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**Valuing damage to
South Australian wetlands
using the Contingent
Valuation Method**

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Valuing damage to South Australian wetlands using the Contingent Valuation Method

J. Bennett, R. Blamey and M. Morrison

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SALINITY
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Executive Summary

This report provides a review of a consultancy performed by Environmental and Resource Economics. Two goals were addressed in the course of the consultancy:

- to undertake a rigorous testing of the Contingent Valuation Method (CVM) as a technique for estimating the value of non-market benefits and costs; and,
- to provide estimates of environmental damage to wetlands in the Upper South East of South Australia (USE).

The CVM is a survey based technique that involves a sample of people being asked their willingness to pay for a set of circumstances defined in a questionnaire. Willingness to pay is the measure economists use to represent a person's value for a good or service.

The wetlands of the USE—notably Tilley Swamp and the Coorong—are the focus of the case study. The environments of these wetlands are expected to be altered as a result of proposed engineering works that will drain groundwater from surrounding agricultural lands affected by dryland salinity.

The approach taken to addressing the two goals of the consultancy was to design and implement for the USE case study, a state-of-the-art CVM survey which included features enabling the testing of hypotheses regarding the suitability of the method to Australian applications.

The CVM strategy emphasised the importance of preliminary research. A three phase process was employed. First, a telephone survey was used to establish the broad-brush picture of the issues involved. This was followed by a sequence of nine focus groups in which the fine detail of the questionnaire design was investigated. Finally, a pre-test of the questionnaire was carried out as a final check for remaining problems.

The questionnaire that emerged from the preliminary research included elements to enable the investigation of three specific issues relating to the validity of the CVM:

- CVM generated results are regarded to be unreliable unless the estimated values are sensitive to differing levels of environmental damage (scope sensitivity);
- The use of different payment vehicles may give rise to different value estimates (payment vehicle bias); and,
- Responses may be sensitive to the format of the willingness to pay elicitation question.

To enable these tests, the sample of over 4,000 respondents who received the questionnaire by post were split into 40 different sub-samples. Corresponding to the three issues tested, the sub-samples were differentiated in terms of:

- two scenarios of environmental damage;
- two payment vehicles; and,
- three formats for the willingness to pay elicitation question.

Response differences across the sub-samples were used to investigate the issues in question.

An overall response rate of 47% was achieved in the survey of SA and NSW electors. A higher rate was achieved in SA (54%) than in NSW (40%).

The results of the survey indicated that sensitivity to scope was present. There is evidence to suggest that those surveyed did not overwhelmingly respond to the willingness to pay question by simply 'dumping' a value to represent their 'warm-glow' of giving to a good cause. Rather, their responses were related to key factors such as the extent of the environmental damage, their more generally expressed attitudes and their socioeconomic characteristics.

The alternative payment vehicles used for this study caused little impact on the value estimates.

An innovative willingness to pay question format was developed for this case study. It was aimed at minimising any dissonance respondents may feel when questioned by permitting them to express their preferences unambiguously. This format was found to offer significant advantages over alternative formats.

Given these results, the conclusion is drawn that the CVM performed well according to tests of the type used in US litigation applications. The estimated value of environmental damage to Tilley Swamp and the Coorong is in the order of \$40 per household as a once off payment. When valued as a separate entity, damage to Tilley Swamp was estimated to be approximately \$20 per household. The relativities of these two estimates demonstrates the importance of establishing an appropriate 'frame' for any application of the CVM. That is, the scenario formulated in the questionnaire must accurately reflect the policy circumstances at hand.

In a wider context, the value estimates derived are indicative of the strength of demand in the community for wetland protection.

The CVM application reported here has also yielded many insights into what can be regarded as appropriate practice for CVM practitioners in Australia. The role of preliminary research is paramount in forming a sound base for a successful CVM application. Scope testing is a valuable tool for checking the validity of the results generated. Payment vehicle selection is critical to the plausibility of a CVM questionnaire. Some particular aspects of the 'Australian psyche' have to be recognised and counter-acted in the design of CVM surveys, especially a lack of trust in governments and a reluctance to take personal responsibility for what are perceived to be issues that are the role of government. It is apparent also that Australians are eager to express more than a simple yes/no response when asked if they are willing to pay for a good in a CVM application. The dissonance minimising format developed for this project appears to offer significant potential in this regard.

SECTION 1

Background

Introduction

On 31 January 1996, the Australian Bureau of Agricultural Economics (ABARE) sub-contracted Environmental and Resource Economics (ERE) to perform a consultancy which had as its aim:

“to test the contingent valuation method and help to develop stated preference techniques for future application to valuation problems in Australia, in particular those relating to dryland salinity.”

The terms of reference for the consultancy specified the use of a case study approach. The focus of the case study was the estimation of the value of changes to the environment of Tilley Swamp and the Coorong resulting from proposed groundwater drainage works in the Upper South East region of South Australia (USE). This report presents the findings of the consultancy.

The research work undertaken for the consultancy forms a part of the National Dryland Salinity R,D&E program. Under the NDSP, ABARE has undertaken extensive modelling and costing of the dryland salinity problem in a number of priority regions around Australia. The USE is one such priority region. This consultancy has been commissioned to fill a perceived gap in knowledge regarding the estimation of off-site, environmental damage costs caused by dryland salinity. Whilst it is set in the context of the specifics of the dryland salinity problems of the USE, it is intended to provide methodological information which will be of significance across a wider range of settings where the estimation of non-market, environmental impacts is problematic.

ERE approached the consultancy with two goals. The first was to undertake a rigorous testing of one non-market valuation technique, the Contingent Valuation Method (CVM) and in so doing, endeavour to develop that technique in an Australian setting. The second was to provide value estimates that are relevant to the specific policy issue of environmental damage in the USE. In this section of the consultancy report, background information about these two aims is provided. First, details of the current standing of the CVM in Australia and internationally are given. These details explain why the issue of non-market valuation and the use of CVM specifically are problematic and hence deserving of detailed investigation. Second, the problems associated with dryland salinity in the USE and the policy issues surrounding these problems are detailed to provide the context for the particular setting of the CVM application undertaken for this consultancy.

Non-market valuation

With the community showing a growing interest in the natural environment, policy makers have become increasingly concerned to account for the environmental impacts of their decisions. Environmental Impact Statements (EIS) are frequently performed to fulfil this requirement but they often fall short in providing a rigorous quantification of trade-offs that might be integral to the decision. For instance, an EIS may document the number of breeding birds that will be displaced if a wetland environment is degraded. However, it may not incorporate an estimation of the loss suffered by the community as a result of the birds' displacement in terms which make it directly comparable to any off-setting gains that may also occur.

The technique used by economists to assist in assessing the trade-offs faced by society when choosing between alternative uses of resources is benefit–cost analysis (BCA). In a BCA of a proposed re-allocation of resources, changes in the well-being of the community, both for better or for worse, are valued in dollar terms. This affords a comparison of options which potentially encompasses all aspects of a proposal. However, because environmental changes are rarely valued through market transactions, dollar values for them are not readily attainable. This limits the application of BCA where environmental impacts are expected. To overcome this limitation, economists have devised an array of techniques which can be used to estimate environmental values in dollar terms. These so-called ‘non-market’ valuation techniques are of two fundamental types:

1. revealed preference techniques; and
2. stated preference techniques.

Revealed preference techniques rely on the inference of values from peoples’ actions in markets which have a clearly defined relationship with the environmental good under consideration. For instance, the value of a scenic vista to home owners along a cliff top may be inferred from the prices of their houses. Revealed preference techniques have some limitations. They can only provide ex-post values and are thus unhelpful when new situations are expected to emerge as a result of policy decisions. Secondly, they are only useful in the estimation of a limited range of values. Mostly, these are values generated from the direct use of the environment. So whilst the revealed preference techniques are well founded in theory and well tried in application, they do not provide a comprehensive coverage of the range of non-market values. To fill these gaps, stated preference techniques have been devised.

Stated preference techniques use the responses of a sample of people who answer a set of survey questions specifically designed to generate estimates of non-market values. Usually in stated preference technique applications, survey respondents are asked to consider a hypothetical question of the kind—“What would you choose if...?” A circumstance or a number of alternative scenarios are presented to the respondent and on the basis of the choices indicated, values are estimated. Because of the flexibility afforded by the hypothetical nature of the questions involved, stated preference techniques do not suffer the limitations of the revealed preference techniques. They can be used to estimate the full array of use and non-use values generated by environmental assets and they can be used prospectively or retrospectively.

The array of stated preference techniques include contingent ranking and rating, choice modelling and the contingent valuation method (CVM). A review of these techniques by Morrison, Blamey, Bennett and Louviere (1996) suggests that the paired comparisons, contingent rating and contingent ranking techniques have theoretical problems and that choice modelling is still in its developmental phase. CVM has thus been, and remains, the best known and most widely applied stated preference technique.

A typical CVM application involves the distribution of a questionnaire (by mail, personal interview or telephone interview) to a sample of people affected by the environmental change under consideration. The questionnaire usually contains three core components:

- the description of a hypothetical scenario involving the loss of environmental amenity being valued;
- a willingness to pay question, either of an open-ended nature (How much are you willing to pay to avoid the environmental loss?) or in a discrete choice format (Are you willing to pay \$x to see the environmental loss avoided?)
- a series of socioeconomic and attitudinal questions.

The CVM is a controversial technique. In its most widely known application in Australia—the Resource Assessment Commission’s estimation of the environmental damage that would result from mining at Coronation Hill, adjacent to Kakadu National Park in the Northern Territory¹—the CVM was heavily criticised². This criticism paralleled the debate in the United States of America (USA) which surrounded the use of the CVM to estimate, for litigation purposes, the value of the environmental damage that resulted from the grounding of the Exxon Valdez. In essence, the controversy arose because the CVM is based on the use of what respondents say they would do in certain hypothetical circumstances. The hypothesis put forward by the critics is that these expressions of intentions may not be what actually would happen. The contention is that CVM value estimates are therefore biased and unreliable.

Numerous types of potential bias have been put forward in the non-market valuation literature. They include:

- strategic bias, where respondents, perceiving an opportunity to influence policy outcomes, misrepresent their preferences deliberately;
- hypothetical bias, where respondents believe that the questioning is hypothetical and of little or no policy relevance and so not worth taking the time to consider their preferences carefully;
- ‘warm-glow’ bias, where respondents gain enjoyment from the process of offering to pay to a ‘good cause’ rather than from the good being valued; and,
- payment vehicle bias, where the instrument of collection of CVM bids is not a neutral factor in people expressing their preferences.

Considerable research has focused on determining the extent to which these biases occur. Much of this research has been undertaken in the USA where the legal standing of CVM as a technique suitable for the estimation of damages in litigation has provided extra impetus to proving (or disproving) the validity of the method. A culmination of this research came in the findings of a panel of experts specifically convened by the US National Oceanic and Atmospheric Administration (the NOAA Panel) to assess the validity of the CVM. The NOAA panel found, with some caveats, that the CVM was a technique capable of providing estimates of environmental damages that are useful as a starting point for the determination of damage payments in the judicial process³. The caveats primarily consisted of a set of recommendations as to what CVM practices would constitute an acceptable application of the technique.

Despite this conditional acceptance of the CVM in the USA legal system and a burgeoning list of litigation and resource management applications in the USA and, to a lesser extent, Europe, the technique has remained somewhat under a cloud of mistrust in Australia. Many policy advisers remain sceptical. To an extent, this may relate to a suspicion that circumstances in Australia are somewhat different from those prevailing in either the USA or Europe and that these conditions make the CVM unworkable here (Bennett and Carter, 1993). What ever the reason, Australian applications are relatively rare.

An impasse has therefore emerged in the Australian context of CVM application. Despite strong demands being made of policy advisers to provide dollar value estimates of environmental impacts, there has been a reluctance to use the CVM (Bennett, 1996).

Two remedies for this impasse are apparent.

The first is to develop new stated preference techniques that avoid the perceived problems of CVM. This is the direction taken in the development of Choice Modelling (Morrison et al. 1996).

1 See Imber, Wilks and Stevenson (1991)

2 For a review of the Coronation Hill controversy, see Bennett (1996)

3 See Portney (1994) for a succinct outline of the NOAA Panel’s findings.

The second direction is the testing and refinement of the CVM. The testing process is useful either to confirm the suspicions of the sceptics and so allow the re-direction of research effort to the development of alternative techniques, or to allay the fears of the sceptics. Refinement is useful if it is found that the fundamentals of the method are sound but improvements in accuracy and reliability are possible.

It is the testing and refinement approach that is pursued under this consultancy.

Dryland salinity in the Upper South East

The setting designated by ABARE for the testing and refinement of the CVM undertaken in this consultancy was the estimation of the costs associated with certain environmental damages resulting from dryland salinity in the USE.

Following the extensive clearing of native vegetation and the failure of deep-rooted perennial lucerne, groundwater levels in the USE have risen to the point where dryland salinity has become a major problem for agricultural enterprises in the region. Ecologically significant stands of remnant vegetation in the region, notably areas around wetlands have also been adversely affected. A management plan to deal with this and associated flooding problems was subjected to a major EIS in 1993 (Upper South East Dryland Salinity and Flood Management Plan Steering Committee, 1993). Subsequently, agreement has been reached between Federal, State and Local Government agencies to implement certain engineering works that will drain away saline groundwater from agriculturally and ecologically sensitive areas. As the proposal for these works stands, some of the drained groundwater will be released into Tilley Swamp and the southern Coorong.

The Coorong is part of a national park and is listed as a wetland of international importance under the Ramsar Convention. The southern Coorong has an environment that is unique in Australia. It contains water that is hypersaline. In other words, the water in the Coorong is saltier than sea water. These conditions ensure the production of large amounts of aquatic plants and fauna—such as insect larvae and salt flies—which provide food for a wide range of water birds. The southern Coorong is one of only a few major areas in southern Australia which are used by migratory and other water birds, particularly during drought times. Tilley Swamp is one of a series of shallow fresh water wetlands located inland from the Coorong. It contains an existing conservation park and a further one is proposed. The primary vegetation in the wetland is tea tree. Tilley Swamp provides habitat and feeding areas for water birds and other fauna.

The release of saline groundwater drained from surrounding areas into Tilley Swamp and the Coorong would result in some environmental change to these areas. Material in the EIS and discussions with environmental scientists from universities and government agencies were used to establish the extent of the change. For Tilley Swamp, the implications were projected to be:

- flooding to a depth of two metres, making it too deep for some water birds to feed, except at the shoreline;
- death of the tea trees;
- a fall in the number of water birds that, on average, use the area for habitat from 40,000 to 10,000; and,
- a decline in the number of the five rare species of water birds found there.

For the Coorong, the impacts were projected to be:

- the dilution of the hypersaline water of the southern Coorong so that it would be only as salty as sea water⁴ with a resultant reduction in the diversity of habitats in the region;

⁴ Whilst the groundwater drained from the surrounding region is sufficiently saline to affect salt intolerant plants, it is less saline than the hyper saline waters of the southern Coorong. The addition of the drained groundwater would therefore reduce the salinity of the Coorong.

- the replacement of the aquatic plants that require hypersaline water with a consequential reduction in the amount of food available for waterbirds; and,
- a fall in the number of water birds using the Coorong from 130,000 to 70,000, on average, each summer.

To avoid these environmental consequences, an alternative, but more costly scheme would see the saline groundwater piped under the extensive coastal dune system lying between the wetlands and the ocean, for release into the sea.

The trade-off relevant to this consultancy is between an increased burden on taxpayers and the maintenance of environmental conditions in Tilley Swamp and the Coorong. The aim specific to the CVM application is therefore to estimate the cost of environmental damage likely to be caused to Tilley Swamp and the Coorong by the discharge of saline groundwater without the construction of the pipe.

Structure of this report

The approach adopted for the consultancy was to undertake the environmental cost estimation exercise using a number of variants of what is now regarded as state-of-the-art CVM practice⁵. The variants were designed to enable the testing of a number of specific hypotheses relating to the ability of the CVM to yield reliable estimates of non-market values in an Australian context. They also related to modifications to the basic technique which were hypothesised to improve the capability of the CVM, especially in the Australian context.

Critical to the state-of-the-art application is a heavy emphasis on qualitative research that is preparatory to the formulation of the questionnaire, the sampling and the research design. For this consultancy, three stages of preliminary research were undertaken before the CVM questionnaire and research design were finalised.

These were:

1. an initial telephone survey;
2. a sequence of focus group discussions; and,
3. a pilot testing of a draft questionnaire.

The first two of these stages are described in detail in Sections 2 and 3 of this report. The outcome of the telephone survey and focus group discussions—the questionnaire—is then detailed in Section 4 along with a description of the research design formulated for the study, the logistics of the survey process and an analysis of the composition of the sample.

The questionnaire was designed to address a number of research issues that go to the core of the ability of the technique to perform in the Australian context. These are:

1. The sensitivity of CVM estimates to the scope of the non-market impact under consideration;
2. The impact of the payment vehicle on CVM generated non-market value estimates; and,
3. The effect of alternative preference elicitation formats on the performance of the CVM.

The analyses of the survey results as they pertain to these issues are the subject of Sections 5, 6 and 7 respectively of this report.

In Section 8 some conclusions are drawn. These are of two kinds. First, the implications of the results for the formulation of policy relating to dryland salinity in the USE are discussed. Second, the implications of this study for the use of the CVM in future Australian applications are considered. A key component of those considerations is a discussion of the lessons for applying the CVM that have been learnt during this particular application.

⁵ This is taken to be defined by recent studies undertaken by Natural Resources Damage Assessment Inc in the USA for the National Oceanic and Atmospheric Administration. For instance, see Carson, Hanemann, Kopp, Krosnick, Mitchell, Presser, Ruud, & Smith (1994).

SECTION 2

The Telephone Survey

Introduction

The telephone survey was undertaken to provide preliminary information for designing the draft CVM survey. A telephone survey was used because it provides such information in a timely and cost-effective fashion and permits any inferences drawn to be based on a sufficiently large sample size. It also enables subsequent focus groups to be used primarily for the more detailed process of refining draft surveys.

The sample selected for the telephone survey was random and was conducted between 5 February and 10 March 1996⁶. The sampling statistics are reported in Table 1. The total sample was segmented between three geographic locations—Sydney, Adelaide and Naracoorte—to investigate whether and how responses change with site proximity. The sub-samples were also split to enable analysis of different responses arising from alternative perceptions of Tilley Swamp and the Coorong.

Table 1
Sampling statistics

Sub-sample	# telephoned	# successful interviews	Response rate #1 (%)	Response rate #2 (%)
Sydney	204	40	20	34
Adelaide	178	44	25	42
Naracoorte	159	50	31	56
TOTAL	541	134	25	43

Note: Response rate #1 includes all telephone calls and Response rate #2 excludes respondents who didn't answer the telephone

The response rate was adequate for the purposes of the telephone survey. Over 40% of those people who were called and who answered the telephone completed the survey. The main groups of people who declined to participate in the survey were: the aged, ethnic groups, people 'not interested', people 'too busy', and people who cited a poor understanding of environmental issues.

The distribution of the sub-samples according to age and sex is shown in Table 2. The distributions do not show any strong sampling bias, except for some skewing toward older people in the Naracoorte sample.

Table 2
Respondents' age and sex

Sub-sample	% Male	%<30	%30-50	%>50
Sydney	45	30	40	30
Adelaide	45	27	34	39
Naracoorte	52	12	40	48

⁶ The questionnaire and questionnaire protocol are reported in Appendix 1.

The telephone survey sought to provide information on the following design aspects of the CVM survey:

Context: Questions 1 and 2 sought information on the environmental issues of importance to respondents and on the relative importance respondents place on protecting wetlands. This information was required to enable an understanding of the context in which respondents set the issue of wetland protection. This is described as the 'framing' of the good being analysed.

Understanding of terms: Questions 3 and 4 were designed to determine the level of understanding in the community of the terms 'soil salinity' and 'wetland'. This information was required to enable an assessment of how simply these concepts would need to be presented in the survey.

Attributes of wetlands: Answers to Question 5 provided information on the attributes of wetlands that respondents value. Knowledge of these attributes was required for the development of descriptions of the Coorong and Tilley Swamp and the impacts of not building the pipe.

Payment vehicles: Questions 6 and 7 were targeted at determining which payment vehicles respondents thought were most likely and appropriate for collecting the revenue required to fund the pipe. This information was required to identify payment vehicles that respondents would consider plausible. Answers to these questions also indicate whether people think that they should have to pay for environmental goods. This has an important implication for the successful use of the CVM. If respondents consider the provision of goods such as the pipe to be a responsibility of government, the use of CVM would be particularly problematic (Blamey, 1995).

Plausibility of the survey: Questions 8 and 9 sought to determine whether respondents are likely to believe that the government would undertake a survey of the type proposed. If respondents think that the government is 'political' or not interested in their opinion, they are unlikely to take the survey seriously.

Appropriate range of WTP bids: Question 10 sought to scope the range of likely willingness to pay (WTP) bids for use in the elicitation question. Also, by asking a deliberately ambiguous question, the criteria people use to decide whether they are WTP for the pipe can be discovered. An understanding of these criteria was needed to ensure that adequate information for respondents to make decisions was provided in the CVM survey.

Results

The results of the telephone survey are examined in detail in Appendix A1 on page 50. In this section an overview of the more significant results is presented. These results were subsequently used to develop the draft CVM survey.

Context: The most important environmental issues to respondents were air pollution, water pollution, waste and litter, land degradation, logging, land clearing and loss of species. Wetlands was not a primary issue of concern to respondents. However, nor was it consistently ranked at the bottom of the list of other environmental issues.

Understanding of terms: The understanding in the community of the terms 'soil salinity' and 'wetlands' is only moderate, with the level of understanding generally being poorer in Sydney.

Attributes of wetlands: The most important attributes of wetlands to respondents were: wildlife and birds, habitat, provision of an ecosystem, trees and plants, their preservation, aesthetics, water purification and recreation.

Payment vehicles: The most appropriate payment vehicles appeared to be increased income taxes, special purpose levies and local government rates. Voluntary trust funds were not frequently mentioned. A number of responses suggested that the money for the pipe should be allocated from existing government revenues. There is also some evidence that the Coorong is seen as a site of national importance and hence it is reasonable for all to contribute. In contrast, Tilley Swamp was seen more as a local issue.

Plausibility of the survey: Many respondents thought that the government should engage in community consultation when issues such as the one at hand are being considered. Furthermore, there was general confidence that the government would institute a proper process of decision making. This suggests that respondents are likely to believe that the government would undertake a survey where they are asked to give their opinions on the pipe proposal.

Appropriate range of WTP bids: The appropriate range of WTP bids differed across the regions. In Sydney the range appeared to be \$1–40, in Adelaide \$1–100, and in Naracoorte \$1–250.

Respondents wanted to be convinced of the success of the project. They also wanted to know the total cost involved, the number of people paying, and that contributions would be equitable.

Conclusions

A number of important conclusions relating to the design of the draft questionnaire and the appropriate direction to be taken in the subsequent focus groups were drawn from the results of the telephone survey.

The relatively low ranking of wetland issues amongst other, competing, environmental issues carries the implication that the questionnaire design would need to provide careful consideration of the framing of the pipe issue. Clearly there are many other issues that are regarded by unprompted respondents to have greater call on their and the governments' funds. Putting the pipe issue in the context of those other issues is therefore an important questionnaire design requirement.

The lack of familiarity with the technicalities of the dryland salinity issue and with wetlands implied that the questionnaire would need to be designed using simple explanations of special terms. Respondents could not be expected to understand jargon.

The attributes of wetlands found to be paramount in respondents' minds gave a clear indication of the emphasis required for the descriptions of the environmental damage to be used in the questionnaire.

The picture that began to emerge from the information collected on payment vehicles is that it is clearly a complex matter. It pointed to a need for the focus group discussions to concentrate on the selection of payment vehicle suited to the case.

The positive response to the plausibility of the survey process gave the green light to the further development of the CVM application in the focus group phase.

SECTION 3

The Focus Groups

Introduction

The information gleaned from the telephone survey provided a useful starting point for the design of the CVM questionnaire and the associated research design. However, whilst that information gave an overview of the general public's perceptions of some of the issues to be addressed by the questionnaire, it did not allow a careful examination of those issues. This type of in-depth analysis is best gathered during focus group discussions⁷.

The approach taken for the focus group discussions carried out for this project was to present participants with one of a range of draft questionnaires for them firstly to answer and then to discuss. The focus group participants were told that the questionnaire was the draft of one that the government was intending to send to a large sample of individuals.

The design of the various draft questionnaires was based on the results of the telephone survey and the experience of the ERE team in designing other CVM questionnaires. Whilst the primary aim of the focus groups was to pilot test the draft questionnaires, a number of other specific tasks were undertaken. First, standard questions of respondent comprehension and format suitability were addressed. Secondly, by presenting alternative versions of the questionnaire to respondents for their consideration, the feasibility of a number of research directions was assessed. Finally, the focus group discussions were used to identify new research questions.

Methods

Qualitative data were obtained from nine focus group sessions. These were held (three each) in Naracoorte, Adelaide and Sydney in March 1996⁸. Each group followed the same basic pattern. Following some opening discussions at a general level, the facilitator requested respondents to fill out their draft CVM questionnaire. Each questionnaire contained basic information regarding the saline groundwater drainage problem in the USE, how the pipe would prevent the environmental impacts on Tilley Swamp and the Coorong, the cost of the proposal and a payment vehicle. A draft map was included with each questionnaire to illustrate the location of the problem area and the proposed pipe. Each questionnaire concluded by asking individuals whether they were prepared to pay the cost.

Prompts in the discussion took the form:

- What influenced your response the most?;
- Did you find anything to be unclear or ambiguous?;
- Is there anything that you disagreed with or didn't like?;

7 A focus group is defined by Krueger (1988, p18) as a "carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment. It is conducted with approximately seven to ten people by a skilled interviewer. The discussion is relaxed, comfortable, and often enjoyable for the participants as they share their ideas and perceptions." A key advantage of the focus group over structured and even semi-structured interviews is that respondents are not limited by the choices offered. Researchers can thus see reality from the subject's perspective.

8 Participant recruitment was undertaken by Techsearch Pty Ltd for the Naracoorte and Adelaide groups. Applecorn Research organised the Sydney groups. The only specification given for recruitment was to ensure approximately eight individuals aged 18 or over attend any one meeting and that, overall, the group profile should be as demographically representative of the general population for that town or city as possible. Special purpose focus group rooms were used for the Adelaide and Sydney groups. A conference room in a motel was used for the Naracoorte discussions. The discussions were facilitated by ERE team members.

- Was there any information that you thought was missing?;
- What further information do you think you need?; and,
- Did you think any of the information was biased?

Results

Analysis of the focus group discussions was afforded by the examination of the video and audio tapes made of the proceedings. The results of the focus groups are necessarily qualitative. Such qualitative research is important for identifying the beliefs and attitudes that affect individual's decisions about environmental matters and gaining some appreciation of the relative importance of these constructs. The broad results of the focus groups are presented here by way of reference to verbatim quotes (in italics). The particular group to which the quotes correspond is indicated at the end of the citation for each quote, using the abbreviations N1–3, A1–3, and S1–S3. N2 thus refers to the second focus group conducted in Naracoorte. Where exchanges among several individuals are given, the first individual's statement is preceded by a '1', the second by a '2', and so on.

The results are grouped under four headings relating to the four particular issues that emerged from the discussions as significant to the questionnaire design.

Communication

The findings of the telephone survey regarding appropriate communication levels were confirmed in the focus groups. Participants expressed a general aversion to technical terms or jargon such as 'hypersaline', 'nutrients', 'heavy metals', 'semi-permanent', etc. In part, the use of such terms added to the confusion most felt regarding the processes involved in the dryland salinity problem. A further confusion between what is meant by a 'drain' and a 'pipe' was also identified.

Participants indicated a strong desire for clarity of description and a straightforward, logical ordering of information.

So a precis, then background, the problem and the cure. Something like that. (A2)

A number of specific points of information were identified as critical to the descriptive phase of the questionnaire⁹.

First, participants required information relating to why the pipe should be constructed. This involves acceptance that the Coorong would be negatively affected by a rise in water level.

What would happen if the water level did rise—would some other things flourish? (N1)

You need to know how endangered some of these species are... (N3)

Has there been an environmental study on it? (N1)

A number of special 'triggers' seemed important. The fact that the Coorong is part of a national park, and a world heritage area, provided an important indicator for individuals of the need to leave it in its current state.

1. The last sentence where it says Australia has international obligations really sums the whole thing up.

We can't touch it. 2. It carries a lot of weight. (A2)

Exposure to media coverage of the issue was also taken as an indicator of importance.

I've never even heard of this issue until tonight...so why hasn't this been publicised earlier if it is so important. (S1)

⁹ See Blamey (1996b) for a theoretical analysis of the role the different aspects of the contingent valuation scenario play in the activation of environmental norms.

As well as wanting to decide if the problem being addressed by the pipe was important, participants wanted to be sure that the solution proposed would be effective. In addition, a number of respondents wanted to know if the drainage system that would cause the flows of saline groundwater into the wetlands, would work.

You say it's going to improve these things...I beg to differ...I think it may not improve it. (N1)

Will the aboriginal people let the pipeline go through there? (N1)

Are there any alternatives to the pipeline, such as desalination plants? (A1)

A common theme running through most groups involved the consequences of building the pipe.

Why isn't there any impact on the ocean [of putting the water in there]? (N3)

What sort of effect is that pipeline going to have coming across the land? ...What sort of clearing do they have to do?...Will that cause erosion? (A1)

One effect that the request for a financial contribution had on individuals was to make them defensively re-analyse the need for the pipe. The presence of other environmental and social problems meant that this often involved the assessment of relative need, or need in the presence of substitute and complement causes. In other words, the payment question caused respondents to frame the pipe issue in the context of other calls upon their budget. Generally speaking, the further individuals lived from the USE, the less concerned they became about the pipe.

People could look at this and probably identify a 100 other [environmental] issues of approximately equal importance. (A3)

So many things need doing in the environment. We've got to get the priorities right. Because we can't go on paying and paying. (S1)

Allied to concerns about the effectiveness of the pipe were concerns expressed about the effectiveness of individuals' payments, especially the extent to which government would earmark, or target, donations for the pipe (ie. a lack of trust in the government).

Will it be like the road taxes? Will it go onto what they say it will? (A3)

Look at the petrol tax that we are paying...It doesn't go to the roads. (A3)

To just add more taxes on would be filling the pockets of the politicians. (A2)

Payment vehicle

Following on from the telephone survey results, special attention in the focus groups was directed to the selection of an appropriate payment vehicle. This consideration began by introducing respondents to questions regarding responsibility for the problem and the solution.

Respondents in the Naracoorte groups correctly identified the main causes of the salinity problem: the clearing of native vegetation, excessive irrigation and the lucerne aphid crisis. Responsibility for the salinity problem, however, was often seen as distinct from responsibility for the problem created by the drainage system. Although a number of participants attributed both problems to farming practices, some attributed the problem associated with the drain to poor government decisions.

The problem is, when people started to farm like that back 200 years ago, they [the farmers] didn't know about these things...so it's not totally the farmer's fault. (S1)

They haven't told us what is causing the salinity in the first place....He's [the farmer] gone there and decided to plant on it, and it's not working out. Get off the land! (S1)

To me it sounds as if they [government] should have done a more thorough EIS before they approved it [the drainage system]. (S2)

A question that commonly arose was whether the responsibility for payment should extend to those living outside SA. Some participants thought that the States could better deal with their own issues.

NSW government could concentrate on saving the Parramatta river, the Nepean river. Victoria and... SA could maybe get together for the Murray and stuff like that. (S1)

Why should we pay? It's in their backyard. (S1)

Others thought preserving the Coorong is a national responsibility.

The Coorong not only benefits SA but it benefits all of Australia—so everybody should chip in. (A3)

I'd like to see it Australia wide, because the Coorong is a national heritage to the whole country. It's not something South Australians only are proud of. There are a lot of Australians who are also proud of it. So I'd like to see the whole of Australia pay for the pipeline. (A1)

Some participants thought that whether or not the Coorong is likely to be considered of national importance depends on public awareness of it. If people were made aware of it, it would be of greater national importance. However, on probing, they agreed that people should pay if it is actually of national importance, even if they were unaware of its status.

Although a number of participants thought that, in principle, all Australians should pay, because all Australians stand to benefit from improvements in the Coorong, they were less willing to endorse such a requirement when reciprocity between States was considered.

...one thing that concerns me...is that if you set a precedent...the Coorong needs this and we get Australia to do it...what if there's a thousand million dollars of work that wants doing in Queensland...once you get a precedent set you'll be paying for environmental problems in other states. (A2)

1. We can't afford to pay for their problems. Why should they pay for ours? 2. We do. (N1)

The distribution of the financial burden was also raised as an issue. Some individuals thought that those who are least able to afford payment should not have to pay anything, or at least not as much as others who are financially better off. Thus even though individuals may have contributed to a problem, and stand to benefit from its treatment, it may not be appropriate for them to pay.

1. People who are on the dole...and pensioners—do they have to pay too? 2. Well, they couldn't afford it. (A3)

I'd want to know more about the levy. How is it going to be collected? What, is it going to be a % of your wage, or is it going to be a flat rate? Because pensioners ...are they going to pay the same amount of money? (S3)

A key component of the focus group strategy was to present a number of different versions of the draft questionnaire to respondents. The reaction of individuals to several different payment mechanisms was explored using this technique. These were:

- a levy on income tax;
- a levy on house or water rates; and,
- an abattoir levy.

The reactions of respondents to these alternatives are now considered.

Income tax

There was significant resistance, in all but one group, to the idea of funding the pipe through an increase in income taxes. To a large degree, this was driven by perceptions regarding government responsibility. That is, there was a sentiment that it was the responsibility of government to pay for such measures through the application of existing taxation revenue¹⁰.

Let's fund this elsewhere from another department's revenue...or go across the broad range of state government departments and say well lets talk about a reallocation of budgets. (A1)

These sort of issues are really what taxes should pay for. What do you pay your taxes for? You pay your taxes to have things that can't be done by private enterprise. (A3)

¹⁰ Blamey (1996a) reports widespread public support for environmental improvements in Australia being paid for out of existing taxation revenue.

Some concerns related to an income tax levy were also raised.

It's an inappropriate method of collection anyway, because... a lot of people don't lodge tax returns. (S1)

Why not the general taxpayers? ... too hard to administer? (N3)

1. Too much evasion... and you don't know whether its really going there then; 2. also inequitable. (N3)

Others were more positive.

1. I think it's probably the easiest way. 2. It's the fairest way. (N2)

I think this [income tax] is an appropriate way to pay for the pipeline, because the Coorong area and that belongs to all of SA... (N2)

Some participants suggested that a progressive tax would be more equitable.

1. They could vary the amount on your income. If you earn \$50,000 a year you pay \$100. If you earn \$5,000 a year you pay \$20. 2. Maybe they could make it a sliding scale on people's income, and make it so that some pay more [than others]... But I think every single person should do something. (N2)

Land and water rates

The idea of payment through increases in property or water rates received mixed support among the groups. This mechanism appealed to most as being more appropriate at a local, or possibly State level. For the purpose of redirecting water, payment through water rates appeared to make more sense to individuals than payment through property rates. The fact that various levies on water rates had already been imposed in some areas appeared to create a degree of resistance to the suggestion of further rates increases. Some individuals began to question how their rates are being used. Payment through rates was also questioned on distributive grounds.

Numerous individuals appeared to conduct a type of incidence analysis of the proposed payment arrangements.

Everyone's not paying anyway, because a lot of people don't even own a house. (N2)

But everyone doesn't pay water rates... They get their own water. (N2)

1. The people who are renting... they miss out again... 2. If they've got to raise the money from somewhere it should be a general tax that everybody pays. Not just householders. (A3)

There was also a degree of scepticism regarding the prospect of landlords being able to pass the levy on to their tenants.

Don't think they would do that. How would they do that? They sign a lease with the rent on it... It's very hard for the landlords to change the rent. (N2)

Abattoir levy

Overall, the idea of paying for the pipe through a levy to be imposed on abattoirs, and thus passed on to the consumers of meat products, received little support. The main concerns appeared to be that non-meat eaters should pay, abattoirs are suffering enough financial pressure as it is and that other sectors (such as wineries and crops) are also responsible for the dryland salinity problem.

So vegetarians get out of it. N1; It's an environmental issue and should be funded on a greater scale. (N1)

Across all the possible payment vehicles tested, a major concern expressed was with the size of the suggested tax increase. The questionnaire stated that if the pipe was to be built, each Australian taxpayer would have to make a once off additional payment of \$50. Participants were generally aware of the impact this \$50 would have on them indicating that a plausible scenario had been established in the questionnaire.

For my daughter it would be like a hit on the back of the head. (A1)

That \$50, it could be your kid's new shoes. (S1)

1. I could think of about 20 things I could go out and buy for \$50. Giving \$50 to SA—when it's not even in NSW...

2. I think that's a lot. \$50 for every person in Australia. 3 That's a lot of money. (S1)

Another finding concerned the information participants needed when deciding whether or not to favour the pipe at a cost of \$50 per head. A theme that ran across all nine groups, with consensus in most if not all groups, was the need for information regarding the total cost of building the pipe. By dividing this estimate by an estimate of the number of individuals paying, individuals could decide whether the \$50 per head figure represented *reasonable value*. Some individuals also appeared to frame the question of whether to favour the pipe at a cost of \$50 in terms of whether the costs associated with a decline in the value of the Coorong (and Tilley Swamp) exceed the cost of building the pipe.

I think it is insulting people's intelligence not to give them an estimate [of cost]. (S1)

You need a costing in this because people won't agree to pay \$50 if it doesn't sound credible. (N1)

How many taxpayers? If there is 10 million taxpayers, paying \$50, that's \$500 million...! (S1)

We need to know what the pipe costs so we can decide if the Coorong is worth it. (S1)

Blamey (1996a) argues that trust in government, and trust in other citizens, are likely to be important factors driving the acceptability of alternative payment vehicles. Bennett and Carter (1993) suggest that a "unique Australian cynicism" may mean that the selection of a payment vehicle is especially difficult in the Australian context. A major theme running across the groups concerned trust, or lack thereof, in government. One variant of this concerned the appropriate use of funds, which has already been considered. Another concerned the proposed one-off levy.

The other thing I wouldn't trust is the levy being applied for one year only...in my experience they never add onto the price of something and then take it off. Once its there they find an excuse to leave it there permanently. (N3)

I've got a lot of suspicion about once-off levies. We've all paid our once-off petrol tax for five years. We've all paid our once off levy on water rates, for a number of years, and lots of other once offs. And there's lots of other issues that might come up. (S1)

The extent to which individuals trust others to contribute \$50 toward the pipe is evident in their different reactions to suggestions of compulsory and voluntary payment.

If it was voluntary, you'd probably find that a lot of people might leave it off...But if you were forced to do it, it's just extra on top of your tax. (N2)

1. It should be a voluntary payment. 2. They wouldn't raise much then would they. (A3)

Framing strategies

Two strategies were investigated to ensure that the draft questionnaire was adequately framed in terms of other priorities for expenditure held both by respondents and government agencies. One was the use of a reminder statement before the willingness to pay question and the second involved a completely different approach to the questioning process—the use of a top-down disaggregation approach.

In Naracoorte and Adelaide the following reminder statement was provided:

When thinking about whether you are in favour of the pipe, keep in mind other environmental projects that may cost you additional money, such as maintaining the shoreline, and cleaning up stormwater and the rivers it enters, such as the Sturt River and the River Torrens.

In Sydney, a different version was provided:

When thinking about whether you are in favour of the pipe, keep in mind other environmental projects throughout NSW and Australia that may cost you additional money, such as cleaning up rivers such as the Hawkesbury–Nepean, and the Murray, cleaning up badly polluted beaches, and protecting native forests.

Reactions to these statements were encouraging in that they ensured respondents were aware of competing options for expenditure. However, two worrying 'side-effects' emerged. First, the statement appeared to cause some confusion amongst respondents.

What's the river Torrens got to do with the South East. (N1)

I'm just really...concerned about this last bit [reminder statement]... That really concerns me because we don't really know how much cost there is going to be [associated with the listed environmental issues]. (A1)

Second, the listing of other issues tended to exacerbate problems associated with payment vehicle protest and plausibility.

What's to say they get \$50 off every person and then they go "Ohh—we are a million short. We'll hit them for some more." And then they turn around and say "Ohh, Sydney is getting the Olympics—We'll get stuck in there and we'll clean up the Nepean–Hawkesbury". Like to me...that would be a priority. (S2)

That's what I'm saying. The money should go into an environmental fund—for everything. (S1)

Its just telling you that you'll be up for a lot more money. (S2)

The use of a disaggregation format where respondents begin by specifying a willingness to pay for generic environmental issues and are then asked to divide that sum between competing projects, created even greater confusion. First, the more inclusive the generic environmental good, the more individuals asked "What are our taxes paying for?". The wider the breadth of projects involved in the composite good, the more respondents queried their responsibility to fund the whole array.

In comparing the disaggregation version with the single issue version, respondents indicated a greater degree of confusion when faced with the disaggregation version. It would appear that it contained too much information for respondents to assimilate meaningfully.

I think its confusing to give people too much information. I think you are better off asking people whether they are prepared annually to subscribe to some project—that can be determined by need—that is, by the government—and this particular project is most pressing. (A3)

I think it [disaggregation version] confuses people. If you do your own housekeeping and you want to buy a new fridge, a new washer, new carpet, what do you do—you buy one thing at a time. (A3)

Elicitation formats

Discussion during the focus group sessions suggested that respondents wanted to be less restricted when answering the simple 'to pay or not to pay' question.

Shouldn't there be a third option...favour pipe but with other alternatives...For example, other payment methods. (A2)

It says that if you favour [the pipe] you will pay \$50. I think it should also...give you the option to say something about...who should pay and how it should be paid. Instead of just saying—if you are in favour—yes or no—but how do you think this should be funded—out of existing taxes, or out of additional taxes—and then you will get a true response. (A3)

Comments such as these made in the earlier focus groups lead to the trialing in subsequent groups of an elicitation format which involved three possible choice options. Although this appeared to create less conflict, some respondents felt that more response options were needed. For example, one participant commented without prompting:

Maybe there should be five or six options. (S6)

It was this comment that led to the development of five point elicitation format for one version of the questionnaire.

Conclusions

The focus groups yielded a rich array of information not only on the strengths and weaknesses of the draft questionnaires but also on potential directions for the revision of those drafts. Many of the design features integrated into the questionnaire that was finally used for the project, had their origin at this stage of the research.

The richness of the information generated in the focus groups suggests strongly that this phase is crucial to the successful application of the CVM. Not only does it prevent the analyst from making mistakes in the questionnaire design phase that are ultimately very expensive, but it is also important in the development of the technique generally and specifically for the case at hand.

The focus groups exposed several nuances of CVM application which may be peculiarly Australian. Two of the most important of these relate to trust and responsibility. Respondents tended to express a lack of trust in the government: they doubted that payment would be 'once-off' and that the money collected would be spent only on the project. It was apparent that respondents would need to be assured in the questionnaire that the government would act faithfully in these ways. Also, contrary to the NOAA Panel recommendation that respondents should be reminded about potential alternative expenditures, the reminder statement appeared to exacerbate such problems. Hence, it appears that in the Australian context, reminders about substitute projects need careful consideration.

The second nuance involves the concept of responsibility. Respondents tended to believe that the funding of projects like the pipe, is the government's responsibility. It became evident that the questionnaire would have to be designed to convince respondents that the government has insufficient funds available and that the proposal in question would only proceed if respondents would support some form of additional payment.

Finally, and possibly most importantly, the focus groups demonstrated that Australian respondents are uncomfortable with the limitations imposed by the simple dichotomous choice form of questioning recommended by the NOAA panel. Providing avenues for saying 'no' to the WTP question which enabled an expression of the underlying rationale appeared to be important.

The importance of these 'Australian' findings and the other focus group results is well illustrated in the following section where details of the final questionnaire are provided.

SECTION 4

The Questionnaire and its Delivery

The Questionnaire design

The design of the questionnaire used for the case study was based on the accepted 'state-of-the-art' model which has been developed largely in the USA since the NOAA panel handed down its list of recommendations.¹¹ The information gathered in the telephone survey and the focus group sessions was used to adapt this model to the specific context under analysis. The questionnaire was also subjected to peer review through a presentation to the Canberra Branch of the Australian Agricultural and Resource Economics Society and it was circulated in draft form for approval to representatives of the government agencies involved. Finally, the questionnaire was pre-tested with 30 post-graduate management students of The University of New South Wales.

In detailing its design features here, emphasis is placed on the overall structure of the questionnaire. Separate sub-sections are devoted to each component of the questionnaire. The rationale for each component is provided along with a description of how the results of the telephone survey and focus group stages of the project were integrated into particular design features. The questionnaire is provided in Appendix 2.

Embedding

One of the most contentious issues in the recent literature on the CVM has centred on the issue of embedding. The questionnaire was designed specifically to address this issue.

Originally brought to prominence by Kahneman and Knetch (1992), the embedding effect is said to occur when the CVM estimate of a non-market value is lower when it is evaluated as part of a more inclusive good than when it is evaluated alone. For example, an embedding effect would be said to occur if the value of a particular wetland when estimated alone was \$100, while the value of the same wetland was only \$15 if estimated as a part of, say, all Australian wetlands. According to Kahneman and Knetch, CVM estimates of non-market values are unreliable because they reflect motives other than those relevant to the valuation task. Specifically, they hypothesise that people respond to CVM questions in order to enjoy the 'warm glow' of giving. Hence, their responses relate not simply to the value they enjoy from a non-marketed good, but rather are confounded by the value they enjoy from the process of participating. Because of this confounding, values estimated through CVM applications are hypothesised to be largely invariant of the scope of the non-market good concerned. Extreme variants of this hypothesis propose that all CVM generated estimates are in the order of \$10 to \$60 (Cummings, 1989) independent of what is being valued.

Smith (1992) and Carson (1995) help to clarify the notion of embedding. They argue that the Kahneman and Knetsch view fails to specify the problem correctly. Carson (1995) recognises two separate 'components' of the Kahneman and Knetch embedding effect. First, there is what Kahneman and Knetch (1992b) in their reply to Smith (1992) term the "regular embedding effect". This arises when the 'embedding' of substitute goods (say, alternative stands of remnant vegetation) under an umbrella good (all remnant vegetation) results in respondents lowering their marginal values for successive units of the substitutes. Comparing marginal value estimates from different sequences will therefore produce apparent inconsistencies which are simply reflections of the substitutability of the goods in question. Hence, the 'regular embedding effect' is to be expected under the usual neo-classical assumptions of economic behaviour. The critical question its presence begs of CVM practitioners is what array of substitutes should be used to embed or frame the good of interest.

¹¹ An example of this approach is found in Carson et al (1994).

This form of embedding was addressed in the case study in part by using information from both the telephone survey and the focus group discussions. The array of issues that were foremost in peoples' minds when considering expenditure by governments on the environmental was well established in the preliminary research stages. The first part of the questionnaire (**Section A: Some General Issues**) used that knowledge to frame the USE problem. Hence, in Question 1, respondents were reminded of the array of government expenditures and then in Question 2 a range of environmental issues was presented. Both questions required respondents to rank issues according to their preferences. A simple framing statement pointing out that there are many environmental issues that call on government funds was also included after Question 2¹². The focus group results had made it clear that complex framing statements were confusing to respondents.

Carson's second 'component' of the embedding effect is what Kahneman and Knetch (1992b) call "perfect embedding". This is the situation where only the warm glow of giving is reflected in individual CVM responses. Hence, if 'perfect embedding'¹³ is present, respondents are insensitive to the scope of the good they are asked to value: the value estimated for a 100 hectare stand of remnant vegetation is equal to the value estimated for that stand as well as a further 1,000 hectare stand. The presence of scope insensitivities presents an important test for CVM.

The importance of the scope sensitivity test was reinforced by the panel of experts set up by the US National Oceanic and Atmospheric Administration (NOAA) to report on the validity of the CVM. In their final report, Arrow, Solow, Portney, Leamer, Radner and Schuman (1993), recommended a set of guidelines to be used as a means of assessing the reliability of any CVM study. Specifically, and amongst other recommendations, they suggest that unreliable findings would be present if inadequate responsiveness to the scope of the environmental damage was found.

To test for perfect embedding, the questionnaire was designed to enable several tests of scope sensitivity. Most significantly, two damage scenarios were compiled for two splits of the sample. The first involved a description of damage done to Tilley Swamp only. The second involved the extension of this description to encompass damage done to the Coorong. The difference in the extent of damage between these two scenarios was deemed to be sufficiently great to avoid the prospect of scope insensitivity arising because of a low marginal value between them. Tilley Swamp is both relatively small and unknown in comparison to the Coorong. Other tests were enabled through the incorporation of questions relating to the socioeconomic and attitudinal characteristics of respondents. If the warm glow of giving was the principle driving force in CVM responses, there should be little or no relationship between environmental value estimates and the bid amount, income, attitude toward environmental conservation or recreational experience.

Information

In the second section of the questionnaire, **Section B: Damage to Wetlands in the Upper South East Region of South Australia**, care was taken to provide the information respondents needed to make a considered choice regarding the proposed pipe in a manner that:

- was well structured in a logical sequence (The Wetlands; The Problem; The Proposed Solution; How would the pipe be funded);
- used simple language, which had been shown to communicate to respondents the appropriate information; and,
- used the visual aid of a map of the location and a diagram of the pipe concept;

¹² Questions 1 and 2 were expressed in terms of which items should be protected from further cuts in government expenditure. The rationale for this was to make respondents more aware that government funds were limited and hence, to increase the personal responsibility felt for funding the pipe proposal.

¹³ Alternatively known as part-whole bias. It should be noted that 'warm glow' is not the only possible explanation of part-whole bias. See Morrison et al (1996).

As a result of the preliminary research, the term 'drain' was avoided because of the potential confusion with the term 'pipe'. Also included in the questionnaire was a statement to reassure respondents that damage to the environment due to the construction of the pipe and the discharge of the saline water into the ocean would be minimal.

The information section did not include any reference to the costs of constructing the pipe on the grounds that people would use that knowledge to estimate a price for the pipe rather than considering the extent of their consumer surplus. Instead the simple statement—"The proposed pipe would be expensive to build"—was incorporated.

Payment vehicle

Payment vehicles are a crucial element in a CVM survey because they provide the context for payment and are therefore central to achieving a plausible survey. However, the preliminary research failed to identify a fully plausible payment vehicle. The use of water rates was found to be problematic for people who rent or use tank water and so don't pay water rates. Similarly, income taxes were less than ideal as a payment vehicle for respondents who are unemployed or not within the labour force.

Given the difficulties associated with selecting a plausible payment vehicle, it was decided to test for the presence of payment vehicle bias. Payment vehicle bias occurs, according to Mitchell & Carson (1989), "where the payment vehicle is either misperceived or is itself valued in a way not intended by the researcher". There are various manifestations of payment vehicle bias. A vehicle may be problematic, either because it does not apply to certain respondents, because respondents do not believe that the vehicle would ever be implemented or because of ethical views relating to equity or the suitability of the vehicle.

In attempting to identify payment vehicle bias researchers have principally resorted to comparisons of two different payment vehicles. It is hypothesised that payment vehicle bias exists if there are either differences in mean bids or differences in protest or response rates. Studies that have identified payment vehicle bias in this way include Brookshire, Randall & Stoll (1980), and Greenley, Walsh & Young (1981).

The two payment vehicles selected for testing were a water rates surcharge and an increase in income tax. The questionnaire was designed to test for payment vehicle bias by using a split sample across these two payment vehicles. Both were specified as 'one-off' payments. Both embodied the concept of funds being set aside in a special fund to be used only for the pipe construction. To help avoid adverse reactions resulting from equity concerns, it was also stated in the questionnaire that South Australians would pay more than people living in other states.

To back up this split test, questions regarding the plausibility of the payment vehicles were also included. For instance, respondents were asked if they would be willing to pay if an alternative acceptable means of payment could be found.

The willingness to pay question

The preliminary research indicated that the format of the WTP elicitation question was a key factor in determining the performance of the CVM. The issue of respondent ambivalence toward the question and the dissonance it created for respondents came to the fore. To investigate these problems further, the questionnaire was designed to test the performance of three alternative elicitation formats.

The standard dichotomous choice (DC) format was set as the base. A 'polychotomous choice' (PC) format was selected as the first variant. This selection was based on the work of Ready, Whitehead and Blomquist (1995) who argued in favour of a format that allows respondents the opportunity to express the degree to which they support or oppose a proposal. The PC therefore consists of a six-point scale that involves a gradation of preference strengths ranging from 'strongly support proposal' through to 'strongly oppose the proposal'. The less confining range of possible answers is hypothesised to reduce the ambivalence generated by the standard DC format.

However, the preliminary research indicated a broader problem than the ambivalence addressed by Ready et al. In the focus groups, respondents indicated that the DC was difficult to answer because the choices they were being asked to make involved conflicts with their belief systems. This is best described as respondent dissonance.

The PC format does not directly address this conflicting belief dissonance. This is because the PC format still requires individuals to express their views in terms of a single normative dimension: the overall desirability of the environmental proposal. This is little help to those respondents who find themselves wrestling with difficult procedural and/or distributive ethical concerns.

The design of a third elicitation format was therefore directed toward the consideration of the concept of respondent dissonance. This required the development of a question that allowed respondents to express their dissonance and thus reduce any reliance on heuristics involving lexicographic, conservatism or other rules which may compromise the validity of CVM results. The focus group results were fundamental to the development of the alternative format. What resulted is referred to here as the dissonance-minimising elicitation format (DM). The idea behind the DM is to enable respondents to express their attitudes less ambiguously than with either the DC or PC approaches. Instead of using a uni-dimensional ratings scale as with PC, the DM allows respondents to indicate which one of a series of theoretically informed response categories most closely represents their view. The importance of expressive motivations in CVM studies has been emphasised by Blamey (1996b).

The five statements finally chosen were established on the basis of theoretical considerations coupled with focus group findings. From a theoretical perspective, five attitude combinations that respondents may seek to express are apparent. These are (i) support the pipe and can afford payment; (ii) support pipe but it is not worth \$x to me; (iii) support the pipe but cannot afford payment; (iv) support the pipe but object to the levy; and (v) oppose the pipe making payment irrelevant.

The fourth response category was included to permit respondents to express dissonance arising from a possible violation of their ethical views. Rather than including a broad category along the lines of 'support the pipe but object to some aspect of the proposal', it was decided to draw on the focus group finding that the vast majority of objections related to the use of a levy. As previously observed, individuals felt that the pipe should be funded out of existing taxation revenue rather than new and additional taxes. Of course, it is also possible for an objection to the levy to be expressed for reasons of self interest rather than as a reflection of a 'violation of ethical views'. Irrespective of the rationale behind respondents' protests against payment mode, the strategy of including a response option to capture such protests is consistent with Blamey's (1996c) view that the identification of plausible and non-objectionable payment vehicles presents a major challenge facing Australian CVM researchers.

In order to provide value estimates that are not biased downward due to the exclusion of category (iv) respondents, specially designed follow-up questions were included immediately after the CVM question. Specified rules were used to re-code category (iv) responses as either 'yes' or 'no' CVM responses.

What was sought was a positive way of treating protest respondents that does not necessitate their rejection from the data set at the model estimation stage. This is especially important given the high number of such rejections reported in some studies. Loomis, Lockwood and DeLacy (1993), for example, report that approximately 20% of returned surveys were dropped as protests, many because they indicated in the debrief question that they thought the additional parks should be funded out of existing taxes, or that they pay enough taxes. In the focus group sessions conducted for this study, the major source of protest concerned the use of additional rather existing taxes. Those protesters often stated that they would need to be more convinced that government couldn't, or wouldn't pay, before they would consider paying themselves. It follows, therefore, that levy protesters who value the environmental good in excess of the bid value should agree that they would only support the levy if convinced that government wouldn't pay. Such respondents can then be re-coded as 'yes' respondents, rather than being deleted from the data set. Question 4 in the questionnaire was developed in order to follow up on the motivations of protesters so that their preferences, without the effect of the payment vehicle, could be included.

Problem detection

Questions 5 and 6 were designed specifically to detect problems that respondents may experience in answering the questionnaire. The issues of adequacy and bias of the information provided were addressed in Question 5. To determine how well informed the survey respondents were, some additional questions (7, 8, 9 and 10) were included. In Question 6, problems relating to the payment vehicle that emerged from the focus group discussions, were spelt out for the consideration of respondents.

Section E: Can You Help Us? was also designed to detect problems. Respondents were asked in this section some specific questions about their reactions to the questionnaire, including the degree of difficulty they experienced in answering the questions and the amount of influence they perceived the questionnaire results having.

Socioeconomic questions

In line with standard practice, **Section D** of the questionnaire sought socioeconomic data. These included attitudinal information as well as the usual age, sex and income type data.

Research design

The questionnaire was designed to enable the testing of a number of hypotheses pertaining to the validity of the CVM and the results the method produces. To put the questionnaire to the field so that these hypotheses could be tested, a research design was formulated. Given the extent of testing required and budgetary considerations, a mail out questionnaire was selected as the means of delivery. The overall size of the sample taken was restricted to 4,120 individuals drawn randomly from the electoral roll. This sample was split into 40 sub-samples of 103 respondents. Each sub-sample involved a special, differentiating feature that would enable comparisons to be drawn between the value estimates obtained from pairings of sub-samples.

- To test for sensitivity to scope, two damage scenarios were devised. Eight of the sub-samples were provided with the Tilley Swamp damage description. The remaining sub-samples were given the Tilley Swamp/Coorong description.
- To test for a relationship between value and distance of respondent's residence from the site of the damage, half the sub-samples were drawn from South Australian electorates while the remainder came from NSW electorates.

- To test for the impact of payment vehicle, eight of the sub-samples were informed that a water rates surcharge would be the payment vehicle. The remainder were told that an income tax levy would pay for the pipe.
- While the simple DC questioning format was held as the norm, eight sub-samples were given a PC format and another eight were given the DM format.
- For each value estimation exercise involving these different processes, four separate sub-samples were required to provide sufficient reference points for the logit estimation of the relationship between bid value and the proportion of respondents agreeing to pay. The bid amounts were \$5, \$20, \$50, \$100.

To understand fully the nature of this research design, consider sub-samples involved in the scope sensitivity test. For this test, two value estimates are required—one for each damage scenario. However, to achieve each of those estimates, four sub-samples involving four different pipe costs are required. When this process is replicated across NSW and SA, a total of eight sub-samples is required for each damage scenario.

The research design for the SA sub-samples required to perform all the tests set out above is listed in Table 3. The design was replicated for the NSW sample.

Table 3
Research design for the SA sub-samples

Sub-sample	Environmental damage	Payment vehicle	Questioning format	Bid value
1	TS	IT	DC	5
2	TS	IT	DC	20
3	TS	IT	DC	50
4	TS	IT	DC	100
5	TS/C	WR	DC	5
6	TS/C	WR	DC	20
7	TS/C	WR	DC	50
8	TS/C	WR	DC	100
9	TS/C	IT	DC	5
10	TS/C	IT	DC	20
11	TS/C	IT	DC	50
12	TS/C	IT	DC	100
13	TS/C	IT	DM	5
14	TS/C	IT	DM	20
15	TS/C	IT	DM	50
16	TS/C	IT	DM	100
17	TS/C	IT	PC	5
18	TS/C	IT	PC	20
19	TS/C	IT	PC	50
20	TS/C	IT	PC	100

where: TS is damage to Tilley Swamp;
 TS/C is damage to Tilley Swamp AND the Coorong;
 IT is income tax supplement;
 WR is a water rates levy;
 DC is dichotomous choice;
 DM is dissonance minimising elicitation format; and,
 PC is 'polychotomous' choice.

Survey logistics

Datacol Pty Ltd was contracted to manage the logistics of the survey. The questionnaire was in the field from October to December 1996. The Dillman (1978) total design method was used as a base for the survey strategy. Reminder cards were sent out two weeks after the initial dispatch and a complete re-mail of the questionnaire was sent out a further two weeks later. Table 4 sets out response details by state and Table 5 provides the response rates by sub-samples.

Table 4
Response rate by state

State	Sample	Valid Returns	Valid Returns %
NSW	2,060	828	40.2
SA	2,060	1,120	54.4
All	4,120	1,948	47.3

Table 5
Response rate by sub-sample

Sub-sample	Total	Valid returns	Valid returns %
1. TS/IT/DC/5	206	84	40.8
2. TS/IT/DC/20	206	113	54.9
3. TS/IT/DC/20	206	97	47.1
4. TS/IT/DC/100	206	103	50.0
5. TSC/WR/DC/5	206	107	51.9
6. TSC/WR/DC/20	206	100	48.5
7. TSC/WR/DC/50	206	94	45.6
8. TSC/WR/DC/100	206	106	51.5
9. TSC/IT/DC/5	206	102	49.5
10. TSC/IT/DC/20	206	87	42.2
11. TSC/IT/DC/50	206	92	44.7
12. TSC/IT/DC/100	206	104	50.5
13. TSC/IT/DM/5	206	95	46.1
14. TSC/IT/DM/20	206	89	43.2
15. TSC/IT/DM/50	206	95	46.1
16. TSC/IT/DM/100	206	97	47.1
17. TSC/IT/PC/5	206	97	47.1
18. TSC/IT/PC/20	206	92	44.7
19. TSC/IT/PC/50	206	90	43.7
20. TSC/IT/PC/100	206	104	50.5

Of note from these tables is the difference in response rates between NSW and SA. The reason for this differential is difficult to substantiate. Our preferred hypothesis is that interest in the issue was lower in NSW and so fewer people deemed it relevant for them to respond. Alternatively, it can be argued that NSW residents (Sydney residents particularly) are less likely to return any survey than South Australians, for whatever reasons.

SECTION 5

Scope Sensitivity Testing

Two types of scope sensitivity tests were undertaken. The first involved the analysis of the proportion of respondents agreeing to pay the bid value in the dichotomous choice CVM question across the sub-samples. The second used logit estimation techniques to determine the impact of the scope variations between sub-samples on the respondents' dichotomous choice responses.

Proportional analysis

Under the hypothesis that there is sensitivity to the scope of environmental damage described to respondents, the proportion of respondents agreeing to pay the dichotomous choice bid amounts should be statistically significantly higher in the scope (Tilley Swamp and the Coorong) sub-samples than the base (Tilley Swamp only) sub-samples. This can be tested by cross-tabulating responses to the dichotomous choice question against the degree of damage described and considering the chi-squared and Fisher's Exact statistics. Table 6 presents this analysis.

Table 6
Dichotomous choice response for each damage scenario

Damage scenario	Dichotomous choice response (N = 764)		Chi-square probability	Fisher's (1 tail) Exact probability
	Yes (%)	No (%)		
Base	56	44		
Scope	68	32	0.001	5.8E-04

The clear significance of the difference between the base and scope scenarios is apparent from these data. The Fisher's Exact test is one tailed so it is possible to give direction to the difference—the scope 'yes' response is significantly higher than the base 'yes' response. Support is therefore provided for the scope sensitivity hypothesis.

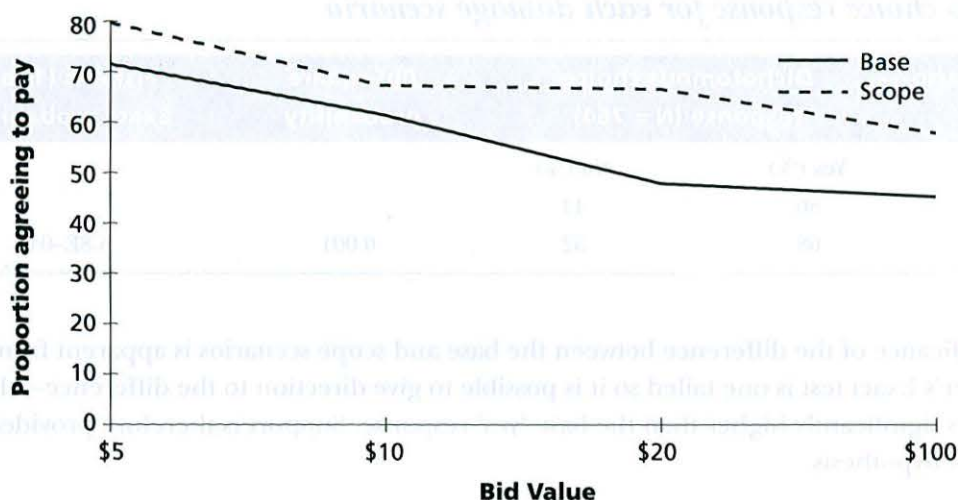
However, the data presented in Table 6 are aggregated across the range of bid values presented to sub-samples for the dichotomous choice question. A more refined analysis of scope sensitivity involves the consideration of the proportion of 'yes' responses according to damage scenario for each of the four bid values. This breakdown of the relationship between proportion and scope enables an analysis of the impact of differing bid values. Table 7 contains the relevant data and Figure 1 provides a graphical illustration of these data.

The proportion data, when considered across the different bid levels, indicate a mixed picture. For the higher two bids, there are strongly significant differences between the two damage scenarios on the basis of the more appropriate Fisher's Exact test. For the lower two bids, the proportions are not statistically different. Hence, scope insensitivity appears to occur only with the \$5 and \$20 bid amounts. One possible explanation of this feature is that respondents are equally willing to pay small amounts of money across different damage scenarios, but when larger amounts of money are involved, they become more selective about giving their support.

Table 7
Proportion of respondents agreeing to pay for each damage scenario by bid values.

Bid value	Damage scenario	Proportion agreeing to pay (%)	Chi-square probability	Fisher's Exact (1 tail) probability
\$5	Base	72	0.19	0.13
	Scope	80		
\$20	Base	62	0.50	0.3
	Scope	67		
\$50	Base	48	0.01	0.01
	Scope	66		
\$100	Base	45	0.06	0.04
	Scope	58		

Figure 1
Scope differences in proportion agreeing to pay



Logit analysis

The proportional analysis presented above is limited because it does not incorporate all the factors that may cause respondents to agree to pay the specified bid amount. A more complete specification of that causal relationship which incorporates the variation in scope as one of the factors of influence is of greater use in determining scope sensitivity. This can be achieved through the estimation of a logit regression equation to explain the dichotomous choice responses across the two sub-samples relevant to the scope testing.

To facilitate this test, two dummy variables were created. The first dummy, SCOPE, is set equal to 1 for the scope sub-samples and 0 for the base sub-samples. The second dummy, STATE, is set equal to 1 for SA sub-samples and 0 for NSW respondents. A significant (and positive) coefficient on the SCOPE dummy would indicate scope sensitivity for the damage description. A significant (and positive) coefficient on the STATE dummy would indicate sensitivity to the location of residence of the respondent.

A number of alternative logit models were run and from these, the following equation was selected as providing the best fit to the data¹⁵. Standard error statistics are presented under the estimated coefficients.

$$\log\{\text{pr}(\text{yes})/[1-\text{pr}(\text{yes})]\} = 0.29 - 0.01 \text{ BID} + 0.43 \text{ SCOPE} + 0.69 \text{ ATT} + 0.65 \text{ VIS}$$

$$(0.16) \quad (0.002) \quad (0.16) \quad (0.18) \quad (0.16)$$

(% correct prediction = 66.8% ; -2 log likelihood = 909 ; N=741)

All the coefficient estimates except the constant are significant at the 99% level.

(where: BID is the \$ amount of payment required in the dichotomous choice question;
SCOPE is the dummy for damage scenario;
ATT is a dummy set to 1 when the respondent indicated they favoured the environment more frequently than development when considering resource use project proposals; and,
VIS is a dummy set to 1 when the respondent expresses an intention to visit the area in the future.)

The SCOPE dummy in the logit expression is highly significant with the expected sign. This finding strongly supports the hypothesis that the CVM results are scope sensitive. Similarly the validity of the CVM responses provided in the questionnaire is supported by the strong significance of the BID coefficient. The negative sign is consistent with expectations. The data indicate that respondents have been aware of the amount they have been asked to consider paying and reacted in a manner consistent with economic theory. The significance of the attitudinal variable (ATT)¹⁶ suggests that respondents have been consistent in their answers between a general, fairly standard survey question and the more difficult and issue CVM question. Furthermore, the dummy variable relating to the presence of use value (VIS) is strongly significant and has a positive coefficient. This implies that people with an intention to visit the area are more likely to want the pipe built. These results are all supportive of the validity of the CVM results obtained.

What the above logit expression does not indicate is that some variables which would, *a priori*, be expected to be significant were not. For instance, the insignificance of the STATE dummy is less supportive of the scope sensitivity hypothesis. The implication is that respondents' dichotomous choice answers are independent of their location. However, this is not sufficient evidence to reject the scope sensitivity hypothesis. A number of additional factors should be considered. It is possible for instance, that dichotomous choice responses mainly reflect the non-use values, such as existence value, supplied by the areas. Location would then be much less important. To some extent, this possibility can be explored by an analysis of use values for the area. If the rate of direct use of the area is different for South Australians than it is for NSW respondents, then it can be argued that there should be sensitivity to location. South Australians would have a use value component to supplement their non-use values that is larger than NSW respondents. To perform this exploration, data relating to the visitation of the area by respondents was cross-tabulated by state of residence. Both past visitation and expected visitation were correlated to state of residence. Not unexpectedly, South Australian respondents were more frequent visitors to the area. The significance of the VIS variable also contradicts the idea that only non-use values are important. Hence, the lack of sensitivity to distance must be regarded as a cause of some concern for the CVM results.

15 The dichotomous choice variable that was used to form the dependent variable for this equation was unadjusted from the raw data. See Section 7 for a description of models specified for variants of this variable that take into account protest responses.

16 There is some risk that the relationship between ATT and the dependant variable is spurious. ATT captures respondents views toward environmental issues in general whereas the dichotomous choice responses relate to one specific environmental issue. A high correlation between the two, as found, would be expected. In the absence of significant socio-economic independent variables, the attitudinal variable has been included.

However, it is still not sufficient evidence to reject the scope sensitivity hypothesis. Another confounding factor could be the different response rates that were recorded for SA and NSW. It is possible that more NSW resident respondents chose not to return their questionnaires simply because they perceived the problem to be irrelevant to them because of their location. By counting non-responses as 'no' answers to the dichotomous choice question, location may become a significant factor. The only way to check this possibility is for non-respondents to be re-surveyed to check their reasons for failing to return their questionnaires. This strategy is unavailable in the context of this study, but may be considered in future applications. In-person interviews or drop-off-pick-up questionnaire delivery modes would also help to avoid this problem.

Another variable which was not significant in the logit analysis of responses was respondent income.^{17,18} The expected positive relationship between income and the willingness of respondents to agree to pay to avoid the environmental damage was not apparent.

To conclude the logit analysis, models were formulated for each of the damage scenario sub-samples. Comparisons between coefficients in the pair of equations then provided a test for differences caused by the variation in damage scenario. The pair of equations is presented below:

$$\text{BASE: } \log\{\text{pr}(\text{yes})/[1-\text{pr}(\text{yes})]\} = 0.25 - 0.01 \text{ BID} + 0.73 \text{ ATT} + 0.83 \text{ VIS}$$

$$(0.20) \quad (0.003) \quad (0.25) \quad (0.22)$$

(% correct prediction = 66.4% ; -2 log likelihood = 470 ; N=376)

All the coefficient estimates except the constant are significant at the 99% level.

$$\text{SCOPE: } \log\{\text{pr}(\text{yes})/[1-\text{pr}(\text{yes})]\} = 0.77 - 0.01 \text{ BID} + 0.64 \text{ ATT} + 0.46 \text{ VIS}$$

$$(0.21) \quad (0.003) \quad (0.23) \quad (0.23)$$

(% correct prediction = 60.6% ; -2 log likelihood = 438; N=365)

All the coefficient estimates except the constant are significant at the 99% level.

The most immediately noticeable difference between the two equations is in the constant¹⁹. This is to be expected given the significance of the SCOPE dummy in the combined equation reported earlier and supports the scope sensitivity hypothesis. The estimates are approximately 2.6 standard errors apart. The BID and ATT coefficient estimates are very similar across the two equations. The BID coefficients are only 0.67 of a standard error apart and the ATT coefficients are 0.38 of a standard error apart, suggesting that the main scope effect occurs in the intercept rather than the slope terms.

17 Note that the attitudinal variable and income are not highly correlated. The inclusion of the income variable does not force the attitudinal variable into insignificance.

18 It is useful to note that in an alternative formulation of the dichotomous choice response data which accounts for protest expressions, income becomes significant at the 95% level. However, the coefficient estimate is extremely small (0.032E-6). An analysis of those respondents excluded because of protest expressions showed a strong correlation with income. More higher income respondents were excluded from the analysis because of protest expressions than lower income respondents.

19 Note that there is some correlation between the VIS variable and the constant. The VIS coefficient estimates in the BASE and SCOPE equations are 1.68 standard errors apart.

Conclusions

For the results of any application of the CVM to be regarded as reliable, it has been concluded that sensitivity to the scope of the non-market good being considered should be established. The rationale for this conclusion is to ensure that the CVM has not been subject to 'perfect embedding' whereby respondents answer the willingness to pay question as a venue for generating satisfaction from the act of supporting 'a good cause'. This potential has variously been described as the 'good cause dump', a 'moral free lunch', 'the warm glow of giving' and 'the purchase of moral satisfaction'. More generally, particularly where the reason for 'perfect embedding' is expanded to include other possible difficulties such as respondent unfamiliarity with the good, 'perfect embedding' has also been called 'part-whole' bias. Both proponents of and critics of CVM regard this potential—whatever it is called—as creating unreliable estimates.

Perfect embedding implies that the respondent's answer to a CVM question will be unaffected by the nature of the good involved. Hence, the act of answering is what is hypothesised to be of value, not the quantity or quality of the good in question. The presence of perfect embedding will therefore be detected by an invariance of willingness to pay to the scope of the good.

The tests reported here demonstrate that the CVM questionnaire designed for this case study produced value estimates which are sensitive to scope variations. It can be concluded that the problem of wide spread perfect embedding has been avoided. Furthermore, the results suggest that the *a priori* expected phenomena of regular embedding is present. When valued alone, the Tilley Swamp damage was estimated at about \$20 per household. But when valued with damage to the Coorong, the estimate was only around \$20 more, even though the Coorong is more widely known and has a more significant ecology. This result shows that the 'frame' developed in the CVM questionnaire must reflect accurately the policy circumstances at hand.

SECTION 6

The Impact of Payment Vehicle

Proportional analysis

A common test for payment vehicle bias involves determining whether the proportion of respondents agreeing to pay the dichotomous choice bid changes across payment vehicles. This can be tested by cross-tabulating responses to the dichotomous choice question across payment vehicles. The results of this test are presented in Table 8.

Table 8
Dichotomous choice response for each payment vehicle

Payment vehicle	Dichotomous choice response (N=778)		Chi-square probability	Fisher's Exact (2 tail) probability
	Yes (%)	No (%)		
Income tax	68.09%	31.91%	0.98	1.00
Water rates	68.16%	31.84%		

It is apparent from Table 8 that the two payment vehicles used did not generate different overall acceptance rates. To confirm this result, the relationship between payment vehicle and DC response were also cross-tabulated for each bid value. These results, displayed in Table 9, also show that payment vehicles have no significant effect on the probability of agreeing to pay for any of the bid amount.

Table 9
Proportion of respondents agreeing to pay under each payment vehicle by bid value

Bid value	Payment vehicle	Proportion agreeing to pay (%)	Chi-square probability	Fisher's Exact (2 tail) probability
\$5	Income tax	75.24	0.37	0.41
	Water rates	80.39		
\$20	Income tax	67.07	0.15	0.18
	Water rates	76.77		
\$50	Income tax	66.29	0.58	0.64
	Water rates	62.37		
\$100	Income tax	57.84	0.97	1.00
	Water rates	58.10		

The convergence of results generated by the two payment vehicles is, however, only a weak test of payment vehicle bias. The results may merely suggest that both payment vehicles are equally biased. Further testing is required to determine if bias is present in the results because of the vehicles used.

Payment vehicle bias may be reflected by differential rates of protest across alternative payment vehicles. To determine if this was the case in the case study, the proportion of respondents protesting at the DC question was cross-tabulated against payment vehicle. The results of this test are shown in Table 10. The chi-square and Fisher's Exact statistic for this cross-tabulation were significant at the 95% level, indicating that there were proportionally more protests under the income tax vehicle. This is indicative of a payment vehicle bias. As a refinement of this result, a further cross-tabulation of the relationship between payment vehicle used and the proportion of respondents protesting was performed. However, in this case, those indicating a protest but who specifically agreed to pay if an alternative, more acceptable payment vehicle could be used were re-coded as non-protesters. The chi-squared statistic from this cross-tabulation was insignificant, showing that the re-coding exercise was capable of successfully reducing the payment vehicle bias that was evident when income tax was used.

Table 10
Proportion of people protesting according to payment vehicle

	Number of respondents not protesting (%)	Number of respondents protesting (%)	Fisher's Exact (one tail) test	Chi-square probability
Income taxes	101 (26.79%)	276 (73.21%)	0.03	0.03
Water rates	81 (20.25%)	319 (79.75%)		

Another sequence of tests for payment vehicle bias involved examining if there were any differences between the payment vehicles in terms of respondents' self-reports of:

- difficulty experienced in answering the DC question,
- discomfort felt whilst answering the question; and,
- dislike of the DC question.

To do this three different cross-tabulations were performed, however none of the chi-square test or Fisher's exact tests indicated any statistically significant differences.

Logit analysis

Further tests for payment vehicle bias were conducted using logit estimation. It was suspected that water rates may be a less suitable payment vehicle in NSW than in South Australia because the authority collecting water rates in NSW has no jurisdiction in SA. To test this, an interaction variable between state of residence and payment vehicle was included in addition to the simple additive variable for payment vehicle in the logistic regression modelling of the DC responses. Neither the interaction nor the additive variables were significant.

Next, an estimation of a logistic regression model that included an interaction variable between payment vehicle and whether the respondent owned their place of residence was undertaken. The rationale for this model specification was an expectation that water rates might not be a suitable payment vehicle for renters as landlords pay water rates and they may not expect the landlord to pass on an increase in water rates. As a result, they may be inclined to 'free-ride' and say 'yes' to a higher bid that they otherwise may be unwilling to pay. The results of this regression are shown below. The coefficient of the interaction variable is significant at the 5% level and has the correct sign. *A priori*, it would be expected to be negative because those who own their houses are less likely to agree to payment.

$$\log\{\text{pr}(\text{yes})/[1-\text{pr}(\text{yes})]\} = 0.76 - 0.01 \text{ BID} + 0.57 \text{ ENVATT} + 0.68 \text{ VISIT} \\ (0.26) \quad (0.00) \quad (0.19) \quad (0.17) \\ +0.71 \text{ VEHICLE} - 0.16 \text{ OWNHOUSE} - 0.8 \text{ OWNHOUSE} * \text{ VEHICLE} \\ (0.35) \quad (0.26) \quad (0.4)$$

(% correct prediction = 69.4; -2 log likelihood 933; N =745)

All the coefficients except OWNHOUSE are significant at the 95 % level.

(where: BID is the \$ amount of payment required in the dichotomous choice question;
 ENVATT is a five point scale indicating the importance of continued government funding forenvironmental projects (5=most important);
 VISIT is a dummy set to 1 if a visit is planned for the future;
 OWNHOUSE is a dummy set to 1 when a respondent owns their place of residence; and,
 VEHICLE is a dummy set to 1 for water rates)

This result indicates that willingness to pay under the water rates vehicle is higher than under the income tax vehicle, and that home owners are less willing to pay an increase in water rates than non-home-owners. Importantly, however, when this equation is re-estimates using a DC dependent variable that incorporates a re-coding of protest voters who would agree to an alternative payment vehicle, the payment vehicle and interaction variables become insignificant. Recoding was again successful in containing payment vehicle bias problems.

A further logistic regression model was developed to test whether work status affected the suitability of a payment vehicle. In particular, it was hypothesised that there was an interaction between work status and payment vehicle. Similar to water rates, income tax may not be a suitable vehicle for people who don't pay income taxes. However, while the coefficient for the interaction term has the correct sign, it is not significant even at the 90% level (p=0.11). This suggests that the suitability of income taxes was not affected by whether or not a person was working at the time.

Plausibility of bid values

A number of other tests were performed to determine whether respondents thought that each of the bid amounts (\$5, 20, 50 and 100) were equally plausible.

The first test conducted was a proportionality test to determine if the number of people protesting the use of the levy increased with the bid amount. The results of this cross-tabulation are shown in Table 11. The Chi-square test for this result is significant at the 95% level, indicating that more people protested use of the levy at higher bid amounts.

Table 11
Proportion of respondents protesting at each bid amount

Bid amount	Number of respondents not protesting (%)	Number of respondents protesting (%)	Chi-square probability
\$5	173 (82.78%)	36 (17.22 %)	0.044
\$20	146 (78.07%)	41 (21.93%)	
\$50	140 (75.68%)	45 (24.32%)	
\$100	149 (71.29%)	60 (28.71%)	

$$\log\{\text{pr}(\text{yes})/[1-\text{pr}(\text{yes})]\} = 0.76 - 0.01 \text{ BID} + 0.57 \text{ ENVATT} + 0.68 \text{ VISIT} \\
(0.26) \quad (0.00) \quad (0.19) \quad (0.17) \\
+0.71 \text{ VEHICLE} - 0.16 \text{ OWNHOUSE} - 0.8 \text{ OWNHOUSE} * \text{VEHICLE} \\
(0.35) \quad (0.26) \quad (0.4)$$

(% correct prediction = 69.4; -2 log likelihood 933; N =745)

All the coefficients except OWNHOUSE are significant at the 95 % level.

(where: BID is the \$ amount of payment required in the dichotomous choice question;
ENVATT is a five point scale indicating the importance of continued government funding forenvironmental projects (5=most important);
VISIT is a dummy set to 1 if a visit is planned for the future;
OWNHOUSE is a dummy set to 1 when a respondent owns their place of residence; and,
VEHICLE is a dummy set to 1 for water rates)

This result indicates that willingness to pay under the water rates vehicle is higher than under the income tax vehicle, and that home owners are less willing to pay an increase in water rates than non-home-owners. Importantly, however, when this equation is re-estimates using a DC dependent variable that incorporates a re-coding of protest voters who would agree to an alternative payment vehicle, the payment vehicle and interaction variables become insignificant. Recoding was again successful in containing payment vehicle bias problems.

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Plausibility of bid values

A number of other tests were performed to determine whether respondents thought that each of the bid amounts (\$5, 20, 50 and 100) were equally plausible.

The first test conducted was a proportionality test to determine if the number of people protesting the use of the levy increased with the bid amount. The results of this cross-tabulation are shown in Table 11. The Chi-square test for this result is significant at the 95% level, indicating that more people protested use of the levy at higher bid amounts.

Table 11
Proportion of respondents protesting at each bid amount

Bid amount	Number of respondents not protesting (%)	Number of respondents protesting (%)	Chi-square probability
\$5	173 (82.78%)	36 (17.22 %)	0.044
\$20	146 (78.07%)	41 (21.93%)	
\$50	140 (75.68%)	45 (24.32%)	
\$100	149 (71.29%)	60 (28.71%)	

Table 12

Proportion of respondents who thought that the levy seemed unrealistically high at each bid amount

Bid amount	Levy perception* (%)				
	1	2	3	4	5
\$5	11 (15.7%)	26 (21.1%)	117 (28.3 %)	33 (35.1%)	2 (10.5%)
\$20	11(15.7%)	20 (16.3%)	103 (24.9%)	29 (30.8%)	5 (26.3%)
\$50	16 (22.9 %)	37(30.1 %)	92 (22.2%)	22 (23.4%)	5 (26.3%)
\$100	32 (45.7%)	40(32.5%)	102 (24.6%)	10 (10.6%)	7 (36.8%)

* 1—strongly agree, 2—agree, 3—neither agree nor disagree, 4—disagree, 5—strongly disagree that the levy was unrealistically high.

Another proportionality test of bid plausibility involved the cross-tabulation of the number of people who considered that the levy seemed unrealistically high (or low) against the amount of the bid. As can be seen in Table 12, a strong relationship was found. The Chi-square statistic is significant at the 99% level. This indicates that more people thought that the amount of levy was unrealistically high as the amount of the bid increased.

Finally, proportionality test were run to determine whether the number of respondents who believed that the government would make the levy one-off or that the government would only spend the money on the pipe, changed with the bid amount. However the chi-square tests for both of these cross tabulations were insignificant.

Conclusions

The empirical evidence presented here suggests that the alternative payment vehicles used have not produced different value estimates. This result is consistent with the contention that there are no strong forms of payment vehicle bias present in the estimates.

However, whilst the incidence of payment vehicle bias may have been minimised, it has not necessarily been removed completely. An interaction between payment vehicle and home ownership suggests that respondents who didn't own their own house may be free-riding under the water rates payment vehicle. A similar interaction between vehicle and work status was not significant. Hence, income tax may be a more suitable payment vehicle where a large sample is involved in the survey. However, it was also found through a cross-tabulation that there were significantly more protests under income taxes. The inclusion of a back-up question asking if respondents were willing to pay if another more suitable payment vehicle could be found, appeared to remedy this problem.

The prospect of more protests being recorded with higher bid amount was also tested. A strong correlation was found. Similarly, there was a strong correlation between bid amount and the number of people who thought that the bid was excessively high or low. This points to a possible weakness with dichotomous choice CVM: difficulties may be experienced in convincing respondents about the plausibility of higher bids. As a result, respondents who are willing to pay larger amounts may protest because they see the assigned bid as unrealistic. This could be expected to result in lower median bids. However, implausible bid values may also increase the likelihood of hypothetical bias, which may result in either lower or higher median bids.

The results reported here indicate that payment vehicle bias can be minimised through carefully selecting a payment vehicle and structuring the survey to maximise payment vehicle plausibility. The use of back-up questions also seems to be helpful in reducing protests. Of the two payment vehicles tested, income tax appeared to perform moderately better, especially when used in association with the back-up questions.

SECTION 7

Alternative Elicitation Formats

Three alternative WTP elicitation formats were trialed in the survey. They were the standard dichotomous choice (DC) format, the 'polychotomous choice' (PC) format of Ready et al (1995) and the dissonance minimising format (DM) devised for this project. The aim of trialing these formats was to determine if either the PC or DM offered a significant improvement over the performance of the DC. To measure any such improvement, a number of performance indicators were used:

- differences in response rates
- proportional analysis
- logit modelling.

Each of these measures are considered separately in this section.

Response rates

The response rates across the three formats were:

- DC: 46.7%;
- DM: 45.6%; and,
- PC: 46.5%.

We can thus reject the hypothesis that the DM and PC formats, by reducing respondent dissonance, lead to higher response rates than DC formats. This result can be contrasted with the marginally higher response rates for the PC format than the DC format reported by Ready et al (1995).

Proportional analysis

For the purpose of comparing the results for the DC, PC and DM approaches, a number of alternative dependent variables were created, differing in the way levy protesters were treated. These alternative dependent variables are defined in Table 13. DC1, PC1 and DM1 are the raw data variables. DC2 and DM2 employ the conventional practice of deleting all levy protesters from the data set. DC3 and DM3 involve the re-coding of levy protesters according to their responses to the follow-up Question 4.

Table 13
Summary of Alternate Dependent Variables

Dependent Variable	Description
DC1	Raw data on DC format.
DC2	DC1 with those who objected to the levy being omitted from the data set.
DC3	DC1 with those who objected to the levy being re-coded according to their responses to the follow-up Question 4.
PC1	PC responses 'strongly support proposal', 'support proposal' and 'slightly support proposal' being coded as 'yes', and 'strongly oppose proposal', 'oppose proposal' and 'slightly oppose proposal' coded as 'no'.
DM1	Raw data for DM, with response 1 coded 'yes', 0 otherwise.
DM2	DM1, with levy protesters (response 4) being omitted from the data set.
DM3	DM1 with levy protesters being re-coded according to their follow-up response.

The proportion of respondents agreeing to pay for the pipe proposal under each treatment is displayed in Table 14.

Table 14
Percentage 'yes' Responses by Bid Value and Response Variable

	Bid				Range	N
	\$5	\$20	\$50	\$100		
DC1 (raw)	80.4	67.1	66.3	57.8	22.6	375
DC2 (protest excluded)	88.2	82.1	76.6	78.7	9.5	312
DC3 (protest re-code)	84.0	78.9	72.1	68.4	15.6	357
PC1 (raw)	75.0	81.3	78.9	68.6	6.4	379
DM1 (raw)	57.9	44.8	23.2	16.7	41.2	373
DM2 (protest excluded)	68.8	59.1	31.4	21.9	46.9	289
DM3 (protest re-code)	69.9	55.4	36.4	26.1	43.8	356

The DC data

A first observation is that the raw DC data suggest a median WTP in excess of \$100, and beyond the range of bid values included within the questionnaire. Consistent with high estimates of WTP is low price sensitivity. It is noted that with DC1, the proportion of respondents supporting the proposal drops by 23% when the bid value increases from \$5 to \$100. This figures can be compared with that of other Australian CVM studies. The range is greater than that of the Resource Assessment Commission's Coronation Hill CVM study. Whilst 65.9% of respondents presented with a bid value of \$100 at the first stage of the double-bounded study gave 'yes' responses, the proportion was only 78.3% at the lowest initial bid value of \$5 (major impact scenario, national sample). The equivalent range for the minor impact scenario was 53.6–64.9%, a difference of slightly over 10% (Imber, Stevenson, and Wilks, 1991).

A second observation from Table 14 is that treating levy protesters as outliers—as is done to form DC2—reduces the range of 'yes' probabilities and considerably increases median WTP.

The re-coding of protests to form DC3 produces 'yes' probabilities in excess of that of DC1, but less than that of DC2. This occurs because DC2 involves the removal of all levy related protest 'no' responses, whereas DC3 involves re-coding some of these as 'yes' responses. Note that 'yes' probabilities are monotone decreasing with price in the case of DC3, but not DC2, where \$50 and \$100 appear to bite equally. This may in part be a reflection of the smaller sample size in DC2 compared with DC1 and DC3. Use of positive re-coding rather than treating all protests as outliers improves the sample size by 14%.

The PC data

The PC results demonstrate very little price sensitivity. Furthermore, the percentage of 'yes' responses increasing from \$5 to \$20, and \$5 to \$50, and only falling for the highest bid value of \$100. It is difficult to attach much credence to these results.

The DM data

The DM produces the highest price sensitivity and the lowest median WTP estimates of the three elicitation formats under trial. All three treatments of the DM data produce ranges of 'yes' proportions in excess of 40%. Only 16.7% of DM1 respondents supported the pipe at \$100, far lower than the equivalent figures for any of the DC and PC formats. The location of the median is sensitive to assumptions involving the treatment of protest respondents, with the median lying in the interval [\$5-\$20] for DM1, and [\$20-\$50] for the other treatments.

These results are consistent with the view that allowing respondents to express the source of their ambivalence leads to cleaner, less noisy data. The DM produces greater price sensitivity, and lower estimates of median WTP.

Whilst the above observations are highly illustrative, they need to be backed up with formal statistical tests before firm conclusions can be drawn. Only in this way can it confidently be concluded that many of the differences reported above are truly significant.

Logit models

Statistically significant coefficients on socio-demographic variables such as education and income were only attainable in a few, simple, models.

A full socio-demographic model for the DC1 data, for example, produced the following results, (standard errors reported in brackets):

$$\begin{aligned} \log[\text{pr}(\text{yes}) / (1 - \text{pr}(\text{yes}))] &= 1.81^* - 0.009 \text{ BID}^* - 0.013 \text{ AGE} + 0.19 \text{ SEX} \\ &\quad (0.48) \quad (0.003) \quad (0.008) \quad (0.25) \\ &\quad -0.000003 \text{ INCOME} + 0.22 \text{ TERTIARY} \\ &\quad (0.000004) \quad (0.32) \end{aligned}$$

* = significant at 95% significance level.

(% correct pred=69.9; LogL (init)=400.569; LogL (final)=387.179; N=322).

Where: AGE is age in years;
SEX = 1 for males and 0 for females;
INCOME is gross income in dollars; and,
TERTIARY = 1 if respondent has a tertiary degree, 0 otherwise.

Dropping AGE and SEX together, or AGE, SEX and TERTIARY together also fails to produce a significant coefficient for INCOME. A basic BID and INCOME specification failed to give statistically significant coefficients for income in all three DC definitions shown in Table 13. However, the same specification did provide significant coefficients in all the DM results. For example, the following result is obtained for the raw DM data:

$$\begin{aligned} \log[\text{pr}(\text{yes}) / (1 - \text{pr}(\text{yes}))] &= -0.09 - 0.02 \text{ BID}^* + 0.00001 \text{ INCOME}^* \\ &\quad (0.23) \quad (0.004) \quad (0.000004) \end{aligned}$$

* = significant at 99% significance level.

(% correct pred=69.9; LogL (init)=444.57; LogL (final)=394.94; N=336).

These results indicate highly significant bid and income coefficients. When levy protesters are re-coded as 'yes' responses according to the definition of DM3, the results are instead as follows:

$$\log[\text{pr}(\text{yes}) / (1 - \text{pr}(\text{yes}))] = 0.25 - 0.02 \text{ BID}^* + 0.00002 \text{ INCOME}^*$$

(0.24) (0.004) (0.000005)

* = significant at 99% significance level.

(% correct pred=69.0; LogL (init)=447.75; LogL (final)=394.48; N=323).

The finding that INCOME has a significant coefficient, with the *a priori* expected positive sign, in all BID-INCOME DM models, but is insignificant in all of the DC models provides strong evidence that the DM format is superior. AGE and SEX were not significant in any models.

To supplement the socioeconomic model estimations, a sequence of attitudinal models were also estimated. Preliminary analyses indicated that INCOME tended to lose its statistical significance when attitudinal independent variables were included, suggesting income may be correlated with measures of respondent attitudes. Hence, for the attitudinal models, income is omitted.

Table 15 shows the independent variables used in the logistic valuation functions.

The attitudes were selected on the basis of a *priori* focus group findings regarding important determinants of CVM responses, and the results of multicollinearity checks. The highest bivariate attitude correlation was 0.25, and parameter estimates appeared stable when one or more of the attitudes was removed. Tables 16 and 17 show the parameter estimates with standard errors (in brackets) and probabilities, initial and final likelihood statistics, percentage correct predictions and the estimated median. Estimates of the median should be treated with caution, since, as noted above, in a number of cases it is estimated to lie outside the range of bid values contained in the survey.

Table 15
Variables Used for Attitudinal Models

Variable	Coding
BID	bid amount in dollars (5, 20, 50, 100)
OPTION	=1 if expect to visit area in future; 0 otherwise
ENVSCORE	5-point scale indicating importance of continued government funding for environmental projects, relative to other areas of government expenditure (5=most important, 1=least important).
CAUSE	5-point Likert scale measuring agreement with the statement "Payment should be restricted to those who caused the problem" (1=Strongly Agree).
DTRUST	5-point Likert scale measuring agreement with the statement "I do not trust government to make the levy one-off" (1=Strongly Agree)

Table 16
Logit Coefficients For DC Models*

	DC1	DC2	DC3
CONSTANT	2.19 (0.61) 0.0004	1.81 (0.76) 0.02	2.05 (0.67) 0.002
BID	-0.01 (0.003) 0.0004	-0.01 (0.004) 0.01	-0.01 (0.004) 0.0004
OPTION	0.51 (0.26) 0.049	0.07 (0.33) 0.85	0.36 (0.28) 0.2
ENVSORE	0.11 (0.1) 0.25	0.22 (0.13) 0.08	0.16 (0.11) 0.14
CAUSE	-0.39 (0.11) 0.0004	-0.20 (0.14) 0.15	-0.31 (0.12) 0.01
DISTRUST	-0.06 (0.12) 0.63	0.05 (0.15) 0.73	0.01 (0.12) 0.92
-2LogL. (initial)	412.1	256.9	349.8
-2LogL. (final)	375.0	246.3	324.9
% corr. pred	70.5	82.0	74.8
N	329	273	314
Estimated Median \$	113	189	136

*Under each coefficient is reported the standard error (in brackets) and the Chi-square probability

Table 17
Logit Coefficients For PC and DM Models*

	PC1	DM1	DM2	DM3
CONSTANT	2.87 (0.70)	1.28 (0.65)	1.76 (0.72)	2.40 (0.65)
	0.00	0.05	0.014	0.0002
BID	-0.004 (0.004)	-0.02 (0.004)	-0.02 (0.004)	-0.02 (0.004)
	0.34	0.0000	0.0000	0.0000
OPTION	-0.07 0.29 0.82	0.67 (0.27)	0.73 (0.31)	0.74 (0.27)
		0.01	0.018	0.006
ENVSCORE	0.22 (0.12)	0.39 (0.1)	0.36 (0.11)	0.21 (0.10)
	0.05	0.0001	0.002	0.027
CAUSE	-0.3 (0.12)	-0.68 (0.13)	-0.73 (0.14)	-0.62 (0.12)
	0.01	0.0000	0.0000	0.0000
DISTRUST	-0.3 (0.14)	-0.14 (0.13)	-0.08 (0.15)	-0.22 (0.13)
	0.04	0.28	0.58	0.09
-2LogL (initial)	328.1	432.1	350.5	435.2
-2LogL (final)	308.8	328.8	260.3	343.0
% corr. pred.	76.0	75.1	76.3	70.7
N	304	326	253	314
Est. Median \$	399	3	35	39

*Under each coefficient is reported the standard error (in brackets) and the Chi-square probability

From the results in Table 17, the PC format appears to perform poorly. The BID variable is statistically insignificant in the model for PC1. This is consistent with the insensitivity to bid value shown in Table 14 for PC1. It would be expected that the attitudinal variables would be highly significant in the explanation of the dependent variables. However, OPTION is insignificant in the PC1 regression, and ENVSCORE is only marginally significant. The median value is estimated to be in the order of \$400. With this evidence, the viability of the PC format must be regarded as highly dubious.

The DC and DM formats appear to perform much better than the PC format. BID is statistically significant in all DC and DM regressions. The BID coefficient is consistently in the order of -0.01 for the DC models and -0.02 for the DM models. This is consistent with the much greater responsiveness to bid values for the DM format shown in Table 14. OPTION is statistically significant in all DM regressions, but in only one of the DC regressions, DC1. ENVSCORE is also significant in all DM results but in none of the DC models. CAUSE is significant in two of the DC regressions and all DM results. DISTRUST is always insignificant for the DC and DM formats.

There is a significant range of median WTP bids across the various DC and DM estimations. Estimates of median WTP range from as little as \$3 in the DM1 case, to \$190 with DC2. Although the higher values involve extrapolation beyond the range of bid values provided in the survey, it is clear that the estimates of WTP vary substantially according to the format used and the treatment of protesters. Treating all protesters as outliers and excluding them, tends to produce estimates of WTP that are higher than those produced by the raw data models for both the DC and DM formats. The DM models yield WTP medians that are consistently lower than the DC models. Given the superiority of the DM models, the estimates they yield must be regarded as superior. Of the DM dependent variable trialed, DM3 is preferred because of its superior treatment of protest responses.

Whilst these results are supportive of the DM approach, it is not clear that its superiority is due to respondents experiencing less dissonance than under the other two formats. Recall that each version of the questionnaire asked respondents to indicate whether they (i) found the CVM question difficult to answer, (ii) felt uncomfortable answering it, and (iii) disliked it. Responses to these questions are dichotomous. Hence they can be regressed on treatment variables such as bid, state of residence and elicitation format to test the hypothesis that the DM causes the least dissonance. These regression models are thus estimated over the pooled data set, with dummies included to capture differences arising from the different formats. The following dummy variables were created accordingly:

DM = 1 if DM format used; 0 otherwise;

PC = 1 if PC format used; 0 otherwise; and

STATE = 1 if respondent lives in South Australia; 0 if New South Wales.

PC and DM were included in the models estimated in both an additive form and in an interactive form with price. The interactive terms were included to provide a test of whether the dissonance created by price is higher with the DC and PC formats than the DM. The results for the 'difficulty' and 'discomfort' regressions are as follows:

$$\begin{aligned} \log[\text{pr}(\text{difficult})/(1-\text{pr}(\text{difficult}))] &= -0.41^* + 0.001 \text{ BID} - 0.09 \text{ STATE} - 0.26 \text{ PC} \\ &\quad (0.19) \quad (0.003) \quad (0.13) \quad (0.25) \\ &\quad -0.39 \text{ DM} + 0.006 \text{ BID} * \text{ PC} + 0.011 \text{ BID} * \text{ DM}^* \\ &\quad (0.25) \quad (0.004) \quad (0.004) \end{aligned}$$

* = statistically significant at 95% significance level.

(% correct pred=60.3; LogL (init)=1403.3; LogL (final)=1381.4; N=1038).

$$\begin{aligned} \log[\text{pr}(\text{discomfort})/(1-\text{pr}(\text{discomfort}))] &= -0.77 + 0.0040 \text{ BID} + 0.0648 \text{ STATE} \\ &\quad (0.20) \quad (0.003) \quad (0.14) \\ &\quad -0.16 \text{ PC} - 0.77 \text{ DM}^* + 0.001 \text{ BID} * \text{ PC} + 0.01 \text{ BID} * \text{ DM}^* \\ &\quad (0.26) \quad (0.28) \quad (0.004) \quad (0.005) \end{aligned}$$

* = statistically significant at 95% significance level.

(% correct pred=66.5; LogL (init)=1215.0; LogL (final)=1190.4; N=953).

The elicitation format has a significant direct additive effect only in the case of the discomfort experienced by DM respondents. The negative coefficient implies that DM respondents experience significantly less discomfort. However, the multiplicative impact of elicitation format and bid value appears to be significant in both the difficulty and discomfort models. The positive coefficients on these coefficient estimates implies that both the DM format creates more problems for respondents as the bid value rises. A similar logit regression run for the 'dislike' response variable produced no significant coefficients. It appears that this analysis gives mixed support for the hypothesis that the use of the DM format causes less respondent dissonance.

Conclusions

The format used for the WTP question has a key role in determining the success of the CVM. Respondents answered very differently when confronted with the three alternative questioning formats used in this study. Consequently, the estimates of value produced differed and it is therefore necessary to draw some conclusions regarding the most appropriate format.

The clearest result is that the PC format has significant faults. All of the performance measures used show problems with the results of the format. The proportion of respondents agreeing to support the proposal was unresponsive to bid values and the logit modelling failed to uncover the expected *a priori* relationships. It is therefore not surprising that the estimated median value derived under the PC was comparatively high.

There were also weaknesses exposed in the DC format. Whilst the proportion of respondents agreeing with the proposal was responsive to bid values, the strength of the relationship was slight. This feature of the DC response has been characteristic of many of the Australian applications of the CVM. Associated with this shallow response function is a high estimate of willingness to pay, again a feature of many Australian CVM applications which have used the DC format. The logit regression modelling carried out for the DC results showed some significant relationships between the willingness to pay response and various attitudinal characteristics, however, the socioeconomic links could not be established.

The DM was found to be comparatively robust. The slope of the bid response function for the DM results was twice that of the DC and consequently, the value estimates generated were significantly lower. Not only were the logit models involving attitudinal variables more statistically significant, but a relationship between income and WTP was established. By all performance measures, the DM was superior to the DC.

The procedure used for the treatment of protest responses has also been shown to have important impacts on the value estimates generated by the CVM. The results presented here show that the deletion of protest responses is an unnecessary loss of data when effective follow-up questions are devised. It may also provide improved estimates of willingness to pay. Re-coding protest responses according to the nature of their protest effectively maintains the sample size and necessarily improves the representativeness of the results generated.

SECTION 8

Conclusions

Two types of conclusions can be drawn from the study detailed in this report. First, the results are of direct relevance to the specific policy issue that formed the focus of the CVM application undertaken—the construction of a pipe to prevent environmental damage being caused to Tilley Swamp and the Coorong. More broadly, the study demonstrates that wetlands are environmental assets that Australians value. Second, the study has implications for the methodology itself.

Policy implications

The direct policy significance of the results generated by this study is in the consideration of the viability of constructing the proposed pipe to prevent the saline groundwater from impacting on the environments of Tilley Swamp and the Coorong. The question to be addressed is whether the social costs of constructing the pipe are bigger or smaller than its social benefits. What costs are born by society because of the pipe? Mostly, the financial costs of its construction. How does society benefit from the construction of the pipe? By avoiding the environmental costs to Tilley Swamp and the Coorong that would otherwise occur. This study, by estimating these avoided costs, has provided an estimate of the social benefits of the pipe that can be useful to those responsible for deciding whether the pipe should be constructed. However, the results presented have yielded a number of value estimates, generated by an array of variants of the CVM. It is important for policy making that this array to be refined.

It is inappropriate to conceive of CVM as a technique that will yield a single value estimate. The method is called 'contingent' simply because the estimates generated are contingent on the circumstances presented to respondents and the style of the questionnaire used. It is possible, however, through the analysis of results, to reduce the set of contingencies to those that are most appropriate to the particular circumstances of the policy issue at hand.

The first stage of this fining down process is to consider the scope of the good involved. The pipe would prevent environmental damage to Tilley Swamp and the Coorong so that is the relevant scope of the good. The questionnaire was designed to frame that good, both in terms of competing environmental issues and other calls on respondents' incomes. So long as the pipe is a priority issue for government policy, the framing created by the questionnaire can be regarded as adequate.

Because the alternative payment vehicles used in this case study were shown in Section 6 to cause no significant variation in value estimates, there is no need to refine the value estimates on that basis. However, it must be noted that the values estimated are necessarily contingent upon the payment vehicles used.

Treatment of protest responses and elicitation format were found to have significant effects. In Section 7, it is shown that the DM format has significant advantages in performance over the DC format, whilst the PC format was deemed unsuitable. Furthermore, using the follow-up strategy to check on the nature of protest responses and re-coding accordingly offers the advantage of maintaining the size of the useable data set and provides potentially improved estimates of willingness to pay. More research into the use of the DM is warranted.

On the basis of these refinements, the estimate of the median value for avoiding damage to Tilley Swamp and the Coorong is in the order of \$40 per person as a once off payment. Some cautions accompany this estimate. First, it is an order of magnitude estimate only. It should not be employed as THE value of the damage avoided. Rather, it should be used as an indicator of the strength of community preferences for the protection of Tilley Swamp and the Coorong. It is also important to note that the response rate for the questionnaire was about half of the sample drawn. Hence, the estimate should not be extrapolated across the whole population. The non-respondents should (conservatively) be regarded as having no value, or at least a markedly lower value than that derived from the survey respondents, for the pipe. The falling response rate as distance from, and experience of, the affected area increased should also be taken as an indicator that values are not uniform across the whole country. Extrapolation should take this into account.

Notwithstanding these matters, it is clear that the value for the protection of the wetlands, expressed through this CVM application, is significant. Aggregating on a household basis over the population of SA alone²⁰, assuming that about half of the population has no value for the pipe²¹, yields an aggregate value estimate of approximately \$10m.

The value estimates generated from this study have wider policy implications. However, it is not appropriate simply to extrapolate them directly to other policy issues. They have been derived in a very specific set of circumstances which will not be replicated in any other context. This is illustrated by a consideration of the sensitivity of the estimates to scope differences. The scope testing process described in Section 5 showed that the Tilley Swamp damage scenario was estimated at about half the value of the Tilley Swamp and the Coorong case. Hence, even though the Coorong is a more ecological significant wetland than Tilley Swamp, its inclusion in the damage scenario only contributed as much as Tilley Swamp when it was the only area damaged. This result can be explained in (at least) two ways. First, respondents may have seen damage avoidance in the two areas as at least partial substitutes and so a diminishing marginal utility function was observed. Secondly, the framing of the good is determined, in part, by the good itself. Hence, the inclusion of Tilley Swamp as a separate entity in the base version of the questionnaire confers on it an importance that contributes to respondents' perceptions. A framing strategy that is appropriate to the policy issue under consideration is therefore essential. Had the policy issue under consideration been different, the mixture of substitutes would also have been different and, given the sensitivity to scope observed in the results reported, it would be expected that the values estimated would have also been different.

The estimates of value generated in this study are contingent upon a number of factors, including the assumption that the construction of the pipe would have only a minimal negative impact on the environment. In the event that there were significant negative impacts to the dune environment and the ocean resources beyond, there would need to be a downward adjustment of the estimated pipe benefit.

What can be learnt from these results in their more general application is that the protection of wetlands in the USE is of concern to the general public. There is support, therefore, from these results for the proposition that the drainage works under way in the USE will be of community benefit because of their role in protecting the wetlands of the area from rising water table levels. This non-market benefit can be taken into account along with the agricultural (marketed) benefits that have already been estimated for the BCA carried out as a component of the EIS for the drainage works.

20 1,001,006 people were registered on the electoral roll as at 4 March 1996. It is assumed that, on average, a household comprises two adults and that individuals in the survey responded as representatives of their household.

21 This fraction is assumed to be represented by the non-respondents to the survey.

Methodology implications

A primary goal of this study was the testing and development in an Australian context of the CVM. A number of significant findings have been generated in addressing this goal.

Preliminary research

To undertake a CVM application without intensive preliminary research would throw doubt on the validity of the results generated. Even basic communication aspects of a questionnaire need to be carefully considered—respondents' understanding and interpretations of concepts can differ markedly from an analyst's *a priori* expectations. A three stage process for this preliminary research is recommended:

- a telephone survey
- focus group discussions; and,
- pilot testing.

Too often in the past CVM questionnaires have gone into the field without adequate preparation. This has meant that respondents, on occasions, answered questions that they interpreted to have meanings very different from that intended. Unfortunately, at least for the immediate future, the implication of this requirement for extensive preliminary research is that the cost of applying the CVM will restrict its use to major resource allocation issues. In the longer term, it is conceivable that CVM practitioners will develop the skills necessary to short cut the process without compromising the validity of the results generated. This will only come with consistent application of the method over a wide range of circumstances.

Questionnaire delivery

The response rates achieved in this study and the quality of the information supplied by respondents indicate that mail questionnaires can be a cost-effective means of applying the CVM. However, some problems are apparent. Whilst the Dillman technique is effective, its requirement of a succession of re-mails can cause respondent resentment. It is also difficult with a mail out questionnaire to perform any follow-up analysis on non-respondents. The latter would be very useful to explore the hypothesis that non-respondents have no value for the good being valued. The preferred method of questionnaire delivery is probably 'drop-off-pick-up' as is used for the census. The method minimises interviewer bias and avoids the stress some respondents feel when confronted by an interviewer. It allows the respondent sufficient time to answer the questions in a considered fashion and provides some opportunity to determine the reason for a respondent refusing to participate. Whilst it is cheaper than personal interviews, it is more costly than mail delivery.

Scope testing

Scope tests in a CVM application perform two valuable roles. First, they provide the analyst with a measure of the success of their application. This is especially important where an application involves some testing of competing hypotheses. The scope test is one of the few ways of verifying a CVM application. Secondly, a scope test will be of use in convincing policy makers and their advisers of the validity of the results generated. In the Australian context, such is the scepticism of the use of CVM that the type of reassurance offered by scope tests will be important at least in the immediate future. The scope testing performed in this case study provides evidence that the 'perfect embedding' problem has been addressed satisfactorily.

However, it must be noted that the 'regular embedding' effect must be taken into account when considering the results of this study. That is, the results generated here are contingent on the particular framing strategy employed by the questionnaire. This strategy refers to the information given to respondents regarding competing and complementary environmental issues. The frame that is appropriate to a particular non-marketed good must be developed specifically for the prevailing circumstances. This will include matters such as the respondents' attitudes to the array of public issues under consideration at the time as well as the government's policy agenda. The preliminary research phases should be geared, in part, to this end.

Payment vehicle selection

The selection of an appropriate payment vehicle remains one of the key features of a CVM application. The task must be a primary focus of the preliminary research. What has been established in this study is that it is very unlikely that a universally acceptable payment vehicle will ever be found for an application. It is therefore unlikely that payment vehicle bias can be eliminated completely. However, that need not mean that the CVM cannot be used. The goal must be to ensure the bias is reduced to an acceptable level. For instance, to accommodate payment vehicle problems that in most CVM applications are recorded as protests and deleted from the sample, follow-up questions can be devised that detect those problems and allow valid responses to be recorded. In cases where respondents in different regions react differently to different payment vehicles, it may be useful to sum regional estimates of total willingness to pay that are estimated with different, regionally optimal, payment vehicles. Most importantly, the payment vehicle used must be recognised as one of the contingencies set up by the application of the CVM. The results generated should be viewed in this context.

Elicitation format

Many of the problems experienced in other Australian CVM applications that used the DC format were experienced in this study. In addressing these problems, the PC format was found to offer no advantage and in fact performed worse than the DC. However, the DM proved advantageous across all the performance measures applied. It offered better responsiveness to bid values, superior logit regression models across both socioeconomic and attitudinal specifications and was considered more favourably by respondents. The apparent superiority of the DM in this application should not, however, be taken as sufficient to adopt it in favour of the DC at this stage. The promise of the DM requires further proving. If it can be shown that in another context the DM replicates its superior performance, then its use as the format of choice would be better established. Part of that proving process would be a scope test with the DM, something that was not possible in this application given the funding available. The results do show, however, that the NOAA recommendation to use the DC format may be counterproductive to the development of the CVM. It is most important that experimentation with alternative formulations of the CVM be undertaken as a part of the method's continued development and evolution.

Applications in the Australian context

This case study has shown that applying the CVM in Australian contexts requires the consideration of a number of particular nuances. The reactions of Australians to CVM questions appear to be subtly different from those of respondents in the USA and Europe. Australians have had less experience of paying for public goods directly through additional taxes and levies and so generally believe that the provision of such goods is the responsibility of government. Australians also tend to be rather cynical about whether then government will actually spend the money collected on the project in question. Minimising this lack of responsibility and trust through careful survey design is considered necessary in Australian applications of the CVM.

Some caveats

What has been demonstrated in this study is that a carefully designed and implemented CVM application can yield results that satisfy standard tests as set out by the US National Oceanic and Atmospheric Administration such as scope sensitivity. The research directed at developing an elicitation format that is more appropriate to the Australian context has resulted in the DM which offers the promise of a significant methodological breakthrough.

It is important to remain guarded in the use of the CVM for a number of reasons. First, the technique is prone to abuse. For the uninitiated, CVM appears to be a simple and cheap way of estimating non-market values. What applications of the method have demonstrated is that for the results generated to be reliable, the use of CVM must be approached in the knowledge of its complexity and with a sufficient budget to address its inherent problems. The second reason for caution is the embedding effect. Whilst this study has shown that a carefully prepared CVM can avoid the trap of perfect embedding, the treatment of regular embedding remains problematic. Although regular embedding is to be expected in a CVM application, the extent to which it is found, is to a large extent determined by the CVM design itself. This implies that for a CVM application to provide acceptable and relevant policy information, the questionnaire must frame the good under consideration to reflect accurately both the priorities of the respondents and those of the government. Both the supply of and demand for the non-market good being valued must be reflected appropriately by the questionnaire design. The framing of the good will have an impact on the values estimated if the CVM application is successful. Therefore, the design of the frame is critical.

Finally, caution must be exercised in the way CVM results are used. CVM analysts must be careful to explain the contingent nature of their results. The value estimates obtained must not be regarded by either analyst, policy maker or policy adviser as the only input into the policy deliberations. The CVM results must be treated as one input which along with other economic, environmental, social and political information will help to achieve better natural resource allocations.

Even more caution must be exercised with the use of CVM results in what has become known as 'benefit transfer'. The temptation for policy makers is to look at other applications of the CVM to provide a guide to the value of a somewhat related (or even completely unrelated) non-market value. For instance, a policy maker may seek to use the \$40 estimate of the USE wetland damage as a value estimate of protecting a wetland on the Murrumbidgee River. Such exercises are fraught with danger. The issues involved are usually environmentally quite different, the affected population can have different characteristics and the framing of the issues are rarely similar. Usually it is only appropriate to use other studies to infer that similar ecosystems are also of some value to the community.

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APPENDIX 1

Analysis of Telephone Survey Responses

Part 1 of the Telephone Survey

The telephone survey was made up of two parts. The questionnaire is reproduced as part of this Appendix on page 57. The first part contained five questions designed to introduce respondents to the issue at hand. The questions asked respondents to think broadly about environmental issues before directing them gradually to the issue of protecting wetlands.

Question 1

An open-ended question was used to find the environmental issues of most importance to respondents. Respondents were asked to state up to five environmental issues, but most respondents were not able to respond with five issues. The average number of issues stated was 3.3 per respondent.

In general 'brown' issues were stated much more frequently than 'green' issues. As shown in Table 18, there was little difference in the responses between Sydney and Adelaide. However, water and air pollution and logging were cited less frequently in Naracoorte. Waste and litter, land degradation, land clearing, loss of species and the use of pesticides were mentioned more frequently in Naracoorte.

The results from this question can be compared to a survey conducted by the NSW EPA (1994) in which a closed ended question format was used. In their survey almost 58% of respondents cited issues related to water pollution, 40.9% of respondents cited issues related to air pollution, 11.5% cited litter, 19% cited loss of forests or bushland, 7.4% cited urban sprawl, 5.3% cited loss of species, 3.3% cited pesticides and 3.5% cited noise. While the EPA's figures are not directly comparable to our figures (which show the number of responses as a percentage of total responses), they do indicate a surprisingly similar pattern for issues that are of importance to respondents.

Question 2

In Question 2 respondents were twice asked to rank three environmental issues. After ranking each group of three issues respondents were then asked to nominate overall which issue was of most and least concern to them. The first three issues were beach pollution, excessive soil salinity and logging in old growth forests. The second three were air pollution in cities, loss of endangered species and wetland damage.

The principle aim of Question 2 was to determine the relative importance of protecting wetlands compared to other environmental issues. The question was included in addition to Question 1 as it provided information about the importance respondents attached to certain issues. It was also possible that the issues cited by respondents in Question 1 would be the ones that most readily come to mind and not necessarily the issues that respondents considered to be the most important²². It was also suspected that few respondents would cite wetlands in Question 1.

²² For example, loss of endangered species was only mentioned in Question 1 by 25 respondents (5% of total responses), yet 22% of respondents said that it was the issue of most concern to them of the six issues mentioned in Question 2.

Table 18
Environmental issues (% of total responses)

Issue	Sydney	Adelaide	Naracoorte	Total
Water pollution	0.27	0.31	0.17	0.25
Air pollution	0.25	0.25	0.16	0.22
Waste and litter	0.08	0.08	0.16	0.11
Land degradation	0.08	0.06	0.16	0.10
Logging	0.12	0.10	0.04	0.09
Land clearing	0.07	0.02	0.11	0.07
Loss of species	0.03	0.03	0.09	0.05
Pesticides	0.02	0.05	0.06	0.04
Nuclear issues	0.02	0.01	0.01	0.01
Noise	0.01	0.02	0.01	0.01
Wetland damage		0.01		0.00
Other	0.03	0.01	0.01	0.02

Overall air pollution, loss of endangered species and soil salinity were the issues of most concern to respondents (see Table 19). In terms of the geographical distribution of responses, loss of endangered species was fairly similar across all regions, but the relative concern about soil salinity increased significantly from Sydney to Adelaide, and from Adelaide to Naracoorte. Concern about air pollution was relatively lower in Naracoorte, but remained high.

Respondents ranked wetland damage, beach pollution, soil salinity and logging in old growth forests most frequently as the least important issue. In terms of the geographical distribution of responses, air pollution and logging were ranked more frequently as being of least concern with proximity to Naracoorte. The number of people citing wetland damage as the least important issue remained constant, at around 25%.

When answering this question many respondents noted the interdependence of issues. In particular they cited old growth forests and loss of endangered species. Consequently if they favoured one of these issues they would tend to favour the other. Some respondents had difficulty understanding what soil salinity or wetland damage meant. These respondents typically ranked the issue that they didn't understand as being of least concern.

Overall these results suggest that respondents view wetland damage as not being of primary importance as an environmental issue. However, only 23% of respondents said it was of least concern to them. Hence while wetland damage is not a primary issue to respondents, it appears to concern respondents.

Table 19
Prioritisation of environmental issues (% of responses)

(a) Issues of most concern to respondents

Issue	Sydney	Adelaide	Naracoorte	Total
Beach pollution	0.16	0.13	0.08	0.12
Soil salinity	0.13	0.21	0.27	0.21
Old growth forests	0.11	0.18	0.14	0.14
Air pollution	0.34	0.26	0.20	0.26
Endangered species	0.24	0.18	0.24	0.22
Wetland damage	0.03	0.03	0.06	0.04

(b) Issues of least concern to respondents

Issue	Sydney	Adelaide	Naracoorte	Total
Beach pollution	0.26	0.16	0.20	0.21
Soil salinity	0.31	0.24	0.04	0.18
Old growth forests	0.06	0.14	0.27	0.17
Air pollution	0.03	0.11	0.16	0.11
Endangered species	0.11	0.14	0.08	0.11
Wetland damage	0.23	0.22	0.24	0.23

Question 3

In Question 3 respondents were asked what the term 'soil salinity' meant to them. This information was needed to determine the level of simplicity required in the wording of the draft CVM survey.

In general respondents' understanding of soil salinity, and its causes, was moderate. This is reflected by the large number of respondents who had no idea (8% of responses) or clearly had the wrong idea of what soil salinity is. The majority of respondents, however, realised that soil salinity was related to soil degradation (19% of responses), salt (19% of responses), poor land management (12% of responses) and lost production (13% of responses).

The general understanding of soil salinity tended to increase with proximity to Naracoorte. In particular, more respondents cited loss of trees and soil degradation as a problem in Adelaide and especially Naracoorte.

Many Sydney respondents cited poor management as a causal factor (19% of responses). Another result of note is that many respondents in Adelaide cited salinity in the Murray River (12% of responses).

Question 4

The purpose of Question 4 was similar to the previous question: to gauge respondents understanding of the term 'wetland' so that appropriate wording could be used in the CVM survey.

The general understanding among respondents of the term 'wetland' was somewhat better than their understanding of the term 'soil salinity'. This is reflected in the higher number of responses (370 responses compared to 240 for soil salinity). Most respondents said that the term 'wetland' meant either a swamp, marsh, bog, billabong, river area or expanse of shallow water (37% of responses). A number of respondents from Naracoorte simply said: "like Bool Lagoon". Many respondents also cited waterbirds, wildlife and habitat (33% of responses). One vivid description of a wetland was: "an expanse of area 90% flooded with wild animals".

In Sydney and Adelaide a number of respondents mentioned mangroves (9% of responses), showing a familiarity with coastal wetlands. In Naracoorte, however, very few respondents cited mangroves. In Adelaide a number of respondents also stated that wetlands could be used for water purification (7% of respondents). Many of the respondents in Adelaide reported the use by local councils in Adelaide of artificial wetlands for stormwater treatment.

The understanding of inland wetlands tended to be poorest in Sydney. Many people had the impression of it being somewhere up north (5% of responses), many thought wetlands were rainforests (6% of responses), many mentioned mangroves (9% of responses), some had no idea (2%) and one person even cited the Great Barrier Reef as an example. This suggests a need for the questionnaire to contain a detailed description of wetlands.

Question 5

In Question 5 respondents were asked what they valued most about wetlands. This question aimed to draw out the attributes of wetlands that people value for use in the CVM survey.

As shown in Table 20, many respondents cited wildlife or birds (28% of responses), habitat (21% of responses) and trees and plants (10% of responses). Many respondents said that they value wetlands because they provide an ecosystem (13% of responses), and simply for their preservation (7% of responses). Very few respondents, however, cited recreation (2% of responses) or aesthetics (5% of responses).

Table 20
Wetland attributes (% of total responses)

Attribute	Sydney	Adelaide	Naracoorte	Total
Wildlife/birds	0.36	0.21	0.27	0.28
Habitat	0.13	0.26	0.25	0.21
Ecosystem	0.18	0.13	0.07	0.13
Trees/plants	0.08	0.09	0.14	0.10
Preservation	0.07	0.05	0.08	0.07
Aesthetics	0.02	0.07	0.05	0.05
Water purification	0.06	0.08		0.05
Recreation		0.02	0.05	0.02
Prevent salinity	0.01		0.02	0.01
Other	0.04	0.01	0.04	0.03

In terms of the geographical distribution of responses, the number of respondents mentioning habitat was considerably lower in Sydney (13% of responses compared to 26% in Adelaide and 25% in Naracoorte). The number of people citing aesthetics was also lower in Sydney (2% of responses), but few people in all of the areas cited the aesthetic features of wetlands. The number of respondents citing wetlands as being ecosystems declined with proximity to Naracoorte.

Part 2 of the telephone survey

After the first part of the survey respondents were read a paragraph describing either the effect of the drainage scheme on The Coorong or Tilley Swamp and the need for the pipe. The second part of the survey involved various questions about the provision of the pipe and how the government would decide whether to build the pipe.

Question 6

In the first part of this question, respondents were asked whom they thought was most likely to end up paying for the pipe. The majority of respondents thought that federal and state taxpayers would pay. Only 22 respondents thought that farmers would contribute or pay fully for the pipe. Many respondents noted that farmers were unable to afford to pay for the pipe.

In the second part of Question 6, respondents were asked how they thought the money for the pipe was most likely to be collected. This question was designed to indicate in an unprompted fashion what the most plausible or believable payments vehicles for the CVM survey would be.

Respondents suggested that the pipe would be paid for by government (32%), or by increased taxes (21% of responses), the use of levies (20% of responses) and rates (8% of responses). It is possible that some respondents would have included levies or rates within their definition of increased taxes. Some respondents nominated charities, but most respondents saw using charities as unrealistic. Only a small percentage of respondents nominated trust funds.

There was a strong difference in the number of respondents who said the money for the pipe is most likely to be allocated by government in the Sydney Coorong and Tilley Swamp sub-samples. In the Coorong sub-sample allocation from government comprised 25% of total responses, while in the Tilley Swamp sub-sample it comprised 73% of total responses. A possible explanation of this result is that respondents saw the effect on Tilley Swamp as small-scale and not a national or a heritage issue, and hence government expenditure is most likely. However, the Tilley Swamp sub-sample is small so only tentative conclusions can be obtained from this result.

Question 7

Question 7 was identical to the previous question except that respondents were asked who they thought *should* pay for the pipe, and how they thought the money *should* be collected. This question therefore sought an indication of who people see as responsible for paying for the pipe.

In the first part of Question 7, the majority of respondents still said state or federal taxpayers. The number of people stating SA taxpayers, however declined from 85 in the previous question to 45 in this question. This even occurred in the Sydney sub-samples, suggesting that respondents believed that payment for the pipe should be shared. Many respondents appeared to think that these wetlands were part of Australia's 'heritage' so everyone should pay for them. For example, one respondent said "it should be everyone in Australia because its part of Australia's heritage". Another respondent said: "everyone benefits from saving wetland areas. Everyone should put in, not just farmers".

The number of respondents citing the government increased from 11 in the previous question to 38 in this question. This increase may reflect the juxtaposition of the question. As many respondents said in the second part of Question 6 that the money should be allocated by government, it would follow that they would say that the government should pay.

In the second part of Question 7 there was a drop in the number of respondents that said that the government should pay for the pipe (from 32% to 27%), but the number is still high. Increased taxes (21% of responses), levies (18% of responses) and rates (6% of responses) were still prominent as potential payment vehicles. More respondents suggested the use of charities (from 5% of responses to 10%). The number of respondents suggesting trust funds remained low.

The divergence between the number of respondents suggesting that the government should pay for the pipe in the Coorong and Tilley Swamp sub-samples was further accentuated. However, the Adelaide sub-samples provided results that were opposite to those found in Sydney: proportionately more respondents thought that for the Coorong the government should pay for the pipe.

Question 8

In Question 8 respondents were asked how they thought the government was likely to decide whether the pipe was to go ahead. This question was included in the survey to gauge the overall plausibility of using a CVM survey. In other words, would respondents believe that the government would genuinely ask them about whether the pipe should be built?

The majority of respondents suggested that the government would do some kind of study (24% of responses) and look at economic factors (18% of responses). Other respondents thought that a political decision would be made (17% of responses) or that the government would simply make an executive decision (7% of responses). Some respondents suggested that the government would consult the community (8% of responses). Overall these results suggest that people believed that the government has a decision making process that is not just *ad hoc* and that community consultation could be part of this process.

There were no significant geographical differences in responses.

Question 9

Question 9 was similar to the previous question except that people were asked how they thought the government *should* decide whether to build the pipe.

Most respondents still thought that the government should do studies (33% of responses), but fewer thought that the government should look at economic factors (a decrease from 18% to 9%). Significantly, there was an increase in the number of people suggesting that the government should consult the community (from 8% to 24%). This was most pronounced in Naracoorte. There was a similar increase in the number of respondents who thought that the decision should be based on the effect on the environment (from 7% to 20%). Many respondents appeared to have lexicographic responses, wanting to avoid damage to the environment at any cost. The following quotes are typical of this type of response: "we can't keep butchering the environment...we must preserve what's unique"; and "there's no decision really to be made if its affecting the environment...it should be costed in to doing what's right for Australia".

Question 10

In this question, respondents were asked how much they think it would be reasonable for the government to ask people to pay for the pipe in terms of a one-off environmental levy on households. The question was deliberately ambiguous so that people would state the reasons why they could not answer. It was hoped that these reasons would indicate the factors that are critical for people in deciding whether they would pay for such a pipe.

Many respondents said that before they would be willing to pay they would need to be sure of the benefit. One respondent said: "we need to know the cost and be convinced and not just told of the benefit". Another respondent said "I'm happy to pay...if something productive can be done, if the results can be proven over some length of time". Comments such as "If its going to work..." were typical.

Many respondents said that they would need to know the cost of the project and the number of people paying before they could answer. These respondents seemed to be wanting to calculate what it is 'fair' for them to pay. It appeared that if the cost was high respondents might be willing to pay more.

Many respondents cited equity as an issue. Many respondents wanted the levy to be charged according to people's ability to pay. They did not want it to be "onerous on the very poor" and in one case "or the very rich".

Some respondents objected to the use of levies. One respondent commented: "levies are nasty. People don't expect them...they're placed on rivers but people don't put away for them...they're a slug". Another respondent said about the increasing number of levies: "people can't afford levies on everything". In Naracoorte several respondents pointed out that rates were the highest in South Australia and that further increases would be difficult to meet. One respondent commented that the "levy would need to be one-off like in Victoria...otherwise people will smell a rat".

There were, however, a number of respondents that did eventually provide answers to this question. The amounts suggested ranged from a few dollars up to about \$250. The majority of people suggested amounts ranging from around \$1-5 up to \$100. Some respondents nominated a percentage of income, typically less than 2%. A local councillor suggested that if the local community (Naracoorte) could be convinced of the worth of the project they could agree to pay up to \$200-250 per household. In Sydney, the bids tended to have a lower range, between \$1-40.

Transcript of the Telephone Survey Questionnaire

Hello. My name is I'm conducting an environmental survey for the Australian Bureau of Agricultural and Resource Economics. It takes only about ten minutes to do the survey and we'd really appreciate your help.

(If unable to assist: Is there a more convenient time that I could call you?)

If continue to refuse, note refusal and proceed to next respondent)

Part 1

1. Please tell me up to five environmental issues that concern you most.
2. In general, which of the following three environmental issues concerns you most? Which of the three concerns you least)? *REPEAT across the two sets of three issues, rotating the sequence.* Which of *(the two top issues)* is of most concern? Which of *(the bottom two issues)* is of most concern?
 - Beach pollution
 - Excessive soil salinity
 - Logging old-growth forests
 - Air pollution in our cities
 - Loss of endangered species
 - Wetland damage
3. One of the issues I just asked you to think about was excessive soil salinity. What does this mean to you?
4. Another of the issues I asked you to think about was the protection of wetlands. What does the term wetland mean to you?
5. What are some of the things that you think are important about wetlands?

Part 2

I'm now going to read a paragraph about a wetland called the Coorong/Tilley Swamp that is about 300 kms south east of Adelaide. To reduce water logging of farm lands, a scheme that drains excess water into the Coorong/Tilley Swamp has been approved. This will damage the wetland. To avoid this, some extra works are planned. These involve a pipe to take the excess water out to sea. But this extra pipe would be costly.

(Split sample 50:50 between the Coorong and Tilley Swamp)

6. If the extra pipe was to be built, who do you think **is most likely** to end up paying for it? How do think the money **is most likely** to be collected?
7. If the extra pipe was to be built, who do you think **should** pay for it? How should that money be collected?
8. How do you think the government **is most likely** to decide whether the pipe is worthwhile?
9. How do you think the government **should** decide if the pipe is worthwhile?
10. If it turned out that a special levy was set up to pay for the pipe—what is the most you think people should be asked to pay as a once off payment?
(note any comments as well as dollar amounts)
11. To help us determine if the sample of people we are interviewing is representative, would you please indicate into which age group you fall.
 1. under 30
 2. 30 to 50
 3. over 50

(Note respondent's sex)

Protocol for the Telephone Survey

1. First Phase: For Naracoorte, Adelaide and Sydney, 30 responses for the Tilley Swamp split and 30 responses for the Coorong split. (TOTAL 180 interviews)
2. All questions to be included in the first five interviews in each split (total of 30 interviews) to assess the relative benefits and costs of including Question 2; specifically if information on wetlands as an issue is coming from Question 1. Also if the respondents are thought to be objecting to the length of the interview by its end, then it would be better to cut out Q2 to reduce the time involved. If benefits are less than the costs—ie. if wetlands are being mentioned in Question 1 or if time is a problem—then proceed without Question 2 but with a modified Question 3; viz, *One issue that some people think is important is damage to wetlands. What do you think of when I say the word wetlands?* If Wetlands are not being mentioned in Question 1, proceed with all questionnaire intact.
3. At the end of the first phase, assess the variability in responses. Has 30 responses produced a reliable indication of preferences in each split? If it has, do not proceed. If variability is strong, continue with 20 more interviews for each split (Tilley Swamp/the Coorong) for Sydney and Adelaide only—Naracoorte's population is too small to proceed.
4. SAMPLING: From the relevant phone book, calculate the number of pages of entries. Divide that number by the number of respondents required eg. 1,000 pages divided by 50 respondents = 20. Thus select the second name from the second column of every xth page where $x = \text{pages} / \text{respondents}$, unless it is not a residential address (perhaps a business address) or for the Naracoorte sample, if it is outside the town area. If these latter conditions apply, select the next name down the column until an entry within the sampling frame is found.
5. RECORD the date and time of the call.
6. If answered ask for an over 18 year old/adult member of the household.
7. If unanswered, note it and proceed to the next valid phone entry down the column.
8. If refused, note it and proceed to the next valid phone entry down the column.
9. Call between 6pm and 9.30pm Monday to Saturday; 2pm and 5pm Tuesday, Thursday, Saturday and Sunday.

APPENDIX 2

The Questionnaire

The questionnaire presented in this appendix is one of the twenty versions that were mailed to respondents in forty sub-samples. Specifically, it uses the Tilley Swamp and the Coorong damage scenario, an increase in income tax as the payment vehicle, the dissonance minimising elicitation format and a \$50 bid value. The fourth, fifth, sixth and seventh pages are specific to this particular questionnaire version. All other pages are common across all versions. The other versions of the variable pages are available on request from Dr Jeff Bennett of ERE on 02 6236 8228.

How to fill out this questionnaire

The questions take different forms. In most cases you only need to circle the number which is closest to your view. Here is an example:

EXAMPLE ONLY

Do you think the government should spend more or less on education?

- | | |
|-------------------------|---|
| Spend more on education | 1 |
| Doesn't matter | 2 |
| Spend less on education | 3 |
| Don't Know | 4 |

If you think the government should spend more on education, you would circle '1' as shown.

Sometimes you need to write in an answer—in these cases, simply write your answer in the space provided. If you have any questions regarding this survey, please contact Dr Russell Blamey of Environmental and Resource Economics on 02 6249 3285.

All your answers will be kept strictly confidential

When you have finished the questionnaire, please use the enclosed reply paid envelope to mail it to:

Reply Paid 28
PO Box 170
Civic Square ACT 2608

We hope you enjoy doing this questionnaire and thank you very much for taking part in the survey.

Section A: Some General Issues

To start off, we would like to find out what you think about some general issues that Australians face today.

Question 1

Below is a list of areas where governments have been considering reductions in funding.

Please **rank** these five areas by placing the numbers 1 (most deserving of continued funding) to 5 (least deserving) in the following boxes:

Education

The Environment

Crime Prevention

Hospitals

Unemployment

Question 2

One of the areas mentioned in Question 1 was 'The Environment'. Please **rank** the following five environmental goals by placing the numbers 1 (most deserving of funding) to 5 (least deserving) in the following boxes:

Reducing water pollution

Conservation of wetlands

Controlling land degradation

Reducing logging of native forests

Reducing air pollution

These are just some of the environmental issues that governments are asked to spend money on. There are many other such issues.

Section B: Damage to Wetlands in the Upper South East Region of South Australia

In this section of this questionnaire we want to tell you about one environmental issue: damage to wetlands in the Upper South East Region of South Australia. We will also tell you about a pipe that would prevent the damage.

Please read carefully the information presented in this section. After you have done this, we will ask if you think the pipe should be built.

The Wetlands

The Coorong and Tilley Swamp are wetlands in the Upper South East Region of South Australia about 200 km south of Adelaide. The Coorong is a large permanent lagoon which is about 100 km long and varies between 2 and 5 km in width. Tilley Swamp is 30 km in length and varies between 3 and 4 km in width. It is flooded only at certain times of the year. **Please take a look at the enclosed map which shows details of the area.**

The Problem

Excess groundwater that is rising to the surface is damaging large areas of farmland in the surrounding region. To help restore agricultural productivity, this excess water will be drained into The Coorong and Tilley Swamp. The best available scientific evidence shows that the excess water will change the environment of The Coorong and Tilley Swamp in the following ways:

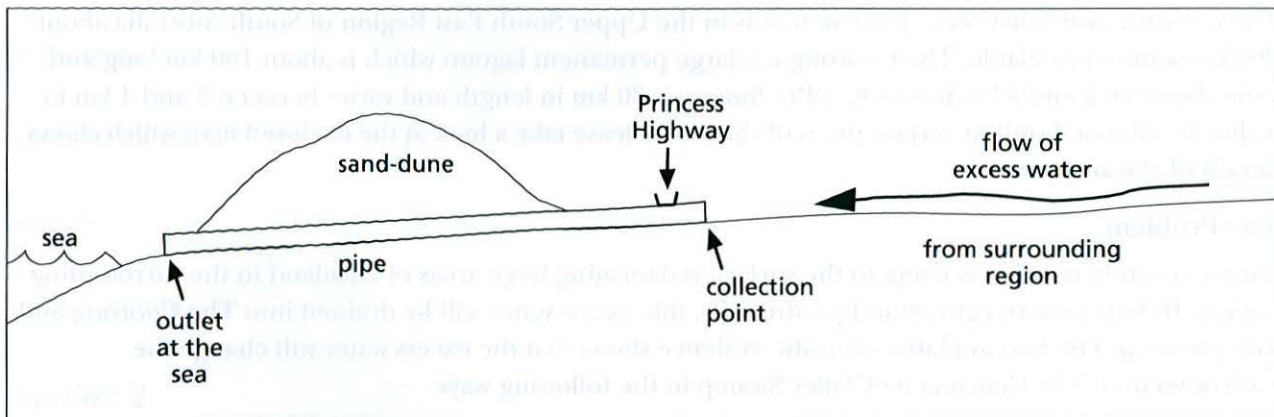
- The extremely salty water of the southern Coorong will be diluted so that it will only be as salty as seawater. This will reduce the diversity of habitats in the region.
- The aquatic plants that require the extremely salty water will be replaced and the amount of food for waterbirds in the southern Coorong will be reduced.
- It is estimated that, on average, the number of waterbirds using the Coorong will fall from 130,000 to 70,000 each summer.
- Tilley Swamp will be flooded to a depth of 2 metres.
- The tea trees in Tilley Swamp will die.
- Tilley Swamp will be too deep for some waterbirds to feed, except at the shoreline.
- The number of waterbirds that, on average, use Tilley Swamp for habitat will fall from 40,000 to 10,000 each year.
- The five rare species of waterbirds that use Tilley Swamp will decline in number.

The Proposed Solution

A pipe has been proposed to avoid these environmental changes (see Diagram below). The pipe would take the excess water out to sea so that it wouldn't enter Tilley Swamp and The Coorong. Excavation through the sand hills would be needed so that the pipe could reach the sea. An Environmental Impact Statement has shown that the excavation and the discharge of the excess water into the ocean would have minimal impacts on the environment.

Diagram

Side-on view of Proposed Pipe



How would the pipe be funded?

The proposed pipe would be expensive to build. The South Australian and Commonwealth Governments do not have enough money to pay for the pipe from existing taxation revenue.

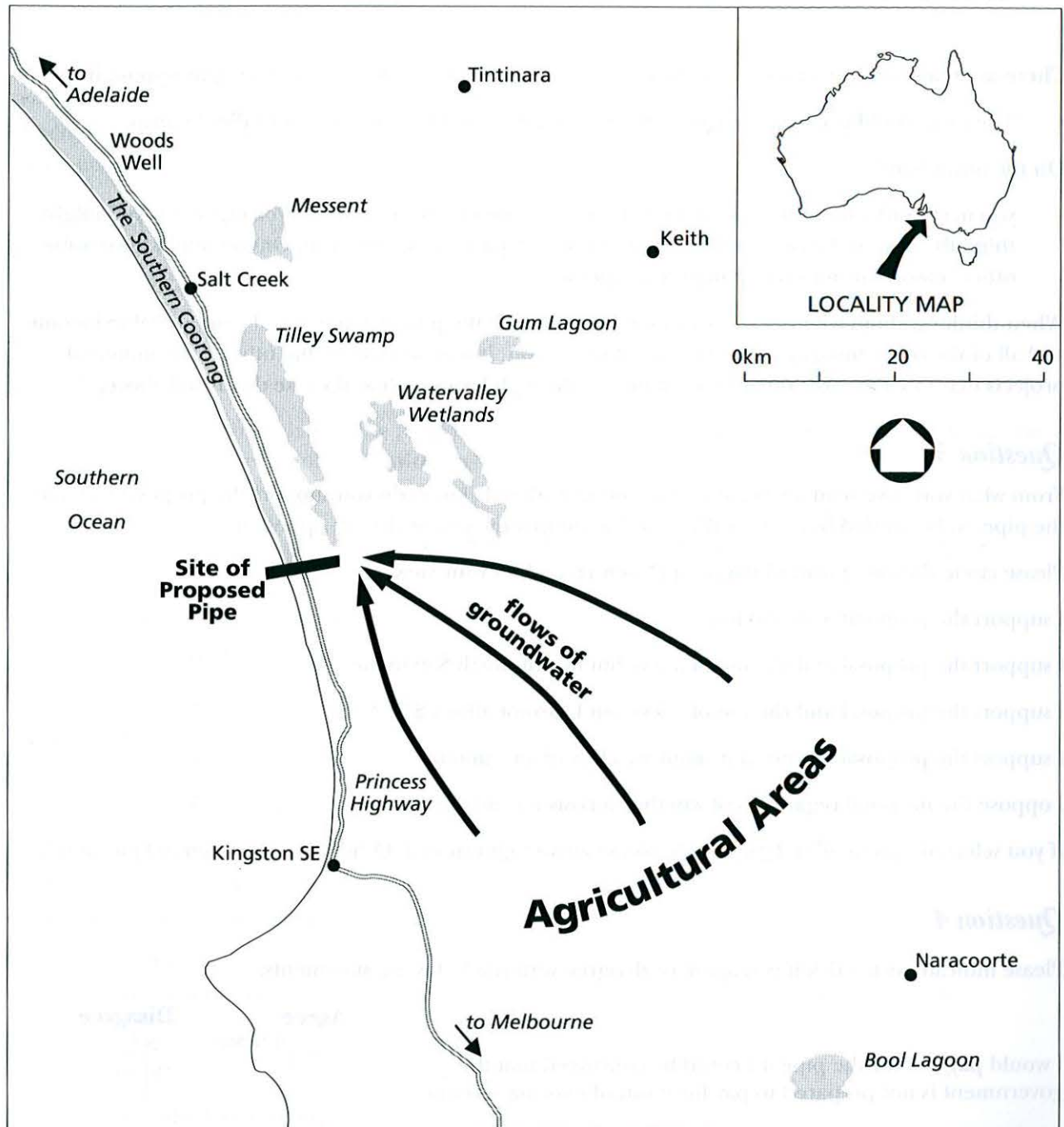
After extensive consultation with members of the community it has been proposed that, if the pipe is to be built, all Australian taxpayers should contribute to its cost. However, those who live in South Australia would pay more than those living in other States.

With this in mind, it has been calculated that building the pipe would require you to make an additional once-off payment of \$50, on your next year's income tax return.

The revenue that is raised would go into a special fund that would only be used to build the pipe.

The pipe will only be built if people are willing to pay this once off pipe levy.

Map
Location of Proposed Pipe



The Coorong is part of a national park and is listed as a wetland of international importance. The southern Coorong has an environment that is unique in Australia. It contains water that is much saltier than seawater. Yet it produces large amounts of aquatic plants and fauna—such as insect larvae and salt flies—which provide food for many waterbirds of many types. The southern Coorong is one of only a few major areas in southern Australia which are used by migratory and other waterbirds, particularly during drought.

Tilley Swamp is one of a series of shallow freshwater wetlands. It contains a conservation park and a further conservation park is proposed. The most common plant in Tilley Swamp is tea tree and it provides habitat and feeding areas for waterbirds and other fauna.

Section C: What Do You Think?

In this section of the questionnaire we want to know your opinion about the proposed pipe, to be funded as described above.

There are reasons why you might favour the proposed pipe, and reasons why you might oppose it:

- The pipe would prevent changes to the environment of The Coorong and Tilley Swamp.

On the other hand...

- you may think that it does not matter if the environment of these areas is changed. Or you might think the cost of the pipe is more than you are prepared to spend on it. Or you might have some other reason for not supporting the proposal.

When thinking about whether or not you are in favour of the pipe, keep in mind your available income and all of the other things you have to spend money on. It is also possible that other environmental projects may one day cost you additional money through levies such as the one described above.

Question 3

From what you have read above, and what you may already know, do you support the proposal to build the pipe, to be funded by a once-off levy of \$50 on income tax, or do you oppose it?

Please circle the *one* option which most closely resembles your view.

- | | |
|---------------------------------------------------------------------------|---|
| I support the proposal with \$50 levy | 1 |
| I support the proposal and the use of a levy but its not worth \$50 to me | 2 |
| I support the proposal and the use of a levy but I cannot afford \$50 | 3 |
| I support the proposal but not if it requires a levy of any amount | 4 |
| I oppose the proposal regardless of whether it costs me anything | 5 |

If you selected option '4' in Question 3, please answer Question 4. Otherwise, please go to Question 5.

Question 4

Please indicate with a tick if you agree or disagree with the following statements.

	Agree	Disagree
I would pay \$50 for the pipe if I could be convinced that the government is not prepared to pay for it out of existing revenue.	<input type="checkbox"/>	<input type="checkbox"/>
I would pay \$50 for the pipe if I could be convinced that the government doesn't have enough money to pay for it.	<input type="checkbox"/>	<input type="checkbox"/>
I cannot afford to pay anything for the pipe.	<input type="checkbox"/>	<input type="checkbox"/>
I would pay \$50 for the pipe if an alternative, acceptable way of collecting the money could be found.	<input type="checkbox"/>	<input type="checkbox"/>

Question 5

Thinking about your response to Question 3, please indicate how strongly you agree or disagree with each of the following statements:

	Strongly Agree	Agree	Neither Agree nor Disagree	Strongly Disagree	Disagree
I felt that I needed more information than was provided.	1	2	3	4	5
I thought the information was biased in favour of the pipe.	1	2	3	4	5
I thought the information was biased against the pipe.	1	2	3	4	5

Question 6

The following statements relate to the proposal to build the pipe mentioned above. Please indicate the extent to which you agree or disagree with each of the following statements.

	Strongly Agree	Agree	Neither Agree nor Disagree	Strongly Disagree	Disagree
People living outside South Australia should not have to pay for the pipe.	1	2	3	4	5
South Australians should not have to pay more than those living in other states	1	2	3	4	5
Payment should be restricted to those who benefit from the pipe.	1	2	3	4	5
Payment should be restricted to those who caused the problem.	1	2	3	4	5
I do not trust the government to spend the levy only on the pipe	1	2	3	4	5
I do not trust government to make the levy once-off	1	2	3	4	5
The amount of the levy seemed unrealistically high or low	1	2	3	4	5

Question 7

Before today, how well informed were you about the excess groundwater that is rising to the surface and damaging large areas of farmland in the Upper South-East region?

- | | |
|--------------------------|---|
| very well informed | 1 |
| moderately well informed | 2 |
| slightly informed | 3 |
| not at all informed | 4 |

Question 8

Before today, how well informed were you about the proposed pipe?

- | | |
|--------------------------|---|
| very well informed | 1 |
| moderately well informed | 2 |
| slightly informed | 3 |
| not at all informed | 4 |

Question 9

Have you ever visited the wetland areas described in Section B?

- | | |
|-----|---|
| YES | 1 |
| NO | 2 |

Question 10

Do you think you will ever visit or re-visit the wetland areas described in Section B?

- | | |
|-----|---|
| YES | 1 |
| NO | 2 |

Section D: You and Your Background

In this section of the questionnaire, we would like ask you a few questions about yourself and your family background to make sure the people we are surveying are representative of the full range of Australians.

Question 11

Over the years, when you have heard about proposed projects where there is a conflict between development and the environment, have you tended to:

- | | |
|-----------------------------------------------------------|---|
| Favour preservation of the environment more frequently | 1 |
| Favour development more frequently | 2 |
| Favour development and environmental preservation equally | 3 |

Question 12

The following statements involve a range of social and economic issues. Please indicate how much you agree or disagree with each of the statements.

	Strongly Agree	Agree	Neither Agree nor Disagree	Strongly Disagree	Disagree
There should be less government regulation of business	1	2	3	4	5
The trade unions in this country have too much power	1	2	3	4	5
More money should be spent on reducing poverty	1	2	3	4	5
Spending on social security should if anything be increased	1	2	3	4	5

Question 13

Which of the following statements comes closest to describing your shopping behaviour?

- | | |
|-----------------------------------------------------------------------------------------------------------------|---|
| I have never purchased environmentally friendly products such as phosphate-free detergents or dolphin-safe tuna | 1 |
| I have tried some environmentally friendly products but do not generally purchase such items | 2 |
| I usually purchase environmentally friendly products | 3 |
| I always purchase environmentally friendly products when available | 4 |

Question 14

What is your age?

Question 15

What is your sex?

Male 1

Female 2

Question 16

Do you have any children?

Yes 1

No 2

If yes, how many have left home and become financially independent?

Question 17

Do you own a house?

Yes 1

No 2

Question 18

What is the **highest** level of education you have obtained or are obtaining?

Never went to school 1

Completed primary only 2

Completed Junior/Intermediate/Form 4/Year 10 3

Completed Secondary/Leaving/Form 6/Year 12 4

Diploma or certificate 5

Tertiary degree 6

Other (please specify) 7

.....

Question 19

To the best of your knowledge please indicate the total income (before taxes) that you and your spouse (if applicable) earned last year.

Under \$5,000	1
\$5,001–\$12,000	2
\$12,001–\$18,000	3
\$18,001–\$24,000	4
\$24,001–\$30,000	5
\$30,001–\$37,500	6
\$37,501–\$45,000	7
\$45,001–\$60,000	8
\$60,001–\$100,000	9
more than \$100,000	10
Don't know	11

Question 20

What is your current work status?

Employed full time	1
Employed part-time	2
Unemployed/looking for work	3
Retired—was self-employed	4
Retired—was not self-employed	5
Full-time student	6
Home duties (home-maker)	7
Self-employed	8
Other (please specify)	9

Section E: Can You Help Us?

We want to thank you for your valuable input on the issues mentioned in the survey. In order to determine how questions of this type might be improved, we would like to ask you a few very brief questions about how you interpreted one of the questions.

Consider Question 3 which asked for your opinion about the proposal to build a pipe.

Question 21

Please indicate with a tick if you agree or disagree with the following statements:

Agree Disagree

Question 3 was difficult to answer

I felt uncomfortable answering Question 3

I did not like Question 3

Question 22

If you had to guess the percentage of our survey respondents that supported the pipe and levy proposal in Question 3, what would your best guess be? %

Question 23

How much do you think the results of this survey will influence decisions about the proposed pipe?

- | | |
|---------------------------|---|
| no influence at all | 1 |
| very little influence | 2 |
| some influence | 3 |
| considerable influence | 4 |
| a great deal of influence | 5 |

Question 24

Finally, how many people do you think a questionnaire like this would be sent to?
Please make your best guess.

Again, thank you for your help in completing this questionnaire.