



Defending Sydney

Adaptive planning for today's flooding and tomorrow's climate risks



Committee
for
Sydney

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AECOM is the world's trusted infrastructure consulting firm, partnering with clients to solve the world's most complex challenges and build legacies for generations to come.



Insurance Australia Group Limited (IAG) is the largest general insurance company in Australia and New Zealand.



Resilient Sydney is a collaboration of all 33 metropolitan councils of Greater Sydney to develop and implement a city-wide resilience strategy.

Defending Sydney was developed through the Committee for Sydney's Resilience Program. The Resilience Program is supported by Ausgrid, Endeavour Energy, Sydney Water, Resilient Sydney and AECOM, and focuses on:

- Identifying opportunities for innovation and economic growth for business, government, and the community in the transition to net zero.
- Determining where and how we invest to ensure system-level resilience and reduce impacts on businesses and communities.
- Building on experience of extreme heat, flood, storms, and fires to reduce direct risks to life, assets and productivity, now and into the future.

This report is informed by lived experience and interdisciplinary knowledge of experts and practitioners across and beyond Greater Sydney. A series of interviews, workshops and extensive peer reviews were convened to identify the key challenges and develop actionable recommendations.



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Executive Summary



Image source: infrastructure NSW, Photo by Adam Hollingworth



Sydney is at a crossroads. We're facing a housing crisis and climate crisis.

The success of solving the housing crisis will be judged on whether more or less people are at risk of the climate crisis and its financial impacts.

Without clear structures to manage this increasingly scary risk cocktail, the result will be more and more development in areas exposed to floods and climate change.

This document is about how we manage these two risks together.

In 2021 and 2022 flooding devastated communities, business and infrastructure here in Sydney, and across the East Coast of Australia. Insurance costs from the 2022 East Coast Floods are estimated at over \$6bn, making it the costliest event for insurers recorded in Australian history. The uninsured costs are estimated at an additional \$15bn. These true costs of natural disasters carry a societal and economic burden across communities, businesses, and government, and disproportionately impact our most vulnerable people.



In the aftermath of the floods, we have seen the first real efforts in NSW to rethink land use planning in the context of flood risk: to look at where we have built historically, absorb new information about risk to communities, and to identify properties for government funded buybacks – a first step towards managed relocation and retreat.

Examples of post-disaster managed relocation have been well documented. Grantham, west of Brisbane is frequently cited for the speed and coordination that relocated 90 family homes within 11 months of the Queensland floods in 2011. After the earthquake sequence in Christchurch NZ in 2010-11, much of eastern Christchurch was ‘red zoned’ by government, with over 7000 houses bought out. In both cases new information about the level of risk being faced by communities led governments to act to reduce that risk. But the political impetus for this kind of intervention fades very quickly after a disaster.

It’s not just homes that are affected. Infrastructure is not currently designed to support communities to cope with growing climate risk. Funding frameworks, whether State or Federal, do not currently enable lifeline infrastructure owners to respond to the growing impact of climate change on services to communities. Collective approaches like regional lifeline infrastructure groups in New Zealand coordinate essential infrastructure and services to reduce the impact of service disruption on communities when power, drinking water, or communications are affected by natural disasters.

While flooding was NSW’s most recent challenge it may not be our next. The trajectory is increasingly clear. We must build our capacity to cope with whatever

comes our way. Over the next decade, Sydney’s population is expected to grow from 5.3 million people to about 6.1 million people¹. Over the same period, our city’s climate is projected to warm by an average 0.7°C¹³, increasing the frequency and severity of extreme rainfall and flooding and other natural hazards such as bushfires.

To confront these challenges, and confront the housing crisis, we need to strengthen our capacity to act before a climate risk becomes a disaster. We believe this means a long-term adaptive approach to strategic land use planning and development, that considers climate risk and puts informed community and First Nations knowledge at the centre of decision-making.

Together, these approaches bring forward a way to engage communities in decision making about the future of their place and test their willingness to live with those risks against other available options. With that information we can collectively develop adaptive pathways – options that respond to future opportunities and constraints, and provide clarity for investment into the future.

A key response to the East Coast flooding has been the creation of a new organisation – NSW Reconstruction Authority – that is empowered to bring natural hazard and climate risk into decision making about land use and infrastructure. The development of NSW’s first State Disaster Mitigation Plan and local Disaster Adaptation Plans – key priorities for the NSW Reconstruction Authority – create an opportunity to lead collaboration and collective decision making with local and Federal Government, community and business.



Three new approaches are needed to address these challenges:



1. Place based adaptive pathways.

We recommend following a Dutch approach, which has been adopted by countries around the world to enable policy makers and communities to understand risk tolerance across the community, infrastructure providers, and with business (including insurers and banks).



2. Climate responsive land use planning.

We recommend following examples from cities around the world, such as New York (climate risk zones), and Norfolk, Virginia (Vision 2100 Land Use Plan). This approach has worked to tell the community that risks are increasing and enable communities to adapt in place or relocate as risk becomes too much.



3. Collaborative decision making.

This is essential to ensure business and community continuity in the face of natural disasters. The Resilient Sydney program identified disjointed governance as one of metropolitan Sydney’s major challenges, working over the past 8 years to build connections across local and State government, to increase equity and build capacity and knowledge for communities to respond to changing risks.

Local Governments are already working across Greater Sydney to develop and implement resilience strategies which means existing capacity to engage and knowledge to bring to the development of Disaster Adaptation Plans. The private sector, including insurers, banks and property developers are also engaging with changing risk and the impact on consumers.

This report seeks to inform and support the work of these agencies and organisations to solve the housing and climate crisis together.

We know it’s not sufficient to wait for disasters, and then try to rezone and relocate affected communities. We need to proactively build the adaptive capacity of communities, business and infrastructure to manage the natural disasters we know are likely to come next and pre-emptively make decisions to relocate when risk profile is too high. We already know that more than half of the future projected growth in Greater Sydney can be accommodated in land around current and planned rail and metro stations. We now have the opportunity to plan for growth and density in ways that are far from floods and other natural hazards.





Recommendations

This report proposes 11 recommendations (and 38 specific actions) for government and businesses to proactively build adaptive capacity. Detailed in Table 1, these recommendations aim to:

- Make climate and natural hazard risk transparent in both strategic land use planning and engaging communities and households to ensure that we are planning and building in areas that are not prone to climate and natural hazard risk
- Engage the financial services sector (particularly insurers and banks) in planning for climate and natural hazard risk. By developing data sharing protocols to build a system wide understanding of risk
- Develop place based adaptation pathways that build on the risk tolerance of community and perspectives of lifeline infrastructure providers
- Leverage Disaster Adaptation Plans to identify climate risk zones, and priority investments in lifeline infrastructure, that respond to changing risk
- Develop a statewide policy for managed retreat – take what we know from here and overseas and build the capacity and process to reduce existing risk to communities.

NOW

COMMIT TO REDUCING FLOOD AND CLIMATE RISK ACROSS SYDNEY (Year 1)

1

Reduce growing climate risk through the 2023 Six Cities Region Plan and City Plans

3

Establish regional critical infrastructure groups

2

Embed community, infrastructure and economy in the State Disaster Mitigation Plan

4

Build collective governance and place-based adaptation pathways through Disaster Adaptation Plans

5

Support Local Governments to assess and communicate risk

NEXT

INVEST IN PLACE-BASED CLIMATE ADAPTATION (Year 2)

6

Focus Federal funding on reducing the costs and impacts of disasters





Figure 1: Our roadmap for defending Sydney

NEW

MANAGE RESIDUAL RISK (Year 3)

7
Engage the financial services sector in disaster adaptation planning

9
Undertake an Integrated Strategic Assessment for Greater Sydney

10
Develop a NSW policy and guideline for planned relocation

8
Enable IPART to accelerate climate adaptation

11
Evaluate progress towards a more climate adaptive Greater Sydney



Table 1: action plan

NOW: COMMIT TO REDUCING FLOOD AND CLIMATE RISK ACROSS SYDNEY (Year 1)

The Issue	Recommended Actions	Responsibility
1. Reduce growing climate risk through the 2023 Six Cities Region Plan and City Plans		
The number of people and assets exposed to natural disasters is rising as we build into areas of existing and projected climate risk. The most effective way to reduce future climate risk is to stop building new dwellings and assets in these locations.	<ol style="list-style-type: none"> Embed in the Six Cities Region Plan, a high, medium and low climate risk overlay that considers projected future climate risk Focus future urban growth in infill areas, close to transport and social infrastructure and away from areas of growing climate risk Measure and report how the Six Cities Region Plan reduces the number of people, dwellings and assets exposed to climate risk. Develop a climate risk policy maturity framework in the Six Cities Region Plan and City Plans to show how land use policy and planning are responding to a changing climate. 	<p>Proposed Lead: Greater Cities Commission</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> NSW Reconstruction Authority NSW Department of Planning Local Governments
2. Embed community, infrastructure and economy in the State Disaster Mitigation Plan		
Preparing plans to reduce the impact of floods and other disasters will require trade-offs between and within communities, and decisions by service providers about when and how to invest. Approaching these essential challenges needs to be framed at a state level to ensure consistency across Sydney and NSW.	<ol style="list-style-type: none"> Develop a consistent methodology for establishing risk tolerance across communities, service providers and Government Provide guidance on how to integrate land use planning and cost/ benefit analysis of alternate mitigation options into Disaster Adaptation Plans Introduce specific climate risk land use zones for high-risk areas and identify areas for possible application 	<p>Proposed Lead: NSW Reconstruction Authority</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> NSW Department of Planning NSW Treasury Utilities/ Telcos
3. Establish regional lifeline infrastructure² groups		
NSW has an emergency management coordination structure that enables clear allocation of responsibility and decision-making. A similar mechanism is needed for lifeline infrastructure – essential services that enable communities to cope and adapt to changing climate risk and increasing disruption.	<ol style="list-style-type: none"> Build on experience from Queensland and New Zealand to co-design a long-term regional adaptation approach for lifeline infrastructure. Identify risk ownership and needs from a place and system perspective, to inform investment planning across lifeline infrastructure. Enhance the role of green infrastructure solutions in contributing to climate adaptation 	<p>Proposed Lead: NSW Reconstruction Authority</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> Utilities (Ausgrid, Sydney Water, Endeavour Energy) INSW Local Government



The Issue	Recommended Actions	Responsibility
4. Build collective governance and place-based adaptation pathways through Disaster Adaptation Plans		
<p>The Resilient Sydney Strategy 2018 called out the complex governance for managing natural hazards and climate risk in Sydney, identifying that no single organisation has the responsibility or power to reduce flood and any other risk. Collaborative planning processes are needed to address this gap to build trusted relationships and allocate responsibilities for reducing natural hazard and climate risk in Greater Sydney.</p>	<ol style="list-style-type: none"> a. Fund the delivery of deep engagement to enable community-led Disaster Adaptation Plans to be created across Greater Sydney. b. Identify climate-informed medium and high-risk locations and share findings with Local Government and community. c. Generate and incorporate consistent data on social capital, social cohesion and social infrastructure to identify high-risk communities. d. Develop sub-regional scale adaptation pathways with community, business, critical infrastructure providers, First Nations communities and other stakeholders. e. Pilot a cost-benefit methodology to identify alternate risk reduction and investment scenarios. 	<p>Proposed Lead: NSW Reconstruction Authority</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> • NSW Department of Planning • NSW Treasury • Universities • Local Government • Resilient Sydney • Utilities
5. Support Local Governments to assess and communicate risk		
<p>Without climate risk scenarios at local government level, we are effectively creating a postcode lottery across Greater Sydney. Most businesses and households are unaware of the natural hazard and climate risk that they face or how this risk impacts them and will change in the future.</p> <p>While local governments work hard to share risk information with their communities, many either don't have the resources to update existing hazard modelling to include climate risk or are reticent to share new information without comprehensive strategies to respond.</p>	<ol style="list-style-type: none"> a. Require and fund mandatory climate risk assessments to inform Local Government flood risk assessments (through the NSW Flood Manual). b. Update quarterly rates notifications to include all hazard exposure linked to asset design standards where possible and identify sources of further information about risk to life and property in each location. c. Update S.107 certificates to include all hazard exposure and how global warming is expected to change or exacerbate these hazards. d. Use climate and climate risk data to support small and medium sized business preparedness and continuity plan development 	<p>Proposed Lead: NSW Department of Planning</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> • Office of Local Government • Local Governments • NSW Treasury • Resilient Sydney

NEXT: INVEST IN PLACE-BASED CLIMATE ADAPTATION (Year 2)

The Issue	Recommended Actions	Responsibility
6. Focus Federal funding on reducing the costs and impacts of disasters		
<p>The Federal Disaster Ready Fund allocates \$200m per year for preparedness, with funds allocated based on a competitive grants process. A new funding logic is needed that takes a more strategic approach to make best use of this limited funding.</p>	<ol style="list-style-type: none"> a. Set funding criteria at Federal level that incentivises land use and development decisions that reduce total asset exposure and enhance life safety, prioritising high risk locations b. Make Federal and State betterment funding available to strengthen assets and dwellings in at-risk locations prior to disasters occurring 	<p>Proposed Lead: National Emergency Management Agency</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> • NSW Reconstruction Authority • NSW Department of Planning • NSW Treasury • Commonwealth Treasury
7. Engage the financial services sector in Disaster Adaptation Planning		
<p>Access to data on flooding and climate scenarios is consistently raised as a barrier to risk informed decision making. Data on risk pricing from insurers and banks is not being included in decision making, potentially undermining future asset values if owners can't afford insurance or to self-insure. There is a need to understand the value chain, and who owns the downside risk of changes in flooding and other hazards.</p>	<ol style="list-style-type: none"> a. Create a Financial Services Forum to bring the knowledge, data and perspective of financial services providers into place-based risk tolerance discussions and Disaster Adaptation Plans b. Engage with financial services providers to identify viable and affordable mitigation options at the household scale to improve asset resilience and insurance affordability in medium risk zones c. Work with financial services and State Government to assemble an accessible climate and climate risk data asset that enables risk informed infrastructure, asset management and land use planning decisions. This data set would be built from existing data assets including what is created by the Hazard Insurance Partnership . d. Partner with financial services providers and State Government to identify who owns the financial risk in the next major flood disaster 	<p>Proposed Lead: NSW Reconstruction Authority</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> • Committee for Sydney • Private Sector / Insurers • Resilient Sydney • Financial Services Regulators • Universities • CSIRO/ Australian Climate Service
8. Enable IPART to accelerate climate adaptation		
<p>The Independent Pricing and Review Tribunal (IPART) can review reasonable funding allocations for many of the key actors responsible for disaster preparedness, including utilities and Local Governments. As findings emerge from Disaster Adaptation Plans, it will be critical to identify the role that IPART can play in funding the actions that key service providers need to implement to enable place-based adaptation.</p>	<ol style="list-style-type: none"> a. Update IPART Terms of Reference to include mandatory consideration of climate change adaptation b. Engage with IPART on the findings of Disaster Adaptation Plans, to determine how IPART can play a more of a leading role in addressing adaptation to natural disaster and climate change 	<p>Proposed Lead: NSW Minister for Planning</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> • IPART • NSW Office of Local Government • Utilities • Local Government • NSW Department of Planning • NSW Treasury





Image source: infreelife.nsw, Photo by Adam Hollingworth

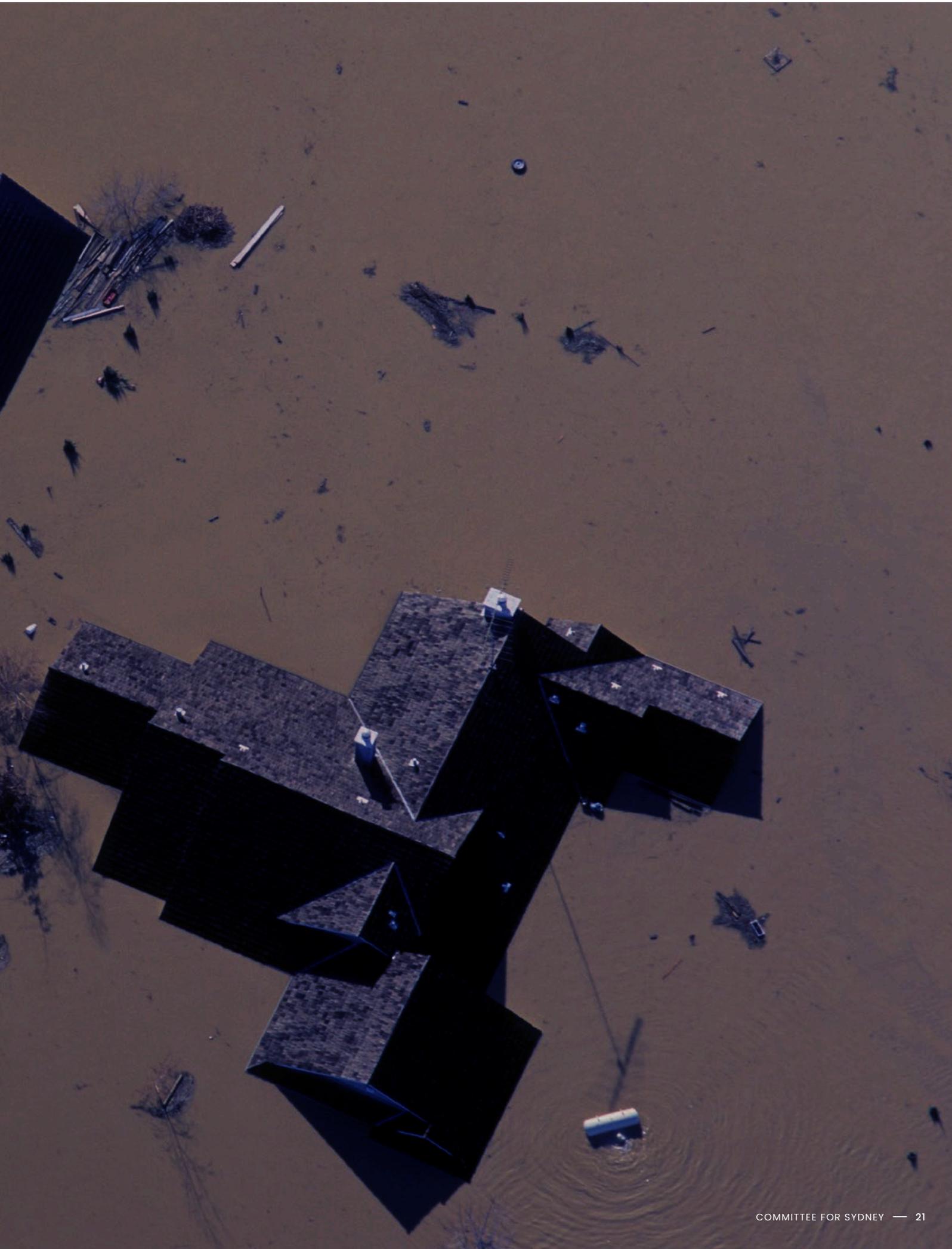


NEW: MANAGE RESIDUAL RISK (Year 3)

The Issue	Recommended Actions	Responsibility
9. Undertake an Integrated Strategic Assessment for Greater Sydney		
<p>As our population grows, some parts of Sydney will adapt to a changing climate, others will experience rapidly increasing risk. We need an approach that identifies the options that enable Sydney to adapt to these changes, and make informed decisions about where and how to grow, and where growing would bring unsustainable risk.</p>	<ol style="list-style-type: none"> Undertake an integrated strategic assessment for Greater Sydney that builds on Disaster Adaptation Plans and enables adaptive planning pathways for the region. Embed deliberative decision-making with First Nations groups, communities and other stakeholders around emerging problems and possible solutions Determine the costs and benefits for risk mitigation at household, suburb, catchment, LGA and region scale, including by connecting housing and asset typologies to hazard exposure 	<p>Proposed Lead: NSW Reconstruction Authority</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> NSW Treasury NSW Department of Planning Local Government Utilities / Telcos Private Sector/ Insurers Local Aboriginal Land Councils/ Aboriginal Corporations
10. Develop a NSW policy and guideline for planned relocation		
<p>Tens of thousands of homes in Sydney are currently at risk, and this number is only expected to grow. Moving communities out of the way of climate risk will both reduce risk to life and to property and reduce the future burden on funding response and recovery.</p>	<ol style="list-style-type: none"> Develop a State level policy and guideline for planned and community-led relocation, informed by lessons from the NSW Northern Rivers, Brisbane and overseas Identify criteria and receiving areas for possible future relocation of residents of high-risk climate zones. Create alignment between planned relocation and local government housing targets. Identify and pilot financial mechanisms to transfer development out of high-risk zones 	<p>Proposed Lead: NSW Reconstruction Authority</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> NSW Department of Planning NSW Treasury Local Government Insurers/ Banks
11. Evaluate progress towards a more climate adaptive Greater Sydney		
<p>There are many programs underway to respond to and prepare for changing natural hazards and climate risk. Given the growing risk to life and assets, there is a clear need to review to what extent these efforts are contributing to a more adaptive city and reducing the risk to communities across Greater Sydney.</p>	<ol style="list-style-type: none"> Review the effectiveness of Disaster Adaptation Planning across Sydney, including changed awareness of flooding and climate risk. Evaluate the progress of lifeline Infrastructure agencies in coordinating, funding and delivering climate adaptive investment plans. Monitor progress on dwelling and asset exposure through land use planning in the 2023 Six Cities Region Plan and City Plans to inform the development of the 2028 revisions. Identify how changes in funding decisions – at State and Federal levels – have contributed to enabling or constraining key service providers 	<p>Proposed Lead: NSW Reconstruction Authority</p> <p>Key Collaborators:</p> <ul style="list-style-type: none"> NSW Department of Planning Greater Cities Commission Local Government IPART National Emergency Management Agency Utilities



I. We must change how we plan for climate risk



Confronted with interlinked crises – housing and growing climate risk – we need to rethink how we defend people’s quality of life in Sydney. Recent extreme floods highlighted the spatial constraints to our city and the legacy of allowing development in high-risk areas.

Australians are grappling with escalating natural disaster-related impacts. Since 2020, twelve ‘significant’ events, including bushfires, storms and floods, have been declared in Greater Sydney alone. 80% of Australians have reported experiencing an extreme weather event at least once since 2019, almost 50% of which were flood-related³.

Over the next decade, Sydney’s population is expected to grow from 5.3 million people to about 6.1 million people⁴. Over the same period, our city’s climate is projected to warm by an average of 0.7°C⁶, increasing the frequency and severity of extreme rainfall, flooding and other natural disasters. We are now faced with the challenge of determining how we will accommodate this growth while adapting to growing climate risk.

We often talk about the resilience of communities during and after a disaster, but what we are really describing is their stoicism – the communities’ ability to show strength in the face of adversity and bounce back post-event. The reality is that their resilience – the capacity to survive, adapt and thrive⁵ – is being undermined by increased exposure to climate risks brought about by land use planning and development decisions.

Sydney’s median property prices currently exceed 13 times the median annual household income⁶. The rising cost of housing, combined with other pressures on the cost of living, are driving growth on the urban fringe. In Sydney, parts of the urban fringe are subject to higher exposure to floods and fires⁷. In other parts of the State, disaster-affected communities are facing decisions about whether to stay or relocate to less risky locations.

A revised flood management policy, the introduction of the NSW Reconstruction Authority⁸, and the preparation of the NSW’s first State Disaster Mitigation Plan reflect the NSW Government’s response to the 2022 NSW Flood Inquiry. However, better connecting climate risk and strategic land use planning to proactively build adaptive capacity remains a work in progress.

We need to start defending Sydney’s local communities and strengthening the capacity to act before a climate risk becomes a disaster. This means:

- implementing a long-term adaptive approach to land use planning and development that considers climate risk and puts informed community at the centre of decision-making
- mean improving the communication of risk information to communities and implementing better placed-based adaptive management strategies
- preparing to relocate some communities due to compounding and severe impacts from climate disasters.

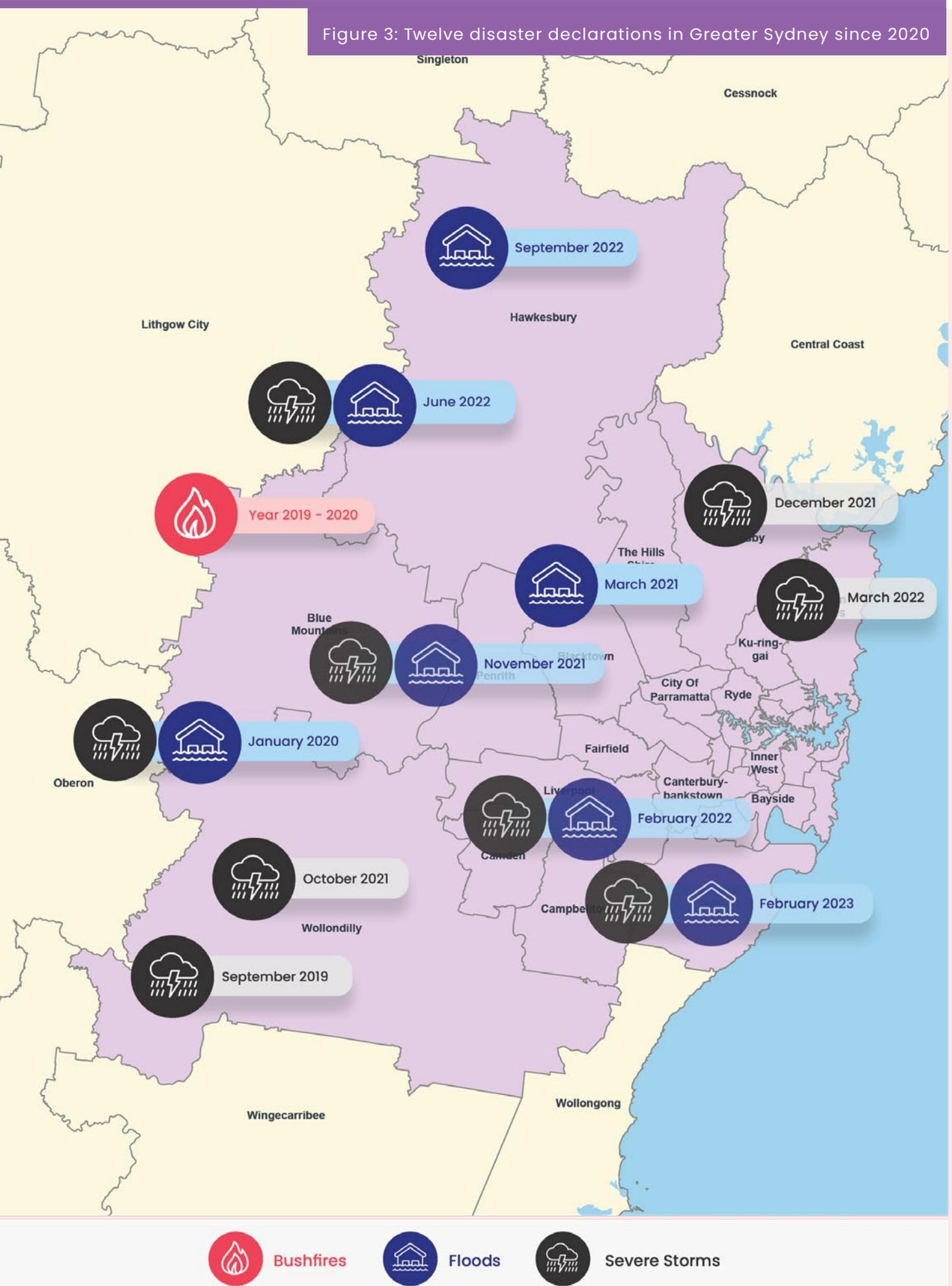
In all cases, collaboration with First Nations and community groups is required to amplify the voice of lived experience and knowledge.

We must do things differently, and we have to start now.



Figure 2: Integrated flood management interventions

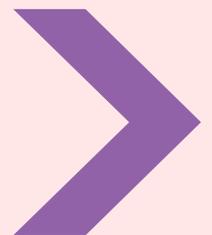
Figure 3: Twelve disaster declarations in Greater Sydney since 2020





“It’s a choice in the end. It’s a human choice. We can think about that future as an opportunity, or we can close our eyes and do nothing and let it happen to us, and see more death and despair, more assets and people lost”

— Henk Ovink, Former First Special Envoy for International Water Affairs





II. The Challenges





Climate-related natural disasters are getting worse

The 2020s has so far been a decade of climate extremes for Greater Sydney. On 1 January 2020, Sydney was ablaze. In the northwest, bushfires destroyed homes and businesses from Lithgow to Bilpin, while a mega-fire engulfed Gospers Mountain. To the southwest, a fire-generated thunderstorm formed over two fires burning near the towns of Mittagong and Braemar⁹. In the following days, a State of Emergency was declared for New South Wales, and Penrith recorded its hottest day on record at 48.9°C – making it the hottest place on Earth at the time¹⁰.

As communities began to rebuild, eastern Australian weather systems shifted to wet conditions and a rare triple-dip La Niña¹¹. Torrential rain led to major flooding in the Hawkesbury and Nepean River catchments, causing consecutive evacuation events for people living north-west of Sydney and Sydney's wettest year on record¹².

Sydney's rainfall variability is driven by climate patterns like the El Niño/La Niña Southern Oscillation (ENSO), the Southern Annular Mode (SAM) and the Indian Ocean Dipole (IOD), which influence ocean temperature and trade winds. However, the observed release of greenhouse gases is causing the atmosphere to heat up, intensifying the global water cycle.

Changes in atmospheric and ocean circulation and regional weather patterns are influencing seasonal rainfall conditions and sea levels beyond natural variability¹³. As our planet warms, the water-holding capacity of the atmosphere increases by

around 7% for every 1°C of warming. This can cause heavier rainfall, which in turn increases flood risk¹⁴.

In Sydney, ongoing oscillation of ENSO may give rise to increased frequency and intensity of short-duration, heavy rainfall events in La Niña years. Leading to increases in flood volumes and peak flow rates, resulting in an elevation in the flood risk profile. By comparison, El Niño years may result in longer periods of drought and bushfires¹⁵.

As of 2022, the Hawkesbury–Nepean Valley was home to 134,000 people, a population projected to double by 2050¹⁶. As the risk of flood and bushfire increases, legacy land use planning decisions may no longer be appropriate. Climate change may further increase this flood risk by increasing the severity and frequency of the flood hazard in the Valley. A region that the Insurance Council of Australia considers to have the highest single flood exposure in New South Wales, if not Australia¹⁷.

Along Sydney's coastline, sea levels are rising, increasing the risk of inundation and damage to coastal infrastructure and communities through permanent inundation of low-lying areas and increased frequency and depth of tidal inundation. Around 80% of the NSW population live within 50 km of the coast, meaning more and more people are at risk of being impacted by sea level rise. The highest risk occurs close to estuaries, where property development in low-lying areas has flourished,¹⁸ driven by potential economic returns despite the growing flood risk.

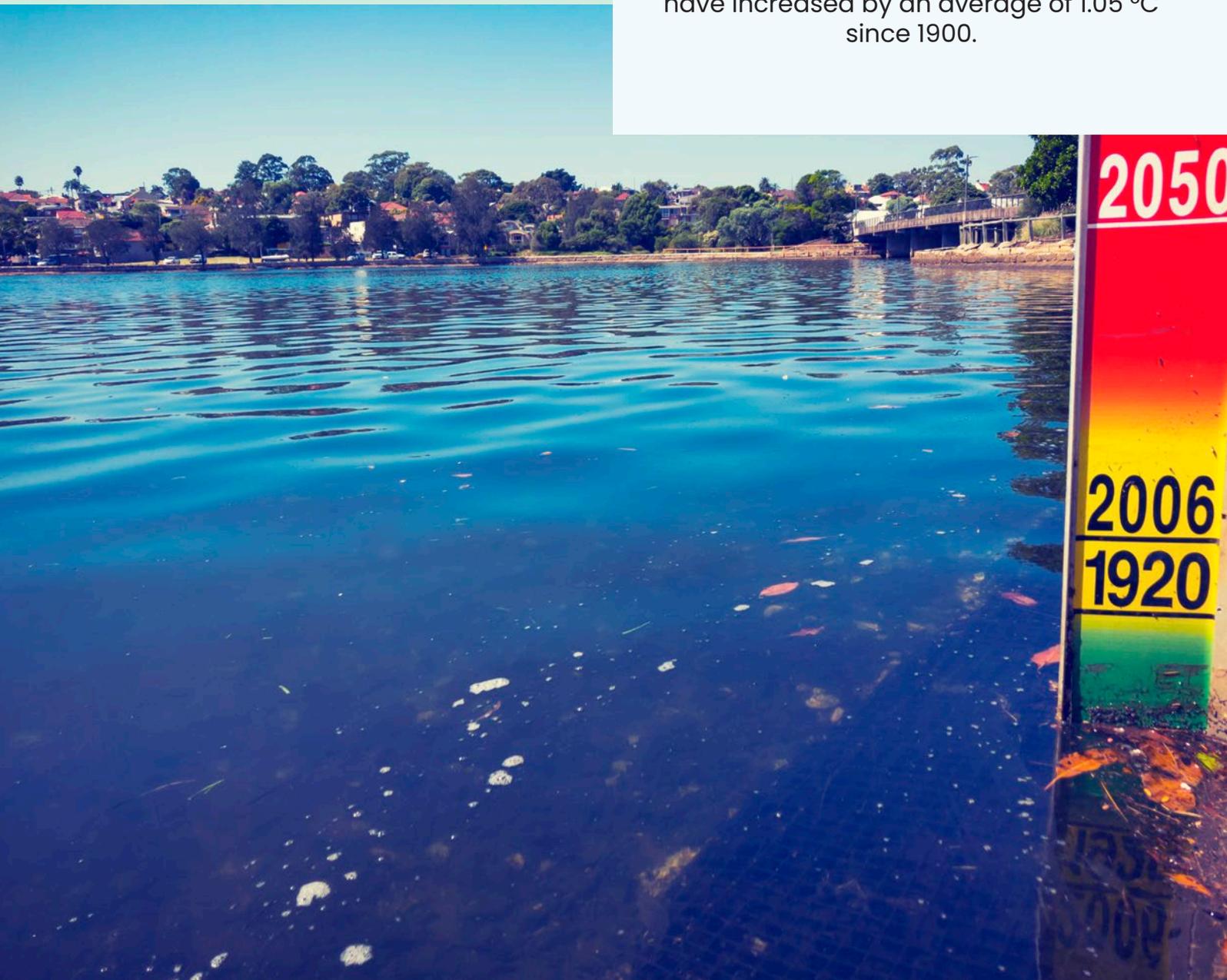
Culturally significant places are being damaged by climate change. Recent floods and bushfires destroyed vast areas of cultural value, and sea level rise is eroding and inundating coastal sites and



burial grounds. Many First Nations Australians in NSW live in areas more likely to be affected by climate change, which increases the impacts on their cultural values and the ability to access and care for Country. Land use planning decisions have the potential to further disrupt First Nations peoples deep cultural and spiritual connections with their traditional lands, identities, connection to Country and ways of life¹⁹.



Australia’s climate has warmed by an average of 1.47 °C since national records began in 1910. Sea surface temperatures have increased by an average of 1.05 °C since 1900.



The cost of disasters is rising

Households, businesses, and government are experiencing more frequent and intense floods, which is increasing recurring recovery costs, and putting pressure on insurance affordability.

Between 2005–2022, the federal government spent \$23.99 billion on disaster recovery and relief through funding mechanisms including the Disaster Recovery Funding Arrangements (DRFA). Comparatively, \$510 million was spent on pre-disaster resilience initiatives. Major reviews of Australia’s disaster funding arrangements have recommended more funds be allocated to climate risk reduction and prevention measures to reduce the cost of natural disasters.

Australia-wide, the costs to the economy of natural disasters are estimated at \$38 billion per year, or 2% of our GDP²⁰. Without intervention, by 2060, it is projected these costs will rise to at least \$73 billion annuallyⁱ.

In response, the National Emergency Management Agency (NEMA) has committed up to \$1 billion to the Disaster Ready Fund (DRF) over five years. Funding disaster resilience and risk reduction initiatives to manage the physical, social and economic impacts of disasters caused by climate change. While funding has increased, progress has been limited as governments face competing budget priorities and funding constraints. Greater visibility of the true cost of natural disasters is needed so governments can better manage recovery costs and capitalise on the savings associated with resilience investment.

The 2022 East Coast floods cost \$7.16 billion in insurance alone, making it one of the costliest events for insurers in Australian history and the second costliest in the world in 2022²¹. However, insured losses represent only a proportion of the costs of natural disasters. The total economic cost of natural disasters, or ‘true costs’ include cascading financial and social impacts to affected communities, such as uninsured property and infrastructure, business disruptions, psychological stress, injury and loss of life.

ⁱ Under a low emissions scenario (RCP 2.6 of the United Nations’ Intergovernmental Panel on Climate Change’s (IPCC) Fifth Assessment Report (AR5)).

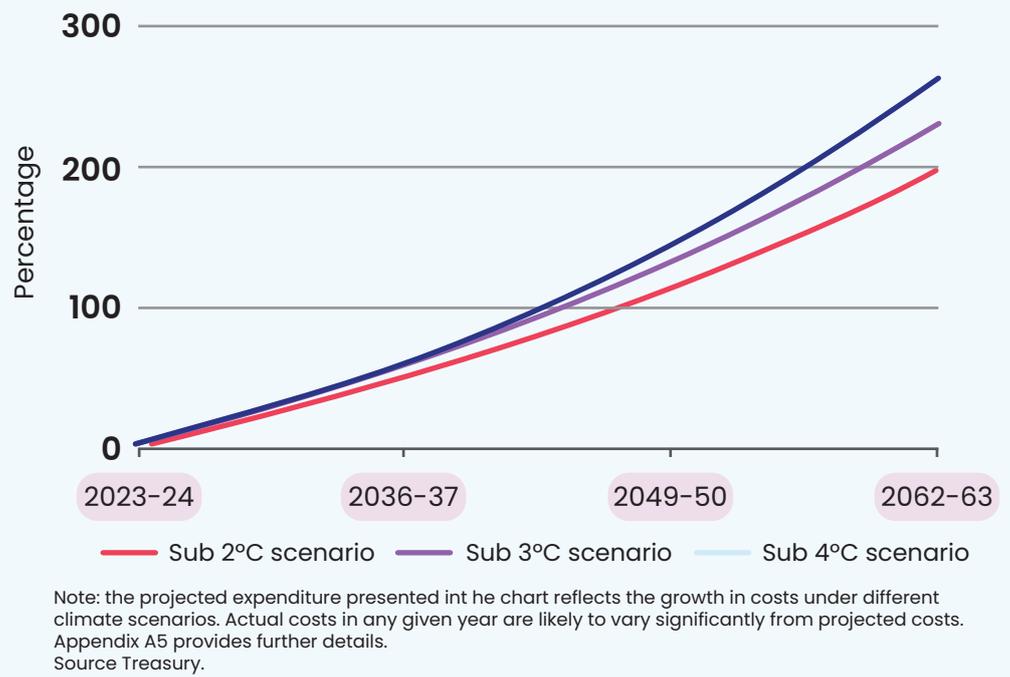


Figure 4: Australian Government expenditure on the DRFA, total percentage change

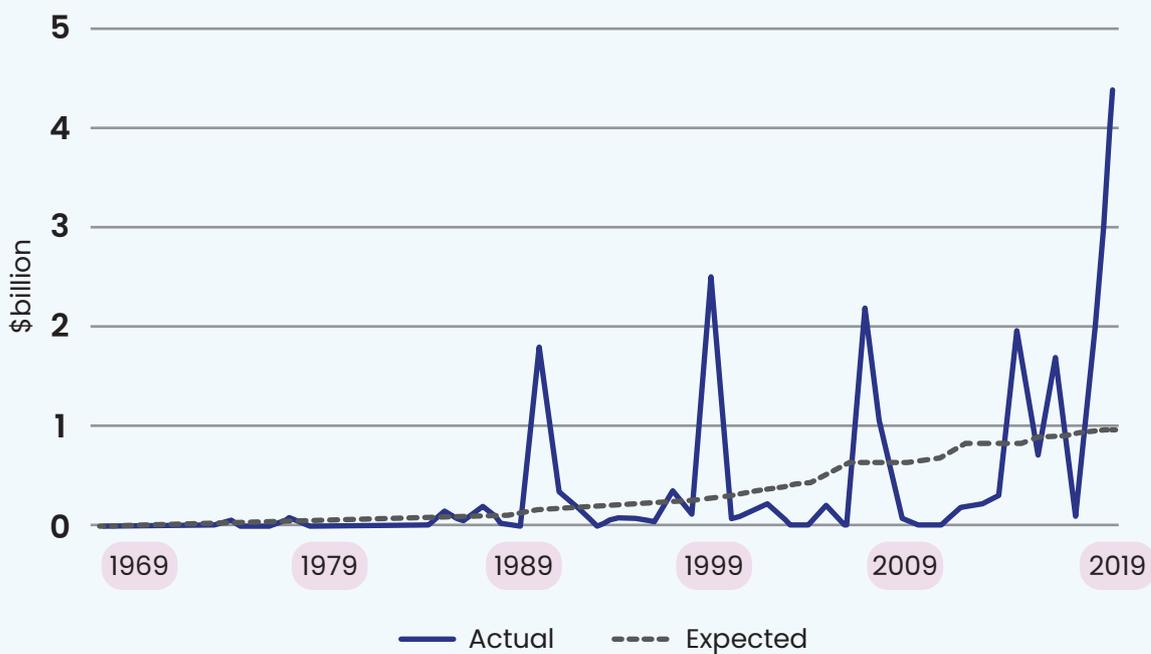


Figure 5: Actual vs Expected NSW Direct Economic Natural Disaster Costs

“In the Northern Rivers floods in NSW, insurers paid claims of around \$5b... It is estimated that the losses for government, private citizens and businesses were three times greater at \$15b – an amount that is not only much larger, but largely unreported...”²²

The true cost of natural disasters carries a societal and economic burden across communities, businesses, and government, disproportionately impacting our cities’ most vulnerable people. Communities with underlying socioeconomic vulnerabilities experience more significant psychological and financial impacts when compounded by trauma from a natural disaster, resulting in social consequences for individuals and local communities that last long after the physical clean-up²³.

Not accounted for is the unpaid efforts of volunteers which make up much of the fire (RFS), emergency services (SES), community services and self-mobilised community responses. In the immediate aftermath of a natural disaster, the value of the tireless efforts of these organisations to support communities traumatised by loss is much harder to cost.

The 2022 Northern Rivers floods have shown us what it looks like when legacy land use planning decisions are not addressed, and the level of climate risk surpasses the community’s adaptive capacity. The result has been post-disaster rezoning and buy-backs to support relocating^{24 25}.

Relief and recovery programmes need to

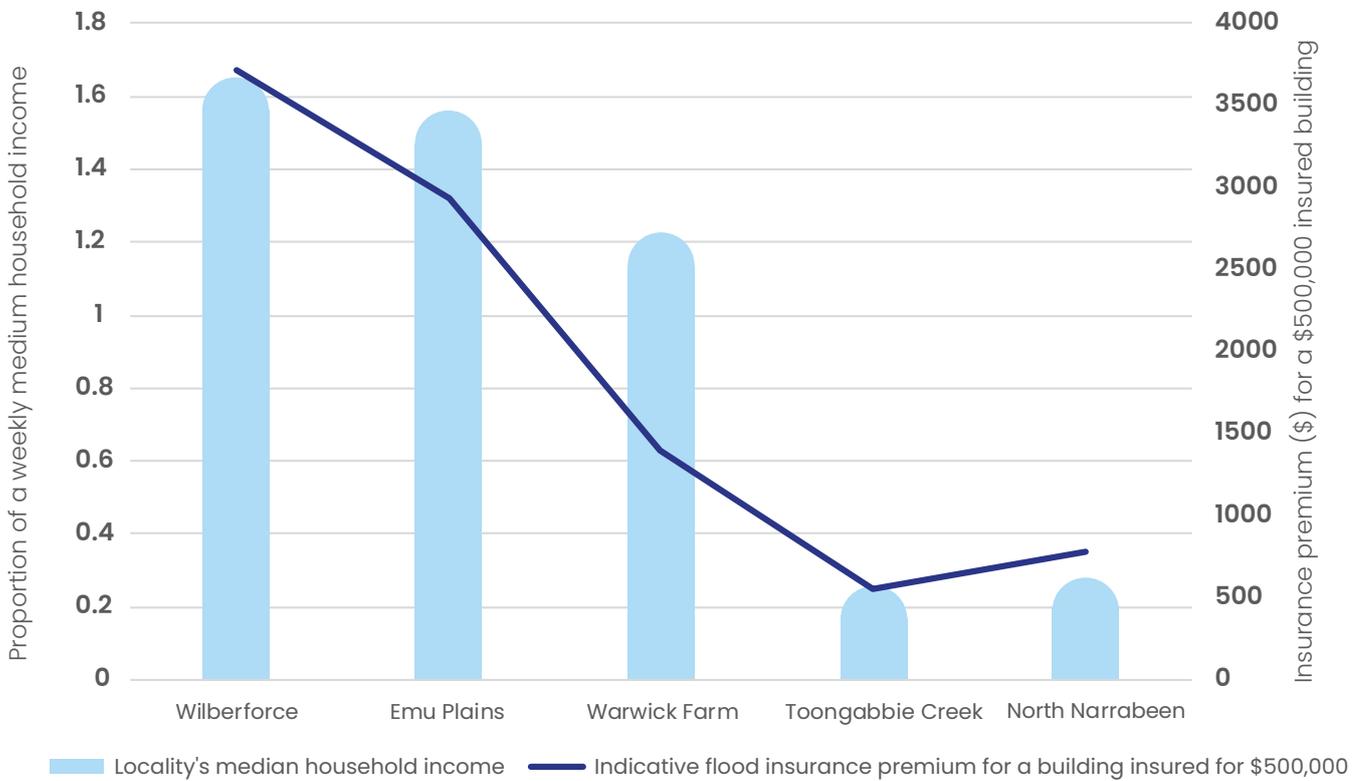
be tailored to meet specific cultural needs such as ensuring that evacuation and recovery efforts do not result in displacement from Country. Respecting the self-determination of those communities and recognizing that planned relocation, can become a tool for displacement without inclusion of First Nations voices.

Insurance price and land use planning are interrelated

Insurance Group Australia (IGA) have highlighted an explicit link between residual risk, insurance, and land use planning controls. Insurance is fundamentally a tool to transfer the financial risk of natural hazards for a price, and that price is based on the risk (alongside other pricing components)ⁱⁱ. The level of natural hazard risk a community faces is directly impacted by land use planning and development controls²⁶. Generally speaking, the tighter these controls, the less residual risk. If we do not have tight planning controls, insurance becomes less affordable. Further, if insurance becomes less affordable for households, this could limit access to mortgage finance as banks require insurance to secure their loan. High insurance prices may in turn also impact on the market value of homes in high risk area²⁷.

This IGA Case Study shows the difference in flood insurance affordability across five hypothetical complying developments at different flood risk areas in Sydney as shown in Figure 6.

ⁱⁱSee further information on insurance premium calculations in the ACCC Northern Australia Insurance Inquiry – Final report, Chapter 4



Note: This above graph is a hypothetical estimate where an Average Annual Loss for flood has been calculated and doubled to account for additional components of a premium such as government taxes, levees and duties, insurer's expenses and margins, and reinsurance costs. For a real-world insurance premium this would be calculated precisely, not estimated in this way.

The example costs outlined below are also only for the flood component of a premium. Most homes in the Sydney basin would also have other natural disaster components in a home premium such as bushfire or storm as well as non-peril risk i.e. liability, house fire theft etc. The estimates are also based on the assumption that each home is a single storey dwelling with replacement cost of \$500,000.

IAG have used the Australian Actuaries Home Insurance Affordability (AAHIA) methodology for quantifying insurance affordability which measures the ratio of annual home insurance premium to the gross annual household income, expressed in weeks. Values for median household income are based on the 2021 census, verified against 2016 census data to ensure that covid-related anomalies across the five sites have not skewed the results.

Figure 6: Flood insurance and land use planning across Sydney (Source IAG)

The land use planning system is being challenged by rapid change

The Australian Institute for Disaster Resilience acknowledges land use planning as “the single most important mitigation measure in minimising the increase in future disaster losses in areas of new development”²⁸. Research by Infrastructure Australia and Infrastructure NSW found that while regional and local strategic plans recognise the need for land use planning to manage the impact of natural disasters on communities, progress is varied and uncoordinated²⁹.

NSW and other jurisdictions are taking a risk-based approach to strategic planning that involves evaluating the current likelihood and consequence of a risk. However, this approach only considers current risk and is limited in the way it accounts for future uncertainties associated with climate change, changing populations and other unplanned events that can exacerbate vulnerabilities.

There is a lack of effective application of climate risk-based planning where climate change projections and scenarios are integrated into decision-making. Hazard maps are often inconsistent in how they adopt localised data and rarely incorporate climate risk³⁰. Climate risk is often deprioritised in strategic planning, as more ‘urgent’ issues such as housing targets are given precedence. However, once a land use decision is made, it is very hard to undo without incurring substantial costs and community engagement.

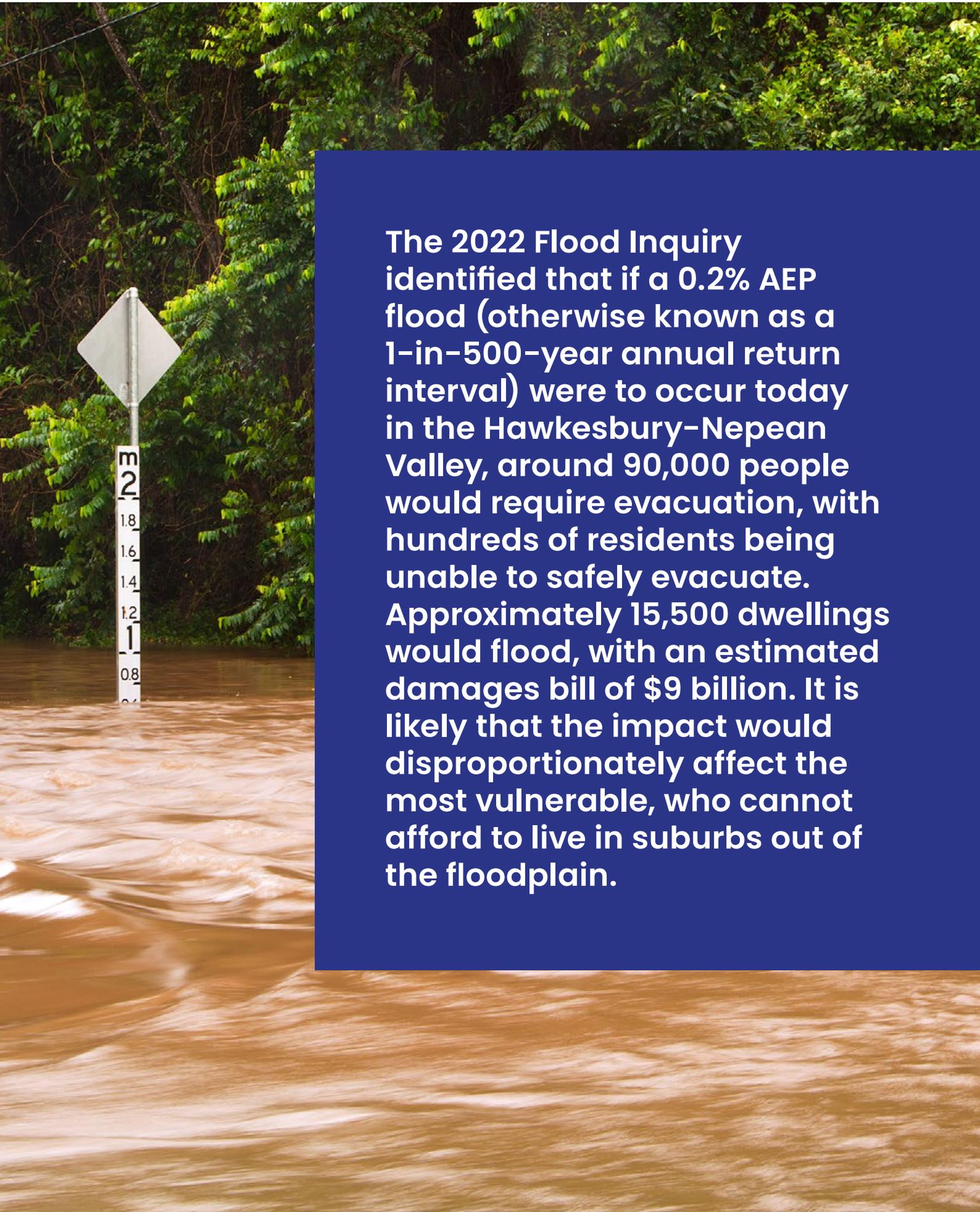
Land use development is continuing to occur in areas of Sydney with known and obvious climate risk. Some Local and

Development Planning Controls (LEP and DCP) have clauses that permit development in flood zones if mitigation measures are installed, such as infilling land, raising floor levels, building embankments, and installing pumps. However, successful redesignation of ‘flood-prone’ to ‘developable’ sets a precedent that results in additional development proposals. Leading to a false sense of security for floodplain residents³¹.

Recent efforts in NSW have been made to enable communities to rebuild more quickly after disaster, yet are also embedding legacy hazard risk. The ‘Natural Disasters’ LEP clause, introduced after the Black Summer bushfires in 2020, provides that while a merit assessment is still required, the rebuild or repair cannot be refused based on any development standards in the LEP.

At a property level, a planning certificate only provides information on planning controls related to whether the land is affected by any restrictions that may hinder future development, such as flood planning levels and bushfire risk. However, the full hazard exposure is rarely disclosed, including the scale of past natural disasters and projected climate change influences on the hazard risk profile, limiting effective evaluation of a property. While the disclosure will likely have controversial implications for property owners, improving awareness of risk and how this is expected to change is needed to protect communities.

As climate change increases the frequency and severity of floods and other natural disasters, better strategic planning and hazard disclosure are needed to plan long-term for uncertainty and community vulnerabilities while evaluating competing sets of lifestyle preferences, interests, and priorities.



The 2022 Flood Inquiry identified that if a 0.2% AEP flood (otherwise known as a 1-in-500-year annual return interval) were to occur today in the Hawkesbury–Nepean Valley, around 90,000 people would require evacuation, with hundreds of residents being unable to safely evacuate. Approximately 15,500 dwellings would flood, with an estimated damages bill of \$9 billion. It is likely that the impact would disproportionately affect the most vulnerable, who cannot afford to live in suburbs out of the floodplain.

Infrastructure systems are designed for the past, not the future

The loss of power during the 2022 East Coast floods was significant in terms of scale, duration and its compounding effect on other services, including telecommunication, sewerage system plants and water supply systems. The loss of services hampered response efforts and caused the most distress to communities because it affected their ability to request flood rescues, communicate with family and friends, provide warnings and access post-emergency information¹.

Similarly, roads were inundated by floodwaters and landslips, damaging them, preventing entry and egress, and further isolating communities from essential services. Following these floods, the Federal and NSW Government funded \$2.5 to \$3 billion in repairs to 13,000 kilometres of damaged roads across the State. As the State recovers from the floods, the cost of critical road maintenance and flood-damage repairs on evacuation routes for local and private roads is beyond the funding and resourcing capacity of local government and private road owners, delaying their ability to rebuild and increasing their vulnerability to future flood events.

While agencies such as Transport for NSW have comprehensive asset and system resilience strategies that consider flood impacts and responses, the NSW Auditor Office found that this was not consistent across all of NSW Government. In an earlier review, the NSW Audit Office found \$120

billion worth of physical assets held by nine NSW Government entities examined had not completed climate risk assessments, and a low capability to do climate risk assessment has been found across state agencies. This figure equates to 1/3 of total NSW Government assets and is a significant and unmitigated risk for asset owners and managers³². In response, DPE and NSW Treasury released the Climate Risk Ready NSW Guide and Course to improve support to agencies and help address this gap.

At the asset level, most of Australia's building stock was constructed after 1996 and, if properly maintained, complies with the National Construction Code (NCC). However, the Building Code doesn't properly recognise extreme natural disasters and define minimum standards that will allow assets to adapt³³.

Asset owners have adopted voluntary credit rating schemes such as those managed by the Green Star Building Council of Australia³⁴ and the Infrastructure Sustainability Council³⁵ that provide guidance on climate risk and resilience assessments and approaches to integrate climate adaptation into the asset lifecycle. However, climate risk assessments are not mandatory for development, resulting in a lack of understanding by asset owners if their asset is designed to withstand future climate impacts and whether investment in adaptation measures is warranted.

'Betterment' is a term used to describe upfront investment in rebuilding assets to a higher standard that can mitigate impacts from floods or natural disasters while contributing to safer communities and saving money for all levels of government in the long term. However, a lack of 'betterment' considerations in building codes and standards or specific



guidance on betterment criteria makes it difficult for state and territory governments to construct compelling business cases for funding applications.

For energy utility owners, funding is regulated on a 5-year basis and is determined by an investment case to the Australian Energy Regulator. The regulatory proposal that informs investment in asset resilience and betterment is co-designed with the community and balanced between priorities of dependability, value for money and innovation investment that serve customers' long-term choices and interests.

Although thorough community engagement allows utilities to demonstrate value-for-money, adaptation measures often face scrutiny. Pre-established investment cases can limit the ability to advocate for investment in asset resilience without the risk of seeming like unnecessary overinvestment or excessively enhancing the network.

Additionally, permanent residents of caravan parks in high-risk areas are often overlooked in betterment investment. The unique combination of private dwelling ownership on leased land also means that this community can miss out on programs intended to assist either homeowners or home renters, specifically during disaster recovery.







Current governance arrangements are unfit for purpose

Governments, utilities, the private sector, and communities all influence land use outcomes. However, fragmented governance within this process is one of Sydney's biggest challenges to integrating flood and climate risk into future land use planning and development conditions³⁶.

In Australia, flood risk management and emergency management are the responsibility of States and Territories, with funding and support provided by the Federal Government. NSW devolves much of the flood risk responsibility to Local Governments, which differ vastly in size and resourcing.

The problem with devolving responsibility is that many local councils do not have a sufficient rate base or resources to allocate for flood risk management, resulting in a variance in methodology, quality and completeness of flood risk assessments and difficulty in understanding catchment-level risk profiles³⁷.

The State Government provides specialist technical support and financial assistance to local councils with lower financial capacity to implement floodplain risk management plans, including guidance through the 2023 Flood Risk Management Manual³⁸. The updated manual provides an approach for re-determining flood planning levels and encourages councils in the same catchment to work cooperatively. The process for re-determination of legacy flood planning levels will require agreement on a tolerable, risk-based Flood Planning Level, which could take years.

There are many actors that play a role in adaptation planning, including governments, utilities, private sector, and communities. Governments, utilities, the private sector, and communities all influence land use outcomes. However, fragmented governance within this process is one of Sydney's biggest challenges to integrating flood and climate risk into future land use planning and development conditions.

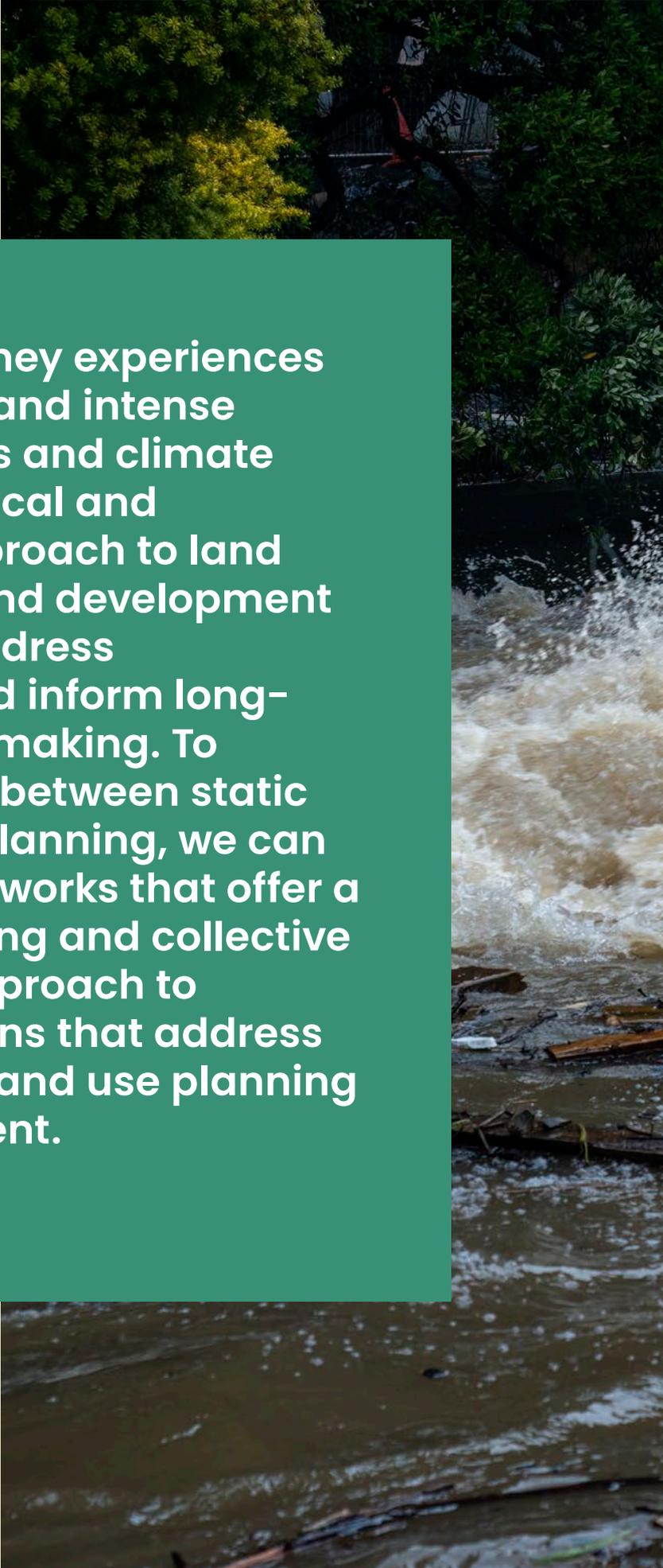
Across NSW, there is no consistent approach to meeting this urgent challenge.





III. Bridging the gap





As Greater Sydney experiences more frequent and intense natural hazards and climate events, a practical and adaptative approach to land use planning and development is needed to address uncertainty and inform long-term decision-making. To bridge the gap between static and adaptive planning, we can leverage frameworks that offer a systems-thinking and collective governance approach to develop solutions that address climate risk in land use planning and development.



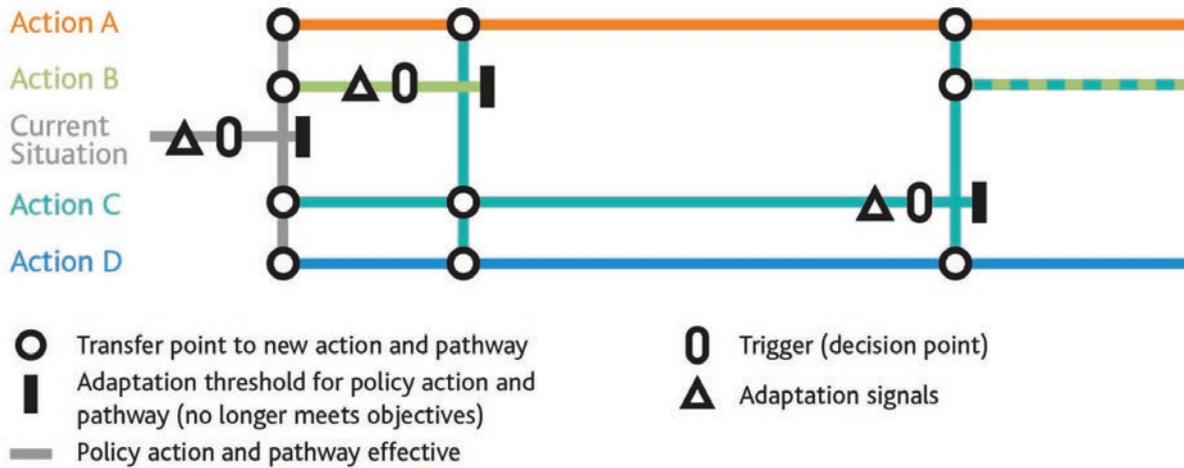


Figure 7: A template for Adaptation pathways (source: Auckland City Council)³⁹

Place-based adaptive pathways

A Dynamic Adaptive Policy Pathways (DAPP) framework recognises the uncertainty associated with climate change and the need to develop multiple potential pathways to adjust to changing conditions. The framework was developed in the Netherlands and has been adopted by countries around the world.

At its core, this approach seeks to understand risk tolerance in the community, among infrastructure providers, and with businesses (including insurers and banks). In the context of planning to reduce climate risk, this means that decision-making can respond to variables such as community risk appetite, evacuation capacity, affordability of insurance, and access to investment (from Government and debt providers).

Mapping actions as decision points over time allows prioritisation of immediate actions to reduce natural hazards and climate risk and the identification of metrics to monitor medium- and longer-term strategies for future risk management. By considering possible future scenarios and change from the start, the framework allows trade-offs between socioeconomic, environmental and hazard exposure to be captured, avoiding risk transfer costs and maladaptation.

In each catchment-based adaptive management plan, adaptive pathways need to include triggers for implementation of infrastructure investment decisions. The triggers can be defined by long-term investment benefits or to mitigate the long-term climate risk identified. Triggers can be developed based on financial and non-financial factors such as risk to life, affordability, avoided costs and environmental value.



CASE STUDY:

CSIRO Adaptation Pathways in QLD⁴⁰

Summary

CSIRO is developing its Enabling Resilience Investment (ERI) approach, which seeks to increase the capacity for decision-makers to proactively reduce climate risks through large-scale future-looking investments. The ERI approach describes various phases, modules and components of activities and assessments to generate options and pathways, build resilience investment cases, and deliver funding and financing pathways. These components help individuals at any level or stage of decision-making to address their gaps in knowledge, reveal important tensions and trade-offs in value priorities, and create governance that generates a wider set of adaptive options and pathways.

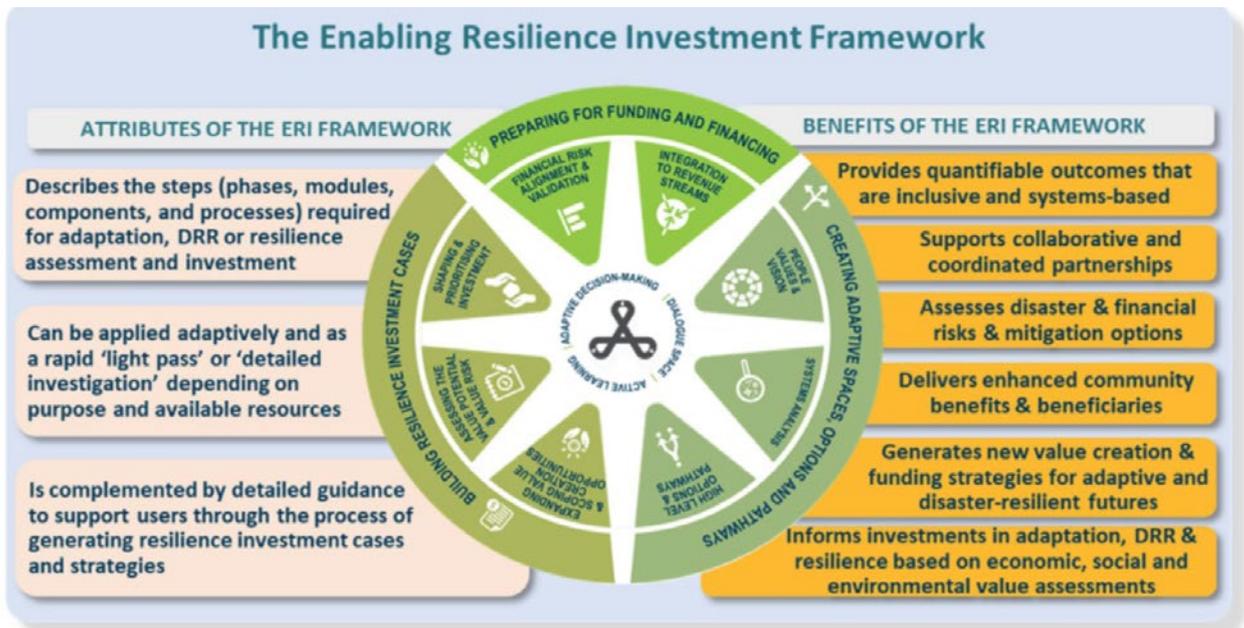


Figure 8: Enabling Resilience Investment Framework (source: CSIRO)

CASE STUDY:

New York Climate Risk Zones⁴¹

Summary

Zoning for Coastal Flood Resiliency is intended to provide homeowners, business owners and practitioners living and working in the city's floodplain the option to design or otherwise retrofit buildings to (a) reduce damage from future flood events, (b) be resilient in the long-term, and (c) potentially improve the affordability of insurance. Overall, the implementation of Zoning for Coastal Flood Resiliency is intended to improve the ability of the city's many flood-prone neighbourhoods to withstand and recover quickly from future storms.

New York City has been working to improve flood resilience since Hurricane Sandy in 2012, with the NYC Department of City Planning (DCP) working with stakeholders across New York City's (NYC) floodplain to develop zoning strategies that help promote resilient buildings and neighbourhoods, and therefore reduce flood risk in the city's most vulnerable areas. The recommendations were developed based on analysis of resilient construction in the floodplain through coordination with partner City agencies and community feedback received during an extensive public engagement process.

Climate responsive land use planning

Cities around the world, including New York City, Norfolk, Virginia, and Christchurch, have introduced land use zoning to manage changing climate risk in their cities. In New York, the city has created zones for coastal climate resilience, which strengthens building standards and limits the types of developments allowed in areas at risk of inundation from storm surges and sea level rise.

"In New York, the City's goal is to increase the capacity of communities located in the floodplain to adapt to climate change while boosting their vibrancy, liveability, and affordability in the long term."⁴¹

Climate risk zones can be either designated new zones or an overlay zone in areas with high and/or growing climate risk. The zone would mandate climate resilient standards to be met for any new builds or retrofits and would create performance expectations on new developments. For example, improving the resilience of critical infrastructure such as roads, bridges, water and sewers to reduce the runoff area being generated by sealed surfaces in urban areas, demonstratable evacuation (that residents could evacuate in response to different types of hazard events), and link areas of high risk to mechanisms to reduce density of development by ensuring state strategic policy and local government planning schemes require consideration of current and future extreme weather risk.



VISION AREAS

Vision 2100 divides the City into four vision areas and provides a set of goals and actions for each (beginning on page 24). The best way to understand the distinction between the four vision areas is to imagine their placement on two competing axes: a vertical axis representing the number of key citywide assets in the present or future and a horizontal axis representing the risk presented by sea level rise or other recurrent flooding risks. The strategy set forth for each vision area is intended to respond to the unique challenges brought about by the unique set of circumstances in each.

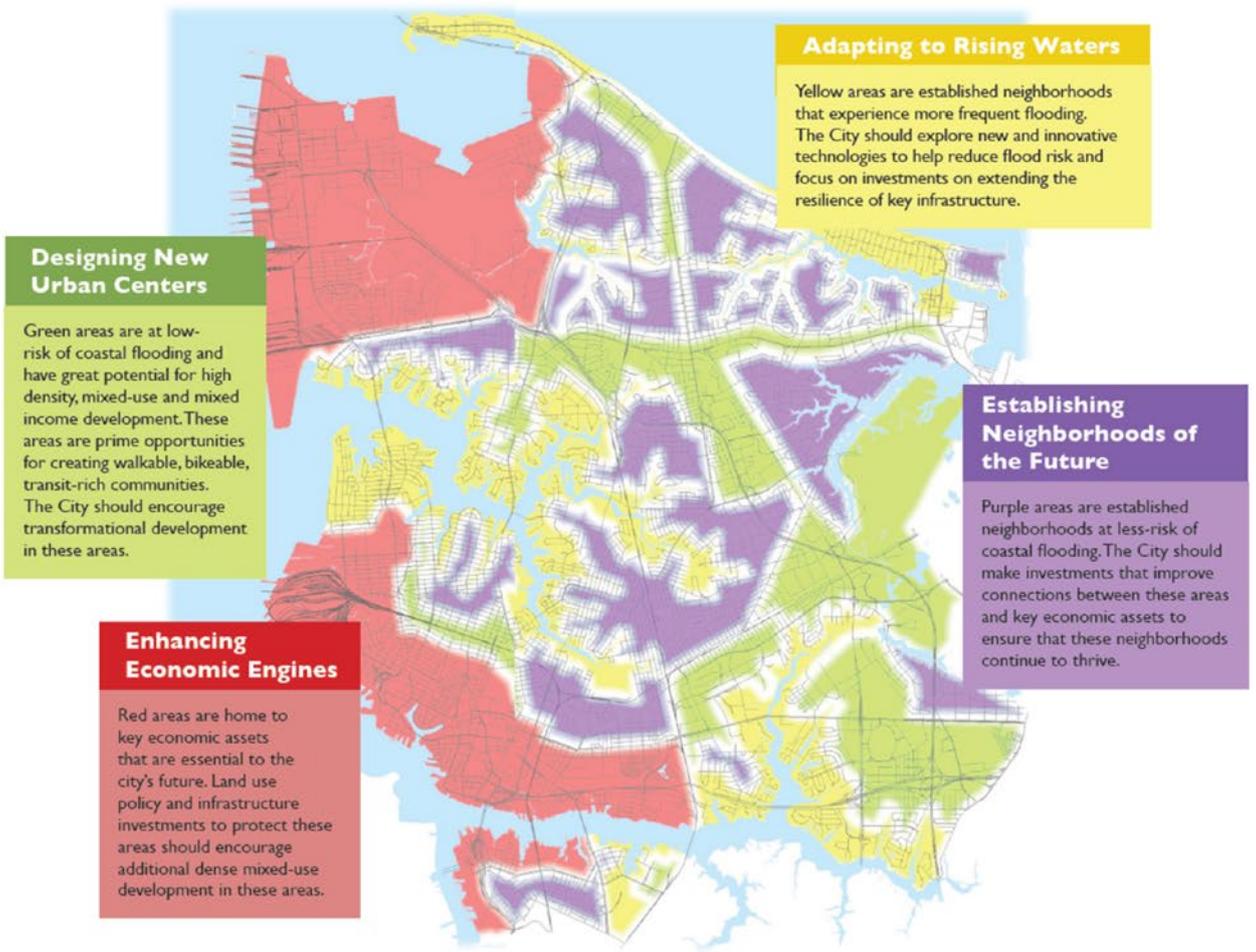
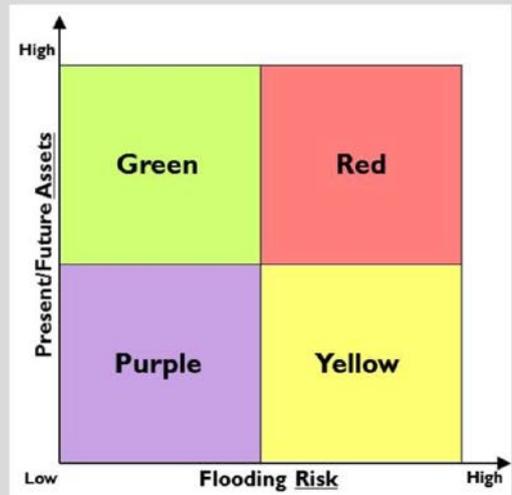


Figure 9: Norfolk 2100 Vision Areas (source: The City of Norfolk)





CASE STUDY:

The Resilient Sydney Data Platform

Summary

Australia's recent experience of intense bushfires, storms, flooding and heat is driving increasingly urgent city action to address the climate emergency. In order to respond across Metropolitan Sydney with so many players, Resilient Sydney recognised the need to be highly collaborative. Sharing the same data and interpreting that data to guide decision-making was one of the things that was identified as having the potential to really unify the city.

Launched in 2019, the Resilient Sydney Platform has enabled city-wide transparency of risks and opportunities and growing accountability for tangible action on the ground. The Platform is an online data portal that allows for the visualisation of city-scale environmental footprints to enable 33 local governments to understand the key environmental impacts in their communities. Tools to interpret the data are hosted in a user-centred program with a focus on the engagement and training of government officers to enable strategic planning of climate actions at the city council level.

Collaborative decision making

In Sydney, the 2018 Resilient Sydney strategy identified that one of our city's major challenges – disjointed governance – makes integrated decision-making difficult. Three layers of government, including 33 local governments, share overlapping responsibilities for supporting our community, economy and environment. The Resilient Sydney program has worked with global and local cities to share best practices, implement actions from the Strategy, and develop networks and campaigns to increase equity and build capacity and knowledge for communities to respond to changing risks.

In New Zealand, Regional Lifeline Infrastructure Groups coordinate activities aimed at reducing infrastructure vulnerabilities to regional-scale emergencies. Lifelines, known as critical infrastructure in Australia, are the essential infrastructure and services that support our community – utility services such as water, wastewater and stormwater, electricity, gas, telecommunications and transportation networks. The lifelines approach recognises that to enable community continuity during floods or any hazard-related disruption, infrastructure needs to be designed with the user in mind and where that user lives or works.

A similar mechanism is needed to identify how lifelines infrastructure constrains or enables adaptation and where long-term investment needs to be made to reduce risk to communities.

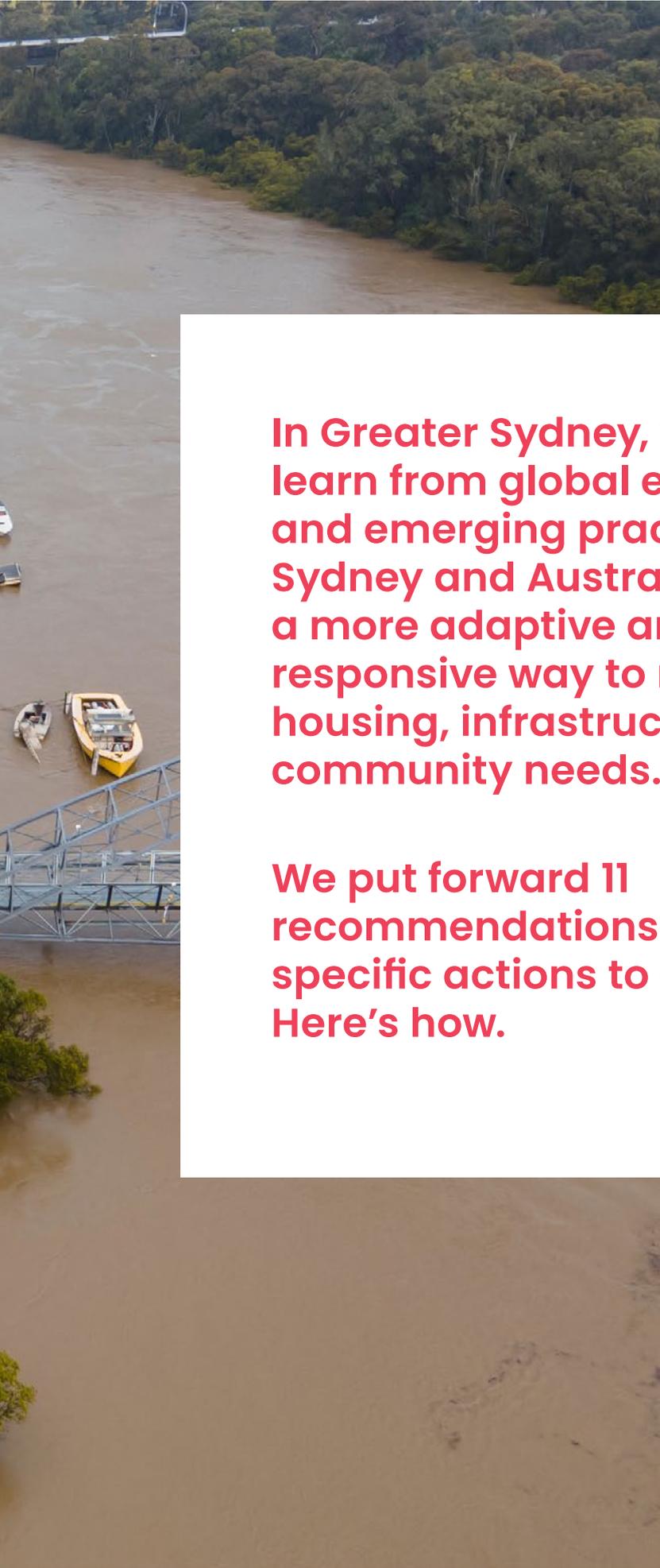


IV. Recommendations



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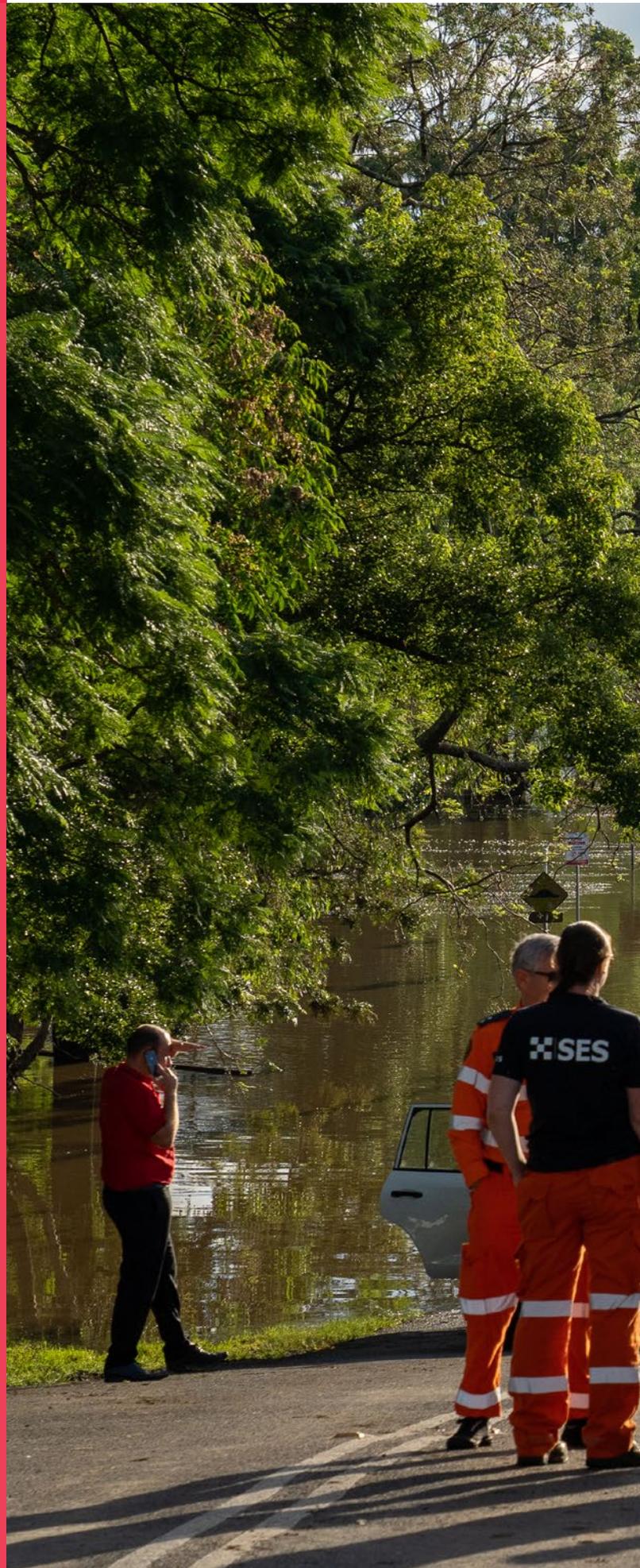




In Greater Sydney, we need to learn from global experience, and emerging practice across Sydney and Australia, to deliver a more adaptive and climate responsive way to meet our housing, infrastructure and community needs.

We put forward 11 recommendations and 38 specific actions to get us there. Here's how.

NOW:
COMMIT TO
REDUCING FLOOD
AND CLIMATE RISK
(Year 1)





1. Reduce growing climate risk through the 2023 Six Cities Region Plan and City Plans

The most effective way to reduce future climate risk is to stop building new dwellings and assets in areas of existing and projected climate risk.

Deciding to consider climate risk in land use planning and to measure how that risk is changing over time is the first step to preparing for a changing climate – as it can help us reduce the number and value of assets at risk, minimise the costs of recovery and reconstruction, and reduce the number of people who are affected by recurring natural disasters like flooding.

Investment needs to be made to reduce risk to communities.

Statistics

“Land use plans for the Hawkesbury Nepean Valley include moving another 54,000 houses or 130,000 people in over the next 30 years, in addition to the 70,000 residents living on the flood plain today.”

– WaterNSW (Warragamba Dam EIS)

Up to 45% of the total projected dwellings required in metropolitan Sydney over the next two decades – 327,000 dwellings – can be accommodated around train stations, out of the way of growing hazards like flooding.

– Committee for Sydney. Rethinking Station Precincts Report 2022

Actions

- a. Embed in the Six Cities Region Plan, a high, medium and low hazard risk overlay that considers projected future climate risk across Greater Sydney.
- b. Focus future urban growth in infill areas, close to transport and social infrastructure and away from areas of growing climate risk.
- c. Measure and report how the Six Cities Region Plan reduces the number of people, dwellings and assets exposed to climate risk.
- d. Develop and embed a climate risk policy maturity framework in the Six Cities Region Plan and City Plans to show how land use policy and planning is responding to a changing climate.

Proposed Lead:

Greater Cities Commission

Key Collaborators:

NSW Reconstruction Authority; NSW Department of Planning; Local Governments

Image source: Infrastructure NSW, Photo by Adam Hollingworth

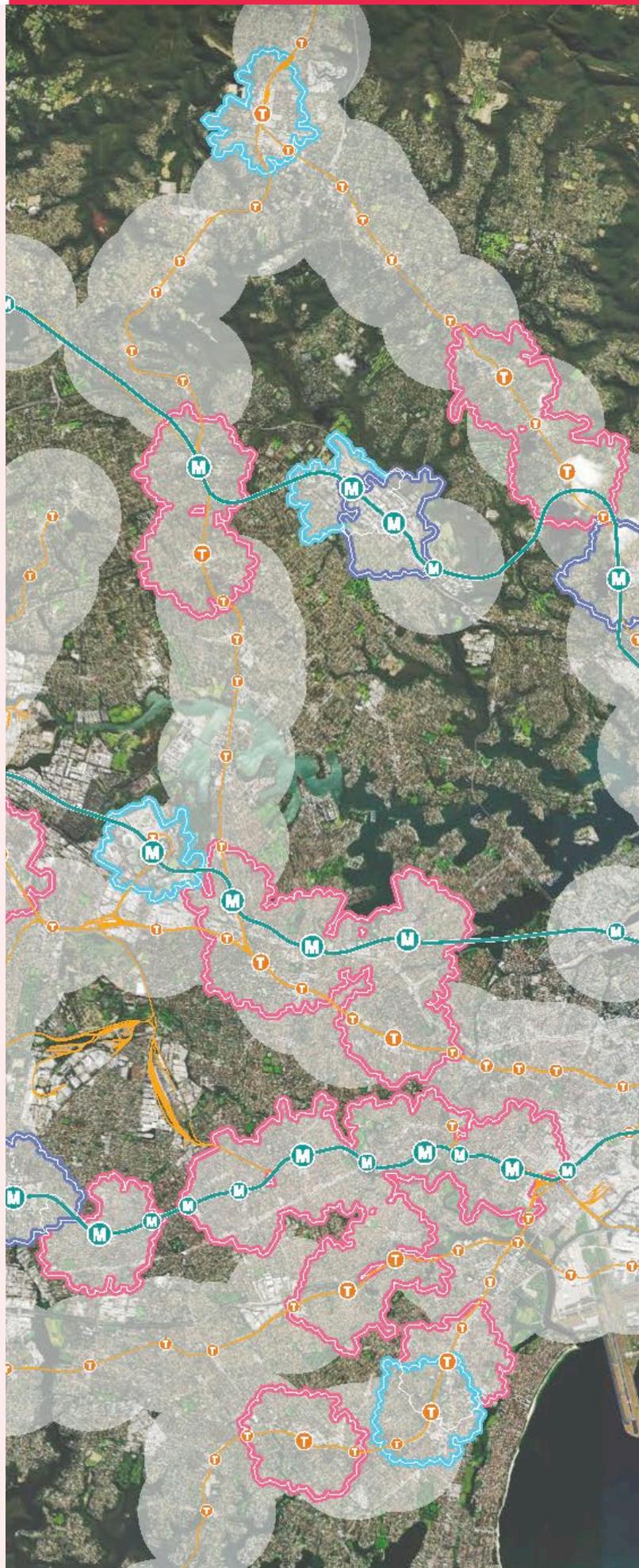




CASE STUDY:

Rethinking Station Precincts⁴²

Research released by the Committee for Sydney in 2022 identified that almost half of the future projected growth in Greater Sydney could be accommodated in highly accessible locations with great amenities close to current and planned rail and metro stations. Up to 45% of the total projected dwellings required in metropolitan Sydney over the next two decades - 327,000 dwellings - can be accommodated around train stations, out of the way of growing hazards like flooding. Simply put, the immediate environs of rail stations are the best place to put Sydney's growth over the coming years for a high-functioning global city.



2. Embed community, infrastructure and economy in the State Disaster Mitigation Plan

Preparing plans to reduce the impact of floods and other disasters will require trade-offs between and within communities. These trade-offs require both a near-term and a long-term perspective to ensure that risk – in the form of new development in areas of growing risk – is not being created beyond the capacity of the community, service providers and Government to cope.

By approaching these essential challenges at a State level through the State Disaster Mitigation Plan – we can ensure consistency across Sydney and NSW and ensure that climate change and community and First Nations perspectives are being incorporated into decision-making.

“The cost of de-risking retrospectively, or in response to a deteriorating risk outlook, is likely to be higher than the costs of actions to manage risks – particularly when it comes to land use planning in the built environment”

— Secretary of the Dept of Prime Minister and Cabinet, Royal Commission into Natural Disaster Arrangements

Actions

- a. Develop a consistent methodology for establishing risk tolerance across communities, service providers and Government.
- b. Provide guidance on how to integrate land use planning and cost/ benefit analysis of alternate mitigation options into Disaster Adaptation Plans.
- c. Introduce specific Climate risk land use zones for high-risk areas and identify areas for possible application.

Proposed Lead:

NSW Reconstruction Authority

Key Collaborators:

NSW Department of Planning; NSW Treasury; Utilities/ Telcos





CASE STUDY:

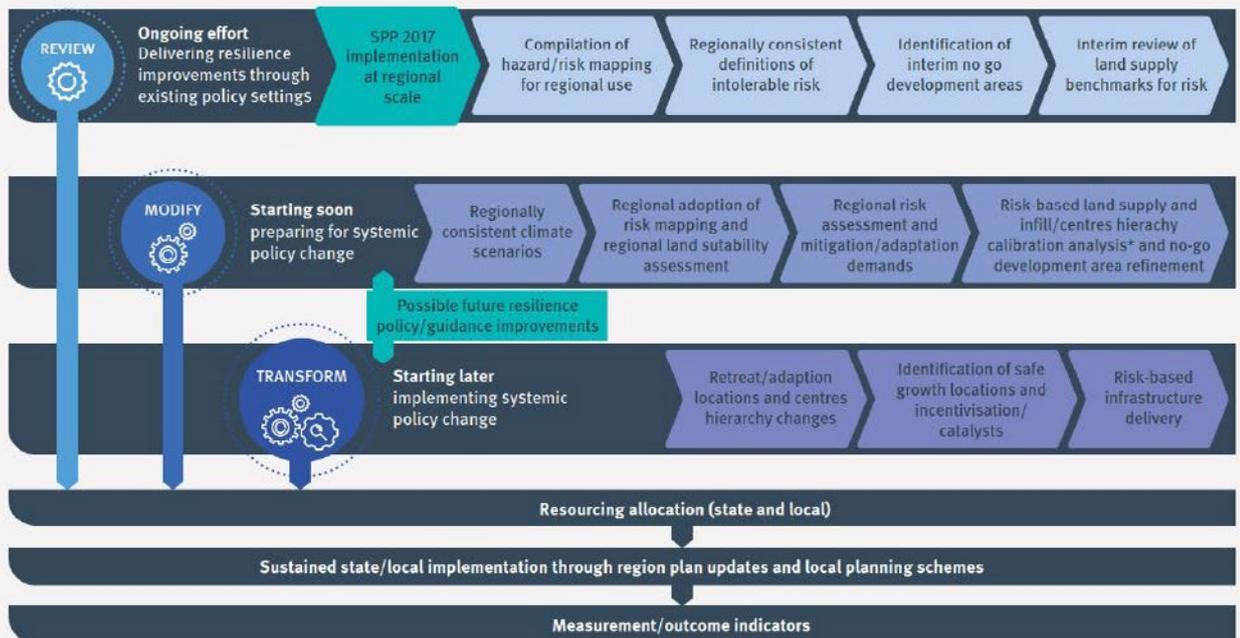
Draft ShapingSEQ 2023⁴³

The draft Southeast Queensland Regional Plan Update recognises that risk-based land use planning policy differs between local governments across the region. The draft plan integrates climate risk management and climate adaptation processes at the regional scale to provide a consistent regionwide understanding of climate and climate risk for land use planning.

Actions within the draft plan include identifying ‘no-go’ future development areas in accordance with the avoidance principles of the Queensland State Planning Policy and the need for longer-term sustained policy and practice change to ensure our settlement pattern and built form is responsive and adapted over the long term to climate risks.

Action for state government Resilience policy maturity framework

Future regional plan reviews are to be undertaken in accordance with the Resilience Policy Maturity Framework.



* Council also include risk-based whole of lifecycle infrastructure planning/prioritisation.
Figure 9: Concept map of the resilience policy maturity framework

Figure 11: Draft SEQ Resilience Policy Maturity Framework (source: ShapingSEQ)

3. Establish regional critical infrastructure groups

NSW has an emergency management coordination structure that enables clear allocation of responsibility and decision making. A similar mechanism is needed to identify how critical infrastructure constrains or enables adaptation, and where long-term investment needs to be made to reduce risk to communities.

Embedding a strategic and collaborative approach to lifeline or critical infrastructure investment would enable government and service providers to look at the impacts of hazards on the region’s infrastructure and identify ways to reduce outage risks and minimise restoration times when outages do occur, particularly given the next to which infrastructure providers rely on each other to deliver services (system interdependencies).

“Some of our customers in Western Sydney were impacted by flooding four times in 18 months. We can raise power poles in some places to reduce specific threats, but we are also reliant on access to affected sites – which sometimes means waiting months for roads to be rebuilt if they’ve been washed away”.

– Vida Cheesman, Endeavour Energy

Actions

- a. Build on experience from Queensland and New Zealand to co-design a long-term regional adaptation approach for lifeline infrastructure.
- b. Identify risk ownership and needs from a place and system perspective to inform investment planning across lifeline infrastructure.
- c. Enhance the role of green infrastructure solutions in contributing to climate adaptation.

Proposed Lead:

NSW Reconstruction Authority

Key Collaborators:

Utilities (Ausgrid, Sydney Water, Endeavour Energy); Telco’s; Infrastructure NSW; Local Government Department of Planning; Local Governments

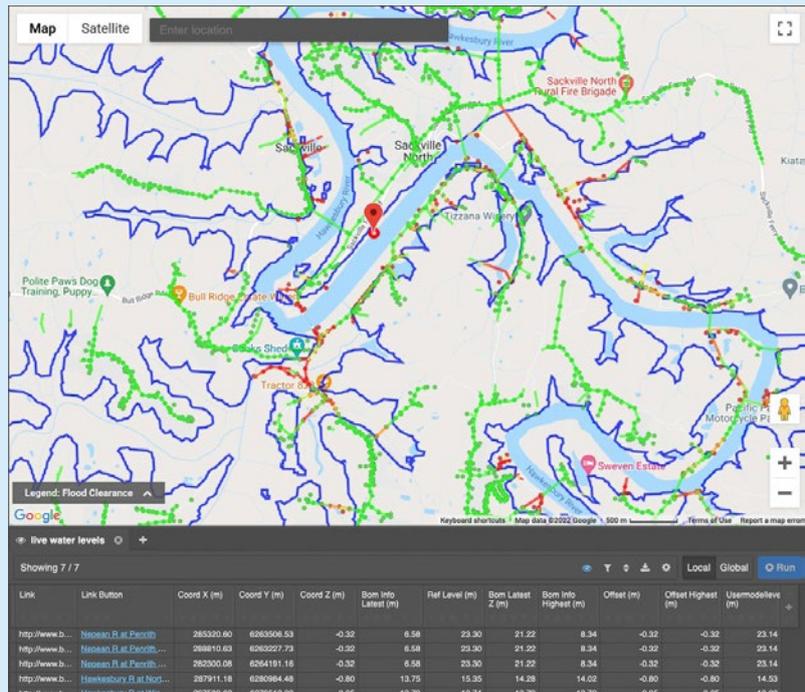


Figure 12a: Live flood levels (source: Endeavour Energy)



CASE STUDY:

Endeavour Energy Digital Twins

A 'digital twin' is a virtual model designed to reflect a physical object, process or system that includes relational interactions with data and simulations. The digital twin accurately identifies clearances between rising floodwaters and powerlines remotely rather than through onsite inspections. With this information, Endeavour Energy can identify high-risk and high-priority areas of its network when simulating extreme weather events — such as high wind, extreme heat, rising floodwater and bushfire — to understand the impact on its network.

The digital twin can be used to see how cables might sag in hot temperatures, which feeders might be impacted first as floodwater rises and which poles might be most at risk of failure in high winds. During flood recovery, the digital twin has allowed Endeavour Energy to quickly inspect and restore flooded properties, dramatically improving the time to restore essential electricity supplies to flood-affected customers so they could start rebuilding their lives and communities.

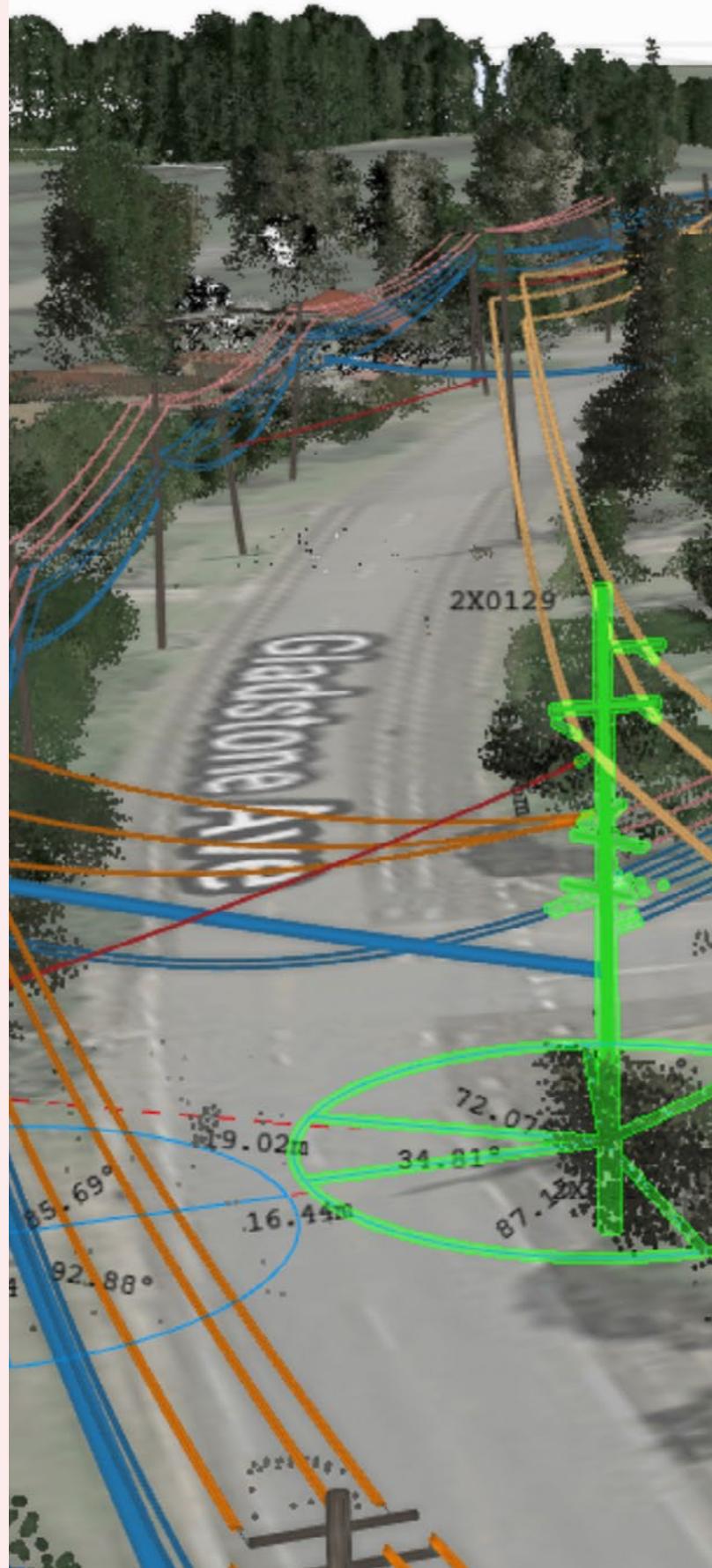


Figure 12b: Digital twin voltage colours (source: Endeavour Energy)

CASE STUDY:

Ausgrid Climate Resilience Decision-Making Frameworks⁴⁴

Ausgrid developed a decision-making framework to guide a forward-looking, long-term perspective on responding to the risks presented by climate change. The decision-making framework:

- provides the basis for developing and justifying non-network and network investment decisions focussed on solutions to maintain network performance in the face of increasing severe weather events.
- promotes finding the right balance in timing for investment as well as the right balance between preparatory investment and responsive investment, underpinned by a commitment to understanding the specific needs of different communities in the network.

Ausgrid has worked closely with groups of community members, including those with the greatest risk from climate change, to design a suite of proposed investments in response to local needs. This iterative and highly participative community engagement process informed a climate resilience investment proposal for inclusion in Ausgrid's 2024-29 regulatory control period to deliver pilot projects in three local areas and across the broader Ausgrid network. This targeted pilot approach will enable Ausgrid to take a staged approach to investment, managing the risks of both under- and over-investment in the face of uncertain localised impacts from climate change while ensuring strong customer willingness to pay.





CASE STUDY:

Infrastructure Australia – Valuing blue and green infrastructure in investment decisions

In 2021, Infrastructure Australia released its 'Pathway to Infrastructure Resilience' report, which stated that "Blue and green infrastructure is not adequately valued for its contribution to reducing risk" and that "Natural assets provide ecosystem services that can complement traditional infrastructure-related services or offset the need for physical investment."

Based on studies by Melbourne Water in the Port Phillip region, the current value of 'living infrastructure' that intercepts water and reduces annual average damage is \$339 million per year. Infrastructure Australia has highlighted the need to approach infrastructure – including blue and green 'living' infrastructure – using a systems approach. That is, recognising the interdependence of the assets and services that enable our cities to function and how disruption to one part of the system can have implications for other connected parts of the city.



4. Build collective governance and place-based adaptation pathways through Disaster Adaptation Plans

The Resilient Sydney Strategy 2018 called out the complex governance for managing climate risk in Sydney, identifying that no single organisation has the responsibility or power to reduce flood and any other risk. Collaborative planning processes are needed to address this gap to build trusted relationships and allocate responsibilities for reducing climate and natural hazard risk in Greater Sydney.

The NSW Reconstruction Authority was established in 2022 can lead the development of a collaborative governance model that brings together a deep understanding of climate risk with the wide range of organisations and people who own those risks – local government, service providers, asset owners, business and communities – to make a decision about the future of the places they live and work in.

Through transparent risk information and a collaborative approach, we can identify who's responsible for mitigating specific risks, the policy and investment levers they have at their disposal, and the constraints that need to be overcome to balance community aspirations and growing climate risk.

“...there are over 100 organisations with some level of control in operating and managing key city systems that sustain our lives and economy in metropolitan Sydney.”

— Resilient Sydney Strategy 2018

Actions

- Fund the delivery of deep engagement to enable community-led Disaster Adaptation Plans to be created across Greater Sydney.
- Identify climate-informed medium and high-risk locations and share findings with Local Government.
- Generate and incorporate consistent data on social capital, social cohesion and social infrastructure to identify high-risk communities.
- Develop sub-regional scale adaptation pathways with community, business, critical infrastructure providers, First Nations communities and other stakeholders.
- Pilot a cost-benefit methodology to identify alternate risk reduction and investment scenarios

Proposed Lead:

NSW Reconstruction Authority

Key Collaborators:

NSW Department of Planning; NSW Treasury; Universities; Local Government; Resilient Sydney; Utilities



CASE STUDY:

Cyclone Risk Categories for properties in New Zealand⁴⁵

In response to cyclone risk in the North Island of New Zealand, the Central Government has designated properties as being either Category 1, 2 or 3. For properties designated Category 2 (where it is determined community and/or property level interventions are feasible to manage future severe weather event risk), the Government will work with councils to help them build flood protection and other resilience measures. The initial support for this is already in place with NZ\$100 million initial funding announced in Budget 2023.

People in homes designated as Category 3 properties (where future severe weather event risk cannot be sufficiently mitigated) will be offered a voluntary buyout by councils – the costs of which will be shared between the Government and councils. A parallel process is also underway to engage with Māori to ensure that there are equitable outcomes for these communities.



5. Support Local Governments to assess and communicate risk

Without climate risk scenarios at local government level, we are effectively creating a postcode lottery across Sydney. Most businesses and households are unaware or have little understanding of the natural hazard and climate risk that they face or how this risk impacts them and will change in the future. While some local governments are working hard to share known hazards risk information with their communities, many either don't have the resources to update existing hazard modelling to include climate risk or are reticent to share new information with their communities without comprehensive strategies to respond.

By making natural hazard and climate risk transparent – to local governments, developers and communities – we can understand the choices that have been made about location and standard or development in relation to climate risk, and ensure that local government, residents and businesses are supported to respond to those transparent risks.

“Leading into 2020/21 summer, surveys of residents indicated that 82% of residents of Hawkesbury Nepean didn't recognise that they were in a high flood risk zone”

— Shane Fitzsimmons, Former Commissioner, Resilience NSW

Actions

- a. Require and fund mandatory climate risk assessments to inform Local Government flood risk assessments (through the NSW Flood Manual).
- b. Update quarterly rates notifications to include all hazard exposure, linked to asset design standards where possible, and identify sources of further information about risk to life and property in each location.
- c. Update S.107 certificates to include all hazard exposure and how global warming is expected to change or exacerbate these hazards.
- d. Use natural hazard and climate risk data to support small and medium sized business preparedness and continuity plan development

Proposed Lead:

NSW Department of Planning

Key Collaborators:

Office of Local Government; Local Governments; Resilient Sydney; NSW Treasury;

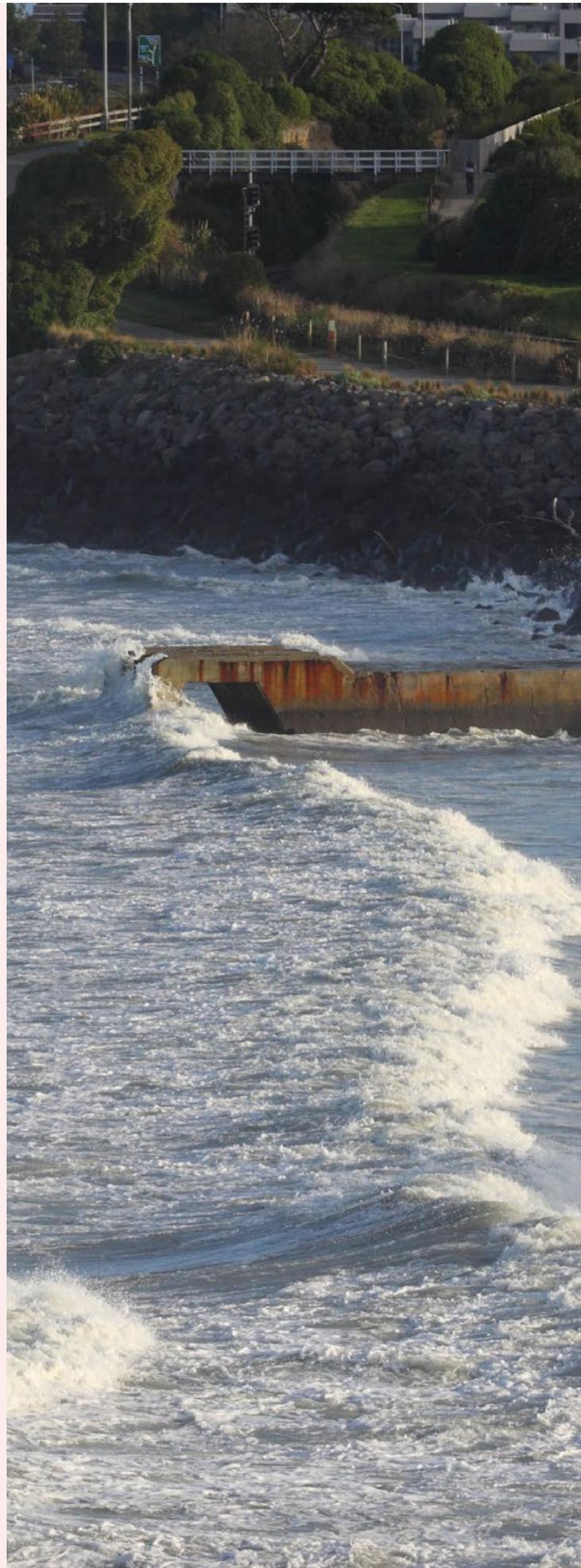




CASE STUDY:

Communicating risk in Wellington, New Zealand

Some areas across the Wellington region have blue lines painted across roads and footpaths to show the safe zone from a Tsunami if there is a long or strong earthquake. These lines show the maximum possible run-up heights and are based on modelling by GNS Science and Greater Wellington Regional Council. Mapping of tsunami red, orange, and yellow zones indicates where evacuation is required in response to official warnings. The City Government has also used virtual reality to show residents what future sea level rise will do to the CBD, allowing them to splash their way up the main street in several feet of water.



CASE STUDY:

The Disaster relief Australia 'Big Map' Capability: methodology⁴⁶

The purpose of the 'Big Map' activity is to better understand the community complexities and develop a community risk profile based on the exposure within an all-hazard environment. The past and present approach to building community resilience has been ad hoc and disjointed. No one organisation has looked to bring everyone involved together at the table to develop a collaborative approach to resilience and recovery moving forward.

Understanding, measuring, and assessing community resilience requires a keen awareness of the links and relationships between the various levels of governance and the different systems that are directly and indirectly affecting communities. Developing strategies for building and enhancing community resilience requires an understanding that vulnerability at any level translates to an increased vulnerability in other areas of the larger system.

At its foundation, the DRA 'Big Map' links into the community where identity is always essentially by what people value and about where they live. However, what a community of people collectively values are open to interpretation and subject to disagreement. This suggests that people and the ways they come to a rough consensus—are necessarily at the very centre of community resilience and their intended future.





NEXT:
INVEST IN PLACE-
BASED CLIMATE
ADAPTATION
(Year 2)





6. Focus Federal funding on reducing the costs and impacts of disasters

The Federal Disaster Ready Fund allocates \$200m per year for preparedness, with funds allocated based on a competitive grants process. A new funding logic is needed that takes a more strategic approach to make best use of this limited funding and begins to undo the current reality that funding flows to those best placed to apply for it, rather than those who need it most.

The Federal Disaster Ready Fund should provide funding on the basis that the density of assets and people at risk of growing natural disasters is reduced, with the long-term impact being a reduction in the extent of post-disaster funding that was needed in each place. This would include leveraging place-based Disaster Adaptation Plans (where these have been completed) to fund interventions aligned with the outcomes identified in those plans.

By aligning Federal Government funding with State, place-based adaptation planning, there is an opportunity to target investment towards interventions identified through collaborative approaches, to accelerate investment through an agreed framework to reduce climate risk and build community capacity to adapt in the short and long-term.

Actions

- a. Set funding criteria at Federal level that incentivise land use and development decisions that reduce total asset exposure and enhance life safety, prioritising high-risk locations
- b. Make Federal and State betterment funding available to strengthen assets and dwellings in at-risk locations prior to disasters occurring

Proposed Lead:

National Emergency Management Agency

Key Collaborators:

NSW Reconstruction Authority; NSW Department of Planning; NSW Treasury; Commonwealth Treasury





CASE STUDY:

Infrastructure Canada's Disaster Mitigation and Adaptation Fund

Infrastructure Canada's Disaster Mitigation and Adaptation Fund (DMAF) provides \$3.38bn over the period 2018–2034 to invest in “structural and natural infrastructure projects to increase the resilience of communities that are impacted by natural disasters triggered by climate change.” The DMAF consists of two funding streams: a small-scale stream for projects between \$1m–\$20m and a large-scale stream for all others. All projects are assessed against the following merit-based criteria, ensuring adherence to a single national strategy:

- Natural hazard risk – how a project impacts health and safety, critical infrastructure and economic activity;
- Community resilience – how a project strengthens community resilience and reduces risk, particularly in the context of climate change;
- Return on investment – including the capacity to decrease or avoid future natural disaster losses;
- Rationale – why the project is the best solution to mitigate the risk;
- Innovation – the capacity to provide innovative solutions and technology, including through using natural infrastructure;
- Risk transfer management – how a project not only mitigates risks in the immediate area but also how it ensures risks are not simply transferred to a neighbouring one;
- Strategic alignment – how a project aligns with national or regional mitigation strategies or frameworks such as land use, allowing for projects to reflect the jurisdictional needs and
- Co-benefits – whether a project provides additional benefits such as reducing greenhouse gases, protecting cultural assets or creating sport and recreational value.



CASE STUDY:

Principles for improving the Federal Government's Disaster Ready Fund

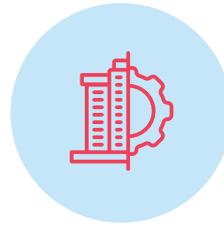


Principle 1: Identify place-based triggers for economic investment plans to enable economic transition for high natural hazard and climate risk areas.

Adaptive planning triggers can inform infrastructure investment decisions by developing and agreeing tolerances to inform a long-term decision-making pathway to accommodate changing natural hazards and climate risk.

Triggers can be developed to identify tolerances for other variables such as community risk appetite, evacuation capacity, affordability of insurance, 'the cost of doing nothing' and access to debt finance.

Feasibility assessments can capture a broader basis of climate-related risk and opportunities, staggered investment (adaptive pathways), social costs and nature-based capital. Informing the development of financial incentives that reflect non-financial values and meet the local appetite for transition.



Principle 2: Invest in the reform of betterment clauses to enable climate adaptive, built, and natural infrastructure.

Reform of regulations to improve retrofitting, asset betterment, and compliance to ensure ongoing maintenance of betterment works must be coordinated across all levels of government.

As part of the reform, an agreement can be defined for when the cost outweighs the benefit of rebuilding infrastructure.

Build Back Better and betterment policy clauses can spur investment in the development of smart technologies, construction methods, nature-based solutions and energy systems to enhance the resilience of critical natural and built infrastructure. Helping to achieve a wide range of benefits to society in terms of ecosystem services.



Principle 3: Invest in social capital to create an enabling environment for community-led resilience building and self-determination.

The dispersal of funding should be allocated in strong collaboration with the local community through two-way information sharing and respecting cultural and social sensitivities.

Consideration of adequate governance models to enable equitable, community-led funding allocation can enable greater social cohesion and risk awareness of the shifting nature of natural hazard and climate risk.

Subsequently, the co-design of incentives and programs can inform short-term recommendations for adaptive management and establish a pathway to hand over ongoing work for community members to own.



7. Engage the financial services sector in Disaster Adaptation Planning

Neither State nor Federal Government owns all the risk from natural disasters and climate change. Acknowledging that these risks are shared, including financial risks, would be a significant step in how we approach planning for natural hazards and climate risk.

Financial risk in each place is shared between households, businesses, insurers, banks, and all levels of Government, among others. This financial risk relates to the cost of disaster response, recovery and reconstruction that is present in each place, costs that can be amplified by recurrent disasters. Who owns that financial risk is not transparent. However, the 2022 East Coast Floods showed that insurers only paid for around 30% of the total cost of that disaster.⁴⁷

In the wake of recent natural disasters, Governments, at State and Federal scales, have also begun signalling that the costs of disasters are unsustainable, meaning that the capacity of Government to act as the 'insurer of last resort' may be limited in the future. This could mean a stricter view on where development is allowed in the future and strategies to reduce legacy risk.

Given how risk is shared across multiple actors, risk tolerance in each place is therefore not just a conversation for Government, communities and infrastructure providers. By bringing banks, insurers and property developers into these processes, we can add valuable

perspectives on the implications of risk-based decisions, including the cost of products like home insurance and how exposed assets (including homes) will be treated by mortgage providers. In short, there is a need to understand the value chain, who owns the downside risk of changes in flooding and other hazards as Sydney continues to grow and change, and the role of land use planning in easing these downside risks.

“...it’s not just the increasingly destructive force of climate-driven disasters themselves that are currently driving higher losses for insurers globally and putting pressure on the Australian reinsurance market. It’s growing asset values, urbanisation and rising populations – often in the most high-risk areas... we are witnessing increasingly expensive reinsurance markets for our country because of what we have experienced in recent years and what we can expect in coming years because of climate change”

— Nick Hawkins, Managing Director and Chief Executive Officer of IAG.⁴⁸



Actions

- a. Create a Financial Services Forum to bring the knowledge, data and perspective of financial services providers into place-based risk tolerance discussions and Disaster Adaptation Plans.
- b. Engage with financial services providers to identify viable and affordable mitigation options at the household scale to improve asset resilience and insurance affordability in medium-risk zones.
- c. Work with financial services and State Government to create an accessible natural hazard and climate risk data asset that enables risk-informed infrastructure, asset management and land use planning decisions.
- d. Partner with financial services providers and the State Government to identify who owns the financial risk in the next major flood disaster.

Proposed Lead:

NSW Reconstruction Authority

Key Collaborators:

Committee for Sydney; Private Sector; Insurers; Resilient Sydney; Australian Prudential Regulation Authority, Australian Banking Association, Financial Services Regulators; Universities; CSIRO/ Australian Climate Service

CASE STUDY:

Commonwealth Bank: Supporting the resilience of home loan customers

CBA can engage with their customers to help them understand and improve the resilience of their homes against increasingly frequent extreme weather events such as droughts, floods, bushfires and storms. In 2023, CBA launched the Building Resilience Pilot program. The aim of the program is to provide customers with information and tools to make informed decisions regarding their home's climate resilience and to identify areas of their homes that may increase their vulnerability to potential climate hazards.

The pilot looks to generate property-specific climate resilience insights for a small cohort of home loan customers in New South Wales who may be exposed to bushfire or flood events and suggests tangible actions that homeowners might consider improving their home's resilience. Climate resilient customers have a reduced risk of climate-related damage to their homes and property. The goal is to expand the pilot to further parts of the home loan portfolio to support more Australians in understanding and managing their exposure to the physical impacts of climate change.

CASE STUDY:

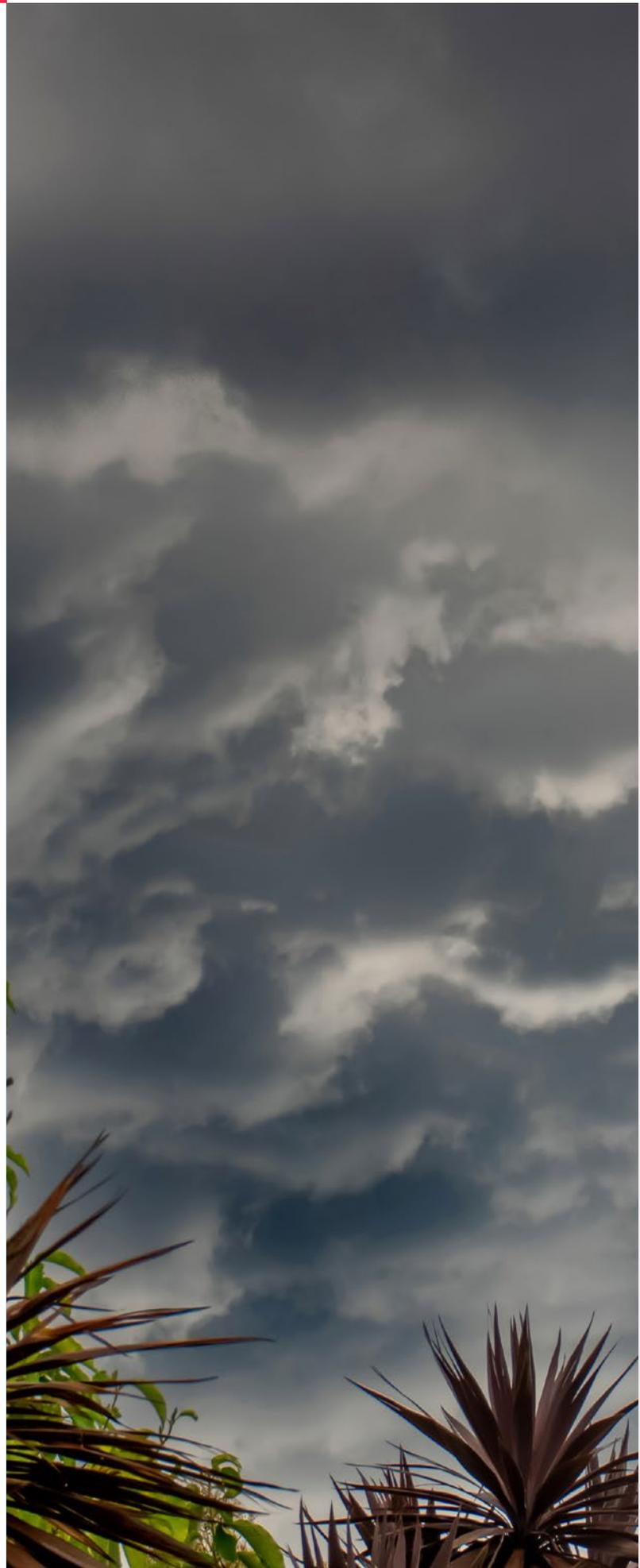
Hazard Insurance Partnership

Natural hazard risk is increasing in many areas of Australia, which is putting pressure on the cost of insurance. Poor insurance coverage makes it harder for households and communities to fully recover if hit by a disaster.

Managed by the National Emergency Management Agency, the Hazards Insurance Partnership (HIP) and strategic insurance projects are helping communities be better prepared for disasters. This HIP is a single touchpoint between the Australian Government and the insurance industry to engage on issues of disaster risk reduction and hazard insurance.

This foundational work is required to:

- identify the most pressing insurance issues in areas with high natural hazard risk;
- target and test the best policy solutions to reduce risk and insurance costs and
- support better consumer outcomes via more affordable insurance and a better understanding of insurance products.





CASE STUDY:

Resilient Building Council: Resilience Rating System

The Resilience Rating system measures the disaster resilience and energy efficiency of buildings and is intended to provide an independent global standard to measure, rate and reward resilience. The rating system starts with an initial Bushfire Resilience Rating in the form of a self-assessment app for households.

The Resilience Rating will make it easier to adapt homes to our changing climate by providing a single home assessment, integrated recommendations and rating certification capability for bushfire, storm, flood, cyclone, heatwave, thermal comfort and energy efficiency. The system works by assessing site-specific risk and measuring a home's vulnerability. It will provide households with a list of evidence-based, tailored actions to adapt their home, improve their resilience rating and enable financial incentives.

Developed by Australia's leading bushfire experts and supported by the Australian federal government, NRMA Insurance, NAB and BlueScope Steel, the Bushfire Resilience Rating system takes a best-practice and holistic approach to bushfire resilience that covers the building, landscaping and ongoing maintenance. The free Bushfire Resilience Rating Home Assessment App will empower everyday Australians with the risk information they need to make their homes more resilient to bushfires. The Resilience Rating system also has the potential to give insurers, banks and investors a framework for financing and rewarding bushfire resilience adaptations.



8. Enable IPART to accelerate climate adaptation

The Independent Pricing and Review Tribunal (IPART) can review reasonable funding allocations for many of the key actors responsible for disaster preparedness, including utilities and Local Governments. As findings emerge from Disaster Adaptation Plans, it will be critical to identify the role that IPART can play in funding the actions that key service providers need to implement to enable place-based adaptation.

IPART is beginning to understand how it will address climate change in its reviews and functions; however, speed is of the essence. Pricing decisions about Local Government rates and water pricing, for example, have a significant impact on the ability of service providers to prepare for extreme weather conditions.

By engaging with IPART on the findings of Disaster Adaptation Plans, there is an opportunity to establish a clear link between the risk tolerance of communities, the impact of extreme weather on service provision to the community, and when and how to invest to minimise the impacts of those events.

Statistics

Following the 2022 floods, Hawkesbury City Council was faced with a \$190 million road repair bill. At the same time, Blue Mountains Council estimated it would cost them \$400 million to rebuild the 22% of their affected road network “so that it doesn’t happen again”.⁴⁹

Actions

- Update IPART Terms of Reference to include mandatory consideration of climate change adaptation.
- Engage with IPART on the findings of Disaster Adaptation Plans to determine how IPART can play a leading role in addressing adaptation to natural disasters and climate change.

Proposed Lead:

NSW Minister for Planning

Key Collaborators:

IPART; NSW Office of Local Government; Utilities; Local Government; NSW Department of Planning; NSW Treasury



NEW:
MANAGE RESIDUAL
RISK (Year 3)





9. Undertake an Integrated Strategic Assessment for Greater Sydney

As our population grows, some parts of Sydney will adapt to a changing climate, others while others will experience rapidly increasing risk. We need an approach that identifies the options that enable Sydney to adapt to these changes, and make informed decisions about where and how to grow, and where growing would bring unsustainable risk.

Across Greater Sydney, we need to consider how demands for economic and equity drivers, like the need for more and diverse housing stock, interface with place-based consideration of how to adapt to growing natural hazards and climate risks, and inform land use planning, infrastructure investment, and disaster preparedness.

By developing adaptation planning pathways across Greater Sydney, we can start to build a picture of how hazard and climate risk will constrain or enable future growth decisions, and identify opportunities to plan and invest in the social and physical infrastructure needed for a range of possible future scenarios. Integrating these findings into the Six Cities Region Plan and City Plans is critical to reducing future risk, and confronting legacy risk across the city.

Actions

- a. Undertake an integrated strategic assessment for Greater Sydney that builds on Disaster Adaptation plans and enables adaptive planning pathways for the region.
- b. Embed deliberative decision-making with First Nations groups, communities and other stakeholders around emerging problems and possible solutions.
- c. Determine the costs and benefits for risk mitigation at household, suburb, catchment, LGA and region scale, including by connecting housing and asset typologies to hazard exposure.

Proposed Lead:

NSW Reconstruction Authority

Key Collaborators:

Local Government; NSW Department of Planning; NSW Treasury; Utilities / Telcos; Private Sector/ Insurers; Local Aboriginal Land Councils/ Aboriginal Corporations





CASE STUDY:

Netherlands Delta Commission – adaptation pathways planning and strategic assessment

The Netherlands Delta Commission is a leading global practitioner in the application of plausible divergent futures, adaptation pathways, strategic assessment and inclusive, deliberative decision-making processes to inform long-term spatial and infrastructure planning for disaster risk reduction and climate change adaptation.

The Delta Works Commission was established following the North Sea flood in 1953, which saw 1,795 people die in some of the most extreme flooding Europe has ever experienced. The country's first Delta Plan was focused on defensive works, but over time, the Commission has increasingly led fundamental research to come up with and implement long-term solutions to protecting the Netherlands against the future impact of climate change, including floods, water shortages, fires and more.

In the course of this work, the Delta Commission has pioneered a new conceptual framework built on plausible divergent futures, dynamic adaptive policy pathways, strategic assessment and risk dialogues to use as a norm for spatial and infrastructure planning and investment decision-making for climate change adaptation.



CASE STUDY:

Maketu Iwi Collective, Maketu Climate Change Adaptation Plan⁵⁰

Maketu is a small coastal town in the Bay of Plenty region of New Zealand. Due to Maketu's geographical position, the area has seen more frequent coastal flooding following subtropical storms. The Maketu Climate Change Adaptation Plan has been developed in conjunction with the local community and outlines interconnected issues, strategic priorities, Māori knowledge (kaupapa)ⁱⁱⁱ and actions that will ensure the Maketu community is prepared for, can adapt to and will be resilient to a changing climate.

There are five strategic priorities: caring for 1) waters, 2) lands, 3) home, 4) ensuring security and self-sufficiency, and 5) fostering and enabling collective knowledge and wisdom. Twelve kaupapa have been identified to drive action and progress for these strategic priorities. They range from the development of mara kai (food gardens) and a tree nursery, as well as a community emergency response plan, education programmes and a land use change project. Seven 'Enabling Actions' will ensure the plan is effective, successful and long-lasting. They include the founding of an iwi-led working group, strong collaboration with relevant stakeholders and project management.

iii Kaupapa Māori knowledge is the systematic organisation of beliefs, experiences, understandings and interpretations of the interactions of Māori people upon Māori people, and Māori people upon their world.





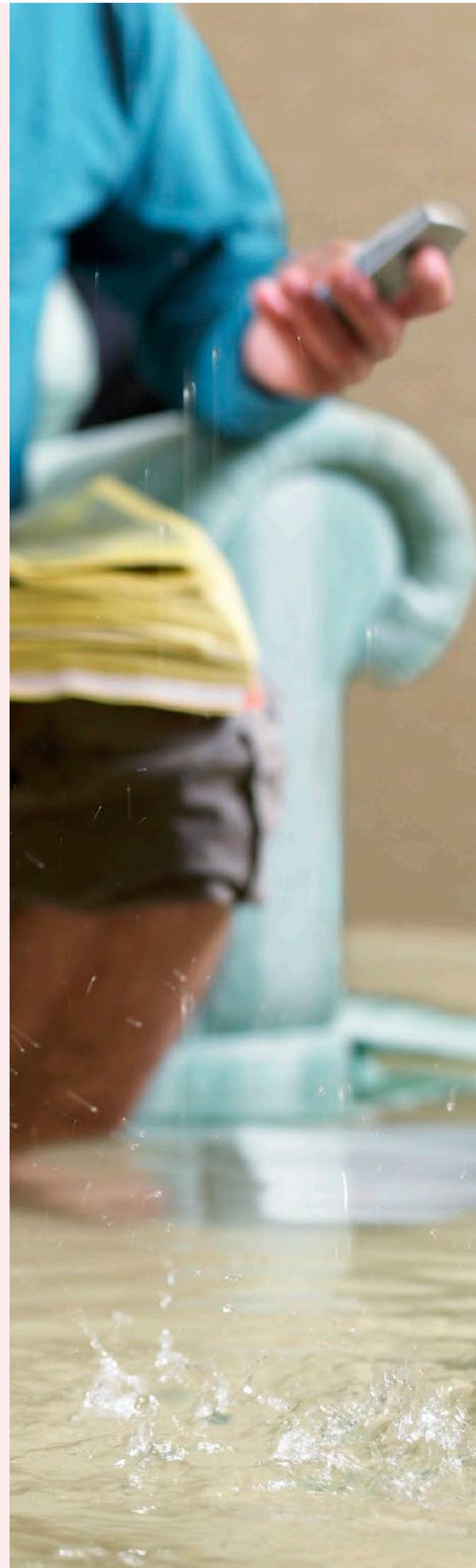
CASE STUDY:

(Even) Better Homes and Gardens: Understanding options for home adaptation upgrades, Victoria⁵¹

The Central Victorian Greenhouse Alliance is partnering with the Castlemaine Institute on this 12-month, community-based research project, which aims to identify practical options for residents living in houses that are more exposed to the impacts of climate change to 'upgrade' or 'retrofit' their homes and gardens to enhance resilience.

Many households in regional Victoria have experienced property damage because of climate-related extreme weather events, including bushfires, storms and floods. Much of the housing stock in the region has not been designed or constructed to withstand projected increases in temperatures and extreme weather events under climate change.

Increasingly the finance, mortgage, and insurance sectors are also taking an interest in how households may be impacted by a changing climate and what households are doing to reduce associated risks. Retrofitting existing homes to enhance climate resilience can benefit residents by improving overall liveability, health and well-being outcomes and resulting in possible reduced costs associated with property damage, higher insurance premiums, and year-round heating and cooling.



10. Develop a NSW policy and guideline for planned relocation

Tens of thousands of homes in Sydney are currently at risk of extreme weather events, and this number is only expected to grow. Many of these households have faced multiple floods in recent years and are still recovering from the mental health and financial impacts of compounding events.

Planned relocation recognises that there may be benefits to the community and to Government and other service providers by acting to reduce the number of people and dwellings exposed to recurrent and/or extreme flooding events ahead of disaster events. It is not a panacea, and the voice of First Nations people is essential in any planned relocation discussion. In the Western Sydney context, flood-prone dwellings are likely to be older, single-storey, and on larger lots – some even with riparian or rural views. Swapping to a newer, low-risk location would likely entail accepting denser living and a different style of housing or neighbourhood.

Individualised approaches to relocation move people out of high-risk areas, reducing social capital and cohesion of both those who leave and those who are left behind. A more collective and planned movement/retreat reduces risk while maintaining social cohesion of a community, acknowledging that this is significantly more challenging to implement.

Putting in place policies and financial mechanisms that enable planned relocation has the potential to build shared understanding that the risk is or will be too high for communities, Government and service providers, and creates a pathway – whether short or long-term- to that safer future.

Globally, there is an emerging roadmap for generating community acceptance of planned relocation as part of building a city's climate resilience. The limited experience of cities that have taken on planned relocation suggests that an effective process depends on critical actions that move the community from denial and anger to acceptance. It is especially important to reframe relocation as not simply a loss of what was but as part of a larger and inspiring vision for what can be for the city's future.⁵²

— Peter Plastrik & John Cleveland,
Innovation Network for Communities





Actions

- a. Develop a State level policy and guideline for planned and community-led relocation, informed by lessons from the NSW Northern Rivers, Brisbane and overseas.
- b. Identify criteria and receiving areas for possible future relocation of residents of high-risk climate zones.
- c. Create alignment between planned relocation and local government housing targets.
- d. Identify and pilot financial mechanisms to transfer development out of high-risk zones.

Proposed Lead:

NSW Reconstruction Authority

Key Collaborators:

NSW Department of Planning; NSW Treasury; Local Government

CASE STUDY:

Transfer of development rights in California⁵³

Transfers of Development Rights (TDRs) are a financial adaptation strategy used to steer development away from areas deemed unsuitable for intensive development. TDRs operate via markets where development rights that have been separated from parcels in certain “sending areas” can be bought and sold as credits that can then be used to develop in “receiving areas.”

TDRs offer a market-based approach to foster voluntary retreat over the long term. Further, they provide a flexible and legal way to extinguish development rights for areas deemed unsuitable for development. The California Coastal Commission has used TDR markets to retire antiquated subdivision lots in the coastal zone. Specifically, the Commission has granted coastal development permits in exchange for retiring development rights in the coastal zone portion of the Santa Monica Mountains. Malibu’s Local Coastal Program includes procedures for transferring development credits to encourage this process.



CASE STUDY:

Inquiry into community-led retreat and adaptation funding, New Zealand

In February 2023, Cyclone Gabrielle hit New Zealand's North Island, leading to more than 10,000 people being displaced and some communities left without transport, power and a way to communicate. In September 2023, the New Zealand Central Government's Parliamentary Environment Committee opened an Inquiry into Climate Adaptation, which is considering options for community-led retreat and adaptation funding.

Around 750,000 New Zealanders and 500,000 buildings worth more than \$145 billion are near rivers and in coastal areas already exposed to extreme flooding. The Inquiry recognised that:

- climate change is increasing the risk of extreme weather events like Cyclone Gabrielle, and eventually, the risk in some places will become so great that it will no longer be safe to live there or affordable to rebuild after a disaster
- the chance of a disaster in some places will increase over time from unlikely to probable, to highly likely and perhaps eventually to certain
- Māori will be disproportionately impacted. Culturally significant sites will be threatened, as will the industries in which many Māori are employed and have assets
- whether, when and how to retreat from at-risk places are issues faced by communities in many countries. A typical approach allows communities to stay in place until a disaster forces them to leave. However, this reactive approach is costly.

The outcome of the Inquiry is to consider whether Aotearoa should develop an enduring system to enable retreat before a disaster and how we can meet the costs of the actions we take to adapt.



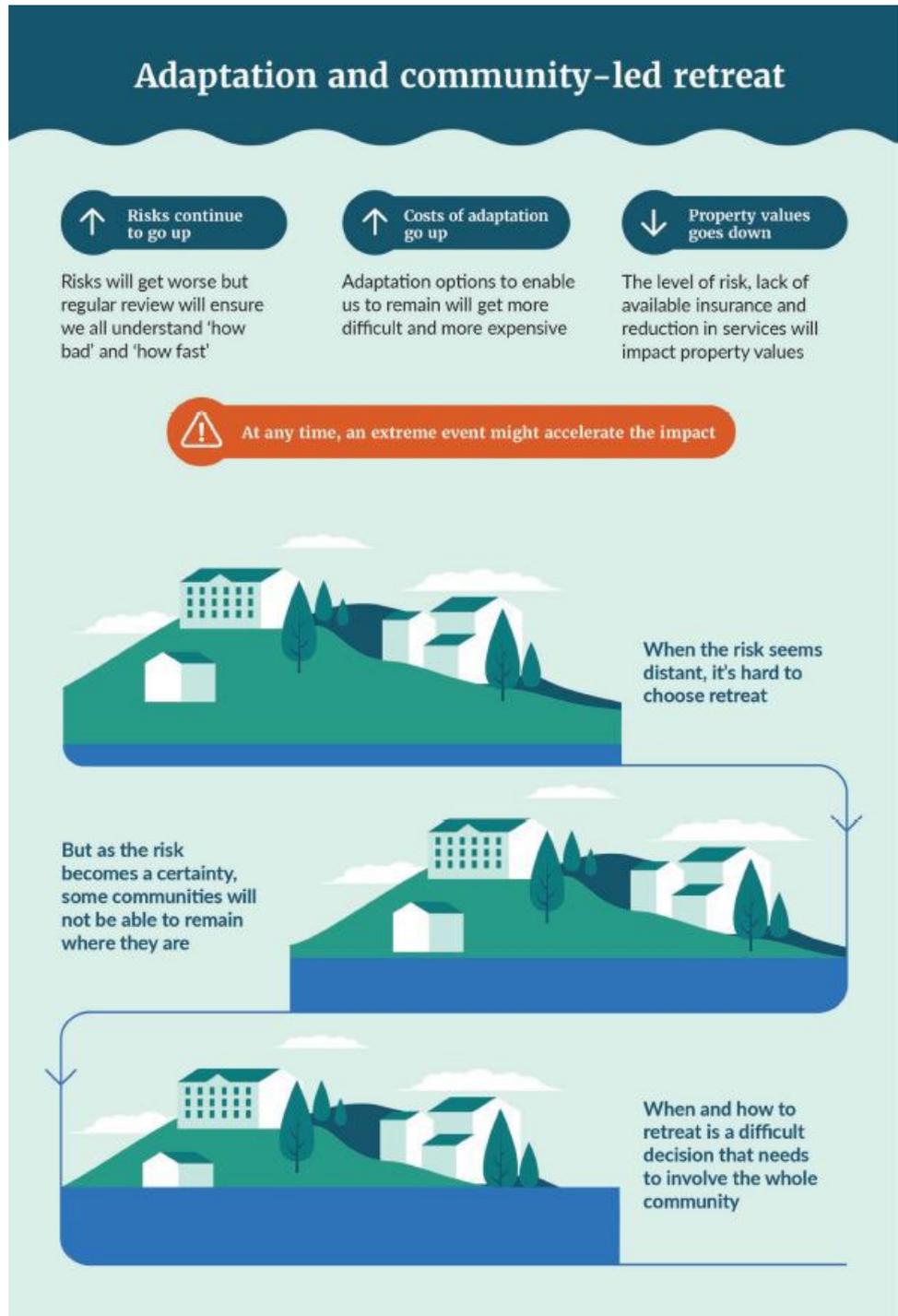
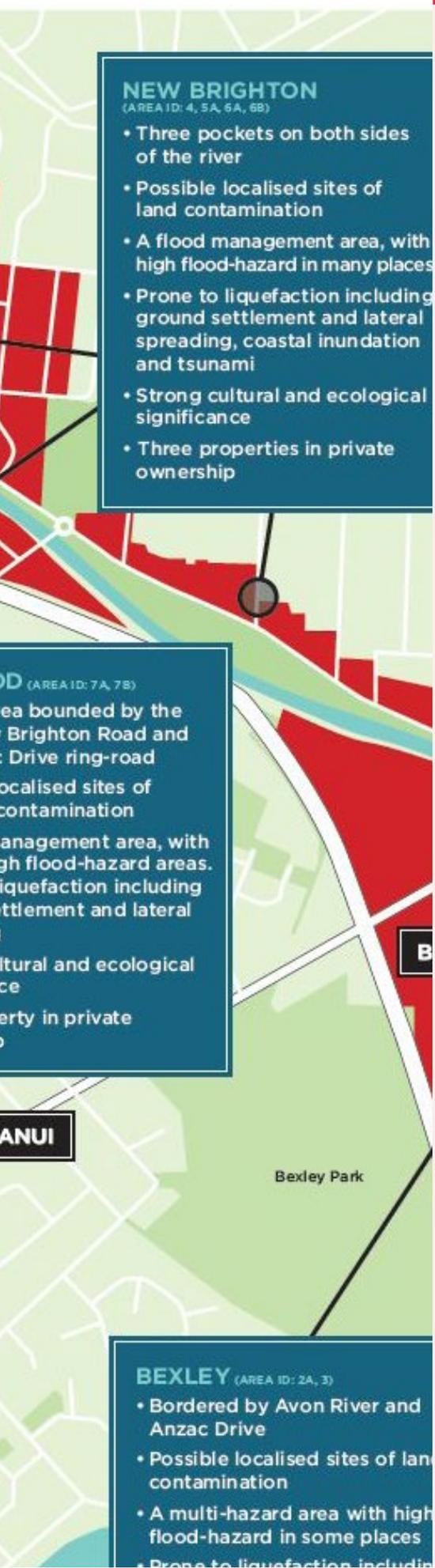


Figure 13: Adaptation and community-led retreat. (source NZ Ministry for the Environment)



Figure 14: Designated 'Red Zones' (source: Christchurch City Council)



CASE STUDY:

Christchurch Red Zones⁵⁴

On February 22, 2011, a magnitude 6.3 earthquake hit Bexley in eastern Christchurch, Aotearoa, New Zealand. The earthquake caused liquefaction (literally turning land into a liquid) across the alluvial soils that had collected along the river over millennia. New knowledge about earthquake risk and the severe subsidence which increased the risk of flooding, made the town infeasible to rebuild.

The town of Bexley was subsequently ‘Red-Zoned’, and the Crown acquired and demolished all built assets, leaving only roads. Those with insurance were offered a buy-back, while those without were informed that services to their homes would be withdrawn. The displacement of thousands of residents had significant emotional and financial impacts, leading to a loss of social networks, increased stress, and a sense of uncertainty about the future.

The Red Zones provided opportunities for positive change, with plans for walking tracks, nature trails, and bike paths, restored wetlands, and a “living laboratory” where methods for adapting to climate change can be trialled.

On the coast, the earthquake also lowered parts of eastern Christchurch by over a metre, making these areas more vulnerable to storm surge and raising questions for local government about how long they continue to invest in services for these communities that will be inundated by rising sea levels within decades. Lessons learned from the Canterbury Earthquake Recovery Authority’s effectiveness and efficiency include the need for recovery agencies to adapt to changing circumstances throughout the phases of recovery, and the importance of establishing effective systems, staffing, and processes that can be adapted to different phases of recovery.

11. Evaluate progress towards a more climate adaptive Greater Sydney

There are many programs underway to respond to and prepare for changing climate risk. Given the growing risk to life and assets, there is a clear need to review to what extent these efforts are contributing to a more adaptive city and reducing the risk to communities across Greater Sydney.

We need to ask ourselves where the new efforts to consider hazard and climate risk in the context of urban growth and development are leading to a more affordable and sustainable future. The first Disaster Adaptation Plan will be delivered in the Hawkesbury-Nepean Valley, but this is only one of many actions noted in this report that contribute to the collective efforts needed to reduce risk across Greater Sydney.

We can't expect to get it all right the first time. We also can't predict what is going to disrupt our city in the next five years. Chances are it will be a different set of challenges, providing an ongoing test as to whether our adaptive management approach is fit for purpose in a changing climate.

By committing to monitoring and learning from what has worked and changed over the first three years, we have an opportunity to course-correct, and re-evaluate if we have the balance right.

Actions

- a. Review the effectiveness of Disaster Adaptation Planning across Sydney, including changed awareness of flooding and climate risk.
- b. Evaluate the progress of lifeline Infrastructure agencies in coordinating, funding and delivering climate adaptive investment plans.
- c. Monitor progress on dwelling and asset exposure through land use planning in the 2023 Six Cities Region Plan and City Plans to inform the development of the 2028 revisions.
- d. Identify how changes in funding decisions – at State and Federal level – have contributed to enabling or constraining key service providers.

Proposed Lead:

NSW Reconstruction Authority

Key Collaborators:

Greater Cities Commission; NSW Department of Planning, Local Government; IPART; National Emergency Management Agency, Utilities



Image source: Infrastructure NSW, Photo by Adam Hollinworth





Innovation Fund Partners

We would like to thank our Innovation Fund Partners for their support of the Committee for Sydney’s research.

Our Innovation Fund Partners are future-focused and outcome-driven. They are leaders of change. Their combined investment underpins our annual research program and, together with our members, enables us to grow our impact and output – striving to create a better Sydney that offers unparalleled opportunity and quality of life for everyone.

We are proud to work with our Innovation Fund Partners: Dexus, ICC Sydney, Campbelltown City Council, JLL, University of Technology Sydney, University of Sydney, University of NSW Cities Institute, Western Sydney Local Area Health District, Western Sydney University, and Lendlease.



Sydney Local Health District



UNSW Cities Institute



Resilience Program Partners

We would like to thank our Resilience Program Partners for supporting the Committee for Sydney’s work to drive solutions to our most pressing resilience challenges.

Our Resilience Program Partners are leaders in their respective fields, embracing the transition to a decarbonised future and adapting to a changing climate. AECOM, Ausgrid, Endeavour Energy, Resilient Sydney and Sydney Water.





References



Endnotes

- 1 Refer: <https://www.smh.com.au/politics/nsw/sydney-s-population-forecast-to-hit-6-1-million-by-2033-20230104-p5cacv.html>
- 2 Critical infrastructure includes, but are not limited to transportation, telecommunication and utilities such as power and water.
- 3 Refer: <https://www.climatecouncil.org.au/resources/mental-health-toll-climate-disasters-australians-revealed-new-national-poll/>
- 4 Refer: <https://www.smh.com.au/politics/nsw/sydney-s-population-forecast-to-hit-6-1-million-by-2033-20230104-p5cacv.html>
- 5 Refer: <https://resilientcitiesnetwork.org/what-is-urban-resilience/>
- 6 Refer: <https://a21234.hostroomcdn.com/wp-content/uploads/2023/09/Committee-for-Sydney-Chronically-Unaffordable-Housing-September-2023.pdf>
- 7 AdaptNSW (2014). Metropolitan Sydney Climate change snapshot. Refer: <https://www.climatechange.environment.nsw.gov.au/sites/default/files/2021-06/Metropolitan%20Sydney%20climate%20change%20snapshot.pdf>
- 8 NSW Government. (2022). NSW Reconstruction Authority Act 2022 No 80. New South Wales Government. Refer: <https://legislation.nsw.gov.au/view/html/inforce/current/act-2022-080>
- 9 Refer: <https://www.abc.net.au/news/2019-12-21/nsw-bushfires-sydney-heatwave-inflames-catastrophic-danger/11820578>
- 10 Refer: <https://www.dailytelegraph.com.au/newslocal/penrith-press/penrith-hits-record-temperature-of-485c-as-heatwave-strikes-nsw/news-story/dcf054647fa47a6fb4e8195515d835fc>
- 11 Refer: <https://www.abc.net.au/news/2023-05-11/black-summer-bushfires-la-nina-link-found/102196030>
- 12 Refer: <https://www.theguardian.com/australia-news/2022/jul/04/sydney-braced-for-another-night-of-flooding-after-region-hit-by-torrential-rain>
- 13 Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023). Understanding Climate Change. Refer: <https://www.dcceew.gov.au/climate-change/policy/climate-science/understanding-climate-change#extreme-weather-events>
- 14 Refer: <https://theconversation.com/yes-australia-is-a-land-of-flooding-rains-but-climate-change-could-be-making-it-worse-157586>
- 15 Bureau of Meteorology (BoM) (2022). State of the Climate. Refer: <http://www.bom.gov.au/state-of-the-climate/2022/documents/2022-state-of-the-climate-web.pdf>
- 16 Refer: <https://theconversation.com/patently-ridiculous-state-government-failures-have-exacerbated-sydneys-flood-disaster-186304>
- 17 Infrastructure NSW (2017). Resilient Valley, resilient Communities Hawkesbury-Nepean Valley Flood Risk Management Strategy. Refer: <https://www.infrastructure.nsw.gov.au/media/zv2c5vzj/infrastructure-nsw-resilient-valley-resilient-communities-2017-jan.pdf>
- 18 Refer: <https://www.climatechange.environment.nsw.gov.au/sea-level-rise>
- 19 AdaptNSW (2023). Climate change impacts on our cultural values. Refer: <https://www.climatechange.environment.nsw.gov.au/cultural-values>
- 20 Australian Business Roundtable for Disaster Resilience & Safer Communities and Deloitte Access Economics (2021). Special report: Update to the economic costs of natural disasters in Australia. Refer: http://australianbusinessroundtable.com.au/assets/documents/Special%20report%3A%20Update%20to%20the%20economic%20costs%20of%20natural%20disasters%20in%20Australia/Special%20report%20_Update%20to%20the%20economic%20costs%20of%20natural%20disasters%20in%20Australia.pdf

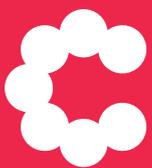
- 21 https://insurancecouncil.com.au/wp-content/uploads/2023/07/20894_ICA_Resilience-Advocacy-Asks-FINAL.pdf
- 22 Geoff Summerhayes (2023) Sharing the risk <https://www.aicd.com.au/risk-management/framework/climate/sharing-the-risk.html>
- 23 Insurance Council Australia (ICA) (2023). Building Australia's Resilience. Refer: <http://australianbusinessroundtable.com.au/assets/documents/Report%20-%20Social%20costs/Report%20-%20The%20economic%20cost%20of%20the%20social%20impact%20of%20natural%20disasters.pdf>
- 24 Refer: <https://www.abc.net.au/news/2022-08-12/indigenous-homelessness-in-northern-rivers-communities/101323636>
- 25 Australian Institute for Disaster Resilience (ADIR) (2018). Community Inclusive Recovery Practice: Working with Indigenous communities in recovery from disasters. Refer: <https://knowledge.aidr.org.au/media/9902/working-with-indigenous-communities-in-recovery-module.pdf>
- 26 Australian Competition & Consumer Commission (2020). Northern Australia insurance inquiry - final report. Refer: <https://www.accc.gov.au/about-us/publications/northern-australia-insurance-inquiry-final-report>
- 27 Refer: <https://theconversation.com/after-the-floods-the-distressing-but-necessary-case-for-managed-retreat-178641>
- 28 AIDR, 2020, 'Land Use Planning for Disaster Resilient Communities', AIDR Handbook Collection, available at: https://knowledge.aidr.org.au/media/7729/aidr_handbookcollection_land-use-planning-for-disaster-resilient-communities_2020.pdf
- 29 Infrastructure Australia (2021). A Pathway to Infrastructure Resilience. Refer: <https://www.infrastructureaustralia.gov.au/sites/default/files/2021-08/Advisory%20Paper%201%20-%20A%20pathway%20to%20Infrastructure%20Resilience%20FINAL.pdf>
- 30 Royal Commission into National Natural Disaster Arrangements (2020). Chapter 19: Land-use planning and building regulation. Refer: <https://naturaldisaster.royalcommission.gov.au/publications/html-report/chapter-19>
- 31 Refer: <https://theconversation.com/to-stop-risky-developments-in-floodplains-we-have-to-tackle-the-profit-motive-and-our-false-sense-of-security-184062>
- 32 Audit Office of New South Wales (2021). Managing climate risks to assets and services. Refer: <https://www.audit.nsw.gov.au/our-work/reports/managing-climate-risks-to-assets-and-services>
- 33 The Australian Building Codes Board (2021). Global Resiliency Dialogue Second Survey of Building Code Stakeholders - Australia Delivering Climate Responsive Resilient Building Codes and Standards. Refer: <https://www.iccsafe.org/wp-content/uploads/Global-Resiliency-Dialogue-Second-Survey-Report-Australia-03112021.pdf>
- 34 Green Building Council Australia (GBCA) (2021). Resilience in the Built Environment. Refer: <https://new.gbca.org.au/green-star/green-star-strategy/resilience-built-environment/>
- 35 Infrastructure Sustainability Council (ISC) (2023). Infrastructure Sustainability Council. Refer: <https://www.iscouncil.org/>
- 36 Resilient Sydney (2018). Resilient Sydney Strategy. Refer: <https://www.cityofsydney.nsw.gov.au/governance-decision-making/resilient-sydney>
- 37 The Geneva Association (2020) Flood Risk Management in Australia Building flood resilience in a changing climate <https://www.iag.com.au/sites/default/files/Documents/Reports/Flood-risk-management-in-Australia-improving-overall-but-stronger-community-level-planning-needed-071220.pdf>
- 38 NSW Department of Planning and Environment (2023). Flood risk management manual. Refer: <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Floodplains/flood-risk-management-manual-2023-230220.pdf>
- 39 Auckland Council (2020). Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan. Refer: <https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/environmental-plans-strategies/aucklands-climate-plan/Documents/auckland-climate-plan.pdf>



- 40 Commonwealth Scientific and Industrial Research Organisation (CSIRO). Adaptation Pathways in QLD: CSIRO. Enabling Resilience Investment approach. Refer: <https://research.csiro.au/enabling-resilience-investment/#:~:text=The%20Enabling%20Resilience%20Investment%20>
- 41 New York City Planning (2019). Zoning for Coastal Flood Resiliency Planning for Resilient Neighbourhoods. Refer: <https://www.nyc.gov/assets/planning/download/pdf/plans-studies/flood-resiliency-update/zoning-for-flood-resiliency.pdf>
- 42 Committee for Sydney (2022). Rethinking Station Precincts. Refer: <https://sydney.org.au/wp-content/uploads/2022/05/Committee-for-Sydney-Rethinking-Station-Precincts-May-2022.pdf>
- 43 Queensland Government (2023) Shaping SEQ – Southeast Queensland Regional Plan (Draft). Refer: https://shapingseq.statedevelopment.qld.gov.au/download_file/147/1
- 44 Ausgrid (2022). Promoting the long-term interests of consumers in a changing climate: A decision-making framework. Refer: <https://cdn.ausgrid.com.au/-/media/Documents/Regulation/Reg-Sub/2022/Ausgrid-Resilience-Framework-DRAFT.pdf?rev=4595964918754ab5a4bf0f3c1f3f485a>
- 45 New Zealand Government (2023). Cyclone Risk Categories for properties in New Zealand. Refer: <https://www.beehive.govt.nz/release/govt-support-councils-buyout-and-better-protection-cyclone-and-flood-affected-properties>
- 46 Refer: <https://storymaps.arcgis.com/stories/bbfc11f81062453ab8f7d8e67d9182d0>
- 47 Geoff Summerhayes (2023). Sharing the Risk. Refer: <https://www.aicd.com.au/risk-management/framework/climate/sharing-the-risk.html>
- 48 Speech at the Insurance Council’s 2023 Annual Dinner. Refer <https://insurancecouncil.com.au/resource/nick-hawkins-speech-at-the-insurance-councils-2023-annual-dinner/#:~:text=But%20according%20to%20SwissRe%2C%20it’s,on%20the%20Australian%20reinsurance%20market.>
- 49 Refer: <https://www.abc.net.au/news/2022-10-20/hawkesbury-city-council-report-potholes-repairs-190-million/101551110>
- 50 He Toka Tū Moana Mō Maketu (2020). Maketu Climate Change Adaptation Plan. Refer: <https://maketu-runanga.iwi.nz/>
- 51 Refer: <https://www.cvga.org.au/even-better-homes-and-gardens.html>
- 52 Cleveland, J and Plastrik, P (2020) In Harm’s Way – How communities are facing the key challenges of building climate resilience. Refer: <https://in4c.net/wp-content/uploads/2021/01/In-Harms-Way-Book-Title-Page-TOC-Foreword-Intro.pdf>
- 53 Stanford Center for Ocean Solutions (2018). Coastal Adaptation Policy Brief. Refer: https://oceansolutions.stanford.edu/sites/g/files/sbiybj25061/files/media/file/elevation_of_structures_web.pdf
- 54 Stuff.co.nz (2019). Red to Green: The evolution of a city’s abandoned acres. Refer: <https://interactives.stuff.co.nz/2019/09/christchurch-red-zone-to-green/>

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