Australian Government

NACC

Emergency Preparedness and Response Plan for Biodiversity and Agricultural Natural Capital in the Northern Agricultural Region

PANEL OF REGIONAL DELIVERY PARTNERS

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ACKNOWLEDGEMENT OF COUNTRY

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

Publication Details

Northern Agricultural Region Biodiversity and Agricultural Natural Capital Emergency Preparedness and Response Plan.

This Plan seeks to improve preparedness for, response to, and recovery from emergency events as they relate to Australian Government biodiversity and agricultural natural-capital assets. This will be achieved through improved integration of assets in emergency planning, response and recovery.

The Plan will enhance the resilience of biodiversity and agricultural natural-capital assets by recognising the risks and threats 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.

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TABLE OF CONTENTS

1. BACKGROUND 1
2. OBJECTIVES OF THIS PLAN 3
3. SCOPE 4
4. EMERGENCY PREPAREDNESS AND RESPONSE ROLES 5
5. IDENTIFICATION OF MANAGEMENT UNIT ASSETS AND SUSCEPTIBILITY 7
6. ASSET RISK (PREPAREDNESS) 26
6.1 Flood 26
6.1 Disease 27
6.2 Drought 28
6.3 Plague 29
6.4 Fire 30
6.6 Extreme Events 31
7. ASSET PROTECTION RESPONSE 41
7.1 Flood 41
7.2 Disease 42
7.3 Drought 43
7.4 Plague 44
7.5 Fire 45
7.6 Extreme Events 46
8. ASSET RECOVERY RESPONSE 56
8.1 Flood 57
8.2 Disease 58
8.3 Drought 60
8.4 Plague 62
8.5 Fire 63
8.6 Extreme Events 65
9. COMMUNITY/STAKEHOLDER ENGAGEMENT 66
9.1 Engagement, Collaboration and Coordination activities 66
9.2 Raising Public Awareness 68

9.3 Education and Training 69
9.4 Key Community/Stakeholder Engagement Gaps 70
9.5 Key Asset Gaps 71
10. LEGAL FRAMEWORK 72
11. RISK MANAGEMENT INCLUDING MITIGATION STRATEGIES 73
12. MONITORING AND DATA 75
13. KEY CONTACTS 77
14. REFERENCES 81
15. APPENDICES 85
Appendix A. Biodiversity Asset Mapping 85
Appendix B. Mapping of Agricultural Assets 100
Appendix C. Mapping of Agricultural Assets Risks in the Northern Agricultural Region 106

1. BACKGROUND

The Northern Agricultural Region (NAR) covers 7.5 million hectares in Western Australia's Wheatbelt, incorporating valuable agricultural land and environmental sites. The NAR encompasses 15 local government areas, from the Shire of Gingin in the South to the Shire of Northampton in the north as well inland to include, Morawa, Perenjori, Dalwallinu, Victoria Plains and Moora. The region continues three nautical miles into coastal waters to the Houtman Abrolhos Islands and islands of the Turquoise Coast.

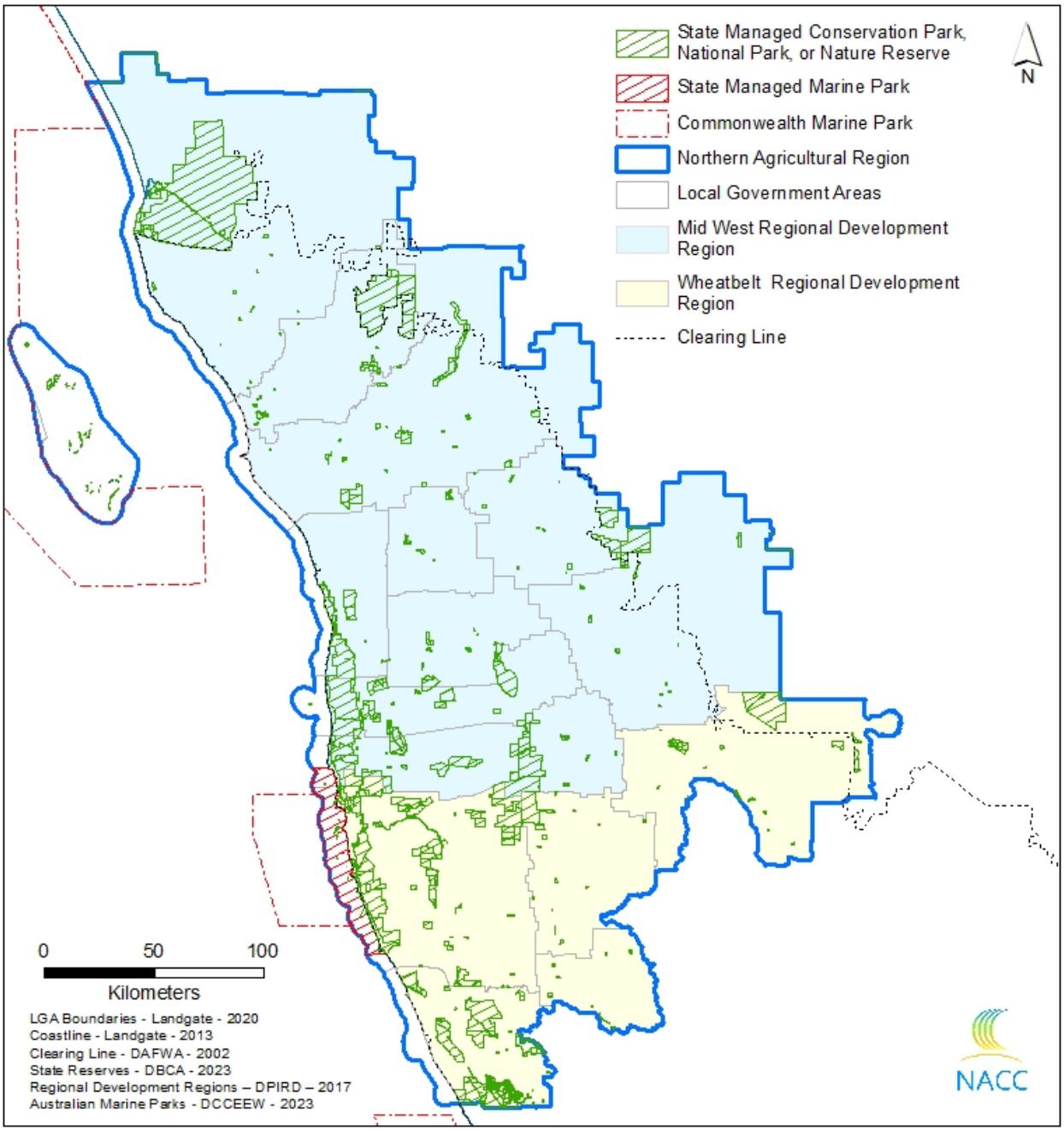

Image 1: General overview of the Northern Agricultural Region.

Around 64, 000 people live in the NAR; approximately 60% of these people are based in Geraldton and the surrounding areas. Broadacre agriculture is the predominant industry, with large economic contributions also coming from horticulture, fishing, mining, and tourism. The region is an enormously important producer of food for local consumption and export. It is also part of an internationally recognised biodiversity hotspot, home to a huge diversity of plants and animals unique to this part of the world.

Some of the critical natural resource management priorities in the NAR are working with local communities to build healthy and productive soils in the face of acidity, salinity and wind erosion, maintain water quality and quantity, and ensure that our unique flora and fauna have access to enough good quality habitat to sustain them in the long term.

There is a growing need to develop preparedness for natural disasters and their impact on biodiversity and agricultural natural capital assets. Ensuring the survival of species and places helps to preserve key ecosystems services such as clean air, water, and climate regulation, all of which profoundly affect human well-being. Disaster preparedness bolsters the resilience of ecosystems, enabling them to recover and flourish following catastrophic events.

Improved preparation and response also contribute to stronger regional economies through sectors such as tourism and agriculture. For example, investment in disaster preparedness results in reduced long-term costs for recovery and restoration post-disaster.

The Plan contributes, in part, to actions under Target 17 of the *Threatened Species Action Plan 2022-32* and Outcomes 1, 2 and 3 of the Natural Heritage Trust (NHT), by addressing vulnerability from extreme weather events relevant to biodiversity and agricultural natural capital assets identified in the NAR, and improving emergency response and planning within jurisdictions. The Plan also contributes to Outcomes 1 and 3 of the Climate-Smart Agriculture Program by supporting the agriculture sector to build resilience to climate change and conserve natural capital and biodiversity on-farm.

This Plan considers the most likely disaster scenarios for MU34, known as The Northern Agricultural Region, which include; Flood, Disease, Drought, Plague, Fire, and Extreme Events. The Plan was built on the lessons learned during the 2019-20 Black Summer bushfires, other recent environmental disasters and on NACC NRMs current regional planning documents, (The regional NRM Plan developed for the Regional Land Partnerships Program (RLP) titled NARvis).

The south west of Australia has been identified as a critical interface for climate change adaptation due to contracting rainfall bands (up to a 20% rainfall reduction), greater seasonal variation and increased temperature (Andrys, Kala, & Lyons, 2017; Islam et al., 2014; Pettit et al., 2015). The NAR is at the forefront of drought susceptibility with known and predicted rainfall decline. Climate change predictions suggest that although there is likely to be a decrease in the genesis of Extreme Events such as Tropical Cyclones, their intensity is likely to increase and they are likely to decay further south (Chand et al., 2019). This will impact previously unaffected communities, whose natural and built environments are vulnerable to these weather events and not yet well adapted.

Making landfall in early 2021, TC Seroja evidenced the extreme events being experienced across the region. TC Seroja caused damages estimated at approximately $272m (AIDR Knowledge Hub, 2021) across the Midwest of WA. The impacts of TC Seroja on the farming communities of Northampton, Chapman Valley, Mingenew, Morawa, and Perenjori, were exacerbated by the remoteness of the communities, causing difficulties in accessing technical services, including those in place to support environmental recovery. These exposed vulnerabilities highlighted a need for

communities to improve both natural and built environment planning and preparedness for future events.

The looming threat of the next severe weather season along with the critical role of Regional Delivery Partners in supporting NRM preparedness and response, have led to NACC NRM being invited to deliver a 'Biodiversity and Agricultural Natural Capital Emergency Preparedness and Response Plan' (the Plan) preceding the 2023/24 severe weather season.

2. OBJECTIVES OF THIS PLAN

The Northern Agricultural Region covers the northern most extent of the productive agricultural zone of WA, contributing significantly to grain and livestock production. It is also part of the south West WA Global Biodiversity Hotspot, encompassing the treasures of Lesueur National Park, Beekeepers Reserve, the Abrolhos Islands and associated Marine Parks. The region is also home to distinct and deep-rooted cultural ties and values.

For over two decades, NACC NRM has been steering the region towards a sustainable, healthy future, through the application of goals, strategies, and the associated actions of these plans. NACC NRM is committed to continuing to work in partnership with the community, industry, and government to ensure the maintenance of our vibrant and prosperous region. The development and delivery of a Biodiversity and Agricultural Natural Capital Emergency Preparedness and Response Plan is one of many important tools employed to achieve this outcome.

Climate predictions for the region state that temperatures will continue to increase across all seasons, hot days will become hotter and more frequent, rainfall will decrease throughout winter and spring, and there will be increasingly intense rainfall events, and a higher likelihood of longer, more frequent droughts. Climatic predictions include a higher risk of dangerous fire-weather, with a projected increase in the number of days classified under a 'severe' fire danger rating. The cumulative effect of climate change alongside these adverse seasonal conditions is poorer production potential and profitability for the agricultural sector. Projected increases in extreme weather events may trigger increases in insect outbreaks and weed prevalence as the climate becomes more inhospitable for biodiversity assets and the competitive advantage of introduced species increases. Biodiversity and agricultural assets are under threat of climate change as a driver of increasingly severe emergencies.

While agricultural land in the region is very productive, it is also under stress. Soils are facing the impacts of wind erosion, water erosion, hard setting, declining fertility, acidification, compaction, water repellence, waterlogging, and salinity. These issues require on-going management on an adaptive basis. The NAR is also experiencing social challenges that have broad impact on management and emergency responsiveness, with a trend towards an ageing farmer population and declining engagement from youth, and succession planning failures. Producers are often under fiscal pressure to return a predicable business cash flow from their agricultural assets, which affects the way in which this sector accepts natural resource management, and whether they have the capacity to engage with emergency preparedness and response planning throughout their agricultural practices. As agriculture accounts for majority of land-use in the region, the recognition of, and engagement with this sector is essential to the achievement of objectives within this Plan.

The objectives of this plan are to improve preparedness for, and response to, emergency events where they occur through better integration of biodiversity and agricultural natural capital assets in

emergency planning and response. This includes efforts to enhance the resilience of biodiversity and agricultural assets by recognising the risks and threats posed by natural disasters and undertaking planning to improve outcomes through actions and management before, during (to the extent possible) and after, to support holistic recovery.

3. SCOPE

This Emergency Preparedness and Response Plan seeks to reduce the impact of catastrophic events on biodiversity and agricultural natural-capital assets. The Plan considers the most likely disaster scenarios for the Region.

The Northern Agricultural Region is home to ~7,480 native plants and animals, including birds, mammals, fish, reptiles, amphibians, invertebrates and plants. Approximately 13% of these (at least 1,000 taxa) are endemic to the region. The NAR is located within the Southwest Australia Biodiversity Hotspot in WA, one of only two Australian internationally recognised global biodiversity hotspot (Myers, N. et al. 2000; CEPF 2020). International biodiversity hotspots contain high levels of natural diversity that is under threat. Specifically, they require a minimum of 1,500 vascular plant species to be present, and to have lost at least 70% of their original habitat, representing a high threat to that diversity.

The NAR also contains three of Australia's national biodiversity hotspots: the Geraldton to Shark Bay Sandplains, Mount Lesueur-Eneabba, and the Central & Eastern Avon Wheatbelt. National biodiversity hotspots are largely intact areas supporting native plant and animal communities and natural ecosystems with a high diversity of locally endemic species. Five recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions, based on distinct regional patterns of landform and vegetation are also located in the NAR. These are the Avon Wheatbelt (Merredin and Katanning), Jarrah Forest (Northern), Swan Coastal Plain (Dandaragan Plateau and Perth), Geraldton Sandplains (Geraldton Hills and Lesueur Sandplain), and Yalgoo (Tallering; Florabase 2013; DAFF 2024).

Although these broad biodiversity assets may not be individually identified, the conservation of these biodiversity assets is considered, and this Plan assesses and provides preparedness and response mechanisms that benefit biodiversity across the region. Biodiversity assets include threatened species and associated habitat features that are identified as priority under the *Threatened Species Action Plan 2022-32*. Other species and assets that rely on comparable habitat and are susceptible to comparable events will also benefit, but specific descriptions are outside of the scope of this Plan. Broadly, biodiversity assets refer to assets identified by commonwealth and state agencies, environment management organisations, or environmental law as important to preserve during emergencies or natural disasters.

Agricultural natural-capital assets relate to the on-farm natural resources that support food and fibre production including soil, air, water, riparian areas, remnant native vegetation, agroforestry and environmental plantings. The Plan focuses on the assets that support agriculture, and risks to agricultural assets. Identification of individual commodities are outside of the scope of this Plan.

To the extent possible, this Plan does not conflict with or duplicate other emergency management plans.

4. EMERGENCY PREPAREDNESS AND RESPONSE ROLES

The framework for emergency management in the Northern Agricultural Region is delineated by the responsibilities of State Government agencies. These entities are tasked with coordinating and planning responses to emergencies within their respective jurisdictions. When the collective resources, including those from government, community, and commercial sectors are insufficient to adequately address the needs of an emergency situation, designated officials have the authority to seek non-financial assistance from the Australian Government through Emergency Management Australia, operating under the Australian Government Disaster Response Plan (COMDISPLAN).

COMDISPLAN serves as a guide for coordinating Australian Government non-financial assistance during disasters or emergencies occurring within Australia or its offshore territories. This assistance encompasses a range of support services such as planning expertise, mapping services, counselling, advice management, and physical assistance. The provision of Australian Government physical assistance is contingent upon specific criteria being met, including the existence of an emergency situation or declaration of a state of emergency, a request for assistance aimed at saving lives or property, the inadequacy of State resources, and the inability of commercial entities or local labour forces to effectively undertake the required tasks.

In Western Australia, emergency management arrangements are established under the *Emergency Management Act* and prescribed in the *Emergency Management Regulations 2006*. These legislative frameworks ensure the prompt and coordinated organization of emergency management activities within the State. Central to these arrangements are Combat Agencies, which are public authorities or entities designated under the EM Regulations to perform emergency management activities. These agencies are tasked based on their functions under existing laws or their specialized knowledge, expertise, or resources. Combat Agencies in Western Australia include the Department of Health, St John Ambulance Western Australia Ltd., Western Australia Police Force, Department of Biodiversity, Conservation and Attractions, Department of Fire and Emergency Services, and local governments.

Specifically, the Department of Biodiversity, Conservation and Attractions (DBCA) is designated as a Combat Agency for fire suppression activities within its managed lands, which include State forests, timber reserves, national parks, conservation parks, and nature reserves. The Department of Fire and Emergency Services also holds combat responsibilities for fire suppression activities. Additionally, the Department of Primary Industries and Regional Development (DPIRD) plays a crucial role in emergency management at a national level, particularly concerning animal and plant pest and disease responses. DPIRD's responsibilities include coordinating responses under the State Support Plan for Animal Welfare in Emergencies, assisting with fish pest events, conducting rapid assessments of disaster impacts on primary industries, and facilitating the recovery of affected industries and regions.

Aligned with state and federal legislation, DPIRD operates to preserve animal and plant biosecurity, soil health, and community safety, while also protecting biodiversity and agricultural assets vulnerable to disaster scenarios. The department is mandated by various state laws and works in conjunction with the *Federal Biosecurity Act 2015* to fulfil its obligations. Within DPIRD, the Commissioner of Soil and Land Conservation oversees the implementation of the *Soil and Land Conservation Act 1945.* This legislation mandates initiatives aimed at curbing land degradation, fostering soil conservation practices, and disseminating information to landholders and the wider public regarding optimal land management techniques. Furthermore, the Commissioner holds a

position on the Soil and Land Conservation Council, which advises the Minister for Agriculture and Food on matters pertaining to the State's land assets. In addition to these responsibilities, the Commissioner maintains communication with the Pastoral Lands Board (PLB) and plays a role associated with the Pastoral Rangelands under the *Land Administration Act 1997*. Soil-related response efforts are often prompted by industry demands and occurrences of natural hazards such as fires and floods.

Local governments are also integral to emergency management efforts, serving as Combat Agencies for fire suppression activities and providing support to relevant Hazard Management Agencies. They play a key role in leading, managing, and coordinating community recovery efforts at the local level, leveraging their close proximity to the community and established networks to provide specialized knowledge and support during and after emergency events.

NACC NRM actively engages with and supports these state and local bodies in their emergency management endeavours. NACC NRM's Purpose is to ensure that the NAR community values and actively protects our region's natural capital, consistent with the Aspirations and Goals of NARvis. NACC NRM's Way is Catalysing Community Conservation through passionate delivery of collaborative on-ground projects and education. NACC NRM provides a focus on biodiversity, coastal and marine conservation, sustainable agriculture, and Aboriginal custodianship. NACC NRM's impact will be that the health of the natural resources and environment of the NAR are improved. NACC NRM works to ensure that the region's natural capital is valued and safeguarded in accordance with regional aspirations and goals. Through collaborative projects and advocacy efforts, NACC NRM contributes to the improvement of natural resource health and environmental sustainability in the region, building on over 25 years of partnership-driven initiatives across national, state, and local scales.

Incorporating the perspectives and involvement of First Nations people is crucial in the preparedness, response, and recovery process for an emergency event in the NAR (Drennan, et al. 2016, Paton et al., 2014). These facets include:

Cultural and Traditional Knowledge	First Nations people possess valuable traditional knowledge about land management, biodiversity, and sustainable practices that can inform emergency strategies. Collaborating with Indigenous elders and communities can ensure that planning and recovery efforts respect and integrate this knowledge into planning and implementation.
Community Engagement and Consultation	Engaging with First Nations communities in the emergency planning process ensures their voices are heard, and their needs and priorities are addressed. Consultation sessions and community meetings can facilitate meaningful dialogue and collaboration between government agencies, local authorities, and Indigenous representatives.
Resource Management and Land Stewardship	First Nations people have a deep connection to the land and ecosystems in the region. Involving Indigenous land managers and rangers in habitat restoration, revegetation, and biodiversity recovery efforts can leverage their expertise in traditional land management practices and enhance the effectiveness of initiatives.

Cultural Heritage Protection	Emergency events can damage cultural sites and Indigenous heritage places. Working closely with First Nations communities to identify and protect culturally significant areas prior, during and post the event is essential. Incorporating Indigenous perspectives into heritage conservation efforts ensures the preservation of cultural identity and connection to Country.
Capacity Building and Employment Opportunities	Providing training, employment, and capacity-building opportunities for First Nations people in preparedness and recovery projects fosters economic empowerment and social inclusion. Supporting Indigenous-led initiatives and enterprises strengthens community resilience and contributes to long-term sustainable development.
Cultural Healing and Well-being	Natural disasters can have profound impacts on the mental health and well-being of First Nations communities. Recognizing and addressing the psychosocial needs of Indigenous peoples through culturally appropriate support services, counselling, and healing programs is essential for community resilience and recovery.

By actively engaging and collaborating with First Nations people throughout all phases—planning, implementation, and decision-making—stakeholders can guarantee that planning, preparedness, and response efforts are inclusive, culturally attuned, and in alignment with the values and goals of Indigenous communities in the NAR. It is crucial for all emergency planning and response stakeholders to recognize this duty and honour the pivotal role of First Nations people.

5. IDENTIFICATION OF MANAGEMENT UNIT ASSETS AND SUSCEPTIBILITY

The Northern Agricultural Region covers 7.5 million hectares in Western Australia's Wheatbelt, stretching across valuable agricultural land and environmental sites. The NAR extends from the Shire of Gingin in the South to the Shire of Northampton in the north and inland to include Mullewa, Morawa, Perenjori and Dalwallinu. Also forming part of the region are coastline and waters out to three nautical miles west, which include the Houtman Abrolhos Islands and islands of the Turquoise Coast.

Broadacre agriculture is the predominant industry, with large economic contributions also coming from fishing, horticulture, mining and tourism. The region is an enormously significant producer of food for both local consumption and export. It is also part of an internationally recognised biodiversity hotspot, home to a huge diversity of plants and animals unique to this part of the world.

The original natural resource managers of the NAR are the Noongar and Yamatji People. They maintain generations of carefully preserved knowledge about biodiversity conservation and traditional land management practices. A recent study showed that total numbers of birds, mammals, and reptiles were highest on lands managed or co-managed by Aboriginal communities (Schuster et al. 2019). Many Aboriginal people continue to rely on Australia's biodiversity, with bush foods, medicines and materials being an important part of local economies, personal identity, and culture (CSIRO. 2014). The concurrence of Aboriginal people and conservation is a cornerstone of land management for biodiversity in the region. Some examples of conservation in action include

the work of the Aboriginal Biodiversity Conservation Foundation, Gunduwa Regional Conservation Association, Western Mulga, and Bush Heritage Australia's Aboriginal Partnerships.

Approximately 22% of the region's land area (including the island groups) is under the protection of a high-conservation-value network of approximately 150 protected areas. Some of these areas include Kalbarri National Park, the Houtman-Abrolhos Islands National Park, Beekeepers Nature Reserve, Jurien Bay Marine Park, and Lesueur National Park.

Biodiversity in the region is threatened by, amongst other things:

- climate change,
- habitat fragmentation,
- large-scale clearing of native vegetation,
- altered hydrological and fire regimes as a result of changes in land uses,
- disturbance as a result of uncontrolled access to fragile environments, and
- the impacts of introduced diseases, weeds, pests and feral animals.

Management of these threats pertains to protecting the remaining native vegetation in the region, rehabilitating or restoring degraded areas to improve ecological function and connectivity, managing fire appropriately, and limiting the impacts of invasive species.

Some of the critical natural resource management priorities in the NAR consist of working with local communities to build healthy and productive soils in the face of acidity, salinity and wind erosion, maintain water quality and quantity, and ensure that the unique flora and fauna have access to enough good quality habitat to sustain them in the long term. In the NAR, biodiversity assets encompass a diverse range of flora, fauna, and ecosystems, including several designated Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Some examples of these assets include:

Threatened ecological communities:

Banksia Woodlands of the Swan Coastal Plain: These woodlands embody a diverse assemblage of Banksia species, along with other native flora such as Eucalypts, Acacias, and understory shrubs. They provide vital habitat for numerous bird species, small mammals, and reptiles, and contribute significantly to regional biodiversity and ecosystem function.

Eucalypt Woodlands of the WA Wheatbelt: These woodlands are comprised of a complex mosaic of eucalypt tree or Mallet species, and a highly variable understory composition and structure. Iconic to the Wheatbelt, these woodlands support a variety of fauna including birds, insects, and mammals, and play a crucial role in maintaining soil stability and water quality in the region.

Subtropical and temperate coastal saltmarsh: This community consists of multiple organisms including vascular and non-vascular flora, many of which are endemic to the Southwest of WA.

National heritage places:

Lesueur National Park boasts a spectacular diversity of native plant species, some of which are endemic only to the region. This rich diversity includes with more than 900 species found within the park's 27,235 hectares, with 111 of these found only in the NAR region.

While specific national heritage places within the Northern Agricultural region may vary, potential sites could include areas of significant cultural or ecological importance, such as Indigenous heritage sites, ancient rock formations, or unique ecosystems with high biodiversity value.

Wetlands:

Important Bird Areas (IBAs): Designated by BirdLife Australia, IBAs within the NAR may include wetlands, coastal areas, and woodlands that support significant populations of threatened or endemic bird species. These areas are vital for bird conservation efforts and may overlap with other biodiversity hotspots in the region.

Threatened fauna and flora:

Carnaby's cockatoo (*Zanda latirostris*): Carnaby's cockatoo is a charismatic bird species native to the southwest of Western Australia. It relies on native vegetation for feeding and nesting, in particular mature trees that provide suitable hollows. Habitat destruction, illegal poaching, and competition for nesting sites with other bird species are major threats to its population.

Malleefowl (*Leipoa ocellata*): The Malleefowl is a ground-dwelling bird endemic to Australia, found in semi-arid and arid regions, including parts of the Northern Agricultural region. Known for its remarkable mound-building behavior for nesting, this species faces threats such as habitat degradation, predation by introduced predators, and altered fire regimes.

Western Swamp Tortoise (*Pseudemydura umbrina*): Endemic to the southwest of Western Australia, including areas within the Northern Agricultural region, the Western Swamp Tortoise is one of Australia's most endangered reptiles. Dependant on ephemeral wetlands for breeding and foraging, this species is vulnerable to habitat loss, degradation, and predation by introduced species.

Eremophila subangustifolia: This critically endangered species is endemic to the NAR and occurs within a highly restricted range. As a species susceptible to many different threats, key conservation priorities include survey, translocation and seed collection and storage.

Approximately 80 fauna species and nearly 900 flora species are considered under threat in the region. Either approved or interim recovery plans, or conservation advice (DBCA, DCCEEW) are in place to manage many of these threatened species. The Australian Government has provided recent investment in the conservation of NAR populations of Black-flanked Rock-wallaby, Chuditch, Malleefowl, Foote's Grevillea, Fitzgerald’s Mulla-Mulla, and Glossy-leaved Hammer Orchid (National Threatened Species Strategy). These biodiversity assets represent the rich natural heritage of the NAR, and underscore the importance of conservation efforts to preserve its ecological integrity and biodiversity for future generations.

Priority Assets for biodiversity and agricultural natural-capital of the NAR are outlined in this Plan, as defined by their National Strategy, Recovery Plan or Approved Conservation Advice, as well as associated asset descriptions, and susceptibility to threats. These susceptibility ratings are based on the available conservation advice and scientific literature regarding the ecological requirements, behavioural traits, and response mechanisms of each priority asset to the relevant emergency scenarios. The ratings reflect the potential impacts of the emergency scenario on a species' habitat, population dynamics, and the assets long-term viability, considering factors such as habitat specificity, life history traits, or ecological resilience. While this may appear specific to biodiversity assets, agricultural assets can also be categorised and managed using the same criteria of history and resilience.

Australian Sea Lion *(Neophoca cinerea)*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Endangered

Western Australia *Biodiversity Conservation Act 2016* - Endangered

South Australia *National Parks and Wildlife Act 1972* – Vulnerable

Internationally IUCN Red List Threatened Species List – Endangered

Description: The Australian Sea Lion is identifiable by its blunt snout and small, tightly rolled external ears. Males and females are differentiated by their colouration and size. Male fur is dark blackish to chocolate brown with a whitish fur on the crown of the head and nape of the neck, whilst female fur is more silvery-grey above, and yellow to cream below. Pups are dark chocolate brown to charcoal in colour at birth up until their first moult, when colouration becomes highly variable. Following this first moult at 4 to 5 months of age, they will resemble an adult female. Adult females weigh 65-100 kg, compared to adult males, which are much larger and weigh between 180 to 250 kg.

Location within NAR: As the only endemic Sea Lion in Western Australia, they dwell on coastlines from Kalbarri in the north of WA to Kingston in SA. Australian Sea Lion occur in colonies and prefer to inhabit islands. Within the NAR, breeding colonies are located on the Houtman Abrolhos Islands and Islands of the Turquoise Coast, monitored by DBCA. Haul out sites are also recorded at various locations on the mainland coast.

Habitat: Australian Sea Lions prefer sandy beaches in isolated bays, however, tend to utilise a wide range of habitats like exposed islands, rock groins, and reefs for haul out sites. Forage habitat is restricted to the continental shelf where Sea Lions target fish, cephalopods, crustaceans, sharks, rays, penguins and gastropods. Diving to depths of up to 150m, Sea Lions target a range of demersal species.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Australian Sea Lion (*Neophoca cinerea)*	Disease:	Vulnerability to pathogens and parasites.	Moderate	Due to the low recruitment rate of Australian Sea Lion, the mortality of pups due to Hookworm infestation significantly affects the population. Disease outbreaks, such as Tuberculosis, leptospirosis or bacterial infections, can affect Australian Sea Lion health and reproductive success. While these events can lead to localized population declines, the overall impact may be mitigated by the species' wide distribution and dispersed breeding colonies. However, the susceptibility is rated medium due to potential mortality and reduced fitness in affected individuals, particularly in densely populated breeding areas.
	Extreme events	Habitat damage and coastal erosion.	Moderate	Australian Sea Lion populations in the NAR are reliant on low lying islands for breeding and with low reproduction capacity, populations are likely to continue to decline in the predicted scenario of a changing climate. Extreme weather events such as cyclones, storm surges, and sea level rise pose a significant threat to Australian sea lion habitats along coastal dunes and beaches. These events can cause erosion, habitat loss, and nesting site destruction, leading to population declines and reproductive failure. As climate change exacerbates extreme weather patterns, the susceptibility of Australian sea lions to habitat erosion is expected to increase, warranting urgent conservation action.

				Increased frequency and intensity of weather events is likely to disrupt breeding colonies with big wave, inundation and high wind events impacting particularly on low lying habitats i.e. Abrolhos Islands. Australian Sea Lions are limited to breeding on coastal islands in the NAR, and therefore the increased intensity and longevity of heatwaves are likely to negatively impact the regions breeding Sea Lion populations. Low-lying islands such as the Houtman Abrolhos will face pressure from rising sea level, and inundation of fragile island features and ecosystems. Reduction in winter rainfall and increases to temperature may lead to the loss of mangrove forests at the Houtman Abrolhos, an important habitat that provides shelter for Sea Lion pups. Warming ocean temperatures and marine heatwaves cause die off events of marine animals and are likely to cause major disruptions to the availability of key food resources for Sea Lions in the NAR.

Chuditch, Western Quoll *Dasyurus geoffroii*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable

Western Australia *Biodiversity Conservation Act 2016* – Vulnerable

South Australia *National Parks and Wildlife Act 1972* – Endangered

Internationally IUCN Red List Threatened Species List – Near threatened

Description: Chuditch are WA's largest endemic marsupial carnivore. Adult males weigh 1.3 kg, while females weigh around 0.9 kg. Resembling a domestic cat in size and shape, Chuditch have a recognisable rufous grey coat, with 40 to 70 conspicuous white spots. Chuditch have a long tail with black course fur from halfway down their tail to the tip.

Location within NAR: Chuditch are now restricted to isolated populations in the Southwest of WA. In the NAR, reintroduced populations are subsisting in the Kalbarri National Park and at the Australian Wildlife Conservancy (AWC)'s Mount Gibson Sanctuary. Anecdotal evidence also suggests that these populations are now spreading to new locations including Ninghan and Eurardy Station.

Habitat: Chuditch inhabit wet and dry sclerophyll forests including Eucalypt and Mallee open forest, low open forest, woodland, and open shrub. As WA's largest marsupial carnivore, Chuditch are opportunistic feeders and prey on a range of reptiles, invertebrates, birds, other mammals, and carrion. Males forage across a home range of >15km² whilst females have a much smaller home range at 3-4 km².

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Chuditch, Western Quoll *Dasyurus geoffroii*	Drought	Reduced availability of resources.	Moderate	Following reintroduction, and with appropriate management, Chuditch are able to maintain their population numbers. The fragmented and isolated nature of both their population and habitat means a broad scale extreme event could cause a local population decline.

	Fire	Habitat destruction and structural change. Chuditch mortalities due to fire and increased predation.	Moderate	Inappropriate and high intensity fire reduces habitat features and quality, and removes prey items critical to population survival. Changes to habitat structure caused by fire have previously resulted in greater exposure to predators. Following reintroduction and with appropriate management, Chuditch are able to maintain their population numbers. The fragmented and isolated nature of both their population and habitat means a broad scale extreme event could cause a local population decline.
	Extreme events	Severe weather events can damage habitat critical to Chuditch survival. Extreme weather may also directly contribute to mortalities	Moderate	Predicted rainfall decline and temperature increase is likely to reduce food and habitat resources. Heatwaves and cold snaps are likely to impact on Chuditch populations and the prey resources they rely on. Following reintroduction and with appropriate management, Chuditch are able to maintain their population numbers. The fragmented and isolated nature of both their population and habitat means a broad scale extreme event could cause a local population decline.

Greater Bilby *Macrotis lagotis*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable

Western Australia *Biodiversity Conservation Act 2016* – Vulnerable

Queensland *Nature Conservation Act 1992* – Endangered

Northern Territory *Territory Parks and Wildlife Conservation Act 2006* – Vulnerable

South Australia *National Parks and Wildlife Act 1972* – Vulnerable

Internationally IUCN Red List of Threatened Species – Vulnerable

Description: A medium sized nocturnal mammal, Greater Bilby has a long nose and large ears, long soft bluish-grey fur over most of its body, a white to cream underside, and a black and white tail. The Greater Bilby is a burrowing species, so is equipped with strong-clawed front feet for digging, and slender hind limbs. Male Greater Bilby's can reach weights of up to 2.5kg, whereas the females, considerably smaller, reach up to just 1.1kg.

Location in the NAR: Greater Bilby is currently only found in the NAR within the predator proof sanctuary at the AWC's Mt Gibson Sanctuary.

Habitat: Greater Bilby historically occupied a range of habitats within a wide range of climatic zones, soils, vegetation, and landforms across as much as 70% of Australia.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Greater Bilby *Macrotis lagotis*	Drought	Reduced availability of resources.	Moderate	Predicted drought periods becoming more severe and longer lasting will likely affect, and possibly alter permanently, habitat and food resources. Greater Bilby in the NAR is restricted to the predator proof enclosure at AWC's Mt Gibson Sanctuary. Therefore, a prolonged drought event could result in a large local population decline. Outside of the NAR, wild Greater Bilby populations are more widespread and may have greater capacity to withstand drought conditions.

	Fire	Habitat destruction and structural change. Greater Bilby Mortalities due to fire and increased predation.	Moderate	Inappropriate and high intensity fire reduces critical habitat features and habitat quality, and removes forage availability. Changes to habitat structure caused by fire have previously resulted in greater exposure to predators. The population of Greater Bilby within the NAR is restricted to the predator proof enclosure at AWC's Mt Gibson Sanctuary. An intense broad scale fire event would be devastating to this single population. Outside of the NAR, Greater Bilby populations are more widespread, and single fire within the NAR is unlikely to cause impacts to the wider wild population.
	Extreme events	Severe weather events can damage critical habitat. Extreme weather may cause direct mortalities.	Moderate	Predicted rainfall decline and temperature increase will likely reduce food and habitat resources directly. Heatwaves and cold snaps are likely to impact on Greater Bilby populations and the forage resources they rely on. The Greater Bilby population within the NAR is restricted to the predator proof enclosure at AWC's Mt Gibson Sanctuary. An extreme event could be devastating to this single population. Outside of the NAR, Greater Bilby populations are more widespread and managed outside of enclosed sanctuaries.

Numbat *Myrmecobius fasciatus*

Commonwealth *Environment Protection and Biodiversity Conservation ACT 1999* – Endangered

Western Australia *Biodiversity Conservation Act 2016* – Endangered

Internationally IUCN Red List of Threatened Species – Endangered

Description: Numbat is a small, diurnal marsupial with reddish-brown fur and a distinct horizontal black stripe across the eye. Numbat have faintly coloured white bands on its shoulder that become more distinct towards the rump, where black bands accentuate each stripe. The underside fur of its body is cream coloured. Its tail is fluffy with long brown fur and white tips, while the underside fur of its tail is brick-red coloured. Males can weigh up to 700g, and females weigh much less, around 550g.

Location in NAR: Numbat is now only found within the predator proof zone of AWC's Mt Gibson Sanctuary in the NAR.

Habitat: Historically, Numbat once inhabited a range of different environments, from mulga woodland and spinifex sandplains to eucalypt forests. Numbat prefer large, hollow, fallen logs for shelter. If unavailable, they will construct a burrow of up to two metres in length and with a small chamber at the end. Numbat were found across much of arid and semi-arid southern Australia, however, only two naturally occurring populations remain, both in south-west Western Australia.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Numbat *Myrmecobius fasciatus*	Drought	Reduced availability of resources.	Moderate	Predicted drought periods becoming more severe and longer lasting will likely affect, and possibly alter permanently, habitat and food resources. The Numbat within the NAR is restricted to the predator proof enclosure at AWC's Mt Gibson Sanctuary. A prolonged drought event on this single restricted population may be devastating. Outside of the NAR Numbat populations are more widespread and managed outside of enclosed sanctuaries.

	Fire	Habitat destruction and structural change. Numbat Mortalities due to fire and increased predation	High	Numbat mortalities occur as a direct result of fire. Inappropriate and high intensity fire reduces critical habitat features and habitat quality, and removes prey items essential for the population survival. Changes to habitat structure caused by fire have previously resulted in greater exposure to predators. The Numbat population within the NAR is restricted to the predator proof enclosure at AWC's Mt Gibson Sanctuary. An intense broad scale fire event would be devastating to this single population. Outside of the NAR, Numbat populations are managed outside of enclosed sanctuaries.
	Extreme events	Severe weather events can damage habitat critical to Numbat survival and extreme weather may cause mortalities	Moderate	Predicted rainfall decline and temperature increase will likely reduce food and habitat resources directly. Increased longevity and intensity of heatwaves and cold snaps are likely to impact on Numbat populations and the prey resources they rely on. The Numbat population within the NAR is restricted to the predator proof enclosure at AWC Mt Gibson Sanctuary. An extreme event could be devastating to this single population. Outside of the NAR, Numbat populations remain outside of managed enclosures.

Carnaby's cockatoo *Zanda latirostris*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Endangered

Western Australia *Biodiversity Conservation Act 2016* – Endangered

Internationally IUCN Red List of Threatened Species – Endangered

Description: Carnaby's cockatoos are large black cockatoos weighing between 520g and 790g at maturity. Their body feathers are brownish black with narrow dull-white scalloping, and their tail feathers are black with large white windows.

Location within NAR: Within the NAR, the endangered Eucalypt Woodlands of the WA Wheatbelt is a key habitat for Carnaby's cockatoo breeding. During the non-breeding season, Carnaby's cockatoos rely on the Proteaceous heaths, which, in the NAR, are located on the sandy soils of the Geraldton Sandplains and the Swan Coastal Plain Bioregions.

Habitat: Being semi migratory, Carnaby's cockatoos utilise remnant Eucalypt Woodlands that boast mature trees (>120 years) with suitable hollows for breeding. During non-breeding season, Carnaby's cockatoos migrate nearer to the coast to forage. It is during this time that younger birds are able to form bonded pairs prior to the upcoming breeding season.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Carnaby's cockatoo *Zanda latirostris*	Drought	Reduced availability of resources	Moderate	Prolonged drought conditions can lead to significant loss or damage to natural vegetation, and reduction/ cessation of seasonal flowering and seed set, reducing availability of forage and seed store for regeneration. Drier than normal conditions can cause damage to old growth Eucalyptus woodlands, including limb loss and even total tree loss.
	Disease	Carnaby cockatoo Mortality.	Moderate	Diseases among Carnaby's cockatoos (Hind-limb paralysis) are not yet well understood. Previously recorded mass mortality events have been linked to agricultural chemicals.

		Phytophthora Dieback habitat loss.		Phytophthora Dieback seriously impacts Proteaceous heaths, which are important to Carnaby cockatoo forage.
	Fire	Habitat destruction and structural change.	High	Increased intensity and frequency of fire within isolated old growth habitat poses a serious threat to Carnaby's breeding populations. The required longevity to form adequate hollows of >120 years could result in individual breeding populations becoming unviable with one event.
	Extreme events	Severe weather events can damage habitat critical Carnaby's cockatoo. Extreme weather can cause mortalities	Moderate	Predicted rainfall reduction and increased temperatures are likely to reduce suitable breeding habitat. Increased longevity and intensity of heatwaves and cold snaps are likely to impact on Carnaby's cockatoo populations and forage resources they rely on. More intense and frequent weather events, such as Cyclone Seroja, are likely to cause the local extinction of breeding Carnaby populations through damage to old growth breeding habitat.

Malleefowl *Leipoa ocellata*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable

Western Australia *Biodiversity Conservation Act 2016* – Vulnerable

Northern Territory *Territory Parks and Wildlife Conservation Act 2000* – Critically endangered

South Australia *National Parks and Wildlife Act 1972* – Vulnerable

New South Wales *Biodiversity Conservation Act 2016* – Endangered

Victoria *Flora and Fauna Guarantee Act 1988* – Endangered

International IUCN Red List of Threatened Species – Vulnerable

Description: Malleefowl are large, ground-dwelling birds with cryptic colouration. Weighing up to 2.5kg and reaching 60 cm in length, they are often compared to a domestic chicken. Male and female Malleefowl have the same colouration, with cream feathers on their breast and underside, a distinct black lateral stripe on their chest, and an intricate pattern of white, brown, reddish brown, grey and black across their wings and neck.

Location within NAR: Malleefowl are found across most of inland NAR, favouring dense Melaleuca shrubland for breeding habitat. While Malleefowl were once widespread, they are now restricted to isolated patches of remnant vegetation within NAR.

Habitat: As a mound building species, Malleefowl require loose substrate and fallen leaf litter to build their large incubating nests. Using large feet, they create a mound up to 5 metres wide and 1 metre high. They then rake nearby fallen debris into the mound, which generates heat as it breaks down. As omnivores, Malleefowl utilise a range of habitats for forage, including Eucalypt Woodlands, Arid and Semi-arid shrublands, Proteaceous heaths, road verges, and open farm paddocks.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Malleefowl *Leipoa ocellata*	Drought	Reduced availability of resources and loss of habitat integrity.	Moderate	Prolonged drought conditions can lead to significant loss or damage to natural vegetation and the reduction/ cessation of seasonal flowering and seed set, impacting forage species and natural regeneration in habitat, which Malleefowl rely on. Drought conditions may lead to deaths and a reduction in local Malleefowl population numbers.

	Fire	Habitat destruction and structural change. Mortality due to fire and increased predation.	High	Malleefowl require long, unburnt habitat to successfully breed (>40years). Predicted climate change with declining rainfall may lead to an increase in intensity and frequency of fire events within Malleefowl habitat. Changes to vegetation structure following fire can lead to higher rates of predation.
	Extreme events	Severe weather events can destroy the integrity of Malleefowl habitat	Moderate	Predicted rainfall decline and increased temperatures are likely to reduce suitable breeding habitat for Malleefowl. Increased longevity and intensity of heatwaves and cold snaps are likely to impact on Malleefowl populations and the resources they rely on for nest building shelter and forage. Malleefowl rely on rainfall for successful breeding. Predicted declines in rainfall and increasing temperatures are likely to reduce the viability of some local populations in the NAR. The patches of Malleefowl habitat within the NAR are small and isolated, making them more susceptible to impacts from extreme weather events.

Australasian Bittern *Botaurus poiciloptilus*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Endangered

Western Australia *Biodiversity Conservation Act 2016* – Endangered

New South Wales *Biodiversity Conservation Act 2016* - Endangered

South Australia *National Parks and Wildlife Act 1972* - Vulnerable

Victoria *Flora and Fauna Guarantee Act 1988* - Threatened

International IUCN Red List of Threatened Species - Vulnerable

Description: The Australasian Bittern is a large, partially nocturnal bird which grows up to heights of 71cm and weighs 1.1 kg on average. The eyebrow and throat are pale, while the side of the neck is dark brown. The upper parts are patterned dark brown, buff and black, and the underside is a streaked brown and buff. The bill is brown and the legs are greenish in colour.

Location within NAR: Australasian Bittern is restricted to wetlands located in the shire of Gingin, in the south of the NAR.

Habitat: Favouring wetland and coastal areas, Australasian Bittern prefer habitats with reed beds, sedges, rushes, reeds, or cutting grass. They mainly occur in freshwater or brackish wetlands and estuaries.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Australasian Bittern *Botaurus poiciloptilus*	Drought	Reduced availability of resources and loss of habitat integrity.	Medium	Predicted drought periods becoming more severe and longer lasting will likely permanently damage habitat refugia within the NAR, with the potential for it to become lost or unavailable as required.
	Fire	Habitat destruction and structural change.	High	Predicted drier weather conditions within the NAR increases the likelihood of more frequent and intense fire events, which will likely reduce the wetland ecosystem condition or availability.
	Extreme events	Severe weather events can	Medium	Predicted rainfall reduction and increased temperatures are likely to reduce suitable habitat for

		damage habitat critical Carnaby's cockatoo survival and extreme weather events can cause mortalities.		Australasian Bittern within its restricted range in the NAR. Predicted rainfall decline and the resulting reduction in peak water level and extent of key wetlands is likely to negatively impact on the quality and quantity of habitat available within the NAR. Increased longevity and intensity of heatwaves and cold snaps are likely to impact on Australasian Bittern populations and forage resources within the NAR.

Western Swamp Tortoise *Pseudemydura umbrina*

Commonwealth *Environment Protection and Conservation Act 1999* - Critically endangered

Western Australia *Biodiversity Conservation Act 2016* – Critically endangered

International IUCN Red List threatened species – Critically endangered

Description: The Western Swamp Tortoise are a freshwater species with a distinct appearance. It is identifiable by its short neck, brown or black shell, five clawed webbed feet, and its tubercles covered neck. Western Swamp Tortoise are the smallest Australian Chelidae (Freshwater turtle). An adult male carapace can grow to lengths of up to 155 mm, weighing no more than 550g. Females are smaller, growing a carapace of lengths up to 135 mm, and weighing in at 410g. The shape of the plastron and the length of the tail are determining factors of the animal's gender.

Location within NAR: The Western Swamp Tortoise is endemic to WA, found only on the clay soils of the highly modified and largely cleared ephemeral wetlands of the Swan Coastal Plain. Within the NAR, the Western Swamp Tortoise is limited to a translocation site within a DBCA managed reserve in the Moore River catchment.

Habitat: The Western Swamp Tortoise lives in shallow, winter-wet swamps that form on clay or sand over-clay areas. During summer months, the tortoise aestivates, which requires suitable habitat close to its swamp habitat. These summer refuges can be dense leaf litter, fallen logs, naturally occurring holes in clay substrate, hollows at tree bases, and burrows dug by other animals.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Western Swamp Tortoise *Pseudemydura umbrina*	Drought	Reduced availability of resources and loss of habitat integrity and availability.	High	Predicted drought conditions becoming more intense and longer lasting will likely permanently damage habitat for the Western Swamp Tortoise within the NAR, with the potential for it to become lost or unavailable as required.
	Fire	Habitat destruction and structural change.	High	Predicted drier weather conditions within the NAR increases the likelihood of more frequent and intense fire events, which will likely reduce the wetland ecosystem condition or availability. Changes to habitat structure due to fire have previously increased predation rates.
	Extreme events	Severe weather events can damage habitat and resources critical to the Western Swamp Tortoise	Medium	Predicted rainfall decline, increasing temperatures, and the resulting reduction in peak water level and extent of key wetlands is likely to negatively impact on the quality and quantity of habitat available within the NAR. Increased longevity and intensity of heatwaves and cold snaps are likely to have a negative impact on Western Swamp Tortoise populations and key resources within the NAR.

Foote's Grevillea *Grevillea calliantha*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Critically endangered

Western Australia *Biodiversity Conservation Act 2016* – Critically endangered

Internationally IUCN Red List of Threatened Species – Critically endangered

Description: A rigid spreading shrub, Foote's grevillea grows to approximately 1 metre high and 2 to 3 metres wide. The rigid (up to) seven lobed leaves are greyish-yellow green in colour and grow up to 7.5 cm long. The flower heads form on the edges and lower sides of the branches, and each has 15 to 30 pouched flowers. The flowers grow to roughly 8 mm long, and are hairy and greenish-yellow, becoming orange in colour as they age. The distinct style is maroon-blackish and up to 40 mm long. Foote's grevillea flowers from August to November.

Location with NAR: Foote's grevillea has a highly restricted distribution, with the wild population occurring within an 8km range. There is more than one translocation site within the NAR to protect the species, and provide both seed and an insurance population.

Habitat: Foote's grevillea is endemic to the Cataby area of Western Australia. The species grows among *Eucalyptus todtiana* and *Corymbia calophylla*, in sandy or sandy-clay soil located in open, low woodland on lower to mid-level hill slopes.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Foote's grevillea *Grevillea calliantha*	Drought	Prolonged drought conditions can lead to Foote's grevillea mortality and habitat loss.	High	Predicted drought conditions becoming more intense and longer lasting will likely impact Foote's grevillea populations by reducing seed set, causing mortalities, and reducing habitat condition.
	Disease	Phytophthora Dieback	Moderate	Proteaceous species are typically susceptible to Phytophthora Dieback. The limited distribution and population of Foote's grevillea means that in the event of Phytophthora Dieback infestation, it is at risk of further population decline/ local extinction.
	Fire	Loss of habitat and mortality.	High	Predicted rainfall decline and increased temperatures are expected to increase fire intensity and frequency within the distribution of Foote's grevillea. This could lead to population decline or local extinction.
	Extreme events	Extreme events can cause decline in habitat condition and population numbers.	Medium	Predicted heatwaves and cold snaps are likely to cause population declines and loss of habitat. Severe weather such as cyclones, wind, and storm events can damage critical habitat and individual plants, leading to population decline.

Scaly-butt Mallee (*Eucalyptus leprophloia)*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Critically endangered

Western Australia *Biodiversity Conservation Act 2016* – Critically endangered

Internationally IUCN Red List of Threatened Species – Critically endangered

Description: Scaly-butt mallee is an erect mallee that grows to 5 metres tall. Its distinctive scaly, curly bark grows 1 metre up the mallee trunks, where it meets the upper bark, a smooth grey over pale-copper colour. Adult leaves are dull green in colour, and grow up to 14 cm long and 2.5 cm wide. The egg-shaped buds are 7 mm long and 4 mm wide, and sit on short stalks. The flowers are a creamy-white colour, and form cup-shaped fruits to the size of 7 mm long and 6 mm wide.

Location within NAR: Scaly-butt mallee is endemic to the NAR, where six recorded populations occur from Badgingarra in the south to Mingenew in the north.

Habitat: Scaly-butt mallee occurs within a range of habitats, including brown loam over laterite on hill slopes, in white sand on valley slopes in wandoo woodland, grey sand and laterite with Coastal blackbutt, on breakaway valley slopes in grey sandy clay loam, and in grey sand and lateritic gravel with Marri and Wandoo.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Scaly-butt Mallee *Eucalyptus leprophloia*	Drought	Prolonged drought conditions may lead to Scaly-butt mallee mortality and habitat loss.	Low	Predicted drought conditions becoming more intense and longer lasting are likely to have impacts on Scaly-butt mallee populations, causing mortality, reducing recruitment opportunities, and negatively impacting habitat conditions.
	Disease	Phytophthora Dieback	Moderate	Proteaceous species are susceptible to Phytophthora Dieback. The limited habitat distribution of Scaly-butt mallee occurs in vegetation susceptible to the disease, which may contribute to the further decline of Scaly-butt mallee populations.
	Fire	Loss of habitat and mortality due to fire	High	Predicted rainfall decline and increased temperatures are expected to increase fire intensity and frequency within the distribution of Scaly-butt mallee. This could lead to population decline or local extinction.
	Extreme events	Extreme events can cause decline in habitat condition and population numbers.	Medium	Predicted heatwaves and cold snaps are likely to cause population declines and loss of habitat. Severe weather such as cyclones, wind, and storm events can damage critical habitat and individual plants, leading to population decline.

Narrow-leaf Eremophila *(Eremophila subangustifolia)*

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Critically endangered

Western Australia *Biodiversity Conservation Act 2016* – Critically endangered

Internationally IUCN Red List of Threatened Species – Critically endangered

Description: Narrow-leaf Eremophila is an upright shrub, growing up to 1.6 m high and presenting pale lilac flowers from July to September

Location within NAR: Endemic to the NAR, Narrow-leaf Eremophila grows in a highly restricted range, on land previously cleared for agricultural use, and sealed road access south of Lake Logue.

Habitat: Narrow-leaf Eremophila grows in slightly saline, pale brown sandy-clay soils on the edges of winter-wet flats and lakes.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Narrow-leaf Eremophila *Eremophila subangustifolia*	Drought	Prolonged drought conditions may lead to Scaly-butt mallee mortality and habitat loss.	Low	Predicted drought conditions becoming more intense and longer lasting are likely to affect Narrow-leaf Eremophila populations, causing mortality, reducing recruitment opportunities, and negatively impacting habitat conditions.
	Disease	Phytophthora Dieback	Moderate	Proteaceous species are susceptible to Phytophthora Dieback. The limited habitat distribution of Narrow-leaf Eremophila occurs within vegetation susceptible to the disease, which may contribute to the further decline of Narrow-leaf Eremophila populations.
	Flood	Flooding is known to cause significant plant mortality.	High	The small population size and previous history of mortality following flooding points to a high risk of population decline in the event of flooding.
	Fire	Loss of habitat and mortality due to fire	High	Predicted rainfall decline and increased temperatures are expected to increase fire intensity and frequency within known range of Narrow-leaf Eremophila. As a relatively short-lived species requiring infrequent fire to stimulate germination of soil-stored seed, an increase in frequency and intensity of fire events may reduce the natural seed bank if fire occurs before plants reach maturity. This could lead to population decline.
	Extreme events	Extreme events can cause decline in habitat condition and population numbers.	Medium	Predicted heatwaves and cold snaps are likely to cause population declines and loss of habitat. Severe weather such as cyclones, wind, and storm events can damage critical habitat and individual plants, leading to population decline.

Eucalypt Woodlands of the WA Wheatbelt

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Critically endangered

Western Australia *Biodiversity Conservation Act 2016* – Critically endangered

Description: Eucalypt Woodlands of the Wheatbelt dominated the Wheatbelt landscape prior to European clearing. Made up of a complex mosaic of eucalypt species with a tree or mallet form and an understorey of highly variable in structure and composition, the woodland associations are closely aligned to the geology and climate characteristics of its location.

Location within NAR: This ecosystem is endemic to the Southwest of WA within the NAR, and is located in highly modified and extensively cleared Wheatbelt zone associated with the geology of the Yilgarn Craton.

Habitat: There is a close association between rainfall and the location of the ecosystem, varying from 600 mm/year rainfall closer to the coast to about 300 mm/year at its eastern edge, defined by warm wet winters and hot dry summers.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Eucalypt Woodlands of the WA Wheatbelt	Drought	Prolonged drought conditions may lead to tree mortality	Moderate	Predicted drought conditions becoming more intense and longer lasting will likely impact Eucalypt Woodlands of the Wheatbelt communities by causing mortality, reducing recruitment opportunities, and negatively impacting habitat condition.
	Disease	Phytophthora Dieback Myrtle rust	Low	Establishment of some pests and diseases in WA would have a significant impact on the Eucalypt Woodlands of the WA Wheatbelt. *Phytophthora* sp. and other plant pathogens have the potential to reduce species diversity and structure within this community.
	Plague	Insect damage Grazing herbivore damage	Low	The recent Shothole borer incursion been identified within in a small number of Eucalyptus hosts. High numbers of grazing animals can stop natural recruitment.
	Flood	Waterlogging and salinity	High	Increased salinity and waterlogging of the landscape, largely due to historic clearing, reduces the condition and extent of Eucalypt Woodlands of the WA Wheatbelt. The small and isolated nature of the community contributes to the high risk of local extinction.
	Fire	Altered Fire regime intensity and frequency	High	Predicted rainfall decline and increased temperatures are expected to increase fire intensity and frequency within the known distribution of this community. An increase in frequency and intensity may result in a reduced seed bank, and death of fire susceptible species such as Salmon gum. Occurrence of fire too often or at inappropriate intervals could lead to population decline, loss of structure and diversity, or local extinction.
	Extreme events	Extreme events can cause damage this community condition and reduce recruitment	Moderate	Predicted heatwaves and cold snaps are likely to cause stress to trees, resulting in changes in the community composition and structure. Severe weather such as cyclones, wind, and storm events can uproot trees and damage habitat condition. Reduced rainfall is likely to change the distribution and viability of some remnant populations.

Banksia Woodlands of the Swan Coastal plain

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – Endangered

Western Australia *Biodiversity Conservation Act 2016* – Endangered

Description: Banksia Woodlands of the Swan Coastal Plain are endemic to the Southwest of WA. Their composition includes a prominent tree layer of Banksia's with scattered eucalypts and other tree species among or emergent from the woodland. The understory has a high level of diversity, made up of dry sclerophyll shrubs, grasses, sedges, rushes, and herbs. Other central characteristics of this community are high endemism and local variation.

Location within NAR: This ecosystem is endemic to the Southwest of WA within the NAR, located on the highly modified and extensively cleared Swan Coastal Plain from Jurien Bay in the north to Dunsborough in the south.

Habitat: The Banksia Woodlands are closely associated with the geology and the Mediterranean climate of the regions. This community inhabits the Swan Coastal Plain bioregion, growing on the deep, nutrient poor sands of the ancient Spearwood and Bassendean dune systems. The dominant Banksia species within this habitat include *Banksia attenuata* (Candlestick banksia) and *Banksia menziesii* (Firewood banksia).

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Banksia Woodlands of the Swan Coastal Plain	Drought	Prolonged drought conditions may lead to mortality and loss of biodiversity	Moderate	Predicted drought conditions becoming more intense and longer lasting will likely impact the diversity, structure, and condition of the Banksia Woodlands of the Swan Coastal Plain by causing plant stress, mortality, and reducing recruitment.
	Disease	Insect damage Phytophthora Dieback	Low	Establishment of some pests and diseases in WA would have a significant impact on threatened communities such as Banksia Woodlands. Phytophthora Dieback, Myrtle rust, and other plant pathogens, if introduced, have the potential to reduce species diversity and structure within this community.
	Fire	Altered Fire regime intensity and frequency	High	Predicted rainfall decline and increased temperatures are expected to increase fire intensity and frequency within the known distribution of this community. An increase in frequency and intensity may result in a reduced seed bank and poor recruitment. Although this community is considered fire-dependent, high intensity fire, or occurrence of fire too often or at inappropriate intervals could lead to population decline, loss of structure and diversity, or local extinction.
	Extreme events	Extreme events can cause damage this community condition and reduce recruitment	Moderate	Predicted heatwaves and cold snaps are likely to cause stress that may change the community's diverse vegetation composition and structure, reducing overall habitat condition. Severe weather such as cyclones, wind, and storm events can uproot trees and damage habitat condition. Reduced rainfall is likely to change the distribution and the viability of some remnant populations.

Sub-tropical and temperate coastal saltmarsh

Commonwealth Environment Protection and Biodiversity Conservation Act 1999 – Vulnerable

Description: Subtropical and temperate coastal saltmarsh are defined by their location within the tidal impact zone, and the organisms that occur within them. Their floristic assemblage is comprised of salt tolerant or halophytic species of grasses, herbs, sedges, rushes, and shrubs that usually succulent in nature. The community also includes non-vascular flora of diatoms, epiphytic algae, and cyanobacterial mats.

Location within NAR: Subtropical and temperate coastal saltmarsh in the NAR occurs in association with estuaries from Kalbarri in the north to Guilderton in the south.

Habitat: The physical environment for the ecological community is coastal areas under regular or intermittent tidal influence, which, within the NAR, is usually associated with estuaries. Species assemblage is influenced by drainage characteristics, soil type, tidal pattern, and elevation, each varying with salinity and inundation conditions.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Subtropical and temperate saltmarsh	Fire	Fire intolerant flora impacts	Low	Predicted rainfall decline and increased temperatures are expected to increase fire intensity and frequency within the known distribution of this community. Some species within this community are fire intolerant, meaning the community requires protection from planned or unplanned fires.
	Extreme events	Habitat loss	High	Rising sea levels threaten to submerge saltmarshes, leading to habitat loss and changes in plant communities. Storms of increasing frequency and intensity threaten to erode saltmarshes and disrupt their ecological functions.

Lesueur National Park

Commonwealth Environment Protection and Biodiversity Conservation Act 1999 – National Heritage

Western Australia *Conservation and Land Management Act 1984* – National Park

Description: National Parks in WA protect significant landscapes, heritage and cultural values, and provide refuge, conserving WA's diverse and often endemic plants and animals**.** Lesueur National Park is home to 122 species of native birds, 52 species of reptiles, and more than 900 species of flora. Lesueur National Park is also geologically diverse, ranging from Mesa formations to salt lakes and remnant coastal dunes.

Location in NAR: Lesueur National Park is located 250km north of Perth and 20kms east of Jurien Bay. At 24 kilometres wide, it spans across 26,987 hectares.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Lesueur National Park	Drought	Habitat and diversity loss Increased fire risk	Moderate	Predicted drought conditions becoming more intense and longer lasting will likely impact the diversity, structure and condition of the Lesueur National Park, causing plant stress, mortality, and reducing recruitment opportunities. Dry, stressed or dead vegetation is likely to increase the risk of fire within Lesueur National Park.
	Disease	Insect damage Phytophthora Dieback	Moderate	Lesueur National Park is currently relatively free of Phytophthora Dieback. Phytophthora Dieback or Myrtle Rust infestation may damage the diversity, condition, and structure of this National Park.
	Fire	Fire intolerant flora impacts	Moderate - high	Predicted rainfall decline and increased temperatures are expected to increase fire intensity and frequency within the known distribution of this community. The diversity of this National Park means that some areas will be fire dependent and others fire sensitive, therefore increases in intensity and frequency of fire may have a moderate to high impact, depending on the community impacted.
	Extreme events	Habitat loss	Moderate - high	Predicted heatwaves and cold snaps are likely to cause stress that may change the community's diverse vegetation composition and structure, reducing overall habitat condition. Severe weather such as cyclones, wind, and storm events can uproot trees and damage habitat condition. Reduced rainfall is likely to change the diversity and distribution of species that are integral to Lesueur National Park.

Agricultural Soils

Commonwealth *National Soil Strategy 2023 – 2028*

Western Australia *Soil and Land Conservation Act 1945*

Description: Soil is the loose, inorganic particles and organic matter that covers most land surfaces, essential in sustaining terrestrial life. Soil is formed through slow and complex processes, and is influenced by variables like geology and location. Soil is a combination of physical, chemical, and biological properties that support plant growth, and provide ecosystem services and habitat for soil organisms. Soil is defined by a range of characteristics, which in turn determine the suitability of soil for agricultural practices. In terms of agriculture, soil is classified into two categories; arable cropping and pasture.

Location within NAR: The NAR covers an area of over 7.5 million hectares, with 70 per cent of land used for mixed farming activities. Around 93 per cent is used for cropping, with the remaining 7 per cent used for pastoral leases.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Agricultural Soils	Flood	Damage soil condition through waterlogging and salinity	Low	Waterlogging and flood events can permanently damage agricultural soils and lead to salinity, compaction, acid sulphate soils, and sheet erosion of topsoil.
	Disease	Loss of productivity	Moderate	Cropping and pastoral soils are susceptible to pathogens and diseases that affect production species (plants and animals) and require ongoing integrated pest management.
	Drought	Loss of vegetation cover and soil fertility, biology and health	Moderate	Most of the cropping and pastoral agriculture in the NAR is rainfall dependant, and with drought in the NAR predicted to become longer and hotter, it will likely reduce/ prevent the viability of some agricultural properties. Drought conditions leave the topsoil devoid of vegetative cover and expose the soil to the risk of erosion, reducing soil availability and health.
	Extreme events	Damage soil condition and biology, Loss of topsoil	Moderate	Predicted frequency and intensity of extreme events such as heat waves and cold snaps is likely to impact soil health across the NAR. Extreme weather events are predicted to increase in intensity and frequency, contributing to the risk for this asset. Erosion, leaching, and structural damage impact the stability and fertility of agricultural soils.

Water resources

Commonwealth *Water Act 2007*

Western Australia *Country Areas Water Supply Act 1947, Metropolitan Arterial Drainage Act 1982, Metropolitan Water Supply, Sewerage, and Drainage Act 1909, Rights in Water and Irrigation Act 1914, Water Agencies (Powers) Act 1984, Waterways Conservation Act 1976*

Description: The NAR's main water resources are surface water and groundwater.

Location within NAR: The NAR's water resources include 5 major river systems and numerous groundwater resources. The NAR is comprise of relatively flat landscape with the majority of the Agricultural activity occurring in sandplain/floodplain systems. Most permanent surface water

locations are at the lower catchment area with varying levels of water quality. Salinity has impacted many inland systems and water sources are impacted by salinity.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Water resources	Drought	Loss of vegetation cover and soil fertility, biology and health	Moderate	Drought conditions in the NAR are predicted to become longer and hotter. Surface water availability and quality will be diminished, impacting the many biodiversity and agricultural assets reliant on surface water availability and/or quality. Water quality will also decline following periods of drought, as the loss of vegetative cover expose the soil to the risk of erosion, causing increased sedimentation of water resources when rainfall does occur.
	Plague	Damage to water bodies	Low	Introduction of aquatic pests can damage the condition and stability of water assets. Introduction of Tilapia to rivers across the NAR has impacted the condition and diversity of in stream ecosystems.
	Fire	Increased Run-off and sedimentation	Low	Predicted rainfall decline and increased temperatures are expected to increase fire intensity and frequency within the catchments of surface water assets, leading to increased run-off and sedimentation. Loss of vegetation around surface water assets will increase evaporation and concentration of salt in salinity-affected areas.
	Extreme events	Sheet erosion, sedimentation, loss of vegetation associated with surface water ecosystems	Moderate	Extreme weather events, including intense and unseasonal rainfall events, can cause increased sedimentation of waterways, a result of sheet (water) erosion washing at-risk soils into waterways. High winds during extreme events can (and have) caused damage to and loss of vegetation associated with surface water systems, reducing bank stability, water quality, and the loss of other ecosystem services.

Native vegetation

Commonwealth Australia's Native Vegetation Framework

Western Australia Native vegetation policy for Western Australia

Description: The NAR's native vegetation is diverse and contains many endemic species. However, following European settlement and historic clearing for agriculture, it is now largely cleared. Native vegetation is an important agricultural asset and provides valuable ecosystem services.

Location within NAR: Most vegetation in the NAR occurs outside of state managed nature reserves remnant vegetation, and is generally restricted to small and isolated patches. It is usually found along waterways and creeks, wetlands, and rocky outcrops, with a considerable portion located on privately managed (agricultural) land.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Native Vegetation	Drought	Drought stress	Moderate	Predicted drought events becoming longer and hotter are likely to cause long term changes and loss of biodiversity in native vegetation. Farm systems rely on the ecosystem services provided by native vegetation, including pollination services, wind breaks, hydrology catchment, and erosion control.
	Disease	Loss of ecosystem services and biodiversity	Moderate	A range of pathogens can affect native vegetation and lead to loss of condition and biodiversity, in turn reducing the quality or quantity of ecosystem services provided to the farm systems.

	Plague	Loss of ecosystem services and biodiversity	Moderate	A range of pests can cause damage to native vegetation, including locusts, rabbits, and introduced invertebrates. This can reduce the condition and extent of remnant vegetation and negatively affect the quality and quantity of the ecosystem services to farm systems.
	Fire	Loss or damage to asset	Moderate	Predicted conditions in the NAR becoming drier and hotter are likely to increase the frequency and intensity of bushfire events. This can severely impact the condition, extent, and diversity of natural vegetation and lead to a loss or reduction in ecosystem services important to farming systems.
	Extreme events	Loss or damage to asset	Moderate	Predicted frequency and intensity of extreme events such as heat waves and cold snaps are likely to negatively impact on the condition, extent, and diversity of native vegetation across the NAR, leading to a loss or reduction in ecosystem services important to farming systems. Extreme weather events are predicted to increase in intensity and frequency, contributing to the risk for this asset. Physical and structural damage is likely to impact the condition, extent, and diversity, reducing the quality and quantity of the ecosystem services provided to farming systems.

6. ASSET RISK (PREPAREDNESS)

To ensure preparedness and safeguard the NAR's assets, proactive measures can be taken. This includes conducting risk assessments, establishing warning systems, implementing land use planning measures, promoting sustainable agricultural practices, restoring riparian zones, and organizing community education campaigns. By undertaking preparedness actions, stakeholders can minimize threats, protect vital resources, and ensure the resilience and sustainability of the region's ecosystems and farming enterprises. Proactive approaches are vital to enhance the region's resilience and sustainability in the face of various threats. Preparedness actions for each of the identified emergency scenarios are outlined in the following sections.

6.1 Flood

To improve flood preparedness and mitigate threats to agricultural and biodiversity assets in the NAR, several proactive actions can be undertaken:

Floodplain Mapping and Risk Assessment: Conduct comprehensive floodplain mapping and risk assessments to identify areas prone to flooding and assess the potential impact on agricultural lands and biodiversity hotspots. This action would typically be undertaken by government agencies such as the Department of Water and Environmental Regulation (DWER) in Western Australia, or by local councils in collaboration with relevant stakeholders.

Development of Flood Early Warning Systems: Implement flood early warning systems equipped with real-time monitoring devices, weather forecasting technologies, and communication networks to provide timely alerts to farmers, land managers, and biodiversity conservationists. This initiative could be led by state emergency management agencies like DFES in Western Australia, in partnership with local government authorities and scientific institutions.

Construction of Flood Mitigation Infrastructure: Construct flood mitigation infrastructure such as levees, flood gates, and detention basins in strategic locations to divert floodwaters away from agricultural areas and sensitive biodiversity habitats. These infrastructure projects would typically

be coordinated and funded by government agencies like DFES, working closely with local councils and landholders.

Land Use Planning and Zoning Regulations: Implement land use planning measures and zoning regulations to restrict development in flood-prone areas and safeguard agricultural lands and biodiversity assets from the impacts of flooding. Local government planning departments would be responsible for enforcing these regulations in consultation with relevant stakeholders and environmental agencies.

Promotion of Sustainable Agricultural Practices: Promote sustainable agricultural practices that enhance soil health, increase water retention capacity, and reduce erosion, thus mitigating the adverse effects of flooding on agricultural productivity. Agricultural extension services provided by organizations such as NACC NRM and DPIRD could deliver training and resources to farmers to ensure the accurate implementation of these practices.

Restoration and Enhancement of Riparian Zones: Restore and enhance riparian zones along watercourses and wetlands to act as natural buffers against flooding, stabilize banks, and provide habitat for native flora and fauna. This initiative could be undertaken through a collaborative effort between landholders, community groups, and environmental organizations like NACC NRM.

Community Education and Awareness Campaigns: Conduct community education and awareness campaigns to raise awareness about flood risks, emergency preparedness, and the importance of conserving biodiversity in flood-prone areas. These campaigns, coordinated by local government authorities, emergency management agencies, community environmental organizations, and NACC NRM, could be applied and amplified through the delivery of workshops, seminars, and outreach programs.

By implementing these flood preparedness actions in the NAR, stakeholders can work together to minimize the threats of flooding to agricultural productivity and biodiversity assets, ensuring the resilience and sustainability of the region's natural resources for future generations.

6.1 Disease

To mitigate the threat of diseases with the potential to impact agricultural and biodiversity assets in the NAR, various proactive actions can be undertaken:

Disease Surveillance and Monitoring: Establish robust disease surveillance and monitoring programs to detect outbreaks early and track disease trends. This initiative could be led by government agencies such as DPIRD, collaborating with agricultural extension services, research institutions, and community groups.

Biosecurity Measures: Implement biosecurity measures to prevent the introduction and spread of diseases within agricultural operations and natural ecosystems. This includes measures such as controlling the movement of people, vehicles, and equipment, practicing good hygiene, and quarantining potentially infected areas. With support and reinforcement from industry organizations and landholders, government agencies like DPIRD could enforce biosecurity protocols.

Disease Resistant Crop Varieties: Promote the adoption of disease-resistant crop varieties and cultivars through research and extension programs. DPIRD and agricultural research institutions would lead research efforts to develop resistant varieties, while agricultural extension services would facilitate the adoption and implementation of these varieties by disseminating information and providing support to farmers.

Vaccination and Disease Management Plans: Develop vaccination programs and disease management plans for livestock and poultry to reduce the incidence and impact of diseases in the agricultural sector. Both veterinary services provided by DPIRD and private veterinarians would administer vaccines and assist farmers in implementing disease management strategies.

Habitat Restoration and Conservation: Restore and conserve natural habitats and biodiversity corridors to support resilient ecosystems capable of withstanding disease pressures. This involves habitat restoration projects undertaken by organizations such as NACC NRM and local conservation groups, with support from government agencies, community, and volunteers.

Public Awareness and Education Campaigns: Conduct public awareness and education campaigns to inform farmers, land managers, and the general public about the risks of disease outbreaks and the importance of biosecurity and disease management practices. These campaigns, organized by DPIRD, local government authorities, and community organizations, could be put into effect through the delivery of workshops, field days, and educational materials.

Early Detection and Rapid Response Teams: Establish early detection and rapid response teams composed of trained personnel equipped to quickly respond to disease outbreaks in agricultural and natural environments. These teams would be coordinated by DPIRD and emergency management agencies, working in collaboration with industry stakeholders and local communities.

By implementing these disease preparedness actions in the NAR, stakeholders can work together to minimize the threat of diseases to agricultural productivity and biodiversity assets, safeguarding the health and resilience of the region's ecosystems and farming enterprises.

6.2 Drought

To mitigate the threat of drought impacts on agricultural productivity and biodiversity assets in the NAR, several proactive actions can be undertaken:

Water Efficiency and Conservation Measures: Implement water efficiency and conservation measures on farms and within natural ecosystems to optimize water use and minimize wastage. This could include upgrading irrigation systems, implementing soil moisture monitoring technologies, and practicing drought-tolerant cropping techniques. Farmers would undertake these actions and implement measures with the support of agricultural extension services and government agencies like DPIRD.

Drought-resistant Crop Varieties: Promote the adoption of drought-resistant crop varieties and cultivars that are better adapted to water-stressed conditions. DPIRD and agricultural research institutions would lead research efforts to develop and test drought-resistant varieties, informing agricultural extension services to provide farmers with apt guidance around selecting and cultivating these varieties.

Livestock Management Strategies: Develop and implement livestock management strategies to cope with limited forage availability and water resources during drought periods. This may involve destocking, adjusting grazing rotations, and providing supplementary feed and water. These strategies would be actioned by livestock producers, supported by DPIRD and veterinary services.

Water Storage and water quality Infrastructure: Invest in water storage and infrastructure, such as dams, tanks, and collection systems, to capture and store water during periods of rainfall for use during droughts. With the support of local councils and agricultural industry bodies, this initiative could be facilitated through government funding programs and incentives.

Habitat Restoration and Revegetation: Restore and revegetate degraded landscapes and biodiversity corridors to enhance ecosystem resilience and provide habitat for wildlife during drought periods. This involves habitat restoration projects led by organizations such as NACC NRM and local conservation groups, in collaboration with government agencies and community volunteers.

Emergency Feed and Water Supplies: Establish emergency feed and water supplies for livestock and wildlife during drought emergencies. This could involve stockpiling and storage of feed and establishing water points in strategic locations, coordinated by DPIRD, local government authorities, and agricultural industry organizations.

Drought Preparedness Planning and Education: Develop drought preparedness plans and educational programs to raise awareness around the risks of drought, and provide guidance on drought management strategies. Development Commissions, DPIRD, local government authorities, and agricultural industry bodies would collaborate to develop and disseminate these resources through workshops, seminars, and extension materials.

By implementing these drought preparedness actions in the NAR, stakeholders can work together to minimize the impact of drought on agricultural productivity and biodiversity assets, building resilience and sustainability in the face of water scarcity challenges.

6.3 Plague

To alleviate the threat of plague impacts on agricultural productivity and biodiversity assets in the NAR, several preparedness actions can be undertaken:

Early Detection and Monitoring Programs: Implement early detection and monitoring programs to identify signs of pest outbreaks and monitor population dynamics. This could involve the deployment of traps, remote sensing technologies, and citizen science initiatives aimed at tracking pest populations. These programs would be coordinated by government agencies such as DPIRD, in collaboration with agricultural industry bodies and research institutions.

Integrated Pest Management (IPM) Strategies: Develop and promote IPM strategies that emphasize the use of multiple pest control tactics, including biological, cultural, and chemical methods, to manage pest populations effectively while minimizing environmental impact. DPIRD, agricultural extension services, and pest management consultants would provide the guidance and support necessary for farmers to be equipped to implement these strategies.

Biosecurity Measures: Strengthen biosecurity measures to prevent the introduction and spread of pests into agricultural and natural ecosystems. This includes the development and implementation of quarantine protocols, inspection regimes, and movement restrictions on agricultural commodities and equipment. Biosecurity measures would be enforced by government agencies such as DPIRD and supported by industry organizations and landholders.

Research and Development: Invest in research and development efforts to develop innovative pest control technologies and management strategies tailored to the local conditions of the NAR and the specific pest species present. This could involve collaborative research projects between DPIRD, universities, and industry partners to address emerging pest threats.

Public Awareness and Education Campaigns: Conduct public awareness and education campaigns to educate farmers, land managers, and the general public about the risks of pest outbreaks, and the importance of early detection and control measures. These campaigns could be organized as

a collaborative effort between NACC NRM, DPIRD, local government authorities, and agricultural industry bodies, and carried out through workshops, field days, and educational materials.

Emergency Response Plans: Develop and maintain emergency response plans to provide a framework in the event of a pest outbreak, and guide coordinated and rapid responses. These plans would outline roles and responsibilities, communication protocols, and response strategies for various stakeholders, including government agencies, industry organizations, and landholders.

Capacity Building and Training Programs: Provide training and capacity-building programs to equip farmers, pest control professionals, and community volunteers with the knowledge and skills required to effectively manage pest outbreaks. These programs, coordinated by DPIRD, agricultural extension services, and industry organizations would be actuated through the delivery of workshops, training sessions, and online resources.

Through the effective implementation of these plague preparedness actions in the NAR, stakeholders can proactively manage pest threats and minimize the impact on agricultural productivity and biodiversity assets, ensuring the resilience and sustainability of the region's ecosystems and farming enterprises.

6.4 Fire

To mitigate the threat of wildfire impacts on agricultural productivity and biodiversity assets in the NAR, several preparedness actions can be undertaken:

Fuel Load Reduction and Vegetation Management: Conduct fuel load reduction activities and vegetation management measures to minimize the risk of wildfires spreading. This includes prescribed burning, mechanical fuel treatments, and maintaining firebreaks around agricultural properties and key biodiversity assets. These actions would primarily be undertaken by landholders, supported by government agencies such as the DFES and local government authorities.

Firebreak Establishment and Maintenance: Establish and maintain firebreaks around agricultural properties, infrastructure, and sensitive ecosystems to create barriers for the purpose of wildfire containment and asset protection. Landholders would be responsible for establishing and maintaining firebreaks, with assistance and guidance from DFES, local councils, and agricultural extension services.

Community Fire Preparedness Programs: Implement community fire preparedness programs to educate residents, landowners, and businesses about wildfire risks and preparedness measures. These programs could include fire awareness campaigns, fire safety workshops, and neighbourhood fire planning initiatives. DFES, local government authorities, and community organizations would collaborate to deliver these programs.

Early Warning Systems and Communication Networks: Establish early warning systems and communication networks to provide timely alerts and updates about wildfire threats to residents, landholders, emergency responders, and other stakeholders. This could involve the installation of fire detection technology, such as fire cameras and smoke sensors, as well as the development of mobile apps and community alert systems. DFES and telecommunications providers would lead the implementation of these systems, with support from local councils and emergency management agencies.

Livestock and Asset Evacuation Plans: Develop plans for the safe and effective evacuation of livestock, pets, and valuable assets, to be employed in the event of a wildfire threat. Farmers and

landholders would create and implement evacuation plans for their properties, coordinating with DFES, veterinary services, and animal welfare organizations to guarantee the safeguarding and relocation of animals and assets.

Collaborative Firefighting Efforts: Coordinate collaborative firefighting efforts between government agencies, volunteer fire brigades, landholders, and community groups to respond effectively to wildfires. This involves the training and equipping of volunteer firefighters, establishing mutual aid agreements, and conducting joint firefighting exercises. DFES, local fire brigades, and volunteer firefighting associations would lead these efforts, with support from other emergency services and stakeholders.

Post-Fire Recovery and Rehabilitation: Develop post-fire recovery and rehabilitation plans to restore affected agricultural lands and biodiversity assets following a wildfire event. This includes erosion control measures, revegetation projects, and monitoring of ecosystem recovery. DFES, environmental agencies, landholders, and community groups would collaborate to implement these plans.

By implementing these fire preparedness actions in the NAR, stakeholders can reduce the threat of wildfires and minimize the impact on agricultural productivity and biodiversity assets, ensuring the resilience and sustainability of the region's ecosystems and farming enterprises.

6.6 Extreme Events

To reduce the threat posed by extreme events (such as the impact of TC Seroja) to agricultural productivity and biodiversity assets in the NAR, various preparedness actions can be undertaken:

Risk Assessment and Vulnerability Mapping: Conduct comprehensive risk assessments and vulnerability mapping exercises to identify areas and assets at risk of extreme events such as storms, floods, heatwaves, and cyclones. This would involve collaboration between government agencies like DPIRD, local councils, and research institutions.

Infrastructure Resilience Enhancement: Elevate the resilience of critical infrastructure, including agricultural buildings, irrigation systems, and biodiversity conservation facilities, to a standard able to withstand the impacts of extreme events. This could involve retrofitting structures, upgrading drainage systems, and incorporating climate-resilient design principles. Landholders, supported by DPIRD, local government authorities, and agricultural industry bodies, would undertake these actions.

Emergency Response Planning and Training: Develop and implement emergency response plans and training programs to prepare farmers, land managers, emergency responders, and community members for extreme events. This includes conducting tabletop exercises, simulation drills, and workshops to practice response and recovery procedures. DPIRD, emergency management agencies, and local councils would coordinate these efforts.

Community Resilience Building: Build community resilience through education, capacity-building, and community engagement initiatives that empower residents and landholders to prepare for and respond to extreme events. This could involve the establishment of community resilience committees, the development of localized emergency plans, and the provision of training in first aid and emergency preparedness. Local government authorities, community organizations, and emergency management agencies would lead these initiatives.

Climate-Resilient Agriculture Practices: Promote the adoption of climate-resilient agriculture practices that contribute to the mitigation of extreme event impacts on agricultural productivity and soil health. This includes techniques such as conservation tillage, cover cropping, crop diversification, and agroforestry. DPIRD, agricultural extension services, and industry organizations would provide guidance and support to farmers in implementing these practices.

Ecosystem Restoration and Conservation: Restore and conserve natural ecosystems and biodiversity assets to enhance their resilience to extreme events and climate change. This involves habitat restoration projects, revegetation efforts, and the creation of green infrastructure, such as riparian buffers and wetland conservation areas. NACC NRM, environmental agencies, and community conservation groups would lead these initiatives.

Early Warning Systems and Information Dissemination: Establish early warning systems and information dissemination channels to communicate timely alerts and updates about approaching extreme weather events to farmers, landholders, emergency responders, and the general public. This could involve the development of mobile apps, weather monitoring stations, and community alert systems. DPIRD, meteorological agencies, and telecommunications providers would collaborate to implement these systems.

By implementing these preparedness actions in the NAR, stakeholders can reduce the threat posed by extreme events to agricultural productivity and biodiversity assets, enhancing the resilience and sustainability of the region's ecosystems and farming enterprises.

The following asset table details current understanding of management across various emergency scenarios and potential associated impacts on priority biodiversity and agricultural assets within the NAR. This understanding supports decision-makers involved in protecting and preserving environmental assets, and is designed to enable proactive planning, effective resource allocation, and further collaborative action.

Asset	Emergency scenario	Actions	Where	Who	Is action currently underway?
Australian Sea Lion *Neophoca cinerea*	Disease	Monitor breeding populations	Breeding grounds within the NAR (Islands of the Turquoise Coast, Houtman Abrolhos)	DBCA, Wildlife Health Australia, veterinarians, NACC NRM	DBCA monitor NAR population
	Extreme Weather	Map important breeding and forage habitat Undertake coastal erosion prevention activities	Coastal habitats and marine habitat in the NAR	DBCA, DPIRD, NACC NRM, DFES, LGAs	CSIRO, climate mapping
Chuditch *Dasyurus geoffroii*	Drought	Monitor populations, Maintain insurance populations	AWC Mt Gibson Sanctuary Kalbarri National Park Chuditch habitat within the NAR	DBCA, DPIRD, AWC, BHA, LGAs, NACC NRM	AWC population monitoring program
	Fire	Firebreaks, Fire management plans,	AWC Mt Gibson Sanctuary Kalbarri National Park Chuditch habitat within the NAR	DBCA, AWC, BHA, NACC NRM, DFES	DBCA controlled burn program Firebreaks

		Proactively protect key refuge, Traditional Ecological Knowledge integrated.			
	Extreme event	Maintain insurance populations, Proactively protect key refugia, Traditional Ecological Knowledge integrated	AWC Mt Gibson Sancturay Kalbarri National Park Chuditch habitat within the NAR	DBCA, LGAs, DFES, NACC NRM	AWC, Climate change strategy CSIRO, climate mapping
Greater Bilby *Macrotis lagotis*	Drought	Monitor populations, Maintain insurance populations	AWC Mt Gibson Sanctuary, Perenjori Shire	DBCA, AWC, BHA, LGAs, NACC NRM, BOM	AWC population monitoring program
	Fire	Firebreaks, Fire management plans, Proactively protect key refuge, Traditional Ecological Knowledge integrated	AWC Mt Gibson Sanctuary, Perenjori Shire	NACC NRM, DBCA, AWC, BHA, DFES, LGAs	Firebreaks, monitoring of fire response
	Extreme event	Maintain insurance populations, Proactively protect key refugia, Traditional Ecological Knowledge integrated	Mt Gibson Sanctuary, Perenjori Shire	DBCA, AWC, BHA, LGAs, NACC NRM, BOM	AWC, Climate change strategy
Numbat *Myrmecobius fasciatus*	Drought	Monitor populations, Maintain insurance populations	Mt Gibson Sanctuary, Perenjori Shire	DBCA, AWC, BHA, LGAs, NACC NRM, BOM	AWC population monitoring
	Fire	Firebreaks, Fire management plans, Proactively protect key refugia, Traditional Ecological Knowledge integrated	Mt Gibson Sanctuary, Perenjori Shire	NACC NRM, DBCA, AWC, BHA, DFES	Firebreaks, monitoring of fire response
	Extreme event	Maintain insurance populations,	Mt Gibson Sanctuary, Perenjori Shire		AWC, Climate change strategy

		Proactively protect key refuge, Traditional Ecological Knowledge integrated			AWC population monitoring
Carnaby's Cockatoo *Zanda latirostris*	Drought	Detailed climate mapping, Sustainable resource planning, climate smart restoration work (local provenance revegetation)	Breeding habitat is closely aligned with the Eucalypt Woodlands of WA Wheatbelt Non breeding forage habitat is closely aligned with the Geraldton Sandplain bioregion and the Swan Coastal bioregion	DBCA, Birdlife WA, Private landholders, NACC NRM, DPIRD, BOM	No
	Disease	Disease mapping, Community awareness, Research	Breeding habitat is closely aligned with the Eucalypt Woodlands of WA Wheatbelt Non breeding forage habitat is closely aligned with the Geraldton Sandplain bioregion and the Swan Coastal bioregion	NACC NRM, Private landholders, DWG, DBCA	Murdoch University disease response monitoring DWG Dieback mapping and management
	Fire	Critical habitat mapping Cultural burning	Breeding habitat is closely aligned with the Eucalypt Woodlands of WA Wheatbelt Non breeding forage habitat is closely aligned with the Geraldton Sandplain bioregion and the Swan Coastal bioregion	DBCA, LGAs, Private landholders, First Nations groups, DPIRD, NACC NRM	DBCA controlled burn program Firebreaks
	Extreme Weather	Critical habitat and climate scenario mapping	Breeding habitat is closely aligned with the Eucalypt Woodlands of WA Wheatbelt Non breeding forage habitat is closely aligned with the Geraldton Sandplain bioregion and the Swan Coastal bioregion	DBCA, DFES, Private landholders, Birdlife WA, NACC NRM, CSIRO	CSIRO, climate mapping
Malleefowl *Leipoa ocellata*	Drought	Critical habitat and climate scenario mapping, climate smart restoration work (local provenance revegetation)	Malleefowl habitat is closely associated with the Mallee and Melaleuca shublands and Eucalypt Woodlands	DBCA, LGAs, Private landholders, First Nations groups, DPIRD, NMRT, WAMRG, NACC NRM	NMRT, WAMRG, NACC NRM breeding population monitoring
	Fire	Critical habitat mapping, cultural burning management	Malleefowl habitat is closely associated with the Mallee and Melaleuca shublands and Eucalypt Woodlands	DBCA, LGAs, private landholders, First Nations groups, DPIRD, NMRT, WAMRG	DBCA controlled burn program NMRT, WAMRG NACC NRM

					breeding monitoring
	Extreme events	Critical habitat and climate scenario mapping, climate smart restoration work	Malleefowl habitat is closely associated with the Mallee and Melaleuca shublands and Eucalypt Woodlands	DBCA, NACC NRM, DFES, CSIRO, Birdlife WA	CSIRO climate mapping
Australasian bittern *Botaurus poicilptilus*	Drought	Protect critical habitat	Wetland areas in the Shire of Gingin	DBCA, Birdlife Australia, NACC NRM,	No
	Fire	Firebreaks	Wetland areas in the Shire of Gingin	DBCA, LGAs, private landholders, First Nations groups, NACC NRM, DFES	DBCA, controlled burn program Firebreaks
	Extreme event	Protect critical habitat	Wetland areas in the Shire of Gingin	DBCA, LGAs, Private landholders, First Nations groups, NACC NRM, DFES.	CSIRO climate mapping
Western Swamp Tortoise *Pseudemydura umbrina*	Drought	Protect critical habitat, population translocation, zoo population	Moore River, ephemeral wetlands on the clay soils of the Swan Coastal Plain	DBCA, NACC NRM, Perth Zoo LGAs	Perth Zoo insurance population DBCA translocation site NACC NRM RDP project
	Fire	Cultural burning, Firebreaks, community engagement	Moore River, ephemeral wetlands on the clay soils of the Swan Coastal Plain	DBCA, NACC NRM, Perth Zoo LGAs, private landholders, DFES	DBCA controlled burn program Firebreaks
	Extreme event	Protect critical habitat, population translocation, zoo population	Moore River, Ephemeral wetlands on the clay soils of the Swan Coastal Plain	DBCA, NACC NRM, Perth Zoo LGAs, private landholders, DFES	CSIRO climate mapping
Foote's Grevillea *Grevillea calliantha*	Drought	Translocation population, seed collection and storage, climate smart habitat restoration	Shire of Dandaragan	DBCA, WA Herbarium, NACC NRM, Iluka resources, private land holders	DBCA translocation population and seed storage
	Disease	Phytophthora Dieback testing and mapping, preventative management	Shire of Dandaragan	DWG , DBCA, NACC NRM, Iluka resources, private land holders	DWG, mapping if Dieback symptoms appear DBCA hygiene policy
	Fire	Firebreaks and cultural burning	Shire of Dandaragan	DBCA, First Nations Groups, NACC NRM, Private	DBCA controlled burn program Firebreaks

				landholders, LGA, DFES	
	Extreme event	Translocation population, seed collection and storage, climate smart habitat restoration	Shire of Dandaragan	DBCA, WA Herbarium, NACC NRM, Iluka resources, private land holders DFES	CSIRO climate mapping
Scaly-butt Mallee *Eucalyptus leprophloia*	Drought	Seed collection and storage, translocation site	Hi-Vallee Farm, The Grange	DBCA, WA Herbarium, private landholders	DBCA seed storage
	Disease	Phytophthora Dieback testing and mapping, preventative management	Hi-Vallee Farm, The Grange, DBCA reserve	DWG, DBCA, private landholders	NACC NRMs, RDP project
	Fire	Firebreaks, Cultural burning	Hi-Vallee Farm, The Grange, DBCA reserve	DBCA, First Nations groups, NACC NRM, Private landholders, LGAs, DFES	DBCA controlled burn program Firebreaks
	Extreme event	Translocation population, seed collection and storage, climate smart habitat restoration	Hi-Vallee Farm, The Grange, DBCA reserve	DBCA, WA Herbarium, First Nations groups, private landholders	CSIRO climate mapping
Narrow-leaf Eremophila *Eremophila subangustifolia*	Drought	Seed collection and storage, translocation site	Lake Logue Nature Reserve, Shire of Carnamah. Main roads reserve	DBCA, WA Herbarium, LGA, Main roads	DBCA, seed storage and population monitoring
	Disease	Phytophthora Dieback testing and mapping, preventative management	Lake Logue Nature Reserve, Shire of Carnamah. Main roads reserve	DWG, DBCA, NACC NRM, LGA, Main roads	DWG, Dieback mapping if symptoms appear
	Flood	Seed collection and storage, translocation site	Lake Logue Nature Reserve, Shire of Carnamah. Main roads reserve	DBCA, WA Herbarium, NACC NRM	DBCA, NACC NRM and WA Herbarium partner project 'Safeguarding Midwest Flora' Saving Native Species Grant.
	Fire	Firebreaks, Cultural burning	Lake Logue Nature Reserve, Shire of Carnamah. Main roads reserve	DBCA, First Nations Groups, NACC NRM, LGA, DFES	DBCA maintain firebreak across their parks DBCA controlled burn program
	Extreme event	Seed collection and storage, translocation site	Lake Logue Nature Reserve, Shire of Carnamah. Main roads reserve	DBCA, First Nations Groups, NACC NRM, LGA, DFES	CSIRO, climate mapping
Eucalypt Woodlands of the WA Wheatbelt	Drought	Critical habitat mapping, seed collection and storage, climate	Isolated remnants within the NAR. Woodland occurs in association with the	DBCA, First Nations Groups, NACC NRM, WA Herbarium,	NACC NRM, RDP project

		mapping, community engagement, research	Geology of the Yilgarn Craton	CSIRO, BOM, Private landholders, LGAs	DBCA, rare flora survey program
	Disease	Community engagement, proactive disease surveillance, Phytophthora testing mapping, research	Isolated remnants within the NAR. Woodland occurs in association with the Geology of the Yilgarn Craton	DPIRD, DBCA, DWG, Research organisations, First Nations Groups, NACC NRM, Private landholders, LGAs	DPIRD Pest and disease surveillance
	Plague	Proactive pest surveillance, effective pest reporting systems, research	Isolated remnants within the NAR. Woodland occurs in association with the Geology of the Yilgarn Craton	DPIRD, DBCA, First Nations Groups, NACC NRM, Private landholders, LGAs	DPIRD Pest and disease surveillance
	Flood	Protect remnant vegetation, seed collection and storage	Isolated remnants in association within the low lying (ancient waterways) landscape of the NAR. Woodland occurs in association with the Geology of the Yilgarn Craton	Private landholders, First Nations groups, NACC NRM, DPIRD, LGAs, DFES	Some private revegetation to slow salinity
	Fire	Firebreaks, Cultural burning, research	Isolated remnants within the NAR. Woodland occurs in association with the Geology of the Yilgarn Craton	Private landholders, First Nations groups, NACC NRM, LGAs, DFES	DBCA controlled burn program Firebreaks
	Extreme event	Critical habitat mapping, climate mapping	Isolated remnants within the NAR. Woodland occurs in association with the Geology of the Yilgarn Craton	CSIRO, BOM, DPIRD, DBCA, Research organisations, First Nations Groups, NACC NRM, Private landholders, LGAs	CSIRO, climate mapping
Banksia woodlands of the Swan Coastal Plain	Drought	Critical habitat mapping, seed collection and storage, climate mapping, community engagement	Isolated remnants within the NAR. Associated with the Swan Coastal Plain Bioregion	DBCA, First Nations Groups, NACC NRM, WA Herbarium, CSIRO, BOM, Private landholders, LGAs	DBCA, Recording flora species death DBCA, rare flora survey program
	Disease	Community engagement, proactive disease surveillance, Phytophthora testing mapping, research	Isolated remnants within the NAR. Associated with the Swan Coastal Plain Bioregion	DPIRD, DBCA, DWG, Research organisations, First Nations Groups, NACC NRM, Private landholders, LGAs	DWG, Dieback mapping if symptoms appear
	Fire	Firebreaks, Cultural burning, research	Isolated remnants within the NAR. Associated with the	Private landholders, First Nations groups, NACC	DBCA controlled burn program

			Swan Coastal Plain Bioregion	NRM, LGAs, DFES	Firebreaks
	Extreme event	Critical habitat mapping, climate mapping	Isolated remnants within the NAR. Associated with the Swan Coastal Plain Bioregion	CSIRO, BOM, DPIRD, DBCA, Research organisations, First Nations Groups, NACC NRM, Private landholders, LGAs	CSIRO, Climate mapping
Subtropical and temperate coastal saltmarshes	Fire	Firebreaks, Cultural burning, research	Subtropical and temperate coastal saltmarsh in the NAR occurs in association with estuaries from Kalbarri in the north to Guilderton in the south	LGAs, First Nations groups, NACC NRM, DFES, DBCA, research organisations	DBCA controlled burn program on DBCA lands adjacent to saltmarshes LGAs managing weed burden and fuel load in urban landscapes
	Extreme event	Critical habitat mapping, climate mapping, remnant vegetation protection, research	Subtropical and temperate coastal saltmarsh in the NAR occurs in association with estuaries from Kalbarri in the north to Guilderton in the south	LGAs, First Nations groups, NACC NRM, DFES, DBCA, CSIRO, BOM, research organisations	CSIRO, climate mapping
Lesueur National Park	Drought	Critical habitat mapping, seed collection and storage, climate mapping, community engagement	Across the range of diverse communities in Lesueur National Park	DBCA, First Nations Groups, NACC NRM, WA Herbarium, CSIRO, BOM, Private landholders, LGAs	DBCA, Recording flora species death DBCA, rare flora survey program
	Disease	Phytophthora Dieback mapping and management Proactive surveillance for Myrtle rust	Across the range of diverse communities in Lesueur National Park	DWG, DBCA, DPIRD, First Nations Groups, NACC NRM, WA Herbarium, Private landholders, LGAs	DBCA and DWG undertake Phytophthora mapping and management State and National Myrtle rust monitoring
	Fire	Firebreaks, Cultural burning, research	Across the range of diverse communities in Lesueur National Park	DBCA, DPIRD, First Nations Groups, NACC NRM, research organisations	DBCA, controlled burn program Firebreaks
	Extreme events	Critical habitat mapping, climate mapping, remnant vegetation protection, research	Across the range of diverse communities in Lesueur National Park	LGAs, First Nations groups, NACC NRM, DFES, DBCA, CSIRO, BOM, research organisations	CSIRO, climate mapping

Agricultural Soils	Drought	Climate mapping, research, Drought resistant crop cultivation and pasture species, community engagement	Arable soils within the NAR	NACC NRM, Farm improvement groups, Private landholders, First Nations groups, DPIRD, agronomists, Research organisations, LGAs	Yes, Southwest Drought and Innovation Adoption Hub, Grower groups, DPIRD, DAFF, DCCEEW
	Disease	Manage soil-borne diseases with practices including crop rotation and soil fumigation Proactive surveillance and management	Arable soils within the NAR	NACC NRM, Farm improvement groups, Private landholders, First Nations groups, DPIRD, agronomists, Research organisations	Yes, Grower groups, DPIRD, GRDC
	Flood	Implement soil erosion prevention measures like contour ploughing and cover cropping Riparian restoration programs	Arable soils within the NAR	NACC NRM, Farm improvement groups, Private landholders, First Nations groups, DPIRD, agronomists, Research organisations, DFES, LGAs	Yes, Grower Groups, Landcare
	Extreme Events	Develop emergency preparedness plans tailored to mitigate the impact of extreme events	Arable soils within the NAR	NACC NRM, Farm improvement groups, Private landholders, First Nations groups, DPIRD, agronomists, Research organisations, DFES, LGAs	Yes, DPIRD
Water Resources	Flood	Manage water effectively with flood levees and diversion channels	Surface and ground water resources in the NAR	NACC NRM, Private landholders, First Nations groups, DPIRD, DWER, Research organisations, DFES, LGAs	No
	Drought	Implement water conservation measures such as increased catchment efficiency, development of water storage infrastructure	Surface and ground water resources in the NAR	Government water management agencies (e.g., DPIRD), local councils, irrigation specialists	Yes, DPIRD, GGA, Grower Groups, DWER

	Plague	Conduct pest surveillance in water catchment areas	Surface and ground water resources in the NAR	Environmental agencies (e.g., DPIRD), pest control authorities, community groups	Yes, DPIRD
	Fire	Develop fire suppression plans for water catchment areas	Surface and ground water resources in the NAR	Government water management agencies (e.g., DPIRD), firefighting agencies	Yes, DFES
	Extreme Events	Enhance the resilience of water infrastructure	Surface and ground water resources in the NAR	Government water management agencies (e.g., DPIRD), infrastructure authorities	Yes, DPIRD
Native Vegetation	Flood	Mapping to identify vegetation susceptible to flooding and rising salinity	Remnant vegetation within the NAR	NACC NRM, Private landholders, First Nations groups, DPIRD, DWER, Research organisations, DFES, LGAs	No
	Disease	Proactive disease surveillance and reporting, Disease mapping	Remnant vegetation within the NAR	NACC NRM, Private landholders, First Nations groups, DPIRD, Research organisations, LGAs	Yes, DBCA, DPIRD, Dieback working Group
	Drought	Develop and implement drought resilience plans for native vegetation	Remnant vegetation within the NAR	NACC NRM, Private landholders, First Nations groups, DPIRD, Research organisations, LGAs	Yes, Development commissions, DBCA
	Plague	Manage invasive species threatening native vegetation Proactive surveillance and reporting	Remnant vegetation within the NAR	NACC NRM, Private landholders, First Nations groups, DPIRD, DWER, Research organisations, LGAs	Yes, DPIRD, DBCA
	Fire	Firebreaks, Cultural burning, restoration work following fires, proactive seed collection and storage of key	Remnant vegetation within the NAR	Private landholders, NACC NRM, DFES, First Nations groups, DBCA, LGAs	Yes, DPIRD, DFES, DBCA, NACC NRM

		vegetation species			
	Extreme Events	Enhance ecosystem resilience with climate-resilient restoration projects	Remnant vegetation within the NAR	NACC NRM, Private landholders, First Nations groups, DPIRD, agronomists, Research organisations, LGAs	Yes, DPIRD, DBCA, NACC NRM

Emergency scenario preparedness for Aboriginal Cultural Heritage sites necessitates a multifaceted approach, especially when considering risks such as drought, flood, fire, and extreme events (O'Keefe, 2016). The mitigation actions largely align with those identified for key biodiversity and agricultural assets, including the monitoring of water sources, implementation of water conservation measures, and plans for activities such as the relocation of artefacts if necessary (Jones, 2005). For fire preparedness, creating firebreaks, developing fire management plans in collaboration with firefighting authorities, and training in fire prevention and suppression techniques are crucial, having benefit across the landscape. Similarly, addressing extreme events requires vulnerability assessments, reinforcing or relocating vulnerable structures and artefacts, providing emergency shelters, and developing effective communication plans.

Importantly, active engagement with the local First Nation community throughout the planning process is indispensable. Engaging Indigenous elders, cultural custodians, and organizations ensures that emergency plans align with First Nation values and priorities. Their traditional knowledge and cultural perspectives enrich the understanding of the site's significance, and inform effective protection strategies (O'Keefe, 2016, Ross & Savage, 2006).

7. ASSET PROTECTION RESPONSE

In immediate response to various emergencies in the NAR, specific response actions are required to protect agricultural productivity and biodiversity assets. These actions, led by various stakeholders, aim to safeguard the region's ecosystems, enhance resilience, and promote sustainable land management practices in the face of adversity. Response actions to each identified scenario are provided in the following sections.

7.1 Flood

In immediate response to a flooding scenario in the NAR, the following actions should be undertaken to protect agricultural productivity and biodiversity assets:

Evacuation of Livestock and Vulnerable Animals: Farmers and landholders should immediately evacuate livestock and vulnerable animals to higher ground or designated evacuation areas. This action should be undertaken as soon as flooding is imminent, typically before any significant rise in floodwaters. Farmers, with support from agricultural extension services and veterinary agencies, would undertake this action.

Protection of Agricultural Infrastructure: Farmers and landholders should take immediate measures to protect agricultural infrastructure, such as machinery, storage facilities, and outbuildings, from flood damage. This may involve relocating equipment to higher ground, reinforcing structures, or

installing temporary flood barriers. Farmers would undertake this action, with support from agricultural service providers, local councils, and emergency management agencies.

Rescue and Relocation of Wildlife: Wildlife rescue teams should be mobilized to evacuate vulnerable species and relocate them from flood-affected areas to safer habitats. This action should be undertaken as soon as flooding occurs, informed and led by trained wildlife rehabilitators, conservation organizations, and community volunteers.

Protection of Riparian Zones and Wetlands: Emergency measures should be implemented to protect riparian zones and wetlands from flooding impacts, such as erosion, sedimentation, and habitat loss. This may involve installing temporary barriers, reinforcing banks, and diverting floodwaters away from sensitive ecosystems. Conservation groups, environmental agencies, and community volunteers would undertake these actions.

Emergency Habitat Restoration: Immediate habitat restoration efforts, such as replanting native vegetation, restoring damaged habitats, and creating buffer zones to absorb excess water, should be initiated to mitigate the impacts of flooding on biodiversity assets. This action should be undertaken as soon as floodwaters recede, with support from conservation organizations, government agencies, and community groups.

Monitoring of Endangered Species: Specialized teams should be deployed to monitor populations of endangered species and assess the impacts of flooding on their habitats and breeding grounds. This action should be ongoing throughout both the flooding event and the recovery phase, with input from wildlife biologists, ecologists, and conservation managers.

Invasive Species Control: Flood events can facilitate the spread of invasive species, which can threaten agricultural assets and native biodiversity. Immediate control measures should be implemented to prevent the establishment and spread of invasive species in flood-affected areas. This may involve targeted eradication efforts, biosecurity measures, and public awareness campaigns. Conservation agencies, land managers, and pest control professionals would undertake these actions.

Emergency Wildlife Feeding and Sheltering: Temporary feeding stations and shelters should be set up to provide emergency support for displaced wildlife, both during and after flooding events. To ensure the welfare of affected animals, this action should be coordinated by wildlife rehabilitators, conservation organizations, and local wildlife authorities.

Community Engagement and Education: Community engagement and education programs should be conducted to raise awareness about the importance of biodiversity conservation, the impacts of flooding on wildlife habitats, and the ways in which individuals can contribute to conservation efforts. This may involve workshops, educational materials, and outreach events organized by conservation groups, government agencies, and environmental educators.

By undertaking these immediate flood response actions in the NAR, stakeholders can protect agricultural productivity and biodiversity assets, minimize damage and losses, and ensure the safety and well-being of communities and livestock during flood events.

7.2 Disease

In immediate response to a disease outbreak scenario in the NAR, stakeholders must undertake actions to mitigate impacts on both agricultural productivity and biodiversity assets. The key response steps are:

Quarantine and Biosecurity Measures: Immediately implement quarantine measures to contain the spread of the disease. Quarantine zones should be established around affected areas to restrict the movement of animals, plants, and agricultural products. Biosecurity protocols, including disinfection procedures and restricted access should be enforced by farmers, biosecurity officers, and agricultural inspectors.

Disease Diagnosis and Confirmation: Rapidly diagnose and confirm the disease through laboratory testing and analysis. Samples should be collected from affected animals, plants, or environmental sources, and sent to diagnostic laboratories for testing. This responsibility lies with veterinarians, plant pathologists, and agricultural scientists.

Emergency Treatment and Management: Implement emergency treatment and management strategies to control the spread of the disease and minimize its impact on agricultural and biodiversity assets. This may include the application of appropriate pesticides, vaccines, or other control measures. Farmers, veterinarians, agronomists, and pest control specialists would undertake these actions.

Communication and Information Sharing: Establish effective communication channels to disseminate information about the disease outbreak to stakeholders, including farmers, landholders, agricultural industry organizations, and government agencies. Updates should be communicated regularly, detailing the status of the outbreak, control measures, and recommended actions. This responsibility lies with agricultural extension services, government agencies, and communication specialists.

Community Engagement and Education: Conduct community engagement and education programs to raise awareness about the disease outbreak and promote preventive measures. Workshops, training sessions, and educational materials should be provided to farmers, landholders, and the general public. Agricultural extension services, veterinarians, and community organizations would lead these efforts.

Coordination of Response Efforts: Coordinate response efforts among relevant stakeholders, including government agencies, industry organizations, research institutions, and community groups. Establish a multi-agency task force or emergency response team to oversee the management of the outbreak and ensure a coordinated approach. This responsibility lies with government agencies, such as DPIRD, and local emergency management authorities, such as DFES.

By undertaking these immediate disease response actions in the NAR, stakeholders can effectively manage disease outbreaks, protect agricultural productivity, and preserve biodiversity assets, ensuring the resilience and sustainability of the region's ecosystems and farming enterprises.

7.3 Drought

In immediate response to a drought scenario in the NAR, stakeholders must undertake actions to mitigate impacts on both agricultural productivity and biodiversity assets. The key response steps are:

Water Conservation and Management: Implement water conservation measures to minimize water usage and optimize water resources. This includes utilising water-preserving technologies, and implementing efficient irrigation and water recycling practices. Farmers, agricultural extension services, and irrigation specialists would undertake these actions on agricultural lands.

Livestock Management and Feed Planning: Develop and implement livestock management strategies to ensure the welfare of animals during drought conditions. This involves adjusting stocking rates, providing supplementary feed, and sourcing alternative water sources for livestock. Farmers, veterinarians, and livestock management experts would undertake these actions on farms and pastoral lands.

Emergency Feed and Water Distribution: Provide emergency feed and water assistance to livestock producers facing resource shortages due to drought. This could involve government-funded relief programs, community donations, and coordination with agricultural industry organizations. Government agencies, agricultural cooperatives, and community groups would coordinate these efforts.

Drought-Tolerant Crop Cultivation: Promote the cultivation of drought-tolerant crops and varieties designed to withstand water scarcity. This includes selecting resilient crop species, implementing moisture conserving soil practices, and optimizing planting schedules. Farmers, agronomists, and agricultural researchers would undertake these actions on cropping lands.

Biodiversity Conservation Measures: Implement biodiversity conservation measures to protect native flora and fauna during drought conditions. This includes habitat restoration, revegetation projects, and initiatives for water provision to wildlife. Conservation organizations, government agencies, and community volunteers would undertake these actions in natural ecosystems and conservation reserves.

Emergency Financial Assistance: Provide emergency financial assistance and support programs to farmers and landholders impacted by drought. This could include introducing low-interest loans, grants for water infrastructure upgrades, and income support measures. Government agencies, agricultural industry bodies, and financial institutions would administer these assistance programs.

Community Resilience Building: Conduct community resilience building initiatives to support affected communities and promote drought preparedness. This includes delivering workshops, training sessions, and information campaigns on drought management strategies, mental health support, and community adaptation measures. Local government authorities, community organizations, and social service agencies would lead these efforts.

By undertaking these immediate drought response actions in the NAR, stakeholders can effectively manage drought impacts, protect agricultural productivity, and preserve biodiversity assets, ensuring the resilience and sustainability of the region's ecosystems and farming enterprises.

7.4 Plague

In immediate response to a plague scenario in the NAR, stakeholders must undertake actions to mitigate impacts on both agricultural productivity and biodiversity assets. The key response steps are:

Quarantine and Biosecurity Measures: Immediately establish quarantine zones and implement biosecurity protocols to prevent the spread of the plague organism. Quarantine areas should be established around affected sites to restrict the movement of people, animals, and equipment. Biosecurity officers, agricultural inspectors, and land managers would enforce these measures.

Integrated Pest Management (IPM): Implement IPM strategies to control the spread of the plague organism and minimize its impact on agricultural and biodiversity assets. This may include the use

of biological control agents, insecticides, and cultural practices to manage pest populations. Farmers, pest control specialists, and agricultural researchers would undertake these actions.

Crop Protection and Harvest Management: Implement crop protection measures to minimize damage to agricultural crops caused by the plague organism. This includes the use of physical barriers, crop rotation, and timely harvesting practices to reduce pest pressure. Farmers and agricultural advisors would implement these measures on affected farms.

Habitat Restoration and Pest Habitat Removal: Conduct habitat restoration efforts to restore plague affected natural ecosystems and biodiversity assets. This involves removing pest habitat, restoring native vegetation, and creating buffer zones to prevent further spread. Biodiversity conservation organizations, land managers, and community volunteers would undertake these actions.

Emergency Pest Control Operations: Initiate emergency pest control operations to reduce pest populations and prevent further spread of the plague organism. This may involve aerial spraying, ground-based treatments, and targeted eradication efforts in affected areas. Pest control companies, government agencies, and agricultural cooperatives would undertake these operations.

Community Engagement and Education: Engage with affected communities to raise awareness about the plague organism and promote preventive measures. This includes providing information about pest identification, control methods, and reporting procedures. Agricultural extension services, community organizations, and local authorities would lead these efforts.

By undertaking these immediate plague response actions in the NAR, stakeholders can effectively manage pest outbreaks, protect agricultural productivity, and preserve biodiversity assets, ensuring the resilience and sustainability of the region's ecosystems and farming enterprises.

7.5 Fire

In immediate response to a fire scenario in the NAR, stakeholders must undertake actions to mitigate impacts on both agricultural productivity and biodiversity assets. The key response steps are:

Emergency Evacuation and Sheltering: Immediately initiate evacuation procedures to ensure the safety of residents, livestock, and property in wildfire-prone areas. Evacuation routes should be established, and emergency shelters should be identified to accommodate displaced individuals and animals. Evacuation procedures and emergency sheltering efforts would be coordinated by DFES in collaboration with local government authorities, community organizations, and emergency services.

Firebreak Establishment and Fuel Management: Implement firebreak construction and fuel management activities to create barriers, which aid in controlling the spread of wildfires. This involves clearing vegetation, creating firebreaks, and reducing fuel loads in strategic locations. Landholders, firefighting crews, and government agencies would undertake these actions.

Livestock and Animal Welfare: Implement measures to protect livestock and ensure their welfare during wildfires. This includes transferring animals to safer areas, providing adequate water and feed sources, and providing medical care as needed. Measures to protect livestock and ensure their welfare during wildfires would involve coordination between DFES, DPIRD, and local veterinary services.

Infrastructure Protection and Asset Defense: Implement measures to protect agricultural infrastructure, buildings, and assets from wildfire damage. This includes installing ember guards,

applying fire-retardant coatings, and clearing combustible materials from around structures. Landholders, firefighting crews, and emergency services would undertake these actions.

Habitat Restoration and Wildlife Rescue: Conduct habitat restoration efforts and wildlife rescue operations to mitigate the impact of wildfires on biodiversity assets. This involves restoring damaged habitats, providing temporary shelters for displaced wildlife, and conducting surveys to assess the extent of wildlife impacts. Habitat restoration efforts and wildlife rescue operations would involve collaboration between DFES, the Department of Biodiversity, Conservation and Attractions (DBCA), biodiversity conservation organizations, and community volunteers.

Fire Suppression and Containment: Mobilize firefighting crews, aerial resources, and firefighting equipment to suppress and contain wildfires. This includes deploying ground crews to establish fire lines, conducting aerial water drops, and coordinating firefighting efforts with neighbouring jurisdictions. Fire suppression and containment efforts would be led by DFES, with support from firefighting agencies, emergency services, and government authorities at both state and local levels.

By undertaking these immediate wildfire response actions in the NAR, stakeholders can effectively manage wildfires, protect agricultural productivity, and preserve biodiversity assets, ensuring the resilience and sustainability of the region's ecosystems and farming enterprises.

7.6 Extreme Events

The key action categories for extreme event response in the NAR include:

Assessment and Reporting: Conducting comprehensive assessments of damage to infrastructure, agricultural properties, and biodiversity assets, with findings reported to relevant authorities. Responsible agencies: DPIRD, local government authorities, and environmental agencies.

Infrastructure Repair and Restoration: Initiating repair works on damaged agricultural infrastructure, including buildings, irrigation systems, and fencing, to restore functionality. Responsible agencies: DPIRD, local government authorities, and relevant industry bodies.

Livestock and Animal Care: Providing veterinary assistance and medical care to injured or distressed animals, and assisting farmers in relocating livestock to safe areas. Responsible agencies: DPIRD, local veterinary services, and agricultural associations.

Habitat Rehabilitation: Implementing habitat restoration projects, including revegetation efforts and erosion control measures, to rehabilitate damaged ecosystems and biodiversity hotspots. Responsible agencies: DBCA, conservation organizations, and community groups.

Community Assistance and Support: Offering financial aid, assistance programs, and mental health support services to affected residents and businesses to aid in their recovery. Responsible agencies: Local government authorities, Department of Communities, and community service organizations.

Continued Monitoring and Assessment: Maintaining ongoing monitoring of environmental conditions and infrastructure stability, and conducting periodic assessments of habitat recovery and agricultural productivity. Responsible agencies: DPIRD, BoM, and environmental agencies.

Lessons Learned and Future Preparedness: Conducting post-event evaluations to identify strengths and weaknesses in response and recovery efforts, with findings used to update

emergency response plans and enhance community preparedness for future cyclone events. Responsible agencies: DFES, DPIRD, and local government authorities.

Asset	Emergency scenario	Actions	Where	Who (During and After)
Australian Sea Lion *Neophoca cinerea*	Disease	Provide medical treatment/ rehabilitation as required Initiate biosecurity measures as required	Breeding grounds, coastal and marine habitat in the NAR	During: Veterinarians, DBCA, Wildlife Health Australia After: Veterinarians, DBCA, Wildlife Health Australia, NACC NRM, LGAs
	Extreme Weather	Conduct post event assessments of habitat damage and plan/ implement habitat restoration	Breeding grounds, coastal and marine habitat in the NAR	During: DBCA, DFES After: DBCA, DPIRD, NACC NRM, LGAs, BOM
Chuditch *Dasyurus geoffroii*	Drought	Conduct post drought assessment Implement habitat restoration projects to support recovery of populations	Kalbarri National Park AWC Mt Gibson Sanctuary Habitat likely to support Chuditch populations	During: AWC, DBCA After: DBCA, DPIRD, Private landholders, AWC, BHA, LGAs, NACC NRM
	Fire	Initial suppression Conduct post fire assessments, Provide medical treatment as required Initiate habitat restoration projects	Kalbarri National Park AWC Mt Gibson Sanctuary Habitat likely to support Chuditch populations	During: Veterinarians, AWC, DFES, DBCA, Private landholders After: DBCA, AWC, BHA, NACC NRM, Private landholders, DFES, Veterinarians
	Extreme Event	Conduct post event assessments of habitat damage and plan/ implement for restoration	Kalbarri National Park AWC Mt Gibson Sanctuary Habitat likely to support Chuditch populations	During: AWC, DBCA, DFES After: DBCA, AWC, LGAs, DFES, NACC NRM, BOM
Greater Bilby *Macrotis lagotis*	Drought	Provide supplementary resources (food, water) for Greater Bilby's in impacted areas Plan/ implement habitat restoration	AWC Mt Gibson Sanctuary, Perenjori Shire	During: AWC After: AWC, BHA, DPIRD, LGAs, NACC NRM, BOM
	Fire	Initial suppression Conduct post fire assessments, Provide medical treatment as required Initiate habitat restoration projects	AWC Mt Gibson Sanctuary, Perenjori Shire	During: AWC, DBCA, DFES, Veterinarians, Private landholders After: NACC NRM, DBCA, AWC, BHA, DFES, Veterinarians
	Extreme Event	Conduct post event assessments of habitat damage and plan/ implement for restoration	AWC Mt Gibson Sanctuary, Perenjori Shire	During: AWC, DFES After: AWC, BHA, LGAs, NACC NRM, BOM

Numbat ***Myrmecobius fasciatus***	Drought	Provide supplementary resources(food, water) for Greater Bilby's in impacted areas	AWC Mt Gibson Sanctuary, Perenjori Shire	During: AWC After: AWC, BHA, LGAs, NACC NRM, BOM, DPIRD
	Fire	Initial suppression Conduct post fire assessments, Provide medical treatment as required Initiate habitat restoration projects	AWC Mt Gibson Sanctuary, Perenjori Shire	During: AWC, DBCA, DFES, Veterinarians, Private landholders After: NACC NRM, DBCA, AWC, BHA, DFES, Veterinarians, Private landholders
	Extreme Event	Conduct post event assessments of habitat damage and plan/ implement for restoration	AWC Mt Gibson Sanctuary, Perenjori Shire	During: AWC, DFES After: AWC, BHA, LGAs, NACC NRM, BOM
Carnaby's Cockatoo ***Zanda latirostris***	Drought	Provide supplementary resources (food, water) for cockatoos in impacted areas Plan/ implement restoration	Breeding habitat and forage habitat within the NAR	During: DBCA, Private landholders, LGAs, Birdlife WA After: Private landholders, First Nations groups, DPIRD, LGAs, Birdlife WA
	Disease	Implement appropriate biosecurity measures Provide medical treatment Conduct post disease assessments	Breeding and forage habitat within the NAR	During: DBCA, Private landholders, Birdlife WA, Veterinarians, Perth Zoo, Murdoch University After: DBCA, LGAs, Private landholders, First Nations groups, DPIRD, Veterinarians, Birdlife WA , Perth Zoo, Murdoch University
	Fire	Initial suppression Conduct post fire assessments, Provide medical treatment as required Plan/ implement restoration	Breeding and forage habitat within the NAR	During: DFES, Private landholders, DBCA, LGAs After: DBCA, LGAs, private landholders, First Nations groups, DPIRD
	Extreme Weather	Conduct post event assessments of habitat damage Plan/ implement habitat restoration	Breeding and forage habitat within the NAR	During: DFES, DBCA, Private landholders After: DBCA, Private landholders, NACC NRM, Bush Heritage, CSIRO, BOM, Birdlife WA
Malleefowl ***Leipoa ocellata***	Drought	Conduct post drought assessments of habitat damage Plan/ implement habitat restoration	Malleefowl habitat within the NAR	During: DBCA, WAMRG, NMRT, Private landholders, First Nations groups

				After: DBCA, LGAs, private landholders, First Nations groups, DPIRD
	Fire	Initial suppression Conduct post fire assessments Provide medical treatment as required Plan/ implement restoration	Malleefowl habitat within the NAR	During: DFES, DBCA, Private landholders, LGAs, First Nations groups After: DBCA, LGAs, private landholders, First Nations groups, DPIRD
	Extreme Events	Conduct post event assessments of habitat damage Plan/ implement habitat restoration	Malleefowl habitat within the NAR	During: DFES, Private landholders, DBCA After: DBCA, NMRT, WAMRG, Private landholders, First Nations groups, NACC NRM, DFES
Australasian Bittern *Botaurus poiciloptilus*	Drought	Conduct post drought surveys to assess population status Conduct post drought assessments of habitat damage Plan/ implement habitat restoration	Wetland areas in the Shire of Gingin	During: Birdlife WA, conservation volunteers, Private landholders After: Birdlife WA, DBCA, NACC NRM, DFES,
	Fire	Initial suppression Conduct post fire assessments, Provide medical treatment as required Plan/ implement habitat restoration	Wetland areas in the Shire of Gingin	During: DFES, Private landholders After: DBCA, LGAs, private landholders, NACC NRM, Birdlife WA, conservation volunteers
	Extreme Event	Conduct event assessments of habitat damage Plan/ implement habitat restoration	Wetland areas in the Shire of Gingin	During: DFES, Private landholders After: DBCA, LGAs, private landholders, First Nations groups, NACC NRM, CSIRO, BOM
Western Swamp Tortoise *Pseudemydura umbrina*	Drought	Conduct drought surveys to assess population status Conduct post drought assessments of habitat damage Plan/ implement habitat restoration	Moore River, ephemeral wetlands on the clay soils of the Swan Coastal Plain	During: Perth Zoo, DBCA, Private landholders, conservation volunteers After: Perth Zoo, DBCA, Private landholders, conservation volunteers LGAs, NACC NRM, MCC
	Fire	Initial suppression Conduct post fire assessments, Provide medical treatment as required	Moore River, ephemeral wetlands on the clay soils of the Swan Coastal Plain	During: DFES, Private landholders, DBCA, After: DBCA, NACC NRM, Perth Zoo, LGAs, Private landholders,

		Plan/ implement habitat restoration		DFES, Veterinarians, MCC, conservation volunteers
	Extreme Event	Conduct post event assessments of habitat damage Plan/ implement restoration	Moore River, ephemeral wetlands on the clay soils of the Swan Coastal Plain	During: DFES, DBCA, Perth Zoo After: DBCA, NACC NRM, Perth Zoo, LGAs, Private landholders, DFES, Veterinarians, MCC, conservation volunteers, CSIRO, BOM
Foote's Grevillea *Grevillea calliantha*	Drought	Conduct drought assessment Plan/ implement restoration	Shire of Dandaragan	During: DBCA, WA herbarium, Iluka Resources, conservation volunteers After: DBCA, WA Herbarium, NACC NRM, Private landholders, First Nations groups, Iluka Resources
	Disease	Map disease spread and generate management plan Implement biosecurity measures	Shire of Dandaragan	During: DBCA, DWG, WA Herbarium, Iluka Resources, Private landholders After: DWG, DBCA, NACC NRM, Private landholders, WA Herbarium, Iluka Resources
	Fire	Initial suppression Post fire mapping and population assessment Plan/ implement restoration	Shire of Dandaragan	During: DFES, DBCA, Private landholders, Iluka Resources After: DBCA, First Nations Groups, NACC NRM, Private landholders, LGAs, WA Herbarium, DFES, Iluka Resources
	Extreme Event	Conduct post event assessments Plan/ implement restoration	Shire of Dandaragan	During: DFES, Private landholders, Iluka Resources After: DBCA, WA Herbarium, NACC NRM, Iluka resources, Private landholders, DFES, LGAs, CSIRO, BOM
Scaly-butt Mallee *Eucalyptus leprophloia*	Drought	Conduct drought assessment Plan/ implement restoration	Hi-Vallee Farm, The Grange	During: DBCA, Private landholders, DPIRD, WA Herbarium After: DBCA, Private landholders, DPIRD, WA Herbarium, LGAs, NACC NRM

	Disease	Map disease spread and generate management plan Implement biosecurity measures	Hi-Vallee Farm, The Grange	During: DWG, DBCA, Private landholders After: DWG, DBCA, private landholders, NACC NRM
	Fire	Initial suppression Post fire mapping and population assessment Plan/ implement restoration	Hi-Vallee Farm, The Grange	During: DFES, Private landholders, DBCA After: DBCA, NACC NRM, Private landholders, LGAs, DFES, LGAs
	Extreme Event	Conduct post event assessments Plan/ implement restoration	Hi-Vallee Farm, The Grange	During: DFES, Private landholders, LGAs After: DBCA, WA Herbarium, Private landholders, DFES, NACC NRM, LGAs, CSIRO, BOM
Narrow-leaf Eremophila *Eremophila subangustifolia*	Drought	Conduct drought assessment Plan/ implement restoration	Lake Logue Nature Reserve, Shire of Carnamah	During: DBCA, Private landholders, WA Herbarium, First Nations groups After: DBCA, WA Herbarium, LGA, Main roads, Private landholders, NACC NRM, First Nations groups
	Disease	Map disease spread and generate management plan Implement biosecurity measures	Lake Logue Nature Reserve, Shire of Carnamah	During: DWG, Main roads, LGAs, DBCA, Private landholders, First Nations groups After: DWG, DBCA, NACC NRM, LGAs, Main roads, First Nations group, WA Herbarium
	Flood	Post flood habitat and population assessment Plan/ implement restoration	Lake Logue Nature Reserve, Shire of Carnamah	During: Main roads, LGAs, DBCA, Private landholders, First Nations groups, WA Herbarium After: Main roads, LGAs, DBCA, Private landholders, First Nations groups, NACC NRM, WA Herbarium
	Fire	Initial suppression Post fire mapping and population assessment Plan/ implement restoration	Lake Logue Nature Reserve, Shire of Carnamah	During: DBCA, First Nations Groups, NACC NRM, LGA, DFES After: DBCA, First Nations Groups, NACC NRM, LGA, DFES, WA Herbarium

	Extreme Event	Conduct post event assessments Plan/ implement restoration	Lake Logue Nature Reserve, Shire of Carnamah	During: DBCA, DFES, Private landholders After: DBCA, First Nations Groups, NACC NRM, LGA, DFES, WA Herbarium, CSIRO, BOM
Eucalypt Woodlands of the WA Wheatbelt	Drought	Conduct drought assessment Plan/ implement restoration	Isolated remnants within the NAR	During: Private landholders, DPIRD, DBCA After: DBCA, First Nations Groups, NACC NRM, WA Herbarium, Private landholders, LGAs
	Disease	Map disease spread and generate management plan Implement biosecurity measures	Isolated remnants within the NAR	During: DWG, DBCA, WA Herbarium, Private landholders After: DBCA, DWG, Research organisations, First Nations Groups, NACC NRM, Private landholders, LGAs, WA Herbarium
	Plague	Conduct post plague assessment Plan\ implement restoration	Isolated remnants within the NAR	During: DPIRD, Private landholders, DBCA After: DPIRD, DBCA, First Nations Groups, NACC NRM, Private landholders, LGAs
	Flood	Post flood ecological community assessment/ mapping Plan/ implement restoration	Isolated remnants in association within the NAR that occur in the ancient drainage channels and low lying landscape	During: DFES, DBCA, Private landholders After: Private landholders, First Nations groups, NACC NRM, DPIRD, LGAs, DFES, WA Herbarium
	Fire	Initial suppression Post fire mapping and population assessment Plan/ implement restoration	Isolated remnants within the NAR	During: DFES, Private landholders, LGAs, DBCA After: DBCA, Private landholders, First Nations groups, NACC NRM, LGAs, WA Herbarium
	Extreme Event	Conduct post event assessments Plan/ implement restoration	Isolated remnants within the NAR	During: DFES, DBCA, Private landholders, BOM After: DBCA, Private landholders, First Nations groups, NACC NRM, LGAs, CSIRO, BOM

Banksia Woodlands of the Swan Coastal Plain	Drought	Conduct drought assessment Plan/ implement restoration	Isolated remnants within the NAR largely restricted to the Shire of Gingin and Dandaragan	During: DBCA, Private landholders After: DBCA, First Nations Groups, NACC NRM, WA Herbarium, Private landholders, LGAs
	Disease	Map disease spread and generate management plan Implement biosecurity measures	Isolated remnants within the NAR largely restricted to the Shire of Gingin and Dandaragan	During: DWG, DBCA, Private landholders, DPIRD After: DPIRD, DBCA, DWG, First Nations groups, NACC NRM, Private landholders, LGAs, WA Herbarium, LGAs
	Fire	Initial suppression Post fire mapping and population assessment Plan/ implement restoration	Isolated remnants within the NAR largely restricted to the Shire of Gingin and Dandaragan	During: DFES, DBCA, Private landholders After: DBCA, Private landholders, First Nations groups, NACC NRM, LGAs, DFES
	Extreme Event	Conduct post event assessments Plan/ implement restoration	Isolated remnants within the NAR largely restricted to the Shire of Gingin and Dandaragan	During: DFES, DBCA, Private landholders After: DBCA, First Nations Groups, NACC NRM, Private landholders, LGAs, CSIRO, BOM
Subtropical and Temperate Coastal Saltmarshes	Fire	Initial suppression Post fire mapping and population assessment Plan/ implement restoration	Subtropical and temperate coastal saltmarsh in the NAR, restricted to ~six estuary areas	During: DFES, DBCA, Private landholders After: LGAs, DBCA, WA Herbarium, First Nations groups, NACC NRM
	Extreme Event	Conduct post event assessments Plan/ implement restoration	Subtropical and temperate coastal saltmarsh in the NAR, restricted to ~six estuary areas	During: DFES, DBCA After: LGAs, First Nations groups, NACC NRM, DBCA, conservation groups, CSIRO, BOM
Lesueur National Park	Drought	Conduct post drought assessment Plan/ implement restoration	Across the range of diverse communities in Lesueur National Park	During: DBCA, First Nations groups After: First Nations Groups, NACC NRM, WA Herbarium, CSIRO, BOM
	Disease	Map disease spread and generate management plan Implement biosecurity measures	Across the range of diverse communities in Lesueur National Park	During: DBCA, DWG, First Nations Groups After: DBCA, DWG, First Nations Groups, NACC NRM

	Fire	Initial suppression Post fire mapping and vegetation assessment Plan/ implement restoration	Across the range of diverse communities in Lesueur National Park	During: DBCA, DFES After: DBCA, First Nations groups, NACC NRM, LGAs, DFES
	Extreme events	Conduct post event assessments Plan/ implement restoration	Across the range of diverse communities in Lesueur National Park	During: DFES, DBCA, After: DBCA, First Nations groups, NACC NRM, LGAs, CSIRO, BOM
Agricultural Soils	Drought	Implement recovery measures such as soil rehydration and nutrient replenishment. Increase groundcovers target >50%	Arable soils within the NAR	During: LGAs, DPIRD, agronomists, Private landholders After: NACC NRM, Farm improvement groups, Private landholders, First Nations groups, DPIRD, agronomists, Regen WA, LGAs, Research organisations
	Disease	Remediate affected soil areas through soil rehabilitation and nutrient management	Arable soils within the NAR	During: DPIRD, Agronomists, LGAs, Private landholders After: NACC NRM, Farm improvement groups, Private landholders, First Nations groups, DPIRD, agronomists, Research organisations
	Flood	Implement soil restoration projects including sediment removal and soil stabilization, short term groundcover target >50%, long term >70% root retention	Arable soils within the NAR	During: DPIRD, LGAs, Private landholders After: NACC NRM, Farm improvement groups, Private landholders, First Nations groups, DPIRD, agronomists, Regen WA, Research organisations, DFES, LGAs
	Extreme Events	Conduct post event assessment Initiate soil erosion control measures and soil rehabilitation projects. Groundcover target >50%	Arable soils within the NAR	During: LGAs DPIRD, DFES, Private landholders After: NACC NRM, Farm improvement groups, Private landholders, First Nations groups, DPIRD, agronomists, Research organisations, DFES, LGAs

Water Resources	Flood	Repair and reinforce flood levees and diversion channels, implement soft barries and diversions to slow future water flow.	Surface and ground water resources in the NAR	During: DWER, DPIRD, LGAs, DFES, Private landholders After: NACC NRM, Private landholders, First Nations groups, DPIRD, DWER, Regen WA, Research organisations, DFES, LGAs
	Drought	Restore water sources and implement water catchment strategies, protection of surface water resources from evaporation. Improve water collection infrastructure	Surface and ground water resources in the NAR	During: DWER, DPIRD, LGAs, DFES, Private landholders After: Government water management agencies (e.g., DPIRD), local councils, irrigation specialists, Private landholders
	Plague	Conduct cleanup and implement pest management strategies, instigate ongoing monitoring to avoid recurrence	Surface and ground water resources in the NAR	During: DWER, DPIRD, LGAs, DFES, Private landholders After: Environmental agencies (e.g., DPIRD), pest control authorities, community groups
	Fire	Repair and upgrade water infrastructure damaged by fires, gauge level of silting from increased erosion in collection areas, establish >50% groundcover around surface water catchment areas	Surface and ground water resources in the NAR	During: DWER, DPIRD, LGAs, DFES, Private landholders After: Government water management agencies (e.g., DPIRD), firefighting agencies
	Extreme Events	Conduct post event assessment Restore damaged water infrastructure and enhance resilience measures	Surface and ground water resources in the NAR	During: DWER, DPIRD, LGAs, DFES, Private landholders After: Government water management agencies (e.g., DPIRD), infrastructure authorities
Native Vegetation	Flood	Implement post-flood habitat restoration projects, implement soft barrier as practicable to reduce future flow	Remnant vegetation within the NAR	During: LGAs, Private Landholders, DFES After: NACC NRM, Private landholders, First Nations groups, DPIRD, DWER, Research organisations, DFES, LGAs
	Disease	Remediate affected vegetation areas through replanting and habitat restoration. Initiate	Remnant vegetation within the NAR	During: LGAs, Private landholders, DPIRD, DBCA

		monitoring to ensure adequate reaction time in case of recurrence		After: NACC NRM, Private landholders, First Nations groups, DPIRD, Research organisations, LGAs
	Drought	Implement recovery plans including habitat rehabilitation and revegetation. weed/invasive species control during period of regeneration	Remnant vegetation within the NAR	During: LGAs, Private landholders After: NACC NRM, Private landholders, First Nations groups, DPIRD, Research organisations, LGAs
	Plague	Conduct clean up and implement invasive species management. Initiate monitoring to ensure adequate reaction time in case of recurrence	Remnant vegetation within the NAR	During: LGAs, Private landholders, DPIRD, DBCA After: NACC NRM, Private landholders, First Nations groups, DPIRD, DWER, Research organisations, LGAs
	Fire	Restore vegetation through replanting, habitat restoration, and seed collection. weed/invasive species control during period of regeneration	Remnant vegetation within the NAR	During: LGAs, Private landholders, DPIRD, DBCA, DFES After: Private landholders, NACC NRM, DFES, First Nations groups, DBCA, LGAs
	Extreme Events	Conduct post event assessment Enhance ecosystem resilience through post-event restoration projects	Remnant vegetation within the NAR	During: LGAs, DFES, Private landholders After: NACC NRM, Private landholders, First Nations groups, DPIRD, agronomists, Research organisations, LGAs

These actions primarily focus on responses and measures to be taken during or after emergency events, such as disease outbreaks, extreme weather conditions, fire, and other extreme events, to aid in the rehabilitation and restoration of affected assets within the NAR.

8. ASSET RECOVERY RESPONSE

Effective emergency management is essential to support the recovery of the Northern Agricultural Region (NAR's agricultural and biodiversity assets in the aftermath of various crises. Whether facing floods, diseases, droughts, plagues, fires, or extreme weather events like cyclones, coordinated actions are necessary to mitigate damage and promote resilience. Each emergency scenario demands specific responses tailored to the affected assets and their unique vulnerabilities. Immediate assessments, infrastructure repairs, soil remediation, crop rehabilitation, livestock support, habitat restoration, and community assistance are among the critical measures required. By involving relevant stakeholders such as DPIRD, local government authorities, environmental agencies, conservation organizations, and community groups, a comprehensive recovery plan can

be implemented to safeguard the region's ecological integrity and agricultural productivity. This proactive approach fosters resilience, promotes sustainable land management practices, and enhances the region's capacity to withstand future emergencies. Specific response actions are outlined in the following sections.

8.1 Flood

In the aftermath of a flood in the NAR, several recovery actions must be undertaken to support agricultural and biodiversity assets. The key recovery actions and corresponding timings, locations, and responsible parties are:

Assessment and Damage Evaluation:

When: Immediately following the flood event.

Where: Across the affected areas of the NAR.

Who: DPIRD, local government authorities, and environmental agencies.

Actions: Conduct comprehensive assessments to evaluate the extent of damage to agricultural infrastructure, crops, soil erosion, and biodiversity hotspots.

Infrastructure Repair and Restoration:

When: As soon as floodwaters recede, and areas are safe to access.

Where: Flood-affected agricultural properties.

Who: DPIRD, local government authorities, and agricultural associations.

Actions: Initiate repair works on damaged infrastructure such as roads, bridges, irrigation systems, and farm buildings. Restore access routes to farms and properties to facilitate recovery efforts.

Soil Remediation and Erosion Control:

When: Immediately following the flood event and ongoing.

Where: Areas with soil erosion and degradation.

Who: DPIRD, DBCA, and local landholders.

Actions: Implement soil remediation measures, such as mulching, reseeding, and contour ploughing, to prevent further erosion and restore soil fertility. Establish erosion control structures such as riparian buffers and sediment traps.

Crop Rehabilitation and Reseeding:

When: After floodwaters have receded and soil conditions permit.

Where: Flood-affected agricultural fields.

Who: Farmers, agricultural extension services, and DPIRD.

Actions: Assess crop damage and replant crops where necessary. Provide farmers with technical assistance and resources for crop rehabilitation, including seedlings, fertilizers, and pest management support.

Livestock Recovery and Health Management:

When: Immediately following the flood event and ongoing.

Where: Livestock farms and properties.

Who: DPIRD, local veterinary services, and agricultural associations.

Actions: Assess livestock health and provide veterinary care as needed. Assist farmers in restocking lost animals and implementing measures to prevent disease outbreaks among surviving livestock.

Habitat Restoration and Biodiversity Recovery:

When: Post-flood recovery phase.

Where: Biodiversity hotspots and conservation areas.

Who: DBCA, conservation organizations, and community groups.

Actions: Implement habitat restoration projects to restore damaged ecosystems and biodiversity hotspots. Conduct revegetation efforts, habitat enhancement, and invasive species management to support biodiversity recovery.

Community Support and Assistance:

When: Throughout the recovery process.

Where: Flood-affected communities.

Who: Local government authorities, community service organizations, and DPIRD.

Actions: Provide support to affected farmers and residents through the provision of financial assistance, counselling services, and mental health support. Coordinate community outreach programs and recovery workshops to facilitate information sharing and support networks.

By implementing these flood emergency recovery actions, stakeholders can support the rehabilitation of agricultural and biodiversity assets in the Northern Agricultural Region, promoting resilience and sustainability in the face of natural disasters.

8.2 Disease

In response to a disease outbreak in the NAR, several recovery actions must be undertaken to support agricultural and biodiversity assets. The key recovery actions and corresponding timings, locations, and responsible parties are:

Assessment and Damage Evaluation:

When: Immediately following the identification of the disease outbreak.

Where: Affected agricultural properties and biodiversity hotspots.

Who: DPIRD, local government authorities, and agricultural associations.

Actions: Conduct thorough assessments to evaluate the extent of damage to crops, livestock, and biodiversity assets. Identify the specific pathogens or diseases responsible for the outbreak.

Quarantine and Biosecurity Measures:

When: Immediately following the identification of the disease outbreak.

Where: Affected agricultural properties and surrounding areas.

Who: DPIRD, Department of Health, and local government authorities.

Actions: Implement quarantine measures to prevent the spread of the disease to unaffected areas. Establish biosecurity protocols for farms and properties to minimize the risk of further contamination.

Disease Management and Control:

When: Throughout the duration of the outbreak and recovery period.

Where: Affected agricultural properties and biodiversity hotspots.

Who: DPIRD, agricultural extension services, and local veterinary services.

Actions: Develop and implement disease management strategies tailored to the specific pathogens involved. Provide farmers with guidance around disease control measures, including vaccination, medication, and sanitation practices.

Crop and Livestock Rehabilitation:

When: Once the disease outbreak is contained.

Where: Affected agricultural properties and livestock farms.

Who: Farmers, DPIRD, and agricultural extension services.

Actions: Assess the health of crops and livestock, and implement rehabilitation measures as needed. Provide farmers with support to replant crops, restock livestock, and restore agricultural productivity.

Habitat Restoration and Biodiversity Recovery:

When: Post-outbreak recovery phase.

Where: Biodiversity hotspots and conservation areas.

Who: DBCA, conservation organisations, and community groups.

Actions: Implement habitat restoration projects to support the recovery of biodiversity assets affected by the disease outbreak. Conduct revegetation efforts, habitat enhancement, and invasive species management to promote ecosystem resilience.

Community Support and Education:

When: Throughout the recovery process.

Where: Affected communities and farming regions.

Who: Local government authorities, community service organizations, and DPIRD.

Actions: Provide support to affected farmers and residents through the provision of financial assistance, counselling services, and educational resources. Offer workshops and training sessions on disease prevention and biosecurity practices to enhance community resilience.

By implementing these disease emergency recovery actions, stakeholders can support the rehabilitation of agricultural and biodiversity assets in the Northern Agricultural Region, promoting resilience and sustainability in the face of disease outbreaks.

8.3 Drought

In response to a drought emergency in the NAR, several recovery actions must be undertaken to support agricultural and biodiversity assets. The key recovery actions and corresponding timings, locations, and responsible parties are:

Assessment and Damage Evaluation:

When: As soon as the drought emergency is declared.

Where: Across the affected agricultural properties and biodiversity hotspots in the NAR.

Who: DPIRD, local government authorities, and agricultural associations.

Actions: Conduct comprehensive assessments to evaluate the extent of damage to crops, livestock, and biodiversity assets. Identify areas most severely affected by the drought.

Water Resource Management:

When: Throughout the duration of the drought and recovery period.

Where: Drought-affected agricultural properties and communities.

Who: DPIRD, local government authorities, and water management agencies.

Actions: Implement water conservation measures and manage available water resources efficiently. Provide guidance to farmers around sustainable irrigation practices and water-saving techniques.

Livestock Management and Support:

When: Throughout the duration of the drought and recovery period.

Where: Drought-affected livestock farms and properties.

Who: DPIRD, local veterinary services, and agricultural associations.

Actions: Provide farmers with livestock management support, including feed supplementation, herd reduction strategies, and access to water sources. Offer veterinary assistance and medical care to ensure the welfare of livestock.

Crop Rehabilitation and Soil Health Restoration:

When: Once drought conditions improve.

Where: Drought-affected agricultural fields and croplands.

Who: Farmers, DPIRD, and agricultural extension services.

Actions: Implement soil conservation measures and soil health improvement programs to restore fertility and productivity. Provide farmers with resources for soil testing, nutrient management, and crop rotation strategies.

Habitat Restoration and Biodiversity Recovery:

When: Post-drought recovery phase.

Where: Biodiversity hotspots and conservation areas.

Who: DBCA, conservation organizations, and community groups.

Actions: Implement habitat restoration projects to support the recovery of biodiversity assets affected by the drought. Conduct revegetation efforts, habitat enhancement, and invasive species management to promote ecosystem resilience.

Monitoring and Research:

When: Ongoing throughout the recovery process.

Where: Biodiversity hotspots and research sites.

Who: DPIRD, research institutions, and environmental agencies.

Actions: Conduct ongoing monitoring of biodiversity indicators to assess recovery progress and identify emerging threats. Support research projects focused on understanding the impacts of drought on ecosystems and developing adaptive management strategies.

Community Engagement and Education:

When: Throughout the recovery process.

Where: Local communities, schools, and conservation areas.

Who: Local government authorities, environmental education organizations, and community groups.

Actions: Engage local communities in biodiversity conservation efforts through educational programs, workshops, and citizen science initiatives. Foster stewardship of natural resources, and promote sustainable land management practices to support long-term biodiversity recovery.

By implementing these drought emergency recovery actions, stakeholders can support the rehabilitation of agricultural and biodiversity assets in the NAR, promoting resilience and sustainability in the face of drought conditions.

8.4 Plague

In response to a plague emergency in the NAR, several recovery actions must be undertaken to support agricultural and biodiversity assets. The key recovery actions and corresponding timings, locations, and responsible parties are:

Assessment and Damage Evaluation:

When: Immediately following the identification of the plague outbreak.

Where: Affected agricultural properties and biodiversity hotspots.

Who: DPIRD, local government authorities, and agricultural associations.

Actions: Conduct thorough assessments to evaluate the extent of damage to crops, livestock, and biodiversity assets. Identify the specific pest or plague species responsible for the outbreak.

Quarantine and Pest Control Measures:

When: Immediately following the identification of the plague outbreak.

Where: Affected agricultural properties and surrounding areas.

Who: DPIRD, Department of Health, and local government authorities.

Actions: Implement quarantine measures to prevent the spread of the plague to unaffected areas. Develop and execute pest control strategies, including chemical treatments, biological control methods, and trapping programs to eradicate or manage the plague species.

Crop and Livestock Rehabilitation:

When: Once the plague outbreak is contained.

Where: Affected agricultural properties and livestock farms.

Who: Farmers, DPIRD, and agricultural extension services.

Actions: Assess the health of crops and livestock, and implement rehabilitation measures as needed. Provide farmers with support to replant crops, restock livestock, and restore agricultural productivity.

Habitat Restoration and Biodiversity Recovery:

When: Post-plague recovery phase.

Where: Biodiversity hotspots and conservation areas.

Who: Department of Biodiversity, Conservation and Attractions (DBCA), conservation organizations, and community groups.

Actions: Implement habitat restoration projects to support the recovery of biodiversity assets affected by the plague outbreak. Conduct habitat rehabilitation efforts, including revegetation, habitat enhancement, and removal of invasive species.

Community Support and Education:

When: Throughout the recovery process.

Where: Affected communities and farming regions.

Who: Local government authorities, community service organizations, and DPIRD.

Actions: Provide support to affected farmers and residents through the provision of financial assistance, counselling services, and educational resources. Offer workshops and training sessions on pest management practices, integrated pest management (IPM) strategies, and prevention measures to minimize future plague outbreaks.

By implementing these plague emergency recovery actions, stakeholders can support the rehabilitation of agricultural and biodiversity assets in the NAR, promoting resilience and sustainability in the face of pest infestations.

8.5 Fire

In the aftermath of a fire emergency in the NAR, several recovery actions must be undertaken to support agricultural and biodiversity assets. The key recovery actions and corresponding timings, locations, and responsible parties are:

Assessment and Damage Evaluation:

When: Immediately following containment of the fire.

Where: Affected agricultural properties, forests, and biodiversity hotspots.

Who: DPIRD, local government authorities, and environmental agencies.

Actions: Conduct comprehensive assessments to evaluate the extent of damage to crops, livestock, infrastructure, forests, and biodiversity assets. Identify priority areas for recovery efforts.

Infrastructure and Property Rehabilitation:

When: Once areas are deemed safe for access.

Where: Fire-affected agricultural properties and communities.

Who: Farmers, landowners, DPIRD, and local government authorities.

Actions: Initiate repair and reconstruction of damaged infrastructure, including buildings, fences, irrigation systems, and roads. Provide property rehabilitation assistance and resources to support farmers and landowners in restoring their livelihoods.

Soil and Land Remediation:

When: Post-fire recovery phase.

Where: Burned areas and degraded lands.

Who: DPIRD, environmental agencies, and land management organizations.

Actions: Implement soil conservation measures and land rehabilitation programs to prevent erosion, restore soil fertility, and promote regrowth of vegetation. Conduct revegetation efforts using native species to stabilize soil and support ecosystem recovery.

Livestock Recovery and Health Management:

When: Immediately following containment of the fire and ongoing.

Where: Livestock farms and properties.

Who: DPIRD, local veterinary services, and agricultural associations.

Actions: Assess the health and welfare of livestock, provide veterinary care as needed, and assist farmers in restocking lost animals. Offer feed and water supplementation support to ensure the well-being of livestock during recovery.

Habitat Restoration and Biodiversity Recovery:

When: Post-fire recovery phase.

Where: Biodiversity hotspots, forests, and conservation areas.

Who: DBCA, conservation organizations, and community groups.

Actions: Implement habitat restoration projects to support the recovery of biodiversity assets affected by the fire. Conduct revegetation, habitat enhancement, and wildlife monitoring to promote ecosystem resilience and biodiversity conservation.

Community Support and Assistance:

When: Throughout the recovery process.

Where: Fire-affected communities and farming regions.

Who: Local government authorities, community service organizations, and DPIRD.

Actions: Provide support to affected farmers and residents through the provision of financial assistance, counselling services, and mental health support. Facilitate community workshops and recovery programs to promote resilience, share information, and foster social cohesion.

By implementing these fire emergency recovery actions, stakeholders can support the rehabilitation of agricultural and biodiversity assets in the Northern Agricultural Region, fostering resilience and sustainable land management practices in the face of future fire events.

8.6 Extreme Events

In the wake of an extreme weather event like a cyclone in the NAR, several recovery actions must be undertaken to support agricultural and biodiversity assets. The key recovery actions and corresponding timings, locations, and responsible parties are:

Initial Damage Assessment:

When: Immediately following the cyclone's passage.

Where: Affected agricultural properties, forests, and biodiversity hotspots.

Who: DPIRD, local government authorities, and environmental agencies.

Actions: Conduct rapid assessments to evaluate the extent of damage to crops, livestock, infrastructure, forests, and biodiversity assets. Identify priority areas for immediate recovery efforts.

Emergency Infrastructure Repair:

When: As soon as areas are deemed safe for access.

Where: Cyclone-affected agricultural properties and communities.

Who: Farmers, landowners, DPIRD, and local government authorities.

Actions: Initiate emergency repair and reconstruction of damaged infrastructure, including buildings, fences, irrigation systems, and roads. Provide support and resources for property owners to restore essential services and facilities.

Soil Erosion Control and Land Rehabilitation:

When: Post-cyclone recovery phase.

Where: Eroded lands and degraded areas.

Who: DPIRD, land management agencies, and conservation organizations.

Actions: Implement soil erosion control measures to prevent further degradation and loss of topsoil. Undertake land rehabilitation activities such as revegetation, contouring, and erosion control structures to stabilize soil and promote recovery of vegetation cover.

Livestock and Animal Welfare Support:

When: Immediately following the cyclone and ongoing.

Where: Livestock farms and properties.

Who: DPIRD, local veterinary services, and agricultural associations.

Actions: Assess the welfare of livestock, provide emergency feed, water, and medical care as necessary. Assist farmers in relocating animals to safer areas and implementing measures to minimize future risks to livestock during extreme weather events.

Habitat Restoration and Biodiversity Recovery:

When: Post-cyclone recovery phase.

Where: Biodiversity hotspots, forests, and conservation areas.

Who: DBCA, conservation organizations, and community groups.

Actions: Implement habitat restoration projects to support the recovery of biodiversity assets affected by the cyclone. Conduct revegetation, habitat enhancement, and wildlife monitoring activities to promote ecosystem resilience and biodiversity conservation.

Community Support and Assistance:

When: Throughout the recovery process.

Where: Cyclone-affected communities and farming regions.

Who: Local government authorities, community service organizations, and DPIRD.

Actions: Provide support to affected farmers and residents through the provision of financial assistance, counselling services, and mental health support. Organize community workshops, information sessions, and recovery programs to facilitate collaboration, share resources, and foster community resilience.

By promptly implementing these extreme weather event recovery actions, stakeholders can facilitate the rehabilitation of agricultural and biodiversity assets in the NAR, enhancing resilience and promoting sustainable land management practices in the face of future cyclones and other natural disasters.

9. COMMUNITY/STAKEHOLDER ENGAGEMENT

This section outlines the approach to developing and communicating this plan to stakeholders, including support for Commonwealth, state and territory government efforts to identify and incorporate biodiversity and agricultural natural capital assets into emergency response management and planning systems. This includes identification of gaps in preparedness action.

9.1 Engagement, Collaboration and Coordination activities

Key strategies involved in effectively communicating a biodiversity and agricultural preparedness plan to stakeholders are:

Stakeholder Engagement: Throughout the planning process, engage stakeholders from various sectors, including government agencies, agricultural organizations, environmental groups, Indigenous communities, and local residents. Seek input, feedback, and collaboration from all parties involved to ensure the plan reflects diverse perspectives and priorities.

Clear Communication Channels: Establish clear communication channels to disseminate the preparedness plan and related information and resources. Utilise a range of platforms and tools such as workshops, meetings, webinars, newsletters, social media, and dedicated websites to ensure the effective engagement of all stakeholder groups.

Tailored Messaging: Tailor communication to different stakeholder groups based on their interests, expertise, and roles in emergency response management. Highlight the relevance of biodiversity and agricultural assets in enhancing resilience and reducing risks during emergencies.

Education and Training: Provide educational resources and training sessions to increase stakeholders' understanding of biodiversity and agricultural preparedness concepts, relevant legislation, and their roles in emergency response planning. Offer practical guidance on integrating biodiversity and agricultural considerations into existing emergency management systems.

Partnership Building: Facilitate partnerships and collaboration among stakeholders at all levels, including Commonwealth, state, and territory governments, to align efforts in identifying and incorporating biodiversity and agricultural assets into emergency response planning systems. Highlight the benefits of collaboration, such as leveraging resources, sharing expertise, and enhancing coordination.

Case Studies and Success Stories: Share case studies and success stories that illustrate the importance and effectiveness of integrating biodiversity and agricultural considerations into emergency response management. Highlight examples where proactive planning and collaboration have led to positive outcomes in preserving natural capital assets and supporting community resilience.

Feedback Mechanisms: Establish mechanisms for stakeholders to provide feedback, raise concerns, and contribute ideas for improvement of the preparedness plan. Encourage open dialogue and constructive engagement to foster a sense of ownership and collective responsibility among stakeholders.

Evaluation and Adaptation: Regularly evaluate the effectiveness of both the preparedness plan and the communication methods used in its dispersal. Solicit feedback from stakeholders, assess engagement levels, and identify areas for improvement. To better meet stakeholders' needs and priorities, use their feedback to inform, where necessary, adjustments to the plan and communication strategies

By employing these strategies, NACC NRM and other stakeholders can effectively communicate the biodiversity and agricultural preparedness plan, garner support for incorporating natural capital assets into emergency response management, and foster collaboration across government levels and stakeholder groups.

COMMUNICATIONS				
Public Announcement	Social media, E-newsletter	Once-off communication	Targeted announcement to social media followers and NACC NRM members	Introduce project to local community
Media Release	Local news and media outlets, NACC NRM media channels	Once-off communication	Broad community engagement	Share results of the process

Social Media	X (Twitter), Facebook, Instagram, LinkedIn	On-going communication	Broad community engagement	Announcements, vulnerability assessment, stakeholder engagement opportunities, launch of Plan
Newsletter Article	NACC Notes	On-going communication	NACC NRM members and E-Newsletter subscribers	Raise awareness and increase community engagement
Launch event	In-person	Once	Community, key stakeholders	Share completed plan and thank contributors

9.2 Raising Public Awareness

Raising public awareness about biodiversity and agricultural preparedness requires targeted communication efforts aimed at informing, educating, and engaging the community. Specific actions that can be taken are:

Public Workshops and Information Sessions: Host workshops, seminars, or information sessions in local communities to educate residents on the importance of biodiversity and agricultural preparedness. Provide opportunities for interactive discussions, Q&A sessions, and hands-on activities to enhance understanding and engagement.

Community Presentations: Deliver presentations at community events, schools, or local meetings to raise awareness about biodiversity and agricultural preparedness. Tailor the content to the audience's interests and concerns, highlighting the relevance of these topics to their daily lives and the local environment.

Educational Materials: Develop educational materials such as brochures, fact sheets, posters, and videos to explain key concepts related to biodiversity and agricultural preparedness in an accessible and engaging manner. Distribute these materials through community centres, libraries, schools, and online platforms.

Media Outreach: Partner with local media outlets (e.g., newspapers, radio stations, TV channels) to disseminate information about biodiversity and agricultural preparedness. Issue press releases, write op-eds, or participate in interviews to raise awareness and reach a wider audience.

Social Media Campaigns: Launch social media campaigns on platforms like Facebook, Twitter, and Instagram to share educational content, tips, and resources related to biodiversity and agricultural preparedness. Use hashtags and visual elements to increase visibility and encourage interaction.

Community Engagement Events: Organize community engagement events such as nature walks, farm tours, or volunteer days that highlight the importance of biodiversity and agricultural practices. These events provide hands-on learning opportunities and foster a sense of connection to the local environment.

Partnerships with Local Organizations: Collaborate with local environmental groups, agricultural associations, schools, businesses, and government agencies to amplify outreach efforts and reach diverse audiences. Pool resources, share networks, and coordinate events to maximize impact.

Online Resources and Tools: Develop online resources and tools, such as interactive maps, webinars, and educational games, to engage the public in learning about biodiversity and agricultural preparedness. Make these resources accessible through a dedicated website or online platform.

Citizen Science Projects: Involve the public in citizen science projects related to biodiversity monitoring, agricultural practices, or environmental conservation. Encourage community members to contribute data and observations, or to participate in research initiatives that contribute to understanding and protecting natural assets.

Public Campaigns and Challenges: Launch public campaigns or challenges that encourage individuals and communities to take action for biodiversity and agricultural preparedness. Examples include tree planting initiatives, composting challenges, or habitat restoration projects that promote hands-on involvement and collective impact.

By implementing these strategies, NACC NRM and other stakeholders can effectively raise public awareness about biodiversity and agricultural preparedness, inspire community action, and foster a culture of stewardship towards natural resources in the Northern Agricultural region.

9.3 Education and Training

The development of education and training around biodiversity and agricultural preparedness is crucial in raising awareness and building capacity among stakeholders. Specific actions that can be taken are:

Workshops and Training Sessions: Organize workshops, training sessions, and seminars focused on biodiversity conservation, sustainable agriculture, and emergency preparedness. Invite experts to deliver presentations and facilitate interactive discussions on relevant topics.

Professional Development Programs: Develop professional development programs tailored to the needs of farmers, landowners, conservationists, emergency responders, and other relevant stakeholders. Offer training courses on topics such as ecosystem management, soil conservation, pest control, and disaster response strategies.

Online Courses and Webinars: Create opportunities for accessible, flexible, and user-friendly learning through the delivery of online courses, webinars, and educational modules for a wide audience. Cover a range of topics related to biodiversity conservation, agricultural best practices, and emergency management principles.

Resource Materials: Develop educational resources such as manuals, guides, handbooks, and toolkits that provide practical information and guidance on biodiversity and agricultural preparedness. Ensure these materials are comprehendible, easily accessible, and available in multiple formats to accommodate different learning preferences.

Field Demonstrations and Experiential Learning: Conduct field demonstrations, farm tours, and hands-on learning experiences to showcase sustainable agricultural practices, habitat restoration techniques, and emergency response strategies in action. Allow participants to engage and directly with the landscape and learn through interactive experience.

Youth Engagement Programs: Engage youth through educational programs, school curricula, and youth clubs focused on biodiversity conservation, sustainable agriculture, and disaster preparedness. Encourage hands-on learning activities, outdoor exploration, and projects that empower and equip young people to become stewards of the environment.

Capacity Building for First Nations Communities: Provide culturally sensitive education and training programs tailored to the needs and priorities of Indigenous communities. Collaborate with Indigenous leaders, elders, and organizations, to ensure content is developed and delivered with a key focus on respecting traditional knowledge and practices.

Certification and Accreditation Programs: Establish certification and accreditation programs that recognize individuals and organizations for their commitment to biodiversity conservation, sustainable agriculture, and emergency preparedness. Offer incentives and recognition for the completion of training courses and adoption of best practices.

Partnerships with Educational Institutions: Partner with schools, colleges, universities, and vocational training institutions to integrate biodiversity and agricultural preparedness topics into formal education curricula. Support student internships, research projects, and experiential learning opportunities in relevant fields.

Continuous Learning Opportunities: Foster a culture of continuous learning by providing stakeholders with opportunities for ongoing development of education, training, and skills. Offer refresher courses, advanced training modules, and networking events to keep individuals informed and engaged in evolving best practices.

By prioritizing education and training initiatives, NACC NRM and other stakeholders can empower individuals and communities with the knowledge, skills, and resources needed to effectively contribute to biodiversity conservation, sustainable agriculture, and emergency preparedness efforts in the Northern Agricultural region.

9.4 Key Community/Stakeholder Engagement Gaps

Identifying gaps in community engagement is crucial in ensuring the effectiveness and inclusivity of the biodiversity and agricultural preparedness plan. Potential key gaps are:

Underrepresentation of Certain Stakeholder Groups: There may be certain demographic groups or communities that are often underrepresented in engagement processes. This might include First Nation communities, low-income populations, remote residents, or culturally diverse groups. Emphasised communication and engagement efforts will be required throughout the planning process, to ensure the inclusion of these communities and the recognition of their perspectives.

Limited Accessibility of Engagement Opportunities: Engagement opportunities may not be accessible to all members of the community due to barriers such as language, technology access, transportation, or disability. Any barriers to accessibility must be addressed for the planning process to be achieved through fair and equitable participation opportunities.

Lack of Tailored Communication and Outreach: Communication and outreach efforts may not be effectively tailored to the diverse needs, preferences, and communication styles of different community members. This can result in the perceived exclusion of certain groups from the planning process. Tailoring communication strategies to diverse demographics is essential for fostering meaningful engagement.

Limited Two-Way Dialogue and Feedback Mechanisms: Engagement efforts may focus primarily on disseminating information rather than facilitating two-way dialogue and soliciting feedback from community members. Establishing robust feedback mechanisms and opportunities for open dialogue should be prioritised, despite often being constrained by time bound processes. These mechanisms and opportunities are critical to building trust, addressing concerns, and incorporating community input into the planning process.

Insufficient Capacity Building and Empowerment: Community members may lack the knowledge, skills, or resources necessary to meaningfully engage in the planning process or take action on biodiversity and agricultural preparedness issues. Providing capacity-building initiatives, training opportunities, and resources to empower community members to participate effectively is critical to support the ongoing preparedness for scenarios outlined in this plan.

Disconnectedness Between Local and Regional Planning Efforts: There may be a disconnect between local-level engagement efforts and broader regional or governmental planning processes. Ensuring alignment and coordination between local, regional, and governmental planning initiatives is essential to coherently and effectively address biodiversity and agricultural preparedness.

Limited Representation of Community Perspectives in Decision-Making: Community perspectives and priorities may not be adequately represented in decision-making processes related to biodiversity and agricultural preparedness. Actively involving community members in decision-making bodies, advisory groups, or governance structures will ensure that their voices and opinions are heard and valued.

In order to address these gaps, proactive efforts are required in enhancing inclusivity, accessibility, and meaningful engagement throughout any planning, preparedness or recovery process. This may involve targeted outreach, capacity-building initiatives, fostering partnerships with community organizations, and adopting participatory decision-making approaches that prioritize community perspectives and priorities.

9.5 Key Asset Gaps

For each listed asset, gaps in preparedness, response and recovery actions have been identified where possible. However, it is recognised that current gaps in understanding relevant to the preparedness and response for specific assets could be subject to change. Research and monitoring efforts have the potential to bridge gaps, while new and emerging threats are capable of heightening existing gaps, or introducing new gaps. Research and monitoring have been broadly identified as requirements for preparedness and response actions throughout this Plan.

Time-sensitive data concerning species distribution and population persistence, especially where observation records are outdated, necessitates further survey and monitoring efforts to inform emergency preparedness, response, and recovery strategies.

Some species' vulnerability to emergencies remains unclear, warranting additional investment and investigation to prevent unintended consequences, and ensure effective management practices. This gap is evident when reviewing underlying mapping data and the associated risk assumptions.

10. LEGAL FRAMEWORK

The development of an emergency preparedness and response plan for the NAR requires NACC NRM and other stakeholders/agencies to navigate various legal and regulatory considerations, including those related to workplace health and safety (WHS). Key legal considerations and potential actions for responding to different emergencies can be surmised as:

Workplace Health and Safety (WHS):

Compliance with relevant WHS legislation, such as the *Work Health and Safety (WHS) Act 2020* (WA) and the *Work Health and Safety (WHS) Regulations 2020* (WA), is crucial to ensure the safety of personnel involved in emergency preparedness and response activities. This includes conducting risk assessments, maintaining safe work practices during emergency operations, and providing appropriate training and personal protective equipment (PPE).

Environmental Regulations:

Adherence to environmental regulations is essential when responding to emergencies such as flood, disease, drought, plague, fire, and extreme events. This may involve compliance with the *Environmental Protection Act 1986* (WA) and associated regulations, obtaining permits or approvals for activities such as habitat restoration, pest management, chemical use, and land rehabilitation, while minimizing impacts on protected species and habitats.

Land Use Planning and Development Controls:

Consideration of land use planning and development controls is necessary to ensure that emergency response actions align with zoning regulations, land tenure arrangements, and development approvals. This includes compliance with the *Planning and Development Act 2005* (WA) and associated planning schemes, assessing land use compatibility, land capability, and land tenure rights when siting infrastructure or undertaking land management activities.

Water Management and Allocation:

Compliance with water management regulations and allocation policies is critical, particularly during drought and water scarcity conditions. NACC NRM and other stakeholders must ensure that any emergency response related water use practices are undertaken in abidance with the *Rights in Water and Irrigation Act 1914* (WA) and associated regulations, water licensing requirements, water entitlements, and environmental flow provisions to minimize impacts on water resources and ecosystems.

Biosecurity and Pest Management:

Adherence to biosecurity regulations and pest management protocols is essential to prevent the spread of diseases, pests, and invasive species during emergency response activities. This may involve compliance with the *Biosecurity and Agriculture Management Act 2007* (WA) and associated regulations, implementing quarantine measures, movement restrictions, and biosecurity protocols to protect agricultural and natural assets from biosecurity threats.

Emergency Management Frameworks:

NACC NRM and other stakeholders should operate within the broader emergency management frameworks established by state and local government authorities. This includes conformity to the *Emergency Management Act 2005* (WA) and associated regulations, coordination with emergency

services, adherence to emergency response protocols, and participation in emergency planning and coordination committees to ensure a cohesive and effective response to emergencies.

11. RISK MANAGEMENT INCLUDING MITIGATION STRATEGIES

The development of an emergency preparedness and response plan for the NAR requires NACC NRM and other stakeholders/agencies to consider various risks, including those related to human health, ecosystem destruction, resource availability, public communication, maintaining communication with emergency services, corporate knowledge, and technological reliance. Key risk considerations can be addressed in the planning process as:

Human Health Risks: Assess and mitigate risks to human health, such as exposure to pollutants, hazardous materials, or contaminants, during emergency response activities. Implement protocols for monitoring air and water quality, providing protective equipment, and conducting health assessments to ensure the wellbeing of personnel involved in emergency operations.

Ecosystem Destruction: Evaluate potential impacts of response actions on ecosystems and biodiversity, taking into consideration the risk of further destruction or disturbance. Implement measures to minimize ecosystem impacts, such as avoiding sensitive habitats, implementing erosion control measures, and conducting post-incident assessments to guide restoration efforts.

Resource Availability: Assess and plan for the availability of resources required for emergency response, including personnel, equipment, supplies, and funding. Develop contingency plans for resource allocation, coordination with external agencies, and mobilization of additional resources as needed during emergencies.

Public Communication: Develop effective communication strategies to inform and engage the public before, during, and after emergencies. Provide timely and accurate information on emergency risks, evacuation procedures, shelter locations, and response actions through various communication channels, including media, social media, websites, and community meetings.

Maintaining Communication with Emergency Services: Establish and maintain channels of communication with emergency services, including local authorities, firefighting agencies, law enforcement, and medical services. Coordinate response efforts, share information, and collaborate on decision-making to ensure a cohesive and effective response to emergencies.

Corporate Knowledge: Preserve and leverage corporate knowledge and expertise within NACC NRM and other agencies/stakeholders to inform emergency preparedness and response efforts. Document lessons learned from past emergencies, conduct training and exercises, and foster collaborative tools and resources to aid knowledge sharing, enhancing preparedness and response capabilities.

Technological Reliance: Evaluate the reliance on technology for emergency communication, data management, mapping, and decision support systems. Identify backup systems, redundancy measures, and alternative communication channels to mitigate the risk of technology failures or disruptions during emergencies.

By considering these risks and integrating appropriate mitigation measures into the emergency preparedness and response plan, NACC NRM and other stakeholders/agencies can effectively manage emergencies and support the resilience of the NAR's agricultural and biodiversity assets while safeguarding human health and minimising environmental impacts.

NACC NRM is committed to providing a safe and healthy work environment where all staff members, volunteers, direct contractors and other stakeholders are able to avoid exposure to harm from hazards. NACC NRM follows all guidelines as recommended under Federal and State Legislation. All employees are expected to follow the safety standards that apply to our organization, and adhere to the Western Australian *Work Health and Safety (WHS) Act 2020*.

Direct Risk and Mitigation actions relevant to the implementation of this Plan include;

Risk	Likelihood	Consequence	Risk Rating	Risk mitigation action	Residual risk
The health, safety and wellbeing of employees or contractors is impacted by their role in responding to an emergency event	Possible	Extreme	High	The philosophy of protecting life and property will take precedence. Emergency services training and accreditation pathways are implemented	Medium
Unintended ecosystem destruction occurs because of emergency response actions	Unlikely	Moderate	Medium	Preparedness plan is provided to emergency services/response agencies for use in incident control centres. The plan is socialised through relevant stakeholders and agencies	Low
Resources are not available to implement this Plan	Unlikely	Moderate	Medium	A partnership approach is used to ensure actions are met	Low
Emergency services organisations are not aware of this Plan	Unlikely	Moderate	Medium	Participation in Regional and State Emergency Management Planning Committees where possible	Low
Impacts on Indigenous Cultural Heritage and Indigenous Cultural and Intellectual Property (ICIP)	Unlikely	Moderate	Medium	Utilise established Aboriginal engagement guidelines, relationships, and search tools. Include collaboration with known knowledge holders, groups, individuals and PBCs	Low
The Plan is not implemented by emergency services organisations	Unlikely	Moderate	Medium	Preparedness plan is provided to emergency services/response agencies. Seek funding to implement the plan	Low

NACC NRM recognises health and safety duty as a ‘person conducting a business or undertaking’ (PCBU). An effective Work Health Safety Plan requires the avid commitment and involvement of all employees, managers, and other stakeholders. This is achieved through consultation, co-operation,

and participation to ensure that, in every case, Work Health and Safety (WHS) issues within our workplace are addressed and resolved using practical solutions.

In workplaces under NACC NRM control, all employees, direct contractors, volunteers, and other stakeholders are responsible for taking reasonable care of their own safety and health, and avoiding activities that may cause harm to or compromise the safety and health of other people.

NACC NRM's Occupational Safety and Health systems align with the:

Work Health and Safety (WHS) Act 2020 (WA);

Work Health and Safety (WHS) Regulations 2020 (WA); and

ISO 45001 Safety Management Systems

If there is any inconsistency between NACC NRM's WHS plans and the WHS Laws, the WHS Laws prevail to the extent of the inconsistency.

12. MONITORING AND DATA

All exported map data is derived from unmodified datasets and as such will be fully available from the original data custodians. This section outlines each data source and where data can be downloaded/accessed, with the exemption of Birdlife Australia data, which is only available on request from Birdlife Australia. All mapping is stored on NACC NRM's physical server and will be available upon request.

Mapping of Assets

For the purpose of this plan, data has been collated from multijurisdictional sources, including several state and federal data sources, with some additional resources provided by Birdlife Australia. Mapping of biodiversity assets has been divided in two main categories; Threatened Ecological Communities, and Species listed as Federal priorities for the NAR. As species locations are often sensitive, this data, where relevant, has been buffered either by the original data custodian or by NACC NRM, to ensure the exact location of species is protected from harm. Mapping produced for this plan serves as an indication of assets and risks, and is based on interpretation of external datasets. Mapping will not remain up to date if datasets are updated or superseded following the completion of the plan.

Priority species mapping is based on the Australian Government's mapping of Species of National Significance and Selected Marine and Cetacean Species (DCCEEW 2024). This data was accessed in May 2024 and can be downloaded from the Australian Government Department of Climate Change, Energy, the Environment and Water's 'Find Environmental Data' geoportal: https://fed.dcceew.gov.au/datasets/erin::species-of-national-environmental-significance-and-selected-marine-and-cetacean-species/explore. This mapping also includes data of known breeding sites of Carnaby's Black Cockatoo, held by Birdlife Australia. This data was provided in June 2020 and has been buffered to protect exact locations.

Threatened Ecological Communities mapping is based on the Australian Government's mapping of Ecological Communities of National Environmental Significance Distributions (DCCEEW 2024). This data was access in May 2024 and can be downloaded from the Australian Government Department of Climate Change, Energy, the Environment and Water's 'Find Environmental Data'

geoportal: https://fed.dcceew.gov.au/datasets/erin::australia-ecological-communities-of-national-environmental-significance-distributions-1/explore

Soils mapping has been presented as Cropping capability and Grazing capability, representing the most common types of agricultural production in the NAR. Maps are derived from the Soil Landscape mapping – Best Available (DPIRD-027), covering Western Australia at the best available scale V05.05. Data is held and provided by Department of Primary Industries and Regional Development, accessed in May 2024, and is available at: https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available

Surface Water Mapping is based on two datasets**.** Water bodies, displayed as permanent surface water data, is from the Digital Earth Australia Waterbodies V3.0. This data was accessed in May 2024, and is available for download at https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search#/metadata/148920. Rivers and streams data is derived from interpretation of Landgate Medium Scale topography v1.4 data. This data is not available from the original data source, but derived maps can be provided by NACC NRM upon request.

Hydrological Zones mapping relates water and soil data, and is based on the Hydrological Zones of Western Australia (DPIRD-069). Hydrological zones are a broad spatial framework that groups areas with similar hydrology. Zone boundaries are derived from hydrological attributes associated with the best available soil-landscape mapping, Version 5.01. Data is held and provided by Department of Primary Industries and Regional Development, accessed in May 2024, and is available at: https://catalogue.data.wa.gov.au/dataset/hydrological-zones-of-western-australia

Native vegetation outside reserves and protected areas mapping is based on Native Vegetation Extent (DPIRD-005), vegetation extent polygons from the mapping of remnant vegetation in Western Australia. Data is held and provided by Department of Primary Industries and Regional Development, accessed in May 2024, and is available at: https://catalogue.data.wa.gov.au/dataset/soil-landscape-land-quality-flood-risk. (This data has been masked to excluded legislated lands and water (DBCA-011) available at https://catalogue.data.wa.gov.au/dataset/dbca-legislated-lands-and-waters, and Protected Areas listed in the Collaborative Australian Protected Areas Database 2022-terrestrial available at: https://fed.dcceew.gov.au/datasets/ec356a872d8048459fe78fc80213dc70_0/explore)

Mapping of Risks

Water Erosion Risk mapping is based on Soil Landscape Land Quality – Water Erosion Risk (DPIRD-013), water erosion risk mapping derived from land quality attribution association with soil landscape mapping. Data is held and provided by Department of Primary Industries and Regional Development, accessed in May 2024, and is available at: https://catalogue.data.wa.gov.au/dataset/soil-landscape-land-quality-water-erosion

Flood Risk mapping is based on Soil Landscape Land Quality – Flood Risk (DPIRD-007), Flood risk mapping derived from land quality attribution association with soil landscape mapping. Data is held and provided by Department of Primary Industries and Regional Development, accessed in May 2024, and is available at: https://catalogue.data.wa.gov.au/dataset/soil-landscape-land-quality-flood-risk

Wind Erosion Risk mapping is based on Soil Landscape Land Quality – Wind Erosion Risk (DPIRD-016), Wind erosion risk mapping derived from land quality attribution association with soil

landscape mapping. Data is held and provided by Department of Primary Industries and Regional Development, accessed in May 2024, and is available at: https://catalogue.data.wa.gov.au/dataset/soil-landscape-land-quality-wind-erosion-risk

Bushfire Risk mapping is based on Bush Fire Prone Areas 2021 (OBRM-019). The Bush Fire Prone Areas 2021 dataset (OBRM-019) identifies bush fire prone areas of Western Australia as designated by the Fire and Emergency Services (FES) Commissioner on 11 December 2021. Data is held and provided by the Office of Bushfire Risk Management, accessed in May 2024, and is available at: https://catalogue.data.wa.gov.au/dataset/bush-fire-prone-areas-2021-obrm-019

Mapping of NAR Scope

State Managed Conservation Park, National Park and Nature Reserves & State Managed Marine Park data was derived from Department of Conservation, Biodiversity and Attraction's legislated lands and water (DBCA-011), accessed in June 2024, and is available at https://catalogue.data.wa.gov.au/dataset/dbca-legislated-lands-and-waters,

Commonwealth Marine Park data was extracted from Australian Government's mapping of Australian Marine Parks- outer boundaries (DCCEEW 2023). This data was accessed in June 2024 and can be downloaded from the Australian Government Department of Climate Change, Energy, the Environment and Water's 'Find Environmental Data' geoportal: https://fed.dcceew.gov.au/datasets/erin::australian-marine-parks-outer-boundaries/about

Regional Development Regions mapping is based on Regional Development Commission Boundaries (DPIRD-020), A dataset that contains Regional Development Commission (RDC) region boundaries in Western Australia. Data is held and provided by Department of Primary Industries and Regional Development, accessed in June 2024, and is available at: https://catalogue.data.wa.gov.au/dataset/regional-development-commission-boundaries

13. KEY CONTACTS

NACC NRM is committed to working in partnership with the community, industry, and government to ensure the maintenance of our vibrant and prosperous region. Our connected and engaged position enables effective delivery of Natural Resource Management, Environmental Conservation, and Sustainable Agriculture practices and activities.

NACC NRM's engagement and communication activities reach a broad key audience. This supports the following summary of key stakeholders, and their roles, required in undertaking post emergency preventative or remediation actions.

ORGANISATION	CONTACT NAME	EMAIL ADDRESS	FIELD	ROLE
Australian Wildlife Conservancy	Amanda Bourne	amanda.bourne@australianwildlife.org	BIO	Species and habitat conservation
Badimia Bandi Barna Aboriginal Corporation	Corinne Fogarty	badimiabbac@gmail.com	AC, BIO	Biodiversity and cultural asset identification, planning, and management. Community engagement

Birdlife WA	Sam Rycken	sam.rycken@birdlife.org.au	BIO	Monitoring and restoration
Bush Heritage Australia	Bill Currans	bill.currans@bushheritage.org.au	AC, BIO	Landscape restoration
Central Regional TAFE – Batavia Coast Maritime Institute	Maryke Gray	maryke.gray@crtafe.wa.edu.au	CM	Education and community engagement
Central Wheatbelt Biosecurity Association	Linda Vernon	eocwba@outlook.com	SUS AG BIO	Biodiversity and agricultural asset protection
City of Greater Geraldton	Caroline Hood	environmentalplanning@cgg.wa.gov.au	LGA	Planning, design, preparedness, and response
DBCA	Anthony Desmond	anthony.desmond@dbca.gov.au	GA, AC, BIO, CM	Landscape restoration and protection
DPIRD	Stephen Davies	stephen.davies@dpird.wa.gov.au	GA, SUS AG	Monitoring, management, planning, and response
DFES	Ranelle Clarke	ranelle.clarke@dfes.wa.gov.au	GA	District Emergency Management
DWER	Alan Bradley	Alan.bradley@dwer.gov.au	BIO SUS AG AC	Water and environmental regulation- clearing, water resource management. Planning and response
DWG	Pip Soulsby	pip.soulsby@dwg.org.au	BIO	Threat identification, planning, and management
Gunduwa Regional Conservation Association	Richard McLellan	mclellan.richard@gmail.com	AC, BIO	Landscape restoration
Grains Research and Development Corporation	Jo Wheeler	Jo.wheeler@grdc.com.au	SUS AG	Research - soil management, disease
Grower Group Alliance	Kalista Bolton	kbolton@gga.org.au	SUS AG	Collaboration within grower groups, drought adoption and innovation,
Kwelena Mambakort Wedge Island Aboriginal Corporation	Annie Shaw	annie.shaw@kmacenvironmental.com	AC, BIO, CM	Biodiversity and cultural asset identification, planning, and management. Community engagement
Liebe Group	Chris O'Callaghan	eo@liebegroup.org.au	SUS AG	Agricultural asset resilience
Midlands Biosecurity Group	Chris O'Callaghan	eo@mbg.org.au	SUS AG BIO	Biodiversity and agricultural asset protection
Mingenew Irwin Group	Dee McKeown	ceo@mig.org.au	SUS AG	Agricultural asset resilience
Moore Catchment Council	Helen Watkins	moorecc@bigpond.com	SUS AG, BIO	Species and habitat conservation

National Malleefowl Recovery Team	Liz Kingston	lizk@nationalmalleefowl.com.au	BIO	Biodiversity asset monitoring and community engagement
Northern Agri Group	Josh Carson	chair@northernagrigroup.com.au	SUS AG	Agricultural asset resilience
Northern Biosecurity Group	Marieke Jansen	nbg_eo@outlook.com	SUS AG, BIO	Biodiversity and agricultural asset protection
Peel Harvey NRM	Jane O'Malley	admin@peel-harvey.org.au	NRM	Biodiversity and agricultural asset identification, planning, and management. Community engagement
Perth NRM	Keith Pekin	keith.pekin@perthnrm.com	NRM	Biodiversity and agricultural asset identification, planning, and management. Community engagement
Rangelands NRM	Chris Curnow	chrisc@rangelandswa.com.au	NRM	Biodiversity and agricultural asset identification, planning, and management. Community engagement
Regen WA	Bonnie Jupp	bonnie.jupp@perthnrm.com	SUS AG	Agricultural asset resilience
Shire of Carnamah	Rob Paull	ceo@carnamah.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Chapman Valley	Jamie Criddle	ceo@chapmanvalley.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Coorow	Mia Maxfield	ceo@coorow.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Dalwallinu	Jean Knight	ceo@dalwallinu.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Dandaragan	Brent Bailey	council@dandaragan.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Gingin	Aaron Cook	aaron.cook@gingin.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Irwin	Shane Ivers	reception@irwin.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Mingenew	Matt Fanning	ceo@mingenew.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Moora	Gavin Robins	ceo@moora.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Morawa	Scott Wildgoose	ceo@morawa.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Northampton	Andrew Campbell	ceo@northampton.wa.gov.au	LGA	Planning, design, preparedness, and response

Shire of Perenjori	Paul Anderson	ceo@perenjori.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Three Springs	Keith Woodward	ceo@threesprings.wa.gov.au	LGA	Planning, design, preparedness, and response
Shire of Victoria Plains	Sean Fletcher	ceo@victoriaplains.wa.gov.au	LGA	Planning, design, preparedness, and response
Three springs Farm Innovation Network (3fin)	Jim Heale	Info@3fin.com.au	SUS AG	Agricultural asset resilience
WA Malleefowl Recovery Group	Harriet Davie/ Liz Kingston	wamalleefowlrg@gmail.com	BIO	Biodiversity asset monitoring and community engagement
Waddy Forest LCDC	Fiona Falconer	davidfiona1@bigpond.com	BIO	Asset management and community engagement
West Koojan-Gillingarra LCDC	Rebecca Kelly	becgillingarra@gmail.com	BIO	Asset management and community engagement
West Midlands Group	Nathan Craig	nathan.craig@wmgroup.org.au	SUS AG	Agricultural asset resilience
Western Mulga	Sandy McEwan	sandy@westernmulga.com.au	AC, BIO	Biodiversity asset management and community engagement
Wheatbelt NRM	Dr Karl O'Callaghan	kocallaghan@wheatbeltnrm.org.au	NRM	Biodiversity and agricultural asset identification, planning, and management. Community engagement
Yamatji Southern Regional Corporation	Daniel Shiosaki	jmprojectofficer@ysrc.com.au	AC, BIO	Biodiversity and cultural asset identification, planning, and management. Community engagement
Yarra Yarra Catchment Management Group	Lizzie King	landcarecoordinator@yarrayarracatchment.org.au	SUS AG	Landscape and agricultural asset conservation
Yuna Farm Improvement Group	Nicole Batten	Yuna.fig@gmail.com	SUS AG	Agricultural asset resilience

***FIELD** represents the key area of responsibility or interest of this stakeholder, which determines the role they may play in the delivery of this Plan.

BIO – Biodiversity Asset interest

AC – Aboriginal Custodianship (broad interest in sites and totemic species, including cultural responsibilities)

GA – Government Authority (Western Australia)

CM – Coastal and Marine Asset interest

SUS AG – Agricultural Asset interest

LGA – Local Government Area with legislative requirements

NRM – Natural Resource Management organisations identified as RDP's

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Acronyms

AWC Australian Wildlife Conservancy

COMDISPLAN Australian Government Disaster Response Plan

CSIRO Commonwealth Scientific and Industrial Research Organisation

DAFF Department of Agriculture, Fisheries and Forestry

DCCEEW Department of Climate Change, Energy, the Environment and Water

DBCA Department of Biodiversity, Conservation and Attractions

DFES Department of Fire and Emergency Services

DPIRD Department of Primary Industries and Regional Development

DWER Department of Water and Environmental Regulation

DWG Dieback Working Group

EM Emergency Management

EPBC Act Environment Protection and Biodiversity Conservation Act 1999

GRDC Grains Research and Development Corporation

IBA Important Bird Area

IBRA Interim Biogeographic Regionalisation for Australia

IPM Integrated Pest Management

MNES Matters of National Environmental Significance

MU34 NRM Regions of Australia's Management Unit number 34

NACC NRM Northern Agricultural Catchments Council

NAR Northern Agricultural Region

NHT Natural Heritage Trust

NMRT National Malleefowl Recovery Team

PBC Prescribed Body Corporate of native title groups and corporations

PCBU Person Conducting a Business or Undertaking

PLB Pastoral Lands Board

RLP Regional Land Partnerships

RDP Regional Delivery Partner

WAMRG Western Australian Malleefowl Recovery Group

WHS Work Health and Safety

15. APPENDICES

Appendix A. Biodiversity Asset Mapping

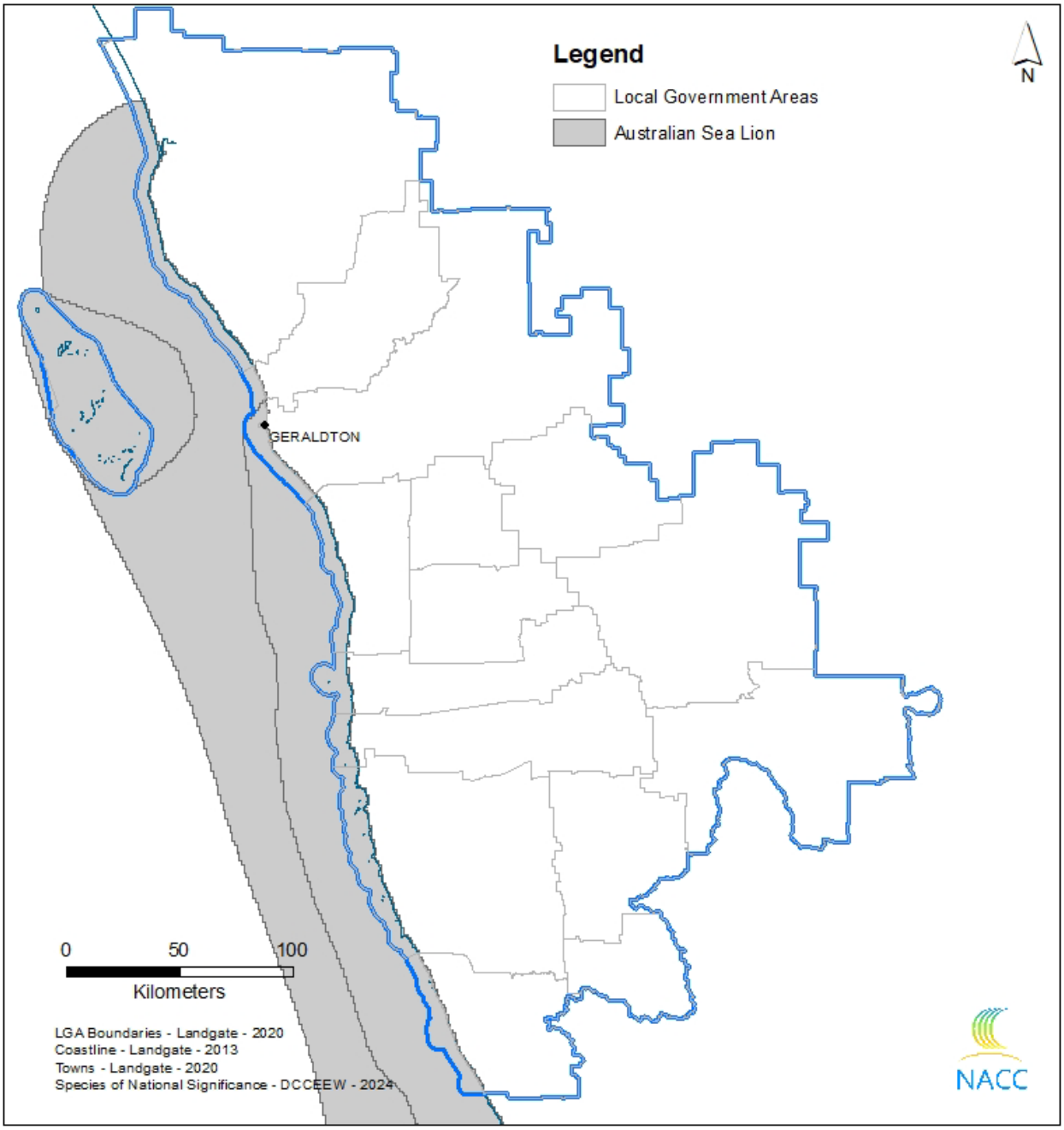
Biodiversity Asset mapping shows the occurrence of species or species habitat of Threatened Ecological Communities and Nationally significant Species.

Asset	Asset Type	Relevant Strategy/Act	Map #
Australian Sea Lion *Neophoca cinerea*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Endangered *Biodiversity Conservation Act 2016* - Endangered	1
Chuditch, Western Quoll *Dasyurus geoffroii*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable *Biodiversity Conservation Act 2016* - Vulnerable	2
Greater Bilby *Macrotis lagotis*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable *Biodiversity Conservation Act 2016* - Vulnerable	3
Numbat *Myrmecobius fasciatus*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Endangered *Biodiversity Conservation Act 2016* - Endangered	4
Carnaby's cockatoo *Zanda latirostris*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Endangered *Biodiversity Conservation Act 2016* - Endangered	5
Malleefowl *Leipoa ocellata*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable *Biodiversity Conservation Act 2016* - Vulnerable	6
Australasian Bittern *Botaurus poiciloptilus*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Endangered *Biodiversity Conservation Act 2016* - Endangered	7
Western Swamp Tortoise *Pseudemydura umbrina*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Critically Endangered *Biodiversity Conservation Act 2016* – Critically Endangered	8
Foote's Grevillea *Grevillea calliantha*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Critically Endangered *Biodiversity Conservation Act 2016* – Critically Endangered	9
Scaly-butt Mallee (*Eucalyptus leprophloia)*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Critically Endangered *Biodiversity Conservation Act 2016* – Critically Endangered	10
row-leaf Eremophila *(Eremophila subangustifolia)*	Nationally Significant Species	*Environment Protection and Biodiversity Conservation Act 1999* – Critically Endangered *Biodiversity Conservation Act 2016* – Critically Endangered	11
Eucalypt Woodlands of the WA Wheatbelt	Threatened Ecological Community	*Environment Protection and Biodiversity Conservation Act 1999* – Critically Endangered *Biodiversity Conservation Act 2016* – Critically Endangered	12
Banksia Woodlands of the Swan Coastal plain	Threatened Ecological Community	*Environment Protection and Biodiversity Conservation Act 1999* – Critically Endangered *Biodiversity Conservation Act 2016* – Critically Endangered	13
Sub-tropical and temperate coastal saltmarsh	Threatened Ecological Community	*Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable	14

Map 1. Australian Sea Lion *(Neophoca cinerea)*

Map outlining the habitat in which the Australian Sea Lion is likely to occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

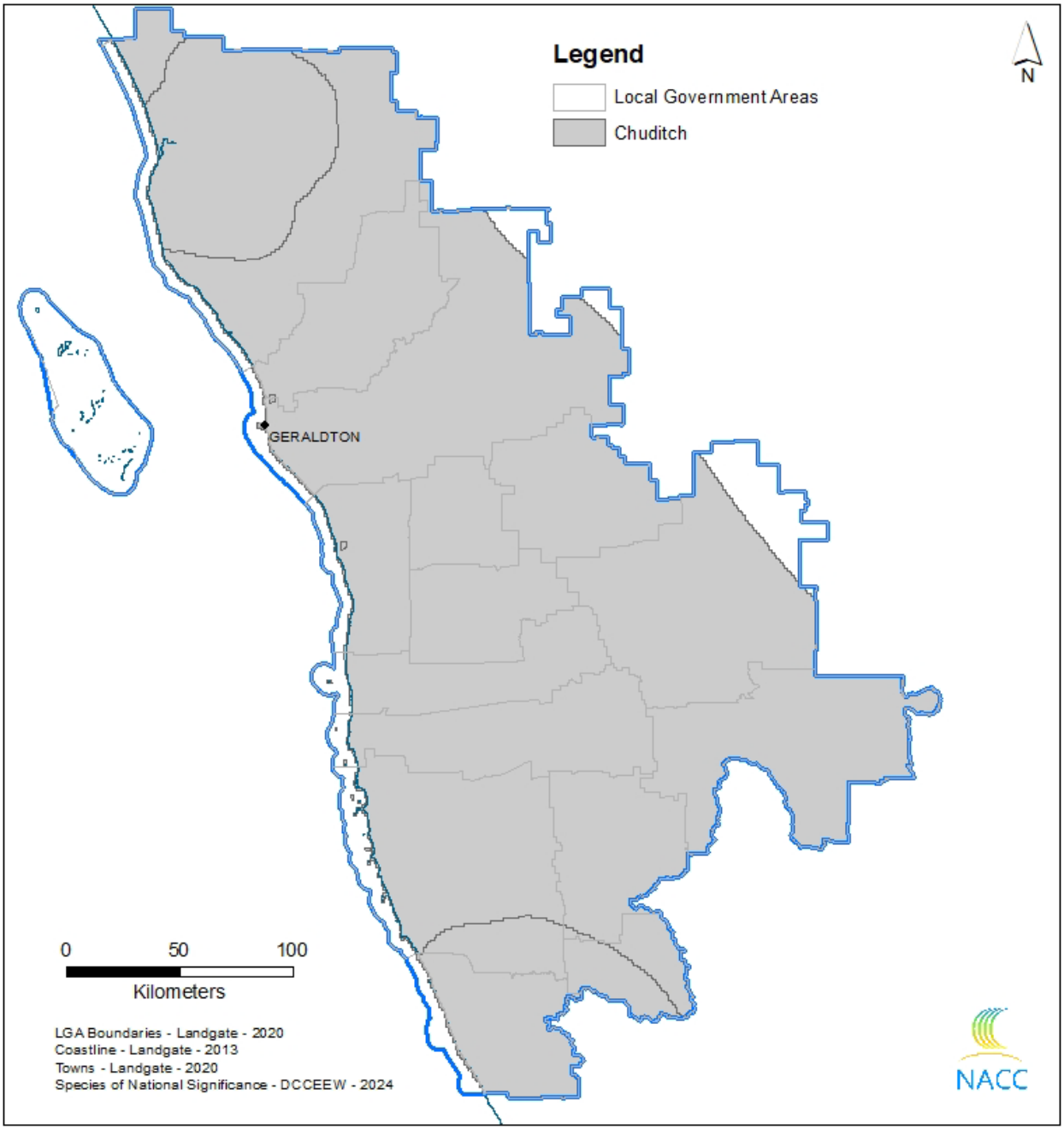
Australian Sea Lions prefer sandy beaches in isolated bays, however, they will utilise a wide range of habitats for haul out sites including exposed islands, rock groins, and reefs. Forage habitat is restricted to the continental shelf where Sea Lions target fish, cephalopods, crustaceans, sharks, rays, penguins and gastropods.



Map 2. Chuditch, Western Quoll *Dasyurus geoffroii*

Map outlining the habitat in which the Chuditch may occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

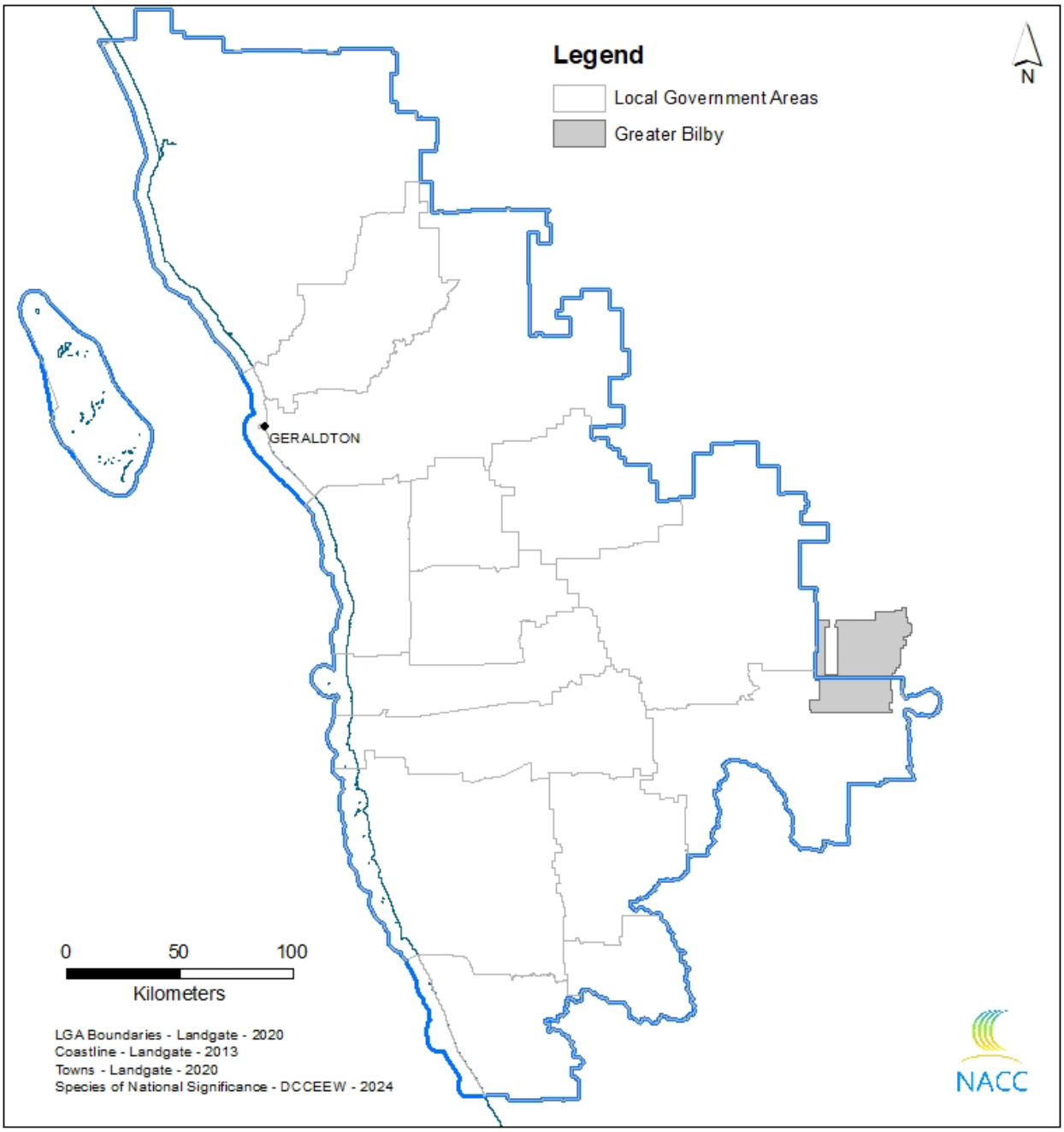
Chuditch inhabit wet and dry sclerophyll forests, including Eucalypt and Mallee open forest, low open forest, woodland, and open shrub. Chuditch are now restricted to isolated populations in the Southwest of WA. In the NAR, reintroduced populations are subsisting in the Kalbarri National Park and at AWC's Mount Gibson Sanctuary



Map 3. Greater Bilby *Macrotis lagotis*

Map outlining the habitat in which the Greater Bilby is known to occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

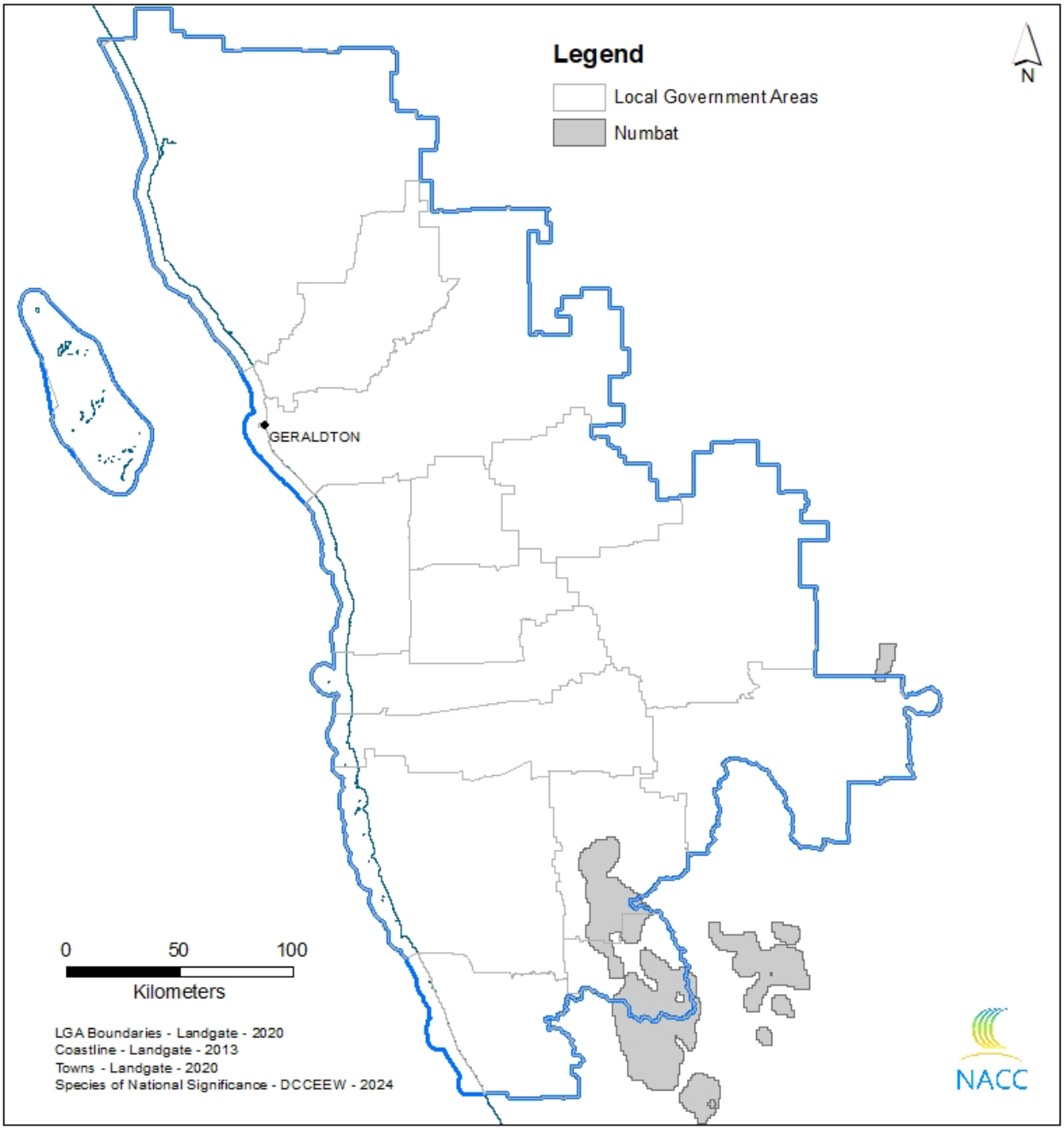
Greater Bilby is currently only found in the NAR, within the predator proof sanctuary at Mt Gibson.



Map 4. Numbat *Myrmecobius fasciatus*

Map outlining the likely habitat in which Numbat may occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

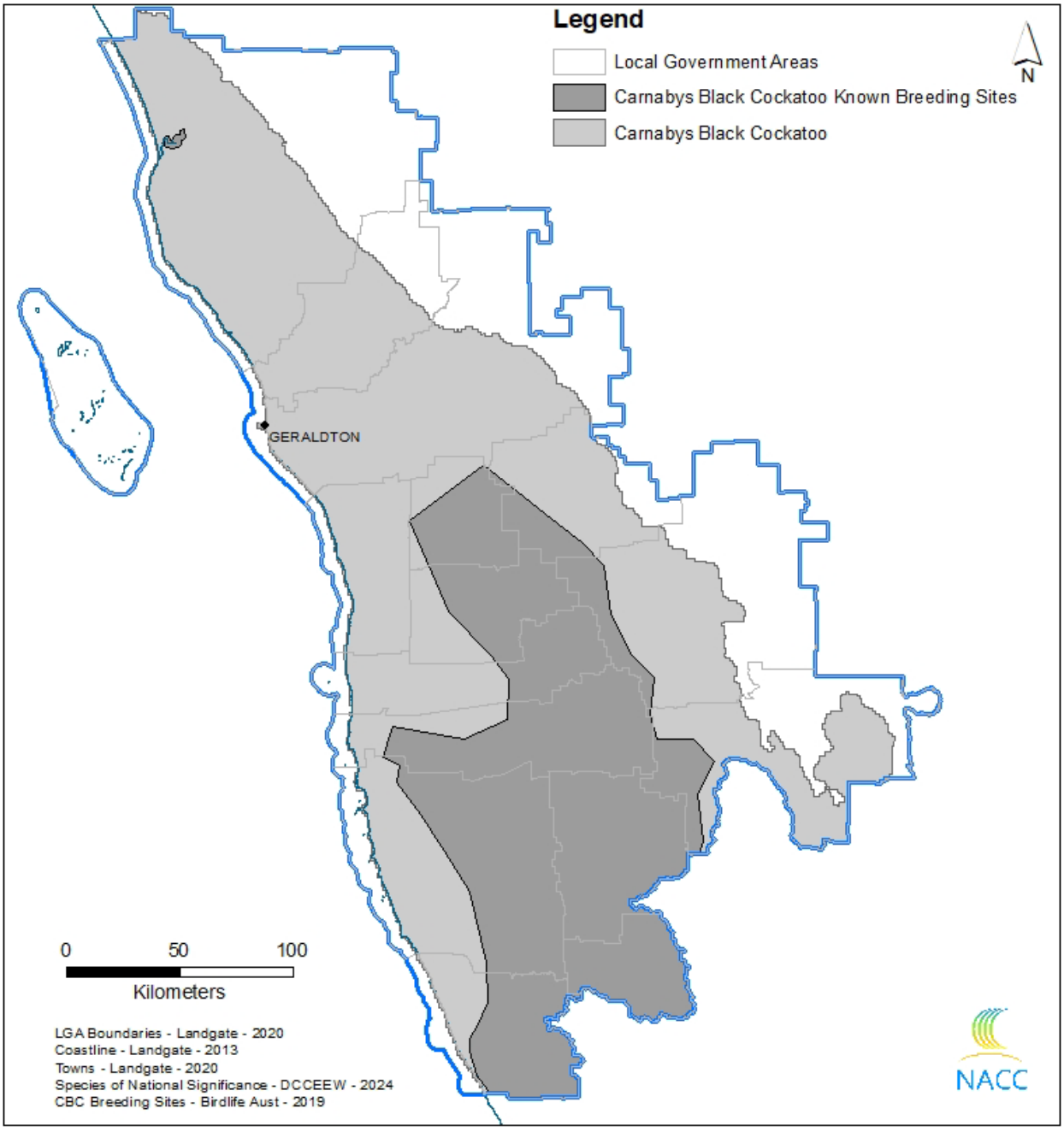
Numbats were historically found in a range of different habitats from mulga woodland and spinifex sandplains to eucalypt woodlands and forests. The only known population in the NAR is within the predator proof sanctuary at Mt Gibson.



Map 5. Carnaby's cockatoo *Zanda latirostris*

Map outlining the habitat in which Carnaby's Cockatoos are likely to occur in the NAR (light Gray), according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024. Additionally, mapping of known breeding locations (dark Gray) is presented as buffered data provided by Birdlife Australia June 2020.

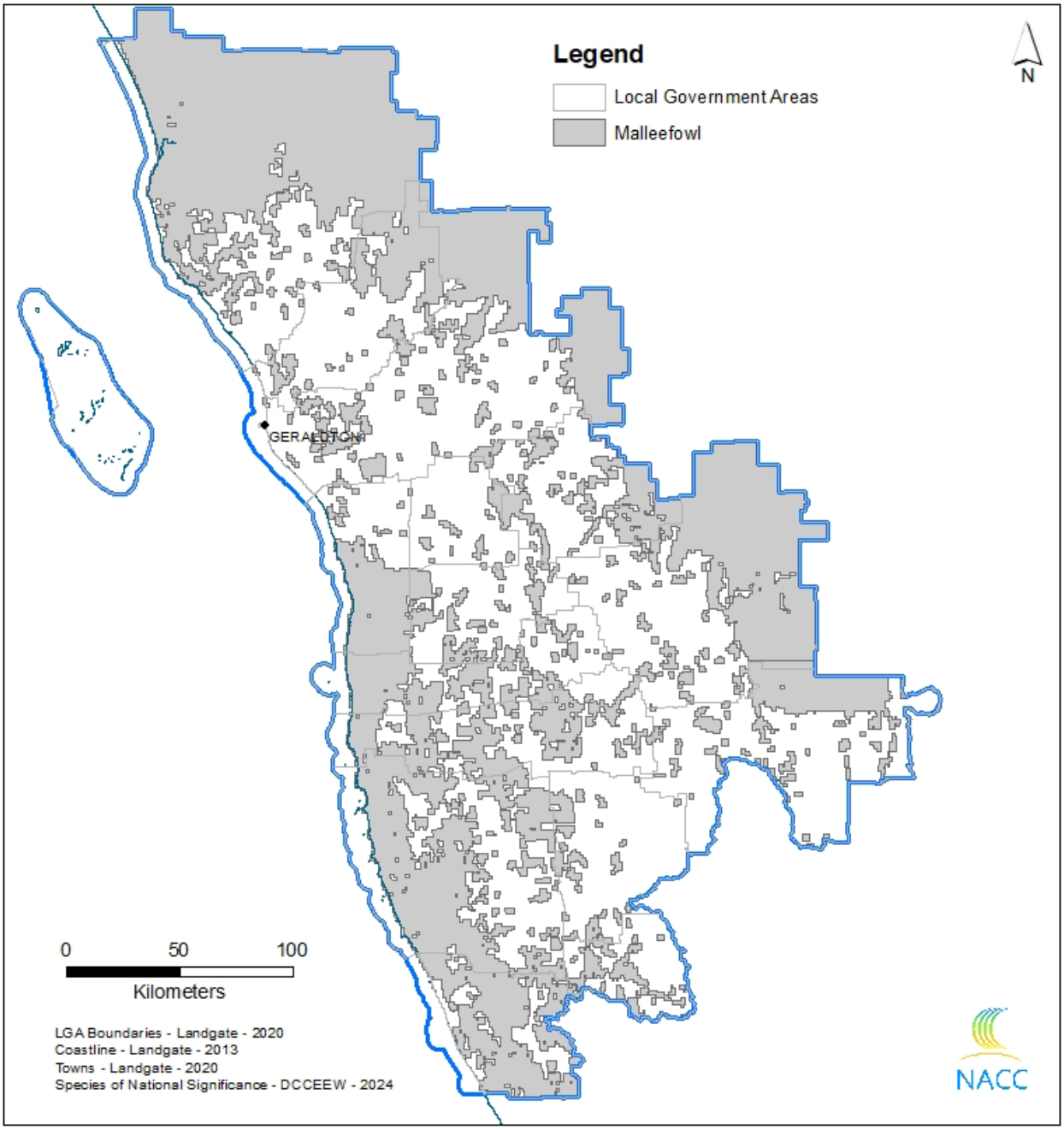
Being semi migratory, Carnaby's cockatoo utilise remnant Eucalypt Woodlands that are home to mature trees (>120 years) with suitable hollows for breeding. Much of this Woodland habitat in the NAR is considered endangered. Key forage habitat includes proteaceous heaths located on the sandy soils of the Geraldton Sandplains and the Swan Coastal Plain Bioregions.



Map 6. Malleefowl *Leipoa ocellata*

Map outlining the habitat in which Malleefowl are likely to occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

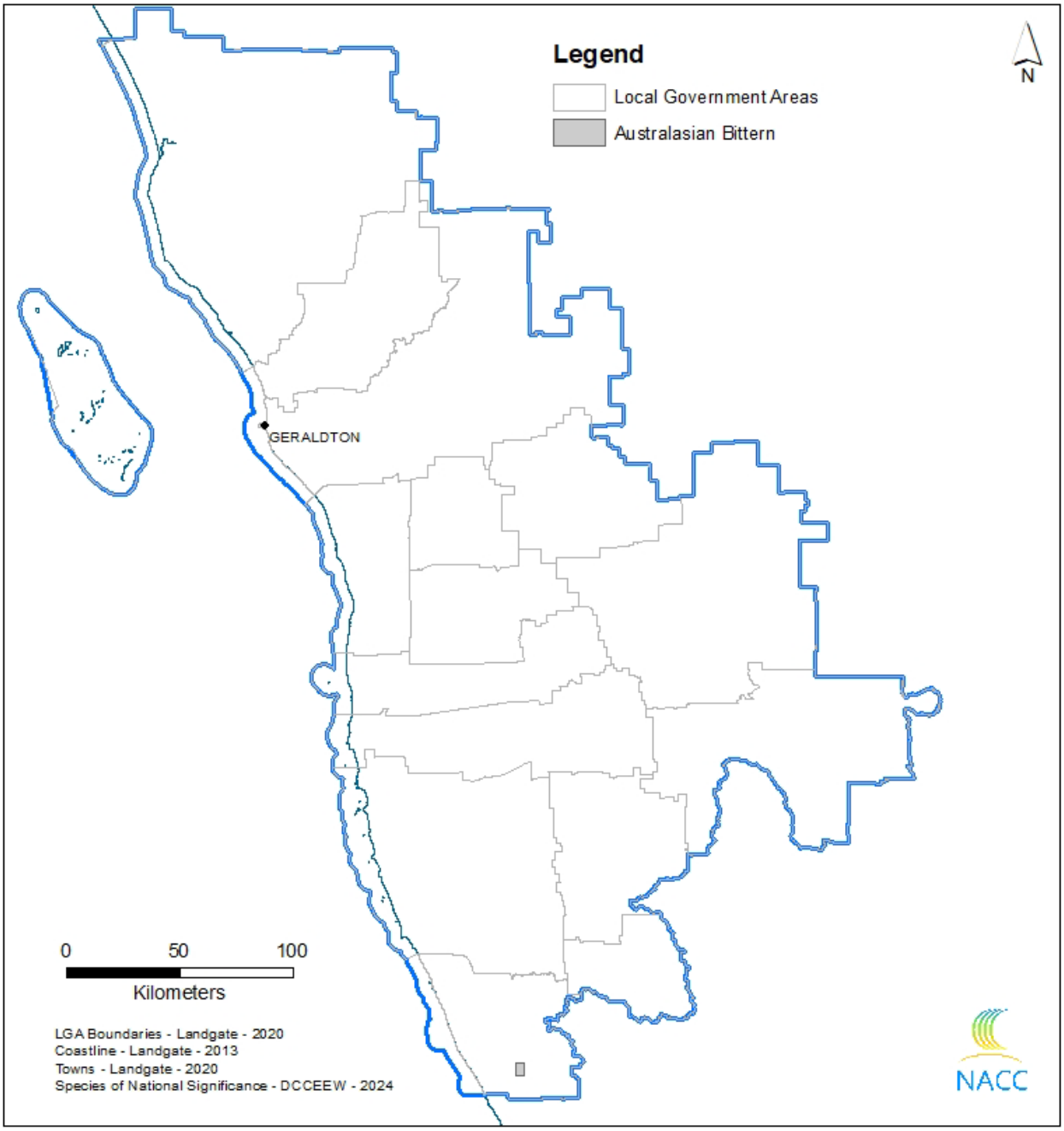
Malleefowl are found across most of inland NAR, favouring dense Melaleuca shrubland for breeding habitat. Once widespread, they are now restricted to isolated patches of remnant vegetation. Malleefowl utilise a range of habitats for forage, including Eucalypt Woodlands, Arid and Semi-arid shrublands, Proteaceous heaths, road verges, and open farm paddocks.



Map 7. Australasian Bittern *Botaurus poiciloptilus*

Map outlining the habitat in which Australasian Bittern are likely to occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

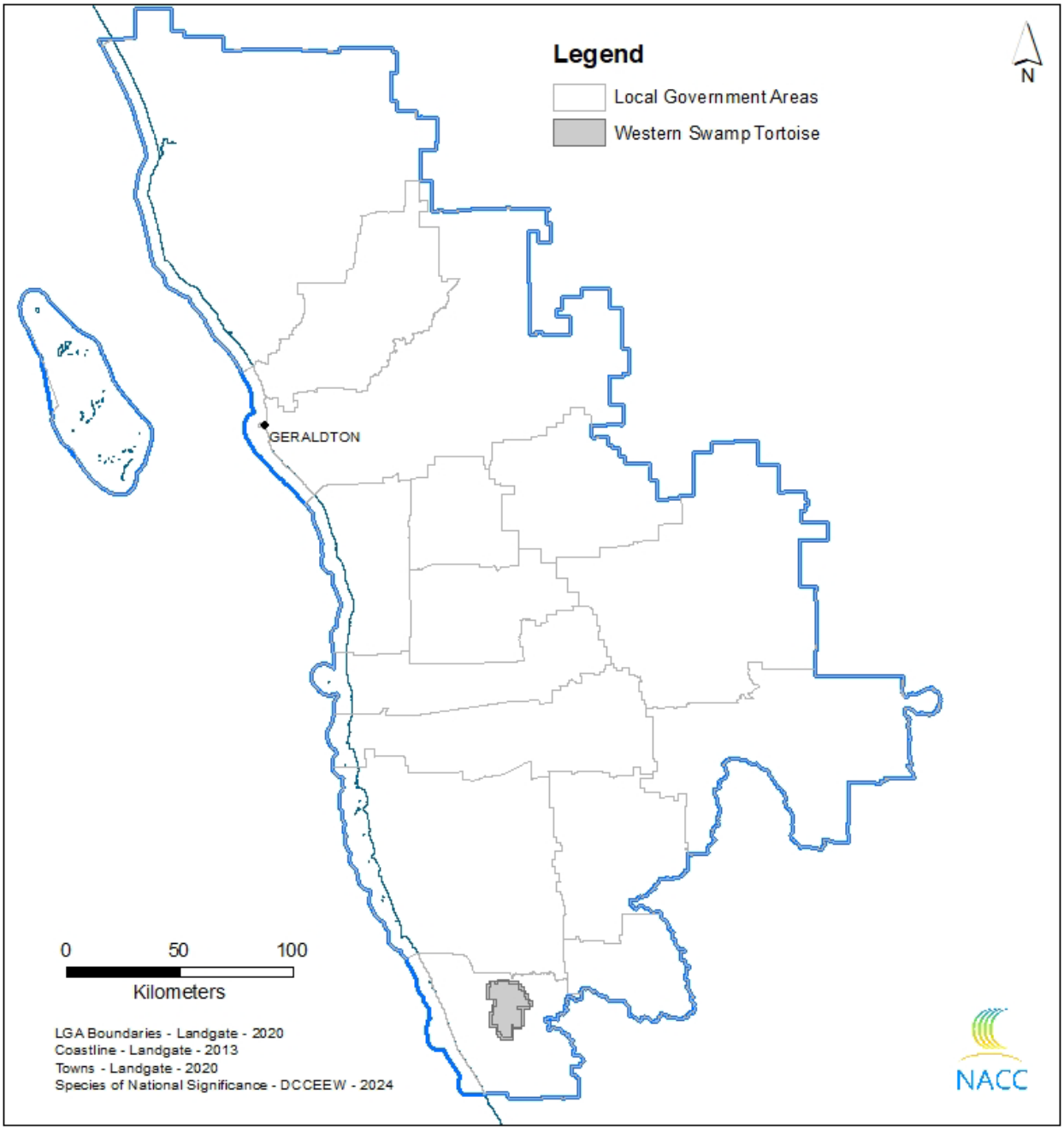
Favouring wetland and coastal areas, Australasian Bittern prefer habitats with reed beds, sedges, rushes, reeds, or cutting grass. They mainly occur in freshwater or brackish wetlands and estuaries, with a range restricted to the Gingin shire in the south of the NAR.



Map 8. Western Swamp Tortoise *Pseudemydura umbrina*

Map outlining the habitat in which Western Swamp Tortoise are likely to occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

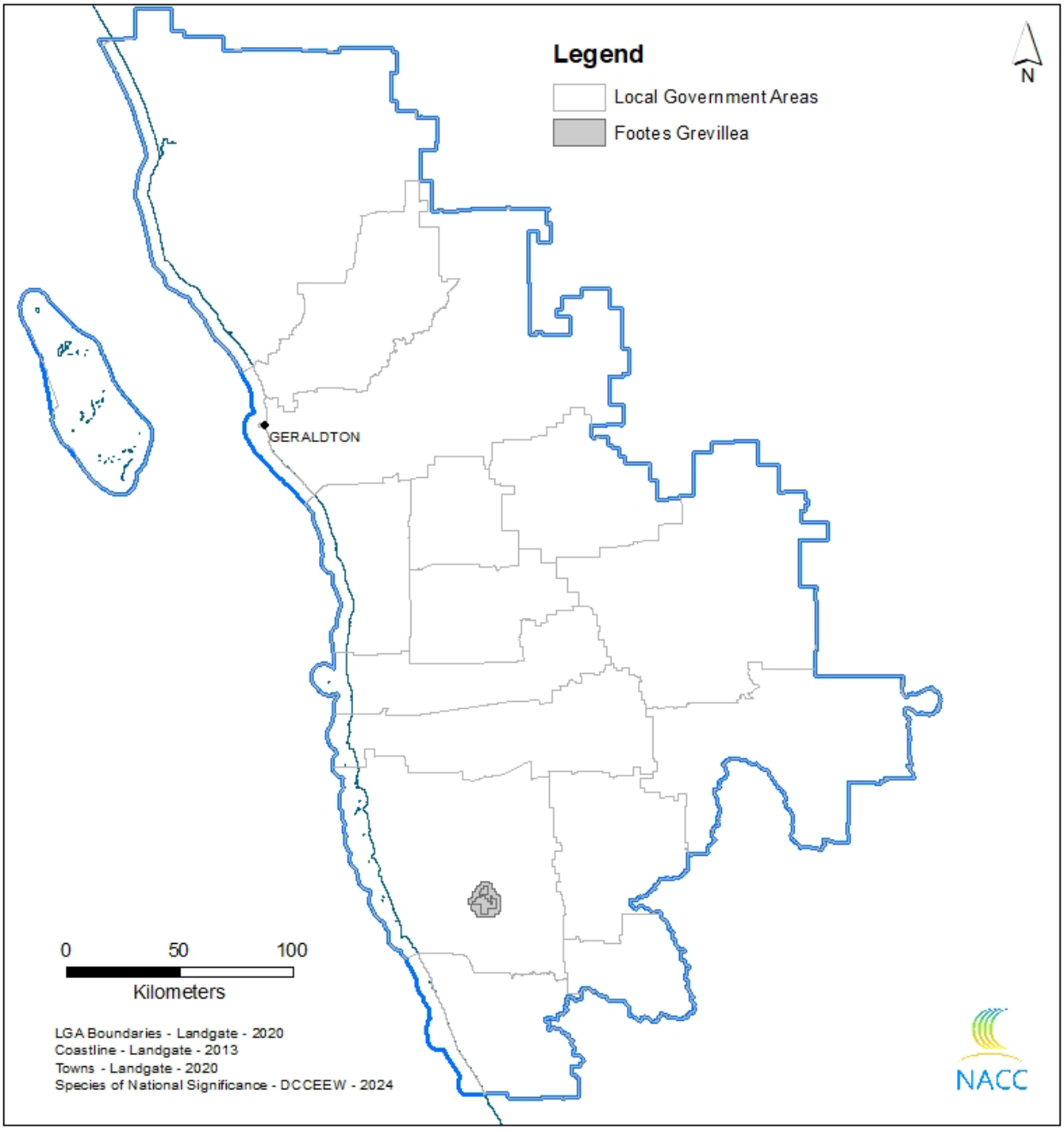
Western Swamp Tortoise live in shallow, winter-wet swamps that form on clay or sand over-clay areas. During the summer months, the tortoise aestivates, requiring suitable habitat close to its swamp habitat. Currently limited in the NAR to the highly modified and largely cleared ephemeral wetlands on the clay soils of the Swan Coastal Plain, the Western Swamp Tortoise is limited to a translocation site within a DBCA managed reserve in the Moore River catchment.



Map 9. Foote's Grevillea *Grevillea calliantha*

Map outlining the habitat in which Foote's Grevillea are likely to naturally occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

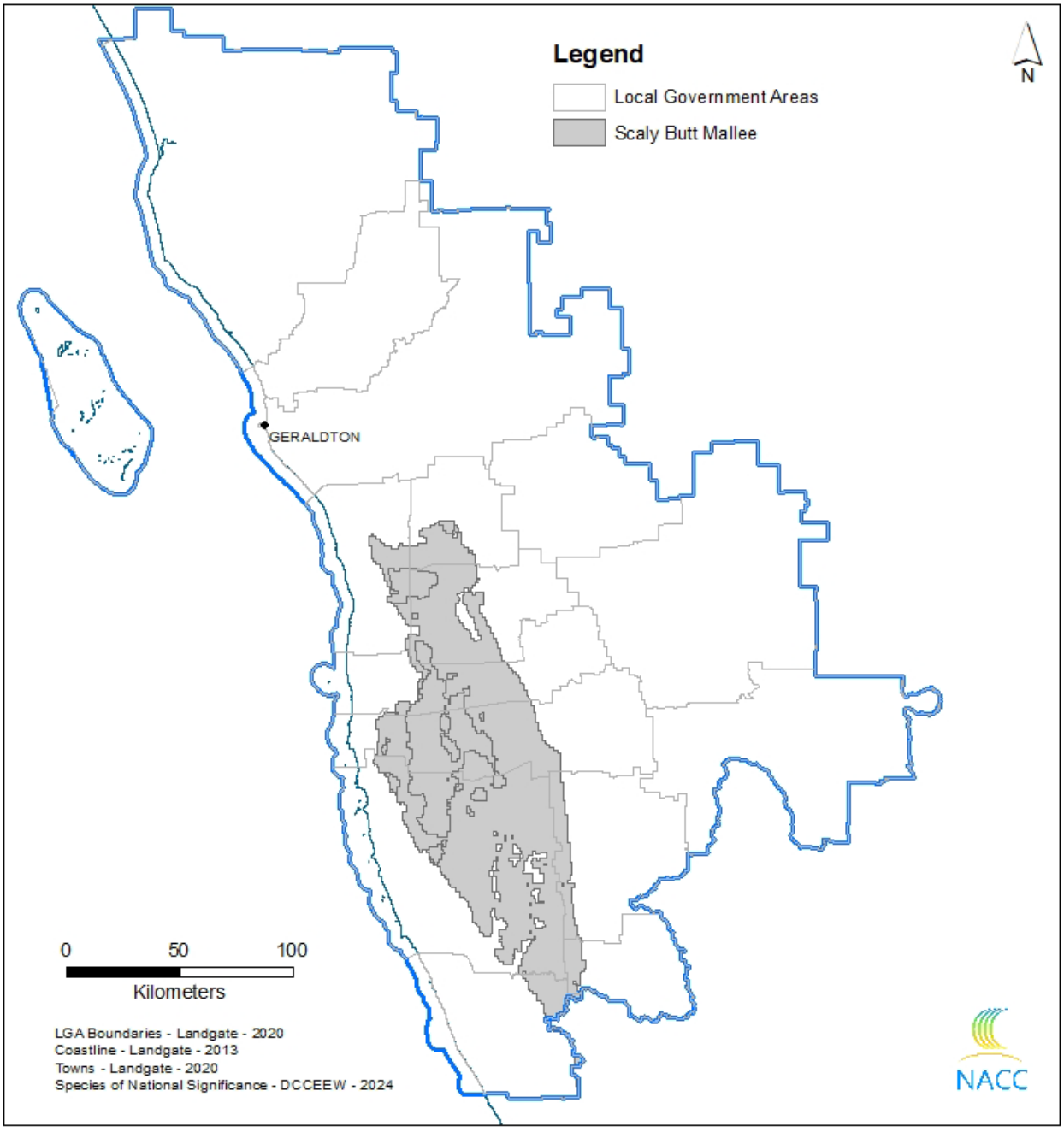
Foote's Grevillea is endemic to the Cataby area of Western Australia. The species grows in sandy or sandy-clay soil in open low woodland of *Eucalyptus todtiana* and *Corymbia calophylla*, on lower to mid-level slopes to low hill. Footes grevillea has a highly restricted distribution, and the wild population occurs only within an 8km range. The NAR is home to more than one translocation site, to protect the species, and provide seed and an insurance population.



Map 10. Scaly-butt Mallee (*Eucalyptus leprophloia)*

Map outlining the habitat in which Scaly-butt Mallee are likely to naturally occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

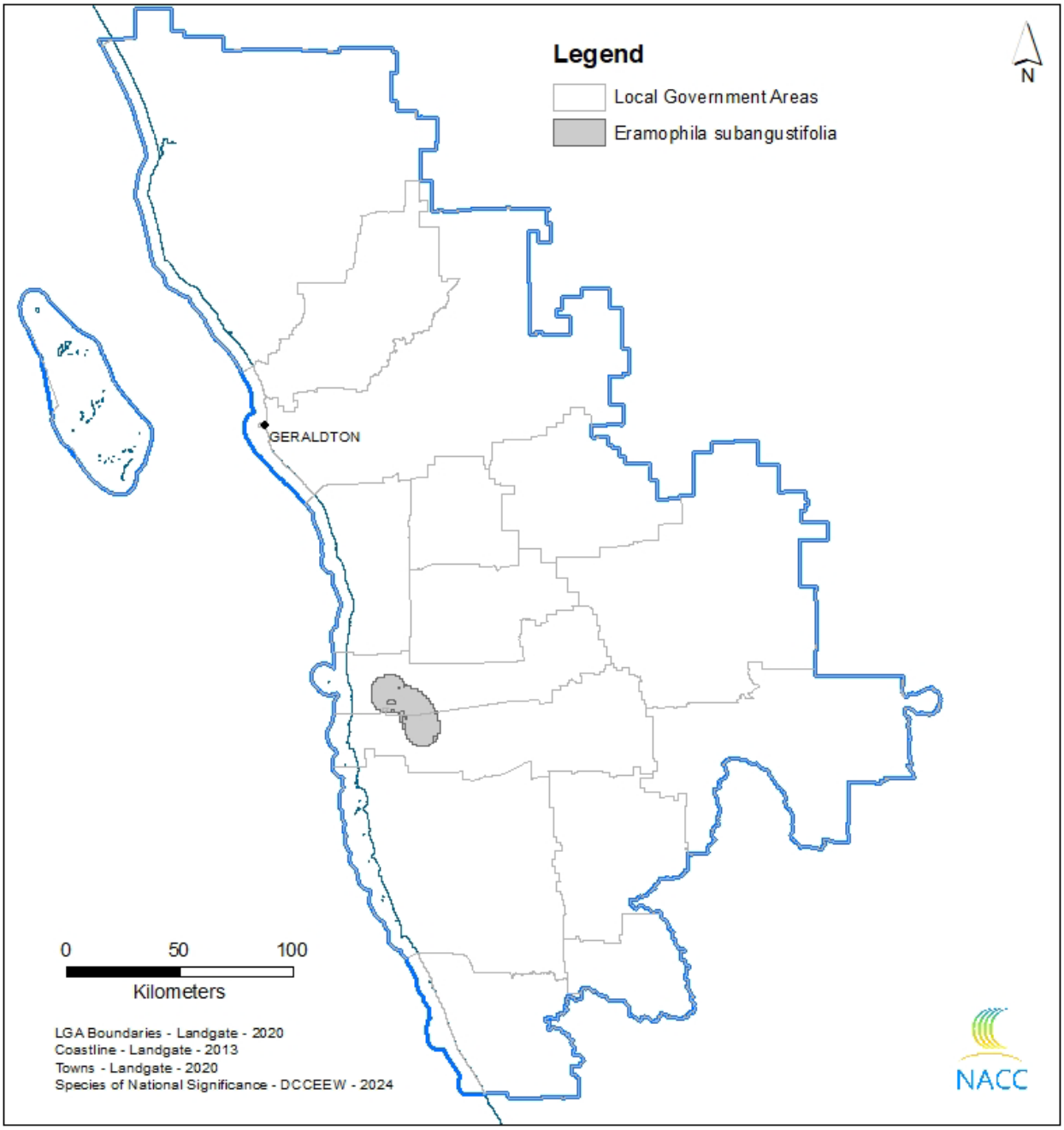
Scaly-butt mallee is endemic to the NAR, where six recorded populations occur from Badgingarra in the south to Mingenew in the north. Occurring within a range of habitats, including brown loam over laterite on hill slopes, in white sand on valley slopes in wandoo woodland, grey sand and laterite with Coastal blackbutt, on breakaway valley slopes in grey sandy clay loam, and in grey sand and lateritic gravel with Marri and Wandoo.



Map 11. Narrow-leaf Eremophila *(Eremophila subangustifolia)*

Map outlining the habitat in which Narrow-leaf Eremophila are likely to naturally occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Species of National Environmental Significance 1km Grids accessed May 2024.

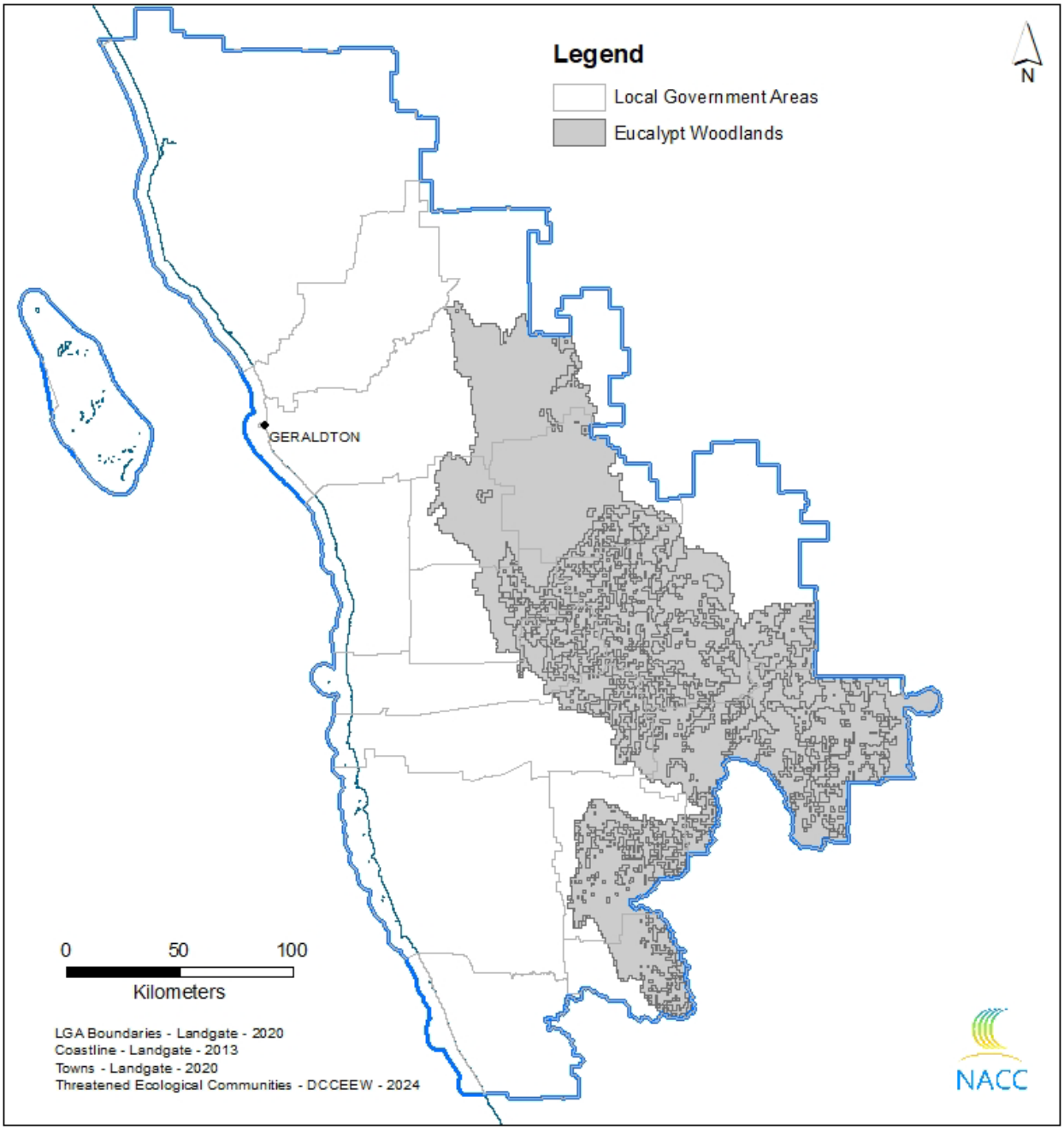
Endemic to the NAR, Narrow-leaf Eremophila grows in a highly restricted range that has been previously cleared for agricultural use, and sealed road access to the south of Lake Logue. It grows in slightly saline, pale brown sandy-clay soils on the edges of winter-wet flats and lakes.



Map 12. Eucalypt Woodlands of the WA Wheatbelt

Map outlining the habitat in which Eucalypt Woodlands may naturally occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Threatened Ecological Communities of National Environmental Significance 1km Grids accessed May 2024.

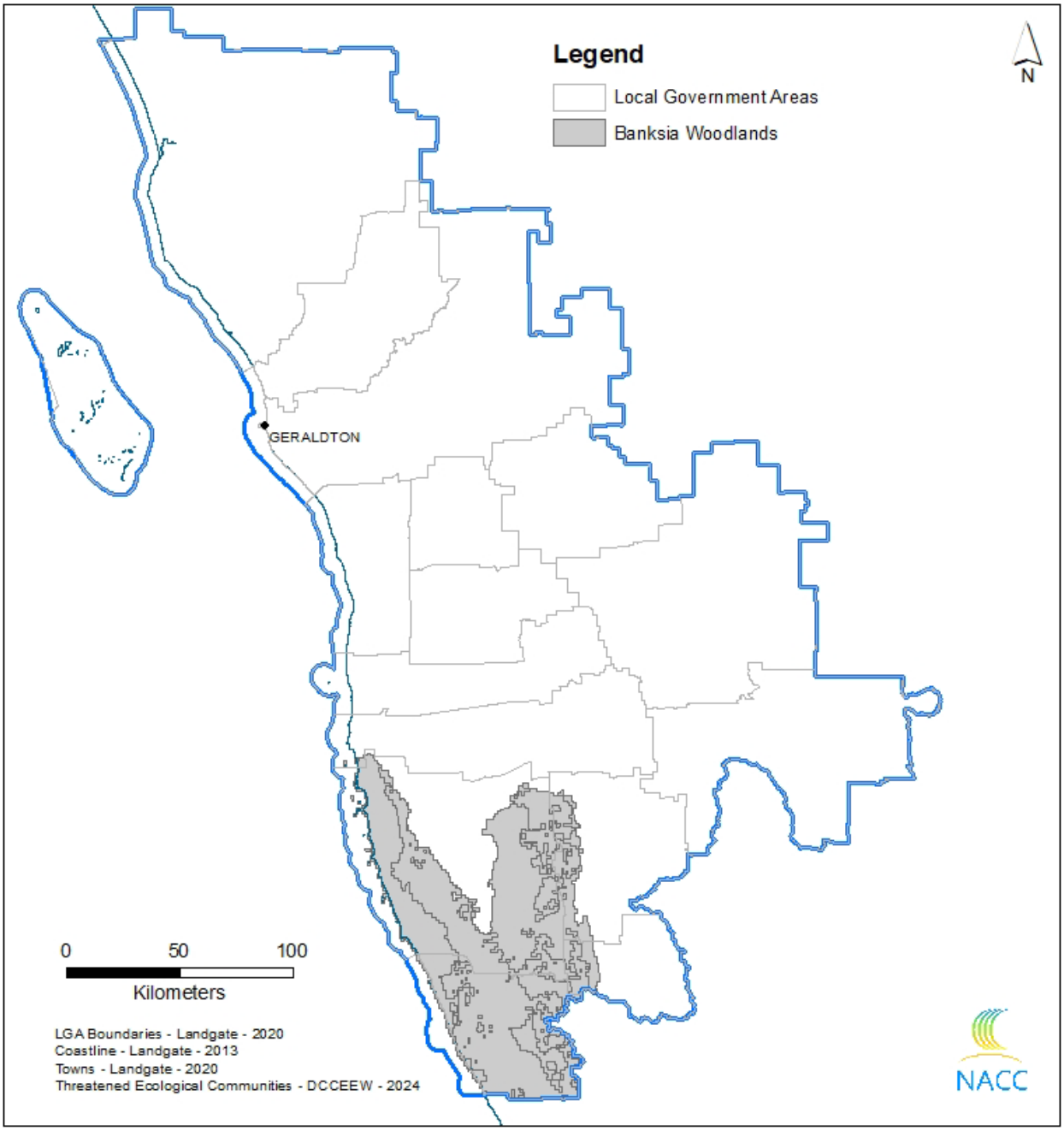
Endemic to the Southwest of WA within the NAR, this ecosystem is in highly modified and extensively cleared Wheatbelt zone associated with the geology of the Yilgarn Craton. There is a close association between rainfall and the location of the ecosystem, varying from 600 mm/year rainfall closer to the coast to about 300 mm/year at its eastern edge defined by warm wet winters and hot dry summers.



Map 13. Banksia Woodlands of the Swan Coastal plain

Map outlining the habitat in which Banksia Woodlands may naturally occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Threatened Ecological Communities of National Environmental Significance 1km Grids accessed May 2024.

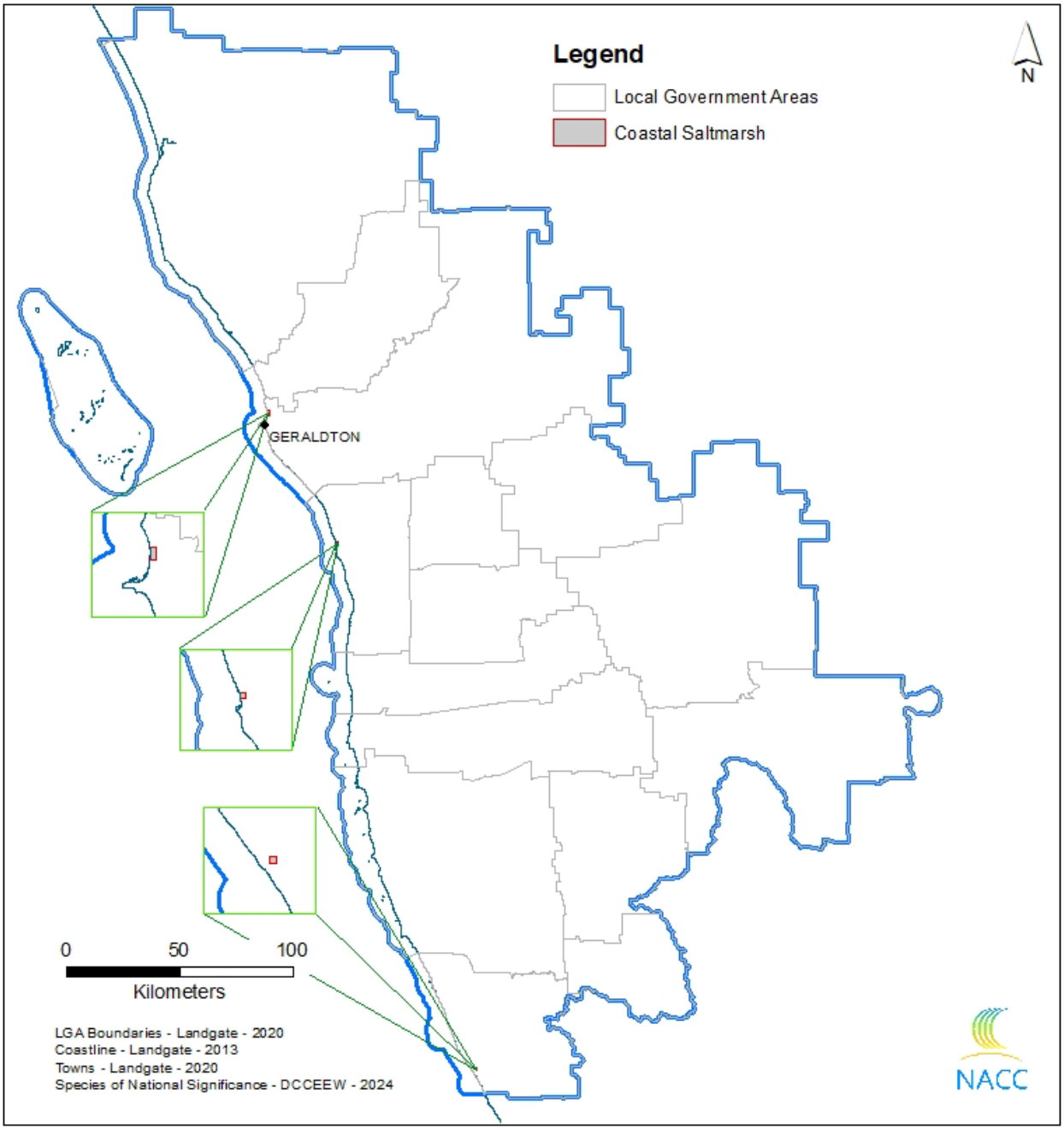
Endemic to the Southwest of WA within the NAR, this ecosystem is located in highly modified and extensively cleared Swan Coastal Plain and can be found from Jurien Bay in the north to Dunsborough in the south. Banksia Woodlands are closely associated with the geology and the Mediterranean climate of the regions. The woodland community is found on the Swan Coastal Plain bioregion on the deep nutrient poor sands of the ancient Spearwood and Bassendean dune systems. The dominant Banksia species within this habitat include *Banksia attenuata* (Candlestick banksia), and *Banksia menziesii* (Firewood banksia).



Map 14. Sub-tropical and temperate coastal saltmarsh

Map outlining the habitat in which Coastal Saltmarsh may naturally occur in the NAR, according to the Department of Climate Change, Energy, the Environment and Water's Threatened Ecological Communities of National Environmental Significance 1km Grids accessed May 2024. Note inset data frames (green outline) at a scale of 1:918,000 providing better visibility of habitat areas .

Subtropical and temperate coastal saltmarsh in the NAR occurs in association with estuaries from Kalbarri in the north to Guilderton in the south. The physical environment for the ecological community is defined as coastal areas under regular or intermittent tidal influence, and within the NAR this is usually associated with estuaries. Species assemblage is influenced by the drainage characteristics, soil type tidal pattern, and elevation; each varying with salinity and inundation conditions.



Appendix B. Mapping of Agricultural Assets

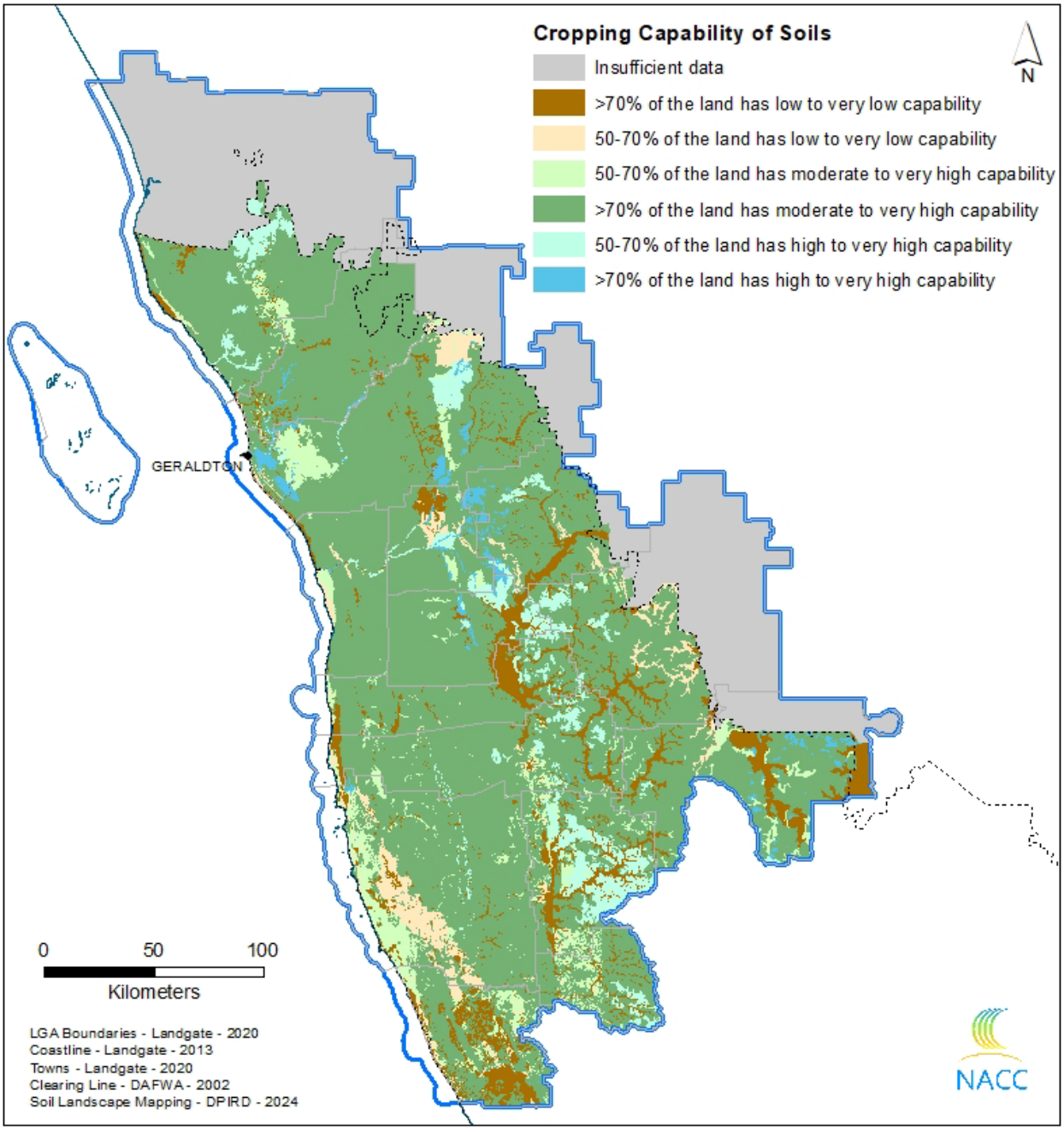
Agricultural assets mapping shows soil capability based on soil type and testing data, surface water, hydrology, and vegetation that occurs outside of legislated or protected areas.

Asset	Relevant Strategy/Act	Map #
Soil (cropping capability)	*National Soil Strategy 2023 – 2028* *Soil and Land Conservation Act 1945*	15
Soil (Grazing capability)	*National Soil Strategy 2023 – 2028* *Soil and Land Conservation Act 1945*	16
Water Resources	*Water Act 2007* *Country Areas Water Supply Act 1947, Metropolitan Arterial Drainage Act 1982, Metropolitan Water Supply, Sewerage, and Drainage Act 1909, Rights in Water and Irrigation Act 1914, Water Agencies (Powers) Act 1984, Waterways Conservation Act 1976*	17 & 18
Vegetation (excluding federal and state managed land)	Australia's Native Vegetation Framework Native vegetation policy for Western Australia	19

Map 15. Cropping Capability of Agricultural Soils

Map of cropping land capability based on the Department of Primary Industries and Regional Development's Soil Landscape mapping – Best Available accessed May 2024.

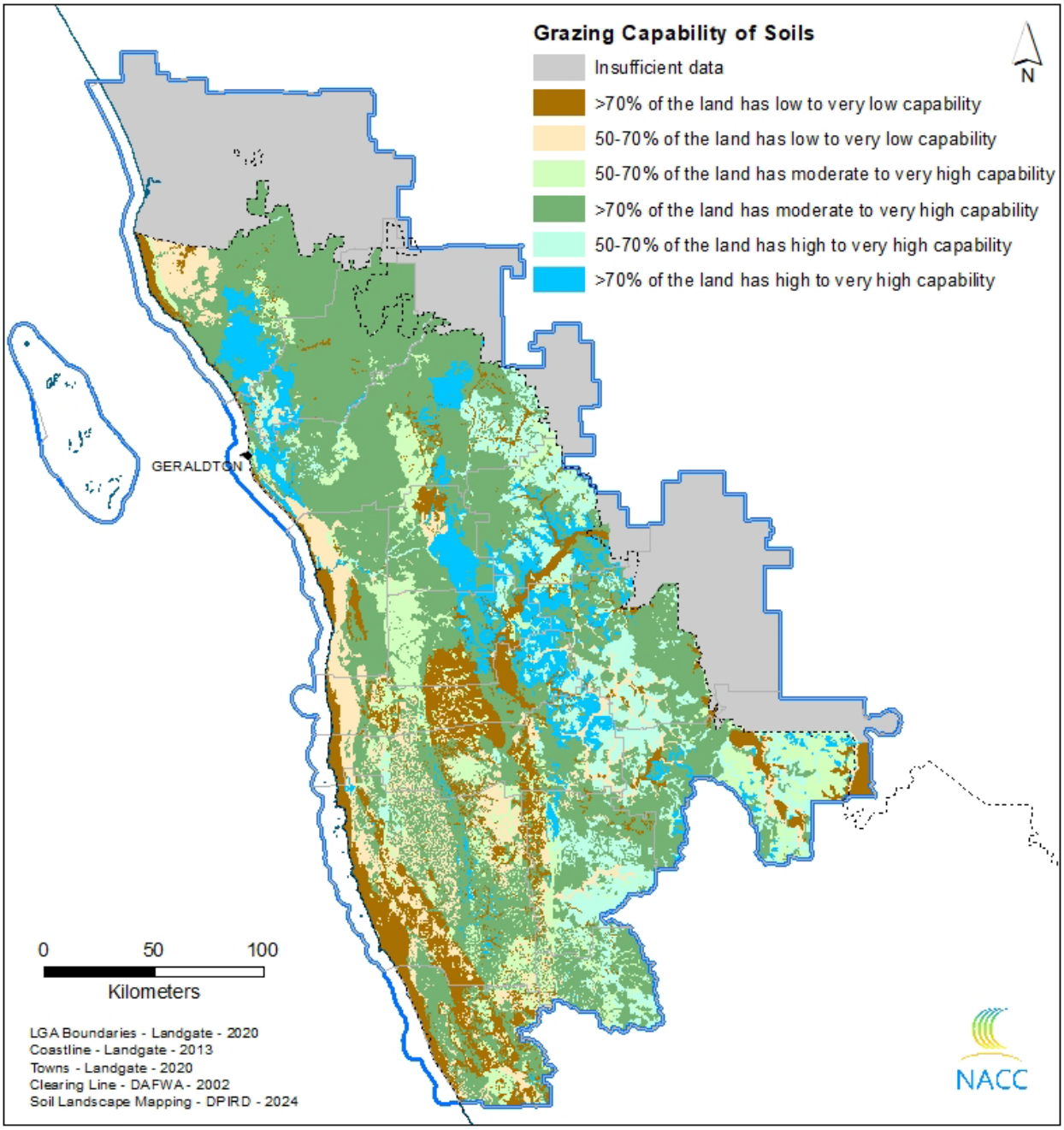
Soil condition is used as an indicator for potential for agricultural production in cropping systems. Data in this map is comprised of soil testing data and various scales and quality, with areas infilled by soil type and quality mapping where test data is not available, to give the best industry scale approximation of capability. Noting that agricultural production is dependent on many factors, including seasonal rainfall and land management practices.



Map 16. Grazing Capability of Agricultural Soils

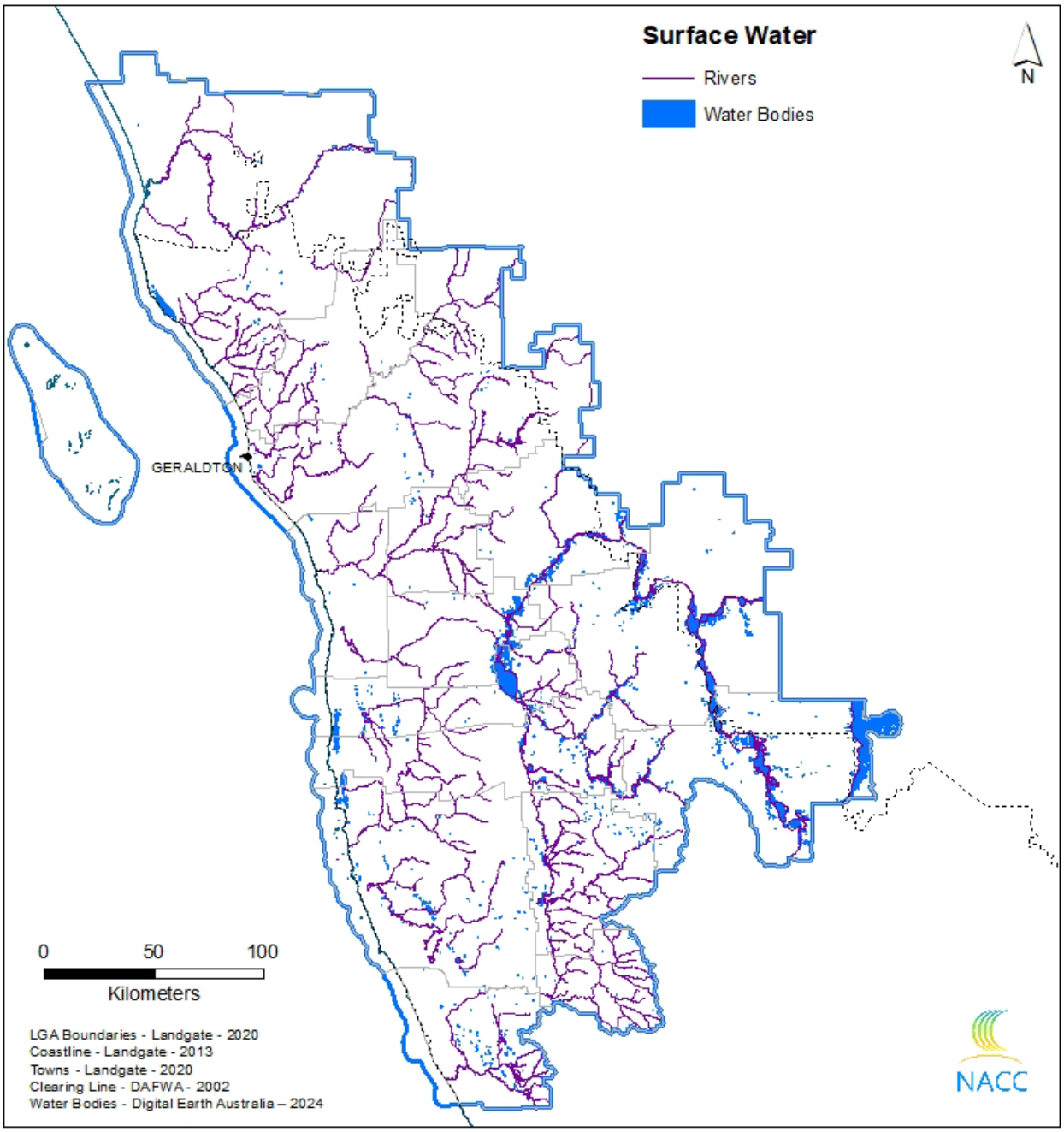
Map of grazing land capability based on the Department of Primary Industries and Regional Development's Soil Landscape mapping – Best Available accessed May 2024

Soil condition is used as an indicator for potential for agricultural production in grazing systems. Data in this map is comprised of soil testing data and various scales and quality, with areas infilled by soil type and quality mapping where test data is not available, to give the best industry scale approximation of capability. Noting that agricultural production is dependent on many factors, including seasonal rainfall and land management practices.



Map 17. Water Resources (Surface Water)

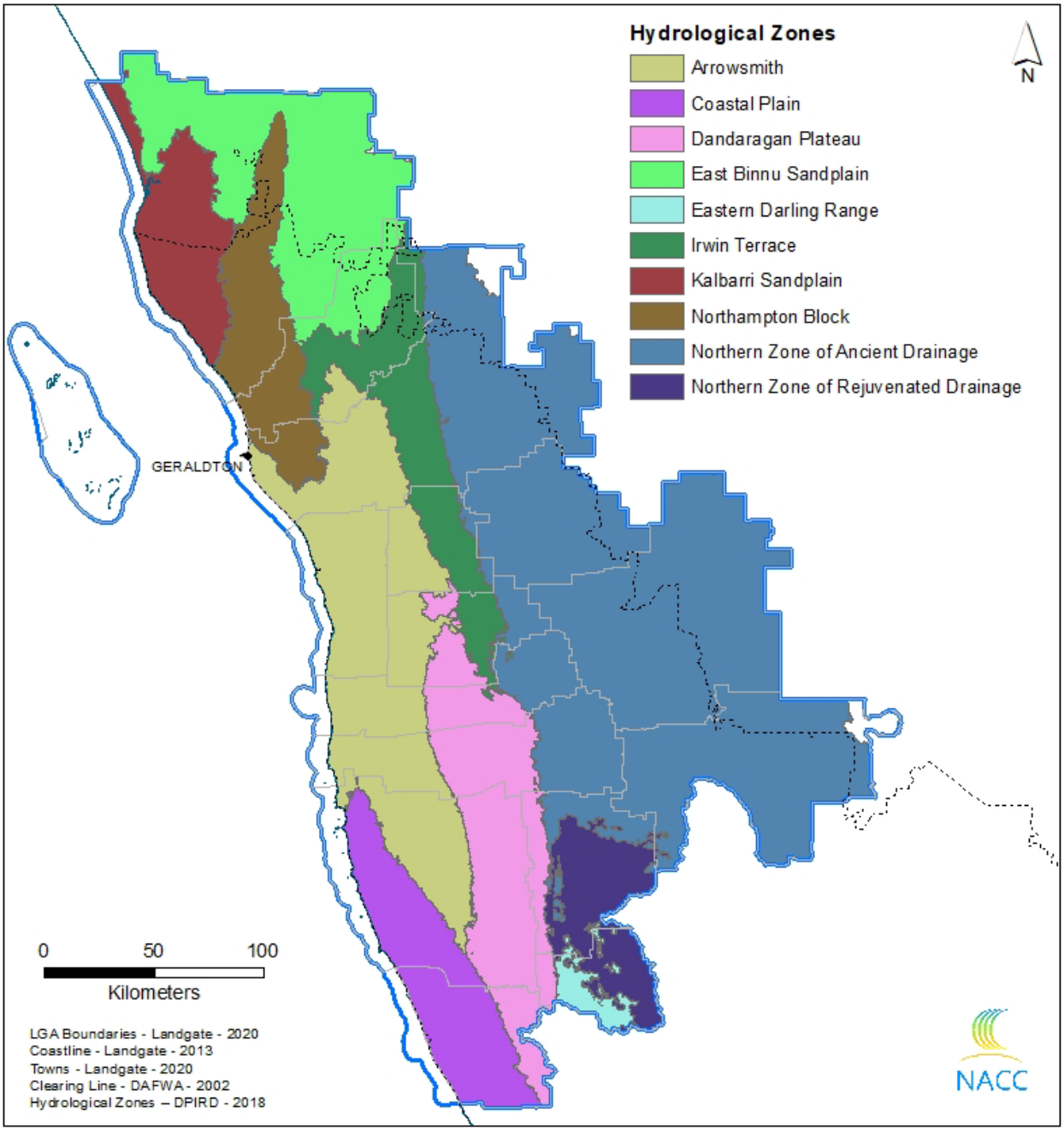
Map of surface water locations and surface water flows (permanent and seasonal) within the NAR, based on two datasets; Digital Earth Australia's Water bodiesV3.0, access May 2024, and Rivers and streams data interpreted from Landgate Medium Scale topography v1.4 data.



Map 18. Water Resources (Hydrological Zones)

Map of the hydrological zones of the NAR, created by relating water and soil data, based on Department of Primary Industries and Regional Development's Hydrological Zones of Western Australia.

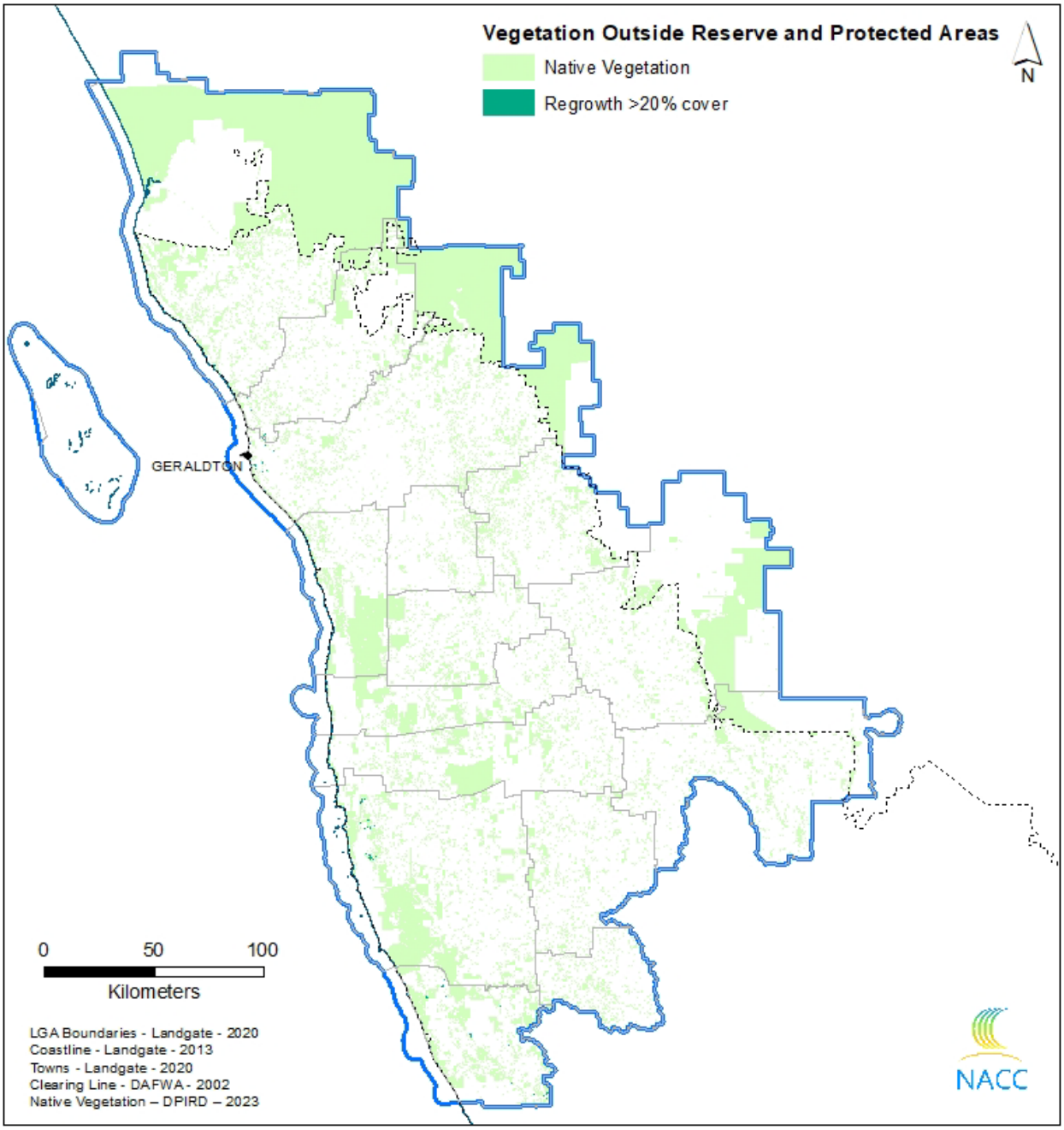
Hydrological zones are a broad spatial framework that group areas with similar hydrology. Zone boundaries are derived from hydrological attributes associated with Department of Primary Industries and Regional Development's best available soil-landscape mapping.



Map 19. Native Vegetation

Map of the extent of remaining native vegetation within the NAR that exist outside of Federally or state managed Reserves, parks or protected areas, based on Department of Primary Industries and Regional Development's Native Vegetation Extent accessed May 2024. Excluded areas were identified through the Department of Biodiversity and Attractions' legislated lands and waters, and the Department of Climate Change, Energy, the Environment and Water's Collaborative Australian Protected Areas Database 2022-terrestrial.

Native vegetation in the NAR is diverse and highly endemic. However, following European settlement and historic clearing for agriculture, it is now largely cleared. Native vegetation is an important agricultural asset that provides valuable ecosystem services. Outside of Federal and State managed nature reserves, remnant vegetation is generally restricted to small and isolated patches, usually along waterways and creeks, wetlands, and rocky outcrops.



Appendix C. Mapping of Agricultural Assets Risks in the Northern Agricultural Region.

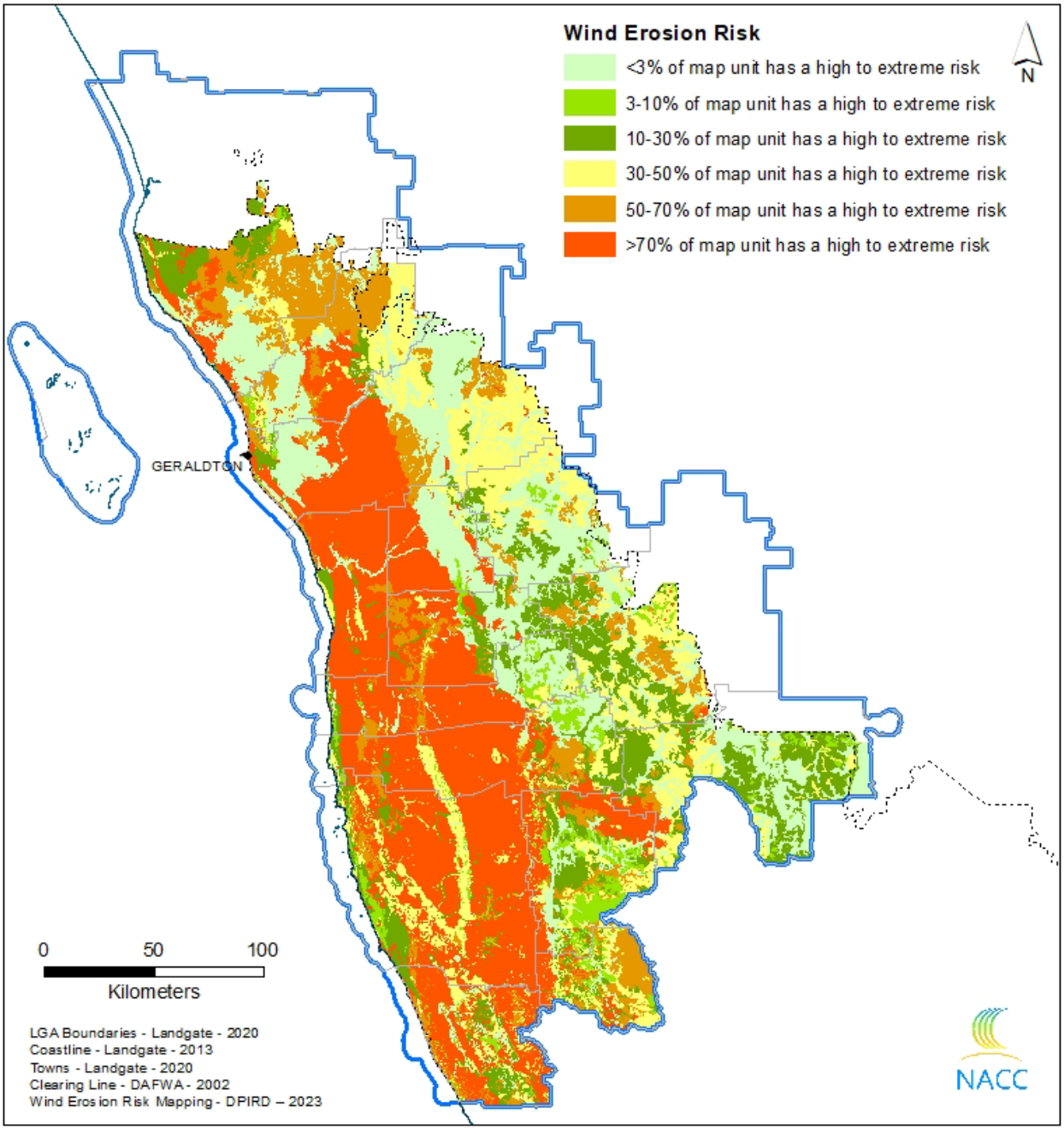
Asset risk mapping has been provided in the context of agricultural assets, however risks are also largely applicable to biodiversity assets.

Risk	Impacted Asset types	Map #
Wind Erosion	Agricultural	20
Water Erosion	Agricultural	21
Flood	Agricultural, Biodiversity	22
Bush Fire	Agricultural, Biodiversity	23

Map 20. Wind Erosion Risk

Map showing the areas of the NAR that are at high to extreme risk of wind erosion in agricultural soils (relating to maps 15&16). These are the areas most likely to be impacted by extreme weather events or unseasonal conditions. Risk is classified by soil type, quality, and total ground cover, based on Department of Primary Industries and Regional Development's Soil Landscape Land Quality – Wind Erosion Risk accessed May 2024.

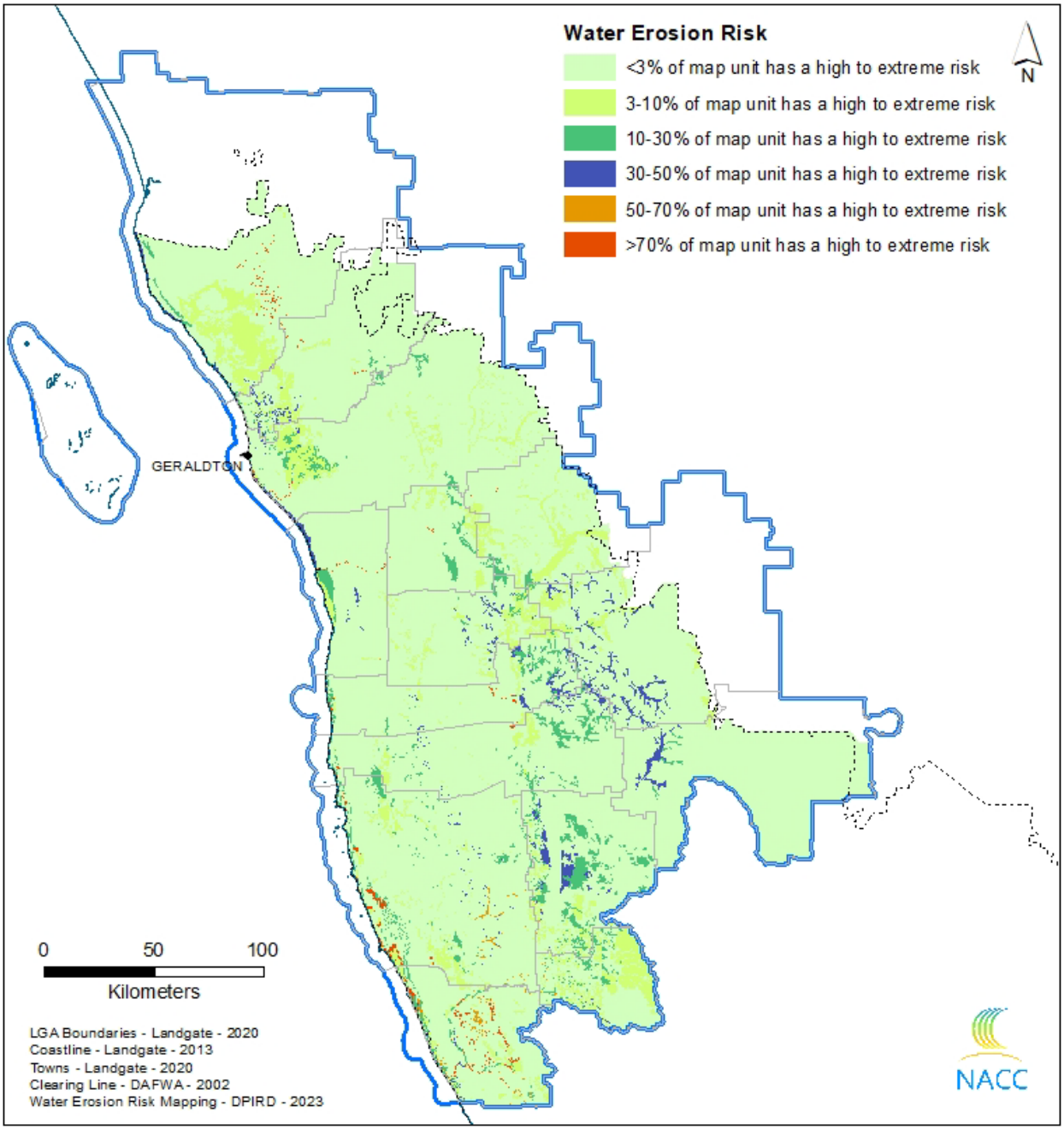
Wind erosion is a major issue in arid and semi-arid regions with sparse vegetation, variable rainfall, and land management that can affect the amount of ground cover and organic matter within soils. Wind erosion is considered a seasonal hazard in the Agricultural region of Western Australia, and is drastically amplified by weather events such as cyclones or unseasonal storms with high wind speed.



Map 21. Water Erosion Risk

Map showing the areas of the NAR that are at a high or extreme risk of water erosion, based on Department of Primary Industries and Regional Development's Soil Landscape Land Quality – Water Erosion Risk accessed May 2024

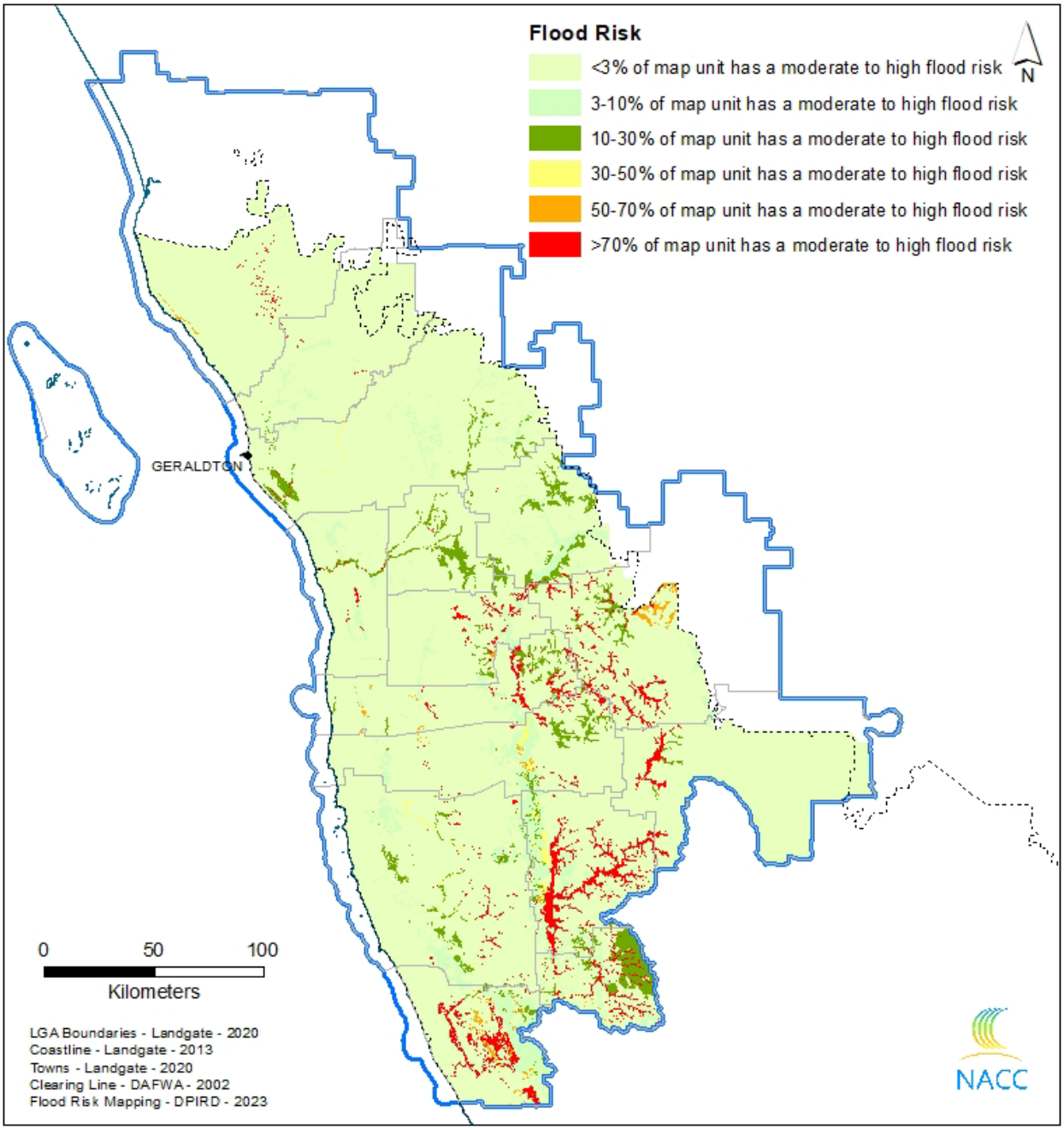
In the NAR, water erosion is largely caused by intense rainfall events with particular risk during localised unseasonal events or during natural disasters (e.g Cyclone). Water erosion is combatted through the retention of living plant material (intact root systems), therefore controlling water erosion in agricultural production systems is a difficult task.



Map 22. Flood Risk

Map showing the total area of the NAR that is at moderate to high risk of flooding, relative to the Agricultural Asset of soil at the subsystem level. Based on Department of Primary Industries and Regional Development's Soil Landscape Land Quality – Flood Risk, accessed May 2024.

Flood risk is relatively low for the majority of the Agricultural land in the NAR, with most moderate to high-risk areas being defined by the topography of the region. Note the location of moderate to high-risk areas in relation to several Species of National Significance and Threatened Ecological Communities (Maps 1 to 14).



Map 23. Bush Fire Risk

Map showing the bushfire prone areas of the NAR, as determined by the Department of Fire and Emergency Services, based on the Office of Bushfire Resource Management's Bush Fire Prone Areas 2021, accessed May 2024.

It is worth noting that the area designated as bushfire prone encompasses all vegetated areas of the NAR, with risk posed to all natural capital assets of the region.