

PUTTING A VALUE ON CLEANER BEACHES IN SYDNEY

SOCIO-ECONOMIC IMPACT OF THE DEEPWATER OCEAN OUTFALLS 25 YEARS ON

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ABSTRACT

In Sydney, three deepwater ocean outfalls were commissioned at North Head, Bondi and Malabar to safely dilute and disperse about 80% of Sydney's sewage effluent several kilometres offshore.

To mark the 25th year of operation, this study has assessed the wider economic and social value generated from improvements in water quality as a result of the outfalls and other wastewater management initiatives. The project assessed a number of different benefits including the value for Sydney residents, tourism and business contribution, health benefits, biodiversity benefits and contributions to Sydney's iconic brand.

The total value attributable to improved water quality for Sydney residents associated with key wastewater management initiatives including the Deepwater Ocean Outfall program is estimated to be worth around \$137 million per year. Using a 7% discount rate, this equates to a lifetime value of around \$2 billion.

INTRODUCTION

There are many reasons why people value beaches; as a place to go, people place value on their existence. Beaches are a place to swim, surf, play, relax, spend time with friends and family or simply enjoy the view.

There are also many factors which affect the likelihood of people visiting beaches and their enjoyment while at the beach, including water quality. Prior to the outfalls being commissioned, our coastal beaches were heavily polluted by cliff-face sewage discharge. Near-shore ecosystems were in decline and beaches were frequently closed due to poor receiving water

quality. Unsurprisingly, there was substantial public dissatisfaction with the state of the beaches. If water quality at the beach is poor, swimmers may become ill, biodiversity may suffer, and the beach experience may be less enjoyable overall.

As such, beaches contribute to the 'liveability' of a city. Increasingly, there is a desire for the large cities around the world to better support quality of life. The Australian Government has a renewed focus on cities, and the NSW Government is seeking to improve Sydney's liveability through initiatives such as the establishment of the Greater Sydney Commission.

Infrastructure investments play an important role in facilitating liveability; in the case of beaches, the old cliff-face outfalls at North Head, Bondi and Malabar were decommissioned and replaced with the Deepwater Ocean Outfalls 25 years ago to contribute to cleaner water at Sydney's coastal beaches.

Alongside other changes to wastewater treatment, beneficial re-use and the trade waste policy, this program has improved water quality at beaches, resulting in a range of benefits and contributions (Figure 1).





Figure 1. Malabar shoreline, currently and before changes to wastewater management, such as the Deepwater Ocean Outfall program

Sydney Water commissioned Deloitte Access Economics (2016) to consider these wider impacts. This study is not a cost-benefit analysis or assessment of the Deepwater Ocean Outfall program or other wastewater management initiatives, but rather focuses on the economic and social value generated from improvements in water quality.

METHODOLOGY

Measuring Impacts

Socio-economic impacts are challenging to measure; the benefits and contribution of beaches to the economy and society are not fully reflected in annual reports of businesses, or in the National Accounts. Indeed, many of these impacts, such as the value of a trip to the beach for an individual, or the reduced likelihood of getting sick at the beach, are partially intangible.

A range of economic modelling and other estimation techniques are used in this study to get a sense of the quantum of benefits associated with beaches, and with cleaner water at beaches. It is important to recognise that these are not precise estimates, but point to the existence of major benefits of infrastructure investments such as deepwater ocean outfalls and other wastewater management initiatives.

This study considered five potential benefits and contributions of beaches, and cleaner water, to society (Figure 2). Three of these are quantified: tourism contributions are estimated by the expenditure of people who are drawn to visit Sydney, health benefits are estimated through reduced costs of absenteeism, and the value for Sydney residents is quantified through

a new survey conducted by Deloitte Access Economics (2016) to understand people's attitudes to the beach.

Four-Stage Approach

A four-stage approach was used to develop the evidence base for this report:

1. Data and literature review: existing data and research on the importance of Sydney's beaches, and the impact of changes to water quality since the Deepwater Ocean Outfall program and other initiatives were reviewed. Key sources of information included the Environmental Monitoring Program which preceded the installation of the deepwater ocean outfalls, water quality data from the Beachwatch monitoring program, as well as additional data and research provided by NSW Health, Tourism Australia, Surf Life Saving NSW and the Sydney Coastal Councils Group as part of the consultation phase.

2. Survey: a survey of Australians and visitors to Australia was undertaken to provide additional, up-to-date primary data for the project. The survey sought to understand the importance of beaches to individuals, and more specifically, the importance of water quality for beach experience, beach existence, and the contribution of beaches and water quality to Sydney's brand. In total, 845 responses were received, with respondents separated into five cohorts.

- a. Sydney beach users – individuals living in Greater Sydney that have visited one or more of Sydney's coastal beaches during the last 12 months (n=224);
- b. Sydney beach non-users – individuals living in Greater Sydney that have not visited one or more of Sydney's coastal beaches during the last 12 months (n=178);

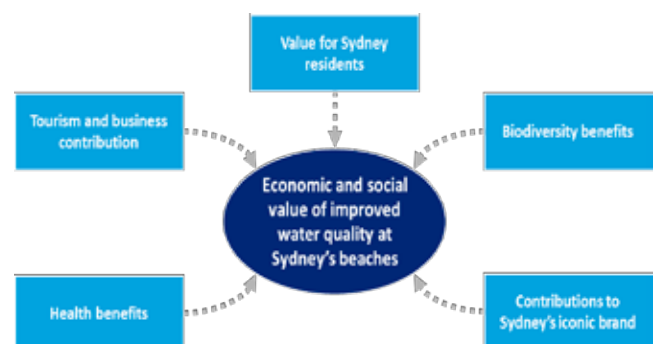


Figure 2. Socio-economic benefits explored in this study

- c. International tourists – individuals ordinarily living in either New Zealand, UK, USA or China, that have visited one or more of Sydney's coastal beaches during the last 12 months (n=217);
 - d. Interstate tourists – individuals ordinarily living outside of NSW that have visited one or more of Sydney's coastal beaches during the last 12 months (n=113); and
 - e. Intrastate tourists – individuals ordinarily living in NSW (but outside Greater Sydney) that have visited one or more of Sydney's coastal beaches during the last 12 months (n=113).
- 3. Consultations:** interviews were held with key stakeholders to provide specific insights on wastewater management activities, including the Deepwater Ocean Outfall program or the importance of water quality at Sydney's coastal beaches more generally. This included technical experts (both currently and formerly employed at Sydney Water) involved with the monitoring of the Deepwater Ocean Outfall program, as well as representatives from NSW Health, Surf Life Saving NSW, the Sydney Coastal Councils Group and Tourism Australia.
- 4. Economic analysis:** a number of economic analysis techniques were employed to quantify the economic and social value associated with improved water quality at Sydney's coastal beaches. This included high level analysis of the health benefits and value for Sydney residents, analysis of the economic contribution of tourism associated with coastal beach water quality and quantification of use and non-use values attributable to coastal water quality at Sydney's coastal beaches.

RESULTS AND DISCUSSION

Value for Sydney Residents

The analysis found the total value of beach use and access for Sydney residents is estimated at around \$1.2 billion per annum, based on estimates of an individual's value of time, with \$94 million of this attributable to beach water quality.

Based on survey responses, it is assumed that each individual in this beach user cohort attends coastal beaches in Sydney an average of eight times per year. This produces a total annual coastal beach visitation estimate for Sydney residents of 31 million visits per year.

Almost two-thirds of beach users surveyed indicated that if water quality levels at all of Sydney's coastal beaches were to fall in line with previous levels, they would reduce their visitation. Based on the survey data and current attendance levels of respondents and adjusting for differences in the deepwater ocean outfalls' impact on different coastal beaches in Sydney, this implies that visits to Sydney's coastal beaches would reduce by almost 4.9 million visits per year if there was a decline in water quality levels, similar to those before the introduction of the Deepwater Ocean Outfall program and other wastewater management activities.

It was also found that beaches were valuable even for Sydney residents who did not visit the beach. Indeed, the research found that 9 out of 10 people that have not visited a coastal beach in Sydney over the last 12 months, still value them for reasons such as their contribution to Sydney's lifestyle and their iconic value to the city. Seventy-eight per cent of non-user respondents reported that there is value for them in the maintenance of current water quality levels at Sydney's coastal beaches. Based on respondents' reported values, it is estimated that the total non-use value of coastal beaches in Sydney is around \$123 million per year, with \$43 million of this attributable to beach water quality, after accounting for the varying impacts of the Deepwater Ocean Outfall program and other wastewater management initiatives on water quality at different beaches.

Overall, the total value of Sydney's coastal beaches for Sydney residents is estimated at around \$1.3 billion per year. Using a 7% discount rate, this equates to a lifetime value for Sydney's coastal beaches of almost \$19 billion. The total value attributable to improved water quality for Sydney residents associated with key wastewater management initiatives including the Deepwater Ocean Outfall program is estimated to be worth around \$137 million per year. Using a 7% discount rate, this equates to a lifetime value of around \$2 billion.

Tourism and Business Contribution

Beaches are also one of Sydney's key attractions for domestic and international tourists (Figure 3). Almost 3.1 million international visitors to Australia made a stopover in Sydney during 2014-15 (TRA, 2015). Over two thirds (69%) of these visitors reported going to the beach at some point while they were in Australia. Visiting beaches is also a popular activity for interstate day trip and overnight visitors to Sydney, with the total number of beach visitors estimated at almost 5 million each year.

Using TRA data and survey responses on the change in tendency to visit one of Sydney's coastal beaches if there was a reduction in water quality, the economic contribution of this tourism suggests that the net value added associated with beach water quality is worth around \$332 million per year to the NSW economy through tourism, with around 80% of this value coming from international visitation. Over 3,500 full time equivalent (FTE) jobs are associated with this tourism, including direct employment of approximately 2,900 FTE jobs within tourism sectors and 600 indirect FTE jobs in supporting industries.

The beach-side business sector also receives revenue from local Sydney residents that attend beaches. The survey undertaken for this project found that 86% of surveyed beach users spent money on their most recent visit to one of Sydney's beaches, even though beach attendance itself is free. Specifically, it was reported that beach users spend \$13 on average per person per visit, including expenditure on food,

drinks, shopping, recreational activities and parking, suggesting Sydney residents spend around \$414 million per year when visiting Sydney's coastal beaches.

Health Benefits

Swimming in water contaminated with sewage, in particular with high concentrations of enterococci and faecal coliform, has been linked to a greater likelihood of gastrointestinal, respiratory, eye and ear conditions (Corbett et al. 1993). The NSW Office of Environment & Heritage (2015) notes gastroenteritis and diarrhoea as key swimming-related illnesses in waters polluted by stormwater or sewage.

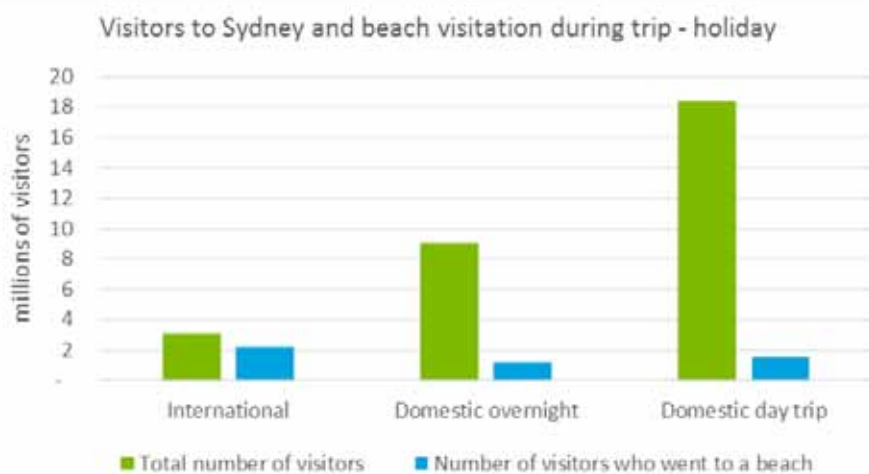
Sydney Water monitoring data suggests that faecal coliform levels at Malabar, North Head and Bondi significantly decreased after the commissioning of the deepwater ocean outfalls at these locations. Levels of faecal coliform (measured as cfu/100mL) were between 81 and 123 times lower than before the outfalls were commissioned. Similarly, Beachwatch data shows that enterococci levels have declined from an average across all recorded samples of 49.7 cfu/100mL in 1993 to 23.5 cfu/100mL in 2015. This suggests significant improvement in beach water quality, in terms of contaminants affecting human health, over time.

Assuming a similar proportion of swimmers at all coastal beaches, and noting the reduction in the incidence of illness post-outfall, it is estimated that the subsequent improvement to beach water quality from the Deepwater Ocean Outfall program and other wastewater management

initiatives may contribute to the avoidance of illness for around 180,000 beach users each year.

The health benefits to the economy are the avoided costs of absenteeism associated with these avoided episodes of illness. The cost of absenteeism is the lost days of work resulting from a period of illness - in this case, gastroenteritis or respiratory illness.

Based on the avoided cases of illness for beach users and average daily earnings, the avoided cost of absenteeism associated with cleaner water at Sydney's coastal beaches could be around \$140 million per year.



Source: TRA (2015)

Figure 3. Visitors to Sydney and beach visitation



Biodiversity Benefits

The decommissioning of the old cliff-face outfalls and subsequent replacement with the Deepwater Ocean Outfall program has significantly improved water quality in and around Sydney's shoreline and has not had any identifiable impact on the marine environment around the new offshore discharge.

While monitoring data by Sydney Water and others over the last 25 years supports this outcome, the possible broader biodiversity benefits due to the outfalls and other wastewater management initiatives alone are difficult to attribute, given the dynamic nature of ecosystems and the complexity with incorporating the economic and social value of biodiversity.

The task of estimating values for environmental and social impacts is also challenging because many of these "goods" are not exchanged through markets. Consequently, market price and demand information is not available. Instead, non-market valuation techniques can be used to estimate the preferences and the value individuals place on the preservation of biodiversity. Willingness to pay (WTP) or contingent valuation study is one such technique that could be used to quantify the socio-economic outcomes of biodiversity preservation.

The study considered previous WTP studies for Australian Households for various marine biodiversity conservation initiatives. One example from Van Bueren & Bennett (2000) estimated, on average, Australian households' WTP for the preservation of a single species to be around \$2.10 per year for 20 years. This means environmental improvements delivered by the Deepwater Ocean Outfall program that successfully preserved marine habitat could have a significant economic value to households in the form of consumers' surplus. To put this in context, in 2015, there

are some 1.8 million households in the greater Sydney area. This implies that the likely consumer surplus from preserving fish species around Sydney's wastewater outfalls could be significant.

Contribution to Sydney's Iconic Brand

Finally, Sydney's coastal beaches are a key part of Sydney's iconic or brand value. Sydney's brand is important in influencing the perceptions of the city by those internationally and interstate and can shape business and economic interactions.

When asked what survey respondents think of when they think of Sydney, overall, 8% said the most important thing they thought of was 'beaches', with this going up to 15% for international tourists. This increased when considering the 'Top 3', with 35% of respondents ranking beaches in their Top 3, alongside Sydney Harbour and the Sydney Opera House, with this going up to 44% for international tourists.

Survey respondents (41%) also indicated that clean water is one of the most important features of beaches for locals and tourists. Clean water was the top response in the survey sub-categories, namely for beach users, non-users and international tourists as well. This demonstrates how clean water is largely synonymous with the beach experience and hence is an important contributor to Sydney's brand value.

CONCLUSION

Sydney Water's purpose in doing this study was to understand the broader economic value that has been created from a large infrastructure investment.

The Deepwater Ocean Outfall program was an excellent case study to look at what additional value they have provided to the local community and the wider NSW economy.

Overall, this research indicates that significant economic and social value is attributable to the improved water quality at Sydney's coastal beaches as a result of wastewater management activities, including the Deepwater Ocean Outfall program. Sydney Water's intent is that the outcome of this study and novel approach taken can now be considered in relation to other large infrastructure projects for the water industry.

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Nicola's role as Manager of Health, Environment & Asset Science is to identify and advise the business on critical scientific trends, policy changes and technological developments in those three key areas, while delivering a research program to optimise system performance and improve health and environmental outcomes. Key achievements include delivering major projects on climate change adaptation planning for Sydney Water operations and implementing large

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Michelle Mountford – Associate Director at Deloitte Economics

Michelle has been involved in estimating economic and social impacts across a number of sectors of the Australian economy, including the value of improved water quality at Sydney's coastal beaches, the value of the Sydney Fish Market, and the value of cultural infrastructure including Questacon, the State Library of NSW and public library network, and NSW State Records.

REFERENCES

Corbett, SJ, Rubin, GL, Curry, GK, Kleinbaum, DG and Sydney Beach Users Study Advisory Group. 1993. *The health effect of swimming at Sydney beaches*, *American Journal of Public Health*, 83(12), 1701-1706.

Deloitte Access Economics. 2016. *Economic and social value of improved water quality at Sydney's coastal beaches*. Available at: <https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economic-social-value-improved-water-quality-sydneys-coastal-beaches-140716.pdf>

NSW Office of Environment & Heritage. 2015. *Swimming-related illnesses*, <http://www.environment.nsw.gov.au/beach/Swimmingillness.htm>.

Tourism Research Australia. 2015. *International Visitor Survey*.

Van Bueren, M and Bennett, J. 2000. *Estimating community values for land and water degradation impacts*, www.gbcma.vic.gov.au/downloads/sircs_review_2005_env_2/Estimating_community_values_for_land_and_water_degradation_i.pdf.

