Biodiversity and Agricultural Natural Capital Emergency Preparedness, Response and Recovery Plan

NOVEMBER 2024

NORTH

Acknowledgement of the Tasmanian Aboriginal people as the Traditional and Original Owners of this land

We pay respect to the Traditional Owners of Tasmania, the Tasmanian Aboriginal people, and acknowledge their continued survival and connection with their land, sea and sky Country that spans millennia.

We acknowledge the many Nations of Tasmanian Aboriginal people, past and present, as the traditional and ongoing owners of their respective countries within Tasmania and the islands.

We pay respect to those who have passed and acknowledge today's Aboriginal people who are the custodians of this land.

We acknowledge that all land, sea, and sky Country holds cultural values that provide strong and continuing significance to the Tasmanian Aboriginal people. We acknowledge that Tasmanian Aboriginal people are part of a continuous culture that holds traditional knowledge about the ecosystems we all depend on. The landscapes of Tasmania have been shaped by Aboriginal management of plants, animals, and water (particularly using fire).

We acknowledge that colonisation and migration has caused injustice for Aboriginal people and impacted the living cultural landscape. This has created a legacy that we seek to improve.

We are working to integrate Aboriginal cultural heritage and knowledge in natural resource management, and to develop better understanding of the cultural, environmental, social and economic dimensions of the region's natural resources from the perspective of Aboriginal people.

Through our work, we aim to reflect these values by recognising that Tasmanian Aboriginal people determine both the boundaries for the sharing of their cultural heritage and opportunities for participation in NRM activities that embrace and support their aspirations. We pay respect to Tasmanian Aboriginal people's requirements to own, care and manage Country by aligning our strategic priorities to Tasmanian Aboriginal people's land, sea and sky Country priorities.

Australian Government

This project is funded by the Australian Government Natural Heritage Trust and delivered by NRM North, a member of the Commonwealth Regional Delivery Partners panel.

Version number	Comments	Date
1	Draft structure and outline, submitted as a part of Milestone 1	8 January 2024
2	Draft for Consultation, submitted as a part of Milestone 2	8 May 2024
3	Draft for comment, distributed for regional and statewide comment	15 May 2024
4	Final for submission as part of Milestone 3	30 May 2024
5	Final for publication	November 2024

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Executive summary

There is a growing need to enhance our preparedness for emergencies 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 wellbeing. Emergency preparedness bolsters the resilience of ecosystems, enabling them to recover and flourish following catastrophic events.

This Plan considers the most likely emergency scenarios for the northern Tasmanian NRM region – flood, coastal inundation, bushfire, and biosecurity incursion emergencies. It focuses on acute events, acknowledging that these interact with and are often exacerbated by longer term changes such as sea level rise or the increasing frequency of intense rainfall events that accompany climate change.

Purpose and objectives of this Plan

The purpose of this Plan and its development is to improve preparedness for, and response to, emergency events 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 emergencies and undertaking planning to improve outcomes through actions and management before, during and after to support recovery.

The objectives of this Plan are to:

- provide an assessment of the susceptibility of priority natural assets in northern Tasmania to bushfire, flood, coastal inundation, and biosecurity emergencies
- identify key preparedness, response and recovery actions required to protect and restore these assets in the event of an emergency
- assess the extent to which current emergency management arrangements protect environmental assets and identify areas where these can be strengthened
- identify roles that NRM North could play in improving emergency management for natural asset protection within existing emergency management frameworks and the supports essential for these roles to be delivered
- facilitate conversation between agencies and individuals involved in emergency management with the goal of identifying opportunities for increased collaboration and coordination to better protect natural assets in northern Tasmania.

Scope

This Plan prioritises biodiversity natural assets that are matters of national significance. It focuses on federally-listed threatened species identified in the Threatened Species Action Plan 2022-2032, federally-listed ecological communities, Ramsar wetlands, and a small number of regional priority species and places. State-listed threatened species and threatened vegetation communities are not considered in this Plan and are a gap that should be considered in future updates of the Plan.

The Plan focuses on acute emergency events. While climate change is recognised as likely to exacerbate the impacts of emergencies through increased frequency and severity of events, as well as through its ongoing impacts on ecosystem resilience, climate change is not explicitly considered in the Plan.

The Plan focuses on bushfire, flood, coastal inundation (storm surge, not sea level rise) and biosecurity emergencies. Other emergencies such as drought, marine heatwaves, and large-scale pollution events (e.g. mine tailing dam failures, oil spills and industrial accidents) are not considered. Biosecurity emergencies refer to events where new invasive organisms with the potential to cause harm to natural assets enter Tasmania, or where invasive organisms already present in Tasmania experience a rapid spread to new areas within the state. Ongoing management of invasive organisms which already have a broad range in Tasmania and for which eradication or containment is no longer an option are not considered in this plan.

Actions are focused on building the resilience of natural assets to emergencies and supporting the natural recovery and regeneration after emergency events. Actions in this Plan are considered in three phases:

1. Preparedness (before the event): Mitigation, prevention and preparation activities aimed at building resilience in biodiversity and agricultural natural capital assets and prioritising areas for protection.
2. Response (during the event): Implementation of specific emergency responses tailored to the nature of the emergency and natural resource management priorities.

3 Recovery (after the event): Focused on supporting natural recovery and regeneration of natural capital assets after the event, restoring the condition of natural assets, and facilitating their return to a state of resilience.

Protection of natural assets under current emergency management arrangements

The Tasmanian Emergency Management Arrangements (TEMA) are a statewide, multi-agency, multi-level approach to emergency management. This Plan outlines key elements of these arrangements which are relevant to the emergencies and assets considered in this Plan:

- Emergency management plans outlining statewide, multi-agency coordination arrangements for either managing risks and consequences of an emergency, or managing a function required by emergencies, such as recovery. Relevant to this plan, there are statewide emergency management plans for bushfire, flood and storms, animal and plant biosecurity, and tsunami. There is also a State Recovery Plan which applies to recovery from all natural hazards outlined in TEMA.
- Emergency management committees (EMCs) set up to ensure a coordinated approach is taken to emergency management which operate at four levels – municipal, regional, state, and ministerial. There is a single regional EMC responsible for northern Tasmania, with municipal emergency management committees for each Local Government Area (LGA).
- Fire management area committees (FMACs) who are responsible for preparing a fire protection plan, known as Bushfire Risk Management Plan (BRMP), for their Fire Management Area (FMA). These plans aim to protect community by reducing bushfire risk across multiple tenures. They are intended to be used by stakeholders to inform their vegetation fire management activities. Plans identify strategic priorities, identify and assess community bushfire risks, and prioritise strategic works in response to those risks. FMACs also work to inform strategic bushfire mitigation activities and programs, and to coordinate vegetation fire management activities including education and information, fuel management. There are three FMACs in northern Tasmania supported by the State Fire Management Council: North East, Flinders and Tamar.
- Recovery planning focused on building resilience. This operates at four scales depending on the scale of the emergency from Level 1 for Emergencies of Local Significance through to Level 4 for Emergencies of National Significance. There are five domains of recovery in Tasmania of which environmental recovery is one.
- Biosecurity emergency management which applies a three-tiered hierarchy established in the Biosecurity Act 2019. This Act sets out principles such as shared responsibility and defines roles and responsibilities for biosecurity management.

Gaps in current approaches

The following gaps in emergency preparedness as it relates to natural assets are identified in this Plan:

- A lack of up-to-date, accessible monitoring data and other information on the location, condition, and threats to threatened species and threatened ecological communities. This is essential for good planning and preparation, minimising negative impacts of emergency response and clean-up activities immediately after an event, and prioritisation and design of recovery programs.
- A lack of knowledge on the part of agency staff, private landholders, and emergency responders as to the location, risks to and requirements of natural assets in preparing for, responding to and recovering from emergencies.
- A lack of resources including funding and access to knowledgeable experts to provide support to private landholders to develop preparation, response, and recovery plans for their properties that include protection of natural assets while also protecting people and infrastructure.
- A lack of information and support for agency staff and landholders in response and recovery operations during and after an emergency event to ensure natural assets are protected and restored. Significant damage to natural assets can and does occur as a result of response and recovery operations where risks to natural assets are not adequately planned for or understood.

- No single organisation has responsibility for the protection of natural assets across all tenures before, during and after emergencies.
- A lack of representation on Municipal and Regional Emergency Management Committees and Fire Management Area Committees of natural resource management organisations engaged with management of biodiversity and agricultural natural assets on private land and other areas outside national parks.
- Expertise and capacity for identifying environmental impacts and designing, resourcing, and implementing recovery programs for emergencies where social, economic and infrastructure impacts are minimal. Emergency events such as bushfires that occur in localised areas away from significant populations and infrastructure can have devastating environmental consequences, particularly for limited range threatened species and ecological communities and assets such as Ramsar wetlands. The small scale of social, economic and infrastructure impacts of these types of emergencies are unlikely to trigger recognition of the emergency at higher than level 1 given the lack of local knowledge of the location, condition, and requirements of many natural assets amongst land managers. Given this lack of knowledge it is possible that impacts on natural assets go unnoticed and that no recovery effort is triggered. This is also an issue where impacts of an emergency event are offsite such as for aquatic species affected by sediment runoff and other pollution after a bushfire event.

Priority activities

Activities that are a high priority to improve protection of priority natural assets from emergency events, which should ideally be commenced shortly are:

- **Data collection, analysis, and access.** There is a lack of available data on the location and condition of many of the natural assets identified in this plan. In some cases, data may have been collected for purposes such as research studies but is not readily available. In other cases, very limited monitoring or research has occurred or what monitoring has been undertaken is out of date. Understanding the current status of priority natural assets in Tasmania is essential for mitigating the negative impacts emergencies and emergency management can have on these assets. Collating dispersed data sets and research as well as undertaking monitoring and data analysis to fill gaps in knowledge is a priority to protect these natural assets. Ensuring this information is readily available and regularly updated is also essential.
- **Identify high priority natural asset locations that should be the immediate focus of emergency planning and on-ground works activities.** While this plan identifies priority natural assets and information on the highest risk areas to these assets for various types of emergencies, there is a need for more in-depth analysis of data and identification of key land managers to be engaged in any planning of on-ground works activities to improve preparedness.
- **Develop emergency response and recovery plans for high priority assets in key locations where this approach would be of most use.** The Tasmanian Parks and Wildlife Service (TPWS) have developed a good methodology for response and recovery planning and have applied this to a select group of threatened species. Rolling this methodology out more broadly to other species and communities for which there is a high likelihood of emergency events occurring with significant potential impacts on the asset, so that these are ready to go once the emergency happens, was identified as a priority during consultation for this Plan. Adapting this approach to areas outside national parks such as privately owned and managed land is a priority activity.

Potential roles for NRM North

While NRM North could play an important role, it does not currently have a significant role in emergency management. NRM North has been subcontracted to deliver emergency recovery programs such as the 2016 Agricultural Landscape Flood Recovery Scheme and to administer biosecurity related programs such as the Weeds Action Fund. This plan identifies several areas where NRM North could play a significant role in emergency management and where our contribution would increase the protection of natural assets from emergencies. In all cases resourcing would be required for NRM North to undertake these activities.

- **Participation in Municipal and Regional Emergency Management Committees and/or Fire Area Management Committees.** Currently many of these committees have no representation from organisations with knowledge and experience of natural resource management and natural asset

protection and recovery, on areas outside of national parks. NRM North has extensive experience working with agricultural landholders and local government for natural resource management and significant knowledge of natural assets on privately owned land. Our participation in these committees would go a long way to filling knowledge and expertise gaps relating to protection of natural assets in planning for emergency events.

- **Identify high priority areas (high risk) and implement programs to increase landscape resilience to emergency events.** These programs should focus on private landholdings and other areas outside national parks. Activities include:
  - weed and pest management to reduce weed and pest sources
  - fencing of remnant native vegetation, riparian zones and sensitive foreshore and intertidal vegetation and habitats
  - creating connected corridors between fragmented habitats to enable movement of species during and after emergency events
  - targeted protection of critical assets in high-risk aquatic environments using sediment control devices in catchment areas (e.g. contour banks).
- **Support landholders to improve on-farm emergency management for natural assets, particularly in high-risk areas.** This could include:
  - work with landholders to develop emergency preparedness, response, and recovery plans for natural assets on their properties
  - increase the capacity of landholders, agency staff, TFS and SES to identify priority natural assets, understand the potential impacts of emergency events and actions undertaken to mitigate risks to infrastructure and people, and implement actions in a way to reduce risks to natural assets and increase their protection from emergency events and their management. This involves development and distribution of information resources and education of these key stakeholders.
- **Implement environmental recovery programs after emergency events.** There are two environmental recovery functions where NRM North has the expertise and connections which would enable them to provide significant support and input:
  - implementation of landscape rehabilitation programs on areas outside national parks and Crown land (i.e. on private and council-owned and managed land)
  - providing advice and other non-financial support to primary producers before and after emergency events to assist with preparedness activities including planning, and for during the clean-up and recovery phase after emergency events.
- **Assist with the development and delivery of Biosecurity Programs for priority natural assets and habitats.** These programs could be undertaken collaboratively with agencies such as TPWS or with councils, agricultural landholders, or forestry companies when natural assets are located on areas outside national parks. NRM North could play a coordination role or could assist directly with program design and delivery.
- **Work collaboratively with landholders, other land managers and researchers to improve monitoring of the location and condition of threatened species and threatened ecological communities.** There is a significant lack of quality, up to date data on the location and condition of natural assets as well as information on the impacts of emergency events and the effectiveness of preparedness, response, and recovery. NRM North could play a significant role in designing and implementing monitoring programs and making data widely available through open-source state and national data bases.

Resourcing requirements

Feedback from stakeholders consistently identified a lack of resources including funding, and trained, expert staff as a barrier to improving the protection of natural assets from emergency events. This gap occurs for all emergencies and all phases from preparedness, response, and recovery. Stakeholders identified a need for significant investment in resourcing activities focused on natural assets as most action and investment is currently focused on infrastructure and community safety and recovery, including economic recovery. Resourcing is a gap for government agencies,

including TPWS, local government and agricultural landholders. Additionally, while NRM North could significantly improve the protection of natural assets from emergencies through the roles outlined above, we are currently not funded for any of these activities and would require a mix of ongoing resources and investment in specific projects targeting particular emergency events, assets and activities in order to deliver these functions.

Gaps in this plan to be addressed in future plans

There are several significant gaps in this Plan that should be addressed in future updates:

- **Cultural values.** The Plan does not attempt to identify or prioritise cultural assets, their susceptibility to emergencies or preparedness, response, and recovery actions for their protection. This is a significant gap that should be addressed in future plans.
- **State-listed threatened species and threatened vegetation communities.** Given the limited time available to develop this Plan, a decision was made to focus on matters of national environmental significance covered by the EPBC Act 1999 and priorities within the Threatened Species Action Plan 2022-2032. The Plan does not include any state-listed threatened species or vegetation communities outside these national priorities. Future updates to this Plan should broaden the scope of biodiversity natural assets to include key state-listed threatened species and threatened vegetation communities.
- **Climate change.** This Plan does not consider climate change, except to acknowledge that climate change is likely to increase the frequency and severity of emergency events considered in this Plan. It will also increase the pressures on ecosystem resilience that natural assets face which make them more susceptible to stochastic events. Future versions of the Plan should consider the influence of climate change on the susceptibility of natural assets to emergency events, and any consequences for the actions required to protect them during preparedness, response, and recovery phases.

1

Background

» Photo: Warren Cameron

1. Background

There is a growing need to enhance our preparedness for emergencies 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 wellbeing. Emergency preparedness bolsters the resilience of ecosystems, enabling them to recover and flourish following catastrophic events.

Better preparation and response also contribute to stronger regional economies through sectors such as tourism and agriculture. For example, by investing in emergency preparedness, long-term costs for recovery and restoration post-emergency are reduced.

On 19 September 2023 the Bureau of Meteorology declared an El Niño weather event. This was reflected by weather observations in the region with below average rainfalls, and both maximum and minimum temperature observations being above average over the 2024 summer. This follows a period of below average rainfall, higher temperatures, and the warmest recorded winter. Consequently, Australia was expecting an increased risk of extreme temperature shifts, such as heatwaves and hotter days, and increased fire danger.

Given the looming threat of the severe weather season, along with the critical role of Regional Delivery Partners in supporting NRM preparedness and response, NRM North was invited to prepare a 'Biodiversity and Agricultural Natural Capital Emergency Preparedness & Recovery Plan' (the Plan). Through the development of this plan, NRM North aims to be able to continue to support our regional stakeholders to maintain the region's biodiversity and agricultural natural capital. The Plan will build on the knowledge and experience NRM North has gained through the implementation of NRM programs and previous recovery actions implemented in response to emergency events.

This Plan considers the most likely emergency scenarios for the northern Tasmanian NRM region – that is, flood, coastal inundation, bushfire, and biosecurity incursion emergencies. It focuses on acute events, acknowledging that these interact with and are often exacerbated by longer term changes such as sea level rise, or the increasing frequency of intense rainfall events that accompany climate change. Other emergencies such as drought and marine heatwaves are not considered.

The Plan was built on the lessons learned during the 2019-20 Black Summer bushfires, floods in northern Tasmania in October 2022, a statewide flood emergency in June and July 2016, and on NRM North's current regional planning documents including the 2030 NRM Strategy Northern Tasmania[1], the State Emergency Management Committee Strategic Directions Framework, the Tasmanian Disaster Resilience Strategy 2020-2025, and Tasmanian Emergency Management Arrangements (TEMA). By identifying vulnerabilities, prioritising actions, and fostering coordination among stakeholders, the Plan seeks to minimise the impact of emergencies on biodiversity and agricultural assets.

The Plan contributes, in part, to actions under Target 17 of the Threatened Species Action Plan 2022-322[2] and Outcomes 1, 2 and 3 of the Natural Heritage Trust (NHT), by addressing vulnerability from extreme weather events relevant to biodiversity[3] and agricultural natural capital assets[4] identified in the northern Tasmania 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.

1 2030 NRM Strategy Northern Tasmania

2 https://www.dcceew.gov.au/sites/default/files/documents/threatened-species-action-plan-2022-2032.pdf

3 Biodiversity assets refer to assets identified by jurisdictions, environment management agencies or environmental law as important to preserve during emergencies e.g., species, ecological communities, habitat features.

4 Agricultural natural capital assets relate to the on-farm natural resources that we rely on for food and fibre production, including soil, air, water, riparian areas, remnant native vegetation, agroforestry and environmental plantings and animals.

Photo: St John Pound

2

Objectives of this plan

2. Objectives of this plan

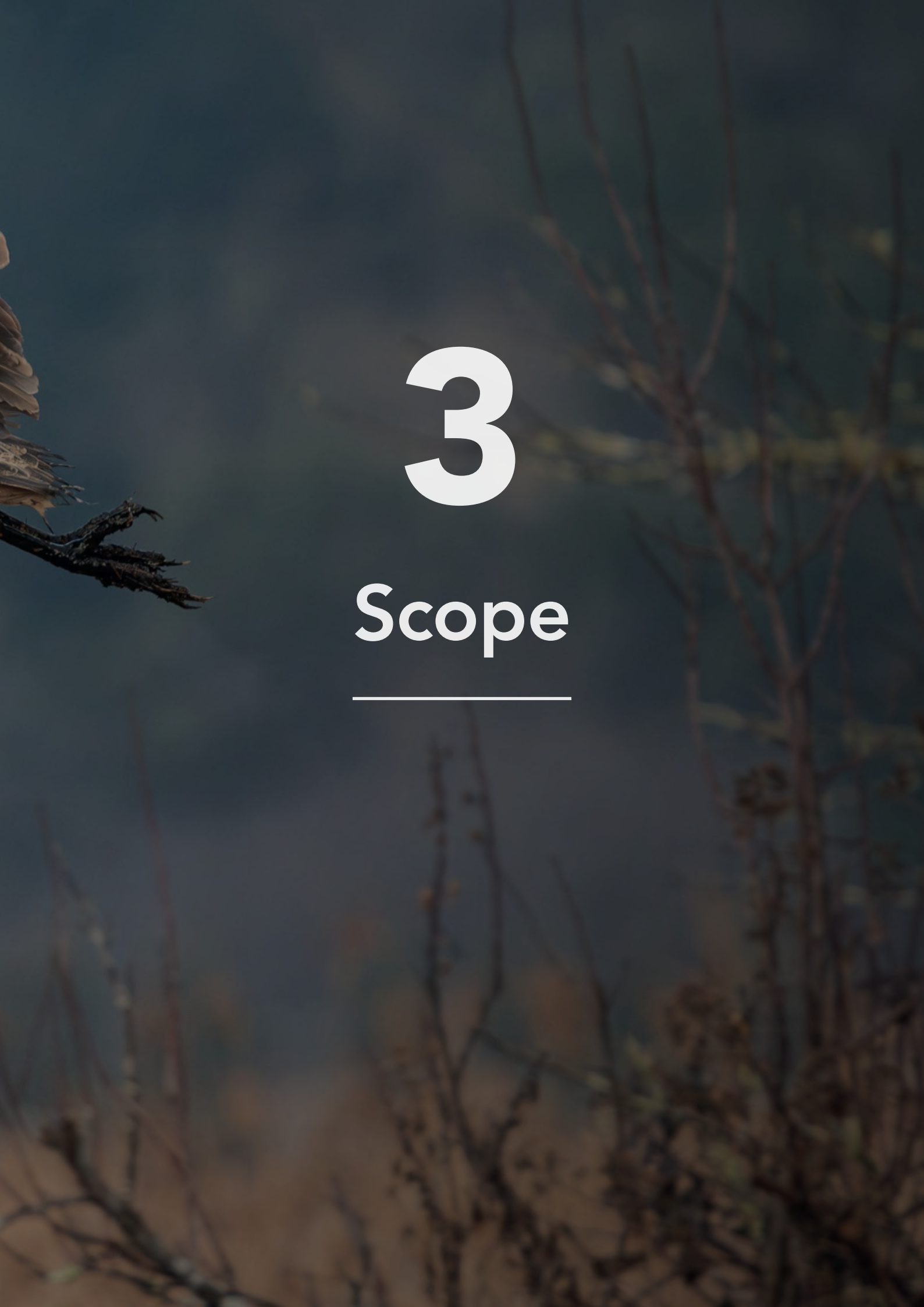
The purpose of this Plan and its development is to improve preparedness for, and response to, emergency events where they occur through better integration of biodiversity and agricultural natural capital assets in emergency planning and response. This includes efforts to enhance the resilience of biodiversity and agricultural assets by recognising the risks and threats posed by emergency events and undertaking planning to improve outcomes through actions and management before, during (to the extent possible) and after to support recovery.

The objectives of this Plan are to:

- Provide an assessment of the susceptibility of priority natural assets in northern Tasmania to bushfire, flood, coastal inundation and biosecurity emergencies.
- Identify key preparedness, response and recovery actions required to protect and restore these assets in the event of an emergency.
- Assess the extent to which current emergency management arrangements protect environmental assets and identify areas where these can be strengthened.
- Identify roles that NRM North could play in improving emergency management for natural asset protection within existing emergency management frameworks and the supports essential for these roles to be delivered.
- Facilitate conversation between agencies and individuals involved in emergency management with the goal of identifying opportunities for better collaboration and coordination to better protect natural assets in northern Tasmania.

» Photo: St John Pound

» Photo: Helen Cunningham



3

Scope

3. Scope and definitions

The Tasmanian Emergency Management Arrangements (TEMA) defines an 'emergency' as '*an event, actual or imminent, which endangers or threatens to endanger life, property or the environment, and which requires a significant and coordinated response*'. Regarding this Plan, the definition of 'emergency' is consistent with that of TEMA. The Plan emphasises the need for a comprehensive and coordinated response to reduce the impacts of emergencies on biodiversity and agricultural natural capital. Emergencies are acute in nature, involving sudden or extreme events that endanger or have the potential to endanger life, property, or the environment. These events may include natural emergencies, such as floods, fires, or storms, as well as human-induced crises, such as industrial accidents or hazardous material spills. It is important to note that while emergencies are acute events, they may also be exacerbated by the chronic effects of factors like climate change.

TABLE 1: Scope of the emergency preparedness and recovery plan for biodiversity and agricultural natural capital assets.

Event	In scope	Out of scope
Wildfires	· Of a scale, intensity, frequency or at a site that could result in a significant impact to biodiversity or agricultural natural assets. · Cultural burns as a management action.	· Cool burns, cultural burns, fire hazard reduction burns, forestry burns, and ecological burns.
Flooding and coastal inundation	· Temporary flood that could result in a significant impact to biodiversity or agricultural natural assets. This would include areas or assets that cannot tolerate flooding. · Episodic arising from storm surge.	· Small, short-term events that do not have a significant impact to values. · Areas that are adapted to flooding. · Tidal flows, sea level rise.
Drought		· Drought is not included in this plan
Biosecurity	· Entry of pest, weeds, and diseases to Tasmania that could result in a significant impact to biodiversity or agricultural natural assets. · Spread to new, highly vulnerable sites within Tasmania. · Management actions to reduce biosecurity risks during other emergencies (e.g. flood, fire).	· Pests, weeds, and diseases that already exist in the state, unless there is a significant change in their distribution or impact. · Agricultural pests, weeds, and diseases (i.e. affecting livestock or crops).
Marine or terrestrial heatwaves		· Sudden and prolonged periods of unusually warm temperatures, impacting ecosystems and production.
Other		· Chronic impacts such as climate change.

Actions are focused on building the resilience of natural assets to emergencies and supporting the natural recovery and regeneration after emergency events. Actions in this Plan are considered in three phases:

1. **Preparedness** (before the event): Mitigation, prevention, and preparation activities aimed at building resilience in biodiversity and agricultural natural capital assets and prioritising areas for protection.
2. **Response** (during the event): Implementation of specific emergency responses tailored to the nature of the emergency and natural resource management priorities.
3. **Recovery** (after the event): Focused on supporting natural recovery and regeneration of natural capital assets after the event, restoring the condition of natural assets, and facilitating their return to a state of resilience.

The Plan identifies areas of collaboration with various stakeholders including landholders and local government as well as engagement by NRM North that could strengthen these activities and improve outcomes for the region's natural capital assets.

» Photo: St John Pound

4

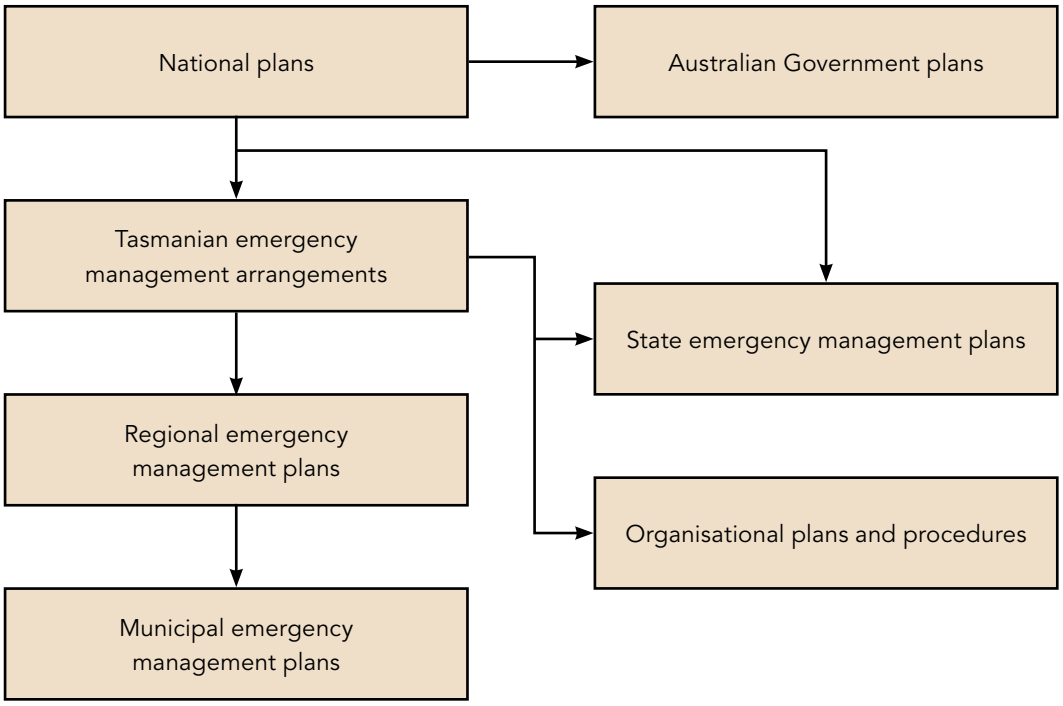
Role of NRM North in emergency preparedness and response

4. Role of NRM North in emergency preparedness and response

The Tasmanian Emergency Management Arrangements (TEMA) operate under the Emergency Management Act 2006. Emergency management planning within Tasmania occurs at multiple levels from state to municipal levels as shown in Figure 1.

FIGURE 1: **Relationship of emergency management plans in Tasmania.**

Source: A23/17325: Guide to Developing and Reviewing State Emergency Management Plans—Feb 2023.



State Emergency Management Plans outline the statewide, multi-agency coordination arrangements:

- managing risks and consequences of emergency (such as bushfire or flood)
- managing a function required by emergencies (such as recovery)

Emergency management planning applies a set of principles which reflect increasing understanding of risks, vulnerabilities, and treatment options across social, built, economic and natural environments.

Relevant to this report, statewide emergency management plans exist for:

- bushfire – the State Fire Protection Plan for which Tasmania Fire Service (TFS) is the responsible agency
- floods and storms – State Flood Emergency Management Plan for which the State Emergency Service (SES) is the responsible agency
- animal and plant biosecurity – biosecurity emergencies for which NRE Tas is the responsible agency
- tsunami – State Tsunami Emergency Response Plan for which SES is the responsible agency
- State Recovery Plan which applies to recovery from all natural hazards outlined in TEMA for which DPAC is the responsible agency.

There is no statewide emergency response plan for coastal inundation outside tsunamis. This is likely to reflect the smaller scale of impact of other forms of coastal inundation and storm surge.

4.1 Emergency Management Planning Governance

The governance framework for emergency management in Tasmania operates at four levels:

- Municipal
- Regional
- State
- Ministerial

An Emergency Management Committee operates at each of these scales with specific functions and representation as outlined in the *Emergency Management Act 2006*. Table 2 summarises the committees that operate at each of these levels, their functions and powers, and representation.

TABLE 2: **Emergency Management Committees defined under the Emergency Management Act 2006.**

Level	Committee	Functions and powers	Representation
Municipal	Municipal Emergency Management Committee (MEMC)	· Determine and review emergency management policy for municipal area (or combined area). · Identify and promote opportunities for improvement.	· Nominated by Councils (see below for representation of MEMC in northern Tasmanian LGAs).
Regional	Regional Emergency Management Committee (REMC)	· Determine and review emergency management policy. · Impose functions on a Municipal Emergency Management Committee. · Identify and promote opportunities for improvement in emergency management.	· Chair – Regional Controller. · Other members as determined by the Regional Controller.
State	State Emergency Management Committee (SEMC)	· Determine and review emergency management policy. · Impose functions on a Regional Emergency Management Committee. · Identify and promote opportunities for improvement in emergency management.	· Chair – State Controller. · Other members determined by the State Controller.
Ministerial	Ministerial Committee for Emergency Management (MCEM)	· Ministerial-level strategic policy oversight of emergency management. · Impose functions relating to emergency management on the State Committee, a State Recovery Coordinator, or the State Recovery Advisor. · Require the State Controller to provide any necessary information. · Establish subcommittees, for the purpose of assisting the Ministerial Committee.	· Chair – Premier. · Secretariat – DPAC. · Deputy Premier. · The Minister assigned the administration of the Act. · State Controller · any other Minister, holder of a position, or person that the Premier considers appropriate.

Table 3 summarises the membership of each of the Municipal Emergency Management Committees operating in northern Tasmania.

TABLE 3: **Membership of Municipal Emergency Management Committees in northern Tasmania.**

Council	Chair	Executive Office	Other members
Break O'Day	Mayor	Municipal Emergency Management Coordinator	· Tasmania Police · State Emergency Service · Tasmania Fire Service · Ambulance Tasmania · Break O'Day Council · St Helens/St Marys District Hospital · Parks and Wildlife Service · St Helens Marine Rescue
City of Launceston	Mayor or a Councillor nominated and endorsed by council	Municipal Emergency Management Coordinator, City of Launceston	· City of Launceston Recovery Coordinator · State Emergency Service · Tasmania Police · Tasmania Fire Service · Ambulance Tasmania · Department of Health · Department of Premier and Cabinet · TasWater · TasNetworks · Red Cross · Migrant Resource Centre North · Department of Education, Children and Young People
Dorset	A Councillor nominated as the council representative to the Committee	Municipal Emergency Management Coordinator	· Ambulance Tasmania · Department of Health – Public Health · Dorset Council · North East Soldiers Memorial Hospital · Parks and Wildlife Service · State Emergency Service · Sustainable Timbers Tasmania · Tasmania Fire Service · Tasmania Police · TasNetworks
Flinders Island	Deputy Mayor	Municipal Emergency Management Coordinator	· Tasmania Police · State Emergency Service · Tasmania Fire Service · Ambulance Tasmania · NRE Tas · TasNetworks/Hydro · Flinders Multi-Purpose Centre · Cape Barren Community Health Centre · Flinders Island Airport · Flinders Island Ports (TasPorts) · Oil Pollution Local Industry Coordinator · Parks and Wildlife · Flinders Recovery Coordinator · Country Women's Association · Telstra · Flinders Island Aboriginal Association Inc. · Flinders Island District High School

Council	Chair	Executive Office	Other members
George Town	Mayor	Municipal Emergency Management Coordinator	· Tasmania Police · State Emergency Service (Northern Region) · Tasmania Fire Service (Northern Region) · Ambulance Tasmania (George Town Ambulance) · George Town Council (Recovery Coordinator) · George Town Hospital · DHS – Public Health · State Emergency Service George Town Unit · TasPorts · Bell Bay Industrial Mutual Aid Group · TasWater · TasNetworks
Meander Valley	Director of Infrastructure Services – Municipal Emergency Management Coordinator	As for Chair	· Deputy Municipal Coordinator (Director Works) · Municipal Recovery Officer (Community Development Officer) · Deputy Municipal Recovery Officer (Youth Development Officer) · Councillor/s · Tasmania Police · State Emergency Service · Tasmania Fire Service · Red Cross · Department of Health & Human Services – Deloraine · Department of Health & Human Services – Westbury · Emergency/Recovery Administration Officer
Northern Midlands	Mayor	Municipal Emergency Management Coordinator	· State Emergency Service · Tasmania Fire Service · Tasmanian Ambulance Service · Northern Midlands Council · Toosey Aged Care
West Tamar	West Tamar Council Representative (unspecified)	Municipal Emergency Management Coordinator	· Tasmania Police · Tasmania Fire Service · TasPorts · Jemena · Maritime College · Tasmanian Health Service (THS) · Beaconsfield Mine (NQ Minerals) · State Emergency Service

Representation on Municipal Emergency Management Committees varies across the region. Three of the eight councils have representatives from Tasmanian Parks and Wildlife Service (TPWS). Other councils have no explicit representation from environmental or natural resource management organisations. No councils have representatives from organisations focused on natural asset protection and recovery on land outside of national parks (e.g. on private land holdings). NRM North currently has no role on Regional or Municipal Emergency Management Committees.

We have participated in past stakeholder consultation activities at statewide and regional planning levels. NRM North could play a useful role at a municipal and/or regional emergency management level in representing interests relating to protection and restoration of natural values in areas outside national parks such as agricultural areas or reserves outside the management of the TPWS. Participation in these committees would require resourcing and legitimacy through invited membership.

4.2 Fire Management Area Committees

There are three Fire Management Area Committees (FMACs) in northern Tasmania, supported by the State Fire Management Council: North East, Flinders and Tamar. The primary role of the FMACs is to prepare a fire protection plan, known as Bushfire Risk Management Plan (BRMP) for their Fire Management Area (FMA). These plans aim to protect community by reducing bushfire risk across multiple tenures. They are intended to be used by stakeholders to inform their vegetation fire management activities. Plans identify strategic priorities, identify and assess community bushfire risks, and prioritise strategic works in response to those risks. FMACs also work to inform strategic bushfire mitigation activities and programs, and to coordinate vegetation fire management activities including education and information, and fuel management.

FMAC membership includes:

- a TFS officer
- local council representatives
- Sustainable Timber Tasmania nominee if the FMA contains or borders state forests
- an NRE Tas nominee if the FMA contains or is adjacent to reserved land
- a person nominated by the Brigade Chiefs' of the brigades wholly or partly within the FMA.

FMACs are also able to request additional representatives based on the requirements of the FMA which will be considered by the SFMC on a case-by-case basis. Membership may include representatives from:

- TasFarmers
- TasWater
- TasNetworks
- Hydro
- Tasmanian Land Conservancy
- Private Land Conservation Program
- Department of Defence
- Private Forestry Companies.

NRM North does not participate in any Fire Management Committees. A potential gap in knowledge base for the current FMACs is an understanding of ecologically sensitive burns and cultural burns particularly for protecting natural assets outside national parks, including those on privately owned land.

4.3 Environmental Recovery

Recovery efforts are focused on building resilience. Management of recovery efforts depends on the scale of the emergency:

- Level 1 – Emergency of Local significance. Locally coordinated recovery managed and coordinated through the Municipal Committee or as per arrangements set out in the Municipal Emergency Management Plans. Applies to emergencies which involve response coordination at the municipal level, possibly with some regional support, a discrete affected area (one LGA or industry sector), and minimal ongoing recovery assistance required from Tasmanian Government agencies.
- Level 2 – Emergency of Regional significance. State-supported recovery with response coordinated at a regional level. Applies to emergencies which involve response coordination at regional level; multiple or dispersed affected areas; impacts across multiple domains requiring assistance from multiple government agencies; and activation of financial assistance measures.
- Level 3 – Emergency of State significance. State coordinated recovery. This applies to emergencies which require response coordination at regional or state levels; multiple local government or regions that involve a small to moderate number of casualties; have significant and complex impacts across multiple recovery domains; and require activation of financial assistance measures.
- Level 4 – Emergency of National significance. This applies to catastrophic emergencies that exceed the state's capability, capacity and systems or may require a nationally supported or coordinated approach.

There are five domains of recovery in Tasmania:

- Social recovery
- Economic recovery
- Infrastructure recovery
- Environmental recovery
- Cross-domain recovery.

The State Recovery Plan defines environmental recovery as primarily focusing on the rehabilitation and restoration of the natural environment. This includes in related portfolio areas such as parks and reserves, agriculture, and other primary producers.

The coordinating agency for environmental recovery is the Department of Natural Resources and Environment Tasmania (NRE Tas) in conjunction with the Environment Protection Authority (EPA). NRE Tas coordinates environmental rehabilitation in consultation with property owners and managers, affected councils, the EPA, and the community.

Table 4 shows the functions, responsible agencies, and supporting agencies for environmental recovery.

TABLE 4: **Environmental Recovery Domain Responsibilities[5].**

5 From the State Emergency Response Plan

Function	Responsible Agency	Support Agency
Environmental health and pollution · Conduct monitoring and surveillance activities · Render (disperse/dilute/neutralise) the hazardous material safe · Decontaminate affected people, places and equipment	· Councils · EPA · Asset owner	· Department of Justice · Department of Health
Crown land, national park, and landscape rehabilitation · Coordinate and undertake natural environment rehabilitation works	· NRE Tas	· NGOs
Aboriginal, natural, and cultural heritage · Undertake assessment of risk posed to natural and cultural heritage places and affected areas · Coordinate and undertake Aboriginal, natural and cultural heritage rehabilitation works, in consultation with affected communities · Undertake recovery monitoring of Aboriginal, natural and cultural heritage places	· DPAC (Aboriginal Heritage Tasmania) · NRE Tas	· Tasmanian Aboriginal Land and Sea Council
Animal welfare, feed, and fodder · Coordinate assistance for household pets and assistance animals presenting at an evacuation centre · Coordinate services to treat and care for affected wildlife · Coordinate and manage services to meet the immediate needs of affected livestock	· Councils · NRE Tas	· Community groups · NGOs
Assistance measures for primary producers · Assess and provide primary producer assistance under the TRRA Community Recovery Policy · Provide advice and other non-financial support to primary producers	· NRE Tas · Industry bodies · NGOs	· DPAC (RRT)
Waste management and carcass removal · Dispose of contaminated waste · Coordinate removal of livestock carcasses	· Councils · NRE Tas	· EPA
Biosecurity and invasive species · Conduct monitoring and surveillance activities · Coordinate the delivery of diagnostic services · Restrict the movement of hazardous organisms	· NRE Tas	

NRM North currently has no defined role in environmental recovery. NRM North has supported recovery after past statewide emergencies on a sub-contractual basis to the state government. NRM North delivered the 2016 Agricultural Landscape Flood Recovery Scheme in northern Tasmania on behalf of the state government, coordinating the distribution of financial support and providing on-ground advice and support to landholders in environmental recovery on their properties.

There are two environmental recovery functions where NRM North has the expertise and connections which would enable us to provide significant support and input:

- Crown land, national park, and landscape rehabilitation – NRM North could play a role in landscape rehabilitation outside national parks and Crown land (i.e. private and council-owned and managed land).
- Assistance measures for primary producers – NRM North could assist in providing advice and other non-financial support to primary producers.

To play this role, NRM North needs to be engaged to deliver programs for a specific emergency situation, or would require ongoing resourcing as well as legitimacy through a recognised role within Tasmania's Emergency Management Recovery Governance Framework and environmental recovery responsibilities to provide ongoing support for emergencies within the region.

4.4 Biosecurity Emergency Management

Management of Biosecurity Emergencies is covered by a single act of parliament, the *Biosecurity Act 2019*. This came into force in May 2023, replacing seven separate Acts covering seeds, animals, plant quarantine, weed management, and vermin control. The Act improves the ability to manage risks offshore before they reach Tasmania, emphasises shared responsibility for maintaining a robust biosecurity system (General Biosecurity Duty), and allows tailoring of detailed biosecurity measures for managing specific issues, activities, or impacts.

The Act establishes a three-tiered hierarchy for biosecurity emergency management[6]:

- An emergency order issued by the Minister for the most urgent situations where there is a high level of uncertainty. This order expires after six months unless remade.
- A control order issued by the Minister for emergencies where the risks are significant but not as urgent or are more clearly understood. This can be in effect for up to five years without needing to be remade.
- Biosecurity zones made by regulations where long-term management of a biosecurity issue is required. These will usually be ongoing until the risk of impact being managed is addressed or accepted. They generally expire after 10 years unless remade. Biosecurity zones can target established populations of animal pests or weeds, or a particular region such as an island to enable application of particular management measures in that area.

The Act provides a legal structure for the development and implementation of biosecurity programs. These can be administered by government, industry groups, or not-for-profit environmental organisations. Biosecurity programs must set out in writing the actions various parties will undertake and how program costs will be met.

The Biosecurity Council, appointed under the *Biosecurity Act 2019,* reviewed the Biosecurity Strategy. An updated Biosecurity Strategy 2023-2027[7] has been released, aiming to guide all stakeholders on the importance of biosecurity and their role. It lays out five strategies and a series of actions in the areas of:

- Shared responsibility
- Risk-based decision making and mitigation
- Biosecurity emergency management
- Legislation and regulation
- Innovation and research

6 https://nre.tas.gov.au/biosecurity-tasmania/biosecurity-act-2019/biosecurity-act-faqs

7 https://nre.tas.gov.au/Documents/Tasmanian Biosecurity Strategy 2023-2027.pdf

Biosecurity Tasmania, a section of NRE Tas, is responsible for actions to prevent, prepare, respond to, and recover from biosecurity emergencies, including those affecting natural assets. The State Special Emergency Management Plan – Biosecurity Emergencies describes the role of NRE Tas, its relationships with other Tasmanian Government agencies, and an overview of processes and arrangements for the management of biosecurity emergencies.

Biosecurity management consists of [8]:

- Prevention – requires a clear understanding of potential threats and pathways of introduction and engagement of landholders, industry, and the community to employ good farm biosecurity practices, import requirements, and report and suspicious threats or diseases.
- Response – with engagement of industry, government agencies and the community:
  - prevent the spread of the pest of disease into and / or within Tasmania
  - identify areas of infection and eradicate the pest or disease
  - control, eradicate and / or provide freedom from the pest or disease
  - provide advice and information to communities and industries
  - support recovery from pest or disease incursions
- Recovery – measures are dependent on the type and scale of biosecurity emergency.

Biosecurity Tasmania provides access to resources for community and industry as well as links to tools to assist farmers to develop farm biosecurity plans.

NRM North is delivering Stage 2 of the Weeds Action Fund (WAF) across Tasmania on behalf of the state government. Announced in 2018, the WAF was originally a $5 million program through to 2024. An additional $1.4 million over two years was announced in the FY 2023-24 state budget to support Stage 3.[9]

The aim of the Weeds Action Fund is to:

- provide a more strategic and targeted approach to tackling high priority weeds that affect agriculture and the environment
- improve the productive value of agricultural land and protect Tasmania's natural values through removing the harmful effects of serious weed threats
- support landowners, local government and the broader community in tackling serious weeds with sustainable, long-term and effective actions
- co-invest with landowners, local government and the broader community to make sustainable, long-term and effective actions to address high priority weeds with eradication as a key objective
- ensure there is a strong, coordinated link between the different levels of government and the Tasmanian community in tackling serious weeds and the delivery of the WAF through the appointment of a Chair of the Weeds Action Fund
- encourage the concept of 'shared responsibility' for weed management and biosecurity in general and provide an opportunity for landowners to co-invest in removing the threat of serious weeds on their properties.

One component of the WAF is assisting land managers with the development of a Weed Management Plan. These plans cover management, control, or eradication of weeds for a specified area. They identify relevant issues and actions to be taken to remove or reduce the weed threat. The WAF also provides funding for weed management, control, and eradication actions with co-investment of cash or in-kind resources to promote shared responsibility.

Under a shared responsibility framework NRM North could play a role in assisting in the development and delivery of Biosecurity Programs for priority natural assets and habitats. This role would require resourcing on a project basis.

8 https://nre.tas.gov.au/biosecurity-tasmania/biosecurity-emergency-management/biosecurity-emergency-management-and-preparedness

9 https://nrmnorth.org.au/sustainableagriculture/weeds-action-fund

5

Identification of Northern Tasmanian assets and susceptibility

5. Identification of northern Tasmanian assets and susceptibility

Natural capital assets considered in this plan were identified in consultation with key stakeholders including state government agencies, local government and NRM North staff. Priorities encapsulated in the Strategy for the region which were informed by extensive community consultation were also considered. The placement of these assets in the landscape and the environments they occupy influence their susceptibility to emergencies and the types of impacts they would subject to, both from the emergency itself and from actions taken to prepare, respond to, and recover from the emergency which can either support or negatively impact the resilience of the asset. This section describes biodiversity and agricultural natural assets in northern Tasmania and the impact bushfire, flood, coastal inundation, and biosecurity emergencies can have on the environments they occupy. The approach to considering susceptibility of each asset to emergencies is then outlined and the susceptibility of each asset to these emergencies is summarised.

5.1 Natural assets in northern Tasmania

Biodiversity assets in the northern Tasmanian region relate to priority species, communities, habitats, and places in the region. The identification of assets in this plan focused on:

- EPBC listed threatened species with a focus on those prioritised through the Threatened Species Action Plan 2022-2032
- EPBC listed threatened ecological communities
- Ramsar wetlands
- Other regionally important species, communities and places identified in the 2030 NRM Strategy Northern Tasmania.

These assets occupy a range of environments that are impacted differently by bushfire, flood, coastal inundation, and biosecurity emergencies. Priority assets in the northern Tasmania are summarised in Table 5 by the environment they occupy.

It should be noted that the focus of this initial plan is on federally-listed threatened species, threatened ecological communities, and Ramsar sites. Future plans should also consider priority state-listed threatened species and threatened vegetation communities.

TABLE 5: **Priority biodiversity natural capital assets in northern Tasmania by environment.**

Environment	Type	Assets
Hillslope and terrestrial environments	EPBC listed Threatened species	· Swift parrot · Eastern quoll · New Holland mouse*[10] · Graveside leek-orchid
	EPBC listed Threatened ecological communities	· Alpine Sphagnum Bogs and Associated Fens · Lowland native grasslands
	Regional priorities	· Wedge-tailed eagle · Shy Susan
Floodplains and riparian zones	EPBC listed Threatened species	· Davies' wax flower · Giant freshwater crayfish*
	EPBC listed Threatened ecological communities	· *Eucalyptus ovata – Callitris oblonga* forest · Tasmanian white gum (*Eucalyptus viminalis*) wet forest · *Eucalyptus ovata / Eucalyptus brookeriana* forests and woodlands
Karst	–	–
Estuaries	Regional priorities	· kanamaluka / Tamar estuary*
Streams and lakes	EPBC listed threatened species	· Swan galaxias · Giant freshwater crayfish*
Coastal dunes and scrub	EPBC Threatened species	· Hooded plover · New Holland mouse*
Wetlands	Ramsar wetlands	· Logan Lagoon · Floodplain Lower Ringarooma River · Jocks Lagoon · East Coast Barren Island Lagoons · Little Waterhouse Lake
	EPBC listed Threatened species	· Australasian bittern · Eastern curlew · Green and gold frog
	EPBC listed Threatened ecological communities	· Subtropical Temperate Coastal Saltmarsh
	Regional priorities	· kanamaluka / Tamar estuary*

10 * Indicates asset is relevant to more than one environment and subject to impacts of emergency events on both environments. Susceptibility and risk for these assets below is described once under the first relevant environment.

In agricultural areas, natural capital assets relate to the soils, remnant native vegetation, insects, and water resources of the region.

Agricultural natural assets in northern Tasmania and their environment are summarised in Table 6.

TABLE 6: Priority agricultural assets and their environments.

Environment	Assets
Hillslope and terrestrial environments	· Healthy soils · Remnant native vegetation and shelter belts · Productive hillslopes
Floodplains and riparian zones	· Native riparian vegetation · Fertile floodplains
Streams and lakes	· Surface and groundwater quality and quantity

5.2 Impacts of various emergencies on each class of assets

Emergencies have a range of impacts on natural assets. Some of these impacts occur as a result of preparation activities, some during the event which can be a result of the emergency or due to emergency responses, and others post-event. Post-event impacts can occur immediately after an event, before or during clean up, or later, and may persist for weeks, months or years after the event. Post-event impacts can be exacerbated or mitigated by preparation, response, and recovery activities.

This section describes the types of impacts each emergency can have on the natural assets in each environment. The specific impact on each asset within the class differ but generally include a selection of those described here. The vulnerability of each natural capital asset considered in this Plan to these impacts is described later in this section.

5.2.1 Bushfire

Figure 2 shows a framework for considering potential impacts of bushfire emergencies on biodiversity and agricultural natural capital assets. The nature and extent of impacts can be expected to be different depending on the magnitude and intensity, frequency, timing, seasonality, and patchiness of bushfires. Many species and vegetation communities require fire as part of their life cycle but fire events that occur too frequently, cover too great an extent, or burn too hot can have serious negative consequences to their long-term survival. Each natural asset is affected differently by various components of this framework. For example, for limited range threatened species such as the Davies' wax flower or Shy Susan, a fire has the potential to impact all remaining individuals of the species making this immediate impact a significant risk. Similarly, for a species such as the Orange-Bellied Parrot, a single fire has the potential to destroy their entire breeding range. For a species such as the giant freshwater crayfish (GFC), fires in the catchment which do not directly impact on GFC habitat may still have significant short to long-term impacts from stream sedimentation and other pollution of surface waters that follows the bushfire event and which are exacerbated by loss of groundcover. Areas of native vegetation or pastures that survive the initial fire event may be significantly damaged by intense grazing pressure on remaining vegetation as wildlife and stock move into these areas. Over time, repeat or extensive fire events may lead to fragmentation of habitat and remnant species and ecological communities making movement between remnants more difficult and reducing the long-term viability of the species or community.

FIGURE 2: **Potential impacts of bushfire emergencies on natural capital assets in environment types during and after events.**

Immediate impacts	Post-event impacts
Hillslopes and terrestrial environments	
· Soil loss from including from deep combustion · Rock spalling · Loss of groundcover · Damage to and loss of native vegetation · Injury to and death of wildlife · Salinisation of areas where saline water used for fire fighting	· Erosion from wind and rainfall events · Rock instability and downslope mass movement · Predation and starvation of surviving wildlife · Increased grazing pressure on remaining and recovering vegetation · Weed and pest incursion · Ongoing impacts of salinisation on vegetation · Change to hydrological regime
Karst	
· Pollution with ash, contaminant runoff · Salinisation where salt water is used for firefighting	· Sedimentation · Degraded water quality from loss of groundcover and reduced filtering due to lost vegetative buffer · Changes to hydrological cycle · Salinisation from runoff in areas where salt water was used for fire fighting
Estuaries	
· Surface and groundwater pollution with ash, contaminant runoff · Salinisation where salt water is used for fire fighting · Loss of and damage to tidal wetland and foreshore vegetation	· Damage to and loss of tidal wetland vegetation, and nesting and foraging areas · Weed and pest incursion · Sedimentation · Degraded water quality from loss of groundcover and reduced filtering due to lost vegetative buffer · Changes to hydrological cycle
Floodplains and riparian zones	
· Loss of groundcover · Damage to and loss of native vegetation · Injury to and death of wildlife · Salinisation of areas where saline water used for fire fighting	· Streambank erosion · Loss of and damage to riparian habitat · Predation and starvation of surviving wildlife · Increased grazing pressure on remaining and recovering vegetation · Weed and pest incursion · Ongoing impacts of salinisation on vegetation
Streams and lakes	
· Surface and groundwater pollution with ash, contaminant runoff · Salinisation where salt water is used for fire fighting	· Waterway sedimentation · Degraded water quality from loss of groundcover and reduced filtering due to lost vegetative buffer · Changes to hydrological cycle · Salinisation from runoff in areas where salt water was used for fire fighting

Immediate impacts	Post-event impacts
Coastal dunes and scrub	
· Loss of groundcover · Damage to and loss of native vegetation · Injury to and death of wildlife	· Dune erosion · Loss of vegetation and nesting and foraging areas · Predation and starvation of surviving wildlife · Increased grazing pressure on remaining and recovering vegetation · Weed and pest incursion
Wetlands	
· Damage to and loss of native vegetation · Injury to and death of wildlife · Surface and groundwater pollution with ash and associated nutrients	· Damage to and loss of vegetation and nesting and foraging areas · Predation and starvation of surviving wildlife · Increased grazing pressure on remaining and recovering vegetation · Weed and pest incursion · Sedimentation · Ongoing decline in water quality from lost vegetative buffer · Changes to hydrological cycle

5.2.2 Flood

Figure 3 shows the conceptual framework for considering the impacts of floods on biodiversity and agricultural natural assets. As was the case for fire, floods are essential to many species and communities, particularly wetlands and riparian vegetation communities. These communities have adapted to a cycle of flooding which replenishes soil moisture, surface, and groundwaters and the nutrients that these vegetation communities depend on for their survival. Negative impacts on natural assets have occurred with changes to the flood and hydrological regime that result from climate change and human impacts on the landscape. The type and load of pollutants and contaminants transported to the stream has also been modified by land use and management change in the catchment. Weeds and other debris are transported to areas downstream. Changes in riparian cover and management have also modified the way in which riparian areas are impacted by floods. While hillslopes and many terrestrial environments are not affected by river rise, intense rainfall events associated with floods can cause significant damage. The impacts of floods in coastal dunes and scrub environments also largely relate to intense rainfall events. Intense rainfall events in coastal areas frequently occur with storm surge and coastal inundation.

FIGURE 3: **Potential impacts of flood emergencies on natural capital assets in environment types during and after events.**

Immediate impacts	Post-event impacts
Hillslopes and terrestrial environments	
· Landslip · Hillslope erosion · Excess nutrients, sediments, contaminants from the hillslope environment transported to the stream	· Loss of fertile topsoils · Impacts on vegetation from mass movement and landslip · Increased grazing pressure from displaced pest species such as deer and from native grazing animals
Karst	
· Soil erosion · Transport of soils, nutrients, pathogens, and contaminants to the subsurface · Concentration of debris in negative relief features · Loss and damage to surface vegetation	· Changes to Karst hydrological regimes · Collapse and subsidence of bedrock and unconsolidated sediments · Loss of soils and ongoing erosion impacting recovery of vegetation · Further transport of soils, nutrients, pathogens, and contaminants from changed formations, loss of groundcover, and changes to hydrology · Impacts on Karst habitats, flora, and fauna species
Estuaries	
· Surface and groundwater pollution from sediments, nutrients, pathogens, and other contaminants · Debris transported to estuary from catchments and foreshore areas · Rapid change in salinity, temperature, and other environmental conditions · Loss of and damage to tidal wetland and foreshore vegetation	· Damage to and loss of tidal wetland vegetation, and nesting and foraging areas · Sedimentation of benthic habitats · Weed and pest incursion where flood has transported these to new sites · Degraded water quality, including impacts on physiochemistry such as dissolved oxygen and pH as well as chlorophyll-a from pollutant inputs and changes in salinity and temperature · Impacts of increased turbidity on feeding and migration of aquatic species · Other impacts on aquatic flora and fauna species
Floodplains and riparian zones	
· Deposition of hazardous materials including chemicals and dead stock on the floodplain · Deposition of other problematic materials including hay bales, building materials, cobble and debris · Damage to and loss of riparian habitat, vegetation communities, and flora and fauna species from bank erosion	· Stream bank erosion and slumping · Increased grazing pressure and stock impacts on riparian zones from lost and damaged fencing · Disease and pathogens transported to new sites and from dead stock and other hazardous debris · Riparian weeds transported to new sites · Damage from recovery activities such as using machinery to move debris off floodplains, particularly where this is disposed of in the stream · Ongoing impacts on flora and fauna from damaged and lost habitat and vegetation, including increased predation and starvation of affected species

Immediate impacts	Post-event impacts
Streams and lakes	
· Surface and ground pollution from sediments, nutrients, pathogens, and other contaminants · Debris transported to estuary from catchments and foreshore areas · Loss of and damage to instream vegetation and benthos	· Damage to and loss of instream vegetation and habitat · Sedimentation of benthic habitats · Weed and pest incursion where flood has transported these to new sites · Degraded water quality, including impacts on physiochemistry such as dissolved oxygen and pH as well as chlorophyll-a from pollutant inputs and changes in temperature · Impacts of increased turbidity on feeding and migration of aquatic species · Other impacts on aquatic flora and fauna species, including fish kills from changes in dissolved oxygen · Increased waterborne pathogens
Coastal dunes and scrub	
· Intense rainfall events destabilising dune especially where vegetation has been removed or damaged	· Dune erosion · Loss of groundcover, vegetation and nesting and foraging areas
Wetlands	
· Surface and ground pollution from sediments, nutrients, pathogens, and other contaminants · Debris transported to wetland from catchments areas · Damage to vegetation and nesting sites · Injury and death of fauna species	· Ongoing damage to and loss of vegetation and nesting and foraging areas · Increased grazing pressure on remaining and recovering vegetation · Weed and pest incursion · Changes in water quality from pollutant and contaminants transported from catchment · Ongoing sedimentation from upstream erosion (of hillslopes and riparian areas) · Impacts of debris deposited in wetland

5.2.3 Coastal inundation

Figure 4 shows the conceptual framework for considering impacts of coastal inundation on biodiversity and agricultural natural capital assets. Note that in this context, coastal inundation focuses on the effects of high tides, floods, and storm surge in the coastal zone rather than climate change-induced sea level rise. Regardless, climate change can be expected to exacerbate many of these effects. Coastal inundation frequently occurs concurrent to flood and intense rainfall events, with impacts of each exacerbated by the effects of the other. This section focuses on impacts on the coastal zone – estuarine, wetlands in the coastal zone, and coastal dune and scrub environments.
Like other emergencies, many of the actions taken to mitigate impacts of coastal inundation on people and infrastructure have negative impacts on natural assets before, during and after coastal inundation events.

FIGURE 4: **Potential impacts of coastal inundation emergencies on natural capital assets in environment types during and after events.**

Immediate impacts	Post-event impacts
Estuaries	
· Direct impacts including destruction of native coastal vegetation and habitats · Injury to and death of fauna in the tidal and impact zone · Loss of groundcover and soil stability in the tidal zone, including mudflat scour, slumping, and undercutting · Salinisation of near coastal soils · Localised salinisation of groundwater and freshwater resources · Changes to river mouth in estuarine systems · Mobilisation of pollutants and contaminants from foreshore areas	· Fragmentation of remnant vegetation and diminished refugia · Damage to nesting and foraging sites for bird species · Destabilisation, slumping, and undercutting of mudflats and foreshore areas with lost vegetation · Degraded water quality from mobilised pollutants and contaminants
Coastal dunes and scrub	
· Direct impacts including destruction of native coastal vegetation and habitats · Injury to and death of fauna · Loss of groundcover and reduced dune and soil stability · Salinisation of near coastal soils · Localised salinisation of groundwater and freshwater resources	· Dune erosion · Loss of groundcover, vegetation, and nesting and foraging areas · Reduced habitat and fragmentation of habitat, species, and ecological communities · Weed and pest incursion to degraded sites · Increased predation of eggs, young, and adult birds
Wetlands	
· Direct impacts including destruction of native coastal vegetation and habitats · Injury to and death of fauna in the tidal and impact zone · Loss of groundcover and soil stability · Salinisation of near coastal soils · Localised salinisation of groundwater and freshwater resources · Changes to coastal wetlands inlet and tidal exchange · Mobilisation of pollutants and contaminants from foreshore areas into wetland systems	· Fragmentation of remnant vegetation and diminished refugia · Damage to nesting and foraging sites for bird species · Dune erosion and change to inlet conditions · Changes to tidal exchange and salinity where previously closed systems become open · Degraded water quality from mobilised pollutants and contaminants · Weed and pest incursion to degraded sites · Increased predation of eggs, young, and adult birds

5.2.4 Biosecurity

For the purposes of this Plan, a biosecurity emergency occurs when either:

- a previously unknown invasive organism enters Tasmania
- an organism that was contained within Tasmania experiences a significant spread including establishment in previously uninfected environments.

Immediate impacts occur on entry to a new area and are focused on individual animals and plants. Subsequent impacts are on populations and habitat and include indirect impact on flora and fauna not impacted immediately through loss of habitat, food sources or population numbers and genetic diversity.

Three main types of biosecurity emergency types are considered:

- Pests – invasive fauna species
- Weeds – invasive flora species
- Disease causing pathogens including fungi, bacteria, viruses, and parasites.

While some impacts depend on environment (e.g. water quality impacts or changes in flow regime in streams), the nature of impact depends more on the type of biosecurity event than the environment in which it occurs.

Figure 5 summarises the potential impacts of the three main types of biosecurity emergencies considered in this report.

FIGURE 5: **Potential impacts of different types of biosecurity emergencies on natural capital assets during and after entry events.**

Immediate impacts	Post-event impacts
Pests	
· Predation of eggs, juveniles and adults · Browsing, trampling and physically damaging native vegetation · Introduce disease to native fauna · Introduce toxins to environments	· Reduced fauna population and increased vulnerability through loss of genetic diversity · Degraded vegetation, reduced flora population and extent, and genetic diversity increasing vulnerability · Loss of and damage to habitat for flora and fauna species impacting ecosystems · Changes to hydrology including through changes in soil structure and localised drainage · Degraded water quality through changes in nutrient regime, shading, temperature, damage to streambanks and release of toxins
Disease-causing pathogens – fungi, bacteria, viruses, parasites	
· Mortality of affected individuals – flora or fauna	· Reduced fauna population of directly impacted species and of those indirectly affected by loss of food sources and habitat, and increased vulnerability through loss of genetic diversity · Degraded vegetation, reduced flora population and extent, and genetic diversity increasing vulnerability · Loss of and damage to habitat for flora and fauna species impacting ecosystems
Weeds	
· Increased competition for light, nutrients, water and space crowding out native flora	· Loss of flora individuals and extent, loss of genetic diversity and increased vulnerability of remaining plants · Damage to and loss of habitat for native flora and fauna · Reduced fauna population relying on habitat or vegetation as a food source, increased vulnerability through loss of genetic diversity · Changes to hydrology including through changes in soil structure and drainage, or through stream alternating weeds · Degraded water quality through changes in nutrient regime, shading, temperature and release of toxins

5.3 Approach to assessing risk

A risk assessment model was developed for bushfire, flood, and coastal inundation emergencies, with the model run for both biodiversity and agricultural natural capital assets. The three major components of each risk assessment model are:

1. Threat Rating (input): describes the extent and likelihood and severity of the threat
2. Natural Asset Priority Rating (input): describes the extent of the natural assets which are then rated against all other assets in terms of priority for conservation value and / or the asset's vulnerability to the threat
3. Risk Assessment Rating (output): describes the combination of the two above rating models which can be used to identify areas at highest risk to the threat

A detailed description of the risk assessment modelling process is provided as a separate report available from the NRM North website and is titled: Esk Spatial Report – Emergency Preparedness Statewide Spatial Analysis and Mapping Report. Maps showing risk assessments for biodiversity and agricultural natural assets for each LGA in the northern region of Tasmania are also available for download from the NRM North website.

An additional consideration in assessing risk and the susceptibility of an asset to each emergency relates to the land tenure and reserve status of the asset. Assets which predominantly occur on private land or otherwise outside national parks are more susceptible to emergencies for a range of reasons including:

- the asset is less likely to be identified by the land manager and the nature of threats and requirements of the asset less likely to be understood
- assets outside national parks are less likely to have emergency response and recovery plans in place and land managers are unlikely to have the specialist the ecological knowledge and expertise to develop and implement such plans
- land managers are likely to be balancing recovery across multiple domains, such as infrastructure, production, and community needs (including for example significant clean up or rebuilding of their own homes or other buildings on their property. A lack of cash flow, increased costs and impacts on income during the phase after emergency events can significantly impact the capacity of landholders to implement any recovery actions. In these cases, environmental recovery is generally considered to be less of a priority by the land manager.

Good preparation and planning, including education and training, is essential to addressing the additional risks posed to these natural assets.

5.4 Biodiversity assets

This section summarises the susceptibility of biodiversity natural capital assets to bushfire, flood, coastal inundation, and biosecurity emergencies. Assets have been separated by the environments they occupy reflecting the similarity of impacts and threats across assets in these environments (see Tables 7 to 12).

Figures showing the location of priority biodiversity natural assets and modelled risks to emergencies are given in Appendix 2. The figure number for each asset is provided in the table under the asset name.

5.4.1 Hillslope and terrestrial environments

TABLE 7: **Susceptibility of biodiversity natural capital assets in hillslope and terrestrial environments to emergencies. Note figures of asset locations are in Appendix 2. Figure numbers for asset locations.**

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Swift parrot – threatened species **(Fig. 6)**	Bushfire	· Damage to habitat vegetation including hollows and maturation of nectar rich plants depending on fire frequency and severity.	Moderate	Limited range in areas of high fire susceptibility, low population numbers and multiple threats in addition to fire.
Eastern quoll – threatened species **(Fig. 7)**	Bushfire	· Damage to habitat vegetation and further fragmentation of habitat and population through injury, death, post-event starvation and predation.	High	Population decline in north and east of Tasmania with fragmented remnant population vulnerable to stochastic events. Over 40% remaining range is on private freehold land.
	Biosecurity	· Damage to and loss of habitat or food source from introduced pest, weed or disease. · Sickness, injury, or death of individuals from disease and predation. · Loss of genetic diversity from population impacts.	High	Widespread quoll mortality from 1890 to 1910 due to disease was the most likely cause of extinction of mainland quolls.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
New Holland mouse – threated species **(Fig. 8)**	Bushfire	· Damage to habitat vegetation including loss/damage to appropriate age class vegetation. · Weed invasion post-event. · Loss of population through injury, death and predation by pests post-event. · Dune erosion and ongoing damage to coastal dune vegetation.	High	Limited range species with specific habitat requirements, high susceptibility to fire.
	Flood	· Damage to habitat from intense rainfall events and weed incursion post event.	Moderate	Limited range species with specific habitat requirements sensitive to intense rainfall and flooding, habitat already fragmented.
	Coastal inundation	· Damage to dunes and coastal vegetation habitat. · Injury to and loss of individuals. · Further damage to fragmented habitats and populations.	High	Limited range species with specific habitat requirements directly impacted by storm surge and coastal inundation.
	Biosecurity	· Loss of and damage to already fragmented habitat. · Loss of individuals and reduced genetic diversity of surviving populations. · Further fragmentation of populations.	High	Species sensitive to diseases including toxoplasmosis. Habitat sensitive to outbreaks of *Phytophthora cinnamomic* and weed species. Predation and destruction of habitat by pest species.
Graveside leek-orchid – threatened species **(Fig. 9)**	Bushfire	· Damage to plants from fire and fire protection activities. · Weed incursion after fires. · Increased grazing pressure from native grazers post-fire event.	High	Limited range endemic species with extremely observed low population on a single landholding.
	Biosecurity	· Increased competition for habitat from invasive species.	Moderate	Limited range endemic species are very sensitive to loss of habitat through competition.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Alpine sphagnum bogs and associated fens – threatened ecological community **(Fig. 21)**	Bushfire	· Damage to and loss of vegetation and peat. · Increased grazing pressure post-event by pest and native grazers. · Weed and disease incursion post-event. · Rock spalling and destabilisation and erosion. · Changes in hydrological regime.	High	This TEC is not well adapted to bushfire which can change the ecological character of alpine areas to the extent that they no longer meet listing criteria.
	Flood	· Changes in water quality and hydrological regime from intense rainfall events.	Low	Almost entire asset in the northern region within national parks or other TPWS managed land so low levels of pollution expected from surrounding environment.
	Biosecurity	· Competition and predation of aquatic species by pests such as trout. · Predation of fauna by cats. · Trampling and damage to vegetation and drainage by feral horses, deer, feral pigs, rabbits. · Weeds altering vegetation structure, habitat, and drainage. · Flora and fauna species sensitive to pathogens and disease.	Moderate	Fragile ecosystem sensitive to trampling, grazing, competition, predation, and disease.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Lowland native grasslands of Tasmania – threatened ecological community **(Fig. 19)**	Bushfire	· Planned burns and fire events can impact if frequency and intensity impacts vegetation community characteristics. · Damage to and loss of important vegetation. · Rock spalling, groundcover loss causing erosion and mass movement. · Post-event loss of the community through conversion of burnt areas to pastures. · Weed incursion. · Increased grazing pressure.	Moderate	86% of this TEC is on private land with risks associated with fire preparation activities, and post-event conversion of burnt areas to pasture or crops as well as increased grazing pressure.
	Flood	· Damage to vegetation. · Hillslope and stream bank erosion impacting vegetation. · Runoff of fertilisers from neighbouring pastures. · Damage from overgrazing during and following floods.	Low	TEC is dispersed across large areas of the region. Localised impacts of flooding will occur on a smaller range with fewer long-term impacts expected.
	Biosecurity	· Weeds and pest animals cause damage to vegetation through trampling, over grazing and competition.	Moderate	86% of the TEC is on private freehold, generally in areas with grazing. Stock provide a source of and transmission vehicle for weeds and diseases.
Wedge-tailed eagle – regional priority threatened species **(Fig. 10)**	Bushfire	· Loss of and damage to old-growth forest habitat. · Disruption of breeding and nesting.	Low	Widely dispersed species.
Shy Susan – regional priority threatened species **(Fig. 18)**	Bushfire	· Impacts local flora from unsuitable fire frequency and intensity. · Direct loss of vegetation and reduced genetic diversity. · Impacts post-fire of increased browsing by native wildlife.	High	Limited range endemic species, sensitive to inappropriate fire regimes (too frequent/not frequent enough) and browsing by native wildlife after fires.
	Flood	· Impact of high intensity rainfall on vegetation, erosion, and destabilisation of substrate.	Low	Habitat away from flood zones, impacts limited to rainfall event.
	Biosecurity	· Plant damage and dieback due to disease. · Damage to seedlings and plants from browsing by pest species. · Competition from weed species. reducing and degrading habitat. · Loss of genetic diversity.	Moderate	Limited range for endemic species sensitive to weeds and disease such as *Phytophthora cinammoni*.

5.4.2 Floodplains and riparian zones

TABLE 8: Susceptibility of biodiversity natural capital assets in floodplain and riparian zone environments to emergencies.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Davies' wax flower – threatened species **(Fig. 11)**	Bushfire	· Direct damage to plants and habitat from fire. · Impacts floristics from too frequent fires. · Competition from weeds post-fire event and from increased browsing by native and pest animal species. · Damage to fencing on private land may increase grazing pressure after a fire event.	High	Limited range endemic, 25% of potential range on private freehold land with a range of other stressors.
	Flood	· Damage to banks and riparian habitat due to bank erosion and debris. · Direct damage of storms and intense rainfall to plants and surrounding canopy. · Competition from weeds. · Damage to fencing on private land may increase grazing pressure after a flood event.	High	Limited range endemic, 25% of potential range on private freehold land with a range of other stressors.
	Biosecurity	· Plant damage and dieback due to disease. · Damage to seedlings and plants from browsing by pest species. · Competition from weed species reducing and degrading habitat. · Loss of genetic diversity.	High	Limited range endemic, trials have shown high susceptibility to soil-borne plant pathogens. Highly sensitive to competition from weeds and browsing by pest species.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Giant freshwater crayfish – threatened species **(Fig. 12)**	Bushfire	· Loss of and damage to riparian vegetation and degraded water quality impacting habitat. · Sedimentation from increased hillslope and bank erosion impact a GFC's ability to transpire oxygen through their gills.	Moderate	Over half of range is on private freehold land with little in reserves. Impacts are off-site and management is complex.
	Flood	· Loss of and damage to riparian vegetation and degraded water quality impacting on habitat. · Sedimentation from increased hillslope and bank erosion impact a GFC's ability to transpire oxygen through their gills. · Creation of instream barriers from log jams and debris impacting on hydrological regime, connectivity, and instream habitat.	Moderate	Over half of range is on private freehold land with little in reserves. Post-flood recovery actions have potential for significant negative consequences and management is complex.
	Biosecurity	· Impact on individuals from disease, predation of juveniles and adults by pest species.	Low	Population widely dispersed across north and north-west with little interaction across range.
***Eucalyptus ovata – Callitris oblonga* forest – threatened ecological community** **(Fig. 23)**	Bushfire	· Fire frequency at less than 5-10 years impacts on succession. · Direct damage to vegetation and understorey and loss of habitat. · Weed invasion post-fire events. · Increased trampling and grazing pressure on remnants post-fire damage vegetation. · Further fragmentation of ecological community. · Risk of conversion of damaged asset post-event before recovery occurs.	High	Nearly 80% of range on private freehold land, highly fragmented and impacted by multiple other stressors reducing resilience.
	Flood	· Flood-borne debris and bank erosion causing damage to vegetation. · Increased trampling and grazing pressure post-flood where fencing damaged. · Weed invasion from weeds transported during flood events.	Moderate	Nearly 80% of range on private freehold land, highly fragmented and impacted by multiple other stressors reducing resilience.
	Biosecurity	· Impact of weeds and pest species on fragmented habitat, reducing resilience to other stressors.	Moderate	Nearly 80% of range on private freehold land, highly fragmented and impacted by multiple other stressors reducing resilience.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Tasmanian white gum *(Eucalyptus viminalis)* wet forest – threatened ecological community **(Fig. 22)**	Bushfire	· More frequent but lower intensity fires are becoming more common, which can lead to weeds and simplification of understorey. · Increased grazing pressure from native browsers post-fire event preventing natural recruitment of *E. viminalis*. · Increased trampling and grazing of stock post-fire due to damage to fences and impacts on alternative food sources. · Changes in water availability and hydrological regime. · Risk of conversion of damaged asset post-event before recovery occurs.	High	Highly fragmented with approximately 50% of range on private freehold land. Key species highly sensitive to inappropriate fire frequency and intensity in areas with high likelihood of fire.
	Flood	· Severe weather impact on vegetation. · Changes in hydrological regime.	Low	Vegetation on high rainfall with well-drained soils. Not confined to flood impact areas.
	Biosecurity	· Increased competition and degradation of habitat from weeds. · Hybridisation of trees with introduced species (native and plantation).	Moderate	Fragmentation from historic clearing has increased vulnerability to invasion by exotic species.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
***Eucalyptus ovata / Eucalyptus brookeriana* forests and woodlands – threatened ecological community** **(Fig. 24)**	Fire	· Damage to vegetation and increased fragmentation and isolation of remnants. · Impacts floristics of inappropriate fire regimes. · Increased grazing and browsing pressure on remnants post-fire due to lost fencing / protection as well as reduced food sources. · Changes to hydrology due to changes in catchment vegetation age structure post-fire. · Vegetation damage due to increased salinity where salt water is used to respond to fire threat. · Risk of conversion of damaged asset post-event before recovery occurs.	High	Highly fragmented ecological community with over 60% on private freehold land. Community resilience impacted by a range of other pressures. Sensitive to fire impacts and impacts of preparation and response actions.
	Flood	· Damage to and loss of vegetation in riparian zones from flood waters and debris. · Stream bank erosion and slumping where vegetation loss has occurred, reducing potential habitat. · Degraded water quality from contaminants and nutrients transported by flood waters. · Weed incursion from weeds transported to new sites by floods. · Increased grazing pressure where fences have been lost to flood.	Low	Remnants broadly dispersed across the landscape so flood damage likely to be restricted to patches in impact zones.
	Biosecurity	· Ecological community is degraded by invasive species through competition, browsing, trampling and damage.	Moderate	Fragmented remnants on private freehold land reduced community resilience and increases vulnerability to weed and pest invasion.

5.4.3 Estuaries

TABLE 9: Susceptibility of biodiversity natural capital assets in stream and lake environments to emergencies.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
kanamaluka / Tamar estuary – Regional priority **(Fig. 30)**	Bushfire	· Foreshore and intertidal vegetation communities altered by inappropriate fire regime. · Increased dune erosion from damage to and loss of vegetation. · Impact on water quality from ash and contaminated runoff. · Sedimentation from erosion due to loss of catchment groundcover. · Weed incursion to areas of regrowth in foreshore and intertidal areas reducing native vegetation recovery. · Injury to and death of fauna reliant on foreshore and intertidal vegetation, damage to nests, eggs, and chicks. · Impact on aquatic fauna through sedimentation of the water column, contaminants and other pollutants including impacts on feeding and migration, chronic and acute toxicity, and reduced dissolved oxygen leading to fish kills.	Low	The estuary is 70 km long with a large catchment area. Bushfire could be expected to have localised impacts on sections of the estuary but with tidal flushing, a fire event of the magnitude required to impact the entire estuary would be rare.
	Flood	· Surface and groundwater pollution from sediments, nutrients, pathogens, and other contaminants. · Debris transported to estuary from catchments and foreshore areas. · Rapid change in salinity, temperature, and other environmental conditions. · Damage to and loss of tidal wetland vegetation, and nesting and foraging areas. · Sedimentation of benthic habitats. · Weed and pest incursion where flood has transported these to new sites. · Degraded water quality including impacts on physiochemistry such as dissolved oxygen and pH as well as chlorophyll-a from pollutant inputs and changes in salinity and temperature. · Impact of increased turbidity on feeding and migration of aquatic species. · Other impacts on aquatic flora and fauna species.	Moderate	The estuary is adapted to large flood events. Risks come from the non-natural components of flood emergencies including contaminants, weeds, and debris. Major flood events are relatively regular and impact estuary-wide. Very large floods have the potential to be catastrophic given the contaminants and other pollutants that would result from flooding of areas such as Invermay.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
kanamaluka / Tamar estuary – Regional priority **(Fig. 30)** **continued**	Coastal inundation	· Direct impacts including destruction of native coastal vegetation and habitats. · Injury to and death of fauna in the tidal and impact zone. · Loss of groundcover and soil stability leading to destabilisation, slumping, and undercutting of mudflats and foreshore areas with lost vegetation. · Salinisation of near coastal soils. · Localised salinisation of groundwater and freshwater resources. · Changes to river mouth. · Mobilisation of pollutants and contaminants from foreshore areas and consequently degraded water quality. · Fragmentation of remnant vegetation and diminished refugia. · Damage to nesting and foraging sites for bird species.	Moderate	The estuary has a large foreshore and intertidal area. Significant modifications have been made to protect human settlements and infrastructure which influence the way inundation impacts on other areas. Additionally, foreshore development, roads and other uses have impacted on refugia and the capacity of the system to naturally recover.
	Biosecurity	· Impact on vegetation and habitat through competition with weeds, damage by browsing, and trampling by pest fauna, and disease. · Impacts fauna through degraded habitat and food sources, predation by invasive pests, destruction of nests, eggs, and young by pest species, and mortality from disease.	Moderate	The estuary is large and already under pressure from numerous weed and pest species including rice grass and gambusia. Recreational and commercial fishing are potential vectors for the entry and spread of invasive organisms.

5.4.4 Streams and lakes

TABLE 10: **Susceptibility of biodiversity assets in stream and lake environments to emergencies.**

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Swan Galaxias – threatened species (Fig. 13)	Bushfire	· Impact on riparian vegetation through fire damage and increased grazing pressure leading to reduced buffering of pollutants and destabilisation of banks. · Increased sedimentation from runoff and bank erosion. · Degraded water quality through contaminated runoff and ash.	Moderate	Over 60% of habitat is on private freehold land. Impacts are off-site and complex, making them more difficult to manage. Species is confined to limited range in upland streams with little connectivity between populations.
	Flood	· Creation of barriers through log jams and debris that limit movement and degrade habitat. · Destruction of or damage to existing barriers that prevent movement of pest species into habitat. · Impact on riparian vegetation, reduced buffering of pollutants and destabilisation of banks. · Increased grazing pressure on riparian vegetation where fencing has been damaged. · Increased sedimentation from runoff and bank erosion. · Sensitive to increase in frequency of floods and higher flood flows.	High	Over 60% of habitat is on private freehold land. Impacts are off-site and complex making them more difficult to manage. Species is confined to limited range in upland streams with little connectivity between populations
	Biosecurity	· Increased predation leading to loss of individuals, reduced populations and genetic diversity. Lack of connectivity between fragmented remaining habitat makes remnants less resilient to impacts.	High	Species only survives in trout-free streams. Predation by native and introduced species is a major threat, currently limited by barriers of movement into habitat. Limited range.

5.4.5 Coastal dunes and scrub

TABLE 11: **Susceptibility of biodiversity assets in coastal dune and scrub environments to emergencies.**

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Hooded plover – threatened species **(Fig. 14)**	Bushfire	· Destruction of dune vegetation and consequent dune destabilisation and erosion reduces nesting sites. · Direct impact of fire on nests, chicks, and eggs. · Invasive weeds damage habitat and limit natural recovery post-fire.	Low	Habitat dispersed across coastline with limited susceptibility to a single fire event.
	Flood	· Intense rainfall event and flooding of river mouth / estuarine areas of coastal zone can impact dunes including vegetation, stability, nesting sites, eggs, and chicks. · Transport of weeds into new areas by floods impacting vegetation recovery.	Moderate	Habitat dispersed across coastline including broad areas susceptible to a single flood or intense rainfall event.
	Coastal inundation	· Dune erosion and destruction of dune vegetation reduces nesting sites and habitat. · Direct impact of storm surge on nests, chicks, and eggs. · Invasive weeds damage habitat and limit natural recovery post-storm surge. · Impacts protective measures such as sea walls reducing habitat and increasing erosion of other dune areas during storms.	High	Habitat along coastal fringe highly susceptibility to storm surge events. Habitat is highly fragmented and under significant pressure from urban development and human disturbance reducing resilience to storm surge events.
	Biosecurity	· Invasive weeds damage dune habitat, limiting nesting sites and increasing overcrowding at remaining sites. · Predation of eggs, chicks, and adults by a broad range of pest species.	High	Coastal habitat occurs in close proximity to urban areas and human settlements. These fragment and reduce habitat and are a source of pests and weeds into the environment.

5.4.6 Wetlands

TABLE 12: **Susceptibility of biodiversity assets in wetland environments to emergencies.**

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Logan Lagoon – Ramsar site **(Fig. 25)**	Bushfire	· Vegetation communities altered by inappropriate fire regimes. · Increased dune erosion from damage to and loss of vegetation. · Impact on water quality from ash and contaminated runoff. · Sedimentation from erosion due to lost groundcover. · Weed incursion to areas of regrowth reducing native vegetation recovery. · An increase of fire frequency can lead to a change in floristics to more fire tolerant species changing the ecology of the site. · Injury to and death of fauna, damage to nests, eggs, and chicks.	Moderate	Fire hazard is possible to likely with overall fire risk rated at moderate.
	Flood	· Impact on wetland habitat of weeds, sedimentation, and increased grazing pressure after floods where fencing has been damaged. · Impact of pest species transported to new areas. · Damage to wetland habitat through debris, contaminants, sediments, nutrients, and pathogens delivered by floods. · Direct damage to nests, loss of eggs and chicks to flood waters. · Impact of weed invasion into new areas transported by flood waters.	Low	Flood risk is moderate but susceptibility to impact from weeds, debris, contaminants etc. is low due to tenure (TPWS) and minimal private holdings in the small catchment area.
	Coastal inundation	· Destabilisation of dunes leading to opening of the lagoon mouth changing the nature of the lagoon. · Direct damage to dune vegetation and nesting sites.	Moderate	Lagoon is created by coastal barrier dune. Major changes can occur if coastal inundation causes a change in hydrology.
	Biosecurity	· Impact on vegetation and habitat through competition with weeds, and damage by browsing and trampling by pest fauna, and disease. · Impacts fauna through degraded habitat and food sources, predation by invasive pests, destruction of nests, eggs and young by pest species, and mortality from disease.	Moderate	Site is susceptible to pathogens such as chytrid fungus which have not been identified there yet.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Floodplain Lower Ringarooma River – Ramsar wetland **(Fig. 26)**	Bushfire	· Increased dune erosion from damage to and loss of vegetation. · Impact on water quality from ash and contaminated runoff. · Sedimentation from erosion due to lost groundcover. · Weed incursion to areas of regrowth reducing native vegetation recovery. · An increase of fire frequency can lead to a change in floristics to more fire tolerant species changing the ecology of the site. · Injury to and death of fauna, damage to nests, eggs, and chicks.	Moderate	Fire hazard is possible to likely with overall fire risk rated at moderate. Over 50% of the Ramsar site is freehold. The site is complex with a diverse range of pressures and threats.
	Flood	· Impact on wetland habitat of weeds, sedimentation, and increased grazing pressure after floods where fencing has been damaged. · Impact of pest species transported to new areas. · Damage to wetland habitat through debris, contaminants, sediments, nutrients, and pathogens delivered by floods. · Direct damage to nests, loss of eggs and chicks to flood waters. · Impact of weed invasion into new areas transported by flood waters.	Moderate	The wetland is at the end of the Ringarooma River and can be expected to be impacted by floodwaters containing debris, nutrients, sediments, and contaminants from this system. Over 50% of the Ramsar site is freehold. The site is complex with a diverse range of pressures and threats.
	Coastal inundation	· Direct impact on vegetation and dunes. · Destabilisation of dunes making vegetation recovery more difficult. · Direct impact on nests, eggs, chicks, and other fauna inhabiting the coastal zone of the site.	Moderate	Site has 3 to 4 km of coast covering sandy beaches, dunes, and river mouth. Coastal and estuarine sections of the wetland are vulnerable to coastal inundation.
	Biosecurity	· Impacts vegetation and habitat through competition with weeds, damage by browsing and trampling by pest fauna, and disease. · Impact on fauna through degraded habitat and food sources, predation by invasive pests, destruction of nests, eggs and young by pest species and mortality from disease.	Moderate	Weed threats to vegetation in the freshwater component of the wetland considered a threat in the recovery plan.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Jocks Lagoon – Ramsar wetland **(Fig. 27)**	Bushfire	· Loss of and damage to vegetation and groundcover from fire. · Increased fire frequency can lead to a change in floristics to more fire tolerant species changing the ecology of the site. · Injury to and death of fauna, damage to nests, eggs, and chicks. · Impact on water quality from ash and contaminated runoff. · Sedimentation from erosion due to loss of groundcover. · Weed incursion to areas of regrowth reducing native vegetation recovery. · Salinisation of wetland and damage to vegetation from use of salt water in fire suppression.	Moderate	Fire hazard is possible to likely with overall fire risk rated at moderate. Nearly 90% of the site is private freehold land and some impacts are off-site making management more complex.
	Flood	· Impact on wetland habitat of weeds, sedimentation, and increased grazing pressure after floods where fencing has been damaged. · Impact of pest species transported to new areas. · Damage to wetland habitat through debris, contaminants, sediments, nutrients, and pathogens delivered by floods. · Direct damage to nests, loss of eggs and chicks to flood waters. · Impact of weed invasion into new areas transported by flood waters.	Low	Flood risk rating is moderate but susceptibility to impacts from weeds, debris, contaminants etc. is low due to small relatively simple catchment area.
	Coastal inundation	· Impacts dune vegetation destabilising and reactivating dunes. · Salinisation of groundwater and of freshwater lagoon impacting on aquatic species and vegetation.	Moderate	Lagoon sits between two parallel dunes approx. 200-300m inland and is threatened by coastal recession and dune activation.
	Biosecurity	· Impacts vegetation and habitat through competition with weeds, damage by browsing and trampling by pest fauna, and disease. · Impacts fauna through degraded habitat and food sources, predation by invasive pests, destruction of nests, eggs, and young by pest species, and mortality from disease.	Moderate	Chytrid fungus would lead to loss of brown froglet and eastern banjo frog from site. Phytophthora would lead to loss and change to native vegetation structure.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
East Coast Barren Island Lagoons – Ramsar wetland **(Fig. 28)**	Bushfire	· Loss of and damage to vegetation and groundcover from fire. · Increased dune erosion from damage to and loss of vegetation. · Impact on water quality from ash and contaminated runoff. · Sedimentation from erosion due to loss of groundcover. · Weed incursion to areas of regrowth reducing native vegetation recovery. · Increased fire frequency can lead to a change in floristics to more fire tolerant species changing the ecology of the site. · Injury to and death of fauna, damage to nests, eggs, and chicks.	Moderate	Fire hazard is possible to likely with overall fire risk rated at moderate.
	Flood	· Impact on wetland habitat of weeds, sedimentation, and increased grazing pressure after floods where fencing has been damaged. · Impact of pest species transported to new areas. · Damage to wetland habitat through debris, contaminants, sediments, nutrients, and pathogens delivered by floods. · Direct damage to nests, loss of eggs and chicks to flood waters. · Impact of weed invasion into new areas transported by flood waters.	Low	Flood risk is moderate but susceptibility to impacts from weeds, debris, contaminants etc. is low due to remote location and tenure (Aboriginal Land Council of Tasmania).
	Coastal inundation	· Direct impact on vegetation and dunes. · Destabilisation of dunes making vegetation recovery more difficult. · Direct impact on nests, eggs, chicks, and other fauna inhabiting the coastal zone of the site.	Low	Site contains a diverse range of wetlands and lagoons in close proximity to each other with variable salinity and hydrology. Remote site with little human impact likely to recover naturally from coastal inundation events.
	Biosecurity	· Impacts vegetation and habitat through competition with weeds, damage by browsing and trampling by pest fauna, and disease. · Impacts fauna through degraded habitat and food sources, predation by invasive pests, destruction of nests, eggs, and young by pest species, and mortality from disease.	Moderate	Wetland vegetation and fauna highly susceptible to pest species and pathogens.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Little Waterhouse – Ramsar wetland **(Fig. 29)**	Bushfire	· Loss of and damage to vegetation and groundcover from fire. · Increased fire frequency can lead to a change in floristics to more fire tolerant species changing the ecology of the site. · Injury to and death of fauna, damage to nests, eggs, and chicks. · Impact on water quality from ash and contaminated runoff. · Sedimentation from erosion due to loss of groundcover. · Weed incursion to areas of regrowth reducing native vegetation recovery. · Salinisation of wetland and damage to vegetation from use of salt water in fire suppression.	Moderate	Fire hazard is possible to likely with overall fire risk rated at moderate.
	Flood	· Damage to the constructed sand barrier holding back lake waters. · Impact on wetland habitat of weeds, sedimentation, and increased grazing pressure after floods where fencing has been damaged. · Impact of pest species transported to new areas. · Damage to wetland habitat through debris, contaminants, sediments, nutrients, and pathogens delivered by floods. · Direct damage to nests, loss of eggs and chicks to flood waters. · Impact of weed invasion into new areas transported by flood waters.	High	Flood risk rating is moderate but significant threat to the lagoon posed by destruction of the constructed sand barrier at the end of the lake which would lead to large loss of lake area.
	Biosecurity	· Impacts vegetation and habitat through competition with weeds, damage by browsing and trampling by pest fauna, and disease. · Impacts fauna through degraded habitat and food sources, predation by invasive pests, destruction of nests, eggs, and young by pest species, and mortality from disease.	Moderate	Wetland vegetation and fauna, especially dwarf galaxias and green and gold frog, highly susceptible to pest species and pathogens.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Australasian bittern – threatened species **(Fig. 15)**	Bushfire	· Damage to and loss of wetland vegetation. · Increased grazing pressure on wetland vegetation due to damaged fencing as well as damage to alternative food sources post-fire, damage to vegetation, trampling nests, and damage to habitats and shelters. · Degraded water quality from ash and contaminants from fire grounds. · Sedimentation and increased turbidity from eroded soils where groundcover has been lost. · Increase in weeds and pest species after fire events – reduced habitat, trampled vegetation and eggs, predation of eggs and chicks by cats, rats, and pigs.	Moderate	Nearly 40% of range is on private freehold land and many impacts are off-site making management more complex.
	Flood	· Damage to wetland habitat through debris, contaminants, sediments, nutrients, and pathogens delivered by floods. · Direct damage to nests, loss of eggs and chicks to flood waters. · Impact of weed invasion into new areas transported by flood waters.	Moderate	Wetland environment is highly sensitive to physical impacts of floods on habitat. Floods also directly impacts on nests including eggs and chicks. Nearly 40% of range is on private freehold land and many impacts are off-site making management more complex.
	Coastal inundation	· Salinisation of previously freshwater wetlands through changes in lagoon opening, increased salinisation of groundwater and surface water through storm surge. · Direct impact on habitat including wetland vegetation and nests as well as chicks and eggs.	Moderate	Coastal zone habitat under significant pressure from human use and surrounding land uses. Potential for a single event to impact directly on a significant section of habitat.
	Biosecurity	· Species impacted through direct loss of eggs, chicks, and adults due to predation and trampling as well as through loss of and damage to habitat from weed invasion, trampling and grazing.	Low	Habitat fragments are highly dispersed across the region with limited interconnectivity.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Eastern curlew – threatened species **(Fig. 16)**	Bushfire	· Direct impact on fire on vegetation and nesting sites.	Low	Sandflat and mudflat habitat not at a high risk of fire events.
	Flood	· Damage to wetland vegetation, mudflats and sand flats from flood waters and debris.	Low	Broadly dispersed coastal habitat not at high risk of impact from a single flood event.
	Coastal inundation	· Impacts on intertidal and near shore vegetation and habitat. · Erosion of mudflats and sandflats and resultant loss of habitat. · Direct loss of eggs, chicks, and adults. · Loss of habitat from actions to prevent impacts of coastal inundation on people and property.	High	Species concentrated in specific sections of the coast zone potentially impacted by a single coastal inundation event. Over 40% is private freehold land making management and recovery more complex.
	Biosecurity	· Species impacted through direct loss of eggs, chicks, and adults due to predation and trampling. · Loss of and damage to habitat from weed invasion, trampling and grazing.	Moderate	Species concentrated in specific sections of the coastal zone. Resilience impacts by a wide range of pressures and proximity to urban development is a potential source of pests and weeds into habitat. Over 40% is private freehold land making management and recovery more complex.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Green and gold frog – threatened species **(Fig. 17)**	Bushfire	· Water quality impacts of ash, nutrients, sediments on wetland habitats.	Low	Population is widely dispersed across the region and unlikely to be impacted by a single fire event.
	Flood	· Impact on wetland habitat of weeds, sedimentation, and increased grazing pressure after floods where fencing has been damaged. · Impact on individuals of contaminants and other pollutants transported by floodwaters. · Impact of pest species transported to new areas.	Moderate	Aquatic habitats are connected by flood events with significant proportion of habitat able to be impacted by a single flood event. Species is sensitive to water quality and pest movement.
	Coastal inundation	· Susceptible to increased salinity - moderate salinity protects from chytrid fungus but more high salinity would impact individuals.	Low	Population is widely dispersed across the region and unlikely to be impacted by a single coastal inundation event.
	Biosecurity	· Impact of weeds on habitat through competition with native vegetation species. · Impact of pest species through predation of frogs, eggs, and tadpoles. · Loss of frogs, eggs, and tadpoles to pathogens such as *Batrachochytrium dendrobatidis* and chytrid fungus.	High	Species is sensitive to fungal pathogens such as *Batrachochytrium dendrobatidis* and predation by pest terrestrial and aquatic species. Gambusia is a threat that is currently contained but beyond eradication. Over 40% of range is on private freehold land making control more difficult.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Subtropical Temperate Coastal Saltmarsh – threatened ecological community **(Fig. 20)**	Bushfire	· Loss of and damage to vegetation through impact on floristics from inappropriate fire regimes and impacts of fire on fire-intolerant plants. · Increased grazing pressure post-fire due to loss of fencing and/or reduced alternative food sources for grazing animals.	Low	Fragmented coastal ecological community unlikely to be significantly impacted by a single fire event.
	Flood	· Deposition of sediments and debris in intertidal zone and saltmarsh habitat. · Direct damage to saltmarsh vegetation from flood waters. · Scouring of mudflats resulting in destabilisation and slumping of areas of intertidal vegetation. · Weed invasion by weeds moved by flood events (e.g. rice grass).	Moderate	Saltmarsh is generally located in the intertidal zone of estuaries. These are impacted by large pulses of freshwater carrying debris, sediments, nutrients and contaminants. Their connection to freshwater systems means multiple areas can be impacted by the same flood event.
	Coastal inundation	· Damage to and loss of saltmarsh vegetation from storm surge impact. · Erosion of intertidal substrate. · Competition and crowding out of regrowth by weed species.	High	Location of saltmarsh along the coastal zone and preference for estuaries and calm bays means significant areas of the TEC could be impacted by a single storm surge event.
	Biosecurity	· Weeds can compete with native vegetation, alter the functioning of the vegetation community, and potentially alter fire regimes.	Moderate	Ecological community sensitive to weed invasion, with significant loss of extent in areas such as the kanamuluka / Tamar estuary from weeds like rice grass. Eradication and treatment of weeds is difficult once established.

5.5 Agricultural natural capital assets

This section summarises the susceptibility of agricultural natural assets to bushfire, flood, coastal inundation, and biosecurity emergencies. Assets have been separated by the environments they occupy, reflecting the similarity of impacts and threats across assets in these environments (see Tables 13 to 15). Figures showing the location of priority agricultural natural assets and modelled risks to emergencies are given in Appendix 2. The figure number for each asset is provided in the table under the asset name.

5.5.1 Hillslope and terrestrial environments

TABLE 13: **Susceptibility of agricultural natural assets in hillslope and terrestrial environments to emergencies.**

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Healthy soils and productive hillslopes (Fig. 34)	Bushfire	· Soil loss from deep combustion. · Erosion from loss of groundcover. · Salinisation of soils where saltwater is used for fire suppression.	High	Large extent of groundcover loss and soil damage by fires making them highly vulnerable to all types of erosion.
	Flood	· Landslip and erosion from intense rainfall events.	High	Loss of soils through erosion and mass movement highly likely where groundcover is insufficient.
	Coastal inundation	· Salinisation of near coastal soils.	Low	Small area of asset affected; impact likely to be temporary.
	Biosecurity	· Impact of soil-borne pathogens on soil health.	Moderate	Asset is susceptible to a range of pathogens. Containment and eradication are difficult once established.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Remnant native vegetation and shelter belts **(Fig. 32)**	Bushfire	· Damage to and loss of vegetation. · Loss of understory and destabilisation. · Increased grazing pressure post-fire from loss of fencing and where alternative food sources are impacted. · Changes in floristics of remaining vegetation with difficulties in recruitment from inappropriate fire regimes. · Weed and pest invasion post-fire event impacting on natural recovery.	High	Remnant native vegetation is often highly fragmented, subject to edge effects and vulnerable to a range of stressors making natural recovery difficult. It is also sensitive to the impacts of inappropriate preparedness and response actions.
	Flood	Damage to vegetation from intense rainfall event.	Low	Vegetation generally protects against erosion and other damage from intense rainfall events.
	Coastal inundation	Damage to vegetation from coastal inundation event.	Low	Small proportion of agricultural land natural asset impacted by a single coastal inundation event.
	Biosecurity	Vegetation damage and loss due to weeds, browsing and trampling by introduced pests, or through disease.	High	Remnant native vegetation is often highly fragmented, subject to edge effects and vulnerable to a range of stressors making natural recovery difficult. It is also sensitive to the impacts of inappropriate preparedness and response actions.

5.5.2 Floodplains and riparian zones

TABLE 14: Susceptibility of agricultural natural assets in floodplain and riparian zone environments to emergencies.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Native riparian vegetation (Fig. 31)	Bushfire	· Damage to and loss of native riparian vegetation. · Loss of groundcover destabilises stream banks. · Increased grazing pressure on remaining and recovering vegetation post-fire from loss of fencing and where alternative food sources are impacted. · Changes in floristics of remaining vegetation with difficulties in recruitment from inappropriate fire regimes. · Weed and pest invasion post-fire event impacting natural recovery.	High	Native riparian vegetation is often highly fragmented, subject to edge effects and vulnerable to a range of stressors making natural recovery difficult. It is also sensitive to the impact of inappropriate preparedness and response actions.
	Flood	· Deposition of hazardous materials including chemicals and dead stock on the floodplain. · Deposition of other problematic debris including hay bales, fencing materials, cobble, and rocks. · Stream bank erosion and slumping. · Increased grazing pressure and stock impact on riparian zones from lost and damaged fencing. · Disease and pathogens transported to new sites and from dead stock and other hazardous debris. · Riparian weeds transported to new sites. · Damage from recovery activities such as using machinery to move debris off floodplains, particularly where this is disposed of in the stream.	High	Native riparian vegetation is often highly fragmented, subject to edge effects and vulnerable to a range of stressors making natural recovery difficult. It is also sensitive to the impact of inappropriate preparedness and response actions.
	Biosecurity	· Vegetation damage and loss due to weeds, browsing and trampling by introduced pests or through disease.	High	Native riparian vegetation is often highly fragmented, subject to edge effects and vulnerable to a range of stressors making natural recovery difficult. It is also sensitive to the impact of inappropriate preparedness and response actions.

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Fertile floodplains (Fig. 33)	Bushfire	· Soil loss from deep combustion. · Erosion from loss of groundcover. · Salinisation of soils where salt water is used for fire suppression.	Moderate	Lower risks of erosion than hillslope sites.
	Flood	· Deposition of hazardous materials including chemicals and dead stock on the floodplain. · Deposition of other problematic debris including hay bales, fencing materials, cobble, and rocks. · Stream bank erosion and slumping. · Channel mobilisation and impact of landholder efforts to restore original stream channels.	High	Previous major flood events have shown that impacts of debris and channel mobilisation have been significant and a major focus of recovery efforts.
	Biosecurity	· Impact of soil-borne pathogens on soil health.	Moderate	Asset is susceptible to a range of pathogens. Containment and eradication are difficult once established.

5.5.3 Streams and lakes

TABLE 15: **Susceptibility of agricultural natural assets in stream and lake environments to emergencies.**

Asset	Emergency scenario	Why it poses a threat	Susceptibility	Why
Surface and groundwater quality and quantity	Bushfire	· Surface and groundwater pollution with ash, contaminant runoff. · Salinisation where saltwater is used for fire fighting. · Waterway sedimentation. · Degraded water quality from loss of groundcover and reduced filtering due to lost vegetative buffer. · Changes to hydrological cycle.	High	Landscape scale loss of groundcover results in very large sediment loads from rainfall events post-fire until groundcover is restored.
	Flood	· Surface and ground pollution from sediments, nutrients, pathogens, and other contaminants transported by floodwaters.	High	Floods mobilise large volumes of contaminants, sediments, and other pollutants. Dead stock and wildlife increase pathogens.
	Coastal inundation	· Salinisation of near coastal freshwater streams and waterbodies and groundwater systems.	Low	Impacts are generally short-term and not widespread.
	Biosecurity	· Some invasive species can degrade water quality through the release of toxins, changing turbidity by stirring sediment.	Low	Impacts are unlikely to be widespread.

6. Asset preparedness

Fire and flood are essential to the functioning of many of Tasmania's ecosystems. The negative impact of these emergencies on natural assets is often due to their interaction with other human-induced pressures such as weed and pest incursion post-emergency events, or further fragmentation of remaining habitats and populations that make them more vulnerable to stochastic events. Many actions that are taken to mitigate the impact of emergencies on people and infrastructure in any of the three phases (prepare, respond or recover) also have the potential to themselves have a negative impact on natural assets where these are not adequately considered. Building the resilience of landscapes and ecosystems before natural emergencies and supporting them through the recovery process to restore this resilience is key to protecting natural assets from the negative impacts of emergencies.

Analysis of spatial data on natural assets and feedback from key stakeholders consulted during the development of this plan identified several gaps and opportunities in the preparation for emergencies to minimise impacts on natural assets:

- There is a lack of data on the location and condition of many of the natural assets identified in this Plan. Understanding the current status of priority natural assets in Tasmania is essential for mitigating the negative impact that emergencies and emergency management can have on these assets.
- There is little monitoring of the environmental impact of emergencies on natural assets during response and recovery phases. This gap is most significant for natural assets that are situated outside areas managed by the Tasmanian Parks and Wildlife Service, particularly on privately or council owned or managed lands.
- While legislation and State Emergency Plans consider the environmental impact of emergencies, feedback from local government indicates natural assets are rarely considered in Municipal Emergency Management Plans. Some staff indicated limited knowledge with respect to the location of threatened species and ecological communities in their municipality, the nature of impacts that emergencies and emergency management actions might have on these natural assets, or the actions they should take to mitigate these impacts.

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Asset preparedness

- Some councils also saw opportunities to include emergency management in other plans and policies for land and waterways they manage such as Reserve Management Plans and Urban Waterway Strategies. Larger councils indicated they generally had the knowledge and skills in-house to undertake this work, while smaller councils indicated a lack of capacity in this area.
- Some staff indicated a lack of information and support for agricultural landholders in considering natural assets as part of their preparation, response, and recovery activities in the event of an emergency. Council staff indicated they were often the first point of contact for many landholders seeking support and information during and after an emergency, but many councils lacked staff with the knowledge or skills to provide this support. This is a significant issue for smaller councils whose LGA often contain large areas of agricultural land and a diverse range of natural assets. While NRM organisations were a logical point of contact for this information and support, without adequate resourcing for this activity they were not in a position to help landholders prepare for or respond to emergencies in a way that mitigated the impact on natural assets. Stakeholders indicated developing information resources for landholders and staff and helping them to develop Emergency Preparedness, Response and Recovery Plans for their properties that consider the needs of natural assets would be useful to mitigate the impact of emergencies on natural assets located on privately or council owned or managed land.
- Landscape-scale planning of fire regimes and ecological values is a gap. Strategic plans for fire management are using a landscape approach but there is limited focus on ecological values. The question of how to do good ecological management that reduces risks to people is not being considered to the extent it needs to be. Some stakeholders consulted indicated they thought it is unlikely there will ever be sufficient resourcing for this to occur.
- The Tasmanian Parks and Wildlife Service has developed a good methodology for response and recovery planning and have applied this to a select group of threatened species. Stakeholders indicated that an important preparation action is to roll this methodology out more broadly to other species and communities for which there is a high likelihood of emergency events occurring with significant potential impacts on the asset so that these are ready to go once an emergency happens.

Many of the actions required for specific natural assets depend on the land tenure of the site. For natural assets that are primarily on private land or council owned and managed land, priority preparedness actions will often involve education of the landholders or staff to help them identify the asset and understand its susceptibility to both the emergency and potential preparedness, response, and recovery actions they may take on their land to protect people, stock, and infrastructure. Assistance with developing a response, recovery, and restoration plan with a focus on natural assets on their property or council land may be a vital preparedness activity to protect the natural asset from future emergencies. This may need to be supplemented by education and training of the landholders and/or staff to ensure appropriate methods are implemented before, during and after emergency events. Programs such as Red Hot Tips which focuses on supporting landholders to undertake ecologically sensitive planned burns as part of a fuel reduction strategy is a good tool for improving preparedness. Education and information provision about response and recovery actions to protect natural assets during and after emergencies as well as broader preparation actions is generally a gap.

Inclusion of these natural assets in Municipal Emergency Management Plans, considering their location, requirements, and susceptibility, as well as appropriate preparedness, response, and recovery actions, is important. Resourcing to support planning activities and on-ground actions required before, during and after emergencies is also often required to ensure these are implemented. For natural assets in council managed land, inclusion of these natural assets and emergency responses in Reserve Management plans and other relevant council plans and policies is a useful approach to ensure their protection. Support for this activity may be required where councils lack the in-house knowledge, skills, or other resources for this to occur.

Important preparedness actions for all priority biodiversity assets in this Plan are:

- to ensure mapping is up to date, confirming the relevance of previously mapped locations and

identifying new areas for protection

- ongoing research to understand the condition of threatened species and ecological communities as well as pressures and threats to these. The interaction between these pressures and threats and emergencies and emergency preparedness, response and recovery activities also need to be understood
- ensuring mapped data and research on biodiversity natural capital assets is available to land and emergency response managers and is considered in emergency preparation and response and recovery activities.

In addition, for rehabilitation of flora species and habitat, ensuring sufficient supply of seedlings and other materials required for revegetation is an important preparation action. For threatened species this may mean maintaining herbarium seed banks for the species.

Specific preparedness actions for each biodiversity and agricultural natural asset are summarised below. As was the case for Section 5, these have been separated into the environments they occupy to capture similarities between many of the impacts and preparedness actions required for assets within those environments. These sections also describe the types of preparedness actions often undertaken to protect people and infrastructure that negatively impact natural assets. Feedback from stakeholders indicated a key challenge in protecting natural assets in emergencies was to identify approaches and actions that provided protection to people, infrastructure, and natural assets and to ensure these are implemented. The general feeling was that where there was a choice between protecting people and infrastructure or natural assets, then actions focused on people and infrastructure would always take priority often to the detriment of environmental values.

NRM North currently has a limited role in emergency management. Areas where NRM North could play a role in preparing for emergencies to protect natural assets if adequate resourcing to support this work are highlighted.

6.1 Bushfire

Potential negative impacts of bushfire on natural assets include:

- damage to and loss of remnant native vegetation, including threatened flora and threatened ecological communities as well as habitat for threatened fauna species
- injury and death of fauna species during the fire and starvation and predation of surviving fauna after the fire event
- increased grazing pressure on remnant vegetation and groundcover after the bushfire
- impact on floristics of native vegetation where fire frequency or intensity is not appropriate for the needs of vegetation
- fragmentation of remaining vegetation, habitat, and fauna populations
- loss of groundcover, riparian vegetation and topsoils increasing susceptibility to erosion and in some areas (particularly in alpine areas and coastal dunes and scrub environments) impacting the capacity of vegetation to recover after the emergency
- stream sedimentation and increased turbidity due to hillslope erosion, landslip and streambank erosion caused by the loss of groundcover and riparian vegetation
- degraded water quality from ash and associated nutrients and contaminants transported to streams as well as increased salinity from large volumes of saltwater used for firefighting during events. Salt water can also impact soils and vegetation well after the bushfire event
- changes in the hydrological regime from lost forest cover and changes in the age profile of forests with regrowth.

Preparedness actions undertaken to protect people and infrastructure that have the potential to negatively impact environmental values if these are not also prioritised during design and implementation are:

- controlled burns that do not account for the fire regime requirements of vegetation. This is a particular issue for threatened ecological communities where the impact on understorey, fallen timber and leaf litter can degrade the ecological community to the extent that it no longer meets listing criteria. For many threatened species, inappropriate fire regimes can reduce long-term survival and propagation with maturity, flowering, seed production, survival and generation potentially impacted
- clearing of buffer zones and removal of understory in stands of remnant vegetation to reduce fire risks to nearby people and infrastructure can remove habitat and have a direct impact on vegetation
- creation of access roads and use of heavy machinery can compact soils, change local hydrology, fragment habitat, and limit the movement of plants and animals reducing their resilience.

Typical bushfire preparedness actions for natural assets in each of the environments are summarised in Table 16.

TABLE 16: **Typical bushfire preparedness actions for natural assets by environment.**

Environment	Preparation
Hillslope and terrestrial environments	Increase landscape resilience to emergency through: · Weed and pest management to reduce weed and pest sources · Fencing of remnant native vegetation · Creating connected corridors between fragmented habitats to enable movement of species during and after emergency events · Maintenance of good soil moisture · Targeted protection of priority, vulnerable assets through ecologically sensitive controlled burns
Floodplains and riparian zones	Increase landscape resilience to emergency through: · Weed and pest management to reduce weed and pest sources · Fencing of remnant native vegetation · Creating connected corridors between fragmented habitats to enable movement of species during and after emergency events · Targeted protection of priority, vulnerable riparian and floodplain assets through ecologically sensitive controlled burns
Estuaries	Increase landscape resilience to emergency through: · Weed and pest management to reduce weed and pest sources · Fencing of sensitive foreshore and intertidal vegetation and habitats · Targeted protection of priority, vulnerable estuarine assets through ecologically sensitive controlled burns in catchment areas · Targeted protection of critical assets in high-risk areas using sediment control devices in catchment areas (e.g. contour banks)
Streams and lakes	Increase landscape resilience to emergency through: · Weed and pest management in riparian areas · Fencing of native riparian vegetation · Targeted protection of priority, vulnerable estuarine assets through ecologically sensitive controlled burns in catchment areas · Targeted protection of critical assets in high-risk areas using sediment control devices in catchment areas (e.g. contour banks)
Coastal dunes and scrub	Increase landscape resilience to emergency through: · Weed and pest management in coastal dune and scrub areas · Dune stabilisation and protection of coastal scrub and dune vegetation · Creating connected corridors between fragmented habitats to enable movement of species during and after emergency events · Targeted protection of priority, vulnerable coastal assets through ecologically sensitive controlled burns in neighbouring areas
Wetlands	Increase landscape resilience to emergency through: · Weed and pest management · Fencing of wetland areas · Targeted protection of priority, vulnerable wetland assets through ecologically sensitive controlled burns in catchment areas · Targeted protection of critical assets in high-risk areas using sediment control devices in catchment areas (e.g. contour banks)

In addition, developing seed banks, translocation, and creating insurance populations should be considered for vulnerable limited range flora and fauna species and ecological communities to create resilience to bushfire emergencies.

There are three Fire Management Area Committees (FMAC) operating in northern Tasmania supported by the State Fire Management Council: Tamar, North East and Flinders. These committees release a Bushfire Risk Management Plan annually for their fire management area. These plans identify priority assets, including natural assets, and apply a risk rating to these. Treatment plans for priority assets are identified.

While all three plans identify natural assets, none of the three plans for the northern region currently propose treatment options for any natural value. For most natural assets considered here it's not clear how the assets in the BRMP relate to the priority biodiversity assets in this document.

6.1.1 Biodiversity natural assets

Bushfire preparedness actions to protect biodiversity natural assets are summarised in Table 17. Note many of these actions are currently unfunded and are unlikely to occur without additional resources. For all actions, analysis of GIS data to identify high priority areas (high likelihood, high risk, key habitat/population) is required to target on-ground action.

TABLE 17: **Preparedness actions for protecting Biodiversity natural assets from bushfire emergencies.**

Environment	Asset	Actions	Where	Who	Is action currently underway?
Hillslope and terrestrial environments	Swift parrot – threatened species	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans.	· Northern Midlands LGA	· NRM North · NRE Tas · Northern Midlands Council · TFS	No
	Eastern quoll – threatened species Bushfire	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Revegetation projects to supplement existing habitat.	· Break O'Day LGA	· NRM North · NRE Tas · Break O'Day Council · TFS · Sustainable Timbers	No
	New Holland mouse – threated species	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Incorporate fire management in Wingaroo Nature Reserve Management Plan. · Implement Northern Region Strategic Fire Management Plan. · Revegetation projects to supplement existing habitat.	· Flinders Island LGA	· NRM North · NRE Tas · Flinders Council · TFS	Some – Wingaroo Nature Reserve Management Plan and Northern Region Strategic Fire Management plan actions complete

Environment	Asset	Actions	Where	Who	Is action currently underway?
Hillslope and terrestrial environments continued	Graveside leek-orchid – threatened species	· Education and Information for council staff and TFS. · Incorporate fire management in cemetery management plan. · Inclusion in municipal emergency management plans.	· Northern Midlands LGA	· NRM North · NRE Tas · Northern Midlands Council · TFS	No
	Alpine sphagnum bogs and associated fens – threatened ecological community	· Incorporate bushfire management in the Ben Lomond National Park Management Plan. · Implement Northern Region Strategic Fire Management Plan.	· Meander Valley LGA	· TPWS	Yes
	Lowland native grasslands of Tasmania – threatened ecological community	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Revegetation projects to supplement existing habitat.	· Northern Midlands LGA	· NRM North · NRE Tas · Northern Midlands Council · TFS	No
	Shy Susan – regional priority threatened species	· Education and Information for landholders, council staff and TFS. · Inclusion in municipal emergency management plans. · Establish and maintain a seed bank. · Revegetation projects to supplement existing population and range.	· West Tamar LGA	· NRM North · NRE Tas · West Tamar Council · TFS	No
Floodplains and riparian zones	Davies' wax flower – threatened species	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Establish and maintain a seed bank. · Revegetation projects to supplement existing population and range.	· Break O'Day LGA	· NRM North · NRE Tas · Break O'Day Council · TFS	No
	Giant freshwater crayfish – threatened species	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Revegetation projects to supplement existing habitat.	· 1st priority – Dorset LGA · Further focus: Meander Valley, Launceston, and George Town LGA	· NRM North · NRE Tas · Dorset Council · TFS	No

Environment	Asset	Actions	Where	Who	Is action currently underway?
Floodplains and riparian zones continued	*Eucalyptus ovata – Callitris oblonga* forest – threatened ecological community	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Maintain a seed bank for *Callitris oblonga*. · Revegetation projects to supplement existing habitat.	· Northern Midlands LGA	· NRM North · NRE Tas · Northern Midlands Council · TFS	No
	Tasmanian white gum (*Eucalyptus viminalis*) wet forest – threatened ecological community	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Revegetation projects to supplement existing habitat.	· Meander Valley LGA · Dorset LGA · Flinders Island LGA · Launceston LGA	· NRM North · NRE Tas · Meander Valley Council · Dorset Council · Flinders Council · City of Launceston Council · TFS	No
	Eucalyptus ovata / Eucalyptus brookeriana forests and woodlands – threatened ecological community	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Revegetation projects to supplement existing habitat.	· Launceston LGA · Meander Valley LGA · Northern Midlands LGA · West Tamar LGA	· NRM North · NRE Tas · Meander Valley Council · Northern Midlands Council · City of Launceston Council · West Tamar Council · TFS	No
Streams and lakes	Swan Galaxias – threatened species	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Manage risks to water quality by managing implementing sediment control in high-risk areas. · Inclusion in municipal emergency management plans.	· Northern Midlands LGA	· NRM North · NRE Tas · Northern Midlands Council · TFS	No

Environment	Asset	Actions	Where	Who	Is action currently underway?
Wetlands	Logan Lagoon – Ramsar wetland	· Inclusion in municipal emergency management plans. · Targeted protection in Fire Area Management Plan. · Implement Northern Region Strategic Fire Management Plan. · Develop site bushfire specific recovery plan.	· Flinders Island LGA	· Flinders FMAC · NRE Tas · Flinders Council · TFS	No
	Floodplain Lower Ringarooma River – Ramsar wetland	· Inclusion in municipal emergency management plans. · Targeted protection in Fire Area Management Plan. · Implement Northern Region Strategic Fire Management Plan. · Develop site bushfire specific recovery plan.	· Dorset LGA	· North East FMAC · NRE Tas · Dorset Council · TFS	No
	Jocks Lagoon – Ramsar wetland	· Inclusion in municipal emergency management plans. · Targeted protection in Fire Area Management Plan. · Implement Northern Region Strategic Fire Management Plan. · Develop site bushfire specific recovery plan.	· Break O Day LGA	· North East FMAC · NRE Tas · Break O Day Council · TFS · landholders	No
	East Coast Barren Island Lagoons – Ramsar wetland	· Inclusion in municipal emergency management plans. · Targeted protection in Fire Area Management Plan. · Implement Northern Region Strategic Fire Management Plan. · Develop site specific bushfire recovery plan.	· Flinders Island LGA	· Flinders FMAC · NRE Tas · Flinders Council · TFS · Cape Barren Island Aboriginal Association	No
	Little Whitehouse Lake	· Inclusion in municipal emergency management plans. · Targeted protection in Fire Area Management Plan. · Include fire management including bushfire recovery actions in Waterhouse Conservation Management Plan and update if required. · Implement Northern Region Strategic Fire Management Plan.	· Dorset LGA	· North East FMAC · NRE Tas · Dorset Council · TFS · TPWS	Fire has been included in the Waterhouse Conservation Area Management Plan
	Australasian bittern – threatened species	· Education and Information for landholders, council staff and TFS. · Support landholders to develop bushfire preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans.	· Dorset LGA · Flinders Island LGA · Launceston LGA · Meander LGA · West Tamar LGA	· NRM North · NRE Tas · Dorset Council · Flinders Council · City of Launceston Council · Meander Valley Council · West Tamar Council · TFS	No

6.1.2 Agricultural natural assets

Agricultural natural assets are broadly dispersed across the landscape and by their nature are on private land. Preparedness actions for these natural assets requires a property level, integrated approach across all assets with coordination and cooperation between neighbouring landholders and other land managers. In agricultural landscapes key preparedness actions to protect natural assets are:

- support landholders to plan for and undertake ecologically sensitive planned burns, currently provided by the Red Hot Tips program
- provide information, education and support for other activities landholders can take to prepare for bushfire that will protect their natural assets. This includes actions outlined in Table 16 (such as pest and weed control and maintenance of good soil moisture) that reduce the pressure of natural assets before bushfire events and help increase their resilience to emergency events
- support landholders in areas that are at a moderate to high risk from bushfire to develop Bushfire Emergency Preparedness, Response and Recovery Plans for natural assets on their properties. These resources should include general information on best practice activities that support resilience and those that can impact negatively on natural assets. Information on permitting requirements for recovery activities would be useful.

6.2 Flood

Potential negative impacts of flood on biodiversity assets relate to the impacts of intense rainfall events as well as rapid rises in waters in streams, rivers, and lakes. These include:

- hillslope erosion and landslip leading to a loss of fertile topsoils and damage to remnant vegetation
- excess nutrients, sediments, and contaminants from the hillslope environment transported to the stream which consequently impact groundwater and surface water systems
- transport of weeds to downslope and riparian areas
- increased grazing pressure on remaining groundcover from displaced pest species such as deer and from native grazing animals during the event and in the weeks after
- deposition of hazardous materials and problematic debris on the floodplain including chemicals, dead stock, fencing materials, cobble and other rocks and gravels
- damage to and loss of riparian habitat, vegetation communities, and flora and fauna species
- stream bank erosion, slumping and increased impact of stock access after the flood event due to increased stock access to streams where fencing has been damaged, and where there is a lack of riparian vegetation either due to land management practices before the flood, or where riparian vegetation has been removed or damaged by the flood
- degraded surface and groundwater water quality, increased turbidity and stream sedimentation from pollutants and contaminants transported to the stream as well as sediments from hillslope, gully and streambank erosion
- impact on aquatic fauna and flora species from water quality degradation.

Land management significantly affects these impacts. Practices which reduce or remove groundcover from hillslopes, floodplains and riparian zones can make these areas vulnerable to erosion during intense rainfall events and flooding. Installation of levees and other structures to protect infrastructure and people from floods can cause direct damage to ecosystems, impacting riparian and foreshore vegetation, cutting off tidal and floodplain wetlands and riparian and foreshore vegetation from important flooding events, which can lead to a loss of vegetation and habitat for fauna species. These structures can also increase flow velocities and cause further damage to streams and riparian zones downstream. Structures such as culverts and bridges can also change the movement of water during floods and lead to erosion and loss of and damage to riparian vegetation.

Typical flood preparedness actions for natural assets are summarised in Table 18.

TABLE 18: **Typical flood preparedness actions for natural assets by environment.**

Environment	Preparation
Hillslope and terrestrial environments	Increase landscape resilience to emergency through: · Fencing stock out of remnant vegetation · Maintaining good cover on hillslopes and other terrestrial environments to reduce vulnerability to erosion due to intense rainfall events · Stabilising gully heads to reduce mass movement and gully erosion as a result of intense rainfall · Weed management to reduce weed sources for transport downslope and along riparian zones and floodplains during floods and intense rainfall events · Pest management to decrease pressure on remnant vegetation, groundcover, and fauna species · Creating connected corridors between fragmented habitats to enable movement of species during and after emergency events
Floodplains and riparian zones	Increase landscape resilience to emergency through: · Fencing stock out of riparian zones using flood proof fencing and appropriate placement of fences to protect streambanks and riparian vegetation. · Revegetation of riparian zones where natural recovery is insufficient · Weed management to reduce weed sources for transport downslope and along riparian zones and floodplains during floods and intense rainfall events · Creating connected corridors between fragmented habitats to enable movement of species during and after emergency events · Establish translocation sites for vulnerable limited range flora and fauna species and ecological communities to increase resilience to flood emergencies
Estuaries	Increase landscape resilience to emergency through good catchment management: · Fencing stock out of riparian zones and foreshore areas using flood proof fencing and appropriate placement of fences to protect streambanks, riparian vegetation, and foreshore vegetation. Revegetation of riparian zones and foreshore areas where natural recovery is insufficient · Safe storage of chemicals as well as potential debris to minimise transport to streams · Decontamination of areas at high risk of leaching contaminants during intense rainfall events · Fencing stock out of remnant vegetation · Maintaining good cover on hillslopes and other terrestrial environments to reduce vulnerability to erosion due to intense rainfall events · Stabilising gully heads to reduce mass movement and gully erosion as a result of intense rainfall · Weed management to reduce weed sources for transport downslope and along riparian zones and floodplains during floods and intense rainfall events · Pest management to decrease pressure on remnant vegetation and groundcover Other actions to increase the resilience of estuaries to emergencies are management of aquatic pests and weeds.

Environment	Preparation
Streams and lakes	Increase landscape resilience to emergency through good catchment management: · Fencing stock out of riparian zones and foreshore areas using flood proof fencing and appropriate placement of fences to protect streambanks and riparian vegetation · Revegetation of riparian zones and foreshore areas where natural recovery is insufficient · Safe storage of chemicals as well as potential debris to minimise transport to streams · Decontamination of areas at high risk of leaching contaminants during intense rainfall events · Maintaining good cover on hillslopes and other terrestrial environments to reduce vulnerability to erosion due to intense rainfall events · Stabilising gully heads to reduce mass movement and gully erosion as a result of intense rainfall · Weed management to reduce weed sources for transport downslope and along riparian zones and floodplains during floods and intense rainfall events · Pest management to decrease pressure on remnant vegetation and groundcover Other actions to increase the resilience of streams and lakes to flood emergencies are: · Management of aquatic pests and weeds · Managing existing log jams and debris in streams · Ensuring good design of infrastructure such as levees for asset protection, bridges, and culverts to minimise impacts on natural assets · Establish translocation sites for vulnerable limited range flora and fauna species and ecological communities to increase resilience to flood emergencies
Coastal dunes and scrub	Increase landscape resilience to emergency through: · Weed and pest management in coastal dune and scrub areas · Dune stabilisation and protection of coastal scrub and dune vegetation · Creating connected corridors between fragmented habitats to enable movement of species during and after emergency events · Targeted protection of priority, vulnerable coastal assets through ecologically sensitive controlled burns in neighbouring areas
Wetlands	Increase landscape resilience to emergency through good catchment management: · Fencing stock out of riparian zones and foreshore areas using flood proof fencing and appropriate placement of fences to protect streambanks and riparian vegetation · Revegetation of riparian zones and foreshore areas where natural recovery is insufficient · Safe storage of chemicals as well as potential debris to minimise transport to wetlands · Decontamination of areas at high risk of leaching contaminants during intense rainfall events · Maintaining good cover on hillslopes and other terrestrial environments to reduce vulnerability to erosion due to intense rainfall events · Stabilising gully heads to reduce mass movement and gully erosion as a result of intense rainfall · Weed management to reduce weed sources for transport downslope and along riparian zones and floodplains during floods and intense rainfall events · Pest management to decrease pressure on remnant vegetation and groundcover Other actions to increase the resilience of wetlands to flood emergencies are: · Management of aquatic pests and weeds · Establish translocation sites for vulnerable limited range flora and fauna species and ecological communities to increase resilience to flood emergencies

6.2.1 Biodiversity natural assets

Flood preparedness actions to protect biodiversity natural assets are summarised in Table 19. The focus of these broad actions should be on relevant typical actions outlined in Table 18 above for the environment type.

Note many of these actions are currently unfunded and are unlikely to occur without additional resources. For all actions, analysis of GIS data to identify high priority areas (high likelihood, high risk, key habitat/population) is required to target on-ground action.

TABLE 19: **Preparedness actions for protecting Biodiversity natural assets from flood emergencies.**

Environment	Asset	Actions	Where	Who	Is action currently underway?
Hillslope and terrestrial environments	New Holland mouse – threated species	· Education and Information for landholders, council staff. · Support landholders to develop flood preparedness, response and recovery plans. · Inclusion in municipal emergency management plans.	· Flinders Island LGA	· NRM North · NRE Tas · Flinders Council · SES	No
Floodplains and riparian zones	Davies' wax flower – threatened species	· Education and Information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Establish and maintain a seed bank.	· Break O'Day LGA	· NRM North · NRE Tas · Break O'Day Council · SES	Partial
	Giant freshwater crayfish – threatened species	· Education and Information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans.	· 1st priority – Dorset LGA · Further focus: Meander Valley, Launceston, and George Town LGA	· NRM North · NRE Tas · Dorset Council · SES	No
	Eucalyptus ovata – Callitris oblonga forest – threatened ecological community	· Education and Information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans. · Maintain a seed bank for *Callitris oblonga*.	· Northern Midlands LGA	· NRM North, NRE Tas, Northern Midlands Council, SES	Partial
	Tasmanian white gum (*Eucalyptus viminalis*) wet forest – threatened ecological community	· Education and Information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans.	· Meander Valley LGA · Dorset LGA · Flinders Island LGA · Launceston LGA	· NRM North · NRE Tas · Meander Valley Council · Dorset Council · Flinders Council · City of Launceston · SES	No

Environment	Asset	Actions	Where	Who	Is action currently underway?
Floodplains and riparian zones continued	*Eucalyptus ovata / Eucalyptus brookeriana* forests and woodlands – threatened ecological community	· Education and Information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans.	· Launceston LGA · Meander Valley LGA · Northern Midlands LGA · West Tamar LGA	· NRM North · NRE Tas · Meander Valley Council · Northern Midlands Council · City of Launceston · West Tamar Council · SES	No
Estuaries	kanamaluka / Tamar estuary – Regional priority	· Inclusion in municipal emergency management plans. · Develop site specific flood preparedness, response, and recovery plans for critical assets areas within the estuary.	· Launceston LGA · West Tamar LGA · George Town LGA	· NRM North/TEER · NRE Tas · West Tamar Council · George Town Council · City of Launceston · SES	No
Streams and lakes	Swan Galaxias – threatened species	· Education and information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Manage risks to water quality by managing potential debris (especially log jams) and designing and implementing sediment control in high-risk areas. · Inclusion in municipal emergency management plans.	· Northern Midlands LGA	· NRM North · NRE Tas · Northern Midlands Council · SES	No
Coastal dunes and scrub	Hooded plover – threatened species	· Education and information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans.	· Break O'Day LGA · Dorset LGA · Flinders Island LGA · George Town LGA · West Tamar LGA	· NRM North · NRE Tas · Northern Midlands Council · SES	No
Wetlands	Floodplain Lower Ringarooma River – Ramsar wetland	· Include flood preparation and recovery in the Lower Floodplain Ringarooma River site management plan. · Inclusion in municipal emergency management plans.	· Dorset LGA	· NRM North · NRE Tas · Dorset Council · SES	No
	Little Waterhouse – Ramsar wetland	· Include flood preparation and recovery in the Waterhouse Conservation Area Management Plan. · Inclusion in municipal emergency management plans.	· Dorset LGA	· TPWS	No

Environment	Asset	Actions	Where	Who	Is action currently underway?
Wetlands continued	Australasian bittern – threatened species	· Education and information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans.	· Flinders Island LGA	· NRM North · NRE Tas · Flinders Council · SES	No
	Green and gold frog – threatened species	· Education and information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Inclusion in municipal emergency management plans.	· Dorset LGA · Meander Valley LGA	· NRM North · NRE Tas · Dorset Council · Meander Valley Council · SES	No
	Subtropical Temperate Coastal Saltmarsh – threatened ecological community	· Education and information for landholders, council staff and SES. · Support landholders to develop flood preparedness, response, and recovery plans. · Incorporate flood preparedness, response, and recovery in relevant Conservation Area Management Plans. · Inclusion in municipal emergency management plans.	· Dorset LGA · Flinders Island LGA · Break O'Day LGA	· NRM North · NRE Tas · Dorset Council · Flinders Council · Break O'Day Council · SES · TPWS	No

6.2.2 Agricultural natural assets

Agricultural natural assets are broadly dispersed across the landscape and by their nature are on private land. Preparedness actions for these natural assets requires a property level, integrated approach across all assets with coordination and cooperation between neighbouring landholders and other land managers. In agricultural landscapes key preparedness actions to protect natural assets are:

- provide information, education and support for other activities landholders can take to prepare for flood that will protect their natural assets. This includes actions outlined in Table 18 (such as pest and weed control and maintenance of groundcover) that reduce the pressure of natural assets before flood events and help increase their resilience to intense rainfall and floods.
- support landholders in areas that are at a moderate to high level of risk from flood to develop Flood Emergency Preparedness, Response and Recovery Plans for natural assets on their properties. These resources should include general information on best practice activities that support resilience and those that can impact negatively on natural assets. Information on permitting requirements for recovery activities would be useful.

6.3 Coastal inundation

Coastal inundation or storm surge often happens in combination with intense rainfall and flooding events. The impact of coastal inundation emergencies depend on tides and other flooding, and vary between estuaries and other areas of the coast.

The potential negative impacts of coastal inundation emergencies on natural assets are:

- damage to and loss of vegetation, especially coastal scrub. Damage to native vegetation can reduce competition with weeds and allow weeds to overtake areas making recovery of native vegetation more difficult. These weeds can reduce habitat for fauna species in the coastal zone and impact on feeding and breeding

- dune erosion and destabilisation as a result of lost vegetation and scour. This can make natural restoration of dune vegetation challenging. This can impact nests and habitat for birds and other animals
- storm surge in estuaries can impact mudflats and intertidal zone vegetation. This can destabilise mudflats, leading to slumping and in some cases further damage to vegetation where the substrate has been destabilised
- water quality impacts from mobilisation of pollutants from soil surfaces and buried within mudflats and other coastal sediments
- injury to and death of fauna as a direct impact of the event. Increased predation and starvation after the event with the loss of habitat
- localised salinisation of coastal soils and surface and groundwater systems. This can impact vegetation
- changes to the river mouth of estuaries and to the character of coastal lakes and wetlands. Storm surge events can open previously closed lakes and lagoons to tidal exchange, changing their ecological character and impacting flora and fauna species.

It is common for actions to be taken to mitigate the impact of coastal inundation on people and infrastructure such as building sea walls. These have a direct and indirect impact on habitats, flora and fauna. Direct impacts include removal of vegetation and dune systems and associated habitat. Indirect impacts include increased erosion and exacerbated impacts of storm surge at sites away from the sea walls due to changes in water movement and velocities caused by hard surfacing. Restrictions on retreat and refugia of coastal ecosystems include roads, tidal levees, and wetland infill. These reduce the resilience of natural assets in the coastal zone to coastal inundation emergencies, as well as to longer term increases in sea levels due to climate change.

Preparedness actions to mitigate the impacts of coastal inundation emergencies on natural assets include:

- use ecologically sensitive approaches to risk reduction (e.g. soft engineering solutions such as environmentally friendly sea walls) for people and infrastructure which maintain habitat and don't exacerbate off-site impacts
- allow for appropriate buffers between the coast and infrastructure and other developments to avoid the need to provide protection to these assets, and to allow for retreat and movement of dune and ecosystems during and after coastal inundation events
- protect and improve potential habitat for dune and beach dependent species to increase availability of habitat.

Developing seed banks, translocation and creating insurance populations should be considered for vulnerable limited range flora and fauna species and ecological communities to create resilience to coastal inundation emergencies.

6.3.1 Biodiversity natural assets

Coastal inundation preparedness actions to protect biodiversity natural assets are summarised in Table 20. Note many of these actions are currently unfunded and are unlikely to occur without additional resources. For all actions, analysis of GIS data to identify high priority areas (high likelihood, high risk, key habitat/population) is required to target on-ground action.

TABLE 20: **Preparedness actions for protecting Biodiversity natural assets from coastal inundation emergencies.**

Environment	Asset	Actions	Where	Who	Is action currently underway?
Estuaries	kanamaluka / Tamar estuary – Regional priority	· Develop site specific coastal inundation preparedness, response, and recovery plans for critical asset areas.	· Launceston LGA · West Tamar LGA · George Town LGA	· NRM North · NRE Tas · City of Launceston · West Tamar Council · George Town Council	No
Coastal dunes and scrub	Hooded plover – threatened species	· Work with landholders and council to develop site specific coastal inundation preparedness, response, and recovery plans for critical asset areas.	· Break O'Day LGA · Dorset LGA · Flinders Island LGA · George Town LGA · West Tamar LGA	· NRM North · NRE Tas · Dorset Council · George Town Council · Flinders Council · West Tamar Council	No
Wetlands	Logan Lagoon – Ramsar wetland	· Develop site specific coastal inundation preparedness, response, and recovery plan.	· Flinders Island LGA	· NRM North · NRE Tas · Flinders Council · TPWS	No
	Floodplain Lower Ringarooma River – Ramsar wetland	· Include coastal inundation preparation and recovery in the Lower Floodplain Ringarooma River site management plan.	· Dorset LGA	· NRM North · NRE Tas · Dorset Council · TPWS	No
	Jocks Lagoon – Ramsar wetland	· Develop a site specific management plan and include coastal inundation, preparedness, and recovery in the plan.	· Break O'Day LGA	· NRM North · NRE Tas · Dorset Council	No
	Australasian bittern – threatened species	· Work with landholders and council to develop site specific coastal inundation, preparedness, response, and recovery plans for critical asset areas.	· Flinders LGA · Dorset LGA	· NRM North · NRE Tas · Dorset Council · Flinders Council	No
	Eastern curlew – threatened species	· Work with landholders and council to develop site specific coastal inundation, preparedness, response, and recovery plans for critical asset areas.	· Flinders LGA · Dorset LGA · Break O'Day LGA	· NRM North · NRE Tas · Dorset Council · Flinders Council	No
	Subtropical Temperate Coastal Saltmarsh – threatened ecological community	· Work with landholders and council to develop site specific coastal inundation, preparedness, response, and recovery plans for critical asset areas.	· Flinders LGA · Dorset LGA · Break O'Day LGA	· NRM North · NRE Tas · Dorset Council · Flinders Council	No

6.3.2 Agricultural natural assets

There are no agricultural assets identified with moderate to high risk from coastal inundation.

6.4 Biosecurity

Planning for and managing biosecurity emergencies can be considered in terms of [11]:

- prevention of entry where the species is absent
- eradication when there are small, localised populations of the species
- containment where there has been a rapid increase in distribution and abundance of the species with many populations
- asset based protection where the species is widespread and abundant throughout its potential range.

Preparedness actions aim to prevent the entry of species into Tasmania and prevent their spread where entry occurs. Many preparedness actions are focused on creating systems and knowledge that can rapidly react when entry occurs, and which can be used as part of a strategy to eradicate the species if possible, or contain the species where spread is such that eradication is no longer possible. Key preparedness actions to protect natural assets from biosecurity emergencies are:

- monitoring critical habitats, vegetation, and fauna species for new and emerging biosecurity threats
- ongoing research into emerging and potential biosecurity threats including species and ecosystems most vulnerable to these threats
- ensuring reporting systems are in place and well understood to respond to entry and rapid spread events
- community education and public awareness of invasive organisms and risk
- educate landholders and land managers to recognise threats and on-ground management options including hygiene practices
- assist landholders with the development of farm biosecurity plans that include biosecurity threats to natural assets. Biosecurity Tasmania has good resources for landholders on the development of farm specific biosecurity plans [12]. There are online resources such as Farm Biosecurity available to assist landholders[13]
- implementing good hygiene practice in critical asset areas to minimise risks of entry and spread of potential invasive organisms
- develop seedbanks, translocate vulnerable limited range flora and fauna species and ecological communities to create resilience to biosecurity emergencies, and create insurance populations in areas where asset-based protection is possible.

Biosecurity Tasmania is the lead agency for managing biosecurity emergencies in Tasmania. They undertake community, industry, and landholder education; provide information resources; and are the agency to which threats are reported. Biosecurity management emphasises the importance of shared responsibility and a general biosecurity duty of care. They undertake a broad range of preparedness actions. This section focuses on actions at land manager scales as part of the shared responsibility approach. NRM North does not have a specific role in biosecurity emergency preparedness but could play a strong role in the development of asset specific biosecurity management plans if resourced.

6.4.1 Biodiversity natural assets

Biosecurity preparedness actions to protect biodiversity natural assets are summarised in Table 21. Actions focus on prevention of new invasive organisms entering an asset area, containment of already present invasive organisms, and increasing the resilience of ecosystems to emerging threats including new biosecurity threats. Note many of these actions are currently unfunded and are unlikely to occur without additional resources. For all actions, analysis of GIS data to identify high priority areas (high likelihood, high risk, key habitat/population) is required to target on-ground action.

11 Victorian Government (2010) Invasive Plants and Animals Policy Framework, DPI Victoria, Melbourne

12 https://nre.tas.gov.au/biosecurity-tasmania/biosecurity/biosecurity-for-new-and-small-landholders

13 https://www.farmbiosecurity.com.au/about/

TABLE 21: **Preparedness actions for protecting Biodiversity natural assets from biosecurity emergencies.**

Environment	Asset	Actions	Where	Who	Is action currently underway?
Hillslope and terrestrial environments	Eastern quoll – threatened species	· Develop farm biosecurity plans. · Implement preventative hygiene practices.	· Break O'Day LGA	· Landholders	Partial
	New Holland mouse – threated species	· Develop farm biosecurity plans. · Develop conservation area biosecurity plan. · Implement preventative hygiene practices.	· Flinders Island LGA	· Landholders · TPWS	Partial
	Graveside leek-orchid – threatened species	· Develop cemetery biosecurity plan. · Implement preventative hygiene practices.	· Northern Midlands LGA	· Cemetery operators	No
	Alpine sphagnum bogs and associated fens – threatened ecological community	· TWHHA Biosecurity Plan. · Implement preventative hygiene practices.	· Meander Valley LGA	· TPWS	Yes
	Lowland native grasslands of Tasmania – threatened ecological community	· Develop farm biosecurity plans. · Implement preventative hygiene practices.	· Northern Midlands LGA	· Landholders	Partial
	Wedge-tailed eagle – regional priority threatened species	· Develop farm biosecurity plans. · Develop site biosecurity plans. · Implement preventative hygiene practices.	· Break O'Day LGA · Dorset LGA · Meander Valley LGA · Launceston LGA · Northern Midlands LGA	· Landholders · Sustainable Timbers Tasmania	Partial
	Shy Susan – regional priority threatened species	· Include biosecurity in Shy Susan adaptative management plan. · Implement preventative hygiene practices.	· West Tamar LGA	· TPWS · NRM North	Yes

Environment	Asset	Actions	Where	Who	Is action currently underway?
Floodplains and riparian zones	Davies' wax flower – threatened species	· Develop farm biosecurity plans. · Implement preventative hygiene practices.	· Break O'Day LGA	· Landholders	Partial
	Giant freshwater crayfish – threatened species	· Develop farm biosecurity plans. · Develop conservation area biosecurity plans. · Implement preventative hygiene practices.	· 1st priority – Dorset LGA · Further focus: Meander Valley, Launceston, and George Town LGA	· Landholders · TPWS	Partial
	Eucalyptus ovata – *Callitris oblonga* forest – threatened ecological community	· Develop farm biosecurity plans. · Implement preventative hygiene practices.	· Northern Midlands LGA	· Landholders	Partial
	Tasmanian white gum (*Eucalyptus viminalis*) wet forest – threatened ecological community	· Develop farm biosecurity plans. · Implement preventative hygiene practices.	· Meander Valley LGA · Dorset LGA · Flinders Island LGA · Launceston LGA	· Landholders	Partial
Estuaries	kanamaluka / Tamar estuary – Regional priority	· Develop port biosecurity plans. · Implement preventative hygiene practices. · Education of recreational users.	· Launceston LGA · Meander Valley LGA · Northern Midlands LGA · West Tamar LGA	· Biosecurity Tasmania · TasPorts	Yes
Streams and lakes	Swan Galaxias – threatened species	· Monitor for and eradicate trout in trout-free habitat areas. · Develop inland waterway biosecurity plans. · Implement preventative hygiene practices. · Education of recreational users.	· Northern Midlands LGA	· Inland Fisheries · Biosecurity Tasmania	Yes
Coastal dunes and scrub	Hooded plover – threatened species	· Develop farm biosecurity plans. · Develop conservation area biosecurity plans. · Implement preventative hygiene practices.	· Break O'Day LGA · Dorset LGA · Flinders Island LGA · George Town LGA · West Tamar LGA	· Landholders · TPWS	Partial

Environment	Asset	Actions	Where	Who	Is action currently underway?
Wetlands	Logan Lagoon – Ramsar wetland	· Develop site biosecurity plans. · Develop farm biosecurity plans on neighbouring farms. · Implement preventative hygiene practices.	· Flinders Island LGA	· TPWS	Partial
	Floodplain Lower Ringarooma River – Ramsar wetland	· Develop site biosecurity plans. · Develop farm biosecurity plans on neighbouring farms. · Implement preventative hygiene practices.	· Dorset LGA	· TPWS	Partial
	Jocks Lagoon – Ramsar wetland	· Develop site biosecurity plans. · Implement preventative hygiene practices.	· Break O'Day LGA	· Landholder · TPWS	Partial
	East Coast Barren Island Lagoons – Ramsar wetland	· Develop site biosecurity plans. · Implement preventative hygiene practices.	· Flinders Island LGA	· Cape Barren Island Aboriginal Association · TPWS	Yes
	Australasian bittern – threatened species	· Develop site biosecurity plans. · Implement preventative hygiene practices.	· Flinders Island LGA	· Landholders · TPWS	Partial
	Eastern curlew – threatened species	· Develop site biosecurity plans. · Develop farm biosecurity plans. · Implement preventative hygiene practices. · Education of recreational users.	· Flinders LGA · Dorset LGA · Break O'Day LGA	· Landholders · TPWS	Partial
	Green and gold frog – threatened species	· Develop site biosecurity plans. · Develop farm biosecurity plans. · Implement preventative hygiene practices.	· Dorset LGA · Meander Valley LGA	· Landholders · TPWS	Partial
	Subtropical Temperate Coastal Saltmarsh – threatened ecological community	· Develop site biosecurity plans. · Implement preventative hygiene practices.	· Dorset LGA · Flinders Island LGA · Break O'Day LGA	· TPWS	Yes

6.4.2 Agricultural natural assets

Agricultural natural assets are broadly dispersed across the landscape and by their nature are on private land. The *Biosecurity Act 2019* requires a General Biosecurity Duty of landholders which means landholders are expected to take all reasonable and practical measures to prevent, eliminate or minimise biosecurity risks. As part of delivering on this duty landholders are encouraged to:

- develop a farm biosecurity management plan for their property
- implement preventative hygiene measures to minimise risks of entry and spread of invasive organisms to and from their properties
- conduct monitoring and surveillance for potential threats and report these to Biosecurity Tasmania.

7

Asset response and recovery

7. Asset response and recovery

Well-designed and implemented response actions both during an emergency event and after the event as part of the recovery process can build the resilience of natural systems, allowing them to recover from the impacts of the emergency. While bushfire, flood, and coastal inundation are natural processes that many Tasmanian ecosystems have adapted to, other pressures on these systems can hamper natural recovery processes. For example, emergency events can transport weeds and pest species and provide an environment in which they can rapidly spread. This can impede the natural recovery of vegetation, particularly the understorey, and impact on the survival of fauna and flora species in the recovery period. Historic land clearing and land management practices have made many ecosystems vulnerable to stochastic events such as bushfire, flood, and coastal inundation through fragmentation and degraded condition of remnant populations.

Poorly designed and implemented response and recovery actions can also have a direct and indirect effect on species, ecological communities, and habitats. The immediate focus on clean-up as part of the initial response and recovery phase also has the potential to create considerable negative impacts on natural assets if not managed appropriately. Response and recovery efforts often focus on protection of people and infrastructure and restoration of services and communities, with the environmental impacts of these actions a secondary concern. Feedback from key stakeholders in the development of this Plan indicated that a major challenge was to find response and recovery approaches that protected and restored services, infrastructure, and community while also protecting natural assets. Good preparation can assist with this, ensuring natural assets are considered alongside community assets and infrastructure in emergency management plans.

Response and recovery are a shared responsibility across the community, landholders, government-owned enterprises, and all levels of government. NRM North has played a role in emergency recovery following past emergencies through delivery of subcontracted recovery programs such as the 2016 Flood Recovery Program. This allowed for recovery actions to be designed to protect natural assets while also addressing the impact of productivity and profitability on landholders.

Section 4 outlined Tasmania's emergency response arrangements and framework. As described in that section, recovery efforts are focused on building resilience, and management of recovery efforts depends on the scale of the emergency with locally significant emergencies at Level 1, regionally significant emergencies at Level 2, state significant emergencies at Level 3, and emergencies of national significance at Level 4.

While emergency management planning considers domains including environmental recovery, risks to natural assets are posed where the levels of emergency identified through the needs assessment differ substantially by domain. For example, a localised fire may have minimal impacts on people or infrastructure (level 1 or below social, economic, and infrastructure) but has the potential to cause the extinction of a limited range endemic threated species or threatened ecological community (level 3 or 4 environmental impact). In this example, it is unlikely that any emergency response or recovery would be triggered beyond a level 1 emergency. Emergency events such as bushfires that occur in localised areas away from significant populations and infrastructure can have devastating environmental consequences, particularly for limited range threatened species and ecological communities and assets such as Ramsar wetlands. The small scale of social, economic, and infrastructure impacts of these types of emergencies are unlikely to trigger recognition of the emergency at higher than level 1 given the lack of local knowledge of the location, condition, and requirements of many natural assets amongst land managers. Given this lack of knowledge, it is possible that the impact on natural assets go unnoticed and that no recovery effort is triggered. This is also an issue where the impact of an emergency event is offsite such as aquatic species affected by sediment runoff and other pollution after a bushfire event.

The consequences of the difference in emergency severity rating across domains for recovery depends, to an extent, on land tenure and the land manager responsible for preparation, response, and recovery actions where economic and infrastructure impacts are considered to constitute a level 1 emergency:

- on council or privately owned land, local government will bear the primary responsibility for identifying impacts and working with landholders to implement recovery actions for natural assets for small scale

localised emergencies. For most municipalities in Tasmania, identifying the nature and extent of the environmental impact is likely to be beyond their capability, as is recovery planning and implementation for natural assets

- on land managed by the Tasmanian Parks and Wildlife Service, in-house knowledge and capacity is likely to exist that would enable identification of environmental impacts as well as recovery planning and implementation. Challenges exist with competing priorities and resourcing restrictions.

Consultation with key stakeholders including local and state government agencies and NRM organisations identified a range of issues and gaps with emergency management response and recovery for natural assets that link back to the severity of the emergency and land tenure of areas where natural resources are impacted.

Important response and recovery actions for all emergencies and priority natural assets are:

- ensuring land managers and people responsible for emergency response are aware of the location of natural assets and the recovery and response actions that may impact them, both positively and negatively. Key stakeholders said that making information resources available to landholders and land managers to inform their recovery efforts would reduce the likelihood of poorly designed and implemented response and recovery actions. These resources included checklists to assist landholders to work through the steps involved in recovery including permitting requirements and information sheets on explaining good practice. Ideally these actions and resources are identified and collated within site specific asset preparedness, response, and recovery plans developed in the Asset Preparedness phase.
- landholders and council staff having access to services for expert advice in the aftermath of emergencies was seen as important and a gap in current approaches to emergency response. Ongoing resourcing for such a service would substantially improve outcomes for natural assets during and after emergencies
- rapid impact assessment in the aftermath of emergency events is undertaken for priority natural assets to assist in the design and implementation of recovery actions
- monitoring and ongoing condition assessment of priority natural assets to ensure that response and recovery actions to protect and restore these assets are being achieved. This allows for adaptive management of the response and recovery.

Good preparation as outlined in the previous section is essential to the protection and restoration of natural assets during the response and recovery phases.

7.1 Bushfire

Table 22 summarises typical actions during the response and recovery phases of bushfire emergencies that can be used to protect and restore natural assets in environments outlined in Section 4.

TABLE 22: **Typical response (during event) and recovery (after event) actions to protect and restore natural assets from bushfire.**

Environment	Response	Recovery
Hillslope and terrestrial environments	· Targeted protection of priority asset locations using fire suppression and fire breaks to protect critical areas. · Protect known habitat and vegetation patches from accidental damage during fire suppression.	· Rapid impact assessment and initiation of recovery plans for priority natural assets. · Protect remnant vegetation and new growth. · Re-establish groundcover and rehabilitate habitats where necessary. · Ensure ongoing post-fire weed and pest control. · Provide supplemental feed in remnant vegetation to avoid overgrazing.
Floodplains and riparian zones	· Fire suppression and fire breaks in critical areas to protect riparian vegetation. · Use best practice standards in relation to the construction of mineral earth breaks and the application of fire retardants. · Minimise use of bulldozers where possible and avoid use of machinery in riparian zones. · Minimise fire impacts in riparian zones during fuel-reduction and back-burning operations. · Map control lines to allow for rapid rehabilitation after the fire to minimise erosion, water quality and vegetation impacts.	· Rapid impact assessment and initiation of recovery plans for priority natural assets. · Fence and protect remnant patches not impacted by fire. · Re-establish riparian protection including fencing and vegetation. · Ensure ongoing post-fire weed and pest control. · Provide supplemental to avoid overgrazing of remnant vegetation. · Stabilise streambanks in priority areas to protect against streambank erosion where riparian vegetation is damaged or lost. · Use soil and erosion control such as sediment fencing, booms, hay bales, jute matting/geotextiles in high-risk areas.
Estuaries	· Fire suppression in critical catchment areas. · Use best practice standards in relation to the construction of mineral earth breaks and the application of fire retardants. · Minimise fire impacts in foreshore areas during fuel-reduction and back-burning operations. · Avoid the use of fire retardants and foams near foreshore areas. · Map control lines to allow for rapid rehabilitation after the fire to minimise erosion and water quality impacts.	· Rapid impact assessment and initiation of recovery plans for priority natural assets. · Re-establish protection of foreshore vegetation including fencing and revegetation where necessary. · Ensure ongoing post-fire weed and pest control. · Use soil and erosion control such as sediment fencing, booms, hay bales, jute matting/geotextiles in high-risk areas.

Environment	Response	Recovery
Streams and lakes	· Fire suppression in critical catchment areas. · Use best practice standards in relation to the construction of mineral earth breaks and the application of fire retardants. · Minimise use of bulldozers where possible and avoid use of machinery in riparian zones. · Minimise fire impacts in riparian zones during fuel-reduction and back-burning operations. · Avoid use of fire retardants and foams near waterways and sensitive wetlands or riparian zones. · Map control lines to allow for rapid rehabilitation after the fire to minimise erosion and water quality impacts.	· Restore groundcover in catchment areas by re-establishing pastures or native vegetation as appropriate. · Use soil and erosion control such as sediment fencing, booms, hay bales, jute matting/geotextiles in high-risk areas. · Re-establish riparian protection including fencing and vegetation. · Targeted environmental flow releases to dilute poor quality water from fire being washed to affected tributaries. · Rehabilitation of control lines as soon as possible.
Coastal dunes and scrub	· Targeted protection of priority asset locations using fire suppression to protect critical areas. · Protect known habitat and vegetation patches from accidental damage during fire suppression. · Minimise use of bulldozers where possible and avoid use of machinery in sensitive dune areas. · Map control lines to allow for rapid rehabilitation after the fire to minimise erosion and enable recovery.	· Rapid impact assessment and initiation of recovery plans for priority natural assets. · Protect remnant vegetation and new growth. · Re-establish coastal native vegetation and rehabilitate habitats where necessary. · Stabilise dunes to enable natural regeneration and restoration. · Ensure ongoing post-fire weed and pest control. · Rehabilitation of control lines as soon as possible.
Wetlands	· Fire suppression in critical catchment areas. · Use best practice standards in relation to the construction of mineral earth breaks and the application of fire retardants. · Minimise use of bulldozers where possible and avoid use of machinery around wetlands. · Minimise fire impacts in wetlands zones during fuel-reduction and back-burning operations. · Avoid use of fire retardants and foams near sensitive wetlands. · Map control lines to allow for rapid rehabilitation after the fire to minimise erosion and water quality impacts.	· Rapid impact assessment and initiation of recovery plans for priority natural assets. · Fence and protect remnant patches not impacted by fire. · Re-establish wetland protection including fencing and revegetation where necessary. · Ensure ongoing post-fire weed and pest control. · Provide supplemental feed to avoid overgrazing of remnant wetland and surrounding vegetation. · Use soil and erosion control such as sediment fencing, booms, hay bales, jute matting/geotextiles in high-risk areas.

7.1.1 Biodiversity natural assets

Bushfire response and recovery actions to protect biodiversity natural assets are summarised in Table 23. Note many of these actions are currently unfunded and are unlikely to occur without additional resources.

TABLE 23: Response and recovery actions for protecting Biodiversity assets from bushfire emergencies.

Environment	Asset	Phase	Actions	Where	Who
Hillslope and terrestrial environments	Swift parrot – threatened species	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Northern Midlands LGA · Break O'Day LGA	· Landholders · Sustainable Timbers Tasmania · Northern Midlands Council · Break O'Day Council · TPWS
	Eastern quoll – threatened species Bushfire	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Break O'Day LGA	· Landholders · Sustainable Timbers Tasmania · Break O'Day Council · TPWS · TFS
	New Holland mouse – threated species	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities. · Implement actions in Northern Region Strategic Management Plan in affected areas of Wingaroo Nature Reserve.	· Flinders Island LGA	· Landholders · NRE Tas · Flinders Council · TFS
	Graveside leek-orchid – threatened species	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Northern Midlands LGA	· Landholders · NRE Tas · Northern Midlands Council · TFS
	Alpine sphagnum bogs and associated fens – threatened ecological community	Response & Recovery	· Implement Northern Region Strategic Fire Management Plan. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Meander Valley LGA	· TPWS
	Lowland native grasslands of Tasmania – threatened ecological community	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Northern Midlands LGA	· Landholders · NRE Tas · Northern Midlands Council · TFS

Environment	Asset	Phase	Actions	Where	Who
Hillslope and terrestrial environments continued	Shy Susan – regional priority threatened species	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities. · Implement Northern Region Strategic Fire Management Plan (Dan Hills Conservation Area).	· West Tamar LGA	· Landholders · NRE Tas · West Tamar Council · TFS · TPWS
Floodplains and riparian zones	Davies' wax flower – threatened species	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Break O'Day LGA	· Landholders · NRE Tas · Break O'Day Council · TFS
	Giant freshwater crayfish – threatened species	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities. · Implement Northern Region Strategic Fire Management Plan.	· 1st priority – Dorset LGA · Further focus: Meander Valley, Launceston, and George Town LGA	· Landholders · NRE Tas · Dorset Council · TFS · Sustainable Timbers Tasmania · TPWS
	Eucalyptus ovata – Callitris oblonga forest – threatened ecological community	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Northern Midlands LGA	· Landholders · NRE Tas · Northern Midlands Council · TFS
	Tasmanian white gum (*Eucalyptus viminalis*) wet forest – threatened ecological community	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Meander Valley LGA · Dorset LGA · Flinders Island LGA · Launceston LGA	· Landholders · NRE Tas · Meander Valley Council · Dorset Council · Flinders Council · City of Launceston · TFS
	Eucalyptus ovata / Eucalyptus brookeriana Forests and Woodlands – threatened ecological community	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Launceston LGA · Meander Valley LGA · Northern Midlands LGA · West Tamar LGA	· Landholders · NRE Tas · Meander Valley Council · Northern Midlands Council · City of Launceston · West Tamar Council · TFS

Environment	Asset	Phase	Actions	Where	Who
Streams and lakes	Swan Galaxias – threatened species	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities plans.	· Northern Midlands LGA	· Landholders · NRE Tas · Northern Midlands Council · TFS · Sustainable Timbers Tasmania
Wetlands	Logan Lagoon – Ramsar wetland	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities plans.	· Flinders Island LGA	· Flinders FMAC · NRE Tas · Flinders Council · TFS
	Floodplain Lower Ringarooma River – Ramsar wetland	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities plans.	· Dorset LGA	· North East FMAC · NRE Tas · Dorset Council · TFS
	Jocks Lagoon – Ramsar wetland	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities plans.	· Break O'Day LGA	· Landholders · NRE Tas · Break O'Day Council · TFS · TPWS
	East Coast Barren Island Lagoons – Ramsar wetland	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities plans.	· Flinders Island LGA	· Cape Barren Island Aboriginal Association · NRE Tas · Flinders Council · TFS
	Little Whitehouse Lake	Response & Recovery	· Implement Northern Region Strategic Fire Management Plan. · Undertake rapid impact assessment and identify target areas for recovery activities plans.	· Dorset LGA	· NRE Tas · Dorset Council · TFS · TPWS
	Australasian bittern – threatened species	Response & Recovery	· Implement site specific bushfire preparedness, response, and recovery plans for critical asset areas. · Implement Northern Region Strategic Fire Management Plan. · Undertake rapid impact assessment and identify target areas for recovery activities plans.	· Flinders Island LGA · Dorset LGA	· Landholders · NRE Tas · Flinders Council · Dorset Council · TFS · TPWS

7.1.2 Agricultural natural assets

Agricultural natural assets are broadly dispersed across the landscape and by their nature are on private land. Response and recovery actions for these natural assets requires a property level, integrated approach across all assets with coordination and cooperation between neighbouring landholders and other land managers. As was the case with biodiversity natural assets, good preparation is the precursor to good outcomes in the response and recovery phases. In particular, being ready to go in the period immediately after a fire to protect natural assets from further damage before natural recovery is possible, is critical to effective action.

In agricultural landscapes, key response actions to protect natural assets from bushfire emergencies are:

- creating fire suppression and fire breaks in critical areas to protect native remnant and riparian vegetation
- implementation of best practice standards in relation to the construction of mineral earth breaks and the application of fire retardants
- minimising the use of bulldozers where possible and avoiding the use of machinery in riparian zones
- minimising fire impacts in riparian zones during fuel-reduction and back-burning operations
- mapping control lines to allow for rapid rehabilitation after the fire to minimise erosion, and the impact on water quality and vegetation.

Key recovery actions to protect agricultural natural assets from bushfire emergencies are:

- protecting remnant vegetation and new growth including with the use of fencing
- re-establishing groundcover including cover crops to minimise erosion
- ongoing post-fire weed and pest control
- providing supplemental feed in remnant vegetation to avoid overgrazing
- re-establishing riparian protection including fencing and vegetation
- stabilising streambanks to protect against erosion where riparian vegetation is damaged or lost
- using soil and erosion control such as sediment fencing, booms, hay bales, jute matting/geotextiles in high-risk areas to minimise mass movement and sediment delivery to stream.

Critical issues in recovery that need to be addressed are resourcing for natural asset restoration and recovery, the provision of expert advice and support, availability of materials and seedlings for rehabilitation works, and competing demands from other areas of recovery that may be more immediate such as recovering from the impacts of fire on housing, mental and physical health, farm infrastructure, income, and productivity.

7.2 Flood

Table 24 summarises typical actions during the response and recovery phases of flood emergencies that can be used to protect and restore natural assets in each of the environments outlined in Section 4.

TABLE 24: **Typical response (during event) and recovery (after event) actions to protect and restore natural assets from bushfire.**

Environment	Response	Recovery
Hillslope and terrestrial environments	· Provide feed to animals outside the flood impact zone to reduce grazing pressure on remaining vegetation. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals immediately before or during rainfall events. · Ensure safe storage of chemicals and other contaminants.	· Restore groundcover on hillslopes using native vegetation or cover crops as appropriate. · Provide supplementary feed to animals outside the flood zone to reduce grazing pressure on remaining vegetation. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals on saturated soils after intense rainfall events.
Floodplains and riparian zones	· Avoid use of pesticides, herbicides, fertilisers, and other chemicals immediately before or during rainfall events. · Ensure safe storage of chemicals and other contaminants.	· Debris removal using best practice in riparian zones and floodplains e.g. minimise vegetation damage, minimise creation of tracks from vehicle use in riparian areas and rehabilitate where unavoidable, don't push debris into river, and avoid burning timber debris in riparian zones. · Re-establish riparian protection including flood resistant fencing in appropriate locations to minimise future flood damage. · Revegetation where appropriate. · Bank re-establishment and stabilisation where appropriate using environmentally sensitive design and placement. · Ensure ongoing post-flood weed and pest control. · Provide supplementary feed to animals to reduce grazing pressure on remaining vegetation. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals on saturated soils in riparian zone and floodplain as well as near catchment areas after flood and intense rainfall events.
Estuaries	· Targeted protection of water quality to reduce sediment and pollutant runoff to streams e.g. using haybales. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals immediately before or during rainfall events. · Ensure safe storage of chemicals and other contaminants.	· Debris removal using best practice in estuary foreshore and intertidal zones e.g. minimise vegetation damage, minimise creation of tracks from vehicle use and rehabilitate where unavoidable, don't push debris into estuary, and avoid burning timber debris in foreshore areas. · Remove significant debris from estuary waterways (e.g. constricting flows and tidal movements impacting on channel navigability) using approaches that are mindful of potential impacts on water quality, benthos, or direct impacts on aquatic species. · Re-establish foreshore vegetation protection including appropriately designed and placed fencing. · Ongoing targeted stabilisation of foreshore and intertidal areas to avoid slumping and falling of priority vegetation where undercutting has occurred and vegetation has been lost or damaged. · Revegetation where appropriate. · Ensure ongoing post-flood weed and pest control. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals on saturated soils in catchment areas after flood and intense rainfall events.

Environment	Response	Recovery
Streams and lakes	· Targeted protection of water quality to reduce sediment and pollutant runoff to streams e.g. using haybales. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals immediately before or during rainfall events. · Ensure safe storage of chemicals and other contaminants.	· Restore groundcover on hillslopes and catchment areas using native vegetation or cover crops as appropriate. · Ongoing targeted protection of water quality to reduce sediment and pollutant runoff to streams e.g. using haybales. · Debris removal using best practice in riparian zones and floodplains e.g. minimise vegetation damage, minimise creation of tracks from vehicle use in riparian areas and rehabilitate where unavoidable, don't push debris into river, avoid burning timber debris in riparian zone. · Re-establish riparian protection including flood resistant fencing in appropriate locations to minimise future flood damage. · Revegetation where appropriate. · Bank re-establishment and/or stabilisation where appropriate using environmentally sensitive design and placement. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals on saturated soils in catchment areas after flood and intense rainfall events.
Coastal dunes and scrub	· Dune stabilisation and targeted protection of dune dependent natural assets. · Avoid damage to sensitive coastal dune and scrub environments through vehicle and machinery use.	· Dune stabilisation and rehabilitation of vehicle tracks. · Protect remaining native vegetation and revegetate where required to restore habitat and native vegetation. · Ensure ongoing post-flood weed and pest control.
Wetlands	· Targeted protection of water quality to reduce sediment and pollutant runoff to streams e.g. using haybales. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals immediately before or during rainfall events. · Ensure safe storage of chemicals and other contaminants.	· Debris removal using best practice in wetland areas e.g. minimise vegetation damage, minimise creation of tracks from vehicle use and rehabilitate where unavoidable, don't push debris into wetland, avoid burning timber debris in areas adjacent to the wetland. · Re-establish wetland vegetation protection including appropriately designed and placed fencing. · Revegetation where appropriate. · Ensure ongoing post-flood weed and pest control. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals on saturated soils in surrounding areas after flood and intense rainfall events.

7.2.1 Biodiversity natural assets

Flood response and recovery actions to protect biodiversity natural assets are summarised in Table 25. Note many of these actions are currently unfunded and are unlikely to occur without additional resources.

TABLE 25: **Preparedness actions for protecting Biodiversity assets from flood emergencies.**

Environment	Asset	Phase	Actions	Where	Who
Hillslope and terrestrial environments	New Holland mouse – threated species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Flinders Island LGA	· Landholders · NRE Tas · Flinders Council · TPWS
Floodplains and riparian zones	Davies' wax flower – threatened species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Break O'Day LGA	· Landholders · NRE Tas · Break O'Day Council
	Giant freshwater crayfish – threatened species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· 1st priority – Dorset and Launceston LGA · Further focus: Meander Valley and George Town LGAs	· Landholders, NRE Tas · Dorset Council · City of Launceston · Sustainable Timbers Tasmania · TPWS
	Eucalyptus ovata – Callitris oblonga forest – threatened ecological community	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Northern Midlands LGA	· Landholders · NRE Tas · Northern Midlands Council
	Tasmanian white gum (*Eucalyptus viminalis*) wet forest – threatened ecological community	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Meander Valley LGA · Dorset LGA · Flinders Island LGA · Launceston LGA	· Landholders · NRE Tas · Meander Valley Council · Dorset Council · Flinders Council · City of Launceston
	Eucalyptus ovata / Eucalyptus brookeriana Forests and Woodlands – threatened ecological community	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Launceston LGA · Meander Valley LGA · Northern Midlands LGA · West Tamar LGA	· Landholders · NRE Tas · Meander Valley Council · Northern Midlands Council · City of Launceston · West Tamar Council

Environment	Asset	Phase	Actions	Where	Who
Estuaries	kanamaluka / Tamar estuary – Regional priority	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Launceston LGA · West Tamar LGA · George Town LGA	· NRM North/TEER · NRE Tas · West Tamar Council · George Town Council · City of Launceston · SES
Streams and lakes	Swan Galaxias – threatened species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Northern Midlands LGA	· Landholders · NRE Tas · Northern Midlands Council · Sustainable Timbers Tasmania · TPWS
Coastal dunes and scrub	Hooded plover – threatened species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Break O'Day LGA · Dorset LGA · Flinders Island LGA · George Town LGA · West Tamar LGA	· Landholders · NRE Tas · Flinders Council · Dorset Council · Break O'Day Council · George Town Council · West Tamar Council · TPWS

Environment	Asset	Phase	Actions	Where	Who
Wetlands	Floodplain Lower Ringarooma River – Ramsar wetland	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Dorset LGA	· Landholders · NRE Tas · Dorset Council · TPWS
	Little Waterhouse – Ramsar wetland	Response & Recovery	· Implement flood recovery actions in the Waterhouse Conservation Area Management Plan.	· Dorset LGA	· Landholders · NRE Tas · Dorset Council · TPWS
	Australasian bittern – threatened species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Flinders Island LGA	· Landholders · NRE Tas · Flinders Council · TPWS
	Green and gold frog – threatened species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Dorset LGA · Meander Valley LGA	· NRM North · NRE Tas · Dorset Council Meander Valley Council · TPWS
	Subtropical Temperate Coastal Saltmarsh – threatened ecological community	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Dorset LGA · Flinders Island LGA · Break O'Day LGA	· Landholders, NRE Tas · Dorset Council · Flinders Council · Break O'Day Council · TPWS

7.2.2 Agricultural natural assets

Agricultural natural assets are broadly dispersed across the landscape and by their nature are on private land. Response and recovery actions for these natural assets requires a property level, integrated approach across all assets with coordination and cooperation between neighbouring landholders and other land managers. As was the case with biodiversity natural assets, good preparation is the precursor to good outcomes in the response and recovery phases. In particular, being ready to go in the period immediately after a flood to protect natural assets from further damage before natural recovery is possible, is critical to effective action.

In agricultural landscapes key response actions to protect natural assets from flood emergencies are:

- providing feed to animals outside the flood impact zone to reduce grazing pressure on remaining vegetation
- avoiding use of pesticides, herbicides, fertilisers, and other chemicals immediately before or during rainfall events
- ensuring safe storage of chemicals and other contaminants.

Key recovery actions to protect agricultural natural assets from bushfire emergencies are:

- restoring groundcover on hillslopes using native vegetation or cover crops as appropriate
- providing supplementary feed to animals outside the flood zone to reduce grazing pressure on remaining vegetation
- avoiding use of pesticides, herbicides, fertilisers, and other chemicals on saturated soils after intense rainfall events

- debris removal using best practice in riparian zones and floodplains e.g. minimise vegetation damage, minimise creation of tracks from vehicle use in riparian areas and rehabilitate where unavoidable, don't push debris into river, and avoid burning timber debris in riparian zone
- re-establishing riparian protection including flood resistant fencing in appropriate locations to minimise future flood damage. Revegetation of riparian zones where appropriate
- bank re-establishment and stabilisation where appropriate using environmentally sensitive design and placement
- undertaking a program of post-flood weed and pest control.

Critical issues in recovery that need to be addressed are resourcing for natural asset restoration and recovery, the provision of expert advice and support, availability of materials and seedlings for rehabilitation works, and competing demands from other areas of recovery that may be more immediate such as recovering from the impacts of fire on housing, mental and physical health, farm infrastructure, income, and productivity.

7.3 Coastal inundation

Table 26 summarises typical actions during the response and recovery phases of coastal inundation emergencies that can be used to protect and restore natural assets in relevant environments outlined in Section 4.

TABLE 26: **Typical response (during event) and recovery (after event) actions to protect and restore natural assets from bushfire.**

Environment	Response	Recovery
Estuaries	Targeted stabilisation of foreshore and intertidal areas to avoid slumping and falling of priority vegetation where undercutting has occurred and vegetation has been lost or damaged.	· Debris removal (e.g. ocean waste, plastics) using best practice to minimise impacts on foreshore and intertidal vegetation and aquatic environments. · Re-establish foreshore vegetation protection including appropriately designed and placed fencing. · Ongoing targeted stabilisation of foreshore and intertidal areas to avoid slumping and falling of priority vegetation where undercutting has occurred and vegetation has been lost or damaged. · Revegetation where appropriate. · Ensure ongoing post-flood weed and pest control. · Avoid use of pesticides, herbicides, fertilisers, and other chemicals on saturated soils after flood and intense rainfall events.
Coastal dunes and scrub	Stabilise dunes where vegetation and groundcover has been lost.	· Dune stabilisation and targeted protection of dune dependent natural assets. · Protect remaining native vegetation and revegetate where required to restore habitat and native vegetation. · Ensure ongoing weed and pest control. · Protect remaining nesting sites and habitat. · Avoid damage to sensitive coastal dune and scrub environments through vehicle and machinery use. · Debris removal (e.g. ocean waste, plastics) using best practice to minimise impacts on dunes and remaining coastal vegetation.
Wetlands	None.	· Debris removal from wetland (e.g. ocean waste, plastics) using best practice to minimise impacts on vegetation and aquatic environments. · Re-establish foreshore vegetation protection including appropriately designed and placed fencing. · Revegetation where appropriate. · Ensure ongoing post-event weed and pest control.

7.3.1 Biodiversity natural assets

Coastal inundation response and recovery actions to protect biodiversity natural assets are summarised in Table 27. Note many of these actions are currently unfunded and are unlikely to occur without additional resources.

TABLE 27: Preparedness actions for protecting Biodiversity assets from coastal inundation emergencies

Environment	Asset	Purpose	Actions	Where	Who
Estuaries	kanamaluka / Tamar estuary – Regional priority	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Launceston LGA · West Tamar LGA · George Town LGA	· Landholders · NRM North/TEER · NRE Tas · City of Launceston · West Tamar Council · George Town Council
Coastal dunes and scrub	Hooded plover – threatened species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Break O'Day LGA · Dorset LGA · Flinders Island LGA · George Town LGA · West Tamar LGA	· Landholders · NRE Tas · Break O'Day Council · Dorset Council · George Town Council · Flinders Council · West Tamar Council · TPWS
Wetlands	Logan Lagoon – Ramsar wetland	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Flinders Island LGA	· Landholders · NRE Tas · Flinders Council
	Floodplain Lower Ringarooma River – Ramsar wetland	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Dorset LGA	· Landholders · NRE Tas · Dorset Council · TPWS
	Jocks Lagoon – Ramsar wetland	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Break O'Day LGA	· Landholders · NRE Tas · Dorset Council

Environment	Asset	Purpose	Actions	Where	Who
Wetlands continued	Australasian bittern – threatened species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Flinders LGA · Dorset LGA	· Landholders · NRE Tas · Dorset Council · Flinders Council · TPWS
	Eastern curlew – threatened species	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Flinders LGA · Dorset LGA · Break O'Day LGA	· Landholders · NRE Tas · Dorset Council · Flinders Council · TPWS
	Subtropical Temperate Coastal Saltmarsh – threatened ecological community	Response & Recovery	· Implement site specific flood preparedness, response, and recovery plans for critical asset areas. · Undertake rapid impact assessment and identify target areas for recovery activities.	· Flinders LGA · Dorset LGA · Break O'Day LGA	· Landholders · NRE Tas · Break O'Day Council · Dorset Council · Flinders Council · TWPS

7.3.2 Agricultural natural assets

There are no agricultural assets identified with moderate to high risk from coastal inundation.

7.4 Biosecurity

In general, actions to respond and recover from biosecurity emergencies are similar in all environments. In this Plan, a biosecurity emergency relates to the entry of an invasive organism into Tasmania or significant spread of an invasive organism outside a previously limited range.

Key actions during the response phase are:

- regular monitoring and reporting of the entry and movement of the invasive organism
- identification of sources of the invasive organism and management to remove risks of new entry
- implementation of biosecurity hygiene practices to avoid spread and contain the invasive organism
- eradication of populations of the invasive organism where possible
- asset-based protection of priority natural assets that are likely to be sensitive to the organism, either directly or through impacts on habitat or food sources.

In the recovery phase actions are:

- ongoing monitoring and reporting including monitoring of known sources to avoid new entry
- continue biosecurity hygiene practices to minimise risks of spread from areas where organisms may persist
- eradication of small populations in new areas to contain invasive organism and avoid further spread
- ongoing asset-based protection of priority natural assets that are likely to be sensitive to the invasive organism, either directly or indirectly such as through impacts on habitat or food sources.

Biosecurity emergency response and recovery is managed through Biosecurity Tasmania. Community, landholders, and industry have a responsibility to engage with response and recovery activities as part of their General Biosecurity Duty under the *Biosecurity Act 2019*. NRM North has no specific role in biosecurity response and recovery but could play a role in developing and implementing Biosecurity Programs to address biosecurity emergencies, focusing on either eradication, containment, or asset-based protection.

7.4.1 Biodiversity natural assets

Table 28 summarises typical actions during the response and recovery phases of biosecurity emergencies that can be used to protect and restore natural assets in relevant environments outlined in Section 4.

TABLE 28: Response and recovery actions for protecting Biodiversity assets from bushfire emergencies.

Environment	Asset	Phase	Actions	Where	Who
Hillslope and terrestrial environments	Eastern quoll – threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Break O'Day LGA	· Landholders
	New Holland mouse – threated species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Flinders Island LGA	· Landholders · TPWS
	Graveside leek-orchid – threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Northern Midlands LGA	· Cemetery operators
	Alpine sphagnum bogs and associated fens – threatened ecological community	Response & Recovery	· Implement biosecurity response and recovery actions as guided by the TWWHA Biosecurity Management Plan and Biosecurity Tasmania.	· Meander Valley LGA	· TPWS
	Lowland native grasslands of Tasmania – threatened ecological community	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Northern Midlands LGA	· Landholders
	Wedge-tailed eagle – regional priority threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Break O'Day LGA · Dorset LGA · Meander Valley LGA · Launceston LGA · Northern Midlands LGA	· Landholders · Sustainable Timbers Tasmania
	Shy Susan – regional priority threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· West Tamar LGA	· TPWS · NRM North

Environment	Asset	Phase	Actions	Where	Who
Floodplains and riparian zones	Davies' wax flower – threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Break O'Day LGA	· Landholders
	Giant freshwater crayfish – threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· 1st priority – Dorset LGA, Launceston LGA · Further focus: Meander Valley and George Town LGA	· Landholders · TPWS
	Eucalyptus ovata – Callitris oblonga forest – threatened ecological community	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Northern Midlands LGA	· Landholders
	Tasmanian white gum (*Eucalyptus viminalis*) wet forest – threatened ecological community	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Meander Valley LGA · Dorset LGA · Flinders Island LGA · Launceston LGA	· Landholders
Estuaries	kanamaluka / Tamar estuary – Regional priority	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Launceston LGA · George Town LGA · West Tamar LGA	· Biosecurity Tasmania · TasPorts
Streams and lakes	Swan Galaxias – threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Northern Midlands LGA	· Inland fisheries · Biosecurity Tasmania
Coastal dunes and scrub	Hooded plover – threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Break O'Day LGA · Dorset LGA · Flinders Island LGA · George Town LGA · West Tamar LGA	· Landholders · TPWS

Environment	Asset	Phase	Actions	Where	Who
Wetlands	Logan Lagoon – Ramsar wetland	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Flinders Island LGA	· TPWS
	Floodplain Lower Ringarooma River – Ramsar wetland	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Dorset LGA	· TPWS
	Jocks Lagoon – Ramsar wetland	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Break O'Day LGA	· Landholder · TPWS
	East Coast Barren Island Lagoons – Ramsar wetland	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Flinders Island LGA	· Cape Barren Island Aboriginal Association · TPWS
	Australasian bittern – threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Flinders Island LGA	· Landholders · TPWS
	Eastern curlew – threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Flinders LGA · Dorset LGA · Break O'Day LGA	· Landholders · TPWS
	Green and gold frog – threatened species	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Dorset LGA · Meander Valley LGA	· Landholders · TPWS
	Subtropical Temperate Coastal Saltmarsh – threatened ecological community	Response & Recovery	· Implement biosecurity response and recovery actions as guided by Biosecurity Tasmania.	· Dorset LGA · Flinders Island LGA · Break O'Day LGA	· TPWS

7.4.2 Agricultural natural assets

Agricultural natural assets are broadly dispersed across the landscape and by their nature are on private land. Biosecurity emergency response and recovery actions for natural assets are managed through Biosecurity Tasmania. Landholders have a responsibility to engage with response and recovery activities as part of their General Biosecurity Duty under the *Biosecurity Act 2019*. Specific response and recovery actions are developed by Biosecurity Tasmania based on the nature and scale of the threat.

8

Community/ stakeholder engagement

8. Community / stakeholder engagement

In developing this Plan, NRM North in collaboration with NRM South and Cradle Coast NRM engaged with key stakeholders statewide to:

- seek feedback on priority natural assets and their threats
- understand potential impacts of emergencies and emergency management on natural assets
- identify the types of actions that could be implemented to mitigate impacts before, during and after emergencies
- understand current approaches to emergency management including roles and responsibilities as well as gaps and opportunities for NRMs and other stakeholders to work more closely together to enhance emergency management
- seek feedback on a final draft of this Plan.

This consultation was undertaken in three phases and involved one-on-one semi-structured interviews, statewide workshops, email feedback on a discussion paper, and opportunities to comment on a final draft of this plan through online surveys, email, and a workshop. Engagement focused on state and local government representatives, industry representatives from agricultural and forestry sectors, representatives from government owned enterprises, and people involved in Statewide Emergency Management activities.

This section proposes next steps in communicating where gaps have been identified in the preparedness for different emergencies to protect natural assets. Potential roles for NRM North in assisting to fill some of these gaps have been identified. These potential activities would be subject to resourcing and the support and willingness of other agencies to collaborate with NRM North within existing emergency management frameworks and arrangements.

8.1 Key gaps

Community and stakeholder consultation identified the following gaps in emergency preparedness as it relates to natural assets:

- a lack of knowledge on the part of some staff, private landholders, and emergency responders as to the location, risks to and requirements of natural assets in preparing for, responding to and recovering from emergencies
- a lack of resources including funding and access to knowledgeable experts to provide support to private landholders to develop preparation, response and recovery plans for their properties that include protection of natural assets while also protecting people and infrastructure
- a lack of information and support for council staff and landholders during response and recovery operations during and after an emergency event to ensure natural assets are protected and restored. Significant damage to natural assets can and does occur as a result of response and recovery operations where risks to natural assets are not adequately planned for or understood. Some stakeholders indicated that there was 'no one on the other end of the phone' available to provide this type of support and advice following emergencies and as a result many recovery activities occur that cause significant unintended harm to natural assets.

Potential roles for NRM North in filling some of these gaps are outlined below.

8.2 Engagement, Collaboration and Coordination activities

Council staff spoke of the challenges faced in incorporating protection of natural assets, particularly those on private property and council owned and managed land, in municipal emergency management plans. Many councils lack staff who are skilled and knowledgeable in ecology or natural resource and environmental management. NRM North could play an important role supporting local government and Municipal Emergency Management Committees in considering natural assets in Municipal and Regional Emergency Management Plans as well as in other plans and policy documents such as Reserve Management Plans and Urban Waterway Management Plans as they are developed and updated by councils.

NRM North could also play a role in assisting landholders develop emergency preparedness, response and recovery plans for their properties which identify and protect natural assets on their property or neighbouring properties.

During response and recovery phases NRM North could play a role in supporting landholders and councils undertaking response and recovery activities, providing information and advice on the risks of various activities to natural assets as well as the actions that can

protect natural assets and promote their restoration and rebuild resilience. NRM North has filled this role under contract to the state government for large-scale emergencies (e.g. 2016 Agricultural Landscape Flood Recovery Scheme) in the past. A gap exists for smaller scale emergencies where impacts on people and infrastructure are not of a scale to trigger recovery funding programs but where impacts on natural assets of both the emergency and emergency management activities can be significant.

8.3 Raising Public Awareness

NRM North has strong links with the community including landholders, councils, government owned enterprises, state government agencies and the general community. We have access to communication channels which are often not available to other organisations. NRM North could leverage these links and communication channels to raise public awareness of:

- the potential impacts of emergencies and emergency responses on our natural assets
- the actions people can take to prepare for emergencies that build the resilience of natural assets
- response and recovery activities that protect and restore natural assets
- avenues for further information, support and resourcing available to the community to protect and restore natural assets during and after emergencies.

8.4 Education and Training

NRM North have a long history of extension activities, providing education and training to a broad range of people including landholders, staff, trades people, and general community members. A major gap in emergency preparedness for natural asset protection identified through community and stakeholder engagement in the development of this Plan was a lack of knowledge and information on considering natural assets in emergency management amongst many staff, landholders, and emergency responders. NRM North is well placed to design preparation, response, and recovery checklists, and deliver education and training to a range of stakeholders involved in emergency preparation, response, and recovery.

» Photo: St John Pound

9

Legal framework

9. Legal framework

Key legislation and regulatory considerations required to deliver this plan and actions identified with it are summarised in Table 29 below.

TABLE 29: **Key legislation and regulatory considerations.**

Legislation or Regulation	Requirement
Biosecurity Act 2019	· Requires General Biosecurity Duty including a duty of care to take all reasonable and practical measures to prevent, eliminate or minimise biosecurity risks. · Request approval for Biosecurity Program including the actions various parties will undertake and how program costs will be met.
Tasmanian Emergency Management Act 2006	· Provides the legal framework for emergency management in Tasmania, setting out state, regional, and municipal responsibilities.
Tasmanian Emergency Management Arrangements (TEMA)	· Outlines the roles, authorities, and responsibilities for emergency management, including governance, administrative and legal frameworks; and · Defines the planning and management arrangements that bring all the different elements together.
Work Health and Safety Act 2012 (Tas) (WHS Act)	· Requires as far as reasonably practicable, that all persons, while at work, are safe from injury and risks to health, safety, and welfare, by providing them with a safe working environment and safe systems of work.
Environment Protection and Biodiversity Conservation Act 1999	· Legal framework to protect and manage unique plants, animals, habitats, and places. This includes heritage sites, marine areas, some wetlands, and other protected matters.
Fire Service Act 1979	· Lays out fire services in the state and the law relating to preventing and extinguishing fires and the protection of life and property from fire.
Threatened Species Protection Act 1995	· Provides for the protection and management of Tasmania's threatened native flora and fauna and to enable and promote the conservation of native flora and fauna.
Nature Conservation Act 2002	· Pertaining to invasive terrestrial animals.
Crown Lands Act 1976	· Provides for the management of public reserves and licences to take material from Crown land.
National Parks and Reserves Management Act 2002	· Management of parks and reserves based on management objectives of each class of reserve, declaration, and management of Marine Protected Areas.
Cat Management Act 2009	· Control of cats.
Inland Fisheries Act 1995	· Pests and diseases of managed and wild freshwater fish, pests, and diseases of managed and wild freshwater plants.
Natural Resource Management Act 2002	· Provides a structure and mechanisms for delivering effective management of natural resources in the state including NRM organisations.
Water Management Act 1999	· Provides for the use and management of freshwater resources.

Legislation or Regulation	Requirement
Forest Practices Act 1985	· Ensures that all forest practices are conducted in accordance with the Forest Practices Code.
Living Marine Resources Management Act 1995	· Diseases of managed and wild marine fish, invasive marine pests, plants, and animals.
Primary Produce Safety Act 2011	· Breeches in primary production food standards and product integrity.
Agricultural and Veterinary Chemicals (Tasmania) Act 1994	· Response in relation to misuse and subsequent impacts in relation to agricultural and veterinary chemicals.
Land Use Planning and Approvals Act 1993	· Bushfire hazard management plans.
Local Government Act 1993	· Council functions and operations.

10

Risk management including mitigation strategies

10. Risk management including mitigation strategies

This section outlines the key overarching risks associated with NRM North's implementation of this Plan's actions and how they can be mitigated. This does not provide an assessment of emergencies risks in Tasmania – this can be found in the Tasmanian Disaster Risk Assessment (TASDRA, 2022).

Table 30 outlines the key overarching risks associated with implementation of preparedness, response, and recovery actions for biodiversity and agricultural natural capital assets, and risk mitigation actions.

Ratings for the likelihood, consequence, and overall risk were assigned using NRM North's Risk Management Framework.

In developing the risk matrix for this Plan, the following assumptions have been made regarding the assessment of risks:

1. Stakeholder commitment:
   The assessment of likelihood for identified risks assumes an active commitment to implementation of the plan by responsible agencies, including the Australian Government, and support for the necessary resourcing to implement mitigation measures and response actions. It is acknowledged that implementation of the Plan itself is currently unfunded and assessments attached to most risks are contingent upon investment by relevant agencies.
2. External factors:
   Numerous risks identified are beyond the direct control and mitigation capabilities of NRM North. Our capacity to influence or control these actions is limited, leading to uncertainties in risk mitigation.

It is essential to recognise these assumptions while interpreting the Plan and utilising the risk matrix, as they significantly affect the likelihood and severity assessments of identified risks. Adjustments may be required as circumstances evolve, particularly regarding funding availability and the actions of external stakeholders involved in emergency response scenarios.

TABLE 30: **Key overarching risks associated with implementation of asset preparedness and response actions.**

Risk	Likelihood	Consequence	Risk Rating	Risk mitigation action	Residual risk
Assets not adequately identified due to gaps in knowledge, paucity of data or inadequate time or resources	Likely	Major	High	Identify resource needs and secure funding for asset identification, data collection, and resource allocation. Conduct regular reviews of risk assessment to identify potential threats to biodiversity and agricultural assets.	Moderate
Lack of funding/ resources for spatial mapping updates, preparation planning, or Plan implementation	Likely	Major	High	Ensure budgets are estimated and funding identified for personnel, equipment, and other necessary resources.	High
Absence of a detailed preparedness plan leading to uncoordinated and ineffective actions during an emergency	Moderate	Moderate	Significant	Develop a detailed preparedness plan of emergencies, ensuring it is comprehensive and adaptable to various emergency scenarios.	Moderate
Lack of training and education resulting in misunderstanding or non-compliance with the preparedness plan	Moderate	Minor	Moderate	Provide training and education to relevant stakeholders on the preparedness plan. Identify gaps in knowledge prior to designing training sessions.	Low
WHS concerns affecting the health, safety, and wellbeing of responders	Likely	Major	High	Prioritise WHS, implement WHS training and planning to ensure responders are adequately prepared for their roles.	Significant
Unintended environmental impacts, including ecosystem destruction from emergency response actions	Likely	Major	High	Design the preparedness plan to align with emergency services systems and provide it to relevant agencies for use in incident control centres. Socialise the plan through regular planning, training and exercises.	Significant
Inadequate preparedness actions causing significant damage to biodiversity and agricultural assets	Moderate	Major	High	Develop a detailed emergency response plan that outlines actions to be taken during an event, focusing on minimising damage to biodiversity and agricultural assets.	Significant

Risk	Likelihood	Consequence	Risk Rating	Risk mitigation action	Residual risk
Inadequate coordination leading to disarray and inefficiencies during emergencies, lack of Plan knowledge or implementation by emergency services organisations	Likely	Major	High	Establish a coordination mechanism to ensure effective communication and collaboration among stakeholders during emergencies (e.g. a dedicated communication platform). Consult with experts during planning to ensure effectiveness.	Significant
Delayed response actions due to inability to quickly mobilise resources	Moderate	Minor	Moderate	Ensure resources can be quickly mobilised during an event by identifying capabilities, training needs, and maintaining readiness.	Low
Ineffective communication leading to misinformation and panic	Moderate	Moderate	Significant	Develop a communication strategy to keep the public informed during emergencies, including regular updates, warnings, and advice on protective measures.	Moderate
Insufficient recovery actions hindering the restoration of assets post-emergency.	Likely	Major	High	Conduct a post-emergency assessment to evaluate damage to biodiversity and agricultural assets and identify necessary recovery actions.	Significant
Failure to conduct a thorough post-emergency assessment resulting in inadequate recovery actions	Moderate	Moderate	Significant	Implement restoration activities to recover biodiversity and agricultural assets following emergencies.	Moderate
Inadequate restoration activities delaying asset recovery.	Likely	Moderate	Significant	Regularly review risk assessments and update plans to address delays and new or emerging threats to biodiversity and agricultural assets.	Moderate
Lack of insight from historical lessons leading to recurring errors.	Moderate	Minor	Moderate	Review the effectiveness of preparedness, response, and recovery actions and incorporate lessons learned into future planning. Update and communicate plan changes accordingly.	Low
Lack of monitoring to measure effectiveness and detect impacts	Moderate	Minor	Moderate	Develop a monitoring system to measure the effectiveness of risk management actions and detect impacts on biodiversity and agricultural assets.	Low
Chronic impacts leading to actions not achieving desired outcomes.	Likely	Major	High	Develop strategies to mitigate chronic impacts on biodiversity and agricultural assets, considering long-term sustainability and resilience measures.	Significant

11

Monitoring and data

» Photo: St John Pound

11. Monitoring and data

Available data was sourced for natural capital assets and included collating statewide data from various sources, including but not limited to:

- The Tasmanian Government Land Information System (theLIST)
- Australian Government open data portal
- Geoscience Australia and any other relevant portals.

This data was filtered based on the priorities agreed in collaboration with both the NRM South and Cradle Coast NRM organisations. A series of data layers has been created for each of the natural capital asset groups. For example:

- Threatened and important species
- Threatened and important ecological communities
- Important biodiversity areas, soils, and vegetation.

Risk assessment models have been developed for each threat identified in this scope (fire, flood, coastal erosion, coastal inundation), both for biodiversity and agricultural natural capital assets where relevant.

The three major components of each risk assessment model are:

- Threat Rating (input): describes the extent and likelihood/severity of the threat
- Natural Capital Asset Priority Rating (input): describes the extent of the natural capital assets, which are then rated against all other assets in terms of priority for conservation value and/or the asset's vulnerability to the threat
- Risk Assessment Rating (output): describes the combination of the two above rating models which can be used to identify areas at highest risk to the threat.

A detailed description of the risk assessment modelling process is provided as a separate report available on the NRM North website. It is titled: Esk Spatial Report - Emergency Preparedness – Statewide Spatial Analysis and Mapping Report.

The underlying process to update and combine all the input layers was designed and built around a well-structured and semi-automated GIS model using standard ESRI software. The benefit of this approach is that all or individual inputs to the models can be easily adjusted and the whole model re- run either annually or on-demand to inform ongoing emergency plan revisions. This means that plans can be kept current and therefore effective, as threat conditions change.

Together these provide an ongoing resource that NRM North and other agencies responsible for Emergency Preparedness, Response, and Recovery can use in decision making prior to, during, and after future emergency events. The key outputs as part of this project include:

- Data package including all base layers used provided for use in Desktop and web feature services
- Biodiversity and Agricultural Natural Capital Risk Assessment Models, one for each threat
- A series of heat mapping PDF Maps generated from Risk Assessment Models for each threat.

PDF Maps of outputs from the Biodiversity and Agricultural Natural Capital Risk Assessment Models are available from the NRM North website to accompany this plan. Shapefiles are available upon request. The full data package and associated Biodiversity and Agricultural Natural Capital Risk Assessment Models will be made available to the Australian Government via SIGBOX. SIGBOX is the department's preferred method of securely uploading, downloading, and sharing large files. SIGBOX is a web application that can be accessed from any location, allowing data files to be shared securely between departmental staff and external stakeholders. For internal use NRM North will maintain the data in the NRM North GIS Directory which may be made accessible to other stakeholders on request.

12

Key contacts

» Photo: Thomas Spencer

12. Key contacts

More information on this Plan and the associated modelling and mapping products can be found on the NRM North website.

NRM North can be contacted at admin@nrmnorth.org.au or on (03) 6333 7777.

Appendices

» Photo: Philip Milner

Appendix 1. Priority biodiversity natural assets

This section describes priority biodiversity assets in northern Tasmania considered in this Plan. Information in this section was used to inform assessment of susceptibility of the asset to each type of emergency as well as preparedness, response, and recovery activities required to protect and restore the asset.

Threatened species

Table 31 summarises the key features including location, description, threats, tenure, and extent in northern Tasmania of threatened species considered in this Plan.

TABLE 31: **Description of threatened species in northern Tasmania considered in this Plan.**

Asset	Location	Habitat	Threats	Tenure	Range area in northern Tasmania (ha)
Swift parrot	Primarily south and east coasts, with breeding habitat in the north-west, between Launceston and Smithton, with habitats highly fragmented.	Habitat is mirrored around blue gum.	· Residential and industrial development · Agricultural tree senescence and dieback · Regeneration Suppression · Frequent Fire · Climate Change · Collisions · Competition · Disease · Illegal Capture and Trading	Private freehold = 15% Other TPWS[14] managed = 17% FPPF[15] = 20% PTPZL[16] = 43%	19,547
Eastern quoll	Bruny Island and the north of Tasmania, in areas of low rainfall and cold minimum temperatures. Occasionally found in the west of the state in wetter areas.	Open grassland, dry eucalypt forest, coastal scrub, alpine heathland, tussock grassland and grassy woodland.	· Predation by cats, dogs, and foxes · Disease – was a major factor in mainland extinction · Climate Change · Non-target poisoning · Road mortality · Decline and fragmentation of population – massive decline in population in north and east Tasmania assumed to be as a result of stochastic weather event	Private freehold = 41% NP = 11% FPPF = 7% PTPZL = 36%	1,150
New Holland mouse	Fragmented habitat across Tasmania	Open heathlands, open woodland with a heathland understorey and vegetated sand dunes.	· Habitat Loss and disturbance · Predation · Fire · Competition for food · Climate change · Disease	Private freehold = 15% Other TPWS managed = 84%	7,290

14 Tasmanian Parks and Wildlife Service

15 Future Potential Production Forest

16 Permanent Timber Production Zone Land

Asset	Location	Habitat	Threats	Tenure	Range area in northern Tasmania (ha)
Graveside leek-orchid	Northern Midlands region (Campbell town Cemetery)	Grows in native grassland, on well drained basaltic loams.	· Small population and potential genetic issues · Cemetery maintenance such as mowing and slashing · Grazing by native species · Trampling by visitors · Competition from invasive species · Illegal collection of plants	Private freehold = 98%	1,296
Wedge-tailed eagle	Statewide	Known to live in all habitats, but especially requires old growth forest on sheltered sites for nesting.	· Loss of habitat · Nest disturbance · Unnatural Mortality Persecution (e.g. shooting) · Electrocution · Collision · Oiling · Entanglement · Pollution	· NA	0
Davies' wax flower	Banks of lower reaches of Georges River	Riparian zone.	· Small population size · Fire · Clearing of habitat · Flood and storm damage · Invasive weeds · Disease – highly susceptible · Stock grazing and trampling · Browsing by native animals · Climate Change	· Private freehold = 25% · Other TPWS managed = 16% · FPPF = 24% · PTPZL = 19%	917

Asset	Location	Habitat	Threats	Tenure	Range area in northern Tasmania (ha)
Giant freshwater crayfish	Northern rivers	Well-shaded streams, with good water quality, low sediment levels, snags, pools, and undercut banks.	· Habitat loss/sedimentation of waterways – removal and disturbance of vegetation, bank erosion, removal of snags, channelisation, siltation, nutrification, instream barriers, changes in flow regime, and thermal regime. · Forestry – road construction, establishment and subsequent harvesting of plantation timber affecting nutrient dynamics, sedimentation, geomorphology, stream flow, instream habitat and carbon budgets. · Agriculture – clearing of riparian vegetation, removal of snags, extensive modification of stream channels (including dam construction), access by stock, water abstraction and inflows of agricultural chemicals and nutrients. · Modification to water flow · Illegal Fishing · Climate Change	Private freehold = 51% Other TPWS managed = 16% FPPF = 7% PTPZL = 19%	210,987
Swan Galaxias	Headwaters of the Swan River above Hardings Falls and tributaries of the Macquarie River	Trout free streams only.	· Predation by native and introduced fish species · Land management – riparian vegetation clearing, more frequent flooding and higher flood flows · Climate Change and drying of small headwater streams · Construction of water storage if cause inundation of habitat, destruction of barriers that limit movement of introduced species and alter flow regime	Private freehold = 61% Other TPWS managed = 15% FPPF = 9% PTPZL = 11%	11,838

Asset	Location	Habitat	Threats	Tenure	Range area in northern Tasmania (ha)
Hooded plover	Widely distributed across coasts and offshore islands	Sandy beaches.	· Disturbance through human activity – eggs and nests crushed, off-leash fogs predate flightless chicks · Predators – foxes, cats, dogs, livestock, magpies, ravens and silver gulls · Oil spills · Vehicles on beach impacting prey availability · Pollution causing entanglement and ingestion of waste, encourages predators into the area to scavenge · Dunes being impacted by sea level rising and protective measures against sea level rise, houses being built closer to the dunes, resulting in less suitable habitat, large storms and weather events eroding the dunes and coastline · Invasive weeds in dune habitat	NA	Unmapped
Australasian bittern	Eastern Tasmania	Wetlands with dense vegetation from 0.5–3.5 metres in height, where it forages in still, shallow water up to 0.3 m deep. The edge of waterways.	· Loss of wetlands due to drainage, conversion, weeds resulting in ploughing, geomorphic change including erosion and sedimentation, vegetation changes · Fire reducing vegetation · Livestock overgrazing – can trample nests and damage habitats and shelters · Climate change – reduced rainfall, longer and more frequent droughts resulting breeding quality and quantity and increasing risks of wildfire · Reduced water quality – salinity, acidification, siltation, nutrients, contaminants · Invasive species – trampling vegetation, habitats and eggs by pigs, horses, goats, deer. Predation of eggs and chicks by cats, rats and pigs · Loss of genetic diversification	Private freehold = 38% Other TPWS managed = 53%	7805

Asset	Location	Habitat	Threats	Tenure	Range area in northern Tasmania (ha)
Eastern curlew	North, east and south-east areas. Coastal areas, rarely recorded inland.	Sandflats and mudflats with vegetation or sea grass.	· Coastal development in the migratory flyway · Loss and degradation of coastal mudflats and wetlands from development, agricultural and industrial use, weed incursion · Disturbance from recreational users especially off-lead dogs · Less food sources in overcrowded sites from reduced available habitat · Climate change – submergence of wetlands and habitats, temperature impacts on vegetation used for breeding sites · Hunting · Fisheries · Pollution	Private freehold = 42% Other TPWS managed = 48%	65,051
Green and gold frog	Coastal lowlands	Coastal swamps, marshes, dune swales, lagoons, lakes, and other estuaries as well as riverine floodplain wetlands and billabongs. Fast flowing water.	· Loss, modification and fragmentation of aquatic and adjacent habitats – clearing and grazing, infill, weeds, changes in flow regime, pollution of wetlands · Barriers to movement from fragmentation and structures such as roads and fences · Drought · Disease – fungal pathogen called *Batrachochytrium dendrobatidis* impacts both tadpoles and adult amphibians which results in a high mortality rate · Predation by pest species such as *Gambusia*, cats and foxes · Biocides · Ultra-violet B radiation	Private freehold = 44% Other TPWS managed = 43%	14,762

Asset	Location	Habitat	Threats	Tenure	Range area in northern Tasmania (ha)
Shy Susan	Foothills of the Dazzler Range near Beaconsfield	Shallow soils, gently sloping hills, of easterly or south easterly aspect.	· Mining activities · Land clearance · Fire · Unsuitable fire frequency · Human activities · Recreational and illegal harvesting activities · Disease · European rabbits · Domestic stock · Native species · Weeds	Private freehold = 4% Other TPWS managed = 88% FPPF = 7%	116

Threatened ecological communities

Table 32 summarises the key features including location, description, threats, tenure, and extent in northern Tasmania of threatened ecological communities considered in this Plan.

TABLE 32: **Description of threatened ecological communities in northern Tasmania considered in this Plan.**

Asset	Location	Description	Threats	Tenure	Extent in Northern Tasmania (ha)
Lowland native grasslands of Tasmania	Areas up to 600m in the Midlands and east coast and on Flinders and Cape Barren Islands; in alluvial flats in valley bottoms and on gentle slopes	Ground layer of grasses and other herbs where trees and shrubs are absent to sparse. Two major subtypes are differentiated by dominant native tussock-forming perennial grass species: Lowland *Poa labillardieri* (silver tussock grass) grassland and *Themeda triandra* (kangaroo grass) grassland	· Clearance, conversion, and fragmentation of remnants · Fertiliser runoff from nearby pastures giving exotic plants a competitive advantage · Weeds and pest animals · Fire · Grazing regimes · Climate Change · Urban expansion · Off-road vehicle distribution · Salinity · Level of protection in reserves	Private freehold = 86% Other TPWS managed = 12%	7,323
Subtropical and Temperate Coastal Saltmarsh	Scattered in estuaries and calm bays around the coast, with more extensive areas in the kanamaluka/Tamar estuary, the Pipers River, the Ringarooma River, Cape Portland, Little Musselroe Bay, Scamander River and Henderson Lagoon. There are patches on the east coast of Cape Barren Island and at North East River, Long Point and Logan Lagoon on Flinders Island	Salt-tolerant vegetation including grasses, herbs, sedges, rushes and shrubs. Two defined types in Tasmania – succulent saltmarsh and grassy saltmarsh	· Clearing and fragmentation including in surrounding areas and catchments where it may result in changes to sediment delivery · "Land Claim" and infilling · Altered hydrology/tidal restriction · Invasive species · Climate change - current and projected sea level rises, rises in temperature and an increased level of storms will be a severe threat to the saltmarshes · Recreation especially recreational vehicles impacting on habitat · Pollution including gross pollutants and contaminants · Eutrophication · Acid Sulphate soils · Grazing · Insect control including use of insecticides and habitat modifications to control insects · Evaporative salt production and other mining · Inappropriate fire regimes and impacts on fire intolerant plants	Private freehold = 14% Other TPWS managed = 77%	4,349

Asset	Location	Description	Threats	Tenure	Extent in Northern Tasmania (ha)
Alpine sphagnum bogs and associated fens	Naturally discontinuous occurring primarily in gullies, depressions and cold air drainage sites, and on slopes where soils are waterlogged in permanently wet sites in high rainfall alpine, sub-alpine and montane areas	Two distinct components of high mountain wetlands that are both restricted in area and typically occur together: · Bogs – usually the visual presence of Sphagnum subspecies · Fens – shallow, open water pools with or without emergent aquatic plants often near to or surrounded by bogs The presence of a peat substratum is a defining component of the ecological community	· Climate change – loss of bogs and fens due to changes in snowfall and snowmelt regimes, which will affect groundwater and runoff patterns · Fire – not adapted to fire, leads to loss of vegetation and subsequent soil loss which makes recovery and restoration difficult · Grazing and trampling · Invasive species including feral horses, deer, feral pigs, rabbits, foxes, feral cats, trout, weeds and pathogens/disease · Infrastructure development including water infrastructure, resorts, tracks and roads, off-track recreation, peat and sphagnum harvesting, timber harvesting and groundwater extraction	NP = 79% Other TPWS managed = 7% PTPZL = 12%	1,531
Tasmanian white gum (*Eucalyptus viminalis*) wet forest	Moderately fertile to fertile well-drained soils in areas where fire is normally infrequent and rainfall is high (generally greater than 1000mm/year) Very small, fragmented patches across the region including on Cape Barren and Flinders Island	Wet eucalypt forest with either a wet sclerophyll or missed forest understory. The canopy is dominated by white gum (*Eucalyptus viminalis*).	· Clearing of land · Legacy of fragmentation due to historic clearing increasing vulnerability to invasion by exotic species · Hybridisation of trees related to silviculture with native and plantation species · More frequent but lower intensity fires are becoming more common, which can lead to weeds and simplification of the understorey. · Invasive species · Overabundant native browsers such as of pademelon (*Thylogale billardierii*) and brush-tailed possum (*Trichosurus vulpecula*) prevents the natural recruitment of *E. viminalis*. · Climate change and severe weather · Changes in water availability and hydrological regime · Trampling and grazing from livestock	Private freehold = 48% Other TPWS managed = 26% PTPZL = 15%	5,294

Asset	Location	Description	Threats	Tenure	Extent in Northern Tasmania (ha)
***Eucalyptus ovata – Callitris oblonga* Forest**	Near-stream and riparian environments primarily in the Northern Midlands, along the St. Pauls and South Esk rivers and 50km away at Cataract Gorge near Launceston. Largely on alluvial flats but may also extend onto other areas and substrates above flood level, including rocky outcrops	A shrubby eucalypt woodland to forest, sometimes grading into tall shrubland. The eucalypts typically associated with the ecological community are *E. ovata* and to a lesser extent *E. viminalis*. The absence of *E. ovata* or any other co-occurring taxa does not indicate an absence of the ecological community, provided *Callitris oblonga* is still present	· Habitat degradation due to weed invasion, causing fire hazards as well as waterlogging and sedimentation. · Fires less than 5-10 years will eventually ruin the ecological community with new vegetation being burnt before it is reproductive. · Flood-borne debris may cause damage to the ecological community as well as erosion to riverbanks · Trampling and grazing within the ecological community which can cause significant damage · Fragmentation due to vegetation clearing · Climate change – an increase of temperatures as well as a change in rainfall patterns may affect the environmental range of the community as well as increase the number of weeds	· Private freehold = 77% · Other TPWS managed = 9%	4,047
***Eucalyptus ovata / Eucalyptus brookeriana* Forests and Woodlands**	Occur in low-lying damp sites, including riverine habitats	A type of eucalypt forest to woodland that is restricted to Tasmania and is associated with sites that are typically damp and/or poorly draining. The national ecological community has several variants, notably a major component dominated by *Eucalyptus ovata* (black gum) and another dominated by *E. brookeriana* (Brookers gum)	· Clearance of native vegetation · Impacts from invasive species · Altered hydrology and water quality at sites including disruption of surface water flows, increased salinity, excessive groundwater extraction and eutrophication	· Private freehold = 61% Other TPWS managed = 20% · FPPF = 4% · PTPZL = 8%	8,612

Ramsar wetlands

Table 33 summarises the key features including location, description, threats, tenure, and extent in northern Tasmania of Ramsar wetlands considered in this Plan.

TABLE 33: **Description of Ramsar wetlands in northern Tasmania considered in this Plan**

Asset	Location	Ecological character essential features	Threats	Tenure	Extent in Northern Tasmania (ha)
Logan Lagoon	South-east corner of Flinders Island	· Climate – temperate climate with rainfall the source of freshwater inflows and high levels of evaporation · Geomorphology – coastal barrier system with dunes enclosing the coast, forming large lagoons · Hydrological regime – highly variable ranging from stagnant and hypersaline (no inflow, evaporation), to fresh-brackish (high inflows and rainfall), or be saline during periods of seawater ingress via a breached lagoon-sea entrance · Water quality – salinity, nutrients, turbidity, toxicants · Vegetation – submerged macrophytes, saltmarsh, herblands and grasslands. Away from the shores of the lagoon the habitat changes to sedgeland, heathland and swampy forests · Birds – the site regularly supports 1% of the global or regional population of: hooded plover, fairy Tern, musk duck, and chestnut teal; Many of the migratory waders are listed under CAMBA, JAMBA, ROKAMBA and the Convention on Migratory Species; the site provides important resting and feeding areas for waterfowl and shorebirds migrating between south-eastern Australia and Tasmania	· Inappropriate fire regime altering vegetation communities and increasing susceptibility of dunes to erosion · Recreational vehicles · Alteration to drainage regime – modification of natural flow into the lagoon, artificial opening of the lagoon mouth, can leave to reduced water depth threatening some species, unnatural water quality conditions. · Introduced species/diseases – chytrid fungus is a potential threat not yet identified. Other threats from pest and weed species · Surrounding land use/agriculture causing sediment deposition and increased turbidity, high nutrient levels from pastoral runoff, salinisation, movement of weeds into the site · Climate change – sea level rising, variations in water depth, altered habitat conditions, availability for flora and fauna, coastal retreat and habitat loss	Other TPWS managed = 100%	2,208
Floodplain Lower Ringarooma River	On the far north-east coast of Tasmania, 9 km north-west of the township of Gladstone	Three zones: · Coastal zone covers the entire coast of the site (three to four kilometres), including the combined mouth of the Boobyalla and Ringarooma rivers and contains the foredunes and sandy beach of the site, as well as the delta · Estuary zone is wave dominated, with a flood tide delta, includes a shorefront barrier, a flood/ebb delta, an area of salt marsh, tidal sand banks and the channel. There also appears to be the beginning of a coastal lagoon behind the shorefront barrier · Freshwater wetlands formed on a floodplain that widens downstream of a shallow and constricted valley (Jerie and Household 2001). In wide, flat areas of the lower floodplain water from high flow events leaves the channel, fills depressions in the landscape and creates natural levees with the deposition of material. Water is impeded by these forming a mosaic of seasonally inundated and permanent water bodies	· Climate change – sea level rising can affect the ecosystem through an incursion of saltwater. There would be large amounts of fluctuations in natural rainfall and more extremities. · Changes in geomorphology – fine silts washed downstream and into the river, with the previously gravel-based majority bed now being covered in sand-based sediment, leading to degradation of the riverbed · Accumulate of sediments in substrate (especially mining sediments) · Changes in hydrology particularly where flows push nutrients, sediments and contaminants into estuarine wetland component. · Degraded water quality · Pest and weed incursion	Private freehold = 57% TPWS managed = 43%	3,505

Asset	Location	Ecological character essential features	Threats	Tenure	Extent in Northern Tasmania (ha)
Jocks Lagoon	On the north-east coast of Tasmania, approximately 5 km south-east of the township of St Helens. It lies on the eastern side of a narrow strip of land that extends out to St Helens Point	A freshwater coastal lagoon, lying between parallel dunes approximately 200 to 300 metres inland. It receives water from a small inlet stream with a catchment approximately three kilometres wide and one kilometre long and from local groundwater. The northern half of Jocks Lagoon is mostly a large area of open water with isolated patches of emergent rush and sedge while the southern half of the lagoon is generally covered with rush and sedge emerging from the water surface.	· Recreational vehicles and their impacts on habitats, individuals of rare species, soil erosion and compaction · Lowered groundwater levels due to extraction · Eutrophication of surface and groundwaters · Weed infestation · Discharge of toxicants to surface and groundwaters · Spread of root rot, phytophthora, chytrid Fungus · Slashing changing vegetation community and eliminating some species · Fire – changes to vegetation communities, changes to geomorphology via erosion, changes to hydrology via infiltration as well as landform · Alien species introduction · Acid sulphate soils reducing diversity and abundance of aquatic flora and fauna · Climate change – reduced inflows and evaporation rates, resulting in changes to all water dependant ecosystem. Coastal recession and dune reactivation.	Private freehold = 87% Other TPWS managed = 13%	19
East Coast Barren Island Lagoons	Along the eastern edge of Cape Barren Island, occupying most of the eastern lowland and lagoon complex, from just north of Tar Point down to Jamieson's Bay, extending westwards from the coast for a distance varying from 1 to 4 km	A diversity of wetlands and lagoons lying in close proximity to each other. Four low energy estuarine systems, the barrier impounded Thirsty Lagoon, Little Creek, and two small unnamed systems, are flushed by intermittent freshwater inputs from shallow, frequently dendritic stream channels. Spits and bars located at the entrances to these estuarine systems suggest intermittent flushing by marine waters. Lagoons vary in area, depth, salinity and continuity of inundation. This is reflected in the different dominant vegetation communities, ranging from saltmarsh able to withstand extended periods of drying, to freshwater plant species intolerant of saline conditions. The site is almost completely devoid of human impact.	· Fire – the removal of vegetation which leads to exposure to underlying sediment. An increase of fire frequency can lead to a change in floristics to more fire tolerant species. Loss of habitat, flora, and fauna · Introduced species · Pathogens such as *Phytophthora cinnamomic* · Vehicle access leading to erosion and increased run-off, increased turbidity, disturbance of native species, loss of habitat, introduction of weed propagules and pathogens. · Grazing · Climate change – may influence wetland physical and chemical processes, groundwater discharge, the diversity of wetlands type, wetland biology. · Change in the distribution and abundance of flora and fauna Change in the lifecycles of fauna	Cape Barren Island Aboriginal Association holds tenure	4,446

Asset	Location	Ecological character essential features	Threats	Tenure	Extent in Northern Tasmania (ha)
Little Waterhouse Lake	Located 7 km south-west of Waterhouse Point which lies between the towns of Bridport and Tomahawk, on the north-east coast of Tasmania	Freshwater lagoon. The site is separated into two distinct sections: · Lake and adjacent floodplain originally formed by natural dune encroachment but subsequently the result of a dam built when the lake opened to the sea following heavy rainfall in the 1950s · Pool and marshland downstream of the dam, created by seepage through and under the dam wall. The wetland is home to rare plant species, green and gold frogs, dwarf galaxias and a diversity of macrophyte species	· Changes to the lakes water quality through inappropriate land use in the Tobacco Creek catchment, upstream of the site · Changes to the site's hydrology through groundwater extractions elsewhere within the aquifer · Change to the site's hydrology through breaching of the dam wall · Alien fish stocking · Vegetation clearance on-site and in surrounding areas · Vehicle and Recreational use at the site · Weeds · Animal and plant diseases and pathogens · Duck hunting · Climate change	NP=100%	56

Appendix 2. Locations of priority natural assets

Biodiversity Natural Assets

This section shows best available information on the range of priority biodiversity assets in northern Tasmania. The assessed priority for each species shown in these figures reflect modelled priorities only and does not capture additional considerations such as tenure used in the final assessment of the susceptibility of the natural asset to the various types of emergency events.

Threatened species

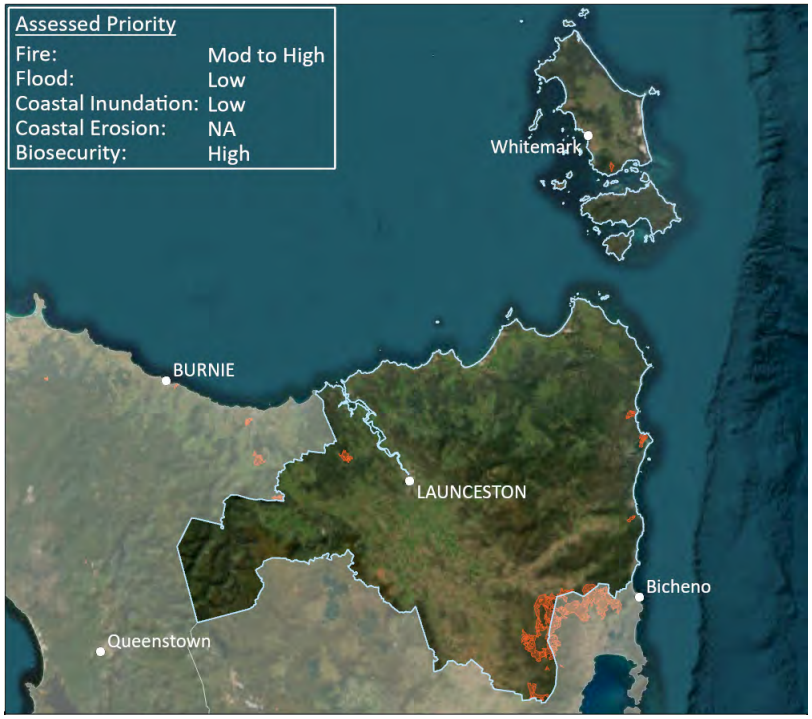

FIGURE 6: **Species range in northern Tasmania: Swift parrot (*Lathamus discolor*)**

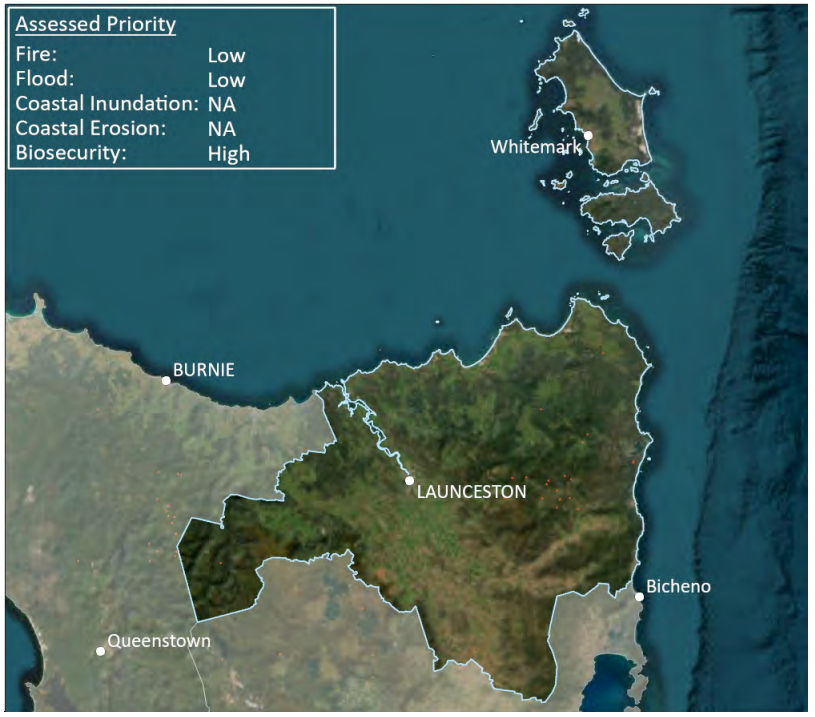

FIGURE 7: **Species range in northern Tasmania: Eastern quoll (*Dasyurus viverrinus*)**

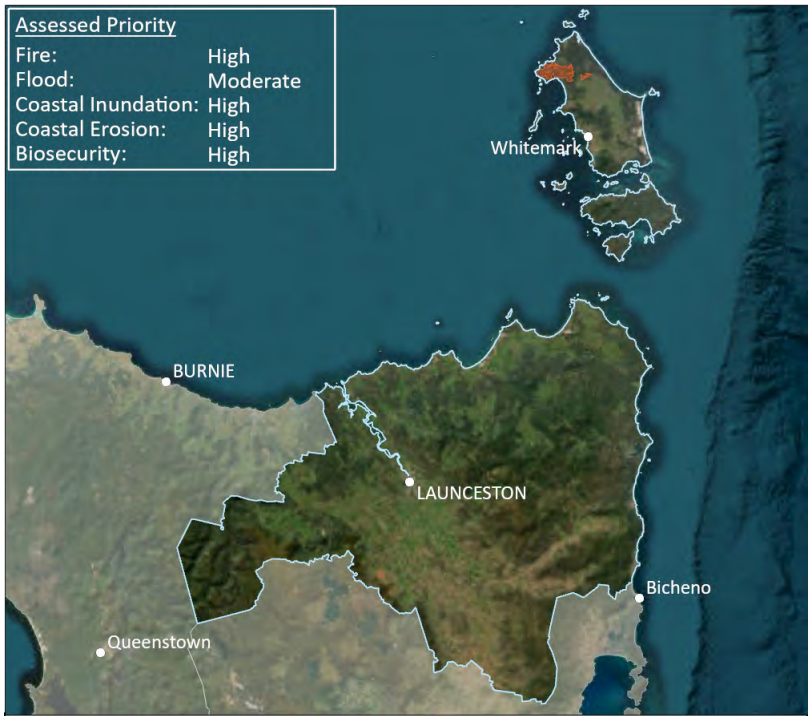

FIGURE 8: **Species range in northern Tasmania: New Holland mouse (*Pseudomys novahollandiae*)**

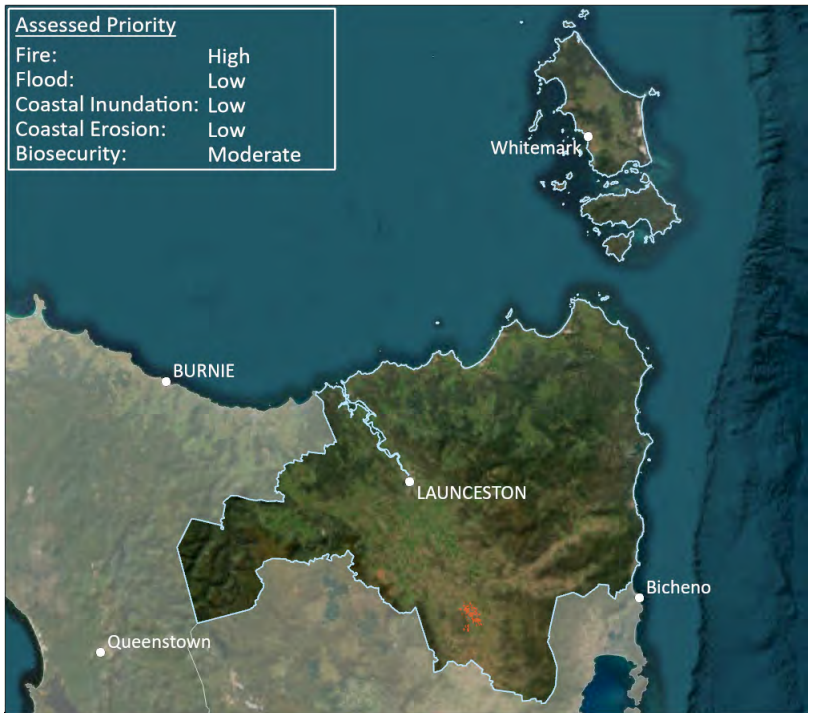

FIGURE 9: **Species range in northern Tasmania: Graveside leek-orchid (*Prasophyllum taphanyx*)**

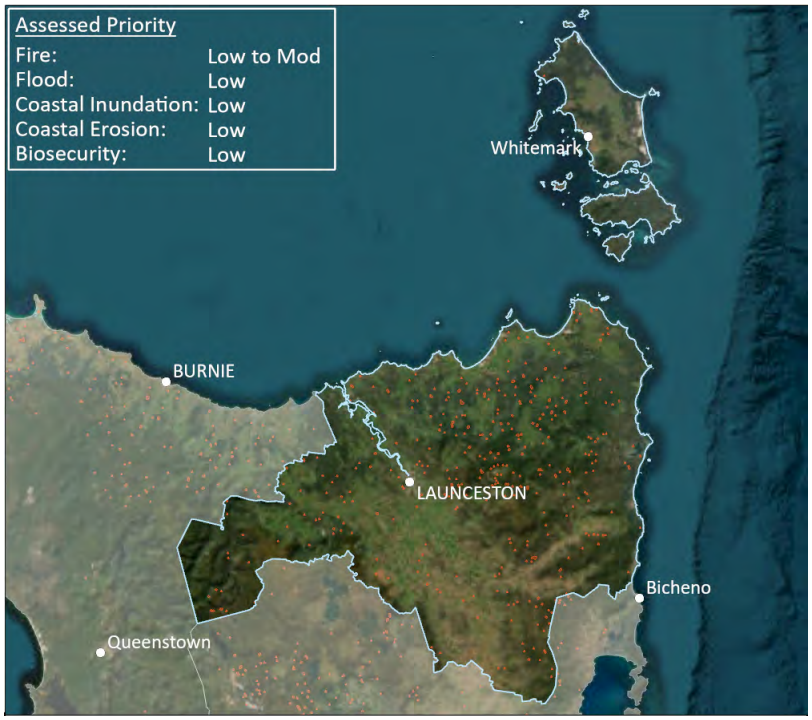

FIGURE 10: **Species range in northern Tasmania: *Aquila audax fleayi***
Wedge-tailed eagle

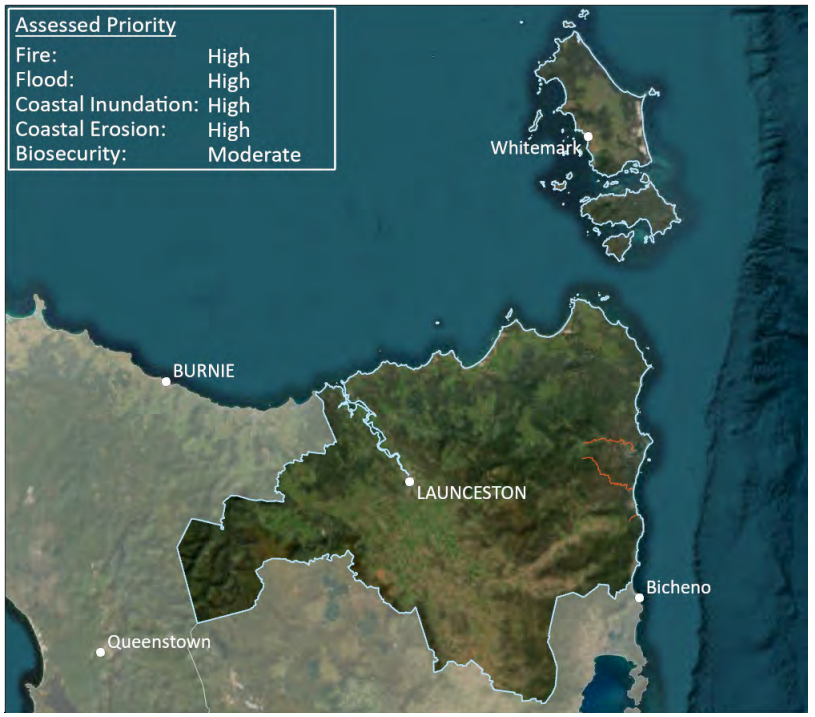

FIGURE 11: **Species range in northern Tasmania: *Phebalium daviesii***
Davies' wax flower

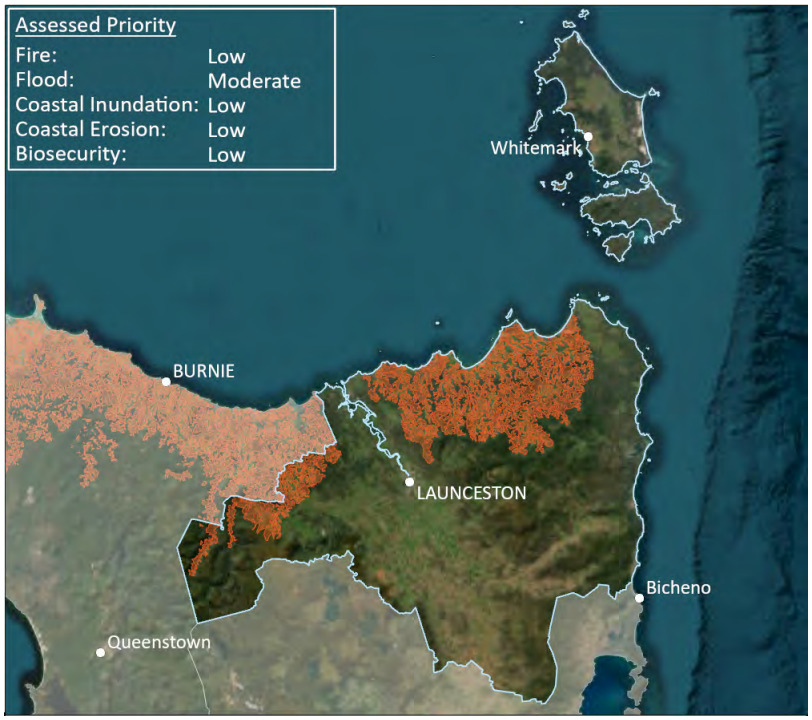

FIGURE 12: **Species range in northern Tasmania: *Astacopsis gouldi***
Giant freshwater crayfish

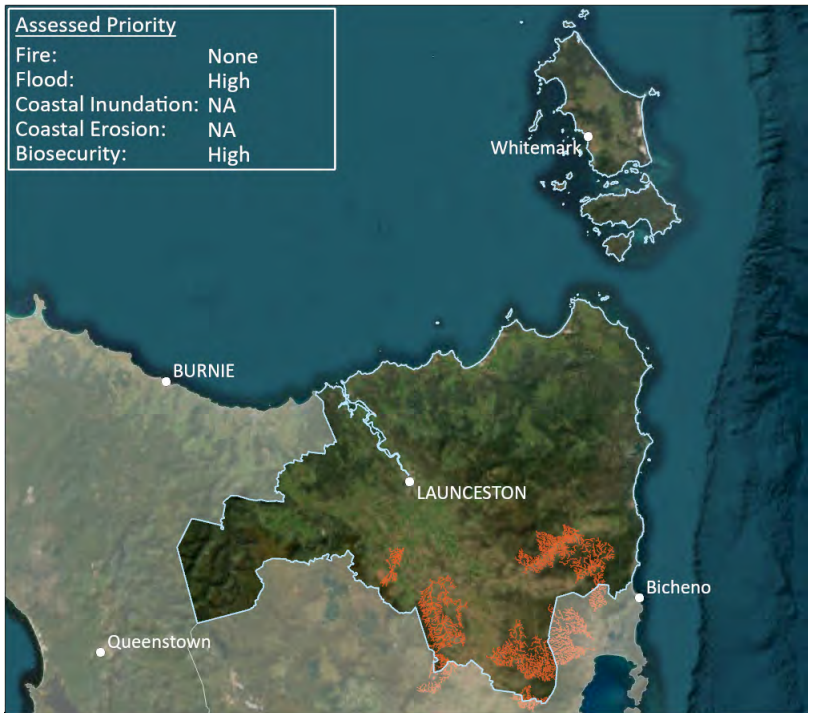

FIGURE 13: **Species range in northern Tasmania: *Galaxias fontanus***
Swan Galaxias

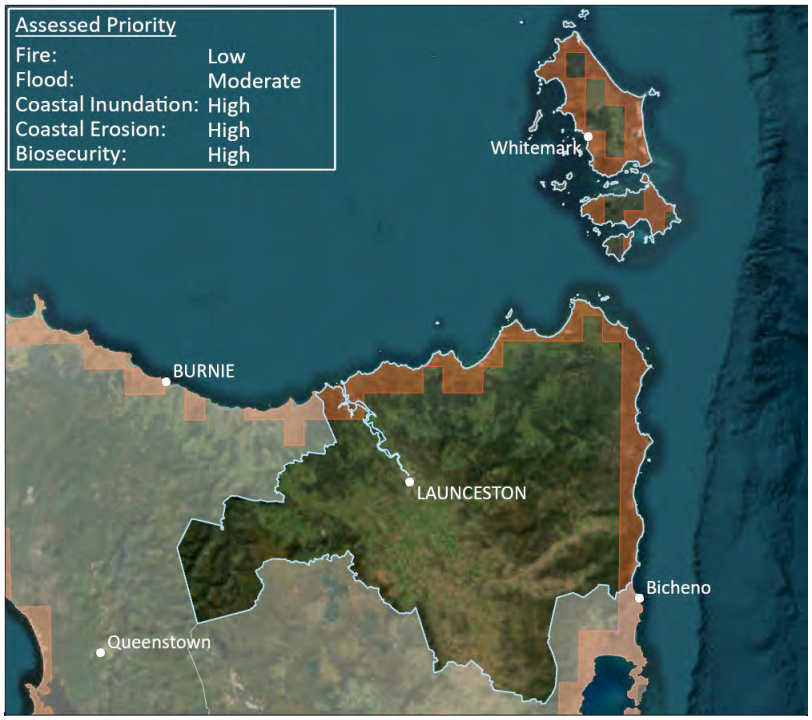

FIGURE 14: **Species range in northern Tasmania: *Thinornis cucullatus cucullatus* Hooded plover**

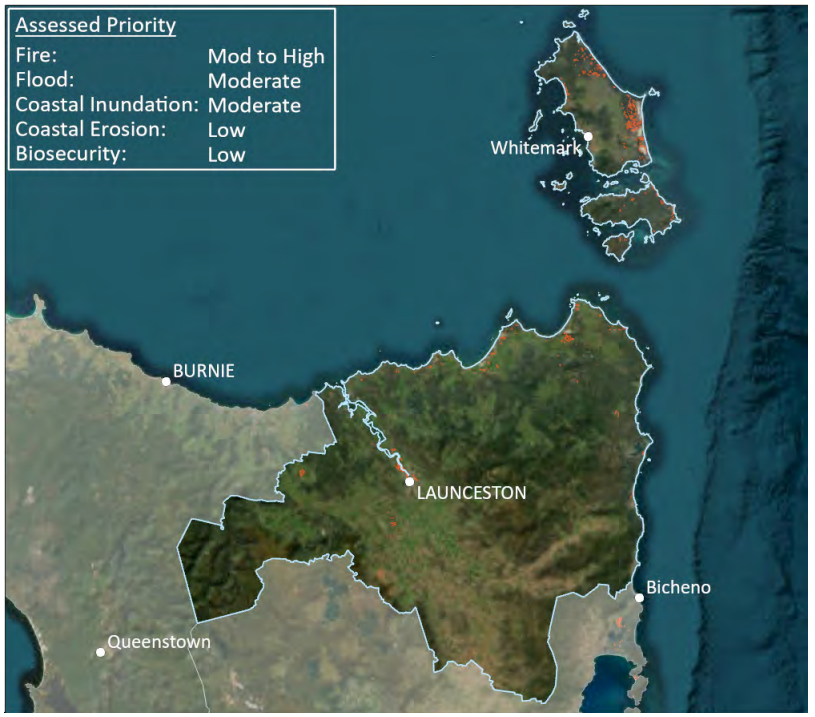

FIGURE 15: **Species range in northern Tasmania: *Botaurus poiciloptilus* Australasian Bittern**

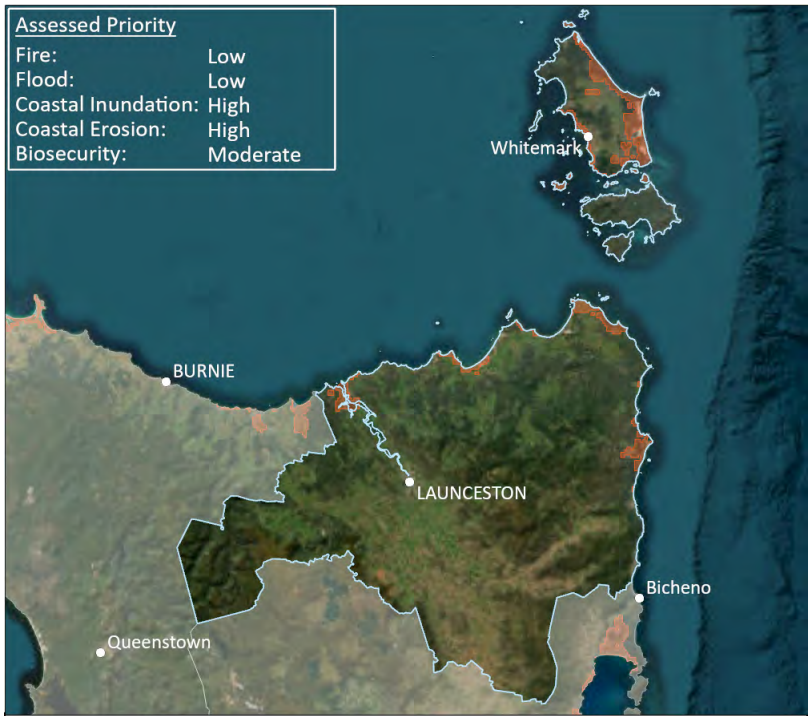

FIGURE 16: **Species range in northern Tasmania: *Numenius madagascariensis* Eastern curlew**

FIGURE 17: **Species range in northern Tasmania: *Litoria raniformis* Green and gold frog**

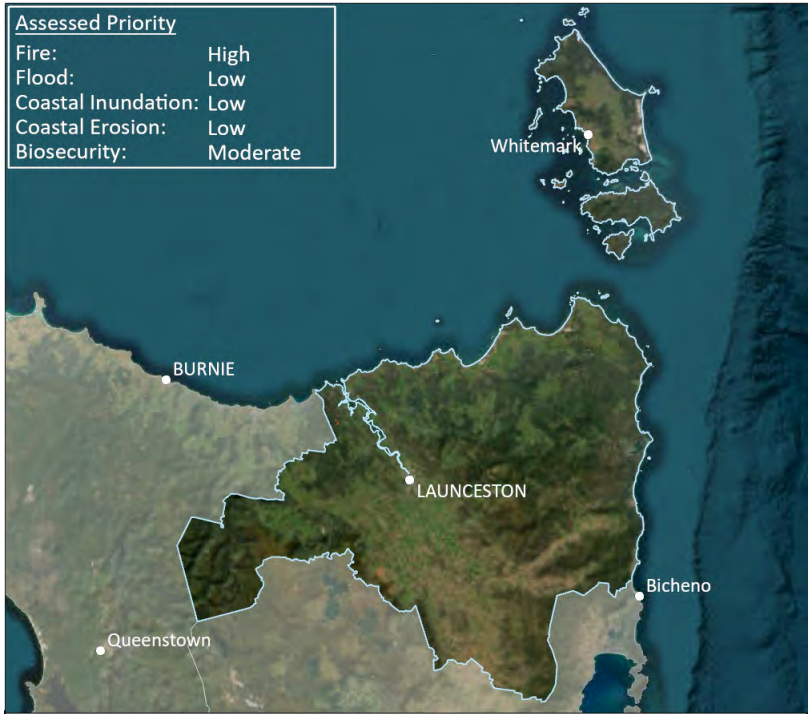

FIGURE 18: **Species range in northern Tasmania: *Tetratheca gunnii* Shy Susan**

Threatened ecological communities

FIGURE 19: **Range in northern Tasmania: Lowland native grasslands of Tasmania (Threatened ecological community)**

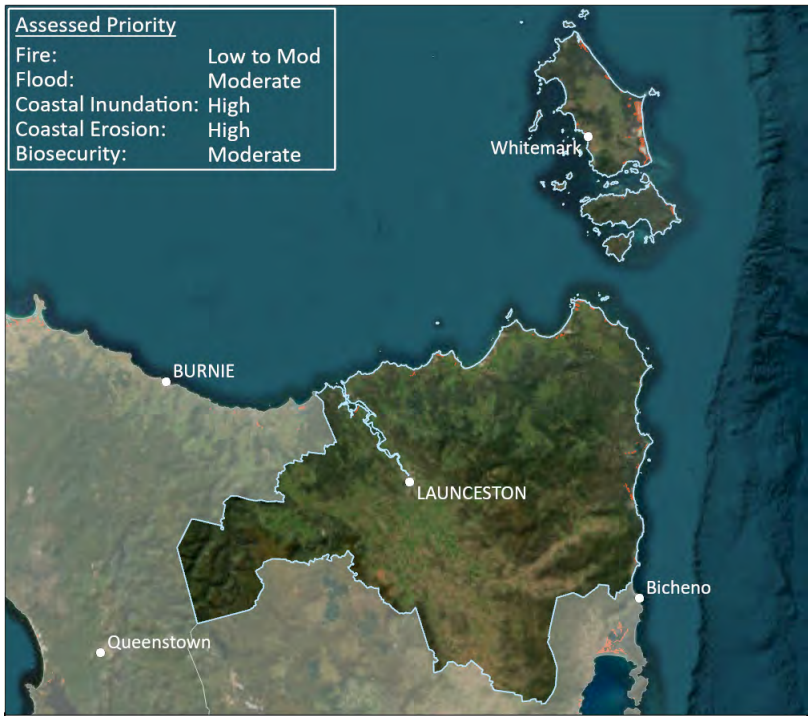

FIGURE 20: **Range in northern Tasmania: Subtropical and Temperate Coastal Saltmarsh (Threatened ecological community)**

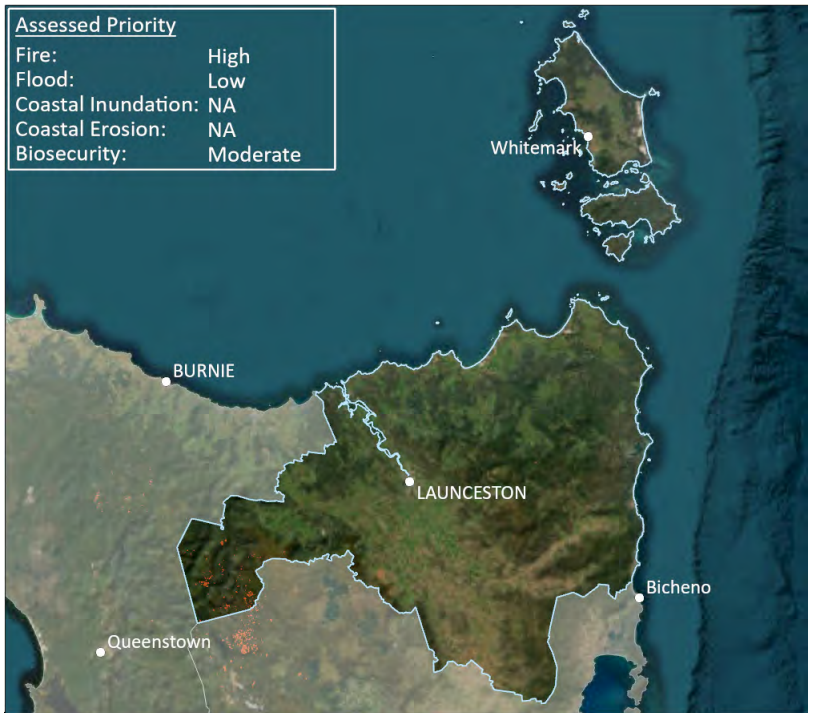

FIGURE 21: **Range in northern Tasmania: Alpine sphagnum bogs and associated fens (Threatened ecological community)**

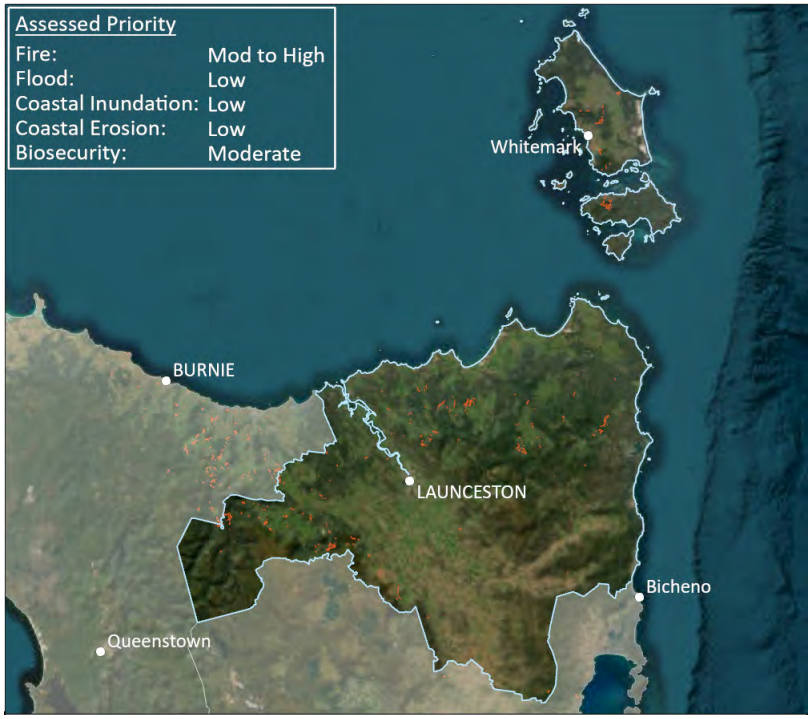

FIGURE 22: **Range in northern Tasmania: Tasmanian white gum (*Eucalyptus viminalis*) wet forest (Threatened ecological community)**

FIGURE 23: **Range in northern Tasmania: Eucalyptus ovata (*Callitris oblonga*) forest (Threatened ecological community)**

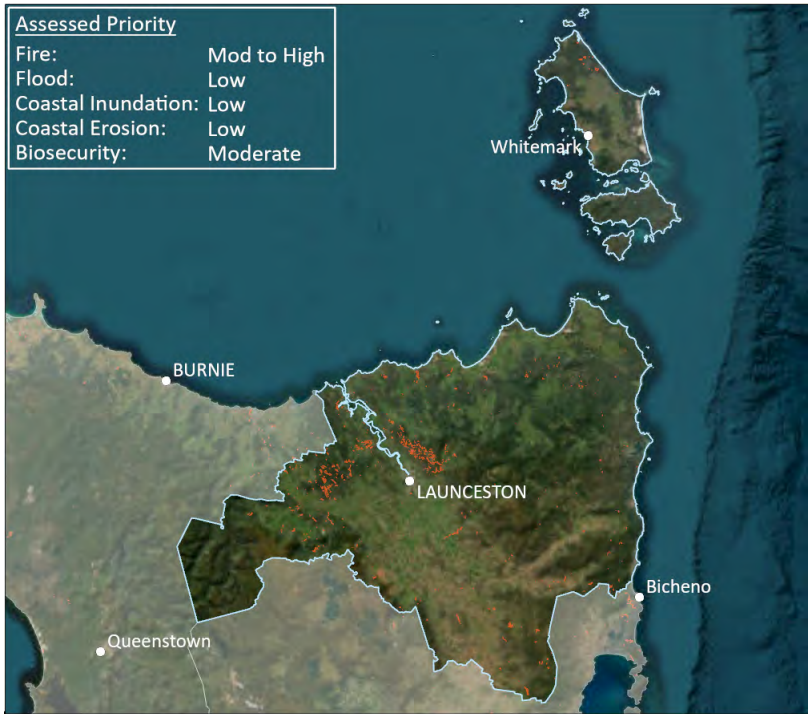

FIGURE 24: **Range in northern Tasmania: *Eucalyptus ovata / Eucalyptus brookeriana* forests and woodlands (Threatened ecological community)**

Ramsar wetlands

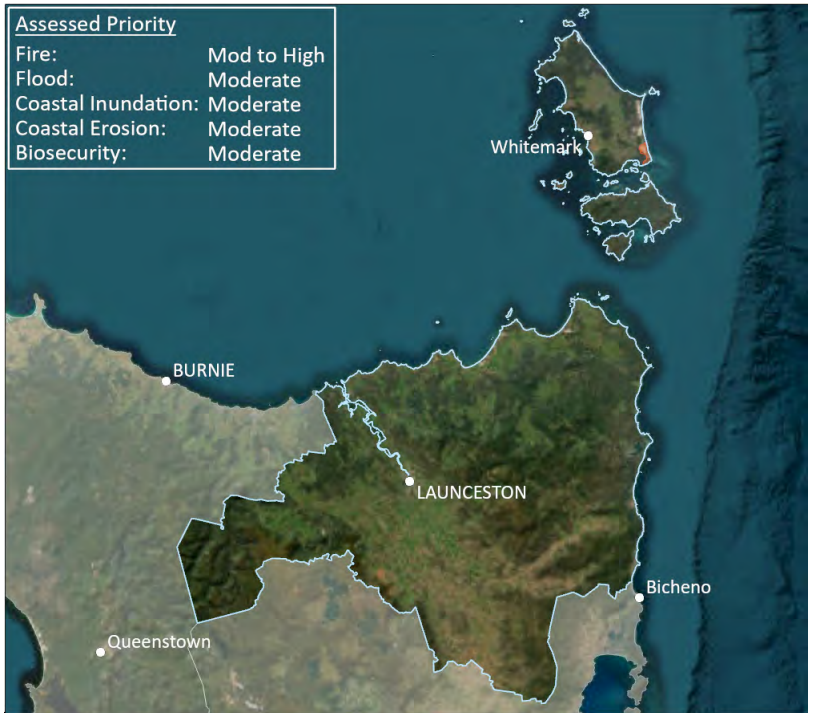

FIGURE 25: **Location of Ramsar wetland: Logan Lagoon**

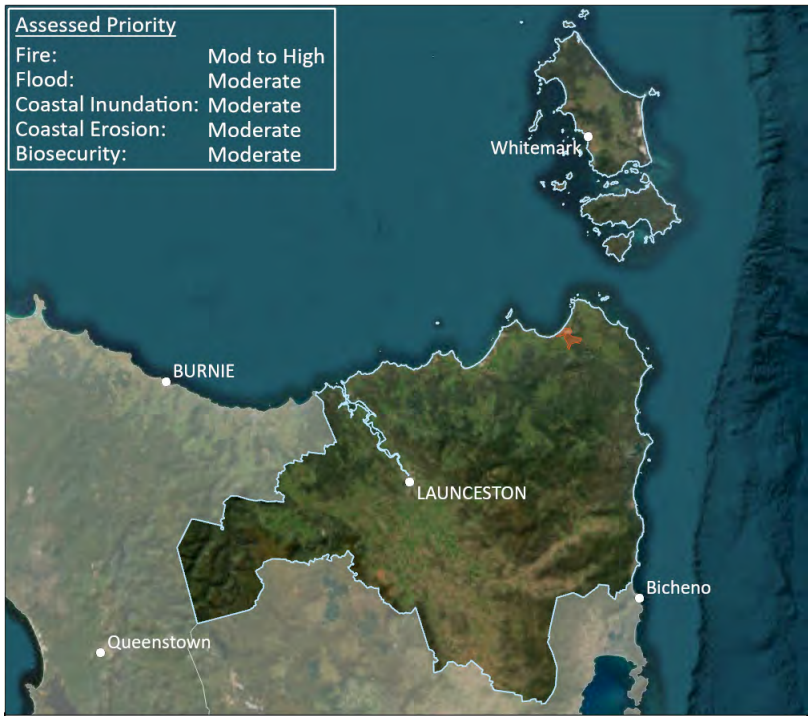

FIGURE 26: **Location of Ramsar wetland: Floodplain Lower Ringarooma River**

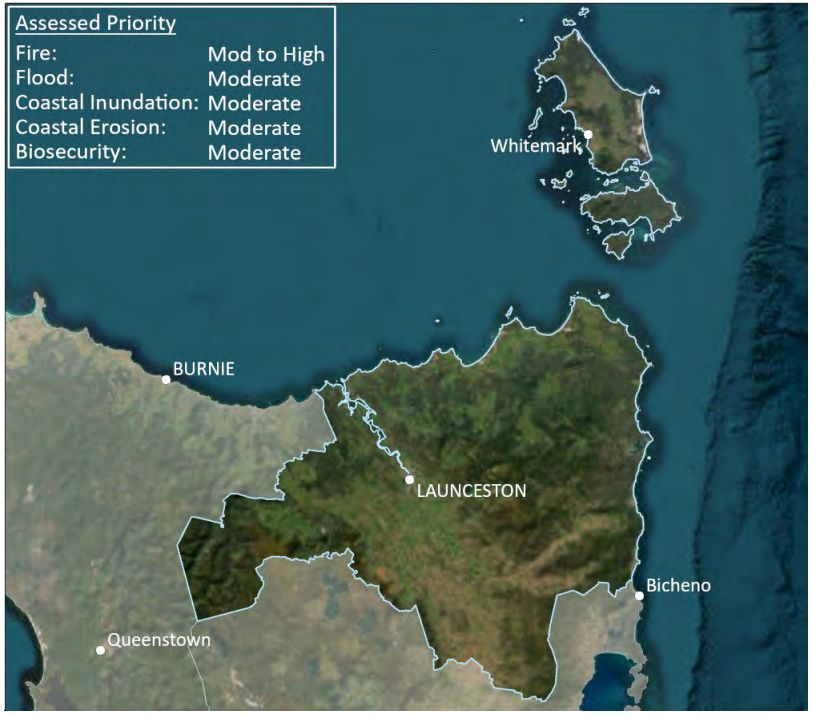

FIGURE 27: **Location of Ramsar wetland: Jocks Lagoon**

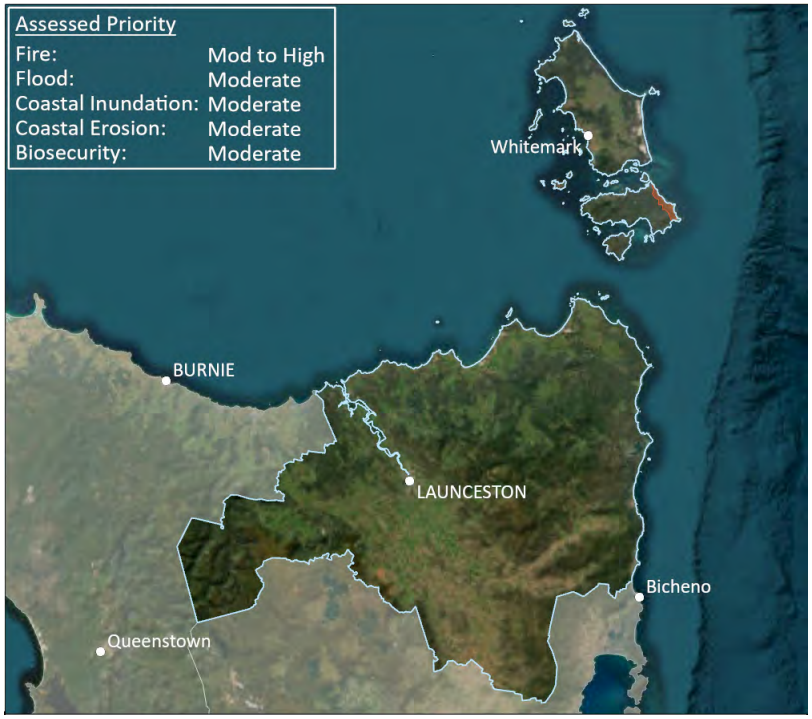

FIGURE 28: **Location of Ramsar wetland: East Coast Barren Island Lagoons**

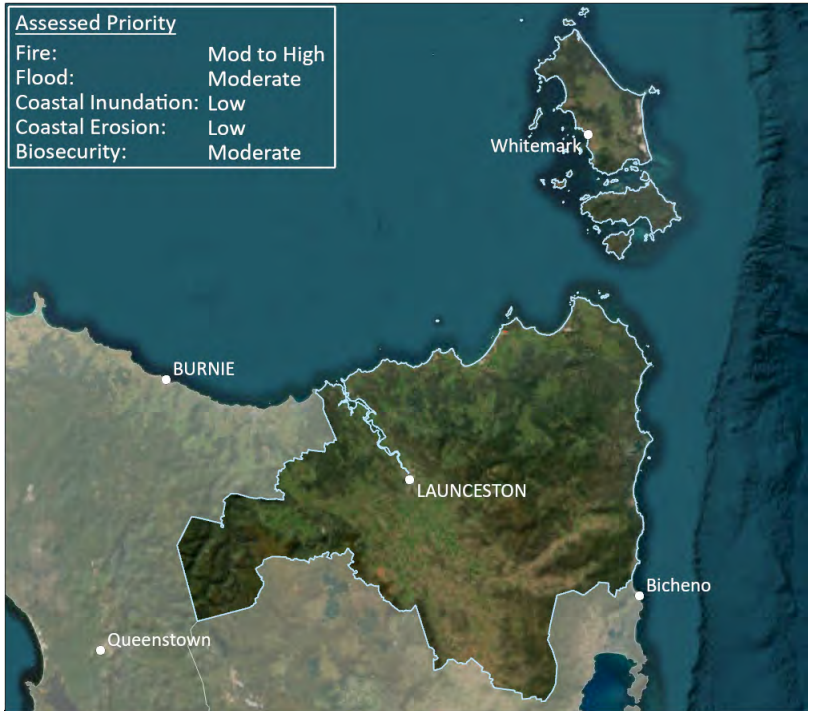

FIGURE 29: **Location of Ramsar wetland: Little Waterhouse Lake**

Other regional priorities

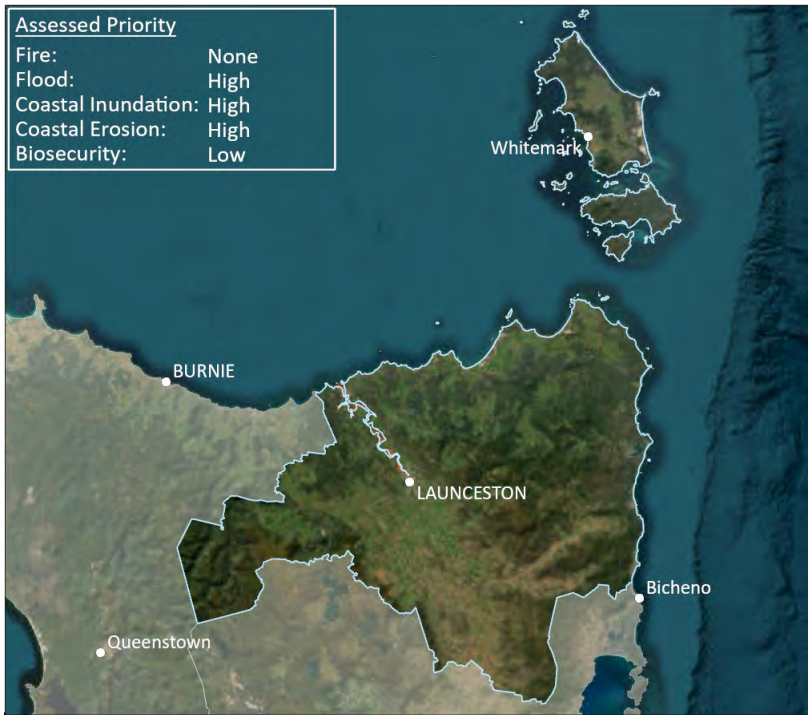

FIGURE 30: **kanamaluka / Tamar estuary (Regional priority)**

Agricultural Natural Assets

This section contains maps showing the location of key agricultural natural assets.

FIGURE 31: **Remnant native riparian vegetation in northern Tasmania**

FIGURE 32: **Remnant native vegetation in northern Tasmania**

FIGURE 33: **Floodplains in northern Tasmania**

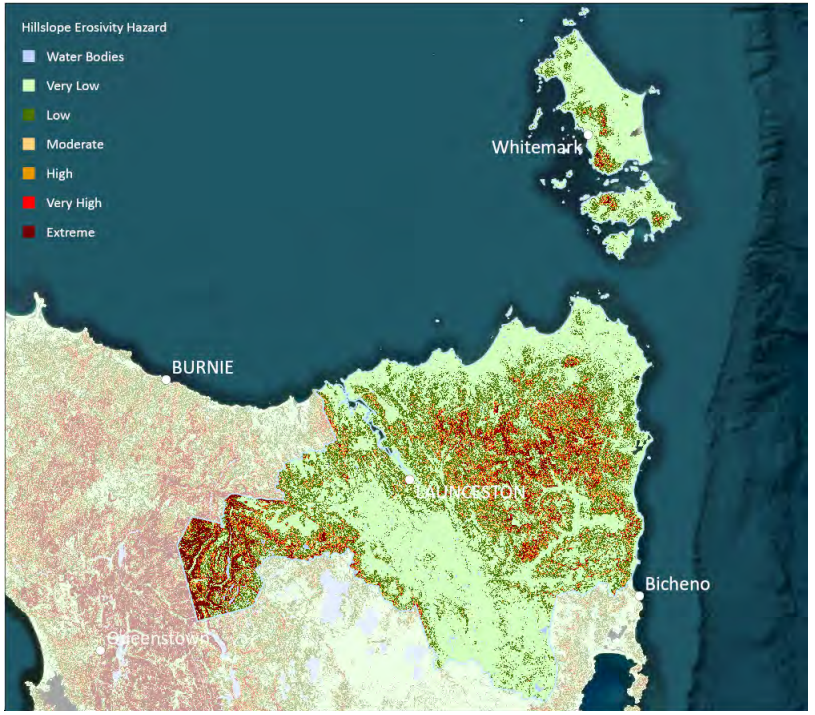

FIGURE 34: **Hillslope (hillslope erosivity) in northern Tasmania**

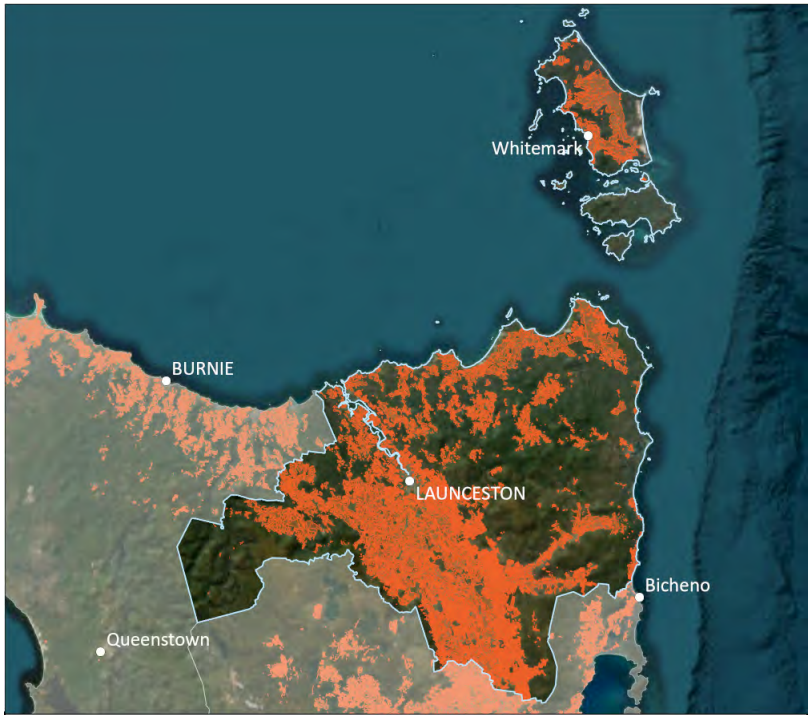

FIGURE 35: **Agricultural soils in northern Tasmania**

Appendix 3: Acronyms

BBIMAG	Bell Bay Industrial Mutual Aid Group
BRMP	Bushfire Risk Management Plan
CWA	Country Womens Association
DPAC	Department of Premier and Cabinet
DPAC (RRT)	Department of Premier and Cabinet (Resilience and Recovery Tasmania)
EMCs	Emergency Management Committees
EPA	Environmental Protection Authority
EPBC	*Environment and Biodiversity Conservation Act 1999* (C'wlth)
ESRI	Environmental Systems Research Institute
FIAAI	Flinders Island Aboriginal Association Inc.
FMA	Fire Management Area
FMACs	Fire Management Area Committees
GFC	Giant Freshwater Crayfish
GIS	Geographic Information System
LGA	Local Government Area
MCEM	Ministerial Committee for Emergency Management
MEMC	Municipal Emergency Management Committee
NGOs	Non-Government Organisations
NHT	Natural Heritage Trust
NRE	Department of Natural Resources and Environment
NRM	Natural Resource Management
REMC	Regional Emergency Management Committee
SEMC	State Emergency Management Committee
SES	Tasmanian State Emergency Service
TEC	Threatened Ecological Community
TEER	Tamar Estuary and Esk Rivers Program
TFS	Tasmania Fire Service
THS	Tasmanian Health Service
TPWS	Tasmania Parks and Wildlife Service
TEMA	Tasmanian Emergency Management Arrangements
TWWHA	Tasmanian Wilderness World Heritage Area
WAF	Weeds Action Fund

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