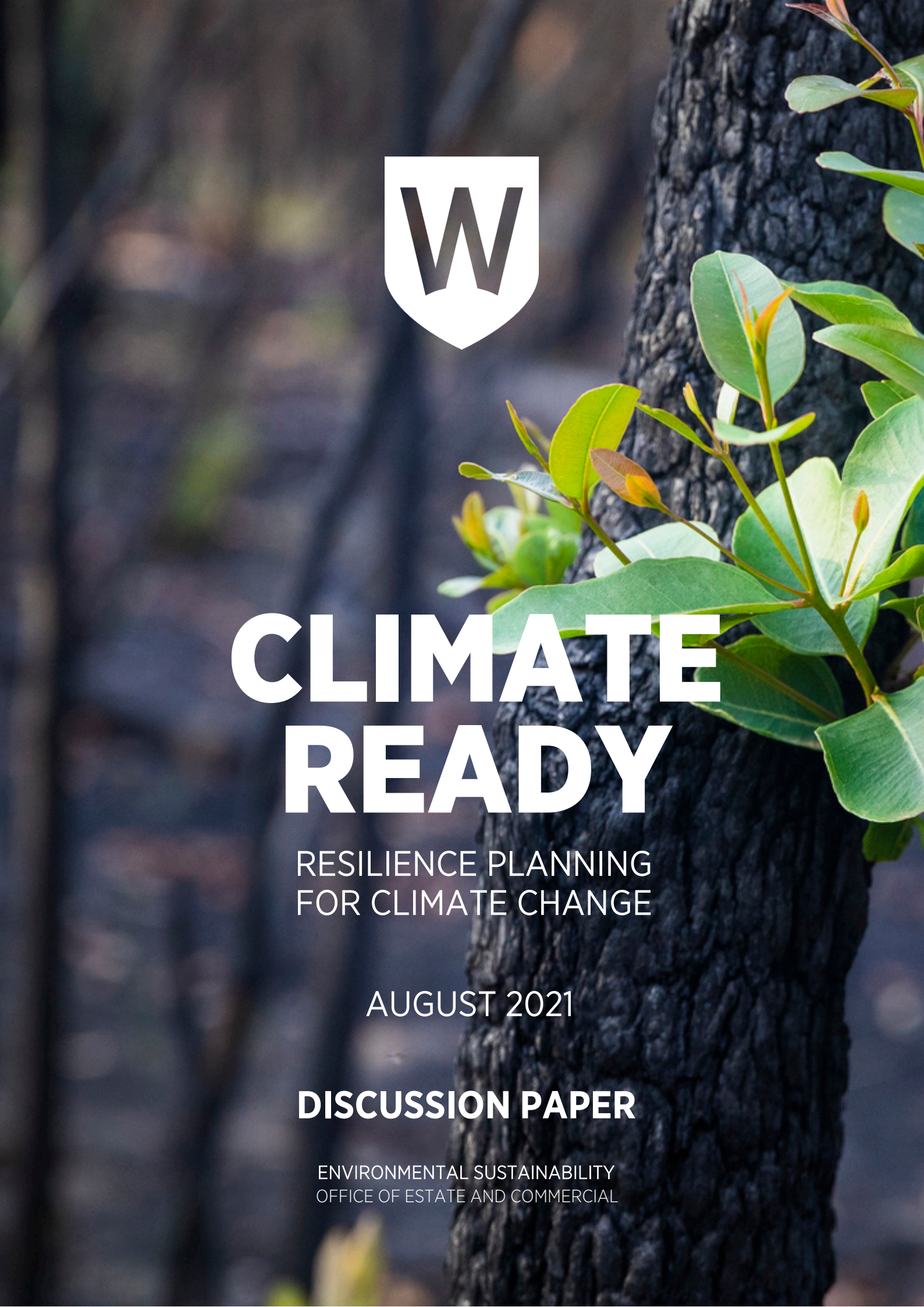

CLIMATE READY

RESILIENCE PLANNING FOR CLIMATE CHANGE

AUGUST 2021

DISCUSSION PAPER

ENVIRONMENTAL SUSTAINABILITY
OFFICE OF ESTATE AND COMMERCIAL

CONTENTS

1. OVERVIEW

This report reflects an update in our progress towards managing climate change risks, and builds upon the initial Preliminary Resilience Assessment (PRA) (2019). Following CSIRO's (2020) characterisation of the lifecycle of managing resilience, the structure of this report is as follows:

- Planning and preparedness
- Operational responses
- Recovery, learning and improvement.

Key initiatives for planning and preparedness are outlined, building upon the thematic recommendations emerging from the PRA. In seeking to embed resilience in Western's strategy and planning, initiatives include:

- Sustainability being a core pillar of Sustaining Success 2021-2026, and incorporating the targets developed in the University's Sustainable Energy Strategy.
- The Environmental Sustainability Action Plan (ESAP) including resilience to climate change risks as one of its key themes.
- The emerging Sustainability and Resilience Decadal Plan which incorporates resilience as a key theme.
- Living Labs having developed as a key engagement strategy theme of the ESAP.
- Green Star buildings as a key theme with opportunities for Green Star Communities.

Integrative infrastructure strategies and interventions are summarised and build upon a preliminary risk assessment in the PRA, with initiatives outlined for electricity and gas supply, water supplies and resources, building fabric and services, plant and equipment, research facilities, outdoor operations, and public spaces.

Operational responses include management behaviours reflecting mitigation, adaptation and response capabilities. Integrated operational responses are outlined, including those related to the Sustainable Energy Strategy, solar carparks, water recycling and reuse, cooling landscapes and vegetation, the Hawkesbury Bushfire Unit, Resilience Roadshows and regional collaboration.

Since the development of the PRA, devastating and cascading impacts associated with bushfires, urban temperatures, flooding and the COVID-19 pandemic have been experienced. In response to these, key reports have emerged such as CSIRO's responses to Climate and Disaster Resilience, and globally there have been calls for the higher education sector to respond to the challenges inherent in climate change. Reflections on COVID-19 and the 'new normal' are presented based upon interpretation of our experience here at Western.

1.1 Recommendations for improvement

The adapted structure drawn from the CSIRO's report to address the lifecycle of preparedness and planning, operational response, recovery, lessons learned, and subsequent improvement is a productive and pragmatic model. Further steps will be made to develop the planning and operational strategies outlined in this report, and more critical national and international perspective will no doubt, continue to emerge.

An emerging recommendation for Western is that resilience planning for climate change should be incorporated in a broader framework for Business Continuity and Resilience, integrating:

- Resilience planning for climate change risks (urban heat, bushfire risk, and storm intensity)
- Failures of critical infrastructure, including but not limited to, supply of power and water, communications, research protection, and critical business functions.
- Future responses to public health and biosecurity risks, and changes in work practices and systems emerging as part of the 'new normal' following COVID-19.

2. PLANNING AND PREPAREDNESS

This document builds upon the Preliminary Resilience Assessment (PRA 2019) to outline strategic and operational responses for addressing climate change risks. Given the recent evidence of cumulative impacts, and the focus of resilience planning on avoiding cascading systemic failure, adaptive strategies must be integrative and pragmatic; addressing both mitigation and adaptation to multiple risks to enhance systemic resilience. Key aspects identified in the PRA included embedding resilience in Western's strategy and planning, and developing integrative infrastructure strategies (Box 1).

Box 1. Recommendations identified in the Preliminary Resilience Assessment

1. **Embedding resilience in WSU strategy and planning, through:**
   - → Building integrated capacities across functional domains of WSU
   - → Embedding integrative strategies, such as Living Labs in WSU Strategy
   - → The building of Green Star structures within Green Star community precincts
2. **Developing integrative infrastructure strategies and interventions, including:**
   - → Infrastructure strategies identified in infrastructure risk assessment
   - → Applying design and operational strategies identified by The Property Council

2.1 Development and engagement

This discussion paper reflects our situation in July 2021 following the impacts of the COVID-19 pandemic, the 2019-20 bushfires, and the floods across the Hawkesbury and NSW in March 2021. Since the initial development of the Preliminary Resilience Assessment (PRA) in 2018-19, many direct engagements and consultations have been limited in application due to the ongoing pandemic. Subsequently, a number of forums were translated to participants and audiences via Zoom Microsoft Teams and other such technologies.

During the development of the PRA, input was sought from within the Office of Estate and Commercial (OEC), along with campus-based workshops held on Hawkesbury, Kingswood and Parramatta City campuses, with invitations sent to academic and operational staff involved in developing Living Lab initiatives. Following the compilation of information into the PRA, Resilience Roadshows were held at Kingswood and Hawkesbury campuses, showcasing the range of local champions and Living Labs emerging on each site as contributions to our toolkit for innovation and resilience. Unfortunately, the COVID-19 pandemic surfaced before a similar roadshow could be convened at Parramatta campus.

This discussion paper is intended to be distributed to stakeholder representatives to contribute to conversation around the challenges and opportunities associated with our ongoing development of resilience strategies for our Western communities of practice, and the campuses and infrastructure that supports our University. It is hoped that the distribution of this discussion paper will contribute to ongoing dialogue regarding personal and organisational resilience in the face of climate change and the suite of other macro-scale pressures and challenges we currently face.

It must be noted that this document - and its focus on resilience to climate change risks - only addresses key attributes from a perspective of campus environmental sustainability and related functional perspectives. It does not attempt to encompass the broad changes in hybrid approaches to teaching and learning, or other domains of activity, other than to indicate the clear opportunities for strategic alignment.

2.2 Embedding resilience in Western's strategy and planning

Building integrated capacities across functional domains of WSU

During 2019 and 2020, significant initiatives have occurred since the finalisation of the Preliminary Resilience Assessment in February 2019, including:

- Development of the Western's strategic plan Sustaining Success 2021-2026 with sustainability as a core pillar, and incorporating the targets for renewable energy and carbon neutrality from the Sustainable Energy Strategy.
- Establishment of the Environmental Sustainability Action Plan, which includes Resilience and Climate Change as one of its ten key themes, and the associated Sustainable Energy Strategy informing action plans towards targets of 100% renewable energy by 2025, and carbon neutrality by 2030.
- Development of Western's Sustainability and Resilience 2030 decadal strategy, which incorporates resilience as a key theme.

These strategic and operational plans will propose a framework within which the organisational capacities of Western are focused for the 2021-2026 strategic plan, broader aspirational targets for the Sustainability Decadal Strategy, and action plans and targets through 2025 and 2030 in the Environmental Sustainability Action Plan.

Embedding integrative strategies, such as Living Labs in Western's Sustaining Success

As part of the development of the Environmental Sustainability Action Plan (ESAP), Living Lab initiative are integral engagement strategies for each key theme of the plan, as well as having all initiatives as they develop available on the Environmental Sustainability Living Lab website. The ESAP also seeks to broaden the scope of traditional environmental themes to reflect emerging concepts and practices, including water cycle management, waste and circular economy, peri-urban agriculture, and social and corporate responsibility.

Building on Green Star buildings towards Green Star community precincts

Western Growth is a key strategy for establishing Green Star accredited vertical CBD campuses at strategic locations across Greater Western Sydney that have links to public transport. Parramatta City campus (Peter Shergold Building), Liverpool City campus (Ngara Nguru Building), Caddens Corner Werrington, and sites underway for Bankstown City campus and Parramatta Engineering Hub are all Green Star rated.

The Werrington campus re-development is also well underway with precinct master planning. Initial discussions have been undertaken with the Green Building Council of Australia (GBCA) regarding the opportunity to implement a Green Star Communities rating system. This rating addresses several themes relevant to resilience planning for climate change risk including governance, liveability, economic prosperity, environment, and innovation.

2.3 Developing integrative infrastructure strategies and interventions

Infrastructure strategies identified in infrastructure risk assessment

In the PRA, a preliminary risk assessment was undertaken (Table 1), with ongoing planning and strategies identified below.

Table 1. Preliminary risk assessment of critical campus assets

CRITICAL ASSETS AND CONDITION	PRIORITY SHOCKS / STRESSES	CONSEQUENCE / VULNERABILITY	ADAPTATION STRATEGY
Electricity and gas supply (HV & LV) – limited peak demand and alternative supplies	• Price increases • Changes in regulatory arrangements • Supply interrupt - storms / bushfire • Demand during periods of heat	• Financial stress • Impacts on business continuity • Excessive peak demand	• Hedging through renewables • Energy efficiency • Research protection measures • Peak demand management
Water supplies and resources – SWC supply, and non- potable sources on HWK, minor eg on PEN, CTN & PTA	• Supply interruption / restrictions • Changes in regulatory arrangements • Drought	• Business continuity • Loss of amenity / assets	• Water harvesting and recycling • Water use efficiency
Building fabric and services – varied age and condition of > 500 buildings plus new portfolio of CBD locations	• Tolerances to heat • Operational tolerances of HVAC • Changes in regulatory arrangements	• Operational flexibility to conditions • Ability to maintain thermal comfort	• Strategic asset planning • Design for thermal tolerance • Energy efficiency • Passive design and landscaping
Research facilities – distributed high intensity controlled environments	• Power supply interruption • Impact on operation during heat • Impact of bushfire, outdoor facilities	• Loss of controlled conditions • Loss of critical data /materials	• Research protection measures • Bush fire mitigation strategies
Outdoor operations (eg farm, environmental assets) –developed on HWK, minimal elsewhere	• Drought / storm surge / flood • Bushfire • Biosecurity incident	• Loss / death of assets • Impacts on animal welfare • Impacts on biodiversity	• Water recycling / resources • Bushfire planning & preparedness • Land and biosecurity management
Public spaces – generally good amenity / condition informed by safety through design	• Thermal comfort during heat • Storm damage • Drought conditions	• Health and safety risks • Loss of amenity	• Precinct design for amenity • Cooling and shading elements • Water harvesting and reuse

Electricity and gas supply

- Development of a Sustainable Energy Strategy, and consideration in relation to energy supply contracts and renewal.
- Engagement though NSW DPIE for energy coaching, and participation in DPIE's Sustainability Advantage Program.

Water supplies and resources

- Continued risk management planning for the utilisation of recycled water and stormwater on Hawkesbury campus.
- Developing control automation for harvesting of stormwater, wetland treatment and transfer for irrigation of campus landscape and amenity.
- Review other water harvesting opportunities

Building fabric and services

- Continued development of Green Star accredited CBD campuses, incorporating progress towards WELL rating systems.
- Development of an Asset Management Strategy to inform maintenance schedules and investment in refurbishment on the basis of asset condition and lifecycle.
- Continued application of preventative maintenance services, such as essential building fire safety certification, and electrical and HVAC services.

Plant and equipment

- Planning and review of internal guidelines in a manner consistent with adaptation strategies recommended by NSW Property Council to address: increased HVAC demand, maintenance and cost, thermal comfort and heat stress and impacts of bushfire and extreme storms (Box 1).
- Opportunity to build upon BMS capabilities - such as load-shedding - implemented on Parramatta campus to automated load-shedding on other campuses.
- Modular best practice PV pilots, including rooftop, carpark and solar farm situations, with potential integrated data analytics to be trialled.
- Improved data stewardship of compliance reporting of greenhouse gas emissions under National Greenhouse Energy Reporting scheme (NGER), supported by improved data governance.

Research facilities

- Research protection initiatives to address risks including interruption of water and power supply
- Bushfire risk in outdoor research facilities such as EucFACE.
- Establishment of drenching system, bushfire mitigation strategies, and response capability through the Hawkesbury Bushfire Unit.

Outdoor operations

- Development of stormwater and rainwater utilisation across campuses, building upon the use of stormwater, recycled water and rainwater across campuses.
- Planning of landscaping strategies for shading and cooling, using appropriate native and introduced species for campus gardens and successional replanting.
- Ensuring biosecurity risk assessments and protocols are followed, particularly for the commercial Hawkesbury Farm grazing operation.

Public spaces

- Cooling elements with planting and light-coloured materials, reflecting principles of the Landscape Masterplans, and Hawkesbury campus Landscape Plan
- Pilot and planned rollout of carpark solar structures to reduce heat and support amenity and safety through design.

Box 2. Design and operational adaptation strategies (PCA 2017)

As outlined in the PRA (2019), several design and operational strategies have been identified by the NSW Property Council (PCA 2017) to address:

- Increased HVAC demand, maintenance and cost
- Thermal comfort and heat stress
- Bushfire and extreme storms.

Adaptation strategies for increased HVAC demand, maintenance, and cost

- Reducing dependence on HVAC through passive design, e.g. natural ventilation, performance glazing, façade and roof insulation, and shade structures on north and west facades.
- Design and operation of high efficiency HVAC and controls / monitoring; sizing and sensitivity to temperature scenarios.
- Data analytics for performance feedback, and on-site renewables to off-set energy costs.

Adaptation strategies for thermal comfort and heat stress

- Design sizing of HVAC and operation, and permanent shading on north & west facades.
- Operation including improved 'thermal envelope' (e.g. insulation, glazing, shading, cool roof technologies).
- Understand the impact or impairment of assets that may fail when triggered by extreme heat and review the reliance on third party infrastructure. (PCA 2017)
- Design and operation of areas that would be used as indoor / shade refuges through shading and increased reflectance, and having extreme heat / weather plans.

Adaptation strategies to bushfire and extreme storms

- Design and operate appropriate air quality monitoring and filtration within buildings, along with bushfire risk management as part of emergency procedures.
- Design of critical plant location in relation to extreme storms, along with appropriate landscape selection to reduce debris, potential injury and damage.
- Ensure operations incorporate roof signage and fixtures that can withstand high wind intensity, with plant securely protected or relocated.
- Consider guards on HVAC condensers to protect from hail damage, and hail resistant materials for roofing and glazing.

3. OPERATIONAL RESPONSES

Operational responses include management behaviours informed by the strategies and planning identified above. The safe occupation and operation of campus and amenity is paramount to overall business continuity, and thus, minimising the impact of climate change risks stands as the overarching goal. Balancing relevant mitigation, adaptation and response capabilities is therefore central to achieving this objective. The following section outlines some of the integrated operational responses underway.

3.1 Sustainable Energy Strategy

As one of the key themes of the Environmental Sustainability Action Plan (ESAP), the recently developed Sustainable Energy Strategy provides a rational scenario for progress towards targets of 100% renewable energy sources by 2025, and carbon neutrality by 2030 aligned with the Climate Active framework. These targets are informed by 9 thematic areas of action planning, used to model potential progress towards the targets, and as robust guidelines for developing these action plans in more detail. These action plans include:

- Energy efficiency
- Buying clean energy (e.g. 100% renewable GreenPower™)
- Behind-the-meter solar (e.g. onsite solar)
- Waste management
- Supply chain management
- Grid decarbonisation
- Sustainable transport
- Carbon neutral strategy (i.e. offsetting for residual emissions).

3.2 Solar carparks

Urban carparks of exposed black asphalt are recognised as one the key urban landscape elements contributing to urban heat, while also being one of the 'low hanging fruit' for remediating this issue (Pfautsch pers. comm.). A pilot application of a modular solar carpark structure on Kingswood campus reflects a similar strategy being applied across a number of universities, and commercial precincts such as the Sydney Markets. Based on a lightweight steel structure with a roof of solar panels, these provide multiple benefits, including:

- Generation of renewable energy at times of peak cooling demand
- Shading and cooling of the carpark surface reducing urban heat
- Safety through design, including sun protection, and protection from storm damage
- Amenity for carpark users, and suitability for accessible parking
- Option to integrate other services, such as EV charging stations.

3.3 Water recycling and reuse

Water recycling and reuse on Hawkesbury campus continues to be a critical strategy for buffering variable rainfall intensity and distribution. Supply of recycled water supply from Sydney Water and stormwater harvesting are valuable water resources, with uses including:

- Farm pasture production supported by irrigation of recycled water
- Campus landscape amenity through irrigation of stormwater
- Playing fields maintained through irrigation with recycled water management
- Protection of EucFACE research with drenching system of potable and recycled water.

All such uses contribute to landscape maintenance and cooling at times of high urban heat, minimum rainfall, and high bushfire risk.

3.4 Cooling landscapes and vegetation

Cooling of campus landscapes is actively pursued through maintaining remnant bushland, public green space, and productive agricultural land and water storages. Remnant Cumberland Plain and riparian vegetation on Hawkesbury, Kingswood, Parramatta, and Campbelltown is maintained through protection from clearing, weed management and bush regeneration, and hazard reduction burning which promotes ecological health. The presence of tree cover, gardens and green space within our public outdoor spaces offer significant cooling and shading benefits, while also reflecting therapeutic benefit and physical protection from the harshness of the elements. Further, architectural techniques, such as green roof and green wall technologies, are becoming more normative applications within inhabitable builds and support opportunities for passive cooling.

The collaborative Living Lab research project '*What Plant Where* ?' between Western and Macquarie is assessing relevant species mixes for urban landscape planting. On Hawkesbury campus, there are also regenerative agricultural practices and recycled water storages and treatment wetlands which contribute to local cooling.

3.5 Hawkesbury Bushfire Unit

Developed around research protection associated with bushfire risk to the EucFACE site, a small Hawkesbury Bushfire Unit comprises staff from Technical Services associated with the facility, the Office of Estate and Commercial, and Campus Safety and Security. A Bushfire Unit Management Plan is currently being updated, reflecting the training, equipment and escalation of preparedness following general bushfire risk rating (Preparedness and Planning), hazard reduction and live fire actions based around SOPs and collaboration with NSW Rural Fire Services (Responses). A fundamental issue to the BFU is the dwindling number of participants due to loss of personnel through organisational change processes, necessitating a membership drive which had been put on hold due to COVID-19.

Fortunately, all actions to date have been successful, and the fundamental recovery from bushfires through hazard reduction initiatives and live fire responses has been in relation to the generally positive ecological benefits of fire in the landscape.

3.6 Regional collaboration

The potential impacts on public health and amenity from extremes of heat, direct bushfire impacts and air quality, and damage from storm and flooding incidents are clearly apparent. Across Western Sydney, Councils and government agencies are focusing more on managing climate risks, and this provides a strong opportunity for increasing collaborative initiatives. A prime example is that of the Department of Health's Climate Resilient Healthcare Working Group associated with the Nepean Blue Mountains Local Health District.

Participation with the working group has developed, including discussions regarding potential Western student placements and research collaboration, particularly in relation to the Penrith Sustainable Innovation Community associated with the Werrington campus redevelopment. Another key example is Penrith City Council's Resilient Penrith Action Plan, 2021-2030. Building upon the Resilient Cities methodology and the UN Sustainable Development Goals, the plan provides a vulnerability assessment and action plan, with identified areas including: "Building resilience through accessible services and spaces; Cooling the city; Community awareness and preparedness; and Collaboration." (PCC 2021).

3.7 Resilience Roadshows

Building upon the focus on campus-based Living Labs as an engagement strategy, a series of Resilience Roadshows were undertaken in 2019 on Kingswood and Hawkesbury campuses. Introductions to the Roadshows focused generally on the recommendations of the PRA, with the content of each Roadshow focusing on local academic champions developing the range of Living Lab initiatives on each campus, and student representation.

4. RECOVERY, LESSONS LEARNED AND IMPROVEMENT

Since the development of the Preliminary Resilience Assessment (PRA) in 2018, we have continued to experience the devastating effects and risks associated with climate change, notably the increased intensity of bushfires, urban temperatures in Western Sydney, periods of drought and subsequent flooding. We have also experienced the compounding impacts of the COVID-19 pandemic presenting significant challenges to organisational resilience. This has driven changes in our behaviours and expectations of what the 'new normal' may be, with emerging pandemic responses also a critical part of our current resilience planning.

In response to these recent issues, a number of key publications have become public that address broad issues of integration and coordination for climate and disaster resilience (e.g. CSIRO 2020), and associated global challenges to the higher education sector (e.g. HEPI 2020).

4.1 Australian responses to climate and disaster resilience

Throughout 2019-20, Australia experienced cascading effects from the impacts of major bushfires, floods, and droughts. In response to this, CSIRO was commissioned to recommend ways in which Australia could increase its climate and disaster resilience, with the results published in a report entitled 'Climate and Disaster Resilience' (CSIRO 2020). The study drew upon a United Nations definition of resilience as "*...the ability of a system, community or society exposed to hazards to resist, absorb, accommodate 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 functions*." (CSIRO 2020, p.2).

Considering resilience as a lifecycle was deemed a pragmatic approach "the lifecycle of managing climate and disaster resilience can be characterised as (i) planning and preparation, (ii) response, (iii) recovery and (iv) learning and improvement to build further resilience. Through improvement and resilience building, future events may be prevented from becoming disasters." (CSIRO, 2020, p.2).

Continual improvement as experience grows and threats evolve is essential. Such improvement includes building into the planning and investment of critical infrastructure and capability, the ability to review risks and plan for various scenarios, and perform post event assessments.

Key recommendations (Box 3) reflected the following main themes:

- A harmonised and collaborative national approach reflecting global best practice
- Systems thinking to address complexity; risk management and stakeholder learning
- Data enabled common frameworks for resilience planning and operational management
- Essential role of community in building resilience and engagement
- Investment in targeted research, science and technology
- Embedding resilience in 'building back' all future planning, agricultural and urban land use, and investment. (CSIRO 2020).

Box 3. Recommendations for Climate and Disaster Resilience (CSIRO 2020)

Planning and preparation

- National approach required
- Continued learning from global best practice
- A systems approach is critical to dealing with complexity
- Data as a key enabler
- Community plays an essential role in all phases of resilience building
- Scope to further empower indigenous fire knowledge and land management practices
- Bushfire hazard reduction is complex
- Continue to embrace and invest in science and technology

Response

- Reliable communications are critical to good situational awareness
- Greater interoperability should be a guiding principle for more effective use of resources

Recovery

- Contextual to nature event and needs of community
- Resourcing of emergency management delivery on the ground (e.g. volunteers)
- Recovery planning to empower communities and engage all levels of organisation
- Longitudinal studies of health and welfare to guide mental and physical support
- Information resources to address ecological and cultural values

Building further resilience

- Learning from each event and regular review of risks drives continual improvement
- Resilience needs to be embedded in key investment decisions

4.2 Global higher education and climate change

Increasingly, threats from climate change – be they scientific, technical and/or ecological in nature – are seen as a challenge for higher education institutions when addressing social and economic inequalities and contributing to the production of knowledge (e.g. Facer 2020).

This recent paper - focusing on the UK higher education sector - recommended the need for the redesign of day-to-day operations, reinvigorating civic role, reshaping knowledge structures, and refocusing the educational mission (Box 4).

Box 4. Climate change and responses for UK higher education (Facer 2020)

Redesigning operations to reduce emissions, nurture biodiversity and adapt to the impacts of climate change.

- Reconfigure their day-to-day operations to achieve urgent, substantial and monitored climate action mitigation and biodiversity enhancement action in accordance with the Paris climate commitments and the Aichi biodiversity targets
- Develop a clear operational plan for implementing climate change adaptation measures developed in partnership with local communities

Reinvigorating the civic role of institutions to build ecologically and socially resilient communities.

- Develop an endowment, investment and procurement plan oriented towards ecological and economic sustainability
- Develop a civic engagement strategy that identifies how to build stronger partnerships to create sustainable futures
- Explore how they can rebalance their educational offerings to support older adults transitioning away from high-carbon forms of work.

Reshaping the knowledge structures of the university to address the interdisciplinary complexity of climate change.

- Examine the institutional barriers – historic, organisational, cultural – to building dialogue across disciplines and with knowledge traditions outside the university and establish the institutional structures and practices needed to address these barriers.

Refocusing the educational mission of the institution to support students to develop the emotional, intellectual and practical capabilities to live well with each other and the planet in the era of climate change.

- Initiate an institution-wide process to bring together staff and students to develop programmes that are adequate to support our peers and our planet.

4.3 Reflections on COVID-19 and the 'new normal'

The COVID-19 pandemic has had major consequences for our communities, organisations, and the tertiary sector at micro, meso and macro scales. Across the tertiary sector, increased risk to public health has driven the need for business operations to adapt to such significant changes to our individual and collective behaviours. This has raised critical questions regarding the fundamentals of business operations, fast-tracking the online mode of teaching and learning, and flexible work arrangements for academic and professional staff. These changes are likely to have ongoing ramifications as part of our 'new normal' going forward.

In terms of general operating models, two key sector issues became apparent. Firstly, financial reliance on a large proportion of income from overseas students, particularly from a singular source country; and secondly, the unwillingness of federal government to provide support similar to other industries (e.g. Job Keeper Program). Key outcomes for Western include the:

- Importance of financial models such as the Western Growth strategy and associated corpus for financial resilience.
- Continued need for streamlining and cost-efficiencies to work through the immediate post COVID-19 years.

While distance and online learning has been used to some degree across all universities, the need for the transition of teaching to largely online resources has been a significant challenge. In both secondary and tertiary settings, it has also reinforced a divide between students with skills and resources for online learning, and those for which this is not so accessible.

An outcome for Western has been:

- Rapid development of online platforms (e.g. Blackboard) and related online content such as filming, which provide a wealth of digital resources not previously available.

For both academic and professional staff, the rapid changes to largely working from home (WFH) include the utilisation of online tools such as Zoom and remote access to operational systems. Flexible work arrangements required to balance work and personal engagements from a single location can elicit both successes and hurdles for a staff base with diverse duties and obligations. Though flexible WFH arrangements are certain to be part of the ongoing 'new normal'.

Key implications emerging include:

- Sourcing more for staff to access online and acknowledging the importance of local bandwidth limitations, including for teaching, research, and essential operational systems.
- Space management and utilisation implications of reduced density of traditional open plan workspace, and requisite building services efficiencies, e.g. HVAC.
- Service delivery models across all areas of the extended University network of campuses and staff and students WFH.

4.4 Recommendations for improvement

Further steps will be made to develop the planning and operational strategies outlined in this report. The adapted structure drawn from the CSIRO's report to address the lifecycle of preparedness and planning, operational response, recovery, lessons learned and improvement are robust and pragmatic model of characterisation and critical construction. More critical national and international perspective will no doubt continue to emerge.

A key recommendation emerging is that resilience planning for climate change for Western be incorporated in a broader Framework for Business Continuity and Resilience, integrating:

- Resilience planning for climate change risks (urban heat, bushfire risk, storm intensity)
- Failures of critical infrastructure, including but not limited to supply of power and water, communications, research protection, and critical business functions.
- Future responses to public health and biosecurity risks, and changes in work practices and systems emerging as part of the 'new normal' following COVID-19.

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