COMMERCIAL IN CONFIDENCE

FINAL REPORT

Willingness to pay for reduced litter and illegal dumping

Stated preference research

Prepared for
New South Wales Environment Protection Authority, Sustainability Victoria, and Queensland Department of Environment and Science

8 February 2022

THE CENTRE FOR INTERNATIONAL ECONOMICS
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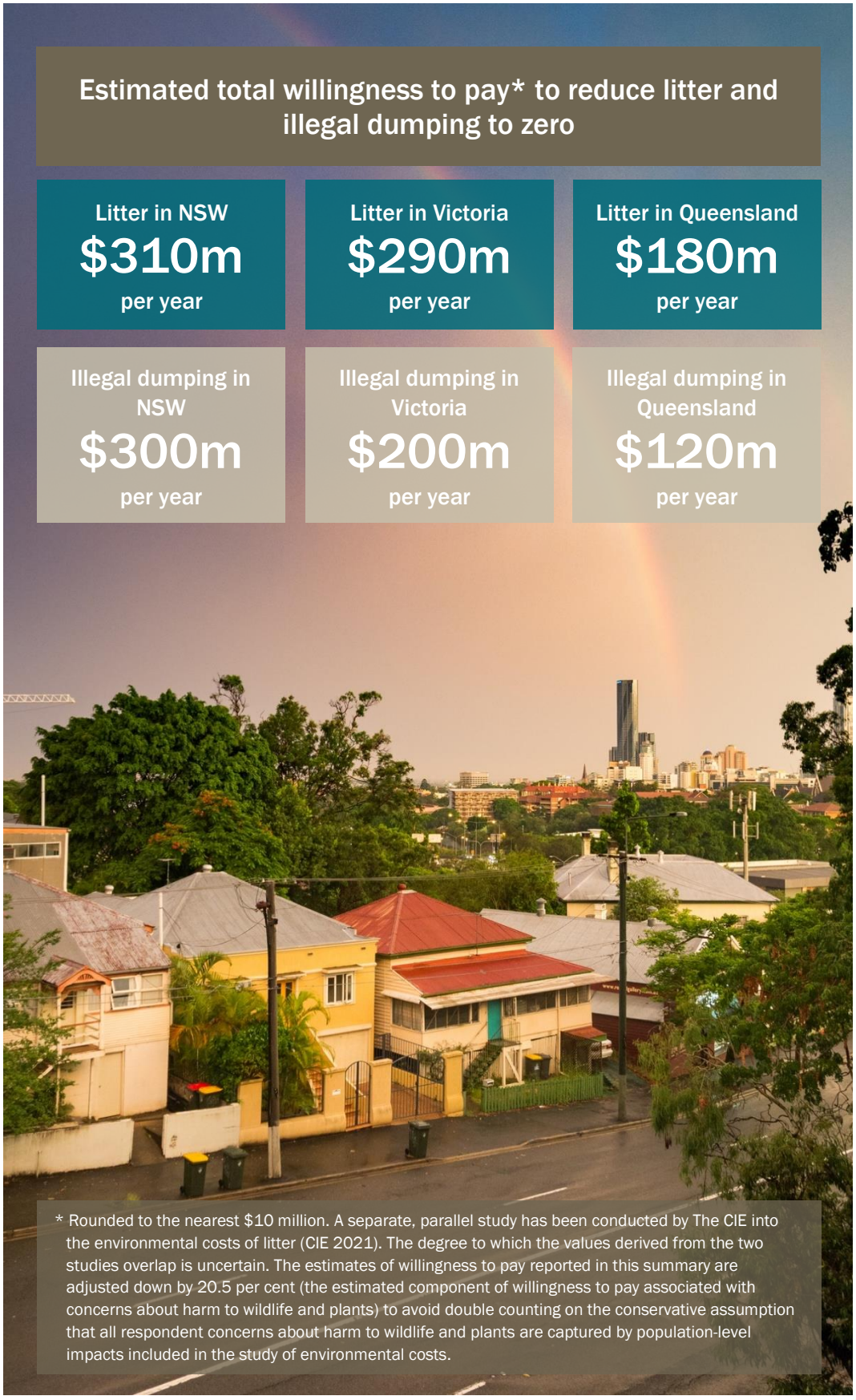
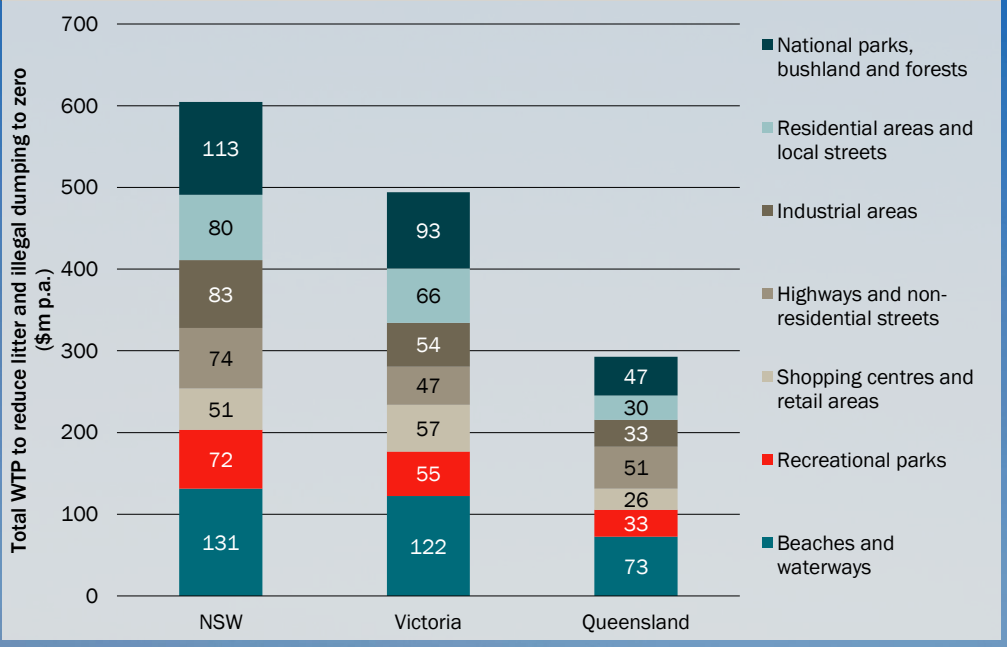
Summary

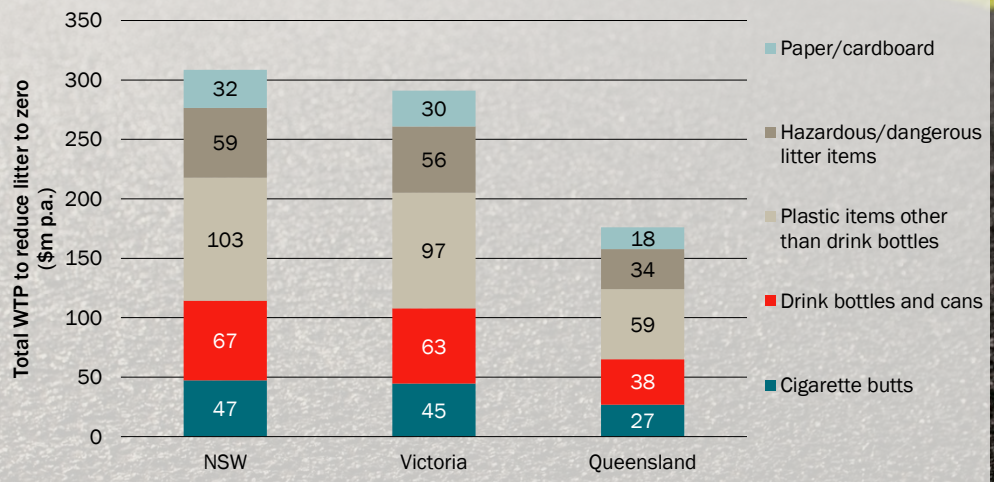

Online survey of
3 017
households across NSW, Victoria, and Queensland
20 896
discrete choice tasks completed
18 102
best-worst scaling tasks completed
Survey responses to repeated choice questions reveal the amounts the community is willing to pay for various reductions in litter and illegal dumping
Option 1
Option 2
Option 3
You pay an extra $2 per month ($24 per year) in ongoing taxes, rates and product prices
You pay an extra $3 per month ($36 per year) in ongoing taxes, rates and product prices
No change in ongoing taxes, rates and product prices
25% of highways and non-residential streets have noticeable litter
5% of highways and non-residential streets have noticeable litter
25% of highways and non-residential streets have noticeable litter
Each of those places with noticable litter has a High amount of litter
Each of those places with noticable litter has a Moderate amount of litter
Each of those places with noticable litter has a Very high amount of litter
You see illegally dumped waste at highways and non-residential streets Twice a year
You see illegally dumped waste at highways and non-residential streets Once a quarter
You see illegally dumped waste at highways and non-residential streets Once a quarter


Estimated total willingness to pay* to reduce litter and illegal dumping to zero
Litter in NSW
$310m
per year
Litter in Victoria
$290m
per year
Litter in Queensland
$180m
per year
Illegal dumping in NSW
$300m
per year
Illegal dumping in Victoria
$200m
per year
Illegal dumping in Queensland
$120m
per year
* Rounded to the nearest $10 million. A separate, parallel study has been conducted by The CIE into the environmental costs of litter (CIE 2021). The degree to which the values derived from the two studies overlap is uncertain. The estimates of willingness to pay reported in this summary are adjusted down by 20.5 per cent (the estimated component of willingness to pay associated with concerns about harm to wildlife and plants) to avoid double counting on the conservative assumption that all respondent concerns about harm to wildlife and plants are captured by population-level impacts included in the study of environmental costs.

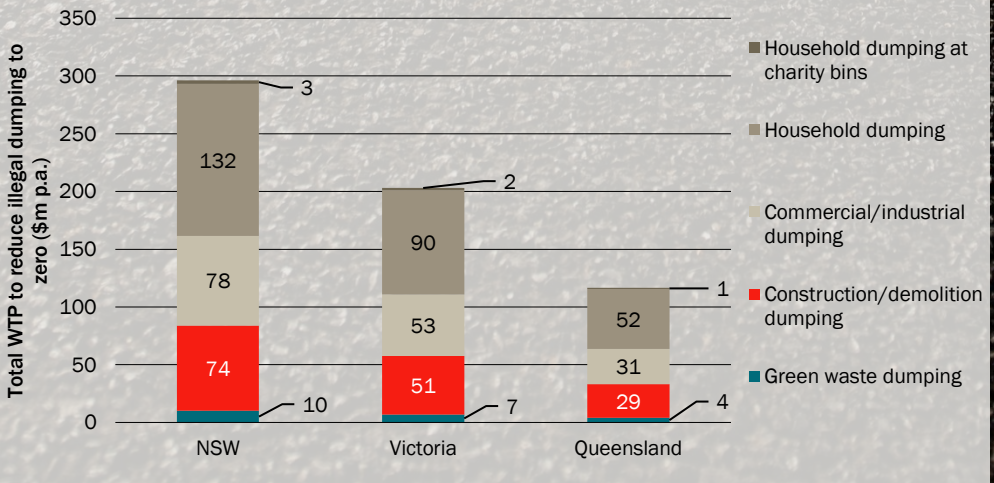
Willingness to pay to reduce litter and illegal dumping is highest at natural environments, such as beaches, waterways, national parks, bushland, and forests



Plastic items are the costliest type of litter. They are the most frequently noticed type of litter and are disliked more than all other types except hazardous/dangerous items.

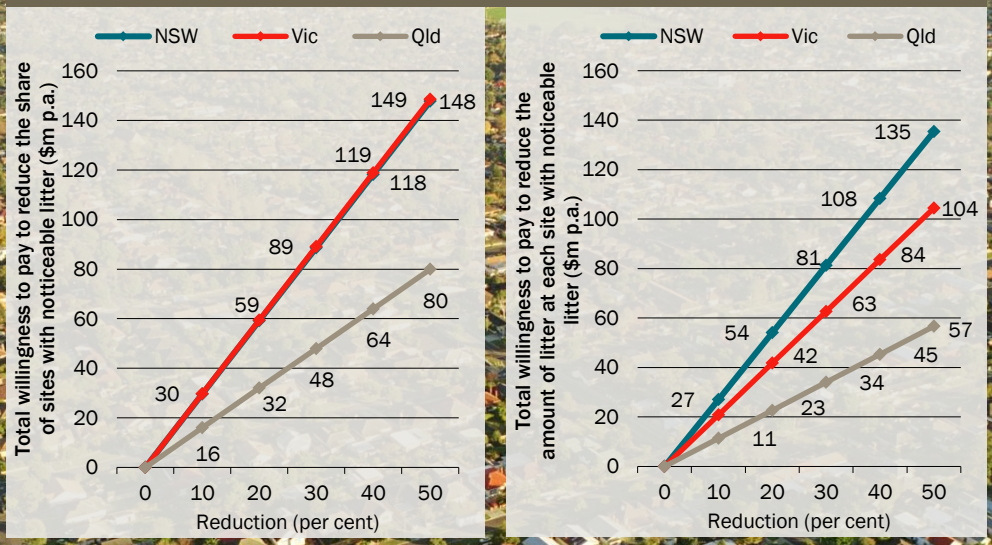


Household waste is the costliest type of illegal dumping. Although it is disliked less than commercial, industrial or construction dumping, it is seen more often.

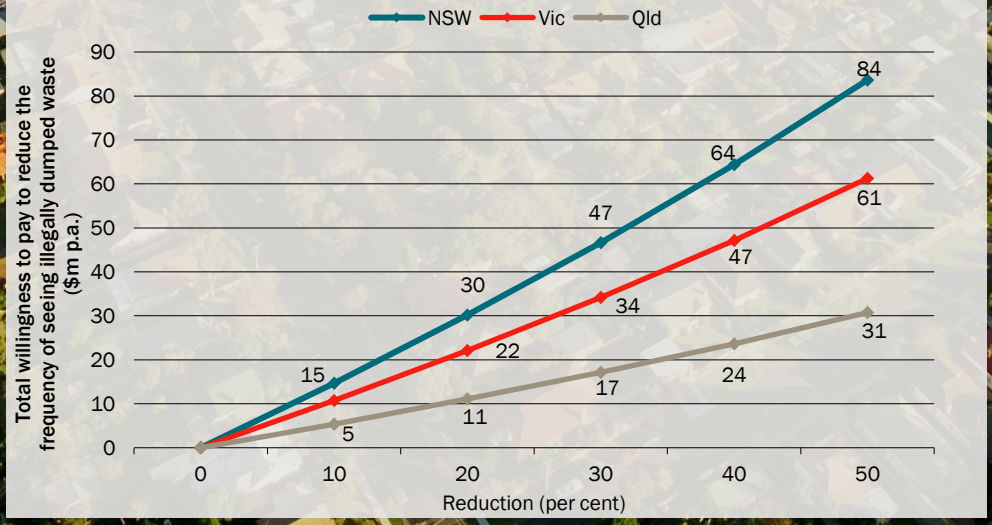


Willingness to pay varies with the size of reductions in litter and illegal dumping

The community prefers reducing the number of sites that have noticeable litter over reducing the amount of litter at sites with noticeable litter



Willingness to pay per unit reduction in illegal dumping increases with the size of the reduction. Doubling the size of a reduction more than doubles the amount the community is willing to pay.



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BOXES, CHARTS AND TABLES

1 Introduction

About this study

This study was undertaken for the New South Wales (NSW) Environment Protection Authority (EPA), Sustainability Victoria, and The Queensland Department of Environment and Science. The purpose of the study is to inform policy analysis, particularly cost-benefit analysis (CBA), of government actions that could reduce litter and illegal dumping. CBA of alternative actions requires monetary estimates of the costs of litter and illegal dumping.

Two other studies are being conducted to provide input to the calculation of the total cost of litter and illegal dumping:

- a study of the direct costs from litter and illegal dumping (such as the clean-up costs incurred to achieve current litter levels), and
- a study of the environmental costs from litter and illegal dumping, particularly the impact on wildlife.

This study focuses on the bundle of remaining elements of the cost of litter and illegal dumping, including:

- visual amenity
- perceived safety risks, and
- non-use values for the pollution of natural environments.

Due to an absence of real market observations, these costs need to be estimated using non-market valuation techniques. The costs are measured as the maximum amount the community would be willing to pay to avoid the litter and illegal dumping.

This study estimates willingness to pay (WTP) for a range of different reductions in litter and illegal dumping, including:

- reductions in the proportion of places that have noticeable litter
- reductions in the amount of litter at places with noticeable litter
- reductions in the frequency with which people see illegally dumped waste, and
- reducing litter and illegal dumping to zero.

It estimates how these values vary across different types of sites, including both natural and built environments, across different types of litter and illegal dumping, and across different states. It also estimates the personal characteristics that are most correlated with WTP to reduce litter and illegal dumping.

Prior to this study, estimates of community WTP for reduced litter have largely been drawn from a national study conducted by PricewaterhouseCoopers in 2010 (EPHC

2010). Several shortcomings in this study have been identified by ABARE (2010) and Marsden Jacob Associates (Environment Protection Authority 2017). The CIE conducted a study of WTP to reduce litter for the Victorian Department of Environment, Land, Water and Planning in 2018 (CIE 2019), but that study has not yet been released and had a narrower focus (on drink container litter). The present study provides value estimates for a range of litter and illegal dumping outcomes that have not previously been estimated by stated preference research in Australia. These estimates will enable cost-benefit analysis to better inform decisions about levels of funding and program prioritisation.

Approach

The conventional measure of economic benefit from an improvement in environmental outcomes is the maximum amount that individuals would be willing to pay for the improvement (Randall and Stoll 1980). We use stated preference techniques to measure this amount for a range of different changes in litter and illegal dumping outcomes.

The objectives of the study present several challenges for survey design and analysis, including:

- covering many different combinations of the types and amounts of litter and illegal dumping and the types of site at which they are located
- describing litter and illegal dumping outcomes in a way that is meaningful to respondents but also enables translation to the relevant measures of volume, items or incidents used in data collection and policy
- disentangling the various benefits that make up WTP for reduced litter and illegal dumping, to avoid double counting with the separate study of the environmental costs of litter (CIE 2021), and
- accounting for part-whole bias/sub-additivity, where values for specified types of litter and/or illegal dumping reduction may sum to a greater value than the value of the zero-litter-and-illegal-dumping outcome.

To value changes in the amount (but not the composition) of litter and illegal dumping, we use the discrete choice experiment (DCE) technique, which is sometimes called choice modelling or conjoint analysis. DCE surveys involve presenting respondents with several choice questions. Each choice question presents two or more hypothetical scenarios with specified cost and asks the respondent to indicate their preferred option. The scenarios are described by multiple attributes and the levels assigned to attributes vary (by design) over scenarios and over questions. Respondents' choices reveal the value they place on changes in each attribute.

To measure WTP for changes in the *composition* of litter and illegal dumping, we use the contingent valuation technique in combination with the 'object case' (Case 1) best-worst scaling technique, both of which are simplified versions of DCE. We also use the contingent valuation technique to value the near-zero litter and illegal dumping outcome.

1.1 Objectives and techniques

Outcomes to be valued	Technique
Reductions in the amount of litter by site type	Discrete choice experiment ▪ Within-subject: amount of litter ▪ Between-subject: site type
Reductions in the amount of illegal dumping by site type	Discrete choice experiment
Near-zero litter and illegal dumping	Contingent valuation
Changes in the composition of litter types	Best-worst scaling calibrated to WTP using contingent valuation
Changes in the composition of illegal dumping types	Non-monetary contingent valuation

Source: CIE

A rigorous methodology was applied in this study, including:

- pretesting the survey instrument
- conducting fieldwork over four separate waves, with model estimation conducted and adjustments made to stated preference questions between the waves
- using an efficient experimental design (the combinations of attribute levels across DCE alternatives) for waves 2-4 based on preferences elicited in the first wave,
- estimating WTP using statistical models that account for variation in preferences across respondents for each attribute and correlation in that variation across attributes, and
- peer review by DCE expert, Professor Riccardo Scarpa (see appendix F).

2 The research method

Survey instrument

The survey instrument was designed to meet best-practice in stated preference research. The questionnaire (see appendix B) comprised the following:

- a welcome, with instructions and information about privacy
- screening questions to ensure the survey was being completed on a computer or large tablet and to ensure representative samples that exclude respondents with potential conflicts of interest
- factual information about litter and illegal dumping
- information about the site type to which the respondent had been assigned and questions about how frequently they visit that type of site
- questions about the baseline amount and mix of types of litter and illegal dumping experienced by the respondent
- information on the impacts of litter and what the government can do to influence the amount of litter
- instructions about the choice questions, including an example question and a 'cheap talk' script to limit hypothetical bias by reminding respondents of the consequentiality of the survey and their budget constraint
- eight DCE questions – discussed in further detail below
- debriefing questions about the motivation behind and approach taken by the respondent to the DCE questions, including the respective roles of amenity, safety, and environmental concerns
- six best-worst scaling questions measuring preferences across various types of litter – discussed in further detail below
- a contingent valuation question for a hypothetical program to replace plastic litter with cardboard litter
- questions about preferences across types of illegal dumping
- a contingent valuation question for a hypothetical program to eliminate all litter and illegal dumping
- further debriefing questions, including plausibility, consequentiality and the impact of the COVID-19 pandemic
- questions about the respondent's characteristics.

The questionnaire was developed through several stages of review and testing, including:

- review and input from NSW EPA, SV and Queensland DES staff
- pretesting interviews (see appendix A), and

- pilot waves of survey fieldwork.

Discrete choice experiment

There are several important decisions that must be made when designing a DCE. These include:

- the attributes to be included in the choice tasks and how those attributes should be defined
- the number of alternatives to be included in each choice task and whether one of the alternatives should represent the status quo
- the number of questions to be answered by each respondent
- the levels that the attributes can take in the questions;
- the combinations of attribute levels in each question (that is, the experimental design)
- the order in which questions are presented to each respondent, and
- the information, instructions and/or questions used to prepare respondents for the choice.

The decisions taken in relation to these matters in the present study are discussed below.

Attributes of litter outcomes

A key challenge in this project was developing meaningful descriptions of the nature and extent of visible litter. The attributes included in the DCE were:

- the monthly cost through ongoing taxes, rates and product prices
- the proportion of sites with noticeable litter
- the amount of litter at each of those places with noticeable litter, and
- how often you see illegally dumped waste at sites.

The cost attribute was defined as an ongoing payment to reflect the ongoing nature of the costs involved in the policy options. We chose a broad payment vehicle of taxes, rates and product prices. Alternative, more specific vehicles, such as rates on your property or an increase in the price of products with packaging that is often littered, were problematic since they are seen to be avoidable by significant proportions of the population.

In recognition of the fact that there are many public spaces with little or no noticeable litter, we used two types of attribute to describe litter – the proportion of places with litter and the amount of litter in those places. Both of these attributes had been found to be statistically significant in The CIE's study of WTP to reduce litter in Victoria in 2018. Further, government action to reduce litter variously impacts these two dimensions. For example, clean-up policies change a site from having litter to having no litter (at least

temporarily). On the other hand, Container Deposit Schemes reduce the amount of litter items at each site.[1]

The impact of litter policies is often measured in terms of a reduction in the volume of litter. For example, the 'Don't be a Tosser!' Campaign was estimated to reduce the volume of litter by 0.97 percentage points in 2020/21 (Inform Economics 2021).

However, NSW has now moved to item-based measures (table 2.1). It was agreed in project workshops that the survey should prioritise measuring WTP for changes in the number of items, but should also enable estimation of WTP for changes in volumes.

The survey measures illegal dumping in terms of the frequency with which illegally dumped waste is seen, as this aligns best with the preferences of consumers. Policy analysis may require assumptions about how many times the illegally dumped waste associated with a specific incident is seen. For example, the NSW Illegal Dumping Strategy 2017-21 sets a target of reducing the number of dumping incidents by 30 per cent (NSW Government 2017). We do not consider reductions in the volume or amount of illegal dumping in each incident, as this measure does not appear to be a focus of government policy.

2.1 Litter prevention targets by jurisdiction

Jurisdiction	Targets
New South Wales	▪ 60 per cent reduction in litter items by 2030 ▪ 30 per cent reduction plastic litter items by 2025 ▪ 50 per cent reduction in cigarette butt littering behaviour by 2030
Queensland	▪ No specific targets
Victoria	▪ Up to 50 per cent less litter of beverage containers

Source: NSW EPA, Queensland Department of Environment and Heritage Protection, EPA Victoria, Sustainability Victoria, and CIE.

Site type was not included as an attribute, but, rather, each respondent was allocated to a specified site type, so that preferences across site types can be measured between subjects:

- beaches and waterways
- recreational parks
- shopping centres and retail areas
- highways and non-residential streets
- industrial areas
- residential areas and local streets
- national parks, bushland and forests

Litter type was excluded from the DCE attributes to keep the choice tasks from becoming too complex. WTP for changes in the mix of litter types was measured using a

1 Container Deposit Schemes also change the composition of litter, which is discussed in the subsequent chapter.

combination of best-worst scaling and contingent valuation questions, as discussed further below.

The options were not presented in the format traditionally used in DCE studies, with attributes listed down the left-hand column. Instead, we used a format that consumers are used to seeing when comparing market products and services on websites, such as mobile phone plans, in which attribute descriptions are included in every option column, with the information that varies from one option to another presented in a larger font.

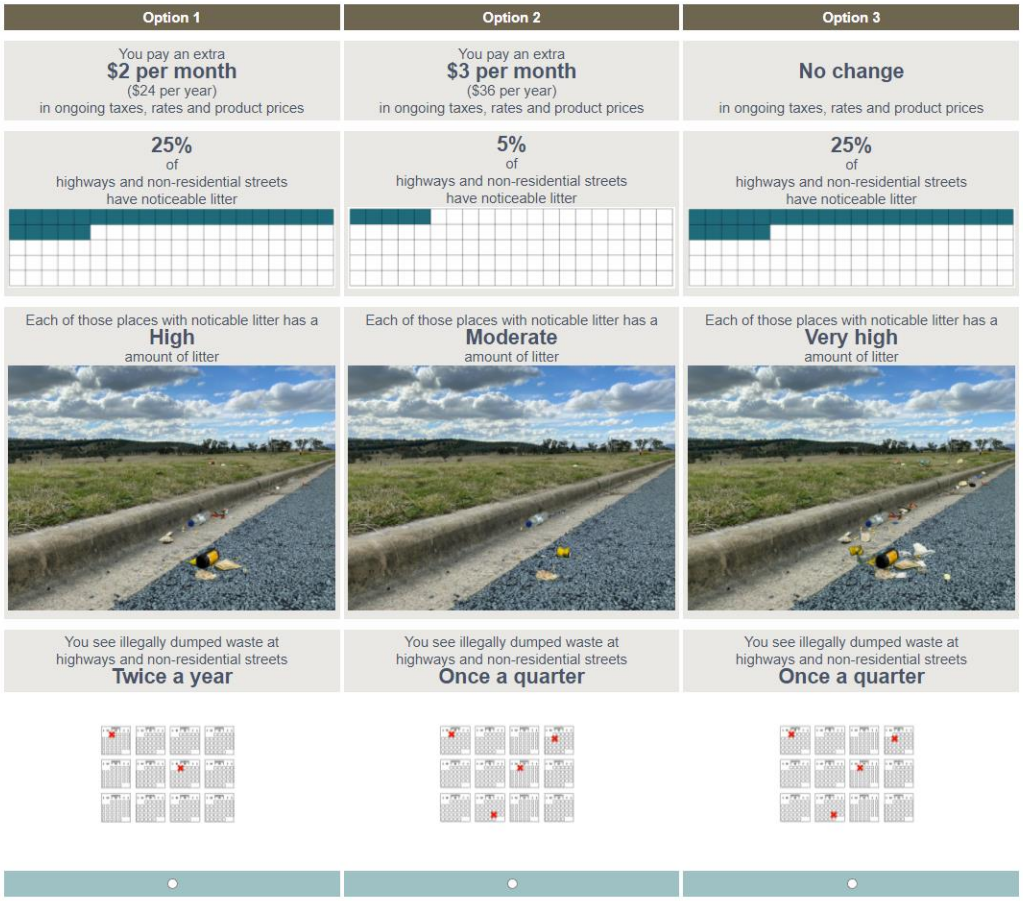
Photographs were used to depict the 'amount of litter' attribute. A different set of photographs was used for each site type (shown in Appendix C). Larger versions of the photographs were provided in new windows if respondents clicked on the photos within the choice task to help respondents more clearly see the differences between levels. The visibility of differences in litter amounts in the smaller photos embedded in the choice tasks was a concern that had been raised in testing, particularly for the lower levels of litter. A table showing the number of bulky and fine litter items associated with each level of the 'amount of litter' attribute was shown when the mouse cursor hovered over the text describing the attribute. To avoid influencing respondent attention to that attribute, graphics were also included the illustrate the proportion of sites with litter and the frequency with which you see illegally dumped waste. An example of a choice task is set out in figure 2.2.

Number of alternatives per task

Each DCE question comprised three alternatives, with one of those alternatives being the status quo. This design was judged to strike an appropriate balance between statistical power and task complexity. Previous studies have found that statistical significance for a given sample size has been low where choice tasks presented only a status quo alternative and a single change option (for example, see Rolfe and Bennett 2009). Presenting four or more alternatives in each choice task was judged to be too cognitively demanding, based on feedback from participants in past studies conducted by the CIE. Feedback from pretesting interviews indicated that the choice tasks should not be any more complex than the three-alternative format that was tested.

One of the alternatives was specified as the status quo to account for reference-dependent decision making, for which there is now a large body of evidence from behavioural economics, including in support of prospect theory (Kahnemann and Tversky 1979), as well as empirical DCE research (Dhar and Simonson 2003).

2.2 Example of a choice task



Data source: CIE

Number of questions per respondent

The questionnaire included eight choice tasks. The risk of respondents dropping out of self-administered questionnaires increases with the number of choice tasks presented. The number of respondents required to obtain statistically significant estimates of WTP reduces with the number of choice tasks presented to each respondent. A sequence of eight choice tasks per respondent was judged to strike an appropriate balance between these two considerations, noting the significant number of other questions included in the questionnaire.

Attribute levels

The attribute levels used in the DCE questions are set out in tables 2.3 and 2.4. The levels for the attributes in the 'no change' option (Option 3) were based on each respondent's reported experience of litter. The ranges in levels for the change options were selected to at least cover the impacts expected to be included in the CBA of a policy intervention. They were selected to be large enough to enable statistically significant estimation, but not so large as to be perceived as infeasible by respondents.

The range of cost levels for each site type was adjusted between each wave of fieldwork to cover the range of WTP and WTA implied by the pilot results for the best and worst possible combinations of attribute levels in the design.

2.3 Cost attribute levels for Option 1/2

Site type	Wave 1	Wave 2/3	Wave 4
beaches and waterways and national parks, bushland and forests	$2 per month ($24 per year) $4 per month ($48 per year) $6 per month ($72 per year) $8 per month ($96 per year) $10 per month ($120 per year) $20 per month ($240 per year)	$2 per month ($24 per year) $4 per month ($48 per year) $6 per month ($72 per year) $8 per month ($96 per year) $10 per month ($120 per year) $20 per month ($240 per year)	$0 per month ($0 per year)[a] $3 per month ($36 per year) $6 per month ($72 per year) $9 per month ($108 per year) $12 per month ($144 per year) $15 per month ($180 per year) $30 per month ($360 per year)
recreational parks and residential areas and local streets	$2 per month ($24 per year) $4 per month ($48 per year) $6 per month ($72 per year) $8 per month ($96 per year) $10 per month ($120 per year) $20 per month ($240 per year)	$1 per month ($12 per year) $2 per month ($24 per year) $3 per month ($36 per year) $4 per month ($48 per year) $5 per month ($60 per year) $10 per month ($120 per year)	$0 per month ($0 per year)[a] $1 per month ($12 per year) $2 per month ($24 per year) $3 per month ($36 per year) $4 per month ($48 per year) $6 per month ($72 per year) $10 per month ($120 per year)
highways and non-residential streets and industrial areas and shopping centres and retail areas	$1 per month ($12 per year) $2 per month ($24 per year) $3 per month ($36 per year) $4 per month ($48 per year) $5 per month ($60 per year) $10 per month ($120 per year)	$1 per month ($12 per year) $2 per month ($24 per year) $3 per month ($36 per year) $4 per month ($48 per year) $5 per month ($60 per year) $10 per month ($120 per year)	$0 per month ($0 per year)[a] $1 per month ($12 per year) $2 per month ($24 per year) $3 per month ($36 per year) $4 per month ($48 per year) $6 per month ($72 per year) $10 per month ($120 per year)

[a] Shown only to respondents selecting 'Low' as their status quo amount of litter

Source: CIE

2.4 Other attribute levels

	Option 1/2	Option 3
... of [site type] have noticeable litter	<Q8 response> <Q8 response> - 1 level <Q8 response> - 2 levels where the levels are: 1 1% 2 2.5% 3 5% 4 10% 5 25% 6 50%	<Q8 response>

	Option 1/2	Option 3
	7 75% 8 90% 9 100%	
Each of those places with noticeable litter has a ... amount of litter	<Q9 response> + 1 level [a] <Q9 response> <Q9 response> - 1 level <Q9 response> - 2 levels [b] Very low Low Moderate High Very high	<Q9 response>
You see illegally dumped waste at [site type] ...	<Q12 response> <Q12 response> - 1 level <Q12 response> - 2 levels [c] where the levels are: Never Once every five years Once a year Twice a year Once a quarter Once a month Once a fortnight Once a week 2-4 times a week Every weekday Every day	<Q12 response> [d]

[a] Wave 4 only. Shown only to respondents selecting 'Low' as their status quo amount of litter.

[b] Shown only to respondents selecting 'Moderate', 'High' or 'Very high' as their status quo amount of litter.

[c] Not shown to respondents selecting 'Once every five years' as their status quo frequency of seeing illegally dumped waste (-1 was shown instead).

[d] Respondents selecting 'Never' as their status quo were shown choice tasks without an illegal dumping attribute.

Source: CIE

The photographs used to depict the amounts of litter at each site type are set out in appendix C. A total of 35 photographs were created to illustrate the five litter amounts for each of the seven site types. They were taken from around 30-40 cm above ground level of an area of roughly 100 square metres. The photographs for the 'beaches and waterways' site type were staged with litter at the site. For the other site types, litter was photographed on green screen and added to photographs digitally. The items used in the photographs were based on the mix of litter observed in the National Litter Index.

2.5 Litter used in photographs

	Very low	Low	Moderate	High	Very high
	Items	Items	Items	Items	Items
Cigarettes	2	8	16	28	72
Glass bottle 375 ml				1	1
Metal – large			1	2	4
Metal – small			1	2	5
Miscellaneous				1	2
Paper/card – large			1	2	5
Paper/card – small		2	3	6	16
Plastic – large			1	2	4
Plastic – small	1	2	3	6	15

Source: CIE

Table 2.6 was shown to respondents when the mouse cursor hovered over the 'amount of litter' attribute.

2.6 'Mouse hover' table of litter quantities

Amount of litter	Bulky items	Fine items	Total items
	Items per 100 square metres (approx. size of an apartment)	Items per 100 square metres (approx. size of an apartment)	Items per 100 square metres (approx. size of an apartment)
Very low	0	3	3
Low	0	12	12
Moderate	3	22	25
High	7	43	50
Very high	14	111	125

Source: CIE

The moderate level was based on data from the pilot of the Australian Litter Measure (AusLM), which found an average of 253 items per 1000 square metres.[2] The other levels cover a wide range from 10 per cent to 500 per cent of the moderate level.

Experimental design

To conduct a DCE, the analyst needs to assign combinations of attribute levels to the various alternatives and questions. These combinations are referred to as the experimental design. The experimental design has a direct impact on the statistical significance of estimates of WTP. If some information about preferences is known, it is possible to generate an experimental design that can elicit statistically significant

2 The AusLM pilot was conducted in 2021 across a sample of 23 sites across Queensland, Victoria and Western Australia. This is only a small sample size and gives quite a different picture about litter densities compared to the National Litter Index (NLI). For Victoria in 2018/19, there was an average of 21 items per 1000 square metres based on the NLI data.

estimates of WTP from a smaller number of respondents than a randomly generated design.

The first wave of fieldwork used an 'optimal orthogonal-in-the-differences' design. This type of design is constructed such that attributes do not take the same level across the change options within a question. Manual adjustments were made to ensure the design did not include any dominated alternatives (i.e. an alternative that is not better on at least one attribute when compared to each other alternative in the same choice task). This type of design may not turn out to be particularly efficient *ex post*, but it represents a prudent approach to designing DCEs when little information is available about population preferences over the hypothetical alternatives.

Information on preferences gathered in the first wave of fieldwork (around 10 per cent of the sample) was used to generate a design for the second wave of fieldwork that did not include wasteful 'no-brainer' questions. The approach improved the statistical confidence intervals around the estimates of WTP derived from responses to the questions in the design (Scarpa and Rose 2008).[3] This approach was repeated after the second and third waves of fieldwork (each 20 per cent of the sample).

All waves of fieldwork used designs with nine blocks of eight questions, with each respondent answering only one block. The reason for using multiple blocks was to improve design efficiency and limit the impact of any single choice task on the results. In waves 3 and 4, the nine blocks comprised two separate designs of 5 and 4 blocks developed for respondents with and without a 'Low' status quo level of litter. Respondents with a 'Low' status quo level of litter comprised roughly half of the sample. The design for these respondents accounted for them having only one lower level for amount of litter than their status quo — 'Very low'. In Wave 4, we included *increases* in the amount of litter to 'Moderate' in some options, only where the options also contained a reduction in the proportion of sites with noticeable litter.

Instructions, priming and debriefing

Before being presented with the choice tasks, respondents were shown an example of a choice task, with a list of the correct interpretations of each attribute level in Option 1. Respondents were told how to access larger versions of the photos in the choice tasks and a table showing the number of items of litter associated with each of the amount levels in the choice tasks.

Respondents were reminded of the following:

- The next eight questions look very similar. Once you select an option and click next, it may not look like a new page, but the numbers describing the packages in 'Option 1' and 'Option 2' will have changed. Please, pay attention to these.

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3 The prior parameter estimates used to generate the efficiency criteria were based on estimates of WTP from basic multinomial logit models run on the data collected in the first wave of fieldwork. Constraints were included in the design search to preclude dominated alternatives and to set ranges for the number of times each attribute level could appear in the design.

- Some of the combinations of litter and dumping outcomes may look strange to you. That is because there are a range of government initiatives that can influence the way that different types of litter or dumping are reduced in different places.
- The results of this survey will influence the amount of litter and illegal dumping in your state and your cost of living, so please answer the questions as though you are really making the decision and committing to pay the proposed amounts.
- There may be things other than litter reduction you would prefer to spend your money on.

The latter two reminders perform the role of a 'cheap talk' script in maximising the consequentiality of the survey and minimising hypothetical bias.

A list of debriefing questions was included to probe the respondent's decision-making process. The questions covered:

- how easy or difficult it was to answer the questions
- perceptions of the plausibility of the options in the choice questions
- the way respondents answered any questions with options they perceived to be implausible (where applicable)
- reasons for choosing the 'no change' option in all questions (where applicable), and
- perceptions of how influential the survey would be on government action on litter and on cost.

Contingent valuation

Two contingent valuation questions were included in the survey instrument — one designed to value a scenario with near-zero litter and illegal dumping, and another to value a change in the composition of litter away from plastic towards cardboard.

The question followed a brief description of the scenario. To maximise plausibility, the description for the zero-litter scenario included a link to a report on a program that had effectively reduced litter to zero in recreational parks in Bankstown. Each respondent was offered the program at a different cost level drawn from the levels set out in the table below.

2.7 Levels for the contingent valuation questions

Scenario	Levels
Zero litter and dumping: If maintaining this near-zero litter outcome would permanently increase the amount you pay in taxes, rates and product prices each month by $..., would you vote for this large government program?	Wave 1-2: 5, 20, 50, 100 Wave 3-4: 5, 20, 50, 150
Change in litter composition: If this program would permanently increase the amount you pay in taxes, rates and product prices each month by $..., would you vote for the program?	Wave 1-2: 1, 2, 5, 10 Wave 3-4: 1, 2, 5, 20

Source: CIE

The response options involved a certainty scale containing a reminder of cost:

- At that cost to me, I definitely would vote for the program
- At that cost to me, I probably would vote for the program
- At that cost to me, I am not sure whether I would vote for the program
- At that cost to me, I probably would not vote for the program
- At that cost to me, I definitely would not vote for the program

Non-monetary contingent valuation questions were used to estimate respondents' marginal rates of substitution for different types of illegal dumping. In each question, respondents were asked to indicate which would be worse — seeing five incidents of household dumping or seeing a specified number of incidents of a specified type of dumping. The levels that the number of incidents could take in the question for each specified type of dumping is set out in the table below.

2.8 Levels for the non-monetary contingent valuation questions

Option	Levels
Seeing ... incidents per year of green waste dumping	Wave 1-2: 5, 7, 10, 15 Wave 3-4: 5, 10, 15, 30
Seeing ... incidents per year of construction/demolition waste dumping (e.g. timber, concrete, bricks, tiles, rubble)	1, 3, 5, 7
Seeing ... incidents per year of commercial/industrial waste dumping (e.g. pallets, cardboard, plastic film, etc.)	1, 3, 5, 7
Seeing ... incidents per year of household waste dumping at other locations in shopping centres and retail areas[a]	1, 3, 5, 7

[a] This option was compared with seeing five incidents of household dumping at charity bins and donation points

Source: CIE

Best-worst scaling

Best-worst scaling questions were used to measure preferences across different types of litter. Some 13 items were used in the questions to represent the broad categories of litter that had been used in questions about respondent perceptions of the composition of litter.

2.9 Items used in best-worst scaling

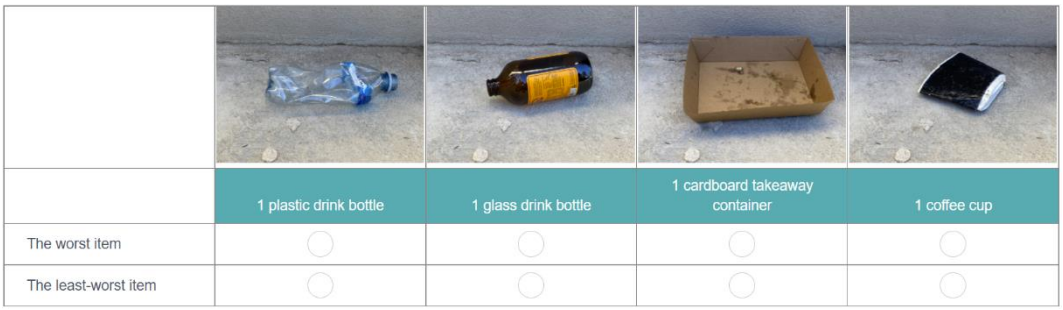
Litter category	Items used in best-worst scaling
Cigarette butts	1 cigarette butt 10 cigarette butts
Drink bottles and cans	1 glass drink bottle 1 plastic drink bottle 1 aluminium can
Plastic items other than drink bottles and cans	1 plastic bag 1 plastic takeaway container

Litter category	Items used in best-worst scaling
Hazardous / dangerous litter items (including syringes, broken glass, face masks, diapers, condoms)	1 condom 1 disposable nappy 1 syringe
Food scraps (including apple cores, banana peels, takeaway food)	1 apple core
Paper (including advertising, flyers, newspapers, receipts, cardboard, coffee cups)	1 cardboard takeaway container 1 coffee cup

Source: CIE

Each respondent answered a series of six best-worst scaling questions. Each question showed four items and asked respondents to identify the items that are worst and least worst in terms of being seen as litter at the site type to which the respondent had been assigned. The items varied from one question to the next as part of a balanced incomplete block design, comprising 13 blocks of six questions — 78 questions in total. This type of design ensures each item appears the same number of times in the design and is uncorrelated with items with which it appears.

2.10 Example of a best-worst scaling question



Data source: CIE/Pureprofile survey

3 The sample

Recruitment

The fieldwork was conducted in September to November 2021. All respondents were sampled through the Pureprofile online panel and were compensated for their time through Pureprofile's rewards system.

Overall, 3017 respondents completed the questionnaire. This sample size enabled statistically significant estimation of WTP for a range of different litter and illegal dumping reduction scenarios (see the discussion of estimation from page 45, particularly Table 5.4, and appendix D). It is a similar order of magnitude to the sample sizes used in comparable surveys. For example, EPHC (2010) used a sample size of 3432 across all states and territories. Borriello and Rose (2022) used a sample size of 1502 for NSW only.

In addition, there were 396 incomplete responses and 360 respondents were screened out because either:

- they or someone else in their household work in the market research industry or for the NSW Environment Protection Authority, Queensland Department of Environment and Science, or Sustainability Victoria (251 people); or
- the quotas for their age, gender or location categories had already been filled (109 respondents).

Quotas were set using Australian Bureau of Statistics Census 2016 data, accessed via TableBuilder.

Characteristics and representativeness

Our sample contains a mix of respondents across age group, gender, area, device used for the survey, and property ownership status. This spread is reasonably consistent across states reflecting quotas that were applied for each age, gender and area cohort within each state. Quotas were not applied for property ownership or device type.

3.1 Composition of the sample

Cohort	Count of respondents				Share of total			
	NSW	QLD	VIC	Total	NSW	QLD	VIC	Total
	Number	Number	Number	Number	Per cent	Per cent	Per cent	Per cent
Age								
18-19 years	7	6	10	23	0.7	0.6	1.0	0.8

Cohort	Count of respondents				Share of total			
	NSW	QLD	VIC	Total	NSW	QLD	VIC	Total
	Number	Number	Number	Number	Per cent	Per cent	Per cent	Per cent
20-29 years	130	79	111	320	12.9	7.8	11.1	10.6
30-39 years	191	140	171	502	19.0	13.9	17.0	16.6
40-49 years	164	136	162	462	16.3	13.5	16.2	15.3
50-59 years	170	186	177	533	16.9	18.4	17.6	17.7
60-69 years	181	222	200	603	18.0	22.0	19.9	20.0
70-79 years	128	200	141	469	12.7	19.8	14.1	15.5
80 years or over	34	40	31	105	3.4	4.0	3.1	3.5
Gender								
Female	503	561	510	1574	50.0	55.6	50.8	52.2
Male	495	445	490	1430	49.3	44.1	48.9	47.4
Non-binary	2	2	2	6	0.2	0.2	0.2	0.2
Area								
Metro	683	559	798	2040	68.0	55.4	79.6	67.6
Regional	322	450	204	976	32.0	44.6	20.3	32.4
Other	0	0	1	1	0.0	0.0	0.1	0.0
Device								
Laptop computer	518	468	504	1490	51.5	46.4	50.2	49.4
Desktop computer	409	451	426	1286	40.7	44.7	42.5	42.6
Standard-sized tablet	78	90	73	241	7.8	8.9	7.3	8.0
Property ownership								
Owned outright or with a mortgage	686	697	717	2100	68.3	69.1	71.5	69.6
Being rented or occupied rent-free	309	299	272	880	30.7	29.6	27.1	29.2
Other	10	13	14	37	1.0	1.3	1.4	1.2
Total								
All respondents	**1005**	**1009**	**1003**	**3017**	**100.0**	**100.0**	**100.0**	**100.0**

Source: CIE.

The basic sample characteristics set out in table 3.2 show the sample was very representative in terms of age, gender and location. The main exception to this is that younger (under 50) respondents are underrepresented. Therefore, we calculate sampling weights to be used in model estimation which ensure that results are representative of the population in terms of age. Note that we have combined the age categories for 18-19 and 20-29, given that 18-19 is such a small cohort. This is to avoid a very large sample weight (which would be 4.20) on the 18-19 year old cohort. Sample weights are not provided for gender or area, because these variables are not found to be drivers of WTP, as discussed in chapter 5.

3.2 Sample representativeness and weights

Cohort	Our sample	Population	Difference	Sample weights
	Per cent	Per cent	Per cent	Ratio
Age				
18-29 years	11.4	21.0	9.7	1.85
30-39 years	16.6	17.9	1.3	1.08
40-49 years	15.3	17.4	2.1	1.14
50-59 years	17.7	16.3	-1.4	0.92
60-69 years	20.0	13.6	-6.4	0.68
70-79 years	15.5	8.5	-7.0	0.55
80 years or over	3.5	5.2	1.7	1.49
Gender				
Female	52.2	50.8	-1.4	N/A
Male	47.4	49.2	1.8	N/A
Non-binary	0.2	N/A [a]	-0.2	N/A
Area				
Metro	67.6	62.8	-4.8	N/A
Regional	32.4	37.2	4.8	N/A

[a] Note that the **ABS only publishes data split by male and female sex, rather than split by gender including non-binary.**

Source: CIE, population statistics from Australian Bureau of Statistics Census 2016, accessed via TableBuilder.

4 Baseline litter experience and attitudes

Status quo for litter

For the site type to which they were allocated, each respondent was asked to indicate:

- The share of sites that they visit which have noticeable litter, and
- The amount of litter they see on each occasion that they see noticeable litter, which was specified using images and a measure of items per 100m2 (e.g. a low amount corresponds to 12 items per 100m2).

Responses to these questions suggest there is significant variation in the amount of litter that respondents see (table 4.1). While around 60 per cent of respondents see noticeable litter at very few sites (no more than 10 per cent), a small minority see litter at all or almost all sites. The amount of litter at each site is most commonly low, but there are significant shares of respondents seeing higher amounts of litter at each site.

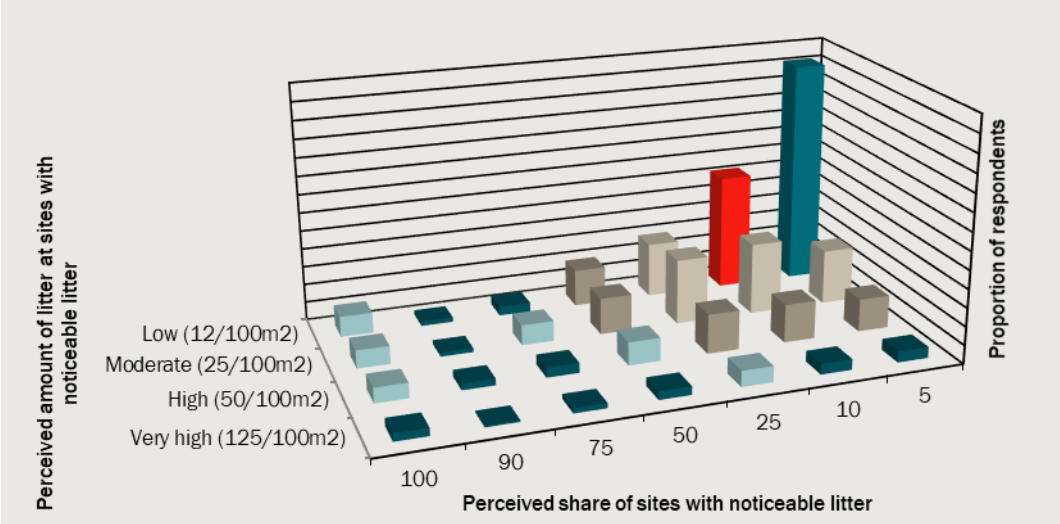
4.1 Respondent perceptions of existing litter

Litter level	Count	Share
	Number	Per cent
Share of sites with noticeable litter		
None	405	13.4
5 per cent	879	29.1
10 per cent	641	21.2
25 per cent	475	15.7
50 per cent	285	9.4
75 per cent	120	4.0
90 per cent	45	1.5
All of them	167	5.5
Amount of litter at each site with noticeable litter		
No litter	405	13.4
Low (12 items/100m2)	1266	42.0
Moderate (25 items/100m2)	734	24.3
High (50 items/100m2)	449	14.9
Very high (125 items/100m2)	163	5.4
Total		
All respondents	**3017**	**100.0**

Source: CIE.

Chart 4.2 shows the extent of the skewed distribution of litter experience across respondents (at their assigned site type), with most respondents seeing relatively low amounts of litter at a relatively low share of sites.

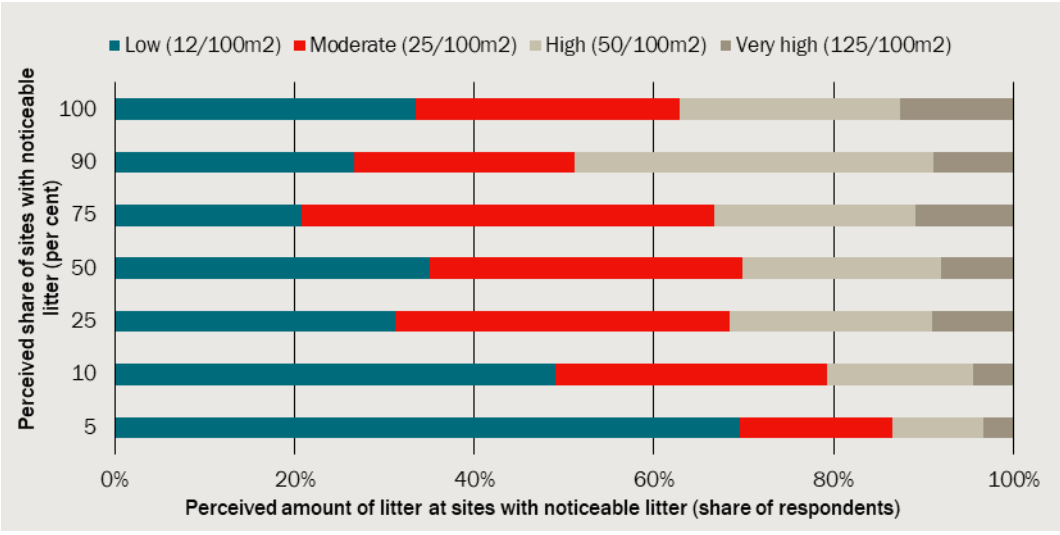
4.2 The distribution of litter over sites



Data source: CIE

Respondents seeing a high share of sites with noticeable litter tended to also indicate seeing higher amounts of litter at each site (chart 4.3). For example, while only 30 per cent of respondents seeing litter at 5 per cent of sites indicated they saw moderate-or-higher litter amounts, this share rises to 65-80 per cent for all respondents seeing more than 25 per cent of sites with litter. It is possible that site types or regions with greater volumes of litter will have both more sites with litter and more litter at those sites. It is also possible this correlation is due to variation across respondents in awareness of litter.

4.3 Baseline amount of litter by share of sites with noticeable litter



Data source: CIE.

Table 4.4 provides the weighted average (across respondents) share of sites with noticeable litter for each site type and each state, including respondents indicating they never see litter. Responses indicate the site types with the greatest share of sites with noticeable litter are beaches/waterways, recreational parks in Victoria, and highways/non-residential streets in NSW and Queensland. Residential areas and local streets have the lowest share of sites with noticeable litter.

4.4 Weighted average share of sites with noticeable litter by site type by state

	NSW	Victoria	Queensland
	Weighted average share of sites	Weighted average share of sites	Weighted average share of sites
Beaches and waterways	24.1	32.4	26.0
Recreational parks	20.0	27.6	20.7
Shopping centres and retail areas	19.0	21.9	21.7
Highways and non-residential streets	28.6	19.8	27.4
Industrial areas	25.0	21.6	20.8
Residential areas and local streets	15.0	14.8	14.0
National parks, bushland and forests	19.0	23.5	21.6
Total	**21.5**	**23.1**	**21.7**

Source: CIE

The share of respondents that never see litter varies across sites, but is highest in Victoria (except at highways and non-residential streets) (table 4.5). Yet, the Victorians who do see litter, see it at such a large share of sites that the weighted average share of sites is slightly higher for Victoria than for the other states.

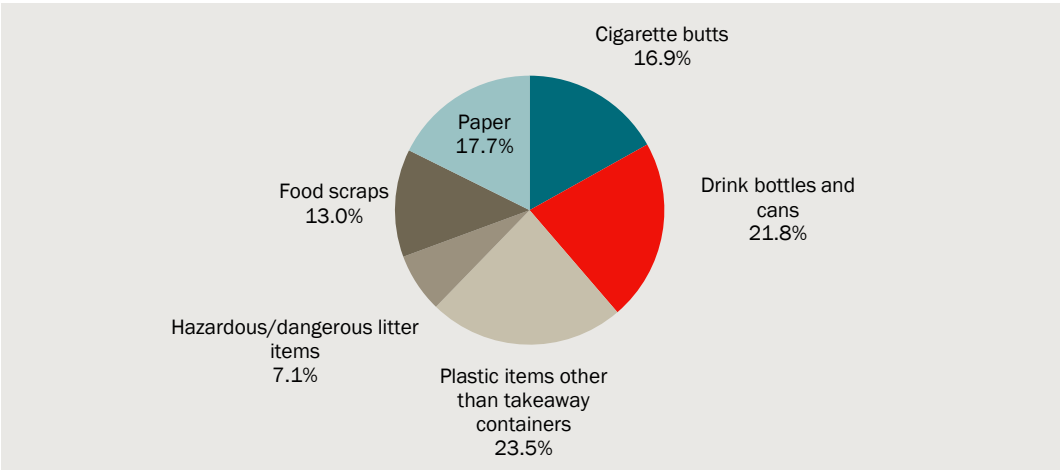
4.5 Share of respondents who never see litter by site type by state

Site	NSW	VIC	QLD
	Per cent	Per cent	Per cent
Beaches and waterways	10.6	13.6	9.3
Highways and non-residential streets	9.4	9.2	10.6
Industrial areas	13.7	15.4	16.2
National parks, bushland and forests	13.2	17.5	12.9
Recreational parks	7.1	21.4	14.9
Residential areas and local streets	13.3	14.4	11.9
Shopping centres and retail areas	15.6	19.4	12.2

Source: CIE

The composition of litter by type of item is shown in chart 4.6. This excludes respondents who see no litter, and is an average across all respondents who see litter regardless of the amount of litter they see.

4.6 Typical composition of litter items respondents see



Data source: CIE.

Status quo for illegal dumping

The typical respondent sees illegally dumped waste relatively infrequently, with a median frequency of two or four sightings per year, depending on the site type and state. However, there were a small number of respondents who see dumped waste very frequently, such as on a weekly or even daily basis, which results in an average frequency as high as almost 100 sightings per year in residential areas and local streets. This is partially associated with people visiting these sites more frequently (see table 4.11 later in this chapter for average sightings per visit and appendix E for visitation rates).

4.7 Respondent perceptions of existing illegal dumping

Site	NSW	VIC	QLD
	Sightings per year	Sightings per year	Sightings per year
Mean			
Beaches and waterways	51.1	29.5	24.6
Highways and non-residential streets	68.4	77.8	64.0
Industrial areas	51.2	43.2	38.1
National parks, bushland and forests	41.9	40.5	27.6
Recreational parks	52.4	62.3	33.4
Residential areas and local streets	93.4	85.5	83.2
Shopping centres and retail areas	49.8	49.2	39.8
Median			
Beaches and waterways	2	2	2
Highways and non-residential streets	12	26	12
Industrial areas	4	4	2
National parks, bushland and forests	2	2	2
Recreational parks	12	4	2

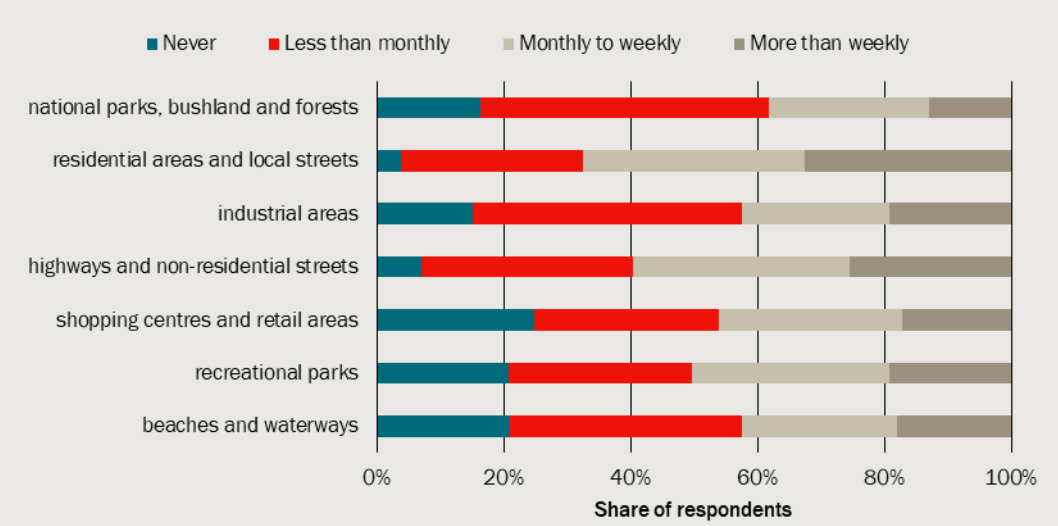
Site	NSW	VIC	QLD
	Sightings per year	Sightings per year	Sightings per year
Residential areas and local streets	26	26	26
Shopping centres and retail areas	4	12	4

Note: These figures exclude Wave 1 of the survey (approximately 10 per cent of sample) because these respondents were not asked this question about dumping frequency if they indicated they never saw sites with noticeable litter. Subsequent waves of the survey asked all respondents about how often they observed dumping, regardless of whether they reported seeing sites with noticeable litter or not.

Source: CIE.

The distribution of the frequency of seeing illegally dumped waste varies across site types (charts 4.8 to 4.10). There is a significant share of respondents who see illegally dumped waste more than once a week, ranging from 7 per cent at Victorian beaches and waterways to as high as 33 per cent at NSW residential areas and local streets. These respondents indicating hundreds of sightings each year result in the mean sighting frequency being much greater than the median.

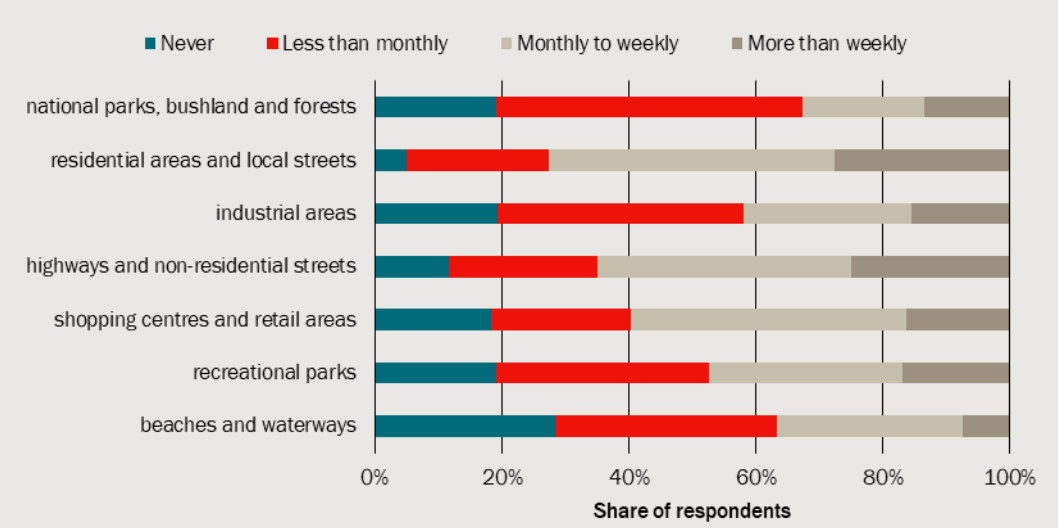
4.8 Illegally dumped waste sighting frequency level – New South Wales



Note: These figures exclude Wave 1 of the survey (approximately 10 per cent of sample) because these respondents were not asked this question about dumping frequency if they indicated they never saw sites with noticeable litter. Subsequent waves of the survey asked all respondents about how often they observed dumping, regardless of whether they reported seeing sites with noticeable litter or not.

Source: CIE.

4.9 Illegally dumped waste sighting frequency level – Victoria



Note: These figures exclude Wave 1 of the survey (approximately 10 per cent of sample) because these respondents were not asked this question about dumping frequency if they indicated they never saw sites with noticeable litter. Subsequent waves of the survey asked all respondents about how often they observed dumping, regardless of whether they reported seeing sites with noticeable litter or not.

Source: CIE.

4.10 Illegally dumped waste sighting frequency level – Queensland

Note: These figures exclude Wave 1 of the survey (approximately 10 per cent of sample) because these respondents were not asked this question about dumping frequency if they indicated they never saw sites with noticeable litter. Subsequent waves of the survey asked all respondents about how often they observed dumping, regardless of whether they reported seeing sites with noticeable litter or not.

Source: CIE.

Respondents were asked both how frequently they go to their assigned site type and how often they see illegally dumped waste at that site type. The average sightings of illegally dumped waste per visit are set out in table 4.11. The averages exceed one sighting per visit for industrial areas and for national parks, bushland and forests, which indicates either very high levels of dumping at these site types or that some respondents may have overestimated the frequency with which they see illegally dumped waste; for example, by thinking of sightings across all site types rather than only their assigned site type.

4.11 Average sightings of illegally dumped waste per visit by site type by state

	NSW	Victoria	Queensland
	sightings per visit	sightings per visit	sightings per visit
Beaches and waterways	0.84	0.86	0.39
Recreational parks	0.74	0.68	0.62
Shopping centres and retail areas	0.39	0.44	0.34
Highways and non-residential streets	0.62	0.60	0.43
Industrial areas	1.10	1.12	1.00
Residential areas and local streets[a]	0.26	0.23	0.23
National parks, bushland and forests	1.15	1.28	1.30
Total	**0.50**	**0.49**	**0.39**

[a] The number of visits to residential areas and local streets was assumed to be 365 days per year

Source: CIE

Most dumping incidents are associated with household waste (table 4.12). Green waste and mulch is more common at sites which are natural environments, such as beaches, waterways and parks.

4.12 Average composition of sighted illegally dumped waste by state

Site	Household waste at charity bins or donation points	Household waste	Green waste and mulch	Construction and demolition	Commercial and industrial	Total
	Sightings per year	Sightings per year	Sightings per year	Sightings per year	Sightings per year	Sightings per year
New South Wales						
Beaches and waterways	N/A	16.9	10.7	7.7	15.7	51.1
Recreational parks	N/A	18.5	23.5	6.1	4.2	52.4
Shopping centres and retail areas	32.5	11.1	1.9	2.1	2.2	49.8
Highways and non-residential streets	N/A	40.2	7.2	11.6	9.3	68.4
Industrial areas	N/A	19.0	6.1	10.5	15.6	51.2
Residential areas and local streets	N/A	69.3	9.4	9.1	5.5	93.4
National parks, bushland and forests	N/A	14.8	18.3	2.9	5.8	41.9
Victoria						
Beaches and waterways	N/A	14.9	8.8	3.5	2.3	29.5
Recreational parks	N/A	19.0	20.5	9.1	13.7	62.2
Shopping centres and retail areas	36.7	8.2	1.4	1.6	1.3	49.2
Highways and non-residential streets	N/A	41.3	14.8	9.6	12.1	77.8

Site	Household waste at charity bins or donation points	Household waste	Green waste and mulch	Construction and demolition	Commercial and industrial	Total
	Sightings per year	Sightings per year	Sightings per year	Sightings per year	Sightings per year	Sightings per year
Industrial areas	N/A	11.6	3.0	13.3	15.3	43.2
Residential areas and local streets	N/A	63.5	9.9	6.8	5.3	85.5
National parks, bushland and forests	N/A	11.2	18.4	5.0	5.9	40.5
Queensland						
Beaches and waterways	N/A	8.9	9.7	3.5	2.5	24.6
Recreational parks	N/A	16.9	14.0	1.6	1.0	33.4
Shopping centres and retail areas	32.4	6.0	0.2	0.2	1.0	39.8
Highways and non-residential streets	N/A	37.5	9.2	8.5	8.7	64.0
Industrial areas	N/A	14.2	1.3	12.2	10.4	38.1
Residential areas and local streets	N/A	57.4	15.8	7.2	2.7	83.2
National parks, bushland and forests	N/A	9.6	4.8	8.6	4.6	27.6
Total						
Beaches and waterways	N/A	13.6	9.8	5.0	7.0	35.3
Recreational parks	N/A	18.1	19.3	5.6	6.4	49.4
Shopping centres and retail areas	33.9	8.3	1.1	1.3	1.5	46.1
Highways and non-residential streets	N/A	39.7	10.6	9.8	10.1	70.2
Industrial areas	N/A	14.9	3.4	12.0	13.7	43.9
Residential areas and local streets	N/A	63.3	11.8	7.7	4.4	87.3
National parks, bushland and forests	N/A	11.7	13.3	5.7	5.4	36.1

Note: These figures exclude Wave 1 of the survey (approximately 10 per cent of sample) because these respondents were not asked this question about dumping frequency if they indicated they never saw sites with noticeable litter. Subsequent waves of the survey asked all respondents about how often they observed dumping, regardless of whether they reported seeing sites with noticeable litter or not.

Source: CIE

More respondents never see illegally dumped waste at their assigned site type (table 4.13) than the share that never see litter at their assigned site type (recall table 4.5).

4.13 Share of respondents who never see illegal dumping at their assigned site type

Site	NSW	VIC	QLD
	Per cent	Per cent	Per cent
Beaches and waterways	20.9	28.5	24.6
Highways and non-residential streets	7.0	11.7	11.1
Industrial areas	15.2	19.4	16.4
National parks, bushland and forests	16.3	19.2	22.2
Recreational parks	20.8	19.1	32.0
Residential areas and local streets	3.9	5.0	10.3
Shopping centres and retail areas	24.8	18.4	28.0

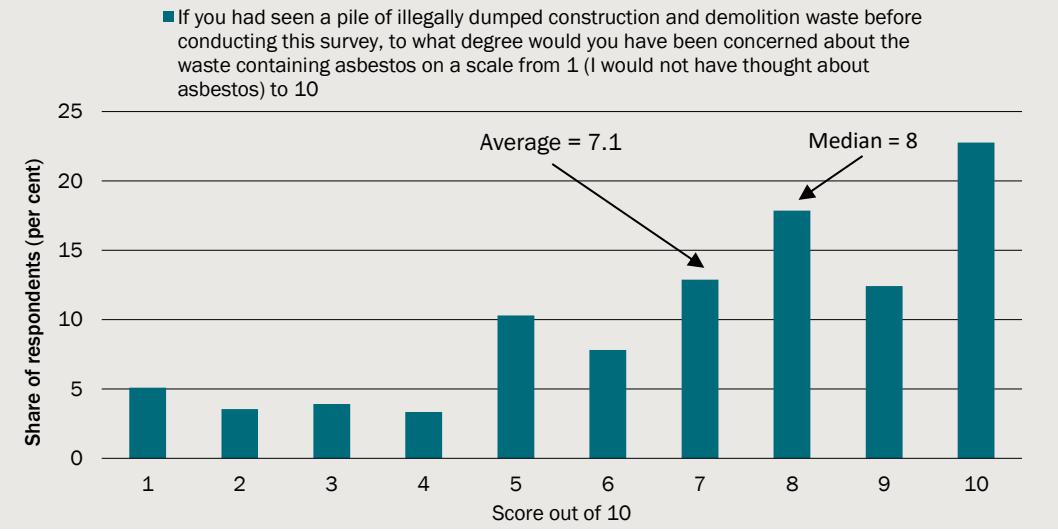
Note: These figures exclude Wave 1 of the survey (approximately 10 per cent of sample) because these respondents were not asked this question about dumping frequency if they indicated they never saw sites with noticeable litter. Subsequent waves of the survey asked all respondents about how often they observed dumping, regardless of whether they reported seeing sites with noticeable litter or not.

Source: CIE

Litter and illegal dumping attitudes

Most respondents reported that they would have been concerned about illegally dumped construction and demolition waste containing asbestos, even before completing the survey (chart 4.14). This relatively high degree of awareness or concern is likely to factor into the value that respondents placed on reducing the frequency of illegal dumping of construction and demolition waste.

4.14 Degree of concern about asbestos in illegally dumped waste

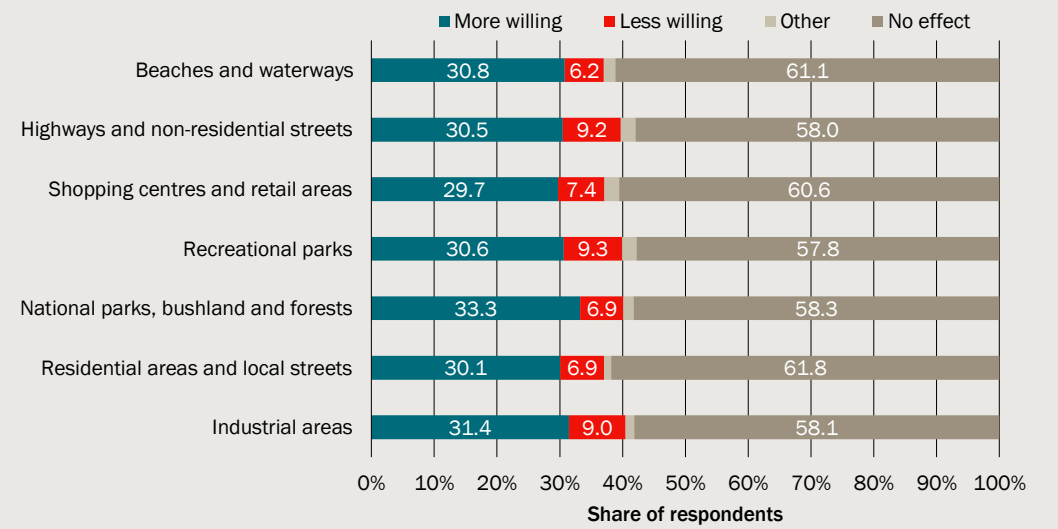


Data source: CIE.

The COVID-19 pandemic may affect attitudes towards litter and illegal dumping because people may be changing their frequency with which they visit sites and therefore how often they see litter. There may also be changes in the composition of litter as a result of COVID-19, such as littering of facemasks. COVID-19 appears to have had a neutral or

positive impact on willingness to support litter reduction programs, and this impact is very consistent across site types (chart 4.15).

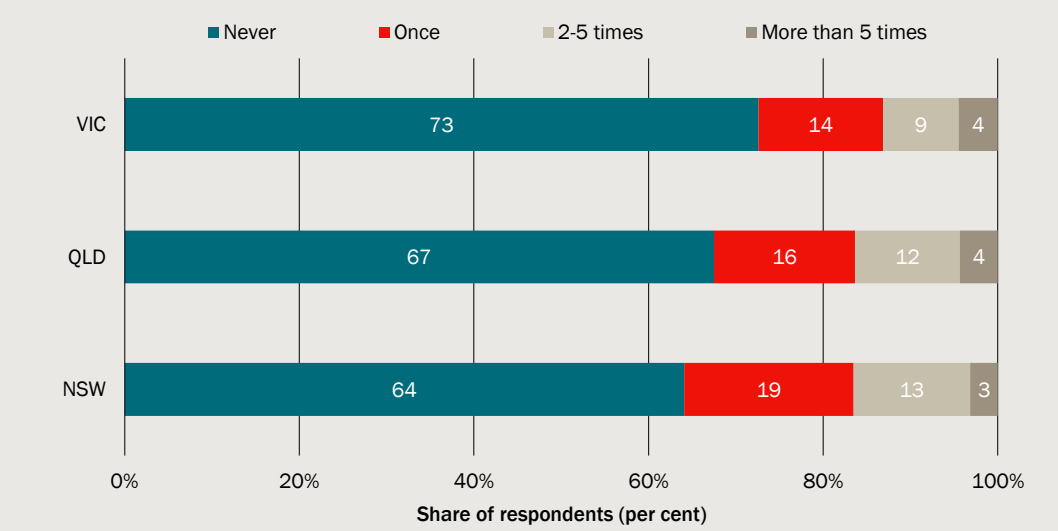
4.15 Impact of COVID-19 on willingness to support litter reduction programs



Data source: CIE.

One indicator of preferences about litter may be whether a respondent participates in clean-up programs, such as Clean Up Australia Day.[4] A majority of respondents have never participated in clean-up programs, and Victoria has the lowest participation rate of the three states covered by the survey.

4.16 Share of respondents that have participated in a clean-up program



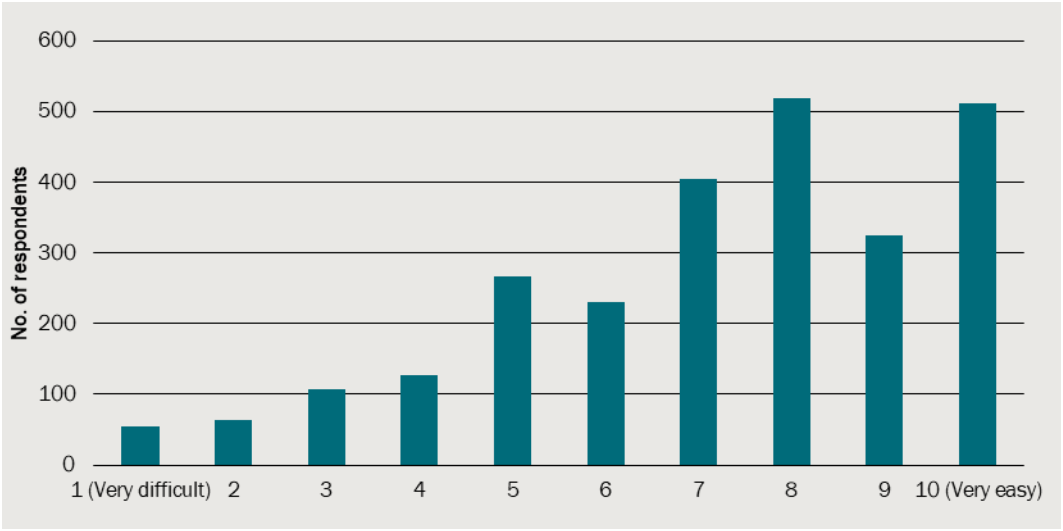
Data source: CIE.

4 https://www.cleanupaustraliaday.org.au/

Perceptions of the survey instrument

Very few respondents indicated having significant difficulty answering the choice questions. When asked to rate how easy the questions were to answer on a scale from 1 (very difficult) to 10 (very easy), more than three quarters of respondents gave a response of 6 or higher. The mean response was 7.2. Only 14 per cent of respondents gave a response of less than 5.

4.17 Choice question difficulty



Q23 - How easy did you find answering the options questions on a scale from 1 (very difficult) to 10 (very easy)?
Data source: CIE

Some 26 per cent of respondents who participated in the choice exercise thought there was at least one option that government actions would be unable to achieve, but around four in five of those respondents indicated that they answered the questions as though the option would be delivered. Only 7 per cent of respondents indicated they answered the question as though they would get a different outcome to that described in the question.

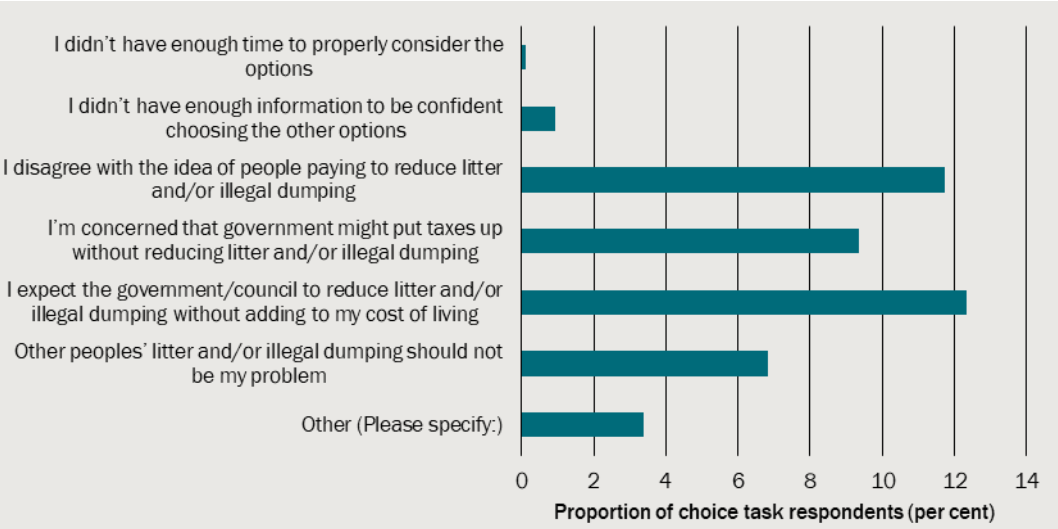
4.18 Choice question plausibility and implications for response

Q25	Q26	Count	Count
		No. resp.	per cent
Yes		1184	45
No		690	26
	I answered the question(s) as though I would be getting the litter, illegal dumping and cost of living impacts as described...	511	20
	I answered the question(s) as though I would be getting different litter, illegal dumping and cost of living impacts...	179	7
Don't know		738	28
Total		2612	100

Q25 - Did you believe that government actions would be able to achieve any of the options presented?
Q26 - When you saw options that you did not believe the government could achieve, how did you go about answering the question(s)?
Source: CIE

Around 22 per cent of the respondents who answered the choice questions (i.e. respondents who see at least some litter) selected the 'no change' option in all of the choice questions. The most common reasons given for this choice pattern were an expectation that government should reduce litter and illegal dumping without cost to the respondent, disagreement with the concept of paying to reduce litter, and concern that the government may increase costs without delivering the litter reductions.

4.19 Reasons for serial non-participation in the discrete choice questions



Q27 - Why did you select the 'no change' option in every option question?

Data source: CIE

Visual amenity was the largest motivation for WTP, on average. Reducing harm to wildlife and plants, safety, and non-use preservation were also important considerations. Reducing other types of anti-social behaviour was the least important of the five motivations that were put to respondents. The little variation in motivations across site types accord with expectations. Visual amenity is less important in industrial areas than at other sites. Non-use preservation and reducing harm to wildlife is more important at National Parks than at other site types. Safety is more important near the home.

4.20 Motivations for willingness to pay to reduce litter and illegal dumping

Site	Making the places I visit look more pleasant or natural	Preserving natural environments that I don't visit	Making places safer	Reducing harm to wildlife and plants	Reducing other types of anti-social behaviour
	Average rating	Average rating	Average rating	Average rating	Average rating
Beaches and waterways	8.2	7.9	7.7	8.1	6.9
Recreational parks	8.3	7.9	7.9	8.2	7.2
Shopping centres and retail areas	8.3	7.5	7.8	7.9	7.2
Highways and non-residential streets	8.3	7.7	7.7	8.0	7.2

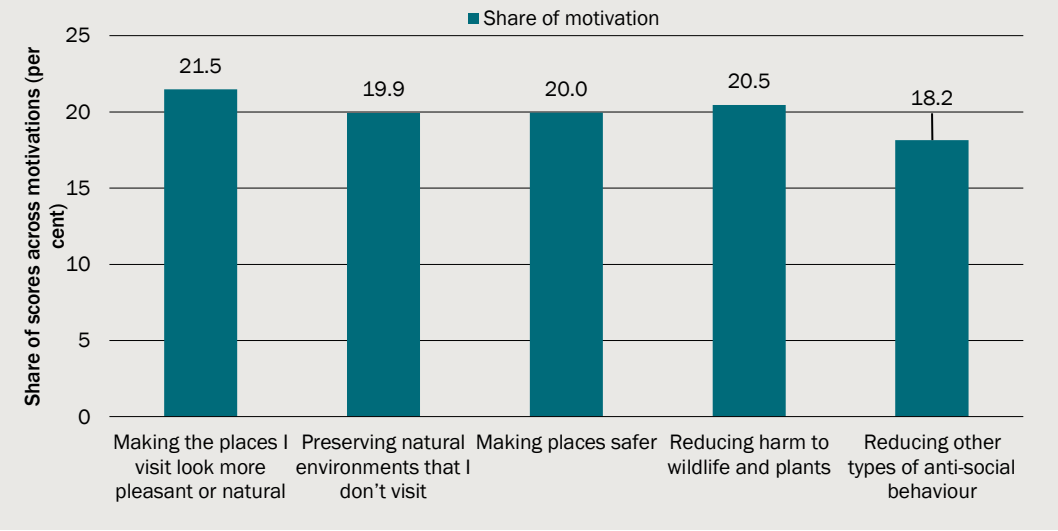
Site	Making the places I visit look more pleasant or natural	Preserving natural environments that I don't visit	Making places safer	Reducing harm to wildlife and plants	Reducing other types of anti-social behaviour
	Average rating	Average rating	Average rating	Average rating	Average rating
Industrial areas	7.7	7.3	7.6	7.5	7.0
Residential areas and local streets	8.4	7.7	8.0	7.6	6.9
National parks, bushland and forests	8.4	8.1	7.7	8.3	7.2
Total	**8.2**	**7.7**	**7.8**	**7.9**	**7.1**

Q28 - How much was your willingness to support reductions in litter and dumping due to the benefit below on a scale from 1 to 10?
Note: Percentage base excludes respondents selecting 'no change' in every question and respondents with a zero-litter baseline.
Source: CIE

Most respondents provided similar responses to each question, but the average level of responses across these questions varied significantly across respondents. That is, many respondents answered '8 out of 10' for all five questions, while many respondents answered '3 out of 10'. Accordingly, we convert the scores into a share of total scores across the five questions, yielding an estimate of the share of total motivation accounted for by each factor.

The most important factor by a small margin is the aesthetic or amenity impact of litter and illegal dumping, in that removing litter or dumped waste will make places look more pleasant or natural. Reducing harm to wildlife and plants is estimated to comprise 20.5 per cent of willingness to pay, on average. In chapter 7, we use this estimate to derive estimates of total WTP that exclude the component associated with concerns about wildlife and plant harm. The purpose of doing so is to provide estimates of WTP that can be added to valuations of the environmental impacts of reducing litter and illegal dumping without risking the double counting of benefits.

4.21 Motivations for valuing reduced litter and illegal dumping



Data source: CIE

Around 9 in 10 respondents expected government action on litter and illegal dumping would lead to additional costs to them. However, only around 6 in 10 expected the survey would affect government action on litter. We test the sensitivity of key WTP estimates to the inclusion or exclusion of respondents who found the survey inconsequential.

4.22 Consequentiality of the survey

	Count	Count
	No. resp.	per cent
Q49 - To what degree do you expect that the results of this survey will affect government action on litter and illegal dumping in your state?		
I believe it is very likely the survey will affect government action on litter and illegal dumping	377	12
I believe it is somewhat likely the survey will affect government action on litter and illegal dumping	1484	49
I don't think the survey will affect government action on litter and illegal dumping	1156	38
Q50 - Do you expect government action on litter and illegal dumping would lead to you paying costs through taxes, rates and product prices?		
I believe it is very likely I would pay costs	1427	47
I believe it is somewhat likely I would pay costs	1258	42
I don't think I would pay any costs	332	11

Source: CIE

5 *Average willingness to pay for reductions in litter and illegal dumping*

Reductions in litter and illegal dumping can take various forms. We separately estimate the WTP to:

- reduce the share of sites with noticeable litter,
- reduce the amount of litter at each site,
- reduce the frequency of seeing illegally dumped waste, and
- reducing litter and illegal dumping to zero.

For a given site type, these estimates can be added together without concerns about subadditivity (the sum of the value of various parts exceeding the value of the whole), since the estimates were derived from a choice exercise that combined changes on all these dimensions. More caution is needed when adding WTP estimates across site types, since site type varied across but not within subjects. This issue is discussed further in chapter 7.

Separately estimating the value of partial and complete (i.e. to zero litter and illegal dumping) reductions is important because the value of litter/illegal dumping reductions may be non-linear, and evidence from this study is needed to characterise that non-linearity. Separately estimating the value of reductions in the share of sites with noticeable litter and the amount of litter is important because of this non-linearity, since a reduction in the share of sites with noticeable litter is analogous to reducing the amount of litter at some sites to zero.

Partial reductions in litter and/or illegal dumping

Model estimation

We estimated numerous models on the data from the DCE questions to identify a final set of selected models that capture the most important relationships for the research questions. The central WTP estimates presented in this chapter are estimated using a single panel mixed multinomial logit model,[5] with fixed parameters for cost-related

5 The mixed logit model measures the degree to which changes in each feature/attribute affect the probability that an option is chosen (or, when applied within the framework of random utility theory, the degree to which they affect indirect utility) and the degree to which these effects vary across respondents. WTP for a specified change in a non-monetary attribute is calculated as the change in the monetary attribute that, when combined with the change in the

attributes and random (normal distribution) parameters for the main litter attributes. The model allowed for full correlation between the distributions of the random parameters. Sampling weights were used to account for under- and over-sampling of various age categories. The model shows that respondents made considered choices on the basis of the attribute levels presented, as evidenced by the signs and relatively large z-values on the parameter estimates. Appendix D contains detailed estimation results for the main model.

Various alternative specifications for capturing the non-linear preference for the proportion of places with litter were estimated but excluded from the final set of models because they did not significantly improve model fit (table 5.1).

5.1 Alternative specifications for key attributes

Attribute	Variable specification included in main model	Alternative variable specifications tested
Share of sites with noticeable litter	Continuous variable for the share of sites in percentage terms (e.g. 5 corresponding to 5 per cent)	▪ Dummy variable for each level of the share variable ▪ Ratio of a continuous share variable for the option relative to the status quo (e.g. 0.1 for an option with 5 per cent of sites having noticeable litter relative to a status quo of 50 per cent of sites)
Amount of litter at each site	Dummy variable for each level of amount (i.e. very low, low, moderate, high and very high)	▪ Continuous variable for amount in terms of the number of items per square metre (e.g. 12 items per 100m2 for the low level) ▪ Ratio of a continuous amount variable for the option relative to the status quo (e.g. 0.5 for an option with moderate [25 items] with a status quo of high [50 items])
Illegally dumped waste sighting frequency	Square root of a continuous variable for annual frequency of sightings (e.g. seeing dumped waste every week corresponds to 52 sightings per year, and a square root of ~7.2)	▪ Continuous variable for annual sighting frequency (e.g. seeing illegally dumped waste every week corresponds to 52 sightings per year) ▪ Dummy variable for each level of sighting frequency (e.g. weekly, once every five years, etc.)

Source: CIE.

Other alternative model specifications that were tested but not chosen include:

- Conditional logit regression models, which do not allow for random parameters, and
- Separate models by site, which required a very large amount of processing time for the mixed logit specification and would not offer materially more robust results than the single mixed logit model. The key attribute variables in table 5.1 and the status quo variable were interacted with dummy variables for state and site to obtain separate effects for each state/site combination.

Estimates of willingness to pay

Estimates of average WTP for various reductions in litter and illegal dumping are provided by state and by site type, with 95 per cent confidence intervals, in table 5.4. All

non-monetary attribute, would keep choice probability/utility unchanged. For a recent discussion of variants of the mixed logit model, see Hess and Train 2017.

the estimates of WTP for partial reductions in litter and illegal dumping in this report are calculated using the values in this table. They are unconditional estimates of WTP that can be generalised to the broader population. The DCE statistical model was estimated on a subset of around 60 per cent of the respondents who commenced the survey (excluding respondents who were screened out, for example due to age or location quotas being full). The 40 per cent of respondents not used in model estimation either indicated that they never see litter, chose the 'no change' option in every choice task, or dropped out of the survey. When calculating estimates of unconditional mean WTP, we assume these respondents have zero WTP to reduce litter or illegal dumping. The weightings applied to estimates of conditional mean WTP for the litter attributes by state by site type are set out in table 5.2.

5.2 Weightings applied to conditional estimates of WTP for reduced litter

Site type	NSW	Victoria	Queensland	Total
	per cent	per cent	per cent	per cent
Beaches and waterways	64.5	56.6	65.0	62.0
Recreational parks	64.7	58.0	50.3	57.6
Shopping centres and retail areas	54.5	58.1	51.6	54.9
Highways and non-residential streets	59.3	63.6	63.8	62.3
Industrial areas	64.6	62.0	60.9	62.5
Residential areas and local streets	61.4	61.0	58.7	60.3
National parks, bushland and forests	60.8	56.3	58.4	58.5
All sites	**61.5**	**59.4**	**58.4**	**59.7**

Source: CIE

The weightings applied to estimates of conditional mean WTP for the illegal dumping attribute are set out in table 5.3. These weights account for the fact that 231 respondents to the choice tasks did not see the dumping attribute because they had indicated they never see illegally dumped waste. These respondents are assumed to have zero WTP to reduce illegal dumping. The weights also account for 602 respondents who do see illegally dumped waste, but did not see the choice tasks because they indicated they never see litter. The latter respondents are assumed to have the same WTP to avoid seeing illegal dumping as the respondents who answered the choice tasks. The combined effect of accounting for these two groups is that unconditional estimates of WTP to reduce illegal dumping are 18 per cent higher than they would otherwise have been.

5.3 Weightings applied to conditional estimates of WTP for reduced illegal dumping

Site type	NSW	Victoria	Queensland	Total
	per cent	per cent	per cent	per cent
Beaches and waterways	68.6	60.3	66.3	65.1
Recreational parks	68.5	67.0	55.8	63.7
Shopping centres and retail areas	65.5	72.6	62.6	67.1
Highways and non-residential streets	78.7	74.3	76.9	76.5

Site type	NSW	Victoria	Queensland	Total
	per cent	per cent	per cent	per cent
Industrial areas	72.5	69.5	73.5	71.9
Residential areas and local streets	83.7	83.1	79.7	82.1
National parks, bushland and forests	71.4	67.2	65.9	68.1
Total	**72.7**	**70.5**	**68.6**	**70.6**

Source: CIE

5.4 Estimates of unconditional average willingness to pay for reductions in litter and illegal dumping by state by site type

	One percentage point decrease in the proportion of sites with noticeable litter	Change in amount of litter at sites with noticeable litter: 'High' to 'Very low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Moderate'	Change in amount of litter at sites with noticeable litter: 'Very high' to 'High'	Unit decrease in the square root of number of days per year seeing dumped waste
	$/mth	$/mth	$/mth	$/mth	$/mth	$/mth
Queensland beaches						
Point estimate	0.09	3.40	3.76	1.65	2.04	0.28
Lower bound	0.06	2.23	2.61	0.71	0.40	0.17
Upper bound	0.11	4.57	4.92	2.59	3.68	0.39
Queensland highways						
Point estimate	0.05	1.87	2.07	0.91	1.12	0.18
Lower bound	0.03	1.21	1.42	0.39	0.21	0.11
Upper bound	0.06	2.52	2.72	1.42	2.02	0.25
Queensland industrial						
Point estimate	0.04	1.66	1.84	0.80	0.99	0.16
Lower bound	0.03	1.08	1.26	0.35	0.19	0.10
Upper bound	0.06	2.24	2.41	1.26	1.80	0.22
Queensland National Parks						
Point estimate	0.06	2.46	2.72	1.19	1.47	0.22
Lower bound	0.05	1.67	1.95	0.53	0.29	0.14
Upper bound	0.08	3.25	3.49	1.85	2.66	0.31
Queensland recreational parks						
Point estimate	0.04	1.63	1.80	0.79	0.98	0.15
Lower bound	0.03	1.02	1.19	0.33	0.18	0.08

	One percentage point decrease in the proportion of sites with noticeable litter	Change in amount of litter at sites with noticeable litter: 'High' to 'Very low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Moderate'	Change in amount of litter at sites with noticeable litter: 'Very high' to 'High'	Unit decrease in the square root of number of days per year seeing dumped waste
	$/mth	$/mth	$/mth	$/mth	$/mth	$/mth
Upper bound	0.06	2.24	2.42	1.25	1.77	0.21
Queensland residential						
Point estimate	0.03	1.29	1.42	0.62	0.77	0.14
Lower bound	0.02	0.85	0.99	0.27	0.15	0.09
Upper bound	0.04	1.72	1.85	0.97	1.39	0.19
Queensland retail						
Point estimate	0.03	1.11	1.23	0.54	0.67	0.11
Lower bound	0.02	0.73	0.85	0.23	0.13	0.07
Upper bound	0.04	1.50	1.61	0.85	1.21	0.15
Victoria beaches						
Point estimate	0.11	4.15	4.59	2.01	2.49	0.36
Lower bound	0.07	2.62	3.05	0.84	0.46	0.21
Upper bound	0.14	5.68	6.14	3.19	4.52	0.50
Victoria highways						
Point estimate	0.04	1.68	1.86	0.82	1.01	0.16
Lower bound	0.03	1.12	1.31	0.36	0.20	0.10
Upper bound	0.06	2.24	2.41	1.27	1.82	0.22
Victoria industrial						
Point estimate	0.06	2.21	2.44	1.07	1.32	0.20
Lower bound	0.04	1.40	1.63	0.45	0.26	0.12
Upper bound	0.08	3.02	3.26	1.69	2.39	0.28

	One percentage point decrease in the proportion of sites with noticeable litter	Change in amount of litter at sites with noticeable litter: 'High' to 'Very low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Moderate'	Change in amount of litter at sites with noticeable litter: 'Very high' to 'High'	Unit decrease in the square root of number of days per year seeing dumped waste
	$/mth	$/mth	$/mth	$/mth	$/mth	$/mth
Victoria National Parks						
Point estimate	0.10	3.69	4.08	1.79	2.21	0.35
Lower bound	0.06	2.31	2.69	0.73	0.43	0.21
Upper bound	0.13	5.07	5.47	2.84	3.99	0.50
Victoria recreational parks						
Point estimate	0.05	1.74	1.92	0.84	1.04	0.16
Lower bound	0.03	1.12	1.30	0.36	0.20	0.10
Upper bound	0.06	2.36	2.54	1.33	1.89	0.23
Victoria residential						
Point estimate	0.06	2.44	2.70	1.18	1.46	0.27
Lower bound	0.04	1.53	1.77	0.50	0.28	0.15
Upper bound	0.09	3.36	3.63	1.87	2.65	0.38
Victoria retail						
Point estimate	0.05	2.03	2.24	0.98	1.21	0.20
Lower bound	0.04	1.29	1.50	0.42	0.23	0.12
Upper bound	0.07	2.76	2.98	1.55	2.19	0.29
NSW beaches						
Point estimate	0.11	4.07	4.50	1.97	2.44	0.35
Lower bound	0.08	2.70	3.15	0.87	0.48	0.21
Upper bound	0.14	5.44	5.86	3.08	4.40	0.48
NSW highways						

	One percentage point decrease in the proportion of sites with noticeable litter	Change in amount of litter at sites with noticeable litter: 'High' to 'Very low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Moderate'	Change in amount of litter at sites with noticeable litter: 'Very high' to 'High'	Unit decrease in the square root of number of days per year seeing dumped waste
	$/mth	$/mth	$/mth	$/mth	$/mth	$/mth
Point estimate	0.05	1.78	1.97	0.86	1.07	0.19
Lower bound	0.03	1.14	1.33	0.37	0.19	0.11
Upper bound	0.06	2.42	2.61	1.36	1.94	0.27
NSW industrial						
Point estimate	0.06	2.45	2.72	1.19	1.47	0.22
Lower bound	0.04	1.53	1.78	0.49	0.29	0.13
Upper bound	0.09	3.38	3.66	1.89	2.66	0.31
NSW National Parks						
Point estimate	0.11	4.37	4.84	2.12	2.62	0.41
Lower bound	0.08	2.79	3.25	0.89	0.49	0.25
Upper bound	0.15	5.96	6.43	3.35	4.75	0.58
NSW recreational parks						
Point estimate	0.07	2.66	2.94	1.29	1.59	0.23
Lower bound	0.05	1.67	1.95	0.54	0.28	0.13
Upper bound	0.09	3.64	3.93	2.04	2.90	0.32
NSW residential						
Point estimate	0.06	2.24	2.48	1.09	1.34	0.25
Lower bound	0.04	1.43	1.67	0.46	0.26	0.15
Upper bound	0.08	3.05	3.29	1.71	2.43	0.34
NSW retail						
Point estimate	0.05	1.74	1.92	0.84	1.04	0.17

	One percentage point decrease in the proportion of sites with noticeable litter	Change in amount of litter at sites with noticeable litter: 'High' to 'Very low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Moderate'	Change in amount of litter at sites with noticeable litter: 'Very high' to 'High'	Unit decrease in the square root of number of days per year seeing dumped waste
	$/mth	$/mth	$/mth	$/mth	$/mth	$/mth
Lower bound	0.03	1.09	1.27	0.35	0.19	0.10
Upper bound	0.06	2.38	2.57	1.33	1.89	0.24

Note: Lower bound and upper bounds represent the 95 per cent confidence interval. The estimates are weighted down to account for some of the population having a zero-litter or zero-dumping baseline. They represent the WTP for the reduction among those who see some litter/dumping, averaged over the whole population.

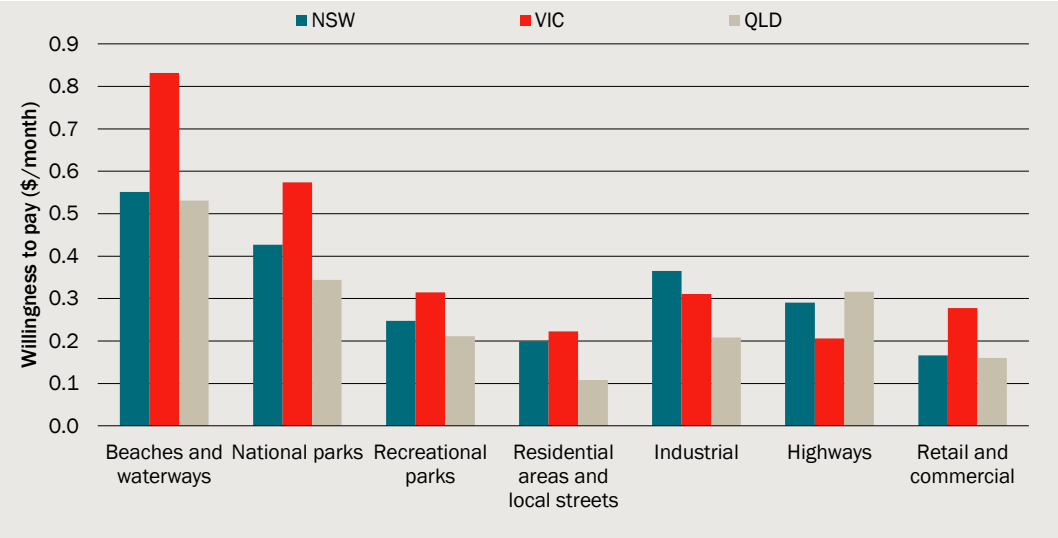
Source: CIE

The estimates in this report are calculated in terms of WTP per month (or per year). Analysts wishing to convert these estimates to 'per visit' values can use the visitation rate tables in appendix E to approximate these values.

Reduction in share of sites with noticeable litter

Models estimated with dummy variables for each level of the share of sites with noticeable litter found WTP is close to linear over the share of sites. In our model, each percentage point reduction in the share of sites with litter has the same WTP. As an example, figure 5.5 shows unconditional mean WTP for a 20 per cent reduction in the share of sites. This is calculated as a 20 per cent proportional reduction in the share of sites, taking account of the existing levels of litter at each site type in each state. For example, a 20 per cent reduction in the share of NSW beaches and waterways with noticeable litter moves the share by around 5 percentage points from 26 per cent of sites to 21 per cent of sites.[6] WTP for other reductions in the number of sites with noticeable litter can be estimated by linear extrapolation or interpolation from these results.

5.5 Willingness to pay for a 20 per cent reduction in the share of sites with litter



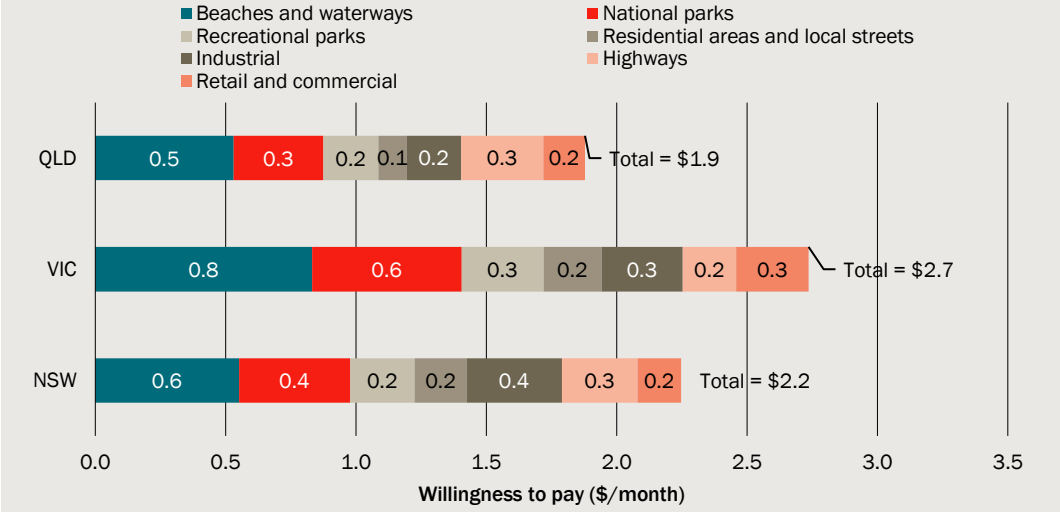
Note: The estimates are weighted down to account for some of the population having a zero-litter or zero-dumping baseline. They represent the WTP for the reduction among those who see some litter/dumping, averaged over the whole population.

Data source: CIE.

Table 5.6 shows the same results summed across site types for each state. Average WTP per household is highest in Victoria. This result is partly due to Victoria having a higher baseline share of sites with noticeable litter at site types with higher WTP such as beaches and waterways and national parks, bushland and forests, and therefore a 20 per cent reduction involves a greater percentage-point reduction in the share of sites with noticeable litter.

6 The 26 per cent baseline is the 24 per cent figure in table 4.4, adjusted to exclude respondents not included in the choice analysis (i.e. respondents who chose the 'no change' option in every choice task).

5.6 Willingness to pay for a 20 per cent reduction in the share of all sites with litter



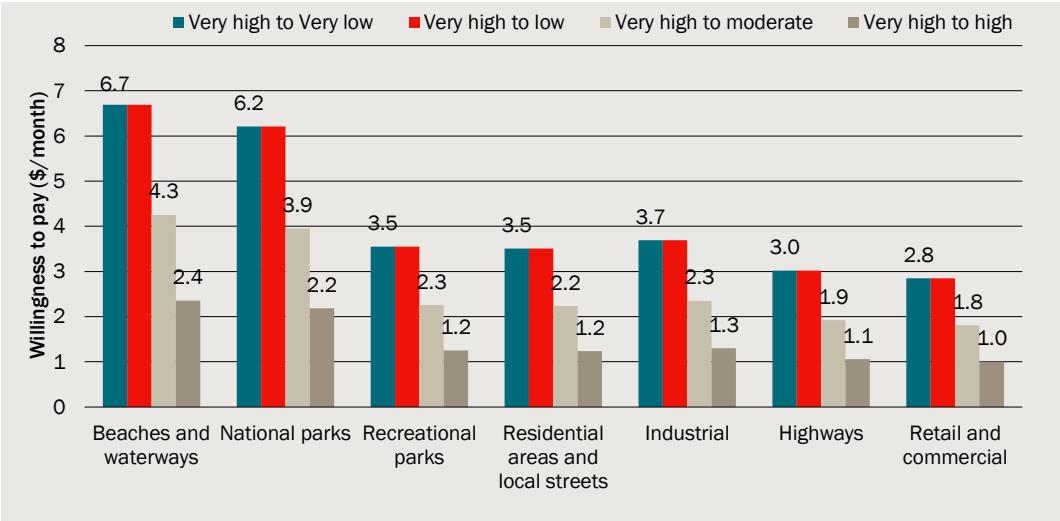
Note: The estimates are weighted down to account for some of the population having a zero-litter or zero-dumping baseline.

Data source: CIE.

Reduction in amount of litter at each site

WTP for reduced amounts of litter at sites with noticeable litter is measured for discrete changes in the five levels used in the survey, ranging from 'very low' (3 items per 100 m^2) to 'very high' (125 items per 100 m^2). WTP to reduce litter amounts from 'low' (12 items per 100 m^2) to 'very low' was statistically insignificant. WTP estimates for changes in levels of litter, across the three states combined, are illustrated in figure 5.7. Estimates for changes not represented by the column in the chart can be calculated by taking differences between the columns. For example, unconditional mean WTP to reduce litter amounts from 'moderate' to 'low' at beaches and waterways is approximately 6.7 minus 4.3; i.e. $2.40 per month.

5.7 Willingness to pay for reduced amounts of litter at sites with litter

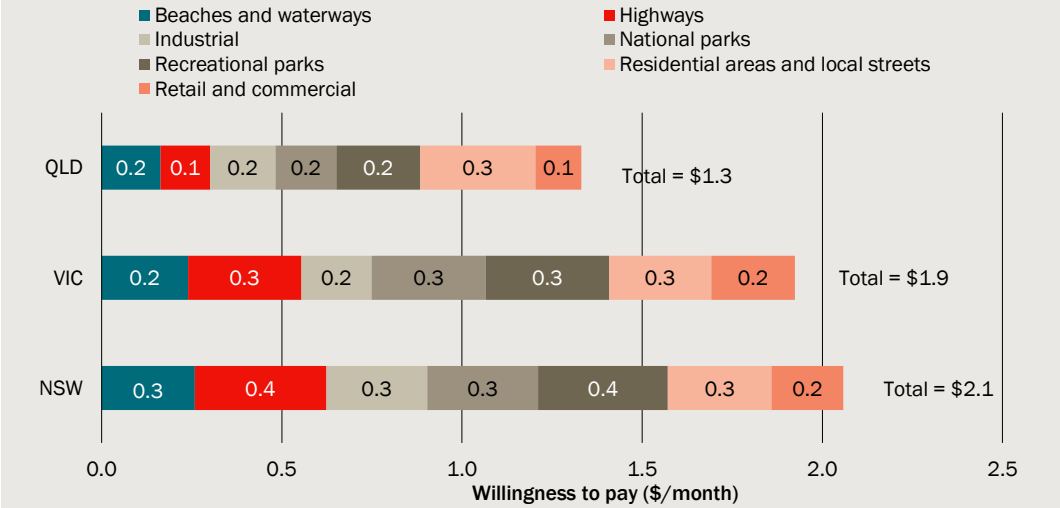


Note: The estimates are weighted down to account for some of the population having a zero-litter or zero-dumping baseline.

Data source: CIE.

These estimates can be combined with respondents' perceptions of the existing amounts of litter to calculate WTP for a percentage reduction in litter amounts. For example, estimates of unconditional mean WTP to reduce litter amounts by 20 per cent are shown in figure 5.8. The reduction in litter when moving between the discrete levels shown above is at least 50 per cent. We assume a linear interpolation, so that WTP for a 20 per cent reduction from 'high' would be two fifths of the WTP for the 50 per cent reduction from 'high' to 'moderate'. We conduct this calculation at each status quo level of litter and weight by the prevalence of that level.

5.8 Willingness to pay for a 20 per cent reduction in litter amounts across all sites



Note: The estimates are weighted down to account for some of the population having a zero-litter or zero-dumping baseline. They represent the WTP for the reduction among those who see some litter/dumping, averaged over the whole population.

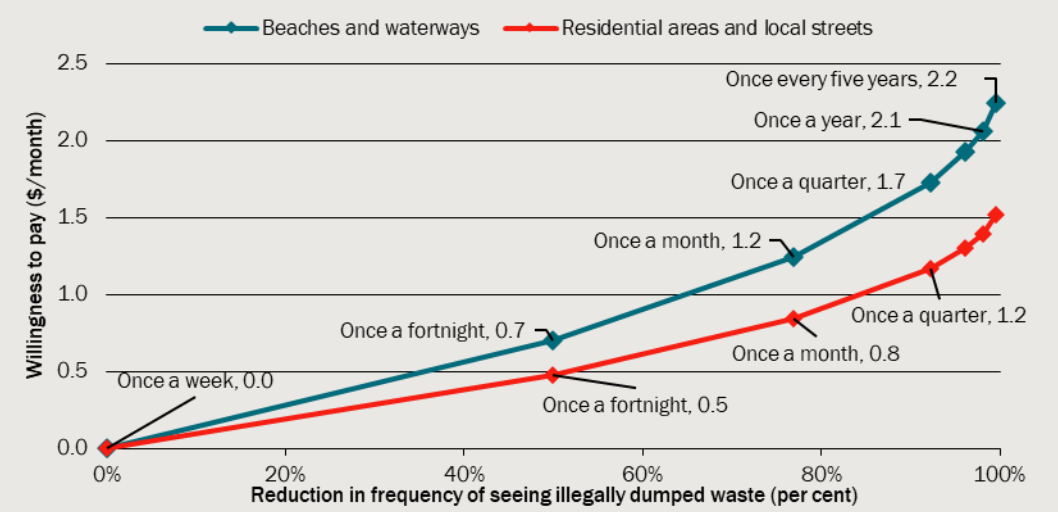
Data source: CIE.

Reduction in frequency of dumping

WTP for reductions in the frequency with which illegal dumping is seen is non-linear over frequency. The best-fitting model found that disamenity is related to the square root of the frequency with which dumped waste is seen. So, the impact of moving from seeing no dumping to seeing dumping fortnightly is greater than the impact of moving from seeing dumping fortnightly to seeing dumping weekly. The reverse is true for reductions in dumping. WTP to reduce the frequency of seeing dumped waste by 52 sightings per year will be more than double the WTP to reduce the frequency by 26 sightings per year.

Chart 5.9 provides an example of WTP for reduced dumping at two selected site types from a status quo level of seeing waste 'once a week'. Respondents who currently see illegally dumped waste once a week at beaches and waterways are willing to pay around $2 per month to reduce the frequency to around 'once a year'. The value of reductions in illegal dumping is higher for those who see dumping more frequently. For example, while a 50 per cent reduction is worth $0.7 per month if the respondent sees dumping once a week, a reduction from once a month to once a quarter (67 per cent) is worth only $0.5 per month.

5.9 Willingness to pay to reduce illegally dumped waste at two selected site types



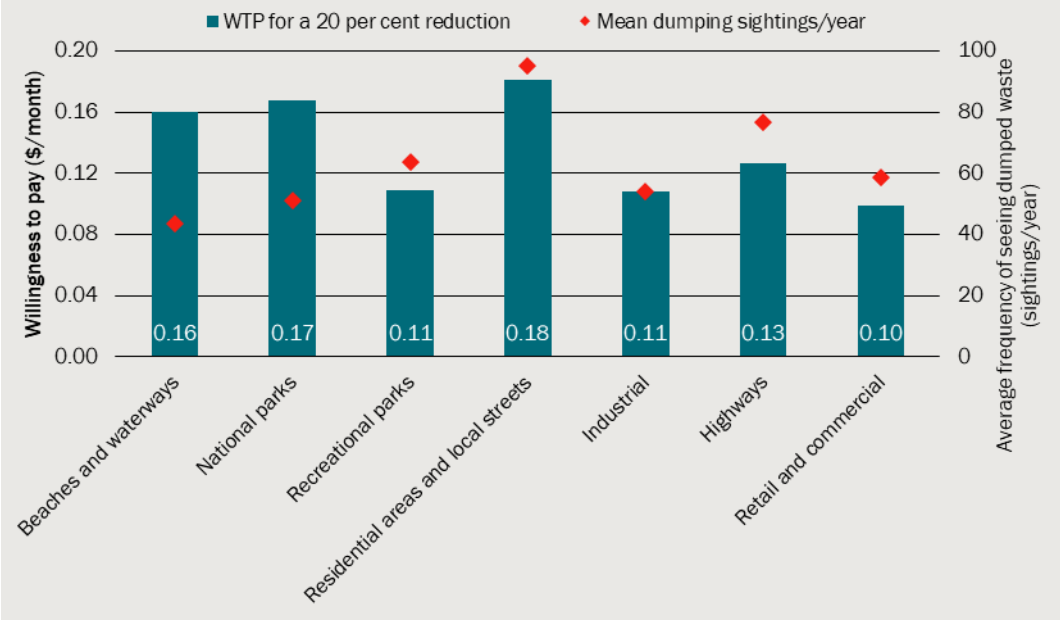
Note: The estimates are weighted down to account for some of the population having a zero-litter or zero-dumping baseline. They represent the WTP for the reduction among those who see some litter/dumping, averaged over the whole population.

Data source: CIE.

Since WTP for reductions in illegal dumping depends on the current frequency with which each person sees illegal dumping, WTP for a 20 per cent reduction across the entire population will depend on the distribution of frequency with which people see illegal dumping. WTP for a given percentage reduction is highest for residential areas and local streets. This is despite respondents indicating they are willing to pay more to achieve a given change in dumping outcomes at beaches and waterways. The reason for residential areas and local streets having the highest WTP is that respondents indicated this is where they most frequently see illegal dumping (chart 5.10). As a result, this is the site for which proportionate reductions are valued most highly.

The process for estimating the value of a 20 per cent reduction is to estimate the value of a reduction by 20 per cent for each status quo sighting frequency. We then estimate a weighted average by state and site for the value of a 20 per cent reduction across all levels of status quo sighting frequency. The weighting is the share of respondents that see each level of status quo dumping (e.g. 3 per cent see dumping every day at beaches and waterways, while 12 per cent see dumping every day at residential areas and local streets).

5.10 Baseline frequency of and willingness to pay to avoid seeing dumped waste

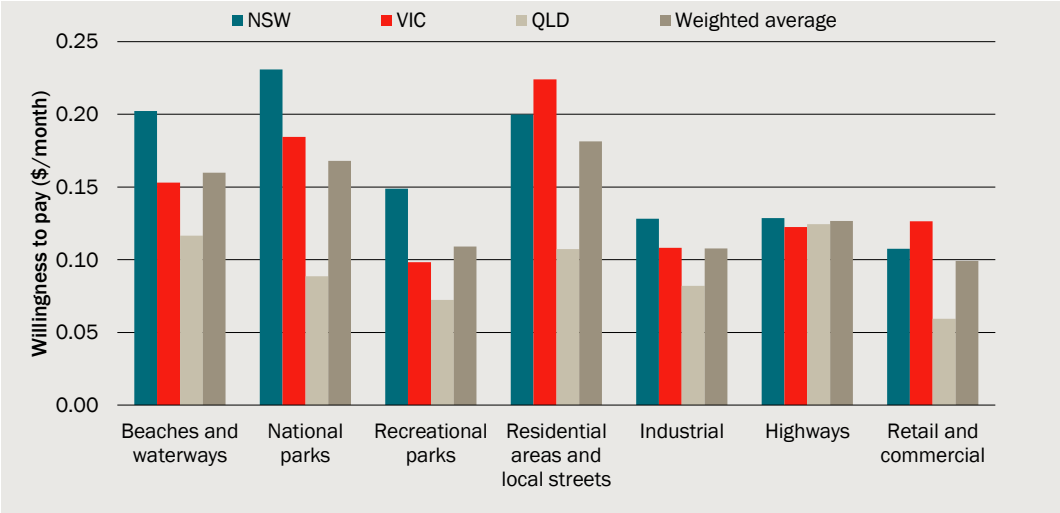


Note: The estimates are weighted down to account for some of the population having a zero-litter or zero-dumping baseline. They represent the WTP for the reduction among those who see some litter/dumping, averaged over the whole population.

Data source: CIE.

The value of avoiding dumped waste is highest for NSW across most site types (chart 5.11). The difference is most dramatic for natural environments, while there is a notably lower value placed by Queensland respondents on reducing illegal dumping in residential areas and local streets.

5.11 Willingness to pay for a 20 per cent reduction in illegal dumping by site type

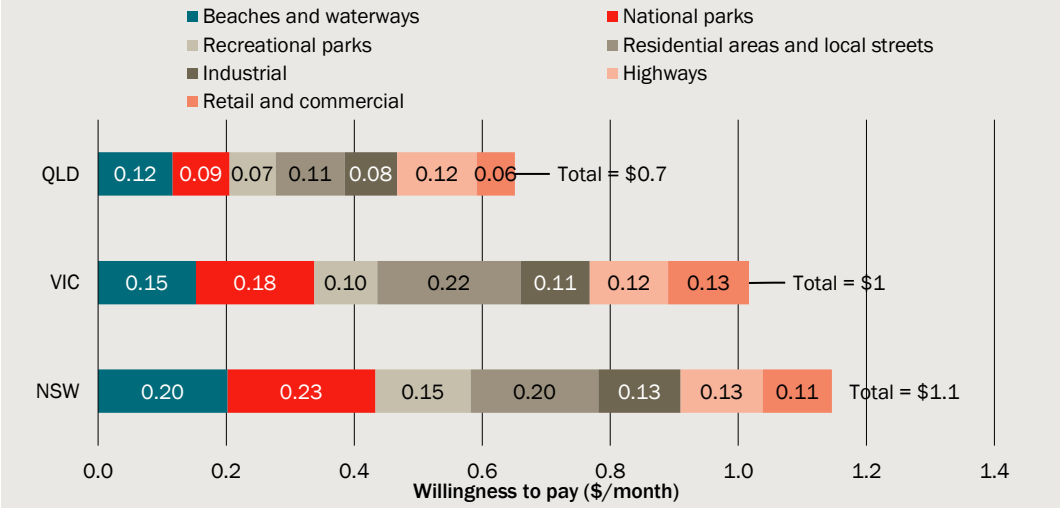


Note: The estimates are weighted down to account for some of the population having a zero-litter or zero-dumping baseline. They represent the WTP for the reduction among those who see some litter/dumping, averaged over the whole population.

Data source: CIE.

WTP summed across all site types is highest in NSW, much of which is due to higher values placed on reducing dumping frequency in natural areas (chart 5.12).

5.12 Willingness to pay for a 20 per cent reduction in illegal dumping across all sites



Note: The estimates are weighted down to account for some of the population having a zero-litter or zero-dumping baseline. They represent the WTP for the reduction among those who see some litter/dumping, averaged over the whole population.

Data source: CIE.

Robustness checks

We have tested several model variants to provide an indication of the robustness of the results to different sample frames. A short description of each of the models is set out in table 5.13.

5.13 Inclusion of respondents in each model based on characteristics

Rules imposed	#1 – All	#2 – Engaged	#3 – Attentive and engaged	#4 – Fully Attentive and engaged	#5 – Attentive, engaged and consequential	#6 – Fully attentive, engaged and consequential
Chose status quo for every question	✓	×	×	×	×	×
Failed the quality control question	✓	✓	×	×	×	×
Took less than 5 minutes to complete	✓	✓	✓	×	✓	×
Indicated that they found some options implausible and answered the questions as though the attribute levels were different to those shown	✓	✓	✓	×	✓	×
Those who thought the survey wasn't at least somewhat likely to affect government action	✓	✓	✓	✓	×	×
Number of respondents	**2 612**	**2 039**	**1 807**	**1 712**	**1 248**	**1 197**

Note: A tick means that respondents meeting this requirement were included in the sample, while a cross means they were excluded from the sample for that model.

Source: CIE.

By way of example, the estimates of willingness to pay for reductions in litter and illegal dumping at Queensland beaches and waterways from each of the six models described above are set out in table 5.14. The 'subsample #1' estimates of WTP are unconditional means. The other estimates can be considered unconditional only on the assumption that respondents excluded (in addition to those already excluded in subsample #1) have the same preferences as those included in the choice model. Limiting the sample to more attentive respondents who see the survey as consequential tends to increase estimates of WTP slightly, but this is not consistent across all the attributes. Overall, the model is reasonably robust to decisions about respondent-exclusion criteria.

5.14 Estimates of willingness to pay for reductions in litter/illegal dumping at Queensland beaches and waterways based on various subsamples

Model	One percentage point decrease in the proportion of sites with noticeable litter	Change in amount of litter at sites with noticeable litter: 'High' to 'Very low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Low'	Change in amount of litter at sites with noticeable litter: 'High' to 'Moderate'	Change in amount of litter at sites with noticeable litter: 'Very high' to 'High'	Unit decrease in the square root of number of days per year seeing dumped waste
	$/month	$/month	$/month	$/month	$/month	$/month
Subsample #1	0.14	5.32	6.28	2.21	4.40	0.84
Subsample #2	0.12	5.09	5.86	1.57	3.47	0.56
Subsample #3	0.14	5.68	6.59	1.90	4.90	0.67
Subsample #4	0.16	6.58	7.54	2.23	4.99	0.78
Subsample #5	0.14	5.60	6.47	1.79	4.62	0.69
Subsample #6	0.15	6.15	7.10	1.84	4.96	0.79

Source: CIE

Zero litter and illegal dumping

To estimate average WTP from responses to the contingent valuation question about the zero-litter-and-dumping scenario, assumptions are required in relation to:

- how the certainty scale will be converted to votes for or against the hypothetical program, and
- how average WTP will be measured from the resulting demand curve.

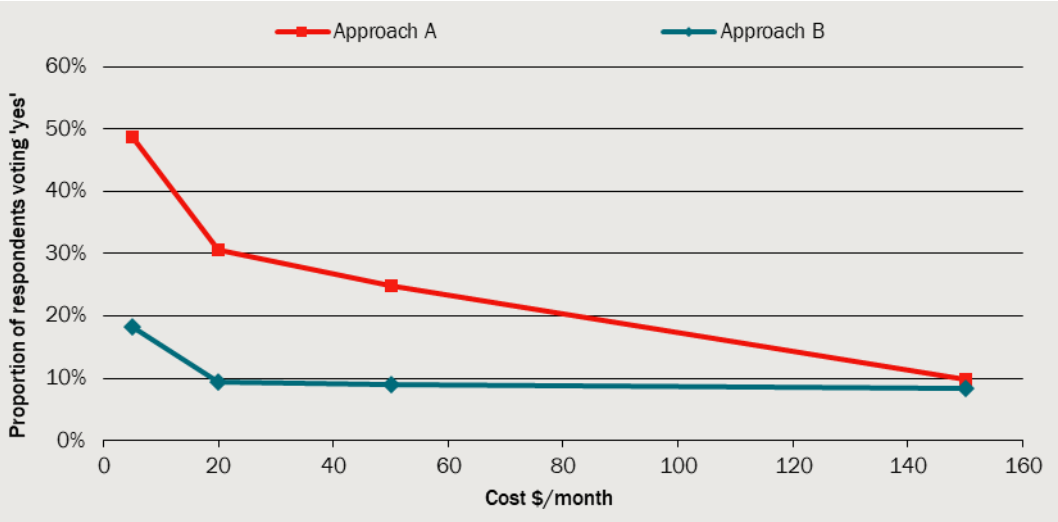
In relation to the first point, we assume 'At that cost to me, I definitely would vote for the program' is a 'yes' vote, 'At that cost to me, I probably would vote for the program' is a 'yes' vote at the cost level immediately below the level presented to the respondent, and all other responses are a 'no' vote (Approach A). To assist with sensitivity testing, we also provide results based on an assumption that 'At that cost to me, I definitely would vote for the program' is a 'yes' vote and all other responses are a 'no' vote (Approach B).

In relation to the second point, we measure average WTP using the lower bound of the Turnbull estimator. The lower bound of the Turnbull estimator is a conservative estimate of the area under the demand curve derived by summing the area of a series of rectangles

defined by the discrete price points. It assumes, for example, that the demand at prices between the $5 and $20 price points used in the survey is equal to the observed demand at $20, the demand at prices between $20 and $50 is equal to the demand observed at $50, and so on.

The distribution of WTP is highly skewed. Median WTP is zero, but around a tenth of respondents were willing to pay at least $150 per month (figure 5.15).

5.15 Demand for zero-litter-and-dumping scenario

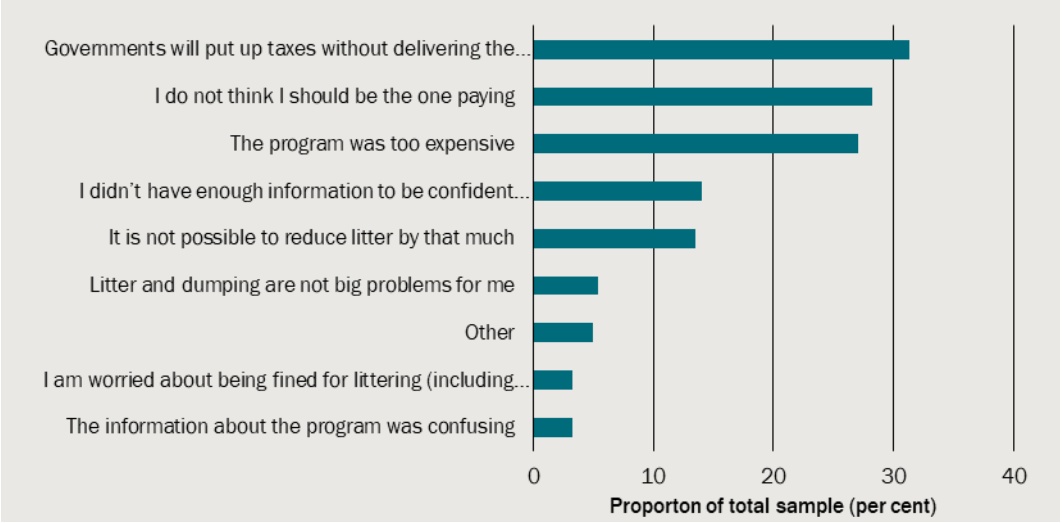


Note: The sample is n=2785 (between 681 and 703 for each of the four price levels. It excludes 232 respondents who were shown a $100 cost level in the early waves of survey fieldwork. Sample weights were used for age categories.

Data source: CIE

The reasons given for voting against the program were largely mistrust in government and unwillingness to pay – either because the proposed cost was too high or because others (especially those littering) should pay. Many of the verbatim comments from respondents also indicated a distaste for litter, with an unwillingness to pay for reductions due to a belief that those responsible should pay (e.g. via fines or harsher penalties). These results suggest the valuation questions in the survey will tend to underestimate the economic benefits from litter reduction. Omitting the respondents holding this view from the calculation of average WTP is not considered a viable means of correcting for the underestimation, as the view may be correlated with underlying preferences. Instead, we note this among the range of assumptions that contribute to uncertainty over the true value of WTP for zero litter and illegal dumping.

5.16 Reasons for voting against the zero-litter program



Data source: CIE

A Turnbull estimator was used to measure mean WTP conditional on the respondent answering the contingent valuation question. To estimate unconditional mean WTP we multiply the conditional estimate by the survey completion rates (one minus the drop-out rate) in table 5.17. Sample weights were used to correct for under- and over-sampling of age categories.

5.17 Survey completion rates

	NSW	Victoria	Queensland	Total
	per cent	per cent	per cent	per cent
Survey completion rate	89.0	87.5	88.7	88.4

Source: CIE

Unconditional mean WTP to eliminate litter and illegal dumping is estimated at $22 per month. If we exclude from the sample respondents who indicated they answered the question as though litter and dumping wouldn't be reduced all the way to zero, respondents who failed the attention test, and respondents who didn't think government action on litter and illegal dumping would lead to them paying costs (roughly halving the sample), conditional average WTP is estimated at $27 per month.[7] When using the latter number in aggregation of total WTP (or calculating an unconditional average WTP), assumptions would need to be made about the preferences of the excluded respondents. It may be that finding the question plausible and consequential and paying attention are characteristics that are correlated with underlying preferences.

7 These estimates of mean WTP for different respondent exclusion criteria are weighted to account for zero WTP by respondents who dropped out of the survey, indicated they never see litter, or chose the 'no change' option in all choice tasks. However, they do not make a similar adjustment for the respondents excluded as part of this sensitivity testing. Treating these estimates as unconditional would involve an assumption that the excluded respondents have the same WTP as the included respondents.

5.18 Average willingness to pay to eliminate litter and illegal dumping

Sample	Sample	WTP approach A	WTP approach B
	n	$/mth	$/mth
All three states			
Full sample	2785	22	12
Respondents finding program plausible	2045	26	14
Respondents passing attention test	2494	20	10
Respondents finding survey consequential	2480	23	13
Respondents fitting all three criteria above	1649	27	14
New South Wales			
Full sample	944	23	13
Respondents finding program plausible	718	27	14
Respondents passing attention test	838	20	10
Respondents finding survey consequential	844	25	14
Respondents fitting all three criteria above	579	27	13
Victoria			
Full sample	922	23	13
Respondents finding program plausible	684	29	15
Respondents passing attention test	828	22	12
Respondents finding survey consequential	805	26	14
Respondents fitting all three criteria above	545	30	16
Queensland			
Full sample	911	17	10
Respondents finding program plausible	621	22	12
Respondents passing attention test	824	16	9
Respondents finding survey consequential	826	18	10
Respondents fitting all three criteria above	509	22	11

Source: CIE

6 Average willingness to pay for changes in composition

Changes in the composition of litter

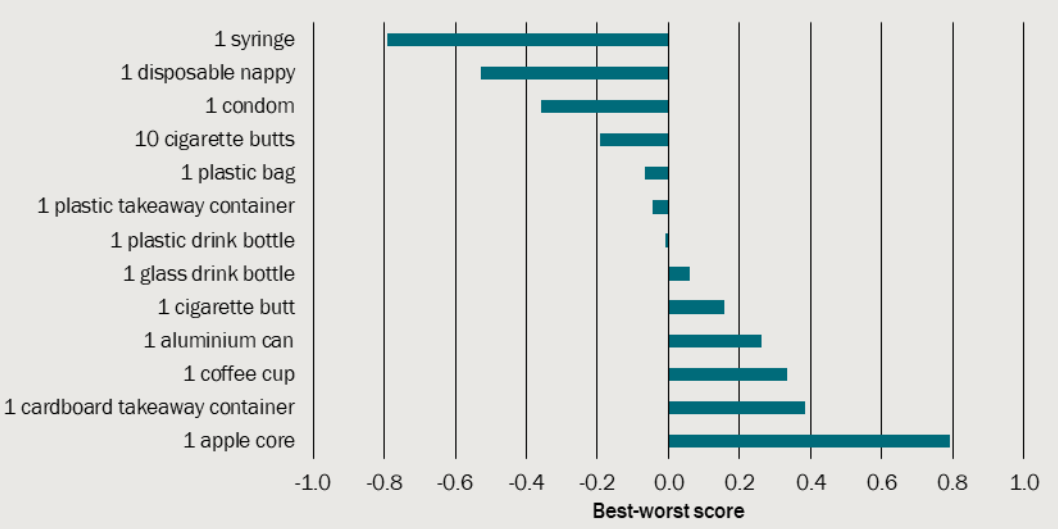
Best-worst scores

Figure 6.1 shows the scores for each item included in the best-worst scaling exercise. The scores are equal to:

$$Best - worst\ score = \frac{(\#Q\ chosen\ as\ least\ worst - \#Q\ chosen\ as\ worst)}{\#Q\ shown}$$

Because the experimental design was a balanced incomplete block design, these scores represent the relative disamenity of the items. Consistent with expectations, food scraps were the least worst items, while hazardous items were the worst items.

6.1 Best-worst scores by item

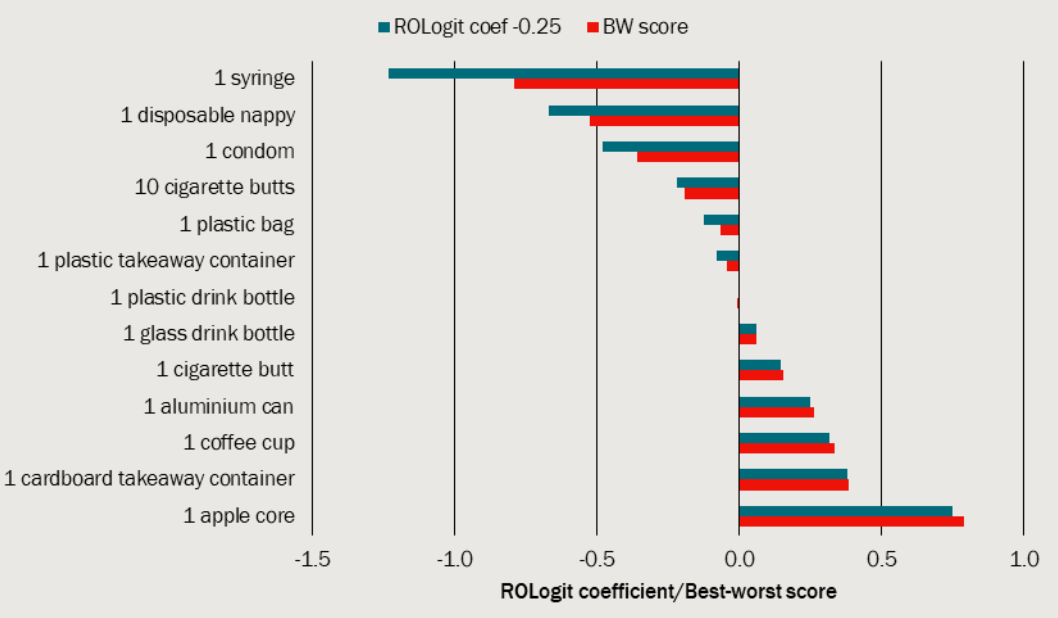


Data source: CIE

Model estimation

For the purpose of converting these relative preferences to a measure of WTP, we estimated the impact of each item on utility using a rank-ordered logit model. The rank order of the coefficients is the same as the best-worst scores, however the coefficients indicate a greater relative disamenity from the hazardous items (figure 6.2).

6.2 Rank-ordered logit coefficients compared with best-worst scores

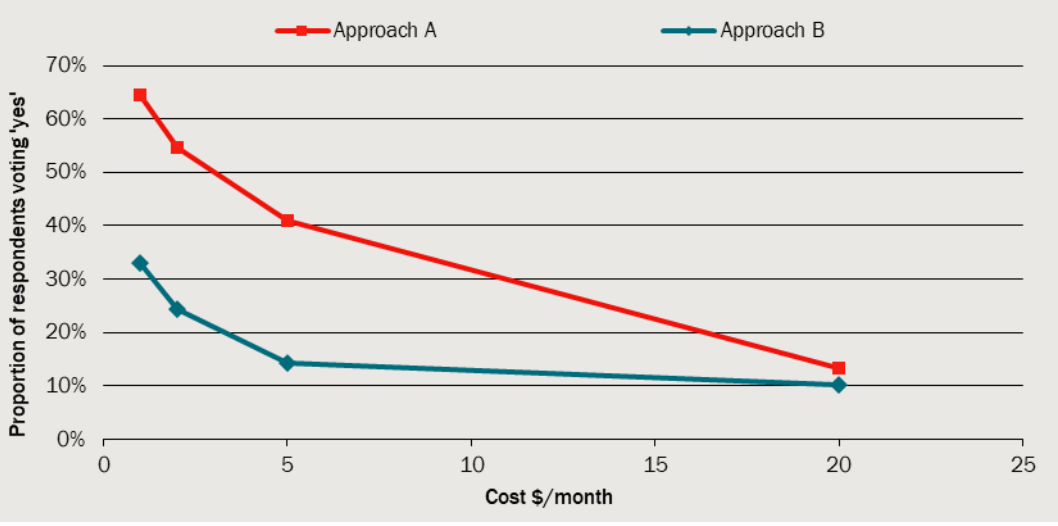


Data source: CIE

Estimates of willingness to pay

To convert the measures of utility derived from the best-worst scaling questions to a measure of WTP, the survey instrument included a contingent valuation question about a specific change in the composition of litter — a shift from plastic to cardboard. The results, under the same set of assumptions used for the zero-litter contingent valuation exercise discussed on page 58, are shown in figure 6.3 and table 6.4.

6.3 Demand for change in litter composition from plastic to cardboard



Note: The sample is n=2785 (between 683 and 703 for each of the four price levels. It excludes 232 respondents who were shown a $10 cost level in the early waves of survey fieldwork. Sampling weights were used based on age.

Data source: CIE

6.4 Unconditional mean willingness to pay for change in litter composition from plastic to cardboard

Sample	Sample	WTP approach A	WTP approach B
	n	$/mth	$/mth
Full sample	2802	3.92	2.24
Respondents paying attention	2512	3.68	2.06
Respondents finding survey consequential – government action	1827	5.04	2.83
Respondents finding survey consequential – impact on rates, taxes and product prices	2503	4.29	2.41
Respondents satisfying all three criteria above	1461	5.02	2.69

Source: CIE

Based on survey responses about the existing level and mix of litter, respondents perceive 1.9 plastic items other than drink bottles per 100 m^2. on average across all site types. This represents 25 per cent of perceived litter by item. We assume this is approximately the amount of litter that would shift from plastic to cardboard under the scenario being valued.

We provide two examples of how the WTP value can be combined with the rank-ordered logit coefficients to estimate WTP for changes in litter composition:

- a shift from one type of litter to another, and
- decomposing WTP for a reduction in litter into WTP for reductions in each type of litter.

Shift from one type of litter to another

We assume the estimated WTP of $3.92 per month represents the difference in implicit prices per percentage point of litter for the two types, multiplied by the number of percentage points of litter changing type:

$$\$3.92/mth = 25\left(P_{pp,card} - P_{pp,plastic}\right)$$

The difference between the rank-order logit coefficients for the cardboard and plastic takeaway containers was -0.46. This means that a scaling factor x_{pp} = -0.35 can be used to convert differences in rank-ordered logit coefficients to differences in implicit prices (P) per percentage point (pp) of litter.

$$\left(P_{pp,card} - P_{pp,plastic}\right) = x_{pp}.\left(\beta_{card} - \beta_{plastic}\right)$$

$$x_{pp} = \frac{\$3.92/mth}{25\left(\beta_{card} - \beta_{plastic}\right)} = -0.35$$

For example, WTP to change 5 per cent of litter from plastic drink bottles to aluminium cans would be estimated as:

$$WTP = (0 - 0.3296).(-0.35).5 = \$0.57/mth$$

where the coefficient on aluminium cans is zero, as it was the dummy variable omitted from the logit regression (with the impacts of all other items on utility measured relative to that of aluminium cans).

Decomposing WTP for litter reductions by type

The estimate of WTP for the plastic-to-cardboard shift can also be used to estimate a scaling factor for converting differences in rank-ordered logit coefficients to differences in implicit prices per litter *item*. This scaling factor is -4.53.

$$\$3.92/mth = 1.9\left(P_{item,card} - P_{item,plastic}\right)$$

$$\left(P_{item,card} - P_{item,plastic}\right) = x_{item}.\left(\beta_{card} - \beta_{plastic}\right)$$

$$x_{item} = \frac{\$3.92/mth}{1.9\left(\beta_{card} - \beta_{plastic}\right)} = -4.53$$

We can use this relationship to decompose estimates of WTP for reductions in litter. For example, we could decompose the estimated WTP for a reduction in the amount of litter at sites with noticeable litter across all site types from moderate to low. This estimate is $10.76 per month.

We assume this estimated WTP is a sum product of the number of items of various types and their respective implicit prices (i.e. litter-type-specific WTP):

$$\$10.76/mth = \sum_i Items_i P_i$$

where *Items* is the reduction in the number of items per 100 m^2 of type i, and P is the implicit price per item of type i.

Using the relationship between the rank-ordered logit coefficients and implicit prices, this equation can be solved for the implicit price for each item. The results are set out in table 6.5.

6.5 Decomposing willingness to pay for reduction in litter from 'moderate' to 'low'

	Respondents' perceived composition	50% reduction	Weighted average ROLogit coef.[a]	Disaggregation of WTP	Implicit price
	Items/100m2 across all sites	Items/100m2 across all sites		$/mth	$/mth/item per 100m2
Cigarette butts[b]	1.23	0.62	0.103	1.64	2.67
Drink bottles and cans	1.67	0.83	0.134	2.34	2.81
Plastic items other than drink bottles and cans	1.89	0.95	0.362	3.63	3.83
Hazardous / dangerous litter items (including syringes, broken glass, face masks, diapers, condoms)	0.66	0.33	0.910	2.08	6.32

	Respondents' perceived composition	50% reduction	Weighted average ROLogit coef.[a]	Disaggregation of WTP	Implicit price
	Items/100m2 across all sites	Items/100m2 across all sites		$/mth	$/mth/item per 100m2
Food scraps (including apple cores, banana peels, takeaway food)	0.96	0.48	-0.501	-0.03	-0.07
Paper (including advertising, flyers, newspapers, receipts, cardboard, coffee cups)	1.27	0.64	-0.104	1.10	1.73
Total	7.68	3.84		10.76	

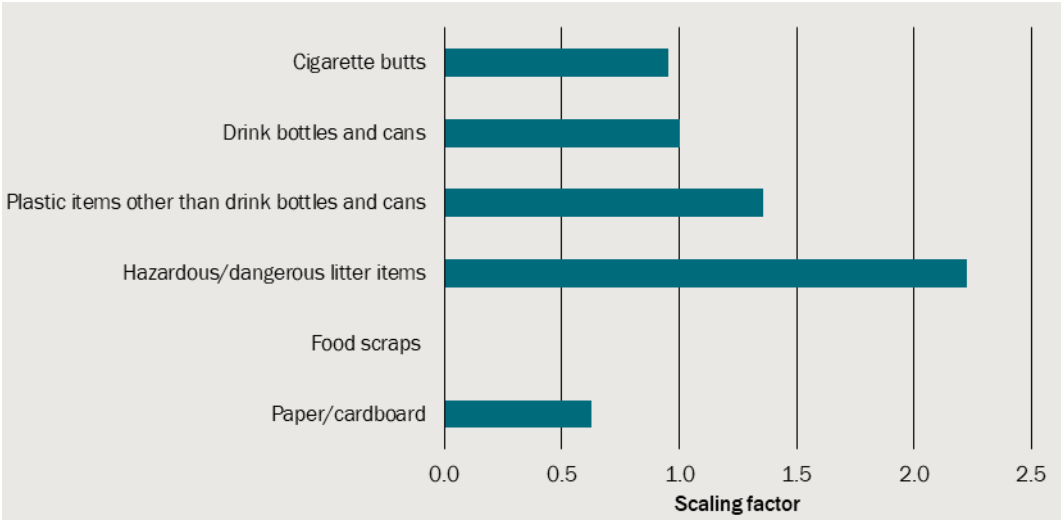
[a] These coefficients are calculated as weighted averages of the rank-ordered logit coefficients for the items relevant to the category, where the weights are based on items counts from the National Litter Index counts for Victoria in 2018/19.

[b] In this example, we use the estimate of disamenity for a single cigarette butt. The best-worst scaling exercise also include '10 cigarette butts' as an item.

Source: CIE

This calculation suggests the WTP to reduce food scraps (represented by the apple core in the best-worst scaling) is approximately zero. For the purpose of developing scaling factors for WTP by litter type, we adjust the total WTP being decomposed to $11.02 per month so that the implicit price for food scraps becomes zero. The scaling factors implied by these implicit prices are illustrated in figure 6.6. These factors are sensitive to a range of assumptions. We have not derived state-specific estimates, since any differences across states would be well inside the range of uncertainty resulting from combining results from two separate valuation exercises.

6.6 Adjusting willingness to pay to reduce litter amounts for type of litter



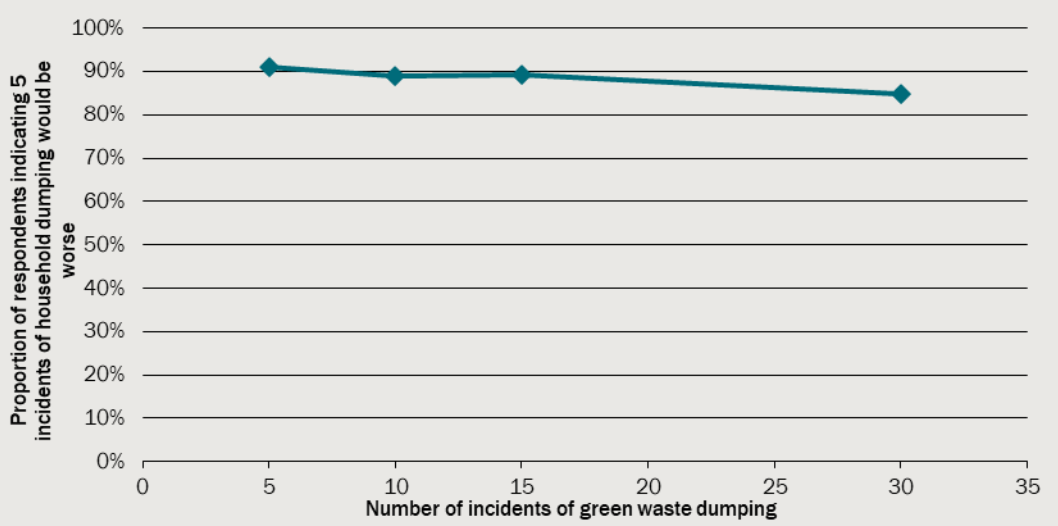
Data source: CIE

This decomposition suggests the 'per item' WTP to reduce hazardous and dangerous litter is slightly more than double the 'per item' WTP to reduce littered drink bottles and cans. WTP to reduce plastic items other than drink bottles is around 36 per cent higher than WTP to reduce drink bottles and cans. WTP to reduce paper and cardboard litter is around 37 per cent lower than WTP to reduce drink bottles and cans.

Changes in the composition of illegal dumping

The results from the non-monetary contingent valuation questions about types of illegal dumping are shown in figure 6.7 to 6.10 below. Even though the maximum 'price' for green waste dumping was increased to 30 incidents after the initial waves of the survey, the proportion of respondents indicating five incidents of household dumping would be worse remained greater than 80 per cent.

6.7 Willingness to substitute household for green waste dumping

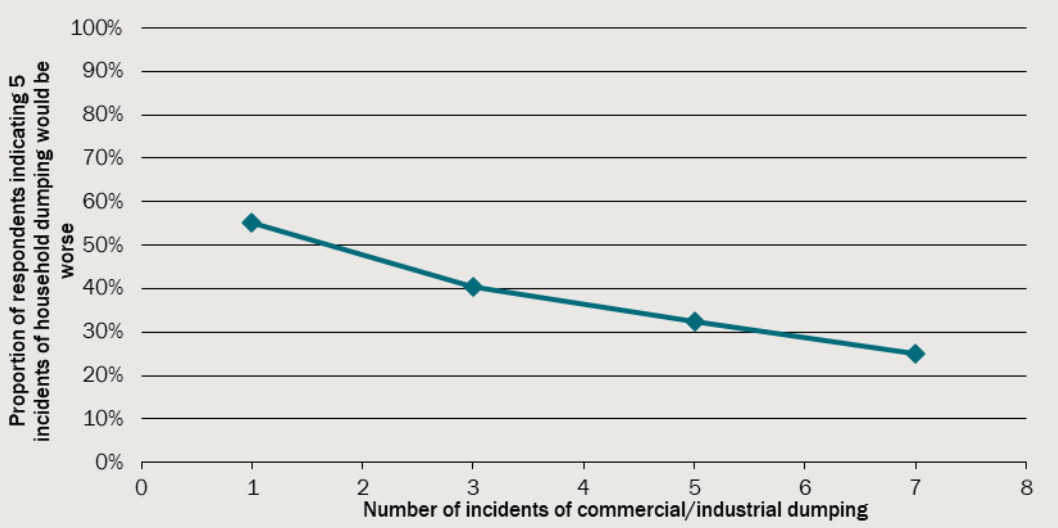


Data source: CIE

6.8 Willingness to substitute household for construction/demolition waste dumping

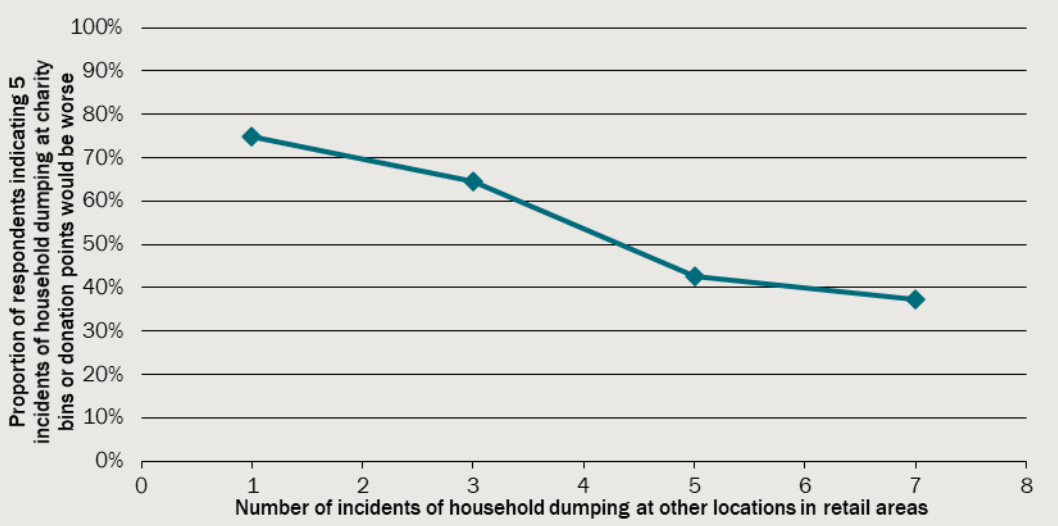
Data source: CIE

6.9 Willingness to substitute household for commercial/industrial waste dumping



Data source: CIE

6.10 Willingness to substitute household dumping at charity bins with household dumping at other locations in retail areas



Data source: CIE

Using these 'demand curves' we estimate the mean marginal rates of substitution between dumping types. The areas under the demand curves above indicate the willingness to accept other types of dumping in exchange for five household dumping incidents. These will tend to underestimate the area, since we captured only a portion of the demand curve, particularly in the case of green waste. The marginal rates of substitution are calculated by dividing these areas by five, so that they represent the willingness to substitute for only one incident, and inverting (except in the case of the charity bins question), so that all rates are measured in terms of household waste dumping incidents.

These marginal rates of substitution can be combined with respondent perceptions of the existing composition of illegal dumping incidents to derive scaling factors for each type of

dumping (table 6.11). The multipliers can be used to convert the estimates of WTP for reductions in dumping discussed in the previous chapter to estimates of WTP for reductions in specific types of dumping. For example, if a 20 per cent reduction in dumping was to be met entirely by reducing household dumping, the WTP estimates in the previous chapter would be multiplied by 0.90.

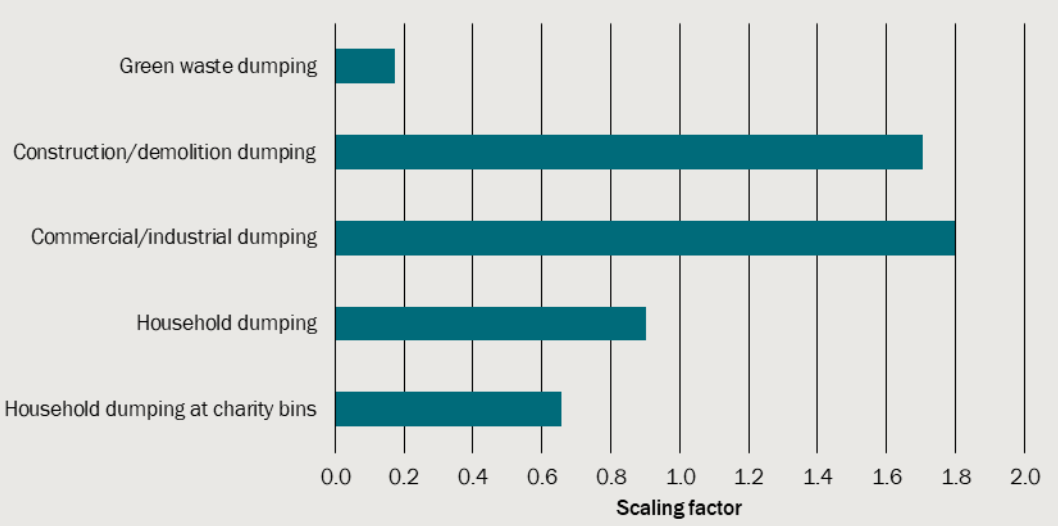
6.11 Calculation of willingness-to-pay multipliers for types of illegal dumping

	Existing composition		Mean marginal rate of substitution	Household dumping equivalent of existing dumping	Disaggregation of WTP	Scaling factor
	Average sightings p.a. per site type	Sightings p.a.	Household waste sightings p.a.	Household waste sightings p.a.	per cent	
Green waste dumping	10	67	0.19	13	3	0.17
Construction/demolition dumping	7	49	1.89	92	25	1.71
Commercial/industrial dumping	7	49	2.00	97	26	1.80
Household dumping	24	165	1.00	165	44	0.90
Household dumping at charity bins	5	5	0.73	4	1	0.66

Source: CIE

The levels of willingness to pay to avoid the various types of illegal dumping, relative to the average estimated in the previous chapter, are illustrated in figure 6.12. Construction/demolition and commercial/industrial waste is about twice as bad as household waste. Illegally dumped green waste is by far the least costly type of dumping.

6.12 Adjusting willingness to pay for type of illegal dumping



Data source: CIE

7 Aggregation to total willingness to pay

Approach

In cost-benefit analysis, the values estimated in this survey need to be aggregated over the relevant population. Some environmental valuation studies assume a lower mean WTP in the population not surveyed than observed in the sample. A well-known paper by Morrison (2000) found that 30 per cent of people who didn't respond to a survey had similar preferences to those who had responded. This approach was developed to deal with potential selection bias when respondents are recruited using an invitation that specifies the topic of the survey. It is unsurprising that the decision whether to accept an invitation to participate is correlated with preferences regarding the survey topic.

In the present study, selection bias is less of a concern. Respondents were part of an online panel. They had already agreed to complete surveys. The panel, Pureprofile, offers surveys to respondents in a feed that doesn't advertise the survey topics. There is therefore no reason to suspect that the decision to participate is related to WTP to reduce litter. The decision to drop out of the survey, in contrast, may well be correlated with preferences. In calculating our estimates of unconditional mean WTP we have made the conservative assumption that respondents who drop out have zero WTP to reduce litter and illegal dumping and that the drop-out rate reflects the proportion of people holding these preferences in the wider population.

The estimates of unconditional mean WTP can therefore be multiplied directly by the population to obtain estimates of aggregate WTP.

The questionnaire was not explicit about whether the respondent was answering on behalf of their household or as an individual. The reference to rates in the payment vehicle may have given respondents the impression that payment would be levied only once on each household. We therefore adopt the conservative assumption of aggregating WTP over households rather than persons.

The separate study of the environmental cost of litter (CIE 2021) includes values for population-level impacts on wildlife and plants. The present study included questions on the role of various motivations for WTP (or sub-benefits), including concerns about wildlife and plants, to allow WTP estimates to be allocated across the sub-benefits. The purpose of including this question was to enable adjustments that would avoid double counting across the two studies. The responses to the question indicate that WTP estimates need to be reduced by 20.5 per cent to remove the component related to harm to wildlife and plants. However, the degree of overlap between the wildlife/plant impacts valued by the two studies is unclear. The study of the environmental cost of litter focussed on population-level impacts, such as the cost of moving a species from vulnerable to endangered. Respondents in this study are likely to care about those impacts, but may also care about wildlife deaths at the places they visit even if those

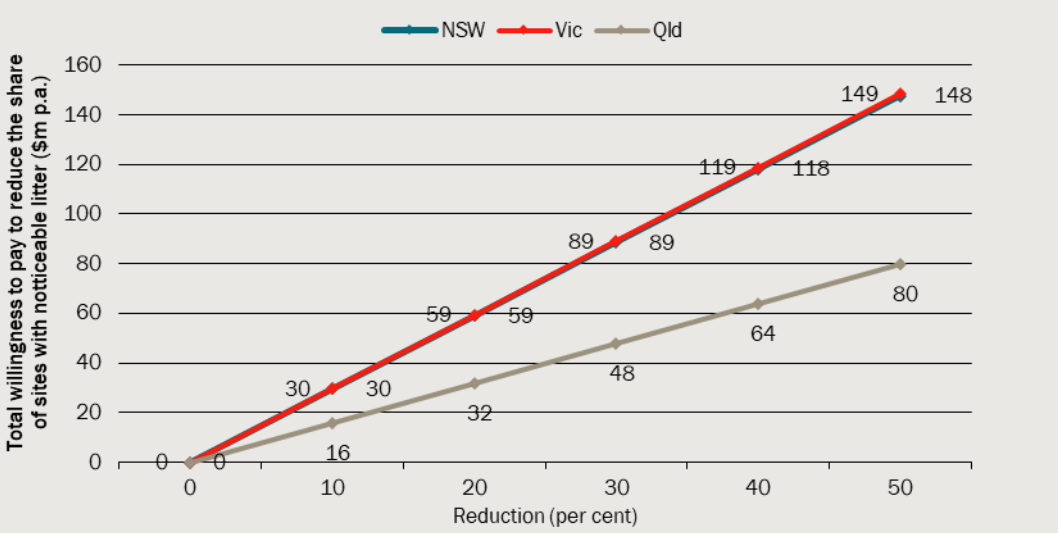
deaths do not result in material population-level impacts or endangerment of species. We are unable to further disaggregate the WTP values to separate the respective roles of these two types of impact. It is therefore possible that adjusting WTP estimates down by 20.5 per cent reduction would remove values that are not captured in the study on the environmental cost of litter. We therefore consider the 20.5 per cent adjustment a conservative estimate of WTP and report estimates with and without the adjustment so that CBA can test sensitivity of results to alternative assumptions about the degree of overlap between the two studies.

Total willingness to pay for partial reductions in litter and illegal dumping

By way of example, estimates of total WTP for 20 per cent reductions in each of the attributes included in the DCE are set out in table 7.2. The total value of reductions in litter is lower for reductions in the amount of litter at each site compared to reductions in the share of sites with noticeable litter. The WTP for a 20 per cent reduction in the frequency of illegal dumping is lower again. The same adjustment is made to each estimate to exclude the value of avoiding wildlife/plant harm.

The value of other reductions in litter can be interpolated or extrapolated linearly with respect to reductions up to 50 per cent (charts 7.1 and 7.3). Reductions in litter amounts of more than 50 per cent are non-linear. For dumping, there is a very slight non-linearity in the value of reductions (chart 7.4), whereby the WTP per percentage point for large reductions is greater than for small reductions.

7.1 Total willingness to pay for reductions in the share of sites with noticeable litter



Data source: CIE.

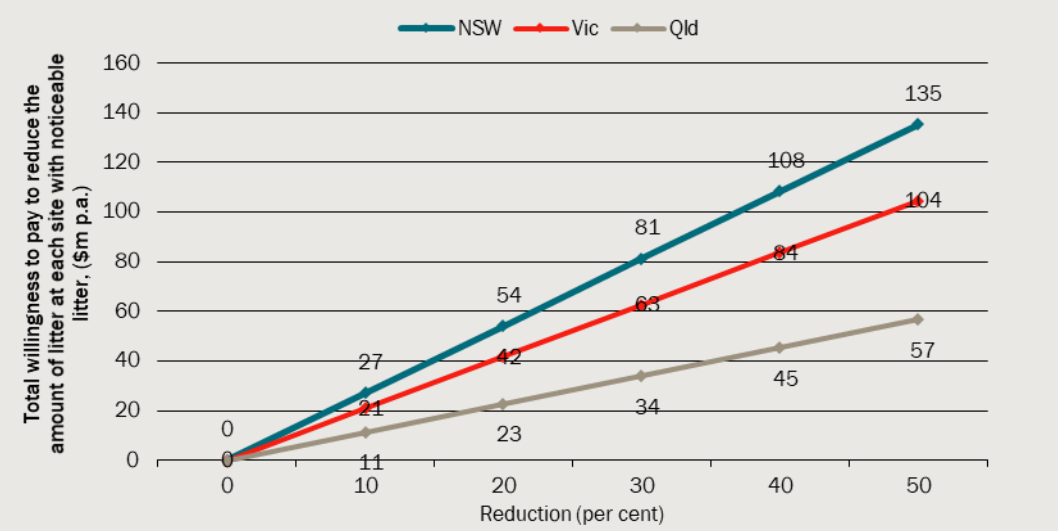
7.2 Total willingness to pay for reductions in litter and illegal dumping by 20 per cent

	Unconditional mean WTP	Unconditional mean WTP	Occupied private dwellings	Total WTP	Adjustment to exclude value of avoiding wildlife/ plant harm	Total WTP excluding value of avoided wildlife/ plant harm
	$/household/month	$/household/year	Number	$m/year	Per cent	$m/year
Reduction in litter amounts by 20 per cent						
NSW	2.1	24.7	2 740 199	67.7	80	54.2
VIC	1.9	23.1	2 261 833	52.2	80	41.8
QLD	1.3	16.0	1 772 857	28.3	80	22.7
Total	**1.8**	**21.9**	**6 774 889**	**148.2**	**80**	**118.6**
Reduction in sites with litter by 20 per cent						
NSW	2.2	27.0	2 740 199	73.9	80	59.1
VIC	2.7	32.8	2 261 833	74.3	80	59.4
QLD	1.9	22.5	1 772 857	40.0	80	32.0
Total	**2.3**	**27.8**	**6 774 889**	**188.1**	**80**	**150.5**
Reduction in frequency of seeing illegally dumped waste by 20 per cent						
NSW	1.1	13.8	2 740 199	37.7	80	30.1
VIC	1.0	12.2	2 261 833	27.6	80	22.1
QLD	0.7	7.8	1 772 857	13.8	80	11.1
Total	**1.0**	**11.7**	**6 774 889**	**79.1**	**80**	**63.3**

Note: The total row has been calculated by taking the sum of WTP across the three states, then dividing this by the total number of households to estimate mean WTP.

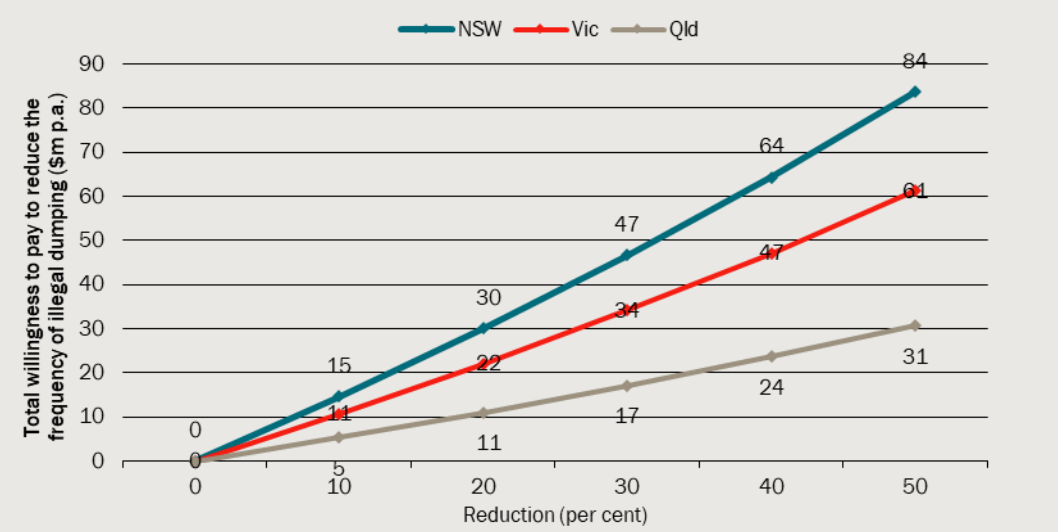
Source: CIE.

7.3 Total willingness to pay to reduce the amount of litter at sites with litter



Data source: CIE.

7.4 Total willingness to pay to reduce illegal dumping



Data source: CIE.

Total willingness to pay for zero litter and illegal dumping

One of the objectives of this study was to estimate the amenity, safety, and non-wildlife-and-plant-damage environmental component of the total cost of litter and illegal dumping. This value is equal to WTP for the zero-litter-and-illegal-dumping scenario, aggregated across the population.

Caution is needed when applying the estimates of WTP for the zero litter and dumping scenario. Demand was insensitive to prices above $50 per month and the WTP estimates derived using the Turnbull estimator are therefore sensitive to the choice of price levels

above $50 used in the survey. There is also uncertainty created by the fact that nearly 30 per cent of respondents found the scenario implausible and answered as though a smaller reduction in litter and dumping would be delivered. The analyst must choose between including these respondents in the estimation of WTP, noting their stated WTP underestimates the value they would place on a zero-litter outcome, and excluding them, noting it is possible they have different underlying preferences to those who found the question plausible. We adopt the former approach in this report.

The results of the aggregation are set out in table 7.5. It shows the total cost of litter and illegal dumping across the three states could be in the order of $1.8 billion per year, or $1.4 billion per year excluding WTP to avoid wildlife and plant harm.

7.5 The estimated total cost of litter and illegal dumping

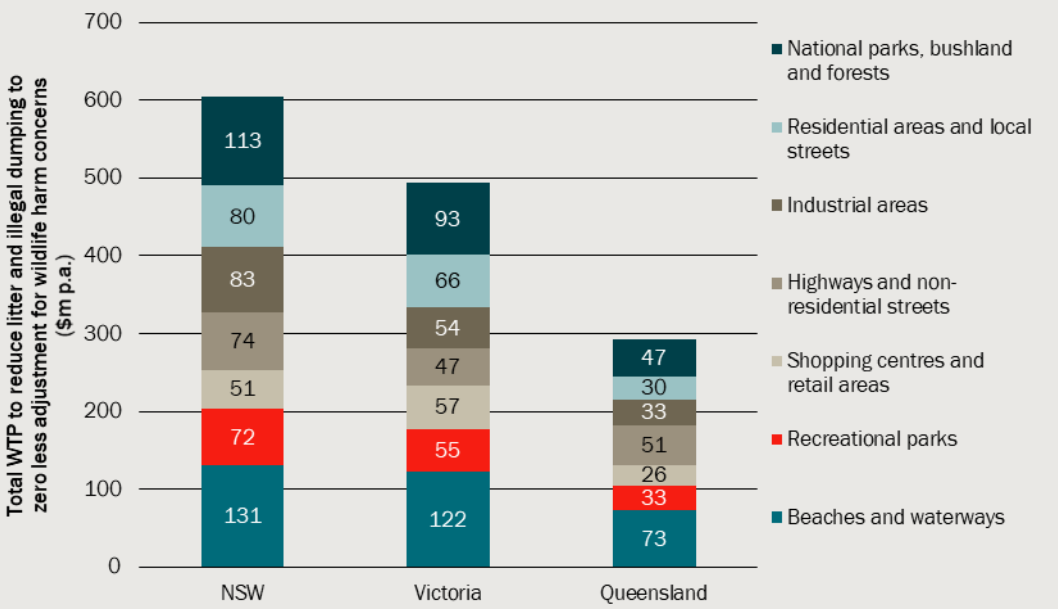
	All three states	NSW	Vic	Qld
Unconditional mean WTP $/respondent/mth	22	23	23	17
Unconditional mean WTP $/respondent/a	258	278	275	208
Occupied private dwellings	6 774 889	2 740 199	2 261 833	1 772 857
Total WTP $m/a	**1751**	**761**	**621**	**368**
Adjustment to remove wildlife/plant component	-20.5%	-20.5%	-20.5%	-20.5%
Net WTP $m/a	**1392**	**605**	**494**	**293**

Source: CIE; ABS 2016 Census; ABS national, state and territory population

These figures should be considered an example of how the results can be aggregated. They lie within a wide range of estimates that can be derived under different assumptions about treatment of the certainty scale in the contingent valuation question, the criteria for excluding respondents from the calculation of mean WTP, and the extent of any adjustment for concerns about wildlife and plant harm already covered by the separate study of environmental costs (CIE 2021).

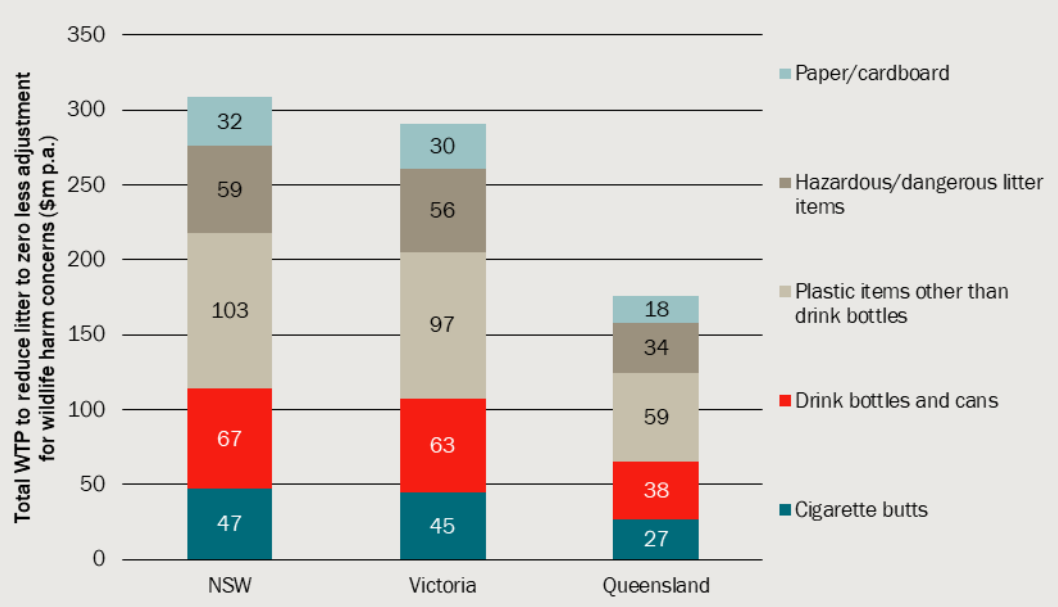
A decomposition of this total WTP by site type (figure 7.6) and by litter/dumping type (figures 7.7 and 7.8) can be approximated using the model of WTP for partial reductions and the scaling factors developed for various litter and dumping types.

7.6 Total willingness to pay for zero litter and illegal dumping by site type



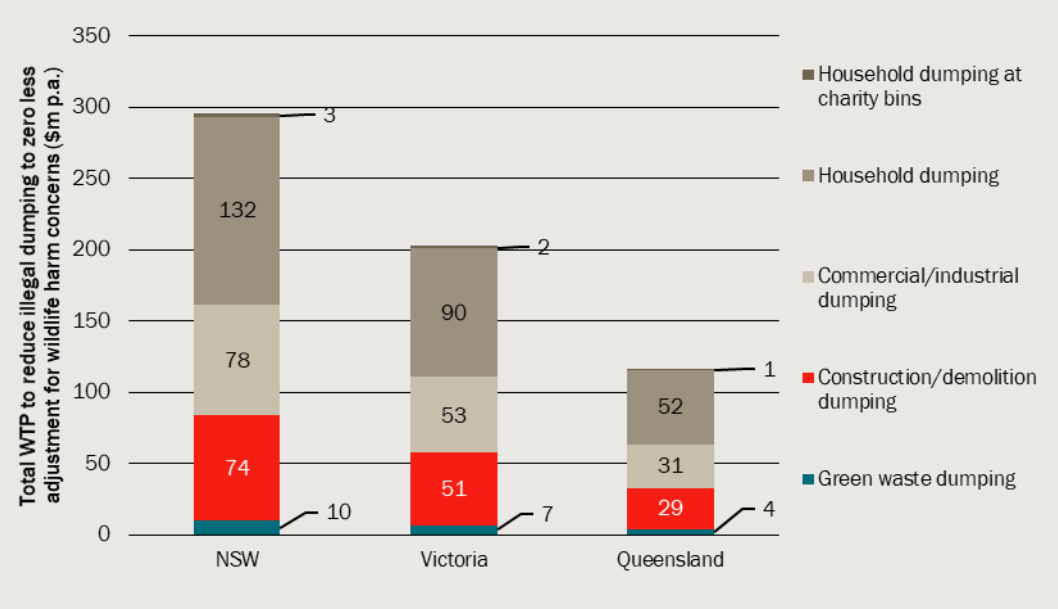
Data source: CIE

7.7 Total willingness to pay for zero litter by type of litter



Data source: CIE

7.8 Total willingness to pay for zero illegal dumping by type of waste



Data source: CIE

Subadditivity of willingness to pay

It is well-established in the stated preference literature that the sum of the valuations placed by an individual on the parts of a good is often larger than the valuation placed on the good as a whole. This phenomenon has been investigated under a range of labels, including part-whole bias (Carson and Mitchell 1989) and embedding (Kahnemann and Knetsch 1992). As noted by Hahnemann (1994), it combines three distinct notions:

> One assertion, which arises when the object of preference is thought to be simply the number of lakes, is that willingness-to-pay varies inadequately with changes in the scale or scope of the item being valued. This is a scope effect. Alternatively, if each lake is seen as a separate argument in the utility function, then the assertion is that a given lake has quite different value if it is first, second or tenth in a set of items to be valued—it gets a high value when the first, but it adds little or nothing to total value when second or tenth. This is a sequencing effect. Thirdly, with either preference structure, the willingness-to-pay for a composite change in a group of public goods may be less than the sum of the willingnesses-to-pay for the individual changes separately. This is a sub-additivity effect.

In the present study, respondents' choices reveal their WTP for reductions in litter and illegal dumping *at a specified site type*. Each respondent was assigned to one of seven site types included in the study. There is therefore some uncertainty over respondents' WTP for reductions in litter and illegal dumping occurring across *all* site types. Hahnemann (1994) notes that some subadditivity is to be expected due to substitution effects and diminishing marginal rates of substitution. If litter is reduced at inland waterways and beaches, for example, a respondent may visit those places instead of visiting recreational parks and then be less willing to pay to reduce litter at recreational parks.

In the absence of a solid basis for quantifying this subadditivity, we have used a simple summation of valuations across site types in this report. Comparison of the results across

the questions in the survey dealing with a specific site type and all sites does not indicate the presence of subadditivity. When extending the models of WTP for partial reductions to estimate WTP for a 100 per cent reduction in litter and illegal dumping (excluding the value placed on option labels; i.e. the anti-status-quo bias), the simple summation did not exceed the estimated WTP for the zero-litter-and-illegal-dumping scenario (figure 7.9).

7.9 Check for subadditivity

Data source: CIE

If the WTP estimates associated with option labels (alternative-specific constants) are included in the summation, then subadditivity is present. If analysts wish to include the value of anti-status-quo bias in welfare estimates, we would recommend applying the estimate of WTP for the zero litter and illegal dumping scenario derived from the contingent valuation question as an upper limit on estimates of the welfare impacts of partial reductions.

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A Pretesting interview questions

- How long did it take to complete the survey?
- Were there any parts of the survey that were confusing or unclear?
- Was the reading material too long or too brief?
- In Q9, did one of the options reflect the litter you typically see? Were they all too high or all too low?
- Did you have difficulty answering Q11? Would it have been easier to estimate the percentage of each litter type you see, ensuring the percentages sum to 100?
- Did you have difficulty answering Q13? Would it have been easier to estimate the number of times you've seen different types of dumping over a specified period?
- Other than the Excel questions, which questions did you need to stop and think most about?
- Were the options questions in Excel difficult to answer?
- What was your thought process when answering the Excel questions? (e.g. which features did you look at first?)
- In the Excel questions, did you think about how reductions in litter would be achieved? That is, were you picturing litter being picked up by volunteers, council workers, not being littered in the first place, or some other method? IF the method of achieving the reduction was specified in the question, would this have affected your responses?
- Did any of the options in Excel look strange to you? Which ones and why?
- In the Excel questions, did you find you were picking the 'no change' option a lot? If so, why?
- In the Excel questions, did you find you were picking the highest-cost or lowest-cost option across all of the questions?
- In the Excel questions, did you think mostly about litter in the location shown in the photo or did you think about litter in the locations you visit?
- Please explain what you thought the red crosses signified at the bottom of each option.
- In the Excel questions, did you find the graphics helpful?
- In the Excel questions, did you believe that your cost of living would be affected under the different options?
- Were you confident about your answers to questions about the amount of litter you see (Q8 and Q9)? Did you think the 'no change' option in the Excel questions was realistic?

- In Q27, when you are asked about how your willingness to pay would change if litter were to be reduced at sites you would never visit, please how you thought about answering this question. What did you see as the benefits of reducing litter at places you won't visit, if any?
- In Q28-Q33, was the task clear? Was the wording 'worst item' and 'least-worst item' clear?
- In Q35, how difficult was it to say how much your willingness to pay to reduce plastic litter was driven by wildlife harm, rather than visual amenity or health risks?
- In Q39, did you think a near-zero litter outcome was plausible? If not, how did you go about answering the question?
- Did the questionnaire seem neutral and factual about litter?

B Questionnaire

Welcome

Thank you for participating in this survey, which is being run by Pureprofile and the Centre for International Economics on behalf of the New South Wales Environment Protection Authority, Queensland Department of Environment and Science, and Sustainability Victoria.

This survey is about litter and illegal dumping. Your input is very important and will affect the actions taken by governments in New South Wales, Queensland and Victoria to manage litter and illegal dumping.

This questionnaire will take around 15 minutes to complete.

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.

In the unlikely event of any technical difficulties please click on the technical support e-mail link.

Please Keep In Mind

Do not use your Back or Forward browser buttons while you are taking this survey. Once you answer a question, you will not be able to go back and change your answer.

Before we go through to the main study, we would like to ask you some questions to make sure we are interviewing a good cross section of people.

1. What type of device are you using to answer this survey?
    a. Desktop computer
    b. Laptop computer
    c. Standard-sized tablet (larger than 9-inch screen)
    d. Mini tablet (screen 9-inch or smaller) **RAISE ERROR**
    e. Mobile phone **RAISE ERROR**

ERROR PAGE

The device you are using is too small for this survey. Please resume the survey on a desktop computer, laptop computer or standard-sized tablet.

2. Do you or a member of your household work in the market research industry or for the NSW Environment Protection Authority, Queensland Department of Environment and Science, or Sustainability Victoria?
    a. Yes **TERMINATE**
    b. No
3. What is the postcode of your home address? **TERMINATE IF OUT OF AREA. CHECK QUOTAS.**
4. Are you… **CHECK QUOTAS**
    a. Male
    b. Female
    c. Other
    d. Prefer not to say
5. What is your age? **CHECK QUOTAS**
    a. Less than 18 years **TERMINATE**
    b. 18-19 years
    c. 20-29 years
    d. 30-39 years
    e. 40-49 years
    f. 50-59 years
    g. 60-69 years
    h. 70-79 years

i. 80 years or over

6. Is the place you live in:

   a. Owned outright or with a mortgage

   b. Being rented or occupied rent-free

   c. Other (please specify) _____

TERMINATE PAGE

Thank you for your patience in answering these questions. Unfortunately, we do not need you to participate in our research this time, but we sincerely appreciate your time and assistance today.

This questionnaire is about litter and illegal dumping.

It has four main parts:

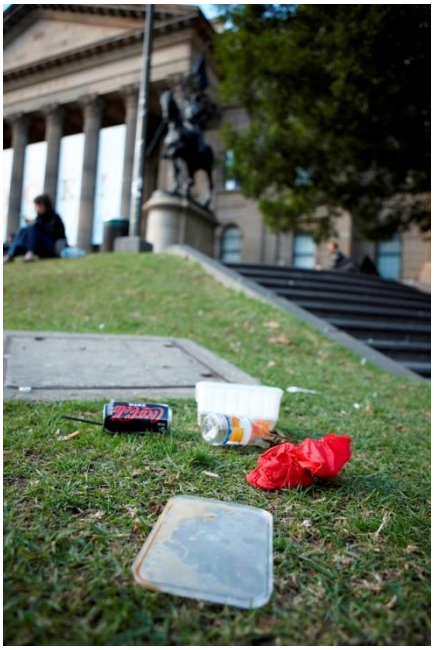
- information about litter and illegal dumping
- questions about the litter and illegal dumping you see
- questions about options for managing litter and illegal dumping
- questions about you

Litter is rubbish that has been left lying in open or public space.

According to the National Litter Index, there is an average of 18 littered items (or around 1.7 litres of litter) per 1000 square metres (around the size of a large residential block) in urban and near-urban areas in Australia.

These numbers would be even higher if governments weren't spending millions of dollars each year to clean up litter.

Roughly half of littered items are cigarette butts. Other common items of litter include drink bottles and cans, takeaway containers, cutlery and straws, and other paper rubbish.



Illegal dumping is unauthorised disposal of any waste that is larger than litter on either land or water.

It may include unauthorised landfilling, where waste, often from construction or demolition, is used as 'fill'.

More than half of illegally dumped waste is household waste, including furniture, clothes, mattresses, domestic rubbish, and whitegoods. This includes unwanted items placed on the kerbside outside booked or scheduled collection service times. Other types of material dumped illegally include building and construction materials, green waste (including mulch), and commercial and industrial materials.

Tens of thousands of illegal dumping incidents happen in Australia every year.

Litter and illegally dumped waste are found at all sorts of locations.

In this survey, we want to ask you about litter and dumping at **[SITE]**

[SITE] ALLOCATE BASED ON LEAST FILL FROM:

beaches and waterways

recreational parks

shopping centres and retail areas

highways and non-residential streets

industrial areas

residential areas and local streets

national parks, bushland and forests

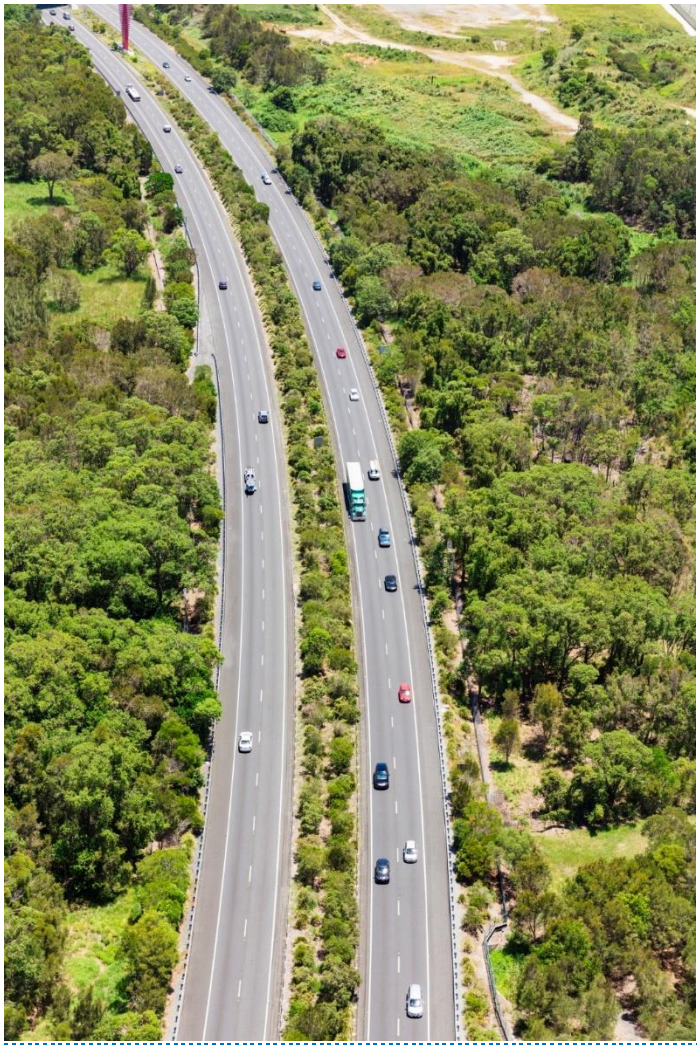
INSERT PHOTO(S) FOR [SITE]

beaches and waterways


recreational parks


shopping centres and retail areas

highways and non-residential streets



industrial areas

residential areas and local streets

national parks, bushland and forests

INSERT DESCRIPTION FOR [SITE]:

We want you to think about beaches and inland waterways you visit. Specifically, this refers to beaches and waterways frequently visited by people for activities such as recreation and relaxation. This also includes frontage and adjacent recreational space, such as a picnic area next to a river or a playground next to a beach.

We want you to think about recreational parks you visit that are away from beaches and waterways. These are public outdoor spaces frequently visited by people for recreation and leisure. They may include your local playground, gardens or sportsfields. They exclude National Parks, bushland and forests.

We want you to think about any shopping strips, arcades, local shops, markets and plant nurseries you visit, including adjacent car parks. These include streets with retail stores on one or both sides of the street.

We want you to think about highways and main roads that you drive on. These are straight open stretches of sealed road with wide verges that typically act as an arterial for traffic between and around population centres.

We want you to think about industrial areas you visit, including the streets and car parks in those areas. These include areas with either light industrial activities (e.g. mechanic workshops, factories, industrial offices, warehouses) or heavy industrial activities (e.g. waste facilities, ports, steel mills, chemical manufacturing plants). They exclude shopping centres or large-format retail (e.g. hardware stores).

We want you to think about the streets near your home and other residential areas you visit. These are streets with homes and/or apartments on both sides of the street.

We want you to think about National Parks, bushland and forests you visit within New South Wales, Victoria and Queensland. These may include alpine areas, rainforests, coastal wilderness, state forests, and crown land reserves.

7. How frequently do you go to **[SITE]** (when there are no COVID-19 pandemic public health orders) **SKIP QUESTION IF SITE=residential areas and local streets**

    a. Every day
    b. Every weekday
    c. 3-4 days every week
    d. 1-2 days every week
    e. 1-2 days every fortnight
    f. 1-2 days every month
    g. 3-4 weeks (21-28 days) every year
    h. 1-2 weeks (7-14 days) every year
    i. 1-2 days every year
    j. 3-4 weeks (21-28 days) every five years
    k. 1-2 weeks (7-14 days) every five years
    l. A few days every five years
    m. Almost never

8. How many of the **[SITES]** you go to have a noticeable amount of litter? (Please give us your personal impression. It doesn't need to be precise.)

    a. None **SKIP TO Q12, ANSWER Q12-Q14, THEN SKIP TO BEST-WORST SCALING (Q33)**
    b. 5 per cent
    c. 10 per cent
    d. 25 per cent
    e. 50 per cent
    f. 75 per cent
    g. 90 per cent
    h. All of them

9. When at those **[SITES]** with noticeable litter, which of the photos below is closest to the amount of litter you typically see there? **PLEASE USE THE**

PHOTOS FOR THE RELEVANT SITE (BEACHES AND WATERWAYS IS SHOWN BELOW FOR EXAMPLE)

o	A low amount of litter 12 items per 100 m^2 (approx. size of an apartment)	
o	A moderate amount of litter 25 items per 100 m^2 (approx. size of an apartment)	
o	A high amount of litter 50 items per 100 m^2 (approx. size of an apartment)	

o	A very high amount of litter 125 items per 100 m^2 (approx. size of an apartment)	

10. When at those **[SITES]** with noticeable litter, which types of litter do you see the most? Please rank these types from 1 (the type you see the most) to 6 (the type you see the least). **ROTATE**

    a. Cigarette butts

    b. Drink bottles and cans

    c. Plastic items other than drink bottles and cans (including takeaway food containers, straws, snack bags, single use items, cutlery, bottle tops, coffee cup lids, plastic bags, and polystyrene)

    d. Hazardous / dangerous litter items (including syringes, broken glass, face masks, diapers, condoms)

    e. Food scraps (including apple cores, banana peels, takeaway food)

    f. Paper (including advertising, flyers, newspapers, receipts, cardboard, coffee cups)

11. At **[SITES]** with noticeable litter, roughly, what percentage of the littered items are each of the following types?

    Please put a number in every cell. For litter types you never see, please put zero.

    ORDER AS PER RESPONSE TO Q10. DISPLAY ERROR MESSAGE IF INPUTS DON'T SUM TO 100. REDCORD IN DATA IF ERROR MESSAGE IS DISPLAYED.

Cigarette butts	%
Drink bottles and cans	%
Plastic items other than beverage containers (including takeaway food containers, straws, snack bags, single use	%

items, cutlery, bottle tops, coffee cup lids, plastic bags, and polystyrene)	
Hazardous / dangerous litter items (including syringes, broken glass, face masks, diapers, condoms)	%
Food scraps (including apple cores, banana peels, takeaway food)	%
Paper (including advertising, flyers, newspapers, receipts, cardboard, coffee cups)	%
Other, including non-plastic items (including bits, fragments, scraps, miscellaneous, foil, all other non-plastic material)	%
	SHOW RUNNING TOTAL

12. How often do you see illegally dumped waste (larger items than litter, such as bags of rubbish, furniture, or piles of mulch or rubble) at **[SITE]** (when there are no COVID-19 pandemic public health orders)? Please give us your personal impression. It doesn't need to be precise.

    a. Every day
    b. Every weekday
    c. 2-4 times a week
    d. Once a week
    e. Once a fortnight
    f. Once a month
    g. Once a quarter
    h. Twice a year
    i. Once a year
    j. Once every five years
    k. Never **SKIP Q13 AND Q14**

13. Which types of illegally dumped waste have you seen at **[SITE]**? Select all that apply. (The photos show examples of dumping in different places. Please think only about dumping at **[SITE]**.)

o	Household waste (including domestic goods, whitegoods) at charity bins or donation points **SHOW THIS OPTION ONLY FOR [SITE]=shopping centres and retail areas**

	
o	Household waste (including domestic goods, whitegoods) at other locations in shopping centres and retail areas) **SHOW HIGHLIGHTED TEXT ONLY FOR [SITE]=shopping centres and retail areas** 
o	Green waste and mulch 
o	Construction and demolition (e.g. timber, concrete, bricks, tiles, rubble)

	
○	Commercial and industrial (e.g. pallets, cardboard, plastic film, etc.) 

14. IF MORE THAN ONE OPTION IS SELECTED IN Q13 On the occasions when you see illegally dumped waste at [SITE], what percentage of the dumped waste do you think would be the following types? Please input a number for each type so that the numbers sum to 100. ONLY INCLUDE OPTIONS SELECTED IN Q13

Dumping type	Per cent at [SITE]
Household waste (including domestic goods, whitegoods) at charity bins or donation points 	

Household waste (including domestic goods, whitegoods) at other locations in shopping centres and retail areas) SHOW HIGHLIGHTED TEXT ONLY FOR [SITE]=shopping centres and retail areas 	
Green waste and mulch 	
Construction and demolition (e.g. timber, concrete, bricks, tiles, rubble) 	
Commercial and industrial (e.g. pallets, cardboard, plastic film, etc.)	

	
	SHOW RUNNING TOTAL

Littering and illegal dumping have several negative impacts, including:

- They look unpleasant
- Some materials pose health risks
- Some materials can cause environmental damage
- They make people more worried about other types of anti-social behaviour
- They are costly to clean up

There are several different actions governments could take to reduce the amount of litter or illegal dumping you see, including:

- Hiring more cleaners to remove litter and illegally dumped material, and do more frequent clean-ups
- Increasing the deposit refunded for each drink bottle/can returned for recycling (a container deposit scheme)
- Advertising or educational campaigns
- Increasing policing of littering or illegal dumping
- Reducing fees for landfill (and increasing other taxes instead)

Each of these actions would come at an extra cost that would be paid by you and others through a combination of rates/taxes and prices for products.

SHOW ONLY IF Q6=b

Although you do not pay property rates directly, any increase levied on your landlord would in time be passed through to you as increases in rent.

You will now be asked eight questions about options for government action on litter and illegal dumping.

Each question has three options. One of the options involves no change. The other two options involve a reduction in litter and/or illegal dumping at **[SITE]** at a specified ongoing cost to you. You will be asked to choose your preferred option by clicking one box in the bottom row.

Reductions in litter and dumping would happen across your State. The options show the impact on the places you see.

Under Option 1 in the example below you would:

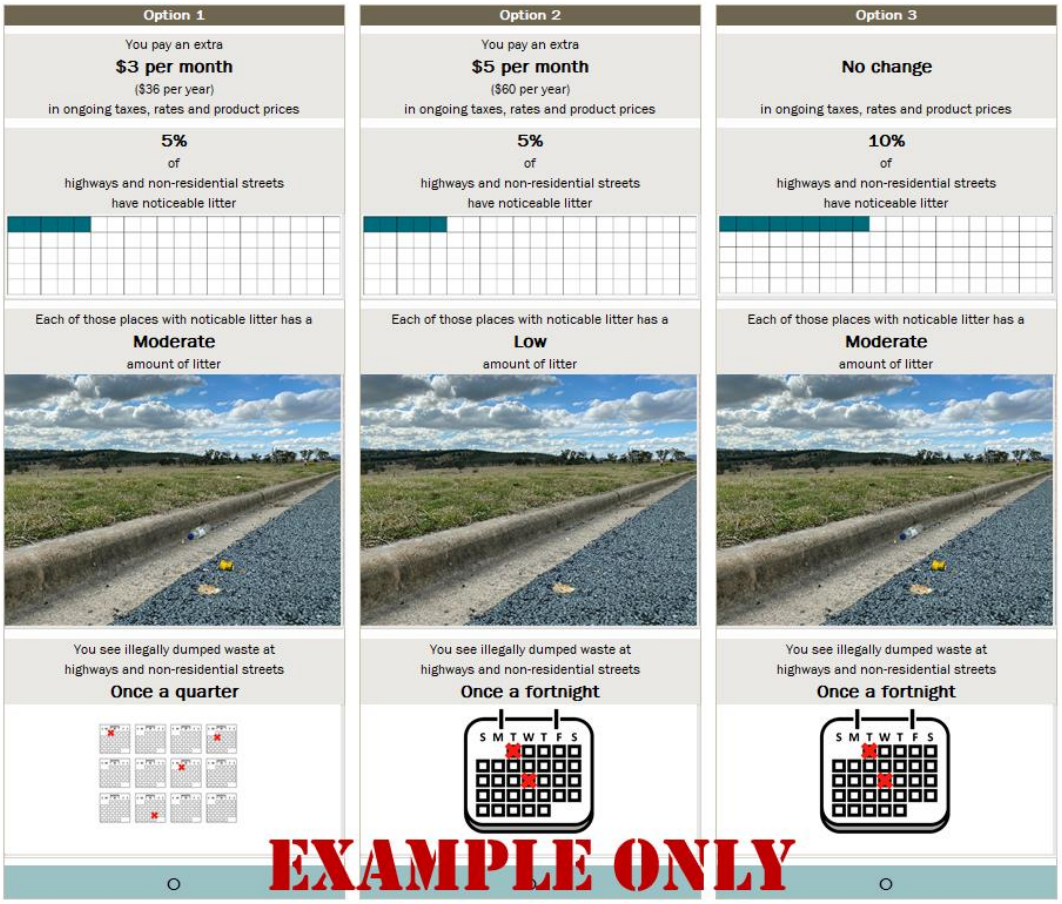
- pay an extra $3 per month in ongoing taxes, rates and product prices, and
- notice litter at 5 per cent of the **[SITE]** you visit, and
- see a moderate amount of litter at those 5 per cent of places, and
- see illegally dumped waste at **[SITE]** once per quarter.

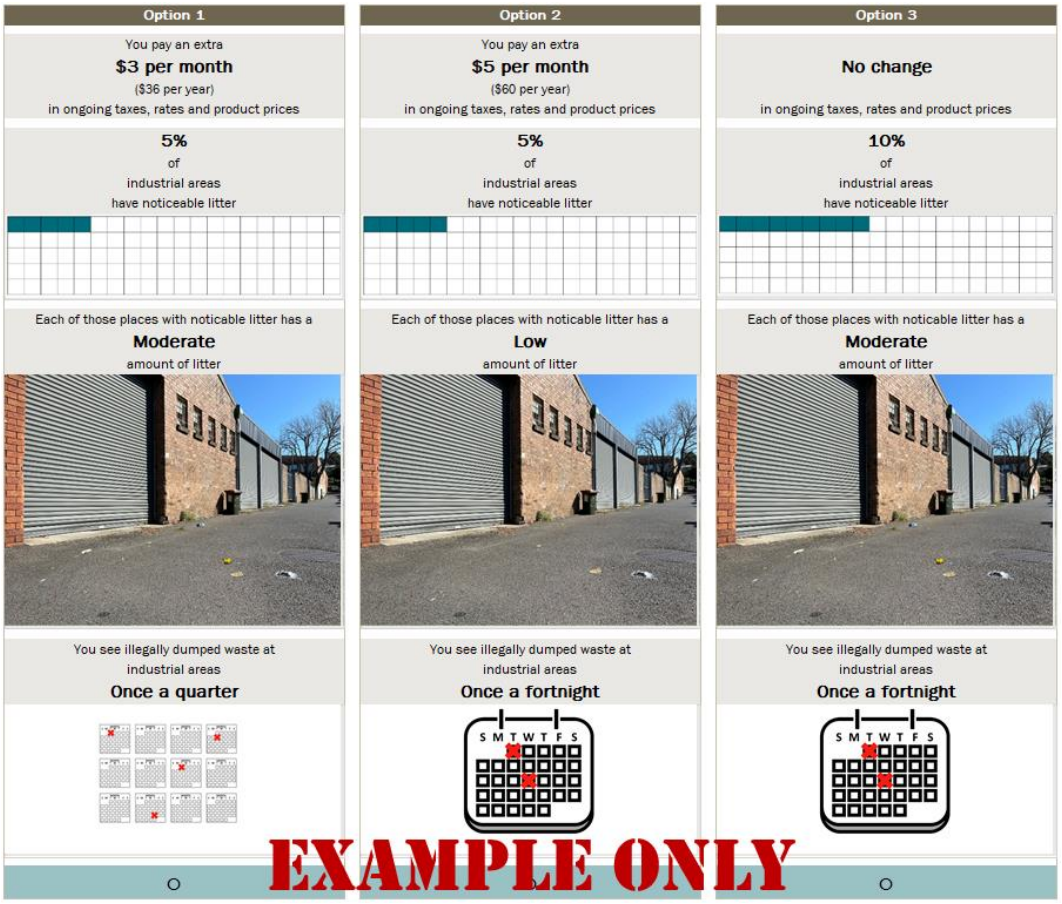
If you prefer that package of outcomes to the packages offered in Option 2 and the 'No change' option, you would choose Option 1.

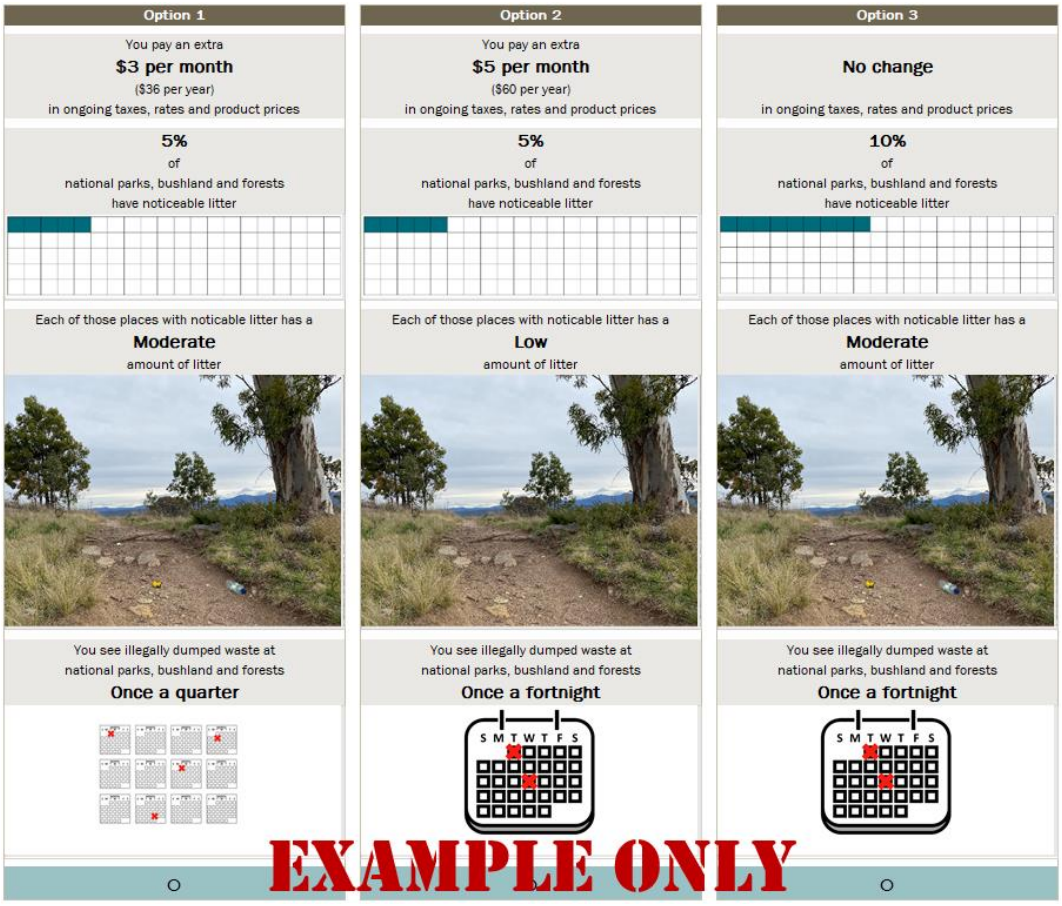
If you want a reminder of how much litter we mean by 'high', 'moderate' and 'low', click on those terms and an information box will open in a new window.

The photos provide an example of what the amount of litter looks like. Click on the photos if you want to see a larger image in a new window.

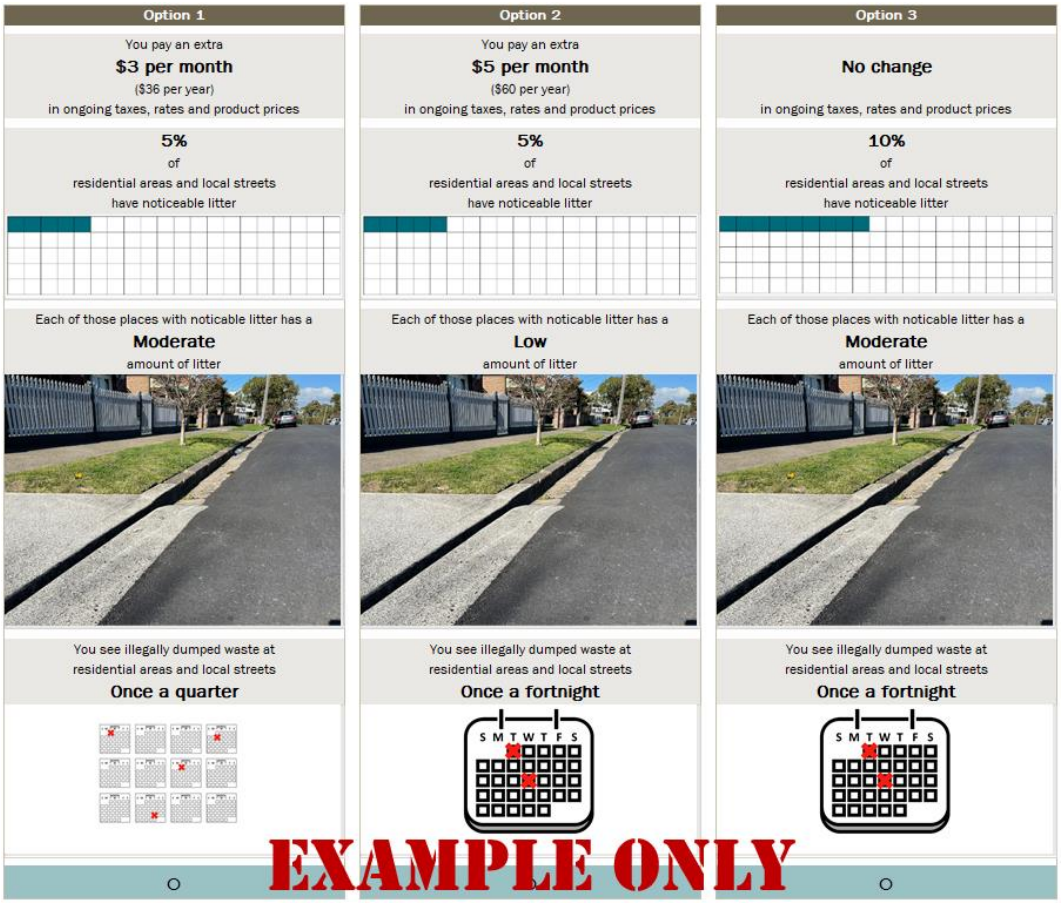
INSERT EXAMPLE IMAGE FOR THE RELEVANT SITE

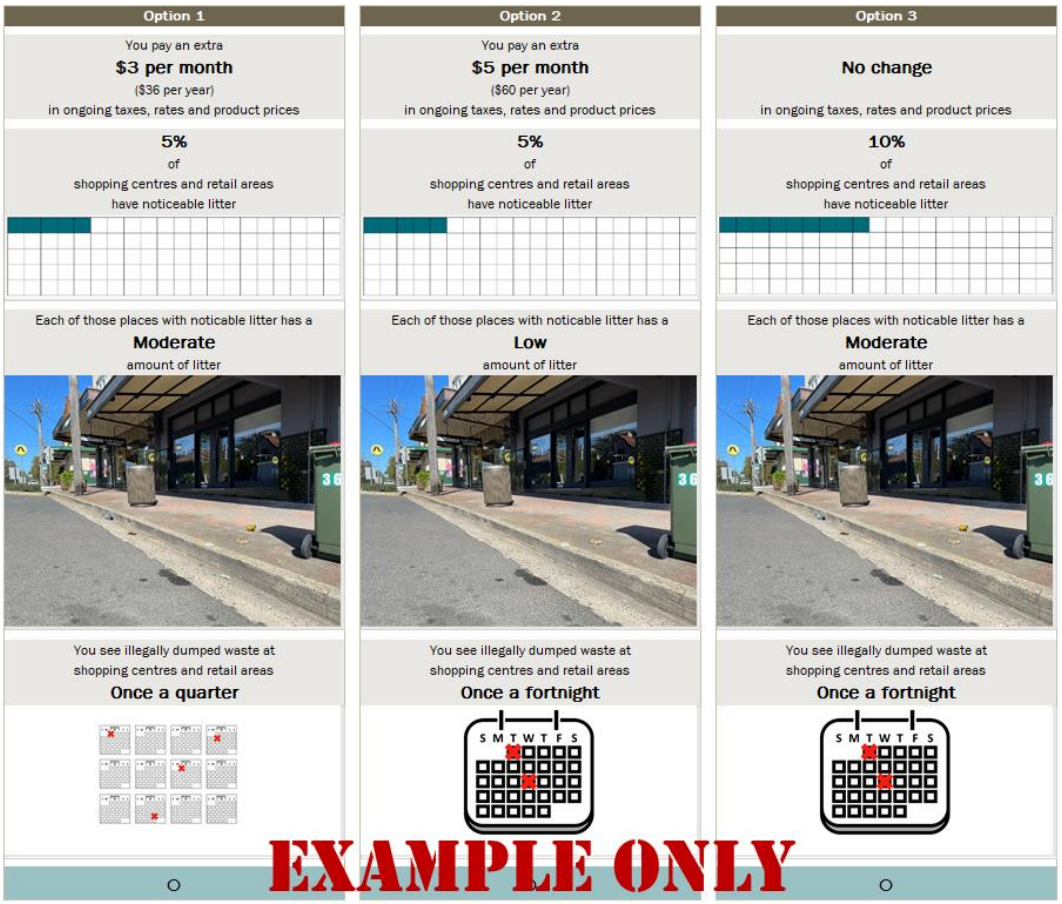

Option 1
You pay an extra
$3 per month
($36 per year)
in ongoing taxes, rates and product prices
5%
of
highways and non-residential streets
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
highways and non-residential streets
Once a quarter
Option 2
You pay an extra
$5 per month
($60 per year)
in ongoing taxes, rates and product prices
5%
of
highways and non-residential streets
have noticeable litter
Each of those places with noticable litter has a
Low
amount of litter
You see illegally dumped waste at
highways and non-residential streets
Once a fortnight
S M T W T F S
Option 3
No change
in ongoing taxes, rates and product prices
10%
of
highways and non-residential streets
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
highways and non-residential streets
Once a fortnight
S M T W T F S
EXAMPLE ONLY

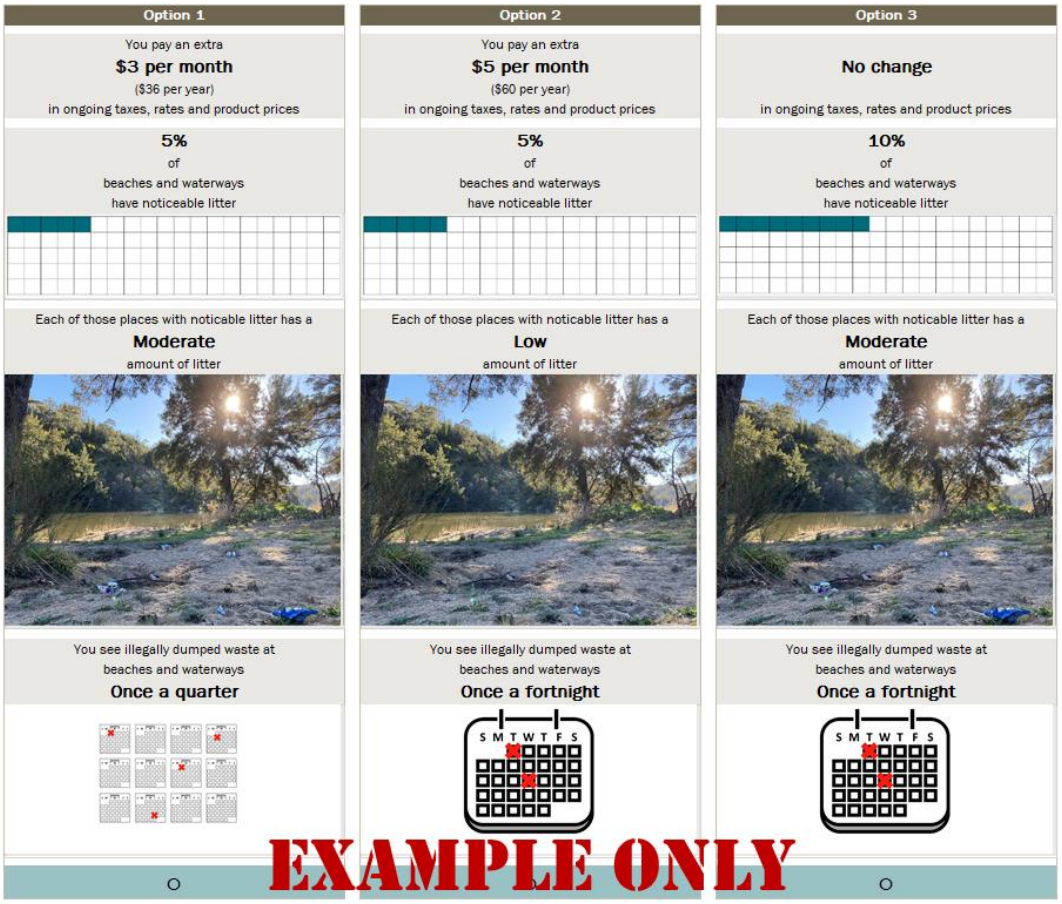

Option 1
You pay an extra
$3 per month
($36 per year)
in ongoing taxes, rates and product prices
5%
of
industrial areas
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
industrial areas
Once a quarter
Option 2
You pay an extra
$5 per month
($60 per year)
in ongoing taxes, rates and product prices
5%
of
industrial areas
have noticeable litter
Each of those places with noticable litter has a
Low
amount of litter
You see illegally dumped waste at
industrial areas
Once a fortnight
S M T W T F S
Option 3
No change
in ongoing taxes, rates and product prices
10%
of
industrial areas
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
industrial areas
Once a fortnight
S M T W T F S
EXAMPLE ONLY


Option 1
You pay an extra
$3 per month
($36 per year)
in ongoing taxes, rates and product prices
5%
of
national parks, bushland and forests
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
national parks, bushland and forests
Once a quarter
Option 2
You pay an extra
$5 per month
($60 per year)
in ongoing taxes, rates and product prices
5%
of
national parks, bushland and forests
have noticeable litter
Each of those places with noticable litter has a
Low
amount of litter
You see illegally dumped waste at
national parks, bushland and forests
Once a fortnight
Option 3
No change
in ongoing taxes, rates and product prices
10%
of
national parks, bushland and forests
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
national parks, bushland and forests
Once a fortnight
EXAMPLE ONLY


Option 1
You pay an extra
$3 per month
($36 per year)
in ongoing taxes, rates and product prices
5%
of
recreational parks
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
recreational parks
Once a quarter
Option 2
You pay an extra
$5 per month
($60 per year)
in ongoing taxes, rates and product prices
5%
of
recreational parks
have noticeable litter
Each of those places with noticable litter has a
Low
amount of litter
You see illegally dumped waste at
recreational parks
Once a fortnight
S M T W T F S
Option 3
No change
in ongoing taxes, rates and product prices
10%
of
recreational parks
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
recreational parks
Once a fortnight
S M T W T F S
EXAMPLE ONLY


Option 1
You pay an extra
$3 per month
($36 per year)
in ongoing taxes, rates and product prices
5%
of
residential areas and local streets
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
residential areas and local streets
Once a quarter
Option 2
You pay an extra
$5 per month
($60 per year)
in ongoing taxes, rates and product prices
5%
of
residential areas and local streets
have noticeable litter
Each of those places with noticable litter has a
Low
amount of litter
You see illegally dumped waste at
residential areas and local streets
Once a fortnight
S M T W T F S
Option 3
No change
in ongoing taxes, rates and product prices
10%
of
residential areas and local streets
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
residential areas and local streets
Once a fortnight
S M T W T F S
EXAMPLE ONLY


Option 1
You pay an extra
$3 per month
($36 per year)
in ongoing taxes, rates and product prices
5%
of
shopping centres and retail areas
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
shopping centres and retail areas
Once a quarter
Option 2
You pay an extra
$5 per month
($60 per year)
in ongoing taxes, rates and product prices
5%
of
shopping centres and retail areas
have noticeable litter
Each of those places with noticable litter has a
Low
amount of litter
You see illegally dumped waste at
shopping centres and retail areas
Once a fortnight
Option 3
No change
in ongoing taxes, rates and product prices
10%
of
shopping centres and retail areas
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
shopping centres and retail areas
Once a fortnight
EXAMPLE ONLY


Option 1
You pay an extra
$3 per month
($36 per year)
in ongoing taxes, rates and product prices
5%
of
beaches and waterways
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
beaches and waterways
Once a quarter
Option 2
You pay an extra
$5 per month
($60 per year)
in ongoing taxes, rates and product prices
5%
of
beaches and waterways
have noticeable litter
Each of those places with noticable litter has a
Low
amount of litter
You see illegally dumped waste at
beaches and waterways
Once a fortnight
S M T W T F S
Option 3
No change
in ongoing taxes, rates and product prices
10%
of
beaches and waterways
have noticeable litter
Each of those places with noticable litter has a
Moderate
amount of litter
You see illegally dumped waste at
beaches and waterways
Once a fortnight
S M T W T F S
EXAMPLE ONLY

A few things to remember:

- The next eight questions look very similar. Once you select an option and click next, it may not look like a new page, but the numbers describing the packages in 'Option 1' and 'Option 2' will have changed. Please, pay attention to these.
- Some of the combinations of litter and dumping outcomes may look strange to you. That is because there are a range of government initiatives that can influence the way that different types of litter or dumping are reduced in different places.
- The results of this survey will influence the amount of litter and illegal dumping in your state and your cost of living, so please answer the questions as though you are really making the decision and committing to pay the proposed amounts.
- There may be things other than litter reduction you would prefer to spend your money on.

PLEASE HAVE THE FOLLOWING TABLE APPEAR WHEN RESPONDENTS CLICK ON THE ROW OF THE CHOICE QUESTIONS CONTAINING THE DESCRIPTION OF THE AMOUNT OF LITTER – 'Low', 'Moderate', 'High', etc.

Amount of litter	Bulky items	Fine items	Total items
	Items per 100 square metres (approx. size of an apartment)	Items per 100 square metres (approx. size of an apartment)	Items per 100 square metres (approx. size of an apartment)
Very low	0	3	3
Low	0	12	12
Moderate	3	22	25
High	7	43	50
Very high	14	111	125

PLEASE INCLUDE HOVER ZOOM OVER THE PHOTO IMAGES OR, IF HOVER ZOOM IS NOT POSSIBLE, HAVE FULL SIZE IMAGES OPEN IN A NEW WINDOW WHEN RESPONDENT CLICKS ON A PHOTO.

15. If these were the only options available, which option would you choose?

    Choice question 1 of 8

    <Choice task>

16. If these were the only options available, which option would you choose?

    Choice question 2 of 8

    <Choice task>

17. If these were the only options available, which option would you choose?

    Choice question 3 of 8

    <Choice task>

18. If these were the only options available, which option would you choose?

    Choice question 4 of 8

    <Choice task>

19. If these were the only options available, which option would you choose?

    Choice question 5 of 8

    <Choice task>

20. If these were the only options available, which option would you choose?

Choice question 6 of 8

<Choice task>

21. If these were the only options available, which option would you choose?

Choice question 7 of 8

<Choice task>

22. If these were the only options available, which option would you choose?

Choice question 8 of 8

<Choice task>

23. How easy did you find answering the options questions on a scale from 1 (very difficult) to 10 (very easy)?

1-10 scale

24. Reading instructions carefully and paying attention are very important in this survey. If you are paying attention, please choose 'Moderately disagree' below.

    a. Strongly agree
    b. Moderately agree
    c. Somewhat agree
    d. Neither agree nor disagree
    e. Somewhat disagree
    f. Moderately disagree
    g. Strongly disagree
    h. Don't know

25. Did you believe that government actions would be able to achieve any of the options presented?

    a. Yes **SKIP TO Q27**
    b. No
    c. Don't know **SKIP TO Q27**

26. When you saw options that you did not believe the government could achieve, how did you go about answering the question(s)?

    a. I answered the question(s) as though I would be getting the litter, illegal dumping and cost of living impacts as described in the packages

b. I answered the question(s) as though I would be getting different litter, illegal dumping and cost of living impacts to those described in the packages

Q27 IS ONLY FOR RESPONDENTS WHO CHOSE 'NO CHANGE' IN ALL SIX CHOICE QUESTIONS

27. Why did you select the 'no change' option in every option question? Select all that apply.
    a. I didn't have enough time to properly consider the options
    b. I didn't have enough information to be confident choosing the other options
    c. I disagree with the idea of people paying to reduce litter and/or illegal dumping
    d. I'm concerned that government might put taxes up without reducing litter and/or illegal dumping
    e. I expect the government/council to reduce litter and/or illegal dumping without adding to my cost of living
    f. Other peoples' litter and/or illegal dumping should not be my problem
    g. Other _____

THE QUESTION BELOW IS ONLY FOR RESPONDENTS WHO DON'T SEE Q27

There are several benefits from reducing litter and dumping. How much was your willingness to support reductions in litter and dumping due to the benefit below on a scale from 1 (=I didn't think about this benefit at all) to 10 (=this was the only benefit I thought about)? **CAROUSEL ITEMS BELOW, ROTATE ORDER**

28. Making the places I visit look more pleasant or natural
29. Preserving natural environments that I don't visit
30. Making places safer
31. Reducing harm to wildlife and plants
32. Reducing other types of anti-social behaviour

1-10 scale

You will now be asked a series of six questions about different types of litter.

In each question, you will see four different items. You will be asked to select the item you think is the worst (the item you most dislike seeing at **[SITE]**). You will also be asked to select the item you think is the least worst.

The questions will look like the example below. You will be asked to select one box in each row.

				
	1 plastic drink bottle	1 glass drink bottle	1 cardboard takeaway container	1 coffee cup
The worst item	○	○	○	○
The least-worst item	○	○	○	○

For any items of litter that you haven't seen at **[SITE]**, please imagine what it would be like.

33. Please look at the list of items and select one box in the top row below the item you most dislike seeing and select one box in the bottom row below the item you least dislike seeing.

    <Best-worst scaling question 1>

34. Please look at the list of items and select one box in the top row below the item you most dislike seeing and select one box in the bottom row below the item you least dislike seeing.

    <Best-worst scaling question 2>

35. Please look at the list of items and select one box in the top row below the item you most dislike seeing and select one box in the bottom row below the item you least dislike seeing.

    <Best-worst scaling question 3>

36. Please look at the list of items and select one box in the top row below the item you most dislike seeing and select one box in the bottom row below the item you least dislike seeing.

    <Best-worst scaling question 4>

37. Please look at the list of items and select one box in the top row below the item you most dislike seeing and select one box in the bottom row below the item you least dislike seeing.

    <Best-worst scaling question 5>

38. Please look at the list of items and select one box in the top row below the item you most dislike seeing and select one box in the bottom row below the item you least dislike seeing.

<Best-worst scaling question 6>

39. Consider a government program that would ensure you never see littered plastic takeaway containers, straws, cutlery, and single-use items in your State, but, instead, you see littered cardboard or bamboo items. This change would happen not only at **[SITE]**, but all other places as well.

If this program would permanently increase the amount you pay in taxes, rates and product prices **each month by $X** (the amount you pay **each year by $X*12**), would you vote for the program?

a. At that cost to me, I definitely would vote for the program
b. At that cost to me, I probably would vote for the program
c. At that cost to me, I am not sure whether I would vote for the program
d. At that cost to me, I probably would not vote for the program
e. At that cost to me, I definitely would not vote for the program

SET X BASED ON LEAST FILL: 1, 2, 5, 20

40. **IF a OR b ABOVE** People have a range of reasons for disliking **plastic litter** more than **cardboard litter**, including that:

- it looks unpleasant for longer
- it poses health risks for longer
- it may stop environments from being in their natural state for longer
- it can harm wildlife and plants, and
- it makes people more worried about other types of anti-social behaviour.

How much was your willingness to contribute to the program due to concerns about **harm to wildlife and plants** on a scale from 1 (=**harm to wildlife and plants** was not one of the reasons I was willing to contribute) to 10 (**harm to wildlife and plants** was the only reason I was willing to contribute)?

1-10 scale

Now, a few questions about which types of illegal dumping you dislike the most.

41. At **[SITE]**, which would be worse?
    a. Seeing 5 incidents per year of household waste dumping (e.g. furniture, clothes, mattresses, domestic rubbish, and whitegoods)
    b. Seeing **X** incidents per year of green waste dumping

    DRAW X BY LEAST FILL FROM 5, 10, 15, 30

42. At **[SITE]**, which would be worse?
    a. Seeing 5 incidents per year of household waste dumping
    b. Seeing **X** incidents per year of construction/demolition waste dumping (e.g. timber, concrete, bricks, tiles, rubble)

    DRAW X BY LEAST FILL FROM 1, 3, 5, 7

43. At **[SITE]**, which would be worse?
    a. Seeing 5 incidents per year of household waste dumping
    b. Seeing **X** incidents per year of commercial/industrial waste dumping (e.g. pallets, cardboard, plastic film, etc.)

    DRAW X BY LEAST FILL FROM 1, 3, 5, 7

44. **IF [SITES] IS shopping centres and retail areas** Which would be worse?
    a. Seeing 5 incidents per year of household waste dumping at charity bins and donation points
    b. Seeing **X** incidents per year of household waste dumping at other locations in shopping centres and retail areas

    DRAW X BY LEAST FILL FROM 1, 3, 5, 7

45. If governments invested in a large program involving education, incentive provision, deterrence, and cleaning initiatives, it would be possible to make sure you almost never see any litter or illegally dumped waste. This program would prevent or remove litter and dumped waste not only from **[SITES]** but also from **all other places** as well. It would happen instead of (not in addition to) the options you were shown earlier in this survey.

    Other places around the world, such as Calgary and Singapore, have shown this near-zero litter outcome is possible. Near-zero litter and dumping outcomes have also been achieved at hotspots in Australia. For an example click here.

    If maintaining this near-zero litter and dumping outcome would permanently increase the amount you pay in taxes, rates and product prices **each month by $X** (the amount you pay **each year by $X*12**), would you vote for this large government program? (Assume you would start paying only when the near-zero litter and dumping outcome has been achieved.)

    a. At that cost to me, I definitely would vote for the program
    b. At that cost to me, I probably would vote for the program
    c. At that cost to me, I am not sure whether I would vote for the program
    d. At that cost to me, I probably would not vote for the program
    e. At that cost to me, I definitely would not vote for the program

    SET X BASED ON LEAST FILL: 5, 20, 50, 150

46. Do you think it would be possible to achieve a near-zero litter outcome in the places you see?

    a. Yes
    b. No, but I answered the question as though it would be possible
    c. No. I answered the question as though the program would achieve a smaller reduction in litter.

IF SELECTED c-e IN Q45

47. What were the main reasons for your decision? Select all that apply. **ROTATE EXCEPT OTHER**

    a. The program was too expensive
    b. The information about the program was confusing
    c. I didn't have enough information to be confident voting for the program

d. It is not possible to reduce litter by that much
e. Governments will put up taxes without delivering the litter reductions
f. I am worried about being fined for littering (including accidentally)
g. Litter and dumping are not big problems for me
h. I do not think I should be the one paying
i. Other _____

48. If you had seen a pile of illegally dumped construction and demolition waste before conducting this survey, to what degree would you have been concerned about the waste containing asbestos on a scale from 1 (I would not have thought about asbestos) to 10 (I would have been very concerned about asbestos)?

    1-10 scale

49. To what degree do you expect that the results of this survey will affect government action on litter and illegal dumping in your state?

    a. I believe it is very likely the survey will affect government action on litter and illegal dumping
    b. I believe it is somewhat likely the survey will affect government action on litter and illegal dumping
    c. I don't think the survey will affect government action on litter and illegal dumping

50. Do you expect government action on litter and illegal dumping would lead to you paying costs through taxes, rates and product prices?

    a. I believe it is very likely I would pay costs
    b. I believe it is somewhat likely I would pay costs
    c. I don't think I would pay any costs

51. What effect has the COVID-19 pandemic and associated public health orders had on your willingness to support litter-reduction programs at **[SITES]**? (Select all that apply)

    a. I am now more willing to support litter-reduction programs at those places
    b. I am now less willing to support litter-reduction programs at those places
    c. Other (please specify) _____

or

d. No effect

52. Over the past five years, how many times have you volunteered your time or donated money for a clean-up activity for public places (e.g. Clean Up Australia Day)?

    a. Never

    b. Once

    c. 2-5 times

    d. More than 5 times

The following questions are about your demographic characteristics. This data is needed to ensure the survey covers a good cross-section of the community. Your responses will be anonymised and reported only in a grouped format.

53. Do you speak a language other than English at home?

    a. No, English only

    b. Yes

54. Which best describes your household:

    a. Couple/family without children at home

    b. Couple/family with children at home

    c. One parent family

    d. Group household

    e. Single person household

    f. Other

55. What is your work status?

    a. Working full time

    b. Working part time/casually

    c. Student

    d. Not currently employed

    e. Home duties

    f. Retired

g. Other

56. **ONLY IF ANSWERED NOT d in Q54** What is your approximate annual household income before tax?

    a. Less than $41,600 per year (less than $800 per week)
    b. $41,600 - $78,000 per year ($800 - $1,500 per week)
    c. $78,000 - $104,000 per year ($1,500 - $2,000 per week)
    d. $104,000 - $156,000 per year ($2,000 - $3,000 per week)
    e. More than $156,000 per year (more than $3,000 per week)
    f. Do not wish to answer

57. **ONLY IF ANSWERED d in Q54** What is your approximate annual personal income before tax?

    a. Less than $41,600 per year (less than $800 per week)
    b. $41,600 - $78,000 per year ($800 - $1,500 per week)
    c. $78,000 - $104,000 per year ($1,500 - $2,000 per week)
    d. $104,000 - $156,000 per year ($2,000 - $3,000 per week)
    e. More than $156,000 per year (more than $3,000 per week)
    f. Do not wish to answer

58. Finally, is there any feedback you would like to provide on this survey? **ALLOW ZERO INPUT**

    _____
    _____
    _____
    _____

Thank you for participating in this survey. Your opinions are very important.

C Photographs used in the discrete choice experiment

C.1 Photographs used to depict litter at beaches and waterways

Amount of litter	Photograph
Very low	
Low	

Amount of litter	Photograph
Moderate	
High	

Amount of litter	Photograph
Very high	

Source: CIE

C.2 Photographs used to depict litter at recreational parks

Amount of litter	Photograph
Very low	

Amount of litter	Photograph
Low	
Moderate	

Amount of litter	Photograph
High	
Very high	

Source: CIE

C.3 Photographs used to depict litter at highways and non-residential streets

Amount of litter	Photograph
Very low	
Low	

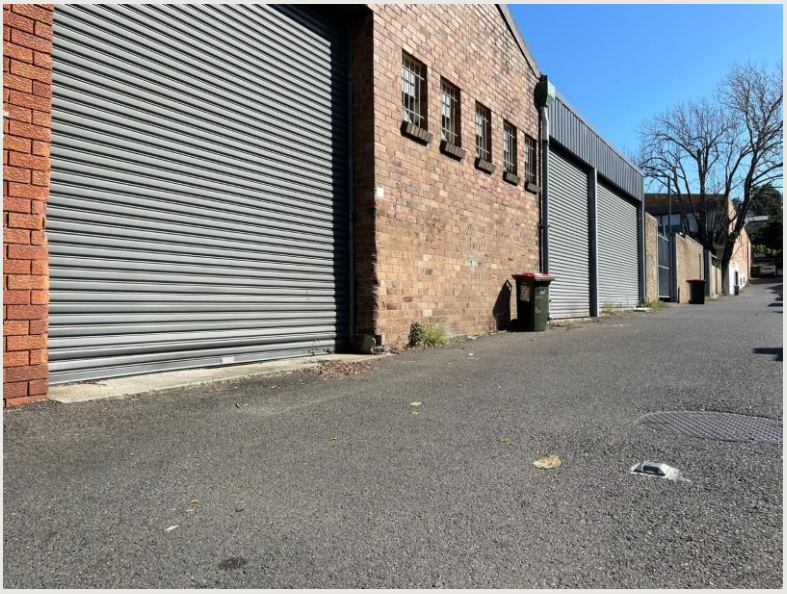
Amount of litter	Photograph
Moderate	
High	

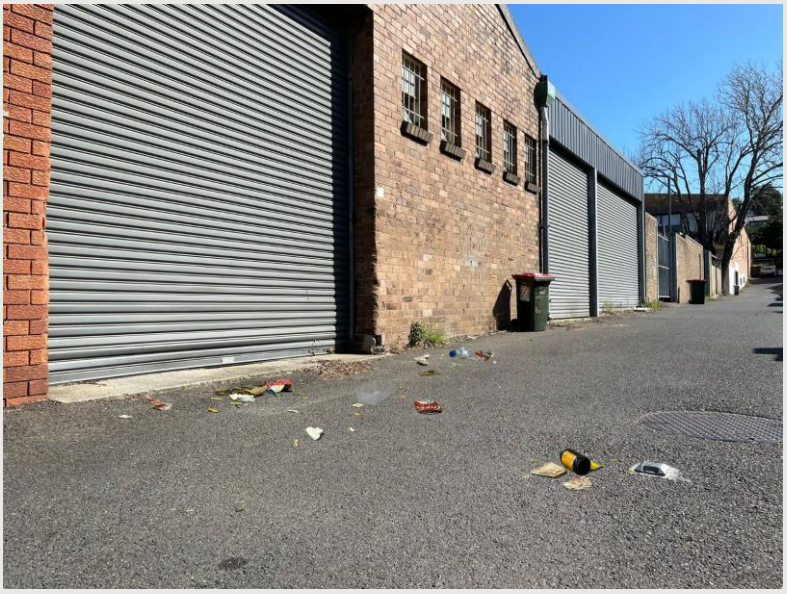
Amount of litter	Photograph
Very high	

Source: CIE

C.4 Photographs used to depict litter at industrial sites

Amount of litter	Photograph
Very low	

Amount of litter	Photograph
Low	
Moderate	

Amount of litter	Photograph
High	
Very high	

Source: CIE

C.5 Photographs used to depict litter at national parks

Amount of litter	Photograph
Very low	
Low	

Amount of litter	Photograph
Moderate	
High	

Amount of litter	Photograph
Very high	

Source: CIE

C.6 Photographs used to depict litter at residential sites

Amount of litter	Photograph
Very low	

Amount of litter	Photograph
Low	
Moderate	

Amount of litter	Photograph
High	
Very high	

Source: CIE

C.7 Photographs used to depict litter at commercial/retail sites

Amount of litter	Photograph
Very low	
Low	

Amount of litter	Photograph
Moderate	
High	

Amount of litter	Photograph
Very high	

Source: CIE

D Estimation results

D.1 Model of household choice

	Coef.	Z value
Fixed parameters		
Interactions with cost: You pay an extra $... per month in ongoing taxes, rates and product prices		
Queensland beaches and waterways	-0.171	-10.1
Queensland highways and non-residential streets	-0.306	-9.3
Queensland industrial areas	-0.329	-9.7
Queensland national parks, bushland and forests	-0.213	-12.4
Queensland recreational parks	-0.277	-7.9
Queensland residential areas and local streets	-0.409	-10.5
Queensland shopping centres and retail areas	-0.416	-9.9
Victoria beaches and waterways	-0.122	-8.3
Victoria highways and non-residential streets	-0.339	-10.4
Victoria industrial areas	-0.252	-8.2
Victoria national parks, bushland and forests	-0.137	-8.2
Victoria recreational parks	-0.300	-8.9
Victoria residential areas and local streets	-0.224	-7.6
Victoria shopping centres and retail areas	-0.257	-8.1
NSW beaches and waterways	-0.142	-10.3
NSW highways and non-residential streets	-0.299	-8.6
NSW industrial areas	-0.236	-7.7
NSW national parks, bushland and forests	-0.125	-8.6
NSW recreational parks	-0.219	-7.9
NSW residential areas and local streets	-0.246	-8.6
NSW shopping centres and retail areas	-0.282	-8.2
Random parameters: means		
Interactions with alternative-specific constant: No change		
beaches and waterways	-1.348	-8.8
highways and non-residential streets	-1.679	-9.7
industrial areas	-0.962	-6.9
	-1.565	-9.5

	Coef.	Z value
recreational parks	-1.309	-8.1
residential areas and local streets	-1.540	-8.3
shopping centres and retail areas	-1.197	-7.2
Proportion of places with noticeable litter (100 per cent = 100)	-0.023	-8.5
Amount of litter at places with noticeable litter: Very low (dummy)	0.897	6.7
Amount of litter at places with noticeable litter: Low (dummy)	0.993	8.0
Amount of litter at places with noticeable litter: Moderate (dummy)	0.435	3.7
Amount of litter at places with noticeable litter: Very high (dummy)	-0.538	-2.5
Square root of number of days per year you see illegally dumped waste	-0.072	-5.8
Random parameters: standard deviations		
Interactions with alternative-specific constant: No change		
beaches and waterways	1.864	11.39
highways and non-residential streets	1.804	9.55
industrial areas	0.717	1.56
national parks, bushland and forests	1.107	3.73
recreational parks	1.371	5.46
residential areas and local streets	0.536	0.94
shopping centres and retail areas	-0.017	-0.05
Proportion of places with noticeable litter (100 per cent = 100)	0.037	3.43
Amount of litter at places with noticeable litter: Very low (dummy)	1.261	2.67
Amount of litter at places with noticeable litter: Low (dummy)	0.494	2.62
Amount of litter at places with noticeable litter: Moderate (dummy)	0.383	2.33
Amount of litter at places with noticeable litter: Very high (dummy)	-0.759	-2.26
Square root of number of days per year you see illegally dumped waste	-0.009	-0.20
Random parameters: cross-parameter correlations		
/l21	-0.189	-0.63
/l31	0.885	3.34
/l41	0.926	3.54
/l51	-0.282	-0.83
/l61	0.909	2.14
/l71	0.531	1.63
/l81	0.005	0.76
/l91	-0.168	-0.62
/l101	-0.309	-1.33
/l111	0.639	2.89
/l121	-0.219	-0.67
/l131	0.018	0.76
/l32	0.801	2.86
/l42	0.732	2.64
/l52	0.352	1.03

	Coef.	Z value
/l62	0.783	2.81
/l72	-0.128	-0.36
/l82	0.019	2.59
/l92	0.193	0.74
/l102	0.391	1.67
/l112	0.281	1.31
/l122	-0.076	-0.24
/l132	0.053	2.00
/l43	-0.609	-1.58
/l53	-0.013	-0.04
/l63	-0.248	-0.36
/l73	-1.099	-4.27
/l83	-0.008	-1.09
/l93	1.006	2.50
/l103	0.572	1.60
/l113	0.479	1.49
/l123	-0.117	-0.21
/l133	-0.005	-0.13
/l54	-0.905	-3.01
/l64	-0.957	-3.22
/l74	-0.968	-3.19
/l84	0.014	2.11
/l94	-0.441	-1.13
/l104	-0.285	-0.75
/l114	0.062	0.18
/l124	0.345	1.00
/l134	0.018	0.57
/l65	0.207	0.50
/l75	0.053	0.15
/l85	0.021	3.34
/l95	-1.266	-3.89
/l105	-1.160	-4.05
/l115	-0.526	-2.05
/l125	0.677	1.91
/l135	0.086	3.11
/l76	-0.927	-2.56
/l86	0.017	1.44
/l96	-0.647	-1.30
/l106	-0.450	-1.15
/l116	-0.507	-1.74
/l126	0.484	1.07

	Coef.	Z value
/l136	-0.046	-1.09
/l87	-0.008	-0.82
/l97	-0.502	-1.40
/l107	-0.368	-1.05
/l117	0.021	0.07
/l127	0.005	0.01
/l137	-0.062	-1.76
/l98	-1.348	-3.30
/l108	-1.174	-2.76
/l118	-0.990	-3.03
/l128	0.487	1.07
/l138	-0.024	-0.57
/l109	0.887	1.98
/l119	0.557	1.91
/l129	0.490	0.95
/l139	-0.050	-1.30
/l1110	0.516	2.33
/l1210	-0.396	-0.94
/l1310	0.046	1.35
/l1211	0.811	2.02
/l1311	-0.131	-4.77
/l1312	0.015	0.45
Model fit		
Choice observations		14 456
Individuals		1 807
Log likelihood		-13 049

Source: CIE

E Visitation rates

E.1 Average number of times per year respondents go to their assigned site type

	beaches and waterways	recreational parks	shopping centres and retail areas	highways and non-residential streets	industrial areas	national parks, bushland and forests
	Visits per year	Visits per year	Visits per year	Visits per year	Visits per year	Visits per year
Full sample						
NSW	62	69	129	111	46	38
Victoria	36	83	109	128	36	31
Queensland	64	54	113	142	36	20
Sample used in mixed logit model						
NSW	58	73	142	116	58	50
Victoria	35	102	120	131	45	39
Queensland	62	58	136	160	43	26

Note: The site type 'Residential areas and local streets' was omitted from the question about visitation frequency.
Source: CIE

E.2 Visitation rate responses for full survey sample

	beaches and waterways	recreational parks	shopping centres and retail areas	highways and non-residential streets	industrial areas	national parks, bushland and forests
	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.
NSW						
Every day	6	9	10	18	4	4
Every weekday	7	5	11	8	5	3
3-4 days every week	16	9	33	21	10	6
1-2 days every week	10	27	52	21	14	10
1-2 days every fortnight	20	21	19	14	13	12
1-2 days every month	25	21	6	14	16	29

	beaches and waterways	recreational parks	shopping centres and retail areas	highways and non-residential streets	industrial areas	national parks, bushland and forests
	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.
3-4 weeks (21-28 days) every year	11	7		8	6	5
1-2 weeks (7-14 days) every year	16	4	2	13	9	15
1-2 days every year	18	8		6	15	25
3-4 weeks (21-28 days) every five years					1	
1-2 weeks (7-14 days) every five years	3	2			2	3
A few days every five years	7	3		4	8	11
Almost never	12	25	2	11	43	21
Victoria						
Every day	3	9	7	22	6	1
Every weekday	1	7	6	14	2	4
3-4 days every week	7	19	36	23	5	6
1-2 days every week	13	34	67	29	8	9
1-2 days every fortnight	10	16	19	18	11	6
1-2 days every month	25	14	11	12	16	20
3-4 weeks (21-28 days) every year	13	2	6	7	2	3
1-2 weeks (7-14 days) every year	20	9	1	8	10	19
1-2 days every year	20	13		1	18	31
3-4 weeks (21-28 days) every five years	1			4	2	2
1-2 weeks (7-14 days) every five years	2	2			1	
A few days every five years	11	3		3	8	12
Almost never	14	20	3	10	53	19

	beaches and waterways	recreational parks	shopping centres and retail areas	highways and non-residential streets	industrial areas	national parks, bushland and forests
	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.
Queensland						
Every day	7	3	7	30	1	3
Every weekday	1	2	12	10	8	
3-4 days every week	20	15	27	20	5	2
1-2 days every week	15	22	49	26	12	4
1-2 days every fortnight	14	25	26	8	10	9
1-2 days every month	24	21	5	11	21	27
3-4 weeks (21-28 days) every year	4	3	2	6	7	8
1-2 weeks (7-14 days) every year	16	9	7	13	9	16
1-2 days every year	18	14	2	5	18	34
3-4 weeks (21-28 days) every five years	3			1		3
1-2 weeks (7-14 days) every five years		1	1			5
A few days every five years	7	4		2	8	14
Almost never	11	21	1	9	50	29

Source: CIE

E.3 Visitation rate responses for respondents included in the mixed logit model

	beaches and waterways	recreational parks	shopping centres and retail areas	highways and non-residential streets	industrial areas	national parks, bushland and forests
	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.
NSW						
Every day	2	7	8	11	4	4
Every weekday	5	4	8	6	5	3
3-4 days every week	13	6	23	17	9	6

	beaches and waterways	recreational parks	shopping centres and retail areas	highways and non-residential streets	industrial areas	national parks, bushland and forests
	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.
1-2 days every week	8	23	28	16	10	7
1-2 days every fortnight	17	15	11	10	11	10
1-2 days every month	19	15	5	5	14	22
3-4 weeks (21-28 days) every year	9	6		7	6	2
1-2 weeks (7-14 days) every year	9	4	1	7	7	14
1-2 days every year	15	7		5	12	18
3-4 weeks (21-28 days) every five years					1	
1-2 weeks (7-14 days) every five years	2	1			2	2
A few days every five years	6	2		3	4	3
Almost never	4	13	0	5	21	7
Victoria						
Every day	1	7	5	14	5	1
Every weekday	0	6	5	13	2	3
3-4 days every week	6	17	28	19	4	6
1-2 days every week	8	25	42	22	8	6
1-2 days every fortnight	9	11	10	14	10	5
1-2 days every month	21	11	5	11	13	16
3-4 weeks (21-28 days) every year	9	2	2	6	2	3
1-2 weeks (7-14 days) every year	15	8	1	7	8	13
1-2 days every year	11	5		0	15	19
3-4 weeks (21-28 days) every five years	0			2	1	1

	beaches and waterways	recreational parks	shopping centres and retail areas	highways and non-residential streets	industrial areas	national parks, bushland and forests
	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.	No. resp.
1-2 weeks (7-14 days) every five years	2	2			0	
A few days every five years	4	1		1	6	9
Almost never	7	2	2	3	26	6
Queensland						
Every day	3	1	6	27	1	3
Every weekday	1	2	10	6	6	
3-4 days every week	15	10	18	16	5	2
1-2 days every week	14	15	30	19	9	3
1-2 days every fortnight	14	14	9	5	10	6
1-2 days every month	19	15	2	7	12	24
3-4 weeks (21-28 days) every year	3	2	1	4	6	5
1-2 weeks (7-14 days) every year	11	8	2	7	5	12
1-2 days every year	10	9	1	1	13	19
3-4 weeks (21-28 days) every five years	3			1		3
1-2 weeks (7-14 days) every five years		0	1			5
A few days every five years	3	3		2	8	6
Almost never	6	4	0	7	26	13

Source: CIE

F Expert peer review

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23rd, December, 2021

Peer Review: Willingness to pay for reduced litter and illegal dumping

To whom it may concern,

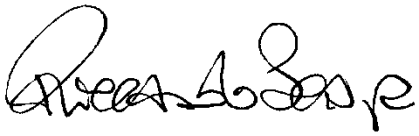
I write to communicate my involvement as an expert of the New Zealand Institute of Business Research of the Waikato Management School in the peer review of the above-mentioned study undertaken by the Centre for International Economics in the Australian states of New South Wales, Victoria and Queensland. I have been involved in the development of the various stated choice surveys, their administration, data analysis and interpretation. I engaged in consultation and dialogue with Dr. Benjamin McNair and Dennis McCarthy from the beginning of this endeavor and at several stages of advancement in the conduction of the study. In particular, I reviewed the technical details of the experimental designs for the stated choice surveys, the ex-ante bias-reduction approach (cheap talk), the framing of contingent valuation questions and the estimation approach to the best-worst data analysis within the framework of random utility. I found the resulting designs employed in each survey to be well grounded in the theory and current practice of experimental design for stated choice data collection and administration.

I was also involved in evaluating the various model estimation procedures in the draft reports. I reviewed the congruence of the interpretation of the statistical model results for policy recommendation and found it robust and coherent with my understanding of these models. In emails exchanges and videoconferencing with Dr. McNair we discussed alternative approaches to best-worst scaling data analysis to address issues of WTP derivation from this data and consistency with CV estimates, which led to the approach undertaken. We both agreed the random utility framework approach would be the most suitable for the underlying data given the purpose of the study.

With the information in my possession, I am satisfied that the report fully meets the state of practice in commercial consultancy environments in nonmarket valuation studies via stated choice. In fact, the techniques used in this study go beyond commonly established practice and include approaches at the forefront of the discipline (e.g. nonmonetary contingent valuation and BW-scaling calibrated to WTP from CV), which many, including myself, would consider state of the art. Overall I am very satisfied with the quality of the report and the supporting data analysis and specification search, which in my opinion made an excellent use of the resources made available for the study. The CIE team successfully tackled a valuation topic that is complex and presents several challenges.

Sincerely yours,

Riccardo Scarpa



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