



Img. 1 Sydney Harbour (licensed under CC BY 2.0)

SYDNEY AUSTRALIA

2022 Exploring Urban Resilience Pathways



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About the report and the collection

Exploring Urban Resilience Pathways

This report is part of a collection wishing to provide a global overview about different cities' experience in resilience, and how this is evolving. The series is titled "Exploring Urban Resilience Pathways" and each report is prepared by one student of the Int. MSc. in City Resilience Design and Management (URNet-UIC Barcelona). During the first semester, students develop these reports as a learning outcome for their acquired analytical skills: to find, understand, organize, and communicate critically different perspectives, approaches, and models of urban resilience implementation, in a chosen city.

The aim of each report is thus to offer an easy-to-read overview about how adaptive capacities have been evolving in a selected city. The reports explore the past and current mechanisms through which each city responded to overlapping shocks and stresses. Nowadays current City Resilience Strategies – launched and supported by the Rockefeller 100RC program – are included within these analyses, representing the ultimate trend of understanding and implementing city resilience. Finally, current COVID19 pandemic responses are the final lens through which resilience mechanisms are discussed, to understand the alignment of resilience with other key urban goals, and ultimately respect to urban living.

What is interesting to learn from this series of reports, is that each of them critically discusses how cities managed adaptive responses to different treats, and how the concept of resilience evolved. Although the scope of these reports is ambitious and the analysis could result complex, the presentation has been designed to be easy to read and accessible to the general public. Each report of this collection maintains a standard structure, facilitating the reading and the reports (and cities) comparison.

Hope this initiative contributes to spread the understanding about how resilience has been framed and implemented in many cities across the globe.

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Director of the International Msc. in City Resilience Design and Management

SYDNEY AUSTRALIA

2021 Exploring Urban Resilience Pathways

SUMMARY

Sydney is Australia's largest metropolis, set around a series of natural harbours and extends towards the Blue Mountains eucalypt forests. Aboriginal and Torres Strait Islander peoples settled and have cared for the lands and waters of the Sydney region for over 60,000 years. However, European colonisation at the end of the eighteenth century had a devastating impact on First Nations people and led to dramatic changes to the landscapes and land use practices, exacerbating Sydney's present-day vulnerabilities.

Australia is the land of 'drought and flooding rains', and the connection to and ability to withstand the extremes of the natural environment is etched in the Australian psyche. Resilience has intuitively been characterized in terms of disaster risk reduction and 'coping'. Through this lens, Sydney has been familiar with urban resilience for many decades.

In addition Sydney is facing challenges related to rapid population increase. The city's urban growth exacerbates underlying chronic stresses including socioeconomic disadvantage, housing affordability and social cohesion.

When the Rockefeller 100 Resilient Cities (100RC) program was initiated and the *Resilient Sydney* report (2018) published, it catalysed a renewed, holistic view of resilience, balancing disaster risk management with environmental and social justice. Above all, the five-year 100RC process facilitated horizontal dialogue across the city's complex layers of governance. This has laid the foundations for a more interconnected and integrated understanding of resilience.

Sydney will need to anticipate future urban growth needs and development trends and incorporate environmental assets and social justice into the resilience lens to ensure communities can thrive.



ACKNOWLEDGEMENT

Aboriginal people have had a continuous connection with the area encompassed by Sydney for more than 60,000 years. They are the First People and traditional custodians of the lands, skies, and waters.

This report acknowledges the groups who have custodial care for the lands and waters of Sydney, including the Eora, Dharug, Dharawal, Gundungurra, Darkinjung, Guringai and peoples.

A resilient Sydney must respect and acknowledge the connection Aboriginal and Torres Strait Islander people have to managing, cultivating, and caring for the environment and continuing to practice and share their culture.

Img. 2 Blue Mountain, Sydney
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The term 'Aboriginal and Torres Strait Islander' is used in this document to refer to Australia's First Nations people.

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LIST OF ABBREVIATIONS

100 RC	100 Resilient Cities
AIDR	Australian Institute for Disaster Resilience
AUD	Australian Dollars
CBD	Central Business District
CFA	Country Fire Authority
COAG	Council of Australian Governments
CoS	City of Sydney
GDP	Gross Domestic Product
GSC	Greater Sydney Commission
IPCC	International Governmental Panel on Climate Change
NSW	New South Wales
SDG	Sustainable Development Goals



Img. 3 Hyde Park, Sydney
(licensed under CC BY 2.0)

INTRO

GREATER SYDNEY

INTRODUCTION TO THE CITY

Sydney is a global city and Australia's largest metropolis in the region of New South Wales (NSW). Situated on Australia's Pacific east coast, Sydney is set around a deep natural harbour and extends towards the Blue Mountains eucalypt forests.

Aboriginal and Torres Strait Islander peoples settled and have cared for the lands of waters of the Sydney region for over 60,000 years. The Eora, Dharug, Dharawal, Gundungurra, Darkinjung, and Guringai people have a common ancestry to the lands, waters, and sacred sites of the Sydney region (RSO [B], 2021). European colonisation at the end of the eighteenth century had a devastating impact on First Nations people and led to dramatic changes to landscapes, ecology, and land use practices. These changes owe much to the present vulnerability of the Greater Sydney region to manage and mitigate social, environmental, and economic stresses and shocks.

Socio-cultural character

The most recent census (ABS, 2016) noted that Sydney is home to 21 per cent of Australia's population across a land area of approximately 1.2 million hectares. Sydney is growing rapidly and its projected population is for 7 million residents by the year 2060 (ABS, 2016). The city is also one of the most culturally and linguistically diverse in the world with approximately 45 per cent of residents born outside of Australia and for the first time since colonisation, most people born overseas are from Asia, rather than Europe.

Economic development and prosperity

Sydney is a key contributor to the Australia's economic prosperity (40% of Australia's GDP). The major drivers of the economy are the financial sector, tertiary education, and manufacturing. However, Greater Sydney is the third least affordable city in the world with the median house price 12.2 times the median household income (URI, 2022).

Fig. 1 Demographic overview (graphic created by author and adapted from census data (ABS, 2016))

Snapshot of Greater Sydney

Population of

5,367,206



Area

1,236,819
km²

8 million
people by 2056

\$461
million



GDP, contributing **32%**
share of Australia's
economy in 2019-2020

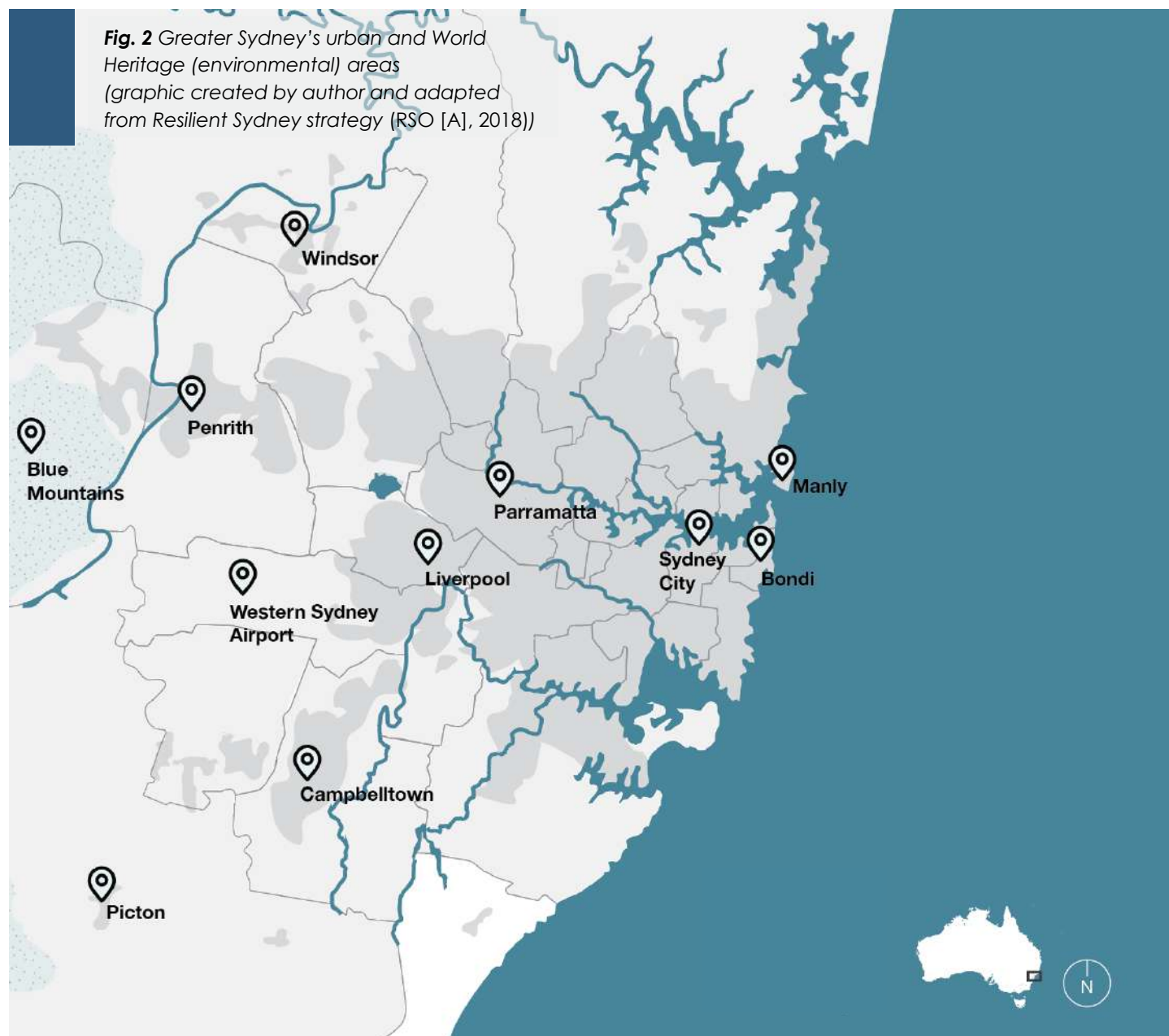


40%

speak a language other
than English at home

(Mandarin, Arabic, Cantonese,
Vietnamese, and Greek)

Fig. 2 Greater Sydney's urban and World Heritage (environmental) areas
(graphic created by author and adapted from Resilient Sydney strategy (RSO [A], 2018))



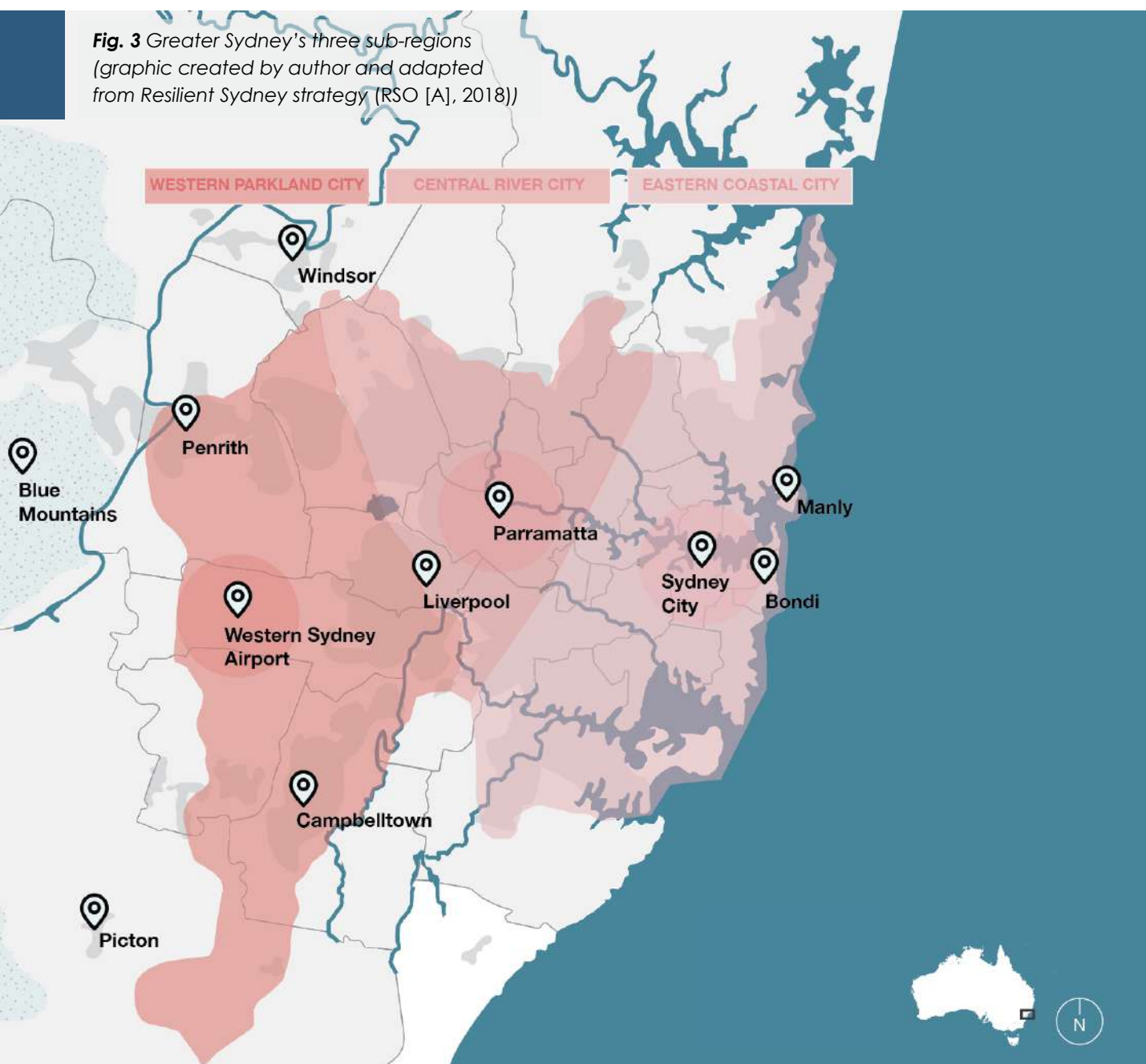
LEGEND

- Greater Sydney area
- Urban area
- World Heritage environmental area
- Waterway/ water course
- Municipal boundaries

Notable characteristics of Greater Sydney:

- Sydney's young and culturally diverse population west and southwest.
- North and east are home to an older, ageing demographic.
- National parks and a 'green belt' constrain urban growth, although agricultural and industrial land in the west and southwest is being rezoned for residential subdivision.
- Sydney housing is expensive, particularly in the north and southeast.
- Water, including large harbour, coastal beaches, rivers, and creeks define the landscape.

Fig. 3 Greater Sydney's three sub-regions
(graphic created by author and adapted
from Resilient Sydney strategy (RSO [A], 2018))



LEGEND

- Greater Sydney area
- Urban area
- World Heritage environmental area
- Waterway/water course
- Municipal boundaries

This map shows Greater Sydney as a metropolis of 'three cities': the Western Parkland City, Central River City and Eastern Coastal City. The intention to create a decentralised urban model and ensure sustainable growth of the city (GSC, 2017) and to address:

- Spatial inequality of access to transport, jobs, and education in the west and southwest.
- Create new financial centres in the west and central areas in addition to the city's established CBD in the east of the city.



Img. 4 Towlers Bay, Koorring-gai Chase National Park (licensed under CC BY 2.0)



Img. 5 Sydney Metro construction, Barangaroo (licensed under CC BY 2.0)

Natural environment & climate

Sydney is a water city, with a warm climate, shaped by 'droughts and flooding rains' (McKellar 1904). The city extends from the foothills of the Blue Mountains to the Pacific Ocean. The island ecology of Australia has led to many unique endemic plant and animal species, however urban development is placing native flora and fauna at risk. The natural environment has informed the social, cultural, and economic fabric of Sydney. As Sydney's climate changes, and the city's natural and urban environment are increasingly affected by warming temperatures and extreme weather.

Built environment

Urban Sydney is characterized sprawling low-density development and the city's topography has constrained the development of infrastructure and spatially divided communities (RSO [A], 2018). Sydney's east and central areas are generally cooler than the west and southwest due to accessibility to waterways, coastal areas, and green space. The city is moving from a monocentric to a polycentric model through a vision of 'three cities' where residents will be able to live within 30 minutes of their jobs, services and amenities (GSC, 2017). Several major transport infrastructure projects are in delivery (e.g. new underground metro rail lines) which will improve the unequal access to multimodal transport options.

Governance structure

Australia is a constitutional monarchy, following the Westminster-style system of government. Governance is divided across three tiers: the Federal (Commonwealth), State Government (regional), and Local Governments (municipalities). Sydney is not represented by one single municipal entity, yet by 33 local government authorities. Local government authorities have responsibility for managing local roads, waste collection, open spaces, and community infrastructure (including libraries and recreational facilities). While the state government (New South Wales) is responsible for major roads, public transport, policing, education, and major infrastructure projects. The complexity of Sydney's governance poses challenges for integrated decision making, and the ability to form partnerships, share knowledge and understand the impact pathways of critical decisions (Cred Consulting, 2017).

CONTEXT FOR RESILIENCE

This report addresses resilience in the context of cities and urbanisation. This report is guided by the United Nations Disaster Risk Reduction's definition for *resilience*:

Resilience is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and function (UNDRR, 2022)

As this report will show, the term 'resilience' has predominantly been used in Australia and Sydney in the context of disaster risk reduction and coping with acute shocks such as extreme weather events (flooding, storms, bushfire, and heatwaves).

In 2015, Sydney was selected to pioneer 100 Resilient Cities (100RC) to build resilience to the physical, social, and economic challenges (Rockefeller Foundation, 2022). As part of the 100RC pathway, the Resilient Sydney Office, hosted by the City of Sydney, began work in 2016, releasing the *Resilient Sydney* strategy in 2018 (RSO [A], 2018), with the collaboration of metropolitan Sydney's 33 local government authorities and the State Government. While the *Resilient Sydney* strategy is sponsored by the City of Sydney, planning for Greater Sydney is overseen by the Greater Sydney Commission (GSC); a key partner in 100RC.

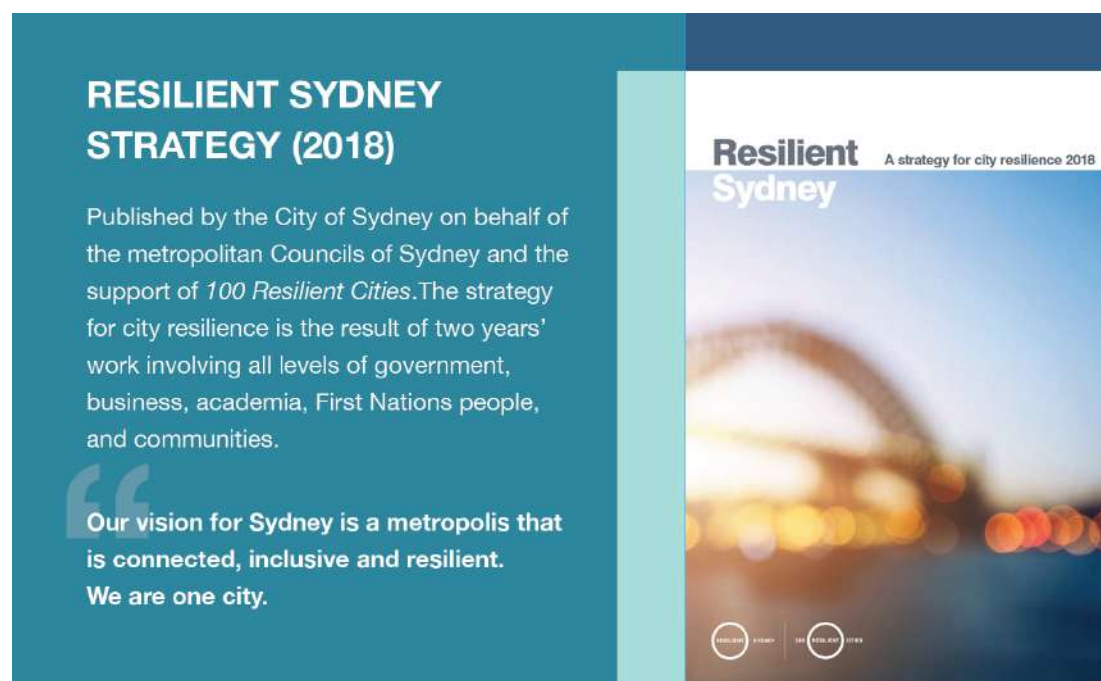


Fig. 4 *Resilient Sydney* strategy (RSO [A], 2018)

Sydney is facing future challenges related to rapid population growth and increasingly extreme weather events induced by climate change. This report explores Greater Sydney's experience with resilience prior to the 100RC program and the city's current experience, after the implementation of the *Resilient Sydney* strategy (2018).

Img. 6 The Rocks, Sydney Harbour
(licensed by CC BY 2.0)



CITY PAST

ADAPTIVE PATHWAY

SETTING THE SCENE

Early European settlers had little experience with the variable climate of Sydney and did not have the plant varieties, land management, infrastructure, or institutional arrangement to deal with the local conditions (Howden, 2014). However, Australia's Aboriginal and Torres Strait Islander people have a longer understanding of the climate and changes in the landscape and have curated adaptive pathways for thousands of years.

Greater Sydney is susceptible to acute shocks, such as more frequent and severe extreme weather events. Sydney is facing underlying chronic stresses which are exacerbated by the city's rapid population increase, exacerbating socioeconomic disadvantage and housing affordability. This section outlines Greater Sydney's interactions with urban resilience in the period leading up to the establishment of the Resilient Sydney Office.

Figure 5, over page, illustrates the history of implementation of policies, strategies, and projects at a global, national, and state level in response to key shocks and stresses, prior to the establishment of the 100RC program. The timeline shows the alignment of the city's periods of growth as they relate to the types of interventions that addressed resilience. It demonstrates that growth of the metropolitan region has set the scene for resilience as the city has become more unequal and is subject to the impacts of climate change and natural hazards. Since 2010, there has been an increasing number of interventions at all levels of government, which has in turn created a convoluted and complex governance environment.

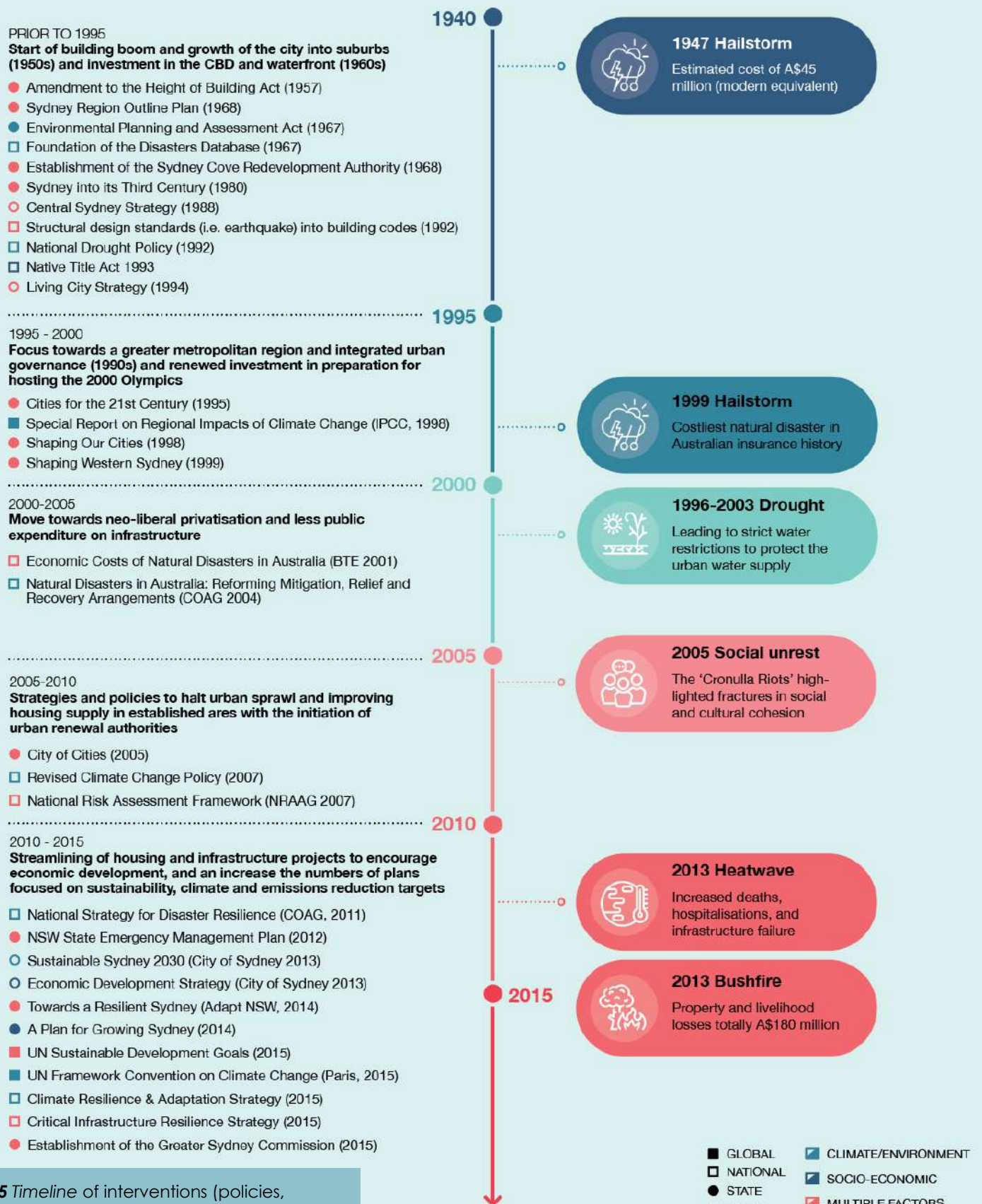


Fig. 5 Timeline of interventions (policies, strategies, and public bodies) implemented prior to 2016 (graphic created by author)



ACUTE SHOCKS

Acute shocks are sudden, sharp events that weaken the fabric of a community or system. The main shocks are outlined in figure 6 in order of their perceived level of importance (e.g. frequency, level and risk, and extent of social, economic, and environmental impact) (RSO [C] 2016).



Fig. 6 Sydney's main shocks (created by author and adapted from Resilient Sydney strategy (RSO [A], 2018))

Extreme weather was identified as the highest risk, based on the number of past events, the level of disruption caused and the projected future trends. Increasingly, people, buildings and infrastructure assets are being exposed to natural hazards as the pressures of urban development extend into areas of high risk (Middelmann M. H, 2007).

The maps on the following pages highlight the locations of acute shocks: flooding, heatwaves, and bushfires. The west, southwest and northwest are at the greatest risk to extreme weather events than the wider city. These hazards lead to disaster as they intersect with exposed and vulnerable communities in the western region of the city as the consequences exceed the capacity of communities to cope (Adger, 2006).

Exposure to flooding and hailstorms

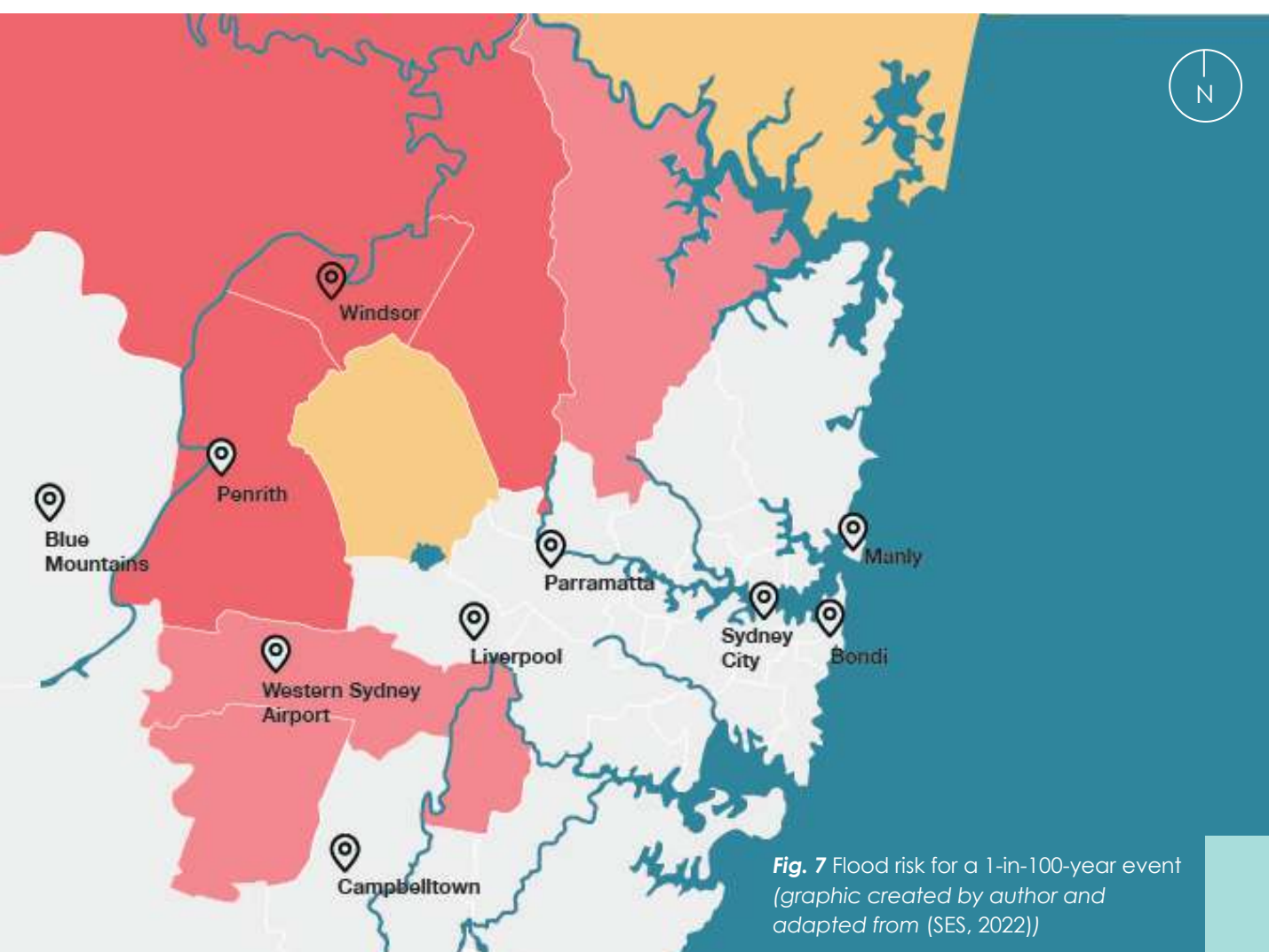
Flooding and hailstorms are increasing in frequency and contribute to the highest natural hazard damage, estimated to contribute 29% of the average annual natural hazard damage in Australia (BTE, 2001). Sydney's 1999 hailstorm was the largest insurance payout at that point in time (Middelmann M. H, 2007).

Floods cost on average

\$314 million
per year

The 1999 Sydney hailstorm caused damage estimated at

\$2.2 billion



LEGEND

- Greater Sydney area
- Waterway/ water course
- Municipal boundaries
- Low risk
- Medium risk
- High risk

Exposure to heatwaves and drought

Australia is vulnerable to changes in temperature due to its extensive arid and semi-arid zone, which in turn increases the likelihood and frequency of heatwaves and drought (IPCC, 2022). Sydney is particularly vulnerable to prolonged drought with severe impacts on agriculture, the economy, and individual comfort and enjoyment (Middelmann M. H, 2007).

The 2013 heatwave lead to the hospitalisation of

263 people

In the city's west

By 2050, Sydney needs to find

80%

more water

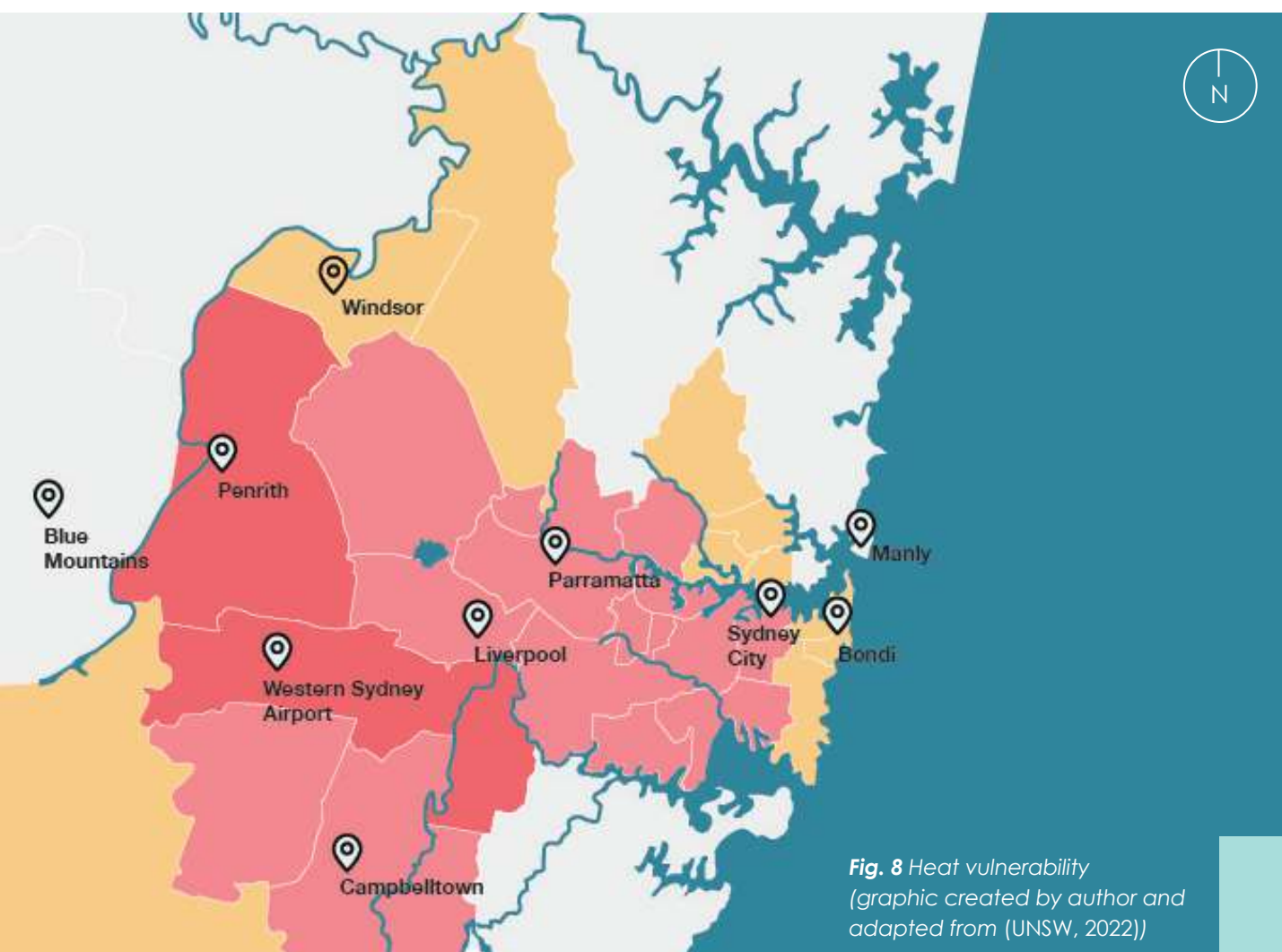


Fig. 8 Heat vulnerability
(graphic created by author and adapted from (UNSW, 2022))

LEGEND

- Greater Sydney area
- Waterway/ water course
- Municipal boundaries
- Low risk
- Medium risk
- High risk

Exposure to bushfire

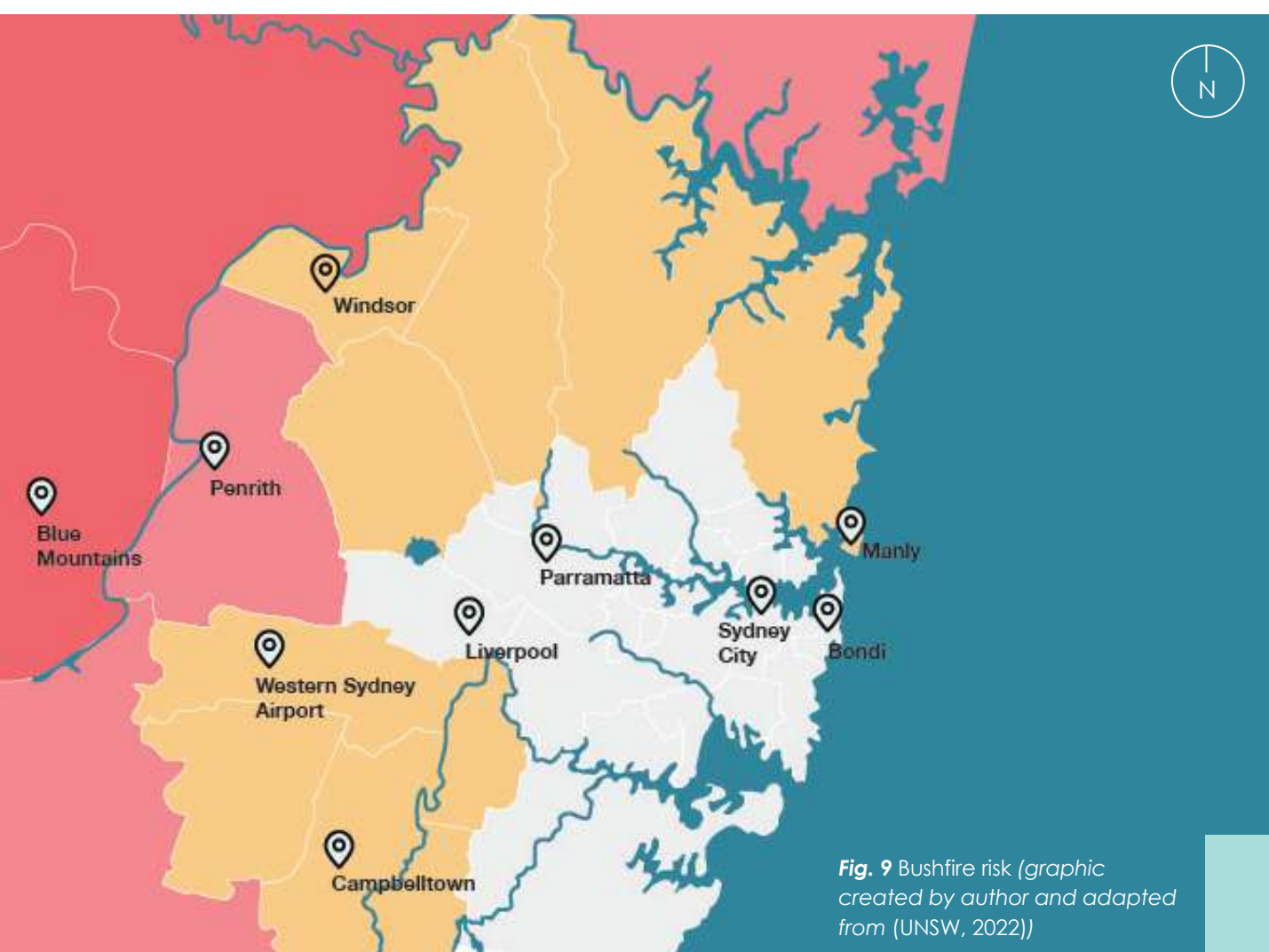
With a projected temperature increase of 0.1°C per decade, coupled with an increase in heatwaves and water scarcity, the potential for bushfires across Sydney is increasing (IPCC, 2022). Bushfires have impact communities adjacent to forest and parkland, particularly along the western and northern periphery of the city (Climate Council, 2014).

Australia will experience a temperature increase of

0.3 – 1.4°C

Sydney's 2013 bushfire saw estimated losses to property and livelihood of

\$180 million



LEGEND

- Greater Sydney area
- Waterway/ water course
- Municipal boundaries
- Low risk
- Medium risk
- High risk



CHRONIC STRESSES

Chronic stresses are slow moving impacts that weaken the fabric of a community or system. Greater Sydney's main stresses are outlined in figure 10 in order of importance (RSO [C] 2016).

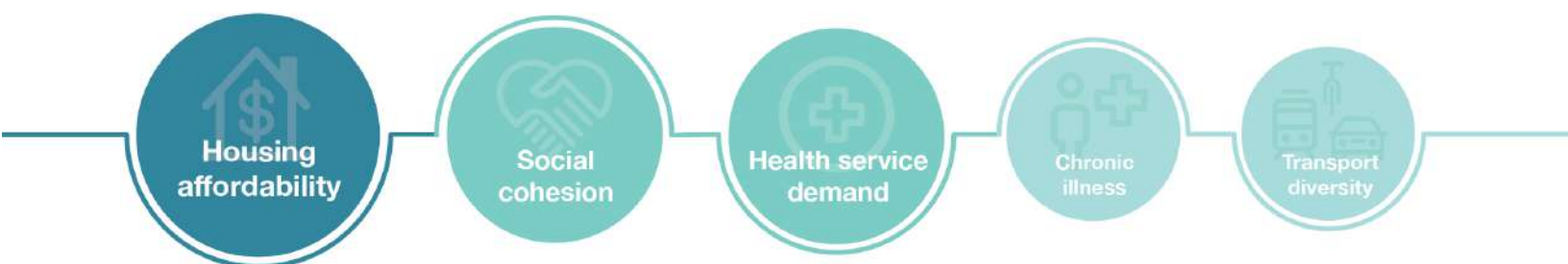


Fig. 10 Sydney's main stresses (created by author and adapted from Resilient Sydney strategy (RSO [A], 2018))

Housing affordability was identified as the highest risk, while social cohesion and health service demand were also reported as core stresses. These chronic stresses are interrelated with the city's acute shocks (e.g. flooding and heatwaves) where shocks and stresses tend to be in the same vulnerable areas. As Sydney's population and density continue to grow, it reinforces the socioeconomic divide between communities and the cost of living in Sydney (Cred Consulting, 2017).

The maps on the following pages highlight the locations of two chronic stresses: rapid urban growth and socio-economic disadvantage. The west and southwest experience both in greater proportion to the wider city. When linked to the occurrence of acute shocks in the same region, it demonstrates communities in the west and southwest are more vulnerable to environmental and social change (Adger, 2006).

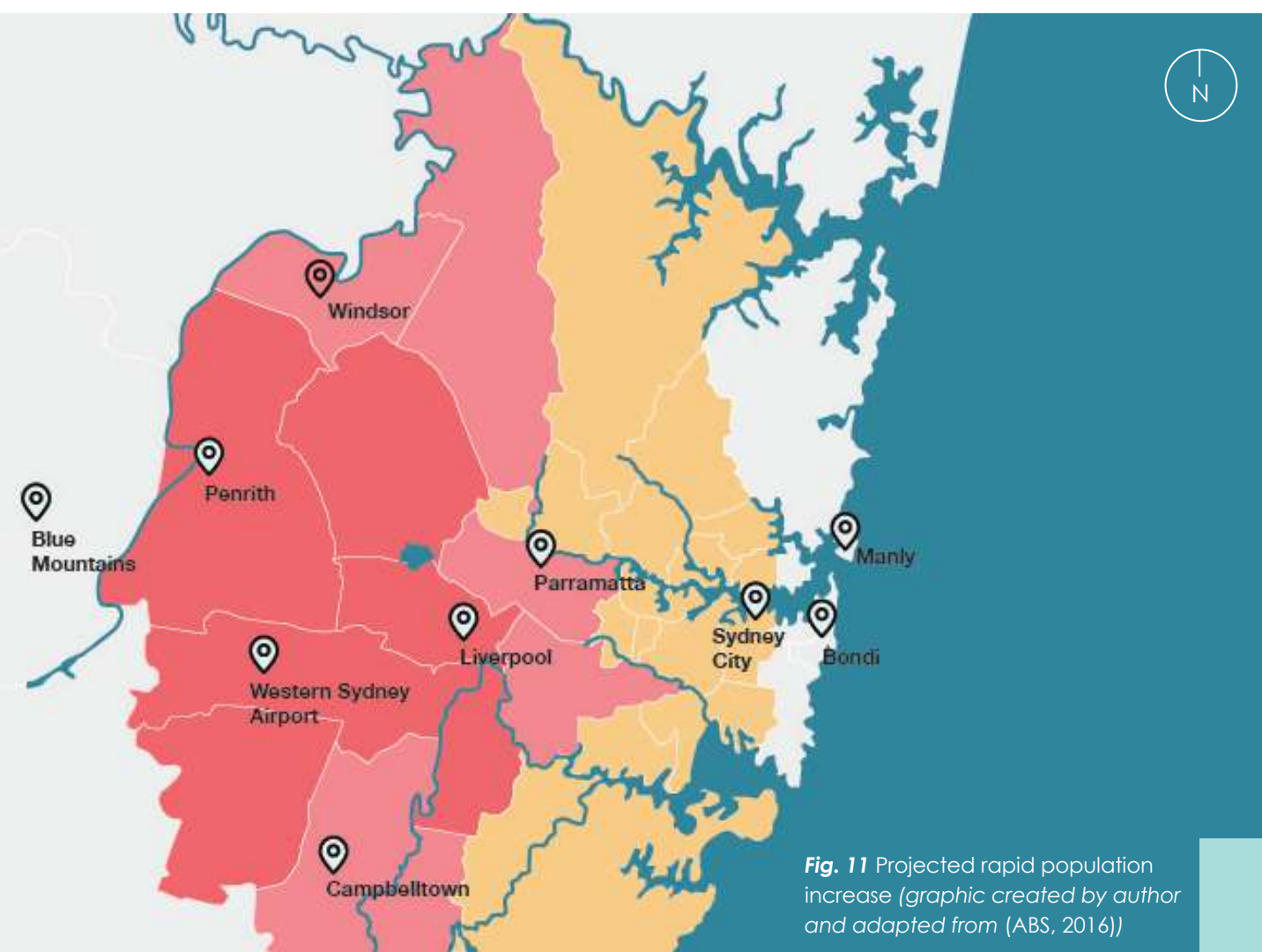
Areas of rapid population growth

Greater Sydney is experiencing rapid growth, reshaping the existing urban fabric, and creating new communities. The city will need to accommodate more than 725,000 additional homes, mostly in the west and southwest (GSC, 2016).

Sydney's west will need to accommodate

3 million

people by 2050



LEGEND

- Greater Sydney area
- Waterway/ water course
- Municipal boundaries
- Low
- Medium
- High

Areas of socio-economic disadvantage

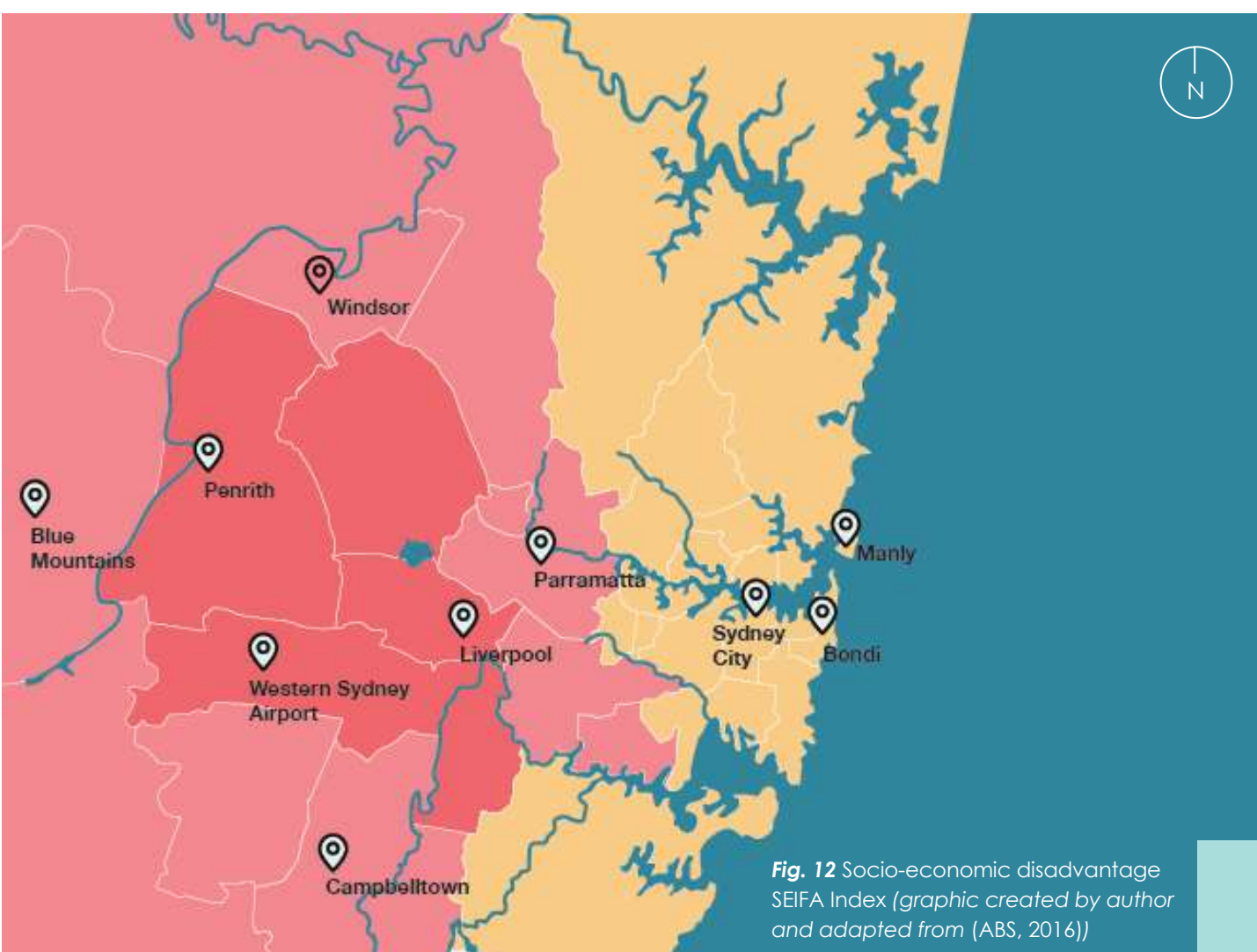
Greater Sydney is one of the most culturally diverse cities in the world (ABS, 2016). The city's west has the highest level of relative socio-economic disadvantage.

60% of people

living in western Sydney were born overseas

1%

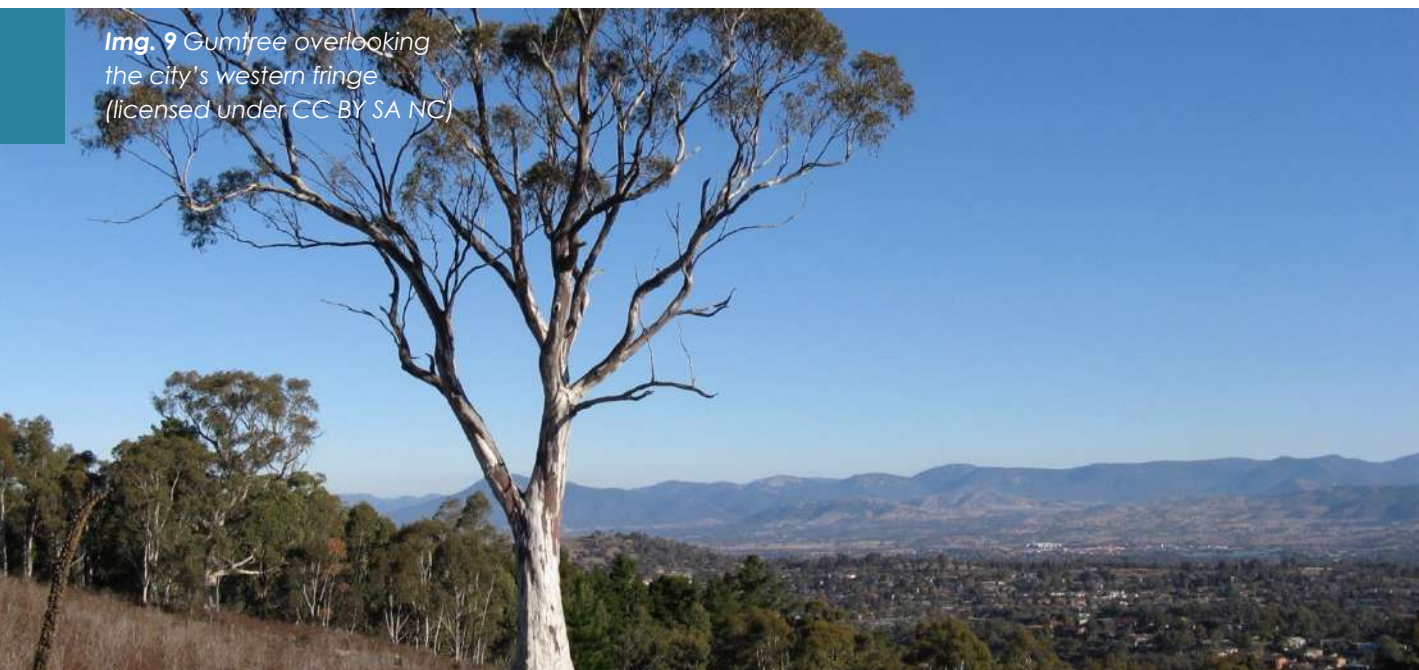
of the Greater Sydney population identify as Aboriginal or Torres Strait Islander



LEGEND

- Greater Sydney area
- Waterway/ water course
- Municipal boundaries
- Low
- Medium
- High

Img. 9 Gumtree overlooking the city's western fringe (licensed under CC-BY SA NC)



APPROACH TO RESILIENCE PRIOR TO 100RC

Sydney is not unfamiliar with resilience, prior to the 100RC programme. From around 2014, Strategies such as *Towards a Resilient Sydney* and the initiation of *AdaptNSW*, have specifically addressed the resilience of Greater Sydney. Likewise, as Australia's variable climate has seen a greater frequency and scale of natural hazards, mitigating risks and adaptation has been important at a national, regional, and local level.

The following paragraphs provide an overview of the way resilience (including mitigation and adaption) have been addressed prior to the 100RC programme and the set out the challenges faced to address resilience in Sydney since 2016.

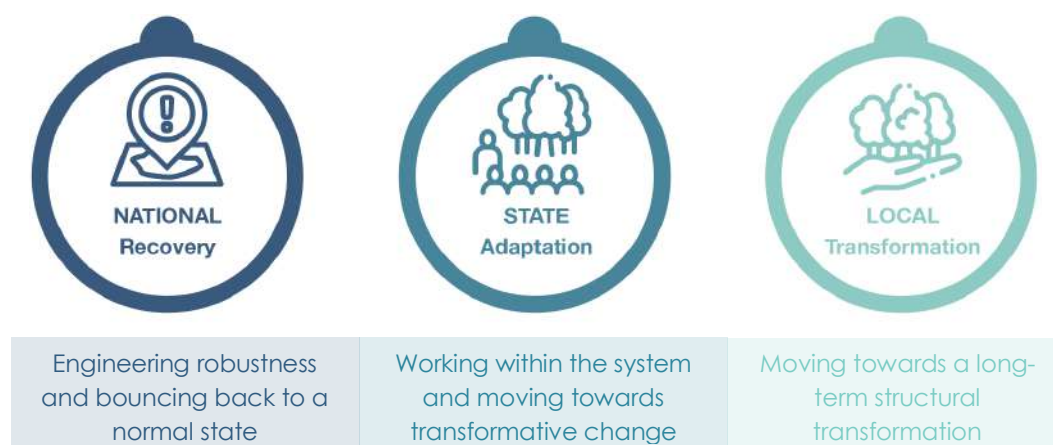


Fig. 13 Overview of the approach to resilience across three levels of government (graphic created by author, theory adapted from Chelleri et al. (2015))

Responses to natural hazards have been framed through risk reduction

Greater Sydney is prone to natural hazards, and their frequency and severity have increased over time. The city has continued to implement risk reduction strategies and coping mechanisms for many decades in response to these hazards. Mark Howden et al. note the development of effective climate records and analysis over the centuries following colonisation started to provide the basis for climate risk management which has progressed over time (Howden, 2014). Therefore, urban resilience has tended to be associated with environmental conditions and climate change, with a focus on responding to an immediate hazard. The 2011 *National Disaster Resilience Strategy* (DoHA, 2011) was the first approach to address resilience at a national level, although the strategy placed resilience in the context of disaster risk management.

The three tiers of government have also been instrumental in collecting and providing shared access to data related to shocks and stresses. At a state government level, there has been a lot of work placed into researching and mitigating risks through early-warning data (e.g. the State government's *NSW Flood Data Portal*), which have been made available for communities and local governments to access targeted information, increase their awareness of the risk, and prepared for extreme weather events.

Urban growth continues to occur in areas vulnerable to shocks and stresses

Fundamentally, the overview of shocks and stresses showed that Sydney's model for growth is enhancing vulnerabilities. Acute shocks generally occur in Sydney's west, south-west, and north-west and underlying chronic stresses such as affordable housing and social cohesion, are equally more persistent in the city's west and south-west. At the same time, these are the areas of Sydney accommodating the city's current and projected urban growth.

Urban growth has exacerbated vulnerabilities and the ability to respond to more frequent shocks and stresses. Measures to address means of coping occur through State and municipal governance arrangements (e.g. AdaptNSW), policies, and strategies. However, plans and strategies have generally not framed targets for sustainable, equitable growth opportunities, set out meaningful performance indicators or accountability for achieving progress (O'Neill, 2013).



Complex governance has created a challenging stakeholder environment

Governance is a key challenge, with competing jurisdictions and multiple overlaying plans, policies, and strategies. Responses to shocks and stresses have been challenged by governance complexities across the three tiers of government, and prior to 2016, the approach to resilience in Sydney has been more vertical in nature. This is evidenced by the timeline in figure 5 (timeline) which shows there are many national and state level strategies which address similar themes; however, they do not address each other or acknowledge interdependencies. For example, the national government issued the *National Strategy for Disaster Resilience Strategy* in 2011, within a year of the state government releasing their *NSW State Emergency Management Plan* and the City of Sydney at a local government level releasing their *Sustainable Sydney 2030* plan.

Greater Sydney has worked towards increasing collaboration across tiers of government and society, and improved preparedness for future shocks and stresses in the two years leading up to the start of *Resilient Sydney*. The State government inaugurated Adapt NSW in 2014 as a new department with the mission to 'help households, businesses, and government to understand and adapt to climate change impacts' (Adapt NSW, 2014) and in the same year set out the foundation for what would become the Greater Sydney Commission (*A Plan for Growing Sydney*, 2014). The GSC has since served to coordinate the strategic growth of Sydney and cut-through barriers to integration and interdependence. This demonstrated an attempt to address resilience horizontally, albeit through the lens of climate change impact and risk mitigation.



Img. 11 Watching fireworks from Barangaroo Park, Sydney Harbour CC BY NC)

NOWADAYS

URBAN RESILIENCE

2018 100RC RESILIENCE STRATEGY

The *Resilient Sydney* strategy (2018), developed through the Rockefeller 100 Resilient Cities project, set out a coordinated plan to mitigate and build back better in the face of shocks and stresses. The strategy was developed through engagement with “1,000 representatives from all levels of government, business, academia, community services, First Nations Peoples and our local communities” (RSO [A], 2018). The focus of urban resilience is captured through a multi-layered-layered lens of social, political, and environmental resilience. It identified governance as the primary resilience challenge, as to date, the failure to understand connections and interdependencies was impacting decision-making and increasing vulnerability. Figure 11 provides an overview of the key directions outlined to create a *Resilient Sydney*.

Img. 12 Bondi Icebergs, Sydney NSW
(licensed under CC BY 2.0)



Resilient Sydney Key Directions

The *Resilient Sydney* strategy (RSO [A], 2018) outlines five core directions for ensuring Sydneysiders understand and are prepared to manage resilience challenges:

- 1 People centred city**
Include communities in decisions making for growth & equity
- 2 Live with our climate**
Adapt to sustain quality of life & the environment
- 3 Connect for strength**
Every Sydneysider will feel they belong in our community & city
- 4 Get ready**
Know how to prepare, respond & recover
- 5 One city**
Work collaboratively as one city

Fig. 14 *Resilient Sydney* strategy key directions (RSO [A], 2018))

Prioritising governance and collaboration

As fragmented governance has prohibited progress in building Sydney's urban resilience, collaboration is outlined as a priority in the strategy. Direction 5 'One city' places governance at the heart of a *Resilient Sydney*. Since joining the 100 RC in 2014, the Resilient Sydney Office has seeded a new collaborative governance model to address interdependencies and create a shared voice and provide a cross-boundary and cross-jurisdictional discussion around resilience.

Despite funding for 100 RC ceasing, the City of Sydney has continued to sponsor the Chief Resilience Officer role and two further positions in the Resilient Sydney Office. The Resilient Sydney Working Group maintain a regular dialogue with stakeholders and Greater Sydney's 33 participating Councils.

As such, the key outcomes of the *Resilient Sydney* strategy (2018) in relation to governance include better coordination between all tiers of government and stakeholders, a shared dialogue between emergency services and government agencies, and increased agency and sense of inclusion.



Img. 13 Sydney Harbour and the Sydney Opera House (licensed under CC BY 2.0)

Focus on social justice and community agency

The strategy places an emphasis on the social determinants of urban resilience. Four of the five directions for the strategy relate to being people-centred and working together. Social cohesion, community agency, and community preparedness were recognised as priorities by participants in the consultation process (RSO [A], 2018). Solutions proposed include learning from First Nations Peoples, investing in community awareness raising and ensuring decision-making reflects Sydney's diverse cultures. Additionally, the need for community agency, and building social capital, reflects the need to create solutions using local knowledge and create the bonds and ties between communities to enable them to prepare and adapt together.

Australia has a long history of community-based resilience initiatives, which makes social resilience a powerful tool for achieving urban resilience. For example, fighting the threat of bushfires is led by paid Fire Service members in partnerships with many volunteer firefighters from, generally from rural or peri-urban communities who live in high-risk areas.

*Img. 14 Smoke haze, Sydney, 2020
(licensed under CC BY-ND)*



Setting expectations around adaptation to climate change

The strategy places a focus on inaction to reducing carbon emissions and adapting to the changing climate as integral to Sydney's resilience. Directions 2 'Live with our climate' and direction 4 'get ready' specifically address adaptation to climate change as a priority with solutions proposed including decentralised renewable energy, changes to building codes, and city greening (RSO [A], 2018). This approach maintains the status quo, thereby focusing on resilience in the context of risk reduction and preparedness.

With the strategy sponsored at a state and local government level, climate adaptation has been unburdened by the politics that dominate discussions of GHG emissions reductions at a national level, where the national government are working against committing to emissions targets. Australia's decentralized model of governance has allowed State and local governments to establish and respond to their own climate policies and GHG reduction targets.

RESILIENCE APPROACHES AFTER 100 RC

As previously discussed, Sydney prior to 2016 has explored resilience through risk mitigation. Climate change and natural hazards were a key instigator for resilience measures at a national, state, and local level. However, the Greater Sydney Commission which began operation in 2015, recognises that, “while planning for resilience has traditionally focused on responses to natural hazards and climate change, it is increasingly being used to consider a wider range of social and economic shocks and stresses” (GSC, 2017). The Resilient Sydney Office created the framework for addressing resilience more holistically, considering social justice, governance, and interdependencies.

Figure 14 shows the occurrence of recent acute shocks in Greater Sydney since the *Resilient Sydney* strategy (2018) was finalised. Two of these events (the ‘Black Summer’ bushfires and Covid-19 pandemic) have been on an unprecedented scale.

Shocks & stresses are increasing in frequency



Natural hazard bushfires: (2019-2020)

Smoke from the fires blanketed Sydney, with some areas exceeding the national standard of tolerable particulate matter (air pollution) for 32 days (Virgilio G., 2021) and severely impacted communities around Sydney’s western fringe. Since the 2019-2020 bushfires, the Western Sydney Regional Organisation of Councils (a conglomerate of Council’s comprising the western region of Great Sydney) have been exploring ways to build resilience to heatwaves and fire events with strategies such as *Turn Down the Heat* (WSROC, 2021).

Disease pandemic: Covid-19 (2020-ongoing)

The most vulnerable communities – those who were more likely to contract the disease, be hospitalised, or experience unemployment or under-employment – lived in the city’s west and south-west. The GSC released a report at the end of 2020 titled, *City-shaping impacts of COVID-19: Towards a resilient Greater Sydney* (GSC, 2020). The report identified community-oriented projects as the key to recovery and resilience.

Fig. 15 Shocks and stresses after 100RC

PLANS, POLICIES & STRATEGIES

SHOCKS & STRESSES

- **Inception of the Resilient Sydney Office (2016)**
- Technical Guidelines for Urban Green Cover in NSW (2015)
- NSW Climate Change Policy Framework (2016)
- Minimising the impact of extreme heat: A guide for local government (2016)
- Greater Sydney Regional Plan - Metropolis of Three Cities (2016)
- National Resilience Knowledge Hub initiated (AIDR 2017)
- **Phase I: City Context Report & Preliminary Resilience Assessment (2017)**
- Better Placed: An integrated design policy for the built environment of NSW (Government Architect NSW 2017)
- **Phase II: Diagnostic Report & Engagement Report (2018)**
- **Phase III: Resilient Sydney: A strategy for city resilience (2018)**
- State Infrastructure Strategy 2018-2038 (Infrastructure NSW 2018)
- Turn Down the Heat Strategy (WSROC 2018)
- Transition Strategy for a Water Sensitive Greater Sydney (CRC 2018)
- Profiling Australia's Vulnerability: the interconnected causes and cascading effects of systemic disaster risk (Department of Home Affairs 2018)
- Amendment to NSW Environmental Planning and Assessment Act 1979 (2018)
- A City for All: Towards a socially just and resilient Sydney (City of Sydney 2019)
- Resilient Sydney Monitoring and Evaluation Framework (2019)
- Establishment of the Resilient Sydney Platform (2019)
- **Continuation of Resilience Sydney Office (2020)**
- Greener Places Design Guide (NSW Government Architect 2020)
- NSW Net Zero Plan – Stage 1 2020-2030 (DPIE 2020)
- The Pulse of Greater Sydney 2020 (Greater Sydney Commission 2020)
- **Resilient Sydney - Outcomes and Insights Report (2021)**
- **Resilience Assessment Guide (2021)**
- Establishment of Resilience NSW Office [disaster resilience] (2020)
- Draft Connecting with Country Framework (Government Architect NSW 2020)
- Designing with Country Discussion Paper (Government Architect NSW 2020)
- Draft Environmental Strategy 2021 - 2025 (City of Sydney 2021)
- Ryde Resilience Plan 2030 (2021)
- Resilient Penrith Action Plan 2021-2030 (City of Penrith 2021)
- Greater Sydney Water Strategy (Department of Planning, Industry & Environment, in development)

2016

2018

2020

2022



2016 Storm

100 year storm event and king tide, leading to A\$304 million in losses



2017 Heatwave

Increased deaths, hospitalisations, and infrastructure failure



2019-2020 Bushfires

Worst bushfires in Australian history with over 35 days of poor air quality due to smoke



2020 (ongoing) Disease pandemic

Covid-19 global pandemic



2021-2022 Flooding

Thousands of evacuations and millions in damages (costs yet to be calculated)

- GLOBAL
- NATIONAL
- STATE
- LOCAL
- 100 RC
- CITY RESILIENCE OFFICE (after 100RC)
- CLIMATE/ENVIRONMENT
- SOCIO-ECONOMIC
- MULTIPLE FACTORS

Fig. 16 Timeline of interventions (policies, strategies, and public bodies) implemented after 2016 (created by author)

What has not changed?

AT A NATIONAL LEVEL, PLANNING FOR RESILIENCE IS STILL DRIVEN BY SHOCKS

The national government have continued to focus on resilience through the lens of disaster risk management to acute shocks rather than chronic stresses. For example, since 2016 the national government have establishment the *National Recovery and Resilience Agency*, the *Australian Institute for Disaster Resilience*, and the *Australian Disaster Resilience Knowledge Hub*. While these are active steps in addressing resilience and preparedness, they are focused primarily on natural or man-made disasters and risk management to acute shocks.

There has been less focus on chronic stresses, such as housing affordability, managing population growth, and addressing social cohesion. As was the case with approaches prior to 2016, there has been less appetite to address the chronic stresses of the city as they relate to solutions that may impact broader economic prosperity and GDP because they are regarded as counterintuitive to growth and prosperity. The trade-off, therefore, is between maintaining economic growth to the benefit of the 'whole' yet neglecting the issues that are entrenching socio-economic disparity. Sydney's west, south-west and north-west are more vulnerable, yet they are the areas expected accommodate the population growth.

LIMITED ACCOUNTABILITY, MONITORING, OR EVALUATION MECHANISMS

To ensure actin and accountability, applying Monitoring, Evaluation, Reporting and Learning (MERL) is essential and where plans lack MERL, they are not self-reflective or able to critique and evaluate long-term success of initiatives, plans and actions. In most instances, including the *Resilient Sydney* strategy (2018), this was lacking or limited to a minimal number of pages. However, the Resilient Sydney Office issued an *Outcomes and Insights Report* (Clear Horizons, 2021) by an independent contractor to evaluate how the 100RC process and resilience strategy itself had or had not been successful.

Equally, resilience plans have been limited in outlining capacity and resources for initiatives and projects. The Resilient Sydney Office have had several limitations on effectiveness due to funding and resourcing, and a lack of authority (Clear Horizons, 2021). The lack of a sustainable funding model has also undermined the potential for the 33 councils to implement projects and initiatives. Local governments also do not have access to the large-scale funding resource available at a national or state level. This creates a disparity between the connection to community and ability to implement projects.



Img. 15 Barangaroo Park walking track (licensed under CC BY-ND)

What has changed?

ENHANCED DECISION-MAKING AT A LOCAL LEVEL

Local governments are generally more proactive in implementing plans and policies with resilience actions (Global Access Partners, 2021). Sydney's 33 councils that are incorporated in the Greater Sydney area have all been involved in developing the *Resilient Sydney* strategy (2018). Local governments in western Sydney have also been proactive in developing their own resilience plans, following the format and tools from the 100RC process. For example, Penrith City Council published their *Resilience Action Plan 2021-2030* in 2018 (PCC, 2018) with actions that aligned to the *Resilient Sydney* strategy (RSO [A], 2018). Ryde City Council were the first municipality to release a specific resilience plan, *Ryde Resilience Plan 2030* (2021) to better prepare the community for future shocks and stresses. These plans have addressed resilience as a concept with a broader meaning, addressing measurable risks as well as broader challenges and underlying chronic stresses such as socio-economic disparities.

The fact that 30 councils invested directly in Resilient Sydney by making voluntary financial contributions was seen by several informants as evidence of Resilient Sydney's value, and the extent to which it had been able to build support and momentum for resilience work.

– Resilient Sydney Outcomes and Insights Report (Clear Horizons, 2021)

GREATER FOCUS ON STRUCTURAL AND RELATIONAL GOVERNANCE TO ADDRESS RESILIENCE

The *Resilient Sydney* Office has strengthened relationships between councils, state government, stakeholder, and communities. The *Resilient Sydney Outcomes and Insights Report* analysed the impacts of the strategy, finding that "Resilient Sydney has significantly changed the political and institutional landscape and set an important precedent for city-wide resilience" (Clear Horizons, 2021). Improvement in the way decisions have been made and access to accurate and consistent data enabled local governments to priorities their projects and budgets. These include the *Resilient Sydney Platform* and the *Penrith City Council Resilience Strategy* (2021).

Relationship building work is widely viewed as one of its key strengths and successes of the 100RC process and it has facilitated more widespread and effective collaboration by connecting stakeholders and supporting implementation. The *Resilient Sydney Outcomes and Insights Report* (Clear Horizons, 2021) notes that "through its concerted efforts to neutralise competitiveness and division between and within state and local governments, and to build trust and shared goals among participating stakeholders, the Resilient Sydney Office has made significant progress in addressing governance challenges."

The following page provides a snapshot of Sydney's largest urban regeneration project, the Western Sydney Aerotropolis, which was initiated since 2016. The project has been explored in detail to explore the approach to resilience and the challenge it ultimately presents to secure a just and sustainable future for Sydney.

DISCUSSION AND CONCLUSION

FUTURE RESILIENCE FOR SYDNEY

Is urban resilience at odds with population growth and urban development?

The analysis in this report has shown that Sydney, in the land of 'drought and flooding rains', is susceptible to frequent extreme weather events and prolonged impacts of warming temperatures. As such, Sydney has characterised resilience through the lens of risk mitigation and 'coping'. In addition to the likelihood of more frequent and severe extreme weather events, Sydney is facing challenges related to rapid population increase. These underlying factors are exacerbated when considering the city's chronic stresses include socioeconomic disadvantage, housing affordability and social inclusion.

100RC and the *Resilient Sydney* strategy (2018) catalysed a renewed, more holistic view of resilience, balancing disaster risk management with environmental and social justice. Above all, the five-year process facilitated horizontal dialogue across the city's complex and convoluted layers of governance. This has laid the foundations for a more interconnected and integrated response.

However, for Sydney to address its future resilience there has been silence around some of the trade-offs and challenges of what a Resilient Sydney should look like with 3 million more people in the next 20 years. This section provides a summary overview of the key challenges to urban resilience moving forward and the approach Sydney has taken, whether good or bad, and how this can provide lessons for other cities.

APPROACH

We need to move from resilience as risk reduction to transformation

Sydney's resilience pathway has tended to be associated with responding to an immediate risk or exposure and disaster response, recovery and mitigation are reasonably developed across Sydney (Middelmann M. H, 2007) This in line with trends where urban resilience has been related mainly to climate change adaptation and disaster management perspectives (Chelleri et al., 2015). As such, the implementation of policies, strategies, and projects has been focused on developing robustness rather than oriented towards transformation. This report has shown that while at a national level there has been no change, the regional and metropolitan level have sought to contextualise resilience holistically to address the interconnectedness between social, economic, and environmental realms.

LIVED EXPERIENCE

Interactions with impacted communities are needed to address interdependencies

Understanding the connections and interdependencies in an urban system is central to resilience. Urban resilience literature notes that the impacts of a shock event depend on where, when, and to whom it occurs (Meerow S & Newell J, 2016), and the variability of the context is embedded in the lived experiences of these shocks and stresses. However, lived experience and this variability is rarely captured in resilience policy, often due to quantitative assessment tools based on technical data sets (Chelleri L & Olazabal M, 2012). In Sydney, the social impacts of shocks and stresses are experienced differently by communities, yet this has been under acknowledged in policies, strategies, and projects. This demonstrates the importance of multi-stakeholder inclusion in planning processes to account for the variabilities and to understand the interdependencies.

SPATIAL DIMENSIONS

Sydney needs to consider its wider context and its role in the Asia-Pacific region

While this report has addressed resilience in relation to Sydney, it has not considered Sydney's role in its global geographic location – the Asia Pacific region. Responding to acute shocks in New South Wales, such as upstream flooding, and bushfire management takes energy and resources from Sydney. Likewise, with sea level rise and natural disasters, Sydney will need to play a role in supporting Pacific nations (e.g. Tonga and the Kiribati) and south-east Asian countries (e.g. Papua New Guinea and Indonesia) who's citizens may be forced to migrate due to sea level rise. Recent resilience theory speaks to the complexity of delineating the boundaries of a city-system and where 'shifts in one location or at one scale impact those at others' (Meerow S Newell J & Stults M, 2016). Sydney's experience with resilience has had to trade-off the priorities of some over others (e.g. climate migrants).

TRADE-OFFS

Urban growth should not occur in areas with a significant risk profile

Sydney's West and south-west are the regions that will need to accommodate the city's future growth. However, they are also the areas with the greatest risk profile, in terms of urban heat, exposure to hazards, and socioeconomic disadvantage. New urban development in these areas will further encroach on natural environments. Brenner and Christian highlighted the dilemma of the 'disintegration of the hinterland' where the hinterlands of major cities are being reconfigured as they are functionalised to facilitate the continued expansion of industrial urbanisation and its associated planetary urban networks (Brenner N & Schmid C, 2014). Urban development will address underlying streets such as housing affordability, yet this may come at the expense of exposing communities to future hazards and shocks, without the adaptation mechanisms needed to address them. The tension, therefore, is balancing the resilience in terms of the needs of the whole (Greater Sydney) with the specific needs of geographies (e.g. the western region).

CHANGING MINDSETS

Resilience will be challenged by the status quo and approach to growth

One of Sydney's greatest challenges is how to ensure quality urban outcomes are produced when the city's urban form (e.g. environmental performance standards) works against *Resilient Sydney*. Dajon Veldman (2020) reflected that urban development in western Sydney since the 1990s has resulted in an urban form that is not sympathetic to the landscape, the ecology or the water cycle and the full set of benefits available to future residents is compromised by continued cookie cutter housing into bulldozed clay plains (Veldman D., 2020). Urban sprawl in some ways is counterintuitive to resilience as it reinforces the chronic stresses in some regions. The urban form and character are driven by individual expectations of what prosperity represents for them; the preference is often to own a detached home with room for private vehicles and private outdoor recreation spaces. Therefore, transformational change for Sydney needs to understand how to accommodate growth in established areas of Sydney with established coping mechanisms, high amenity, and a high level of social capital, through a higher density urban form (e.g. multi-dwelling building stock) and the community's expectations need to be readdressed.

GOVERNANCE

Establishing coordination arrangements is an essential first step

Resilient Sydney chose to tackle the city's disjointed governance as an imperative, before starting or implementing strategies and actions. *Resilient Sydney* has been able to build significant 'soft' power through its effectiveness as a unified voice for councils, and its ability to draw on a solid evidence base (Clear Horizons, 2021). Governance is important because it ensures accountability and is essential to monitoring and evaluating the implementation of actions, strategies, and projects (Asadzadeh A et al., 2022). Creating new platforms for dialogue and clearly delineated governance ensures that the temporal and spatial dimensions of resilience are considered, identifying the coordination of strategies across city boundaries (Chelleri et al., 2015). Governance is also the mechanism through which to understand and implement a funding pipeline for local government and communities. However, without a clear and agreed mandate, a resilient city office cannot 'compel' action at any level, despite establishing effective governance arrangements, which has been the case for the Resilient Sydney Office.

Urban resilience is not just about removing vulnerabilities and climate-proofing, yet a broader sustainable development focused on adaptation and transformation and inclusive of socio-ecological understandings of resilience (Chelleri et al., 2015). Sydney, prior to 2016, addressed resilience through the former, however the Resilient Sydney Office has sought to capture the wider complexities the urban system. Sydney needs to be more visionary, strategic, inclusive, and resilient to capture the complex opportunity fit for a modern metropolis (Veldman D., 2020). The city will need to anticipate future urban growth needs and development trends and incorporates vital attributes such as environmental assets and social justice to create places with contextual attributes that ensure communities can thrive.

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Exploring Urban Resilience Pathways
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