NACC

In the Wake of the Storm

Emergency Planning For Natural Asset Recovery & Resilience

A guideline for local shires of the Northern Agricultural Region

Australian Government
Department of Industry, Science, Energy and Resources

NACC

SHIRE OF MINGENEW

MORAWA
BREAKING NEW GROUND

Shire of Perenjori
Embrace Opportunity

Catalysing Community Conservation

Acknowledgement of Country

NACC NRM respectfully acknowledges the Yamatji and Noongar people who are the Traditional Owners and original natural resource managers of the Northern Agricultural Region. We pay our respect to all of the Aboriginal Elders and leaders in the region, past, present and emerging.

In the Wake of the Storm Guidelines - Australian Government's Preparing Australian Communities Grant.

These Guidelines seek to improve preparedness for, response to, and recovery from emergency events as they relate to natural-capital assets. This will be achieved through improved integration of assets in planning, response and recovery.

The implementation of these Guidelines are intended to enhance the resilience of built and natural-capital assets by recognising the risks posed by natural disasters and undertaking planning to improve outcomes through actions and management before, during (to the extent possible) and post-event to support recovery. NACC NRM (Northern Agricultural Catchments Council Incorporated)

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Figure 1: Seroja caused major damage to vegetation throughout the Northern Agricultural Region. Image courtesy of Diana van Buerle

About These Guidelines

These guidelines have been created to provide framework for assisting Local Government Authorities (LGAs) in preparing their emergency management assessments and establishing associated emergency committees. Identifying, protecting, and restoring the natural assets and green infrastructure within a community is essential and this guide aims to provide resilience in the face of a changing climate. NACC NRM has compiled this guide in partnership with the LGAs of Mingenew, Morawa, and Perenjori to align with the needs and aspirations of each community.

In April of 2021, Severe Tropical Cyclone Seroja (hereafter known as Seroja) identified the need for natural asset protection and resilient planting methods. Across the region, the resulting widespread damage affected both remnant native vegetation and urban amenity plantings. Additionally, vegetation debris had caused secondary damage to property and infrastructure, which prompted the need for refined assessment of tree placement and species selection to inform all future revegetation efforts.

Following any severe weather event, the primary objective is to ensure the safety of the community, followed by commencing works to restore essential services, and finally to initiate clean-up efforts. Historically, throughout times of crisis and recovery, the condition and ongoing resilience of the natural environment are overlooked. However, thorough documentation has recognised an intricate relationship in which the natural environment is in many ways essential to underpinning the built, social and economic environments. Emergency and recovery plans that have from inception prioritised natural assets and green infrastructure are invaluable to LGAs and the broader community of land managers.

Note: These guidelines should be used in conjunction with established LGA objectives and in line with local policy and law. For an outline of current policies, relevant resources, and regulations around Western Australia's emergency recovery procedures, see Appendix 2.

How To Use These Guidelines

These guidelines can be utilised in the planning and recovery phases of your community's Local Emergency Management Arrangement to adopt best practice management techniques.

Section 1.0 Emergency Management Planning and your Community details baseline information for establishing emergency tools, including the prevention, preparedness, response and repair model, the four key environments to consider when planning, and recovery principles.

Section 2.0 Climate Change and your Community outlines the broader climate projections for the Northern Agricultural Region (NAR) and provides guidance around how to research specific implications for your emergency management plan in a changing climate.

Section 3.0 Roles and Responsibilities for Emergency Management identifies the legal and social requirements of LGAs when planning for emergency scenarios and highlights the need to include both the intrinsic and extrinsic values of natural assets and green infrastructure in a community.

Section 4.0 Natural Environment Recovery – Phase One summaries activities recommended to be undertaken by LGAs as part of the initial response and short-term recovery plans post extreme event.

Section 5.0 Natural Environmental Recovery – Phase Two reviews activities recommended to be undertaken by LGAs as part of the secondary phase of recovery response.

Terms and Definitions

Adaptation: The process of adapting to forecast or actual changes in the climate.

Built environment: Physical infrastructure assets (transport, energy, telecommunications, and water utilities, housing, commercial precinct and other built assets).

Build back better: A set of principles that support the recovery, rehabilitation and reconstruction phases after a disaster or extreme event, aimed at increasing the resilience of communities by integrating disaster risk reduction measures into the restoration of social, built, economic and natural environments.

Climate risk: The potential for climate change to impact both physical and social, built, economic and natural environments.

Community: A social group with a commonality of association and/or location, shared experiences, or function and with a number of things in common including, culture, heritage, language, ethnicity, occupation or workplace.

Disaster: A serious disruption of the functioning of a community or society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity that may lead to the loss of or impacts to social, natural, built or economic environments.

Green infrastructure: Green Infrastructure is a planned network of natural (or semi-natural) areas, designed and managed to deliver a wide range of benefits to communities (parks, street trees, water catchment areas).

Impact: The adverse or beneficial consequence or outcome of a recognised ‘risk’ on natural and human systems generally. Impacts refer broadly to effects on lives, livelihoods, economic or infrastructure.

Natural Environment: The natural environment refers to natural assets such as wetlands, rivers, forests, oceans, complex natural ecosystems, and agriculture and water sources. For the purpose of this manual, ‘natural environment’ includes all vegetation in residential urban areas as well as rural non-residential.

Natural Hazard: A process of natural causes or phenomenon that may cause loss of life, injury (general health impacts), infrastructure damage, social and economic disruption or environmental degradation.

Preparedness: Measures to ensure that communities, resources and services are capable of coping with the effects of an emergency, should one occur; the state of being prepared.

Prevention: Measures to eliminate or reduce the incidence or severity of emergencies.

Recovery: The coordinated process of supporting emergency-affected communities in the multifaceted reconstruction of the physical infrastructure and restoration of emotional, social, economic and physical well-being. Recovery is a complex process, which requires a proactive approach and extensive pre-event planning and consideration.

Resilience: The capacity of a system, community or society that has been impacted by a particular hazard to adapt and recover from the outcomes of the hazard in an efficient and timely manner.

Risk: The likelihood of harmful consequences to arise from the interaction of hazards, communities and the environment; the chance of something happening that will have an impact upon objectives. Risk is measured in terms of consequences and likelihood; a measure of harm, taking into account the consequences and likelihood of an event.

Figure 2: Damage to a property in the Shire of Perenjori, caused by Seroja. Image courtesy of Kirk and Silvia Pohl

1.0 Introduction

Western Australian communities are likely to be impacted by a changing climate and left vulnerable to an increase in weather event intensity and frequency. As Local Government Authorities (LGAs) are at the forefront of preparing for and responding to the changing climate, reviewal of existing emergency arrangements is vital. Similarly, future recovery plans will need to be established with strategic environmental planning incorporated, to allow for increased resilience and preparedness in the face of climate uncertainty and extreme weather events.

Seroja crossed the Port Gregory coast on 11 April 2021 at around 8:15pm, and would go on to highlight the vulnerability of regional communities across the Northern Agricultural Region (NAR). The resulting damage was substantial, affecting both built infrastructure and vegetation in Kalbarri, Northampton, Port Gregory, Morawa, Mingenew, Perenjori, Carnamah, Geraldton and other inland towns. Grave impacts on power infrastructure led to an estimated 30,000 Western Power customers without power for 72 hours, and a further 2,300 waiting 16 days for power to be restored. Disruptions to other essential services including communication, transportation, and emergency response left regional residents stranded and unable to contact loved ones.

Following the initial clean up, rural communities have encountered further challenges in attempting to rebuild. Disruptions to supply chains have led to shortages in building supplies, protracted distribution times, limited or no accommodation available for contractors, and extended waiting periods for insurance claims. These factors have had cumulative effect on the recovery and welfare of communities.

Natural disasters and associated issues are estimated to cost the Western Australian economy $120 billion between 2020 and 2060 (Deloitte Access Economics 2021). These costs are driven by not only the rising frequency and complexity of natural disasters and hazards, but also Australia's growing population and reliance on centralised power systems.

Communities located within the NAR face additional costs and complexities in the isolated nature of their settlements, adding to the pressure on LGAs to effectively manage their response to and recovery from climate change and extreme weather events.

In order to combat the range of impacts forecasted to accompany a changing climate, Western Australian governments, businesses, and local communities must be proactive in establishing a comprehensive and strategic plan with the aim of building resilient and capable communities.

2.0 Emergency Management Planning and Your Community

As part of building resilient and prepared communities, LGAs are required to have a Local Emergency Management Arrangement (LEMA) in place. These plans enhance community readiness and centralise management strategies, plans, agreements, and other documents required during an emergency situation. See the links below to ensure you are up to date with Emergency Management Act requirements. Once you have generated your LGA LEMA and established the relevant subcommittees, these guidelines can assist in planning for future events and protecting your community's environmental assets.

- WA Government's Emergency Management Guidelines and Resources Webpage
  - Link: https://www.wa.gov.au/government/document-collections/emergency-management-guidelines
- LEMA Local Emergency Management Arrangements Guideline and Model
  - Link: https://www.wa.gov.au/system/files/2023-11/lema_guideline_and_model_0.pdf
- LEMA Local Recovery Guidelines
  - Link: https://www.wa.gov.au/system/files/2024-07/local_recovery_guideline_v3.03.pdf

Figure 3: Serious infrastructure damage to the Perenjori Hotel after Seroja. Image courtesy of Kirk and Silvia Pohl

2.1 Prevention, Preparedness, Response, Recovery Model (PPRR)

For improved community resilience, the Prevention, Preparedness, Response, Recovery (PPRR) Model as available for LGAs to utilise in conjunction with pre-existing plans and local knowledge to generate an adaptable and informed plan. The Australian Government, through its Preparing Australian Communities funding, is committed to supporting a more proactive approach to mitigating and planning for climate risk in regional communities.

Using the PPRR model, objectives and goals can be dissected into smaller, more manageable tasks. For the purpose of these guidelines, the recovery phase will focus specifically on the natural environment.

The four phases of emergency management can be used when planning for natural disasters (Australian Emergency Management Arrangement 2019).

Figure 4: The four phases of emergency management, based on the Australian National Disaster Response's dynamic process

The emergency management cycle should be viewed as a dynamic process that evolves with the changing needs of the community. There are often no specified time frames in which these phases occur, and many activities overlap.

2.2 The Four Community Environments

When planning for emergency management, four 'environments' need to be considered; natural, built, economic and social environments. These environments are intrinsically linked and therefore should not be considered in isolation. The impacts of Seroja have highlighted the potential knock on effects of each environment within a community. Extensive damage to vegetation and infrastructure resulted in costly and delayed repairing and rebuilding works, and took a significant toll on the vigour and vitality of the community. These guidelines provide information on developing Emergency Management Planning that prioritises building the resilience of communities within the NAR and recovery planning for the natural environment.

Figure 5: Ensuring national continuity in Emergency Management Planning - a community can be broken down into four main environments

2.3 The Natural Environment

The natural environment can be defined as the natural assets and green infrastructure that exist within a region. Examples of the natural environment include landscape features (waterways, ranges, arable agricultural land, etc.), vegetation features (remnant bushland, revegetation and amenity planting) and biodiversity values.

2.4 The Principles of Recovery

As outlined by the Australian Institute for Disaster Resilience, there are six principles of recovery aimed at assisting LGAs to plan for their recovery effort. These are:

1. Understand the context
2. Recognise the complexity
3. Use community-led approaches
4. Coordinate all activities
5. Communicate effectively
6. Recognise and build capacity

In order to be effective, these principles require adaptability, communication, and the participation and cooperation of various stakeholders.

Often, small communities must navigate significant limitations in their capacity to respond and recover. These limitations are a product of many contributing factors, including inadequate funding and people power, and a lack of pre-planning. These can in turn, have a negative effect on the recovery process and create issues like a rushed rebuild or missing and/or incomplete key actions. One of these key actions is analysing the community's vulnerabilities and applying findings to the rebuild process to inform a more resilient future.

Understand the context: Successful recovery is reliant on a sound understanding of the community's context. For example, the community's history, future priorities, demographics, economic capacity, built, social and natural environments.

Recognise the complexity: Successful recovery is subject to the complexity of both the emergency and the community.

Use community-led approaches: Successful recovery is a community centred, flexible, and responsive process, which engages members of the community and supports them to move forward.

Coordinate all activities: Successful recovery requires a planned, coordinated and adaptive approach between community and partner agencies, and must be informed by continuing assessments of impacts and needs.

Communicate effectively: Successful recovery is dependent on effective communication between the affected community, partners and stakeholders.

Recognise and build capacity: Successful recovery recognises, supports and builds on individual, community and organizational capacity and resilience.

Post disaster recovery is a complex and multi-faceted process. The United Nations, 2017 describes this process as 'the restoration or improvement of livelihoods and health, as well as economic, physical, social, cultural and environmental assets, systems and activities of a disaster affected community or society, aligning with the principles of sustainable development and 'build back better', to avoid or reduce future disaster risk."

These principles help to frame the recovery effort and can be incorporated into LGA LEMA to plan and construct effective recovery strategies. One overarching plan may be created with subsections for each recovery environment (natural, built, economic or social) and then adapted in the context of the situation as required.

3.0 Climate Change Resilience Planning

Climate change is set to challenge all aspects of our regional communities; economic prosperity, built and natural amenities, environmental health, ecosystem services, and overall community wellbeing. Already, communities around the region are experiencing weather and climate extremes and events, emphasising the need to ensure and enhance their resilience and adaptability. Broad stakeholder engagement and ongoing support will be crucial to an effective planning process.

A strong foundation for emergency and resilience planning lies in a comprehensive understanding of climate change trends for your region and any predicted associated impacts. LGAs and other regional planning organisations can then generate risk management plans that utilise science-based climate predictions unique to their region, and hence, are in alignment with their community needs.

Scientific initiatives such as the 'Australian State of the Environment 2021' (Department of Agriculture, Water, and the Environment) and 'Climate Change in Australia – Projections for Australia's NRM Regions' provide ongoing research that assist in refining and expanding our knowledge of a changing climate and related impacts on regional communities. Climate change is considered inevitable by the International Panel on Climate Change, reinforcing the necessity for emergency planning to be prioritised within communities.

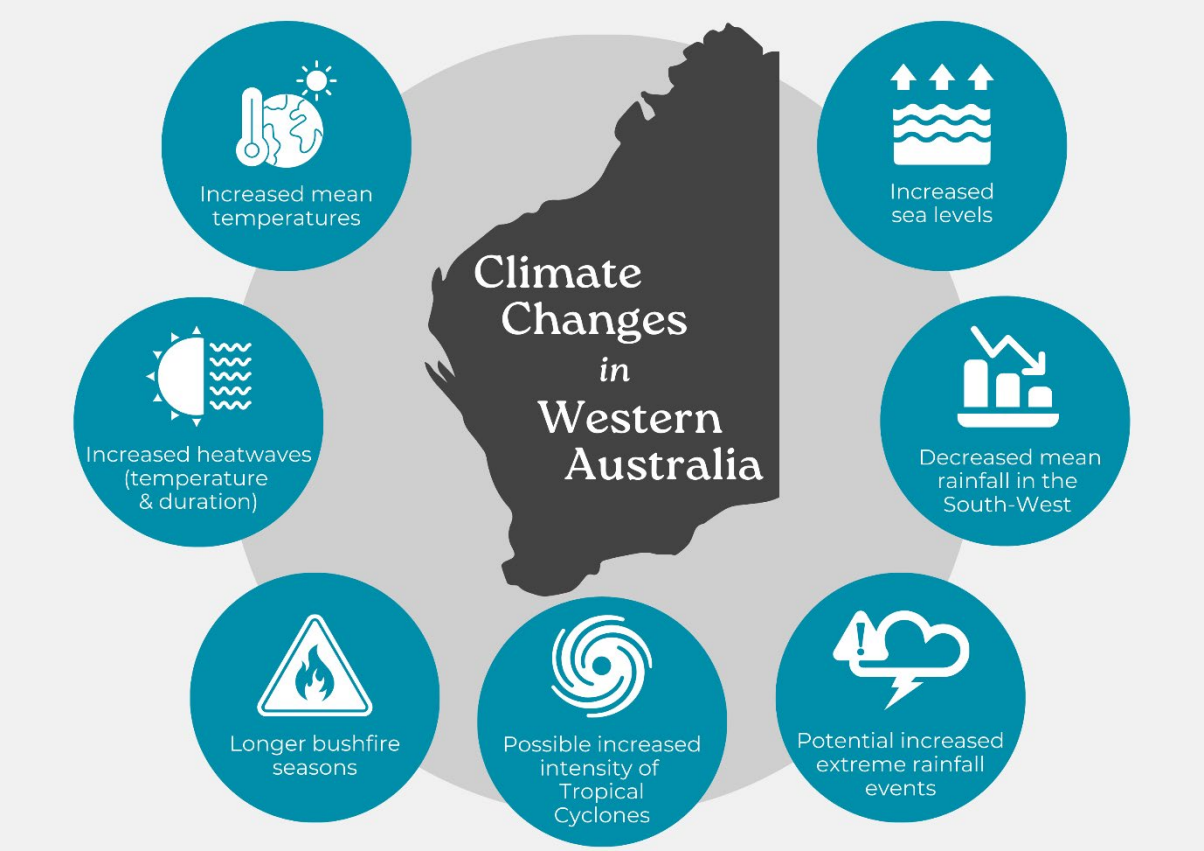

Figure 6: Anticipated direct and indirect impacts of climate changes on Western Australia's natural and built environments. Graphic adapted from the 'Climate Resilient WA – Directions for the State's Climate Adaptation Strategy' Government of Western Australia Department of Water and Environmental Regulation, December 2022

3.1 Climate Resources

When seeking out helpful resources, a recommended starting point is the Commonwealth Scientific and Industrial Research Organisation (CSIRO) website, Climate Change in Australia. This interactive site offers climate information, projections, tools and data, and allows users to tailor their search to specific areas, climates and clusters around the country.

Additionally, the Western Australian Climate Policy, created in 2020, outlines the government's plan to work with all sectors of the Western Australian economy for a prosperous and resilient low-carbon future

- Climate Change in Australia
    - Link: https://www.climatechangeinaustralia.gov.au/en/projections-tools/
- Western Australian Climate Policy
    - Link: Western_Australian_Climate_Policy.pdf (www.wa.gov.au)

4.0 Roles and Responsibilities (Emergency Management)

Clear roles and responsibilities are crucial in emergency management. Similarly, successful recovery following an emergency event requires collaboration across a range of stakeholders, namely individuals, government agencies and non-government organisations.

Within a community, each sector is able to contribute to emergency management, based on their capacity, resources, and level of authority to provide a broad knowledge base. During an emergency, LGAs are on the frontline to ensure the safety and resilience of their communities, and as such, are required under the Emergency Management Act 2005 to design a LEMA. In partnership with a panel of qualified community members, the local emergency management committee provide LGAs with guidance and conduct assessments of the emergency procedures for optimal results.

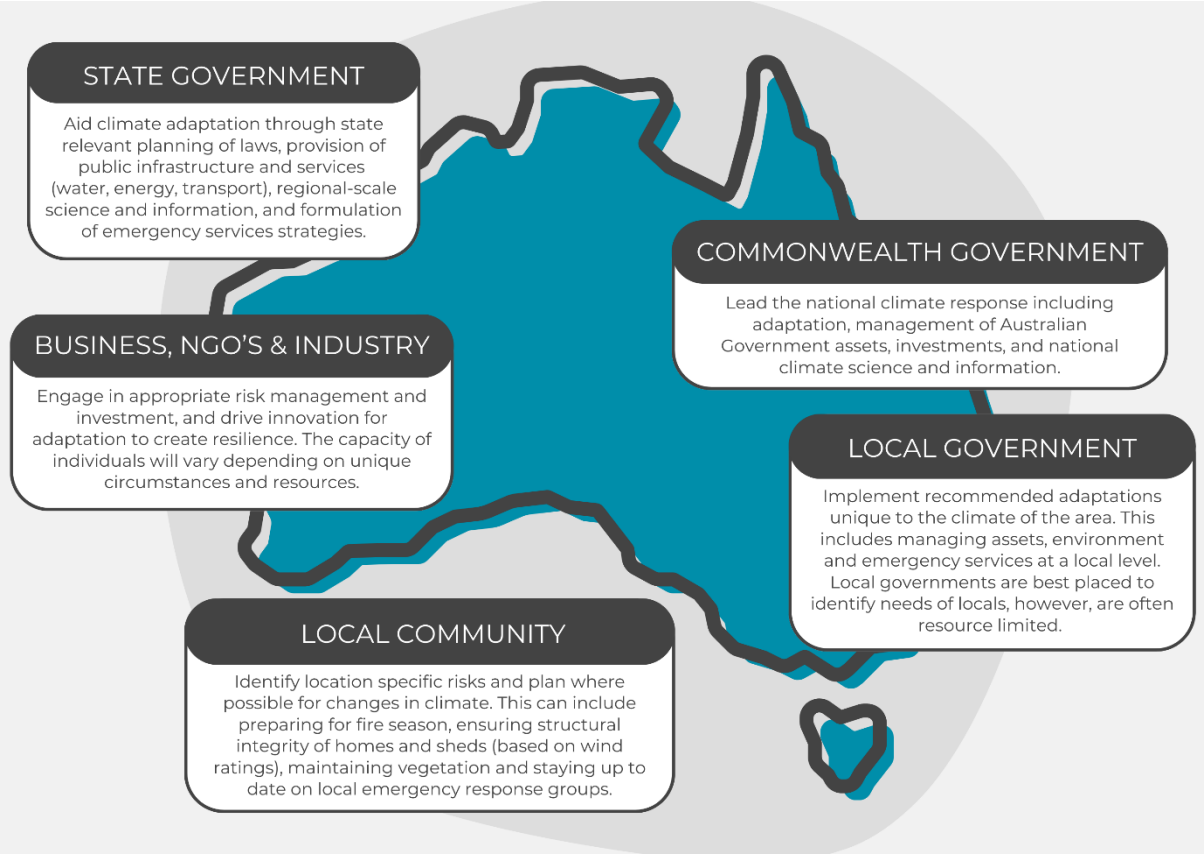

Figure 7: The roles of community and state during recovery. Graphic adapted from the 'Climate Resilient WA – Directions for the State's Climate Adaptation Strategy' Government of Western Australia Department of Water and Environmental Regulation, December 2022

In order for a community to effectively adapt and efficiently respond to an emergency event, targeted preparation and planning is required to identify risks and mitigation actions specific to the needs of the LGA.

Local governments are typically equipped with useful information around the history, local priorities, population statistics, and unique requirements of their community and local natural and built environments.

Therefore, they have a responsibility to ensure the following:

- Continuously build and promote resilience
- Undertake cost effective measures to mitigate effects of hazards on communities, including conducting emergency risk assessments (for the natural environment this would include environmental surveys)
- Systematically account for risk assessment and land use planning to reduce hazards
- Ensure local emergency planning, preparation and measures are up to date
- Ensure adequate local emergency response capacity, including volunteer resources
- Undertake public education, promoting awareness of hazards in the community
- Continue to supply services to the municipalities (waste collection, pollution control, water provision)
- Undertake appropriate post emergency analysis and debrief, documenting lessons learnt

4.1 Local Government Environmental Emergency Planning

Identifying roles and responsibilities of key stakeholders and partners prior to an emergency event will significantly improve the efficiency and responsiveness of a community. These guidelines recommend recording all relevant partners and stakeholders, noting associated abilities or skills they are able to offer based on their function within the community (see Appendix 3 for recommended partners).

Although it is impossible to predict exactly how an event may affect the community, an understanding of the ‘most likely’ consequences can inform a local task force and framework to perform the most necessary functions and identify any emergencies likely to occur.

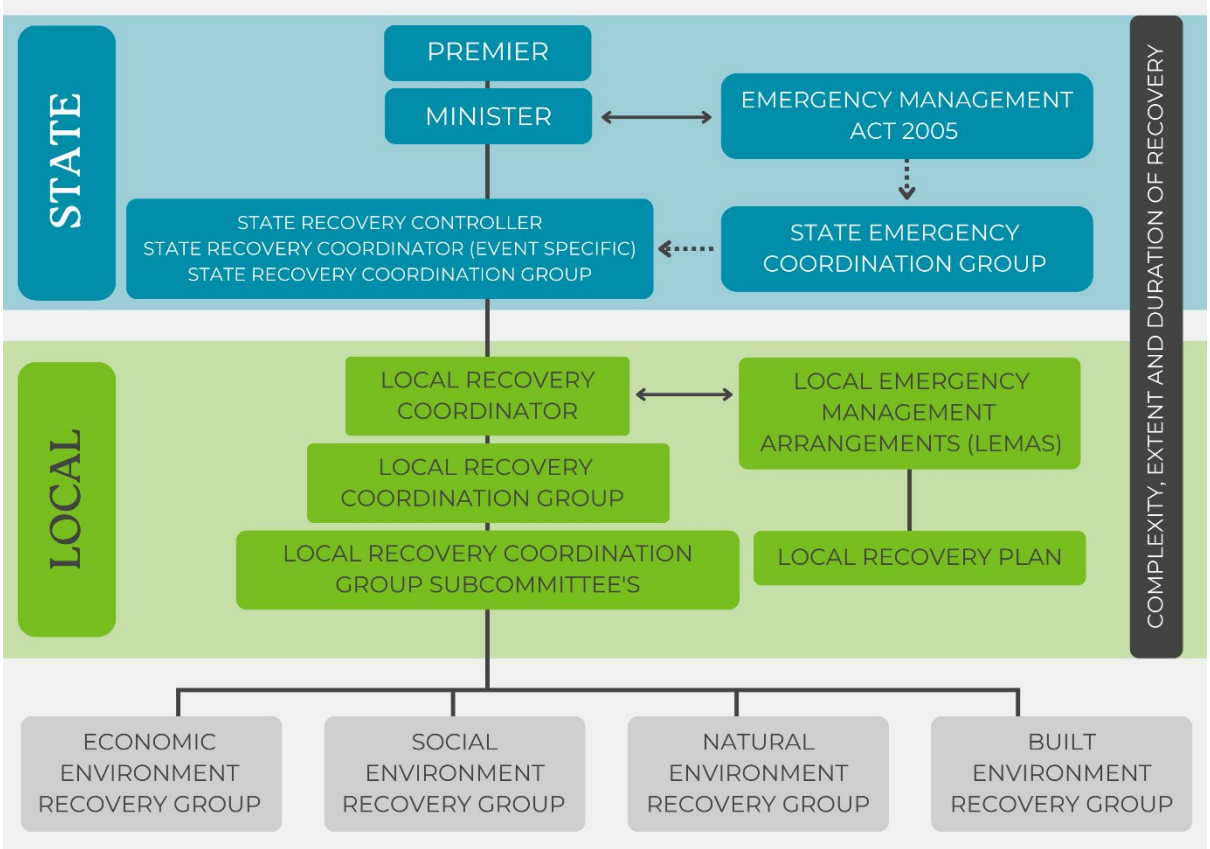

Figure 8: Local and state government involvement varies depending on the severity of the emergency event

This basic outline will ensure communities can quickly establish connections between regions and industry sectors as required. In smaller communities, limited resources may mean that a back-up plan allowing external aid is required to boost the community's capacity.

Utilising the identified partners, establishing sub-committees dedicated to each of the four environments – natural, built, economic and social – will ensure that the stakeholders, specialists, and community groups are employed in their relevant field and able to provide expertise and knowledge. In order to carry out an unbiased and in-depth assessment to guide future actions, it is important to assemble a team consisting of ranging disciplines and experiences, representing a robust cross section of the community.

All parties and their senior management must commit to employing a shared framework, obtained through transparent communication and agreement of a common issue or objective. In this instance, the common objective is prioritising the recovery of the natural environment, alongside and in conjunction to other recovering environments. There are many mutual benefits to engaging a collaborative partnership; shared resources (staff and finances), enhanced capacity to attract external funding, and an established network of multi-disciplinary skills and experience.

When designing the emergency recovery plan, it is important to lay out the committee's objectives or goals in a clear statement, employing a simple format. Alongside ach objective will be corresponding actions required, responsibilities of all partied involved in actions, and a measurable outcome.

5.0 Natural Environment Recovery – Phase One (Short Term)

Phase one of recovery, also known as short-term recovery, is the initial response period typically focusing on the restoration of facilities, the re-opening of businesses and the mitigation of further hazards. It is during this phase that environmental assets and integrity are often overlooked, and sometimes, continue to be overlooked until much further in the recovery process when it becomes unavoidable.

In order to prioritise the natural environment in phase one recovery actions, ensure that a proactive approach is adopted that clearly identifies and values key natural assets. Employing an organised and systematic emergency recovery plan can set the tone of the initial week following a disaster and positively shape the community's ongoing journey to recovery.

Prioritising natural assets through carrying out mapping and risk assessments can assist in taking an efficient and effective approach to this initial period. As a result, emergency coordinators can readily draw upon established plans to act quickly in prioritising resources and protecting key assets. Some examples of natural assets that may be of priority include:

- Biodiversity richness or endemism (flora and fauna)
- Priority or threatened species/ ecosystems
- Green Infrastructure
- Sites of cultural or historical significance

Key threats to consider during phase one include environmental contamination, pollution, and accidental discharge of hazardous material. These areas of risk should be clearly identified within the emergency management planning and overlayed with key natural assets to identify threats. Risk assessment will provide an opportunity to identify any mitigation efforts or key actions to protect natural assets.

5.1 Phase One Emergency Recovery Planning and Response

Phase one will consist of activities that focus on safety, basic needs and the restoration of essential services. It is during this period that the LGA should aim to mobilise their subcommittees, who operate under the direction of priorities and actions relevant to their specific effort. Calling on the subcommittees to act delegates responsibilities in a clear, structured manner and ensures the thorough assessment of all areas of the community. As a result, recovery activities are able promptly commence, allowing for a more efficient recovery.

Once activated, the natural environment subcommittee will require a set of quantifiable objectives that can be easily adapted to accommodate the varying requirements following emergency events (flood, fire, and cyclone). Broad relief and recovery efforts may include:

- Coordinate rapid environmental assessment of affected municipality
- Coordinate response to natural environment hazards
- Coordinate preservation of community assets (parks, street trees, waterways)
- Ensure disaster risk reduction is considered in planning, rebuilding and reconstruction
- Ensure community consultation and involvement in decision making processes
- Coordinate rehabilitation of the natural environment in municipality

Key stakeholders that are able to offer skill sets in natural environment response and recovery subcommittees include:

- Combat Groups - Parks and Wildlife (Department of Biodiversity, Conservation and Attractions)
- Industry Bodies - Department of Planning, Land and Heritage, WALGA representative
- NGO's - Environmental groups, Natural Resource Management Councils, Grower Groups
- Community Volunteer Groups (local environmental groups)

5. 2 Environmental Tools to Consider during Phase One

Historically, standard emergency plans have largely focused on the recovery of built, economic and social environments, with minor reference to the recovery of the natural environment.

Increasing awareness of the important role ecosystems play in human health and wellbeing has led to a growing emphasis on disaster management activities that support the identification and mitigation of potential damage after extreme events. To successfully protect and restore the natural environment following an emergency event, it is vital to identify tools that support environmental assessment and direct the recovery actions.

5.2.1 Rapid Environmental Assessment

Rapid Environmental Assessment (REA) is a tool designed to provide a simple methodology for identifying, defining, and prioritising potential environmental risks following an extreme weather event. Incorporating REA into the early stages of recovery allows a triage-based response. It is important to note this activity is a swift, visual assessment often carried out by LGA employees.

The premise of an REA is based on conducting simple analysis of the following areas of information;

The general context of the disaster: A summary of the event or disaster that has occurred, detailing the overall impact, response requirements, pre-existing environmental pressures, and potential factors that may influence the LGA's capacity for an environmentally aware response.

Disaster related factors influencing the natural environment impact: Factors that have the potential to either positively or negatively influence the severity of impact to the natural environment. These factors are related to spatial, social, and economic conditions like population density, extent and severity of event, level of displacement and resources available.

Possible immediate environmental impacts of disaster agents: Hazards resulting from an event can lead to direct or indirect impacts on the natural environment, which may require immediate intervention to eliminate threat to human life and/or serious damage to the natural environment. An REA functions to identify these hazards and rate them according to the degree of threat.

Potential negative environmental consequences of relief operations: The initial relief activities after a severe event focus on preservation of life, and stabilising community wellbeing and living conditions. The need for urgent response will often overlook any secondary negative impacts occurring during or caused by these activities. By conducting a rapid identification of potential consequences in the context of the event, activities can be modified to mitigate further damage to the natural environment.

For ease of use, the REA can be broken into four main steps; organisation level assessment, community level assessment, consolidation and analysis, and subsequent action and mitigation. Each of these four steps consist of recommended key objectives to be completed, however, to ensure efficiency in a time sensitive situation, it is advised that objectives are customised and in line with LGA protocols and procedures.

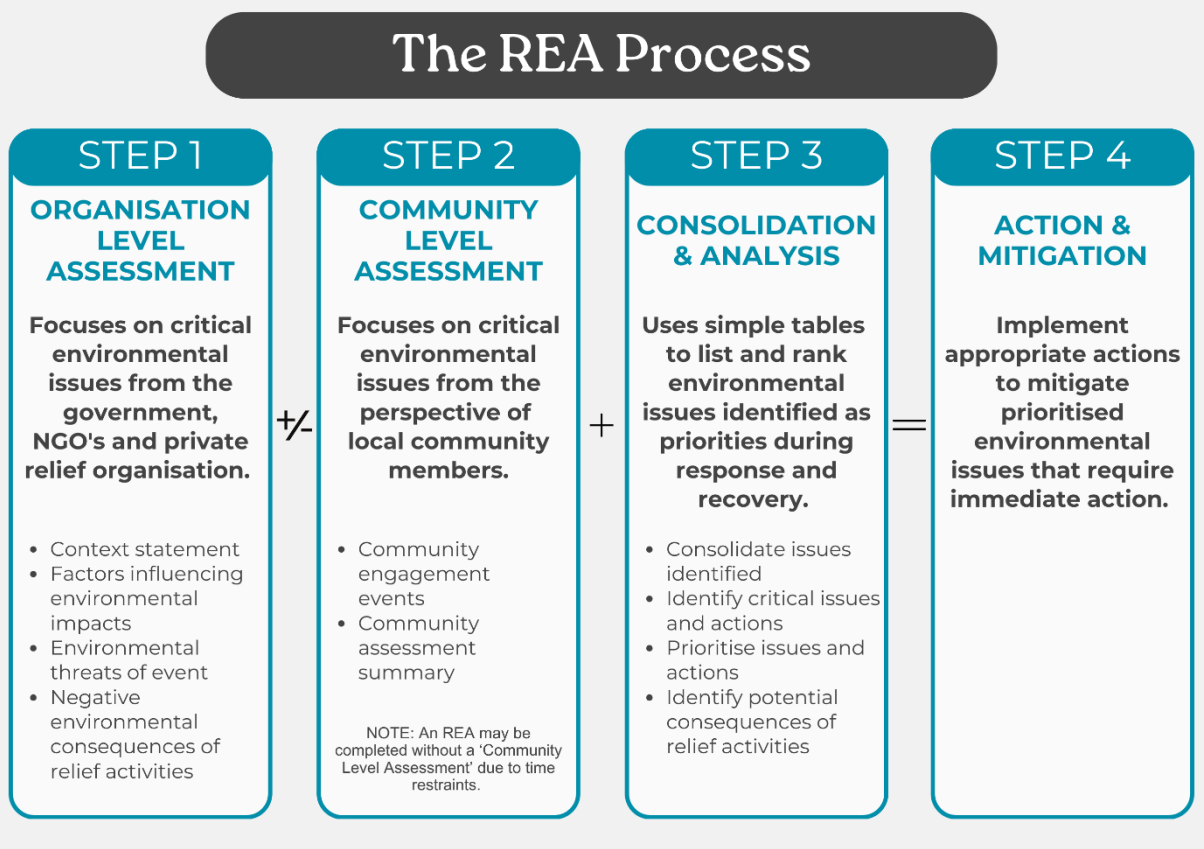

Figure 9: The Rapid Environmental Impact Assessment process. Graphic adapted with permission from Rapid Environmental Impact Assessment in Disaster Response. Copyright 2003 Cooperative for Assistance and Relief Everywhere Inc (CARE)

5.2.2 Community Clean Up Effort

The initial aftermath of a severe weather event often sees communities faced with widespread damage and debris, and hence, the tedious and daunting task of cleaning up and rebuilding. Having a structured community clean-up plan ready for immediate implementation can allow for a more environmentally restorative approach and limit further damage to the natural environment.

Although it is not possible to predict all potential scenarios following an extreme event, abiding by a framework that is flexible and adaptable to a range of scenarios can assist in guiding clean-up processes according to scale and severity. Within the clean-up process, debris and refuse will require sorting and disposal in accordance with the local government's

requirements for waste management. For example, an LGA may direct community members to deliver vegetation or damaged trees to a specific location for chipping and mulching, with the product of this process used across community gardens and parks.

Important objectives of a clean-up plan may include;

- Customising response and recovery efforts according to the event
- Carrying out risk based assessment for natural assets like road side verges, heritage listed trees and community parks
- Implementing a communications plan for community awareness of and involvement in debris management
- Providing technical support for hazardous waste clean-up

Historically, the immediate reaction following an emergency event has been to initiate clearing all debris and vegetation in the vicinity. However, this process requires careful consideration and should emphasise that minimising further damage to the already vulnerable natural environment is of high priority.

While it goes without saying that re-establishing the community quickly and effectively is an ideal outcome, a clear emergency plan will help to guarantee the completion of these activities in a manner that is safe and effective for both the community and the natural environment.

Figure 10: A street in the Shire of Mingenew littered with debris. Image courtesy of Fiona Cosgrove

5. 3 Transition (Phase One to Phase Two)

Transition from recovery phase one to recovery phase two marks the conclusion of the short-term emergency response phase. Due to the unique circumstances posed by extreme event scenarios and the community's capacity to cope, there is no specific timeframe allocated to phase one; upon completion, the process moves into phase two. However, depending on the emergency and subsequent impacts, transition may span across 6 - 12 months, with the potential for considerable overlap between the two phases of recovery.

Figure 11: Tree root failure causing damage to surrounding infrastructure. Image courtesy of Fiona Cosgrove

6.0 Natural Environment Recovery – Phase Two (Long Term)

Phase two can also be referred to as long-term recovery and is defined by the inevitable progression of activities and a shift in priorities with accompanying new objectives. As there is no predictable timeframe to mark the commencement of phase two, the transition will become apparent through the occurrence of criteria. This may include:

- The restoration of community connections and relationships, networks, and social structure
- The replacement or planned removal of temporary arrangements for relief and initial recovery, to allow for permanent structures
- The ongoing investigation and summary of the event

Phase two of recovery could last for months or even years before a community is able to transition back to a 'recovered state' and recommence planning and preparation management. This will largely depend on the community's capacity, the pre-event planning and preparation in place, and the severity of the event that occurred.

Figure 12: Damage to vegetation seen on the edges of reserves, roads and properties. Images courtesy of Jarna Kendle

6.1 Phase Two Emergency Recovery Planning and Long-Term Management

At this point of the recovery process, communities are making progress in the restoration of buildings and infrastructure. However, it is important to ensure that the restoration of built environments does not take priority over the regeneration of the natural environment. Evaluating options to advance both areas can lead to a greater understanding of the interactions between the two environments and result in necessary adaptations for a resilient future.

In the long-term phase of recovery, the role of the LGA's natural environment sub-committee adapts to accommodate new goals around compiling baseline data, re-evaluating capacity and resources, and re-defining new objectives for the unfolding situation. A coinciding re-evaluation of the sub-committee's initial objectives will establish if and/or where targets are being met, and if and/or where additional work is required.

6.2 Environmental Tools to Consider during Phase Two

Within phase two, the sub-committee can re-assess the future requirements for the recovery of the natural environment, and implement additional tools for assessment or restoration. Depending on a number of variables including the extent and context of the event, ongoing

professional investigation into the natural environment impact may be advisable to establish the degree of damage and the associated restoration requirements.

6.2.1 Broad Scale Ecological Assessment

Broad scale ecological assessment provides an in depth insight into the damage caused by an extreme event. This type of assessment requires a qualified specialist with the relevant experience necessary for the situation. More than one expert may be required, to ensure a thorough analysis of the environmental impacts. The scope of the assessment should be tailored to the event, focused either on identified areas of significance, or on the whole area of impact.

As discussed in Section 5.2.1, a rapid environmental assessment, or REA, provides the LGA with a basic overview of the initial impacts following the event. A broad scale assessment may be deemed unnecessary or irrelevant depending on the scale and impacts of the event. Large-scale extreme weather events or hazards (such as chemical spills) will require ongoing monitoring and assessment to collect precise and repeatable data. The information collected in the REA can act as a guide in this ongoing assessment and provide baseline data for future assessment.

The environmental sub-committee can use information obtained from this assessment to inform priority actions for both the safety of the community and the restoration of the natural environment.

6.2.2 Resilient Restoration Techniques

Crucial to the recovery of the natural environment is the restoration and revegetation of damaged flora across landscapes; urban streetscapes, parks and reserves, and agricultural land. As part of the restoration process, modifications may be made to vegetation for the overall increased sustainability and resilience of the natural environment. If implemented correctly, this process can also offer benefits to the social and economic environments of the community.

Revegetation is the process of re-planting trees, shrubs, ground covers, and grasses into an area of disturbed land. Healthy vegetation provides a range of ecosystem services, including reduced wind and water erosion, reduced runoff, sequestered carbon, decreased evaporation, and reduced urban heat island effects. The restoration process provides valuable opportunities for LGAs to ‘build back better’ and, through careful planning and management, create a more sustainable and enduring community.

The term ‘resilient vegetation’ is subjective to each specific site. Expert consultation and planning is recommended prior to commencing on ground works (see Figure 9). Insights

gained from the REA and/ or broad scale ecological assessments will help to inform considerations such as tree attributes and location of planting, in alignment with the LGA's long-term objectives.

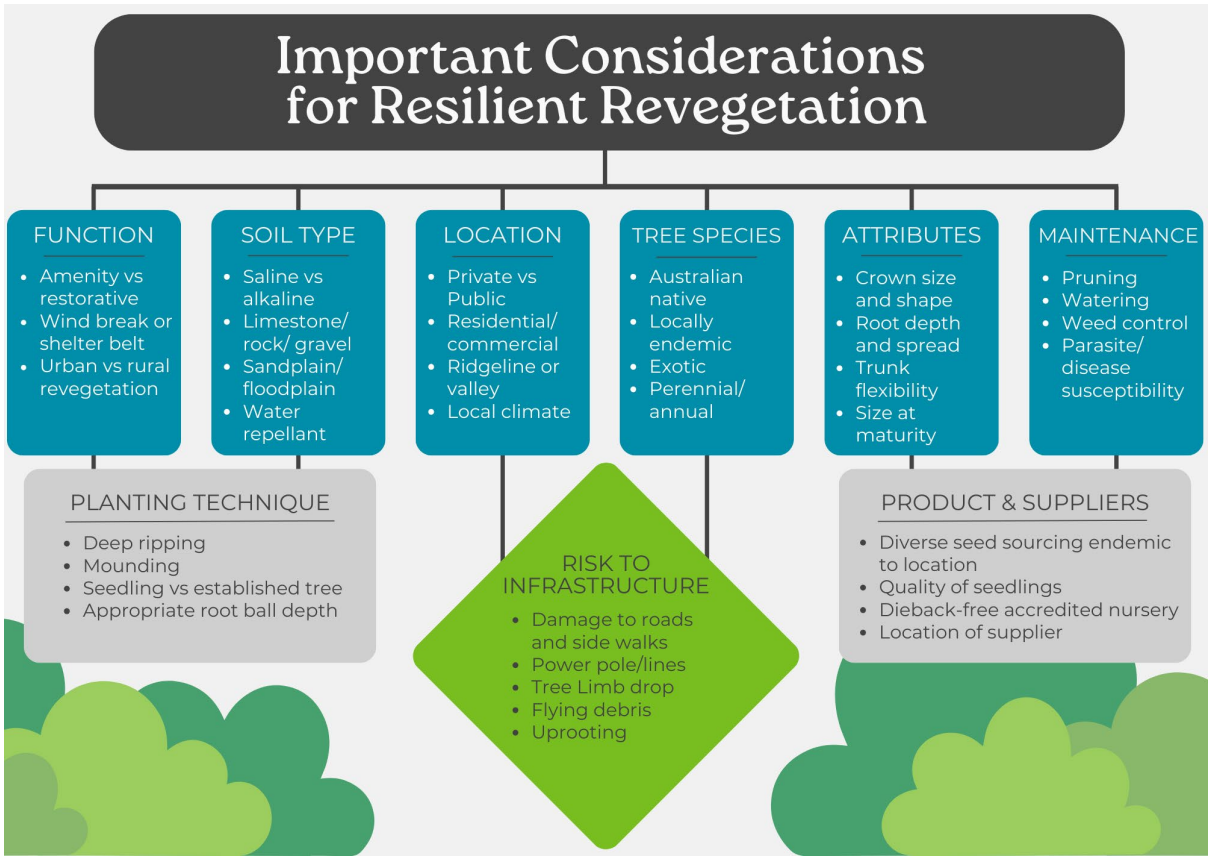

Figure 13: Considerations for resilient revegetation

There are limited examples of previous natural environmental assessments within NAR communities following extreme weather events. However, a common theme observed elsewhere is the importance of trees as physical barriers. Strategically placed trees and tree lines of suitable species have proven to be of great benefit to the community, slowing and/or stopping airborne debris from causing further damage. It must be emphasised that the removal of any or all trees is not an appropriate response to extreme weather, and will likely cause significant secondary problems throughout the natural environment. A key supporting example of this response is high river sediment due to run off.

Phase two of recovery presents an opportunity to explore areas of the natural environment that, as a result of the event, have been degraded, severely impacted, or are structurally hazardous. This is where tools such as revegetation for resilience can be trialled by the recovery committee. LGAs can incorporate these findings into future planning and development once the community has moved past recovery and are back to a state of normal functioning.

6.2.3 Recommended Planting by Zones

During extreme weather events, vegetation can cause significant damage to the built infrastructure. Therefore, careful planning prior to planting is essential, considering the arrangement, location and type of vegetation in relation to any surrounding built environment.

By integrating aspects of the natural environment into local landscape planning and development, communities can take a proactive approach to this development. This approach will help minimise future risk to the built environment, and contribute to re-establishing vulnerable natural environment to be more resilient.

'Zoning' is a concept previously employed by organisations like Main Roads and Water Corporation, which incorporates the strategic planning of vegetation location into projects. Zoning allows for tactical division of a site into areas that can be analysed based on risk. Employing this method can help to inform plant selection and decrease the risk from identified hazards.

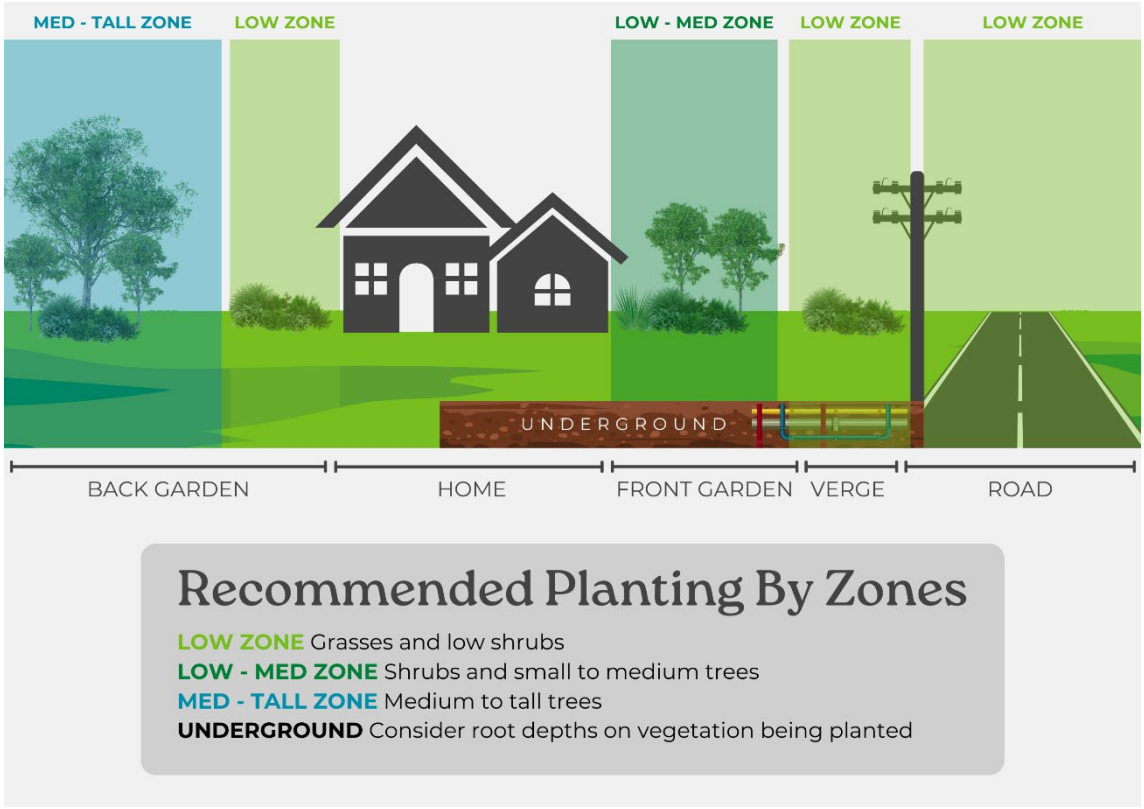

Figure 14: Zoning can ensure that appropriate vegetation is planted, minimising potential impacts to surround built infrastructure and building a resilient natural environment. Graphic adapted from Water Corporation, 'Water Wise Gardening'

The above figure highlights the process of dividing restoration efforts into ‘zones’ and addressing the built infrastructure in each sector. In doing so, each site can be assigned an appropriate revegetation composition plan.

LGAs may choose to implement zoning within recovery projects to mitigate any potential hazards to built infrastructure during an extreme weather event, ensure natural capital for the future, and improve overall community resilience. A simplified version of the initiative may be used during the second phase of recovery while a community is still working to return to normal administration. In later phases, a more refined and long-term approach may be integrated into LGA policies on land planning strategies. The below figure illustrates the zone and planting layout relevant to each.

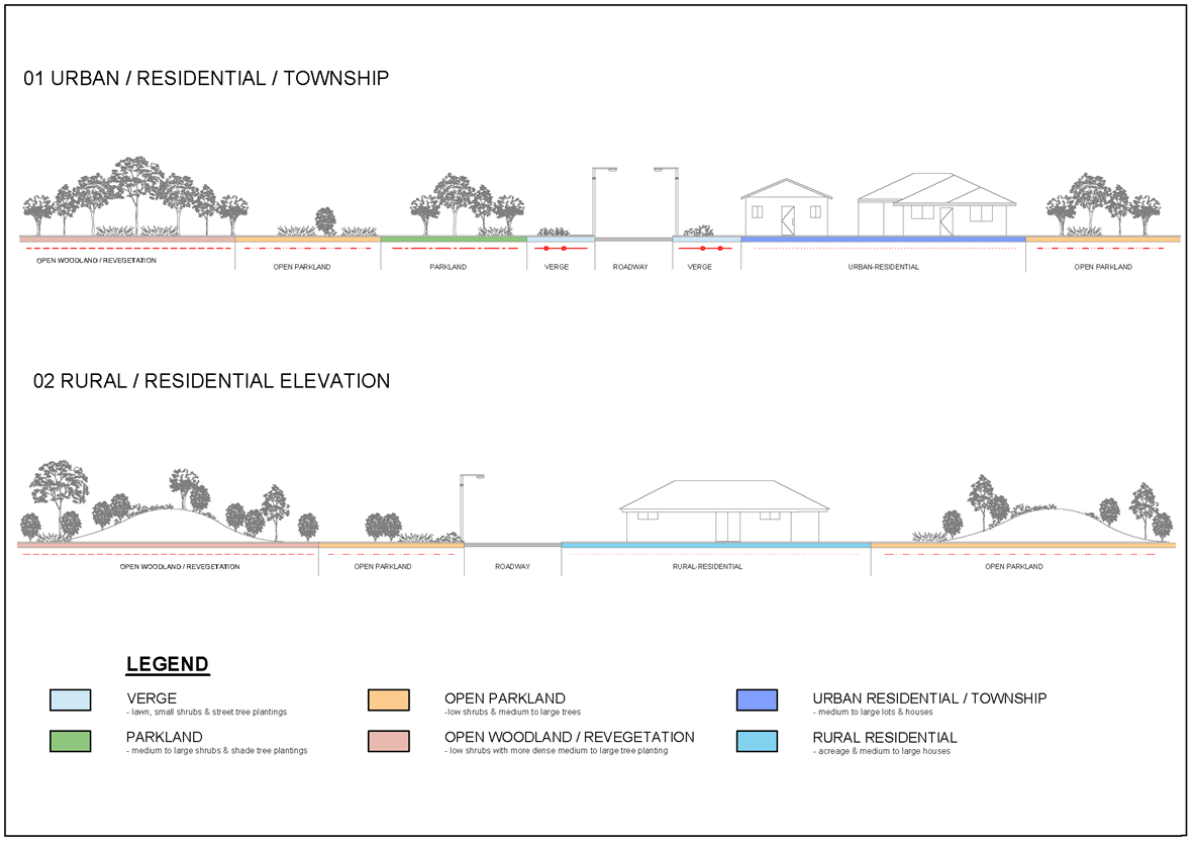

Figure 15: Placement and type of vegetation for communities. Image provided by Mr Chadwick Barron of Barron Building Surveying

Table 1: Advice for built infrastructure likely to be adjacent to planted vegetation

Community Zone	Description	Advice
Roadway	Transport network infrastructure	Roadways are an essential part of all communities and if impacted by extreme events, can have life threatening implications. Roadways are to be kept clear of vegetation. Any islands or median strips are to adhere to height and width of tree crown restraints (in line with main roads regulations).
Verge	Zone either side of the roadway	Verges can have infrastructure such as power poles, drains, pipes and underground communication networks. Specifications for clearance on either sides of the roadway may also be implemented by Main Roads. To protect this infrastructure, vegetation should be restricted to lawn, small shrubs or street trees selected and approved by the LGA.
Urban residential	Medium to large properties ranging from low densities	Urban residential properties may benefit from recommendations for optimal use of land to protect property. Open parkland is often surrounding suburbs of urban residential lots and should be planted with low shrubs and medium to large trees.
Rural residential	Large properties over a hectare with low-density housing	With large areas of land, a greater composition of vegetation may be used with less risk to infrastructure due to clearance spaces. Open woodlands to parkland may be appropriately positioned surrounding rural residential zones. Vegetation placement and arrangement should also account for weather patterns specific to the area, like predominant wind direction and speed.

Table 2: Planting zone descriptions

Planting Zone	Canopy Description	Recommended Plant Height
Parkland	Medium to large shrubs and shade tree plantings	Tree height from 2 – 5 metres and ground cover 0.5 – 1 metres
Open Parkland	Low shrubs & medium to large trees	Diverse shrubs height 1 – 3 metres and ground cover 0.5 – 1 metre
Open woodland/ revegetation	Low shrubs with more dense medium to large tree planting	Tree height varies from 2 – 8 metres, shrubs 1 – 3 metres and ground cover 0.5 – 1 metre

Many factors influence the way vegetation could be impacted by an extreme event. The above table identifies some of the key consideration when planning a resilient revegetation or amenity planting project.

Table 3: Key factors contributing to outcomes during extreme event conditions.

Physical Inputs	Advice	Outcomes for Built Environment
Soil Profile	Soil profile/type can tolerate waterlogged soil in a weather event. Vegetation species types can develop well or poor in different soils.	Well-drained soil can increase the stability and performance of vegetation to develop good root systems and therefore be able to withstand a weather event.
Species	Avoid trees and shrubs with shallow root systems where close to infrastructure or if met with opportunity to encourage deeper root systems. Trees with a taproot or a deep root system are far more structurally stable and durable than species with shallow root systems. When planting in groups, allow adequate space for root systems to develop. Trees with branches arranged in clear layers allow the wind to pass through above and below each layer, relatively	Infrastructure is far less likely to suffer from damage caused by uprooted vegetation in an extreme weather event.

	unimpeded. Smaller leaves offer less wind resistance than larger leaves. However, locally indigenous trees with large leaves usually shed their leaves early on in a cyclone, so the branches are under less pressure. Large trees with large leaves that do not easily shed will be under much more pressure from strong winds.	
Trunk Structure	Trees with a flat bark structure are much more resilient in bushfire events. Trunks that are renowned for failing under wind pressure should not be planted in close proximity to the built environment.	The risk of a bushfire is decreased, as is the likelihood of unfastened and unpredictable debris causing damage during a wind event.
Disease/Insect Attack	Plants that are prone to disease attack or insects should be closely monitored, if not avoided completely. Vegetation that is vulnerable to attack may become unstable.	Damaged or diseased vegetation will not be as resilient to a weather event.
Canopy Cover	Large tree canopies are effective in reducing heat sink into the built environment, but canopy covers can cause trees and shrubs to be top heavy. This could cause wind resistance, and vegetation may not be able to withstand wind forces. Interconnected canopy covers increase bushfire canopy fire loads.	Canopy covers are at risk of toppling and, in a bushfire event, increasing heat levels, posing a threat to nearby or interconnected vegetation.
Planting Arrangement	Arrangement of vegetation can reduce wind severity and pressure on the built environment, creating a shielding effect and/or deflection to protect building infrastructure. Placement of vegetation in a dome shape configuration could enhance the shielding and potentially protect the integrity of broader vegetation.	Effective strategic planting can deflect wind to larger vegetation (trees) and shield both infrastructure and vegetation. Plans must take into consideration the physical infrastructure and allow for vegetation failure.

	Trees planted in clusters offer mutual support compared to those planted in rows, particularly when coinciding with wind direction. This was evident in 'Cyclone Yasi' when tree lines running across the wind were completely dismantled, while tree lines running with the wind remained mostly intact. These tree lines were able to withstand the wind, as the first few trees had fallen and, in turn, provided protection for the remaining vegetation.	E.g., height of vegetation away from infrastructure, one and half times the height of vegetation.
Erosion	Slopes and hardstand surfaces need to be managed to avoid the soil profile becoming overly soaked. Extreme weather events likely consist of rain, which can cause shallow rooted vegetation to become waterlogged and fall victim to strong winds. These vegetation types require good, sloped drainage away from built environment.	Soil erosion can cause infiltration into storm water systems. This may flood areas and cause waterlogging to nearby vegetation.
Terrain	Terrain can significantly affect the amount of wind and radiant heat vegetation is exposed to and its ability to shield the built environment. A 500m radial assessment is recommended to determine the Terrain Category as per AS 4055. This will offer some insight into whether the re-vegetation is able to provide shield to the built environment.	Terrain and location of re-vegetation can have a positive effect to the built environment, and provide protection from the elements.
Physical Infrastructure	Parkland infrastructure should not increase the water logging of vegetation. Open space can provide additional separation distance to major infrastructure and allow wind movement within an area (roadways, drainage, buildings). When	Physical infrastructure can enable ease of access to perform maintenance and increase the amenities', design.

	designing hard infrastructure, considerations should extend to clearing and planting of vegetation to avoid wind tunnels.	

The below figure illustrates the movement of wind across a revegetated site, using a tiered globe lay out. One of the key aspects of this design is the lack of linear plantings and diverse plant selection. This composition helps to slow high wind speeds and debris, offering protection to built assets.

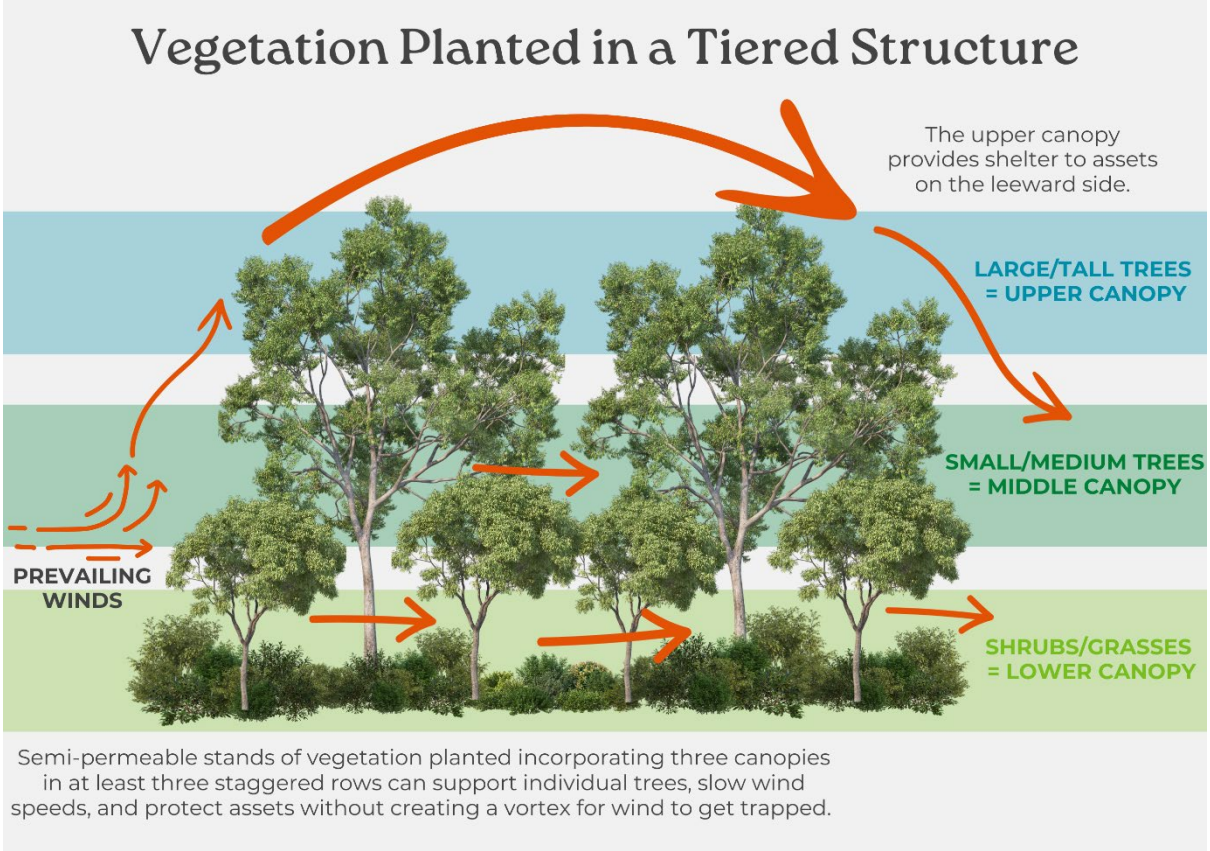

Figure 16: Recommended planting of vegetation in a tiered structure. Graphic adapted from 'The effects of density (permeability) on wind flow and turbulence', Quill, R et al.

Elements of structural change that are relevant to the NAR include the use of different canopy heights, planting density and locations within the landscape, and avoiding rows of planting. Communities of varying landscape and size can apply the zoning approach to their re-vegetation planning. It is an effective method that can be easily adapted to different situations, locations, and target objectives.

6.3 Transition

The transition from phase two recovery back to a state of normality – albeit with ongoing maintenance works - will look different for every community. This period will unfold depending on the contributing factors of the event and the capacity of the community. As seen with Seroja, long-term recovery activities may continue within a community for upwards of two years from when the initial event occurred.

The transition period is identifiable by actions that may include:

- The introduction of new laws and regulations, informed by learnings and/or outcomes of the event (i.e. building laws)
- The planning and/or implementation of new developments
- An increase in innovation towards resilience

In the late stages of recovery, a community may naturally experience subject fatigue and from a potentially protruded restoration journey. This could result in premature abandonment of recovery activities or an abrupt break in the emergency management cycle with no plans to further transition into prevention and resilience planning. Recognition and awareness of these risks are crucial to staying the course of continued recovery and ensuring improved community capacity and resilience for the future.

7.0 Summary

The cumulative affect of a series of unusual conditions led to Cyclone Seroja to cross the Midwest coast in April of 2021, causing severe widespread damage to several of the NAR's remote and vulnerable communities. As the event unfolded and evolved into a recovery effort, challenges arose, emphasising the need to support LGAs in building climate resilient communities. These guidelines recognise the critical role an LGA plays in implementing informed and up to date best practices for the safeguarding of their community.

The changing climate is expected to see storm events of increased frequency and intensity, extended periods of drought, decreased annual rainfall, and rising air temperatures. These projections reinforce the pressure on communities to proactively adopt climate smart innovations and work towards the improved resilience of natural assets. The key to doing so lies in prioritising significant planning and preparation prior to, and in anticipation of, the occurrence of an emergency event.

LGAs are required to have a current Local Emergency Management Arrangement (LEMA) that clearly outlines the recovery plans for the built, social and economic environments of a community. These guidelines reinforce the need to have the natural environment considered as a priority area within a LEMA. Detailing clear objectives for each of the four environments before, during and after an emergency will help to guide an effective and efficient recovery process. The defined identification and allocation of roles and responsibilities, including those within the LEMA Natural Environment Subcommittee, will further contribute to the enhanced capacity of a community in their response.

The natural environment is often overlooked in the initial response following an emergency event. Developing and employing the appropriate emergency management tools will safeguard natural assets, with the potential to also benefit a community's built, social and economic environments. Investing in planning will equip LGA's and land managers with the capacity to respond from a prepared and informed position, promote a more environmentally restorative approach, and, in turn, build a robust and highly adaptable natural environment.

Recognising the value of the natural environment and the ways in which the community benefits from thriving natural assets will contribute enormously to establishing a resilient and vibrant community.

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9.0 Appendices

Appendix 1.0 - Case Studies

1.1 Mingenew Spring Regional Garden Project

Demonstration site summary: The Shire of Mingenew selected a site of cultural and historic value to its community. Located in the town centre, the Mingenew Spring is adjacent to the local caravan park, and is recognised as a tourist attraction. During colonisation, the spring was utilised as a stock watering point, then as the town water supply and market garden irrigation. The spring has since dried up, and the reserve set aside for conservation. However, the area has suffered from the impacts of weeds and historical land use. This project set out to beautify the area with tourism and the adjacent caravan park as key driving factors. The Shire of Mingenew sought technical advice from LA3 Urban Design & Landscape Architecture business to design and implement the Mingenew Spring project. Advice was also sought from the Kings Parks botanical experts, regarding native revegetation species selection.

Lessons learnt: Some of the challenges for this site included its small size and location within a sensitive ecosystem. When undertaking revegetation all project sites will have individual challenges and requirements. This site is located within a remnant Eucalypt woodland and using techniques such as scalping or ripping may have caused unwanted damage to the root systems. Future restoration efforts within the Mingenew Spring may use weed matting or woodchip mulch to reduce weed burden. Another takeaway is the loss of some larger plants; using smaller tube stock is recommended in un-reticulated revegetation as they have been shown to establish more effectively.

Site Photos

1.2 Morawa case study

Demonstration site summary: The Shire of Morawa identified two demonstration sites of significant value to the community; the Widimia Walking Trail and its associated conservation reserve, and the Morawa Golf Course. Seroja impacted the vegetation at both of these sites causing limb loss and uprooting of established trees. Part of a previous revegetation project the The Widimia Walking Trail and conservation reserve is dominated by a single tree species being York gum. Revegetation at the Widimia Walking Trail was therefore, focussed on providing floristic diversity. The inclusion of a range of tree and shrub species is expected to provide an Upper, Mid and Lower story that will provide wind protection, slow and capture water, and offer complex habitat for native fauna when mature. Similarly, the revegetation for the Morawa Golf Course is designed to provide a tiered vegetation structure. Once established this diverse shrub and tree layer will provide a wind buffer to protect both the large established gums and golf courses built infrastructure. Overall 8000 locally native trees and shrubs were planted in Morawa's two demonstration sites. 'There is a need to regenerate and replant native rem veg areas in and around WA's country towns. They are invaluable well used areas for our native animals and our community' Ian Pulbrook said.

Lessons Learned: Whilst the revegetation is in its first year of establishment the use of rip lines and planting with endemic species has enabled a successful establishment in the first 3 months. This site also provides an example of how semi established tree monocultures can be enhanced by incorporating a diverse understory.

Site Photos




1.3 Perenjori case study

Demonstration site summary: The demonstration site chosen by the Shire of Perenjori was the Perenjori Golf Course. Located within the townsite it is an important recreational community asset. Revegetation and restoration was focussed on future resilience and is expected to provide environmental and social benefits. The damage caused by Seroja within the Perenjori Golf Course is still evident with uprooted trees and limb damage still present. Utilising the planting principles outlined in these guidelines, this demonstration site aims to reduce the impact to vegetation and infrastructure during future extreme weather conditions. 8000 locally native trees and shrubs were planted at the Perenjori Golf Course providing Upper, mid and lower story vegetation. The planting was focussed along the fairway's to enhance the vegetation under the large established Eucalypts. Once established the diverse tree and shrub layers will help to diffuse high winds, capture and slow water runoff, provide complex habitat systems for native fauna and be a valued a public asset.

Lessons Learned: Thorough planning and site selection resulted in streamlined communication and coordination of logistics. Revegetation goals were delivered on time and within budget. The use of ripping, weed control and locally native tube stock has enable these seedlings to establish well in the first 3 months. Shire of Perenjori Chief Executive Officer Paul Anderson said the project was delivered efficiently and effectively with the support of NACC NRM's Biodiversity Project Officer. "It is important to understand the impact of tree planting in a non-regimented manner to dissipate storm energy and protect the regions naturally occurring, planted and built assets," Paul said.

Site photos

Appendix 2.0 – Planning References

Important references and sources of information for emergency recovery planning.

- Emergency Management Act 2005 (EM Act) https://www.legislation.wa.gov.au/legislation/statutes.nsf/RedirectURL?OpenAgent&query=mrdoc_45857.pdf
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- State Emergency Management Policy (State EM Policy) https://www.wa.gov.au/government/publications/state-emergency-management-policy
- State Emergency Management Plan (State EM Plan) https://www.wa.gov.au/government/publications/state-emergency-management-plan
- Australian Disaster Resilience Community Recovery Handbook (AIDR 2018) https://knowledge.aidr.org.au/media/5634/community-recovery-handbook.pdf

Appendix 3.0 – Stakeholders & Authorities for Natural Environment Management Recovery Teams

Authorities	Description	Organisations
Hazard Management Agencies (HMA)	A delegated person or group responsible for managing both their associated hazard and the response to an event arising from prescribed hazard. They may also lead other emergency management activities around the prevention, preparedness and recovery relevant to their prescribed hazard/s.	- Agriculture Director General - Arc Infrastructure Pty Ltd - Chief Executive Officer, Department of Health - Chief Executive Officer, Department of Transport - Commissioner of Police - Fire and Emergency Services Commissioner - Public Transport Authority
Local Government Authorities (LGA)	Responsible for the preparation of local emergency management arrangements and lead community based recovery efforts.	

Essential Service Providers (ESP)	Also known as Essential Service Network Operators, ESP's are owners/operators of critical infrastructure that may be impacted by an emergency and/or essential to recovery.	- Bureau of Meteorology - Department of Defence - Australian Red Cross - Main Roads - Water Corporation
Combat Agencies (CA)	Agencies with clearly identified or legislated roles in an emergency.	- Department of Biodiversity, Conservation and Attractions - St John Ambulance Western Australia
Industry Bodies (IB)	Industries that have non-legislated supporting roles in emergency management.	- Department of Planning, Lands and Heritage (DPLH) - Department of Water and Environmental Regulation (DWER) - Western Australian Local Government Association (WALGA)
Other	Organisations that can provide a wide range of critical support to HMAs during the recovery process.	- Non Government Organisations (NGOs) - Community Groups (volunteer fire services etc.)

Table 4: Authorities considered as vital stakeholders in response and recovery teams.

Appendix 4.0 – Characteristics of Landscape & Vegetation that Affect Resilience

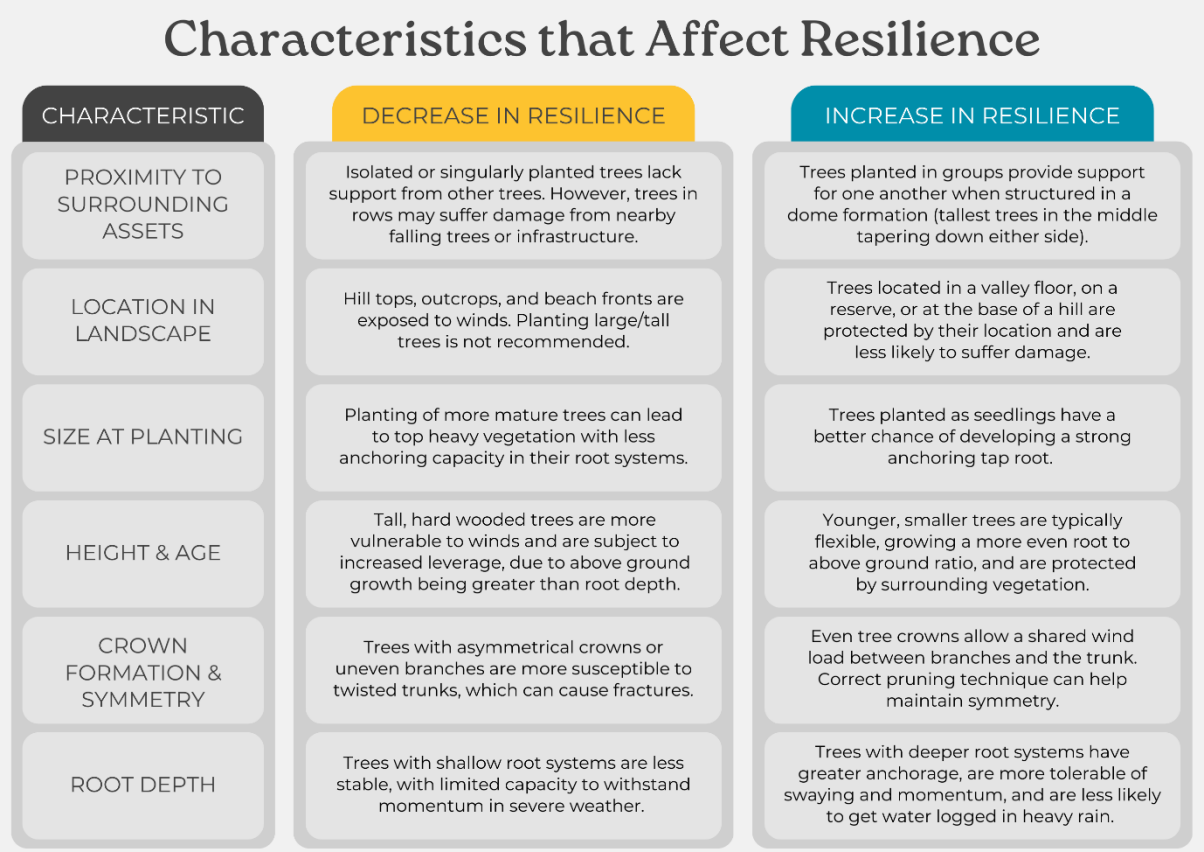

Figure 17: Characteristics of landscape and vegetation that affect resilience. Graphic adapted from 'An assessment of tree susceptibility and resistance to cyclones', Dr Greg Calvert, 2011

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