

Beach Erosion and Nourishment in Gold Coast: Perceptions, Policies and Prospects

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Abstract: The combination of ongoing urban development and forecasted impacts of the changing climate are projected to place many coastal areas at risk. One of the associated risks is beach erosion, and consequently, nourishment initiatives have become a costly sustainable development issue for local and state governments. For instance, the popular Palm Beach, a nearly four kilometres stretch of sandy beach on the southern Gold Coast in Queensland, Australia has been identified as being more susceptible to serious erosion than other beaches in the city. Consequently, the local council has spent millions of dollars on beach nourishment and is seeking ways to fund the initiative. In this context of coastal management, an exploratory pilot research project was undertaken to examine the question of - "how do local residents and tourists perceive the problem of beach erosion and to what extent are they willing to support beach nourishment initiatives"? Results of quantitative analyses of 68 face to face survey responses of beach goers (local residents and tourists) are outlined in terms of Willingness to Donate (WTD) framework. Findings indicate: a) more than three-quarters of respondents perceived beach nourishment as an important issue, b) local residents were more willing to volunteer towards beach nourishment, and c) tourists were more willing to donate money to work towards resolving the problem. The financial and policy implications of these findings in the context of beach nourishment are discussed.

Introduction

More than two-thirds of the Australian population resides in coastal areas (Department of Climate Change, 2009). Beaches as natural assets have undoubtedly become an integral part of Australian culture and identity (see Hartley & Green, 2006) with significant and concomitant social, economic, and environmental values. The combination of ongoing urban growth and forecasted impacts associated with the changing climate is likely to place many coastal areas across the country at risk of deterioration or degradation (Hennessy et al., 2007). The problems of coastal erosion, and consequently, beach nourishment initiatives have become a costly adaptation priority for local governments. For instance, the iconic tourism destination in Southeast Queensland – the Gold Coast region – has been struggling to cope with the erosion along 35 km of sandy shorelines. The region is one of the top five performing tourism regions in Australia that caters for more than 4 million visitors annually who spent over \$4 billion in 2010/2011 (DRET, 2012). Raybould et al. (2011) estimated the economic value of Gold Coast beaches associated with tourism as high as \$300 million per year.

In order to maintain the cultural as well as economic benefits of coastal amenities, Gold Coast beach nourishment projects have been undertaken since the mid-1970s. Since these projects mitigate storm damage and protect coastal areas as well as properties, the Gold Coast City Council (GCCC) considers beach replenishment as vital to securing the future of the regional economy (Strauss et al., 2009). It is in this context, a pilot research project was carried out in 2014 to explore the broader research question: "how do local residents and tourists perceive the problem of beach erosion and to what extent are they willing to support nourishment of Palm Beach"? This paper reports on quantitative analyses of 68 face to face survey responses of Palm Beach goers (local residents and tourists). The paper begins by setting the scene on the issue of beach erosion in Palm Beach. Following this, the contingent valuation literature with emphasis on willingness to donate is reviewed. The method and results are presented next. Finally, the paper discusses the financial and policy implications of these findings in the context of beach nourishment in Palm Beach.

Palm Beach and Erosion

Palm Beach, spanning over a 3.8 kilometres stretch of sandy beach, is a suburb located on the southern Gold Coast (Figure 1). The archaeological evidence indicates that aboriginal people inhabited the area as far as 20,000 years ago. It is also considered an old European Settlement, associated with sugar plantations dating back to 1870s (CGC, 2015a). The suburb of Palm Beach is spread over 632 hectares and supports a population of 14,000 people (ABS, 2012). It is popular with beach goers (both locals and

tourists) because of white sandy beaches and world class surfing. Raybould & Lazarow (2009) found Palm Beach was one of the most frequently visited beaches in the Gold Coast region. Palm Beach, however, is also identified as being the most vulnerable amongst all beaches in the region and is frequently eroded back to the sea wall (Strauss et al., 2011). During large and prolonged storm events, sand is removed from the beach and the inner surf bar and deposited further out to sea on the outer storm bars. A series of cyclones in 1954 and 1967 adversely affected beaches in south-east Queensland, including Palm Beach. In addition, sand is also predominantly transported northwards along the beach by longshore drift. Sand does not always return to the beach by natural processes before the next storm. As a result, there are significant beach changes with adverse impacts on coastal areas and adjacent properties (CGC, 2015b). The local council has been dredging the nearby Currumbin Creek and using the excess sand for the nourishment of Palm Beach at least once a year for the past three decades (Noriega, 2008).

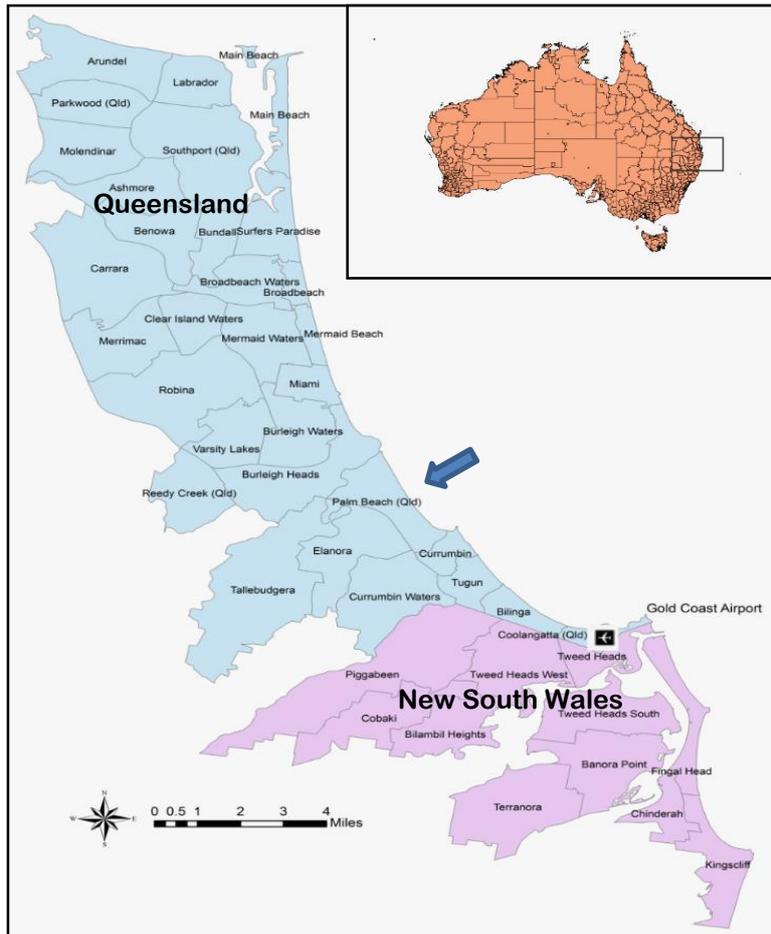


Figure 1: Location map of Palm Beach (Map Courtesy: M. N. Mahmood)

Beach Management Policies

The combination of ongoing urban growth and erosion associated with the changing climate has emerged as a major coastal policy challenge for the Gold Coast. Beach nourishment initiatives are a costly issue for the both local and state governments. Although coastal planning and management is predominantly a state government responsibility with local governments having nested responsibilities, Wescott (2006) called for more federal government involvement in the management of beaches as they are critical to the continuing environmental, economic, and social wellbeing of the nation. There are six local and state level policies, plans and strategies relevant to Palm Beach erosion and nourishment. As Table 1 indicates, there are two state level policies, one regional NRM plan, and three local government plans/strategies. For instance, the Palm Beach Shoreline Project was commenced in 2013 under the Three Point Plan for Coastal Protection (CGC, 2013a). It aims to protect and improve the Palm Beach foreshore for the benefits of locals, businesses and visitors with a price tag of nearly AUD\$ 17 million. The council had initially proposed that the state government should bear half of the nourishment cost, and yet the state government openly dismissed the proposal by suggesting beach nourishment is a local council matter and should be funded locally (Kent, 2013). Although the ramifications of this inability to

reach consensus will be discussed later, it is clear that the existing policies have neither prevented the beaches from eroding nor secured funding for the nourishment initiatives. The critical break between the strategic and policy treatments of the beach and the need for responsible coastal management seems to be problematic. We contend that inputs from additional stakeholders e.g. beach users need to be brought into the mix to develop new insights into dealing with financial aspects of beach erosion and nourishment.

Table 1: Various policies, plans and strategies related to beach erosion and nourishment

Year	Policy	Responsibility	Relevance to Palm Beach
1995	Coastal Protection and Management Act	The Government of Queensland	Refers to the scheme prepared by the Beach Protection Authority (defunct in 2003) for the Protection of all Gold Coast beaches against erosion and encroachment
2009-2031	Southeast Queensland NRM Plan	Southeast Queensland Catchments (Not-For-Profit)	Aspires to have all open coastlines (headlands, beaches and dunes) in better condition by 2031 when compared to 2006
2010	Gold Coast Shoreline Management Plan	City of Gold Coast	Recommended 77 actions including the Palm Beach Shoreline Project
2012	Queensland Coastal Plan	The Queensland Government	Palm Beach listed as one of the sites that required specific management actions
2013	Three Point Plan for Coastal Protection	City of Gold Coast and the Queensland Government (proposed on a 50/50 basis)	Palm Beach Shoreline Project listed as an activity
2013	Ocean Beaches Strategy 2013-2023	City of Gold Coast and the Queensland Government (joint stewardship)	One of the five strategies that are to be transformational for the city that aims to actively engage local stakeholders in ocean beach management including Palm Beach

The issue of nourishment is not only limited to the maintenance of coastal areas but also to balance the needs of both local residents and tourists (see Pogue & Lee, 1999). It is therefore important for government agencies responsible for managing beaches to understand the beach value from both groups of beach goers. While local residents' perceptions provide an avenue for learning about their concern for maintain quality of life and identity, tourist preferences can inform the urgency of beach nourishment. In addition, estimation of beach user's intention to contribute, either financially or in-kind, towards the maintenance or nourishment of degraded beaches allows more realistic options for financing/managing nourishment initiatives. Assessment of non-market values is particularly useful for agencies to make decisions regarding beach management and nourishment (Dixon et al., 2012). It is in this context, literature on estimation of the economic value is briefly reviewed in the next section.

Literature Review

The economic value of beach can be used to inform coastal policies and management practices. The review of earlier research on coastal management reveals that several studies have examined respondent's perceptions of beaches and associated economic value. For example, Alves et al. (2015) interviewed 756 beach goers in Spain to examine their perceptions of coastal erosion and found that although there is a great public awareness of beach erosion amongst the locals; their willingness to pay for beach management improvement was minimal. Whereas Blakemore & Williams (2008) interviewed 246 beachgoers in Turkey, the majority of the respondents being British tourists, and found that the overwhelming majority of respondents were willing to pay for beach use if that meant that the beach would be better maintained or improved. Dixon et al. (2012) compared the economic value of access to the beaches in South Carolina between locals and tourists and highlighted the utility of such aggregate information to local government agencies and coastal managers responsible for the development and implementation of long term beach nourishment programs. Economic valuation research involving the combination of both beach goers (locals and tourists) is contended to generate useful strategic insights into Palm Beach erosion and nourishment.

Economic value is defined by the economic behaviour in the context of supply and demand within the market. It is simply the amount of money individuals are willing to forgo (pay) in order to receive a good or services or the amount of money they are willing to accept in compensation for the loss of a good or services (Garrod & Willis, 1999). The idea of economic evaluation itself is concerned with the proper allocation of resources in order to improve welfare of the beaches and its users. Economic value of any goods or services is generally measured in terms of willingness to pay for the commodity less what it costs to supply. This approach complements a welfare economics concept based on socially acceptable understanding that people would not contribute towards the maintenance of beach amenities unless they know that the cost of long-term benefits is less than cost of immediate benefits. However, it is often argued that the presence of beaches alone should have an existence value regardless of whether or not they provide benefits. Hence, this paper acknowledged that economic valuation is only one of several ways to define and measure benefits associated with coastal areas, and recognizes that religious, cultural, and other locally acceptable valuation are equally valid ways to ascertain the overall value of beaches (see Barbier et al., 1997) but these are outside of the scope of this paper.

The notion of economic value can be broadly separated into categories of market (use values) and non-market (non-use values). These two values together constitute a total economic value of any natural resource such as beaches. A non-market valuation can be carried out using revealed preference methods or stated preference methods. One way to calculate revealed preference is the Travel Cost Method (TCM). The TCM assumes that the costs an individual incurs in visiting a recreational site are a measure of his or her valuation of that site. The approach involves asking visitors questions about where they have travelled from and the costs they have incurred (Haab & McConnell, 2002). However, TCM is only applicable to estimating a portion of the non-use value as it is not able to measure total economic value (Parsons, 2003). The other technique to ascertain non-use values is to rely on the stated preference methods in order to capture the value of demand for natural resources through surveys (Haab & McConnell, 2002). The Contingent Valuation Method (CVM) is a stated preference technique that directly infers economic values by asking people their maximum willingness to pay and/or willingness to accept compensation for changes in goods or services (Callan & Thomas, 2000). The term 'contingent' in CVM suggests that it is about simulating a hypothetical market for the goods in question. Although this hypothetical nature is the main criticism, a well-designed CVM studies can estimate values both use and non-use values of natural resources and have been regarded as reliable for policy assessment (Mitchell & Carson, 1989).

Contingent valuation studies seeking options to fund nourishment strategies can be useful to develop viable coastal management programs. However, questions regarding economic value in relation to beach users' willingness to donate (WTD), either money or time, towards nourishment or if they consider erosion/nourishment as government (local, state, and federal) responsibility remain unexamined in Australia. Drawing on Champ (1997), we deploy WTD as a plausible vehicle to respond to the research question.

Data Collection and Analysis

Frankfort-Nachmias and Nachmias (1996) suggest that a well-designed research necessitates the researcher to address the questions of: "What shall we observe? Whom shall we study? How will the data be collected? When will observations be made?" (p. 98). This study makes use of an exploratory research approach to collect and analyse data. Exploratory research is often useful in new areas of inquiry, where the objectives of the research are to generate some initial ideas (or 'hunches') about that phenomenon (Bhattacharjee, 2012 p. 6). This type of research involves both qualitative and quantitative techniques and has the potential to provide significant policy insights and directions into the future research. Following the approval (ECN-13-222) by the Human Research Ethics Committee at Southern Cross University, data collection and analysis were carried out between the months of February and March 2014. A face to face semi-structured survey was carried out primarily to investigate the association between socio-economic attributes of local residents and tourists and their willingness to donate per visit and volunteer on a weekly basis.

Several studies have preferred a dichotomous (yes or no) contingent valuation technique over the open ended responses (Boyle et al., 1996; Asgary, & Penfold, 2011; Dhakal, 2007), especially in valuing natural resources because respondents have no prior experiences in purchasing such goods. Furthermore, dichotomous technique is more effective in a semi-structured survey because it provides an opportunity for the interviewer to motivate respondents to make a greater effort in eliciting donation values, to control the pace and sequence of an interview and to explain any complex scenarios arising during the interview (Mitchell & Carson, 1989). The survey collected socioeconomic attributes, perceptions about beach erosion and nourishment, willingness to donate, and willingness to volunteer of the respondents. Respondents were provided with a simple hypothetical scenario of a donation box

near the beach entrance. If respondents were willing to donate, their likely contributions per visit were collected with a close ended option of \$1, \$2, \$5, \$10, \$20, and \$50. Similarly, if the respondents indicated that they were willing to volunteer (on a weekly basis) towards beach management activities e.g. plantation, dune management, volunteering time was collected as up to one hour/week, two hours/week, three hours/week, or four hours/week. A total of 68 respondents were interviewed. The survey data were processed, organised and analysed using Excel and SPSS. Tests such as cross-tabulations and non-linear regression analyses were employed in order to calculate odds ratios of WTD.

Attributes of Survey Respondents

Table 2: Attributes of survey respondents

Socio-economic Variables	Categories	Tourists	Local	Total
Gender	Male	17 (48.6%)	20 (60.6%)	37 (54.5%)
	Female	18 (51.4%)	13 (39.4%)	31 (45.5%)
	Total	35 (100%)	33 (100%)	68 (100%)
Age group	18-24	8 (22.9%)	1 (3.0%)	9 (13.2%)
	25-34	5 (14.3%)	6 (18.2%)	11 (16.2%)
	35-44	9 (25.7%)	10 (30.3%)	19 (27.9%)
	45-54	9 (25.7%)	7 (21.2%)	16 (23.5%)
	55-64	3 (8.6%)	4 (12.1%)	7 (10.3%)
	65 and up	1 (2.9%)	5 (15.2%)	6 (8.8%)
	Total	35 (100%)	33 (100%)	68 (100%)
Education	TAFE/Trade	12 (34.3%)	4 (12.1%)	16 (23.5%)
	High School	7 (20%)	5 (15.2%)	12 (17.6%)
	Bachelors	12 (34.3%)	15 (45.5%)	27 (39.7%)
	Postgrad	4 (11.4%)	9 (27.3%)	13 (19.1%)
	Total	35 (100%)	33 (100%)	68 (100%)
Income	Up to \$999/week	14 (40%)	30 (90.9%)	43 (64.7%)
	\$1000-\$1999/week	15 (42.9%)	2(6.1%)	17 (25%)
	\$2000-\$2999/week	3 (8.6%)	0 (0%)	3 (4.4%)
	\$3000/week and above	3 (8.6%)	1 (3%)	4 (5.9%)
	Total	35 (100%)	33 (100%)	68 (100%)

Of the total 68 respondents, 35 (51.5%) were tourists and 33 (49.5%) were locals and 37 (54.5%) were female and 31 (45.5%) were male. As Table 2 indicates, nearly half were between the age of 25 and 54. The majority (40%) of respondents had a bachelor degree as the highest level of education. Nearly three-fourths of local respondents (73%) had a bachelor degree or higher qualification. The Australian Bureau of Statistics (ABS) (2012) data indicate that nearly 12% of Palm Beach residents (1642 in total) had similar levels of educational qualification. Nearly two thirds (65%) of survey respondents reported of an income of up to \$999/week, and 91% of local residents were in the same income bracket. This is in line with the median personal income of Palm Beach residents being \$553/week (ABS, 2012).

Perceptions about Beach Erosion and Nourishment Cost

The survey collected perceptions of the respondents in terms of whether or not the issue of Beach erosion as well as Beach nourishment were important. Nearly 62% and 78% respondents perceived beach erosion and beach nourishment were important issues for them respectively. The survey also collected perceptions of the respondents in terms of which level of government should pay for most of the cost of beach nourishment. The majority (56%) of the respondents indicated the state government, followed by 46% the federal government and 31% at local government. There were no significant differences between the perceptions of locals and tourists.

Willingness to Volunteer and Willingness to Donate

The survey asked respondents – “if a donation box was installed near the beach, would you be willing to donate to fix the beach?” If yes, they were asked how much per the visit. The survey also asked respondents – “would you be willing to do volunteering work to fix the beach?”, and if yes, how many hours a week? Only five out of 35 (14%) tourists were willing to volunteer one or more hours a week, whereas 16 out of 33 (48.5%) locals were willing to volunteer one or more hours/week. This difference was found to be statistically significant [$\chi^2 = 9.307$, $df = 1$, $p = 0.002$]. Given that over 17% of Palm Beach residents aged between 20 and 75 reported of being actively engaged in volunteering (ABS, 2012) local respondent’s interest in volunteering is not surprising. The willingness to donate ranged from \$2 to \$20. 25 out of 35 (71%) tourists were willing to donate at least two dollars or more/visit. However, only 15 out of 33 (45.5%) locals were willing to donate two dollars or more/visit. This difference was found to be statistically significant [$\chi^2 = 4.731$, $df = 1$, $p = 0.030$].

Odds of Making a Donation

A binary logistic regression technique was used to estimate the odds ratio in order to determine the associations between dependent variable “willingness to donate” and 11 categorical independent variables: perceptions about beach erosion (3), level of governments that should pay for the nourishment (3), socio-economic variables (4), and willingness to volunteer to fix the beach. The odds ratio refers to the probability of the outcome occurring in one group compared to the outcome not occurring. Out of 68 WTD responses, one response was incomplete and removed from the analysis. The logistic regression model was able to predict 40% of variance as indicated by the Nagelkerke R^2 value.

<i>Independent Variables</i>	<i>Coeff.</i>	<i>S.E.</i>	<i>p Value</i>	<i>Wald</i>	<i>Odds ratio</i>	<i>95% CI</i>
Gender	1.567	.780	.044*	4.041	4.794	1.040, 22.098
Respondent type	2.339	.947	.013*	6.109	10.375	1.623, 66.326
State Gov. should bear most of the cost of nourishment	-2.273	.810	.005*	7.883	.103	.021, .503
Constant	.589	1.132	.603	.271	1.802	

Note: * $p \leq 0.05$, Nagelkerke $R^2 = .402$; Cox & Snell $R^2 = .299$; Omnibus Tests of Model Coefficients: $\chi^2 = 23.781$, $df = 12$, $p = 0.022$

As Table 3 depicts, three independent variables were found to have statistically significant influence on survey respondent’s WTD. First, male respondents were five times more likely to donate than female counterparts. The fact that 44% of female respondents were not WTD explains the preference of male respondents. Second, tourists were 10 times more likely to donate than locals. The fact that only 38% locals were WTD explains the preference of tourists. This finding is also consistent with the observations of Dixon et al. (2012) who found that locals were willing to pay less than tourists in order to access the beach. Third, negative coefficient associated with respondents who perceived that state government should bear most of the cost of nourishment and WTD suggests that the odds of them WTD is 9 times (1/.103) less likely. Given that 61% locals indicated the state government should bear the cost of nourishment but only 46% are WTD explains this reverse association. While the interpretation of odds-ratios is particularly challenging when the dependent and independent variables have negative association (DesJardins, 2001), the lack of social capital i.e. trusting relationship between Palm Beach residents and GCCC (Ardern, 2014) might be a factor. For instance, given that relation between local communities and local government agencies influences environmental governance (Dhakal, 2011; Dhakal 2014), Jones et al. (2015) found a positive association between social capital and WTP of locals for coastal defences in England.

Limitations and Future Research

As with any empirical analysis there are limitations to this pilot exploratory research. First, the smaller sample size of 68 respondents is the first one. Ideally, contingent valuation survey would require a sample size of 161 (Mitchell & Carson, 1989). It is expected that a large scale study will be carried out in the future. In addition, due to time and resource constraints, close ended dichotomous technique was used under the “donation box near the beach entrance scenario” for eliciting respondents’ WTD. Multiple scenarios of donation based on the severity of erosion in multiple locations across the Palm Beach shoreline could provide granulated information in future studies. Drawing on Bandara & Tisdell (2005),

the assumption that greater the beach erosion, the more beach users are willing to donate for nourishment can also be tested. Second limitation is the adoption of only stated preference techniques in the study. Adamowicz et al. (2004) contended that while valuation techniques of stated preference and revealed preference have differences but some complementarity. Future studies could explore the differences between stated preferences (WTD) and revealed preference (TCM) regarding supporting coastal management in Palm Beach. Third, although the lack of trust between residents and council is an issue, aspects of social capital were not addressed in this exploratory research. Drawing on Dhakal (2015), future investigations could explore the potential implications of government-community relations on WTD as well as WTV of local residents towards beach nourishment initiatives.

Discussion and Conclusion

In this paper, we used WTD as a contingent valuation technique to capture local and tourist's intention to make donations towards beach nourishment activities. Several studies have used WTD as an effective way to gauge people's perceptions towards the issue that they have been asked to hypothetically contribute. For example, Sakonnakon et al. (2012) examined tourists' WTD to protect an iconic cultural heritage in Thailand from risks associated with flooding and found that respondents were WTD about \$5.5 per visit. Similarly, Poria et al. (2014) examined WTD in order to restore socialist monuments in Bulgaria and found that depending upon respondent's affiliation with monuments as a part of their own heritage; they were WTD approximately between \$2 and \$3 per visit. In line with these studies, the findings reported in this paper indicate that a donation scheme, if implemented successfully, has the potential to generate funding for beach nourishment programs in Palm Beach and elsewhere. The other significant finding of this research is that most respondents perceived it was state government's responsibility to bear most of the cost of nourishment. This revelation warrants further discussion mainly because as mentioned earlier, the expenses associated with beach nourishment has been a difficult issue between the Gold Coast Council and the Government of Queensland. Notwithstanding the ecological impacts of beach nourishment activities (see Noriega, 2008), this conflict over who should bear the cost of nourishment has two broader economic and policy related ramifications.

Salient between the two is the prospect that fewer tourists will visit Palm Beach (and other eroded beaches) in the future. Consequently, the city of Gold Coast and ultimately the State of Queensland may end up with significantly less revenue from tourism with potential adverse impacts on already dwindling funding availability for beach nourishment. Although it was reported that beach erosion might not have deterred travellers from visiting the Gold Coast (Kane, 2013), the full extent of impact of erosion on tourism numbers is yet to be calculated. The policy ramification is much wider in scope in the context of the level of government ultimately responsible for managing beaches in the state of Queensland. Despite a clear policy focus on the required outcome of beach protection through beach nourishment or erosion prevention, the one institutional thread that binds the multiple policy tiers that negotiates or secures funding for the management and protection of the beach is clearly lacking. This paper contends that an institutional framework may offer a more coherent and comprehensive response to the issue of beach protection. A statutory body focused on addressing and managing coastal erosion such as the Beach Protection Authority that was dissolved in 2003 could play a vital role not only in fostering tangible engagement with various stakeholders but also in highlighting the urgent need for providing a dedicated funding stream for broader urban sustainable development in vulnerable beaches like Palm Beach.

Acknowledgements

The authors are grateful to Dr. Muhammad N. Mahmood (USQ, Toowoomba) for his inputs in research design and GIS map. We also acknowledge and thank two anonymous reviewers whose comments were most helpful.

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