CoreLogic

Coastal Risk Scores for Financial Risk Assessment

Australia
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About CoreLogic

CoreLogic is a leading property information, analytics and services provider in the United States, Australia and New Zealand. CoreLogic helps clients identify and manage growth opportunities, improve performance and mitigate risk, by providing clients with innovative, technology-based services and access to rich data and analytics.

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Introduction

In the next three decades it's expected that coastal risk will crystallise, with the tangible effects of climate change already being felt in most parts of Australia. This is leading to direct physical and financial consequences. Coastal risk has far-reaching implications for the country's property market and its supporting financial sector, including property valuations, bank loan viability and insurance premiums.

In August 2021, the United Nations Intergovernmental Panel on Climate Change (IPCC) released its latest report, the Sixth Assessment Report (AR6).

Here's what the IPCC had to say[1]:

01 It is unequivocal that human influence has warmed the atmosphere, ocean and land.

02 Human-induced climate change is affecting many weather and climate extremes such as heatwaves, heavy precipitation, droughts and tropical cyclones.

03 The impact of the change appears to be faster and more pronounced than previously anticipated.

While the implications are numerous and diverse, the report drew special attention to Australia's circumstances as an island nation:

"Relative sea level rose at a rate higher than the global average in recent decades; sandy shorelines have retreated in many locations; relative sea level rise is projected to continue in the 21st century and beyond, contributing to increased coastal flooding and shoreline retreat along sandy coasts throughout Australasia."

– AR6 Working Group I – The Physical Science Basis

Since the release of the IPCC report, Australia's peak insurance body has responded with its own findings and implications. The Insurance Council of Australia (ICA) released a report on the impact of the Actions of the Sea and Future Risks[2] in October 2021, stating that:

"Climate change is driving rising sea levels and exacerbating coastal hazards known as 'Actions of the Sea' such as coastal inundation, erosion, and recession."

The ICA recommended

"building a national picture of coastal hazard risks and how to address it".

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[1] IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. In Press. See reference link IPCC_AR6_WGI_Citation.pdf.

[2] The Insurance Council of Australia. Actions of the Sea and Future Risks. page 3,October 2021, accessed 23 February 2022: https://insurancecouncil.com.au/wp-content/uploads/2021/11/2021Oct_Actions-of-the-sea_Final.pdf

Research methodology:
defining coastal risk scoring

Storm surges

During storms, sea water is pushed onshore by strong winds and surges above normal high tide levels, and potentially far inland, ultimately dramatically eroding the seashore.

CoreLogic's risk model examines waterfront properties that are at risk of being subject to extensive damage based on their distance to shoreline and their elevation. A matrix of elevation and distance establishes the risk ranking from Very High (lowest elevation closest to shore) to Low (higher elevation and remote from shore).

Long-term erosion

Regular tidal activity can steadily erode the coastline over time. At CoreLogic, we extracted data provided by Geoscience Australia of the shoreline movements captured by satellite imagery from 1988 to 2021, measuring the change in distance for each and every property.[3]

We then created an algorithm that calculates the coastal retreat rate for each property over time. This helps identify the time remaining before a property is likely "to fall into the water" because of future erosion, assuming a constant retreat rate. We established a ranking with Very High corresponding to a retreat rate in less than 30 years.

Rising sea levels

The mean global sea level has risen 30cm between 1900 and 2017 – a rate of 0.26cm per year. However, this rate is being accelerated by climate change, with sea levels predicted to rise between 1m and 2.5m by the end of the century. Our dataset takes into account the previous 30 year trend of rising sea levels.

Our Coastal Risk Score: a combination of storm surge and erosion potential

Our methodology combines the two coastal risk types – storm surge and gradual erosion – and translates this risk in a practical scoring system: Low Risk, Medium Risk, High Risk and Very High Risk.

Below shows the risks associated with each band:

Very High Risk

Risk of gradual coastal erosion reaching dwelling within 30 years and/or very high risk of significant storm surge impact.

High Risk

Risk of gradual coastal erosion reaching dwelling within 60 years and/or high risk of significant storm surge impact.

Medium Risk

Risk of gradual coastal erosion reaching dwelling within 120 years and/or medium risk of significant storm surge impact.

Low Risk

Risk of gradual coastal erosion reaching dwelling within 240 years and/or low risk of significant storm surge impact.

No Risk

Gradual coastal erosion likely to reach dwelling in more than 240 years OR no rate of retreat (stable coastline) and distance from coast and/or elevation above maximum expected storm surge height.

How we identify at-risk properties

As CoreLogic continues to capture transactional data on property listings and sales, we're measuring the potential impact of climate change on specific locations over time – and the flow-on effects for housing demand and values.

Drawing on 40 years of hazard data from multiple sources, and using advanced location analytics, we've calculated and assigned a coastal risk rating for (where possible) all residential Australian property from our database, along a corridor of 800m from the coast. Subject to available data, the coastal risk is based on storm surges, erosion and rising sea levels.

As we have seen, our risk-score methodology evaluates combined coastal risks based on the following compounding mechanisms: storm surge (rapid erosion) and change in coastline (slow erosion). The latter is derived from a 30-year dataset, and also implicitly considers on-going rising sea level trends.

Quantifying Australia's Coastal Risk

The Australian population is unevenly distributed, with 46% – almost half of all Australians – living within 10km of the coastline. At a more granular level, one in 10 residential dwellings (houses, units and farms) are located within 1km of the coastline, corresponding to more than $1 trillion of residential property wealth. These figures are broken down by state and territory in Table 1. The distribution of wealth has accelerated significantly in the past five years, with growth rates increasing 100% or more in some local government areas (LGAs).

1 km coastline	No. properties	% of dwellings	Billion $ valuation (2021)	% of res. wealth
NSW	309,956	10%	$ 423.2	12%
VIC	187,643	7%	$ 228.3	10%
QLD	311,148	14%	$ 218.4	16%
WA	122,952	11%	$ 83	13%
SA	85,931	11%	$ 48.5	12%
TAS	53,069	22%	$ 30.9	25%
NT	16,494	9%	$ 8	21%
Australia	**1,087,193**	**10%**	**$ 1,040.5**	**12%**

Table 1: Number of properties and associated residential wealth (houses, units/flats and farms) within 1km of the coastline by state and territory.

Australia's property wealth is principally distributed on the eastern and south-eastern seaboard. A significant concentration of residential property wealth is located in the country's premium coastal, river and harbourfront locations.

In Queensland these areas encompass the Sunshine Coast, Brisbane and the Gold Coast. In NSW these markets can be found on the Central Coast, in Newcastle, Greater Sydney and south to Wollongong in the Illawarra. The Victorian Southern Coast and Adelaide Metropolitan Coast are also prime coastal regions in the country's southern states.

Property value relative to the coastal shores

While coastal risk concerns a relatively narrow distance from the coast, it is an area where a lot of residential wealth and high-density living are concentrated. Spectacular views and limited supply attract a premium for Australia's best coastal properties. In the past two years there has been a broad demographic shift where more Australians are prepared to consider housing options outside of the capital cities.

Working from home has been a catalyst of this trend with more people basing themselves in regional locations during the pandemic. This shift to working remotely and subsequent increase in demand for regional property has caused the value of coastal properties to accelerate significantly in the past year.

Queensland's Gold Coast and Sunshine Coast benefited enormously from this trend, recording annual median value increases of 33.0% and 34.4% respectively in the 12 months to January 2022.

Similarly, the Kiama LGA, a blue-ribbon coastal hamlet south of Sydney, recorded the highest growth of any council region in Australia, with property values up 41.6% in the 12 months to the end of January.

Columns 3 and 5 in Table 1 on previous page indicate that property value wealth is greater along the coast relative to the rest of the dwellings in each state.

As a sandy, flat coastline, the Gold Coast offers plenty of opportunity for dwellings to be close to the coast, where being on an elevated position might bias comparative price with distance from the coastline. Mermaid Beach, a prestigious beachside suburb on the Gold Coast, is a prime example of this: its consistent sandy structure allows for a uniformed density of buildings, with somewhat similar architecture.

Figure 1 below shows the relation between distance to beach and property value, with property values skyrocketing closer to the beach. This trend is not exclusive to Mermaid Beach, but common throughout the Gold Coast and the Sunshine Coast. We find this trend reinforced on Sydney's Northern Beaches and Eastern Suburbs, and also with the beachfront houses in Melbourne's south-east, stretching from Mentone to Bonbeach.
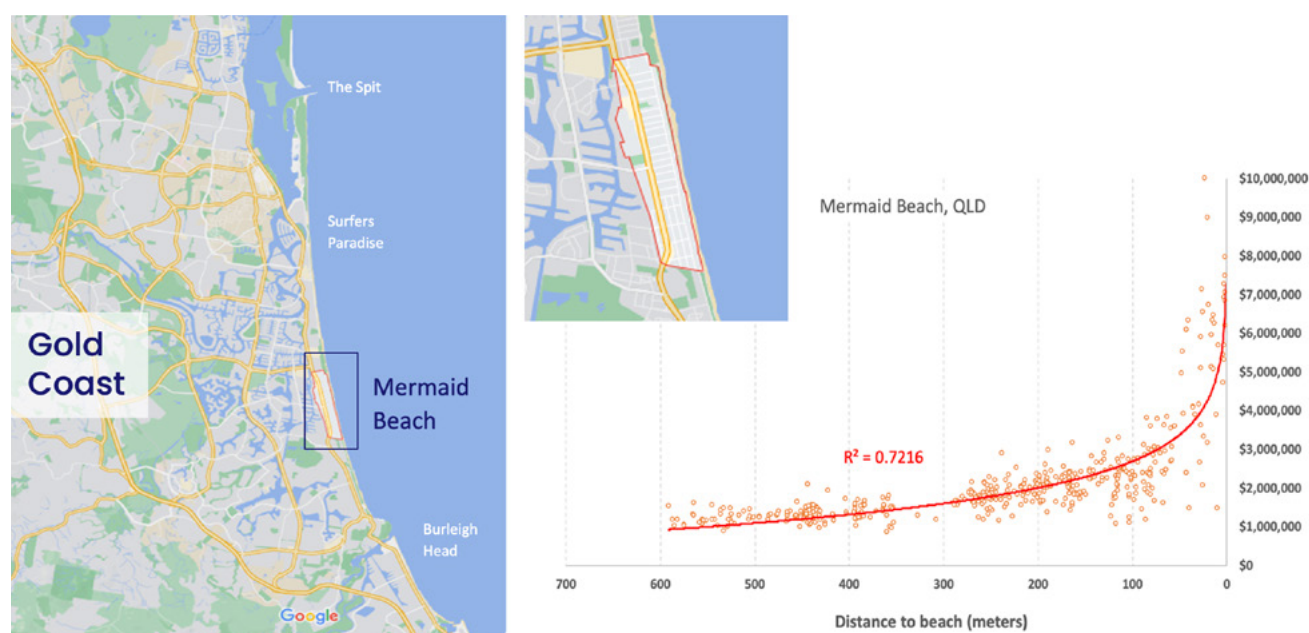

Figure 1: As illustrated by Mermaid Beach on the Gold Coast, the price of properties is highly correlated with its proximity to the sea (sample based on three-bedroom dwellings only).

Identifying storm surge risk

CoreLogic has established a Storm Surge Risk Rating by incorporating distance to coastline with elevation contours, identifying a residential property's susceptibility to storm surge inundation.

In Figure 2, we illustrate how the Storm Surge Risk Rating model identifies locations and categorises properties. The diagram shows how we're able to identify risk at a granular property level by using the Narrabeen/Collaroy coastline on Sydney's Northern Beaches and Wamberal/North Avoca on the Central Coast as examples.

Both areas have experienced significant and multiple storm surge events in the recent years, resulting in sudden, storm-induced erosion of beachfront property.
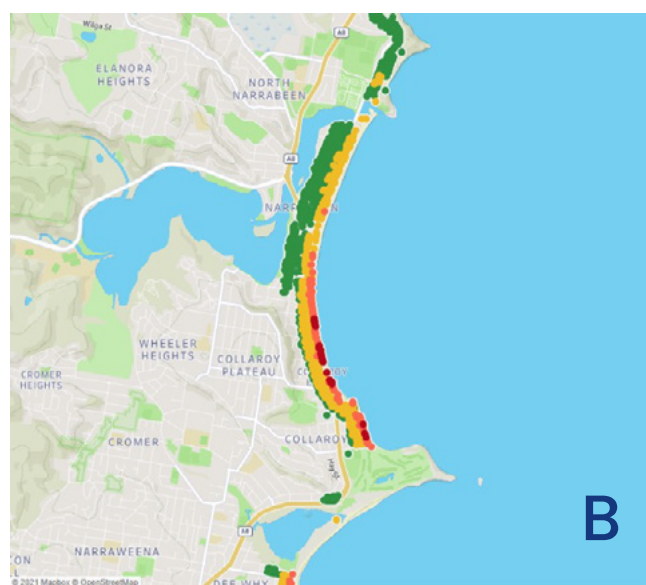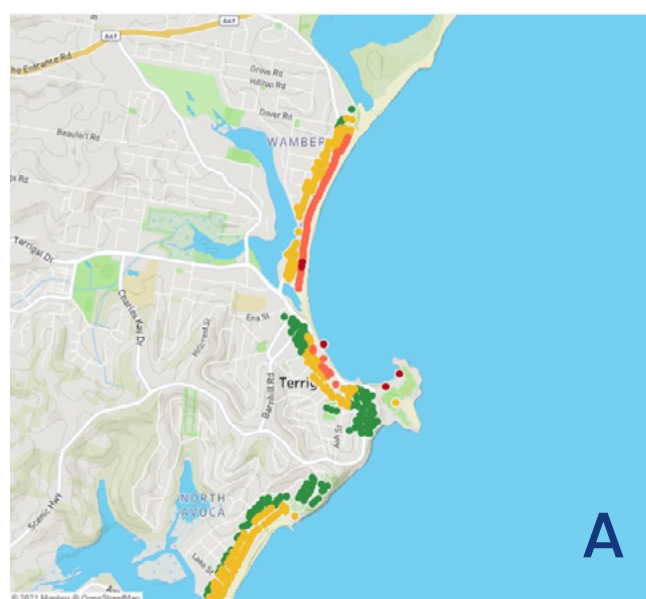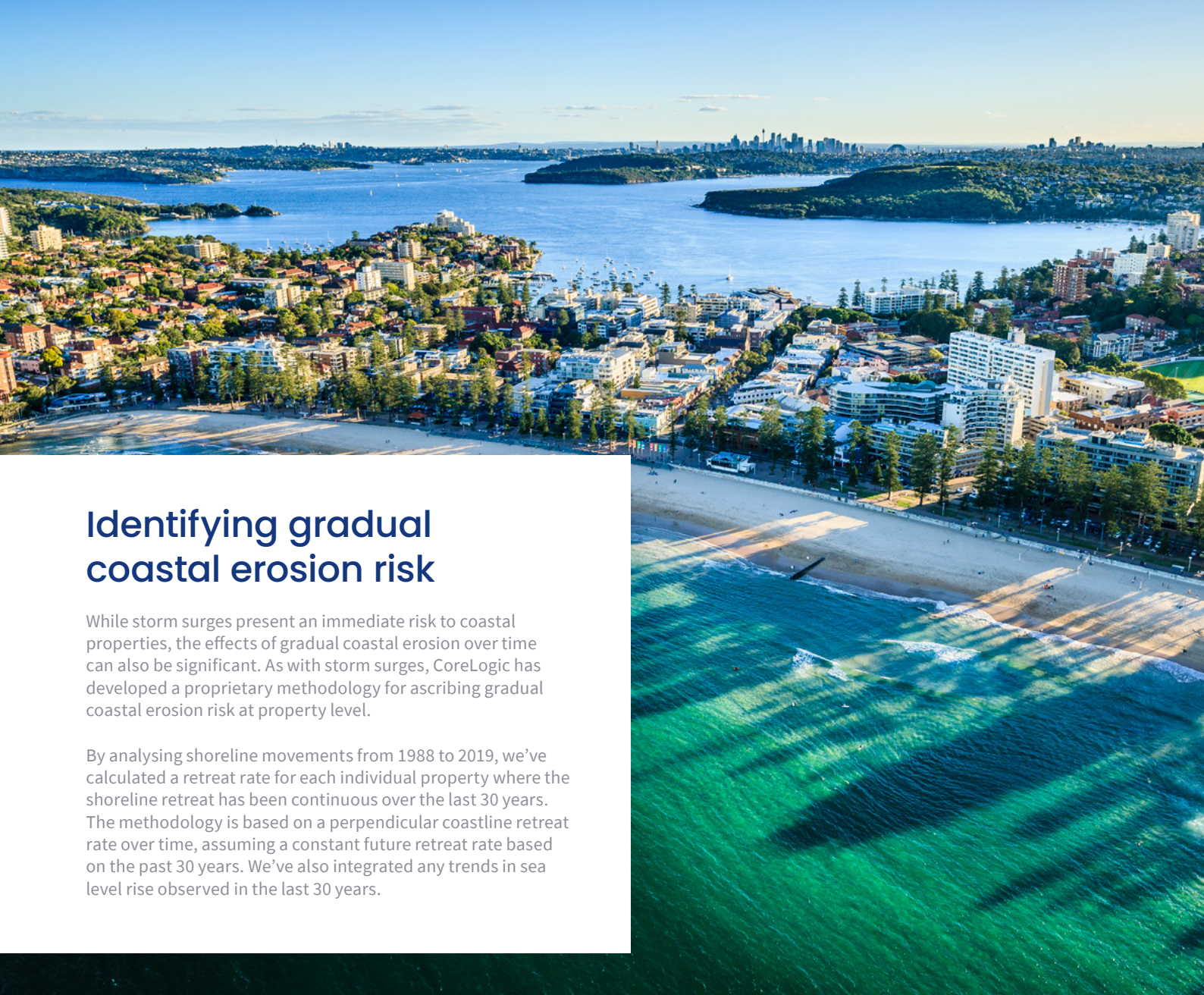

Very High ●
High ●
Medium ●
Low ●

Figure 2: CoreLogic Storm Surge Risk Rating derived for A Wamberal and North Avoca and B for properties in Narrabeen and Collaroy. All properties within 200m of the coastline were evaluated.

Identifying gradual coastal erosion risk

While storm surges present an immediate risk to coastal properties, the effects of gradual coastal erosion over time can also be significant. As with storm surges, CoreLogic has developed a proprietary methodology for ascribing gradual coastal erosion risk at property level.

By analysing shoreline movements from 1988 to 2019, we've calculated a retreat rate for each individual property where the shoreline retreat has been continuous over the last 30 years. The methodology is based on a perpendicular coastline retreat rate over time, assuming a constant future retreat rate based on the past 30 years. We've also integrated any trends in sea level rise observed in the last 30 years.
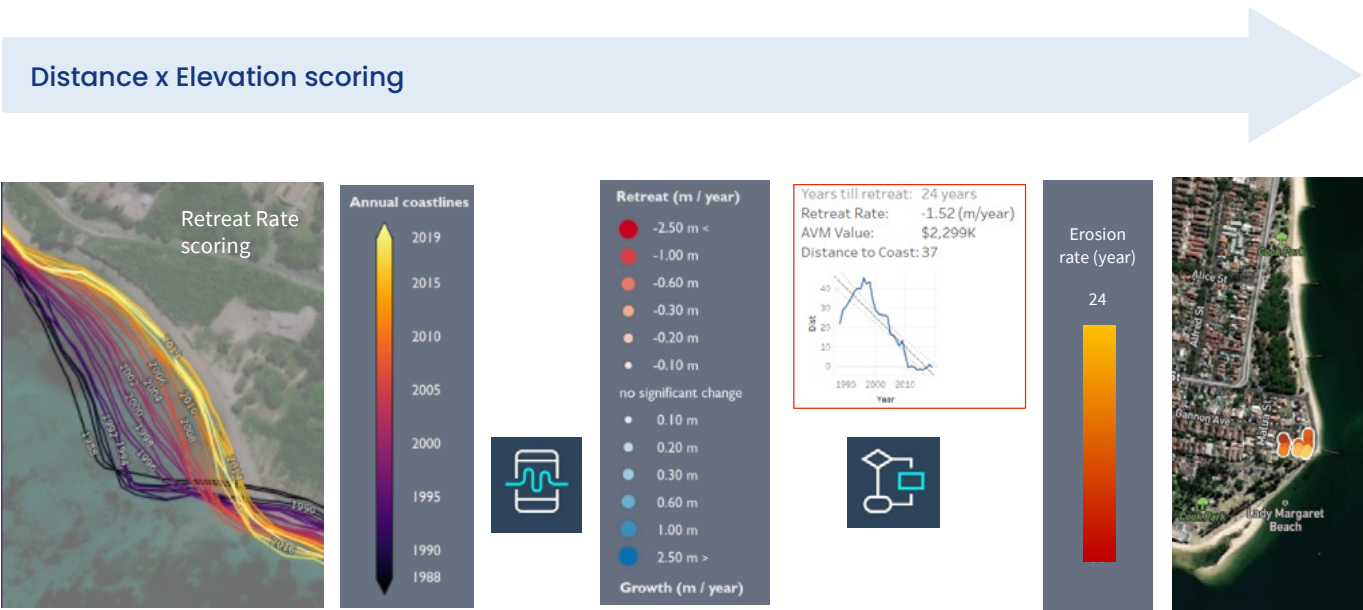
Distance x Elevation scoring

Figure 3: How we determine the coastal erosion score.

Table 2 ranks The top 20 Australian suburbs with the highest retreat rates.

Suburb (LGA)	State	Avg. coastal distance (m)	Avg. retreat rate (metre/year)
East Mackay (Mackay Regional)	QLD	424	7.72
Kinka Beach (Livingstone)	QLD	358	7.25
Queenscliff (Queenscliffe)	VIC	139	6.43
Portland (Glenelg)	VIC	274	5.64
Broadwater (Busselton)	WA	247	5.01
Deepwater (Gladstone Regional)	QLD	248	4.89
Port Wakefield (Wakefield)	SA	165	4.64
Amity (Redland)	QLD	87	4.60
Fisherman Bay (Barunga West)	SA	14	4.32
Tomahawk (Dorset)	TAS	222	4.27
Baroota (Mount Remarkable)	SA	193	4.13
Cungulla (Townsville City)	QLD	170	3.99
Little Swanport (Glamorgan-Spring Bay)	TAS	126	3.87
Inverloch (Bass Coast)	VIC	162	3.62
Airdmillan (Burdekin)	QLD	45	3.58
Exmouth (Exmouth)	WA	169	3.43
North Batemans Bay (Eurobodalla)	NSW	129	3.42
Jarvisfield (Burdekin)	QLD	68	3.38
Craignish (Fraser Coast Regional)	QLD	180	3.22
Semaphore South (Port Adelaide Enfield)	SA	165	3.2

Table 2: The 20 highest retreat rates (in metres per year) around Australia.

CoreLogic's Coastal Risk Score:
a composite model

Finally, by integrating all types of coastal risk, CoreLogic has created a composite risk score. While the individual scores provide valuable nuance, a single metric can be integrated into finance risk ratings – such as an insurance premium rating, portfolio valuations or a bank's loan origination process.

Our methodology combines the two coastal risk types – storm surge and gradual erosion. From these risk types we created a coastal risk scoring system: from No Risk, Low Risk, Medium Risk, High Risk through to Very High Risk. For instance, dwellings categorised as 'Very High' risk may be impacted by coastal retreat within the next 30 years, and may also be at very high risk of significant storm surge impact.

Overall in Australia, CoreLogic estimates $5.3 billion worth of properties are subject to Very High coastal risk, and another $19.5 billion are at High risk (see Table 3 below).

Coastal Risk Score	No. detached dwellings	No. apartment dwellings	Residential value ($ billion AUD)
Very High	2,187	2,062	$5.3
High	10,507	7,379	$19.6
Medium	55,178	54,494	$109.0
Low	468,421	304,173	$718.6
Total	**536,293**	**368,108**	**$852.6**

Table 3: Number of properties and equivalent Value at Risk (VaR) exposed to coastal risk.

Suburbs most at risk around Australia

CoreLogic has established a list of all suburbs most at risk of coastal erosion by state/territory, property value and number of dwellings. We have evaluated the number of dwellings that are subject to potential financial devastation from coastal risk, counting individual dwellings to illustrate those at Very High and High risk, distinguishing between detached residential houses (individual dwellings) and units in each state or territory.
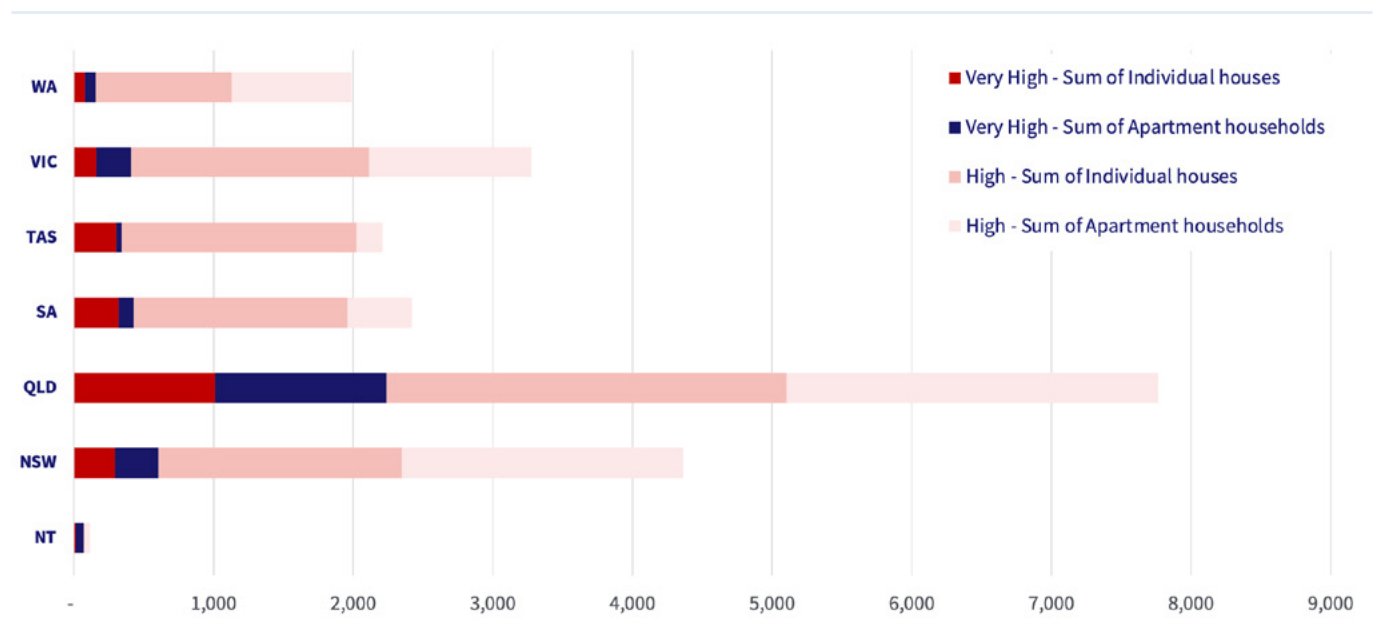

Figure 4: Number of residential dwellings with significant coastal risk (Very High and High risk) by state/territory.

At a national level, our analysis indicates that Queensland has the highest concentration of properties at 'Very High' risk for both number of individual houses and units, owing to the Sunshine and Gold Coast's densely populated coastline.

However, NSW, Tasmania and South Australia also have a large number of individual houses classified as being at 'Very High' risk of coastal damage.

In capturing the Value at Risk (VaR), we've estimated the top 10 suburbs around Australia with the most value at risk. Table 4 below shows the estimated number and type of dwellings alongside the total estimated property Value at Risk.
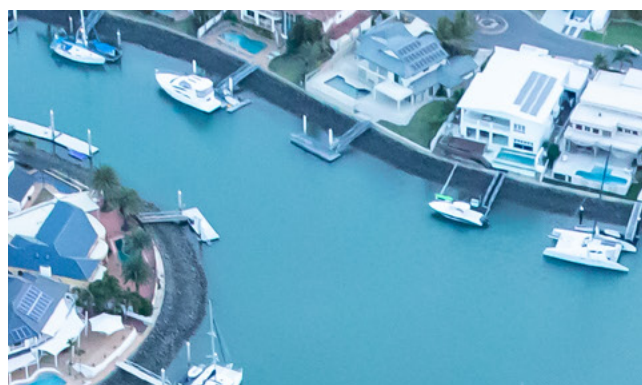
Suburb (LGA)	State	No. of dwellings	Apartment dwellings	Property Value at Risk (VaR)
Paradise Point (Gold Coast City)	QLD	406	43	$ 1,466.9 M
Cronulla (Sutherland)	NSW	8	254	$ 486.4 M
Port Melbourne (Port Phillip)	VIC	29	202	$ 483.8 M
Manly (Northern Beaches)	NSW	21	109	$ 462.1 M
Aspendale (Kingston)	VIC	112	136	$ 455.3 M
Runaway Bay (Gold Coast City)	QLD	136	219	$ 424.1 M
Brighton (Bayside)	VIC	50	43	$ 415.4 M
Caloundra (Sunshine Coast Regional)	QLD	20	523	$ 380.5 M
Collaroy (Northern Beaches)	NSW	34	74	$ 375.9 M
Golden Beach (Sunshine Coast Regional)	QLD	100	294	$ 340.6 M

Table 4: Top 10 suburbs by number of buildings estimated to be exposed to CoreLogic's Very High and High Risk coastal index.

The common traits of the top 10 suburbs are their close proximity to the coast, low elevation, fastest coastal retreat figures and high property values.

Paradise Point, a coastal suburb of the Gold Coast's northern end, is a luxury boating mecca with manmade canals and gated communities such as Ephraim Island and Sovereign Island, where property values grew 50% over the five years to January 2022.

Paradise Point has the highest concentration of detached houses most vulnerable. As a consequence of their high retail value, estimated at $1.4 trillion within 6.4km^2, no other suburb has such a high concentration of residential wealth subject to high coastal risk. About 20% of the suburb is at high risk, equivalent to 40% of the suburb's total residential value.

Cronulla, Manly (Sydney, NSW) and Port Melbourne (VIC) also rank highly due to the high residential apartment value and density of apartment dwellings within close proximity to the coastline.

Table 5 Top five suburbs by state or territory with the highest estimated total property value at risk.

State	Suburb (LGA)	# Individual houses	# Apartment buildings	# Apartment dwellings	Sum Value at Risk ($ million)	5-year median price growth at end of Jan 2022
QLD	Paradise Point (Gold Coast City)	406	18	43	$1,467m	50.0%
QLD	Runaway Bay (Gold Coast City)	136	43	219	$424m	47.8%
QLD	Caloundra (Sunshine Coast Regional)	20	41	523	$381m	66.8%
QLD	Golden Beach (Sunshine Coast Regional)	100	38	294	$341m	58.8%
QLD	Noosa Heads (Noosa)	0	7	84	$291m	93.5%
NSW	Cronulla (Sutherland)	8	26	254	$486m	12.5%
NSW	Manly (Northern Beaches)	21	10	109	$462m	33.1%
NSW	Collaroy (Northern Beaches)	34	6	74	$376m	42.1%
NSW	Ettalong Beach (Central Coast)	74	33	171	$277m	47.9%
NSW	Wamberal (Central Coast)	52	11	51	$260m	44.4%
VIC	Port Melbourne (Port Phillip)	29	6	202	$484m	20.4%
VIC	Aspendale (Kingston)	112	38	136	$455m	26.3%
VIC	Brighton (Bayside)	50	9	43	$415m	17.6%
VIC	Middle Park (Port Phillip)	32	16	135	$324m	11.7%
VIC	Williamstown (Hobsons Bay)	54	15	72	$219m	19.7%
WA	Mindarie (Wanneroo)	76	14	136	$201m	11.8%
WA	Dunsborough (Busselton)	61	4	17	$135m	28.6%
WA	Bunbury (Bunbury)	14	17	245	$132m	15.2%
WA	West Busselton (Busselton)	105	2	2	$108m	14.2%
WA	Broadwater (Busselton)	93	5	109	$92m	10.8%
SA	Glenelg North (Holdfast Bay)	48	17	147	$200m	33.2%
SA	Port Lincoln (Port Lincoln)	131	58	108	$119m	N/A
SA	Somerton Park (Holdfast Bay)	40	13	26	$114m	37.6%
SA	Encounter Bay (Victor Harbor)	75	13	25	$91m	37.7%
SA	Glenelg South (Holdfast Bay)	22	17	49	$85m	33.5%
TAS	Sandy Bay (Hobart)	73	21	66	$223m	54.3%
TAS	Lauderdale (Clarence)	182	2	2	$153m	77.4%
TAS	Opossum Bay (Clarence)	84	0	0	$70m	N/A
TAS	Kingston Beach (Kingborough)	34	10	37	$58m	71.0%
TAS	Howrah (Clarence)	43	7	23	$52m	73.3%

Table 5: Top five suburbs with estimated residential wealth at 'Very High' and 'High' coastal risk, by state.

Unsurprisingly, Queensland's vast coastal hotspots, and significant rise in median values in the past five years, puts it at the top of Australia's most vulnerable states for coastal damage. Several of its most popular residential and holiday suburbs, including Paradise Point and Runaway Bay on the Gold Coast, the Sunshine Coast's Caloundra, Golden Beach and holiday units on Noosa Heads' Main Beach feature in the top 10 list of suburbs (Table 4).

For NSW, the suburbs of Cronulla, Manly and Collaroy in Sydney, but also Ettalong and Wamberal on the Central Coast, have been identified as being at High Risk. High coastal risk alongside increasing asset value will continue to put pressure on the financial sector.

This is not an isolated phenomenon: we can observe the increased wealth at risk across all the states as Table 5 shows. Associating property value and growth for every individual coastal dwelling is of great assistance for the finance sector in understanding the impact of a loan or a possible devaluation through time. It also helps understand insurance affordability and assists planning for long-term wealth preservation.

Conclusion

Identifying coastal risk has never been more urgent than today. According to the latest IPCC report[4] released in August 2021, sea level rise, combined with potentially more extreme climate episodes such as cyclones or storms, will only increase coastal risk in Australia.

Coastal properties are more at risk than ever. Australia's attraction to its coastal areas and waterfront properties is well established. This has led to significant property development along stretches of shoreline and around popular coastal towns in the last 30 years. At the same time, property values have risen significantly with a correlated increase in value closer to the shore, resulting in more wealth at risk from the compounding environmental hazards.

Understanding the coastal risk associated with those properties is important to every owner, potential buyer and ultimately the banking and finance sector that is supporting the expansion of new coastal properties in number and in value.

Consequently, credit risk and long-term loans are directly impacted by these natural trends. Equally, for any financial institution, it is important to evaluate the potential downturn in property values or the concentration of wealth at risk.

Increasing coastal risk is also adding pressure on insurance rates. Property owners face increasing insurance premiums and restricted insurance coverage, together diminishing their insurance affordability and protection of their significant assets.

For more information, please visit CoreLogic's Climate Risk Solutions webpage. https://www.corelogic.com.au/products/climate-risk-solution

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[4] IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. In Press. See reference link IPCC_AR6_WGI_Citation.pdf.

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