Insurability and Sustainable Risk Management of 'Actions of the Sea' in a Changing Climate

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Coastal hazards exacerbated by sea level rise present a growing protection gap to property owners and the wider community. 'Actions of the Sea' have been a traditional exclusion from insurance policies given their inevitable nature and this present a reputational risk to the industry. Insurance issues regarding coastal inundation and erosion are explored using a case study approach, investigating extreme events impacting Sydney, Australia. A novel multidisciplinary approach combining expertise of coastal hazard assessment and engineers, insurance professionals and urban planning was applied to unravel the deep complexities of the problem. National scale recommendations are formed from the technical findings [1].

CASE STUDY APPROACH

The case study focuses on the June 2016 storm event impacting Collaroy/Narrabeen. It firstly seeks to understand the differential damage and hence risk presented by coastal inundation and erosion to property, respectively, and the relative insurability of each hazard. It then investigates the subsequent coastal management response among the key actors including the property owners, local council and state agencies, and uncovers the key issues regarding the engineering, land use planning and economic decisions. Finally, these issues are contextualized within the broader Australian coastal hazard policy space.

OVERVIEW OF THE EVENT

The June 2016 East Coast Low storm had an estimated return period of 50 to 60 years based on the observed beach erosion and inundation as a result of wave overtopping. The east coast low tracked southward along the NSW coastline from 4th to 6th June. The low had multiple low-pressure centres, with one closer to the coast producing heavy rainfall and extreme winds, and another further offshore generating large northeasterly to easterly ocean swell impacting the NSW coastline. The large northeasterly offshore waves in combination with a high-water level resulted in the highest coastal water levels and wave runup levels at Collaroy-Narrabeen since May 1974. The return period of the wave runup levels in the study area are well correlated with the observed erosion, which is also an approximate 50-year event for the study area and the most significant since May 1974. The Collaroy-Narrabeen case study site is dominated by the effects of coastal erosion and some coastal inundation as a result of wave effects. Figure 1 presents a pre-and-post storm aerial impact comparison of the coastal erosion from the event for a section of the case study area. Figure 2 presents an oblique aerial image highlighting some of the property damage and impacts from the storm.

Flood inundation of property in the study area would have been dominated by short duration, episodic flows from wave runup and overtopping of the eroded shoreline. The nature of flooding from wave runup and overtopping is significantly different to sustained inundation of property from storm surge, creeks, rivers or stormwater. It has become typical of home and contents insurance policies which include flood coverage to include flooding from storm surge, whilst excluding wave impacts. Based on the case study area, the flooding impacts on a particular property from wave dominated processes is less severe than from storm surge. In the case study area, properties with some form of coastal protection from either engineered structures or remnant structures from earlier emergency works had significantly reduced erosion impacts on their properties.

Figure 1. Nearmap images for southern section of study area: Pre-storm 06/05/2016 (left) and Ppst-storm 08/06/2016 (right).

Figure 2. UAV aerial view of beach erosion at Narrabeen-Collaroy in June 2016 (Source: UNSW WRL, 2016).

DAMAGE ASSESSMENT

A summary of the damage levels observed from site observations and high-resolution aerial images is presented in Table 1. Apart from structural risk to some properties, damage to potable water and sewer systems rendered properties inhabitable. Work was completed within 12-days of the storm to provide temporary sewer pipes to numerous

properties in the case study area [3].

Table 1. Assessment scale for property impact from actions of the sea.

Severity Category	Impact Potential	Typical Post-Storm Repairs	No. Properties
Severe	Likely some inundation of primary building. Significant erosion which exposes primary building foundations and/or causes damage to primary building.	Significant refilling of site. Repairs to landscaping and exterior structures and interior / exterior inundation damage. Structural assessment of primary building and possible structural repairs. Repair or upgrade to coastal protection structures.	16
Medium	Possible for some inundation of primary building. Erosion impacts extend into property area but do not impact on primary building.	Refilling of site. Repairs to landscaping. Possible repairs for exterior structures and interior / exterior flood damage. Repair or upgrade to coastal protection structures.	37
Boundary	Unlikely to be any inundation of primary building. Erosion impacts limited to seaward boundary or coastal protection structure.	Repair or upgrade to coastal protection structures. Minor landscaping repairs.	7

PLANNING AND ENGINEERING RESPONSE

This storm event coincided with the implementation of the NSW Coastal Management Act (2016) which provided an updated policy and planning framework for coastal management. The planning framework for the study area seeks to balance the needs of the community and the ability for property owners to protect their homes, whilst ensuring the majority cost of coastal protection is borne by the beneficiaries of the protection. This case study has shown that whilst on-the-ground coastal protection can be implemented with conditions to protect environmental and community values, the approval timeframe can be long (2-3 years) and construction of works is expensive and subject to unique legal complexities as property owners jointly fund and oversee the design and construction of protection along a number of contiguous properties.

The long-term plan to balance needs between protection of property, and community and environment values is not yet resolved. With future storms and accelerating sea level rise, additional management and engineering responses will be required in the study area. Ensuring beach amenity with future sea level rise may require long-term beach nourishment which will have considerable cost.

ECONOMIC IMPACT ASSESSMENT

The economic impact assessment highlights the damage costs from three different factors: loss of land from erosion, damage to structures from erosion and damage to structures from inundation. The economic costs over the long-term from erosion damage to structures is significant (Table 2). Whilst the damage impact from storms less than 50-year ARI return period is relatively low, the potential damage from a 100-year ARI event is significant and may require a complete re-build of a property. For the properties impacted by the event, the total AAD is in the order of $14,000 to $29,000. If insurance were available for the land area, then insurance premiums would be in excess of these values. This suggests relatively high ongoing costs and affordability issues for these properties.

Using the AAD information, the present value across the properties was estimated (Table 2), showing that the total damage ranges from around $190k to $400k in present value terms. This is around 5% to 10% of the property price relative to the typical house prices in this area.

Table 2. Annual Average Damage Ranges and Present Value of Damages to Properties.

Range	Land Repair	Inundation	Building	% Property Value
Median	$2078	$511	$15033	6.0%
Min	$1797	$511	$11347	4.6%
Max	$9320	$511	$19204	9.8%

The economic assessment of the seawall being constructed in the study area indicates that the overall economic metrics for the seawall are neutral. However, the seawall provides significant protection for the 100-year event which would be expected to cause substantial structural damage. The overall cost of protection for each property owner covered by the seawall is approximately $230,000. This is a substantial capital cost and represents 4-5% of current property values in the study area. For areas with low property values, the cost of coastal protection can become unfavourable from an economic and investment perspective as the cost of coastal protection is relatively independent of property value.

FINDINGS

This broad-ranging study had several technical findings for the insurance industry and policy recommendations. The very term ‘Actions of the Sea’ shows that nuances between different coastal hazards and their modes of damage were not well understood in the insurance industry and

professionally recommended definitions of each hazard that could form the basis of future standard policy wordings were provided.

A key outcome from the case study is that the damage and cost of repairs from erosion are significantly greater than inundation, even though wave dominated or storm surge dominated inundation of properties may occur more frequently or impact a larger number of properties. This implies that while coastal inundation can be insurable at locations where the annual risk of impact is not too high, coastal erosion is not an insurable hazard with very high annualized costs to repair and restore. However, insurability is complicated by the need to differentiate between coastal inundation and erosion damage post-event, and sea level rise would reduce insurability of inundation over time. High resolution remotely sensed data can help with this hazard differentiation. For the insurance industry to have confidence in the risk mitigation provided by coastal protection works, a certification scheme of both the works and the professionals signing off on the works is desirable.
The key issues are distilled into three themes:

1. *The scale of mitigation investment required is yet to be appreciated*: The economic analysis in the case study found a negative to marginal cost-benefit impact of mitigation investment for individual property owners. For example, recent seawall defence works at Collaroy/Narrabeen in Sydney cost an average of $230,000 per property. Property protection at this cost is unaffordable to many in less prestigious areas and community based funding will be required. Scaling this to a national context, it is estimated that Australia will require at least $30 billion (net present cost) of investment in large scale coastal protection and adaptation projects over the next 50 years.

A recommendation is made for a long-term funding mechanism to address coastal hazard risk mitigation and adaptation. Coastal management options are highly localised, so locally appropriate responses need to be funded on a regionally-based priority basis rather than a one-size-fits all approach. Both hard and soft defence options have practical limitations as sea level continues to rise. Property owners and communities need to be informed on options and details of coastal protection works that affect their properties and communities.

2. *Data and Risk Assessment:* A plan to address Australia's exposure to coastal hazards as sea level rises requires national level view of risk. Data gaps identified were for:
- National Coastal Hazard Information Database.
- National Exposure Asset Register.
- Damage curves for coastal inundation.
- Coastal Defence Register with details on the location and type of coastal protection and key design parameters.
- High Resolution Event Monitoring.

3. *Consistent and Risk Based Land Planning and Engineering Design Standards:* The case study uncovered practical limits within the current land use planning regimes and property tenure arrangements for long-term protection from sea level rise. Adaptive management and planned retreat from the coastal hazard zone may be the best option for community over the long term. Coastal hazards and sea level rise should be managed by government rather than individual property owners, so that outcomes are in the best interests of the wider local community over a long period of time. These approaches need to be accommodated in planning controls and land tenure and funded from sustainable schemes at the state or federal level.

The public report of this study [4] was successful in advocating for $50 million in coastal mitigation funding from the Australian federal government. This success underlines the impact of combining coastal engineering insights with the insurance industry's understanding of risk and lays down a roadmap for combined government/industry leadership on coastal hazards as sea level rises.

REFERENCES
[1] Baird (2021). Actions of the Sea Data and Knowledge Development: Summary Report. Prepared for Insurance Council of Australia. October 2021.
[2] Department of Justice NSW (2016). State Recovery Co-ordinator Report: June 2016 East Coast Low.
[3] NSW Coastal Management Act (2016)
[4] ICA. 2021. Climate Change Impact Series: Actions of the Sea and Future Risks. October 2021