Non-market valuation instruments for measuring community values affected by coastal hazards: guidance and an application

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Report Overview

This report contains two related publications.

PART A – Non-market valuation instruments for measuring community values affected by coastal hazards and their management

Part A of this report, originally published on 9th February 2018, contains an overview of economic approaches that can be used to measure community values affected by coastal hazards and their management, as well as survey templates that coastal managers can implement to measure values, and guidance material on how to use those templates. Part A has been updated subsequent to its original publication, with the relevant changes noted in the footnotes of the report.

This part of the report should be cited as:

Rogers, A.A. and Burton, M.P. 2019, "Non-market valuation instruments for measuring community values affected by coastal hazards and their management". Report prepared for the Western Australian Department of Planning, Lands & Heritage by The University of Western Australia, Crawley.

PART B – Testing the application of non-market valuation instruments for measuring community values affected by coastal hazards: Yanchep Beach case study

Part B of this report presents an application of the survey templates that are described in Part A through a case study on community values for Yanchep Beach. It provides a description of the results and how they may subsequently be used to help coastal managers in coastal adaptation decisions.

This part of the report should be cited as:

Rogers, A.A., Burton, M.P. and Subroy, V. 2019, "Testing the application of non-market valuation instruments for measuring community values affected by coastal hazards: Yanchep Beach case study". Report prepared for the Western Australian Department of Planning, Lands & Heritage by The University of Western Australia, Crawley.

PART A

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Glossary

Attributes: the set of policy or program features or characteristics that are valued in a discrete choice experiment. These attributes relate to changes in outcomes associated with coastal assets.

Choice scenario: a question used in a discrete choice experiment which contains multiple policy options or management programs, each defined by a set of attributes, with the levels of the attributes varying between different options.

Coastal assets: the coastal goods or services that are affected by coastal hazards and/or hazard management.

Coastal hazards: the sources of damage to coastal assets. In this context coastal hazards refer to erosion and inundation.

Discrete choice experiments: a stated preference approach that estimates how individuals make trade-offs between changes in different characteristics, or attributes, of a non-market good, including a trade-off with the cost of providing these changes.

Erosion: a process where parts of the shoreline are worn away due to waves, tides, wind or human activities.

Experimental design: a statistical design that is used to arrange the levels of attributes in choice scenarios for a discrete choice experiment.

Inundation: a process where water occupies previously dry land, including temporary (e.g. flooding) and permanent (e.g. sea level rise) inundation.

Marginal utility: a measure of the utility (value) associated with an incremental change in the quantity or quality of an outcome.

Non-market valuation: a set of economic approaches for estimating intangible values in financial-equivalent terms.

Non-market values: the intangible, non-financial or non-economic values that people hold for goods and services that are not bought and sold through a market.

Non-use value: the value derived from the satisfaction of knowing a good exists without there being any planned or actual use of the good.

Revealed preference method: a non-market valuation approach that uses information from markets associated with the non-market good being valued, or from observing people's behaviour in their use of the good, to infer an individual's willingness to pay for it.

Stated preference method: a non-market valuation approach that uses survey-based instruments to ask individuals how much they are willing to pay to achieve an outcome, or asks about their preferences for making trade-offs between different outcomes.

Total economic value: the overall value of an asset, measured in dollars, including both market and non-market values, and use and non-use values.

Travel cost method: a revealed preference approach where the costs associated with making a trip to visit a site are used to infer how much people are willing to pay for each visit.

Use value: the value derived from the actual use of a good by an individual, or by the individual reserving the option to use it at some point in the future.

Utility: an economic measure of an individual's wellbeing or welfare.

Willingness to pay: a measure of the value an individual holds for an asset, or a change in an outcome, defined in terms of how much they would be willing to pay for that outcome.

Contents

List of appendices and templates

1. Introduction

The primary coastal hazards affecting the Western Australia coastline are erosion and inundation (Western Australian Planning Commission 2014). These hazards have the potential to affect a wide range of coastal assets that both the coastal and broader Western Australian communities value. Various adaptation or management options exist that are able to mitigate the effects of these hazards on coastal assets. These management actions can sometimes lead to improvements of certain assets, while being to the detriment of others.

In all cases, coastal hazard management interventions carry substantial economic costs for implementation. To determine which management interventions are the most cost-effective to implement, it is important to have an understanding of the benefits of protecting coastal assets to the community. The protection of some coastal assets will lead to quantifiable economic benefits, for example, the revenue generated through coastal tourism enterprises. However, many coastal assets also have non-market, or intangible, values associated with them. These include social and environmental values such as those associated with recreational opportunities, the aesthetics or amenity of an area, and the existence-related values of protecting habitats for flora and fauna. These "non-market values" can be quantified through economic approaches that estimate financial-equivalent values for the intangible elements of social and environmental assets. By measuring intangible values in dollars direct trade-offs can be made between the full set of costs and benefits of different policy and management options for coastal hazard mitigation.

The objective of this report is to outline survey instruments that are capable of quantitatively measuring these non-market values for the coastal assets affected by coastal hazards and their management in financial-equivalent terms. It is anticipated that the values estimated through application of these survey instruments can be used to assess the benefits of coastal hazard management plans against the costs of implementation (e.g. using a benefit-cost analysis), and to compare the values of different coastal assets to determine which management interventions are appropriate.

The report is organised in the following way. In section 2 we provide an overview of two different approaches to non-market valuation, travel cost and discrete choice experiments, outlining their respective advantages and disadvantages. Section 3 explains the process by which the survey instrument that is the focus of this report was developed. It also details each section of the survey. The survey developed provides a template from which site-specific surveys can be developed. Section 4 outlines which aspects of the survey instrument require modification, and some generic advice on how to proceed with that. Section 5 provides details on the methods used for data analysis, so that the survey outcomes can provide useful information. Section 6 concludes with some guidance on how to aggregate the values generated from the data analysis from sample-based results to population-based estimates that may be used in benefit-cost analysis.

The report also includes a number of appendices and templates. The appendices include a review of the different methods available for measuring coastal values, a copy of the pilot survey developed for Cottesloe beach, and the statistical analysis of the pilot data. The sample size is small, and the intention is not that these results are usable in any real decision or policy setting: rather they are illustrative of the way the analysis is conducted, and the form of the results generated. A fourth appendix provides some additional technical information about the experimental design used to develop the choice experiment. There are also four templates that coastal managers can use to adapt the survey to a new coastal location, which include guidance on which aspects of the survey should be modified.

2. Non-market valuation approaches

A brief overview of the economic approaches selected to quantitatively measure intangible values in the survey instrument is provided below. Appendix 1 'Review of methods to measure coastal values' provides a more in depth overview of a broader range of economic and non-economic methods that can measure coastal values, including a summary of the advantages and disadvantages of each approach.

2.1 What are non-market values?

In this context, non-market values relate to the intangible, non-economic, or non-financial values associated with changes in the environmental or social outcomes of coastal assets that are affected by coastal hazards or their management.

The net sum of all values associated with an asset, including market and non-market values, is known as the total economic value (Figure 1). Values are generally defined as either use or non-use values (Bateman et al. 2002).

Use values relate to actual, planned or potential use of an asset, and can be either market or non-market in nature. Non-market use values for coastal assets include:

- Recreation values, e.g. ability to use an area for swimming, relaxing, surfing, wind surfing, snorkelling, wind surfing, scuba diving, walking, running, cycling, picnicking, socialising, exercising pets, camping, boating, four-wheel driving, etc.
- Aesthetic and amenity values, e.g. ability to appreciate scenic views of an area.
- Safety values, e.g. provision of measures to enhance public safety such as surf life savers, beach patrols, and infrastructure to manage storm runoff.
- Option values, e.g. maintenance or protection of assets such that they available to use for the above purposes in the future.

All non-use values are categorised as non-market values. Non-use values for coastal assets include:

- Existence values, e.g. the knowledge that biodiversity, threatened or iconic species and functional ecosystems exist.
- Bequest values, e.g. knowledge that an area is being maintained or protected for future generations.
- Altruistic values, e.g. knowledge that an area is being maintained or protected for others to use the area even if you personally will not.

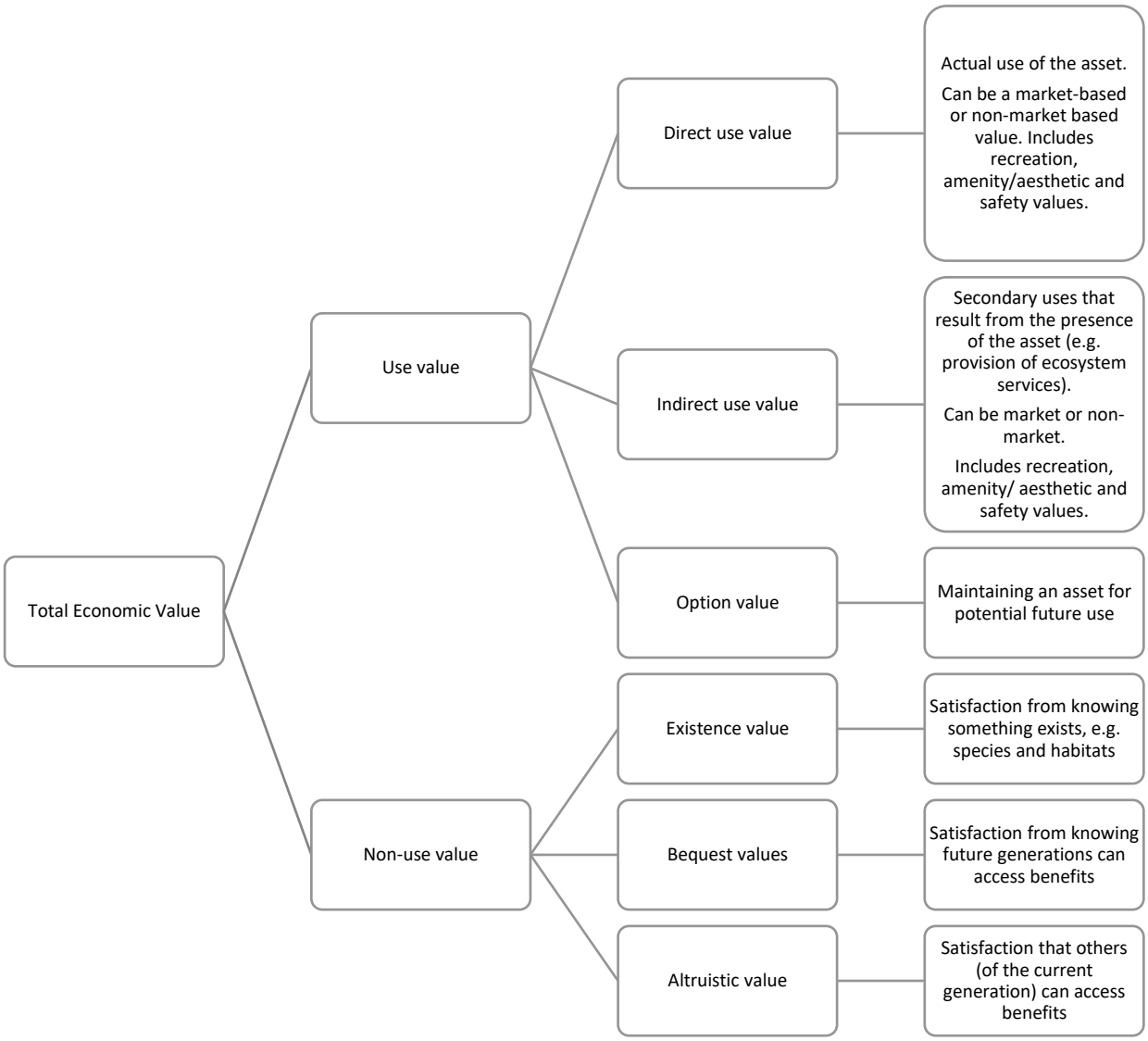

Figure 1. Total economic value of an asset.

Note that the impact that coastal hazards and their management will have on values will depend on the specific characteristics of the asset and how it is impacted. For example, location of the asset is important: the uses (and therefore use values) of urban beaches are often different to those of remote beaches, and existence values are more likely to be important for remote, undisturbed assets. Different users may react to changes in physical condition of an asset in different ways, and therefore the same change can result in positive values for some members of the community, and negative values for others. For example, construction of a seawall to protect residential buildings might be received positively by local residents, but negatively by visitors to the beach. Or infrastructure that dissipates wave energy might be received favourably by families and swimmers, but not by surfers. Accordingly, the context under which values are measured is an important consideration when trying to quantify non-market values.

2.2 Non-market valuation approaches

There are a number of non-market valuation approaches that can measure how much people are willing to pay for coastal assets. An extensive review of the available approaches revealed that, for the purpose of providing financial estimates of coastal assets affected by coastal hazards, two approaches were particularly appropriate: the discrete choice experiment and travel cost method approaches (see Appendix 1).

2.2.1 Discrete choice experiments

Discrete choice experiments are used to estimate how individuals make trade-offs between different features, or attributes, of an asset (Bennett and Blamey 2001). Respondents are given a sequence of hypothetical choice scenarios, where each scenario is comprised of a number of options. The options describe, for example, different hazard management programs in terms of its attributes. The level, in terms of the marginal change in quantity or quality, of each attribute varies across the different options. One of the attributes that is usually included in the trade-off scenario is a cost which is used to calculate willingness to pay. For example, we could estimate how much people are willing to pay for protecting different lengths of foreshore infrastructure relative to having different lengths of a sandy beaches left available for recreation.

Discrete choice experiments are useful for measuring non-market values in the context of coastal hazard management because they can:

- Capture the total economic value of the coastal assets for which values are being measured, including the use-related and non-use values of the assets.
- Capture the non-market value of multiple coastal assets in the one survey instrument.
- Measure incremental, or marginal, changes in quantity or quality of the assets affected by coastal hazards. This is particularly important because hazard impacts may not be absolute, e.g. a beach is usually not lost overnight, but there is a gradual (incremental) decline in the quality of the beach, which is what can be captured through this approach.

For more information on the discrete choice experiment method, refer to Pearce and Ozdemiroglu (2002):

http://webarchive.nationalarchives.gov.uk/20120919162306/http://www.communities.gov.uk/documents/corporate/pdf/146871.pdf

2.2.2 Travel cost method

The travel-cost method is commonly used to measure values associated with recreation. It uses information about the costs associated with making a trip to visit a site to infer how much people are willing to pay for each visit. These costs include monetary expenses like fuel costs, food expenditures, entry fees, and other on-site purchases, and non-monetary expenses, such as the implicit time cost for travel (Hanley and Barbier, 2009). We can then explore how willingness to pay varies by site, based on the different characteristics at each site.

Given the focus on recreational use value, this approach does not provide the total economic value of a coastal asset, nor values for multiple assets or multiple changes in quantity/quality of the asset contingent on the impacts of coastal hazards. However, relative to the discrete choice experiment, it

is a simpler approach to implement and is still able to provide a lower-bound estimate of the financial non-market value of a coastal location.

For more information on the travel cost method, refer to Parsons (2013):

https://works.bepress.com/george_parsons/35/download/

3. Survey design

3.1 Consultation process

The survey design was informed by extensive consultation to ensure that the resulting template would capture the required values and would be adaptable to different locations and populations.

Stage 1: Stakeholder workshop

A workshop with experts in coastal hazard planning was held to discuss the scope of the survey instrument. The outcomes of the workshop were as follows:

- The survey would focus on the impacts of coastal hazards, specifically erosion and inundation, and not on other issues that may affect coastal assets such as weed incursion or urban development policies. Anthropogenic contributions to impacts of erosion (e.g. four-wheel driving) were deemed to be in scope.
- The key coastal assets that were considered to (a) be relevant across a wide range of beach locations along the WA coast, (b) likely to be impacted by coastal hazards, and (c) likely to be of importance to the community, included:
    - Beach reserve: the sand reserve immediately at the shoreline.
    - Land reserve: the social space set back from the beach, including grassy areas, picnic and barbeque facilities, toilet blocks, play equipment, and sporting areas.
    - Coastal habitats/ecosystems: the dune vegetation, nearshore ecosystems, shorebird habitat.
    - Access: the pathways/stairways down to the beach, proximity of parking and public transport to the beach access point, and access to facilities that enable other activities like fishing jetties or boat ramps.
    - Social infrastructure/buildings/services: the restaurants, cafes, kiosks, and commercial centres that act as social hubs or service providers to the community.
    - Cultural heritage: the Indigenous, European, natural or built heritage associated with the coast.
    - Residential/private housing: the private residences that people might value for the knowledge that other people can live near the beach.

Stage 2: Public focus groups

Focus groups were held with members of the community to confirm which coastal assets should be included in the survey template and to test general comprehension of the instrument. Acknowledging the potential application of the template to different target populations, one group was held with members of a coastal community (8 participants), and another with members of the public drawn from non-coastal locations (8 participants). The participants represented a range of demographics (gender, age, educational/employment background). The outcomes of the focus groups were as follows:

- There was agreement that the following coastal assets were important to include as attributes in the choice experiment:
    - Sandy beaches, i.e. the beach reserve as listed above.
    - Foreshore reserve, i.e. the land reserve as listed above.
    - Natural reserve, i.e. the coastal habitats/ecosystems.

    - Beach access, revised from the original definition of access to focus on the number of access points to the sandy beach (walkways, stairways, ramps, etc). Participants believed that access points were a separate issue to parking/transport availability, and that the former were more important for inclusion.
    - Retail, dining and club facilities, i.e. social infrastructure/buildings/services as listed above.
- Cultural heritage was omitted as an attribute: it was thought to be an important coastal asset, but difficult to define as an attribute due to its variable nature (i.e. it could be related to Indigenous/European, built/natural, or some other form of culture or heritage value) and it being inherently non-generic (i.e. the importance and type of heritage is highly location specific).
- Private residences were omitted as an attribute: participants generally thought this was more relevant to those who lived in the private residences. Inclusion in the choice experiment might have been of value to demonstrate that they prefer other attributes relative to this one in making trade-offs, but given the complexity of the choice scenarios (and the ability to measure the economic value of residential property through other means) there was a preference to leave this out.
- Those aspects omitted from the choice experiment were thought to be adequately captured through other questions in the survey instrument.
- The payment vehicle was debated according to the appropriateness of using local council rates or a tax-based payment. The coastal focus group participants believed rates-based payments were unfair given that non-locals could visit and use their beach. The non-coastal focus group participants thought that a tax-based payment would be useful to ensure the relevance of the payment to people who don't live within the Local Government Area.
- Participants requested basic information be included about the management interventions that might be used, so that they could visualise what this might mean for the beach. However, they were willing to accept the separation of specific management interventions and the outcomes for coastal assets provided it was explained to them that we were interested in the values people held for changes in the condition of assets, not the particular management intervention. That is, it was not essential to identify what management action would be used to achieve the changes in outcomes for coastal assets.

Stage 3: Expert review

The coastal expert stakeholder group and two non-market valuation practitioners (independent from the project) were invited to comment on the final draft of the survey instrument. Comments were addressed and integrated into the survey instrument prior to pilot testing.

3.2 Survey sections

The survey is divided into six main sections, which can be viewed in Template 1:

- Screening questions: includes three socio-demographic questions that can be used to screen-out respondents who are not relevant for the target sample (gender, age and place of residency).
- Introduction: provides an overview of the survey objectives and defines the scope with respect to coastal hazards and the beach location.
- Part 1: includes the travel cost questions and questions about beach experience.

- Part 2: provides a description of the choice experiment attributes and sets the frame for the choice scenarios.
- Part 3: includes the choice experiment questions and associated debriefing questions.
- Part 4: includes other socio-demographic questions.

3.3 Non-economic questions

The survey includes non-economic questions that relate to behaviour that can be used to provide additional understanding of people's preferences and uses of the beach. These questions can also be integrated into the economic analyses of the travel cost and choice experiment data, to identify how willingness to pay varies across different types of people.

Questions include [*with reference provided to question in Template 1*]:

- The types of activities that people undertake at the beach [*Part 1, Q1.2*].
- Whether public parking availability and public transportation services are adequate [*Part 1, Q1.9 and Q1.10*].
- Identification of substitute sites that people visit, instead of the beach in focus, and reasons why they prefer those sites instead [*Part 1, Q1.11*].
- Identification of which types of values (i.e. see Figure 1) people believe are important to protect at the beach [*Part 1, Q1.12*]. This includes questions related to the importance of maintaining the cultural heritage values at the beach, and the importance of people being able to live near the beach.
- Indicators of familiarity with the beach, including:
    - Whether they have coastal views from their home or place of employment [*Part 4, Q4.3*].
    - Whether they belong to coastal conservation groups [*Part 4, Q4.4*].
    - Whether they belong to coastal recreation groups [*Part 4, Q4.5*].
    - Whether they are employed in a coastal-related field [*Part 4, Q4.6*].
- Open-ended questions enabling respondents to give a more detailed perspective on particular issues, including:
    - Comments on the general use and importance of beaches [*Part 1, Q1.13*].
    - Comments on the management actions used to control coastal hazards [*Part 2, Q2.1*].
    - Comments on the coastal features described for the choice experiment [*Part 2, Q2.2; Part 3, Q3.9*].
    - General comments [*Part 4, Q4.10*].

3.4 Discrete choice experiment

3.4.1 Choice experiment framing

The framing of the choice experiment is generic to enable application to a range of coastal locations and hazard contexts.

Referring to Template 1 Part 2, the key pieces of information that respondents are given to create the context for the choice scenarios are as follows:

1. A time horizon is set, after which the damages to the coastal features will be realised.
2. A list of potential management actions with a brief definition of each included.

3. An explanation of different management actions that could have positive or negative impacts on difference coastal features, in order to acknowledge that some management interventions are better suited to protecting specific assets to the detriment of others (e.g. seawalls). This sets up the ability to include losses and gains in the attribute levels for the choice experiment.
4. Uncertainty in the impacts of coastal hazards on coastal features is acknowledged, to be transparent with respondents that we don't know precisely what will happen in the future.
5. It is explained to respondents that we are interested in understanding how they value changes in the outcomes for the coastal features, and not the specific management interventions used to achieve those outcomes. This allows us to estimate the values for the coastal assets directly, without having to take into account which management interventions are feasible and which ones will have positive or negative impacts on specific assets as this is likely to be location-specific.

3.4.2 Attributes

The attributes selected are intended to represent the types of coastal assets that are:

(a) common across coastal locations in Western Australia;
(b) likely to be impacted by coastal hazards; and,
(c) likely to be important to the community.

Examples of how the attributes are described and presented to respondents are provided in Template 1.

For each attribute, respondents are provided with:

- A clear definition of what the attribute is, along with images that describe the attribute.
- A description of what the current state of the attribute is (in absolute terms, for example, the square metre area of sandy beach)
- A description of what the degraded state of the attribute is expected to be at the end of the specified time horizon (see 3.4.1, item 1), if no management action is used.
- A number of levels reflecting how the condition of the attributes might change based on some unspecified management intervention. It is assumed that, for the purpose of determining levels, each attribute is independent of one another. That is, the condition of one attribute does not define the condition of another: it is possible to have an increase in the level of one attribute while having a decrease in the level of another.

The five coastal assets, defined as 'coastal features' in the survey instrument, are:

1. Sandy beach:
   "This is the area of sandy beach available for recreational use at high tide"
   (*and optionally:* "…, as measured at the end of the winter season when the area is smallest").
   Four levels representing changes in condition of the beach are given, based on percentage area (and also described in terms of square metres).

2. Foreshore reserve:
   "This is the land reserve adjacent to the sandy beach that is available for recreational use. It includes recreational facilities such as change rooms, open grassy areas, shelter, play equipment, barbeques and picnic tables".

Four levels representing changes in condition of the foreshore are given, based on percentage area (and also described in terms of square metres).

3. Natural reserve:
   "This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation".
   Four levels representing changes in condition of the nature reserve are given, based on percentage area (and also described in terms of square metres).

4. Beach access:
   "This includes the provision of pathways and stairs that service the beach, as well as ramps for disability access".
   Three levels representing changes in the condition of beach access are given, described as poor, average and good access, where each level of access is based on the distance between access points.[1]

5. Retail, dining & club facilities:
   "This includes the provision of retail, food outlets and other public services along the foreshore reserve".
   Two levels representing changes in the condition of the facilities are given, where they are either present or absent.

3.4.2 Payment vehicle

Respondents are informed that funds must be sourced to manage the impacts of coastal hazards. The (hypothetical) payment vehicle used to collect these additional funds is "a special State Fund, where payments are collected from all Western Australian households".

The use of a State Fund makes the cost attribute in the choice experiment applicable to any member of the West Australian public. The process of how this fund would be collected is deliberately left unspecified: a judgement was made based on the focus group discussions that this ambiguity was preferable to being specific (e.g. using something as specific as "an income tax" raises issues about how federally sourced funds filter back to the relevant State/Local government agencies).

3.4.3 Choice experiment instructions

A set of instructions are provided to respondents to explain how they should approach and answer the choice scenarios.

Of particular importance, these instructions include:

1. A description of how long the hypothetical payment timeframe is.
   Note that the payment timeframe does not need to reflect the timeframe for ongoing management/maintenance costs. The calculation of willingness to pay is separate from the calculation of the costs of management: the two are subsequently able to be compared through a benefit-cost analysis where all values are converted to net present values.

[1] This definition of access was seen as appropriate for the particular application, at Cottesloe Beach. Alternative definitions of the 3 levels could be employed as appropriate in other contexts – see Section 4.4.1.

2. That respondents should be mindful of their own financial circumstances, or in other words consider how much of their disposable income they really want to spend on coastal hazard management relative to other things that they could spend their money on.
3. A consequential statement about how the findings of the study will be used. This important to encourage respondents to take the task seriously, as the survey results might have a real impact on future decision making, and hence on outcomes that they care about.

3.4.4 Choice scenarios and experimental design

Respondents are required to answer a set of five choice scenario questions. An example of a question is given in Figure 2. The scenarios include three hypothetical management options that result in a set of different outcomes for the five coastal features. One of the options is the same in every scenario and is a 'status quo' option: it has a $0 cost and reflects what will happen if there is no management intervention.

Information is included with each choice scenario to remind respondents what the current state of the coastal features is at the moment, and also a reminder of the definition of each of the attributes.

Management scenario 1: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 Sandy beach	50%	75%	50%	100%
 Foreshore reserve	25%	75%	50%	100%
 Natural reserve	100%	50%	25%	100%
 Beach access	Average	Average	Average	Good
 Retail, dining & club facilities	Present	Present	Absent	Present
Cost to you each year, for 10 years	$100	$50	$0	

Figure 2. Example of a choice scenario question.

Multiple questions must be asked, because there are many different combinations of attributes and levels that could occur, meaning there are many different potential options that could be offered. We need to understand how people make trade-offs across a sufficient number of these options to then be able to estimate the willingness to pay for different attribute levels.

The choice scenarios are generated from an experimental design which arranges the levels of attributes that appear in each option of each scenario in a way that enables an efficient statistical analysis of respondents' preferences.

There are 25 choice scenarios in total, blocked into five groups of five (see Appendix 4 and Template 2). Each respondent is assigned one block, so that for every five respondents there is a full replication of the design.

3.4.5 Debriefing questions

A set of debriefing questions are asked following the choice scenarios to provide insight into how respondents are answering the set of five scenarios. The debriefing questions include (see Template 1):

- A question for respondents who always select the status quo option (option 3) in every scenario [*Part 3, Q3.SQ*].
  This question is used to identify protest responses from legitimate responses.
  Protest responses are characterised by people who object to some element of the survey framing, which means they are unlikely to be taking the task seriously and provide unreliable data. For example, they might object to the payment vehicle or to information presented about coastal hazard impacts.
  Legitimate responses are characterised by people who genuinely prefer the status quo option, who can't afford the other options or who don't think that additional investment is needed to manage the impacts of coastal hazards at that particular beach (which is different from them objecting to the idea that the impacts of the hazards will occur – this is a protest response).
- Attribute non-attendance questions [*Part 3, Q3.1, Q3.2*].
  Attribute non-attendance refers to instances where a respondent consistently ignores a particular attribute from the trade-offs they are making when selecting an option in the choice scenarios. Respondents are asked to identify non-attendance to the cost attribute (Q3.1) and to the coastal features (Q3.2).
- Ranking of the coastal features in terms of their importance [*Part 3, Q3.2*].
  In addition to measuring non-attendance, Q3.2 also measures how respondents rank the coastal features. This can be used to validate the willingness to pay estimates derived from the choice experiment, for example, we would expect to see that people are willing to pay more for the coastal features that are ranked highly.
- Indicators of reliability of responses, for example:
  - Whether respondents remembered to think about how much they could afford (i.e. were aware of their disposable income) in relation to the options they chose [*Part 3, Q3.3*].
  - Whether they found the choice task confusing [*Part 3, Q3.4*].
  - How certain they were of the responses they gave [*Part 3, Q3.5*].
  - Whether they thought the survey provided them with accurate information [*Part 3, Q3.6*].
  - Measures related to the consequential statement (see 3.4.3, item 3) to judge how they perceived the usefulness of the survey (Q3.7), and whether they think the results will actually be used (Q3.8) [*Part 3, Q3.7, Q3.8*].

3.5 Travel cost questions

The travel cost questions are designed to gain an understanding of how much people 'spend', in terms of travel costs or time costs, to visit the beach location.

Travel costs can only be meaningfully completed by visitors of the particular beach. Accordingly, a question is included at the beginning of Part 1 to direct recent visitors to answer these questions, and otherwise skip to a later part of the survey [*Part 1, Q1.1*].

Given the variation in use of coastal locations in Western Australia between hotter and colder months, the travel cost questions are designed to collect data for both time periods.

Questions for the beach-visiting respondents include:

- How often they visit the beach, to establish trip frequency [*Part 1, Q1.3, Q1.4*].
- How many people travel with them, to be able to divide the travel costs per person [*Part 1, Q1.5*].
- How far they travel (distance), how long it takes them (time) and by what mode of transport they use to get to the beach, which can be used to establish the cost of a typical trip [*Part 1, Q1.6, Q1.7*].
- Whether their trip to the beach includes multiple stops at other places, which can be used to adjust the trip cost [*Part 1, Q1.8*].

4. Survey implementation

This section outlines the steps required to adapt the template for your specific needs. Statistical and/or economic skills are required to analyse the data collected via these survey instruments; however, the survey templates themselves can be adapted and implemented in a variety of coastal locations and contexts by coastal managers (such that an economic practitioner does not need to be engaged until after data collection).

The steps should be followed in conjunction with the advice provided in Templates 1, 2, 3 and 4.

4.1 Coastal location

First you must determine the particular coastal location that you are measuring values for:

- It can be a specific beach site, e.g. a few hundred metres of coast associated with a hub of activity.
- It can be a short stretch of coast, e.g. 10-20km.
    - If valuing a stretch of coast, for a discrete choice experiment, it must be a reasonably consistent stretch of coast for which you can generically define the impacts of coastal hazards on that part of the coast, i.e. the effects of erosion and inundation should be relatively consistent in the time horizon that you specify.
    - If you are able to define the hazard impacts generically, and define a set of levels for the attributes that are sensible, then the template can be applied in this manner.
- The template is not designed to estimate values for large tracts of coastline.

4.2 Target population

Second you must decide who the coastal location matters to, and which population's values you wish to evaluate, for example:

- Local beaches might only matter to local communities.
- Iconic, tourist beaches might matter to a wider transect of the population.
- Specific types of beaches might matter more to a particular type of user group
- Intact, remote beaches with high environmental quality might be relevant to the State-wide population due to the non-use values they could hold for such a site.

Identifying the target population influences how one recruits respondents to the survey.

4.3 Which survey template to use

Selection of the correct survey template depends on what you want to estimate values for.

The 'DCE+TC survey instrument' (Templates 1, 2 and 3) should be used if you want:

- To understand how people value coastal assets contingent on the impacts of coastal hazards.
- An in-depth understanding of what types of coastal assets people value at the site, and the trade-offs they are prepared to make between different coastal assets.
- An estimate of the total economic value for coastal assets (including use and non-use related values).
- Incremental, marginal measures of willingness to pay for changes in levels (or changes in the quantity or quality) of coastal assets.

The 'TC-only survey instrument' (Template 4) should be used if you want:

- A lower bound estimate of the current dollar value of the site as a whole, that is not contingent on the incremental impacts of coastal hazards.
- A focus on use-related recreation value, not a measure of total economic value.
- A shorter survey instrument that is quicker and easier to implement.
- To use intercept sampling of beach users, as it is more appropriate for this sampling approach due to its shorter length.

4.4 Discrete choice experiment and travel cost survey

A number of elements in the 'DCE+TC survey template' (Template 1) require adaptation to your site.

The instructions in Template 1 provide direction as to what areas of the template require updating, or can optionally be updated, to suit your coastal location. These are summarised below.

Step 1. Location [*Yellow highlight in template*]:

- You will need to specify your particular location where flagged throughout the survey template, including defining the specific boundaries of your location.
- Some questions in Part 1 are varied by hot (November-April) and cold (May-October) seasons. Update the seasonal divide as required for your location [*Part 1, Q1.2, Q1.3 and Q1.4, Pink highlight in template*].
- You will also need to consider what substitute sites are relevant to your site for some questions in Part 1, based where your site is located and who your target population is [*Part 1, Q1.11 and Q1.13, Light green highlight in template*].

Step 2. Target sample [*Blue highlight in template*]:

- The template is designed for a sample of the Western Australian population.
- If you are targeting a different population (e.g. Perth metropolitan, Local Government Area, particular user group) you will need to change the relevant text.

Step 3. Payment vehicle [*Blue highlight in template*]:

- Related to the target sample, the template is designed using a State Fund as the payment vehicle. This makes the cost attribute in the choice experiment applicable to all West Australian households, and is relatively a less controversial payment mechanism.
- If your target sample is within a Local Government Area, and your coastal site is a local beach used predominantly by local residents, you might consider 'an increase in council rates' as your payment vehicle. If you choose to make this change, also change the text that describes who manages (and pays for the management of) the site to be Local Government only, and not inclusive of State Government agencies.
- If your target sample is a particular user group, you could consider a fee-based payment vehicle, e.g. an entry, parking or registration fee.
- The payment vehicle needs to be credible to respondents. In selecting it, care needs to be taken that it is both feasible and binding.

Step 4. Timeframe for hazard impact [*Yellow highlight in template*]:

- Where possible, this timeframe should reflect the actual (modelled) timeframe within which these damages are likely to occur. That may not always be feasible, for example, if the timeframe is 70 years where the impacts may not be considered important by current generations: if you ask people to pay now to manage impacts that will only appear after many years, quite rationally their willingness to pay may be very small (because the discounted net present value of impacts that occur far into the future will be small). The alternative is to use a shorter time frame to identify the values held by the community, and then, if necessary, discount those to account for the appropriate difference in time frames. That is, if the experimental time frame says that the impact occurs in 10 years, but the modelling suggests that it will occur in 25, then the experimental values would be discounted down using a 15 year time frame, at whatever discount rate is being employed.

Step 5. Attribute descriptions [*Yellow highlight in template*]: see Section 4.4.1 below

Step 6. Payment timeframe for the cost attribute [*Dark green highlight in template*]:

- This timeframe should be within the range of 1 to 10 years, which is within a time period over which people are likely to have a reasonable understanding of their expected income and budgets. If the time horizon for hazard impact (see Step 4) is within 10 years, then it would be sensible to match the payment timeframe for consistency. Otherwise we recommend selecting a timeframe within the range of 1 to 5 years.

Step 7. Choice scenarios [*Yellow highlight in template*]: see Section 4.4.2 below

4.4.1 Attribute descriptions

The attributes selected are expected to be relevant for most coastal locations.

There is some flexibility in how you can define the attributes for your coastal location. You can change the numbers/quantities/qualities that define each attribute level to suit your own site, provided that you use the same number of levels that are specified in the original experimental design:

- 4 different levels for Sandy beach, Foreshore reserve and Natural reserve
- 3 different levels for Beach access points
- 2 different levels for Retail, dining & club facilities

If the circumstances are that these experimental dimensions need to be changed (e.g. a different number of levels or attributes is required), then a new experimental design is required. These can be generated relatively easily, but require specialised software to ensure that the design will allow you to identify the values – see Section 4.4.2.

❖ *Sandy beach, Foreshore reserve and Natural reserve*

- Levels for each of these attributes are based on percentage area.
- Define an appropriate range, e.g. what you currently have in terms of the existing area of the attribute as an optimal level, and what you think the worst case scenario might be (e.g.

what will happen without management intervention in the future, or with a management action that is to the detriment of one of the attributes).

- Assign 4 percentage area levels based on this range. The template proposes a range from 25%-100%, but your range can be smaller or larger.
- In the attribute description:
    - Note which of these levels represents the current situation – what you get now.
    - Note which of these levels represents the status quo situation – what you will get in the specified time horizon if there is no management intervention.
    - Include the absolute measurements in the attribute description, i.e. what the percentage area means in actual terms (metres squared or similar).
    - Ideally include a visual reference as well, at least for the current situation level: how the area compares to the size of something people are familiar with (e.g. a sporting ground; an aerial image of the coast pointing out the geographical reaches of the attribute.
- The descriptions of these three attributes will be applicable to most locations, but you can adjust the descriptions to be more specific if required, for example:
    - Add or delete items from the list of recreational facilities included in the foreshore reserve definition (i.e. change rooms, open grassy areas, shelter, play equipment, barbeques, picnic tables).
    - Add or delete specific ecosystem types for natural reserves (e.g. include shorebird habitat).

❖ *Beach access points*

- Levels are categorical descriptions (poor, average, good) that are based on distance between access points.
- Define an appropriate range, e.g. how many access points there are now, and what you think the worst case scenario might be in the future due to hazard or management impacts.
- In the attribute description:
    - Assign absolute numbers to the frequency of access points to the 3 categorical levels, and refer to the status quo and current situation conditions:
        - Poor = what you will get in the specified time horizon if there is no management intervention (e.g. only 1 access point),
        - Average = something in between (e.g. access points every 200m),
        - Good = what you get now (e.g. access points every 50m).
    - Ideally include a visual reference as well, at least for the current situation level, e.g. an aerial image of the coast pointing out the available access points.
- This approach should be suitable when measuring the values for longer stretches of coast.
- In some cases, distance between access points may not be relevant, e.g. if your site is a very specific beach hub that might only span for a couple of hundred metres and has only one major access point. In this case, you can re-define the attribute to be about a different measure of beach access. For example:
    - "Type of access provided" where the levels might be "Poor – sand path only; average – concreted & sand paths; good – stairs, concreted & sand paths"
    - "Distance to sandy beach from main carpark" where the levels might be "Poor – 100m; average – 50m; good – 20m".

❖ *Retail, dining & club facilities*

- Levels are based on the presence or absence of these facilities being provided.
- You will need to update the text that states what particular facilities are at your site, e.g. "Currently, the services provided include cafes, restaurants and surf club facilities".
- Ensure that there is no overlap between the types of general facilities included in the 'Foreshore reserve' attribute description (e.g. change rooms and barbeque/picnic areas, which are maintained by people but don't require human staffing to run on a day-to-day basis), and the specific facilities or services included here.
- Generally, you will state that presence of facilities will represent the current situation, and absence of facilities will represent the situation in the future due to hazard or management impacts.
- It is possible that for some remote locations the current situation will be that there are no facilities provided. In this case, you could propose that some are built in future.

4.4.2 Choice scenarios and experimental design

Once your levels are decided for each of the attributes you can use the 'DCE experimental design' Template 2 and 'DCE choice scenarios' Template 3 to construct your choice scenario questions.

Experimental designs

Ensuring the choice scenarios have appropriate combinations of attribute levels is essential for the statistical identification of the values of interest. It is possible to severely compromise the outcomes of the survey if the design is not implemented appropriately. A key requirement is that respondents have to face 'difficult' choices, where they are asked to make trade-offs between better outcomes for some attributes and worse outcomes for others in the set of options they must choose from. A situation where one option has better outcomes for all attributes relative to another option reveals nothing about the intensity of preferences.

Note that the experimental design provided assumes that all attribute levels are independent of one another (an increase in the level of one attribute allows for the possibility of a decrease in another). Orthogonality in the attribute levels is desirable, as it allows the identification of the value attached to each level of each attribute.

In most cases we expect that all combinations of attribute levels will be feasible through some means. For example, in one location, it might be possible to envisage that one could have a loss of Foreshore reserve space, but a gain in Sandy beach space: erosion might reduce the original beach space, but sand nourishment could be used to reinstate that space at the expense of the foreshore reserve. The experimental design is appropriate for this situation.

However, it is possible that for some coastal locations there may be certain combinations of attributes and levels that are infeasible. For example, sand nourishment may not be practicable at a particular location, and it might be impossible to lose part of the foreshore space before all of the beach space is lost to erosion first. In this case there might be concerns about the believability of the survey instrument if you present a scenario with an increase in Sandy beach space and a decrease in Foreshore reserve. New experimental designs can be generated for this situation, but they require the use of specialised software to ensure that, statistically, one can still identify the values for the changes in assets.

In general, it is advisable to re-generate an experimental design whenever there are significant changes in the way attributes are described or in the levels that are assigned to them, to ensure robustness of results. Revising the design is relatively straightforward, and adds little to the work involved in re-framing a survey to another context. However, minor changes may not cause a great loss in the statistical efficiency of the design, for example, revising the levels of an attribute within the existing range of levels already specified, or adjusting (increasing/decreasing) all attributes' levels by the same factor. If changes are viewed as minor, then the templates provided can be used.

We recommend that the survey be implemented within the bounds of the provided experimental design (i.e. with respect to the attributes and levels described) where possible. Exceptions may exist where there is specific evidence to suggest this is impractical, for example, based on expert advice that there are technical infeasibilities in the way attribute levels are combined, or where public focus groups identify a particular issue with the design (e.g. the cost levels are too high). We would recommend re-running of the design software[2] for more extreme changes in the attribute level specifications. Such circumstances requiring a new design could include cases where:

- An infeasible combination of one attribute level with another attribute level exists, and must be omitted from the design (e.g. the area of Sandy beach must be <25% before there can be any loss of the Foreshore reserve).
- A different number of attribute levels is required (e.g. 3 or 5 levels for Sandy beach instead of 4 levels).
- A range of attribute levels is required that is a substantial extrapolation from the range used in this design (e.g. 0%-80%, or 50%-150%, instead of 25-100% for the area-based attributes).
- One of the attributes is not relevant for inclusion and should be omitted from the design (e.g. Recreational, dining & club facilities are not currently present, nor suitable to consider for future presence at the location).
- The way in which an attribute and its levels are specified does not fit within the advice given in the templates (e.g. if beach access cannot be defined by relating poor/average/good levels of access to the number, type or length of access points).

Generating the choice scenarios

The 25 choice scenarios provided in Template 2 need to be adjusted to suit your four percentage levels chosen for the Sandy beach, Foreshore reserve and Natural reserve attributes. For example, if you are using a level range of 40%, 60%, 80%, 100% for Sandy beach, you would replace the 25% level in the template with your level of 40%, the 50% level in the template with your level of 60%, and so on. If changes are made its important to maintain the relativity between levels, i.e. the lowest level value in the template design should be replaced by the lowest of the newly proposed level values.

The levels for the Cost, Beach access, and Recreational, dining & club facilities attributes are already embedded in the template: the changes that you can make for these attributes are covered in the text for the attribute descriptions, as discussed above.

[2] Re-generating an experimental design can be done very quickly using the Ngene software and the syntax script provided in Appendix 4.

You will need to generate your 'status quo' option: this will comprise of the level for each attribute that describes the impacts in the future if there is no management intervention.

You will also need to define the 'current situation'. This does not form an option for respondents to select in the choice scenario, but is included as a reference point so that they can compare how the options presented compare to the current situation. This will usually comprise of the level for each attribute that describes what they currently have at the coastal location. However, it is possible that the levels used in the current situation will not form part of the levels included in the other three options. For example, if it is expected that the impacts of coastal hazards will be so severe that no management intervention can protect 100% of the existing Sandy beach, you might show 100% in the 'current situation', but levels in the three choice scenario options might only range to a maximum of 80%.

You can use the image in Template 3 to transform your choice scenarios into a presentable format for inclusion in the survey instrument.

Finally, you will need to generate one additional choice scenario image that can be used as an example to illustrate how respondents should answer the set of questions.

4.5 Travel cost-only survey

To implement the 'TC-only survey instrument', refer to the instructions in Template 4. Adaptation of this template to your site is straightforward: it requires you to update location and sample specific information only (also see steps 1 and 2 under Section 4.3 above).

4.6 Survey administration

4.6.1 Sampling approaches

The survey can be administered through different approaches, including:

- Online:
    - The survey is programmed online using questionnaire authoring software (e.g. Qualtrics, SurveyMonkey).
    - Market research companies that maintain online panels of individuals can be used to collect a representative sample of your target population (e.g. Online Research Unit, Research Now, Pure Profile) and direct them to the survey.
    - A web link to the survey can be advertised through other websites (e.g. local community and tourism webpages) or through handouts/flyers left in mail boxes.
- Mail-out: paper-based surveys can be mailed out to people.
- Phone: The 'TC-only survey instrument' (Template 4) can be administered over the phone. The 'DCE+TC survey instrument' is too complex for phone-based administration.
- Intercept sampling:
    - More appropriate for the 'TC-only survey instrument' Template 4 if you are intercepting people who are busily involved in some other activity, due to its shorter duration.
    - You can apply the 'DCE+TC survey instrument' Template 1 by intercept sampling if it is not disruptive to the individuals you are targeting, but be aware of the amount of time it requires for people to complete it.

- If the survey if programmed online, you can use tablet devices for intercept sampling, and also provide printed information flyers with the survey link on and hand them out to people who are too busy to complete the survey on the spot.

4.6.2 Sample size

The accuracy of the survey instrument is increased by having larger samples. Simple models can often be estimated with as few as 100 respondents. This is particularly the case when the sampled population is relatively homogeneous and the location is well known to that population. In such a case, preferences are often quite similar across individuals enabling estimation of a statistically significant model with a small sample. However, we recommend that larger samples are collected. The risk of using a small sample is that it is not possible to identify, with the required precision, the values that are held for the assets. One may conclude that the public does not value an asset when in fact the problem is the sample is not large enough to identify the value. This is particularly important when sampling from heterogeneous populations (e.g. the broader West Australian community) where there is likely to be a diversity of knowledge and preferences for the coastal location, or if you want to be able to understand how willingness to pay for the coastal assets varies for different types of people. In such cases samples sizes upwards of 300 are desirable.

4.6.3 Incentives

If surveys are time consuming, it can be difficult to encourage people to complete surveys in sufficient numbers. In some circumstances completion incentives may improve the number of respondents. Incentives can take a number of forms: cash rewards, or goods or services received for completion, or alternatively entry into a prize draw for the chance of winning the same. Incentives for each respondent needs to be small, and appropriate for the time required to complete the survey: they should not be seen as inducements to complete. Entry into a prize draw allows a larger, more attention grabbing item to be made available, but then obviously only a few respondents will receive a reward.

If respondents are drawn from an online panel then the incentive structure will be determined and managed by the recruitment company. The specific incentives offered by recruitment companies are typically digital dollars that can be later banked for real currency, with the amount offered for completion based on the length of the survey[3].

If incentives are to be organised and managed in-house, then the means by which personal details are collected to contact respondents needs to be managed with care. At the start of a survey there is often a statement of anonymity being maintained: that responses will not be matched to individuals. If email/address information is collected for the purpose of incentives it should be separated permanently from the respondents' answers as soon as possible.

[3] The actual amount offered is generally considered proprietary information by the recruitment company, and therefore unknown to the researcher, but is usually within the range of a few dollars.

5. Data analysis

This section outlines some basic considerations for data analysis and a brief summary of the underlying theory. Familiarity with statistical analyses will be required for data analysis. Statistical software is required to analyse the data, for example: R (freely available), Stata, Nlogit or Latent Gold.

5.1 Analysis of discrete choice data

5.1.1 Data management

The first step in analysing the discrete choice experiment data is the removal of protest responses. As described in Section 3.4.5, some respondents may not be answering the choice task in the manner that is required, and should be removed from the sample. Protest respondents are those individuals who selected the status quo option (Option 3) for every choice scenario, and then in the follow-up question [*Part 3, Q3.SQ*] selected *a response other than*[4]:

- "I preferred this option to all others"
- "I could not afford the other options"

The two answers listed above are still relevant for inclusion in the data set: these answers do not indicate protest responses, and are legitimate reasons for preferring the status quo. Those who chose other options are indicating that they did not consider all of the alternatives in the expected way, i.e. they are not considering all attributes and making a considered trade-off between levels. The treatment of these individuals when generating aggregate community values is dealt with in Section 6.1 below.

If the survey is conducted using online software that logs the completion time, it is also useful to remove responses that were unrealistically fast. We do not expect that an individual who is reading the questions properly could complete the full survey in less than 10 minutes, and any individuals who took less than this amount of time should be removed from the sample.

5.1.2 Discrete choice analysis

The theory of consumer choice underpins the analysis of the non-market valuation data, where it is assumed that individuals maximise their utility (or wellbeing) subject to their budget constraints. In particular, choice experiment analysis is based on Lancaster's 'characteristics theory of value' which assumes that a public good (e.g. a coastal location) can be described in terms of its characteristics, or a set of attributes (e.g. coastal assets), and that each of these attributes contributes to the total value of the good (Bateman et al. 2002). In relation to the current context, this theoretical underpinning means that respondents are selecting the options from the choice scenarios that provide them with the most utility based on the levels of the attributes that are offered in that option, while weighing up the cost of that option and considering what other things they might want to spend their money on.

[4] In the original report (dated February 2018), a third non-protest option was included in this question: "I don't think that the coastal features described for [insert location] need further investment to manage the impacts of coastal hazards". This response option has subsequently been removed from the report and associated templates as the interpretation of the response is already captured through other response options in Q3.SQ.

Random utility theory is used to model the data, where utility (*U*) is a function of the vector of attributes (*X*) of alternative *i*, the parameters (*β*) of alternative *i*, and the unobservable utility (*ε*) or error component of alternative *i*:

$$U_i = \beta X_i + \varepsilon_i \qquad \text{Equation 1}$$

The error component represents the unobservable component of an individual's choice – we can only observe the choices an individual makes in relation to the levels of the attributes provided in each option and not any other factors that they might be considering while making their choice.

The multinomial logit model (also known as the conditional logit model) is used to estimate the probability of an alternative *i* being chosen by individual *n*, and is represented as follows:

$$P_{ni} = \frac{e^{\lambda\beta' x_{ni}}}{\sum_j e^{\lambda\beta' x_{nj}}} \qquad \text{Equation 2}$$

Lambda (*λ*) is a scale parameter, which is inversely proportional to the standard deviation of the error term, that is, it scales the attribute coefficients according to the variance of the unobserved utility. It is not possible to separately identify the scale and beta parameters, thus the estimated parameters are interpreted as scaled marginal utilities. This means that the coefficients estimated in one choice model are not comparable to the coefficients measured in another – they can only be interpreted as being relative to the other coefficients within the same model.

However, it is possible to account for heteroscedasticity in the error variance, that is, that different people may have different levels of certainty in their choices, as long as it is understood that the scale for some individual is arbitrarily set to equal 1, and all other scales are measured relative to that baseline value. In that case equation 2 above is re-stated as:

$$P_{ni} = \frac{e^{\lambda_n\beta' x_{ni}}}{\sum_j e^{\lambda_n\beta' x_{nj}}} \qquad \text{Equation 3}$$

Here the scale is allowed to vary across individuals, but must be explicitly modelled. A common format is to use an exponential form, i.e.

$$\lambda_n = \exp(\partial z_n) \qquad \text{Equation 4}$$

The exponential format is useful, in that it imposes that the scale coefficient is always positive (which it has to be by definition) but can take on various values depending on the value of the vector of individual specific characteristics z_n. This is the heteroscedastic conditional logit model[5]. For

[5] The description of the heteroscedastic conditional logit has been added to this amended report as it was used to model data in Part B of the report. This model was not described in the original report dated February

example, assuming that the vector z consists of a single dummy variable for gender, which takes a value of 0 for male and 1 for others, then the implication is that the scale coefficient for males is 1 (exp(0)), and the value for non-males is defined relative to 1, based on the estimated value of the coefficient ∂. If z is a continuous variable, such as age, then the baseline is determined by the individual who has a value of zero for the variable (i.e. the implied scale for someone aged zero). Although statistically it does not matter where the baseline is drawn, it can impact interpretation (see Davis et al 2019) so it is best to re-base the z variables so they take a value of zero at the mean or mode of the sample.

The marginal willingness to pay of an attribute is calculated by the negative ratio of the coefficient for the non-monetary attribute (*a*) to that of the cost attribute (*b*), calculating a dollar value:

$$Marginal\ willingness\ to\ pay = -\frac{\beta_a}{\beta_b} \qquad \text{Equation 5}$$

Note that irrespective of whether it is assumed that the scale coefficient is constant across all individuals, or it varies, the scale parameter drops out of the ratio of any two coefficients in the measurement of willingness to pay, so the estimated dollar values are comparable across different models. That is, they are independent of scale.

Note also that equation 5 can also be applied to any two non-monetary attribute coefficients to determine the rate at which one can be traded off against the other – known as the marginal rate of substitution.

For practical applications of the multinomial logit model to inform decision making, a useful addition to the model is to capture heterogeneity within the sample by assuming that the marginal utilities of individuals are not constant, but vary. Supporting questions that are asked in a survey, such as the collection of socio-demographic data, debriefing questions, and questions related to beach use or experience, offer observable differences across individuals. Heterogeneity in attribute marginal utility can be modelled by respecifying β from Equation 1, for individual *n* and attribute *k*, as:

$$\beta_{nk} = \beta_k + \delta_k z_n \qquad \text{Equation 6}$$

where δ represents the effect of individual characteristics (z_n) on marginal utility. Supporting questions that are worthy of investigating in the model are described in Section 3. These questions can be used to explain preferences for a particular attribute, for example, is someone is a dog walker [*Part 1, Q1.2*] they might have a higher willingness to pay for the area of Sandy beach than other individuals. Examples of including these 'covariates' or 'interaction terms' in the model are shown in Appendix 3: Pilot study results.

There are many advancements on the multinomial logit model that can model preferences in different ways. Refer to Pearce and Ozdemiroglu (2002) and Train (2009) for more detail on the analytical approach, including the model described here and information about mixed multinomial (or random parameter) logit models, nested logit models, and latent class models.

2018. It remains that there are many modelling approaches available, and readers should refer to Pearce and Ozdemiroglu (2002) and Train (2009) for an overview.

5.2 Analysis of travel cost data

5.2.1 Data management

The basic data management process for the travel cost data starts from the same basis as outlined above, with some consideration of whether respondents are giving considered responses. Those who appear to be completing at a faster rate than seems possible if they are considering the questions should be dropped from the sample. There is less basis for dropping respondents on the basis of 'protest' behaviour in this case.

A variety of data are recorded related to the visitation of individuals in the travel cost section of the survey. Some conversion/coding of this data is required to then enable estimation of the travel cost model.

Trip frequency

An estimate is needed for trip frequency over the appropriate period (hot/cold months). Those who do not visit the beach in the last 12 months are reported as having a value of zero [*Part 1, Q1.1*]. For those who report positive levels the frequency is coded as an absolute number as below [*Part 1, Q1.3 and Q1.4*]:

- Nearly every day (5-7 times a week) = 6 times a week
- A few times a week (2-4 times a week) = 3 times a week
- About once a week = 1 time a week
- About once a fortnight = 1 time a fortnight
- About once a month = 1 time a month
- Less than once a month = 1 time during the specified time interval
- Never = 0

These values need them to be converted into a comparable rate per time period, e.g. if an annual rate was used as a base, weekly rates would be multiplied by 52, fortnightly by 26, etc.

Distance travelled.

Distance travelled is assumed to be from their home location to the coastal location. Four possible measures of distance travelled are available, depending on how home location is identified:

1. Lon/lat coordinates of the IP address recorded by the survey software. This is captured for all respondents. An issue is that the accuracy of location is not high, and will be irrelevant if the respondent is answering at work, or while away from their home.
2. Lon/Lat coordinates at the centre of the LGA they report [*Part 4, Q4.1*]. This has the advantage that it is relatively consistent across respondents, but will be inaccurate for LGAs that are geographically large.
3. Lon/lat of street intersection. We ask for the nearest street intersection to their house [*Part 4, Q4.2*]. This is likely to be the most accurate measure (absent of an actual street address, which we do not collect for ethical/anonymity reasons), though some respondents may choose not to complete that information.
4. An estimate of the distance travelled provided by the respondent [*Part 1, Q1.6*].

Approaches 1-3 above require the use of some form of geo-routing software that can identify the distance (driven/walked rather than straight line) between the location and the beach. Approach (4) may not be that accurate depending on the respondent's knowledge of their distance travelled.

Potentially the most accurate method is hierarchical:

Use approach (3) for those who report full street data

Then for those remaining

Check coordinates from (1) with the LGA reported, and use if within the relevant LGA

Then for those remaining

Use the central location of the LGA reported.

Approach (4) may be used to validate the estimates generated from this process, and to provide estimates of time taken. Note that those who do not visit the beach will not provide data for approach (4) and hence will have to have an approximation of time taken based on distance. An assumption is also required for mode of transport for these individuals. Private car use is probably the most consistent method of determining travel time for this category (depending on the coastal location and existing knowledge of most common mode of transport used by visitors).

Cost of travel

Cost of travel conventionally consists of two elements: direct costs (e.g. fuel) and the cost of travel time.

Direct costs can be estimated directly from distance by applying some rule: in the analysis that follows a value of 10c/km is used (which is an approximate cost for car travel). However, this value could be modulated in a number of ways:

- If walking or travelling by bicycle, direct costs should be zero.
- If travelling by public transport, direct costs are collected in the survey and should be used instead [*Part 1, Q1.7*].
- Size/type of motor vehicle is captured in the survey for a typical trip, and costs per/km could be adjusted for this [*Part 1, Q1.6*].
- If typically a number of people are included in each trip to the beach, and a private car is used, costs should be adjusted to reflect cost per trip per person.

The use of costs to reflect travel time is more controversial. It is possible in some contexts that the time spent travelling is not a cost at all but part of the recreational experience (e.g. if walking to the beach is seen as part of an exercise regime). If travel time is a cost then an appropriate cost per minute is needed. This is typically based on earnings, implying that the opportunity cost of time travelled is linked to what could be earned. However, it is not clear that this should be the case when travel occurs outside of work time (e.g. on weekends), when one could argue that the opportunity cost of time is unrelated to earned income. When income is used, often it is included as a percentage of earnings, and a sensitivity analysis is conducted for the implications of different levels used.

5.2.2 Travel cost analysis

For surveys of a broader population, the data is *untruncated.* This means it is expected to include zero values for those who do not visit the coastal location. This is different to intercept surveys at the beach, where by definition, one does not collect data from those who do not visit; that is, the observations are *truncated*. Truncated data comes with a number of issues, for example, distance itself may be a reason for not visiting a beach and hence one is missing useful information, and intercept surveys are by definition more likely to capture data from people who visit more often, so one does not have a random sample of individuals who visit beaches.

The standard model for estimating the relationship between visitation rates, costs and other variables is the *negative binomial model*. Yen and Adamowicz (1993) provide an overview of the method.

Briefly, visitation rates for person *i* (V_i) are explained as a (nonlinear) function of a vector of explanatory variables:

$$V_i = f(\beta X) \qquad \text{Equation 7}$$

Where β are unknown parameters to be estimated, and X are explanatory variables. The model is available in standard statistical packages. If:

$$\beta X = \beta_0 + \beta_1 \, Travel\ Cost + \beta_2 X_2 \ldots\ldots \beta_n X_n \qquad \text{Equation 8}$$

Then:

$$Value\ associated\ with\ a\ trip = -1/\beta_1 \qquad \text{Equation 9}$$

This will be the same for all respondents: differences in sociodemographics that lead to differences in behaviour may lead to more trips being taken by some people, but the assumption is that the value per trip is the same for all individuals. Differences in value per trip would occur if separate models are estimated for different subsamples of the data

Other sociodemographic variables may be included in the model to account for variability in visitation rates (e.g. age gender etc.). An area of potential interest is the difference in behaviour of those who visit the beach for different reasons (e.g. primarily for swimming, or for the use of facilities). With a sufficient sample size, separate analysis could be conducted for different groups.

Use of any beach will be conditioned by the substitute activities available to respondents. Depending on the nature of their visit these could be wide ranging (e.g. if the primary objective is for relaxation out of the water, any green open space may be a potential substitute). However, the obvious issue is location of other substitute beaches. For example, if we consider the western coastline of WA, respondents surveyed along a north/south axis running parallel to the coast are likely to have a much greater response to distance as they will have closer substitutes compared to those surveyed along an east/west axis (i.e. one perpendicular to the coast), as, although distance may increase proportionally, the distance to substitute beaches will also increase. Calculating distance to nearest substitute beach, and incorporating into the model would improve the accuracy of estimates.

6. Using the values in decision making

There are two main ways in which non-market values can be used in policy and decision making (Pandit et al. 2015):

1. Conceptually, by improving the understanding of policy issues;
    - This relates to policy advocacy.
    - Advocacy can take the form of using non-market values to demonstrate the benefits of changing existing policy, or to retain existing policy.
    - This use is typically qualitative in nature.
    - In the context of coastal hazards, this could relate to comparing the magnitude of values for protecting different assets, and therefore which management interventions are most appropriate (e.g. implementing a seawall may not be appropriate if the community values Sandy beaches and Beach access more highly than the Foreshore reserve).
2. Instrumentally, by directly influencing policy and management decisions.
    - Instrumental uses for non-market values are typically quantitative.
    - This includes using the values in damage assessment or compensation claims, in setting user fees for recreational resources, or in benefit-cost analyses.
    - In the context of coastal hazards, this could relate to using benefit-cost analyses to determine the net present value of alternative management options for a coastal location, to establish which options provide the greatest benefits relative to the costs of implementation.

Here we provide some general advice on what to consider when aggregating the willingness to pay values calculated from analysis of the survey data for the potential uses above.

6.1 Using values from discrete choice models

The value estimates obtained from a discrete choice model are measured in terms of the marginal willingness to pay for incremental changes in the quantity or quality of an attribute. To use these values in decision making, several steps are typically required to aggregate the values.

Step 1. Reconstruction of the valuation scenario

Assuming that there is some proposed management intervention, and that this intervention will result in changes to multiple attributes, then you need to determine what the anticipated change is for each attribute affected. Then, the marginal willingness to pay values can be added together for each of the relevant attributes. For example, in a scenario where a management intervention will result in:

- A loss of 50% of Sandy beach,
- Maintaining 75% of Foreshore reserve, and
- Recreational, dining & club facilities will remain present,

Willingness to pay would be calculated as:

Willingness to pay ($) per 1% increase in Sandy beach x -50
+
Willingness to pay ($) per 1% increase in Foreshore reserve x 75
+
Willingness to pay ($) for presence of facilities

These willingness to pay estimates are per household, per year for the specified payment period in the survey.

Step 2. Aggregation across households

The willingness to pay for the reconstructed scenario must then be aggregated across the number of households for the relevant population. This is simply a matter of multiplying the dollar amount x the number of households.

However, consideration must be given as to which households are relevant for inclusion. Obviously, the sampled population is an indicator of which households to aggregate over: if you have sampled a local community for a valuation of a local beach, then you would only aggregate over that local population.

Willingness to pay might also vary depending on the socio-demographics or different types of beach users. In this case, willingness to pay for the reconstructed scenario in Step 1 should be calculated separately for each demographic, and then multiplied across the number of households of that demographic. To establish the number of households to multiply across, there may be separate data on the number of households that conform to that demographic (e.g. Census data can be used for an accurate reflection of most socio-demographics for the Western Australian population), or you can use the proportions of individuals in your sample who belong to a particular demographic (e.g. the number who use the beach for surfing) as being indicative where necessary.

Conservative aggregation approaches are generally recommended. Interrogation of the debriefing questions in the survey can be used to identify potential proportions of households in the population who may not be willing to pay for particular attributes. For example, if attribute non-attendance is found to be a significant explanatory factor in the choice model (e.g. some individuals ignore the Sandy beach attribute, and have a willingness to pay of $0 for it, while other individuals are willing to pay a positive amount), you might only aggregate the positive willingness to pay amount across a proportion of households in your target population based on the proportion of individuals in your sample who did not ignore the attribute.

This is a particular issue for those who have been identified as ‘protest’ respondents, i.e. those who have identified themselves in the debriefing questions as not wishing to pay for management change for reasons other than not valuing the asset (see section 3.4.5 and 5.1.1). A conservative mechanism is to assume that this group of individuals hold a zero value for the assets, and that a similar proportion of the full population also hold that value. That is, if there are 20% of the respondents in the sample who are deemed protesters, then the willingness to pay value would only be aggregated across 80% of the target population.

Step 3. Conversion to net present value

The values collected in the survey are per year for a specified payment period, such that the next step is to multiply the estimate derived from Step 2 over the number of years specified for the payment period (e.g. 5 years).

However, this is not the final figure that should be used to inform decision making: this aggregated value that respondents would be willing to pay must be converted to a net present value, which reflects the current value of the future values. There are two common ways to calculate the appropriate value to be used in benefit-cost analysis, depending on the context that the value will be used in.

The first is to convert to a capitalised value, which provides the total value that is expected to be realised over the life span of the scenario, in current dollar terms:

$$Net\ present\ value = Aggregated\ willingness\ to\ pay\ x\ \frac{(1-(1+r)^{-t})}{r} \qquad \text{Equation 10}$$

Where *t* is the number of years specified by the payment period, and *r* is the chosen discount rate (typically ranging between 0.05-0.10). This value would be appropriate if one was comparing the benefits identified by respondents to a one-off capital cost (or capital cost and maintenance payments expressed as a net present value).

The second is to convert the short payment stream into the equivalent perpetual stream, which provides the annual value of the scenario in current dollar terms (i.e. what they would be prepared to pay in perpetuity to achieve the stated change in assets):

$$Perpetual\ annual\ payment = Aggregated\ willingness\ to\ pay\ x\ (1-(1+r)^{-t}) \qquad \text{Equation 11}$$

In practice, a range of values for *r* should be used to test the sensitivity of the willingness to pay of the reconstructed scenarios to changes in the discount rate, particularly if using these estimates in a quantitative decision tool such as benefit-cost analysis.

6.2 Using values from travel cost models

The outcome of the travel cost model is an estimate of the consumer surplus or willingness to pay associated with a trip to the beach. As noted above, the model implies that this is constant for all trips made.

The value of the model is that it can easily identify the value of the resource as a whole: if one were to lose access to the beach in its totality, then the economic loss to visitors would be the estimated as:

Trip value x total number of trips.

This does not mean that visitors would not shift to other beaches if this were to occur, but the estimate of the willingness to pay implicitly includes the influence of substitute sites that are available. If there were to be some partial loss of facilities at a beach, presumably there would be a

partial loss in visitation. For example, if for some reason retail and dining facilities were lost, but access to the beach and sea was retained, then those who visit primarily for the former reason may be expected to leave (in Eliot et al. (2005) 11.5% of respondents gave access to cafes/restaurants as the primary reason for visiting). One could then value that loss of access at the common rate per trip. If models are estimated that separately identify values based on type of visit, then those values could be applied to each type of loss. However, what the model requires is some estimate of reduction in trips in response to a particular partial degradation, which would have to be generated from some other source.

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Appendix 1

A review of methodologies to measure values affected by coastal hazards and their management

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1. Introduction

This literature review aims to identify appropriate approaches for quantitatively measuring coastal values in the context of coastal hazards and their management. In doing so, it sets out a series of recommendations to identify preferred approaches based on the asset type affected by hazards and their management, the value types relevant for the asset, and the specific conditions of the policy or decision context under consideration.

Coastal assets can have market-based value, for example the tangible or financial values associated with business revenue from cafés, hotels and restaurants, or marinas and ports. However, many coastal assets also have non-market values, or intangible values, associated with them. These include social and environmental values such as those associated with recreational opportunities, the aesthetics or amenity of an area, and the existence-related values of protecting habitats for flora and fauna.

While market-based values are well-documented, non-market values can be more difficult to quantify. However, non-market values can be large and can sometimes outweigh the market costs or benefits of a proposed management or policy change. These types of values are commonly accounted for in decision-making through qualitative statements and recommendations. A particular issue with qualitative approaches is that they lack the ability to report non-market values in metrics that are comparable to market-based values, and therefore direct trade-offs cannot be made between the full set of costs and benefits of different policy and management options.

Pannell and Gibson (2016) tested the performance of decision metrics aimed at prioritising environmental projects and found that ignoring quantitative information such as non-market values from the decision process resulted in significantly poorer decision-making. Despite this result, Rogers et al. (2015) found that non-market values are rarely used to inform environmental decision-making in Australia, but that environmental decision-makers acknowledge the rigour with which quantitative valuation approaches can bring to decision-making. Impediments to the use of such approaches included a lack of understanding and capacity (e.g. time and budget constraints).

This highlights the need to ensure valuation tools are accessible for decision-makers to use so that they are able to quantify non-market values in a manner that allows them to be incorporated into evidence-based decision-making. Accordingly, this review focusses on the methods available to quantitatively measure non-market values, as opposed to market-based values. Some qualitative approaches are also discussed, where they may be more appropriate to extract in-depth information about issues that are unclear (i.e. there is insufficient background information to generate a framework for quantitative valuation) or where there may be insufficient sample available for rigorous quantitative assessment.

We first identify the major hazards relevant for coastal management (Section 2), and then the assets affected by these hazards (Section 3). The non-market values related to the coastal assets are then defined (Section 4), followed by an overview of the methods available to measure these values (Section 5). Section 6 presents a selection of literature that has applied these methods in coastal valuation. Finally, a set of recommendations are made as to the most appropriate methods to apply in particular coastal valuation contexts (Section 7).

2. Coastal hazards in Western Australia

The primary hazards threatening coastal assets in Western Australia are erosion and inundation, and resulting damage to artificial structures (Western Australian Planning Commission 2014). The

impacts of erosion and inundation are experienced particularly during storm events, and are likely to become more prominent due to predicted sea level rise from climate change. They can also result from general weather patterns including tides, currents, wind and climate cycles. Erosion can lead to permanent loss of land, while inundation is typically a temporary inconvenience (BMT Oceanica 2014).

3. Assets affected by coastal hazards and their management

Given the length of coastline in Western Australia, ranging from populated urban areas to remote locations, there is a wide range of assets that can potentially be affected by coastal hazards or their management. This review deals with those assets that potentially have non-market environmental or social values attached to them and not assets that hold predominantly economic value only, which can be measured by market-based instruments. A list of common coastal assets is provided in Table 1.

The physical condition of coastal assets may be altered directly by a coastal hazard, or through different mitigation actions aimed at managing hazards. The management hierarchy for coastal hazards is to: avoid (e.g. by not building assets where they can be affected), undertake planned or managed retreat (where losses are accepted and moveable assets relocated), accommodate (e.g. design assets to withstand the impacts of hazards), and protect (e.g. construction of infrastructure to protect assets from hazard impacts (Western Australian Planning Commission 2014). Common forms of management actions for erosion and inundation include beach nourishment, concrete matting, and construction of seawalls, groynes, and offshore breakwaters. The changes in condition of the asset result in changes to the values held for the assets.

Table 1. Coastal assets that that support non-market values that might be affected by coastal hazards or their management, their corresponding non-market values, and recommended methods of quantifying those values.

Assets	Relevant non-market values	Recommended methods
Beaches	Recreational Aesthetic/amenity Existence (marine ecology in the intertidal zone) Bequest Altruistic Option	Discrete choice experiment Contingent valuation Contingent behaviour Travel cost method Non-economic methods
Nearshore ecosystems (e.g. seagrass meadows, reefs)	Recreational Aesthetic/amenity Existence (marine ecology) Bequest Altruistic Option	Discrete choice experiment Contingent valuation Contingent behaviour Travel cost method Non-economic methods
Dunes	Recreational Aesthetic/amenity Existence (flora & fauna, ecosystem functionality) Bequest Altruistic Option	Discrete choice experiment Contingent valuation Contingent behaviour Travel cost method Non-economic methods
Foreshore reserves	Recreational Aesthetic/amenity Existence (flora & fauna, ecosystem functionality) Bequest	Discrete choice experiment Contingent valuation Contingent behaviour Travel cost method

Assets	Relevant non-market values	Recommended methods
	Altruistic Option	Non-economic methods
Beach facilities (e.g. toilets, bbqs/picnic areas, shelter, play equipment, parking)	Recreational Altruistic Option	Discrete choice experiment Contingent valuation Contingent behaviour Travel cost method Non-economic methods
Recreation facilities (e.g. fishing jetties, boat ramps, sporting grounds)	Recreational Altruistic Option	Discrete choice experiment Contingent valuation Contingent behaviour Travel cost method Non-economic methods
Walkways, cycle paths, coastal drives	Recreational Aesthetic/amenity Altruistic Option	Discrete choice experiment Contingent valuation Contingent behaviour Travel cost method Non-economic methods
Surf Life Saving Clubs	Recreational Safety Altruistic Option	Discrete choice experiment Contingent valuation Contingent behaviour Non-economic methods
Cultural heritage (e.g. heritage buildings, harbours)	Recreational Aesthetic/amenity Existence Bequest Altruistic Option	Discrete choice experiment Contingent valuation Contingent behaviour Travel cost method Non-economic methods
Stormwater and sewerage infrastructure	Safety Altruistic Option	Discrete choice experiment Contingent valuation Contingent behaviour Non-economic methods
Coastal accommodation (e.g. caravan parks, camping areas, resorts, residential housing)*	Aesthetic/amenity Recreational Bequest Altruistic Option	Travel cost method Contingent behaviour Hedonic pricing Non-economic methods

*While economic or market-based values are applicable for these assets, they are included here to the extent that their location also provides additional non-market benefits for users which may not be wholly captured by the market, and/or non-market valuation methods may be able to give an indication of the non-market benefit component of the associated market prices.

4. Non-market values associated with affected assets

The net sum of all values associated with an asset, including market and non-market values, is known as the total economic value (Figure 1). Values are generally defined as either use or non-use values (Bateman et al. 2002).

Use values relate to actual, planned or potential use of an asset, and can be either market or non-market in nature. Non-market use values for coastal assets include:

- Recreation values, e.g. ability to use an area for swimming, relaxing, surfing, wind surfing, snorkelling, wind surfing, scuba diving, walking, running, cycling, picnicking, socialising, exercising pets, camping, boating, four-wheel driving, etc.
- Aesthetic and amenity values, e.g. ability to appreciate scenic views of an area.

- Safety values, e.g. provision of measures to enhance public safety such as surf life savers, beach patrols, and infrastructure to manage storm runoff.
- Option values, e.g. maintenance or protection of assets such that they available to use for the above purposes in the future.

All non-use values are categorised as non-market values. Non-use values for coastal assets include:

- Existence values, e.g. the knowledge that biodiversity, threatened or iconic species and functional ecosystems exist.
- Bequest values, e.g. knowledge that an area is being maintained or protected for future generations.
- Altruistic values, e.g. knowledge that an area is being maintained or protected for others to use the area even if you personally will not.

Table 1 shows the specific use and non-use value types associated with different coastal assets.

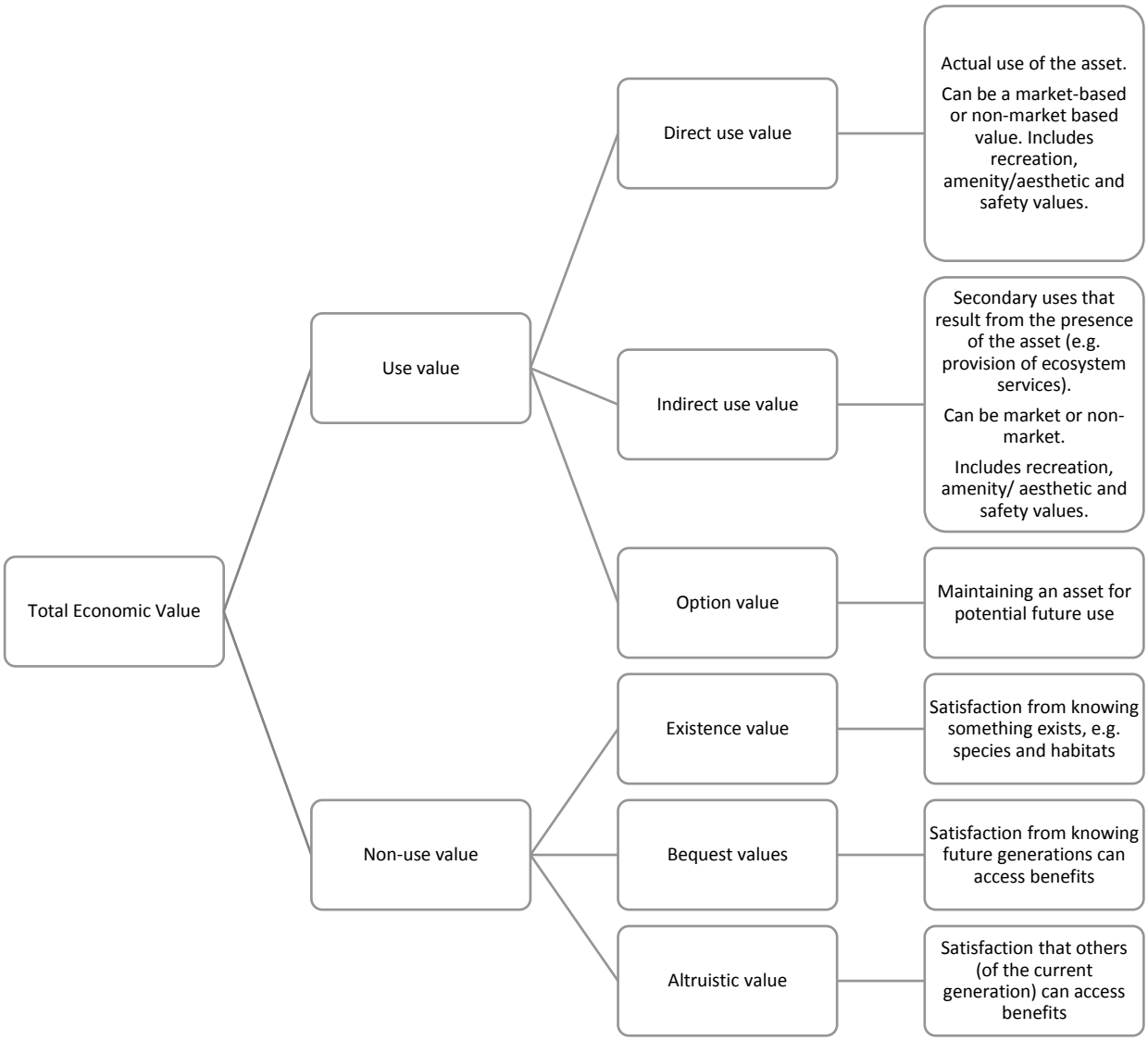

Figure 1. Total economic value of an asset.

Note that the impact that coastal hazards and their management will have on values will depend on the specific characteristics of the asset and how it is impacted. For example, location of the asset is important: the uses (and therefore use values) of urban beaches are often different to those of remote beaches, and existence values are more likely to be important for remote, undisturbed assets. Different users may react to changes in physical condition of an asset in different ways, and therefore the same change can result in positive values for some members of the community, and negative values for others. For example, construction of a seawall to protect residential buildings might be received positively by local residents, but negatively by visitors to the beach. Or infrastructure that dissipates wave energy might be received favourably by families and swimmers, but not by surfers. Accordingly, the context under which values are measured is an important consideration when trying to quantify non-market values.

5. Methods to quantify coastal values

Numerous methods exist that are able to quantify coastal values. Here, we present the methods under the categorisation of non-market valuation approaches and non-economic approaches.

5.1 Non-market valuation

Non-market valuation measures values in monetary or financial equivalent terms. This means that dollar estimates are provided, which can be used to compare directly against other monetary costs and benefits associated with coastal hazard management. Values are estimated as an individual's willingness to pay for improvements or changes in the quantity or quality of an asset. The estimates can then be aggregated to the relevant population to indicate the overall value of the asset.

There are two main ways in which non-market values can be used in policy and decision-making (Pandit et al. 2015):

(1) Conceptually, by improving the understanding of policy issues. For example, through policy advocacy where the values demonstrate the benefits of changing (or retaining) existing policy. This use is typically qualitative in nature.

(2) Instrumentally, by directly influencing policy and management decisions include using the values in damage assessment or compensation claims, in setting user fees for recreational resources, or in Benefit: Cost Analyses. This use is typically quantitative in nature. However, there is no presumption that because dollar values can be associated with an asset that they should therefore be provided via any market/pricing mechanism: they can remain as publicly provided assets; the valuation process simply brings those values to the decision process on a common basis with market assets.

There are two general forms of non-market valuation: revealed and stated preference methods.

5.1.2 Revealed preference methods

Revealed-preference methods use information from markets associated with the asset being valued, or from observing people's behaviour in their use of the asset, to infer an individual's willingness to pay for the asset. These methods are limited in that they can only measure the use values associated with an asset. Accordingly, they should be interpreted as providing a conservative lower bound estimate of value, as non-use values are neglected. However, given that they are based on observed data, they can be perceived as providing more credible value estimates than stated preference methods (Bateman et al. 2002).

Travel cost method

The travel-cost method is commonly used to measure values associated with recreation. It uses information about the costs associated with making a trip to visit a site to infer how much people are willing to pay for each visit. These costs include monetary expenses like fuel costs, food expenditures, entry fees, and other on-site purchases, and non-monetary expenses, such as the implicit time cost for travel (Hanley and Barbier, 2009). We can then explore how willingness to pay varies by site, based on the different characteristics at each site.

Advantages:

- Based on revealed preferences which provides conservative lower-bound value estimates.
- Survey instruments are generally simple to design, and easy for the respondent to complete.
- Sometimes visitation data already exists for a location that is suitable for use (e.g. if a tourism agency has collected data for another purpose).

Disadvantages:

- Cannot measure non-use value, i.e. limited to assets that have site visits.
- Difficult to apply when users make multi-purpose or multi-stop trips, as it is hard to partition the value attributed to each purpose/location (Perman et al. 1999).
- Needs complex data if the effects of substitution possibilities are to be captured.

Hedonic pricing method

Hedonic pricing analyses investigate how the characteristics of an asset influence its market value (Hanley and Barbier, 2009; Perman et al., 1999). For example, this method can be applied to property markets to estimate the values for scenic coastal views or proximity to the beach. By examining the premiums that are paid for housing with these non-market characteristics we can infer people's willingness to pay for the coastal asset.

Advantages:

- Based on market data which provides conservative lower-bound value estimates.
- House price data already exists (though often needs to be purchased).

Disadvantages:

- Cannot measure non-use value.
- Only identifies values held by those who live locally, and have purchased property.

5.1.3 Stated preference methods

Stated preference methods use survey-based instruments to ask individuals how much they are willing to pay to achieve an outcome or about their preferences for making trade-offs between different outcomes. Stated preference methods have the advantage of being able to measure both use and non-use values (Bateman et al. 2002). They are the only approach capable of assigning monetary estimates to non-use values. However, the questionnaire framework generally involves the setting out of a hypothetical context which respondents are asked to indicate their preferences for. The hypothetical nature of the questions can lead to what is known as hypothetical bias: a situation where respondents might not respond truthfully because the decision isn't real. This can lead to over-estimation of willingness to pay, but can be managed through careful design of the survey instrument.

Contingent valuation

Contingent valuation estimates the value of assets by directly asking how individuals how much they would be willing to pay to implement a change or prevent an impact (Hanley and Barbier, 2009). For example, individuals might be asked how much they are willing to pay to implement a beach nourishment program to alleviate the impacts of erosion and maintain an area for recreation.

Advantages:

- Stated preference allows the quantification of both use and non-use values.
- Survey instruments are simple to design.

Disadvantages:

- Can be subject to hypothetical bias, particularly with poor survey designs.
- Can only measure the value of an absolute change rather than multiple, marginal changes.
- May be difficult to differentiate between use and non-use values bundled together, which may be important to avoid double counting in aggregation (e.g. if aggregating values estimated by both revealed and stated preference methods).

Contingent behaviour

Contingent behaviour is similar to contingent valuation, but instead of gauging how people's demand changes for an asset in relation to price it assesses how other measures of demand, commonly in terms of visitation rates, change in relation to hypothetical changes in the quantity or quality of an asset (Bateman et al. 2002). For example, individuals could be asked if they would make more or less trips to the beach under different scenarios which each lead to different recreational and amenity outcomes such as leaving erosion unmanaged, implementing beach nourishment programs, or constructing a seawall.

Advantages:

- Survey instruments are simple to design.
- Can be used in conjunction with the travel cost method to estimate willingness to pay under the different scenarios considered.
- Can be used to measure the value of multiple scenarios.

Disadvantages:

- While the question format is based on stated preferences, the measures of demand are based on use of the asset so non-use values cannot be measured.
- Can be subject to hypothetical bias, particularly with poor survey designs.
- Can only measure the value of an absolute change rather than marginal changes.

Discrete choice experiments

Discrete choice experiments are used to estimate how individuals make trade-offs between different features, or attributes, of an asset (Bennett and Blamey 2001). Respondents are given a sequence of hypothetical choice scenarios, where each scenario is comprised of a number of options. The options describe, for example, different hazard management programs in terms of its attributes. The level, in terms of the marginal change in quantity or quality, of each attribute varies across the different options. One of the attributes that is usually included in the trade-off scenario is a cost which is used to calculate willingness to pay. For example, we could estimate how much people are willing to pay

for protecting different lengths of foreshore infrastructure with a seawall relative to having different lengths of a sandy beaches left available for recreation.

Advantages:

- Stated preference allows the quantification of both use and non-use values.
- Can measure the values associated with multiple, marginal changes.
- Quantifies the trade-offs that people make between different outcomes or values (which can be measured in monetary or non-monetary terms).
- Richer source of information.

Disadvantages:

- Can be subject to hypothetical bias, particularly with poor survey designs, but less affected than contingent valuation.
- Survey design is complex and takes longer than other approaches.
- The assessment of multiple, marginal changes means that a structured experimental design is used that can sometimes require larger sample sizes relative to other approaches.
- Questionnaires can take longer for respondents to complete than other approaches.
- May be difficult to differentiate between use and non-use values bundled together, which may be important to avoid double counting in aggregation (e.g. if aggregating values estimated by both revealed and stated preference methods).

5.1.3 Benefit transfer

Benefit transfer is a process where the results of non-market values estimated for original study sites, such as those values measured by studies using the approaches described above, are extrapolated to predict values for different policy sites (Johnston et al. 2015). The ease at which benefit transfer can be implemented varies depending on the approach chosen. There are some straightforward approaches where willingness to pay values are lifted directly from the original study and adjusted with simple calculations to match the policy site characteristics based on differences in the population, time and scale of the asset (e.g. converting foreign currencies, accounting for inflation, and aggregating to the correct population size). There are other more complex approaches that require substantial effort in collating data from multiple studies and estimating functions to determine values for the policy site, but can provide a greater level of accuracy in the transfer of values.

Advantages:

- Can find studies measuring use and non-use values for application in benefit transfer.
- The straightforward approaches for benefit transfer are easy to implement: they can be done quickly, cheaply, and by decision-makers themselves. However, these approaches are only appropriate when there is a very strong match between the policy site characteristics and decision context and that of the study site.

Disadvantages:

- Transferred values will carry a higher degree of error than the estimates provided through original research studies, because there is never a perfect match between policy and study sites.
- The original study values are also subject to the biases of the methods used to calculate them, as described for the methods above.

- The more complex approaches, which have greater accuracy, can be as time consuming and expensive as original research studies, and will require input from an experienced economist.

5.2 Non-economic approaches

The advantages of the approaches outlined above are that they generate monetary measures for the assets under threat, and there is theoretical basis for how those values are derived. However, there are a range of other approaches that can be used to identify values. Christie et al. (2012) provide an overview of alternative methods, summarised in Table 2. These include quantitative and qualitative approaches. While quantitative analyses are generally preferred for the generation of data suitable for inclusion in decision support tools, qualitative approaches can be particularly useful as a first step to identifying the scope of issues relevant to a population in relation to the affected asset. This approach can then be followed by a quantitative assessment of values over a representative sample of the relevant community.

Table 2. Summary of non-monetary methods of evaluating importance of social or environmental assets (adapted from Christie et al. 2012, p.71).

Approach	Formats	Methods
Consultative methods	Questionnaires Interviews	Consultative methods are structured processes of inquiry into people's perceptions of an issue. - Both formats are typically administered to individual respondents. - Questionnaires tend to focus on gathering quantitative data. Methods of collecting information include scoring systems (e.g. likert scores for importance of assets, or allocating a fixed number of points to alternative assets). - In-depth interviews collect qualitative data.
Deliberative and participatory processes	Focus groups Citizen juries Delphi surveys Q-methodology Public participatory GIS	Deliberative and participatory approaches utilise group based activities to attain detailed information about people's relationships with the asset of focus. - Focus groups are small group discussion sessions about an issue, which may involve semi-structured question scripts. - Citizen juries involve a court-like process in which participants review the available evidence before making final judgements on the future of the asset. - Q-methodology asks individuals to sort and rank items (e.g. a series of statements about the qualities or importance of an asset). - Delphi surveys involve a multi-round process where individuals are consulted about an issue; responses are collated, summarised, and made available to the group; and the individuals (or group collectively) are consulted again (and the process may be repeated). - Public participatory GIS uses maps to ask respondents to identify which locations may hold values for them. This can be differentiated by type of value (e.g. recreational/spiritual etc.).
Methods for reviewing information	Systematic reviews	An assessment of existing scientific evidence of the likely outcomes of various actions. Protocols for and outcomes of the review should be peer-assessed pre- and post-review, respectively.

Advantages:

- Can assess use and non-use values (including in quantitative, but non-monetary, metrics).
- Questionnaire-based methods employed by these approaches typically involve simpler question formats than non-market valuation approaches.
- Interview-based and group discussion methods provide in-depth information and can reveal insights into issues that might be missed in structured questionnaire-based approaches.
- With large enough sample sizes (e.g. n>50), quantitative analyses can be performed on data collected through methods that are typically qualitative in nature (e.g. themes can be identified, categorised and quantitatively assessed from interview transcripts).

Disadvantages:

- Values measured cannot be used in a directly comparable manner in trade-off decisions with other market costs and benefits. However, the values obtained via these public consultation methods could be used to inform expert judgements during a decision making exercise or the use of a decision tool such as multi-criteria analysis.
- Interview-based and group discussion methods are difficult to apply to representative samples of the broader community.

6. Existing applications of methods to quantify coastal values

There are thousands of published environmental and social value applications using the approaches discussed above. These include applications to coastal assets in Australia and internationally. A selection of relevant studies are discussed here to illustrate how different methods have been applied and the value measurements they provide.

In Western Australia, studies have measured coastal amenity values, values associated with protecting marine and riverine ecology, and recreational values for the Swan River. McCartney (2006) used the contingent valuation method to estimate the social value of seascapes in the Jurien Bay Marine Park. They proposed that a wind farm could be built either offshore or along the coastal dunes, which would result in changes to the seascape and its aesthetic or amenity value. Alternatively, people could opt to pay to shift the wind farm to a site inland where it would not interrupt views of the coast. An on-site sample of locals and tourists in the Jurien region were each willing to pay $34 or $36 to protect the view of the coastal dune or seascapes, respectively.

Rogers (2013a, 2013b) measured West Australian's willingness to pay to protect ecology in the Ningaloo and Ngari Capes marine parks using an online discrete choice experiment. Non-use (existence, bequest, altruistic) values and use values (recreation, aesthetic, amenity) were relevant to the ecological attributes considered in the study. Individuals were willing to pay between $50 and $82 for a 5% increase in whale shark, marine turtle, fish or coral populations at Ningaloo, and between $25 and $52 for 5% increase in abalone, seagrass or fish populations at the Capes (Rogers 2013a). The magnitude of willingness to pay was found to be dependent on the management processes by which conservation outcomes were achieved, and on the way in which these management processes restricted certain recreational activities (Rogers 2013b). For example, individuals who enjoyed four wheel driving on the beach at Ningaloo were either not willing to pay for increases in turtle populations or in some cases required compensation (i.e. had a negative willingness to pay) when the management process involved a beach closure, indicating the negative impact on recreational value outweighed the positive impacts of conservation value for these individuals.

In a discrete choice experiment measuring the ecological and recreational values of the Swan Canning River System, Rogers et al. (2013) found that the West Australians' were willing to pay over $100 each for improvements in dolphin health or vegetation condition, and $59 each to reduce the frequency of fish kill events. Similarly, a sample of the Perth Metropolitan population revealed that people were willing to pay for recreational improvements on the rivers, including the provision of more coastal boat ramps, increases in length of walk trails, increases in the number of boat-prohibited areas for other recreation and an increase in the number of ferry services.

In an extensive valuation study of the Kimberley coast, Spencer-Cotton et al (2015) investigated the values held for the coastal waters of the Kimberley, WA. The analysis considered assets that included the marine ecosystem, increased recreational access and the protection of the 'wilderness' characteristics of the coast. Data were collected from a choice experiment and a participatory GIS process, allowing for a spatially explicit analysis that identified values across the length of the coast, and differentiated between those who were local to the region, and those who lived in Perth. Although some improvement in access for recreation was valued, the highest level of access was not. There were also strong values for preserving the wilderness aspects of the region. These results reflect the tensions within management of this resource: access is required to facilitate use values in the area, but access and development may be seen as compromising that which is valued.

Rolfe and Gregg (2012) conducted a travel cost and contingent behaviour study that sampled local users' recreation preferences for a stretch of regional beaches along the coast in Queensland, adjacent to the Great Barrier Reef. They found a beach visit was worth $35.09 per person. Blackwell (2007) used the travel cost method to estimate the value of a recreational visit to a specific site in Queensland, an urban surf beach in Mooloolaba. For local users only, they found that a beach visit was worth $17.51 per person, but when estimating the value of a beach visit for both local and tourist users, they found that visitors were willing to pay almost $120.

Windle and Rolfe (2014) address the values associated with provision of beach facilities and the management of coastal erosion in southeast Queensland using the discrete choice experiment and contingent valuation approaches. A sample of Brisbane respondents, including users and non-users of local beaches, were willing to pay $101 per household per year (for 5 years) to reduce erosion impacts over 75km of beach ($1.35/km). Respondents were willing to pay, per household per year (for 3 years), $26 for toilet facilities to be provided at beaches, $20 for monthly beach cleaning, and $36 for lifeguards to be present at peak periods on weekends and holidays. Blackwell and Tisdell (2010) also analysed how much Australian beach users were willing to pay for one extra lifeguard or lifesaver to be present in their Mooloolaba study, at a value of $1.43 per person per visit.

In addition to the selection of specific studies above, there are also publications that review the state of coastal valuation. For example, Peters and Hawkins (2009) reviewed 18 international studies that estimated willingness to pay for entry fees to marine parks, while Londono and Johnston (2012) used a meta-analysis of 27 valuation studies to review willingness to pay for tropical reef recreation. Torres and Hanley (2016) reviewed 196 international studies on the valuation of coastal and marine ecosystem services. They found that coastal and marine ecosystems have high recreational benefits and that these are positively correlated with the quality of, and high magnitudes of willingness to pay for, ecosystem protection. Non-use values including those related to cultural services and biodiversity were also important.

7. Recommendations on suitable valuation approaches

Recommendations are provided on which methods are the most suitable for valuing different contexts in two ways. First, in Table 1, we list the methods that are most easily applied to measure values associated with different coastal assets. However, not all methods listed will capture all value types for the asset, and they measure the values in different ways. Accordingly, Table 3 also lists recommended methods based on policy context. The two tables can be cross-checked to determine which subset of methods are most applicable to the asset type, value type, and decision context.

Table 3. Recommended valuation methods based upon the specific requirements of the policy and decision-making process.

Policy and decision-making context	Recommended methods
Monetary estimates are desirable (e.g. for input into a benefit: cost analysis)	Travel cost method Contingent behaviour + travel cost method Hedonic pricing Contingent valuation Discrete choice experiments
Non-use values are important	Contingent valuation Discrete choice experiments Consultative methods Deliberative/participatory methods Systematic review
Recreational use, aesthetic/amenity or safety values are important	Travel cost method Contingent behaviour Contingent valuation Discrete choice experiments Consultative methods Deliberative/participatory methods Systematic review
Evaluating multiple scenarios is desirable	Contingent behaviour Discrete choice experiments
Evaluating multiple, marginal changes to an asset is desirable	Discrete choice experiments
Evaluating the total value of a management change to an asset	Contingent valuation
Quantitative, but non-monetary measures of value are desirable	Consultative methods (*questionnaire-based*) Deliberative/participatory methods (*Q-methodology*)
Short policy/decision timeframe requiring a quick application	Travel cost method Contingent behaviour Contingent valuation Hedonic pricing Consultative methods Deliberative/participatory methods Systematic review
Available sample size is limited (e.g. n<50 for specific stakeholder groups)	Consultative methods (*interview-based*) Deliberative/participatory methods (*focus groups, citizen juries, Delphi surveys, public participatory GIS*)
Requires assessment of a large heterogeneous population (e.g. West Australia community)	Travel cost method Contingent behaviour Contingent valuation Discrete choice experiments Consultative methods (*questionnaire-based*) Deliberative/participatory methods (*Q-methodology*)

Policy and decision-making context	Recommended methods
Requires on-site sampling of visitors (e.g. recreational users)	Travel cost method Contingent behaviour Contingent valuation Discrete choice experiments Consultative methods (*questionnaire-based*) Deliberative/participatory methods (*Q-methodology*)
Scoping of potential issues or community understanding is required	Consultative methods (*interview-based*) Deliberative/participatory methods (*focus groups, Delphi surveys*)

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Appendix 2: Cottesloe Beach pilot survey instrument

Welcome to the Cottesloe Beach survey

We would like to start with a few questions about yourself:

S1) What is your gender?

- Male
- Female
- Non-binary/other

S2) Which age group applies to you?

- Under 18 years
- 18-30 years
- 31-45 years
- 46-60 years
- 61-75 years
- Over 75

S3) Where do you live?

- Perth metropolitan area
- Regional Western Australia
- Other part of Australia
- International visitor

Commented [Advice1]: This document reflects the pilot survey that was programmed online.

BOLD RED TEXT indicates flow logic of the survey (i.e. skipping questions etc.) These instructions were not visible to respondents, as the survey flow was automated in the online version.

ORANGE TEXT in comments box indicates information that was displayed as a hover box in the online survey.

Commented [Advice2]: **Selection of these options = screen out**

Preferences for managing coastal hazards at Cottesloe Beach

Dear Sir/Madam,

Thank you for reading this introduction screen which outlines a research project being conducted at The University of Western Australia, in conjunction with the WA Department of Planning, Lands and Heritage.

This survey aims to understand your preferences for managing the coastal environment and infrastructure at Cottesloe Beach from coastal hazards.

You have been selected at random from the Western Australian population to participate in this research.

Your opinion is important – we will be surveying a large number of people to obtain a representative view of the community.

Participation involves completing a survey that will take approximately 20 minutes of your time. Your involvement is voluntary, and you may withdraw from the survey at any time. You must be at least 18 years of age to participate.

If you consent to participate in this study, please complete the survey that follows. If you have any questions feel free to contact me on the details below.

You can download a copy of this information sheet here.

Kind regards,

Dr Abbie Rogers
Research Fellow
The University of Western Australia
P: 6488 5506
E: abbie.rogers@uwa.edu.au

Approval to conduct this research has been provided by the University of Western Australia, in accordance with its ethics review and approval procedures. Any person considering participation in this research project, or agreeing to participate, may raise any questions or issues with the researchers at any time.

In addition, any person not satisfied with the response of researchers may raise ethics issues or concerns, and may make any complaints about this research project by contacting the Human Ethics Office at the University of Western Australia on (08) 6488 3703 or by emailing to humanethics@uwa.edu.au

All research participants are entitled to retain a copy of any Participant Information Form and/or Participant Consent Form relating to this research project.

All responses will be stored securely. Overall results may be published, but will not be linked to individual information. Only researchers working on this project will have access to the data.

What this survey is about

Coastal environments and infrastructure, including Cottesloe Beach, are exposed to many threatening processes. Threats might include coastal hazards, the spread of weeds, urban development, or others.

This survey focuses on the impacts caused by coastal hazards.

This survey aims to understand your preferences for protecting the coast at Cottesloe Beach from these hazards.

In Western Australia, the main hazards that affect our coast are erosion and inundation.

Erosion is a process where parts of the shoreline are worn away due to waves, tides, wind or human activities. It can change the shape and form of the coast, reducing the area between the ocean and features on the land, and even allowing inundation.

Erosion on a beach at Seabird.
Credit: ABC News, Bonnie Christian

Inundation is when water occupies previously dry land. It can be temporary or permanent:

- Permanent inundation refers to the loss of land due to sea level rise.
- Temporary inundation is the flooding of an area due to storm surge, high tides or large waves.

Perth storm resulting in inundation of roads.
Credit: *Hannah Woodward/Twitter*

Storm events and rising sea levels are likely to result in a greater impact of erosion and inundation on our coast in future years.

Coastal features, such as sandy beaches, grassed foreshore reserves, natural reserves containing animals and plants, beach access points, and retail, dining and club facilities can be impacted by the erosion and inundation.

Different management actions can be used to avoid or reduce the impacts of coastal hazards. These actions are usually funded by Local Government and/or State Government agencies.

The survey has 4 main parts:

PART 1: Some questions about your experiences with Cottesloe Beach.

PART 2: A description of how some coastal features will be impacted by coastal hazards in the next 10 years. This information is needed for Part 3.

PART 3: A series of hypothetical management scenarios. You will be asked to choose one of 3 options for each scenario. Each option involves different outcomes for a few important features of the coast.

PART 4: Some questions about you, to make sure the group of people that respond to this survey are representative of the broader community.

PART 1 - Your experiences with Cottesloe Beach

Cottesloe Beach includes the stretch of sandy beach and associated foreshore areas starting at the groyne at the southern end of the main beach and spanning 1.5km up towards North Street.

The following questions relate to your experience with Cottesloe Beach.

Q1.1) Have you visited Cottesloe Beach in the last year?

- Yes [*answer the questions below*]
- No [*skip to Q1.11 on page 9*]

Q1.2) Thinking about a typical trip to Cottesloe Beach first in the hotter months, and then in the colder months, what activities do you usually undertake?

Select all that apply

	Hot months (Nov-April)	Cold months (May-Oct)
Swimming		
Snorkelling		
Scuba diving		
Surfing		
Windsurfing		
Kitesurfing		
Stand up paddle boarding		
Kayaking		
Water skiing		
Jet skiing		
Sailing		
Boating (private motorised vessel)		
Boating (chartered/hired motorised vessel)		
Fishing – shore based		
Fishing – boat based		
Walking		
Running		
Dog walking		
Sandboarding		
Relaxing		
Socialising with friends or family		
Picnicking or barbecuing		
Visiting playgrounds		
Visiting Aboriginal heritage sites		
Visiting European heritage sites		
Watching wildlife		
Beach combing – e.g. shell collecting		
Replanting native plants & removing weeds		

Dining at restaurants, cafes, kiosks, pubs etc.		
Attending events – e.g. concerts, sporting, arts events		
Other (specify)		

Q1.3) How often on average would you visit Cottesloe Beach per month during the hotter months (November to April)?

- Nearly every day (5-7 times a week)
- A few times a week (2-4 times a week)
- About once a week
- About once a fortnight
- About once a month
- Less than once a month
- Never

Q1.4) How often on average would you visit Cottesloe Beach per month during the colder months (May to October)?

- Nearly every day (5-7 times a week)
- A few times a week (2-4 times a week)
- About once a week
- About once a fortnight
- About once a month
- Less than once a month
- Never

Q1.5) How many people usually come with you to the beach?

_____ adults _____ children

Q1.6) Thinking about a typical trip to Cottesloe beach, please identify the distance you travel, and the time you take in the table below (one-way).

If a single trip involves more than one mode of transport (e.g. bus, followed by walking) please indicate distance and time for BOTH means of transport for a single trip.

For reference: Perth City to Cottesloe Beach = 12km

	Distance (km)	Time (minutes)
Walk		
Bicycle		
Motorcycle		
Small car		
Large car, ute, 4WD, small truck		
Bus [*answer Q1.7 below*]		
Train [*answer Q1.7 below*]		
Other (please specify)		

Q1.7) If you take the bus or train as part of the trip, how much do you typically pay:

One way? $_____

or

Round trip $_____

Q1.8) On a typical trip to Cottesloe Beach, do you normally combine the trip with other activities unrelated to the beach (e.g. visiting the beach while going to/from work)?

- ○ No – visiting Cottesloe Beach is typically the only stop I make on the trip
- ○ Yes – I typically make multiple stops when I visit Cottesloe Beach

Q1.9) What do you think about the public transport services available to access Cottesloe Beach?

Insufficient public transport				Sufficient public transport
1	2	3	4	5
○	○	○	○	○

Q1.10) What do you think about the availability of parking at Cottesloe Beach?

Insufficient parking available				Sufficient parking available
1	2	3	4	5
○	○	○	○	○

Q1.11) Aside from Cottesloe Beach, there are other places that you could visit around the Perth metropolitan region to enjoy outdoor recreation activities, including other beaches, lakes, wetlands, rivers or parks.

When you want to do outdoor recreation activities, do you usually visit Cottesloe Beach or one of these other areas?

- ○ Use Cottesloe Beach most of the time [*skip to Q1.12 on page 11*]
- ○ Use other locations most of the time [*answer questions Q1.11a, Q1.11b (if relevant) and Q1.11c below*]
- ○ I usually don't visit any outdoor recreation areas in the Perth metropolitan region [*skip to Q1.12 on page 11*]

Q1.11a) If you prefer other locations, what is the main reason?

- ○ Closer to where you live than Cottesloe Beach
- ○ Better suited to the type of outdoor activity than Cottesloe Beach **[***Answer Q1.11b below***]**
- ○ Better accessibility than Cottesloe Beach (e.g. car parking, boat ramps, walkways and stairs)
- ○ Better facilities/amenities than Cottesloe Beach (e.g. bbq's, playground equipment, toilets)
- ○ There are fewer people using it than Cottesloe Beach
- ○ Nicer environment than Cottesloe Beach (e.g. cleaner, more natural)
- ○ Safer environment than Cottesloe Beach (e.g. calmer water, more sheltered, more secure)
- ○ Other (please specify): .....

Q1.11b) Which types of outdoor recreation activities you prefer to do at other sites rather than at Cottesloe Beach?

Select all that apply

○ Swimming	○ Walking
○ Snorkelling	○ Running
○ Scuba diving	○ Dog walking
○ Surfing	○ Sandboarding
○ Windsurfing	○ Relaxing
○ Kitesurfing	○ Socialising with friends or family
○ Stand up paddle boarding	○ Picnicking or barbecuing
○ Kayaking	○ Visiting playgrounds
○ Water skiing	○ Visiting Aboriginal heritage sites
○ Jet skiing	○ Visiting European heritage sites
○ Sailing	○ Watching wildlife
○ Boating (private motorised vessel)	○ Beach combing – e.g. shell collecting
○ Boating (chartered/hired motorised vessel)	○ Replanting native plants & removing weeds
○ Fishing – shore based	○ Dining at restaurants, cafes, kiosks, pubs etc.
○ Fishing – boat based	○ Attending events – e.g. concerts, sporting, arts events
○ Other (specify): ……	

Q1.11c) Of the other outdoor recreation areas that you prefer relative to Cottesloe Beach, what are the main ones?

Please list

……

……

……

……

Q1.12) State how much you agree that it is important to protect, manage, and maintain Cottesloe Beach in its current state for the following reasons (*tick the relevant boxes in the table below*):

It is important to maintain Cottesloe Beach in its current state:	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
For my own recreational use					
For other people's recreational use					
For the option that I can use it for recreation at some time in the future					
For future generations to use for recreation					
For people to be able to live nearby					
For environmental health, including flora and fauna habitat					
For cultural significance, including Aboriginal and European heritage					
For commercial use					
For tourism					

Q1.13) Do you have any other comments you would like to add about how you use Cottesloe Beach or other beaches in the Perth metropolitan region, or why you think these beaches are important?

(*you may skip this question if you prefer)*

_____

_____

_____

_____

_____

PART 2 – The state of coastal features at Cottesloe Beach

You will need to read this information to be able to answer the management scenarios in Part 3.

Over the next 10 years coastal hazards will cause damage to Cottesloe Beach.

Coastal features that are affected by the hazards include sandy beaches; foreshore reserves; natural reserves; beach access; and retail, dining and club facilities.

Different management actions can be used to address the hazards and control their impact on the coastal features. Management actions include:

- *Sand replacement*
- *Dune stabilisation and sand management*
- *Dune construction*
- *Reef construction or restoration*
- *Offshore breakwaters*
- *Seawalls*
- *Groynes*
- *Relocating facilities*

*Hover mouse over for more information

Different management actions can have positive impacts on some coastal features while having negative impacts, or no influence at all, on others. For example, a seawall might protect the foreshore reserve, but lead to a decrease in the area of sandy beach available.

There is a degree of uncertainty about the precise impact that the hazards and their management will have on the coastal features in the 10 year timeframe, but the information that follows is based on the best available information, including modelling of global trends in coastal hazards.

Q2.1) Do you have any opinions about the management actions listed above and how appropriate they are for coastal hazard management at Cottesloe Beach?

You may skip this question if you prefer

_____

_____

_____

_____

_____

Commented [Advice3]: HOVER BOX: Importing sand to re-establish the area of sandy beach.

Commented [Advice4]: HOVER BOX: Revegetating dunes and using structures to control human movement (e.g. fences, pathways), so that the flow of sand is controlled.

Commented [Advice5]: HOVER BOX: Reconstructing sand dunes that no longer exist to control the flow of sand and water on the coastline.

Commented [Advice6]: HOVER BOX: Building artificial reef structures or restoring damaged natural reefs to control sand and tidal movements near the shore.

Commented [Advice7]: HOVER BOX: Concrete blocks or boulders that are sunk offshore to slow wave energy.

Commented [Advice8]: HOVER BOX: A hard rock or concrete wall built along the coast used to prevent waves from eroding the foreshore reserve or to protect it from flooding.

Commented [Advice9]: HOVER BOX: A barrier or wall perpendicular to the coast used to manage water and sand movement to protect the beach on one side of the structure.

Commented [Advice10]: HOVER BOX: Instead of protecting coastal features where they are, they are moved or rebuilt at a new location.

In the questions that follow in Part 3:

- We will focus on the outcomes of management actions on coastal features. These varying outcomes may have an effect on your enjoyment of the beach.

- It doesn't matter what management action was used, we are focussing on the condition of the coastal features themselves.

- What we want to know is how you would value different outcomes if the condition of the coastal features was to change.

Now we will describe our 5 coastal features

1. Sandy Beach

This is the area of sandy beach available for recreational use at high tide.

Currently, there are about 30,000 square metres of sandy beach available for use: an area roughly 20 metres wide along the 1.5km stretch of beach (or, about 1 ½ times the size of Subiaco Oval).

In 10 years time, without any management action, it is expected that the area of beach available for use will be only 50% (half) of what is currently available.

Different hazard management actions could lead to increases or decreases in the amount of sandy beach, ranging from:

- 25% of the current beach (7,500m^2)
- 50% of the current beach (15,000m^2) – i.e. the expected area in 10 years time
- 75% of the current beach (22,500m^2)
- 100% of the current beach (30,000m^2) – i.e. there is no change from today

2. Foreshore reserve

This is the land reserve adjacent to the sandy beach that is available for recreational use. It includes recreational facilities such as change rooms, open grassy areas, shelter, play equipment, barbeques and picnic tables.

Currently, there are about 12,000 square metres of foreshore reserve available for use (or, about ½ the size of Subiaco Oval).

In 10 years time, without any management action, it is expected that the area of foreshore reserve available for use will be only 50% of the current area.

Different hazard management actions could lead to increases or decreases in the amount of foreshore reserve, ranging from:

- 25% of the current foreshore reserve (3,000m^2)
- 50% of the current foreshore reserve (6,000m^2) – the expected area in 10 years time
- 75% of the current foreshore reserve (9,000m^2)
- 100% of the current foreshore reserve (12,000m^2) – i.e. there is no change from today

3. Natural reserve

This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation.

Currently, there are about 20,000 square metres of natural reserve (or, about the same sized area as Subiaco Oval).

In 10 years time, without any management action, it is expected that the area of natural reserves will be only 25% of the current area.

Different hazard management actions could lead to increases or decreases in the amount of foreshore reserve, ranging from:

- 25% of the current natural reserve (5,000m^2) – the expected area in 10 years time
- 50% of the current natural reserve (10,000m^2)
- 75% of the current natural reserve (15,000m^2)
- 100% of the current natural reserve (20,000m^2) – i.e. there is no change from today

4. Beach access

This includes the provision of pathways and stairs that service the beach, as well as ramps for disability access.

Currently beach access is good, with there being pathways, stairs and ramps leading down to the beach about every 50 metres.

In 10 years' time, without any management action, it is expected that accessibility will be average, with some pathways, stairs and ramps no longer connecting to the beach, meaning the distance between access points will be 200 metres.

Different hazard management actions could change the accessibility to either:

- Poor, with only one access point to the beach
- Average, with access points every 200m – i.e. the expected amount in 10 years time
- Good, with access points every 50m – i.e. there is no change from today

5. Retail, dining & club facilities

This includes the provision of retail, food outlets and other public services along the foreshore reserve.

Currently, the services provided include cafés, restaurants and surf club facilities.

In 10 years time, with no management action, it is expected that foreshore space will not be able to support any of these facilities.

Different hazard management actions could mean that these facilities are either:

- Absent, where current facilities deteriorate and are removed – i.e. the expected situation in 10 years time
- Present, where current facilities are maintained – i.e. there is no change from today

Q2.2) Do you have any opinions about the state of the coastal features we have described, in terms of the way they could change in size, amount or presence, due to impacts from coastal hazards and their management?

(*you may skip this question if you prefer)*

_____
_____
_____
_____
_____

What can we do?

To maintain the current condition of the coastal features described above, additional funds are required to increase the budget that Western Australian Local and State Government agencies have available to manage our coastal environments.

Sourcing additional funds to invest in coastal hazard management at Cottesloe Beach could be achieved through a special State Fund, where payments are collected from all Western Australian households.

PART 3 – Management scenarios

In this part, you will be asked a number of questions about the outcomes of management for the coastal features described in Part 2.

The management costs associated with improving these features will be raised through a State Fund, with payments collected from Western Australian households. The funds collected would be used specifically for managing the impacts of coastal hazards.

These payments will apply for a **period of 10 years**, with the management outcomes achieved by the end of this period.

Please read the following guidelines before proceeding further:

- You will be presented with **5 hypothetical management scenarios**. Each question should be treated independently.
- In each scenario, you will be presented with **3 options**. Each option offers a different combination of outcomes for the coastal features. The combinations are different according to the size, amount or presence of each feature offered in 10 years' time. They also differ according to the management cost. The increased cost to you is presented as an annual figure to be paid for a period of 10 years.
- In each scenario, you will be asked to choose the option that is most appealing to you. You need to be **mindful of your own financial circumstances**, i.e. consider the limit of how much you can realistically afford given your current household income and personal expenses.
- We will be surveying a large number of people to work out the values held across the WA community.

The findings that emerge from this study may be used to inform future investment decisions for managing the impact of coastal hazards at Cottesloe Beach.

Here is an example of the type of question you will have to answer.

When answering the management scenarios, don't forget to:

- Consider each option (looking down each column)
- Keep in mind what you can afford when weighing up the cost of each option
- Choose your most preferred option based on the assumption that these are the only options available to you
- Treat each management scenario independently. You don't need to remember or anticipate the choices you make across the series of scenarios.

You can make your selection by clicking on the box containing the option.

Once you have selected it the box will turn green. You should only select one.

In the example below, the respondent has decided that they are prepared to pay $50 a year for the next 10 years to ensure greater protection of the Foreshore reserve and retail, dining and club facilities, even though the area of Sandy beach will be reduced further.

Management scenario EX: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time.	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 Sandy beach	25%	25%	50%	100%
 Foreshore reserve	100%	75%	50%	100%
 Natural reserve	25%	25%	25%	100%
 Beach access	Average	Poor	Average	Good
 Retail, dining & club facilities	Present	Absent	Absent	Present
Cost to you each year, for 10 years	$50	$400	$0	

Now we would like you to answer 5 of these questions

Management scenario 1: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 **Sandy beach**	50%	50%	50%	100%
 **Foreshore reserve**	25%	75%	50%	100%
 **Natural reserve**	50%	25%	25%	100%
 **Beach access**	Average	Good	Average	Good
 **Retail, dining & club facilities**	Absent	Absent	Absent	Present
Cost to you each year, for 10 years	$400	$50	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice11]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m². In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice12]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m². In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice13]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m². In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice14]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice15]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

Management scenario 2: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 Sandy beach	50%	25%	50%	100%
 Foreshore reserve	75%	25%	50%	100%
 Natural reserve	25%	75%	25%	100%
 Beach access	Good	Average	Average	Good
 Retail, dining & club facilities	Present	Absent	Absent	Present
Cost to you each year, for 10 years	$100	$100	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice16]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice17]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice18]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice19]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice20]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

Management scenario 3: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 Sandy beach	25%	75%	50%	100%
 Foreshore reserve	25%	50%	50%	100%
 Natural reserve	25%	50%	25%	100%
 Beach access	Average	Good	Average	Good
 Retail, dining & club facilities	Present	Present	Absent	Present
Cost to you each year, for 10 years	$50	$100	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice21]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m². In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice22]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m². In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice23]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m². In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice24]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice25]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

Management scenario 4: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 Sandy beach	100%	25%	50%	100%
 Foreshore reserve	100%	75%	50%	100%
 Natural reserve	75%	100%	25%	100%
 Beach access	Good	Average	Average	Good
 Retail, dining & club facilities	Present	Present	Absent	Present
Cost to you each year, for 10 years	$100	$200	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice26]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice27]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice28]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice29]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice30]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

Management scenario 5: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 Sandy beach	100%	25%	50%	100%
 Foreshore reserve	100%	100%	50%	100%
 Natural reserve	50%	25%	25%	100%
 Beach access	Good	Average	Average	Good
 Retail, dining & club facilities	Absent	Present	Absent	Present
Cost to you each year, for 10 years	$400	$100	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice31]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m². In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice32]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m². In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice33]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m². In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice34]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice35]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

[Question answered if respondent always selected Option 3]

Q3.SQ) You selected Option 3 (the situation in 10 years time with no management change) for ALL 5 management scenarios.

Please provide your reason why, choosing from the list below:

- I preferred this option to all others
- I could not afford the other options
- I believe funding to manage the impacts of coastal hazards should come from somewhere other than my own pocket
- I believe funding to manage the impacts of coastal hazards should be collected by some other means than a State tax
- I don't think that the coastal features described for Cottesloe Beach need further investment to manage the impacts of coastal hazards
- I don't trust that the funds would be used to manage the impacts of coastal hazards at Cottesloe Beach
- I don't believe that there will be impacts from coastal hazards (i.e. erosion and/or inundation) during this time period
- I don't believe I should have to make these choices
- Other (please specify): .....

PART 3 continued

You are now more than 80% of the way through the survey.

There are 9 follow-up questions about the management scenarios and survey in general.

Q3.1) In each management scenario, was the amount of the extra payment required for the different options (i.e. the 'cost to you each year, for 10 years') important to you when making your choices?

- Yes
- No

Q3.2) Thinking about the coastal features described in the scenarios, could you rank which were the most important when making your choices?

Rank 1 as most important, 5 as least important.

If you did not care whether the amount of the feature(s) increased/decreased/stayed the same, do not rank the feature.

Coastal Feature:	**Rank:**
Sandy beach	
Foreshore reserve	
Natural reserve	
Beach access	
Retail, dining & club facilities	

Q3.3) Did you think about your household budget, and how much you could afford, while making your choices for the scenarios?

- Yes
- No

Q3.4) Did you find the scenarios confusing or particularly difficult to answer?

- Yes
- No

Q3.5) Please indicate on the following scale how certain you were of the answers you gave in the scenarios:

Very uncertain									Very certain
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Q3.6) What did you think about the information that was provided to describe the coastal features of Cottesloe Beach?

- ○ I thought it was an informative and accurate description
- ○ I would have liked more information
- ○ I thought the descriptions were inaccurate
- ○ I thought there was too much information
- ○ I though the information was confusing

Q3.7) How useful do you think the results of this study would be to inform future investment decisions about the coastal features at Cottesloe Beach:

Not very useful									Very useful
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Q3.8) How likely do you think it is that the results of this study will be used by decision makers to inform future investment decisions about the coastal features at Cottesloe Beach:

Very unlikely									Very likely
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Q3.9) Do you have any other comments about the coastal features described for Cottesloe Beach that you would like to add?

Y*ou may skip this question if you prefer*

_____
_____
_____
_____

PART 4 – Questions about you

You are almost at the end of the survey.

These final questions are to make sure that the group of people that respond to this survey are representative of the general community.

Rest assured that your individual responses will remain confidential and we will only use the collected data in aggregate form.

Q4.1) Which Local Government Area do you live in?

- Armadale, City of
- Bassendean, Town of
- Bayswater, City of
- Belmont, City of
- Cambridge, Town of
- Canning, City of
- Claremont, Town of
- Cockburn, City of
- Cottesloe, Town of **[***Answer Q4.1a***]**
- East Fremantle, Town of
- Fremantle, City of
- Gosnells, City of
- Joondalup, City of
- Kalamunda, Shire of
- Kwinana, Town of
- Melville, City of
- Mosman Park, Town of
- Mundaring, Shire of
- Nedlands, City of
- Peppermint Grove, Shire of
- Perth, City of
- Serpentine-Jarrahdale, Shire of
- South Perth, City of
- Stirling, City of
- Subiaco, City of
- Swan, City of
- Victoria Park, Town of
- Vincent, City of
- Wanneroo, City of
- Regional local government area
- Not listed / Unsure

Q4.1a) Do you live within —what you would consider to be— a reasonable walking distance of Cottesloe Beach?

- Yes
- No

Q4.2) What are the streets that form the nearest intersection to where you live?

E.g. Stirling Highway *and* Bruce Street

We don't want to know your exact address, but we would like to identify roughly how far it is between your house and Cottesloe Beach.

_____ *and* _____

Q4.3) Do you have a view of the ocean or coastal dunes (of any part of the coast, not just Cottesloe) from your usual place of residence and/or employment?

- Yes
- No

Q4.4) Do you belong to any conservation groups?

- Yes – coastal conservation groups; list if you would like to:_____
- Yes – other environmental conservation groups; list if you would like to: _____
- No

Q4.5) Do you belong to any recreational groups associated with the coast? *Select all relevant options*

- Surf lifesaving club
- Swimming club
- Sailing club
- Recreational fishing club
- Diving club
- Beach fitness/exercise club
- Other (please specify): .....
- None of these groups

Q4.6) Are you employed or do you volunteer in any of the following fields?

- Coastal management/research/consulting
- Government agencies tasked with coastal responsibilities
- Tourism venture specifically associated with the coast
- Hospitality in a business specifically associated with, or located on, the coast
- Boating industry
- Fishing industry
- Other field associated with the coast (please specify): .....
- None of these fields

Q4.7) Which of the following household descriptions best fits you?

- Single without children
- Single with children – at least some of the children are still dependent
- Single with children – with all children having left home
- Couple without children
- Couple with children – at least some of the children are still dependent
- Couple with children – with all children having left home
- Other (please specify): ……

Q4.8) What is your highest level of education?

- Schooling up to Year 10
- Schooling up to Year 12
- Trade or technical certificate
- University degree (Bachelor, Master, PhD)

Q4.9) What is your gross annual income (i.e. before tax)? *Please provide your shared household income if you have joint management of household finances: otherwise provide your personal income.*

- Under $13,000 (under $250/week)
- $13,000-$25,999 ($250-$500/week)
- $26,000 - $41,599 ($500-$800/week)
- $41,600 - $62,399 ($800-$1200/week)
- $62,400 - $88,399 ($1200-$1700/week)
- $88,400 - $129,999 ($1700-$2500/week)
- $130,000 - $181,999 ($2500-$3500/week)
- $182,000 and over ($3000+/week)
- I would rather not say

Q4.10) If you have any further comments, please note them in the box below:

Thank you for completing this survey – your time is greatly appreciated!

Appendix 3: Cottesloe Beach pilot survey results

This appendix reports some summary results derived from the Cottesloe Beach pilot study.

The primary objective of the pilot was to provide a 'proof of concept' of the survey, i.e. that a representative sample of respondents can complete the survey, and that indicative statistical results can be derived. The results presented here are not intended to be an accurate reflection of results that may be derived if a full survey were implemented.

The survey was launched on November 22nd 2017, and data collection was completed on the 23rd.

A total of 213 respondents entered the survey. These comprised of:

4 screened out as invalid, based on age and location criteria
32 entered survey after quota filled, and were screened out
27 entered survey and did not complete
150 entered survey and completed

This gives an 85% completion rate for those who could validly complete the survey, which is high.

Of the 27 who did not complete, 10 left the survey after the initial information screen was shown. Of the remaining 17, only 6 remained to give information about the importance of protecting Cottesloe beach in Part 1 of the survey, and only one completed any of the choice scenarios in Part 3. The majority of those who did not complete dropped out before information about the choice set task was presented - or conversely: the relatively large amount of information presented in Part 2 to give the context of the choice experiment did not appear to be a trigger for people to abandon the survey.

A summary of descriptive statistics for the sample of 150 respondents is provided in Table A3.1.

Table A3.1. Socio-demographic statistics for the pilot sample.

Socio-demographics	Number of respondents
Gender	
Male	69
Female	81
Age	
18-30 years	29
31-45 years	46
46-60 years	39
61-75 years	35
Over 75 years	1
Education	
Schooling up to year 10	13
Schooling up to year 12	37
Trade or technical certificate	45
University degree	55

A3.1 Discrete choice experiment results

For a valid completion of the discrete choice experiment, respondents need to fully engage with the materials provided, and to consider the choice scenarios. Those who 'click through' the material are unlikely to provide considered responses to the questions.

One indication of attention to material is the time spent completing the survey. There is no categorical time cut-off, but we consider that someone completing in less than 10 minutes is unlikely to be able to fully absorb the material. We therefore dropped all those who completed in a time less than 10 minutes, and hence reduce the sample to 113 respondents.

A further concern are those respondents who may use a heuristic when making choices, and are not trading off across attributes in accordance with the theory underlying the discrete choice model. A heuristic of concern is when respondents select the status quo option in all choices presented to them. Although this may represent considered behaviour (i.e. if someone genuinely prefers the status quo), it can also represent a 'protest' against some aspect of the survey. We identified 25 respondents within the set who complete in more than 10 minutes who demonstrated this behaviour. Each was asked a debriefing question as to why they made those choices. The frequency of answers against each response is given below. The first 2 options and the 5th option (collectively consisting of 5 respondents) are consistent with considered choices: these respondents could still be considered as having looked at all elements of the choices, but decided the status quo was always the best. The other nominated answers indicate some form of protest behaviour. For example, if respondents feel that others should fund the protection of Cottesloe beach, that does not indicate they do not value the beach, but that they believe the payment vehicle used is not correct. Or similarly, if they may not believe that the information provided in the survey about the impacts of natural hazards is correct.

We therefore removed the 18 respondents identified with an asterisk below, taking the available sample down to 95 (Figure A3.1).

Note that although these respondents are dropped from the estimation stage of the modelling, some decision has to be made at a later stage as to how their preferences should be incorporated into the aggregate measure of values, i.e. although they do not give useful information for identifying trade-offs, they may still be assumed to hold values for the asset. This is discussed below.

You selected Option 3 (the situation in 10 years time with no management change) for ALL 5 management scenarios.	N
Please provide the main reason why, choosing from the list below:	
I preferred this option to all others	1
I could not afford the other options	4
I believe funding to manage the impacts of coastal hazards should come from somewhere other than my own pocket	**11***
I believe funding to manage the impacts of coastal hazards should be collected by some other means than a State tax	**3***
I don't think that the coastal features described for Cottesloe Beach need further investment to manage the impacts of coastal hazards	0
I don't trust that the funds would be used to manage the impacts of coastal hazards at Cottesloe Beach	**1***
I don't believe that there will be impacts from coastal hazards (i.e. erosion and/or inundation) during this time period	0*
I don't believe I should have to make these choices	**1***
Other (please specify):	**2***

Figure A3.1. Debrief questions to identify 'protest' respondents, and number of times they were selected. Those with an asterisk indicate protest responses that should be removed from the sample.

The conditional logit model is the workhorse model for estimating preference parameters.

An overview of the survey design and implementation is given in Pearce and Ozdemiroglu (2002) (available here: http://webarchive.nationalarchives.gov.uk/20120919162306/http://www.communities.gov.uk/documents/corporate/pdf/146871.pdf).

While a detailed summary of the theory and estimation is given in Train (2009) chapter 3 (available here: https://eml.berkeley.edu/books/choice2nd/Ch03_p34-75.pdf).

The principle behind the discrete choice model is that the choices made when faced with a limited set of alternatives reveals something about the relative weights (technically: marginal utilities) placed upon the attributes of the alternatives. Statistically, one can identify those weights if a sufficient number of respondents answer the survey. The simplest model assumes that all respondents have the same preferences, or that the estimation is identifying the 'average' weights across the sample. As samples get larger it is possible to identify heterogeneity in preferences: either by estimating split samples, or by including interaction effects where one models the attribute weights using characteristics of respondents, e.g. allowing the marginal utility of an attribute to vary systematically with variables such as age, gender, etc.

Given the small sample size, we explore relatively few interaction effects. However, one important debriefing question we asked is whether respondents considered their household budget while making their choices. If they say 'no' to this question then it is reasonable to infer that the cost attribute did not play an important part in the decision making process for them, while for those who say yes, this implies the cost attribute was being traded-off with other things that they could spend their money on [*Part 3, Q3.3*]. Given the hypothetical nature of the choice experiment, or given the possibility that for some people on high incomes the amounts requested may be seen as trivial, it is possible that some respondents ignored the cost but simply selected attributes that delivered beach outcomes they preferred. Given the central role that the cost attribute plays in determining the economic values, identifying such behaviour is important.

In the debrief question, 18 people (19%) said they did not consider their household budget. We therefore allow the marginal utility of the cost attribute to be influenced by their answer to this question.

We also asked whether people have visited Cottesloe beach in the last year [*Part 1, Q1.1*]: 70% had. One might expect that visitation would also influence the answers given. In this case, we measure how visitation influences the probability of an individual selecting the status quo option, as measured by the marginal utility of the alternative specific constant in the model.

The conditional logit results are reported in Table A3.2 below.

Table A3.2. Choice model for the pilot survey.

Variables	Coefficient		Std. Err.	[95% Conf. Interval]	
Cost					
Budget considered	-0.004	***	0.001	-0.006	-0.003
Budget not considered	-0.001		0.001	-0.003	0.001
Sandy beach	0.011	***	0.003	0.005	0.016
Foreshore reserve	0.007	**	0.003	0.002	0.013
Natural reserve	0.007	*	0.004	0.000	0.013
Beach access average	0.059		0.223	-0.379	0.497
Beach access good	-0.047		0.230	-0.497	0.402
Facilities present	0.502	**	0.199	0.111	0.893
Alternative specific constant					
Recent visitor	0.190		0.404	-0.603	0.983
Not a recent visitor	0.947	**	0.425	0.114	1.780

***, **, * indicates significance at the 99%, 95% and 90% level of confidence, respectively.

The estimated coefficients are the implicit weights being used by respondents as they make choices across the alternatives. We allow there to be a different weight for cost for those who considered their household budget and for those who did not. We generally expect the coefficient on a cost attribute to be negative: all else held constant, respondents prefer lower costs. This is the case for those who considered their budget (-0.004***). Those who did not are estimated to have a small, but insignificant cost effect (-0.001): i.e. their behaviour in the choice experiment is consistent with the debriefing answer given.

We interact the visitation variable with the alternative specific constant (ASC). The ASC is a measure of the utility gained from the status quo option. Strictly, it represents the value attached to that option, over and above the value one might expect to estimate given the attribute levels present in that option relative to the other alternatives. For those who are a recent visitor, the effect is not significant. But for those who are not, the effect is positive and significant (0.947**). This implies that those who are not recent visitors are more likely to select the status quo 'no change' alternative than one might anticipate given the levels of attributes in other alternatives in any choice scenario. This might suggest that those who do not visit are less concerned about protecting the beach.

For the other attributes, increased areas of sandy beach, foreshore and natural reserve are all valued positively. The coefficients for these attributes represent the marginal utility for a 1% increase in area.

Improved beach access was not valued – the coefficients are not statistically different from zero (i.e. not statistically significant). This may be because of the relatively small length of beach involved, and that access was not lost completely: the worst case scenario (against which the average and good levels are compared) was one access point. It may also be the case that the sample size was too small to estimate a significant result for this attribute.

Having facilities present was highly valued.

Interpretation of the estimated coefficients is made easier if one considers the marginal willingness to pay estimates. These are monetary values associated with changes in attribute levels, and are derived as the (negative of the) ratio of attribute and cost coefficients.

Table A3.3 below reports these values for those respondents who considered their household budget (note that formally it is not possible to identify these values for those who did not consider their budget due to the statistically insignificant cost coefficient: there is no increase in cost that would compensate for a change in the attribute if cost is not valued).

Table A3.3 Willingness to pay (WTP) estimates: $ /household /year for 10 years.

	WTP:		**[95% Conf. Interval]**	
Sandy beach: per % increase in area	$2.13	***	0.77	3.49
Foreshore reserve: per % increase in area	$1.88	***	0.58	3.19
Natural reserve: per % increase in area	$1.11		-0.43	2.65
Beach access: increase from poor to average	$20.72		-76.91	118.35
Beach access: increase from poor to good	$4.50		-96.42	105.42
Facilities present	$93.73	**	3.68	183.78

***, **, * indicates significance at the 99%, 95% and 90% level of confidence, respectively.

The interpretation is that the respondent is willing to pay $2.13 per year for 10 years if that ensured that the area of sandy beach was increased by 1%, or $1.88 for a 1% increase in foreshore reserve. The values for natural reserve and increases in beach access are not significantly different from zero. Facilities being present has a willingness to pay of almost $94. Although this is a large value, the units used to measure the attribute should be noted: a 50% increase in foreshore reserve would be valued at the same as the facilities ($1.88 x 50 = $94).

A3.2 Travel cost results

The approach taken to screening the data for the travel cost analysis was different to that employed for the choice experiment. We did not drop any respondents based on speed of completion being less than 10 minutes. The justification for this is

a) The questions involved in the travel cost are simpler, and collected earlier in the survey, and hence may not be so affected by clicking through with haste
b) The analysis is based on one observation per person, and hence the sample size is limited even without removing respondents on that basis. (In the choice experiment there are 5 observations per person – 1 observation for each choice scenario).

However, we do use income and age as covariates (i.e. explanatory variables in the model), and the sample is reduced to 128 due to respondents who were not being willing to give an income value in the socio-demographic questions asked in Part 4 of the survey.

An estimate is needed of the frequency of trips made to Cottesloe beach. We use an approximate estimate based on the question shown in Figure A3.2 below: i.e. someone reporting that they visited nearly every day was estimated as having visited 6*26 times in the 6 month period (i.e. 156 times), and those reporting one visit a month would have an estimated of numbers of trips of 6. This question was asked for both summer and winter periods, as it was expected that visitation would vary across seasons.

Figure A3.2. Trip frequency question, for hotter, Summer months.

As noted above, a number of decisions have to be taken when estimating the travel cost variable used in the travel cost model. The first is the definition of distance travelled. We used the distance from the centre of the respondent's nominated Local Government Area to Cottesloe beach. Having determined the latitude and longitude coordinates, we used the _georoute_ command within the Stata software package to calculate the georouting distance between the two geographical points identified by their coordinates. It uses the HERE API (https://developer.here.com), which calculates distance based on driving, and for normal road conditions. Although this may be inaccurate for those within some larger LGA districts, the proportional error induced for distance to Cottesloe may not be large.

For the cost of travel we applied a simple 10c/km rule, and did not include any value for travel time. We also did not adjust for number of people in the group: if travelling by car then the cost should be shared proportionally. As a result our estimates of value will be lower bounds, but the results are illustrative of the analysis that could be undertaken with a larger sample.

The statistical model used is the negative binomial model, which accounts for the fact that the dependent variables are count variables: i.e. that the variables take non-negative, integer values (Yen, Steven T. and Adamowicz, Wiktor, (1993), Statistical Properties of Welfare Measures from Count-Data Models of Recreation Demand, *Review of Agricultural Economics*, **15**, issue 2, p. 203-215. provide a summary of this type of model), available here: https://econpapers.repec.org/article/ouprevage/v_3a15_3ay_3a1993_3ai_3a2_3ap_3a203-215..htm).

Table A3.4 below reports the results for both the summer and winter models.

As expected, the effect of travel cost on numbers of trips per year is negative. Perhaps more surprisingly the effect of income on trips is also negative: in economic parlance, trips to the beach are an 'inferior' good, with demand falling as income rises. However, this could be interpreted as people with higher incomes having less free time available to visit the beach. Those who are older also take fewer trips.

Table A3.4. Estimates for seasonal travel cost models to Cottesloe Beach.

	Summer model	**Winter model**
Travel cost	-0.481***	-0.578***
Age	-0.037***	-0.011***
Income	-0.011***	-0.047***
constant	6.19***	6.36***
n	128	128
WTP estimates	$2.08 (0.74-3.42)	$1.73 (0.87-2.56)

***, **, * denotes significance at the 99%, 95%, 90% level of confidence, respectively

The value of a trip (described as either the 'consumer surplus' associated with a trip or the Willingness To Pay per trip) is given by -1/{Travel cost}, i.e. the negative inverse of the cost coefficient. Table A3.4 shows the WTP estimates with 95% confidence intervals reported. The estimates are slightly higher for the Summer model, but given the relatively large confidence intervals, one cannot claim that there is a statistical difference. However, for a larger sample size, greater precision in the estimates would be possible.

The estimates are similar to values reported elsewhere in the literature, for example, a value of $3.28 per trip to the Augusta Margaret River region (Anning,D., Ware,D. Raybould,M. and Lazarow,N. (2013) "Valuing beach and surf tourism and recreation in Australian sea change communities" 4th Queensland Coastal Conference. Townsville, Queensland.Oct. 2013).

These estimates of WTP can then be applied to estimates of the total number of trips that people make to Cottesloe Beach to provide an aggregate of the total value of trips.

Appendix 4: DCE experimental design syntax

This appendix reports the experimental design syntax that underlies the choice scenarios.

The objective of the experimental design is to construct choice cards that contain levels of the attributes. The criteria for how the levels are combined is one of statistical efficiency: the ability of the model to identify the parameters of interest.

This appendix contains the design syntax and formatted design matrix. This is provided for reference, as it can be adapted in future (by a non-market valuation practitioner) to make changes to the experimental design (Section A4.1).

The formatted choice scenarios that are derived from this design are provided in Template 2 'DCE experimental design'. This template sets out the 25 choice scenario questions for you to populate with your own attribute levels for your coastal location.

A4.1 Design syntax

The design was generated using a software package called Ngene:

ChoiceMetrics (2014) Ngene 1.1.2 User Manual & Reference Guide, Australia.

A pdf copy of the manual, which goes into some considerable detail on experimental survey design, is available at

https://www.dropbox.com/s/f2kntciuyigetur/NgeneManual112.pdf?dl=0

The syntax that is used to generate the model is reported below.

```
design
;alts =  alt0*,alt1*,alt2*
;rows = 25
;block=5
;eff = (mnl,s)

;alg = mfederov(candidates=2000)

;model:

U(alt1)  = c[-0.005]*cost[50,100,200,400](4-8,4-8,4-8,4-8)+
sb.dummy[-0.25|0.25|0.5]*sb[25,75,100,50]+fr.dummy[-.25|0.25|0.5]*fr[25,75,100,50]+
nr.dummy[0.25|0.5|0.75]*nr[50,75,100,25]+ba.dummy[-0.5|0.25]*ba[0,2,1]+fac[-1]*fac[0,1]/
U(alt2)  = c*cost[50,100,200,400](4-8,4-8,4-8,4-8)
+sb*sb[25,75,100,50]+fr*fr[25,75,100,50]+nr*nr[50,75,100,25]+ba*ba[0,2,1]+fac*fac[0,1]$
```

The variables used are:

Cost =cost to the respondent
Sb =area of sandy beach
Fr = area of foreshore reserve
Nr = area of nature reserve
Ba = beach access, coded 0=poor, 1=average, 2=good
Fac = facilities on the beach 0=present, 1 = not present

Note a number of features of the design:

- It is dummy coded. This means it is possible, with a sufficient sample size, to estimate a parameter for each level of the 'area' variables (Sb, Fr, Nr).

- "Priors" are used to inform the design: these are an estimate of what we think the marginal utility of the different attribute levels might be. They are not an accurate measure of utility, which can't be derived until actual data is collected; they are used to indicate which attribute levels we expect to have a positive or negative influence on individuals' preferences, and which attribute levels might be valued more highly relative to others.

- Although not written out explicitly, there is a 3rd alternative present (alt0) which is the status quo and which is assumed to have a level of utility of zero. In the choice scenarios, this alternative is populated with the status quo levels of each attribute.

- There are 25 'rows' in the design, i.e. 25 choice scenarios.

- Those 25 are blocked into 5 sets of 5.

- We report the design in two ways:

    - The first is in the form of a data matrix outlining the levels of each attribute in each of the two alternatives (see below).
    - The second is as a set of formatted choice cards (see Template 2).

In the formatted data matrix (Table A4.1) we also report a summary of statistical values from the design. The headline estimate is the S-estimate. This indicates the sample size that would be needed to estimate significant parameter estimates, assuming a value of alpha of 0.05, if they had the priors stated. A value of 33 means that a sample of 33 people doing all 25 questions, or 33*5=165 if each do only 1 block of 5 questions. Note that this is an estimate only, and depends on the values of the priors used.

The design is constructed assuming the specific values of the attributes, i.e. the 4 levels for the area-based variables of 25, 50, 75 and 100%. In another implementation, other possible levels may be required (i.e. 10, 40, 60, 100%). Generally, any change in the absolute levels of an attribute could lead to changes in the marginal utilities for those attributes, and hence the priors used in the current design may be less accurate and a new design could be generated for better efficiency. However, it is our experience that small changes in absolute values of levels tend not to significantly alter overall

efficiency statistics of a design, and the current design can be implemented for most adaptations of the survey instrument.

We recommend that the survey be implemented within the bounds of the provided experimental design (i.e. with respect to the attributes and levels described) unless there is specific evidence to suggest this is impractical, e.g. based on expert advice that there are technical infeasibilities in the way attribute levels are combined, or that public focus groups identify a particular issue with the design (e.g. the cost levels are too high).

Generating new designs is not a labour intensive provided one has access to the Ngene software. We would recommend re-running of the design software for more extreme changes in the attribute level specifications. Such circumstances requiring a new design could include cases where:

- A different number of attribute levels is required (e.g. 3 or 5 levels for Sandy beach instead of 4 levels).
- A range of attribute levels is required that is a substantial extrapolation from the range used in this design (e.g. 0%-80%, or 50%-150%, instead of 25-100% for the area-based attributes).
- One of the attributes is not relevant for inclusion and should be omitted from the design (e.g. Recreational, dining & club facilities are not currently present, nor suitable to consider for future presence at the location).
- The way in which an attribute and its levels are specified does not fit within the advice given in the templates (e.g. if beach access cannot be defined by relating poor/average/good levels of access to the number, type or length of access points).

Table A4.1. Formatted data matrix showing the experimental design generated in Ngene.

MNL efficiency measures

Efficiency measures are the criteria by which the design has been constructed

D error	0.28542
A error	0.94470
B estimate	68.1153
S estimate	33.2610

Priors are the initial estimates of parameter sizes needed in the design

Prior	c	sb(d0)	sb(d1)	sb(d2)	fr(d0)	fr(d1)	fr(d2)	nr(d0)	nr(d1)	nr(d2)	ba(d0)	ba(d1)	fac
Fixed prior value	-0.005	-0.25	0.25	0.5	-0.25	0.25	0.5	0.25	0.5	0.75	-0.5	0.25	-1
Sp estimates	1.83519	33.2610	33.199	32.9173	32.8649	33.0651	23.4686	32.9864	23.1290	9.70310	24.6647	31.0929	3.39690
Sp t-ratios	1.44682	0.3398	0.34016	0.34162	0.34189	0.34085	0.40458	0.341262	0.407546	0.629217	0.394655	0.3515	1.063443

Design ***The design reports a level for each attribute, for the two alternatives (prefixes alt1. and alt2.)***

Choice situation	alt1.cost	alt1.sb	alt1.fr	alt1.nr	alt1.ba	alt1.fac	alt2.cost	alt2.sb	alt2.fr	alt2.nr	alt2.ba	alt2.fac	Block
1	400	75	75	25	2	0	100	50	25	50	2	0	4
2	50	50	25	100	0	1	100	75	75	50	1	1	3
3	50	25	50	25	2	0	100	50	25	50	1	0	3
4	100	50	25	100	1	0	50	75	75	50	1	0	2
5	400	50	25	50	1	1	50	50	75	25	2	1	1
6	50	25	25	25	2	0	50	50	75	50	2	1	5
7	50	50	75	75	1	1	200	75	50	50	2	0	3
8	100	75	25	25	1	0	50	25	50	100	1	1	4
9	100	50	75	25	2	0	100	25	25	75	1	1	1
10	400	75	50	75	1	0	50	50	100	50	0	0	5
11	50	25	50	100	0	1	200	50	75	100	1	0	2

12	50	25	25	25	1	0	100	75	50	50	2	0	1
13	100	75	50	100	2	1	50	25	75	75	1	0	5
14	200	75	50	25	1	0	50	25	25	50	1	0	2
15	200	25	50	50	2	0	100	75	75	25	0	0	2
16	400	75	50	50	2	0	100	75	25	25	1	0	4
17	200	75	100	75	2	1	200	25	50	100	1	1	4
18	50	75	100	50	0	0	200	50	25	75	2	1	5
19	100	100	100	75	2	0	200	25	75	100	1	0	1
20	400	100	100	50	1	0	100	25	100	25	1	0	1
21	50	75	50	100	0	0	50	25	50	50	2	0	3
22	100	75	25	25	1	0	400	50	50	50	1	1	3
23	200	50	75	50	2	0	400	25	50	100	1	1	2
24	100	100	25	25	1	0	400	50	100	25	2	0	4
25	200	25	75	25	1	0	400	25	100	25	0	0	5

Template 1: DCE + TC survey instrument

Welcome to the Cottesloe Beach survey

We would like to start with a few questions about yourself:

S1) What is your gender?

- Male
- Female
- Non-binary/other

S2) Which age group applies to you?

- Under 18 years
- 18-30 years
- 31-45 years
- 46-60 years
- 61-75 years
- Over 75

S3) Where do you live?

- [*insert name of LGA here if targeting a local sample, otherwise delete this option*]
- Perth metropolitan area
- Regional Western Australia
- Other part of Australia
- International visitor

Commented [Advice1]:
Legend for annotation throughout template

Comment boxes in normal black text provide general advice or instructions.

BOLD RED TEXT indicates flow logic of the survey (i.e. skipping questions etc.) These instructions should remain in place for a paper-based version of the survey, but can be removed for an online version where the survey programming should make the flow logic automatic**.**

ORANGE TEXT in comments box indicates information that will ideally be displayed as a hover box or pop-up box in an online survey instrument. This information should be integrated into the survey text at the relevant point if administering via a paper-based version.

YELLOW HIGHLIGHTED TEXT indicates wording in the survey template that must be changed for each application of the survey to a new location.

BLUE HIGHLIGHTED TEXT indicates wording in the survey template that could optionally be changed depending on who your target sample is (a local, Perth metropolitan or State-wide community), and depending on the payment vehicle that you deem appropriate for that sample.

PINK HIGHLIGHTED TEXT indicates wording that could be changed with respect to seasonal variations.

LIGHT GREEN HIGHLIGHT TEXT indicates wording that could be changed regarding the geographic area that you think is relevant with respect to providing substitute sites.

DARK GREEN HIGHLIGHTED TEXT indicates the payment timeframe which you might decide to change.

Commented [Advice2]: Adapt this question to screen out respondents who are not part of the target sample.

Preferences for managing coastal hazards at Cottesloe Beach

Dear Sir/Madam,

Thank you for reading this introduction screen which outlines a research project being conducted by [*insert relevant affiliations for the study here*].

This survey aims to understand your preferences for managing the coastal environment and infrastructure at Cottesloe Beach from coastal hazards.

You have been selected at random from the Western Australian population to participate in this research.

Your opinion is important – we will be surveying a large number of people to obtain a representative view of the community.

Participation involves completing a survey that will take approximately 20 minutes of your time. Your involvement is voluntary, and you may withdraw from the survey at any time. You must be at least 18 years of age to participate.

If you consent to participate in this study, please complete the survey that follows. If you have any questions feel free to contact me on the details below.

You can download a copy of this information sheet here.

Kind regards,

INSERT CONTACT DETAILS

Approval to conduct this research has been provided by …. [Insert any relevant ethics approval information here if relevant, otherwise delete].

Commented [Advice3]: If there is a reward/incentive being offered for completing this survey you should mention it before everything else: either here, or before the screening questions on page 1 if appropriate. Make it prominent.

If using an online research panel, the panel company will manage the incentives for you.

If managing the incentive yourself, you will need to consider how you collect contact information ethically (e.g. request email address at the end of the survey, but store that information separately to the rest of your anonymous data set).

Commented [Advice4]: For online survey: provide a pdf equivalent of this first page of the survey for respondents to download.

For paper-based survey: provide this first page of the survey as a handout that respondents can keep, and delete this text.

What this survey is about

Coastal environments and infrastructure, including Cottesloe Beach, are exposed to many threatening processes. Threats might include coastal hazards, the spread of weeds, urban development, or others.

This survey focuses on the impacts caused by coastal hazards.

This survey aims to understand your preferences for protecting the coast at Cottesloe Beach from these hazards.

In Western Australia, the main hazards that affect our coast are erosion and inundation.

Erosion is a process where parts of the shoreline are worn away due to waves, tides, wind or human activities. It can change the shape and form of the coast, reducing the area between the ocean and features on the land, and even allowing inundation.

Erosion on a beach at Seabird.
Credit: ABC News, Bonnie Christian

Inundation is when water occupies previously dry land. It can be temporary or permanent:

- Permanent inundation refers to the loss of land due to sea level rise.
- Temporary inundation is the flooding of an area due to storm surge, high tides or large waves.

Perth storm resulting in inundation of roads.
Credit: *Hannah Woodward/Twitter*

Storm events and rising sea levels are likely to result in a greater impact of erosion and inundation on our coast in future years.

Coastal features, such as sandy beaches, grassed foreshore reserves, natural reserves containing animals and plants, beach access points, and retail, dining and club facilities can be impacted by the erosion and inundation.

Different management actions can be used to avoid or reduce the impacts of coastal hazards. These actions are usually funded by Local Government and/or State Government agencies.

The survey has 4 main parts:

PART 1: Some questions about your experiences with Cottesloe Beach.

PART 2: A description of how some coastal features will be impacted by coastal hazards in the next 10 years. This information is needed for Part 3.

PART 3: A series of hypothetical management scenarios. You will be asked to choose one of 3 options for each scenario. Each option involves different outcomes for a few important features of the coast.

PART 4: Some questions about you, to make sure the group of people that respond to this survey are representative of the broader community.

PART 1 - Your experiences with Cottesloe Beach

Cottesloe Beach includes the stretch of sandy beach and associated foreshore areas starting at the groyne at the southern end of the main beach and spanning 1.5km up towards North Street.

Commented [Advice5]: Define the boundaries of the specific coastal location here.

Commented [Advice6]: Replace image with relevant map of coastal location.

The following questions relate to your experience with Cottesloe Beach.

Q1.1) Have you visited Cottesloe Beach in the last year?

- Yes [*answer the questions below*]
- No [*skip to Q1.11 on page 9*]

Q1.2) Thinking about a typical trip to Cottesloe Beach first in the hotter months, and then in the colder months, what activities do you usually undertake?

Select all that apply

	Hot months (Nov-April)	Cold months (May-Oct)
Swimming		
Snorkelling		
Scuba diving		
Surfing		
Windsurfing		
Kitesurfing		
Stand up paddle boarding		
Kayaking		
Water skiing		
Jet skiing		
Sailing		
Boating (private motorised vessel)		
Boating (chartered/hired motorised vessel)		
Fishing – shore based		
Fishing – boat based		
Four wheel driving		
Off-road biking		
Walking		
Running		
Dog walking		
Sandboarding		
Relaxing		
Socialising with friends or family		
Picnicking or barbecuing		
Visiting playgrounds		
Visiting Aboriginal heritage sites		
Visiting European heritage sites		
Watching wildlife		

Commented [Advice7]: Update list of activities to suit beach location: the list below is inclusive, but you may need to add unique activities specific to the location, or delete those that are not relevant.

Commented [Advice8]: Define the hot & cold seasons as appropriate.

Beach combing – e.g. shell collecting		
Replanting native plants & removing weeds		
Dining at restaurants, cafes, kiosks, pubs etc.		
Attending events – e.g. concerts, sporting, arts events		
Other activity 1 (specify)		
Other activity 2 (specify)		

Q1.3) How often on average would you visit Cottesloe Beach per month during the hotter months (November to April)?

- Nearly every day (5-7 times a week)
- A few times a week (2-4 times a week)
- About once a week
- About once a fortnight
- About once a month
- Less than once a month
- Never

Q1.4) How often on average would you visit Cottesloe Beach per month during the colder months (May to October)?

- Nearly every day (5-7 times a week)
- A few times a week (2-4 times a week)
- About once a week
- About once a fortnight
- About once a month
- Less than once a month
- Never

Q1.5) How many people usually come with you to the beach?

_____ adults _____ children

Q1.6) Thinking about a typical trip to Cottesloe Beach, please identify the distance you travel, and the time you take in the table below (one-way).

If a single trip involves more than one mode of transport (e.g. bus, followed by walking) please indicate distance and time for BOTH means of transport for a single trip.

For reference: Perth City to Cottesloe Beach = 12km

Commented [Advice9]: Use a well-known city/town/landmark familiar to your target sample and provide the distance from that to your beach location to use as an anchor point for determining distance travelled.

	Distance (km)	Time (minutes)
Walk		
Bicycle		
Motorcycle		
Small car		
Large car, ute, 4WD, small truck		
Bus [*answer Q1.7 below*]		
Train [*answer Q1.7 below*]		
Other (please specify)		

Q1.7) If you take the bus or train as part of the trip, how much do you typically pay:

One way? $_____

or

Round trip $_____

Q1.8) On a typical trip to Cottesloe Beach, do you normally combine the trip with other activities unrelated to the beach (e.g. visiting the beach while going to/from work)?

- ○ No – visiting Cottesloe Beach is typically the only stop I make on the trip
- ○ Yes – I typically make multiple stops when I visit Cottesloe Beach

Q1.9) What do you think about the public transport services available to access Cottesloe Beach?

Insufficient public transport				Sufficient public transport
1	2	3	4	5
○	○	○	○	○

Q1.10) What do you think about the availability of parking at Cottesloe Beach?

Insufficient parking available				Sufficient parking available
1	2	3	4	5
○	○	○	○	○

Q1.11) Aside from Cottesloe Beach, there are other places that you could visit around the Perth metropolitan region to enjoy outdoor recreation activities, including other beaches, lakes, wetlands, rivers or parks.

When you want to do outdoor recreation activities, do you usually visit Cottesloe Beach or one of these other areas?

- ○ Use Cottesloe Beach most of the time [*skip to Q1.12 on page 11*]
- ○ Use other locations most of the time [*answer questions Q1.11a, Q1.11b (if relevant) and Q1.11c below*]
- ○ I usually don't visit any outdoor recreation areas in the Perth metropolitan region [*skip to Q1.12 on page 11*]

Q1.11a) If you prefer other locations, what is the main reason?

- ○ Closer to where you live than Cottesloe Beach
- ○ Better suited to the type of outdoor activity than Cottesloe Beach **[***Answer Q1.11b below***]**
- ○ Better accessibility than Cottesloe Beach (e.g. car parking, boat ramps, walkways and stairs)
- ○ Better facilities/amenities than Cottesloe Beach (e.g. bbq's, playground equipment, toilets)
- ○ There are fewer people using it than Cottesloe Beach
- ○ Nicer environment than Cottesloe Beach (e.g. cleaner, more natural)
- ○ Safer environment than Cottesloe Beach (e.g. calmer water, more sheltered, more secure)
- ○ Other (please specify): .....

Q1.11b) Which types of outdoor recreation activities do you prefer to do at other sites rather than at Cottesloe Beach?

Commented [Advice10]: Update list of activities to suit beach location, as for Q1.2

Select all that apply

○ Swimming	○ Walking
○ Snorkelling	○ Running
○ Scuba diving	○ Dog walking
○ Surfing	○ Sandboarding
○ Windsurfing	○ Relaxing
○ Kitesurfing	○ Socialising with friends or family
○ Stand up paddle boarding	○ Picnicking or barbecuing
○ Kayaking	○ Visiting playgrounds
○ Water skiing	○ Visiting Aboriginal heritage sites
○ Jet skiing	○ Visiting European heritage sites
○ Sailing	○ Watching wildlife
○ Boating (private motorised vessel)	○ Beach combing – e.g. shell collecting
○ Boating (chartered/hired motorised vessel)	○ Replanting native plants & removing weeds
○ Fishing – shore based	○ Dining at restaurants, cafes, kiosks, pubs etc.
○ Fishing – boat based	○ Attending events – e.g. concerts, sporting, arts events
○ Four wheel driving	
○ Off-road biking	
○ Other (specify): ……	

Q1.11c) Of the other outdoor recreation areas that you prefer relative to Cottesloe Beach, what are the main ones?

Please list

……

……

……

……

Q1.12) State how much you agree that it is important to protect, manage, and maintain Cottesloe Beach in its current state for the following reasons (*tick the relevant boxes in the table below*):

It is important to maintain Cottesloe Beach in its current state:	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
For my own recreational use					
For other people's recreational use					
For the option that I can use it for recreation at some time in the future					
For future generations to use for recreation					
For people to be able to live nearby					
For environmental health, including flora and fauna habitat					
For cultural significance, including Aboriginal and European heritage					
For commercial use					
For tourism					

Q1.13) Do you have any other comments you would like to add about how you use Cottesloe Beach or other beaches in the Perth metropolitan region, or why you think these beaches are important?

(*you may skip this question if you prefer)*

_____

_____

_____

_____

_____

PART 2 – The state of coastal features at Cottesloe Beach

You will need to read this information to be able to answer the management scenarios in Part 3.

Over the next 10 years coastal hazards will cause damage to Cottesloe Beach.

Coastal features that are affected by the hazards include sandy beaches; foreshore reserves; natural reserves; beach access; and retail, dining and club facilities.

Different management actions can be used to address the hazards and control their impact on the coastal features. Management actions include:

- *Sand replacement*
- *Dune stabilisation and sand management*
- *Dune construction*
- *Reef construction or restoration*
- *Offshore breakwaters*
- *Seawalls*
- *Groynes*
- *Relocating facilities*

*Hover mouse over for more information

Different management actions can have positive impacts on some coastal features while having negative impacts, or no influence at all, on others. For example, a seawall might protect the foreshore reserve, but lead to a decrease in the area of sandy beach available.

There is a degree of uncertainty about the precise impact that the hazards and their management will have on the coastal features in the 10 year timeframe, but the information that follows is based on the best available information, including modelling of global trends in coastal hazards.

Q2.1) Do you have any opinions about the management actions listed above and how appropriate they are for coastal hazard management at Cottesloe Beach?

You may skip this question if you prefer

_____

_____

_____

_____

_____

Commented [Advice11]: If possible, the timeframe should relate to the actual timeframe in which the impacts from the hazards will be realised. If the impacts will occur in the distant future, you can use an experimental timeframe instead (see Section 4.3, Step 4 of report).

Commented [Advice12]: HOVER BOX: Importing sand to re-establish the area of sandy beach, typically undertaken periodically.

Commented [Advice13]: HOVER BOX: Revegetating dunes and using structures to control human movement (e.g. fences, pathways), to improve habitat or reduce sand movement.

Commented [Advice14]: HOVER BOX: Reconstructing sand dunes that no longer exist to control sand being blown by wind, or to provide improved habitat, or to restrict how far waves or floodwaters come onto land.

Commented [Advice15]: HOVER BOX: Building artificial reef structures or restoring damaged natural reefs to provide habitat for marine life and modify wave conditions and movement of sand.

Commented [Advice16]: HOVER BOX: Concrete blocks or boulders that are placed offshore to slow wave energy and movement of sand.

Commented [Advice17]: HOVER BOX: A hard rock or concrete wall built along the coast used to prevent waves from eroding the foreshore reserve or to protect against flooding.

Commented [Advice18]: HOVER BOX: A barrier or wall perpendicular to the coast used to manage how waves move sand, typically by holding sand on one side of the structure.

Commented [Advice19]: HOVER BOX: Instead of protecting coastal features where they are, they are moved or rebuilt at a new location.

In the questions that follow in Part 3:

- We will focus on the outcomes of management actions on coastal features. These varying outcomes may have an effect on your enjoyment of the beach.

- It doesn't matter what management action was used, we are focussing on the condition of the coastal features themselves.

- What we want to know is how you would value different outcomes if the condition of the coastal features was to change.

Now we will describe our 5 coastal features

1. Sandy Beach

This is the area of sandy beach available for recreational use at high tide.

Currently, there are about 30,000 square metres of sandy beach available for use: an area roughly 20 metres wide along the 1.5km stretch of beach (or, about 1 ½ times the size of Subiaco Oval).

In 10 years time, without any management action, it is expected that the area of beach available for use will be only 50% (half) of what is currently available.

Different hazard management actions could lead to increases or decreases in the amount of sandy beach, ranging from:

- 25% of the current beach (7,500m^2)
- 50% of the current beach (15,000m^2) – i.e. the expected area in 10 years time
- 75% of the current beach (22,500m^2)
- 100% of the current beach (30,000m^2) – i.e. there is no change from today

Commented [Advice20]: Replace image.
Also consider including additional images that help to illustrate the current state of the attribute, e.g. an aerial view showing the amount of sandy beach.
Be consistent with the types of images shown for each attribute.

Commented [Advice21]: If there are seasonal variations, add wording to this effect:
"… at high tide, as measured at the end of winter when the area is at its smallest."

2. Foreshore reserve

Commented [Advice22]: Replace image.
Also consider including additional images that help to illustrate the current state of the attribute, e.g. an aerial view showing the amount of foreshore reserve.
Be consistent with the types of images shown for each attribute.

This is the land reserve adjacent to the sandy beach that is available for recreational use. It includes recreational facilities such as change rooms, open grassy areas, shelter, play equipment, barbeques and picnic tables.

Currently, there are about 12,000 square metres of foreshore reserve available for use (or, about ½ the size of Subiaco Oval).

In 10 years time, without any management action, it is expected that the area of foreshore reserve available for use will be only 50% (half) of the current area.

Different hazard management actions could lead to increases or decreases in the amount of foreshore reserve, ranging from:

- 25% of the current foreshore reserve (3,000m^2)
- 50% of the current foreshore reserve (6,000m^2) – the expected area in 10 years time
- 75% of the current foreshore reserve (9,000m^2)
- 100% of the current foreshore reserve (12,000m^2) – i.e. there is no change from today

3. Natural reserve

Commented [Advice23]: Replace image.
Also consider including additional images that help to illustrate the current state of the attribute, e.g. an aerial view showing the amount of natural reserve.
Be consistent with the types of images shown for each attribute.

This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation.

Currently, there are about 20,000 square metres of natural reserve (or, about the same sized area as Subiaco Oval).

In 10 years time, without any management action, it is expected that the area of natural reserves will be only 25% (a quarter) of the current area.

Different hazard management actions could lead to increases or decreases in the amount of foreshore reserve, ranging from:

- 25% of the current natural reserve (5,000m^2) – the expected area in 10 years time
- 50% of the current natural reserve (10,000m^2)
- 75% of the current natural reserve (15,000m^2)
- 100% of the current natural reserve (20,000m^2) – i.e. there is no change from today

4. Beach access

Commented [Advice24]: Replace image.
Also consider including additional images that help to illustrate the current state of the attribute, e.g. an aerial view showing where the beach access points are.
Be consistent with the types of images shown for each attribute.

This includes the provision of pathways and stairs that service the beach, as well as ramps for disability access.

Currently beach access is good, with there being pathways, stairs and ramps leading down to the beach about every 50 metres.

In 10 years time, without any management action, it is expected that accessibility will be average, with some pathways, stairs and ramps no longer connecting to the beach, meaning the distance between access points will be 200 metres.

Different hazard management actions could change the accessibility to either:

- Poor, with only one access point to the beach
- Average, with access points every 200m – i.e. the expected amount in 10 years time
- Good, with access points every 50m – i.e. there is no change from today

5. Retail, dining & club facilities

Commented [Advice25]: Replace image.
Also consider including additional images that help to illustrate the current state of the attribute, e.g. an aerial view pointing out the particular services.
Be consistent with the types of images shown for each attribute.

This includes the provision of retail, food outlets and other public services along the foreshore reserve.

Currently, the services provided include cafés, restaurants and surf club facilities.

In 10 years time, with no management action, it is expected that foreshore space will not be able to support any of these facilities.

Different hazard management actions could mean that these facilities are either:

- Absent, where current facilities deteriorate and are removed – i.e. the expected situation in 10 years time
- Present, where current facilities are maintained – i.e. there is no change from today

Q2.2) Do you have any opinions about the state of the coastal features we have described, in terms of the way they could change in size, amount or presence, due to impacts from coastal hazards and their management?

(*you may skip this question if you prefer)*

_____
_____
_____
_____
_____

What can we do?

To maintain the current condition of the coastal features described above, additional funds are required to increase the budget that Western Australian Local and State Government agencies have available to manage our coastal environments.

Sourcing additional funds to invest in coastal hazard management at Cottesloe Beach could be achieved through a special State Fund, where payments are collected from all Western Australian households.

Commented [Advice26]: The description of the State Fund payment vehicle below is generally the recommended approach.
If using a rates-based payment, this section should read: "To maintain the current condition of the coastal features described above, additional funds are required to increase the budget that the [INSERT NAME OF LGA] has available to manage its coastal environment.

Sourcing additional funds to invest in coastal hazard management at [INSERT BEACH NAME] could be achieved through an increase in council rate payments. It is anticipated that if you rent, the increase in rates will be passed on to you via the home owner through your rental charges."

PART 3 – Management scenarios

In this part, you will be asked a number of questions about the outcomes of management for the coastal features described in Part 2.

Note that while the questions are hypothetical, and the specific management actions are not described, the outcomes in each question have been deemed feasible by experts and can be achieved through combinations of different management actions.

The management costs associated with improving outcomes of these features will be raised through a State Fund, with payments collected from Western Australian households. The funds collected would be used specifically for managing the impacts of coastal hazards.

These payments will apply for a period of 10 years, with the management outcomes achieved by the end of this period.

Please read the following guidelines before proceeding further:

- You will be presented with **5 hypothetical management scenarios**. Each question should be treated independently.
- In each scenario, you will be presented with **3 options**. Each option offers a different combination of outcomes for the coastal features. The combinations are different according to the size, amount or presence of each feature offered in 10 years time. They also differ according to the management cost. The increased cost to you is presented as an annual figure to be paid for a period of 10 years.
- In each scenario, you will be asked to choose the option that is most appealing to you. You need to be **mindful of your own financial circumstances**, i.e. consider the limit of how much you can realistically afford given your current household income and personal expenses.
- We will be surveying a large number of people to work out the values held across the WA community.

The findings that emerge from this study may be used to inform future investment decisions for managing the impact of coastal hazards at Cottesloe Beach.

Here is an example of the type of question you will have to answer.

When answering the management scenarios, don't forget to:

- Consider each option (looking down each column)
- Keep in mind what you can afford when weighing up the cost of each option
- Choose your most preferred option based on the assumption that these are the only options available to you
- Treat each management scenario independently. You don't need to remember or anticipate the choices you make across the series of scenarios.

You can make your selection by clicking on the box containing the option.

Once you have selected it the box will turn green. You should only select one.

In the example below, the respondent has decided that they are prepared to pay $50 a year for the [redacted] to ensure greater protection of the Foreshore reserve and retail, dining and club facilities, even though the area of Sandy beach will be reduced further.

Management scenario EX: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time.	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 Sandy beach	25%	25%	50%	100%
 Foreshore reserve	100%	75%	50%	100%
 Natural reserve	25%	25%	25%	100%
 Beach access	Average	Poor	Average	Good
 Retail, dining & club facilities	Present	Absent	Absent	Present
Cost to you each year, for 10 years	$50	$400	$0	

Now we would like you to answer 5 of these questions

Commented [Advice27]: Replace this with the relevant instructions as to how respondents need to select an answer (different survey software programs will have different ways in which this is done).

Commented [Advice28]: Revise this text to match with the example you provide below.

Commented [Advice29]: Replace with an example image of your formatted choice scenarios.
Do not use an actual question from the experimental design – change the attribute levels in the options so that it is not the same as the questions respondents have to answer.
Have one of the options selected in the image so that it is clear to respondents as to how they should select an answer to the question.

Commented [Advice30]: REPLACE THE IMAGES OF THE 5 CHOICE SCENARIOS WITH YOUR OWN.

Construct your choice scenarios from the experimental design as instructed in Templates 2 and 3.

There will be 5 different versions of this section of the survey: one for each block of 5 choice scenario questions.

For an online survey, you will be able to manage this within the one survey: you can program all five versions of the choice blocks in, and specify survey flow instructions to randomly assign respondents to one of the blocks.
For a paper-based survey, you will need to have five different printed versions of the survey

Management scenario 1: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 **Sandy beach**	50%	50%	50%	100%
 **Foreshore reserve**	25%	75%	50%	100%
 **Natural reserve**	50%	25%	25%	100%
 **Beach access**	Average	Good	Average	Good
 **Retail, dining & club facilities**	Absent	Absent	Absent	Present
Cost to you each year, for 10 years	$400	$50	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice31]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice32]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice33]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice34]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice35]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

Management scenario 2: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 Sandy beach	50%	25%	50%	100%
 Foreshore reserve	75%	25%	50%	100%
 Natural reserve	25%	75%	25%	100%
 Beach access	Good	Average	Average	Good
 Retail, dining & club facilities	Present	Absent	Absent	Present
Cost to you each year, for 10 years	$100	$100	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice36]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice37]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice38]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice39]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice40]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

Management scenario 3: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 **Sandy beach**	25%	75%	50%	100%
 **Foreshore reserve**	25%	50%	50%	100%
 **Natural reserve**	25%	50%	25%	100%
 **Beach access**	Average	Good	Average	Good
 **Retail, dining & club facilities**	Present	Present	Absent	Present
Cost to you each year, for 10 years	$50	$100	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice41]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice42]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice43]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice44]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice45]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

Management scenario 4: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 Sandy beach	100%	25%	50%	100%
 Foreshore reserve	100%	75%	50%	100%
 Natural reserve	75%	100%	25%	100%
 Beach access	Good	Average	Average	Good
 Retail, dining & club facilities	Present	Present	Absent	Present
Cost to you each year, for 10 years	$100	$200	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice46]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice47]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice48]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice49]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice50]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

Management scenario 5: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment:
 **Sandy beach**	100%	25%	50%	100%
 **Foreshore reserve**	100%	100%	50%	100%
 **Natural reserve**	50%	25%	25%	100%
 **Beach access**	Good	Average	Average	Good
 **Retail, dining & club facilities**	Absent	Present	Absent	Present
Cost to you each year, for 10 years	$400	$100	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Foreshore reserve

Natural reserve

Beach access

Retail, dining & club facilities

Commented [Advice51]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. At the moment there is 30,000m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice52]: HOVER BOX: This is the land reserve adjacent to the sandy beach that is available for recreational use. At the moment there is 12,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice53]: HOVER BOX: This is the area of natural reserves next to the coast, including marine ecosystems in the water near the shore and native dune vegetation. At the moment there is 20,000 m^2. In 10 years, different management actions could mean there is between 25% and 100% left.

Commented [Advice54]: HOVER BOX: This includes the provision of pathways, stairs and ramps that service the beach. In 10 years, different management actions could mean a change in access. `Poor' means only one access point along the beach, 'Average' means access points every 200m, 'Good' means current levels of access every 50m.

Commented [Advice55]: HOVER BOX: This includes the provision of retail, food outlets and other public services along the foreshore reserve. At the moment, there are cafes, restaurants and surf club facilities. In 10 years, different management actions could mean that these facilities are either present or absent.

[Question answered if respondent always selected Option 3]

Q3.SQ) You selected Option 3 (the situation in 10 years time with no management change) for ALL 5 management scenarios.

Please provide your reason why, choosing from the list below:

- I preferred this option to all others
- I could not afford the other options
- I believe funding to manage the impacts of coastal hazards should come from somewhere other than my own pocket
- I believe funding to manage the impacts of coastal hazards should be collected by some other means than a State Fund
- I don't trust that the funds would be used to manage the impacts of coastal hazards at Cottesloe Beach
- I don't believe that there will be impacts from coastal hazards (i.e. erosion and/or inundation) during this time period
- I don't believe I should have to make these choices
- Other (please specify): .....

PART 3 continued

You are now more than 80% of the way through the survey.

There are 9 follow-up questions about the management scenarios and survey in general.

Q3.1) In each management scenario, was the amount of the extra payment required for the different options (i.e. the 'cost to you each year, for 10 years') important to you when making your choices?

- Yes
- No

Q3.2) Thinking about the coastal features described in the scenarios, could you rank which were the most important when making your choices?

Rank 1 as most important, 5 as least important.

If you did not care whether the amount of the feature(s) increased/decreased/stayed the same, do not rank the feature.

Coastal Feature:	**Rank:**
Sandy beach	
Foreshore reserve	
Natural reserve	
Beach access	
Retail, dining & club facilities	

Q3.3) Did you think about your household budget, and how much you could afford, while making your choices for the scenarios?

- Yes
- No

Q3.4) Did you find the scenarios confusing or particularly difficult to answer?

- Yes
- No

Q3.5) Please indicate on the following scale how certain you were of the answers you gave in the scenarios:

Very uncertain									Very certain
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Q3.6) What did you think about the information that was provided to describe the coastal features of Cottesloe Beach?

- ○ I thought it was an informative and accurate description
- ○ I would have liked more information
- ○ I thought the descriptions were inaccurate
- ○ I thought there was too much information
- ○ I though the information was confusing

Q3.7) How useful do you think the results of this study would be to inform future investment decisions about the coastal features at Cottesloe Beach:

Not very useful									Very useful
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Q3.8) How likely do you think it is that the results of this study will be used by decision makers to inform future investment decisions about the coastal features at Cottesloe Beach:

Very unlikely									Very likely
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Q3.9) Do you have any other comments about the coastal features described for Cottesloe Beach that you would like to add?

Y*ou may skip this question if you prefer*

_____
_____
_____
_____

PART 4 – Questions about you

You are almost at the end of the survey.

These final questions are to make sure that the group of people that respond to this survey are representative of the general community.

Rest assured that your individual responses will remain confidential and we will only use the collected data in aggregate form.

Q4.1) Which Local Government Area do you live in?

- Armadale, City of
- Bassendean, Town of
- Bayswater, City of
- Belmont, City of
- Cambridge, Town of
- Canning, City of
- Claremont, Town of
- Cockburn, City of
- Cottesloe, Town of [*Answer Q4.1a*]
- East Fremantle, Town of
- Fremantle, City of
- Gosnells, City of
- Joondalup, City of
- Kalamunda, Shire of
- Kwinana, Town of
- Melville, City of
- Mosman Park, Town of
- Mundaring, Shire of
- Nedlands, City of
- Peppermint Grove, Shire of
- Perth, City of
- Serpentine-Jarrahdale, Shire of
- South Perth, City of
- Stirling, City of
- Subiaco, City of
- Swan, City of
- Victoria Park, Town of
- Vincent, City of
- Wanneroo, City of
- Regional local government area
- Not listed / Unsure

Q4.1a) Do you live within —what you would consider to be— a reasonable walking distance of Cottesloe Beach?

- Yes
- No

Q4.2) What are the streets that form the nearest intersection to where you live?

E.g. Stirling Highway *and* Bruce Street

We don't want to know your exact address, but we would like to identify roughly how far it is between your house and Cottesloe Beach.

_____ *and* _____

Commented [Advice56]: This question redirect should be moved to the appropriate LGA corresponding to the beach location.

Commented [Advice57]: This question is currently designed for a sample of the Perth Metropolitan community.

For a State-wide sample, the individual regional LGAs will need to be listed as well.

If the beach location is a regional one, you might prefer to list the LGAs for that particular region, and then have generic options for 'Perth metropolitan local government area' and for 'other regional local government area'.

Commented [Advice58]: The regional LGAs are as follows:

City of Albany, Shire of Ashburton, Shire of Augusta-Margaret River, Shire of Beverley, Shire of Boddington, Shire of Boyup Brook, Shire of Bridgetown-Greenbushes, Shire of Brookton, Shire of Broome, Shire of Broomehill-Tambellup, Shire of Bruce Rock, City of Bunbury, City of Busselton, Shire of Capel, Shire of Carnamah, Shire of Carnarvon, Shire of Chapman Valley, Shire of Chittering, Shire of Christmas Island, Shire of Cocos, Shire of Collie, Shire of Coolgardie, Shire of Coorow, Shire of Corrigin, Shire of Cranbrook, Shire of Cuballing, Shire of Cue, Shire of Cunderdin, Shire of Dalwallinu, Shire of Dandaragan, Shire of Dardanup, Shire of Denmark, Shire of Derby-West Kimberley, Shire of Donnybrook-Balingup, Shire of Dowerin, Shire of Dumbleyung, Shire of Dundas, Shire of East Pilbara, Shire of Esperance, Shire of Exmouth, Shire of Gingin, Shire of Gnowangerup, Shire of Goomalling, City of Greater Geraldton, Shire of Halls Creek, Shire of Harvey, Shire of Irwin, Shire of Jerramungup, City of Kalgoorlie-Boulder, City of Karratha, Shire of Katanning, Shire of Kellerberrin, Shire of Kent, Shire of Kojonup, Shire of Kondinin, Shire of Koorda, Shire of Kulin, Shire of Lake Grace, Shire of Laverton, Shire of Leonora, City of Mandurah, Shire of Manjimup, Shire of Meekatharra, Shire of Menzies, Shire of Merredin, Shire of Mingenew, Shire of Moora, Shire of Morowa, Shire of Mount Magnet, Shire of Mount Marshall, Shire of Mukinbudin, Shire of Murchison, Shire of Murray, Shire of Nannup, Shire of Narembeen, Shire of Narrogin, Shire of Ngaanyatiarraku, Shire of Northam, Shire of Nungarin, Shire of Perenjori, Shire of Pingelly, Shire of Plantagenet, Town of Port Hedland, Shire of Quairading, Shire of Ravensthorpe, Shire of Sandstone, Shire of Serpentine-Jarrahdale, Shire of Shark Bay, Shire of Tammin, Shire of Three Springs, Shire of Toodyay, Shire of Trayning, Shire of Upper Gascoyne, Shire of Victoria Plains, Shire of Wagin, Shire of Wandering, Shire of Waroona, Shire of West Arthur, Shire of Westonia, Shire of Wickepin, Shire of Williams, Shire of Wiluna, Shire of Wongan-Ballidu, Shire of Woodanilling, Shire of Wyalkatchem, Shire of Wyndham East Kimberley, Shire of Yalgoo, Shire of Yilgarn, Shire of York.

Q4.3) Do you have a view of the ocean or coastal dunes (of any part of the coast, not just Cottesloe) from your usual place of residence and/or employment?

- Yes
- No

Q4.4) Do you belong to any conservation groups?

- Yes – coastal conservation groups; list if you would like to:_____
- Yes – other environmental conservation groups; list if you would like to: _____
- No

Q4.5) Do you belong to any recreational groups associated with the coast? *Select all relevant options*

Commented [Advice59]: Add any other recreational groups that are relevant to your coastal location to the list of options.

- Surf lifesaving club
- Swimming club
- Sailing club
- Recreational fishing club
- Diving club
- Beach fitness/exercise club
- Other (please specify): .....
- None of these groups

Q4.6) Are you employed or do you volunteer in any of the following fields?

- Coastal management/research/consulting
- Government agencies tasked with coastal responsibilities
- Tourism venture specifically associated with the coast
- Hospitality in a business specifically associated with, or located on, the coast
- Boating industry
- Fishing industry
- Other field associated with the coast (please specify): .....
- None of these fields

Q4.7) Which of the following household descriptions best fits you?

- Single without children
- Single with children – at least some of the children are still dependent
- Single with children – with all children having left home
- Couple without children
- Couple with children – at least some of the children are still dependent
- Couple with children – with all children having left home
- Other (please specify): .....

Q4.8) What is your highest level of education?

- Schooling up to Year 10
- Schooling up to Year 12
- Trade or technical certificate
- University degree (Bachelor, Master, PhD)

Q4.9) What is your gross annual income (i.e. before tax)? *Please provide your shared household income if you have joint management of household finances: otherwise provide your personal income.*

- Under $13,000 (under $250/week)
- $13,000-$25,999 ($250-$500/week)
- $26,000 - $41,599 ($500-$800/week)
- $41,600 - $62,399 ($800-$1200/week)
- $62,400 - $88,399 ($1200-$1700/week)
- $88,400 - $129,999 ($1700-$2500/week)
- $130,000 - $181,999 ($2500-$3500/week)
- $182,000 and over ($3000+/week)
- I would rather not say

Q4.10) If you have any further comments, please note them in the box below:

Thank you for completing this survey – your time is greatly appreciated!

Template 2: DCE experimental design

This template provides the formatted choice scenarios that can be re-populated with the levels you are using to define your attributes.

- The scenarios are arranged in the 5 blocks of 5 choice scenarios[1].

- The attribute levels for Cost, Beach access, and Recreational, dining & club facilities have already been entered into the scenarios.

- The attribute levels for Sandy beach, Foreshore reserve and Natural reserve that currently appear in the template relate to those used in the pilot study.

  These will require updating according to the levels you are using.

  You can use the table below as a reference point to match your corresponding levels for updating the information in the choice scenario template:

Template level	**Your level**
Sandy beach (Sb)	
25%	
50%	
75%	
100%	
Foreshore reserve (Fr)	
25%	
50%	
75%	
100%	
Natural reserve (Nr)	
25%	
50%	
75%	
100%	

[1] Note that these identification numbers (e.g. Block 1, Scenario 1) are different to the 'choice situation' numbers shown in the design matrix reported in Appendix 4 (Table A4.1) as the scenarios have been rearranged in the correct order for application in a survey (in this case Block1, Scenario 1 is choice situation 5).

Block 1

Block 1, Scenario 1

	alt1	alt2
cost	$400	$50
sb	50	50
fr	25	75
nr	50	25
ba	Average	Good
fac	Absent	Absent

Block 1, Scenario 2

	alt1	alt2
cost	$100	$100
sb	50	25
fr	75	25
nr	25	75
ba	Good	Average
fac	Present	Absent

Block 1, Scenario 3

	alt1	alt2
cost	$50	$100
sb	25	75
fr	25	50
nr	25	50
ba	Average	Good
fac	Present	Present

Block 1, Scenario 4

	alt1	alt2
cost	$100	$200
sb	100	25
fr	100	75
nr	75	100
ba	Good	Average
fac	Present	Present

Block 1, Scenario 5

	alt1	alt2
cost	$400	$100
sb	100	25
fr	100	100
nr	50	25
ba	Average	Average
fac	Present	Present

Block 2

Block 2, Scenario 1

	alt1	alt2
cost	$100	$50
sb	50	75
fr	25	75
nr	100	50
ba	Average	Average
fac	Present	Present

Block 2, Scenario 2

	alt1	alt2
cost	$50	$200
sb	25	50
fr	50	75
nr	100	100
ba	Poor	Average
fac	Absent	Present

Block 2, Scenario 3

	alt1	alt2
cost	$200	$50
sb	75	25
fr	50	25
nr	25	50
ba	Average	Average
fac	Present	Present

Block 2, Scenario 4

	alt1	alt2
cost	$200	$100
sb	25	75
fr	50	75
nr	50	25
ba	Good	Poor
fac	Present	Present

Block 2, Scenario 5

	alt1	alt2
cost	$200	$400
sb	50	25
fr	75	50
nr	50	100
ba	Good	Average
fac	Present	Absent

Block 3

Block 3, Scenario 1

	alt1	alt2
cost	$50	$100
sb	50	75
fr	25	75
nr	100	50
ba	Poor	Average
fac	Absent	Absent

Block 3, Scenario 2

	alt1	alt2
cost	$50	$100
sb	25	50
fr	50	25
nr	25	50
ba	Good	Average
fac	Present	Present

Block 3, Scenario 3

	alt1	alt2
cost	$50	$200
sb	50	75
fr	75	50
nr	75	50
ba	Average	Good
fac	Absent	Present

Block 3, Scenario 4

	alt1	alt2
cost	$50	$50
sb	75	25
fr	50	50
nr	100	50
ba	Poor	Good
fac	Present	Present

Block 3, Scenario 5

	alt1	alt2
cost	$100	$400
sb	75	50
fr	25	50
nr	25	50
ba	Average	Average
fac	Present	Absent

Block 4

Block 4, Scenario 1

	alt1	alt2
cost	$400	$100
sb	75	50
fr	75	25
nr	25	50
ba	Good	Good
fac	Present	Present

Block 4, Scenario 2

	alt1	alt2
cost	$100	$50
sb	75	25
fr	25	50
nr	25	100
ba	Average	Average
fac	Present	Absent

Block 4, Scenario 3

	alt1	alt2
cost	$400	$100
sb	75	75
fr	50	25
nr	50	25
ba	Good	Average
fac	Present	Present

Block 4, Scenario 4

	alt1	alt2
cost	$200	$200
sb	75	25
fr	100	50
nr	75	100
ba	Good	Average
fac	Absent	Absent

Block 4, Scenario 5

	alt1	alt2
cost	$100	$400
sb	100	50
fr	25	100
nr	25	25
ba	Average	Good
fac	Present	Present

Block 5

Block 5, Scenario 1

	alt1	alt2
cost	$50	$50
sb	25	50
fr	25	75
nr	25	50
ba	Good	Good
fac	Present	Absent

Block 5, Scenario 2

	alt1	alt2
cost	$400	$50
sb	75	50
fr	50	100
nr	75	50
ba	Average	Poor
fac	Present	Present

Block 5, Scenario 3

	alt1	alt2
cost	$100	$50
sb	75	25
fr	50	75
nr	100	75
ba	Good	Average
fac	Absent	Present

Block 5, Scenario 4

	alt1	alt2
cost	$50	$200
sb	75	50
fr	100	25
nr	50	75
ba	Poor	Good
fac	Present	Absent

Block 5, Scenario 5

	alt1	alt2
cost	$200	$400
sb	25	25
fr	75	100
nr	25	25
ba	Average	Poor
fac	Present	Present

TEMPLATE 3: DCE CHOICE SCENARIOS

This template provides an example of how you can present the choice scenarios that you have generated from "Template 2: DCE experimental design".

Step 1: In the image on the next slide, replace the images, edit the text describing the payment and hazard impact timeframes, and the levels shown for the status quo (Option 3) and current situation ('What you get now')replace the images as appropriate.

Step 2: Replicate the slide to make 25 copies.

- **You will need 25 choice scenarios plus 1 extra for your example scenario question**.
- Note that the photo images and the text box at the top are not grouped with the table so you must copy & paste the entire slide each time, not just the scenario image.

Step 3: copy across your levels from Template 2 into Options 1 and 2 for each of the choice scenarios.

Step 4: Use your mouse to drag and select all components on each slides, then use the Format tab to Group, and save each scenario as an image.

- This can be inserted into an online software program, and a 'hotspot' function can be used where respondents click on an option to select it, or radio buttons can be provided below the image asking respondents if they would select 'Option 1', 'Option 2', or 'Option 3'.
- If you are using a paper-based version, you may wish to add an extra row to the bottom of the table image, stating "Which of these options would you choose?" with a selection box provided at the bottom of the 3 options.

Management scenario 1: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years time:	**Option 1**	**Option 2**	**Option 3** Situation in 10 years time with no management change	What you get at the moment:
 **Sandy beach**	50%	50%	50%	100%
 **Foreshore reserve**	25%	75%	50%	100%
 **Natural reserve**	50%	25%	25%	100%
 **Beach access**	Average	Good	Average	Good
 **Retail, dining & club facilities**	Absent	Absent	Absent	Present
Cost to you each year, for 10 years	$400	$50	$0	

Template 4: TC-only survey instrument

Welcome to the Cottesloe Beach survey

We would like to start with a few questions about yourself:

S1) What is your gender?

- Male
- Female
- Non-binary/other

S2) Which age group applies to you?

- Under 18 years
- 18-30 years
- 31-45 years
- 46-60 years
- 61-75 years
- Over 75

S3) Where do you live?

- [*insert name of LGA here if targeting a local sample, otherwise delete this option*]
- Perth metropolitan area
- Regional Western Australia
- Other part of Australia
- International visitor

Commented [Advice1]:
Legend for annotation throughout template

Comments in normal black text provide general advice or instructions.

BOLD RED TEXT indicates flow logic of the survey (i.e. skipping questions etc.) These instructions should remain in place for a paper-based version of the survey, but can be removed for an online version where the survey programming should make the flow logic automatic.

YELLOW HIGHLIGHTED TEXT indicates wording in the survey template that must be changed for each application of the survey to a new location.

BLUE HIGHLIGHTED TEXT indicates wording in the survey template that could optionally be changed depending on who your target sample is (a local, Perth metropolitan or State-wide community).

PINK HIGHLIGHTED TEXT indicates wording that could be changed with respect to seasonal variations.

LIGHT GREEN HIGHLIGHT TEXT indicates wording that could be changed regarding the geographic area that you think is relevant with respect to providing substitute sites.

Commented [Advice2]: Adapt this question to screen out respondents who are not part of the target sample.

Preferences for visiting Cottesloe Beach

Dear Sir/Madam,

Thank you for reading this introduction screen which outlines a research project being conducted by [*insert relevant affiliations for the study here*].

This survey aims to understand your preferences for visiting [*Insert beach name* here].

You have been selected at random from the Western Australian population to participate in this research.

Your opinion is important – we will be surveying a large number of people to obtain a representative view of the community.

Participation involves completing a survey that will take approximately 5 to 10 minutes of your time. Your involvement is voluntary, and you may withdraw from the survey at any time. You must be at least 18 years of age to participate.

If you consent to participate in this study, please complete the survey that follows. If you have any questions feel free to contact me on the details below.

You can download a copy of this information sheet here.

Kind regards,

INSERT CONTACT DETAILS

Approval to conduct this research has been provided by …. [Insert any relevant ethics approval information here if relevant, otherwise delete].

Commented [Advice3]: If there is a reward/incentive being offered for completing this survey you should mention it before everything else: either here, or before the screening questions on page 1 if appropriate. Make it prominent.

If using an online research panel, the panel company will manage the incentives for you.

If managing the incentive yourself, you will need to consider how you collect contact information ethically (e.g. request email address at the end of the survey, but store that information separately to the rest of your anonymous data set).

Commented [Advice4]: For online survey: provide a pdf equivalent of this first page of the survey for respondents to download.

For paper-based survey: provide this first page of the survey as a handout that respondents can keep, and delete this text.

What this survey is about

This survey aims to understand how people use [*Insert name of beach here*].

The survey has 2 main parts:

PART 1: Some questions about your experiences with Cottesloe Beach.

PART 2: Some questions about you, to make sure the group of people that respond to this survey are representative of the broader community.

PART 1 - Your experiences with Cottesloe Beach

Cottesloe Beach includes the stretch of sandy beach and associated foreshore areas starting at the groyne at the southern end of the main beach and spanning 1.5km up towards North Street.

Commented [Advice5]: Define the boundaries of the specific coastal location here.

Commented [Advice6]: Replace image with relevant map of coastal location.

The following questions relate to your experience with Cottesloe Beach.

Q1.1) Have you visited Cottesloe Beach in the last year?

- Yes [*answer the questions below*]
- No [*skip to Q1.11 on page 8*]

Q1.2) Thinking about a typical trip to Cottesloe Beach first in the hotter months, and then in the colder months, what activities do you usually undertake?

Select all that apply

	Hot months (Nov-April)	Cold months (May-Oct)
Swimming		
Snorkelling		
Scuba diving		
Surfing		
Windsurfing		
Kitesurfing		
Stand up paddle boarding		
Kayaking		
Water skiing		
Jet skiing		
Sailing		
Boating (private motorised vessel)		
Boating (chartered/hired motorised vessel)		
Fishing – shore based		
Fishing – boat based		
Four wheel driving		
Off-road biking		
Walking		
Running		
Dog walking		
Sandboarding		
Relaxing		
Socialising with friends or family		
Picnicking or barbecuing		
Visiting playgrounds		
Visiting Aboriginal heritage sites		
Visiting European heritage sites		
Watching wildlife		

Commented [Advice7]: Update list of activities to suit beach location: the list below is inclusive, but you may need to add unique activities specific to the location, or delete those that are not relevant.

Commented [Advice8]: Define the hot & cold seasons as appropriate.

Beach combing – e.g. shell collecting		
Replanting native plants & removing weeds		
Dining at restaurants, cafes, kiosks, pubs etc.		
Attending events – e.g. concerts, sporting, arts events		
Other activity 1 (specify)		
Other activity 2 (specify)		

Q1.3) How often on average would you visit Cottesloe Beach per month during the hotter months (November to April)?

- Nearly every day (5-7 times a week)
- A few times a week (2-4 times a week)
- About once a week
- About once a fortnight
- About once a month
- Less than once a month
- Never

Q1.4) How often on average would you visit Cottesloe Beach per month during the colder months (May to October)?

- Nearly every day (5-7 times a week)
- A few times a week (2-4 times a week)
- About once a week
- About once a fortnight
- About once a month
- Less than once a month
- Never

Q1.5) How many people usually come with you to the beach?

_____ adults _____ children

Q1.6) Thinking about a typical trip to Cottesloe Beach, please identify the distance you travel, and the time you take in the table below (one-way).

If a single trip involves more than one mode of transport (e.g. bus, followed by walking) please indicate distance and time for BOTH means of transport for a single trip.

For reference: Perth City to Cottesloe Beach = 12km

Commented [Advice9]: Use a well-known city/town/landmark familiar to your target sample and provide the distance from that to your beach location to use as an anchor point for determining distance travelled.

	Distance (km)	Time (minutes)
Walk		
Bicycle		
Motorcycle		
Small car		
Large car, ute, 4WD, small truck		
Bus [*answer Q1.7 below*]		
Train [*answer Q1.7 below*]		
Other (please specify)		

Q1.7) If you take the bus or train as part of the trip, how much do you typically pay:

One way? $_____

or

Round trip $_____

Q1.8) On a typical trip to Cottesloe Beach, do you normally combine the trip with other activities unrelated to the beach (e.g. visiting the beach while going to/from work)?

- ○ No – visiting Cottesloe Beach is typically the only stop I make on the trip
- ○ Yes – I typically make multiple stops when I visit Cottesloe Beach

Q1.9) What do you think about the public transport services available to access Cottesloe Beach?

Insufficient public transport				Sufficient public transport
1	2	3	4	5
○	○	○	○	○

Q1.10) What do you think about the availability of parking at Cottesloe Beach?

Insufficient parking available				Sufficient parking available
1	2	3	4	5
○	○	○	○	○

Q1.11) Aside from Cottesloe Beach, there are other places that you could visit around the Perth metropolitan region to enjoy outdoor recreation activities, including other beaches, lakes, wetlands, rivers or parks.

When you want to do outdoor recreation activities, do you usually visit Cottesloe Beach or one of these other areas?

- ○ Use Cottesloe Beach most of the time [*skip to Q1.12 on page 10*]
- ○ Use other locations most of the time [*answer questions Q1.11a, Q1.11b (if relevant) and Q1.11c below*]
- ○ I usually don't visit any outdoor recreation areas in the Perth metropolitan region [*skip to Q1.12 on page 10*]

Q1.11a) If you prefer other locations, what is the main reason?

- ○ Closer to where you live than Cottesloe Beach
- ○ Better suited to the type of outdoor activity than Cottesloe Beach **[***Answer Q1.11b below***]**
- ○ Better accessibility than Cottesloe Beach (e.g. car parking, boat ramps, walkways and stairs)
- ○ Better facilities/amenities than Cottesloe Beach (e.g. bbq's, playground equipment, toilets)
- ○ There are fewer people using it than Cottesloe Beach
- ○ Nicer environment than Cottesloe Beach (e.g. cleaner, more natural)
- ○ Safer environment than Cottesloe Beach (e.g. calmer water, more sheltered, more secure)
- ○ Other (please specify): .....

Q1.11b) Which types of outdoor recreation activities do you prefer to do at other sites rather than at Cottesloe Beach?

Select all that apply

○ Swimming	○ Walking
○ Snorkelling	○ Running
○ Scuba diving	○ Dog walking
○ Surfing	○ Sandboarding
○ Windsurfing	○ Relaxing
○ Kitesurfing	○ Socialising with friends or family
○ Stand up paddle boarding	○ Picnicking or barbecuing
○ Kayaking	○ Visiting playgrounds
○ Water skiing	○ Visiting Aboriginal heritage sites
○ Jet skiing	○ Visiting European heritage sites
○ Sailing	○ Watching wildlife
○ Boating (private motorised vessel)	○ Beach combing – e.g. shell collecting
○ Boating (chartered/hired motorised vessel)	○ Replanting native plants & removing weeds
○ Fishing – shore based	○ Dining at restaurants, cafes, kiosks, pubs etc.
○ Fishing – boat based	○ Attending events – e.g. concerts, sporting, arts events
○ Four wheel driving	
○ Off-road biking	
○ Other (specify): ……	

Q1.11c) Of the other outdoor recreation areas that you prefer relative to Cottesloe Beach, what are the main ones?

Please list

……

……

……

……

Commented [Advice10]: Update list of activities to suit beach location, as for Q1.2

Q1.12) State how much you agree that it is important to protect, manage, and maintain Cottesloe Beach in its current state for the following reasons (*tick the relevant boxes in the table below*):

It is important to maintain Cottesloe Beach in its current state:	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
For my own recreational use					
For other people's recreational use					
For the option that I can use it for recreation at some time in the future					
For future generations to use for recreation					
For people to be able to live nearby					
For environmental health, including flora and fauna habitat					
For cultural significance, including Aboriginal and European heritage					
For commercial use					
For tourism					

Q1.13) Do you have any other comments you would like to add about how you use Cottesloe Beach or other beaches in the Perth metropolitan region, or why you think these beaches are important?

(*you may skip this question if you prefer)*

_____

_____

_____

_____

_____

PART 2 – Questions about you

You are almost at the end of the survey.

These final questions are to make sure that the group of people that respond to this survey are representative of the general community.

Rest assured that your individual responses will remain confidential and we will only use the collected data in aggregate form.

Q2.1) Which Local Government Area do you live in?

- Armadale, City of
- Bassendean, Town of
- Bayswater, City of
- Belmont, City of
- Cambridge, Town of
- Canning, City of
- Claremont, Town of
- Cockburn, City of
- Cottesloe, Town of [*Answer Q2.1a*]
- East Fremantle, Town of
- Fremantle, City of
- Gosnells, City of
- Joondalup, City of
- Kalamunda, Shire of
- Kwinana, Town of
- Melville, City of
- Mosman Park, Town of
- Mundaring, Shire of
- Nedlands, City of
- Peppermint Grove, Shire of
- Perth, City of
- Serpentine-Jarrahdale, Shire of
- South Perth, City of
- Stirling, City of
- Subiaco, City of
- Swan, City of
- Victoria Park, Town of
- Vincent, City of
- Wanneroo, City of
- Regional local government area
- Not listed / Unsure

Q2.1a) Do you live within —what you would consider to be— a reasonable walking distance of Cottesloe Beach?

- Yes
- No

Q2.2) What are the streets that form the nearest intersection to where you live?

E.g. Stirling Highway *and* Bruce Street

We don't want to know your exact address, but we would like to identify roughly how far it is between your house and Cottesloe Beach.

_____ *and* _____

Commented [Advice11]: This question redirect should be moved to the appropriate LGA corresponding to the beach location.

Commented [Advice12]: This question is currently designed for a sample of the Perth Metropolitan community.

For a State-wide sample, the individual regional LGAs will need to be listed as well.

If the beach location is a regional one, you might prefer to list the LGAs for that particular region, and then have generic options for 'Perth metropolitan local government area' and for 'other regional local government area'.

Commented [Advice13]: The regional LGAs are as follows:

City of Albany, Shire of Ashburton, Shire of Augusta-Margaret River, Shire of Beverley, Shire of Boddington, Shire of Boyup Brook, Shire of Bridgetown-Greenbushes, Shire of Brookton, Shire of Broome, Shire of Broomehill-Tambellup, Shire of Bruce Rock, City of Bunbury, City of Busselton, Shire of Capel, Shire of Carnamah, Shire of Carnarvon, Shire of Chapman Valley, Shire of Chittering, Shire of Christmas Island, Shire of Cocos, Shire of Collie, Shire of Coolgardie, Shire of Coorow, Shire of Corrigin, Shire of Cranbrook, Shire of Cuballing, Shire of Cue, Shire of Cunderdin, Shire of Dalwallinu, Shire of Dandaragan, Shire of Dardanup, Shire of Denmark, Shire of Derby-West Kimberley, Shire of Donnybrook-Balingup, Shire of Dowerin, Shire of Dumbleyung, Shire of Dundas, Shire of East Pilbara, Shire of Esperance, Shire of Exmouth, Shire of Gingin, Shire of Gnowangerup, Shire of Goomalling, City of Greater Geraldton, Shire of Halls Creek, Shire of Harvey, Shire of Irwin, Shire of Jerramungup, City of Kalgoorlie-Boulder, City of Karratha, Shire of Katanning, Shire of Kellerberrin, Shire of Kent, Shire of Kojonup, Shire of Kondinin, Shire of Koorda, Shire of Kulin, Shire of Lake Grace, Shire of Laverton, Shire of Leonora, City of Mandurah, Shire of Manjimup, Shire of Meekatharra, Shire of Menzies, Shire of Merredin, Shire of Mingenew, Shire of Moora, Shire of Morowa, Shire of Mount Magnet, Shire of Mount Marshall, Shire of Mukinbudin, Shire of Murchison, Shire of Murray, Shire of Nannup, Shire of Narembeen, Shire of Narrogin, Shire of Ngaanyatiarraku, Shire of Northam, Shire of Nungarin, Shire of Perenjori, Shire of Pingelly, Shire of Plantagenet, Town of Port Hedland, Shire of Quairading, Shire of Ravensthorpe, Shire of Sandstone, Shire of Serpentine-Jarrahdale, Shire of Shark Bay, Shire of Tammin, Shire of Three Springs, Shire of Toodyay, Shire of Trayning, Shire of Upper Gascoyne, Shire of Victoria Plains, Shire of Wagin, Shire of Wandering, Shire of Waroona, Shire of West Arthur, Shire of Westonia, Shire of Wickepin, Shire of Williams, Shire of Wiluna, Shire of Wongan-Ballidu, Shire of Woodanilling, Shire of Wyalkatchem, Shire of Wyndham East Kimberley, Shire of Yalgoo, Shire of Yilgarn, Shire of York.

Q2.3) Do you have a view of the ocean or coastal dunes (of any part of the coast, not just Cottesloe) from your usual place of residence and/or employment?

- Yes
- No

Q2.4) Do you belong to any conservation groups?

- Yes – coastal conservation groups; list if you would like to:_____
- Yes – other environmental conservation groups; list if you would like to: _____
- No

Q2.5) Do you belong to any recreational groups associated with the coast? *Select all relevant options*

Commented [Advice14]: Add any other recreational groups that are relevant to your coastal location to the list of options.

- Surf lifesaving club
- Swimming club
- Sailing club
- Recreational fishing club
- Diving club
- Beach fitness/exercise club
- Other (please specify): .....
- None of these groups

Q2.6) Are you employed or do you volunteer in any of the following fields?

- Coastal management/research/consulting
- Government agencies tasked with coastal responsibilities
- Tourism venture specifically associated with the coast
- Hospitality in a business specifically associated with, or located on, the coast
- Boating industry
- Fishing industry
- Other field associated with the coast (please specify): .....
- None of these fields

Q2.7) Which of the following household descriptions best fits you?

- Single without children
- Single with children – at least some of the children are still dependent
- Single with children – with all children having left home
- Couple without children
- Couple with children – at least some of the children are still dependent
- Couple with children – with all children having left home
- Other (please specify): .....

Q2.8) What is your highest level of education?

- Schooling up to Year 10
- Schooling up to Year 12
- Trade or technical certificate
- University degree (Bachelor, Master, PhD)

Q2.9) What is your gross annual income (i.e. before tax)? *Please provide your shared household income if you have joint management of household finances: otherwise provide your personal income.*

- Under $13,000 (under $250/week)
- $13,000-$25,999 ($250-$500/week)
- $26,000 - $41,599 ($500-$800/week)
- $41,600 - $62,399 ($800-$1200/week)
- $62,400 - $88,399 ($1200-$1700/week)
- $88,400 - $129,999 ($1700-$2500/week)
- $130,000 - $181,999 ($2500-$3500/week)
- $182,000 and over ($3000+/week)
- I would rather not say

Q2.10) If you have any further comments, please note them in the box below:

Thank you for completing this survey – your time is greatly appreciated!

PART B

Testing the application of non-market valuation instruments for measuring community values affected by coastal hazards: Yanchep Beach case study

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Executive summary

This report presents an empirical application of the non-market valuation survey instruments developed in Rogers and Burton (2018). These instruments were developed to enable quantification of community values for coastal assets affected by coastal hazards, and provide a consistent and robust methodology to support the community consultation elements within Coastal Hazard Risk Management and Adaptation Planning (CHRMAP) activities. Specifically, this application tests how readily adaptable the survey templates developed in Rogers and Burton (2018) are to a genuine CHRMAP process for Yanchep Beach in the City of Wanneroo.

A discrete choice experiment and travel cost survey were applied to estimate the values of coastal assets at Yanchep Beach, from a sample of 531 respondents across the Perth Metropolitan area.

The travel cost survey revealed how much people were willing to pay to make a trip to Yanchep Beach in the summer and winter months. Willingness to pay was $5.95 and $3.92 per trip, respectively. These estimates are in line with other travel cost valuations for beach trips in Australia.

The discrete choice experiment was the main focus of the study as this approach enables estimation of community values for a range of coastal assets simultaneously, and a distinction of which aspects of Yanchep Beach are most important to protect from coastal hazards, or to accommodate in adaptation plans.

The coastal assets, or attributes, evaluated in the choice experiment (*with the levels that values were measure for*) were:

- The percentage area of sandy beach protected (*25%-100% of current area*)
- The condition of Yanchep Lagoon (*deteriorated or maintained*)
- The percentage area of the adjacent terrestrial natural reserve (*50%-100% of current area*)
- The distance between beach access points (*poor (450m), average (300m), good (150m)*)
- The presence of retail, dining and club facilities, particularly the surf life saving club and Orion Café (*absent or present*)

In estimating willingness to pay, several models were explored to detect heterogeneity in values. We found that residential location was not a key driver of preferences (i.e. local versus non-local communities valued things similarly), but visitation was important in explaining preferences: individuals who had been to Yanchep Beach within the last 12 months ('visitors') had significantly different preferences than people who had not ('non-visitors') (Table E.1). Visitors highly valued protection of the sandy beach and the Yanchep lagoon, while non-visitors held a broader set of values for attributes on the beach. Only non-visitors who were members of an environmental group had a significant value for protecting the Terrestrial nature reserve.

These results demonstrate that the survey instruments can be successfully applied to a case study location to generate quantitative and statistically significant measures of community value for a set of coastal assets.

Importantly, the survey and experimental design templates that were set out in Rogers and Burton (2018) required minimal alteration to be adapted to Yanchep Beach and the attributes defined above. Their adaptation required mainly technical input (available in-house at City of Wanneroo) to inform which coastal assets were relevant, and what level ranges should be specified for the associated attributes in the choice experiment. As was the intention in developing these materials, this suggests that the instruments can be utilised by decision makers (e.g. local governments)

undertaking CHRMAP processes to the point of collecting data, and subsequently engaging a non-market value practitioner to analyse the data appropriately.

Table E.1. Summary of willingness to pay results from the Yanchep Beach discrete choice experiment.

Willingness to pay (2019AUD/household/year for 10 years)	Visitors[a]	Non-visitors
Sandy beach (per % increase in area)	$3.00	$2.04
Yanchep Lagoon maintained	$253.44	$135.97
Terrestrial nature reserve (per % increase in area)		$5.24[b]
Beach access average		$40.31
Beach access good		$51.81
Facilities present		$42.87

All reported estimates statistically significant at the 95% level of confidence or greater.

[a] For the visitor sample, only the sandy beach and Yanchep lagoon were statistically significant attributes, hence willingness to pay is not reported for other attributes.

[b]For the non-visitor sample, the willingness to pay for the Terrestrial nature reserve is for respondents who were members of conservation groups only; non-members did not have a significant response for protection of the nature reserve.

Contents

1. Background

In recognition of the increasing threat from coastal hazards such as erosion and inundation in Western Australia, the State Government generated a set of guidelines to assist coastal planners and land managers to assess risks to coastal assets. The Coastal Hazard Risk Management and Adaptation Planning (CHRMAP) Guidelines (Western Australian Planning Commission, 2019) set out a process to identify and evaluate risks, and establish suitable adaptation options (Figure 1).

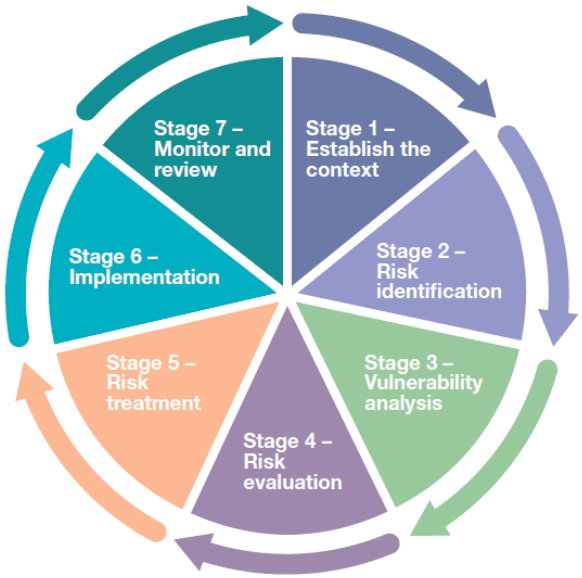

Figure 1. Flowchart outlining the risk management and adaptation process (Source: Western Australian Planning Commission 2019, p.14, Figure 2).

Understanding community values is important for the CHRMAP process. In particular, coastal managers need to understand:

- Which assets are considered important by the community to identify which assets need a risk assessment;
- What tolerance the community has with respect to impacts on assets, either due to hazard events or the adaptation measures used to manage the hazards;
- Which adaptation approach is most appropriate, taking account of the technical feasibility/effectiveness of alternative options, the costs of implementing those options, and the community benefits generated through each option.

Adaptation options follow a management hierarchy of:

1. Avoiding building assets in locations where they can be affected by coastal hazards;
2. Planning a managed retreat, where assets are either relocated, or losses are accepted;
3. Accommodating hazard impacts through careful design of assets;
4. Protecting assets, for example, through engineered structures.

Protection is typically seen as a last resort given the costs associated with constructing and maintaining structures, which include: 'hard' engineering works like groynes, breakwaters, seawalls; 'soft' options such as beach nourishment; and, 'nature-based' or 'hybrid' solutions such as coastal habitat restoration.

However, the benefits of protection or other adaptation options may be substantial, and sufficient to justify the costs. In some cases the benefits may be readily quantified, for example, the profits generated through businesses serving the coastal tourism sector. In many cases, and especially for natural assets, the benefits are likely to be intangible – they will reflect the value to the public generated by protecting a popular beach, an important environmental habitat, or public infrastructure, for example.

These values, referred to as 'non-market values' in economic frameworks, can be quantified through economic approaches enabling them to be compared directly with other financial benefits and costs of adaptation options. Non-market valuation techniques can measure how much an individual is willing to pay for a coastal asset, or for a change in the quality or quantity of that asset. The willingness to pay estimates can be used in economic decision support tools such as benefit-cost analyses that prioritise alternative investment options by establishing which options provide the largest benefits relative to costs, or which actions generate benefits that exceed costs.

Recognising the need to create accessible and consistent methods for understanding community values affected by coastal hazards and the different adaptation approaches, and the opportunity to establish quantitative measures of value that can be utilised in decision support tools, the Department of Planning, Lands & Heritage and the Western Australian Planning Commission contracted The University of Western Australia to develop a non-market valuation instrument for this purpose. Rogers and Burton (2018) provided a set of guidelines and accompanying templates, "Non-market valuation instruments for measuring community values affected by coastal hazards and their management", as a methodology for measuring community values in the CHRMAP process.

Within the survey templates, two non-market valuation approaches are set out:

- A discrete choice experiment: a 'stated preference' approach that estimates how individuals make trade-offs between changes in different characteristics, or attributes, of a non-market good, including a trade-off with the cost of providing this changes.
- A travel cost method: a 'revealed preference' approach where the costs associated with making a trip to visit a site are used to infer how much people are willing to pay for each visit.

The discrete choice experiment is the core methodology, as it can:

- Capture the total economic value of the coastal assets being valued; that is, it can measure both use-related values (e.g. recreation value) and non-use values (e.g. existence value) of an asset.
- Measure values associated with multiple assets in the one survey instrument.
- Measure incremental (marginal) changes in quality or quantity of an asset, which is more commonly the way in which coastal hazards will impact an asset (e.g. gradual erosion or sea level rise, as opposed to immediate and absolute loss of an asset).

The travel cost method was included as an alternative methodology primarily because it is simpler to implement, and therefore may be more accessible for managers who have limited resources for community valuation. This method will provide a lower-bound estimate of economic value for an asset – capturing only values held by those who visit the site for recreation. It will also only measure the value of an asset in its entirety (i.e. presence-absence), and cannot value incremental changes to the asset.

In the development of the methodologies, Rogers and Burton (2018) provided a pilot test of the survey instrument for Cottesloe Beach to demonstrate how the instrument is applied. This pilot test was based on a hypothetical context (i.e. the scenarios evaluated were not embedded as part of a CHRMAP or other decision process) and was not intended to provide results to inform a meaningful decision making context.

The present report provides an empirical application of the survey instrument with the following objectives:

- To test-bed the instruments in the context of a genuine CHRMAP process;
- To illustrate how readily adaptable the survey templates are to different case study locations;
- To estimate non-market values that can be utilised in decision-making for coastal hazard management.

In order to demonstrate these objectives a case study was identified with the City of Wanneroo, who had recently completed their CHRMAP process. The recommendations from the City of Wanneroo CHRMAP included that (Cardno 2018, p.iv):

- They should engage the community to present the results of this CHRMAP and formally assess their willingness to contribute funding.
- A detailed economic assessment should be undertaken to establish the economic value/contribution of natural assets in key vulnerable areas.
- They should undertake a detailed options assessment for management of coastal vulnerability at Yanchep.

Undertaking a non-market valuation study of the value of protecting Yanchep Beach from coastal hazards provides information that can contribute towards addressing each of the above recommendations through community consultation on willingness to pay, estimation of the non-market economic value for protecting the natural assets at Yanchep Beach and provision of quantitative information about community preferences to include in decision making about prioritising adaptation options for Yanchep Beach.

2. Structure of the report

The report consists of five additional sections, focused on the process of implementation of the surveys from the template and the results, plus technical appendices. The following section outlines the methods used, including adaptation of the survey templates from Rogers and Burton (2018) and implementing the survey. Section 4 reports results for the two empirical approaches: discrete choice experiment and travel cost models. Section 5 outlines how the values generated from this study might be used in decision making in the context of Yanchep beach. Section 6 considers whether the values generated may be valid for benefit transfer; that is, how might decision makers in different locations protecting similar assets use the values developed here, without undertaking a new study. Finally, Section 7 provides a summary of how easily the templates provided could be adapted to the Yanchep case study location.

The appendices report a summary of data across the full survey (Appendix A), and a supplementary study (using the same approach) that was conducted in parallel to the main study by a Masters student, for Mindarie Keys beach (Appendix B). A raw transcript of the statistical analysis is provided in Appendix C, and Appendix D provides a copy of the survey instrument after it was adapted from the templates.

3. Methods

3.1 Adaptation of survey templates

The methodology for implementation of the survey followed the steps set out in Rogers and Burton (Section 4: Survey implementation pp18-24, 2018). In order to demonstrate how the non-market valuation tools can be adapted, here we work through each step outlining how specific elements were altered to prepare the survey for Yanchep. We also note that co-author Subroy prepared the templates for use: Subroy is an environmental economist with experience in non-market valuation, but was not involved in the original design of the templates and applied them to Yanchep Beach by following the guidance material, as a means of ensuring the instructions were complete for the purpose of adapting the survey to a new location.

3.1.1 Coastal location

Yanchep Beach, also known as Yanchep lagoon beach, was selected as the coastal location to measure community values in this survey, given the recommendation from the City of Wanneroo CHRMAP process to undertake further assessment of vulnerability options at the location.

The boundaries of Yanchep Beach, as defined in the survey, were arrived at after consultations with officials from the City of Wanneroo. It was decided that Yanchep Beach would include the stretch of sandy beach and associated foreshore areas between Capricorn groyne located to the north of the Yanchep lagoon, down to the headland to the south of the lagoon with Brazier Road as the eastern boundary (Figure 2).

Figure 2. The boundaries of Yanchep Beach defined in the survey.

3.1.2 Target population

Yanchep Beach is popular not only with the local community of the City of Wanneroo where it is located, but also with residents in adjacent Local Government Areas (LGAs) namely the City of Swan, City of Stirling, City of Joondalup, and the shire of Gingin, and also with residents in the broader Perth Metropolitan Area. This is mainly because a distinctive feature of this beach is the Yanchep

lagoon that offers a sheltered area for swimming and snorkelling since waves are usually low in the lagoon. Accordingly, the target population for the survey was:

- The local community in the City of Wanneroo
- Residents in adjacent LGAs (City of Swan/Stirling/Joondalup or Shire of Gingin)
- Residents in the wider Perth Metropolitan Area

3.1.3 Which survey template to use

In Rogers and Burton (2018) a number of templates were developed which can be combined into 2 alternative surveys. As they note:

"The 'DCE+TC survey instrument' (Templates 1, 2 and 3) should be used if you want:

- *To understand how people value coastal assets contingent on the impacts of coastal hazards.*
- *An in-depth understanding of what types of coastal assets people value at the site, and the trade-offs they are prepared to make between different coastal assets.*
- *An estimate of the total economic value for coastal assets (including use and non-use related values).*
- *Incremental, marginal measures of willingness to pay for changes in levels (or changes in the quantity or quality) of coastal assets.*

The 'TC-only survey instrument' (Template 4) should be used if you want:

- *A lower bound estimate of the current dollar value of the site as a whole, that is not contingent on the incremental impacts of coastal hazards.*
- *A focus on use-related recreation value, not a measure of total economic value.*
- *A shorter survey instrument that is quicker and easier to implement.*
- *To use intercept sampling of beach users, as it is more appropriate for this sampling approach due to its shorter length." (p18)*

In this application the 'DCE+TC survey instrument' was selected to enable: a valuation of multiple coastal assets at Yanchep Beach, contingent on the impacts of coastal hazards; an understanding of the trade-offs people are prepared to make between protection of different coastal assets; and a quantitative measure of economic value through estimation of willingness to pay.

3.1.4 Discrete choice experiment and travel cost survey

The 'DCE+TC survey instrument' template was adapted for Yanchep Beach following the steps set out for framing as follows.

Step 1. Location

- The location was modified throughout the template to reflect the location for this survey– Yanchep Beach.

Step 2. Target sample

- The target sample in the template (i.e. the West Australian community) was effectively the same for this survey, and was not modified.

Step 3. Payment Vehicle

- The payment vehicle in the template (i.e. a State Fund) was the same for this survey, and was not modified.

Step 4. *Timeframe for hazard impacts for Yanchep beach*

- After examining the Cardno CHRMAP report (2018), and discussing the same with experts at the City of Wanneroo, the timeframe for significant hazard impacts for Yanchep Beach was determined to be about 50 years, though there is potential for smaller impacts to some coastal assets based on modelling of risks from 2030 onwards. The 50 year timeframe was too far into the future to obtain any meaningful results of values for Yanchep beach held at present by the community (i.e. although people may hold values for the assets, at a 50 year time horizon they may discount those values to such an extent, compared to current expenditure, that the values cannot be accurately identified). Therefore, to identify people's values for Yanchep beach, a shorter timeframe for hazard impacts of 10 years was used. It should be noted that standard accounting principles of discounting costs and benefits that occur across time could be used if it was thought that a specific impact may occur at a different time horizon to that used in the valuation study.

Step 5. *Attribute descriptions*

- See Section 2.1.5 below

Step 6. *Payment timeframe for the cost attribute*

- Since the time horizon for hazard impact was taken to be 10 years, the payment timeframe was accordingly matched for consistency. The payment timeframe for the Yanchep survey was the same as that used in the template (i.e. 10 years).

Step 7. *Choice scenarios*

- See Section 3.1.6 below

3.1.5 Attribute descriptions

The attributes given in the original template — Sandy beach, Foreshore reserve, Natural reserve, Beach access, Retail, dining and club facilities and Cost were updated for the Yanchep survey to reflect their importance in this location.

The majority of the attributes were included according to their broad definitions in the template: *Sandy beach*; *Beach access*; *Retail, dining and club facilities* and *Cost*. Specific details were modified to define the current situation, anticipated status quo in 10 years' time, and the attribute levels for Yanchep beach, as outlined below.

Two changes were made to the attributes included in the Yanchep survey:

1. The *Foreshore reserve* attribute was not included as an attribute in the Yanchep survey. In the template, this attribute was defined as the land reserve adjacent to the sandy beach available for recreational use, including recreational facilities such as change rooms, open grassy areas, shelter, play equipment, barbeques and picnic tables. There were no significant foreshore reserve areas at Yanchep Beach that were expected to be impacted to a great extent in the next 10 to 50 years based on the modelling in the Cardno (2018) report.

In place of the Foreshore reserve the *Yanchep lagoon* was included as an attribute, as it was an important feature of the beach owing to its aesthetic and amenity value as a sheltered spot for swimming and snorkelling, and the associated reef, which made it popular with the Perth community.

2. The *Natural reserve* attribute, defined as including the marine ecosystems in the water near the shore and native dune vegetation in the template, was reduced in scope to reflect only the dune vegetation. This was to avoid double counting of values associated with the key marine habitats (i.e. the reef) that might already be captured through the inclusion of the Yanchep lagoon attribute. To reflect this, the Natural reserve attribute was renamed and described as '*Terrestrial natural reserve*'.

Attribute levels

The levels of the attributes were derived after expert consultation with City of Wanneroo staff, Cardno (2018) report, maps, and other resources. While ranges of attribute levels were based as far as possible on projected estimates of impact to the attributes, we note that they intentionally include upper and lower bound levels that are unlikely, but not implausible. This is to identify people's values at the extremes of what is possible.

- *Sandy beach*
  - Defined as the area of sandy beach available for recreational use at high tide.
  - The current area available was calculated using expert help from the City of Wanneroo, to be approximately 50,000 square metres.
  - Levels for the *Sandy beach* attribute were kept the same as in the template i.e. 25%, 50%, 75% and 100% of current levels.
  - The levels accordingly were:
    - **25% of current area (~12,500 square metres)**
    - **50% of current area (~25,000 square metres)** – the expected area in 10 years' time
    - **75% of current area (~37,500 square metres),** and
    - **100% of current area (~50,000 square metres)** – i.e. there is no change from today

- *Yanchep Lagoon*
  - There were two levels for the *Yanchep lagoon* attribute:
    - **Deteriorated** – where the lagoon deteriorated without management due to coastal inundation – i.e. the expected situation in 10 years' time
    - **Maintained** – where the lagoon was preserved with management action – i.e. there is no change from today

- *Terrestrial natural reserve*
  - Levels for the *Terrestrial natural reserve* attribute were determined keeping in mind the current area of the natural reserve vegetation (43 hectares, calculated by City of Wanneroo), and the estimated losses in the Cardno (2018) report showing up to 80% (9 hectares) could be lost by 2070.
  - Acknowledging the shorter survey timeframe for impact, a 50% loss was selected as the lower bound, with four levels defined for the terrestrial natural reserve attribute:
    - **50% of current area (~22 hectares)**
    - **75% of current area (~32 hectares)** – the expected area in 10 years' time
    - **85% of current area (~36 hectares),** and
    - **100% of current area (~43 hectares)** – i.e. there is no change from today

- *Beach access*
  - Levels for the *Beach access* attribute were kept the same as in the template i.e. poor, average and good, but their specific descriptions were modified for Yanchep Beach to reflect the distance between formal access points (i.e. built pathways, ramps, etc.) along the beach.
  - These levels were described as:
    - **Poor**, with access points every 450m – the expected situation in 10 years' time with no management action
    - **Average**, with access points every 300m – i.e. there is no change from today
    - **Good**, with access points every 150m

- *Retail, dining and club facilities*
  - Defined as including the Yanchep Surf Life Saving Club, the Yanchep Lagoon Beach Café (also called the Orion Café), and carparks and associated infrastructure.
  - Levels for the *Retail, dining and club facilities* attribute were kept the same as in the template i.e. absent and present. They were described as:
    - **Absent**, the Café and carparks deteriorate and are removed – i.e. the expected situation in 10 years' time
    - **Present**, the Café and carparks are maintained and can continue to serve – i.e. there is no change from today

- *Cost*
  - Levels for the *Cost* attribute were the same as in the template. They are: $0, $50, $100, $200, and $400.

3.1.6 Choice scenarios and experimental design

The 'DCE experimental design' (Template 2) and 'DCE choice scenarios' (Template 3) templates were used to construct the choice scenario questions for the Yanchep Beach survey.

The arrangement of attribute levels for *Cost, Sandy beach, Beach access*, and *Recreational, dining & club facilities* were unchanged from that in the experimental design template.

In the experimental design, the *Yanchep Lagoon* attribute was included in place of the *Foreshore reserve* attribute as given in the 'DCE experimental design' template. As noted in section 2.1.5 above, there were only two levels for the Yanchep lagoon attribute–Deteriorated and Maintained. These levels were coded in the experimental design as follows:

- The two lowest levels (i.e. 25% and 50%) of the *Foreshore reserve* attribute in the template were recoded as 'Deteriorated' for the *Yanchep lagoon* attribute for the experimental design for the Yanchep survey.
- The two highest levels (i.e. 75% and 100%) of the *Foreshore reserve* attribute in the template were recoded as 'Maintained' for the *Yanchep lagoon* attribute for the experimental design for the Yanchep survey.

The attribute levels for the *Terrestrial natural reserve* attribute replaced those in the template for the *Natural reserve* attribute. The percentages were different but mapped across as the same number of levels and structure of the attribute was maintained (i.e. the levels of 25%, 50%, 75%, 100% for *natural reserve* became 50%, 75%, 85%, 100% for *Terrestrial natural reserve,* respectively).

While new attributes or altered attributes were included in the Yanchep survey, they were consistent with the bounds of the experimental design template and did not require re-specification of the design.

Template 3 'DCE Choice Scenarios' was used to format the experimental design for the online survey. Photographs of the attributes were sourced to include in the choice scenarios, provided by the City of Wanneroo staff or taken from royalty-free online sources.

3.2 Survey administration

The survey was hosted online using the Qualtrics platform and administered via two modes of elicitation: an online research panel (Dynata), and via the City of Wanneroo community engagement email list. The online panel collected 522 completed responses, with 270 from the City of Wanneroo and neighbouring LGAs, and 252 from the broader Perth Metropolitan region. The remaining sample (31) came through the email list. Dynata provided its panel members with the standard incentives offered by the company for completing a survey; members of the email sample were invited to enter a prize draw for a $500 gift card. Sampling was conducted through May-June 2019.

3.3 Analysis of discrete choice data

Following the steps in Rogers and Burton (Section 5.1: Analysis of discrete choice data pp26-28, 2018), we prepared the data for analysis.

3.3.1 Data management

The guidance material suggests respondents who complete in less than 10 minutes should be removed from the survey, on the basis that they will not have properly considered the materials (i.e. they have just 'clicked-through'). Approximately 77% of the sample answered in over 10 minutes. We have revisited the timeframe for completion on the basis that: recent observation of responses to other like-studies has shown respondents can complete choice experiment surveys in a faster time (unpublished data); online panel respondents may be more likely to complete choice experiments quickly due to familiarity with the format of the task; and, it is possible that respondents in this sample in particular had already completed surveys on coastal hazard management for either Cottesloe or Mindarie, and would therefore already be aware of the background material in the survey and only need to read the location-specific detail, enabling them to complete the task quickly. As a result we excluded any respondent who completed the survey in less than 5 minutes, leaving us with a sample of 531 completed surveys, with 500 of those coming from the online panel (i.e. fast completion only occurred in the online panel).

We then considered protest responses. Protest responses refer to choices made by respondents who are not answering the choice task in the way that was asked. Fundamentally, the expectation is that respondents consider all attributes in the choice scenario and come to a considered choice, trading off attributes against each other, even if they place a value of zero on some attributes. However, it is common for some respondents to not follow this process, but instead use some heuristic. Including the responses from this group in the analysis will distort the estimates of the values held by those who are considering the attributes. Although it is standard practice to remove these individuals from the statistical analysis, identifying those who adopt a heuristic is not straightforward. We focus on those who might be considered to be expressing 'protest' behaviour; that is, those who for some reason object to the framing of the choice questions, and as a result always select the 'status quo' option in all choice sets. A total of 70 respondents selected the status quo option in each of the five choice scenarios they were presented with. But some of these respondents may have genuinely preferred this option, even after considering all attributes. To aid in identification of actual protests a set of follow-up questions was asked of this group. Of these 70

respondents, 26 provided legitimate responses to the follow-up question [*Question Reference*: *Part 3, Q3.3SQ*], stating they preferred this option to all others or could not afford the other options. The remaining 44 respondents selected protest responses to the question and were removed from subsequent analysis of the discrete choice data. It should be noted that this does not mean that these respondents are ignored when making an assessment of population values: they have to be explicitly considered in aggregation of values. This is returned to in section 5 below.

2.3.2 Discrete choice analysis

Data were analysed according to the analytical approach outlined in Rogers and Burton (Section 5.1.2 Discrete choice analysis, pp.26-28, 2018). In addition, in this analysis we consider whether different sub-samples of the population hold different preferences.

4. Results

The sample of 531 respondents had a relatively even spread across gender, representation across all target age categories and a good representation of respondents from the City of Wanneroo, neighbouring LGAs and the broader metropolitan region (Tables 1, 2, 3).

Table 1. Gender distribution

Gender	Number of observations	Percentage (of 531 respondents)
Male	255	48.02
Female	272	51.22
Non-binary/other	4	0.75

Table 2. Age distribution

Age group	Number of observations	Percentage (of 531 respondents)
18-30	73	13.75
31-45	154	29
46-60	140	26.37
61-75	129	24.29
>75	35	6.59

Table 3. Respondent location

Location	Number of observations	Percentage (of 531 respondents)
City of Wanneroo	117	22.03
City of Swan/Joondalup/Stirling OR Shire of Gingin	170	32.02
Perth Metropolitan/Other	244	45.95

4.1 Discrete choice experiment results

As a starting point, a conditional logit model was estimated with all 487 respondents (i.e. the full sample minus the protest responses) and no individual heterogeneity captured (Table 4). This is a simple model that reports 'average' weights of attributes across the sample; that is, it doesn't assume that there are groups of respondents who might have different preferences to one another. The estimated coefficients for the marginal utilities (the attribute weights) are all statistically significant. The cost coefficient is negative, as expected, showing that individuals prefer lower costs. The coefficients for each of the coastal attributes are positive showing that people prefer to see improvements or protection of these assets, discussed further below with respect to the willingness to pay estimates. The alternative specific constant represents the utility associated with the status quo option, over and above the utility associated with the levels of specific attributes that comprise the status quo option. In this case, the coefficient is negative suggesting that individuals generally prefer to see a change away from the predicted status quo.

Table 4. Conditional logit discrete choice model: average preferences.

Variables	Coefficient		Std. Err.	95% Confidence Interval	
Cost	-0.004	***	0.000	-0.005	-0.004
Sandy beach (per % increase in area)	0.013	***	0.001	0.011	0.016
Yanchep Lagoon maintained	0.935	***	0.065	0.808	1.062
Terrestrial nature reserve (per % increase in area)	0.005	**	0.002	0.000	0.009
Beach access average	0.228	**	0.099	0.033	0.423
Beach access good	0.303	***	0.104	0.099	0.508
Facilities present	0.284	***	0.089	0.109	0.459
Alternative specific constant	-0.349	***	0.123	-0.591	-0.107

Notes: number of observations = 2,435; number of respondents = 487; log likelihood = -2255.91
***,** indicates significance at the 99% and 95% level of confidence, respectively.

Table 5. Willingness to pay results from the conditional logit discrete choice model: average preferences.

Willingness to pay (2019AUD/household/year for 10 years)			Std. Err.	95% Confidence Interval	
Sandy beach (per % increase in area)	$2.91	***	0.31	2.30	3.52
Yanchep Lagoon maintained	$207.96	***	19.24	170.24	245.67
Terrestrial nature reserve (per % increase in area)	$1.06	**	0.50	0.08	2.04
Beach access average	$50.70	**	21.67	8.23	93.17
Beach access good	$67.48	***	22.38	23.61	111.35
Facilities present	$63.14	***	19.85	24.22	102.05

***,** indicates significance at the 99% and 95% level of confidence, respectively.

Willingness to pay is estimated from the conditional logit model by taking the negative ratio of a coastal attribute coefficient to that of the cost attribute coefficient. The interpretation of them is the amount that a person would be willing to pay to achieve a one unit improvement in an attribute. A positive value implies they value improvements in the attribute. In the case of a continuous variable (such as beach area) the value is associated with a per unit (i.e. 1 percent) increase. For attributes that are binary categories (e.g. absent/present, or good beach access relative to poor) the value is associated with having the attribute present rather than not. Table 5 reports the willingness to pay estimates from the average preference model. The estimates are reported as 2019 AUD, per household, per year, to be collected for a 10 year payment period.

The magnitudes of some estimates are larger than others because they represent larger marginal changes. For example, respondents were willing to pay $208 to maintain Yanchep Lagoon in its current state and prevent it from deteriorating. They were willing to pay $63 to ensure presence of beach facilities, including the Orion Café and carparks, and prevent them from being removed due to deterioration from hazards.

The willingness to pay estimates for beach access are interpreted relative to the status quo situation of having poor access in 10 years' time, which is equated to having a maintained access point every 450m apart. To improve access to an average condition, equivalent to an access point every 300m, households are willing to pay $51. To improve access to a good condition, equivalent to an access point every 150m, households are willing to pay $67 relative to poor access conditions, or an additional $16 relative to average access. This suggests the largest gain in value is to improve access to a moderate level, but high levels of access are also positively valued.

The willingness to pay values for sandy beach and terrestrial nature reserve are per % increase in area. Sandy beaches are valued almost three times ($3 per % area) as much as nature reserves ($1 per % area). Maintaining the current amount of nature reserve and preventing a loss of 25% (as the predicted status quo in 10 years' time) would equate to a willingness to pay of $26.50 per household. To maintain the current amount of sandy beach and prevent a loss of 50% (as the predicted status quo in 10 years' time) would equate to a willingness to pay of $145.50, meaning protection of this asset is almost as valuable as the maintenance of the lagoon itself.

The results above report a model that does not differentiate across types of people. It is also of interest to consider whether there are groups within the sample who might have different values. Given that the sample has been drawn from across the Perth metropolitan area an obvious question is whether location has an impact on the way one values the assets (e.g. one could hypothesise that those who live locally are willing to pay more to protect the beach assets). To explore this, the data was split into three groups, based on where they live (as identified by the LGA reported).

The three groups were City of Wanneroo (n=108), City of Swan/Joondalup/Stirling or Shire of Gingin (n=156), and the broader Perth Metropolitan area (n=223)

It is then possible to estimate models on each sample separately, and formally test to see if the parameters are the same. The results of this test (reported fully in Appendix C) are that there are no significant differences in parameters ($p=0.3459$) across the three groups, meaning that residential location is not a key driver preferences.

A second possible source of differences in preferences is whether the respondent has reported that they visited the Yanchep beach in the last 12 months. The results of this comparison (also reported in Appendix C) are that there are significant differences in the values held between these two groups ($p<0.001$). We therefore proceed with the analysis splitting the sample into these two groups (visitors n=161, non-visitors n=326).

Within each group there may also be additional differentiation, depending on observed characteristics of the respondents. We find that there are two reported characteristics of the respondent which altered the marginal utility associated with attributes:

- The first was whether they self-reported that "In each management scenario, was the amount of the extra payment required for the different options (i.e. the 'cost to you each year, for 10 years') important to you when making your choices?" One would hypothesise that those who answered "no" (115 respondents out of the non-protest sample of 487) would have a smaller parameter on cost (i.e. the disutility associated with higher costs is less, because it wasn't a key consideration). This is referred to as attendance/non-attendance to cost in the results that follow.

- The second characteristic is whether they are a member of a conservation group (23 out of an estimation sample of 487). One would anticipate that those who have revealed a value

for the environment through membership may also reveal a higher value for the terrestrial nature reserve attribute. This is referred to as being a member/non-member in the results that follow.

Table 6 reports the values for the sample of those who have visited Yanchep Beach in the last 12 months, while Table 7 is for those who had not visited.

Table 6. Conditional logit discrete choice model: visitor sample.

Variables	Coefficient		Std. Err.	95% Confidence Interval	
Cost-attend to cost	-0.003	***	0.001	-0.005	-0.002
Cost - not attend cost	-0.001		0.001	-0.003	0.001
Sandy beach (per % increase in area)	0.010	***	0.002	0.006	0.015
Yanchep Lagoon maintained	0.883	***	0.110	0.668	1.098
Ter. reserve (per % increase in area) member	-0.012		0.012	-0.036	0.011
Ter. reserve: non-member of cons. group	0.004		0.004	-0.004	0.013
Beach access average	0.072		0.162	-0.247	0.391
Beach access good	0.186		0.172	-0.152	0.524
Facilities present	0.219		0.152	-0.080	0.517
Alternative specific constant	-0.697	***	0.211	-1.110	-0.284

Notes: number of choice occasions = 805; number of respondents = 161; log likelihood = -736.73421.
*** indicates significance at the 99% level of confidence.

Note that in Table 7, a heteroscedastic conditional logit model is reported (Davis et al. 2019). This is an extension to the normal conditional logit, which allows the error variance to vary across elements of the sample, reflecting how consistently respondents answer the choice questions. Such models can improve the precision of the estimates that are of direct interest. We find that two variables are significant determinants of this variation in the case of non-visitor sample (no variables were significant in the case of non-visitor):

- *'Useful'* where the question "How useful do you think the results of this study would be to inform future investment decisions about the coastal features at Yanchep Beach?" was asked. The original variable was on a scale of 1-10 and had a modal value of 6 (see Table Q 3.7 in Appendix A). In the statistical analysis this was renormalised by subtracting 6 from all values, so that the modal value of the variable used in estimation = 0 (see Davis et al. 2019).
- *'Difficult*' is a debrief question that asked "Did you find the scenarios confusing or particularly difficult to answer?" (25% said Yes, 75% No).

Including them in the model suggests that those who answer "no" to *Difficult* have a lower variability in their answers to the choice questions, and those who think the study will be useful also have lower variability in their answers.

Table 7. Heteroscedastic conditional logit discrete choice model: non-visitor sample.

Variables	Coefficient		Std. Err.	95% Confidence Interval	
Cost- attend to cost	-0.005	***	0.001	-0.007	-0.003
Cost - not attend to cost	-0.001	*	0.001	-0.002	0.001
Sandy beach (per % increase in area)	0.0100	***	0.002	0.006	0.015
Yanchep Lagoon maintained	0.670	***	0.155	0.366	0.974
Terr. reserve (per % increase in area): member	0.026	***	0.010	0.007	0.045
Terr. reserve: non-member of cons. group	0.002		0.002	-0.001	0.006
Beach access average	0.120	**	0.097	0.008	0.389
Beach access good	0.255	**	0.107	0.047	0.464
Facilities present	0.211	**	0.089	0.036	0.389
Alternative specific constant	-0.197	*	0.112	-0.418	0.024
Model of scale					
Difficult	0.251	***	0.118	0.021	0.482
Useful	0.091	***	0.025	0.042	0.141

Notes: number of choice occasions = 1630; number of respondents = 326;log likelihood = -1439.7938
***,**,* indicates significance at the 99%, 95% and 90% level of confidence, respectively.

The differences in preferences between the two visitation groups are striking. For those who visit (Table 6), the only attributes which are significant are the area of sandy beach, and the lagoon. The terrestrial reserve attribute is not significant for either members or non-members of conservation groups, nor is beach access or presence of facilities. The cost attribute is significant for those who said they attended to cost, but not for those who said they did not (as expected).

For those who do not visit, sandy beach area, lagoon, beach access and facilities being present are all positive and significant. For those who are a member of a conservation group, the terrestrial reserve attribute is also significant, although it is not for those who are not members. Those who do not attend to cost do not have a significant cost attribute. The non-visitors to the area seem to hold a broader set of values for attributes on the beach, while those who visit appear to be much more focused on the beach and lagoon.

Tables 8 and 9 report the willingness to pay for the different attributes. Note that we only report these values for the group who have a significant parameter for cost (those who attend to cost). Those who do not attend to cost will have a very high numerical value for the willingness to pay of attributes, because the models imply that one can take substantial amounts of money from them, without reducing their utility a great deal. However, statistically, these values are not at all precise (note the weakly significant or non-significant coefficient values for those who did not attend to cost in Tables 6 and 7), and there is little value in reporting them. The implications for welfare analysis of having significant groups of respondents who appear to not value cost is discussed in Section 5 below.

Table 8. Willingness to pay results from the conditional logit discrete choice model: visitor sample

Willingness to pay (2019AUD/household/year for 10 years)			Standard Error	95% Confidence Interval	
Sandy beach (per % increase in area)	$3.00	***	0.71	1.61	4.39
Yanchep Lagoon maintained	$253.44	***	47.69	159.96	346.92

*** indicates significance at the 99% level of confidence.

Table 9. Willingness to pay results from the conditional logit discrete choice model: non-visitor sample

Willingness to pay (2019AUD/household/year for 10 years)			Standard Error	95% Confidence Interval	
Sandy beach (per % increase in area)	$2.04	***	0.23	1.59	2.50
Yanchep Lagoon maintained	$135.97	***	13.63	109.24	162.69
Ter. reserve (per % increase in area): if member[$]	$5.24	***	1.68	1.95	8.52
Beach access average	$40.31	**	17.13	6.72	73.89
Beach access good	$51.81	***	17.59	6.72	86.30
Facilities present	$42.87	***	15.10	13.26	72.48

***,** indicates significance at the 99% and 95% level of confidence, respectively.
[$] Willingness to pay if a member of a conservation group

Observationally, the willingness to pay estimates for sandy beach and Yanchep lagoon in the visitor model (Table 8) are closer to that of the average preference model (Table 5). Visitors are willing to pay $3 per percentage increase in area for Sandy beach, which would equate to $150 to protect the current levels of beach area relative to the status quo of 50% loss in 10 years' time. They are willing to pay $253 to protect the lagoon.

When focussing on the non-visitor model (Table 9), the prioritisation of attributes is similar to that of the average preference model, though smaller in the magnitude of the willingness to pay, and with the exception of the Terrestrial nature reserve. For non-visitors, willingness to pay for the Sandy beach and lagoon is much lower than for visitors at $2 (or $102 to prevent a 50% loss), and $136, respectively. Only non-visitor members of conservation groups are willing to pay to protect the Terrestrial nature reserve at $5 per percentage increase in area (but at substantially higher amounts – 5 times as much – relative to the average preference model), equating to $131 to avoid the status quo loss of 25% in 10 years' time.

Non-visitors are willing to pay for beach access and presence of facilities. As for the average preference model, maintaining average beach access, relative to poor, provides the biggest change in value at $40, with improvement to good access worth an additional $12. Maintenance of facilities is worth $43 for non-visitors.

4.2 Travel cost results

The travel cost data allows one to infer the value that visitors to the beach gain as a result of their visit. Because the data was not collected from an intercept survey, the data collected includes those who say that they have not visited (i.e. the data is not truncated, with only positive numbers of

trips). Hence the appropriate count model is a negative binomial regression model (see Burton and Rogers (2018) Section 5.2.2).

As we collected data on both summer and winter usage (defined as number of trips in each season) we can estimate a model for both seasons, with an expectation that the implied value of a trip may be lower in winter

The cost of a trip to Yanchep beach is defined through the distance travelled. Distance was self-reported in the survey by visitors, but not for non-visitors. As we need an estimate of distance for both visitors and non-visitors, for consistency, we use a measure of distance calculated as distance from a central point in the LGA the respondent reports they live in, and Yanchep beach. This is multiplied by 10c/km to get a measure of cost. Distance is estimated using Google maps, so there is some reflection of true travel distance (as opposed to a straight line measure), though there is some degree of approximation as we do not have an accurate measure of where they live within the LGA. However, given the range of the distance variable (going to a maximum of 116km), this variable provides a good measure of the general distance travelled in terms of distinction between those who live close by or further away from Yanchep Beach.

Table 11 reports the results for summer and winter visitation. The sample size is 480, as some respondents did not report an LGA for their home.

Table 11. Estimates for seasonal travel cost models to Yanchep Beach – willingness to pay per person per trip.

	Summer model	**Winter model**
Travel cost	-0.168***	-0.255***
constant	2.944***	3.822***
n	480	480
WTP estimates	$5.95 (1.99-9.92)	$3.92 (2.07-5.78)

*** denotes significance at the 99% level of confidence. 95% confidence intervals in parentheses.

The cost coefficients are negative, implying that those who live further away make fewer trips in both seasons, as expected. The value of a trip (defined as -1/coefficient on cost) is positive and significant in both seasons. Although numerically the value for winter trips is smaller than that for summer, they are not statistically different from each other. The values obtained are larger than those reported for Cottesloe in Rogers and Burton (2018), which may reflect the unique nature of the lagoon at Yanchep, but the values are broadly in line with values obtained in the broader literature (see Section 6).

5. Willingness to pay estimates for decision making

5.1 Choosing which results to use

We present three different sets of valuation results: two different approaches to estimating values from the DCE, and a set of values from the travel cost model. One therefore has to consider when to use each of the results.

The DCE is the core methodology developed in Rogers and Burton (2018) for reasons outlined in Section 1: this is the more comprehensive valuation approach, and can provide more detailed information about multiple assets to aid decision making.

We include the travel cost values primarily for comparison, to illustrate the information that this approach provides should it be adopted for application in other studies, and also to contribute to building a repository of existing travel cost estimates for beach trips in Western Australia (see Section 6).

For the DCE results, the refined models for visitors and non-visitors should be used as these provide a more accurate reflection of preferences for the sample collected, relative to the simpler average preference model. In particular, they provide the adjustments for attendance to the cost attribute, which is important to take into consideration in subsequent welfare analysis.

5.2 Application of willingness to pay estimates for welfare analysis

The guidance in Section 6 of Rogers and Burton (2018, p32-24) should be followed to provide an aggregated net present value of a reconstructed valuation scenario. In this application, this should include an additional step integrated to reweight the proportion of visiting/non-visiting respondents, acknowledging that the proportions identified in this sample may be biased. There is an intentional over-representation of City of Wanneroo and neighbouring LGA residents in the sample relative to the broader Perth Metropolitan region, in order to reveal whether there were differences between local and non-local samples (which we did not detect, see Section 4.1). However, we might expect that a greater proportion of the visitors would be from local areas, and this is indeed the case:

- From the 5 Local Area LGAs (Wanneroo, Joondalup, Stirling, Swan, Gingin): 71% were visitors; 29% non-visitors
- From the Broader Perth Metro region (excluding these 5 LGAs): 46% were visitors; 54% non-visitors

In a real-world application of these results for welfare analysis, one would obtain reliable estimates of visitation by locals and non-locals to Yanchep Beach (e.g. from other data collection sources such as tourism data) to establish what adjustments should be used in aggregation of willingness to pay estimates. Here, *for the purpose of illustrating aggregation only*, we have assumed that the rough proportions of visitation for the population are equivalent to that of the sample collected.

Table 12 shows the appropriate adjustments to apply, given this illustrative assumption, in aggregating willingness to pay by number of households for the visitor and non-visitor samples.

Table 12. Adjustments for visitation by Local Areas and Broader Perth regions.

	Total households[a]	Visitor proportion	Adjusted households for visitors	Non-visitor proportion adjustment	Adjusted households for non-visitors
Local Areas	282415	71%	199611	29%	82804
Broader Perth	535666	46%	243889	54%	291777

[a] ABS Census Quick Stats, available at:
https://www.abs.gov.au/websitedbs/censushome.nsf/home/quickstats?opendocument&navpos=220

A welfare analysis also brings back into consideration the full sample of 531, to account for proportions of protest responses. That is, given that we are unable to reliably establish the value that protesting individuals have for the coastal assets, we take a conservative assumption that their value is zero. The proportion of protestors from the full sample was 8% (and there was no significant difference in this proportion across the visitors/non-visitors, so an 8% adjustment can be applied uniformly across aggregated willingness to pay). This means that we reduce the aggregated willingness to pay to 92% of the total amount.

Similarly, we need to additionally adjust for those that did not attend to the cost attribute, and assume this proportion to also have a zero willingness to pay. The proportion of those who did not attend to cost from the full sample was 22% (again, not significantly different between visitors/non-visitors). This means that we further reduce the aggregated willingness to pay to 78% of the total amount i.e. the effective adjustment is 72% (i.e. 0.92*0.78).

For calculations related to the Terrestrial nature reserve attribute, we need to also consider that only non-visitors who were members of environmental groups were willing to pay for this attribute. These individuals represented around 4% of the non-visitor sample.

As a worked example, we could reconstruct a scenario where a particular adaptation solution is adopted that enables us to protect some of the Sandy beach, but where we lose assets that are set back beyond the beach – the Terrestrial reserve and Facilities. For example, you could imagine a situation where erosion and inundation leads to the coastal watermarks moving landwards. The sandy beach is allowed to retreat landwards and supplemented with a beach nourishment program, at the expense of space available for the terrestrial reserve and café/surf club facilities.

First, we need to work out the aggregate willingness to pay per year for each attribute taking note of the required adjustments above. Then we can reconstruct the willingness to pay for the beach protection scenario, and establish the present value of benefits as follows.

Aggregate willingness to pay for coastal assets

1. Aggregate willingness to pay for protection of 25% Sandy Beach

(i) Willingness to pay per household

Visitors $3.00 / % area x 25% protected = $75

Non-visitors $2.04 / % area x 25% protected = $51

(ii) Adjustments for visitor and non-visitor household proportions (see Table 12)

Local area LGAs:

Visitor households (199611) x visitor willingness to pay ($75) = $14,971,819

Non-visitor households (82804) x non-visitor willingness to pay ($51) = $4,223,008

Broader Perth:
Visitor households (243889) x visitor willingness to pay ($51) = $18,291,655
Non-visitor households (291777) x non-visitor willingness to pay ($51) = $14,880,641

Aggregate willingness to pay = Local area + broader Perth = $52,366,123

(iii) Adjust aggregate willingness to pay for protests and cost attendance

Willingness to pay x 92% non-protest response = $48,024,971
Willingness to pay x 78% cost attendance = **$37,353,823 / year for 10 years**

2. Aggregate willingness to pay for protection of 25% Terrestrial Nature Reserve

(i) Willingness to pay per household
Non-visitor members of environmental groups = $131.00

(ii) Adjustments for visitor and non-visitor household proportions

Local area LGAs:
Non-visitor households (82804) x non-visitor willingness to pay ($131) x environment group proportion (3.63%) = $393,758

Broader Perth:
Non-visitor households (291777) x non-visitor willingness to pay ($131) x environment group proportion (3.63%) = $1,387,488

Aggregate willingness to pay = Local area + broader Perth = $1,781,247

(iii) Adjust aggregate willingness to pay for protests and cost attendance.

Willingness to pay x 92% non-protest response = $1,633,581
Willingness to pay x 78% cost attendance = **$1,270,600 / year for 10 years**

3. Aggregate willingness to pay for protection of Facilities (surf club & café)

(i) Willingness to pay per household
Non-visitors = $42.87

(ii) Adjustments for non-visitor household proportions

Local area LGAs:
Non-visitor households (82804) x non-visitor willingness to pay ($) = $3,548,811

Broader Perth:
Non-visitor households (291777) x non-visitor willingness to pay ($) = $12,508,492

Aggregate willingness to pay = Local area + broader Perth = $16,058,302

(iii) Adjust aggregate willingness to pay for protests and cost attendance.

Willingness to pay x 92% non-protest response = $14,727,069
Willingness to pay x 78% cost attendance = **$11,454,714 / year for 10 years**

Aggregate willingness to pay per year for the beach protection scenario

Benefits of protecting 25% of Sandy beach per year = $37,353,823
Costs (lost benefits) of losing 25% Terrestrial nature reserve ($1,270,600) & facilities ($11,454,714) = 12,725,314

Net willingness to pay per year for beach protection scenario = $24,628,509

Calculate present value of benefits over 10 year payment schedule

Multiply net willingness to pay by 10 year payment = $246,285,086
Convert to Present Value using 7% discount rate[1] = $172,980,338

Net present values for decision making

The estimated present value of $173 million for the beach protection scenario can now be included in decision support tools such as benefit-cost analyses, and weighed against the financial costs and benefits of implementing the adaptation solution (e.g. the costs of beach nourishment). If a positive net present value results from the benefit-cost analysis, the solution leads to a positive impact on welfare.

Note this is a hypothetical example to illustrate how the values can be used in decision making.

It is also important to note that there will be additional considerations in selecting optimal solutions. There may be limited financial resources to implement solutions, in which case the scenario with the highest net present value may not be selected because the costs are still prohibitive. Other solutions that still provide a smaller positive net present value, but also have lower financial costs that fit within existing budgets would then be considered as logical alternatives. There may also be a need to consider the equity of who benefits – benefit-cost analyses consider the overall impact on welfare to the community. Within that, some particular individuals are likely to be made better off, and some worse off.

[1] Equation 8 in Rogers and Burton (2018, p34): NPV = aggregate WTP x $[(1-(1+r)^{-t})/r]$; where r = discount rate, t = number of years

6. Applicability for benefit transfer

An additional consideration of this work over a longer term is the potential to gradually build a database of non-market values related to coastal hazard management, which can be used for benefit transfer. Benefit transfer is an approach that utilises existing values estimated in 'primary studies' (such as those estimated in this report), and translates them to a different 'study site' (another coastal location that has a relatable context), reducing the need for conducting new surveys of community values each time a decision needs to be made (Johnston et al. 2015). When applying benefit transfer techniques, there needs to be an understanding about the confidence with which a value can be translated from one site to another.

Specific translation of how relevant the values estimated in this study on Yanchep Beach are to other coastal locations in the City of Wanneroo was beyond the scope of the work; however, the student project run in conjunction with this project estimated values for Mindarie Keys Beach (see Appendix B) and a brief descriptive comparison is made between the two sets of results as a first indication of whether a benefit transfer approach may be feasible. Due to difference in the assets at these locations, not all attributes from the survey templates were consistently applied, so we are only able to compare values for *Sandy beach*, *Beach access*, and *Retail, dining & club facilities*.

The estimates for protection of Sandy beach (per percentage point) are very similar for the two samples. For those who considered their budget, and are recent visitors, the value for Yanchep is $3.00, while that for Mindarie beach is $2.94 per percentage of beach area. For those who have not visited, the two values are $2.04 and $1.64. The closeness of these values is perhaps not surprising given the similarity of the coastline at both locations, and sampled population, but it does imply a degree of robustness in the approach.

For beach access, it is only non-visitors who value access at Yanchep ($40 and $52 for average and good access) while at Mindarie only the improvement to good access is valued, but at a higher level ($85). An attribute such as access may be deemed much more site specific and hence more difficult to get comparable results. Facilities may face the same issue, and the values are quite disparate here ($43 and $85 for Yanchep and Mindarie respectively).

Travel costs were not estimated as part of the Mindarie study, but the figures obtained for Yanchep ($5.95 and $3.92 per trip for summer and winter seasons, respectively) are similar to estimates obtained from the pilot study at Cottesloe Beach ($2.08 and $1.73 for summer and winter, respectively – see Rogers and Burton, 2018), and for a study by Raybould et al. (2013) who estimated a travel cost model for trips to beaches in the Augusta-Margaret river region ranging from $3.28 to $12.21 per trip depending on the model assumptions.

This limited descriptive comparison suggests that there may be sufficient consistency for some coastal assets to use benefit transfer approaches for valuation (e.g. area of sandy beach), though statistical testing and more observations are required to confirm this. For others which are highly site specific, more evidence is needed to understand the situations in which benefit transfer may or may not be appropriate.

The prospect of building a database or repository of existing case study applications, and adding more observations to this over time, would be valuable in establishing the confidence with which benefit transfer can be reliably applied.

7. Summary of adaptability of the survey templates

This study had three, interlinked objectives. The first was to undertake an implementation of the template developed and reported in Rogers and Burton (2018), to determine its suitability for a CHRMAP decision context; the second being to test how readily adaptable the templates were in this application. The third objective was to generate further estimates of community preferences for assets threatened by coastal erosion in Perth. We have done this in a main study for Yanchep beach, and a second subsidiary study for Mindarie Keys (Appendix B). The value estimates and their application for decision making are discussed above; here we comment on how adaptable and usable the templates and guidance material in the original report were to the Yanchep Beach study.

We find that the template is readily applicable. Some changes were needed for adapting the attributes to the specific context, but these were relatively minor, and in accordance with the guidance material in Rogers and Burton (2018). That is, the instructions set out in the report were adequate to enable adaptation, and the changes were informed by technical information (i.e. expertise that should be available in-house for those undertaking a CHRMAP process).

In the Yanchep study we were able to keep the experimental design that was used in the template, even after accommodating some substitution in the attributes included in the choice experiment[2]. Application of this design to a sample of 531 individuals was sufficient to enable estimation of statistically significant results, and to explore heterogeneity in preferences between different groups of people in the sample collected.

An important point to note regarding the sampling process was that we used an online recruitment company to provide the majority of the sample (n=500). This sample on its own would have been sufficient to analyse the choice model, and contained a reasonable stratification of local and non-local residents and other population demographics. This approach is feasible for coastal locations that are of regional or wider interest to a broad population base, where online panels will be able to meet the requested sample size.

However, for coastal locations that are only of local relevance, or where population bases are small and recruitment companies may have insufficient panel membership, sampling will need to be supported by other approaches. We attempted two supporting approaches. For Yanchep we invited respondents via an email list maintained by the City of Wanneroo community engagement team. We only received 31 completed survey responses from approximately 250 email recipients. For Mindarie, a mail drop with a flyer inviting participation in the online survey was placed in 1000 letterboxes in the immediate local area. Only 10 completed survey responses were received as a result. The latter outcome is consistent with recent efforts to elicit sample from mail drops in other regions of Perth and Bunbury for a separate project. This suggests that more creative methods of eliciting additional sample may be required (e.g. a phone call to confirm participation followed by a flyer/email invitation, or a more substantial incentive than the entry into the $500 prize draw that was offered here). For situations where the preferences of 'users' are of particular interest, intercept surveying on-site is a good alternative.

[2] In the Mindarie study design a new specific design was developed. This was not because the experimental design in the template was inappropriate, but because we needed to optimise the design for the specific attributes that were used in this study to accommodate a small sample size. The small sample size was necessitated by the time and budget restrictions associated with the student project. It was adequate for a student-based study, to demonstrate application of a method and analytical procedures, but we would not recommend such small samples to be used for studies that are intended to inform decision processes.

A final point worth noting was the importance of communicating to technical experts that selection of the attribute levels did not need to be completely accurate or precise, as the choice experiment accommodates the ability to test preferences for options that might be less likely but still in the realm of possibility. The analysis is then able to map out the preference space, and at what incremental points of improvement (or avoided degradation) assets are most valued. The attribute definitions in this case were aided by the fact that the Cardno (2018) report had already identified which coastal assets were likely to be impacted, but additional technical input and informed assumptions were needed to specify the attribute levels. This was achieved through both the technical input from City of Wanneroo and supporting resources (as outlined in Section 3).

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Appendix A. Demographic statistics

Gender distribution

Gender	Number of observations	Percentage (of 531 respondents)
Male	255	48.02
Female	272	51.22
Non-binary/other	4	0.75

Age distribution

Age group	Number of observations	Percentage (of 531 respondents)
18-30	73	13.75
31-45	154	29
46-60	140	26.37
61-75	129	24.29
>75	35	6.59

Respondent location

Location	Number of observations	Percentage (of 531 respondents)
City of Wanneroo	117	22.03
City of Swan/Joondalup/Stirling OR Shire of Gingin	170	32.02
Perth Metro - Other	244	45.95

Income distribution

Income	Number of observations	Percentage (of 531 respondents)
Under $13,000 (under $250/week)	16	3.01
$13,000-$25,999 ($250-$500/week)	66	12.43
$26,000 - $41,599 ($500-$800/week)	83	15.63
$41,600 - $62,399 ($800-$1200/week)	66	12.43
$62,400 - $88,399 ($1200-$1700/week)	75	14.12
$88,400 - $129,999 ($1700-$2500/week)	69	12.99
$130,000 - $181,999 ($2500-$3500/week)	63	11.86
$182,000 and over ($3000+/week)	20	3.77
I would rather not say	73	13.75

Education

Highest level of education	Number of observations	Percentage (of 531 respondents)
Schooling up to Year 10	73	13.75
Schooling up to Year 12	107	20.15
Trade or technical certificate	165	31.07
University degree (Bachelor, Master, PhD)	186	35.03

Type of household

	Number of observations	Percentage (of 531 respondents)
Single without children	105	19.8
Single with children – at least some of the children are still dependent	32	6.0
Single with children – with all children having left home	41	7.7
Couple without children	78	14.7
Couple with children – at least some of the children are still dependent	128	24.1
Couple with children – with all children having left home	122	23.0
Other	25	4.7

Q 1.1)

Have you visited Yanchep beach in the last year?

	Number of observations	Percentage (of 531 respondents)
Yes	173	32.58
No	358	67.42

Q 1.2) *(For those who answered Yes to Q 1.1)*

Thinking about a typical trip to Yanchep Beach first in the hotter months, and then in the colder months, what activities do you usually undertake?

Select all that apply

Activity	Number of observations Hot months (Nov-April)	Number of observations Cold months (May-Oct)	Percentage of 173 respondents Hot months (Nov-April)	Percentage of 173 respondents Cold months (May-Oct)
Swimming	134	16	77.5	9.2
Snorkelling	43	11	24.9	6.4
Scuba diving	15	3	8.7	1.7
Surfing	22	9	12.7	5.2
Windsurfing	16	1	9.2	0.6
Kitesurfing	10	4	5.8	2.3
Stand up paddle boarding	21	3	12.1	1.7
Kayaking	8	5	4.6	2.9
Water skiing	10	2	5.8	1.2
Jet skiing	13	6	7.5	3.5
Sailing	13	2	7.5	1.2
Boating (private motorised vessel)	17	6	9.8	3.5
Boating (chartered/hired motorised vessel)	15	3	8.7	1.7
Fishing – shore based	32	26	18.5	15.0
Fishing – boat based	20	9	11.6	5.2
Walking	107	81	61.8	46.8
Running	23	14	13.3	8.1
Dog walking	35	29	20.2	16.8
Sandboarding	9	2	5.2	1.2
Relaxing	86	43	49.7	24.9
Socialising with friends or family	76	45	43.9	26.0
Picnicking or barbecuing	58	26	33.5	15.0
Visiting playgrounds	33	21	19.1	12.1
Visiting Aboriginal heritage sites	14	7	8.1	4.0

Visiting European heritage sites	15	8	8.7	4.6
Watching wildlife	35	31	20.2	17.9
Beach combing – e.g. shell collecting	32	22	18.5	12.7
Replanting native plants & removing weeds	8	7	4.6	4.0
Dining at restaurants, cafes, kiosks, pubs etc.	64	51	37.0	29.5
Attending events – e.g. concerts, sporting, arts events	20	16	11.6	9.2
Other (specify)	4	4	2.3	2.3

Q 1.3)

How often on average would you visit Yanchep Beach per month during the hotter months (November to April)?

	Number of observations	Percentage (of 173 respondents)
Nearly every day (5-7 times a week)	11	6.4
A few times a week (2-4 times a week)	24	13.9
About once a week	25	14.5
About once a fortnight	21	12.1
About once a month	33	19.1
Less than once a month	57	33.0
Never	2	1.2

Q 1.4)

How often on average would you visit Yanchep Beach per month during the colder months (May to October)?

	Number of observations	Percentage (of 173 respondents)
Nearly every day (5-7 times a week)	4	2.3
A few times a week (2-4 times a week)	17	9.8
About once a week	16	9.3
About once a fortnight	18	10.4
About once a month	22	12.7
Less than once a month	80	46.2
Never	16	9.3

Q 1.5)

How many people usually come with you to the beach?

	Average	Standard deviation	Minimum	Maximum	Number of observations
Adults	2	1	0	12	173
Children	1	1	0	5	133

Q 1.6)

Thinking about a typical trip to Yanchep Beach, please identify the distance you travel, and the time you take in the table below (one-way).

Mode of transport	Distance (km)					Time (minutes)				
	Observations	Average	Standard deviation	Minimum	Maximum	Observations	Average	Standard deviation	Minimum	Maximum
Walk	57	12	31	0	200	58	88	402	0	3000
Bicycle	27	16	40	0	200	26	26	43	0	200
Motorcycle	28	18	26	0	100	27	18	24	0	80
Small car	95	33	30	0	200	93	32	23	0	90
Large car, ute, 4WD, small truck	66	38	65	0	500	65	26	23	0	90
Bus	26	28	54	0	260	26	35	46	0	130
Train	26	23	31	0	100	26	32	42	0	120
Other	11	0	2	0	5	11	6	18	0	60

Q 1.7)

If you take the bus or train as part of the trip, how much do you approximately pay for a one way trip (to the nearest dollar) ?

Observations	Average (in 2019 AU$)	Standard deviation (in 2019 AU$)	Minimum (in 2019 AU$)	Maximum (in 2019 AU$)
29	11	22	0	100

Q 1.8)

On a typical trip to Yanchep Beach, do you normally combine the trip with other activities unrelated to the beach (e.g. visiting the beach while going to/from work)?

	Number of observations	Percentage (of 173 respondents)
No	132	76.3
Yes	41	23.7

Q 1.9)

What do you think of the public transport services available to access Yanchep Beach? *(on a scale from 1 to 10)*

Insufficient public transport

Sufficient public transport

Scale point	Number of observations	Percentage (of 173 respondents)
1	18	10.4
2	17	9.8
3	18	10.4
4	23	13.3
5	34	19.7
6	14	8.1
7	25	14.5
8	16	9.3
9	5	2.9
10	3	1.7

Q 1.10)

What do you think about the availability of parking at Yanchep Beach? *(on a scale from 1 to 10)*.

Insufficient parking available

Sufficient parking available

Scale point	Number of observations	Percentage (of 173 respondents)
1	4	2.3
2	3	1.7
3	14	8.1
4	28	16.2
5	16	9.3
6	19	11.0
7	41	23.7
8	25	14.5
9	12	6.9
10	11	6.4

Q 1.11)

When you want to do outdoor recreation activities, do you usually visit Yanchep Beach or one of these other areas?

	Number of observations	Percentage (of 531 respondents)
Use Yanchep Beach most of the time	69	13.0
Use other locations most of the time **[***Answer Q1.11a below***]**	357	67.2
I usually don't visit any outdoor recreation areas in the Perth metropolitan region	105	19.8

Q 1.11a)

If you prefer other locations, what is the main reason?

	Number of observations	Percentage (of 357 respondents)
Closer to where you live than Yanchep Beach	284	79.6
Better suited to the type of outdoor activity than Yanchep Beach **[***Answer Q1.11b below***]**	16	4.5
Better accessibility than Yanchep Beach (e.g. car parking, boat ramps, walkways and stairs)	11	3.1
Better facilities/amenities than Yanchep Beach (e.g. bbq's, playground equipment, toilets)	7	2.0
There are fewer people using it than Yanchep Beach	3	0.8
Nicer environment than Yanchep Beach (e.g. cleaner, more natural)	6	1.7
Safer environment than Yanchep Beach (e.g. calmer water, more sheltered, more secure)	11	3.1
Other	19	5.3

Q 1.11b)

Which types of outdoor recreation activities do you prefer to do at other sites rather than at Yanchep Beach?

Activity	Number of observations	Percentage (of 16 respondents)
Swimming	6	37.5
Snorkelling	3	18.8
Scuba diving	1	6.3
Surfing	2	12.5
Windsurfing	1	6.3
Kitesurfing	1	6.3
Stand up paddle boarding	0	0.0
Kayaking	0	0.0
Water skiing	1	6.3
Jet skiing	0	0.0
Sailing	1	6.3
Boating (private motorised vessel)	0	0.0
Boating (chartered/hired motorised vessel)	0	0.0
Fishing – shore based	0	0.0
Fishing – boat based	0	0.0
Walking	7	43.8
Running	5	31.3
Dog walking	5	31.3
Sandboarding	1	6.3
Relaxing	10	62.5
Socialising with friends or family	6	37.5
Picnicking or barbecuing	5	31.3
Visiting playgrounds	0	0.0
Visiting Aboriginal heritage sites	0	0.0
Visiting European heritage sites	0	0.0
Watching wildlife	2	12.5
Beach combing – e.g. shell collecting	0	0.0
Replanting native plants & removing weeds	0	0.0
Dining at restaurants, cafes, kiosks, pubs etc.	4	25.0
Attending events – e.g. concerts, sporting, arts events	3	18.8
Other (specify)	0	0.0

Q 1.12)

State how much you agree that it is important to protect, manage, and maintain Yanchep Beach in its current state for the following reasons (tick the relevant boxes in the table below):

It is important to maintain Yanchep Beach in its current state:	Number of respondents					Percentage of 531 respondents				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
For my own recreational use	20	47	206	163	95	3.8	8.9	38.8	30.7	17.9
For other people's recreational use	7	8	83	229	204	1.3	1.5	15.6	43.1	38.4
For the option that I can use it for recreation at some time in the future	8	15	131	234	143	1.5	2.8	24.7	44.1	26.9
For future generations to use for recreation	6	5	65	200	255	1.1	0.9	12.2	37.7	48.0
For people to be able to live nearby	5	16	87	243	180	0.9	3.0	16.4	45.8	33.9
For environmental health, including flora and fauna habitat	3	6	66	187	269	0.6	1.1	12.4	35.2	50.7
For cultural significance, including Aboriginal and European heritage	16	27	135	190	163	3.0	5.1	25.4	35.8	30.7
For commercial use	56	127	205	93	50	10.5	23.9	38.6	17.5	9.4
For tourism	7	17	121	219	167	1.3	3.2	22.8	41.2	31.5

Debrief

Q 3.1)

Was the amount of the extra payment required for the different options (i.e. the 'cost to you each year, for 10 years) important to you when making your choices?

	Number of observations	Percentage (of 531 respondents)
Yes	413	77.8
No	118	22.2

Q 3.2)

Could you rank which were the most important coastal features when making your choices?

Sandy beach

Rank	Number of observations	Percentage (of total)
1	117	26.4
2	153	34.5
3	115	26.0
4	34	7.7
5	24	5.4
Total	*443*	*100.0*

Yanchep lagoon

Rank	Number of observations	Percentage (of total)
1	187	41.9
2	103	23.1
3	76	17.0
4	50	11.2
5	30	6.7
Total	*446*	*100.0*

Terrestrial natural reserve

Rank	Number of observations	Percentage (of total)
1	88	20.1
2	91	20.8
3	123	28.1
4	71	16.2
5	64	14.6
Total	*437*	*100.0*

Beach access

Rank	Number of observations	Percentage (of total)
1	37	8.4
2	67	15.3
3	88	20.1
4	200	45.7
5	46	10.5
Total	*438*	*100.0*

Retail, dining and club facilities

Rank	Number of observations	Percentage (of total)
1	20	5.0
2	34	8.5
3	44	10.9
4	80	19.9
5	224	55.7
Total	*402*	*100.0*

Q 3.3)

Did you think about your household budget, and how much you could afford, while making your choices for the scenarios?

	Number of observations	Percentage (of 531 respondents)
Yes	424	79.8
No	107	20.2

Q 3.4)

Did you find the scenarios confusing or particularly difficult to answer?

	Number of observations	Percentage (of 531 respondents)
Yes	135	25.4
No	396	74.6

Q 3.5)

Please indicate how certain you were of the answers you gave in the scenarios *(on a scale from 1 to 10)*.

	Scale point	Number of observations	Percentage (of 531 respondents)
Very uncertain	1	2	0.4
	2	2	0.4
	3	7	1.3
	4	16	3.0
	5	25	4.7
	6	60	11.3
	7	132	24.9
	8	150	28.2
	9	70	13.2
Very certain	10	67	12.6

Q 3.6)

What did you think about the information that was provided to describe the coastal features of Yanchep Beach?

	Number of observations	Percentage (of 531 respondents)
I thought it was an informative and accurate description	389	73.3
I would have liked more information	83	15.6
I thought the descriptions were inaccurate	16	3.0
I thought there was too much information	18	3.4
I though the information was confusing	25	4.7

Q 3.7)

How useful do you think the results of this study would be to inform future investment decisions about the coastal features at Yanchep Beach? *(on a scale from 1 to 10)*.

	Scale point	Number of observations	Percentage (of 531 respondents)
Not very useful	1	8	1.5
↓	2	2	0.4
	3	7	1.3
	4	15	2.8
	5	27	5.1
	6	70	13.2
	7	121	22.8
	8	140	26.4
	9	81	15.3
Very useful	10	60	11.3

Q 3.8)

How likely do you think it is that the results of this study will be used by decision makers to inform future investment decisions about the coastal features at Yanchep Beach? *(on a scale from 1 to 10)*.

	Scale point	Number of observations	Percentage (of 531 respondents)
Very unlikely	1	14	2.6
↓	2	13	2.4
	3	27	5.1
	4	35	6.6
	5	55	10.4
	6	109	20.5
	7	117	22.0
	8	80	15.1
	9	50	9.4
Very likely	10	31	5.8

Questions about you

Q 4.1)

Which Local Government Area do you live in?

	Number of observations	Percentage (of 531 respondents)
Armadale, City of	20	3.8
Bassendean, Town of	10	1.9
Bayswater, City of	8	1.5
Belmont, City of	8	1.5
Cambridge, Town of	1	0.2
Canning, Town of	20	3.8
Claremont, Town of	2	0.4
Cockburn, City of	17	3.2
East Fremantle, Town of	1	0.2
Fremantle, City of	7	1.3
Gosnells, City of	24	4.5
Joondalup, City of	72	13.6
Kalamunda, Shire of	7	1.3
Kwinana, Town of	15	2.8
Melville, City of	15	2.8
Mosman Park, Town of	1	0.2
Mundaring, Shire of	5	0.9
Nedlands, City of	2	0.4
Perth, City of	16	3.0
Serpentine-Jarrahdale, Shire of	5	0.9
South Perth, City of	8	1.5
Stirling, City of	52	9.8
Subiaco, City of	8	1.5
Swan, City of	49	9.2
Victoria Park, Town of	9	1.7
Vincent, City of	4	0.8
Wanneroo, City of	94	17.7
Regional LGA	12	2.3
Not listed/unsure	39	7.3

Q 4.3)

Do you have a view of the ocean or coastal dunes (of any part of the coast, not just Yanchep) from your usual place of residence and/or employment?

	Number of observations	Percentage (of 531 respondents)
Yes	81	15.3
No	450	84.7

Q 4.4)

Do you belong to any conservation groups? (*Tick all that apply)*

	Number of observations
Yes – coastal conservation groups	34
Yes – other environmental conservation groups	26
No	506

Q 4.5)

Do you belong to any recreational groups associated with the coast? (*Tick all that apply)*

	Number of observations
Surf lifesaving club	16
Swimming club	11
Sailing club	7
Recreational fishing club	10
Diving club	8
Beach fitness/exercise club	19
Other	10
None of these groups	475

Q 4.6)

Are you employed or do you volunteer in any of the following fields? (*Tick all that apply)*

	Number of observations
Coastal management/research/consulting	8
Government agencies tasked with coastal responsibilities	6
Tourism venture specifically associated with the coast	9
Hospitality in a business specifically associated with, or located on, the coast	8
Boating industry	6
Fishing industry	7
Other field associated with the coast	7
None of these fields	496

Appendix B. Mindarie beach study

The Mindarie beach study was a supplementary piece of analysis, conducted by Xiaoyu (Eva) Zheng, as part of her Masters degree, in conjunction with the main study. What is reported here is a summary of the analysis that is reported in Zheng, X. (2019)

Methodology and Methods

Study area

The City's CHRMAP has identified the potential risks and highlight the vulnerability timeframe for the Mindarie Keys beach (Figure B1). Many coastal assets at the beach may be vulnerable to coastal hazard for the next 30 or 70 years based on the CHRMAP result (Cardno, 2018).

Figure B1. Coastal hazard mapping of Mindarie Keys beach (Cardno, 2018).

Mindarie Keys beach is a part of Wanneroo coastal zone, located approximately 36km north of Perth metropolitan area in Western Australia. An area around 2.2km along the beach has been selected by the City of Wanneroo as the appropriate area for the study.

This area starts from the Quinns road to the planned local government area boundary of the City of Wanneroo (Figure B2). It involves many threatened coast assets, such as the sandy beach, the foreshore reserves, and some facilities.

Figure B2. The planned study area in Mindarie Keys beach (Cardno, 2018).

Discrete choice experiment design

The survey-based discrete choice experiments have been reviewed and developed by Rogers and Burton (2018). A pilot study has been successfully conducted at the Cottesloe beach using the survey tools they had developed. This study provides a further test of the survey protocols developed in that study.

Identify the coastal attributes of Mindarie Keys beach

The City of Wanneroo has identified 4 coastal attributes and the attribute's level. The identified attributes and their levels are summarized in Table B1.

Table B1. Attributes and attribute levels of the Mindarie Keys beach assets

Attributes	Levels
Sandy Beach	25%, 50%, 75% and 100%
Foreshore reserve	25%, 50%, 75% and 100%
Beach access	Poor, average and good
Dining , club & retail facilities	Present and absent

1. Sandy Beach

This is an area that is available for recreational use, and provide an aesthetic function for residents and tourists. Different hazard management actions could increase or decrease the amount of the sandy beach area in a 10 years' time. The amount of change of sandy beach area is presented as a percentage (25%, 50%, 75% or 100%).

2. Foreshore reserve

This is a land reserve for recreational use which adjacent to the sandy beach. It provides some recreational facilities such as change rooms, shelters, and barbeque tables. Four levels (25%, 50%, 75% or 100%) are given to represent the percentage area change of the foreshore reserve with the management actions.

3. Beach access

These include pathways and stairs to get to the beach. Different hazard managements can lead to three levels of changes of beach access – poor, average, or good.

4. Dining , club & retail facilities

These facilities involve the restaurant, café and surf clubs that are located in the north of Mindarie Keys beach adjacent the Quinns Road (Figure B3). With the hazard management actions, two different levels are given to represent these facilities change are either present and absent. This attribute does not represent the facilities on the built infrastructure around the marina, which are deemed to be largely protected from sea level rise.

Although the marina at Mindarie Keys has many recreational facilities and natural resources, the marina and the inland harbour are already protected by a large breakwater. The breakwater could also accumulate by the movement of sediment (Ecoscape Pty Ltd., 2004). Compared with other coastal assets, the marina is not expected to be seriously affected by coastal hazards. Therefore, the marina was not valued in this study.

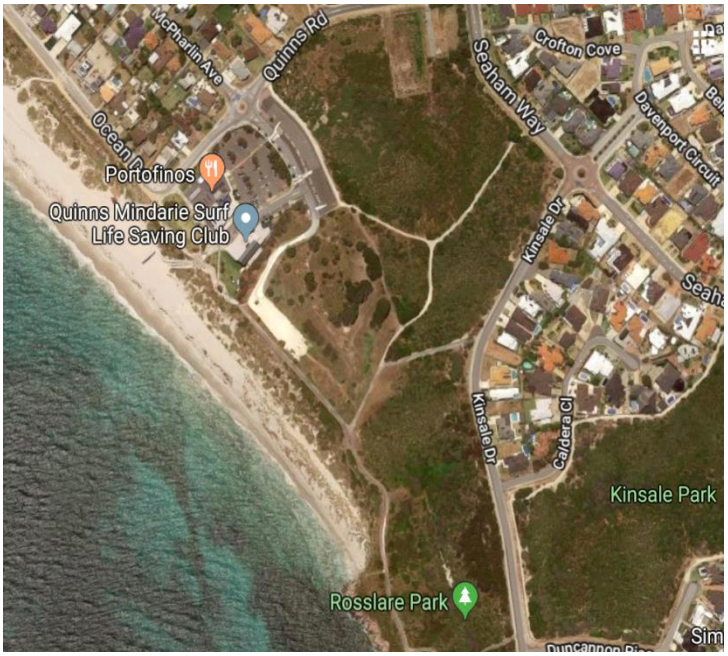

Figure B3. The identified dining, club & retail facilities at the Mindarie Keys beach.

The Western Australian Local and State Government agencies usually use an additional management funds used to improve or maintain the current coastal attributes at Mindarie Keys beach. These additional funds achieved through a hypothetical payment vehicle 'a special State Fund' that will be collected from Western Australian households. Moreover, the payment vehicle as a cost attribute can be used to calculate the marginal willingness to pay of an attribute in the discrete choice experiment.

Survey design

There are 25 representative choice scenarios in total that have been identified for use in this survey (Annex B1) A new design was generated for this study, using Ngene. They were blocked into 5 groups, and each group had 5 different scenarios. Each respondent was allocated one block of questions that was selected at random.

There is a 'status quo' option in every scenario, to reflect the beach condition change if there no further management actions. For example, if people pay $0 a year for the next 10 years, both of the sandy beach and foreshore reserve will be reduced by 50%, beach access will be poor, and dining, club & retail facilities will be absent.

An example of the hypothetical management scenarios is shown in Figure B4.

Scenario 1
#Select only ONE option by clicking on it

Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you get in 10 years time:		Option 1	Option 2	Option 3 Situation in 10 years time with no management change	What you get at the moment
	Sandy Beach	75%	25%	50%	100%
	Foreshore Reserve	50%	25%	50%	100%
	Beach Access	Average	Average	Poor	Poor
	Dining , Club & Retail facilities	Present	Absent	Absent	Present
Cost to you each year, for 10 years		$100	$50	$0	

Figure B4. An example of hypothetical management scenario.

Following the pilot protocol, the survey for Mindarie Keys beach consisted of 6 sections:

Screening questions: Three socio-demographic questions are given for screen-out respondents who are not relevant to the target sample.

Introduction: Introducing the primarily coastal hazards that affects the Western Australian coastline, and explains the surveys aims and significance to all respondents.

PART 1: Respondents are asked to share their personal experience with Mindarie Keys beach.

PART 2: Respondents are given a description of how coastal hazards will impact some coastal features at Mindarie Keys beach in the next 10 years. This information is essential to answer the questions in Part 3.

PART 3: Respondents are given a series of hypothetical management scenarios, with different outcomes for a few important features of the coast, and asked to select the most preferred option from 3 options in each scenario.

PART 4: Socio-demographic questions.

Data analysis

Analysis of the discrete choice experiment followed the process outlined in the main report: conditional logit models that can identify the relative weights placed on attributes are estimated, and the willingness to pay estimates (defined as ratios of attribute to cost parameters) reported. Some interactions are identified as being important for explaining responses, in particular whether respondents had attended to cost, and whether they had visited the beach in the last 12 months.

Although data was collected on visitation and travel costs, on inspection of this data the cost data on visitation did not seem reliable: there were a number of missing values, and some that seemed unreasonably large or small. As a result, the visitation data data was not analysed.

Sampling

This survey was developed and published online using the Qualtrics survey software. This study recruited respondents in two different ways.

1,000 survey postcards were dropped into letterboxes to the local residents in the Mindarie area, inviting people to contribute their opinions for protecting the affected coastal assets at Mindarie Keys beach. However, only 10 completed surveys were received from this route, and this data was not analyzed in this study.

Additional data was collected from an online market research company. It was launched on May 15th, 2019, and data collection was completed on May 17th, 2019. To participate in this survey, all respondents had to be at least 18 years of age and live in the Perth metropolitan area. This recruitment method led to 111 responses. The data was cleaned by removing survey results that were not fully completed or were filled out too quickly (less than 5 minutes). This led to a final sample of 101 respondents.

Summary Socio-demographic statistics

A summary of the socio-demographic attributes of these 101 valid respondents is shown in Table B2. The sample consists of 50 female respondents and 51 male respondents. Most of the respondents (44%) are in the middle-age group, between 31 to 60, and 29 elderly respondents between the age of 61 and 75. Among these 101 respondents, most participants had a university degree (41%) or had a trade or technical certificate (30%).

Table B2. Socio-demographic statistics for Mindarie Keys beach survey.

Socio-demographics	Number of respondents
Gender	
Male	50
Female	51
Age	
18-30 years	22
31-45 years	21
46-60 years	23
61-75 years	29
Over 75 years	6
Education Level	
Schooling up to year 10	14
Schooling up to year 12	16
Trade or technical certificate	30
University degree	41

The distribution of weekly income is reported in Table B3 63 respondents earned less than the average weekly income of Western Australia ($1740.90), while 38 respondents earned more than the average weekly income.

Table B3. Personal weekly income statistics for Mindarie Keys beach survey.

Weekly incomes	Number of respondents
Under $250	7
$250--$500	13
$500--$800	18
$800--$1200	12
$1200--$1700	13
$1700--$2500	16
$2500--$3500	8
$3500 and over	4
Prefer not to say	10

In this survey, 4 respondents belong to the coastal and environmental conservation groups, and 14 respondents are employed in management or consultant volunteer groups (Table B4). In addition, there are 20 respondents who belong to different recreational clubs, such as swimming club, diving club, and recreational fishing clubs.

Table B4. Membership of different groups.

	Number of respondents
Coastal and environmental conservation group	4
Volunteer group	14
Recreation group	20

29 respondents had visited the Mindarie Keys beach in the last year. Of those who have visited the Mindarie Keys beach in the last year, 4 people said they spend less than 30 minutes at the beach, however, 23 respondents said they would like to stay at the beach for 30 minutes to 1 hour to do the various recreational activities or relax. 2 people would spend more than 3 hours at the beach (Table B5).

Table B5. Average hours spent per day on the beach.

Time (hours/day)	Number of respondents
Less than 0.5 hours	4
0.5--1 hour	12
1--3 hours	11
Over 3 hours	2
Total	29

As might be expected, people are more likely to visit the beach in summer time rather than winter time (Figure B5).

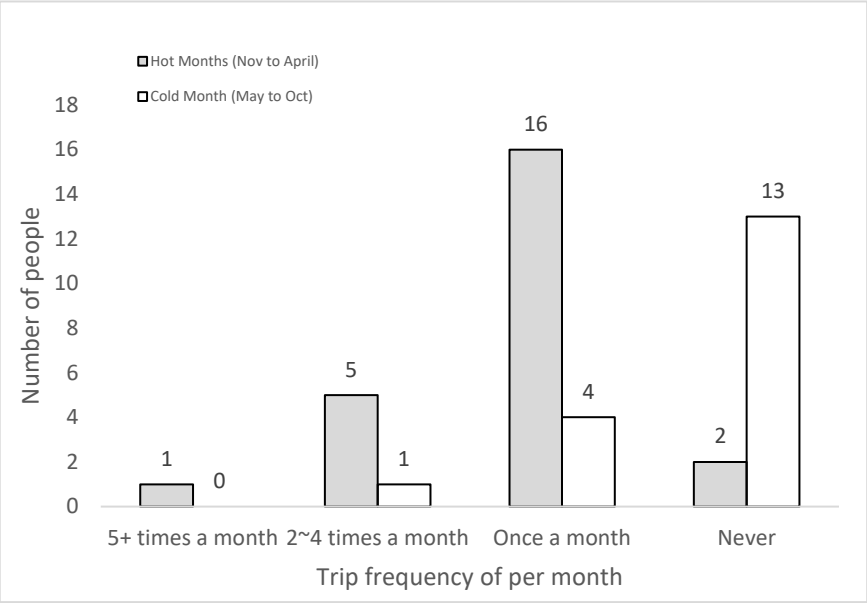

Figure B5. Trip frequency for hot and cold months.

Discrete choice experiment results

An important element of the analysis of the discrete choice data is to identify if segments of the sample are following different heuristics when making their choices. We identify two important groups within the sample.

In order to provide reasonable community values, respondents were asked to consider their financial circumstances when answering the trade-off questions, i.e., consider the limit of how much can realistically afford given their current weekly income and personal expenses. In the debrief questions, respondents were asked if their household budget affected their choices. This survey identified 66 respondents who did consider their budget when making a choice. However, 35 respondents said they did not consider the budget.

Respondents were presented with three options in each scenario. Each option involves a different combination of outcomes for the coastal features. If they choose the 'status quo' option in all five choice scenarios, the survey would ask them to give a reason why they choose the 'status quo' option (Table B6). 2 respondents said they prefer the status

quo is the best option when considered all the influence factors. And 6 people thought that their cost budget could not afford the other options. In addition, selecting the status quo option may also represent a 'protest' behavior to against other alternatives. The options marked with an asterisk were considered to indicate 'protest' behavior. Therefore, 9 'protests' respondents marked with an asterisk (Table B6) were removed, reducing the valid sample size to 92 for the future discrete choice analysis. It is important to note that this does not mean this section of the sample is ignored in terms of values, but that their values cannot be captured through the statistical modelling.

Table B6. Debrief questions to identify the 'protest' respondents: for those who always selected the status quo.

	Number of respondents
I preferred this option to all others	2
I could not afford the other options	6
I believe funding to manage the impacts of coastal hazards should come from somewhere other than my own pocket	1*
I believe funding to manage the impacts of coastal hazards should be collected by some other means than a State tax	5*
I don't think that the coastal features described for Mindarie Beach need further investment to manage the impacts of coastal hazards	0
I don't trust that the funds would be used to manage the impacts of coastal hazards at Mindarie Beach	1*
I don't believe that there will be impacts from coastal hazards (i.e. erosion and/or inundation) during this time period	0*
I don't believe I should have to make these choices	0*
Other (please specify):	2*

The estimated coefficients in the conditional logit results measure the implicit weight of an attribute. In addition, interaction of the attributes with various variables may reflect how respondents' choice behaviour is affected by different elements. A summary of the conditional logit model analysis is shown in Table B7.

We estimate a different cost coefficient for the groups who reported that they considered their cost, or not. Both are statistically significant, but that for the group who do not consider cost is numerically smaller (closer to zero) implying that they placed less weight on the cost attribute when making choices. The interaction with the variable that identifies whether they visited is

significant and positive. The marginal utility of money is identified by the sum of the primary cost effect and the visitation interaction (i.e. for those who considered their budget, but did not visit, the marginal utility of cost is -0.007, but those who considered budget and did visit would have a marginal utility of -0.004 (-0.007+0.003)). The consequence of a smaller (in absolute value) coefficient on cost is a higher willingness to pay.

Of the other attributes, sandy beach area, and having good beach access and facilities present were values. Average beach access (relative to poor) and the foreshore reserve area were not significant i.e. respondents do not appear to value these attributes, as changes in their levels do not influence choices.

The status quo variable is a dummy variable that identifies a value placed on the conditions that would arise if no additional management were put in place, independently of the attribute levels. We find that this effect varies by age of the respondent. Those who are older reveal a greater preference for change (i.e. a negative weight to the status quo).

Table B7. Conditional logit results

Variables	Coefficient		Std. Err.	[95% Conf.	Interval]
Cost					
Budget considered	-0.007	***	0.001	-0.010	-0.005
Budget not considered	-0.003	**	0.001	-0.005	-0.001
Cost*Visitor	0.003	**	0.001	-0.001	0.005
Sandy beach	0.012	***	0.003	0.006	0.018
Foreshore reserve	0.003		0.003	-0.003	0.009
Beach access average	0.011		0.275	-0.528	0.549
Beach access good	0.609	*	0.254	-0.111	1.107
Facilities present	0.636	**	0.199	0.246	1.025
Status quo	0.380		0.401	-0.407	1.166
Status quo*Age	-0.021	***	0.006	-0.033	-0.009

***, **, * indicates significance at the 95% and 90% level of confidence, respectively.

When considering the willingness to pay for attributes, we can divide respondents into four different categories based on the respondents' marginal utility of personal cost. These are reported in Table B8 below. Note that those who did not consider their budget, and recently visited have a cost coefficient which is close to zero, leading to very large, but statistically insignificant WTP estimates. One would typically not consider these values to be reliable.

Table B8. Willingness to pay (WTP) estimates: $ /household /year for 10 years.

	Budget considered				**Budget not considered**			
	Not Recent Visitors		Recent Visitors		Not Recent Visitors		Recent Visitors	
Sandy beach (per % increase in area)	$1.64	**	$2.94	***	$3.62	**	$161.97	
Foreshore reserve (per % increase in area)	$0.38		$0.68		$0.84		$37.55	
Beach access (increase from poor to average)	$1.43		$2.57		$3.17		$141.70	
Beach access (increase from poor to good)	$81.48	*	$146.26	*	$179.87		$8051.30	
Facilities present	$85.11	**	$152.78	**	$187.88	*	$8409.84	
Status quo (age 20)	-6.02		-10.80		-13.28		-594.65	
Status quo (age 60)	-119.73	**	-214.91	**	-264.29	**	-11830.23	

***, **, * indicates significance at the 95% and 90% level of confidence, respectively.

For those who considered their budget, and were not recent visitors, the results indicate they are WTP $1.64 per percentage point increase in beach area, $81 for good access, and a similar amount for maintaining the facilities. Those who were recent visitors were prepared to pay nearly double those values. Those who did not consider their budget and were not recent visitors had higher values again. The results indicate that beach access and having facilities present were seen as equally important, and that this was equivalent to a 50 percentage point change in beach area.

Appendix B References

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Annex B-1.

Table A1. Generating the experimental design by Ngene.

MNL efficiency measures (*the criteria by which the design has been constructed*)	
D error	0.228711
A error	0.8911
B estimate	68.060002
S estimate	31.049276

Prior are the initial estimates of parameter sizes needed in the design

Prior	c	sb(d0)	sb(d1)	sb(d2)	fr(d0)	fr(d1)	fr(d2)	ba(d0)	ba(d1)	fac
Fixed prior value	-0.005	-0.25	0.25	0.5	-0.25	0.25	0.5	-0.5	0.25	-1
Sp estimates	2.17185	30.265324	30.839013	25.864076	31.049276	30.989015	24.443631	28.369406	30.644281	4.951497
Sp t-ratios	1.329968	0.356273	0.352944	0.385396	0.351747	0.352089	0.396436	0.367986	0.354064	0.880821

Design (Reporting a level for each attribute, for the two alternatives (prefixes alt1. and alt2.)

Choice situation	alt1.cost	alt1.sb	alt1.fr	alt1.ba	alt1.fac	alt2.cost	alt2.sb	alt2.fr	alt2.ba	alt2.fac	Block
1	400	75	50	2	1	50	25	50	1	0	4
2	100	50	100	0	0	50	25	75	1	0	5
3	50	50	25	1	0	400	25	100	2	0	3
4	100	75	50	1	0	50	25	25	1	1	1
5	50	100	25	1	1	50	25	75	2	0	4
6	50	25	50	2	0	400	50	100	2	0	2
7	100	50	25	0	0	200	50	75	2	0	5
8	100	25	75	1	0	50	75	50	2	0	1
9	50	50	50	2	0	50	100	25	1	0	3
10	400	100	50	2	0	100	75	25	1	0	2
11	400	75	50	2	0	200	50	75	2	0	3
12	200	75	75	2	0	100	25	25	1	0	4
13	50	25	50	2	1	400	50	25	2	0	1
14	50	75	25	2	0	50	50	75	1	0	3
15	100	25	25	2	0	200	50	50	2	1	5
16	200	50	25	2	0	100	100	75	2	1	4
17	200	25	50	2	0	100	75	100	2	1	2

18	200	75	75	1	0	400	100	50	2	0	4
19	50	50	25	1	0	100	25	100	1	0	1
20	200	100	50	0	1	100	75	75	1	0	1
21	100	50	25	2	0	200	25	50	0	0	2
22	400	50	75	0	0	100	25	50	2	0	3
23	200	75	50	2	0	200	50	75	1	0	2
24	100	50	25	2	1	200	75	50	0	0	5
25	100	50	75	2	0	50	75	50	1	0	5

Appendix C - Estimation results supporting selection of preferred models.

We estimate models for subsamples, and compare to a model that imposes the same preferences across subsamples. We do not include any sociodemographics, apart from the non-attendance to cost.

Location of residents
Are preferences consistent across location of respondents?

```
Full sample


Conditional (fixed-effects) logistic regression

                                                  Number of obs     =      7,305
                                                  LR chi2(9)        =     915.62
                                                  Prob > chi2       =     0.0000
Log likelihood = -2217.3085                       Pseudo R2         =     0.1711

------------------------------------------------------------------------------
          choi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
   costattcost |  -.0057711   .0003568   -16.18   0.000    -.0064704   -.0050718
costnotattcost |  -.0011253   .0004688    -2.40   0.016    -.0020442   -.0002063
            sb |   .0131849   .0012807    10.30   0.000     .0106748     .015695
           tnr |   .0043148   .0023091     1.87   0.062    -.0002109    .0088405
            yl |   .9554233   .0654238    14.60   0.000      .827195    1.083652
           fac |   .2833464   .0897558     3.16   0.002     .1074282    .4592646
               |
            ba |
             1 |   .2193486   .1003636     2.19   0.029     .0226395    .4160577
             2 |   .3104138   .1049661     2.96   0.003     .1046841    .5161435
               |
            sq |  -.3730414   .1245745    -2.99   0.003     -.617203   -.1288799
------------------------------------------------------------------------------

Wanneroo sample

Conditional (fixed-effects) logistic regression

                                                  Number of obs     =      1,620
                                                  LR chi2(9)        =     190.85
                                                  Prob > chi2       =     0.0000
Log likelihood = -497.82392                       Pseudo R2         =     0.1609

------------------------------------------------------------------------------
          choi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
   costattcost |  -.0046124    .000712    -6.48   0.000    -.0060079    -.003217
costnotattcost |  -.0022684   .0009892    -2.29   0.022    -.0042071   -.0003296
            sb |   .0123658   .0026576     4.65   0.000     .0071571    .0175745
           tnr |    .003972   .0048404     0.82   0.412     -.005515     .013459
            yl |   .7663232   .1361863     5.63   0.000     .4994029    1.033244
           fac |   .3401603   .1849754     1.84   0.066    -.0223849    .7027055
               |
            ba |
             1 |   .1661453   .2051897     0.81   0.418    -.2360191    .5683096
             2 |   .0799589   .2149251     0.37   0.710    -.3412865    .5012044
               |
            sq |  -.6169846   .2543381    -2.43   0.015    -1.115478    -.118491
------------------------------------------------------------------------------
```

Swan/Joondalup/Gingin/Stirling sample

```
                                                  Number of obs     =      2,340
                                                  LR chi2(9)        =     297.64
                                                  Prob > chi2       =     0.0000
Log likelihood = -708.09936                       Pseudo R2         =     0.1737

------------------------------------------------------------------------------
          choi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
   costattcost |    -.00526   .0006038    -8.71   0.000    -.0064435   -.0040765
costnotattcost |  -.0004707   .0008567    -0.55   0.583    -.0021498    .0012084
            sb |   .0123491    .002295     5.38   0.000      .007851    .0168472
           tnr |   .0048925   .0041001     1.19   0.233    -.0031435    .0129285
            yl |   1.136205   .1164199     9.76   0.000     .9080261    1.364384
           fac |   .2805887   .1612518     1.74   0.082     -.035459    .5966364
               |
            ba |
             1 |   .1685958   .1763736     0.96   0.339      -.17709    .5142817
             2 |   .2780683    .186786     1.49   0.137    -.0880256    .6441622
               |
            sq |  -.2207345   .2222202    -0.99   0.321    -.6562782    .2148091
------------------------------------------------------------------------------
```

Metropolitan area

```
Conditional (fixed-effects) logistic regression

                                                  Number of obs     =      3,345
                                                  LR chi2(9)        =     446.91
                                                  Prob > chi2       =     0.0000
Log likelihood = -1001.4998                       Pseudo R2         =     0.1824

------------------------------------------------------------------------------
          choi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
   costattcost |  -.0068564   .0005719   -11.99   0.000    -.0079774   -.0057355
costnotattcost |  -.0010765   .0006888    -1.56   0.118    -.0024264    .0002735
            sb |   .0144856   .0019191     7.55   0.000     .0107241     .018247
           tnr |   .0042745   .0034534     1.24   0.216     -.002494     .011043
            yl |   .9290893   .0980246     9.48   0.000     .7369646    1.121214
           fac |   .2730926   .1339671     2.04   0.041     .0105219    .5356632
               |
            ba |
             1 |   .3139587   .1527147     2.06   0.040     .0146434     .613274
             2 |   .4686471   .1584757     2.96   0.003     .1580404    .7792538
               |
            sq |  -.3453343   .1878824    -1.84   0.066     -.713577    .0229083
------------------------------------------------------------------------------
```

Conduct a log likelihood test of whether the aggregate model is appropriate

```
Assumption: (all) nested in (l1, l2, l3)

Akaike's information criterion and Bayesian information criterion

------------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+----------------------------------------------------------------
         all |      7,305 -2675.121  -2217.309       9    4452.617   4514.684
          l1 |      1,620 -593.2506  -497.8239       9    1013.648   1062.159
          l2 |      2,340 -856.9176  -708.0994       9    1434.199    1486.02
          l3 |      3,345 -1224.953    -1001.5       9        2021   2076.037
------------------------------------------------------------------------------
Likelihood-ratio test                                 LR chi2(18) =     19.77
                                                      Prob > chi2 =    0.3459

Assumption: (all) nested in (l1, l2, l3)
```

Results imply that the three groups can be combined (p>0.05).

Now we test for whether the subsamples that visit or not hold different values.

Visitors

```
Conditional (fixed-effects) logistic regression

                                                Number of obs     =      2,415
                                                LR chi2(9)        =     293.31
                                                Prob > chi2       =     0.0000
Log likelihood = -737.73021                     Pseudo R2         =     0.1658

------------------------------------------------------------------------------
        choi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  costattcost |  -.0034601   .0005265    -6.57   0.000    -.0044921   -.0024282
costnotattcost |  -.0010534   .0007887    -1.34   0.182    -.0025993    .0004924
          sb |   .0104558   .0021334     4.90   0.000     .0062744    .0146373
         tnr |   .0031388   .0040125     0.78   0.434    -.0047256    .0110031
          yl |   .8789413   .1095638     8.02   0.000     .6642002    1.093682
         fac |   .2198663   .1521195     1.45   0.148    -.0782823     .518015
             |
          ba |
           1 |   .0771433   .1626483     0.47   0.635    -.2416414    .3959281
           2 |   .1903135   .1724028     1.10   0.270    -.1475897    .5282167
             |
          sq |  -.6931539   .2107109    -3.29   0.001     -1.10614   -.2801681
------------------------------------------------------------------------------
```

Non-visitors

```
Conditional (fixed-effects) logistic regression

                                                Number of obs     =      4,890
                                                LR chi2(9)        =     675.03
                                                Prob > chi2       =     0.0000
Log likelihood = -1453.2255                     Pseudo R2         =     0.1885

------------------------------------------------------------------------------
        choi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  costattcost |   -.007377   .0004969   -14.85   0.000    -.0083508   -.0064031
costnotattcost |  -.0013102   .0005897    -2.22   0.026     -.002466   -.0001543
          sb |   .0149878   .0016229     9.24   0.000     .0118071    .0181686
         tnr |   .0052452   .0028502     1.84   0.066    -.0003411    .0108315
          yl |   1.010614   .0822344    12.29   0.000     .8494378    1.171791
         fac |   .3360124   .1118414     3.00   0.003     .1168072    .5552175
             |
          ba |
           1 |   .3305365   .1287652     2.57   0.010     .0781613    .5829118
           2 |   .3973212   .1335112     2.98   0.003      .135644    .6589984
             |
          sq |  -.2261276   .1565426    -1.44   0.149    -.5329455    .0806904
------------------------------------------------------------------------------
```

```
Likelihood-ratio test                                 LR chi2(9)  =     52.71
                                                      Prob > chi2 =    0.0000

Assumption: (all) nested in (v1, v2)

Akaike's information criterion and Bayesian information criterion

------------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC         BIC
-------------+----------------------------------------------------------------
         all |      7,305 -2675.121  -2217.309       9    4452.617   4514.684
          v1 |      2,415 -884.3829  -737.7302       9     1493.46   1545.566
          v2 |      4,890 -1790.738  -1453.226       9    2924.451   2982.906
------------------------------------------------------------------------------
```

We reject that these groups can be combined (p<0.0001).

But the error variance may be different between groups. So we control for that in the combined data analysis.

Full sample with error heterogeneity

```
Heteroscedastic logistic regression             Number of obs     =       7305
                                                Number of groups  =       2435
                                                LR chi2(1)        =       2.51
Log likelihood = -2216.052                      Prob > chi2       =     0.1129

------------------------------------------------------------------------------
          choi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
variables      |
   costattcost |  -.0053786   .0004186   -12.85   0.000    -.0061991   -.0045582
costnotattcost |  -.0010348   .0004337    -2.39   0.017    -.0018848   -.0001848
            sb |   .0121727   .0013473     9.03   0.000      .009532    .0148134
           tnr |   .0040132   .0021211     1.89   0.058     -.000144    .0081704
            yl |   .8754729   .0791015    11.07   0.000     .7204368    1.030509
           fac |   .2620276    .083325     3.14   0.002     .0987136    .4253417
           ba2 |    .208105   .0925307     2.25   0.025     .0267481    .3894619
           ba3 |    .287939   .0974452     2.95   0.003     .0969499    .4789281
            sq |  -.3290656   .1174476    -2.80   0.005    -.5592586   -.0988726
---------------+--------------------------------------------------------------
het            |
        visit2 |   .1298476   .0836721     1.55   0.121    -.0341467    .2938419
------------------------------------------------------------------------------


Likelihood-ratio test                                 LR chi2(8)  =     50.19
                                                      Prob > chi2 =    0.0000

Assumption: (vishet) nested in (v1, v2)

Akaike's information criterion and Bayesian information criterion

------------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC         BIC
-------------+----------------------------------------------------------------
      vishet |      7,305         .  -2216.052      10    4452.104   4521.067
          v1 |      2,415 -884.3829  -737.7302       9     1493.46   1545.566
          v2 |      4,890 -1790.738  -1453.226       9    2924.451   2982.906
------------------------------------------------------------------------------
```

The results imply that the two groups cannot be combined even when accounting for difference in error variance (p<0.0001).

Appendix D: Yanchep Beach survey instrument

Welcome to the Yanchep Beach survey

We would like to start with a few questions about yourself:

S1) What is your gender?

- Male
- Female
- Non-binary/other

S2) Which age group applies to you?

- Under 18 years
- 18-30 years
- 31-45 years
- 46-60 years
- 61-75 years
- Over 75

S3) Where do you live?

- Perth metropolitan area - City of Waneroo
- Perth metropolitan area - City of Swan/Joondalup/Stirling OR Shire of Gingin
- Perth metropolitan area - Other

Preferences for managing coastal hazards at Yanchep Beach

Dear Sir/Madam,

Thank you for reading this introduction screen which outlines a research project being conducted by The University of Western Australia, in conjunction with the WA Department of Planning, Lands and Heritage.

This survey aims to understand your preferences for managing the coastal environment and infrastructure at Yanchep Beach from coastal hazards.

You have been selected to participate in this research because you are a resident of the Western Australian community.

Your opinion is important – we will be surveying a large number of people to obtain a representative view of the community.

Participation involves completing a survey that will take approximately 20 minutes of your time. The survey has four parts:

PART 1: Some questions about your experiences with Yanchep Beach

PART 2: A description of how some coastal features at Yanchep Beach will be impacted by coastal hazards in the next 10 years.

PART 3: A series of hypothetical management scenarios having different outcomes for a few important features of the coast, where you choose your preferred option

PART 4: Some questions about you to make sure the group of people that respond to this survey are representative of the broader community

Your involvement is voluntary, and you may withdraw from the survey at any time. You must be at least 18 years of age to participate.

If you consent to participate in this study, please complete the survey that follows. If you have any questions feel free to contact me on the details below.

You can download a copy of this information sheet here.

Kind regards,

Dr Abbie Rogers
Research Fellow
The University of Western Australia
P: 6488 5506
E: abbie.rogers@uwa.edu.au

Approval to conduct this research has been provided by the University of Western Australia, in accordance with its ethics review and approval procedures (Approval Number RA/4/20/1036). Any person considering participation in this research project, or agreeing to participate, may raise any questions or issues with the researchers at any time.
In addition, any person not satisfied with the response of researchers may raise ethics issues or concerns, and may make any complaints about this research project by contacting the Human Ethics Office at the University of Western Australia on (08) 6488 3703 or by emailing to humanethics@uwa.edu.au
All research participants are entitled to retain a copy of any Participant Information Form and/or Participant Consent Form relating to this research project. All responses will be stored securely. Overall results may be published, but will not be linked to individual information. Only researchers working on this project will have access to the data.

What this survey is about

Coastal environments and infrastructure, including Yanchep Beach, are exposed to many threatening processes. Threats might include coastal hazards, the spread of weeds, urban development, or others.

This survey focuses on the impacts caused by coastal hazards.

This survey aims to understand your preferences for protecting the coast at Yanchep Beach from these hazards.

In Western Australia, the main hazards that affect our coast are erosion and inundation.

Erosion is a process where parts of the shoreline are worn away due to waves, tides, wind or human activities. It can change the shape and form of the coast, reducing the area between the ocean and features on the land, and even allowing inundation.

Erosion on a beach at Seabird.
Credit: ABC News, Bonnie Christian

Inundation is when water occupies previously dry land. It can be temporary or permanent:

- Permanent inundation refers to the loss of land due to sea level rise.
- Temporary inundation is the flooding of an area due to storm surge, high tides or large waves.

Perth storm resulting in inundation of roads.
Credit: *Hannah Woodward/Twitter*

Storm events and rising sea levels are likely to result in a greater impact of erosion and inundation on our coast in future years.

Coastal features, such as sandy beaches, grassed foreshore reserves, natural reserves containing animals and plants, beach access points, and retail, dining and club facilities can be impacted by the erosion and inundation.

Different management actions can be used to avoid or reduce the impacts of coastal hazards. These actions are usually funded by Local Government and/or State Government agencies.

The survey has 4 main parts:

PART 1: Some questions about your experiences with Yanchep Beach.

PART 2: A description of how some coastal features will be impacted by coastal hazards in the next 10 years. This information is needed for Part 3.

PART 3: A series of hypothetical management scenarios. You will be asked to choose one of 3 options for each scenario. Each option involves different outcomes for a few important features of the coast.

PART 4: Some questions about you, to make sure the group of people that respond to this survey are representative of the broader community.

PART 1 - Your experiences with Yanchep Beach

Yanchep Beach includes the stretch of sandy beach and associated foreshore areas between Capricorn groyne located to the north of the Yanchep lagoon, down to the headland to the south of the lagoon with Brazier Road as the eastern boundary.

The following questions relate to your experience with Yanchep Beach.

Q1.1) Have you visited Yanchep Beach in the last year?

- Yes [*answer the questions below*]
- No [*skip to Q1.11 on page 9*]

Q1.2) Thinking about a typical trip to Yanchep Beach first in the hotter months, and then in the colder months, what activities do you usually undertake?

Select all that apply

	Hot months (Nov-April)	Cold months (May-Oct)
Swimming		
Snorkelling		
Scuba diving		
Surfing		
Windsurfing		
Kitesurfing		
Stand up paddle boarding		
Kayaking		
Water skiing		
Jet skiing		
Sailing		
Boating (private motorised vessel)		
Boating (chartered/hired motorised vessel)		
Fishing – shore based		
Fishing – boat based		
Four wheel driving		
Off-road biking		
Walking		
Running		
Dog walking		
Sandboarding		
Relaxing		
Socialising with friends or family		
Picnicking or barbecuing		
Visiting playgrounds		
Visiting Aboriginal heritage sites		
Visiting European heritage sites		
Watching wildlife		
Beach combing – e.g. shell collecting		
Replanting native plants & removing weeds		
Dining at restaurants, cafes, kiosks, pubs etc.		
Attending events – e.g. concerts, sporting, arts events		
Other activity 1 (specify)		
Other activity 2 (specify)		

Q1.3) How often on average would you visit Yanchep Beach per month during the hotter months (November to April)?

- Nearly every day (5-7 times a week)
- A few times a week (2-4 times a week)
- About once a week
- About once a fortnight
- About once a month
- Less than once a month
- Never

Q1.4) How often on average would you visit Yanchep Beach per month during the colder months (May to October)?

- Nearly every day (5-7 times a week)
- A few times a week (2-4 times a week)
- About once a week
- About once a fortnight
- About once a month
- Less than once a month
- Never

Q1.5) How many people usually come with you to the beach?

_____ adults _____ children

Q1.6) Thinking about a typical trip to Yanchep Beach, please identify the distance you travel, and the time you take in the table below (one-way).

If a single trip involves more than one mode of transport (e.g. bus, followed by walking) please indicate distance and time for BOTH means of transport for a single trip.

For reference: Perth City to Yanchep Beach = 56km

	Distance (km)	Time (minutes)
Walk		
Bicycle		
Motorcycle		
Small car		
Large car, ute, 4WD, small truck		
Bus [*answer Q1.7 below*]		
Train [*answer Q1.7 below*]		
Other (please specify)		

Q1.7) If you take the bus or train as part of the trip, how much do you approximately pay for a one way trip (to the nearest dollar):

cost $_____

Q1.8) On a typical trip to Yanchep Beach, do you normally combine the trip with other activities unrelated to the beach (e.g. visiting the beach while going to/from work)?

- ○ No – visiting Yanchep Beach is typically the only stop I make on the trip
- ○ Yes – I typically make multiple stops when I visit Yanchep Beach

Q1.9) What do you think about the public transport services available to access Yanchep Beach?

Insufficient public transport				Sufficient public transport
1	2	3	4	5
○	○	○	○	○

Q1.10) What do you think about the availability of parking at Yanchep Beach?

Insufficient parking available				Sufficient parking available
1	2	3	4	5
○	○	○	○	○

Q1.11) Aside from Yanchep Beach, there are other places that you could visit around the Perth metropolitan region to enjoy outdoor recreation activities, including other beaches, lakes, wetlands, rivers or parks.

When you want to do outdoor recreation activities, do you usually visit Yanchep Beach or one of these other areas?

- Use Yanchep Beach most of the time [*skip to Q1.12 on page 11*]
- Use other locations most of the time [*answer questions Q1.11a, Q1.11b (if relevant) and Q1.11c below*]
- I usually don't visit any outdoor recreation areas in the Perth metropolitan region [*skip to Q1.12 on page 11*]

Q1.11a) If you prefer other locations, what is the main reason?

- Closer to where you live than Yanchep Beach
- Better suited to the type of outdoor activity than Yanchep Beach **[***Answer Q1.11b below***]**
- Better accessibility than Yanchep Beach (e.g. car parking, boat ramps, walkways and stairs)
- Better facilities/amenities than Yanchep Beach (e.g. bbq's, playground equipment, toilets)
- There are fewer people using it than Yanchep Beach
- Nicer environment than Yanchep Beach (e.g. cleaner, more natural)
- Safer environment than Yanchep Beach (e.g. calmer water, more sheltered, more secure)
- Other (please specify): .....

Q1.11b) Which types of outdoor recreation activities do you prefer to do at other sites rather than at Yanchep Beach?

Select all that apply

○ Swimming	○ Walking
○ Snorkelling	○ Running
○ Scuba diving	○ Dog walking
○ Surfing	○ Sandboarding
○ Windsurfing	○ Relaxing
○ Kitesurfing	○ Socialising with friends or family
○ Stand up paddle boarding	○ Picnicking or barbecuing
○ Kayaking	○ Visiting playgrounds
○ Water skiing	○ Visiting Aboriginal heritage sites
○ Jet skiing	○ Visiting European heritage sites
○ Sailing	○ Watching wildlife
○ Boating (private motorised vessel)	○ Beach combing – e.g. shell collecting
○ Boating (chartered/hired motorised vessel)	○ Replanting native plants & removing weeds
○ Fishing – shore based	○ Dining at restaurants, cafes, kiosks, pubs etc.
○ Fishing – boat based	○ Attending events – e.g. concerts, sporting, arts events
○ Four wheel driving	
○ Off-road biking	
○ Other (specify): …….	

Q1.11c) Of the other outdoor recreation areas that you prefer relative to Yanchep Beach, what are the main ones?

Please list

.....

.....

.....

.....

Q1.12) State how much you agree that it is important to protect, manage, and maintain Yanchep Beach in its current state for the following reasons (*tick the relevant boxes in the table below*):

It is important to maintain Yanchep Beach in its current state:	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
For my own recreational use					
For other people's recreational use					
For the option that I can use it for recreation at some time in the future					
For future generations to use for recreation					
For people to be able to live nearby					
For environmental health, including flora and fauna habitat					
For cultural significance, including Aboriginal and European heritage					
For commercial use					
For tourism					

Q1.13) Do you have any other comments you would like to add about how you use Yanchep Beach or other beaches in the Perth metropolitan region, or why you think these beaches are important?

(*you may skip this question if you prefer)*

_____
_____
_____
_____

PART 2 – The state of coastal features at Yanchep Beach

You will need to read this information to be able to answer the management scenarios in Part 3.

Over the next 10 years coastal hazards will cause damage to Yanchep Beach.

Coastal features that are affected by the hazards include sandy beaches; foreshore reserves; natural reserves; beach access; and retail, dining and club facilities.

Different management actions can be used to address the hazards and control their impact on the coastal features. Management actions include:

- *Sand replacement*
- *Dune stabilisation and sand management*
- *Dune construction*
- *Reef construction or restoration*
- *Offshore breakwaters*
- *Seawalls*
- *Groynes*
- *Relocating facilities*

*Hover mouse over for more information

Different management actions can have positive impacts on some coastal features while having negative impacts, or no influence at all, on others. For example, a seawall might protect the foreshore reserve, but lead to a decrease in the area of sandy beach available.

There is a degree of uncertainty about the precise impact that the hazards and their management will have on the coastal features in the 10 year timeframe, but the information that follows is based on the best available information, including modelling of global trends in coastal hazards.

Q2.1) Do you have any opinions about the management actions listed above and how appropriate they are for coastal hazard management at Yanchep Beach?

You may skip this question if you prefer

_____
_____
_____
_____

Commented [A1]: HOVER BOX: Importing sand to re-establish the area of sandy beach, typically undertaken periodically.

Commented [A2]: HOVER BOX: Revegetating dunes and using structures to control human movement (e.g. fences, pathways), to improve habitat or reduce sand movement.

Commented [A3]: HOVER BOX: Reconstructing sand dunes that no longer exist to control sand being blown by wind, or to provide improved habitat, or to restrict how far waves or floodwaters come onto land.

Commented [A4]: HOVER BOX: Building artificial reef structures or restoring damaged natural reefs to provide habitat for marine life and modify wave conditions and movement of sand.

Commented [A5]: HOVER BOX: Concrete blocks or boulders that are placed offshore to slow wave energy and movement of sand.

Commented [A6]: HOVER BOX: A hard rock or concrete wall built along the coast used to prevent waves from eroding the foreshore reserve or to protect against flooding.

Commented [A7]: HOVER BOX: A barrier or wall perpendicular to the coast used to manage how waves move sand, typically by holding sand on one side of the structure.

Commented [A8]: HOVER BOX: Instead of protecting coastal features where they are, they are moved or rebuilt at a new location.

In the questions that follow in Part 3:

- We will focus on the outcomes of management actions on coastal features. These varying outcomes may have an effect on your enjoyment of the beach.
- It doesn't matter what management action was used, we are focussing on the condition of the coastal features themselves.
- What we want to know is how you would value different outcomes if the condition of the coastal features was to change.

Now we will describe our 5 coastal features

1. Sandy Beach

This is the area of sandy beach available for recreational use at high tide.

Currently, in the summer there are about 50,000 square metres (or 5 hectares) of sandy beach available for use: an area roughly 50 metres wide along the 1 km stretch of beach (or, about 2 ½ times the size of Optus Stadium).

In 10 years' time, without any management action, it is expected that the area of beach available for use will be only 50% (half) of what is currently available.

Different hazard management actions could lead to increases or decreases in the amount of sandy beach, ranging from:

- **25%** of the current beach (~12,500m^2, or 1.25 hectares)
- **50%** of the current beach (~25,000m^2, or 2.5 hectares) – i.e. the expected area in 10 years' time
- **75%** of the current beach (~37,500m^2, or 3.75 hectares)
- **100%** of the current beach (~50,000m^2, or 5 hectares) – i.e. there is no change from today

2. Yanchep Lagoon

Yanchep Lagoon extends north from the northern bluff for 300 m. The reef is attached at the southern end, and the beach curves to the east causing the lagoon to widen to the north. Waves are usually low in the lagoon, making it a sheltered area for swimming and snorkelling, which are popular activities in the lagoon. The lagoon also has aesthetic value, and is a distinct feature of Yanchep beach.

In 10 years' time, with no management action, it is expected that Yanchep lagoon may deteriorate due to coastal inundation. It will still likely be a distinct feature of Yanchep beach, but will be less protected and less suitable as a sheltered area for swimming and snorkelling. However, it is also possible to artificially protect the lagoon and ensure that it the sheltered swimming and snorkelling area that it provides is preserved.

Different hazard management actions could mean that Yanchep lagoon is either:

- **Deteriorated**, where the lagoon deteriorates without management – i.e. the expected situation in 10 years' time
- **Maintained**, where the lagoon is preserved with management action – i.e. there is no change from today

3. Terrestrial natural reserve

This is the area of natural reserves next to the coast, including native dune vegetation.

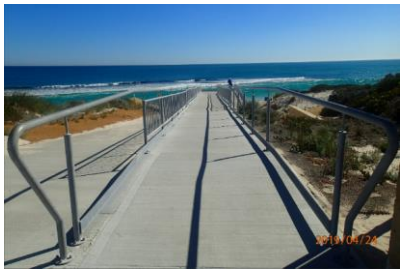
Currently, there are approximately 43 hectares of natural reserve (or, about 20 times the area of the Optus Stadium)

In 10 years' time, without any management action, it is expected that the area of natural reserves will be only 75% (three-quarters) of the current area.

Different hazard management actions could lead to increases or decreases in the amount of natural reserve, ranging from:

- **50%** of the current natural reserve (~22 hectares)
- **75%** of the current natural reserve (~32 hectares) – the expected area in 10 years' time
- **85%** of the current natural reserve (~36 hectares)
- **100%** of the current natural reserve (43 hectares) – i.e. there is no change from today

4. Beach access



This includes the provision of pathways and stairs that service the beach, as well as ramps for disability access. This does not include informal access paths to the beach.

Currently beach access is average, with there being pathways, stairs and ramps leading down to the beach approximately every 300 metres apart. There are stairs leading down to the beach just off the carparks along Brazier Road, and there is ramp access to the beach from the Yanchep Surf Life Saving Club.

In 10 years' time, without any management action, it is expected that accessibility will be poor, with some pathways, stairs and ramps no longer connecting to the beach, meaning the distance between access points will be greater than 450 metres.

Different hazard management actions could change the accessibility to either:

- **Poor**, with access points every 450m – the expected situation in 10 years' time with no management action
- **Average**, with access points every 300m – i.e. there is no change from today
- **Good**, with access points every 150m

5. Retail, dining & club facilities

This includes the provision of retail, food outlets, and other public services along the foreshore reserve.

Currently, the services provided at the Yanchep beach foreshore include the Yanchep Surf Life Saving Club, the Yanchep Lagoon Beach Café (also called the Orion Café), and carparks and associated infrastructure.

In 10 years' time, with no management action, it is expected that coastal erosion and inundation could threaten the Orion Café and the carparks making it necessary to remove them.

Different hazard management actions, therefore, mean that the Orion Café and the carparks and their associated infrastructure are either:

- **Absent** – the Café and carparks deteriorate and are removed – i.e. the expected situation in 10 years' time
- **Present** – the Café and carparks are maintained and can continue to serve – i.e. there is no change from today

Q2.2) Do you have any opinions about the state of the coastal features we have described, in terms of the way they could change in size, amount or presence, due to impacts from coastal hazards and their management?

(*you may skip this question if you prefer)*

_____
_____
_____
_____

What can we do?

To maintain the current condition of the coastal features described above, additional funds are required to increase the budget that Western Australian Local and State Government agencies have available to manage our coastal environments.

Sourcing additional funds to invest in coastal hazard management at Yanchep Beach could be achieved through a special State Fund, where payments are collected from all Western Australian households.

PART 3 – Management scenarios

In this part, you will be asked a number of questions about the outcomes of management for the coastal features described in Part 2.

Note that while the questions are hypothetical, and the specific management actions are not described, the outcomes in each question have been deemed feasible by experts and can be achieved through combinations of different management actions.

The management costs associated with improving outcomes of these features will be raised through a State Fund, with payments collected from Western Australian households. The funds collected would be used specifically for managing the impacts of coastal hazards.

These payments will apply for a **period of 10 years**, with the management outcomes achieved by the end of this period.

Please read the following guidelines before proceeding further:

- You will be presented with **5 hypothetical management scenarios**. Each question should be treated independently.
- In each scenario, you will be presented with **3 options**. Each option offers a different combination of outcomes for the coastal features. The combinations are different according to the size, amount or presence of each feature offered in 10 years' time. They also differ according to the management cost. The increased cost to you is presented as an annual figure to be paid for a period of 10 years.
- In each scenario, you will be asked to choose the option that is most appealing to you. You need to be **mindful of your own financial circumstances**, i.e. consider the limit of how much you can realistically afford given your current household income and personal expenses.
- We will be surveying a large number of people to work out the values held across the WA community.

The findings that emerge from this study may be used to inform future investment decisions for managing the impact of coastal hazards at Yanchep Beach.

Here is an example of the type of question you will have to answer.

When answering the management scenarios, don't forget to:

- Consider each option (looking down each column)
- Keep in mind what you can afford when weighing up the cost of each option
- Choose your most preferred option based on the assumption that these are the only options available to you
- Treat each management scenario independently. You don't need to remember or anticipate the choices you make across the series of scenarios.

You can make your selection by clicking on the box containing the option.

Once you have selected it the box will turn green. You should only select one.

In the example below, the respondent has decided that they are prepared to pay $50 a year for the next 10 years to ensure that the Yanchep lagoon is maintained and Retail, dining and club facilities are present, even though the area of Sandy beach and Terrestrial natural reserve will be reduced to 50% each, and the Beach access will remain average.

Management scenario EX: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years' time:	**Option 1**	**Option 2**	**Option 3** Situation in 10 years' time with no management change	What you get at the moment:
 **Sandy beach**	100%	50%	50%	100%
 **Yanchep lagoon**	Deteriorated	Maintained	Deteriorated	Maintained
 **Terrestrial natural reserve**	75%	50%	75%	100%
 **Beach access**	Good	Average	Poor	Average
 **Retail, dining & club facilities**	Present	Present	Absent	Present
Cost to you each year, for 10 years	$400	$50	$0	

Now we would like you to answer 5 of these questions

Management scenario 1: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years' time:	Option 1	Option 2	Option 3 Situation in 10 years' time with no management change	What you get at the moment:
 **Sandy beach**	50%	50%	50%	100%
 **Yanchep lagoon**	Deteriorated	Maintained	Deteriorated	Maintained
 **Terrestrial natural reserve**	75%	50%	75%	100%
 **Beach access**	Average	Good	Poor	Average
 **Retail, dining & club facilities**	Absent	Absent	Absent	Present
Cost to you each year, for 10 years	$400	$50	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Yanchep lagoon

Terrestrial natural reserve

Beach access

Retail, dining & club facilities

Commented [A9]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. Currently there are 50,000 square metres (or 5 hectares). In 10 years, different management could mean that there is between 25% and 100% left.

Commented [A10]: HOVER BOX: Currently Yanchep lagoon provides a sheltered area for swimming and snorkelling. In 10 years' time, different management could mean that Yanchep lagoon may either deteriorate due to coastal inundation without management, or continue to be maintained with management.

Commented [A11]: HOVER BOX: This is the area of natural reserves next to the coast, including native dune vegetation. Currently, there are 43 hectares. In 10 years, different management could mean that there is between 50% and 100% left.

Commented [A12]: HOVER BOX: This includes the provision of pathways and stairs that service the beach, as well as ramps for disability access. In 10 years, different management could mean a change in access. 'Poor' means access points every 450 metres; 'Average' means access points every 300 metres, which is the current level; 'Good' means access points every 150 metres.

Commented [A13]: HOVER BOX: This includes the provision of retail, food outlets, and other public services along the foreshore reserve. Currently, these include the Yanchep Surf Life Saving Club, the Yanchep Lagoon Beach Café (also called the Orion Café), and car parks and associated infrastructure. In 10 years, different management could mean that these facilities are either present or absent.

Management scenario 2: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years' time:	Option 1	Option 2	Option 3 Situation in 10 years' time with no management change	What you get at the moment:
 **Sandy beach**	50%	25%	50%	100%
 **Yanchep lagoon**	Maintained	Deteriorated	Deteriorated	Maintained
 **Terrestrial natural reserve**	50%	85%	75%	100%
 **Beach access**	Good	Average	Poor	Average
 **Retail, dining & club facilities**	Present	Absent	Absent	Present
Cost to you each year, for 10 years	$100	$100	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Yanchep lagoon

Terrestrial natural reserve

Beach access

Retail, dining & club facilities

Commented [A14]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. Currently there are 50,000 square metres (or 5 hectares). In 10 years, different management could mean that there is between 25% and 100% left.

Commented [A15]: HOVER BOX: Currently Yanchep lagoon provides a sheltered area for swimming and snorkelling. In 10 years' time, different management could mean that Yanchep lagoon may either deteriorate due to coastal inundation without management, or continue to be maintained with management.

Commented [A16]: HOVER BOX: This is the area of natural reserves next to the coast, including native dune vegetation. Currently, there are 43 hectares. In 10 years, different management could mean that there is between 50% and 100% left.

Commented [A17]: HOVER BOX: This includes the provision of pathways and stairs that service the beach, as well as ramps for disability access. In 10 years, different management could mean a change in access. 'Poor' means access points every 450 metres; 'Average' means access points every 300 metres, which is the current level; 'Good' means access points every 150 metres.

Commented [A18]: HOVER BOX: This includes the provision of retail, food outlets, and other public services along the foreshore reserve. Currently, these include the Yanchep Surf Life Saving Club, the Yanchep Lagoon Beach Café (also called the Orion Café), and car parks and associated infrastructure. In 10 years, different management could mean that these facilities are either present or absent.

Management scenario 3: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years' time:	Option 1	Option 2	Option 3 Situation in 10 years' time with no management change	What you get at the moment:
 **Sandy beach**	25%	75%	50%	100%
 **Yanchep lagoon**	Deteriorated	Deteriorated	Deteriorated	Maintained
 **Terrestrial natural reserve**	50%	75%	75%	100%
 **Beach access**	Average	Good	Poor	Average
 **Retail, dining & club facilities**	Present	Present	Absent	Present
Cost to you each year, for 10 years	$50	$100	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Yanchep lagoon

Terrestrial natural reserve

Beach access

Retail, dining & club facilities

Commented [A19]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. Currently there are 50,000 square metres (or 5 hectares). In 10 years, different management could mean that there is between 25% and 100% left.

Commented [A20]: HOVER BOX: Currently Yanchep lagoon provides a sheltered area for swimming and snorkelling. In 10 years' time, different management could mean that Yanchep lagoon may either deteriorate due to coastal inundation without management, or continue to be maintained with management.

Commented [A21]: HOVER BOX: This is the area of natural reserves next to the coast, including native dune vegetation. Currently, there are 43 hectares. In 10 years, different management could mean that there is between 50% and 100% left.

Commented [A22]: HOVER BOX: This includes the provision of pathways and stairs that service the beach, as well as ramps for disability access. In 10 years, different management could mean a change in access. 'Poor' means access points every 450 metres; 'Average' means access points every 300 metres, which is the current level; 'Good' means access points every 150 metres.

Commented [A23]: HOVER BOX: This includes the provision of retail, food outlets, and other public services along the foreshore reserve. Currently, these include the Yanchep Surf Life Saving Club, the Yanchep Lagoon Beach Café (also called the Orion Café), and car parks and associated infrastructure. In 10 years, different management could mean that these facilities are either present or absent.

Management scenario 4: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years' time:	Option 1	Option 2	Option 3 Situation in 10 years' time with no management change	What you get at the moment:
 **Sandy beach**	100%	25%	50%	100%
 **Yanchep lagoon**	Maintained	Maintained	Deteriorated	Maintained
 **Terrestrial natural reserve**	85%	100%	75%	100%
 **Beach access**	Good	Average	Poor	Average
 **Retail, dining & club facilities**	Present	Present	Absent	Present
Cost to you each year, for 10 years	$100	$200	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Yanchep lagoon

Terrestrial natural reserve

Beach access

Retail, dining & club facilities

Commented [A24]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. Currently there are 50,000 square metres (or 5 hectares). In 10 years, different management could mean that there is between 25% and 100% left.

Commented [A25]: HOVER BOX: Currently Yanchep lagoon provides a sheltered area for swimming and snorkelling. In 10 years' time, different management could mean that Yanchep lagoon may either deteriorate due to coastal inundation without management, or continue to be maintained with management.

Commented [A26]: HOVER BOX: This is the area of natural reserves next to the coast, including native dune vegetation. Currently, there are 43 hectares. In 10 years, different management could mean that there is between 50% and 100% left.

Commented [A27]: HOVER BOX: This includes the provision of pathways and stairs that service the beach, as well as ramps for disability access. In 10 years, different management could mean a change in access. 'Poor' means access points every 450 metres; 'Average' means access points every 300 metres, which is the current level; 'Good' means access points every 150 metres.

Commented [A28]: HOVER BOX: This includes the provision of retail, food outlets, and other public services along the foreshore reserve. Currently, these include the Yanchep Surf Life Saving Club, the Yanchep Lagoon Beach Café (also called the Orion Café), and car parks and associated infrastructure. In 10 years, different management could mean that these facilities are either present or absent.

Management scenario 5: Assuming these three options are the only ones available to you, which one would you choose? Remember to be mindful of your budget constraint.

What you will get in 10 years' time:		Option 1	Option 2	Option 3 Situation in 10 years' time with no management change	What you get at the moment:
	**Sandy beach**	100%	25%	50%	100%
	**Yanchep lagoon**	Maintained	Maintained	Deteriorated	Maintained
	**Terrestrial natural reserve**	75%	50%	75%	100%
	**Beach access**	Average	Average	Poor	Average
	**Retail, dining & club facilities**	Present	Present	Absent	Present
Cost to you each year, for 10 years		$400	$100	$0	

A reminder of what is meant by each term is available here:

Sandy beach

Yanchep lagoon

Terrestrial natural reserve

Beach access

Retail, dining & club facilities

Commented [A29]: HOVER BOX: This is the area of sandy beach available for recreational use at high tide. Currently there are 50,000 square metres (or 5 hectares). In 10 years, different management could mean that there is between 25% and 100% left.

Commented [A30]: HOVER BOX: Currently Yanchep lagoon provides a sheltered area for swimming and snorkelling. In 10 years' time, different management could mean that Yanchep lagoon may either deteriorate due to coastal inundation without management, or continue to be maintained with management.

Commented [A31]: HOVER BOX: This is the area of natural reserves next to the coast, including native dune vegetation. Currently, there are 43 hectares. In 10 years, different management could mean that there is between 50% and 100% left.

Commented [A32]: HOVER BOX: This includes the provision of pathways and stairs that service the beach, as well as ramps for disability access. In 10 years, different management could mean a change in access. 'Poor' means access points every 450 metres; 'Average' means access points every 300 metres, which is the current level; 'Good' means access points every 150 metres.

Commented [A33]: HOVER BOX: This includes the provision of retail, food outlets, and other public services along the foreshore reserve. Currently, these include the Yanchep Surf Life Saving Club, the Yanchep Lagoon Beach Café (also called the Orion Café), and car parks and associated infrastructure. In 10 years, different management could mean that these facilities are either present or absent.

[*Question answered if respondent always selected Option 3****]***

Q3.SQ) You selected Option 3 (the situation in 10 years' time with no management change) for ALL 5 management scenarios.

Please provide your reason why, choosing from the list below:

- I preferred this option to all others
- I could not afford the other options
- I believe funding to manage the impacts of coastal hazards should come from somewhere other than my own pocket
- I believe funding to manage the impacts of coastal hazards should be collected by some other means than a State Fund
- I don't think that the coastal features described for Yanchep Beach need further investment to manage the impacts of coastal hazards
- I don't trust that the funds would be used to manage the impacts of coastal hazards at Yanchep Beach
- I don't believe that there will be impacts from coastal hazards (i.e. erosion and/or inundation) during this time period
- I don't believe I should have to make these choices
- Other (please specify): .....

PART 3 continued

You are now more than 80% of the way through the survey.

There are 9 follow-up questions about the management scenarios and survey in general.

Q3.1) In each management scenario, was the amount of the extra payment required for the different options (i.e. the 'cost to you each year, for 10 years) important to you when making your choices?

- o Yes
- o No

Q3.2) Thinking about the coastal features described in the scenarios, could you rank which were the most important when making your choices?

Rank 1 as most important, 5 as least important.

If you did not care whether the amount of the feature(s) increased/decreased/stayed the same, do not rank the feature.

Coastal Feature:	**Rank:**
Sandy beach	
Yanchep lagoon	
Terrestrial natural reserve	
Beach access	
Retail, dining & club facilities	

Q3.3) Did you think about your household budget, and how much you could afford, while making your choices for the scenarios?

- o Yes
- o No

Q3.4) Did you find the scenarios confusing or particularly difficult to answer?

- o Yes
- o No

Q3.5) Please indicate on the following scale how certain you were of the answers you gave in the scenarios:

Very uncertain									Very certain
1	2	3	4	5	6	7	8	9	10
o	o	o	o	o	o	o	o	o	o

Q3.6) What did you think about the information that was provided to describe the coastal features of Yanchep Beach?

- o I thought it was an informative and accurate description
- o I would have liked more information
- o I thought the descriptions were inaccurate
- o I thought there was too much information
- o I though the information was confusing

Q3.7) How useful do you think the results of this study would be to inform future investment decisions about the coastal features at Yanchep Beach:

Not very useful									Very useful
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Q3.8) How likely do you think it is that the results of this study will be used by decision makers to inform future investment decisions about the coastal features at Yanchep Beach:

Very unlikely									Very likely
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Q3.9) Do you have any other comments about the coastal features described for Yanchep Beach that you would like to add?

Y*ou may skip this question if you prefer*

_____
_____
_____

PART 4 – Questions about you

You are almost at the end of the survey.

These final questions are to make sure that the group of people that respond to this survey are representative of the general community.

Rest assured that your individual responses will remain confidential and we will only use the collected data in aggregate form.

Q4.1) Which Local Government Area do you live in?

- Armadale, City of
- Bassendean, Town of
- Bayswater, City of
- Belmont, City of
- Cambridge, Town of
- Canning, City of
- Claremont, Town of
- Cockburn, City of
- Cottesloe, Town of
- East Fremantle, Town of
- Fremantle, City of
- Gosnells, City of
- Joondalup, City of
- Kalamunda, Shire of
- Kwinana, Town of
- Melville, City of
- Mosman Park, Town of
- Mundaring, Shire of
- Nedlands, City of
- Peppermint Grove, Shire of
- Perth, City of
- Serpentine-Jarrahdale, Shire of
- South Perth, City of
- Stirling, City of
- Subiaco, City of
- Swan, City of
- Victoria Park, Town of
- Vincent, City of
- Wanneroo, City of **[***Answer Q4.1a***]**
- Regional local government area
- Not listed / Unsure

Q4.1a) Do you live within —what you would consider to be— a reasonable walking distance of Yanchep Beach?

- Yes
- No

Q4.2) What are the streets that form the nearest intersection to where you live?

E.g. Stirling Highway *and* Bruce Street

We don't want to know your exact address, but we would like to identify roughly how far it is between your house and Yanchep Beach*.*

_____ *and* _____

Q4.3) Do you have a view of the ocean or coastal dunes (of any part of the coast, not just Yanchep) from your usual place of residence and/or employment?

- Yes
- No

Q4.4) Do you belong to any conservation groups?

- Yes – coastal conservation groups; list if you would like to:_____
- Yes – other environmental conservation groups; list if you would like to: _____
- No

Q4.5) Do you belong to any recreational groups associated with the coast? *Select all relevant options*

- Surf lifesaving club
- Swimming club
- Sailing club
- Recreational fishing club
- Diving club
- Beach fitness/exercise club
- Other (please specify): .....
- None of these groups

Q4.6) Are you employed or do you volunteer in any of the following fields?

- Coastal management/research/consulting
- Government agencies tasked with coastal responsibilities
- Tourism venture specifically associated with the coast
- Hospitality in a business specifically associated with, or located on, the coast
- Boating industry
- Fishing industry
- Other field associated with the coast (please specify): .....
- None of these fields

Q4.7) Which of the following household descriptions best fits you?

- Single without children
- Single with children – at least some of the children are still dependent
- Single with children – with all children having left home
- Couple without children
- Couple with children – at least some of the children are still dependent
- Couple with children – with all children having left home
- Other (please specify): …….

Q4.8) What is your highest level of education?

- Schooling up to Year 10
- Schooling up to Year 12
- Trade or technical certificate
- University degree (Bachelor, Master, PhD)

Q4.9) What is your gross annual income (i.e. before tax)? *Please provide your shared household income if you have joint management of household finances: otherwise provide your personal income.*

- Under $13,000 (under $250/week)
- $13,000-$25,999 ($250-$500/week)
- $26,000 - $41,599 ($500-$800/week)
- $41,600 - $62,399 ($800-$1200/week)

- $62,400 - $88,399 ($1200-$1700/week)
- $88,400 - $129,999 ($1700-$2500/week)
- $130,000 - $181,999 ($2500-$3500/week)
- $182,000 and over ($3000+/week)
- I would rather not say

Q4.10) If you have any further comments, please note them in the box below:

Thank you for completing this survey – your time is greatly appreciated!