Going Under:
The imperative to act in Australia's high flood risk suburbs

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Climate Valuation

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About Climate Valuation
- part of The Climate Risk Group

Climate change has shifted the risk landscape for communities around the world. The past few years have borne witness to a sharp increase in catastrophic climate events - from raging wildfires to extreme flooding. For the general public, the first step to responding to the challenges of climate change is understanding the specific risks that their physical assets face and investing in adaptation measures to reduce or mitigate this risk.

Climate Valuation was established in 2016 to help homeowners and homebuyers quantify and manage the physical and financial risks of climate change to residential property. Our analysis harnesses the Climate Risk Engines, leveraging the most advanced extreme weather and climate projections available to deliver location and asset specific insights to users around the world.

Climate Valuation is part of The Climate Risk Group – a group of companies committed to quantifying and communicating the costs of climate change. Climate Valuation's sister company, XDI (Cross Dependency Initiative), works with the international finance sector, governments and companies, providing cutting edge analysis to help make informed decisions. XDI is the world's largest provider of physical climate risk analysis to banks.

Together, XDI and Climate Valuation hope to set business and communities on a pathway from risk to resilience.

Our mission is to influence decision makers – large and small – towards action that prevents catastrophic climate change.

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Local governments have inherited communities in locations that modern technology and climate science now suggest could become unliveable.

The challenge therefore is not to find fault, but to find solutions.

Dr Karl Mallon
Co Founder,
The Climate Risk Group
(Climate Valuation, XDI)

About this report

Going Under:
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risk suburbs

This report looks at the risk of damage from riverine flooding to residential homes across Australia by 2030. It analyses 14,739,901 individual addresses, and 14,995 suburbs under RCP 8.5 scenario.

The primary purpose of this report is to identify those suburbs where the majority of homes are highly vulnerable to becoming uninsurable because of climate exacerbated riverine flooding risk, and to provide an overview of the number of individual homes considered high risk throughout the country.

The second purpose is to make clear that residents, banks, insurers and governments are all likely to lose out if these risks go on unchecked, and that a collaborative approach will be required to move communities and economies from risk to resilience.

Foreword

Climate threats to a viable property market in Australia

In 2009, our report From Risk to Advantage - General Insurers as Key Agents for Climate Change Adaptation warned the finance sector that increasing climate change extreme weather could result in insurers withdrawing their cover.

Ten years later, we issued a new report, Climate Change Risk to Australia's Built Environment – A Second Pass National Assessment stating, "with this information now at hand, it's incumbent upon decision makers in business and government … to instigate the plans and actions to build social, economic, infrastructure and environmental resilience."

Soon after, in 2022, the Climate Council's report "Uninsurable Nation" used our data to identify the Local Government Areas across Australia considered most at risk of becoming uninsurable.

Sadly, these warnings have largely gone unheeded.

Today, the contagion of insurance withdrawal from at-risk locations around the world has already begun, (FT: The uninsurable world: What climate change is costing homeowners) spurred by a combination of precision analytics and a growing acknowledgement that climate change is driving losses from unprecedented extreme weather events. This loss of insurance has far reaching consequences for banks, business, communities and government.

In this report, we identify the Australian suburbs our analysis indicates are most likely to suffer unaffordable insurance costs or mass insurance withdrawal. Either of these outcomes we refer to as 'uninsurable'.

This report contains data, numbers, and hones in on statistics relating to the increased risk of damage from riverine flooding across Australia. But the story it tells is about individuals and communities. It raises the spectre that flooding exacerbated by climate change could result in communities in Australian suburbs being left without access to affordable insurance and/ or mortgage lending - services critical to a functioning property market.

But it is not too late if we act now. Solutions are available and in this report we discuss the policy responses stakeholders in the Australian property market need to take to ensure homeowners are removed from physical and financial harm.

We hope that these stark and very specific findings will provoke the kind of national policy response and co operation between communities, business and government required to move these communities from risk to resilience.

Dr Karl Mallon

Co-Founder, The Climate Risk Group
(XDI, Climate Valuation)

Key Findings

Riverine flooding risk analysis Australia-wide

- This analysis looks at risk of damage from riverine flooding to residential homes across Australia in 2030 under RCP 8.5 scenario.

- It analyses over 14,739,901 individual addresses, and 14,995 suburbs.

- The analysis focuses on homes identified as High Risk Properties (HRP) by 2030 - properties where insurance may become unaffordable or withdrawn completely.

- When looking at trends via suburb (as opposed to individual properties), only suburbs with 1000 or more High Risk Properties are included. Some suburbs dominated by high-rise apartments are also excluded.

- **Red Zone Suburbs** are suburbs where 50-80% of residential properties are at high risk of becoming uninsurable. With investment in adaptation these zones could still be viable.

- **Black Zone Suburbs** are suburbs where over 80% of residential properties are at high risk of becoming uninsurable. In these zones, property buy-back and community relocation will have to be considered.

- It is important to note that every house is different. This is a general analysis that does not take into account the specifics of individual houses. Home owners concerned about their home's vulnerability to climate change hazards should visit Climate Valuation where they can enter information unique to their property (build year, floor height above ground etc) to understand their risk.

High Risk Properties (HRP) – by country and by state

- By 2030, over 3 million Australian homes **(21%)** have exposure to some level of riverine flooding.

- By 2030, **588,857** Australian homes are considered to be High Risk Properties: they carry a high risk of flood cover becoming prohibitively expensive or withdrawn, i.e risk becoming uninsurable.

- NSW is by far the most impacted state, with **206,622** individual homes identified as being at high risk of becoming uninsurable by 2030. This compares with 382,235 homes in all other states put together.

- Queensland is the most impacted after NSW, with **154,263** properties at high risk of becoming uninsurable 2030.

State	Properties analysed	HRP#	HRP%
Victoria	3,837,629	132,102	3.4%
Queensland	3,054,615	154,263	5.1%
New South Wales	4,548,492	206,622	4.5%
South Australia	1,111,373	39,826	3.6%
Western Australia	1,491,242	40,332	2.7%
Tasmania	345,197	7,879	2.3%
Australian Capital Territory	237,973	3,723	1.6%
Northern Territory	109,588	4,110	3.8%
Other Territories	3,792	0	0.0%
Nationwide	**14,739,901**	**588,857**	**4.0%**

Australian suburbs with highest flood risk: Red Zones and Black Zones

Charleville

Dalby

St George

Cunnamulla

Goondiwindi

Tweed Heads, Tweed Heads West

Tweed Heads South
Chinderah

Lismore, South Lismore

Bourke

Walgett

Ballina, West Ballina

Yamba

Coonamble

Nyngan

Grafton

Cannington
South Yunderup

Wickham

Carrington

Port Adelaide

Mulwala

Shepparton

Wangaratta

Kialla

This part of the analysis looks only at suburbs with 1000 or more High Risk Properties (HRP). Some suburbs dominated by high rise dwellings are also excluded. Other suburbs may carry high risk but property numbers are too small and so have been excluded from this report.

⚫ Black Zone Suburbs

Suburbs where more than **80%** of homes are at high risk of becoming uninsurable for riverine flood damage.

🔴 Red Zone Suburbs

Suburbs where **50-80%** of homes are at high risk of becoming uninsurable for riverine flood damage.

- 13 suburbs have been identified as Black Zone suburbs. In these zones, property buy-back and community relocation will have to be considered.

- **A further 15 suburbs have been identified as Red Zone suburbs**. With investment in adaptation these zones could still be viable.

- **Northern NSW is particularly impacted.** In Grafton, Chinderah and Ballina essentially ALL homes are high risk and potentially uninsurable.

- By this analysis, **Shepparton, Victoria, carries the greatest risk in the country.** It's an extremely large suburb, with more than **90%** of homes identified as being at high risk – a total of **17,130** properties.

Australia's Black Zone suburbs

In the suburbs below, more than **80%** of properties are at high risk of becoming uninsurable.

Suburb	State	Properties analysed	High Risk Property %
Grafton	New South Wales	7,020	**100.00%**
Chinderah	New South Wales	1,770	**99.49%**
Ballina	New South Wales	8,889	**99.38%**
West Ballina	New South Wales	2,081	**97.07%**
Bourke	New South Wales	1,520	**96.97%**
Cunnamulla	Queensland	1,128	**93.53%**
Shepparton	Victoria	18,644	**91.88%**
Carrington	New South Wales	1,477	**89.57%**
Nyngan	New South Wales	1,589	**88.23%**
Walgett	New South Wales	1,400	**85.71%**
Tweed Heads South	New South Wales	6,422	**85.00%**
Kialla	Victoria	4,364	**84.76%**
Coonamble	New South Wales	2,008	**80.43%**

Australia's Red Zone suburbs

In the suburbs below, **50-80%** of the properties are at high risk of becoming uninsurable.

Suburb	State	Properties analysed	High Risk Property %
St George	Queensland	2,534	77.62%
Charleville	Queensland	2,632	77.47%
Tweed Heads West	New South Wales	3,598	77.13%
Mulwala	New South Wales	2,694	76.76%
South Lismore	New South Wales	1,518	75.30%
Dalby	Queensland	7,733	72.24%
Cannington	Western Australia	5,030	71.85%
Tweed Heads	New South Wales	7,997	69.20%
Wangaratta	Victoria	11,846	67.82%
Lismore	New South Wales	3,578	58.72%
Yamba	New South Wales	5,428	56.63%
Goondiwindi	Queensland	4,085	54.93%
South Yunderup	Western Australia	2,520	53.69%
Port Adelaide	South Australia	2,343	52.07%
Wickham	New South Wales	1,990	51.16%

State-by-State breakdown

All suburbs in this part of the analysis have 1000 or more High Risk Properties (HRP). Some areas dominated by high-rise apartments have been excluded.

Suburbs are listed in the tables below in order of percentage of High Risk Properties in each suburb, high to low.

Note: some suburbs across Australia may be at high risk but will not be featured here because they are smaller or dominated by high rise buildings.

Australian Capital Territory

Suburb	State	Properties analysed	High Risk Property %
Greenway	Australian Capital Territory	4,318	24.87%

New South Wales

	Suburb	State	Properties analysed	High Risk Property %
	Grafton	New South Wales	7,020	**100.00%**
	Chinderah	New South Wales	1,770	**99.49%**
	Ballina	New South Wales	8,889	**99.38%**
	West Ballina	New South Wales	2,081	**97.07%**
	Bourke	New South Wales	1,520	**96.97%**
	Carrington	New South Wales	1,477	**89.57%**
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	Tweed Heads South	New South Wales	6,422	**85.00%**
	Coonamble	New South Wales	2,008	**80.43%**
	Tweed Heads West	New South Wales	3,598	**77.13%**
	Mulwala	New South Wales	2,694	**76.76%**
	South Lismore	New South Wales	1,518	**75.30%**
	Tweed Heads	New South Wales	7,997	**69.20%**
	Lismore	New South Wales	3,578	**58.72%**
	Yamba	New South Wales	5,428	**56.63%**
	Wickham	New South Wales	1,990	**51.16%**

Suburb	State	Properties analysed	High Risk Property %
Banora Point	New South Wales	8,513	29.80%
Canley Vale	New South Wales	4,032	28.82%
South Grafton	New South Wales	3,919	27.40%
Chipping Norton	New South Wales	4,905	26.69%
Double Bay	New South Wales	4,393	24.97%
Moorebank	New South Wales	5,414	24.42%
Sans Souci	New South Wales	5,971	23.90%
Erskineville	New South Wales	6,649	22.42%
Moama	New South Wales	5,534	22.08%
Fairfield	New South Wales	9,241	15.76%
Coffs Harbour	New South Wales	18,680	12.28%
Mascot	New South Wales	13,498	11.95%
Liverpool	New South Wales	19,184	11.86%
Merrylands	New South Wales	13,996	7.42%

Queensland

Suburb	State	Properties analysed	High Risk Property %
⚫ **Cunnamulla**	Queensland	1,128	**93.53%**
🔴 **St George**	Queensland	2,534	**77.62%**
🔴 **Charleville**	Queensland	2,632	**77.47%**
🔴 **Dalby**	Queensland	7,733	**72.24%**
🔴 **Goondiwindi**	Queensland	4,085	**54.93%**
Noosaville	Queensland	8,699	46.52%
Westcourt	Queensland	2,916	44.65%
Bungalow	Queensland	2,679	41.62%
Tingalpa	Queensland	4,534	38.75%
Manunda	Queensland	3,803	31.45%
Logan Reserve	Queensland	5,302	23.01%
Coombabah	Queensland	6,071	20.84%
Tewantin	Queensland	6,502	18.95%
Carina	Queensland	6,235	16.44%
Maroochydore	Queensland	17,259	15.28%
Coolangatta	Queensland	7,170	14.88%
Mooloolaba	Queensland	7,591	13.77%
Labrador	Queensland	13,360	9.31%
Southport	Queensland	26,764	4.34%

South Australia

	Suburb	State	Properties analysed	High Risk Property %
❗	**Port Adelaide**	South Australia	2,343	**52.07%**
	Renmark	South Australia	3,327	39.22%
	Mawson Lakes	South Australia	6,711	17.23%

Victoria

	Suburb name	State	Properties analysed	High Risk Property %
❗	**Shepparton**	Victoria	18,644	**91.88%**
❗	**Kialla**	Victoria	4,364	**84.76%**
❗	**Wangaratta**	Victoria	11,846	**67.82%**
	Horsham	Victoria	9,447	28.95%
	Bayswater North	Victoria	5,380	19.13%
	Mildura	Victoria	20,932	13.52%
	Echuca	Victoria	9,413	13.38%
	Lalor	Victoria	9,912	13.21%
	Elwood	Victoria	11,023	12.66%
	Noble Park	Victoria	15,331	6.58%
	Pakenham	Victoria	25,526	5.71%
	Clyde North	Victoria	18,577	5.56%
	Berwick	Victoria	22,815	4.92%

Western Australia

	Suburb	State	Properties analysed	High Risk Property %
❗	**Cannington**	Western Australia	5,030	**71.85%**
❗	**South Yunderup**	Western Australia	2,520	**53.69%**
	Shelley	Western Australia	2,284	46.94%
	York	Western Australia	2,315	44.02%
	Northam	Western Australia	5,020	32.99%
	Collie	Western Australia	4,417	27.91%
	Baldivis	Western Australia	17,140	12.47%

How do we prevent these communities from going under?
Our recommendations

People living in homes at high risk of riverine flooding are there through no fault of their own. Yet they are being left in an untenable position, with few if any options. Insurers alone can't provide the answer - they have no control over planning, and are also obliged to protect their profitability. Banks must ensure their lending is secure. Local governments have inherited communities in locations that modern technology and climate science now suggest could become unliveable. The challenge therefore is not to find fault, but to find solutions.

We recommend the following:

Insurers:

- Ensure that existing insurance clients and applicants are made aware of the current and future risks to a property, including forward estimates of insurance costs over the mortgage term of the property.

- Include risk mitigation activities at the property or municipality level in the pricing of a premium and ensure transparency so that owners and developers can include resilience-building measures that will reduce insurance premiums into their cost-benefit analysis.

- Regulators must find mechanisms for insurers to commit to providing affordable cover to a mortgaged home lender for the life of the mortgage so that homeowners are not left stranded, or make it clear that the risks make this untennable.

- Advocate for government adaptation grants for at-risk properties.

- Advocate for government buy-back schemes for properties deemed uninsurable.

Banks:

- Ensure that prospective customers are warned of any known extreme weather and climate change risks to the property before they buy.

- Ensure that the cost of insurance and any relative reduction in property value over the time of the loan are included in approval decisions.

- Provide additional lending to existing and new customers for adaptation works that will protect the property and its inhabitants.

- Require that clients obtain insurance and maintain insurance for the hazards the property is exposed to.

- Require clients to use insurers who are committed to providing affordable cover for the duration of the mortgage.

- Advocate for government adaptation grants for at-risk properties.

- Advocate for government buy-back schemes for properties deemed unviable to mortgage.

Government:

- Commission consistent, high quality and freely available national flood risk mapping for Australia.

- Require that climate change impacts are included in all flood mapping - including high emission and triggered feed-back scenarios.

- Only allow development in flood zones if it is demonstrated the new properties have fully mitigated the risks - including Probable Maximum Flood.

- Provide municipal grants for public risk mitigation works.

- Provide homeowner grants for adaptation and risk mitigation.

- Provide buy-back grants for properties at high risk of unaffordable insurance and where adaptation is not viable.

- Regulate insurers and banks to ensure that they inform existing or prospective clients of extreme weather and climate change risks to the properties of interest.

Methodology

Analysis by The Climate Risk Group companies (XDI and Climate Valuation) is powered by the Climate Risk Engines, one of the most flexible, powerful and trusted sources of physical climate risk data in the world. The Climate Risk Engines use engineering-based methods to assess exposure and vulnerability of asset archetypes to understand the likely damage and failure probability of assets caused by extreme weather and climate change hazards.

How is the analysis performed?

The Climate Risk Engines use a structural analysis approach to calculate risk of damage to the built environment from climate change and extreme weather. The system uses global climate models, combined with local weather and environmental data and engineering archetypes, to calculate probable damage under the IPCC's Representative Concentration Pathways (RCPs) and Shared Socio-economic Pathways (SSPs). To learn more about Structural Analysis Methodology watch this video.

How is risk measured? Maximum-to-Date Value-at-Risk (MVAR)

The Climate Risk Engines analyse climate risk in terms of the probability of property damage - specifically, the Maximum-to-date Value-at-Risk (MVAR) of extreme weather and climate-related hazards. This is done using the purpose-built Climate Risk Engines, which compute the threshold at which the various key components of a building would fail if exposed to various hazards (such as riverine flooding, coastal inundation and bushfires).

MVAR is a measure of the annual risk of damage to an asset. MVAR captures the costs of expected extreme weather and climate related damage, relative to the replacement cost of the building.

To overcome the high levels of variability in climate data a Maximum-to-Date approach is used, which shows the maximum amount of the Value-at-Risk up to and including the year being quoted. This avoids a misleading focus on a low impact year which may be anomalous with the trend. All of these data are then processed to calculate the probability of property damage from climate change and extreme weather for every address in Australia.

How is risk defined?
High Risk Properties

The Climate Risk Engines categorise properties as high, medium or low risk. High Risk Properties (HRP) - the focus of this report - are defined as properties whose estimated annual maximum cost of damage due to climate change is expected to exceed 1% of its replacement cost. It can be reasonably expected that insurance costs or cost of damage or loss of function begin to impair the running costs, market value or income producing ability of this asset.

Models

The Climate Risk Engines combine long term data from local meteorological stations with information about the specific location, such as flood mapping and depths, elevation above sea level, tides and waves, soil type, and forest cover; and data on the assumed building at that address, such as age, construction materials and design. The influence of future climate change is derived by extracting the changes in the statistical distribution of key parameters such as heat, precipitation, wind and humidity from global climate change models from agencies such as CSIRO and the US National Oceanic and Atmospheric Administration (NOAA).

Models that predict a wetter future are used to assess flood risks, models that predict a drier future are used to assess drought risks etc. In this way, the models are structured to provide a 'stress test' and alert property owners to the upper range of possible risks, rather than average projections.

Which specific climate models are used?

The Climate Risk Engines use a wide range of climate General Circulation Models (GCM) and downscaled models for risk analysis. These come from two generations of the Coupled Modelled Intercomparison Projects (CMIP5 and CMIP6) and cover Representative Concentration Pathways (RCPs) and Shared Socio-Economic Pathways (SSPs). In general, The Climate Risk Group concentrates on detailed modeling for the highest emission pathways (RCP8.5/SSP5) with ensemble models selected to stress each hazard separately.

These selected models are mapped to lower impact pathways based on retardation of relevant impact parameters.

Archetypes

The Climate Risk Engines assume a standard modern dwelling is located at each address, i.e. a single story detached house which uses design specifications and materials typical of a recent building.

Why focus on RCP 8.5/SSP5?

Evidence indicates that greenhouse gas emissions are flattening. This is a good sign, but RCP 8.5/SSP5 is still an appropriate scenario to use in a prudent risk assessment:

- given the impacts remain a feasible bound of future levels of warming and impact

- impacts are based on cumulative greenhouse gases in the atmosphere which have followed a high emission pathway until very recently, and

- emissions from feedbacks and tipping points could mean that the combination of human and feedback emissions follow a high emission pathway.

Read The Climate Risk Group's public Methodology Document for an overview of our approach to physical climate risk analysis, specifically the structural analysis methodology.

Third party use of this data

If you would like to use findings or images from this report then we ask that you cite "Going Under: The imperative to act in Australia's high flood risk suburbs" with a link to www.climatevaluation.com.

Disclaimer and terms

Going Under: The imperative to act in Australia's high flood risk suburbs is based on an assessment of risks to Australia's built environment arising from the effects of climate change using a selection of information, data, scientific methods and modelling techniques as described in our methods document. Such information, data, methods and modelling techniques may be subject to limitations.

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