HOW LONG WILL COASTAL DEVELOPMENT BE COMPATIBLE WITH COASTAL HAZARDS?

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Central Coast Council has adopted its Coastal Zone Management Plan (CZMP) for all of Gosford's beaches. One mandated requirement of the CZMP is to address property risk and response categories for all properties in the coastal zone of the open coast and Broken Bay beaches. The updated CZMP has created an opportunity to think creatively in determining future DCP provisions to retain development potential. Council has revisited concepts and established rules relating to development footprints, engineered design, cantilevering and setbacks from the street-side property boundary to improve development potential and enable ongoing development in the short to medium-term.

For planning purposes, a Coastal Building Line has been developed for each beach. These lines have been defined based on the assessed degree of coastal risk as well as established rules relating to building setback from Crown Land. Use of a single building line provides a considered and reasonable balance between a range of factors which have typically not been considered in a holistic fashion under Council Development Control Plans, and supersedes past approaches which use Coastal Hazard Lines as the sole determinant of building setbacks.

Despite some areas being exposed to a high degree of coastal hazard as demonstrated by the 2016 East Coast Low, the Building Line coupled with a flexible approach to use of available lot area allows most beachfront lots in the LGA to retain development potential appropriate to the degree of coastal hazard risk. Consultation with urban design professionals has been carried out to confirm the feasibility of this approach.

This paper presents the approach being applied via a revised DCP to allow beachfront owners to maximise the potential of their land while ensuring that development remains appropriate to the degree of coastal hazard risk.

Background

Historically, coastal processes have threatened sections of the central coast. The damaging storms in the study area have generally been preceded by sequences of storms, often not particularly severe storms in isolation. The key storms to affect the area occurred in May-June 1974, May-June 1978, September 1985, August 1986, September 1995, May 1997, June-July 2007 and June 2016.

In May-June 1974 many houses were threatened with one damaged at Wamberal Beach. In June 1978 beach and dune erosion, attributed to an intense rip cell, undermined and destroyed two houses at Wamberal beachfront. Damage to public assets and recreational amenity has also been experienced for many other beaches in the Gosford area. The Central Coast can be expected to again be exposed to such storms at irregular intervals in the future.

Council takes its responsibilities seriously and, in recognition of the threats to built assets and the impact on the recreational amenity, has displayed a strong tradition of planning for natural hazards. In June 1984 Council established a Coastal Committee to consider coastal risk and management strategies.

Coastal engineering advice was then sought in respect of coastal erosion at Wamberal Beach and Avoca Beach in 1985 and council introduced its first coastal policy, one which included the requirement for identified properties to be constructed on piled foundations, in 1990.

In 1993, Council commissioned a coastal process investigation for all the open coast beaches, while similar investigations were completed for Broken Bay beaches in 1998. Coastline hazard lines were first defined by these studies and adopted as planning controls for development.

Coastal Management Plans developed in 1995 (open coast) and 1999 (Broken Bay) further progressed coastal planning across the former Gosford LGA and allowed the establishment of controls in the existing DCP Chapter.

Council has sought to bring together experts, planners and the community to deal with the complex issues faced in addressing coastal processes. However, these issues are not certain, nor does planning ensure perfect outcomes.

Over the past 5 years council has undertaken a review, update and amalgamation of the previous Coastal Management Plans. The Gosford Beaches Coastal Zone Management Plan (CZMP) was adopted by council on 8 December 2015 to improve management of our coastal risks, while also guiding opportunities for development. The Draft CZMP was then forwarded to the NSW Minster for Planning for certification.

Today, an improved understanding of coastal risks has enabled Council to identify contemporary coastal hazards and prepare appropriate management responses, including development controls.

Risk assessment - Coastal Processes and Hazard Definition Study

Coastal environments are dynamic, so it is important that coastal risk assessments are reviewed over time. Council engaged Worley Parsons to examine and assess the coastal processes and hazards that impact the coastline between Patonga and Forresters Beach.

This risk assessment was the second iteration undertaken across the Gosford beaches and followed an extended period whereby established risk profiles and development controls were widely accepted.

The assessment included consideration of all hazards as required under the NSW coastal management framework, along with consideration of risk to life and property posed by coastal hazards.

Risks were assessed under current and future conditions, and included the natural processes that occur on the beaches. The coastal risk assessment was initially undertaken based on the state-wide Sea Level Rise projections and during a time certain media outlets and lobby groups were critical of the blanket approach applying across the state.

The level of risk assigned to the coastal hazard assessment is a 100 year ARI event, equivalent to the erosion that could happen under a storm event that has approximately a 1% chance of occurring in any one year. It is noted that there is a 40% chance that the severity of such a storm will be exceeded within the next 50 years.

A line was defined for the Zone of Slope Adjustment, being the portion of the dune that would slump following removal of sand by wave erosion, as well as the Zone of Reduced Foundation Capacity for building foundations as per Nielsen et al (1992). This

zone takes into account the reduced factor of safety for stability of the dune adjacent to the storm erosion escarpment. In general (without the construction of a protective structure), dwellings/structures not piled and located within the Zone of Reduced Foundation Capacity would be considered to have an inadequate factor of safety against slip failure. The determination of foundation capacity had not been previously undertaken across the Gosford beaches.

Council endorsed the Open Coast and Broken Bay Beaches Coastal Processes and Hazard Definition Study (CPHDS) report on Tuesday 25 March, 2014. A snapshot of the findings, including a comparison to the previous assessments, is provided in Tables 1 and 2.

Table 1: Coastal risk assessment for private property on Broken Bay beaches

Beach	Old 2097	Inundation	2014 zSA	2014 zRFC	2050 zSA	2050 zRFC	2100 zSA	2100 zRFC
Patonga	**10 (1)**	49 (42)	0	0	0	0	**0**	0
Pearl	**37 (33)**	38 (36)	37 (1)	38 (28)	38 (1)	44 (37)	**41 (16)**	51 (42)
O/Umina	**4 (4)**	2 (1)	2 (1)	3 (1)	2 (1)	3 (1)	**2 (1)**	3 (1)
Killcare	**16 (0)**	38 (0)	22 (0)	26 (0)	27 (0)	32 (0)	**31 (0)**	36 (1)
Total	**67 (38)**	127 (79)	61 (2)	67 (29)	67 (2)	79 (38)	**74 (17)**	90 (44)

Key: Land parcels (private dwellings)
zSA – Zone of Slope Adjustment
zRFC – Zone of Reduced Foundation Capacity

The revised coastal hazard assessment for Broken Bay beaches, when compared with the previous assessment undertaken in 1998, identified an increased risk of erosion to 7 land parcels at 2100. However it also identified a decreased risk to 21 dwellings affected by recession (2100 horizon). This can be attributed to new development having been subject to hazard lines, setbacks and associated controls in the DCP.

Table 2: Coastal risk assessment for private property on open coast beaches

Beach	Old 2045	Inundation	2014 zSA	2014 zRFC	2050 zSA	2050 zRFC	2100 zSA	2100 zRFC
MacMasters	**29 (13)**	2 (0)	13 (1)	33 (19)	**22 (9)**	64 (33)	63 (35)	85 (57)
Avoca Sth	**24 (10)**	73 (56)	11 (0)	27 (7)	**34 (17)**	37 (27)	45 (35)	47 (36)
Avoca Nth	**35 (17)**	26 (25)	27 (6)	44 (36)	**44 (37)**	45 (42)	49 (40)	67 (55)
Terrigal	**1 (1)**	0	0	0	**0**	0	0	1 (1)
Wamberal	**71 (46)**	82 (72)	61 (37)	75 (66)	**76 (67)**	87 (68)	87 (71)	126 (102)

Key: Land parcels (private dwellings)
zSA – Zone of Slope Adjustment
zRFC – Zone of Reduced Foundation Capacity

In comparing coastal hazard assessments for the open coast beaches in 1994 and 2014, a significant increase of erosion risk was predicted. An additional 16 land parcels and 43 dwellings were identified as being affected at the 2050 planning horizon. The nature of coastal hazards and measured recession of beaches on the open coast contributed to this result.

The hazard lines represented the possible extent of erosion, given that large rips can form in a storm and increase the volume of sand taken from the beach in the location directly landward of where the rip forms. Further, the lines do not take into account geotechnical conditions at any particular location and assume the absence of bedrock or buried protective material.

The coastal hazard lines were developed in line with widely accepted coastal engineering methodologies and NSW Government requirements. They provided a theoretical line to assist in guiding the development of appropriate management

options to deal with defined risk. It was also recognised that the hazard information, while providing the basis for the consideration of risk, was not the only driving factor in determining appropriate development going forward.

Application of new risk information

Having received updated risk information, Council had a duty of care to consider this information in relevant decision-making processes which occurred once the study had been endorsed by Council in March 2014.

As Council had information that may affect a buyer's decision to purchase a property, it could be considered negligent if it withheld this information. In good faith and fairness, Council made the information publicly available via its web site and on relevant s149(5) planning certificates. This also ensured consistency with current NSW Government direction.

A review of the relevant DCP Chapter was then required to ensure it reflected the updated risk information. This could only be fully undertaken following the development of the Coastal Zone Management Plan and once management solutions have been recommended.

Observations of existing Gosford Development Control Plan

In considering the updated coastal risk information, some key observations were made about the applicability of the relevant chapter within the existing DCP.

A different planning horizon had been adopted for the open coast and Broken Bay beaches, as they are each based on the previous and location specific coastal risk assessment information undertaken separately in the 1990's. The addition of new risk information resulted in a myriad of lines and confusion in their application (see Figure 1). Of particular note was the ongoing reference to the 'immediate' hazard line which had, in some cases, been defined 20 years previously.

Figure 1 – Example of hazard information available to Council and community

There was no practical nor strategic reason why the planning horizon should be different and it should ideally be adopted based on the level of risk determined at each

beach, which is a function of the intensity of existing development in each area, the quantum of development at risk within the coastal hazard zones and community acceptance.

The Gosford DCP 2013 also identified:

- that buildings or building structures will not be permitted to be constructed on, over or below the land which has been identified by the Coastal Management Plan for Gosford City Open Coast Beaches as subject to designated coastal hazards (exceptions at Wamberal).
- that deep pile foundations be used to reduce the risk of structural damage to coastal development. These foundations are essential in reducing risk to structures from erosion (in the absence of protection or an ability to retreat).
- provisions to ensure that risk to new development due to coastal inundation were minimised.
- differences between major and minor development which created some confusion in development assessment.
- prior to the issue of a Construction Certificate, the registered proprietor was required to execute a positive covenant in favour of Council (pursuant to Section 88E(3) of the Conveyancing Act 1919) whereby the registered proprietor carry out and maintain works to minimise any threat to the dwelling by the effects of the sea. This requirement extended to minor and ancillary developments which should be reviewed as it places an additional (and possibly unnecessary) cost on proponents.

Review of the CZMP created an opportunity to think creatively in determining future DCP provisions, to retain development potential whilst not placing property at increased risk. The review involved Council revisiting concepts and established rules relating to development footprints, engineered design, cantilevering and setbacks from property boundaries as means of enabling ongoing development in the short to medium-term whilst minimising risk posed by coastal hazards.

Council considered the appropriateness of applying flexible approaches to building design in high risk areas whereby it was able to:

- think creatively in determining future DCP provisions
- change thinking from applying development controls or “enablers”
- permit development commensurate to the risk; and
- be confident it does not create further legacy implications for future generations

The streamlining of current and future coastal assessment processes would require the planning horizon in the DCP to be revised. It was decided that the timeframe to be adopted would reflect the economic life of structures and the degree of flexibility able to be reasonably applied when considering risk posed by coastal hazards. For example, the Australian Tax Office allows the entire construction cost of a residential rental property to be deducted over a period of up to 40 years. From this, it can be inferred that the economic life of a dwelling is 40 years. Based on this, the 2050 planning horizon was considered an appropriate planning horizon to adopt for new residential developments.

Under the Draft CZMP, it was proposed to uphold the general basis of the existing DCP in stipulating that development in coastal hazard areas, where allowable, should be founded on deep pile foundations that are landward of a proposed coastal building line.

However, the required setback for dwelling development from the seaward property boundary was considered on a beach by beach basis in a manner which took into account the following:

- the level of coastal risk at each location
- existing intensity of development, asset classes and life at each location
- social fabric of each district and needs/aspirations of the community
- maintenance or enhancement of public access, beach amenity and dune ecology along the foreshore; and
- established enforceable setbacks for single and multi-dwelling properties.

Basis under which the coastal building lines have been developed

Coastal building lines were developed as a means of simplifying the development assessment process and applying an acceptable level of risk. They attempted to provide a considered and reasonable balance within a range of factors including:

- Coastal hazards are expected to increase over time on most beaches due to the projected impacts of climate change
- Potential for subsurface or foundation structures to increase hazards on neighbouring properties (which may not be piled)
- Public safety and access issues on all lands
- Beach amenity, landscape character & view sharing considerations
- Provision of access and services to properties
- Geotechnical qualities; and
- Challenges in property remediation following an erosion event.

In considering the factors outlined above it was considered reasonable for the coastal building lines to be defined based on whichever of the following was the most landward in position:

- 2050 Zone of Slope Adjustment (adjusted to incorporate Council's latest sea level rise projections);
- General allowable setback from the seaward cadastral boundary for beachfront property being 6m for single level dwellings and 10m for multi-level structures; and/or
- Existing building lines (i.e. Umina and Pearl Beaches which were landward of the 2050 zSA)

An exception to this approach has been applied to Patonga where an existing/historic building line exists seaward of the general 6/10m setback described above. As these properties are not assessed as being impacted by coastal hazards to 2100 the existing building line will be retained.

Incorporating Councils latest sea level rise projections into hazard/building lines

The coastline hazard lines defined by the 2014 coastal risk assessment had been defined on the NSW State Government Sea Level Rise Policy Statement (2009) and associated benchmarks. The retraction of the NSW benchmarks created challenges for planning and Council elected to review its sea level rise projections.

On 10 March 2015 Council considered a report and resolved to adopt revised sea level rise planning levels as identified in Table 3 below.

Table 3 – Local sea level rise projection (rates projected from current/2015 levels)

Year	Medium local sea level rise projection based on RCP8.5 measured in metres (m)
2015	0.00
2030	0.07
2050	0.20
2070	0.39
2100	0.74

**Note: To obtain the absolute projected sea level elevation relative to AHD, a further 0.08m would need to be added to these values*

Council's adoption of localised sea level rise projections meant that the hazard zones shifted seaward at most beaches, by the distances indicated in Table 4. These distances inform the locations of the hazard zones and building lines under which the development requirements prescribed for the update of the DCP.

Table 4 – Seaward movement of coastal hazard zones at each beach due to Council's sea level rise benchmarks (adopted 10 March 2015).

Beach	Seaward adjustment of hazard line (m)	
	2050	2100
Patonga	1.4	1.0
Pearl	2.0	1.4
Ocean-Umina	0	0
Putty	3.5	2.5
MacMasters- Copacabana	5.5	3.9
Avoca	7.0	5.0
Terrigal- Wamberal	6.0	4.3
Forresters	0.6	0.4

Special Considerations

Exhibition of the draft Coastal Management Study for public comment highlighted community concern that the coastal management planning process intended to sterilise land for development. This perception was fuelled by assumption that hazard information was the single driver in enabling orderly development of our coastline.
This perception was further fuelled by misinformed media coverage and the support of lobby groups.

Communities in locations severely affected by coastal hazards (i.e. North Avoca and Wamberal) clearly highlighted their desire for continued development of lands in high risk areas though the application of engineered solutions such as piling and cantilevering.

At some of the beachfront lots within coastal hazard areas the provisions of the revised DCP would limit development potential within the lot. To improve development potential in the lots severely impacted by coastal hazards, exceptions were allowed.

The introduction of specific location-based exceptions into the DCP was proposed. Flexibility would also be applied to various design and development parameters. This would enable ongoing development in the most severely affected lots in the short to medium-term. In doing so, Council had to be confident it does not create further legacy implications for future generations and due consideration is given to surrounding sites.

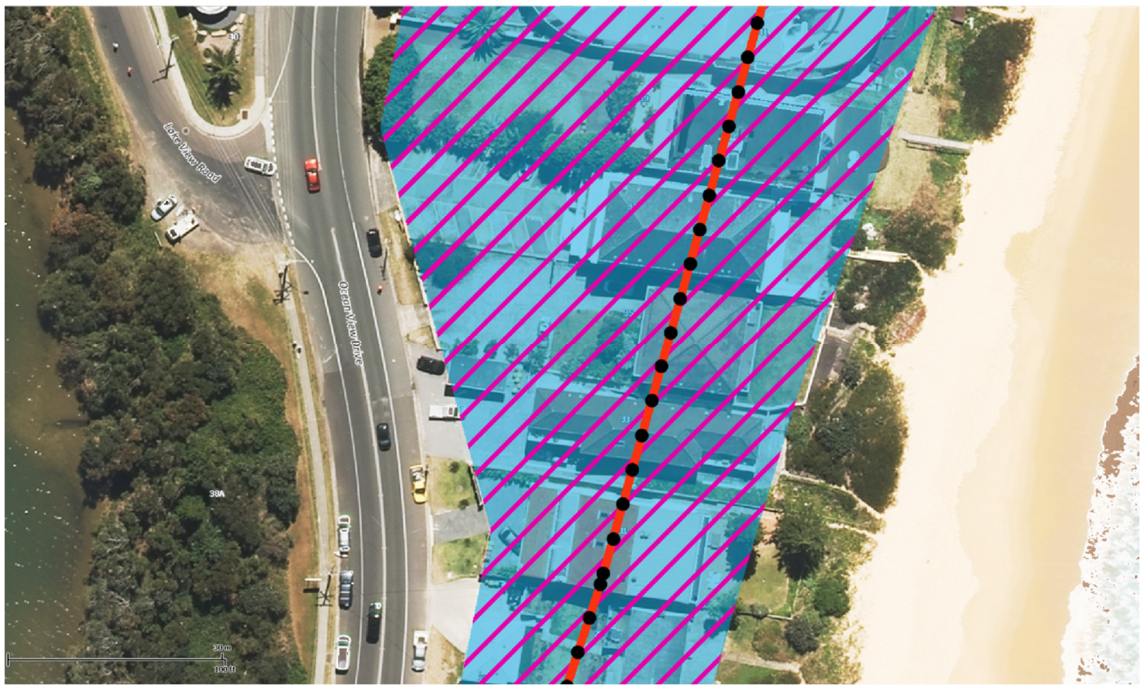

Figure 2 – Example of revised DCP mapping including coastal building line (with 'XY' coordinates, lots where piling is required and lots affected by present day inundation)

One challenge for Council was the disparity and inconsistent size of land parcels across coastal frontage properties.

Data commissioned from the Australian Bureau of Statistics showed that the average floor area of new homes (houses and apartments) stood at 207.6m^2 in the nine months in 2012-13. The average floor area of new free-standing houses stood at 241.1m^2 (ABS, 2013). The average floor area for beachfront dwellings was considered by Council to be larger than this and, for design purposes, a 300 m^2 was used as the desired floor area to be achieved.

Council then, with consideration of sound structural engineering and practical architectural design, were able to determine a minimum developable area to accommodate a dwelling on the most severely affected land parcels in coastal frontage areas. This information then allowed Council to define 'severely impacted land parcels' within its DCP.

Parcels considered to be severely impacted were defined as those where the developable area landward of the coastal building line (excluding setbacks) is **less than 250m^2**.

The DCP requires landowners to provide a surveyors certificate to support any development application to claim eligibility for the application of setback relaxations as identified in Table 5.

Table 5: Sliding scale for application of relaxed setbacks on severely impacted land parcels

Area behind CBL	Road setback (Ground floor)	Road setback (1st floor)	Side setbacks	
			Single level	Multi-level
<150m^2	0m	0m	1 x 0.9m	0.9m / 0.9m
150-175m^2	0m	1.5m	1 x 0.9m	0.9m / 0.9m
175-200m^2	0m	3.0m	0.9m / 0.9m	0.9m / 1.25m
200-225m^2	3.0m	4.5m	0.9m / 0.9m	0.9m / 1.25m
225-250m^2	4.5m	6.0m	0.9m / 0.9m	1.25m / 1.25m

Where the coastal building line is not perpendicular to the side property boundary of the proposed development, the beachfront foundation alignment may be adjusted provided that the alignment does not move seaward (on average) from the position of the mapped coastal building line.

Amendments in the revised DCP Chapter 6.2 Coastal Frontage

The revised DCP Chapter introduced the following key changes:

- A single coastal building line to be referenced in development assessments instead of multiple hazard lines
- An adjustment to the coastline hazard areas to incorporate Council's updated sea level rise benchmark
- Consistency in the planning timeframes across all beaches for the current day, 2050 and 2100
- Special considerations for those properties identified as 'severely affected' by coastal hazards to enable continued development to occur in a safe manner.

Other key amendments proposed to be applied under the revised DCP for coastal development are:

- Cantilevering and other engineered designs are permissible provided certain conditions are satisfied
- To streamline the planning proposal assessments process, the definition of the 'major investment' and 'minor Investment' have been removed and no longer apply
- All new development is to be constructed on deep pile foundations landward of a single coastal building line
- Ancillary structures may be permitted forward of the coastal building line where the applicant demonstrates they will not increase the risk to property and life
- The maintenance provision will continue to apply for existing dwellings
- Beachfront foundation alignment may be adjusted provided that foundations do not move seaward (on average) from the position of the mapped coastal building line
- Flexibility is encouraged including movable structures that may be relocated
- Existing buildings that have been constructed on piles will be allowed to be renovated when certified as being safe
- Geotechnical conditions may influence the ability of properties to be constructed further seaward of the coastal building line if it is proven safe to do so and only under certain conditions.
- Discretion will be applied in the requirement for proponents to facilitate the registration 'positive covenant', 'restriction on use' and/or indemnity.

Consultation with stakeholders

The revised DCP was developed parallel with the coastal planning process with considerable feedback provided by property owners and community through the exhibition of the Draft Coastal Management Study (January-February 2015) and CZMP (August-October 2015) documents.

While the reassessment of coastal risks and change in planning horizons were the predominant factor driving the need for a review, the challenges in development assessment for both assessors and proponents also significantly contributed to the review process.

Council also undertook specific targeted workshopping and consultation with local planning consultants, coastal engineers and architectural firms who are familiar with Gosford's coastal development issues and have experience in planning and design of new development across the Gosford area. The stakeholders were fully supportive of the flexible approaches proposed.

Council's Catchments and Coast Sub-committee, which includes beachfront property owners from all beaches, met numerous times during the planning process. This Sub-committee acted as a litmus test prior to wider engagement and were valuable in assisting Council to formulate management options and discuss submissions received during exhibition. In October 2015, the sub-committee discussed the key elements of the revised DCP Chapter and indicated its full support for the flexible and simplified approach being proposed.

A number of internal meetings were also held amongst management and key staff to discuss and agree on the direction for DCP review. Additionally, staff rigorously considered and tested the chosen approach against actual development applications and across severely impacted land parcels.

On 22 March 2016 council adopted a revised Chapter 6.2 Coastal Frontage of Gosford's Development Control Plan (DCP) 2013. This new chapter came into effect on 15 April 2016.

Closing remarks

The new chapter provides a balanced approach which considers a range of factors and maintains what is considered to be an acceptable level of risk. The revised chapter incorporates flexibility so that development potential on coastal fronting properties is maintained, while also planning responsibly for future coastal risk, including sea level rise.

While coastal hazard lines are an important tool for Councils to assess the degree of hazard applicable to each lot in a beach precinct, they should not be regarded as the sole determinant for development assessment of beachfront lots, as this has in the past been a source of anxiety for some in the community. Traditional coastal hazard lines are simply a tool to help define the level of risk, from which to derive development controls for each lot.

The Coastal Building Line represents a simplified approach, which takes into account aspects in addition to hazard such as public safety and access issues on all lands, beach amenity, landscape character & view sharing considerations as well as provision of access and services to properties. The current DCP chapter represents an innovative approach to coastal planning, whereby a smooth building line has been adopted for each urban precinct, representing a balance between the level of coastal risk and the full range of factors that should be considered when allowing development in an area. The approach has been shown to be successful for the Gosford LGA, as it has been developed in collaboration with urban design experts, affected stakeholders and community representatives.

However, the level of risk predicted for many beaches means that this approach is not sustainable in the medium to long term. Where there are coastal areas subject to high risk, the approach allows development to occur safely in these areas over a typical

dwelling lifespan, while long term solutions are developed and implemented. The current DCP Chapter may provide the last opportunity for property owners to develop should predictions for sea level rise be realised.

The current suite of coastal reform does not appear to have provided the guidance so needed by coastal practitioners and communities. Sustainable, long term solutions to coastal hazards will require significant private and public investment, community education and a paradigm shift in societal attitudes toward coastal hazards, which has yet to be realised. However, the approach presented in this paper will allow coastal communities to realise the value of their seaside location in the interim until appropriate long term solutions are able to be implemented.

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