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Water for a Healthy Country

Sense of Place:

Towards a Methodology to Value Externalities Associated with Urban Water Systems

The Hawkesbury-Nepean Case Study

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The work contained in this report forms part of the research program of the Urban Waterscapes Theme, Water Smart Cities, and is the first stage of a multi-disciplinary study to develop a valuation methodology.

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1.0 Introduction

Australia's urban rivers are increasingly under threat from rising populations and the increasing plethora of demands on them. To plan adequately for their sustainable management there is a need to understand the societal context of decision making. What activities are acceptable on and near rivers, what are people prepared to do to protect their rivers, and when and why might they be prepared to pay for avoidance of negative impacts on water quality and quantity? In this study we examine both those issues by attempting to understand what people may be prepared to do to protect their waterways and why. We also explore when and why people may be prepared to pay for protection.

Towards this end, a human-environment interactions framework needs to be applied to give a complete picture of effects – their causes, value, implications and the potential management options available to address them. In the social sciences, the concept of 'sense of place' is one of the most common that can improve understanding about the relationship between wellbeing and human-environment relationships. Sense of place may broadly be described as the meanings which people assign to a landscape through the process of living in it, and comprises the cognitive, emotional and behavioural dimensions of *place identity, place attachment* and *place dependence* (Ryden, 1993). *Place identity* involves "those dimensions of self that define the individual's personal identity in relation to the physical environment by means of a complex pattern of conscious and unconscious ideas, beliefs, preferences, feelings, values, goals and behavioural tendencies and skills relevant to this environment" (Proshansky, 1978, p. 155). *Place attachment* is a positive bond that develops between groups or individuals and their environment (Altman and Low, 1992). *Place dependence* is an "occupant's perceived strength of association between him or herself and specific places" (Stokols and Shumaker, 1981, p. 457) and incorporates the manner in which environments facilitate the achievement of valued behavioural goals.

While a wealth of literature about sense of place exists, it primarily focuses on measuring individuals' level of sense of place and as yet has failed to investigate the *type* of place it is for different people, and associated behavioural implications. In response to this, Jorgensen and Stedman (2001) have argued that research:

> *…could be oriented toward reflecting the domains of attitude more closely. For example, an attitude-based exploration might include (hypothetically), (1) an overall evaluation of the setting; (2) descriptive cognitions about the setting (what are its perceived attributes, what characteristics does it have); (3) behavioural intentions associated with the place; (4) the quality of the attitude-object relationship characterized by the various dimensions of attitude strength; and (5) actual behaviours that might be reciprocally associated with the attitude. Thus, a sense of place becomes a true 'sense' of place in that it includes descriptive elements about 'what kind of place is this' as well as being more explicitly behaviour-related.* (p. 245)

From an economic perspective, an appreciation of sense of place can be pivotal in informing environmental valuation. As Hailu et al. (2005) found, sense of place variables, as concepts that pertain to the wellbeing individuals obtain from their interactions with particular places, can underpin economic preferences for policy proposals that seek to protect or improve those places. As yet, however, this is the only study of this kind that could be found in the peer reviewed literature.

With this in mind, a study to develop a methodology for valuing urban water externalities[1] was designed with the following research questions.

1. How are the impacts of a given externality affected by interactions involving the urban water system, the community, and the environment?
2. What are the monetary values of the externality and how do they relate to community attitudes, sense of place, and the characteristics of the urban water system?

The role of the Australian Research Centre for Water in Society (ARCWIS) was to conduct the attitudinal component of the research, and was concerned with the first research question. Related objectives were to:

- develop and apply a methodology to measure peoples' sense of place for areas in which aspects of a water system impact human wellbeing;
- identify the community's perspective about the major attributes of these areas (technological, management, social, economic or ecological); and
- develop a model to help identify and evaluate economic externalities of a water system that impact user and non-user wellbeing.

ARCWIS' research built on previous studies that explored general sense of place, as well as specific dimensions of identity, attachment and dependence (Jorgensen & Stedman, 2001; 2006). This enabled a number of key variables to be identified for investigation (see Table 1), along with the types of interrelationships between them. These included both place specific and non-place specific aspects.

The key aim of this study was to examine the possible relationship between sense of place variables and general and economic specific behavioural intentions for environmental protection. It was hypothesised that there would be a strong relationship between sense of place and intentions for environmental protection behaviours. In addition, non place-specific attributes would have an important indirect relationship with protective behaviour, mediated by sense of place variables.

[1] From an economics perspective, an externality may be defined as: "A cost or benefit experienced by one economic agent that results from the actions of another agent or agents."
Retrieved March 1, 2006, from www.econplace.com/mm5e/glossary.html.

Table 1. Variable Names and Descriptions

Variable	Description
Leisure identity salience	The importance of an identity for defining one's self relative to other identities that the individual holds. For the purposes of this research, linking the salience of activities *at rivers in general* to an individual's lifestyle and identity.
Previous experience	Direct and indirect previous experience with the river system
Accessibility	The ease with which the river can be accessed
Subjective knowledge	The amount of personal knowledge about the river system
Familiarity	The level of familiarity with the river system
Place meanings	People's identification with the river system
Threats	Perceived threats to the river
River values	The value given to rivers in general
Satisfaction	Level of satisfaction with both quality and quantity of water of the river system
Perceived water quality and quantity	Perceptions of water quality and quantity of the river system
Importance	Perceived importance of protecting the river system
Attitude	Perceived effectiveness of performing protective measures for the river system
Acceptability	The acceptability of different uses of the river system, commercial and recreational
Behavioural intentions	Intention to perform/undertake protective measures for the river system

2.0 Methodology

The study incorporated a scoping phase, a pilot telephone survey and a final telephone survey of people within Sydney Water's area of operations (see Map 1), which was used as the study boundary. The scoping study elicited key opinions, experiences and issues associated with the Hawkesbury-Nepean River system to inform the questionnaire design. The questionnaire was pilot tested before conducting the final telephone survey. A series of statistical analyses were conducted for the survey data using SPSS.

Map 1. Sydney Water Area of Operations

2.1 The Study Area

For the purposes of this research, focus was given to the Hawkesbury-Nepean River system in New South Wales. This river system runs from South to North, beginning near Bowral south-west of Sydney, wending its way up through Camden, Penrith and Windsor to where the MacDonald and Colo Rivers meet north-west of Sydney, draining 22,000 square km of catchment along its course. It is one of Australia's most important river systems, supplying Sydney and surrounding regions with over 95% of their water supply for both domestic and industrial water needs.

The catchment itself contains large agricultural areas that supply most of Sydney's fresh produce but is also accommodating increasing urban sprawl. The area has extensive extractive, manufacturing and processing industries and is also a major recreational and tourist attraction, attracting significant numbers of visitors to the region. It is estimated that a further 300,000 people may populate the region by 2030 with Sydney's population at that time expected to be about 4.5 million. Given these types of pressures, the river system is an important case study area for research to develop a methodology that has the potential to improve future water management across Australia.

2.2 Scoping Stage

A total of 45 semi-structured telephone interviews were conducted with people in the study area in February 2006. These interviews broadly discussed: the importance of water bodies; knowledge and experiences with the Hawkesbury-Nepean river system; most and least liked aspects of this river system; potential threats and protective measures; and, importance of this river system.

To allow for comparison of results, the study area was divided into three regions: *Hawkesbury-Nepean*, comprising an area approximately twenty kilometres either side of the course of the river system; *Sydney Metropolitan-Coastal*, being everything east of the Hawkesbury-Nepean region; and, *Inland*, comprising areas north and west of the Hawkesbury-Nepean river system within the study boundaries. This categorisation of the study area was used for all further stages of research. A database of random potential interviewees in each region was developed from a software containing private household telephone listings.

For the purposes of the study, the target scoping sample was: 20 people from the Hawkesbury-Nepean region; 15 people from the Sydney Metropolitan-Coastal region; and, 10 people from the Inland region. People were chosen randomly from the database for interview until the target quota for each study region had been achieved.

2.3 The Pilot Test Stage

From the scoping results a survey questionnaire was developed. This was pilot tested through a telephone survey of 20 people in March 2006. The sample comprised seven people from each of the Hawkesbury-Nepean and Sydney Metropolitan-Coastal regions, and six people from the Inland region. An overall gender balance was aimed for. Interviewers were instructed to record any particular issues, difficulties and comments about the questionnaire.

As a result of the outcomes from the pilot test, appropriate changes to the questionnaire were determined and the questionnaire was refined. While the content remained essentially the same, the major aim of this exercise was to ensure a 'community-friendly' questionnaire to elicit the required information. Key modifications included simplifying the wording of questions, improving the flow of the questionnaire and summarising questions under key sense of place categories to reduce the length of the questionnaire.

2.4 The Survey Stage

The telephone survey was conducted from late March to early April 2006. The target survey sample was 400 people, with 200 of these based in the Hawkesbury-Nepean region, and 100 in each of the Sydney Metropolitan-Coastal and Inland regions. This allowed for sufficient data to be gained from each region for comparison and contrast. A list of randomly selected households was given to interviewers to call. Each household had to be contacted a minimum number of five times at different times of the day and on different days before it could be dismissed as "no contact". An effort was made to recruit an equal number of males and females in each region. The final tally was 211 (52.8%) females and 189 (47.3%) males. Only people aged 18 years and over were eligible to participate.

Given the research subject was specific to the Hawkesbury-Nepean River system, a number of potential respondents considered they didn't know enough about the region to answer the questions, in spite of being assured by the interviewers that they didn't need detailed knowledge. This is shown in the refusal rate of 75.56%. In total, 1637 people were contacted to obtain the 400 interviews. Table 2 below shows the number of refusals and the reasons offered, with "not interested" as the most frequent reason for refusal overall (35.57%), as well as providing comparative refusal data by region.

2.4.1 The Questionnaire

The survey questionnaire was the same for all three regions targeted for the study. The survey commenced with a geographical description of the Hawkesbury-Nepean river system. The questionnaire was based on sense of place variables as outlined in Table 1 and was designed to elicit information with respect to categories of:

- association, familiarity, knowledge and accessibility.
- previous experience (direct and indirect).
- perceived quality and quantity of water.
- importance of the river.
- behavioural intentions and effectiveness for river protection.
- place meanings.
- acceptability of river uses.
- river health.
- future visitation.
- general river values.
- leisure identity salience (for general river activities).
- demographics of household unit, age, education, income and gender.
- friends or relatives who live near the Hawkesbury-Nepean River System.

Table 2. Survey Refusal Data

Region	Refusal Reason	Refusal Number	Percentage
All regions	Not interested	440	**35.57**
	Too busy	310	**25.06**
	Insufficient knowledge	275	**22.23**
	No English	95	**7.68**
	Too elderly	83	**6.70**
	Unwell	31	**2.51**
	Other	3	**0.25**
	TOTAL	**1237**	**100.00**

Region	Survey Number	Refusal Number	Percentage Refusal within Regions
Hawkesbury Nepean	200	408	**67.11**
Sydney Metro-Coastal	100	574	**85.16**
Inland	100	255	**71.83**
TOTAL (all regions)	**400**	**1237**	**75.56**

3.0 Results

3.1 Descriptive Statistics

3.1.1 Demographics

As mentioned previously, a total of 400 individuals were surveyed, comprising roughly equal numbers of males and females (189 and 211 respectively). The level of education among participants was quite high, with 41.3% of respondents having a partial or complete university education. Almost a quarter (24.3%) of participants were technically or trade qualified whilst 27.8% had all or some secondary education (full details available in Appendix 1).

Analyses were conducted to identify any significant differences between responses to key variables based on demographic data. The following results were noted.

- No significant differences based on age group.
- No significant differences based on level of education.
- No significant differences based on household income.

These findings therefore provide some confidence in the extrapolation of the major findings to the wider Sydney population.

3.1.2 Association, Familiarity, Knowledge and Accessibility

Nearly all participants had visited the Hawkesbury-Nepean River at some time (82.8%). Of these respondents, 20% had visited frequently, 24.0% had visited infrequently over the last 12 months and 38.8% had not visited the river in the last 12 months. Only 12.3% had travelled past the river but not visited it and 4.8% of participants had never visited the Hawkesbury-Nepean River.

With respect to respondents' familiarity with, knowledge of, and ease of access to the Hawkesbury-Nepean River, nearly a third of all participants were either very familiar or extremely familiar with the river (29.6%). Only 8.3% of participants were not at all familiar with the river, and 62.3% were either vaguely or moderately familiar with the Hawkesbury-Nepean River.

Almost half of the respondents felt that they knew 'something' or 'quite a bit' about the Hawkesbury-Nepean River (46.6%). Only 7% of participants felt that they knew 'a great deal' about the rivers, while 14.3% stated that they knew 'almost nothing'.

Almost half of all participants stated that it was 'fairly easy' for them to visit the Hawkesbury-Nepean River (48%). Only 2.5% of participants stated that it was 'extremely difficult' to visit the river, while 28.8% thought it was 'extremely easy' to visit the river.

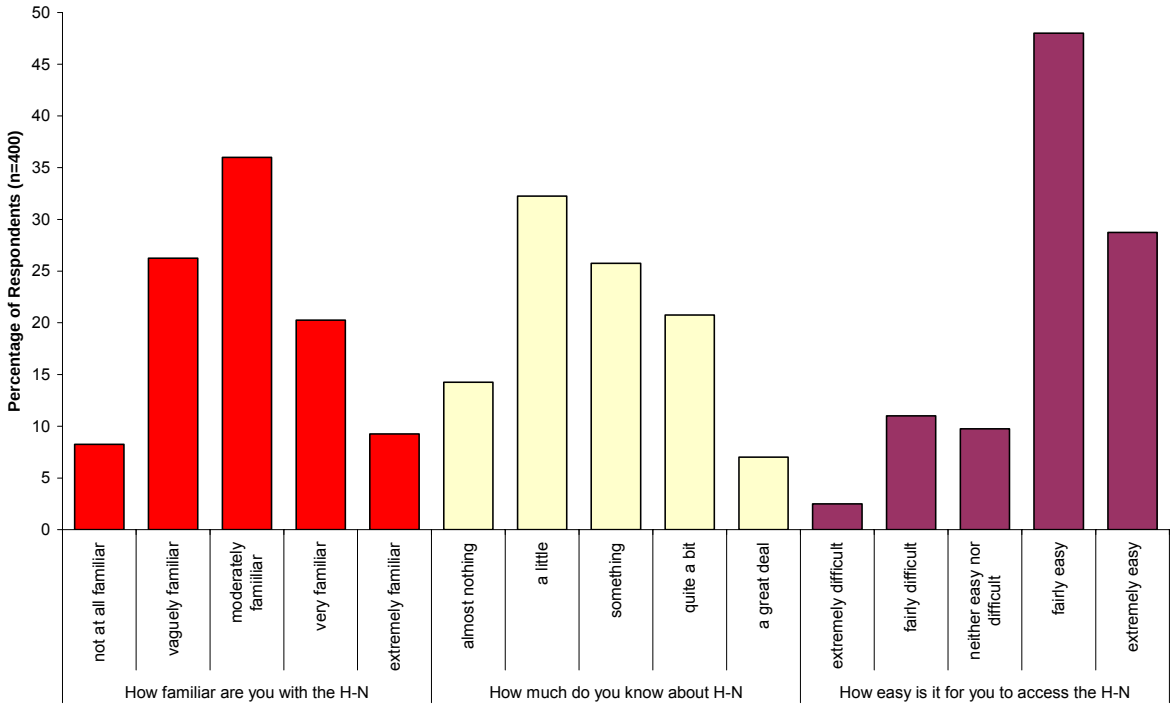

Figure 1. Familiarity, Knowledge and Accessibility of the Hawkesbury-Nepean River System

Association, familiarity, knowledge and accessibility were found to be positively correlated with one another to a significant degree ($p < .01$). This indicated, for example, the more familiar a participant was with the river, the more they reportedly knew about it, the more accessible the river, the more likely they were to have visited it in the last 12 months and so on. The strongest of these relationships was between familiarity and subjective knowledge (r = 0.77).

Differences between respondents' location and items assessing familiarity, association, knowledge and accessibility were examined using analysis of variance (ANOVA) and a number of significant differences were found ($p < .01$).

- Participants from the Hawkesbury-Nepean region were significantly more familiar with the Hawkesbury-Nepean River (mean =3.22) than participants from Sydney Metropolitan-Coastal (mean = 2.68) and Inland areas (mean = 2.73). This group also found the river significantly more accessible (Hawkesbury-Nepean mean = 4.18, Sydney Metropolitan-Coastal = 3.49, and Inland = 3.74).
- Hawkesbury-Nepean participants considered they had higher levels of knowledge (mean = 2.93) than did participants from Sydney Metropolitan-Coastal region (mean = 2.41).
- With respect to demographics, there was a small but significant ($p < .01$) difference between males and females on the item 'how much do you know about the Hawkesbury-Nepean', with males (mean = 2.93) rating their knowledge higher than females (mean = 2.57).

There were no significant differences between regions with respect to association with the Hawkesbury-Nepean River.

3.1.3 Activities on the Hawkesbury-Nepean River

Respondents were asked what activities they most commonly undertook at the Hawkesbury-Nepean River. Main responses can be seen in Table 3, with picnicking, relaxing and walking/hiking as the most popular activities. A full list of activities can be found in Appendix 2.

Table 3. Activities Undertaken at the Hawkesbury-Nepean River

Activity	Percentage of Respondents
Picnicking	43.40
Relaxing (Enjoying Scenery)	37.00
Walking/Hiking	34.00
Recreational Boating	18.40
Recreational Fishing	15.10
Swimming	14.80
Canoeing/Rowing	14.20
Water Skiing	13.00
Tourist/Paddle Ferry Rides	5.42
Watching Wildlife	5.10
Sailing	4.50
Cycling	4.50
Restaurant/Café	4.20
Camping	3.60

3.1.4 Familiarity of Specific Regions of the Hawkesbury-Nepean River

Participants were asked to identify which specific areas of the Hawkesbury-Nepean river system they were familiar with. Interestingly, the top three responses for participants from all regions were the same, with only the order and percentages differing. For each survey region, Windsor, Wiseman's Ferry and Penrith were the areas of the river that respondents were most familiar with. Details are provided in Table 4.

Table 4. Areas of the Hawkesbury-Nepean River Most Familiar to Participants

Familiar Area	Percentage of Responses by Survey Region		
	Hawkesbury-Nepean	Inland	Sydney Metro-Coastal
Windsor	13.0	10.7	13.5
Wiseman's Ferry	6.3	8.3	9.4
Penrith	15.3	25.9	8.2

A full list of locations can be found in Appendix 2.

3.1.5 Perceptions of Water Quality and Quantity

Relatively very few participants thought that the *quality* of water in the Hawkesbury-Nepean River was either 'fairly good' (14%) or 'extremely good' (0.3%). Just over one third of participants thought that the quality of water was either 'fairly bad' (34.0%) or extremely bad (15.8%). A large number of participants thought that the quality of water in the Hawkesbury-Nepean River was neither good nor bad (35.5%).

The largest response to perceptions of water *quantity* was that the amount of water in the Hawkesbury-Nepean River was neither good nor bad (41.8%). Almost the same number of participants rated the quantity of water as either 'fairly bad' (32.8%) or 'extremely bad' (7.5%).

Table 5. Perceptions of Water Quality and Quantity

Perceptions of Water Quality and Quantity	Water Quality Percentage	Water Quantity Percentage
Extremely good	0.30	0.30
Fairly good	14.00	17.50
Neither good nor bad	35.50	41.80
Fairly bad	34.00	32.80
Extremely bad	15.80	7.50

Generally speaking, neither the water quality nor quantity of the Hawkesbury-Nepean River was viewed favourably by survey respondents. There were no differences between survey regions and these perceptions.

3.1.6 Satisfaction with Water Quality and Quantity

Overall, participants were dissatisfied with the *quality* of water in the Hawkesbury-Nepean River, with 53.3% of participants saying they were either 'fairly dissatisfied' (35%) or

‘extremely dissatisfied’ (18.3%) with the quality of water in the river. Only 13.5% of participants were ‘fairly satisfied’ with the quality and 0.5% ‘extremely satisfied’.

Almost half of the participants were ‘neither satisfied nor dissatisfied’ with the *quantity* of water in the Hawkesbury-Nepean River (44.5%) although there were still many who were ‘fairly dissatisfied’ (28.8%) and ‘extremely dissatisfied’ (7.3%). A smaller proportion of participants were ‘satisfied’ with the quantity of water (19% ‘fairly satisfied’, 0.3% ‘extremely satisfied’).

There were no significant differences between participants from different regions on this item.

Table 6. Satisfaction with Water Quality and Quantity

Satisfaction with Water Quality and Quantity	Water Quality Percentage	Water Quantity Percentage
Extremely satisfied	0.50	0.30
Fairly satisfied	13.50	19.00
Neither satisfied nor dissatisfied	32.00	44.50
Fairly dissatisfied	35.00	28.20
Extremely dissatisfied	18.30	7.30

3.1.7 Importance of Protecting the Hawkesbury-Nepean River

Overall participants found protection of the Hawkesbury-Nepean River to be ‘extremely important’ (61.8%). There were no significant differences between participants from different regions on this item.

3.1.8 Place Meanings

Respondents were read 22 statements outlining a range of “meanings” associated with the Hawkesbury-Nepean River system and were asked to rate whether they agreed or disagreed on a five-point scale ranging from ‘strongly disagree’ (1) through to ‘strongly agree’ (5) (see Figure 2). Scores above 3 indicate agreement and scores below 3 indicate disagreement.

For the statement ‘*the Hawkesbury-Nepean is the best place for doing things that I enjoy most*’ the mean response from participants from the Inland sector (2.54) differed significantly from Hawkesbury Nepean participants (3.00; $p < .01$). In this instance, Inland respondents tended to slightly disagree with the statement while Hawkesbury Nepean respondents neither agreed nor disagreed on average.

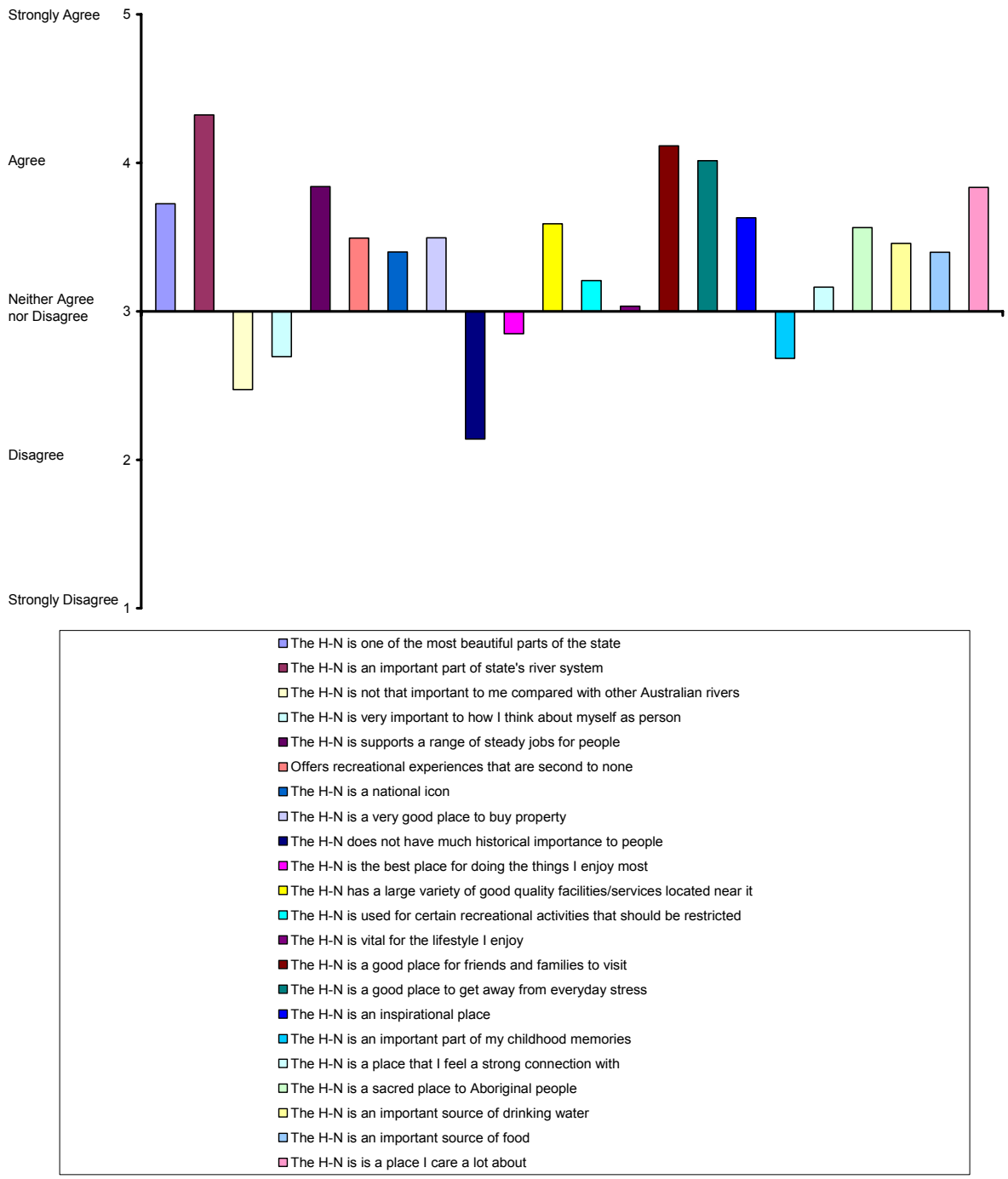

Figure 2. Responses to Statements of Meanings about the Hawkesbury-Nepean River

A similar pattern was shown for the statement '*the Hawkesbury Nepean is vital for the lifestyle I enjoy*' with Inland participants recording a significantly lower mean response (2.69) than Hawkesbury Nepean respondents (3.20; $p < .01$). In this instance, Inland respondents tended to slightly disagree with the statement while Hawkesbury Nepean respondents tended to slightly agree.

In response to the statement '*the Hawkesbury Nepean is a place I care about a lot*', respondents from the Sydney Metropolitan-Coastal sector (3.60) differed significantly from Hawkesbury Nepean respondents (4.01; $p < .01$). In this instance participants from the two regions differed in the extent to which they agreed with the statement.

3.1.9 Uses of the Hawkesbury-Nepean River

Participants were asked to rate how much they agreed or disagreed with a number of potential uses for the Hawkesbury-Nepean River. There were no significant differences between regions, and the mean responses to each item can be seen in Figure 3.

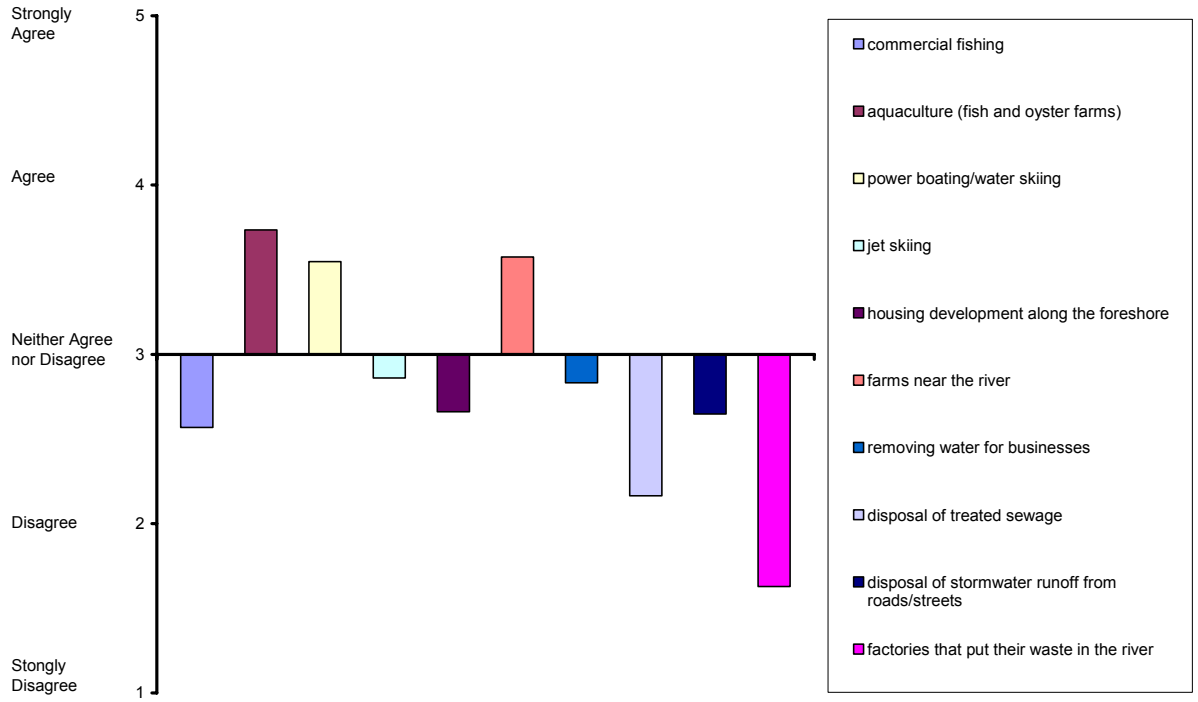

Figure 3. Mean Agreement with Potential River Uses

In Figure 3, a score of 1 equates to 'strongly disagree' and 5 'strongly agree', with the value of 3 being 'neither agree nor disagree'. Only three items were considered to be potentially acceptable uses of the river: aquaculture; power boating/water skiing; and farms along the river. Seven items were considered unacceptable potential uses: commercial fishing; jet skiing; housing developments along the foreshore; removal of water for businesses; disposal of treated sewage; disposal of stormwater; and disposal of factory waste.

3.1.10 Health of the Hawkesbury-Nepean River

Participants were asked to respond to a number of statements regarding the health of the Hawkesbury-Nepean River, on a scale from 1 (strongly disagree) to 5 (strongly agree). Responses indicated that participants were generally unimpressed by the health of the Hawkesbury-Nepean River system. Figure 4 shows that participants disagreed with the statement '*the Hawkesbury-Nepean is a pristine river*' whilst agreeing with negatively worded statements such as '*the Hawkesbury-Nepean has too much sewage being dumped into it*'. The only positively worded statement that participants generally agreed with was '*the Hawkesbury-Nepean supports abundant native wildlife/plants*'.

When responses were examined by region, respondents from the Sydney Metropolitan-Coastal sector rated the statement '*the Hawkesbury-Nepean is a pristine river*' significantly higher than did Hawkesbury-Nepean and Inland participants. However, participants from all regions disagreed with this statement, with Inland and Hawkesbury-Nepean respondents disagreeing significantly more than Sydney Metropolitan-Coastal participants.

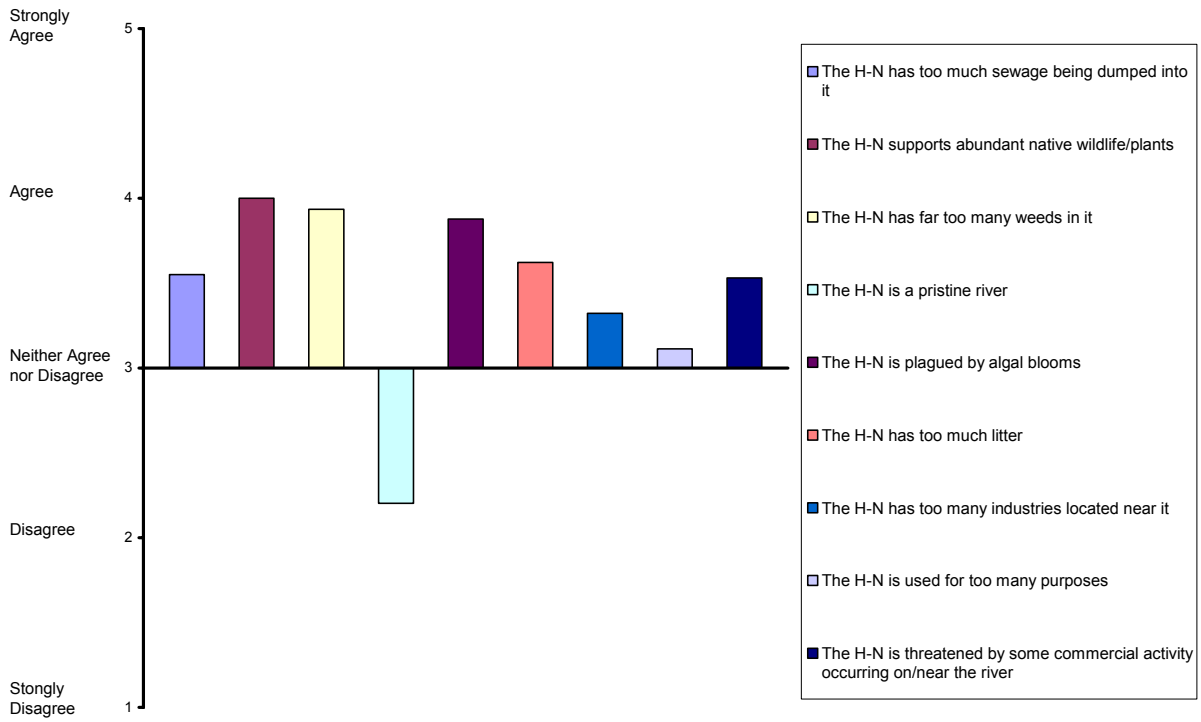

Figure 4. Perceived Health of the Hawkesbury-Nepean River

3.1.11 Behavioural Intentions and Perceived Effectiveness

Participants were asked how likely it was that they would perform certain actions if the quality or the quantity of water in the Hawkesbury-Nepean River was to become a lot worse than currently. They were read eight potential behaviours and asked to rate their likelihood of doing them on a scale from 1 (strongly disagree) to 5 (strongly agree). They then rated how effective they thought these actions would be, on a five point scale ranging from 'extremely ineffective' (1) through to 'extremely effective' (5). Both behavioural intentions and perceived effectiveness can be seen in Figure 5.

The most favoured behavioural intention for protecting the Hawkesbury-Nepean River was signing a petition against further deterioration. Lobbying politicians and donating to environmental groups were also popular. "Doing nothing" was the least favoured activity. With respect to perceived effectiveness of actions, signing a petition was perceived as less effective than contacting media to raise public awareness and joining or forming groups for action. It is of note that while these two activities were rated as likely to be the most effective protective actions, they were rated as being actions that people were unlikely to perform. Not visiting the Hawkesbury-Nepean River was thought to be the least effective protective measure, followed by doing nothing.

With respect to significant differences identified, the behaviour of contacting the media elicited significantly different results from Hawkesbury-Nepean respondents when compared with Sydney Metropolitan-Coastal and Inland respondents ($p < .01$). Respondents from the Hawkesbury-Nepean region rated themselves as more likely to perform this behaviour than the other groups.

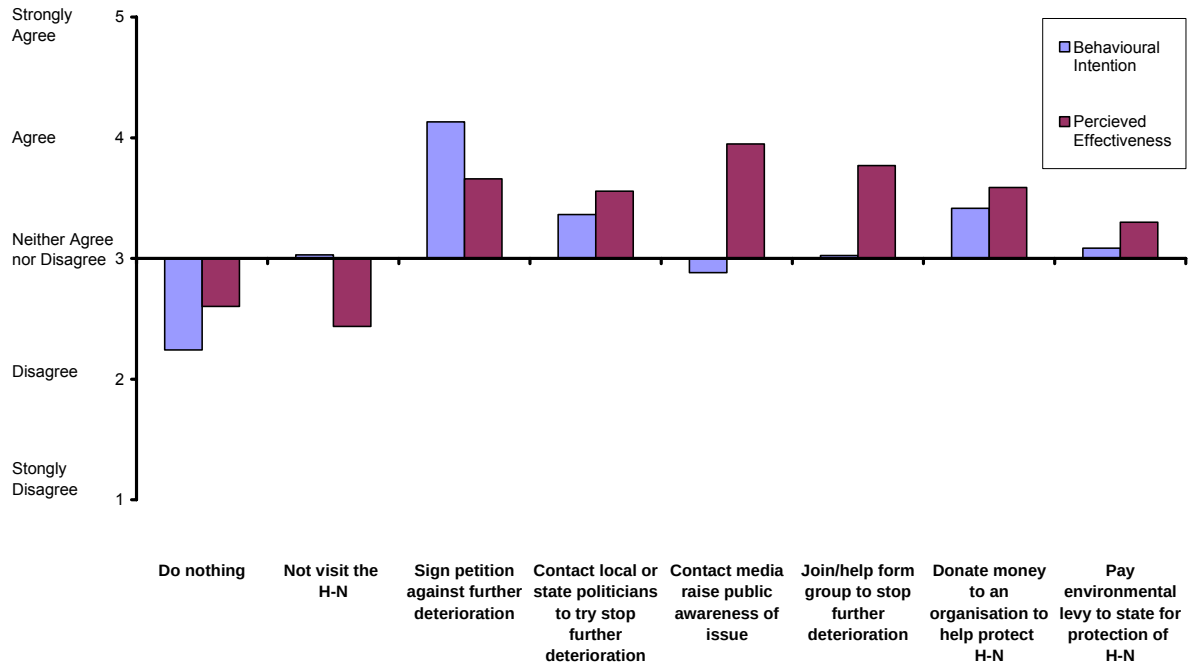

Figure 5. Mean Behavioural Intention and the Perceived Effectiveness of Actions

3.1.12 Future Visitation

More than two-thirds of all respondents said that it was 'highly likely' they would visit the Hawkesbury-Nepean River some time in the future (60.3%). A further 24.8% said that they were 'likely' to visit the Hawkesbury-Nepean River in the future. Just over three-quarters (76.5%) of respondents said that they were either 'very likely' (53.3%) or 'likely' (23.3%) to visit the Hawkesbury-Nepean River sometime in the next 12 months.

A one way analysis of variance indicated that respondents from the Hawkesbury-Nepean (1.49) sector were significantly more likely to visit the Hawkesbury-Nepean River some time in the future than were respondents from the Sydney Metropolitan-Coastal sector (2.06; $p < .01$).

3.1.13 General River Values

As seen in Figure 6, respondents felt that river rights and rivers in general should be protected and are valuable irrespective of human concerns. The exception to this was the item '*people should not be restricted from using the river even if it helps to protect the river'*; the average response to this item was to neither agree nor disagree.

There was a small but significant difference between males and females on the item '*rivers throughout Australia should be protected no matter what it takes'* with females (mean = 4.14) rating the item higher than males (3.81).

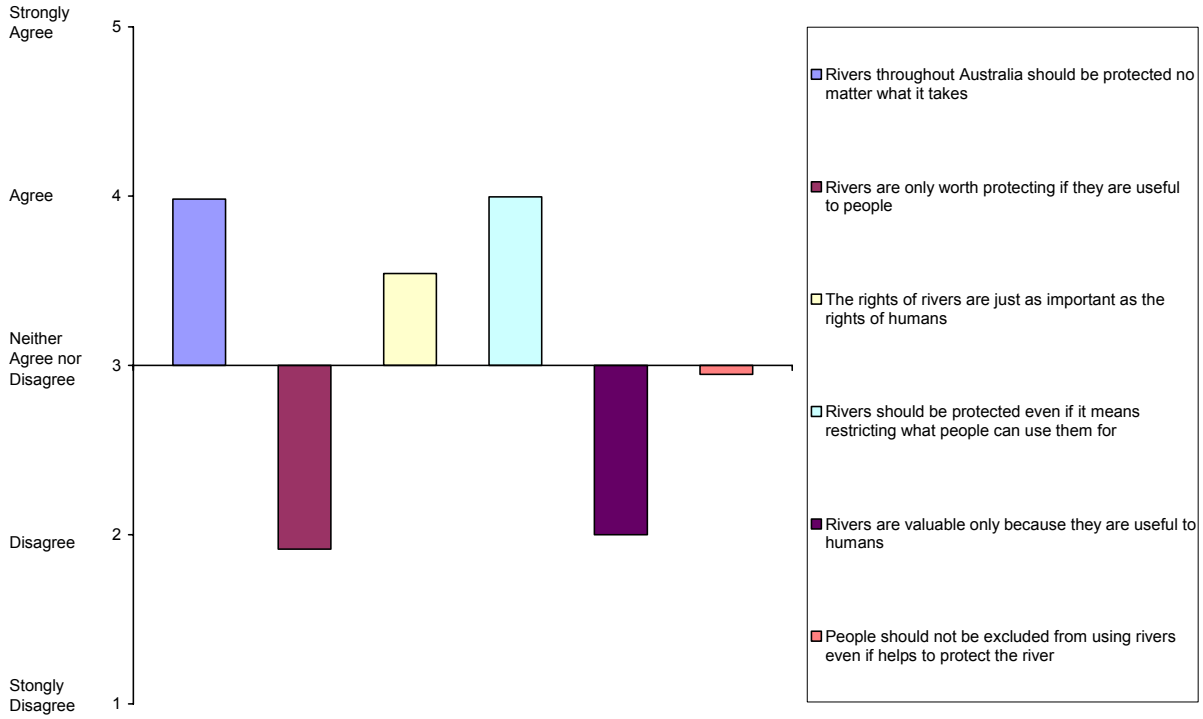

Figure 6. Mean Responses to Items Measuring Ecocentric River Values

3.1.14 Leisure Identity at Rivers Generally

The mean responses to items relating to personal identification with leisure activities at rivers in general were not strong. Responses to the negatively worded items were negative and the positive items slightly positive, suggesting that participants generally felt a slight positive identification with river leisure activities at rivers in general (see Figure 7).

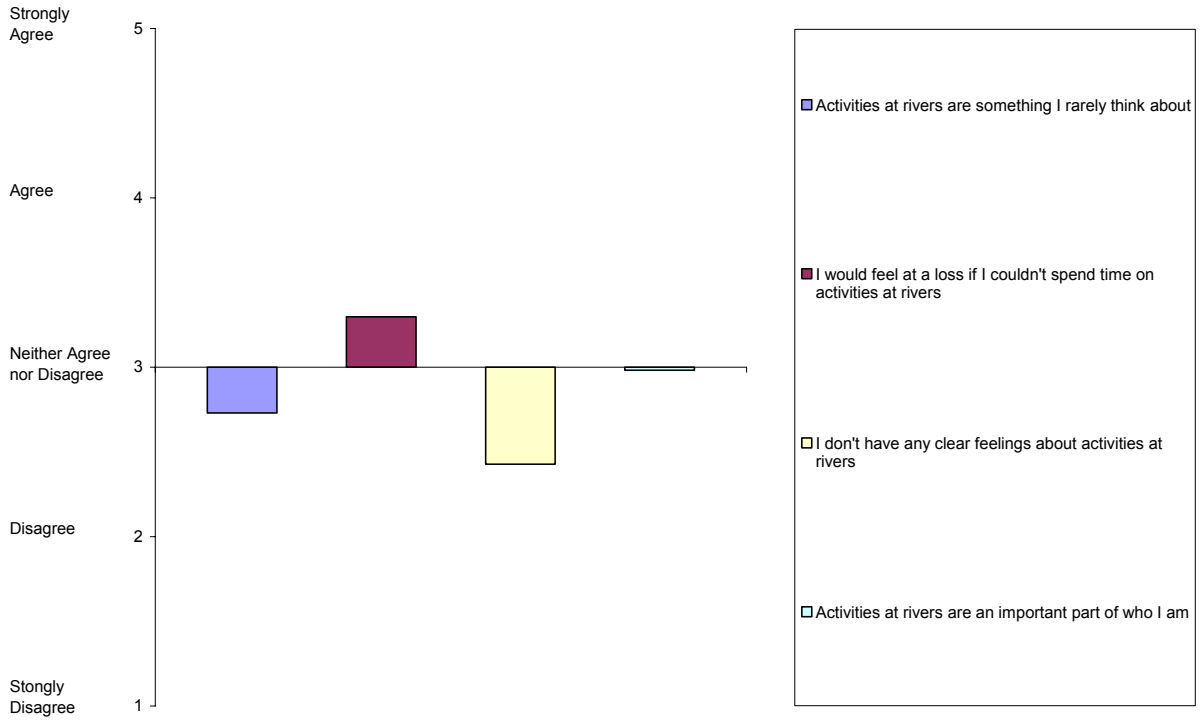

Figure 7. Mean Agreement with Statements of Leisure Identity Associated with Rivers in General

3.2 Structural Equation Modelling

Structural equation modelling (SEM) is a tool used to explore and confirm hypothesised relationships between independent and dependent variables. SEM has the advantage of being able to identify relationships between *latent* variables. Latent variables are constructs that cannot be measured directly and consist of multiple *observed* (directly measurable) variables. SEM can indicate the strength and direction of relationships between variables as well as identify the amount of variance within a dependent variable that is accounted for by independent variables. In the path diagrams that follow, circles represent the *latent variables* and rectangles represent the *observed variables*.

3.2.1 The Hypothesised Model

The hypothesised model of the influence of *sense of place* on predicting behavioural intentions for river protection contained thirteen latent variables and was intended to be exploratory in nature. As such, it was expected that a number of the hypothesised relationships between latent variables would not reach statistical significance. LISREL 8.72 software (Joreskog, Sorbom, du Toit and du Toit, 2000) and Robust Maximum Likelihood Estimation were used to create an initial exploratory model which contained all thirteen hypothesised latent variables, their inter-relationships, and their relationship with behavioural intentions. Non-significant pathways were removed, as were any variables with no significant relationship to any other variables. In this stage of exploration, the following variables were removed from the model.

- Ease of accessibility of the river system.
- Familiarity with the river system.
- Subjective knowledge of the river system.
- Perceptions of water quality and quantity.
- Satisfaction with water quality and quantity.
- Considerations of acceptable uses.

3.2.2 Model 1- Predicting River Protection Behavioural Intentions

The structural equation model shown in Figure 8 was estimated using LISREL 8.72 software and Robust Maximum Likelihood Estimation.[2] Figure 8 shows that all indicators in this model have a positive relationship with the latent variables they were hypothesised to measure. The majority of these relationships are strong to moderate and contribute to the prediction of positive behavioural intentions to protect the Hawkesbury-Nepean River System.

[2] It was necessary in the case of latent variables with only one indicator (Association and Importance) to fix these paths to a pre-specified value. Association was set to .9 while Importance was set to .85. This assumed reliability for Association was higher than Importance as it was judged that Association was going to be the easier, or more straight-forward, question of the two to answer (the higher the ambiguity of a question, the lower its reliability is deemed to be).

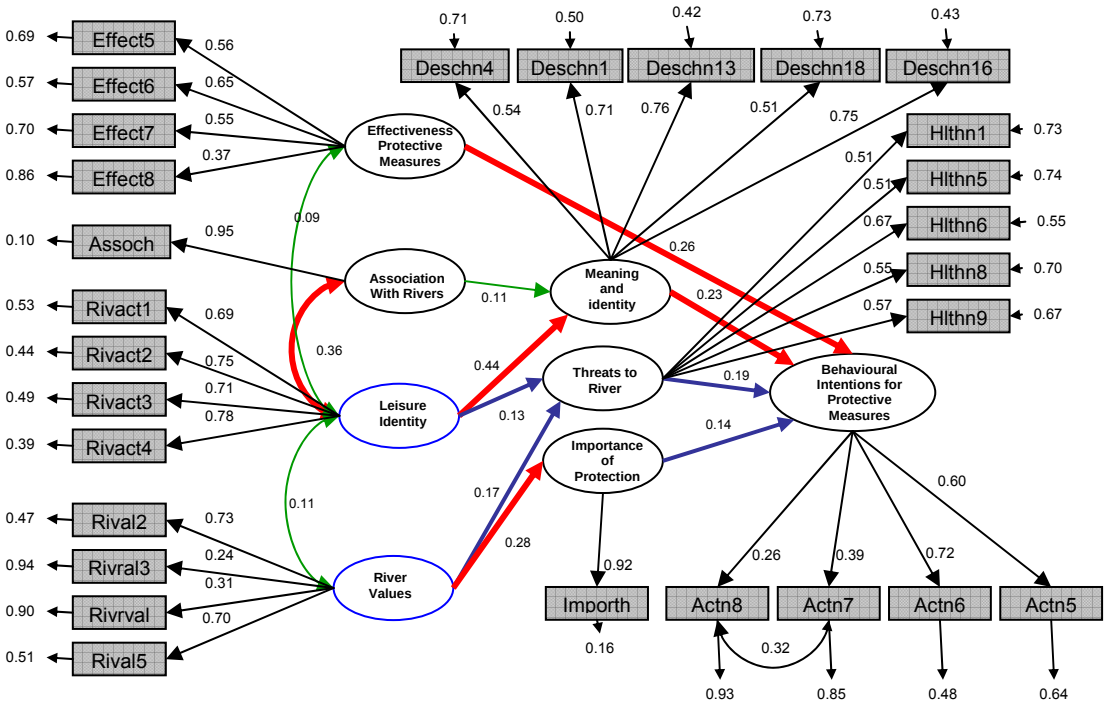

Figure 8. Model 1: Estimated Structural Equation for Protective Behavioural Intentions with Scale Items

Figure 9 below provides a simplified version of the structural equation model, and displays the strength of significant pathways. Large effects are shown as thick red arrows, moderate effects as thinner blue arrows, and weak effects as thin green arrows. Blue circles represent non-place specific variables, whereas black circles represent place specific variables.

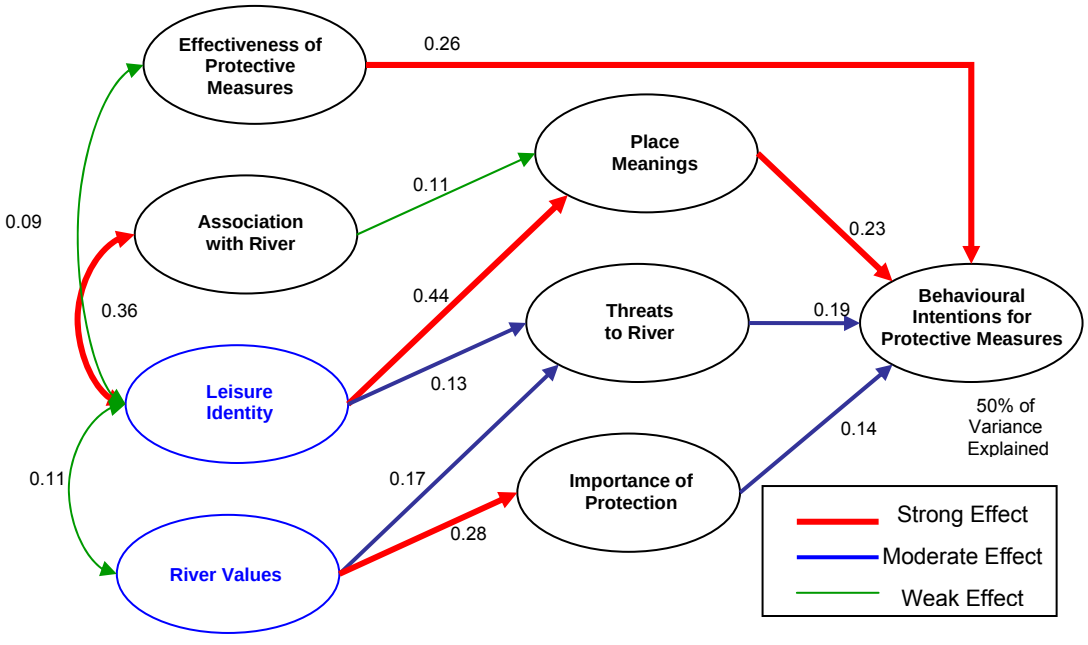

Figure 9. Model 1 Simplified: Estimated Structural Equation Model for Protective Behavioural Intentions

Figure 9 shows that all seven of the latent variables (Effectiveness of Protective Measures, Association, Leisure Identity, River Values, Place Meanings, Threats to River, and Importance of Protection) had significant relationships with Intentions for Protective Measures. While there were direct relationships of Place Meanings, Threats to River, Importance of Protection and Effectiveness of Protective Measures to Behavioural Intentions,

the contributions of Association, Leisure Identity and River Values were mediated through the above variables.

The relationships between the dependent and independent variables in the final model can be summarised as follows.

- *River Values, Leisure Identity, Association and Effectiveness of Protective Measures*

  These four factors are interrelated in the model as indicated by the double-headed correlation arrows between the variables.

  - *River Values and Leisure Identity*

    Higher intrinsic river values for rivers generally are associated with a greater Leisure Identity with rivers generally.

  - *Leisure Identity and Association*

    Greater leisure identity with rivers is associated with greater association with the Hawkesbury-Nepean River.

  - *Leisure Identity and Effectiveness of Protective Measures*

    Greater leisure identity with rivers is associated with perceptions of greater effectiveness of protective measures.

- *River Values*

  Higher intrinsic river values generally leads directly to:

  - an increase in the importance placed on river protection; and
  - an increased perception that the Hawkesbury-Nepean River system is threatened.

While River Values do not directly influence behavioural intent for protecting the Hawkesbury-Nepean River, they affect it indirectly through its relationship with perceived Threats to the River and perceived Importance of Protecting the Hawkesbury-Nepean River.

- *Leisure Identity*

  A greater Leisure Identity with rivers in general leads directly to:

  - an increased perception that the Hawkesbury-Nepean River is threatened; and
  - an increase in place meanings associated with the Hawkesbury-Nepean River.

While Leisure Identity with rivers does not have a direct effect on protection behaviour, it has an indirect effect on it through the variables of Threats to the River and Place Meanings.

- *Association*

  A greater association with the Hawkesbury-Nepean River leads directly to:

  - an increase in place meanings associated with the Hawkesbury-Nepean River.

Association with the Hawkesbury-Nepean River does not have a direct influence on intended protective behaviour, though it has an indirect effect through place meanings.

- *Effectiveness of Protective Measures*

  Perceptions of greater effectiveness of protective measures for the Hawkesbury-Nepean River leads directly to:

  - an increase in intention to undertake protective behaviours.

The model accounted for 50% of the variance in intention to undertake protective measures, and its overall goodness-of-fit indices were satisfactory (see Table 7). The Satorra-Bentler Chi-Square was significant at the .05 level indicating that the model could not reproduce the relationships among the indicators observed in the sample within a .05 level of significance. As the chi-square statistic is known to be upwardly biased in samples of 200 cases or more (Hair et al., 1995) a number of other goodness-of-fit measures are available to test the overall fit of the model. As can be seen in Table 7, the majority of these additional measures were within recommended values (Kline, 2005).

Table 7. Goodness of Model Fit Statistics for Model 1

Fit Statistics	Obtained Value	Recommended Value
Chi-square (df)	<.05 (336)	>.05
SRMR	.077	≤ .08
CFI	.92	≥ .90
GFI	.86	≥ .90
RMSEA	.06	≤ .08

3.3.3 Model 2 - Predicting Willingness to Pay for Protective Measures

In Model 1, the relationship between a range of variables and their ability to predict intentions to perform a number of river protective behaviours was examined. Intentions to perform protective measures was made up of a range of potential actions individuals might carry out, such as *'contact the media to raise public awareness of the issue'* and '*join or form a group to stop further deterioration'*. It also included willingness to pay measures (i.e. *paying for environmental protection through means such as a donation or an environmental levy*). To determine if protective behaviours based solely on a willingness to incur financial costs could be predicted by the same set of latent variables, these behaviours were subjected to a separate analytic procedure. The result was the structural equation model shown in Figure 10.

Model 2 shows that all indicators have a positive relationship with the latent variables they were hypothesised to measure. The majority of these relationships are strong to moderate. It was identified that the latent variables in Model 1 of Association, Place Meanings, and Importance of Protection no longer had significant relationships with any other variables and they were therefore removed.

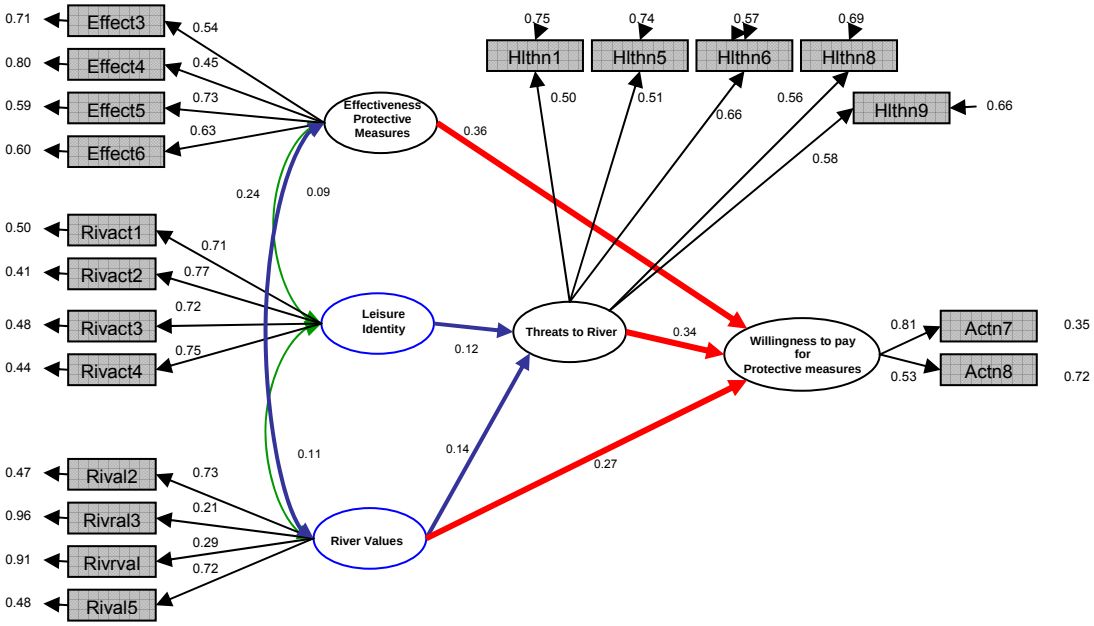

Figure 10. Model 2: Structural Equation Model for Willingness to Pay for Protective Measures with Scale Items

Figure 11 provides a simplified version of the structural equation model, and displays the strength of significant pathways. Again, large effects are shown as thick red arrows, moderate effects as thinner blue arrows, and weak effects as thin green arrows. Blue circles represent non-place specific variables, whereas black circles represent place specific variables.

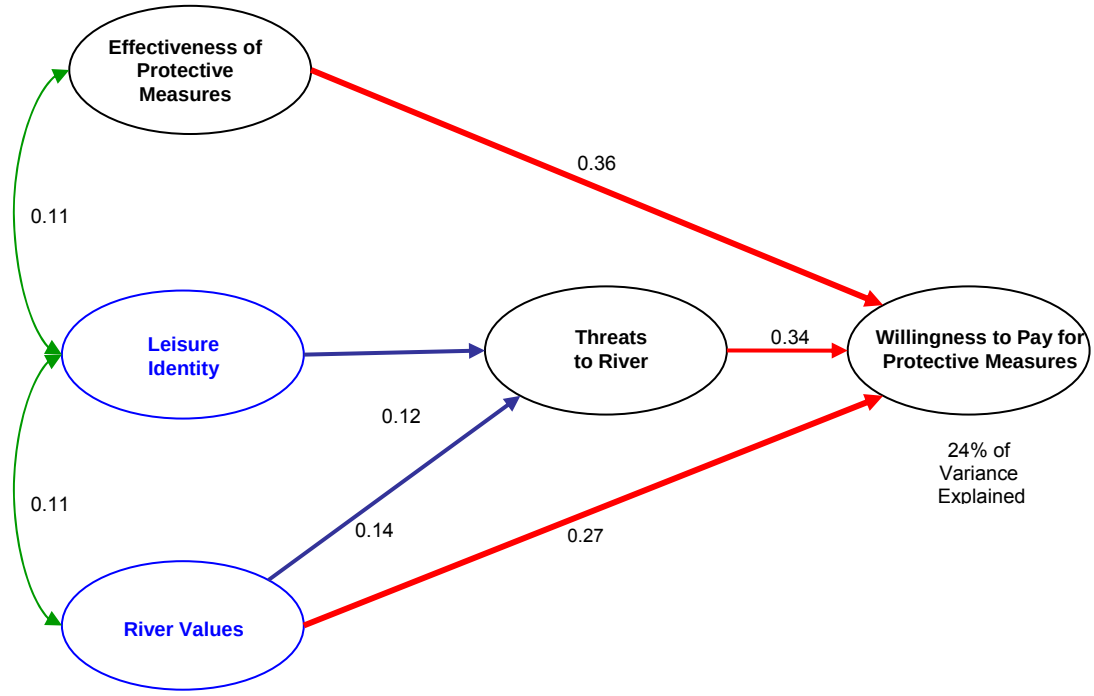

Figure 11. Model 2 Simplified: Estimated Structural Equation Model for Willingness to Pay for Protective Measures

Figure 11 shows that all four of the latent variables (Effectiveness of Protective Measures, Leisure Identity, River Values, and Threats to River) had significant relationships with Willingness to Pay for Protective Measures. While there were direct relationships between Threats to River and Effectiveness of Protective Measures with Willingness to Pay for

Protective Measures, the contribution of Leisure Identity was mediated through Threats to River. The contribution of River Values was both direct and mediated through Threats to River.

The relationships between the dependent and independent variables in the final model can be summarised as follows.

- *River Values, Leisure Identity, and Effectiveness of Protective Measures*

  These three variables are interrelated in the model as indicated by the double-headed correlation arrows between the variables.

  - *River Values and Leisure Identity*

    Higher intrinsic river values generally are associated with a higher leisure identity with rivers in general.

  - *Leisure Identity and Effectiveness of Protective Measures*

    Higher leisure identity with rivers in general is associated with perceptions of greater effectiveness of protective measures for the Hawkesbury-Nepean River.

- *River Values*

  Higher intrinsic river values in general lead directly to:

  - an increased willingness to pay for protective measures for the Hawkesbury-Nepean River system; and
  - a perception of greater threats to the Hawkesbury-Nepean River system.

- *Leisure Identity*

  Higher leisure identity leads directly to:

  - a perception of greater threats to the Hawkesbury-Nepean River system.

- *Effectiveness of Protective Measures*

  Perceptions of greater effectiveness of protective measures for the Hawkesbury-Nepean River system lead directly to:

  - greater willingness to pay for protective measures.

The model accounted for 24% of the variance in willingness to pay for protective measures, and its overall goodness-of-fit indices were satisfactory (see Table 8).

Table 8. Goodness of Model Fit Statistics for Model 2

Fit Statistics	Obtained Value	Recommended Value
Chi-square (df)	<.05 (145)	>.05
SRMR	.05	≤ .08
CFI	.96	≥ .90
GFI	.94	≥ .90
RMSEA	.04	≤ .08

4.0 Summary & Discussion

Of the 400 people surveyed, most respondents had visited the Hawkesbury-Nepean River at some point in time, were familiar with the river system and believed they knew 'something' or 'quite a bit' about the river. Respondents found access to the river to be good.

Participants living in the Hawkesbury-Nepean region were most familiar with the river, and found it easier to access than the other surveyed groups. Respondents from the Hawkesbury-Nepean region also reportedly knew more about the river system than respondents from the Sydney Metropolitan-Coastal region.

Across all surveyed regions, the most familiar areas of the river were Windsor, Wiseman's Ferry and Penrith, although none were nominated by more than about one-fifth of the respondents. Other than these three centres, a wide range of places and areas were nominated by the respondents which suggests that no particular place or feature of the river system dominates Sydney people's impressions.

Respondents generally thought the quality and quantity of water in the river system was poor and were generally dissatisfied with this. Interestingly, these perceptions were common to respondents from all regions, with no significant differences between groups, thus indicating that there is a commonly held view throughout Sydney that the river system requires remedial attention.

Further responses indicated that it was important to protect the river system, and that people were generally unhappy with its health, perceiving there to be a number of threats, including sewage disposal, algal blooms, litter, and adjacent industry. Commercial fishing, jet skiing, housing developments along the foreshore, removal of water for businesses, disposal of treated sewage and disposal of stormwater and factory waste were all considered unacceptable uses of the Hawkesbury-Nepean River across all surveyed groups.

Respondents felt that the actions most likely to benefit the Hawkesbury-Nepean River were contacting the media and joining or forming groups, but these were also actions that respondents generally suggested they would not partake in.

It is of note that there were no significant differences between responses based on age group, level of education, or household income. Rather, the few differences noted were based on regional location.

Through the use of structural equation modelling it was possible to identify which variables were significant predictors of both general and payment specific protective behaviours. Predicting both these sets of behaviours identified that both place specific and non-place specific variables are important. The model of general behavioural intentions predicted 50% of the variance, thus proving to be strong in social science terms. The model of willingness to pay behaviours predicted only 24% of the variance. This however, is to be expected as a payment intention is less specific than are other more definitive behavioural intentions which results in less explanation of variance (e.g. see Heberlein and Black, 1976).

When predicting general protective behaviours a number of variables had no significant direct or indirect relationship to the behaviours, some of which could be considered to be surprising. These were: ease of accessibility; subjective knowledge; familiarity with the river system; perceptions of and satisfaction with water quality and quantity; and considerations of acceptable uses.

The analysis indicated that people who have a high association with the river system, have greater identity with leisure activities at rivers generally, value rivers generally, and are more likely to find greater place meaning (ie. emotional bond) with the Hawkesbury-Nepean. They

also perceive greater threats to the river system and consider river protection to be important.

People who are most likely to undertake protective behaviours are those who find greater place meaning with the river system, have a high threat perception, value river protection, and think that protective measures would be effective.

What this therefore means for the objectives of this project is that those who are more likely to undertake river protective behaviours have a developed *sense of place* which here incorporates *place identity* (river values), *place attachment* (association with the river and place meaning), and *place dependence* (leisure identity; threats to river; and importance of river protection). They also perceive the protective measures to be effective. Put simply, people who have a strong *sense of place* and believe that protective measures will be effective are more likely to take protective action. This finding is in keeping with past research which suggests that respondents prepared to endure some form of behavioural cost would also hold developed beliefs and strong feelings about the place (Shamai, 1991).

When modelling the prediction of willingness to pay for protective measures, three more variables dropped out due to non-significance. These were: place meanings; association with the river; and the importance of protection. This indicates that the *place attachment* component in *sense of place,* while influencing some behavioural decision to protect the Hawkesbury-Nepean, is not influential in decisions to pay for protective measures.

People who are more likely to be willing to pay for protective actions have a strong *place dependence* (strong leisure identity and perceive greater threats to the Hawkesbury-Nepean River), a strong *place identity* (river values), and a belief that protective measures will be effective. This latter variable is actually a general measure of perceived efficacy, rather than an attitude towards the effectiveness of the specific payment measures themselves. That is, people who believe that “problems can be solved” are more likely to be prepared to pay for protective measures. Not surprisingly, those who don’t see a potential outcome from their expenditure are less likely to be willing to pay. This model will be used in future research to assess the motivational components of specific valuation options.

Finally, in terms of intentions for performing protective behaviours or being willing to pay for protective measures, these are clearly linked to a number of threats that are directly associated with the urban water system, specifically: sewage/wastewater disposal; algal blooms; and litter. Further, it was evident that all Sydneysiders were concerned for the health of the river system, regardless of where they lived, and that it was the river system as a whole that was of interest, rather than any specific location.

This then provides some clear directions for the next stage of the research in valuing externalities associated with the urban water system. The design of a payment vehicle would need to show the targeting of the threats of concern to the entire river system, show how the river would benefit from the protective measures provided by the funds, and appeal to the aspects of *sense of place* (place dependence and place identity) that are predictive of the behaviour.

5.0 References

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APPENDIX 1
Demographic Information

Table 1.1. Highest Level of Education

Highest level of education	% of Respondents (N=400)
All or some of primary	1.8
All or some of secondary	27.8
Partial trade or technical qualification	4.5
Trade or technical qualification	24.3
Partial university	4.8
University	36.5
Refused	0.5

Table 1.2. Gross Household Income

Income Bracket	% of Respondents (N=400)
Less than $22,000	11.3
$22,001 to $42,000	18.8
$42,001 to $62,000	16.5
$62,001 to $82,000	13.5
$82,001 to $102,000	12.8
More than $102,000	12.0
Don't know	4.0
Refused	11.3

Table 1.3. Age Group

Age Bracket	% of Respondents (N=400)
Less than 24	4.5
24 to 39	17.3
40 to 55	39.3
56 to 65	19.8
66 to 75	12.3
More than 75	6.5
Refused	0.5

Table 1.4. Unit of people living in the household

Household composition	% of Respondents (N=400)
Single adult less than 65	8.3
Single adult older than 65	8.5
2 adults older less than 65	20.0
2 adults older over 65	12.3
Single adult with child 18 or less	3.8
Single adult child over 18	2.5
2 adults with child 18 or less	25.8
2 adults child over 18	11.0
More than 2 adults no children	4.0
More than 2 adults child 18 or less	2.0
More than 2 adults child over 18	1.3
Refused	0.8

APPENDIX 2
Activities and Familiar Locations

Table 2.1. Activities Undertaken at the Hawkesbury-Nepean River

Activity Undertaken	% of Respondents (N=332)
Picnicking	43.4
Relaxing (Enjoying Scenery)	37.0
Walking/Hiking	34.0
Recreational Boating	18.4
Recreational Fishing	15.1
Swimming	14.8
Canoeing/Rowing	14.2
Water Skiing	13.0
Tourist/Paddle Ferry Rides	5.4
Watching Wildlife	5.1
Cycling	4.5
Sailing	4.5
Restaurant/Café	4.2
Camping	3.6
Jet Skiing	1.8
Crossing over the river/passing through	1.2
Paddling/wading in the water	1.2
Visiting/meeting friends	1.2
Watching ski races	1.2
Employment on or near the river	0.9
SES/fire brigade activities	0.9
Water testing	0.9
4 wheel driving	0.6
Bus trips	0.6
Children's leisure activities	0.6
Holidaying on the river	0.6
House boating	0.6
Jogging	0.6

Table 2.1. (contd.)

Activity Undertaken	% of Respondents (N=332)
Observing the water levels/quality	0.6
Recreational boating	0.6
Abseiling	0.3
Bird watching	0.3
Clean up Australia day	0.3
Craft shows	0.3
Crop growing	0.3
Crossing Wiseman's Ferry	0.3
Family activities	0.3
Horse riding	0.3
Kayaking	0.3
Motor bike riding	0.3
Paddle wheeler	0.3
Revegetation projects	0.3
Scouts	0.3
Sightseeing	0.3
Sitting by the river	0.3
Visiting Danger Island	0.3
Visiting jail	0.3
Visiting parks	0.3
Visiting the Oyster farms	0.3
Walking the dog	0.3
Wildflower sightseeing	0.3
Windsurfing	0.3

Table 2.2. Most Familiar Towns, Landmarks and areas of the Hawkesbury-Nepean River

Area Most Familiar	% of Respondents (N=368)
Towns and Suburbs	
Penrith	33.7
Windsor	25.5
Wiseman's Ferry	15.5
Richmond	11.7
Brooklyn	8.2
Camden	7.1
Emu Plains	4.3
Colo	3.3
Yarramundi	3.0
North Richmond	2.7
Pittwater	2.7
Spencer	2.4
Bowral	2.2
Wallacia	1.9
Wilberforce	1.9
Warragamba	1.6
Agnes Banks	1.4
Glenbrook	1.4
Lower Portland	1.4
Ebenezer	1.1
Sackville	1.1
Mulgoa	0.8
Picton	0.8
Bargo	0.5
Barrengarry	0.5
Berowra	0.5
Church Point	0.5
Gosford	0.5
McArthur	0.5

Table 2.2. (contd.)

Area Most Familiar	% of Respondents (N=368)
McDonald	0.5
Mooney Mooney	0.5
Pitt Town	0.5
Portland	0.5
Springwood	0.5
St Albans	0.5
Brookvale	0.3
Campbell Town	0.3
Caringbah	0.3
Cattai	0.3
Cronulla	0.3
Dangar	0.3
Gunderman	0.3
Highlands	0.3
Hornsby	0.3
Kooringal	0.3
Kurrajong	0.3
Lakes	0.3
Liverpool	0.3
Lower Colo	0.3
Lower Mangrove	0.3
Monutnith	0.3
Mussellbrook	0.3
Pheasants Nest	0.3
Rouse	0.3
Shoalhaven	0.3
Silverdale	0.3
St Mary's	0.3
Watoga	0.3
Winmalee	0.3

Table 2.2. (contd.)

Area Most Familiar	% of Respondents (N=368)
Yiroga	0.3
Rivers and Stretches of River	
Nepean River	4.1
Hawkesbury River	3.3
Broken bay area	2.4
River mouth	1.6
Windsor to Wiseman's Ferry	1.6
Bobbin Head	1.1
Penrith to Windsor	1.1
Cattack Creek	0.8
Lower Hawkesbury	0.8
Wiseman's Ferry to Richmond	0.8
All of the river system	0.5
Camden to Bowral	0.5
Camden to Menangle	0.5
Central Coast area	0.5
Northern end of the river	0.5
Palm beach	0.5
Penrith to Emu Plains	0.5
Penrith to Sackville	0.5
Upper reaches of the river (Richmond area)	0.5
Wiseman's Ferry to Lower Portland	0.5
Apple Tree Bay	0.3
Bar Point	0.3
Bowral Creek	0.3
Bowral to Windsor	0.3
Brisk Bay	0.3
Brooklyn to Berowra	0.3
Coal and Candle Creek	0.3
Colo River	0.3

Table 2.2. (contd.)

Area Most Familiar	% of Respondents (N=368)
Coran River	0.3
Cottage Point	0.3
Down River	0.3
East of Bowral Creek	0.3
Emu Plains to Yarramundi	0.3
From the highway to Warragamba Dam	0.3
Glenbrook Creek	0.3
Horns Creek	0.3
Juno Point	0.3
Kurmond	0.3
Longneck Lagoon	0.3
Lower Portland	0.3
Marramarra area	0.3
McDonald to Lion Island	0.3
Menangle bridge area	0.3
Middle Hawkesbury	0.3
Mouth of the Colo River	0.3
Near the ocean	0.3
Nepean Gorge to Yarramundi	0.3
North Richmond bridge to Windsor bridge	0.3
North Richmond to Windsor	0.3
Northern villages part Richmond	0.3
Panga River	0.3
Parramatta River	0.3
Parsley Bay	0.3
Penrith Lakes	0.3
Penrith to Brooklyn	0.3
Penrith to Emu plains	0.3
Penrith to McArthur	0.3
Penrith to Norton’s basin	0.3

Table 2.2. (contd.)

Area Most Familiar	% of Respondents (N=368)
Penrith to Wiseman's Ferry	0.3
Porrin Creek	0.3
Region north of Penrith	0.3
Richmond to Penrith	0.3
Richmond to Wallacia	0.3
Riley's Tributary	0.3
Robertson to Lower Nepean	0.3
Sackville to north Richmond	0.3
Sackville to river mouth	0.3
Shaw Creek	0.3
Spence to Wiseman's Ferry	0.3
Springwood to Agnes Banks	0.3
Tench Reserve	0.3
Thirlmere Lakes	0.3
Warragamba to Brooklyn	0.3
Warragamba to North Richmond	0.3
West Head	0.3
Windsor to Lower Portland	0.3
Windsor to Sackville	0.3
Wiseman's Ferry to Bridges	0.3
Wiseman's Ferry to Hawks Bridge	0.3
Wollongong to Lithgow	0.3
Yarramundi to Windsor	0.3
Landmarks	
Warragamba dam	2.2
Bents Basin	1.1
Douglas Park	0.8
Dangar Island	0.5
Railway Bridge	0.5
Blue Mountains	0.3

Table 2.2. (contd.)

Area Most Familiar	% of Respondents (N=368)
Boat ramp at Penrith	0.3
Bridge at Richmond	0.3
Bridge north of Sydney	0.3
Brooklyn Bridge	0.3
Coverty Bridge	0.3
Estuary areas	0.3
Faulcon Bridge	0.3
Glenbrook National Park	0.3
Hawkesbury River boat ramp	0.3
Houseboat areas	0.3
Kangaroo Point	0.3
Kurringai Chase	0.3
Lookout near Warragamba	0.3
McKell Park	0.3
McMahon's Point River	0.3
Milson Island	0.3
Mitchell Park	0.3
Mittagong Range	0.3
Mulgoa Lookout	0.3
Nepean Dam	0.3
New bridge near Richmond	0.3
Oyster Farms	0.3
Pearl Beach	0.3
Pete's Bite	0.3
Sackville Ferry	0.3
St Albans Pub	0.3
The Hawkesbury Bridge	0.3
Trent Reserve	0.3
Victoria Bridge	0.3
Yarramundi bridge	0.3

Table 2.2. (contd.)

Area Most Familiar	% of Respondents (N=368)
General Responses	
Salt water areas	0.3
All of the dams	0.3
Whole general area	0.3
Where the train crosses the river	0.3
Picnic areas	0.3
Tench avenue	0.3
Jamison road	0.3
Mulgoa road	0.3
Restaurant areas	0.3
The F3 freeway	0.3
Coasters retreat	0.3
Bays and Harbours	0.3