




Sydney Beaches Valuation Project

Overview & Summary



The background of the page is a composite image. The top half shows blue ocean waves crashing onto a sandy beach. The bottom half is dominated by a large, textured image of a 50 Euro banknote, showing the number '50' and some of the intricate patterns and colors of the currency. The overall color palette is a mix of blues, greens, and earthy browns.

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Purpose of this document

This document summarises the rationale, methodology, key economic findings and management implications for the Sydney Beaches Valuation Project (SVBP). It is designed to provide a quick reference guide for councils, state agencies and consultants considering foreshore management options in response to existing challenges and coastal processes and projected climate change impacts such as shoreline recession and inundation. It provides estimates of the value of a beach day, willingness to pay to avoid future erosion impacts, and the influence of beaches and erosion risk on coastal property markets. Whilst Sydney is the focus, the methods used and results generated have implications nationally in Australia and further afield.

Acknowledgements

The Sydney Beaches Valuation project was supported by a Community Action Grant from the (former) New South Wales (NSW) Greenhouse Office, which is now part of the NSW Office of Environment and Heritage (OEH). A PhD scholarship was provided by the University of NSW, and additional project funding came from CSIRO in the form of a postgraduate studentship.



What was the Sydney Beaches Valuation Project?

The Sydney Beaches Valuation Project (SBVP) sought to estimate the economic value of selected beaches in Sydney, Australia, in order to provide the necessary information to assist local and State government agencies to identify the most appropriate response to both existing coastal management pressures and to projected climate change impacts.

The specific climate change impacts considered most critical for the region¹ are shoreline recession and coastal erosion, which is likely to lead to the loss of beaches and damage to nearby public and private assets. The SBVP was conducted as a collaborative project between the Sydney Coastal Councils Group (SCCG) and the University of New South Wales (UNSW). The project was proposed and funded due to a joint recognition within the academic community, local and State governments that economic information is needed to inform the management of coastal areas subject to these pressures. Assistance was also provided by the NSW Valuer General, the (former) NSW Greenhouse Office, and the coastal and estuarine units of the (former) NSW Department of Environment and Climate Change. Funding was provided by the NSW Greenhouse Office² in the form of a Community Action Grant, with additional project support from CSIRO through an Office of the Chief Executive Postgraduate Studentship.

Empirical valuation studies were conducted at three case study locations: Manly Ocean Beach, Collaroy-Narrabeen, and a combined site in the Hawkesbury River that included the Brooklyn Baths and Dangar Island (Figure 1).

These case study sites were selected to represent the different biophysical environments of the region, and to highlight the key coastal management issues, threats to infrastructure and the loss of amenity values. In-kind support and project guidance for these case studies was provided by Manly Council, Hornsby Shire Council and Warringah Council, respectively.

Valuation methods were selected in response to the key coastal management challenges in the region, vulnerability to inundation and shoreline recession. More specifically, the research sought to answer the questions:

What would the partial or total loss of beaches mean:

- **For tourism and recreation revenue streams?**
(Travel Cost Method)
- **For the local property market?**
(Hedonic Pricing Method);
- **And for beach users:**
Are they willing to pay to prevent erosion?
(Contingent Valuation Method)



¹It was not possible to estimate the CS for Dangar Island or Brooklyn due to small sample sizes.

²Both the NSW Greenhouse Office and Department of Environment and Climate Change are now part of the NSW Office of Environment and Heritage.

Why is it important to know the economic value of beaches?

The results of the valuations are also key knowledge inputs to the future management of the NSW coastal zone, particularly in the decision of how to manage coastal assets in response to ongoing coastal process challenges and enhanced climate change impacts.

In particular, knowing the value of beaches is useful when selecting responses to shoreline recession and erosion. Sydney already experiences severe storms caused by low pressure systems such as **East Coast Lows (ECLs) and tropical cyclones**. These events can remove upwards of **50m of beach width** on exposed coasts, and are often coupled with flooding due to associated rainfall.

The impacts of these storm events will be exacerbated by higher water levels as predicted due to climate-induced sea level rise. The climate change projections for the Sydney region are that a total loss of some beaches is likely within the next century without substantial management intervention,

primarily in the form of beach nourishment. This is a costly exercise, especially when compared to the costs of terminal protection structures such as groynes and seawalls without the use of nourishment, and hence it is important to understand exactly what is at stake when choosing between options with well-defined cost estimates and relatively unknown benefits. It should be noted that the preferred option for most developed coastal locations will be a combined approach incorporating terminal protective structures in conjunction with nourishment to maintain beach amenity. This is despite the fact that in many instances a source of sand for this nourishment is not clearly identified.

Current coastal management challenges in Sydney

Population growth in the coastal zone has rapidly outstripped that in other areas (Greve et al., 2000). This has resulted in rapid coastal development, which brings management challenges and also restricts the available adaptation options as there is both social and economic pressure to protect existing assets in at-risk areas. Coastal properties at risk from erosion or flooding over the next century in NSW were valued at \$1 billion in 2005 and this figure increases yearly due to property value increases and intensified coastal development (Pyper, 2007).

Beaches act as strong sources of attraction for both Australian residents and domestic and international tourists. Australians have a strong geographical affinity to the coast, with around 50% of residential addresses located within seven kilometres of the coastline, and around 6% in the zone that is less than five metres above mean sea-level and within three kilometres of the coast (Chen and McAneney, 2006).

Tourism importance of beaches

Tourism revenue generated by Sydney beaches is an, as yet, unquantified source of income for the resident communities at local, regional and state level. In the year ending June 2013, Sydney received just over 29 million visitors, with total visitor expenditure of \$13.5 billion (Tourism NSW, 2013). In 2001, a survey of international tourists in Sydney determined that, depending on the country of origin, between 20 and 56% (average 36.3%) of visitors visited Bondi beach. This represented total international visitor numbers of just over 1 million (Battye and Suridge, 2002).

This level of international visitation is greater than that for many small countries. It is likely that domestic visitation is also high, as visiting the beach ranks highly as a motivation for travel amongst domestic tourists in Australia. Approximately 1.3 million domestic daytrips taken in the Sydney region in the year ended December 2012 involved visiting the beach (Tourism Research Australia 2012). It is likely that these visits represent a desire for recreation opportunities, but also a desire for nature-enhanced cultural activities, such as eating fish and chips on a beach or coastal promenade.

Projected climate change impacts

Climate change projections will have a range of impacts on the coastal zone (Table 1). The most critical impacts on beaches in the Sydney region were identified by a group of coastal management experts as shoreline recession and inundation. The most critical current management challenges are caused by major storm events, which expose hazards in the coastal zone and limit accessibility of the beaches.

Table 1. Direct and indirect climate change impacts on beaches.

Climate change (driver)	Principal direct physical and ecosystem effects	Potential secondary and indirect impacts
Sea-level rise	increased inundation of coastal zone	disruption of coastal economy, tourism impacts
	increased coastal erosion	displacement of residents in impacted areas
	increased risk of flooding and storm damage	damage to coastal infrastructure, restricted access and enhanced risk when using beaches
	saline intrusion into surface and ground water	health impacts associated with water quality changes
Altered wave climate	increased wave runup	enhanced erosion
	altered erosion and accretion balance	
Storm frequency and intensity changes	increased wave heights, runup and storm surge	increased storm damage
	southward shift in cyclone zones	
Ocean acidification	impacts on reef-building corals	reduced storm protection function, less resilient and functional reefs, dissolution of calcareous beach sand content

Adapted from Aboudha (2006)

As outlined previously, the key impacts considered in the current study is the loss of beaches, whether it is due to storm events in the current day or shoreline recession due to sea level rises. The study estimates what the loss of Sydney beaches would mean in economic terms.



What valuation methods were applied?

Travel Cost Method (TCM)

The Travel Cost Method (TCM) was used to estimate the recreational value provided to beach users by Sydney beaches. The theory behind the TCM is that people will not take a trip unless utility (welfare/happiness) they gain from the trip is more than the trip costs. These expenses include travel costs, onsite costs, and time.

The TCM uses the relationship between travel costs (and travel time) and frequencies of visitation to construct an estimated demand curve (as shown in Figure 2). From this demand curve it is possible to estimate the consumer surplus (CS) of the beach visit, which is essentially the extra 'un-costed' utility or benefit that people get from a beach visit, or the value of that experience.

The TCM is a popular method in environmental valuation and public policy appraisal, as it relies upon observations of real behaviour. It is restricted, however, in that it can only estimate the value that people get from physically using the resource and not all the other potential benefits from beaches such as simply being able to look out a window and see a child building a sandcastle, or seeing a picture of a wave breaking upon a beach on television or in a magazine.

Application of the TCM requires administering surveys to beach users or nearby residents. In the case of the SBVP surveys were conducted both onsite and online, although results presented here are primarily from the onsite survey due to greater sample sizes. Onsite surveys were programmed to be conducted using handheld mobile computers (smartphones) to allow for flexible survey designs, and to speed up data entry which is a key cost of administering such a survey.

A total of 393 complete survey responses were collected onsite, which allowed for estimates of CS for Manly and Collaroy-Narrabeen. Sample sizes for Brooklyn and Dangar Island were too small to allow for reliable estimates.

Figure 1. SCCG member councils and case-study site locations (labelled in red).



The Hedonic Pricing Method (HPM)

The Hedonic Pricing Method (HPM) was employed to identify price premiums for beachfront property in Collaroy-Narrabeen, by exploring the relationship between coastal land prices and environmental attributes.

The willingness to pay (WTP) for the privilege of living on or near the beach is estimated by examining property market records in detail to determine which factors have the greatest influence on price. The HPM takes its name from the Greek word for pleasure, implying that property purchasers act in a way to maximise their own utility or happiness. In the case of valuing beach amenities, this means that they locate themselves as close to the beach as possible, or with as good a view of the beach as possible, subject to their available budget, and the other criteria they have for their house purchase (e.g. number of bedrooms, car spaces, land area, slope, aspect).

In applying the HPM in the current study, approximately 1200 land valuation records were sourced from the NSW Valuer General's Office for the Collaroy-Narrabeen area. The study area is shown in Figure 3. These records related the rateable land value to the characteristics of each property, such as size, zoning and location. Coastal features of interest, such as proximity to the shoreline and beachfront access were also measured. Multiple regression was employed to identify the contribution of each property feature to the overall value of the property. From this relationship, the WTP for beachfront access, coastal proximity and to avoid excessive erosion risk were estimated.

Figure 2. Estimating consumer surplus (CS) from travel cost information

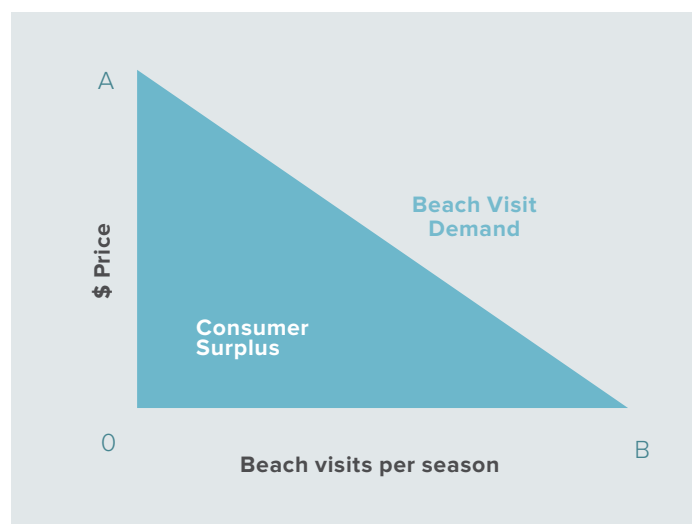


Figure 3. Aerial view of case-study area: Collaroy-Narrabeen beach, Sydney, NSW, Australia.



Aerial photography: Warringah Council

The Contingent Valuation Method (CVM)

The Contingent Valuation Method (CVM) was employed to estimate the WTP of beach visitors for prevention of erosion at the case-study beaches caused by shoreline recession under elevated sea levels.

The CVM works by presenting survey respondents with two situations, the status quo and the predicted or contingent state. They are then asked to indicate how much they would be WTP to ensure the positive change takes place or that the negative change does not. They state their hypothetical WTP under the described scenario, and hence the CVM is a stated preference technique for non-market valuation.

CVM is theoretically appealing, because it is able to estimate non-use values, such as the desire to ensure that beaches are available for future generations, which is known as bequest value. Stated preference methods are also necessary when attempting to value changes which are outside the scope of recorded experience, as there are no behavioural records to rely upon. This is certainly the case when looking at the potential climate change impacts on Sydney beaches. Figure 4 shows a representation of the potential repositioning of the shoreline at Collaroy-Narrabeen by 2050 due to sea level rise.

Due to the hypothetical nature of the method, a lot of effort must be put into ensuring the hypothetical scenario is as realistic as possible, to ensure that the responses to the survey reflect real choices. This is particularly challenging when attempting to predict with any level of certainty what the state of the beach will be in the medium term, as coastal environments are inherently highly variable and subject to a wide range of natural and human influences.

For this reason, the erosion damage scenario was described as a potential loss of the number of days with dry sand on the beach where the survey was conducted (beach name replaced by @beach wildcard in following questions):

- All Sydney councils are considering the future management of their natural resources, and the potential impacts of climate change. One of the most certain of these for coastal areas is a rise in sea-levels. Higher sea-levels are likely to result in the gradual but permanent loss of sand from [@Beach].
- In the shorter term, sea-level rise is likely to result in the more frequent loss of sand from the beach due to normal storm activity. By the year 2050, this could lead to a situation where 10% of the times you visited [@Beach], there was no dry sand present at high tide.

Respondents were then given a description of a hypothetical erosion management fund designed to prevent the 10% loss of 'usable beach days', and asked whether they would be willing to make a voluntary donation to that fund.

- Suppose for a moment that there was a dedicated [@Beach] Beach Management Fund, which could only be used to prevent the erosion described.
- This fund would be administered by a state government agency, and could only be used at [@Beach]. It would be subject to independent annual audit, to ensure that the funds were being spent appropriately.
- In principle, would you be willing to make a once-off donation to such a fund, if it existed?
- Remember that this is only one of a number of potential environmental projects, that there are a number of other beaches which may not be equally affected, and consider your available budget.

If they answered yes to this question, they were then asked a follow-up question to see if they would be WTP a certain amount, with the amounts being randomly assigned and varied between \$5 and \$500:

- Imagine that the [@Beach] management fund has now been established.
- If you were approached by someone seeking donations to the fund, would you be willing to make a once-off donation of X dollars to the fund?

By performing statistical analysis on the responses to this question, and relating the responses to demographic and experience information, it is possible to determine the median WTP for the prevention of beach erosion.

Contingent behaviour response to beach erosion

In addition to questions about travel patterns and WTP for erosion prevention, the surveys conducted both on beaches and online asked people contingent behaviour questions about what they would do if they came to the beach to see that there was no dry sand due to erosion.

- If you had travelled to (@Beach) today to find that the beach was open for swimming, but that there was no dry exposed sand, what would you have done?

Understanding how beach erosion will affect the purchasing and travel behaviour of residents and tourists is critical to understanding the economic impacts of climate change impacts and storm erosion.

Figure 4. Computer generated image showing potential extent of sea-level rise at Collaroy-Narrabeen in 2050, as displayed in newspaper article (Sydney Morning Herald, 2006)



2006



2050

What were the results?

The key research findings of the SBVP are summarized in Table 2. The following sections provide further detail on how these figures differ between the case study locations, and the key drivers of the responses.

This information is important in identifying factors which influence visitation and the likely responses to changes in beach conditions or selection of different protection options such as groynes, seawalls or nourishment.

Table 2. Summary of key SBVP research findings

Economic measure	Expenditure	Value of recreation/Value of a beach day		Willingness to pay (WTP) for prevention of shoreline recession impacts in AD2050		Price premium for beachfront property
		Case study site	Average travel cost (2009 AUD\$ per visit per person)	Consumer surplus* without time cost (2009\$ per person per beach visit)	Consumer surplus with travel time cost at 40% of wage rate (2009\$ per person per beach visit)	
Manly Ocean Beach	6.31	9.20±1.92	16.18±2.98	54		N/A
Collaroy-Narrabeen	2.90	2.72±0.56	10.28±2.59	64	\$116.27± 69.63 Pooled sample from all beaches	70% premium for lakefront location, or location within 1 block from the beach but not beachfront 124% for beachfront properties potentially subject to wave impact 200-265% for beachfront properties outside the wave impact zone
Brooklyn	14.72	Not possible to estimate due to small sample sizes		35		N/A
Dangar Island	7.49			61		N/A

All dollar figures are in 2009 AUD

How much for a day at the beach?

Travel costs were typically less than \$15 per person per one-way trip, which reflects the fact that many respondents live close to the beach or choose to stay in hotels that are near Sydney beaches.

Table 3 provides some further examination of the expenditures associated with visiting each site.

The estuarine sites were relatively remote and drew visitors from a wider region than the metropolitan ocean beaches. There are no good estimates for the number of visitors to these beaches, so it is not possible to estimate the total realmarket expenditure associated with visiting each beach.

This expenditure does not take into account the unpriced value of recreation as part of the beach visit, which has the potential to severely underestimate the true value of the resource. Using the TCM, consumer surplus (CS) estimates, estimates of the benefit beach users get from a beach visit,

were derived for Manly and Collaroy-Narrabeen. These analyses provided estimates for the unpriced value of a beach visit of $\$9.20 \pm 1.92$ for Manly and $\$2.72 \pm 0.56$ for Collaroy-Narrabeen³. Differences in these figures can be related to the difference in visitation patterns. Approximately 60% of visitors to Collaroy-Narrabeen travelled less than 20 minutes to get there, compared to only 36% for Manly.

In addition to monetary costs, travelling to the beach requires the expenditure of time, which can also be valued in economic terms. It is typical in international beach valuation TCM studies to include travel costs and the cost of travel time multiplied by a proportion of the hourly wage rate. This proportion is normally between 25% and 50%, with 40% being used in the SBVP. Using this rate for travel time costs, the CS value of a beach day increases to $\$10.28 \pm 2.59$ for Collaroy-Narrabeen $\$16.18 \pm 2.98$ for Manly Ocean Beach.

Table 3. Expenditure on beach visits by case study location

Case study site	Travel cost average (2009 AUD\$ per visit per person)	Explanatory notes
Collaroy-Narrabeen	\$2.90	Beach frequented by local residents, many walk or ride to the beach so have zero costs
Manly Ocean Beach	\$6.31	Beach popular with tourists, ferry travel (1/3rd of visits) is moderately expensive yet may be a positive experience
Brooklyn Baths	\$14.72	Regionally important beach due to lack of substitutes. Relatively remote location requiring moderate costs
Dangar Island	\$7.49	Sample balanced between island residents with no travel costs and tourists with substantial costs for car/train and ferry access



³ It was not possible to estimate the CS for Dangar Island or Brooklyn due to small sample sizes.

Estimating the number of annual visits to Sydney beaches

In order to provide an estimate of the total annual value of recreation on Sydney beaches, it is necessary to take the value of a beach day and multiply it by the number of visits made each year.

There are no turnstiles at the beach, and available measures of beach visitation are of dubious accuracy or reliability. Hence alternative sources of visitation estimates must be sourced. This section outlines the method used to estimate beach visits for the Sydney region.

Establishing the beach user catchment area

To estimate the number of visits to Sydney beaches by local residents, it is necessary to know the approximate beach user catchment distance of the beaches, or how far people are willing to travel to visit the beach.

Mean one-way travel time for the case study beaches ranged from 29 minutes for Collaroy-Narrabeen to 102 minutes for Dangar Island. The weighted average is 52.9 minutes for the entire sample. A driving time of 53 minutes would enable almost the entire Greater Sydney region to access a beach of some type. Given that Sydney beaches are accessed by those who live outside the Sydney region itself (e.g. residents of the Central Coast and Illawarra), the entire population can be used as a proxy for the catchment area. The residential population of Greater Sydney in the 2011 census was 4,391,636.

How many visits do people take?

Having established the likely user population of Sydney beaches, it is then necessary to estimate how frequently they visit. In the SBVP the frequency of visitation for all users (including tourists who typically only visit a location once) ranges from 4.13 to 12.98 visits per month. This equates to an annual visitation rate of between 48 and 132 per beach user. It should be noted that there is a strong bias in onsite sampling, which means that you are far more likely to survey those who visit most frequently.

Raybould estimated (in 2006) around 48 visits per annum for residents of the Gold Coast, which represents an upper bound of logical figures for Sydney, given the differences in geography and settlement patterns. The Gold Coast is a linear strip development, whereas settlement in Sydney is distributed further to the west and along river valleys. The traffic congestion of Sydney may also limit visitation rates from western suburbs.

In 2007, consultants for the Victorian Coastal Council (URS 2007) estimated that beach users made around 26 visits per year, strongly influenced by the distance of their household from the beach. When non-user residents of Victoria were included, the mean number of visits dropped to around 6.4 visits in a 12 month period.

Total resident beach visits

Taking the conservative estimate of 6.4 visits per year, the total estimated number of beach visits by Sydney residents is around 28.1 million per annum. If it is assumed that residents make around 15 visits per year, this figure increases to 65.9 million residential beach visits per year.



Estimating tourist visits

Tourism Research Australia collects information about the visitation patterns of domestic and international tourists through the National and International Visitor Surveys, respectively.

These surveys record the number of visits and also information about a number of key activities undertaken whilst visiting. Visitor counts for the Sydney region were derived from the daytripper, domestic overnight and international visitor surveys were averaged over three years (December 2010 - December 2012) and weighted by the proportion of those visitors who visited the beach.

In total, there are around 15.2 million beach visits made each year by tourists (Table 4). This assumes a relatively low number of beach visits per trip, particularly for international visitors.

Total value of beach recreation in Sydney

Combining the figures for residents and tourists gives an approximate value of **43.4 million visits per year**, using the most conservative assumptions.

When multiplied by the mean travel expenditure components from the total survey sample (weighted by the number of responses from each location), aggregate values for market expenditure associated with visiting the beach can be estimated. These are shown in Table 5.

Table 6 shows the range of aggregate annual value of recreation on Sydney beaches by tourists and residents. **Figures range from approximately \$120 million p.a. to over \$700 million p.a. which highlights the importance of better understanding beach visitation, and also the scope of the potential losses if beaches are not managed effectively to ensure that their attractive features are preserved.**

Table 4. Total estimated annual visits by tourists to Sydney beaches

	Total trips made by beach visitors	Average number of days per trip (nights +1)	Assumed # of beach visits per trip	Total beach visits (1000s p.a.)
Daytrippers	1,197	1	1	1,197
Domestic Overnight visitors	3,624	5.1	2	7,247
International overnight	1,709	26.1	4	6,838
Total	6,530			15,282

Table 5. Total annual expenditure and value associated with beach visits in Sydney

	Travel expenditure	Onsite expenditure
Weighted average (2009 \$ per visit per person)	6.01	5.05
Aggregate value - 2009 \$ per annum	260.8 million	219.2 million

Table 6. Aggregate annual value of beach recreation in Sydney

Beach where consumer surplus estimate was derived	Total consumer surplus estimate (2009 \$ millions per annum)	Total consumer surplus estimate incorporating travel time costs (2009 \$ millions per annum)
Collaroy-Narrabeen	118.1	446.2
Manly Ocean-Beach	399.3	702.2

What would people do if there was no sand on the beaches?

- As few as 40% of people actually go onto the sand or into the water when visiting the beach
- Approximately 30% of respondents are not affected by short-term loss of sand
- A further 30% would be affected, but not so badly that they would leave

Table 7. Experience of beach closure due to erosion - percentage of respondents

Beach	Collaroy-Narrabeen		Manly Ocean Beach		Brooklyn Baths (n=49)	Dangar Island (n=46)
	Onsite (n=173)	Online (n=35)	Onsite (n=148)	Online (n=63)		
Beach closure	66%	80%	55%	76%	43%	48%

There was a high level of familiarity with beach closures due to erosion amongst the respondents to both the onsite and online surveys (Table 7). At the estuarine sites between 40 and 50% of people had experienced erosion closures, though not necessarily at the survey location. More than half of the visitors to the ocean beaches had experienced beach closures. The difference in the levels of experience with erosion closures mirrors the intensity and frequency of erosion events at the case study locations.

Information collected in this study about the most common activities undertaken at the beach provide for some degree of optimism with regards to the potential impacts of climate-related beach erosion. Analysis of responses from the online survey suggest that only a subsample of beach visitors actually engage in physical contact with either the sand or the water. Table 8 shows responses from the online survey which asked people where they spent the majority of their time during a beach visit. The sample size for Brooklyn and Dangar Island was too small to provide reliable results. Dependent on the type of beach setting, as few as 40% of respondents actually spend the majority of their time either on the sand or in the water.

These differences reflect the different character of the case study beaches with Collaroy-Narrabeen being more of a surfer's beach and Manly attracting many tourists that do not leave the coastal promenade, and are likely to result in different behavioural responses to the loss of sand.

It should be noted that the sampling procedure introduced a bias against the users who spend the majority of time in the water, due to logistical challenges of surveying people in the surf zone. The contingent behaviour question incorporated into this study provides important information regarding the response of beach visitors to the temporary loss of sand at the case study beaches. This information can be used to estimate the likely economic impact of beach closures through integration with travel cost information.

Table 8. Primary location of activity during a beach visit

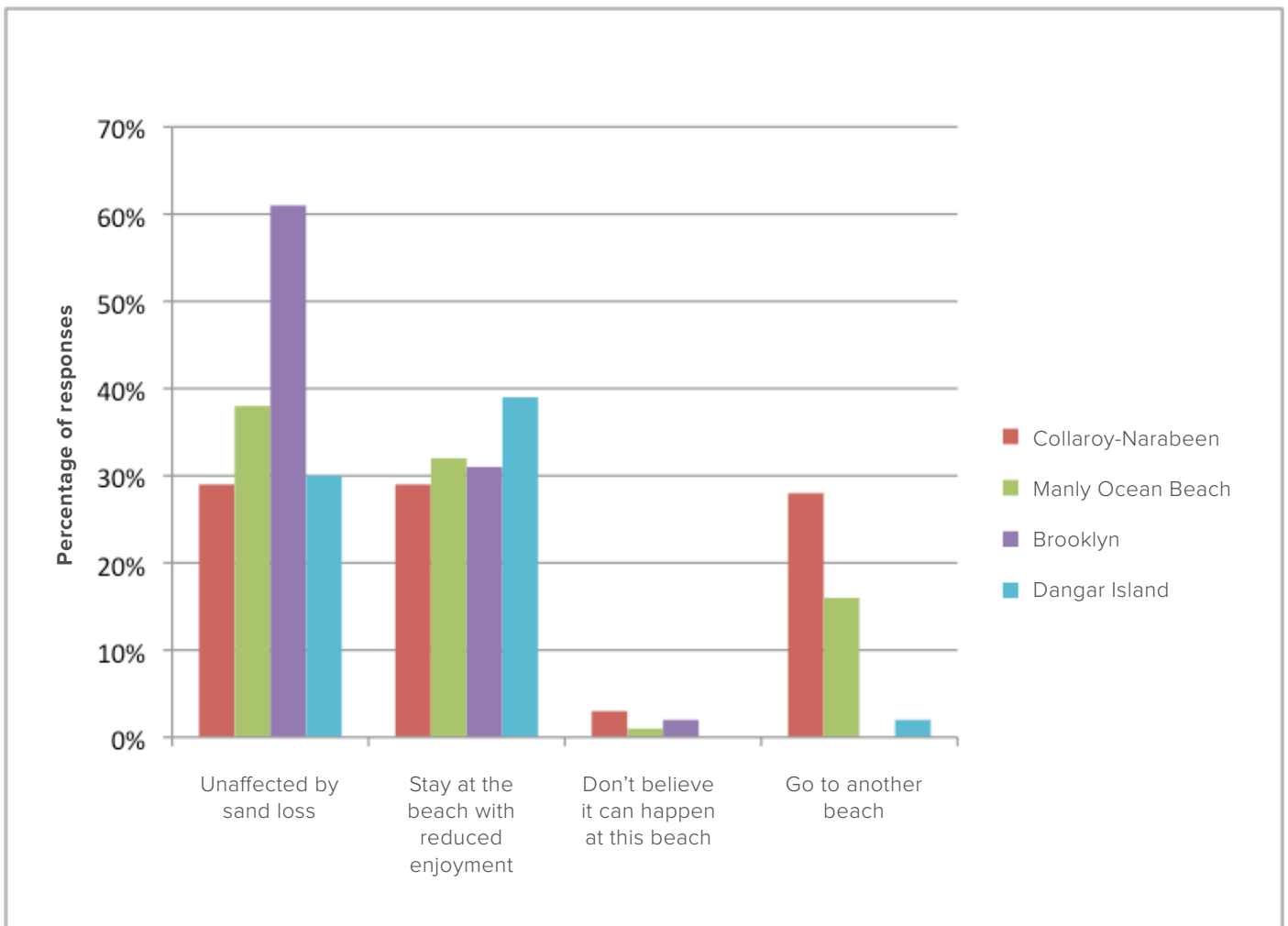
Case study site	Where people spend their time	
	On the sand	In the water
Collaroy-Narrabeen	19%	53%
Manly Ocean Beach	17%	22%

The contingent behaviour question incorporated into this study provides important information regarding the response of beach visitors to the temporary loss of sand at the case study beaches. This information can be used to estimate the likely economic impact of beach closures through integration with travel cost information.

It should be noted that these responses are likely to vary with both the severity and duration of beach erosion, and

that under climate change projections there may be a total and permanent loss of sand at some beaches. It is expected that responses to permanent shoreline recession would differ greatly to those for temporary events. Whilst Sydney remains a capital city with other natural attractions, regional locations that are centred around the coastal lifestyle may be severely affected by the projected climate changes in the longer term. These impacts could be both economic and social.

Figure 5. Response to beach closures caused by erosion



Willingness to pay for erosion prevention

- 415 contingent valuation surveys were completed at the case study beaches
- 78% of respondents believe that by the year 2050, the beach will be closed due to erosion at least 1 out of every 10 times they visit
- A further 30% would be affected, but not so badly that they would leave

Although belief in the erosion scenario was high, equating to around three-quarters (78.3%) of the total sampled population, this did not translate directly into a positive willingness to pay (WTP) for beach erosion protection.

Protest responses accounted for approximately half of the total sample, with statistically significant differences between the case-study sites. Protest responses are defined as those from respondents who do not accept the conditions of the hypothetical donation request. They may object to the form of donation, the restriction of the fund to a single beach, the choice of agency which manages the money, or the way in which the project is to be implemented. Protest rates ranged from 36% at Collaroy-Narrabeen to 65% at Brooklyn. At Manly and Dangar Island the protest rates were 46% and 39%, respectively.

The median WTP for erosion protection was AUD\$116.27±69.63 per person as a once-off donation to prevent erosion occurring in 2050. This figure is for all respondents to the question, and does not consider the reasons given for not being WTP as the question was only asked of those people who indicated in-principle support for the erosion prevention project. Given the sample is from active beach users, it is not appropriate to multiply these figures by all residents of the Sydney or SCCC areas, and hence it is not possible to estimate the total WTP for prevention of erosion of Sydney beaches. It should also be noted that because the CVM is able to consider non-use values that do not require any contact with the resource itself, and Sydney beaches are iconic locations that are known internationally, a true valuation would require a global survey to include everyone who potentially has an interest in the state of Sydney beaches.

Why would people pay?

Analysis of qualitative follow-up responses provides some explanation of the motivations underlying WTP. The most common reason cited for not being WTP was the availability of alternative beaches, particularly for tourists and those that had travelled a long distance to get to the beach. Overall, 36% of those who wouldn't be WTP cited the potential to go to other locations as their primary reason.

Use of the beach was the most commonly cited reason for being willing to contribute to the erosion management project (73% of those who indicated in-principle support for the project). This would suggest that funding options for beach management are likely to be supported primarily by users of the resource, and hence raises the possibility of a beach-usage charge.

Respondents at the locations which experience more frequent erosion (Collaroy-Narrabeen and Manly) were more likely to be WTP to prevent erosion. This suggests that their familiarity with the described situation makes them more likely to believe that it will happen in the future.

Interestingly, whether or not the respondents had seen firsthand the closure of beaches due to erosion before did not have any bearing on whether they would be WTP for preventing that occurrence. This was counter to expectations, but may be because more frequent beach visitors understand that the state of the beach is dynamic and that under present day conditions sand eroded by storms typically returns without external intervention. As noted previously, this is unlikely to be the case under the projected impacts of climate change on Sydney beaches.

Crowd-sourced funding for coastal management?

- The results of the CVM study suggest there is theoretical potential for a beneficiary-pays system of funding for coastal management in Sydney. Over half of beach users stated that they would, in theory, support a coastal erosion management fund. This fund would need to be carefully designed to maximise the chance that people would support such an initiative, with the amount of the financial request being a critical factor.
- Responses indicated significant sensitivity to the amount requested, with all respondents WTP small bid values (\$5), and comparatively few WTP large amounts (\$100-\$500). This means that any user-pays beach management charge would need to be spread across a large number of visitors in order to provide sufficient funds for major interventions.

Table 9. Percentage of positive WTP responses by donation amount requested

WTP bid amount (\$2009)	Percentage of respondents WTP that amount as a once-off donation
5	100.0
10	90.3
25	77.4
50	70.6
100	45.7
500	13.2



It should be noted that free public access to the beach is a right enshrined in coastal policy and legislation in Australia, and charging a beach-user fee is not permitted under these regulatory arrangements. Establishing a voluntary beach management fund as described in the CVM scenario was also not something being considered by State or local governments at the time of the study.

The choice of managing agency for the beach management fund is also important, with thematic analysis of qualitative responses suggesting some respondents had reservations about the competency or trustworthiness of either local or state governments at the time the surveys were completed. Having the fund administered by an independent and respected authority would likely increase the level of support. For highest uptake, the fund would also need to be applied to the respondent’s most frequently visited beach, or in a regional model.

Willingness to pay for beachfront property

- Beachfront properties in the Collaroy-Narrabeen embayment were worth **\$1.93 million** on average, which is around **200%** more than otherwise identical properties in the study area
- Those within the first block from the beach but without beachfront access were worth **\$775k** less than those with beachfront access
- Premiums paid to secure beachfront access totalled around **\$110 million** over the length of the beach



The hedonic analyses conducted for the Collaroy-Narrabeen case study site demonstrated that there were substantial premiums paid for beachfront property. In the simplest model, beachfront properties were worth approximately 200% more than an otherwise identical property in the sample area that did not have beachfront access. The value of a property within one block of the beach but not on the beachfront was approximately 75% more valuable than the reference property. In the crudest terms, this suggests that in Collaroy-Narrabeen having a beach directly in front of your house makes it \$775k more valuable. This indicates that the loss of beaches could have substantial implications for coastal property markets.

Over the length of the study area, these premiums for coastal proximity total around \$110 million of added value, which has substantial implications for Council rates revenue in the region. Analysis was restricted to single-use residential properties, as the complexities of applying this method to apartment buildings and townhouses reduce the level of confidence in the results.

This challenge notwithstanding, there are a large number of multiple-use residences along the length of Collaroy-Narrabeen beach which may be similarly affected by the loss of beach amenity. It is therefore important to understand the drivers of this WTP estimate.

There was substantial variability in beachfront values along the length of Collaroy-Narrabeen beach, with properties in the centre of the beach worth less than those at the northern and southern ends (see Figure 6).

A number of more complex models were employed to investigate the influence of coastal erosion information linked to property titles. It appears that coastal erosion risk information has a strong negative influence on the price premium for beachfront property.

Figure 6 . Land values in Collaroy-Narrabeen



This appears to reflect the differing level of exposure to erosion along the beach. Collaroy-Narrabeen is subject to erosion impacts due to severe storm events. As a result, Warringah Council has identified conducted a number of hazard studies in the region in development of a Coastal Zone Management Plan. Properties in the central portion of the beach are more exposed than properties at either end of the beach, which are either not exposed to the same degree of wave action or are located further landward.

It appears that increased coastal erosion risk has a strong negative influence on the price premium for beachfront property.

Implications for coastal management funding and adaption option selection

The key findings of this study were that the economic values associated with Sydney beaches are extremely high, and that these values stem from behaviour and visitation that is poorly understood.

This project specifically set out to determine the value of daytrip beach visits, as opposed to all of the other potential reasons to visit and live within the Sydney region. As such, the figures presented in this study must be considered highly conservative estimates of the total “true” value of Sydney beaches to the regional, state and national economies. For example, international visitors to Sydney may spend many thousands of dollars during their trip, with at least part of this due to the desire to visit the beaches of Sydney (and elsewhere in Australia). It is difficult to determine what proportion of these longer visits can be attributed to the presence and quality of the beaches, and hence this extra economic value is excluded from the analysis. Local residents may also have paid substantial price premiums to live closer to the beach, thereby reducing their per-visit travel costs. This premium was estimated for Collaroy-Narrabeen, but looks only at the price variability within the suburb, not the difference in property values between the eastern and western suburbs of Sydney.

Very high economic values

The previous disclaimer notwithstanding, the values identified bear repeating as they are substantial and warrant further attention.

- The SBVP estimated that visits to all Sydney beaches were associated with approximately \$260 million in travel costs and around \$220 million in retail expenditure on things such as food and drinks.
- In addition to these market expenditures, the previously unpriced recreation value of these visits is somewhere in the order of \$120-400 million per annum if only travel costs are included, or between \$450-700 million annually if the costs of travel time are taken into consideration, as is typical in the valuation of recreation destinations.
- There are also many millions of dollars tied up in the coastal property markets of Sydney, which are potentially at risk if beaches are permanently lost to erosion and shoreline recession. The SBVP estimated that for a single beach (Collaroy-Narrabeen), the desire to live as close to the beach as possible adds over \$110 million to nearby property prices.
- The SBVP also identified a high level of community belief that climate change will have marked impacts on the presence and state of beaches in the Sydney region, and a desire to see something done to limit the projected erosion impacts. This translated to a moderate willingness to contribute to a fund for erosion prevention, moderated heavily by the amount requested and the design and administration of the fund. This provides clues to the possibility of alternative sources of coastal management funding.

Need for visitation and behavioural study into the use of coastal areas

Despite this high level of economic value and community interest, little is known about how Sydney beaches are used in the current day, or how this use may change in response to changes in the quality and accessibility of these beaches. Efforts to estimate aggregate values for the economic value of beach recreation and the WTP for beach erosion protection are stymied by the absence of visitation figures. Despite the best efforts of the research team, the visitation estimates and aggregate figures must be treated with some caution. The absence of visitation information is a barrier for effective management of all beaches and natural resources or locations, not just Sydney beaches. A recurrent national survey on recreation participation modelled on the US National Survey on Recreation and the Environment is strongly recommended.

A deeper understanding of the way in which residents and tourists use coastal regions is also critical for the selection of appropriate coastal climate change adaptation responses, as without this information there is an increased possibility of maladaptation and perverse outcomes. For example, failure to account for the recreational use of beach areas could lead to selection of hard coastal protection options which do not account for the impact of these structures on the beach itself. The values associated with recreational beach use identified in this study indicate that this would lead to a substantial economic loss. Whilst the HPM study identified that there would be substantial benefits to beachfront residents, this may not match the loss to the broader group of people who visit the beach now or in the future.

Need for improved understanding of physical changes

It is also important to understand in greater detail the site-specific impacts of climate change and even coastal processes in the current day such as flooding and storm erosion, if we are to be able to predict with any degree of confidence the way in which beach users and coastal residents will respond to these changes.

The influence of management interventions on the character and accessibility of the beach are also critical in understanding how this will impact upon economic streams flowing from the use and broader appreciation of those resources. For example, the relative WTP for coastal property under different future management scenarios (nourishment, retreat, seawall construction with and without nourishment) is a critical area of future research effort.

Need for a flexible approach and realistic funding

In the absence of perfect information, and given the scope of the economic impacts suggested by this research, adaptive management should be the preferred option. The use of soft approaches such as beach nourishment is likely to be able to preserve the beach-associated values, whilst also providing flexibility in responding to uncertain climate change impacts. The costs of this flexibility are supported by the benefit estimates identified by this study.

Greater emphasis and funding for coastal management actions from higher levels of government are also necessary, as the majority of these interventions are beyond the economic scope of the local governments charged with protecting these resources for the enjoyment of current and future generations of beachgoers.



Further reading

For further information on the Sydney Beaches Valuation Project

Dave Anning's PhD thesis

Estimation of the economic importance of beaches in Sydney, Australia, and implications for management

SBVP project overview

SBVP policy paper 1: The economic value of recreation on Sydney beaches

SBVP policy paper 2: Sydney beaches, erosion risk and the coastal property market

SBVP policy paper 3: Sydney beach user responses to erosion and willingness to pay for erosion prevention

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