Options	Frequency of Food Waste Collection (240 Litre bin)	Annual Rent on Your Rates Notice	Environmental Outcomes of Attributes		
			(a) Contribution of Household Food Waste to Methane Gas at Council Landfill (%)	(b) Level of Odour Concern from Collection Bins	(c) Extend the Life-span of the Current Landfill
OPTION A	Weekly	\$75	Decreased to 40%	Moderate	Extend by 1 year (to 2035)
OPTION B	Fortnightly	\$75	Decreased to 20%	Mild	Extend by 5 years (to 2039)
OPTION C	None	\$0	Current situation: 50%	Current situation: Not applicable	Current situation: Reaching full capacity in 2034

Q5.1: If three policy options were to be proposed by your Council to start the program, and Options A, B, and C were the only ones available, which one would you prefer the most?

OPTION A **OPTION B** **OPTION C** **UNSURE**

RRCv1-1

Carefully consider the choices provided below.

Choice Set 2

Options	Frequency of Food Waste Collection (240 Litre bin)	Annual Rent on Your Rates Notice	Environmental Outcomes of Attributes		
			(a) Contribution of Household Food Waste to Methane Gas at Council Landfill (%)	(b) Level of Odour Concern from Collection Bins	(c) Extend the Life-span of the Current Landfill
OPTION A	Weekly	\$25	Decreased to 20%	Moderate	Extend by 5 years (to 2039)
OPTION B	Fortnightly	\$25	Decreased to 40%	Mild	Extend by 1 year (to 2035)
OPTION C	None	\$0	Current situation: 50%	Current situation: Not applicable	Current situation: Reaching full capacity in 2034

Q5.2: If three policy options were to be proposed by your Council to start the program, and Options A, B, and C were the only ones available, which one would you prefer the most?

OPTION A

OPTION B

OPTION C

UNSURE

RRCv1-2

Carefully consider the choices provided below.

Choice Set 3

Options	Frequency of Food Waste Collection (240 Litre bin)	Annual Rent on Your Rates Notice	Environmental Outcomes of Attributes		
			(a) Contribution of Household Food Waste to Methane Gas at Council Landfill (%)	(b) Level of Odour Concern from Collection Bins	(c) Extend the Life-span of the Current Landfill
OPTION A	Weekly	\$25	Decreased to 20%	Mild	Extend by 1 year (to 2035)
OPTION B	Fortnightly	\$25	Decreased to 40%	Moderate	Extend by 3 years (to 2037)
OPTION C	None	\$0	Current situation: 50%	Current situation: Not applicable	Current situation: Reaching full capacity in 2034

Q5.3: If three policy options were to be proposed by your Council to start the program, and Options A, B, and C were the only ones available, which one would you prefer the most?

OPTION A

OPTION B

OPTION C

UNSURE

RRCv1-3

Carefully consider the choices provided below.

Choice Set 4

Options	Frequency of Food Waste Collection (240 Litre bin)	Annual Rent on Your Rates Notice	Environmental Outcomes of Attributes		
			(a) Contribution of Household Food Waste to Methane Gas at Council Landfill (%)	(b) Level of Odour Concern from Collection Bins	(c) Extend the Life-span of the Current Landfill
OPTION A	Fortnightly	\$75	Decreased to 40%	Moderate	Extend by 1 year (to 2035)
OPTION B	Weekly	\$75	Decreased to 20%	Mild	Extend by 5 years (to 2039)
OPTION C	None	\$0	Current situation: 50%	Current situation: Not applicable	Current situation: Reaching full capacity in 2034

Q5.4: If three policy options were to be proposed by your Council to start the program, and Options A, B, and C were the only ones available, which one would you prefer the most?

OPTION A

OPTION B

OPTION C

UNSURE

RRCv1-4

Carefully consider the choices provided below.

Choice Set 5

Options	Frequency of Food Waste Collection (240 Litre bin)	Annual Rent on Your Rates Notice	Environmental Outcomes of Attributes		
			(a) Contribution of Household Food Waste to Methane Gas at Council Landfill (%)	(b) Level of Odour Concern from Collection Bins	(c) Extend the Life-span of the Current Landfill
OPTION A	Weekly	\$100	Decreased to 40%	Mild	Extend by 3 years (to 2037)
OPTION B	Fortnightly	\$75	Decreased to 20%	Moderate	Extend by 1 year (to 2035)
OPTION C	None	\$0	Current situation: 50%	Current situation: Not applicable	Current situation: Reaching full capacity in 2034

Q5.5: If three policy options were to be proposed by your Council to start the program, and Options A, B, and C were the only ones available, which one would you prefer the most?

OPTION A

OPTION B

OPTION C

UNSURE

RRCv1-5

Carefully consider the choices provided below.

Choice Set 6

Options	Frequency of Food Waste Collection (240 Litre bin)	Annual Rent on Your Rates Notice	Environmental Outcomes of Attributes		
			(a) Contribution of Household Food Waste to Methane Gas at Council Landfill (%)	(b) Level of Odour Concern from Collection Bins	(c) Extend the Life-span of the Current Landfill
OPTION A	Weekly	\$25	Decreased to 40%	Mild	Extend by 5 years (to 2039)
OPTION B	Fortnightly	\$25	Decreased to 20%	Moderate	Extend by 3 years (to 2037)
OPTION C	None	\$0	Current situation: 50%	Current situation: Not applicable	Current situation: Reaching full capacity in 2034

Q5.6: If three policy options were to be proposed by your Council to start the program, and Options A, B, and C were the only ones available, which one would you prefer the most?

OPTION A

OPTION B

OPTION C

UNSURE

RRCv1-6

Q5.8: If a kerbside food waste collection service was started, would you accept having the general waste bin collection service fortnightly?

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree
- Not sure/Don't know

Q5.9: If a kerbside food waste collection service was started, and there are no changes to your other services, please indicate the maximum additional amount you would consider paying each year in your rates (\$)

Q5.10: What factors best explain your willingness to pay for kerbside collection of foodstuffs?
(Please pick up to three reasons by numbering boxes 1, 2, 3, with 1 = most important)

- ☐ Environmental and social wellbeing obligations
- ☐ I can afford to pay
- ☐ I get good feeling from paying
- ☐ It will make me feel less guilty if/when wasting food
- ☐ Other Councils are also providing similar service to their community
- ☐ Other people in my Council might also be willing to pay
- ☐ It will create employment opportunities for local people
- ☐ Other (please specify)

Q5.11: Please select the top three information sources you tend to trust on issues such as sustainable food consumption and food waste reduction or management.
(Please pick up to three sources by numbering boxes 1, 2, 3, with 1 = most trusted)

- ☐ Newspapers and magazine articles
- ☐ Word of mouth (neighbours, family & friends)
- ☐ Research studies and journal articles
- ☐ Government reports
- ☐ Environmental advocacy groups
- ☐ Local markets (farmers' market, co-ops)
- ☐ TV programs (news, special programs on food, the environment)
- ☐ Community events and festivals
- ☐ Other (please specify)

Section 6: Demographic Questions

The survey will conclude with some demographic questions which are relevant to the research.

Q6.1: What type of accommodation do you live in?

House (single dwelling)

Townhouse

Unit/flat/apartment

Other (please specify)

Q6.2: What is the location of your current accommodation?

City centre/urban

Suburban

Rural/residential

Other (please specify)

Q6.2b: What is the approximate size of your house block?

Less than 800m²

800m²-4000m² (1 acre)

2-3 acres

4-9 acres

10-50 acres

More than 50 acres

Q6.3: How long have you been a resident in your current Council area?

Less than one year

1 to 4 years

5 to 9 years

10 to 15 years

More than 15 years

Q6.4: Thinking about your overall residential situation during your life, have you lived:

Mostly in rural areas

Mostly in urban areas

A bit of both

Other (please specify)

Q6.5: Are you:

Male

Female

Other (Gender X)

Prefer not to say

Q6.6: Please select the main language that you speak at home:

English only

Other first language only

English and other first language

Prefer not to say

Q6.7: What is your highest level of education?

No formal education

Primary school

High school or equivalent

Trade or technical qualification

Tertiary diploma or degree

Postgraduate degree

Other (please specify)

Q6.8: What is your current employment status?

Employed

Self-employed/business

Unemployed

Homemaker/home duties

Student

Retired/pensioner

Unable to work

Other (please specify)

Prefer not to say

Q6.9: What is your approximate combined household income per year after tax?

Under \$40,000

\$40,000 to \$59,999

\$60,000 to \$79,999

\$80,000 to \$99,999

\$100,000 to \$149,999

\$150,000 or more

Prefer not to say

Q6.10: Approximately what percentage of your household monthly income would be spent on food? (%)

If you have any comments you would like to make about the topics raised in the survey please do so below.

Thank you for participating in the survey!

Your responses will contribute to research which will inform government policies to improve current and future food waste management practices in the Central Queensland region.

Click the next arrow to submit and exit the survey.