Our Living Environment

Biodiversity Strategy 2021-2027

Livingstone SHIRE COUNCIL

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Acknowledgement

Council acknowledges the Traditional Country of the Darumbal and Woppaburra Peoples and the Barada Kabalbara and Yetimarala Peoples of the lands and seas of the Livingstone Shire, and recognises that these have always been places of cultural, spiritual, and social significance. Council also recognises the Shire is now home to many other Aboriginal and Torres Strait Islander peoples who make up our vibrant communities. We wish to pay respect to their Elders – past, present and future, and acknowledge the important role the Darumbal and Woppaburra peoples and Barada Kabalbara and Yetimarala peoples, and other Aboriginal and Torres Strait Islander peoples continue to play within the Livingstone Shire community.

Council wishes to thank all contributors and stakeholders involved in the development of this document.

This strategy has been developed with contributions from;

Alistair Melzer
Allan Briggs
Christine Fraser
Michael Hewson (Central Queensland University)
Ian Denley (Denley Environmental)
Alison Adair (Department of Resources)
Kirsten Muir (Bat Care Capricornia)
Jeff Simmons
Joel Fostin
Leo Daniel (Department of Resources)
Nick Smith (Livingstone Shire Council)
Paddy Delalande (Livingstone Shire Council)
Neil Kershaw (Queensland Parks and Wildlife Service Partnerships - Department of Environment and Science)
Ross Lanyon
Fitzroy Basin Association
Queensland Fire and Emergency Services
Julieanne Blake (Wetlands Unit - Department of Environment and Science)
EcoSure
Darumbal Enterprises Pty Ltd
Darumbal People Aboriginal Corporation RNTBC
Woppaburra Land Trust Executive Committee
Woppaburra Traditional Use of Marine Resources Agreement (TUMRA) Steering Committee
Rebecca Allen (Great Barrier Reef Marine Park Authority)
Eric Vanderduys (CSIRO)

Cover Photo: Greater Glider contributed by Eric Vanderduys

PART A – BIODIVERSITY

Introduction

'Our Living Environment' travels through the landscape of Livingstone Shire, guided by the traditional custodians, as we explore the biodiversity that makes us unique.

In Part A, appreciate the values of our shared natural and cultural heritage and understand the threats that we must manage to preserve and restore these values. Here you can find out why biodiversity is so important in Livingstone Shire.

In Part B, find the biodiversity strategies that will help deliver on the goals of the *Livingstone Community Plan - Towards 2050* and the 'Natural Livingstone' strategies of the *Livingstone Shire Council Corporate Plan 2020-2030*. If you want to find out specifically what Council is planning to do to help conserve biodiversity in the Shire, head straight to the Action Plan.

The vision of Livingstone Shire Council is to partner with traditional custodians and our community to protect, sustainably manage and enhance the natural beauty, landscapes and resources of Livingstone Shire, in order to safeguard the sustainability and environmental resilience of the region into the future.

First, let's define some key concepts for understanding the role of biodiversity in maintaining the natural systems that support our economy and community.

What is Biodiversity?

Biodiversity is the variety and variability of living organisms. It is a measure of biological variation at the genetic, species and ecosystem level. The natural diversity of organisms in a place support the healthy function of ecosystems.

What is an Ecosystem?

An ecosystem includes all the living things (plants, animals and organisms) in a given area, interacting with each other, and with their non-living environment (water, rocks, soil and weather). In an ecosystem, each organism has its own niche or role to play. The organisms in an ecosystem are usually well balanced with their environment, so rapid changes to any of the components of the ecosystem can cause it to break down.

An ecosystem may be defined by its particular characteristics or spatial boundaries, it may be as large as the Great Barrier Reef or as small as a tidal pool, that provides a home for plants and animals. Ecosystems provide many services to support our communities and economy, including; food, healthy soil and habitats, clean air and water.

What is a Habitat?

A habitat is where a species of organism lives. It is the natural environment of that species. Habitats may be described by their geographical area and by a specific site (e.g. a rotten log or a hollow tree). The habitat of a species provides the shelter, food and breeding opportunities for that plant or animal to survive and thrive. For some species their habitat is naturally restricted and so they are vulnerable to habitat loss or change.

What is the Carbon Cycle?

Carbon is an essential element to all living things on earth. It is also found in our atmosphere in the form of carbon dioxide (CO_2), it is a key ingredient in the food that sustains us and provides a major source of the energy we use to fuel our global economy.

The carbon cycle describes the process in which carbon atoms continually travel from the atmosphere to the Earth and then back into the atmosphere. Since our planet and its atmosphere form a closed environment, the amount of carbon in this system does not change. Where the carbon is located — in the atmosphere or on Earth — is changing.

On Earth, most carbon is stored in rocks and sediments, while the rest is located in the ocean and in living organisms. These are the reservoirs, or sinks, through which carbon cycles. Carbon is released back into the atmosphere when organisms die, volcanoes erupt, fires blaze, fossil fuels are burned, and through a variety of other mechanisms.

Humans play a major role in the carbon cycle through activities such as the burning of fossil fuels or land development. As a result, the amount of carbon dioxide in the atmosphere is rapidly rising; it is already considerably greater than at any time in the last 800,000 years. (www.climate.gov)

Based on extensive research, the atmospheric science consensus indicates that the rise in CO_2 corresponds with a general warming on a whole-of-Earth basis. The way the extra heat is being redistributed around the globe is changing the weather patterns and ocean currents. Finding ways to keep storing carbon and reducing the amount going into the atmosphere will be key to future climate stability.

What is a Catchment?

A catchment is an area where water is collected by the natural landscape. In a catchment, all rain and run-off water eventually flows to a creek, river, lake or ocean, or into the groundwater system. Natural and human modified systems such as rivers, bushland, farms, dams, homes, plants, animals and people co-exist in a catchment.

The quality and quantity of water in a creek or river is influenced by the extent of healthy vegetation cover and the way land and water is managed within its catchment. Understanding the impacts of land use practises on downstream environments informs integrated catchment management approaches that can protect the environment from excessive erosion or sedimentation, nutrient or chemical contamination and pest invasion.

Our journey through Livingstone Shire will start in the mountains at the top of our catchments, travel downstream via foothills and plains to the creeks and rivers, past the wetlands and floodplains to the coast. Over sand dunes, headlands and beaches to the marine environment and the offshore islands.

1.0 Darumbal Country
Mayimbagu Darumbal nunthi

Welcome to Darumbal country. Traditional Custodians—the Darumbal people— welcome you to their country and ask that you respect and enjoy this special area.

For more than 60,000 years, Darumbal people have lived on this country, thousands of generations living in balance with nature, developing a detailed understanding of the landscape and the diverse plants and animals.

Traditional custodians have cultural relationships with places, plants and animals. Language and cultural practice reflects the importance of wildlife as a source of food and materials. The expert knowledge of indigenous people about medicinal plants and treatments for foods that would otherwise be toxic is an example of the traditional science. There is an opportunity to integrate traditional knowledge and modern science, in order to better manage the natural environment.

Darumbal people understand the connections between living organisms and the landscape. Traditional custodians respect and protect knowledge of and responsibility for country. Deep connections of people and wildlife to the land and sea are expressed through stories, songs, dances and artwork. Darumbal knowledge is shared in this document. The cultural values of looking after country are a guide for ongoing stewardship of our natural resources.

By maintaining their language, Darumbal people are taking control of their cultural identity, thus maintaining the age old tradition of passing on cultural knowledge to their descendants.
If you would like to know about Darumbal Language Education programs, more about the Darumbal language or are interested in seeking permission to use a Darumbal word within your workplace or school please contact the Darumbal People Aboriginal Corporation Registered Native Title Body

Darumbal People Aboriginal Corporation Registered Native Title Body (DPAC RNTBC) is a non-profit organisation that acts on behalf of Darumbal people. We take real action for the benefit of our people. We promote our culture, our language and customs. We are advocates for traditional land management and are the traditional custodians of Darumbal country.

In 2018, Darumbal Elders Aunty Nicky Hatfield & Aunty Sally Vea Vea worked with State and local government to have the names of Jim Crow Mountain and Mount Wheeler changed back to their original Darumbal names of Baga (Jim Crow Mountain) and Gai-i (Mount Wheeler).

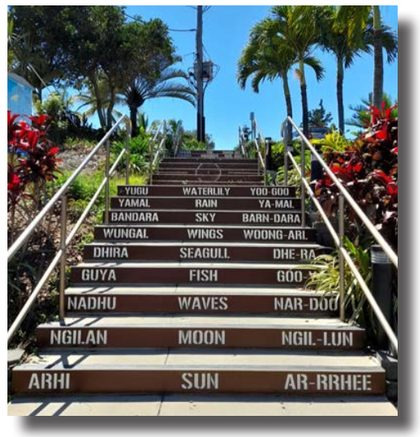
Other places with Darumbal names

Yeppoon Yipun
Mt Hedlow Kulli / Karara
Marlborough Wandu Wangin
Mt Jim Crow Baga
Mt Wheeler Gai-i
Byfield Danamal

General Darumbal words

Hello Gudamulli
Goodbye Yaman Dyangu
Red Min Min
Yellow Bagari
Kangaroo Wura
Emu Gundalu
Yes Yuwi
No Yama
Respect Yadaba

The Darumbal language has been passed down from generation to generation and will continue to do so.



2.0 Climate and Bioregional Influences

Values	Threats
Liveability	Extreme Events
Water Security	Accelerated Erosion
Climate	Changes to Distribution of Plants and Animals
Refugia	Drought
Unique Ecosystems	Intense and Frequent Fires
Recreation	Heat Waves
Scientific and Educational Values	Sea Level Rise
Resilient Ecosystems	

What makes Livingstone Unique?

The climate and the geological history of the Livingstone Shire has a major influence on the biodiversity we find today. The Tropic of Capricorn passes through and intersects the path of the Fitzroy River as it flows toward the Pacific Ocean. We are in the climatic zone generally called subtropical. The Australian Bureau of Meteorology classifies the climate of Livingstone Shire as within the summer dominant seasonal rainfall zone and the warm/hot humid summer thermal zone. The Shire has different climatic conditions from east to west; eastern coastal land has no dry season, while the western portion has a moderately dry winter.

The overlapping climatic conditions give rise to different conditions for the soil, plants and animals to interact with and so we support incredible biodiversity in Livingstone Shire.

Biodiversity is also influenced by 'local weather' where parts of the landscape experience different weather. For example, the topography of the land and the prevailing south-easterly winds produce coastal showers. Byfield receives almost 700 mm more rainfall on average than Yeppoon, with average monthly rainfall significantly higher from January through to March, allowing for the development of wetter rainforest vegetation.

YEPPOON'S TEMPERATURE AVERAGES

ANNUAL AVERAGE MAXIMUM IS 25.9 ^{0}C
HIGHEST RECORDED (28/11/2018) AT 42.2^{0}C
AVERAGE MINIMUM IS 18.7^{0}C
LOWEST RECORDED (25/7/1995) AT -0.1^{0}C
WINTER AVERAGE MAXIMUM IS 22^{0}C
SUMMER AVERAGE MAXIMUM IS 29^{0}C
WINTER AVERAGE YEARLY MINIMUM IS 13^{0}C
SUMMER AVERAGE YEARLY MINIMUM IS 22^{0}C
TEMP ABOVE 30^{0}C ON 30 DAYS A YEAR

YEPPOON'S RAINFALL AVERAGES

ANNUAL AVERAGE RAINFALL IS 978.9 MM
HIGHEST RECORDED IS 1851 MM IN 2010
LOWEST RECORDED IS 488 MM IN 2002
AVERAGE NUMBER OF DAYS IN A YEAR WHEN RAINFALL ABOVE 25 MM IS 11 DAYS

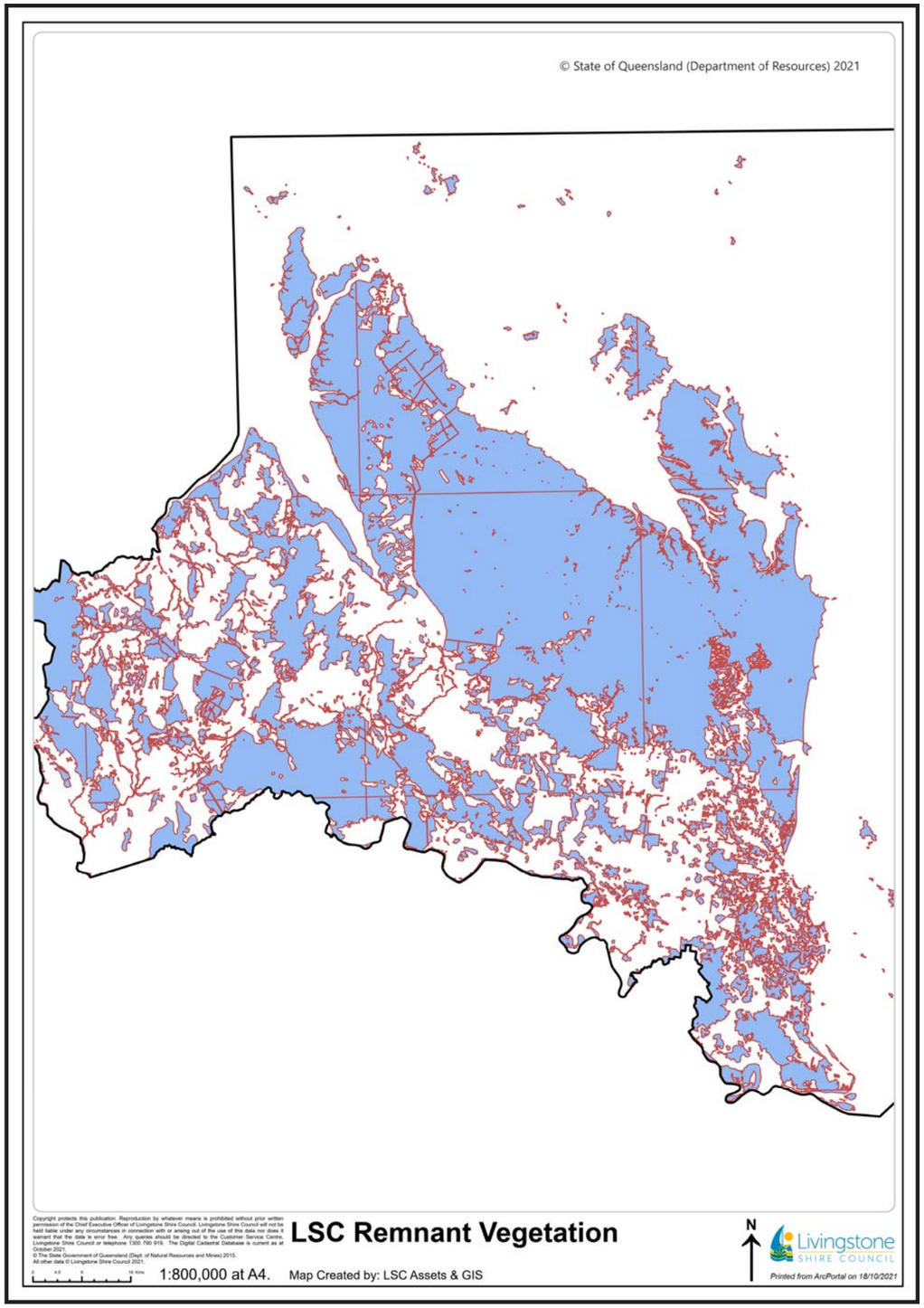
The biodiversity of Livingstone Shire is affected by extreme weather events, such as tropical cyclones, convective storms, drought duration, heatwaves and surface water flooding. These natural events have positive impacts for environmental processes as well as causing negative impacts through wildlife deaths and damage to existing habitats. Positive effects can be seasonal flooding to fill wetlands and recharge groundwater, re-distribution and replenishment of sand and shell deposits, introduction of dynamic processes and nutrient cycling.

These extreme events can be detrimental when the natural environment is already degraded and natural recovery is inhibited. The resilience of biodiversity to extreme disruptions is influenced by landscape characteristics such as; how much moisture the soil holds; if the groundwater has been replenished; the presence of weeds; the temperature of the land surface; rates of evaporation and forest fire danger ratings.

Bioregions and Regional Ecosystems

The Queensland Herbarium has identified thirteen bioregions for Queensland and Livingstone's boundaries are situated within the Central Queensland Coast and Brigalow Belt bioregions.

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. Each regional ecosystem is given a three part code, e.g. 11.11.4. The first part refers to the bioregion; Central Queensland Coast (8) or Brigalow Belt (11). The second part refers to the land zone that the regional ecosystem occurs on. The third part is the ecosystem number and denotes different vegetation. Remnant Vegetation mapped for the Shire is shown in the following map.



Geology of Livingstone Shire

Livingstone Shire has a diverse and interesting geology that is reflected in the distinctive landforms, soils and flora of the area. Much of the geological history of central Queensland is explained in terms of continental plate tectonics over the last 400 million years. Eastern Australia has been on the edge of the Australian continental plate with an oceanic plate subducting westwards. This has led to a history of mountain building through the thrusting and folding of ancient sediments followed by the stretching of basins filling with eroded sediments. Add to this, chains of volcanic islands and deep seated magma intruding into ancient sediments and you have a tumultuous history that is repeated over 200 million years.

Amongst the oldest rocks in Livingstone are the limestone of the Mt Etna and Caves area. 400 million years ago marine sediments were accumulating on the edge of an island arc of volcanoes. Coral reefs fringed this island chain much like the Great Barrier Reef fringes the east coast today. These limestone deposits were buried and only in the recent past have they become exposed on the surface.

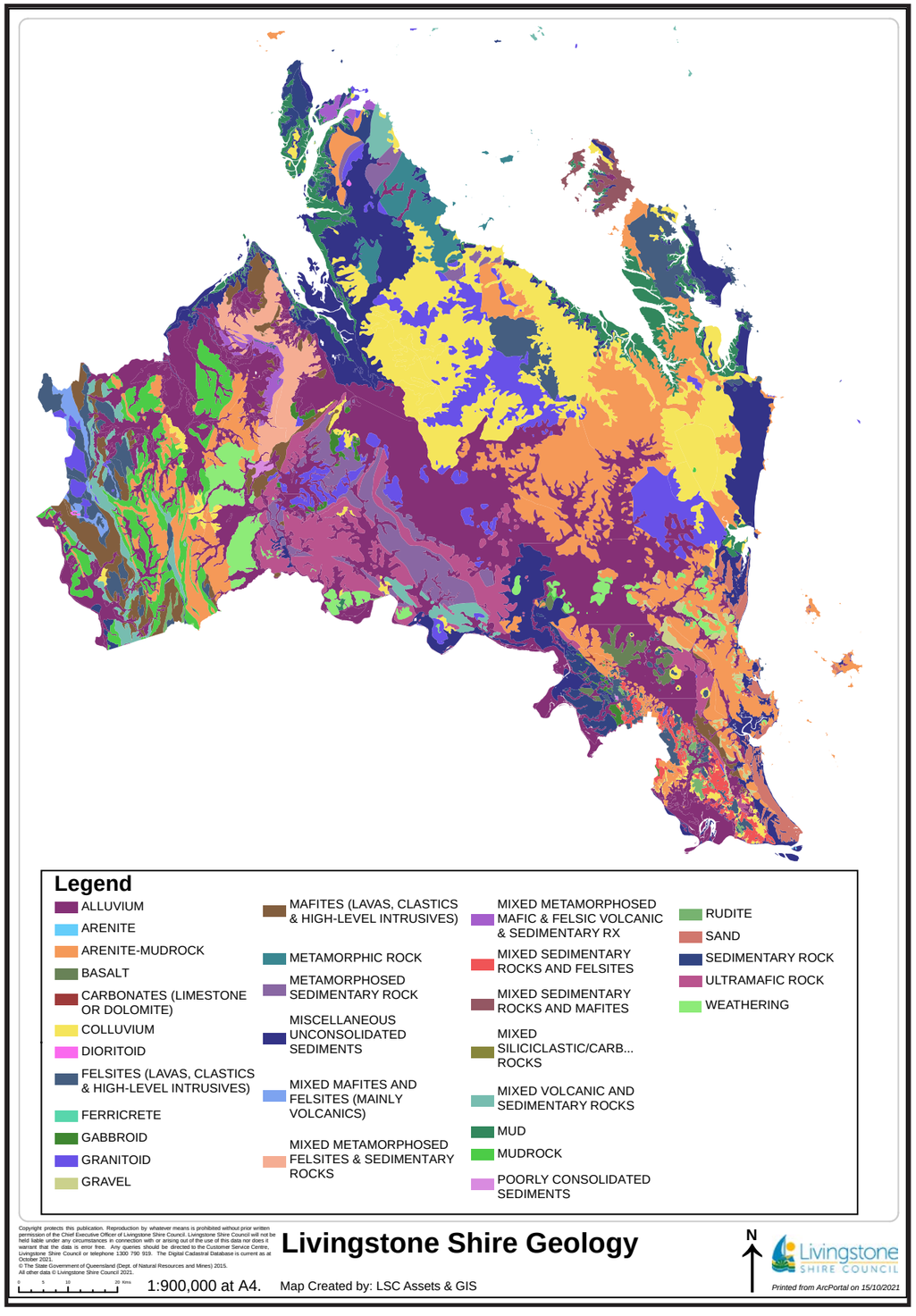
Gravels, sands and muds formed by the erosion of volcanic rocks on the edge of the continent 300 million years ago formed deep sediments. Subsequent burial, metamorphism, faulting and folding has formed the metamorphic rocks seen today in the rocky headlands at Stanage Bay, Emu Park and the Keppel Islands.

To the west, 290 million years ago a major elongate chain of basins started to form and as they subsided deep sediments were deposited on alluvial plains and swamps followed by sea level rise and the deposition of marine sediments. This repeated history of alluvial and marine sediments accumulating over 70 million years in a sinking basin has helped form the well known Bowen Basin with its iconic coal deposits. Meanwhile to the east a period of continental compression resulted in old oceanic crust rocks being deeply metamorphosed into serpentinites. These dark green rocks form a distinctive band from Cawarral in the south to Marlborough in the north. High levels of nickel and chromium give rise to distinctive soils which have been colonized by a characteristic and specialized flora.

During periods of continental compression parts of the continental crust melted generating granite magmas that rose through the crust. They cooled and solidified and now form large oval bodies resisting erosion. The Byfield hills are a good example of this landscape.

Outbursts of volcanic activity 75 million years ago resulted in intrusive plugs and basalt flows. The distinctive trachyte plugs of the Hedlow area and the Capricorn coastline are a great example of volcanic rocks standing tall above today's eroded landscape. Cooling hexagonal columns radiating from the centre of the plug form distinctive patterns as seen at Fan Rock, Double Head and Yeppoon.

The last 20 million years has been a period of erosion forming alluvial floodplains onshore and marine sediments offshore. The Great Barrier Reef started to grow 1.5 million years ago and despite periods of low sea levels during the ice ages of the Quaternary period, still exists today. Coastal processes have accumulated sand into ridges and high dunes that can be seen in the coloured sands of the Byfield National Park.



3.0 Mountains

Values	Threats
Ecological Features and Landforms Wildlife Habitats and Corridors Groundwater Storage Water Catchment Refuge and Shelter Unique Ecosystems Recreation Scenic Amenity Cultural Values Scientific and Educational Values Economic Values of Rock, Minerals, Timber and Water	Mining or Quarries Fire Management Weeds Pest Animals Accelerated Erosion Land Clearing Urban Development Harvesting of Economically Valuable Species Climate Change Impacts (Drought, Fire & Heatwaves)

The hills and mountains of Livingstone support a complex mix of plant communities reflecting the rock and soil type, climate and exposure to wind. These include herbland, grassland, shrubland, woodlands and open forest. Dry rainforest grows in sheltered gullies and creek lines of our mountain ranges and in Byfield a well-developed wet rainforest can be found on the granite hills. The trachyte volcanic plugs on the Hedlow plains, the limestone hills and ridges of Mt Etna and the Caves district, as well as the mountains and ranges of Shoalwater Bay are standout features.

Gawula Aboriginal Land Trust

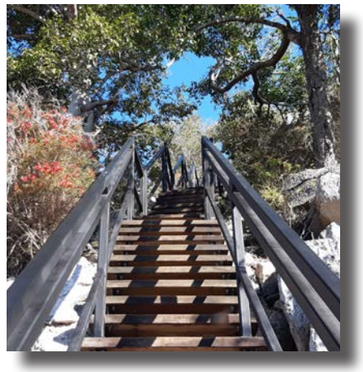
The traditional custodians regained some of their traditional land with the hand back of Gai-i and now the mountain is managed by the Gawula Aboriginal Land Trust.

Darumbal elders hosted the community in a very special walk for Naidoc Week 2021. The walk to the top of Gai-i was attended by 150 people. First, the elders welcomed the visitors to their land and performed a smoking ceremony, and then Darumbal people guided the walkers to the mountaintop. The panoramic views from the mountain are stunning and it is a privilege to be invited by the traditional custodians to experience this special place.

Limestone Hills of Mt Etna and The Caves Area

Guano mining early in the 20th Century occurred in a number of caves in the area. It lasted about twenty five years and had a serious damaging effect on bat populations, notably in Johannsen's Cave. Limestone was mined in the area from a number of sites over the years but the single largest mine occurred on the Eastern side of Mt Etna. After years of cave destruction through mining, community pressure led to mine closure and establishment of a National park. This has secured the caves used by bent -winged bats and ghost bats (an endangered species) as well as the plants and animals found on the limestone outcrops. Recent fires in 2018 devastated the area. The damage to plants and animals is still being assessed. Terraced pools in efflux creeks of the area are unique phenomena rarely seen in Australia and their tenure is not secure.

The rare cave fern *(Tectaria devexa var.devexa)*



Mount Etna National Park walkway

Serpentine

The serpentine landscapes have a patchy distribution that extends over 100 km, and covers some 100,000 ha, from just north of Marlborough to near the mouth of the Fitzroy River in the south-east. The landscapes include the Marlborough Hills, Kunwarara, Canoona, Milman, Bondoola and Cawarral, and encompass six RE's (Table 1) in hills and mountains, undulating low hills and rises as well as alluvial plains.

Serpentine Plant *Pimelia leptospermoides*

Marlborough Blue Cycas ophiolitica *(female with seed)*
Endemic plant of Livingstone Shire

Table 1. Regional Ecosystems within the Serpentine Landscape

Reference	Description
8.11.2	Semi-evergreen notophyll to microphyll vine forest, of foothills and uplands on the metamorphosed sediments.
8.12.14	*Eucalyptus drepanophylla* and/or *E. crebra* and/or *E. exserta* and/or *Acacia spirorbis* subsp. *solandri* and/or *Lophostemon confertus* low woodland on islands and headlands, on Mesozoic to Proterozoic igneous rocks, and Tertiary acid to intermediate volcanics
11.3.25 c	*Eucalyptus camaldulensis* or *E. tereticornis* open forest to woodland. Occurs along fringing drainage lines derived from Serpentinite. Riverine wetland or fringing riverine wetland.
11.3.38	*Eucalyptus tereticornis, Melaleuca viridiflora, Corymbia tessellaris* and *Eucalyptus fibrosa* subsp. *fibrosa* tall woodland with a grassy ground layer on alluvial plains and broad drainage lines derived from Serpentinite
11.3.38a	*Melaleuca bracteata* low woodland. Riverine wetland or fringing riverine wetland.
11.11.7	*Eucalyptus fibrosa* subsp. *fibrosa, Corymbia xanthope* woodland on Serpentinite
11.11.21	Semi-evergreen vine thicket on Serpentinite

Five of the six REs within this landscape are listed as of concern or endangered under the Queensland Nature Conservation Act 1992. Plant communities within these landscapes support at least twelve plant species of high conservation significance (Table 2).

High biodiversity values; The Serpentine Landscapes support high biodiversity values including: (1) a large number of plant species of conservation significance; and (2) a high degree of plant species endemism (eight endemic species).

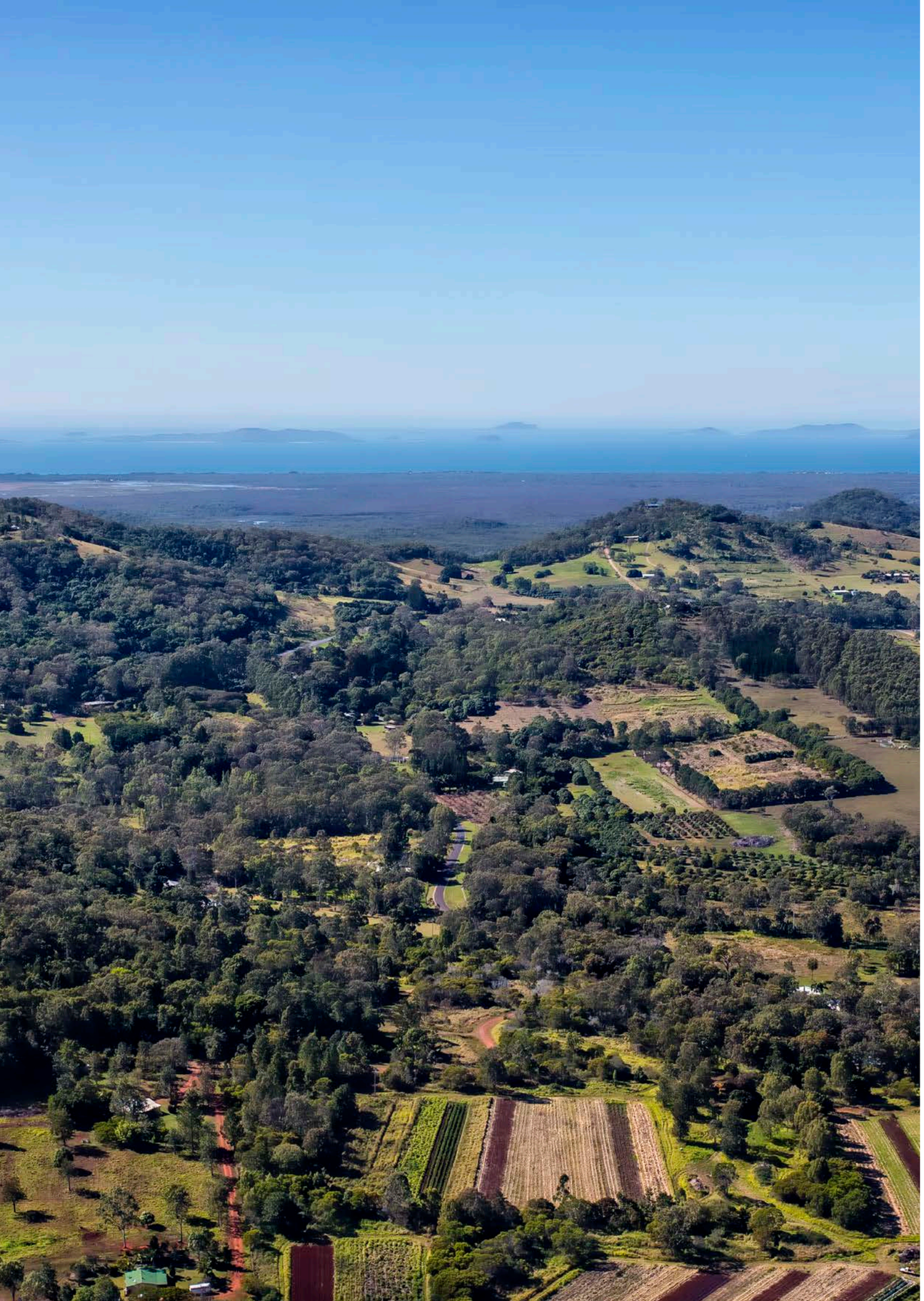
High landscape and geological values; The serpentine landscapes are rare nationally, and the Livingstone Serpentine Landscapes represent the greatest extent in eastern Australia. A 2002 workshop on the Marlborough serpentine landscapes (Exelby et al. 2002) identified three key values of the serpentine landscapes:

1. intactness of the landscape and the conservation values within;
2. the economic values associated with the inherent mineralization of the landscape (although they considered the biodiversity values outweighed the potential economic returns); and
3. the cultural and aesthetic values associated with indigenous communities as well as the contemporary appreciation of landscapes.

Table 2. Plant species of conservation signifigance within the Serpentine Landscapes

Species	Status	Legislation	Notes
Bursaria reevesii	Vulnerable	Qld Nature Conservation (Wildlife) Regulations 2006	Endemic
Capparis thozetiana	Vulnerable	Qld Nature Conservation (Wildlife) Regulations 2006; C'mwlth EPBC Act	Endemic
Corymbia xanthope	Vulnerable	Qld Nature Conservation (Wildlife) Regulations 2006; C'mwlth EPBC Act	Endemic
Cycas ophiolitica	Endangered	Qld Nature Conservation (Wildlife) Regulations 2006; C'mwlth EPBC Act	
Hakea trineura	Vulnerable	Qld Nature Conservation (Wildlife) Regulations 2006; C'mwlth EPBC Act	Endemic
Leucopogon cuspidatus	Vulnerable	C'mwlth EPBC Act	
Macrozamia serpentina	Endangered	Qld Nature Conservation (Wildlife) Regulations 2006	Endemic
Marsdenia brevifolia	Vulnerable	Qld Nature Conservation (Wildlife) Regulations 2006; C'mwlth EPBC Act	
Neoroepera buxifolia	Vulnerable	Qld Nature Conservation (Wildlife) Regulations 2006; C'mwlth EPBC Act	Endemic
Parsonsia larcomensis	Vulnerable	Qld Nature Conservation (Wildlife) Regulations 2006; C'mwlth EPBC Act	
Pimelea leptospermoides	Near threatened; Vulnerable	Qld Nature Conservation (Wildlife) Regulations 2006; C'mwlth EPBC Act	Endemic
Stackhousia tryonii	Near threatened	Qld Nature Conservation (Wildlife) Regulations 2006	Endemic

Extract from Denley and Melzer (2020)



4.0 Foothills and Plains

Values	Threats
Ecological Features and Landforms Wildlife Habitats and Corridors Groundwater Storage Water Catchment Refuge and Shelter Unique Ecosystems Recreation Scenic Amenity Cultural Values Scientific and Educational Values Economic Values of Rock, Minerals, Timber and Water	Mining or Quarries Fire Management Weeds Pest Animals Accelerated Erosion Land Clearing Urban Development Harvesting of Economically Valuable Species Climate Change Impacts

Descending from the mountains, the foothills and plains are the parts of the landscape where people like to live. The cultural heritage of the Darumbal people is found in this landscape such as artefacts and scar trees. In recent times, people have developed their homes, farms and industry in these same areas. Soils are deeper and more fertile here and we find many diverse ecosystems.

Land clearing, agricultural use, water harvesting and urbanisation have extensively modified this environment so wildlife corridors in the landscape are critically important. Biodiversity corridors are areas of natural vegetation that provide habitat and travel paths between the mountains and the habitat on the flats, where animals can access water and food. Waterways and the associated riparian vegetation on the creek banks often provide these wildlife corridors through the landscape.

Foothills and plains are the primary habitat of koalas where their preferred food trees grow on fertile soils beside waterways. Once wide-spread and now rarely seen, this iconic Australian species is under threat due to past hunting, disease and clearing of its habitat. Koalas were hunted by early European settlers for their fur and this trade had a huge impact on their population. Disease also drastically reduced koala numbers and together with broadscale land clearing, koala populations are now listed as Vulnerable under State and Federal legislation.

Did you know?

Koala Research – CQ, formally the Koala Research Centre of Central Queensland, is a community funded research program hosted by CQUniversity. The project receives support and/or funding from a variety of stakeholders, research partners, community partners and individuals. The research group has been operating since 1994.
It was established to support on-going research and to initiate new projects on koala biology, habitat requirements and the effect on koala populations of rural, urban and industrial developments.

In February 2022 the status of the koala was changed from vulnerable to endangered. The change in status means an increased level of protection for koalas in Queensland.

5.0 Rivers and Creeks

Values	Threats
Ecological Features and Landforms	Mining or Quarries
Wildlife Habitats and Corridors	Fire Management
Groundwater Storage	Weeds
Water Catchment	Pest Animals
Refuge and Shelter	Accelerated Erosion
Unique Ecosystems	Land Clearing
Recreation	Urban Development
Scenic Amenity	Harvesting of Economically Valuable Species
Cultural Values	Climate Change Impacts
Scientific and Educational Values	Water Pollution
Economic Values of Rock, Sand and Water	Hydrological Changes
Buffering against Extreme Weather Events such as Storms and Cyclones	

As water flows over the landscape it finds its way into creeks and down into the soil, eventually flowing to a river, lake or ocean. Some of this water stays underground and slowly feeds the rivers in times of low rainfall. Every inch of land forms part of a catchment. Natural and human systems such as rivers, bushland, farms, dams, homes, plants, animals and people co-exist in a catchment.

There are four broad catchments identified for our Shire; known as Fitzroy, Waterpark, Shoalwater and Styx. Within these are the individual creeks flowing into a river or the ocean and into the groundwater system.Shoalwater and Waterpark Catchments are all wholly within the boundaries of the Shire, we share the Fitzroy and the Styx with our neighbouring local government areas.

The Fitzroy River forms the southern and western boundary of the Shire, it is one of the most significant rivers of Queensland. Livingstone shares the Fitzroy River with Rockhampton Regional Council on the opposite bank and at the mouth of the Fitzroy River, Gladstone Regional Council is on the southern bank. Many significant creeks flow into the Fitzroy such as Alligator Creek and Nankin Creek.

Darumbal people know the Fitzroy River as Tunuba. It is of great importance to the traditional custodians and provides the home of very significant wildlife, including barramundi, crocodiles and dolphins. The floodplains of the Fitzroy River also have cultural significance and contain waterholes and lagoons important for the ecology of the River and surrounding habitats.

Shoalwater Catchment, includes Shoalwater Creek (Herbert Creek), the main watercourse draining north into the embayment of Broadsound, and also the smaller creeks draining east of the coast. Waterpark Creek and coastal catchments make up the Waterpark Catchment, this is where most people in Livingstone reside. Waterpark Creek itself arises in the sand dunes of Shoalwater Bay Military Training Area and the Byfield National Park, providing a valuable aquifer that supports the continuous base flow of clean freshwater into Waterpark creek, of the main sources of water supply for the Shire. Waterpark Creek flows to the ocean via Corio Bay.

Other significant coastal creeks flowing east to Keppel Bay include Fishing Creek, Fig Tree Creek, Ross Creek, Cawarral Creek, and Coorooman Creek and Pumpkin Creek. All these creek systems are fed by smaller ephemeral streams that do not flow permanently but turn from a dry gully to a flowing creek during significant rainfall. These drainage lines are a critical part of the catchment and form part of the habitat for fish and aquatic life. The connectivity of these waterways is vital for the passage of fish during flood events and we can easily create waterway barriers when we construct road crossings, dam walls and bunds. Fishways are structures which help fish navigate such constructed barriers, and have been placed at the Waterpark Creek weir and Fitzroy barrage.

Dolphins of the Fitzroy River Estuary

Three species of inshore dolphin are found in the Fitzroy estuary; Australian snubfin dolphin, Australian humpback dolphin, and the Indo-Pacific (inshore) bottlenose dolphin.

Dolphins are long-lived species that are slow to grow and breed, making them vulnerable to impacts and slow to recover.

Australian humpback dolphins are an inshore dolphin found in tropical and subtropical waters in northern Australia and Asia. In southern and central Queensland, humpback dolphins are found in small, isolated populations in enclosed coastal and estuarine waters.

The Fitzroy River estuary and Keppel Bay provide critical habitat for Australian snubfin dolphins. The Fitzroy population is the southernmost extent of the species, and is one of only three known areas where large groups of the dolphins are found. About eighty snubfin dolphins live in the waters at the mouth of the Fitzroy estuary, preferring to stay close to land and the river mouth. The species is of conservation concern and appears to be declining in number.

Both snubfin and humpback dolphins in the Fitzroy Region have accumulated significant industrial contaminants in tissue samples.

What makes a good water supply?

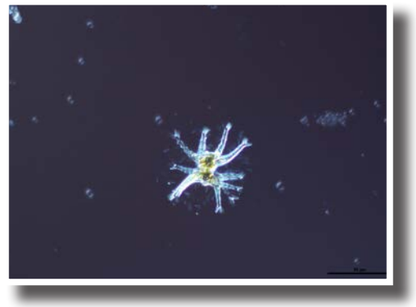
The collaborative Water Quality Study undertaken by Livingstone Shire Council and CQ University has found that the drinking water sourced from Waterpark Creek in Byfield and stored in the Kelly's Dam at Woodbury is of exceptional quality.

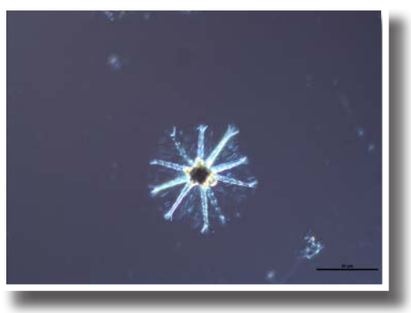
The quality of the source catchment is key to producing high quality drinking water. The Waterpark Creek catchment includes some private land holdings and plantation forestry operations but it is the sand dune aquifer that delivers the constant base flow to Waterpark Creek that Livingstone community relies upon. The sand dune catchment is mainly within the protected area of Byfield National Park and the Shoalwater Bay Military Training Area.

The freshwater lens held within the sand dune catchment is protected from significant pesticide runoff and from waste and sediment entering the source water from human and domestic animals. The protected catchment and the filtering of the sand mass provides high quality drinking water for the Capricorn Coast.

The water is so good that it contains a rare genus of green algae, Staurastrum. Three of the species of Staurastrum found in the water supply storage, Kelly's Dam, are shown here. The three-arm form is found rarely in the Fitzroy River but the others have only been found in lakes in Tasmania and in Kakadu. The 8 to 9 arm circle is even new to specialists on this genus. This algae is sensitive to nutrient and pesticide pollution so by its presence we know the water quality is very good.

To protect our water supply into the future, the catchment must continue to be protected from inappropriate development especially; clearing of native vegetation; use of chemicals; introduction of cattle and other nutrient sources such as septic tanks; and the introduction of pest species such as weeds and cyanobacteria.





6.0 Wetlands

Values	Threats
Ecological Features and Landforms	Fire Management
Wildlife Habitats and Corridors	Weeds
Groundwater Storage	Pest Animals
Water Catchment	Land Clearing
Refuge and Shelter	Urban Development
Unique Ecosystems	Harvesting of Economically Valuable Species
Recreation	Barriers to Fish Passage
Scenic Amenity	Grazing
Cultural Values	Overfishing
Scientific and Educational Values	Climate Change Impacts
Economic Values of Water and Pastures	Water Pollution

Livingstone has an abundance of wetlands, being located between the coastal ranges and the Pacific Ocean, where rivers and creeks have carved their paths across the landscape to find the sea. Wetlands are found in the low-lying flat lands between watercourses and in places where the groundwater comes to the surface or in the wide river flats and estuaries where a river floods and meets the sea.

Wetlands provide special ecological services that support biodiversity and maintain healthy ecosystems. Some of these wetlands support biodiversity at the global scale, a Wetland of International Significance provides essential habitat and food for species that travel from the other side of the world, among its many other values. An excellent source of information about wetlands is the Department of Environment and Science wetlandinfo website.

The Shoalwater and Corio Bays Wetlands are recognised under the International Convention on Wetlands of International Importance (known as the Ramsar Convention). The convention aims to halt the worldwide loss of wetlands and to conserve remaining wetlands through wise use and careful management. The Ramsar Convention encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity.

There are twelve nationally important wetlands in Livingstone Shire, listed in the Directory of Important Wetlands in Australia.

- *Broad Sound*
- *Corio Bay Wetlands*
- *Dismal Swamp - Water Park Creek*
- *Fitzroy River Delta*
- *Fitzroy River Floodplain*
- *Great Barrier Reef Marine Park*
- *Hedlow Wetlands*
- *Island Head Creek - Port Clinton Area*
- *Iwasaki Wetlands*
- *Shoalwater Bay*
- *Yeppoon - Keppel Sands Tidal Wetlands*

Under the Queensland Fisheries Act 1994, tidal wetlands and the marine plants that sustain them are protected. Mangroves are vital for the breeding of many marine species including economically important fish species. Five highly valued wetlands are Declared Fish Habitat Areas under the Fisheries Act in Livingstone Shire; Broadsound, Corio Bay, Leekes Creek, Cawarral Creek and Fitzroy River. These places are regarded as Matters of State Environmental Significance.

Wetlands are of local significance too. They are essential in enabling wildlife to survive and breed, from fish, crabs and aquatic life to the land animals that rely on wetlands for drinking water. Wetlands capture and filter sediments and nutrients, a function that protects downstream and marine environments from land based pollution. To ensure wetlands stay healthy, the wetland vegetation and drainage characteristics or hydrological regime, must be maintained. Protecting the catchment of the wetland and retaining a buffer in its natural state around wetlands is considered best practise.

Some of the other important wetlands are listed as follows;

- *Kinka Wetlands*
- *Waterpark Creek.*
- *Nursery Lagoon, Farnborough Road*
- *Barmaryee Wetlands*
- *Ross Creek and fringing mangroves*
- *Fig Tree Creek*
- *Causeway Lake*
- *Bi-centenary Wetlands, Emu Park*
- *Coorooman Creek and adjacent marine plain*
- *Lake Mary and Lake Mary swamp*
- *Hedlow Creek*
- *Coffee Dam on Paddy's Swamp Road*
- *Greenlake Swamp and Lagoon*
- *Serpentine Lagoon*
- *Lake Stephens*
- *Alligator Creek and swamp*
- *Nerimbera Lagoon*
- *Freshwater wetlands around the oxbow on Fitzroy Vale*
- *"German Jacks" lagoon on Fitzroy Vale*
- *Leekes Creek on Great Keppel Island*
- *Considine Creek on North Keppel Island*
- *Styx River*
- *Terraced efflux pools*
- *Joskeleigh area*
- *Cabbage Tree palm swamp areas, Keppel Sands*
- *Herberts Creek*
- *Shoalwater and Broad Sound*
- *Torrilla Wetlands – Stanage Bay Road*
- *Dismal Swamp*
- *Balangowan Wetlands*
- *Cattle Point*
- *Glen Prairie Wetlands*

In 1996, the international importance of the Shoalwater and Corio Bays wetlands was recognised with the designation of a Ramsar site over the area. The site is one of the largest and most ecologically rich coastal wetland sites in Queensland. This near pristine area covers over 200,000 hectares and stretches along 330 kilometres of coastline between Rockhampton and Mackay on the central Queensland coast. The wetlands are especially rich in wildlife because tropical and subtropical species overlap on Queensland's central coast. Many wetland types are found in the Shoalwater and Corio Bays Area:

These include:

- *fringing coral reefs*
- *shallow open water with seagrass beds*
- *rocky shores, beaches and sandbars*
- *intertidal mudflats and sandflats*
- *mangrove forests and melaleuca woodland*
- *patterned fens*
- *freshwater lagoons, swamps and streams on elevated sandplains.*

Capricorn Yellow Chat

Livingstone Shire and Gladstone Regional Council share the only remaining habitats of the endangered wetland bird, the Capricorn yellow chat. It is known to occur at three localities - Curtis Island, Torilla Plain and the Fitzroy Delta and is most abundant at Torilla Plain, on the Stanage Peninsula. Recent surveys indicate that the total adult population is less than 300 (Houston et al. 2004b, unpub. data). Habitat critical to the survival of the Capricorn yellow chat is wetlands and associated grasslands on seasonally inundated marine plains.

The Capricorn yellow chat is currently listed as 'Critically Endangered' under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* and as 'Endangered' under the *Queensland Nature Conservation Act 1992*.

7.0 Sand Dunes

Values	Threats
Wildlife Habitats and Corridors	Water and Stormwater Pollution
Groundwater Storage	Marine Debris
Water Catchment	Accelerated Erosion
Recreation	Fire Management
Scenic Amenity	Weeds
Cultural Values	Pest Animals
Scientific and Educational Values	Vegetation Clearing
Economic Value of Water	Urban Development
Ecosystem Services	Harvest of Economically Valuable Species
Breeding Places	Climate Change Impacts (Sea Level Rise, Drought, Heatwaves)
Water Quality/Sediment Capture	Inappropriate Vehicle Access and Clearing Associated with Camping
Geological Formations (e,g, Sand Dune Lakes)	
Capacity of the Dunes to Rebuild after Erosion	

Sand dunes are a sedimentary geological feature, being formed through the action of wind and water, from the particles of rock that have been eroded from the landscape and accumulated in river mouths, beaches and coastal plains. Sand dunes are important parts of today's beaches in Livingstone Shire, storing sand to protect and replenish beaches after storms and providing important groundwater aquifers.

Livingstone Shire has extensive sand dune formations that range in age. Our oldest sand dunes were formed in the Pleistocene epoch, back to 1.8 million years ago; these features are longitudinal or parallel sand ridges and swales. These low dunes can be found in the Capricorn wetlands, parts of Kinka lowland area, Keppel Sands, south of Balnagowen and north of Corio Bay, often found inland and beneath sand dunes that are more recent. Modern sand ridge-swale systems formed in the Holocene period (the last 10,000 years) and are found at Balnagowan, Joskeleigh, Kinka, Farnborough and Byfield.

Chenier ridges, or isolated ridges of sand and shell surrounded by coastal mudflats, are found in the Broadsound area and the lower Fitzroy River. Another type of sand dune is parabolic dunes found north of Corio Bay. An extensive province of high dunes is found in the Byfield National Park and the Shoalwater Bay Military Training Area, reaching 100m high with extensive blow out development. These dunes began building in the Pleistocene and landward migration of beach sand continued throughout the Holocene, aligned in the direction of predominant Southeast winds.

These sand dunes are highly significant in a national context as excellent examples of parabolic and parallel dune formations that are in an unmodified condition. They also contain numerous freshwater wetlands on soils that vary from sand with high organic matter to peat layers over one metre thick. Well-developed peat deposits are found in Dismal Swamp, Freshwater Swamp, Clinton Lowlands and Townshend Island.

Water percolating through the dunes is stored in a complex groundwater aquifer that feeds water features within the dunes and provides the base water flow for Waterpark Creek, a vital source of urban water for the Capricorn Coast. Groundwater moves laterally to flow out as springs and "sinkholes" between the dune ridges. Sinkholes are permanent freshwater springs emanating from the floor of parabolic dunes, forming conical topographic depressions, measuring up to thirty metres in depth and 100 metres in width, that usually support rainforest communities like feather palm vine forest.

Groundwater may also flow out at the land surface creating peat springs and occasional open water in the form of lakes, which may be "perched lakes or swamps". The presence of wallum (acidic) freshwater swamps, lakes and streams support populations of honey blue eye *(Pseudomugil mellis)*, a vulnerable freshwater fish species that is likely at or near its northern extent of occurrence in the bioregion.

Did you know?

Sand dunes contain heavy minerals and are sometimes mined for these resources. Sandmining proposals in the Byfield and Shoalwater Bay sand dunes in the 1980s were the subject of a Commonwealth Commission of Inquiry in 1993-4. The Commission made many recommendations including that the sand dunes should not be mined but conserved for the variety of compatible uses that can exist without removing the natural values such as defence training, national park, water supply, conservation, science and education and indigenous cultural heritage.

The Commission presented 35 recommendations and a set of detailed findings with respect to the values of the Area and the potential impacts and effects of various uses and activities. The two major findings of the Commission were that:

(1) the biodiversity and wilderness values of the Area should be conserved and managed as an area of National, State and Regional significance; and

(2) that the conservation use of the Area as a whole (including land and sea) be elevated and recognised as being 'a concurrent and equally significant use with defence use of the area'.

Reference: Commonwealth Commission of Inquiry Shoalwater Bay, Capricornia Coast, Qld, John T. Woodward 1993-4.

Coastal heathlands occur on sand dunes and rocky headlands. Heathlands form in areas where soil and wind conditions prevent the growth of tall trees. Heathlands have highly variable vegetation and structure, and include plants that are mostly shrubs and stunted trees. Heathland vegetation includes many beautiful flowering plants that have a complex ecology including fire dependence.

Sand dunes have significant features, ecosystems and rare or threatened species. One of these specialised ecological communities is littoral rainforest, also called coastal vine thicket or beach scrub.

"Littoral Rainforest and Coastal Vine Thickets of Eastern Australia" is a Threatened Ecological Community protected by the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999.

A critically endangered community that provides habitat for many threatened plants and animals as well as acts as an important buffer to coastal erosion and wind damage. Important species include the black-breasted button-quail *(Turnix melanogaster)*, classified as Vulnerable.

Remnants of littoral rainforest exist along the coastline of Livingstone Shire on both sand and rock. Protection and rehabilitationof these ecosystems is a priority to support biodiversity.

7.0 Beaches and Headlands

Values	Threats
Wildlife Habitats and Corridors Hydrology Groundwater Storage Water Catchment Refuge and Shelter Unique Ecosystems Recreation Scenic Amenity Cultural Values Scientific and Educational Values Economic Values of Rocks, Minerals, Timber and Water Ecosystem Services Breeding Places Habitat Water Quality/Sediment Capture Geological Formations (e.g. Headlands, Caves, Dunes)	Water Pollution Sedimentation Accelerated Erosion Fire Management Weeds Pest Animals Land Clearing Urban Development Harvest of Economically Valuable Species Inappropriate Uses of Beaches and Sand Dunes Vehicle and Pedestrian Impacts

Livingstone has the longest coastline of any local government south of Cape York.

Livingstone has the longest coastline of any local government in Queensland, south of Cape York. The Beach Protection Authority compiled a study of Capricorn Coast Beaches in 1979. This study provides a historical baseline for the condition of our coastline. At that time, Livingstone Shire Council expressed the view that "the beaches are the lifeblood of the Capricorn Coast tourist industry and accordingly no limit can be placed on their value".

Coastal processes and the state of the present day shoreline are influenced by sea level changes over time. In the last 10,000 years, the Holocene epoch, there were increases in sea level up to about 6,000 years ago when the sea reached its present level. The transgression of the sea submerged the land to form Keppel Bay as we know it today. The coastline bordering Keppel Bay is one of the most attractive scenic aspects of the Capricorn Coast, the contrast of stretches of sandy beach and dunes punctuated by prominent headlands and islands.

The present day shoreline is a consequence of the natural forces of wind, wave and current acting on the beach system. These have remained the same for thousands of years creating dynamic but intact beaches. Our coastline is neither totally exposed nor totally sheltered from deep ocean swell. The Fitzroy River is a major drainage system flowing into Keppel Bay. Floods in the Fitzroy have major impacts on the marine environment, mainly caused by cyclones near or crossing the coast.

Beaches are important for shorebirds and species such as the Red-tailed Black Cockatoo which feeds on She-oak seed cones. Headlands have specialised vegetation adapted to the shallow soils and salty winds. Grasslands and heath vegetation provide habitat for protected plants and animals. The Byfield matchstick, *Comesperma oblongatum* is only found in the Shoalwater Bay Military Training Area and Byfield National Park and grows on exposed coastal headlands. This small, bushy shrub is vulnerable to extinction.

Migratory Shorebirds

Migratory shorebirds arrive in late August and September from Siberia and Alaska to feed on tidal mudflats on the mainland and islands/inland wetlands during the summer months. They return to breed in Siberia and Alaska in March/April. Many of these species are declining and are classified as threatened as follows;

Species	EPBC (Federal)	NCA (QLD)
Eastern Curlew, curlew sandpiper, great knot	Critically Endangered	Endangered
Red knot, lesser sand plover	Endangered	Endangered
Bar-tailed godwit (baueri), greater sand plover	Vulnerable	Vulnerable

Resident shorebirds breed during the summer months with species such as the Red-capped Plover breeding on beaches in a shallow scrape where they are vulnerable to disturbance from dogs off leash and where eggs can easily be trampled on. Little Terns breed at Corio Bay during the summer months.

Coastal Erosion

Beach erosion is a natural feature of coastal dynamics but it is commonly regarded as a problem when it represents a threat to property and infrastructure. However, the essence of the problem is that development has occurred within the zone of natural beach movements.

At present there are very few private properties and residences under immediate threat of erosion along the Capricorn Coast. However there are several important areas where the beaches have markedly deteriorated over the years and the available buffer zones in these areas are now insufficient to accommodate the full extent of potential future erosion.

Coastal erosion on Putney Beach, Great Keppel Island, has affected infrastructure and foreshores with the rapid recession of the shoreline. "Our Living Coast" is a Coastal Hazard Adaptation Strategy for the Shire and it helps identify the strategic actions that are required to manage coastal hazards such as erosion, storm surge and sea level rise in the future.

Pandanus - An iconic species under threat...

An iconic and attractive tree of our beaches and headlands is the pandanus tree *(Pandanus tectorius)*. This hardy plant is a keystone species of coastal ecosystems, helping to stabilise land vulnerable to erosion, surviving in a harsh climate with minimal freshwater and providing habitat to numerous insects, reptiles, birds and mammals. A highly significant resource for traditional custodians, the plant is a food and is used to weave many garments, mats and household items.

Part of the critically endangered littoral rainforest and coastal vine thicket community, it is threatened by land clearing, fire, coastal erosion and sea level rise. Recently, it has suffered a new threat, pandanus dieback, caused by the invasion of the Pandanus planthopper *(Jamella australiae)*.

When a Jamella outbreak occurs in the absence of the parasitoid wasp *(Aphanomerus nr. pusillus)*, the planthoppers breed to very high infestation levels and spread rapidly. They live between the tightly packed pandanus leaves, sucking the sap, and laying indicative oval shaped egg rafts. The new larvae emerge and feed on a sugary "honey dew" solution produced by the adults. This sticky residue encourages build up of heavy infestations of fungus and moulds. This whole process caused by the planthopper results in the overall dieback of the pandanus trees.

Currently the Jamella insect is found between Joskeleigh and Byfield with the most predominant area of infestation being around Zilzie and Emu Park with noticeable die back of the pandanus trees in this area. A second inland species of pandanus, found growing besides creek and waterways, is also susceptible to planthopper infestations and dieback.

The Pandanus planthopper is an example of an introduced pest insect that will cause massive declines in biodiversity if left unmanaged. Pandanus dieback can be managed by monitoring Pandanus populations and ensuring the presence of the parasitoid wasp. The use of leaf stripping may also assist with pandanus recovery, which involves the removal of the old deceased leaves from the trees to remove the insect and decaying material from the pandanus tree, preventing crown rot and allowing recovery of the tree.

Woppaburra
TUMRA

8.0 Woppaburra Country

Woppaburra ancestors were the first nation Aboriginal inhabitants of what are now known as the Keppel Islands. Woppaburra were sea-faring saltwater people, island specialists living off the island environment and surrounding inshore reefs and ocean. The main islands occupied, were Konomie (North Keppel Island), Woppa (South/Great Keppel Island), and Burye (Humpy Island). Woppaburra are from a wider Whale Dreaming Indigenous Community around coastal Australia.

"The spiritual saltwater totem for the Woppaburra and our island homelands is Mugga Mugga (Humpback Whale). It is our life-long cultural responsibility to protect our clan totem and its environment our sea country (al-li)."

Woppaburra people are very much involved in protection of cultural heritage and natural resources on their traditional land and sea country. The Woppaburra people's Traditional Use of Marine Resources Agreement (TUMRA) covers the Keppel Islands and surrounding sea country. It covers 561 square kilometres of the Great Barrier Reef Marine Park and was the first offshore agreement of its kind.

Under the agreement the Woppaburra people will continue to develop and implement important sea country management initiatives in partnership with marine management agencies and other organisations. This includes working with scientists and researchers, managing traditional hunting protocols, monitoring of plants and animals and compliance training. Through the Woppaburra TUMRA there has been many successful projects and initiatives surrounding Woppaburra Land and Sea Country.

Traditional custodians maintain strong ties to the North Keppel Island Environmental Education Centre and students of the school are able to learn about the traditional custodians, their culture and history.

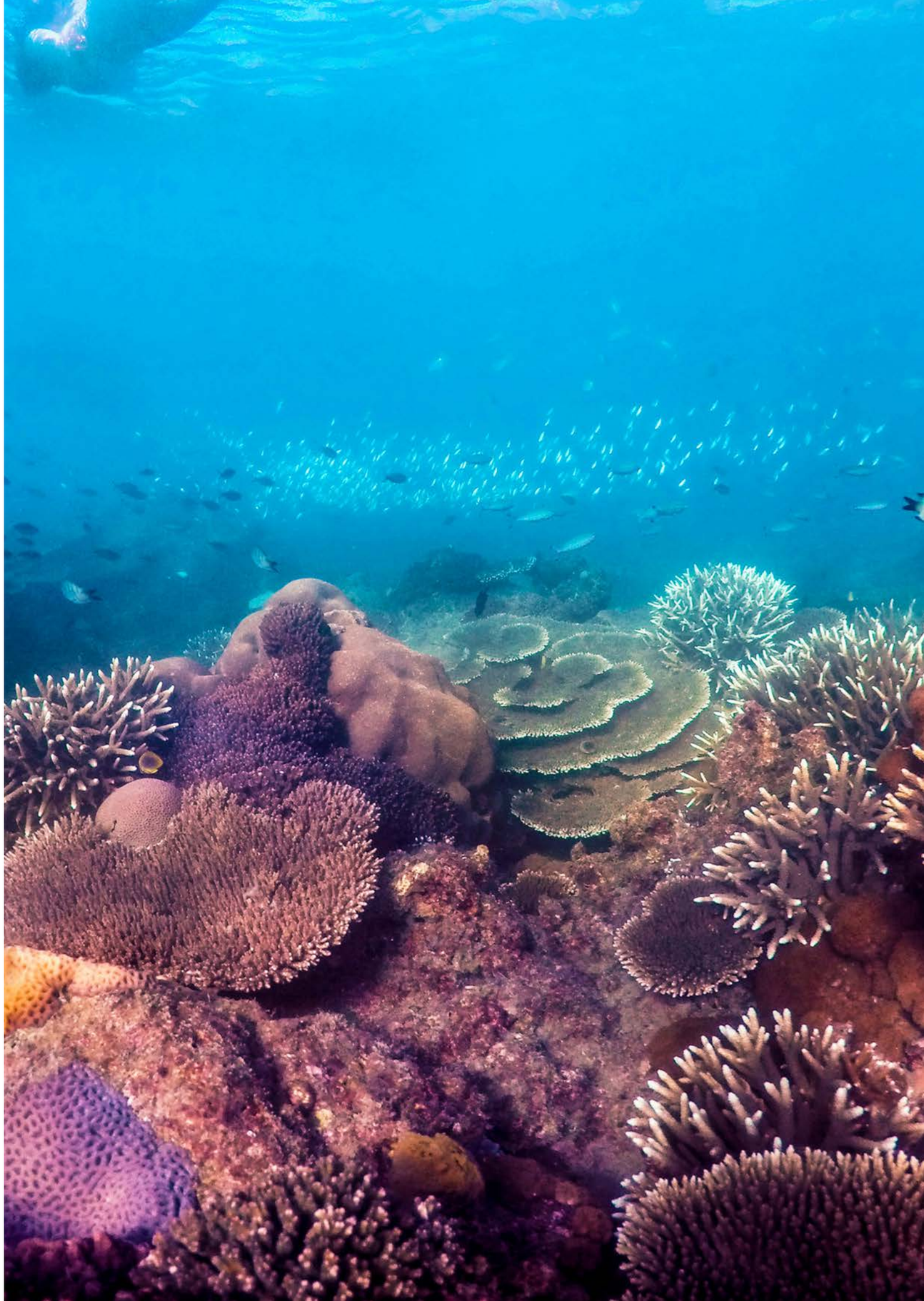
The Leekes Creek Fish Habitat Area was protected for its values and significance to fisheries, sustainability and Woopaburra cultural heritage. The Balban Dara Guya (Leekes Creek) declaration covers an 865ha area from Passage Rocks, to Half Tide Rocks, Big Peninsula and the Leekes Creek estuary. It is a focus that brings the younger people together with the elders, all working in a common direction. Together they have worked on fish surveys identifying a wide range of juvenile target fish species and mature popular species such as barramundi, mangrove jack, bream and whiting.

The declaration prevents coastal development to protect fisheries into the future and to reduce habitat loss and declines in water quality flowing into the Great Barrier Reef, but allows for limited appropriate infrastructure along with legal commercial, recreational and Indigenous fishing.

Sites of cultural heritage importance include shell midden sites around the Keppels that date back to the first nations occupation around 5000 years ago. Taking care of these important sites includes protection from erosion and the impact of pedestrian and vehicle access.

The replacement of the boardwalk over a midden on Great Keppel Island, in 2019, involved a group of young volunteers and local businesses and organisations committed to caring for the protection of the site as well as the cultural and environmental outcomes.

The Coastcare project has helped to protect an at-risk Aboriginal midden site which contains 300-year-old artifacts. The volunteers spent time with the Woppaburra Elders learning about the island's cultural heritage and the importance of caring for their local environment.



9.0 Marine Environments and Islands

Values	Threats
Wildlife Habitats and Corridors	Water Pollution
Hydrology	Sedimentation
Groundwater Storage	Accelerated Erosion
Water Catchment	Fire Management
Refuge and Shelter	Weeds
Unique Ecosystems	Pest Animals
Recreation	Land Clearing
Scenic Amenity	Urban Development
Cultural Values	Harvest of Economically Valuable Species
Scientific and Educational Values	Impacts of Tourism and Recreation
Economic Values	Fisheries Bycatch
Ecosystem Services	Overfishing
Breeding Places	Global Climate Change
Habitat	Boat Strikes
Water Quality/Sediment Capture	
Geological Formations (e.g. Coral Reef)	

The offshore topography of the Capricorn Coast is complex and unique along Queensland's east coast: Adjacent to an area of the Great Barrier Reef where the continental shelf is at its widest and average water depth between the reef and the mainland is greatest. The main body of the reef which acts as a barrier to waves terminates at Swains Reefs, 240 kms northeast of the Capricorn Coast.

Curtis Island forms the southern boundary of Keppel Bay, and while it is to the south of the Shire, in the Gladstone Region, it plays an important part in sheltering Keppel Bay from higher energy wave action.

The Capricorn Coast has a rich diversity of offshore islands and reefs in Keppel Bay and further out in the ocean. These provide nesting locations for thousands of seabirds, birds of prey such as the osprey and Brahminy kite and are important for migratory shorebirds that visit during the summer months from the northern hemisphere. Resident shorebirds such as the pied and sooty oystercatcher also use these islands. Of particular importance is that they provide nesting locations and a refuge for the threatened beach stone-curlew which is particularly affected by human disturbance.

Did you know?

Darumbal traditional custodians have recently developed a Traditional Use of Marine Resource Agreement (TUMRA) to guide projects and initiatives within their Sea Country of the Great Barrier Reef Marine Park. The work will include research and management activities such as the removal of Crown of Thorns starfish from Swains Reefs areas.

Shell World Yeppoon

One measure of the biodiversity of the marine environment is the shells we find on our beaches. Shell collection has been a pastime and a commercial business for a very long time and the history is on display by the Keppel Bay Shell Club.

Shell world Yeppoon is situated within the Capricorn Coast Visitor Information Centre. The centre features over 20,000 shells including fossil, land and marine molluscs. The club has been operating since 1962 and the volunteers collect, clean, prepare the shells for display, share information and process sales. A wide array of marine life is on display including coral varieties, shell craft samples and preserved marine life animals. In many cases, the club has catalogued the historical decline in marine biodiversity as the impacts of harvesting and destructive fishing techniques such as trawling changed the underwater habitat.

From Keppel Bay to Shoalwater Bay the marine environment supports at least four conservation-listed species of turtles including the green, loggerhead, flatback and hawksbill turtles. Of these, the green turtle is most abundant with the other three species in much smaller numbers. Shoalwater Bay is recognised as containing one of the largest and least impacted foraging populations of green turtles in eastern Australia and is a key reference site for monitoring green turtle populations.

It has been estimated that about 500 turtles per km may be present over at least 30 km of mainland coastline during winter months. Based on long term surveys, many of the captured green turtles display strong site fidelity (e.g. residency) to the Area across decades.

Turtle nesting occurs on beaches of the Shire during the summer from October to February. Volunteers monitor turtle nesting and contribute valuable information to assist in better management of threats to hatchling survival.

The Keppel Islands boast beautiful coral reefs with spectacular underwater landscapes. Keppel Bay corals have remained genetically distinct due to the vast distance between other reef systems, with 167 hard coral species and many more soft corals discovered and recorded.

Thick beds of healthy, branching staghorn corals *Acropora* reach to a depth of about 8 metres in the Keppel reefs. Varieties of spectacular, intricate soft corals are found in deep water and associate with molluscs to confuse predators. *Acropora millepora* are neat pin-cushion-shaped coral colonies, that vary in vibrant colours and are exclusively found in this region within the Great Barrier Reef Marine Park.

Shoalwater Bay seagrass meadows are regionally significant in the Mackay/ Capricorn section of the Great Barrier reef. They are nationally important as feeding grounds for Dugongs *Dugong dugon* and green sea turtles *Chelonia mydas*, and provide habitat for prawns and fish.

Along with the Dugongs, marine mammals such as the Australian snubfin dolphins *Orcaella heinsohni,* Indo-pacific humpback dolphins *Sousa chinensis* and migrating whales appear throughout the bay.

Humpback whales tend to migrate to the warmer waters of Capricorn Coast from Antarctica through the months of May- November.

Photo Credit: K.Hoppen, Copyright Commonwealth of Australia (GBRMPA)

Photo Credit: D.Perrine, Copyright Commonwealth of Australia (GBRMPA)

Photo Credit: P.Marshall, Copyright Commonwealth of Australia (GBRMPA)

10.0 Significant Ecosystems and Species

Flora

A search of the Queensland government's Wildnet data base reported 2311 species of plants recorded for the shire.

This includes:

- *thirty species of algae from 6 families;*
- *111 species of fungi from 40 families;*
- *forty species of aquatic plant from 19 families;*
- *2129 species of terrestrial plant from 212 families;*
- *one species of slime mould.*

A list of the Shire's significant species is presented in the table below. This includes one species that is considered to be extinct, three that are critically endangered, 10 endangered, 22 vulnerable and 11 that are near threatened. Note that one of the listed vulnerable species Cycas megacarpa is probably the result of an erroneous identification as the Shire is considered to be outside the range of this species. Byfield fern *(Bowenia serrulata)* is notably absent from the list.

Plant Species of Conservation Signifigance within the Livingstone Shire

Q - QLD Nature Conservation Act 1992 and A - Commonwealth Environment Protection and Biodiversity Act 1999
PE - Presumed Extinct, EX - Extinct, CR - Critically Endangered, E - Endangered, V - Vulnerable, NT - Near Threatened

Family	Scientific Name	Common Name	Q	A
Acanthaceae	*Graptophyllum excelsum*	Scarlet fushia	NT	
Acanthaceae	*Graptophyllum ilicifolium*	Holly-leaved graptophyllum	V	V
Apocynaceae	*Cerbera dumicola*		NT	
Apocynaceae	*Leichhardtia brevifolia*		V	
Apocynaceae	*Parsonsia larcomensis*		V	V
Aspleniaceae	*Hymenasplenium wildii*		V	V
Asteraceae	*Olearia orientalis*		E	
Asteraceae	*Sphaeromorphaea major*		NT	
Byttneriaceae	*Commersonia perkinsiana*	headland commersonia	CR	
Campanulaceae	*Lobelia membranacea*		NT	
Capparaceae	*Capparis humistrata*		E	
Capparaceae	*Capparis thozetiana*		V	V
Casuarinaceae	*Allocasuarina filidens*	Mt. Beerwah she-oak	V	
Cycadaceae	*Cycas megacarpa*		E	E
Cycadaceae	*Cycas ophiolitica*	Marlborough blue	E	E
Cycadaceae	*Cycas terryana*		V	
Ericaceae	*Lissanthe brevistyla*		V	
Euphorbiaceae	*Bertya pedicellata*		NT	
Fabaceae	*Daviesia quoquoversus*		V	
Fabaceae	*Pultenaea setulosa*		V	V
Lamiaceae	*Callicarpa thozetii*		E	
Laxmanniaceae	*Sowerbaea subtilis*		V	
Myrsinaceae	*Myrsine serpenticola*		E	
Myrtaceae	*Corymbia xanthope*	Glen Geddes bloodwood	V	V
Myrtaceae	*Eucalyptus hallii*	Goodwood gum	V	V
Myrtaceae	*Rhodamnia rubescens*	scrub turpentine	CR	
Myrtaceae	*Sannantha brachypoda*		V	
Orchidaceae	*Chiloglottis longiclavata*		NT	
Orchidaceae	*Habenaria xanthantha*		NT	
Orchidaceae	*Phaius australis*	Lesser Swamp-orchid	E	E
Phyllanthaceae	*Actephila bella*		V	
Picrodendraceae	*Neoroepera buxifolia*		V	V
Pittosporaceae	*Bursaria reevesii*		V	
Poaceae	*Paspalum batianoffii*		PE	EX
Polygalaceae	*Comesperma oblongatum*	Byfield Matchstick	V	V
Proteaceae	*Grevillea venusta*	Grevillea	V	
Proteaceae	*Hakea trineura*		V	V
Salicaceae	*Xylosma ovata*		NT	
Sapindaceae	*Cossinia australiana*		E	E
Simaroubaceae	*Samadera bidwillii*		V	V
Sparrmanniaceae	*Corchorus hygrophilus*		V	
Stackhousiaceae	*Stackhousia tryonii*		NT	
Tectariaceae	*Tectaria devexa var. devexa*		E	E
Thymelaeaceae	*Pimelea leptospermoides*		NT	V
Thymelaeaceae	*Pimelea leptospermoides subsp. bowmanni*		CR	
Thymelaeaceae	*Pimelea leptospermoides subsp. leptospermoides*		NT	
Zamiaceae	*Macrozamia serpentina*	Serpentine Zamia	E	

**Extracted from Wildnet 28 July 2021*

The shire has eleven plant species that are endemic, unique to Livingstone Shire. Some are confined to distinct landscape types. A few occur more widely.

These endemics are:

- *Bowenia serrulata* (Byfield)
- *Bursaria reevesii* (serpentine)
- *Capparis thozetiana* (serpentine)
- *Comesperma oblongatum* (Byfield)
- *Corymbia xanthope* (serpentine)
- *Cycas ophiolitica* (shire)
- *Hakea trineura* (serpentine)
- *Macrozamia serpentina* (serpentine)
- *Neoroepera buxifolia* (serpentine)
- *Pimelea leptospermoides* (serpentine)
- *Stackhousia tryonii* (serpentine)

Fauna

Shire-wide audits of the Livingstone Shire fauna have not been undertaken. However, a search of the Queensland government's Wildnet data base returned 653 records of terrestrial, amphibious, and marine fauna (excluding fish and invertebrates):

- *twenty nine amphibians, one exotic and one vulnerable species;*
- *406 birds, five critically endangered, ten endangered, nine vulnerable, fifty one migratory species under international covenants, two regionally exotic species;*
- *ninety five mammals, three endangered species, twelve vulnerable species, one near-threatened species, eleven exotic species;*
- *123 reptiles, one critically endangered species, six vulnerable species, one exotic species.*

Species of conservation significance within the shire are listed in the following table. The list includes:

- *one extinct species;*
- *five endangered species;*
- *nine vulnerable species.*

There were 319 exotic species – fourteen percent of the estimated shire species richness.

Animal Species of Conservation Signifigance within the Livingstone Shire

Q - QLD Nature Conservation Act 1992 and A - Commonwealth Environment Protection and Biodiversity Act 1999
PE - Presumed Extinct, EX - Extinct, CR - Critically Endangered, E - Endangered, V - Vulnerable, NT - Near Threatened

Class	Family	Scientific Name	Common Name	Q	A
Amphibians	*Limnodynastidae*	*Adelotus brevis*	Tusked frog	V	
Birds	*Apodidae*	*Hirundapus caudacutus*	White-throated needletail	V	V
	Burhinidae	*Esacus magnirostris*	Beach stone-curlew	V	
	Cacatuidae	*Calyptorhynchus lathami erebus*	Glossy black-cockatoo (northern)	V	
	Charadriidae	*Charadrius leschenaultii*	Greater sand plover	V	V
	Charadriidae	*Charadrius mongolus*	Lesser sand plover	E	E
	Columbidae	*Geophaps scripta scripta*	Squatter pigeon (southern subspecies)	V	V
	Laridae	*Sternula nereis exsul*	New Caledonian fairy tern	E	
	Meliphagidae	*Epthianura crocea macgregori*	Yellow chat (Capricorn)	E	CE
	Procellariidae	*Ardenna pacifica*	Wedge-tailed shearwater	V	
	Procellariidae	*Macronectes giganteus*	Southern giant-petrel	E	E
	Procellariidae	*Macronectes halli*	Northern giant-petrel	V	V
	Psittacidae	*Lathamus discolor*	Swift parrot	E	CE
	Scolopacidae	*Calidris canutus*	Red knot	E	E
	Scolopacidae	*Calidris ferruginea*	Curlew sandpiper	CR	CE
	Scolopacidae	*Calidris tenuirostris*	Great knot	CR	CE
	Scolopacidae	*Limosa lapponica baueri*	Western Alaskan bar-tailed godwit	V	V
	Scolopacidae	*Numenius madagascariensis*	Eastern curlew	E	CE
	Strigidae	*Ninox strenua*	Powerful owl	V	
	Turnicidae	*Turnix melanogaster*	Black-breasted button-quail	V	V
Mammals	*Balaenopteridae*	*Megaptera novaeangliae*	Humpback whale	V	V
	Delphinidae	*Orcaella heinsohni*	Australian snubfin dolphin	V	
	Delphinidae	*Sousa sahulensis*	Australian humpback dolphin	V	
	Emballonuridae	*Taphozous australis*	Coastal sheathtail bat	NT	
	Megadermatidae	*Macroderma gigas*	Ghost bat	E	V
	Pteropodidae	*Pteropus poliocephalus*	Grey-headed flying-fox	C	V
	Phascolarctidae	*Phascolarctos cinereus*	Koala	E	E
	Pseudocheiridae	*Petauroides armillatus*	Central greater glider	V	V
	Vespertilionidae	*Chalinolobus dwyeri*	Large-eared pied bat	V	V
Ray-finned fishes	*Pseudomugilidae*	*Pseudomugil mellis*	Honey blue eye	V	V
Reptiles	*Chelidae*	*Elseya albagula*	Southern snapping turtle	CR	CE
	Cheloniidae	*Caretta caretta*	Loggerhead turtle	E	E
	Cheloniidae	*Chelonia mydas*	Green turtle	V	V
	Cheloniidae	*Eretmochelys imbricata*	Hawksbill turtle	E	V
	Cheloniidae	*Natator depressus*	Flatback turtle	V	V
	Crocodylidae	*Crocodylus porosus*	Estuarine crocodile	V	
	Elapidae	*Acanthophis antarcticus*	Common death adder	V	
	Elapidae	*Denisonia maculata*	Ornamental snake	V	V
	Elapidae	*Hemiaspis damelii*	Grey snake	E	

**Extracted from Wildnet 28 July 2021*

Within the Shire, there are some areas of particular biodiversity importance. These are the plant communities of the Marlborough Province and the Shoalwater Bay – Byfield district. The serpentinite landscape of the Marlborough Province is a centre of species endemicity that is unique regionally and of importance from a state perspective. The Shoalwater Bay – Byfield district is a region of high species diversity and includes the limits of distribution for many species. Given the altitude of the ranges and the associated climatic effect, this district may be a climate refugia for many species.

Ecologically important precincts of note also include the landscape surrounding the trachyte plugs including the Hedlow and Lake Mary wetlands of national importance.

Golden Eyed Gecko *(Strophurus trux)*

The Golden-eyed gecko was recently discovered in Livingstone Shire. It had been an undescribed reptile fauna since 1997, with the only previous evidence in Queensland Museum collections. The species is believed to be endemic to the Brigalow Belt Bioregion, sighted within steep, rocky Buck Spinifex covered hills. The species is well camouflaged for arid environments, with its' light brown skin and brown spots. However, the Golden-eyed gecko is notably different, with its' remarkably vivid yellow to golden eye.

Vanderduys, E. (2017). A new species of gecko (Squamata: Diplodactylidae: Strophurus). Zootaxa, 316-330

11.0 Living with Wildlife

All of Queensland's native terrestrial animals are protected under the *Nature Conservation Act 1992*. However, there are native animals that pose risks to the health and safety of people, so guidelines are available to help identify and avoid hazardous species or situations. The Queensland Department of Environment and Science also provide permits and licences to support management of some wildlife impacting the wellbeing and safety of people.

Examples of native animals that may be dangerous to people who are in their natural habitat include; crocodiles, sharks and dingoes. There are also poisonous animals that can cause life threatening harm if people are bitten or stung such as certain species of land snakes that have toxic venom; blue ring octopus; sea snakes; jellyfish; stonefish and the freshwater bullrout.

Although many native plants have been part of human diets for thousands of years and are known as "bush tucker", some species have toxins in the leaves and/or seeds and may be poisonous. Never eat wild plants without the benefit of expert advice or guidance from the traditional custodians of the area. Cycads and zamias are toxic to people and animals. Even breathing the smoke of the burning plants can be harmful.

There are more than twenty common species of mosquito in the Livingstone Shire area, some of which are capable of transmitting diseases to humans. These diseases include; Ross River fever, Barmah Forest virus and potentially Dengue fever. Heartworm in dogs is also transmitted by mosquitoes. Mosquitoes can potentially breed in any fresh (polluted and unpolluted), brackish or salt water. This includes stagnant pools, ponds, drains, channels and vessels that hold water (e.g. pots, containers). Council's Vector Control Unit has programs in place to control mosquitoes throughout the year; undertaking routine checks on breeding sites, treating mosquito-breeding, misting of adult mozzies and public education.

Some native animals tolerate urban environments and populations can even increase due to available food and water. Many birds find homes in gardens and parks and this is usually a welcome sight for residents however birds such as Magpies and Plovers can have unwelcome territorial behaviours, generally called "swooping", when protecting their nests.

Some animals will use human infrastructure to shelter in or build their nests on. This may be one way to help animals who have lost natural habitats. For example, the osprey is a very significant species in coastal environments where people also live. Providing nesting platforms can help them survive when natural features are no longer available, such as at Rosslyn Bay Harbour.

Another very important native animal who often roosts in areas that are now surrounded by urban development are flying foxes. These amazing nocturnal animals live in colonies, hang in the trees during the day and forage for nectar at night. They provide an essential ecological service in transporting pollen and seed from place to place. They can travel huge distances to access flowering trees and move between different colonies. The locations of colonies are usually established over many decades and although a colony may vary in numbers over time it remains a place of refuge to raise young. During breeding times flying foxes produce a "musk" smell, they can also be noisy and messy when large numbers congregate.

It is essential to avoid physical contact with wild animals unless you are suitably qualified and vaccinated. Flying foxes are known to carry diseases such as Australian bat lyssavirus which can be transmitted from bats to humans, causing serious illness. The virus can be transmitted when infected bat saliva enters the

human body such as through a bite or scratch. Surveys of wild bat populations have indicated less than one percent of bats carry lyssavirus. However, it is more likely to be found in a sick or injured bats. Vaccines are available for people working with animals. The main way to protect ourselves from diseases carried by animals is to not handle wild or sick animals and to contact suitably qualified and equipped people.

The RSPCA operate a Wildlife Emergencies number to call if you find a sick or injured animal: 1300 ANIMAL (1300 264 625) or you may engage a qualified wildlife carer.

There are non-native animals and plants that impact the environment, cause economic costs to business and community and affect the health of people and animals. For example; pigs, foxes, deer, lantana and parthenium weed. These animals and plants are classified as invasive species under the Biosecurity Act 2014, and pest control programs may be implemented by State government, Council and landowners to reduce them.

Wildlife Carers

Volunteer wildlife carers do an incredible job, treating and caring for injured native animals.

Possums, birds, wallabies, lizards, snakes, turtles, bats, echidnas, the list of animals treated by voluntary carers goes on. To care for native animals, volunteers need to be registered and have completed a course. A wildlife carer collects the injured animal from a Vet, RSPCA or a member of the public. They treat injuries and feed as often as required, sometimes every half hour. Expert advice is sometimes needed and transport to specialists. Caring for the injured animal until it is ready to be released can take as long as six months. During disasters such as bush fires or cyclones the demand on wildlife carers can be overwhelming.

The RSPCA operates a hotline for injured wildlife however it relies on voluntary carers in regional areas to rescue native wildlife. Wildlife Carers receive very little funding and most pay for the food, medication, cages and feeding equipment themselves. Care is 24 hours a day leaving little time for recreation or holidays but there is reward in seeing the animals recover.

12.0 Natural, Historical and Cultural Heritage Values

The richness of the native biodiversity is the product of evolution over millennia and represents the common heritage of all life on earth. We can preserve our natural heritage by looking after the endemic plants and animals, ecosystems and landscapes of our Shire.

Our heritage places have been shaped by the region's history, environment, resources and people. They comprise places of cultural and natural significance that we want to keep, respect and pass on to future generations.

Heritage places in Queensland are assessed and managed at four different levels:

- International: World Heritage Areas are natural and cultural places of 'outstanding universal value' selected by the United Nations Educational, Scientific and Cultural Organisation (UNESCO); such as the Great Barrier Reef.
- National: The National Heritage List comprises natural and cultural places with outstanding heritage value to the nation. The National Heritage List is administered by the Australian Government under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC). The Commonwealth Heritage List also kept under the EPBC Act, is a list of natural, Indigenous and historic heritage places owned by the Australian Government. It includes places connected to defence, communications, customs and other government activities.
- State: Non-indigenous places of cultural heritage significance to Queensland are protected by the Queensland Heritage Act 1992 and are entered in the Queensland Heritage Register. Aboriginal and Torres Strait Islander cultural heritage is protected under separate legislation.
- Local: Places of local heritage significance are identified in an Overlay Map and development near these places is regulated by the Livingstone Shire Planning Scheme. A planning scheme policy identifies the process for listing further heritage places.

The Department of Environment and Science is responsible for the management of heritage places that fit into the State level described above by identifying and protecting them. Heritage places include buildings, structures, cemeteries, archaeological sites, gardens, urban precincts and natural and landscape features. The Queensland Heritage Register includes trees of significance such as the memorial Hoop Pines on Anzac Parade, Yeppoon.

Non-government organisations also advocate for the recognition and care of Australian heritage, such as the National Trust of Australia (Queensland), a not-for-profit organisation and member-based charity which offers people the opportunity to feel connected to significant places. Environmental conservation programmes include the Significant Tree Register, a national initiative to recognize important trees.

National Parks are protected areas managed by the State and are vital for protecting biodiversity in the region. Queensland's Protected Area Strategy 2020–2030 (PDF, 5.6MB) is a ten-year plan for supporting the growth, better management and sustainability of the state's public protected estate and private conservation areas. There are 31 State reserves and Nature Refuges in the Livingstone Shire, including mainland and island national parks. The most recent addition has been Wild Duck Island.

Of importance is ensuring that these protected areas are able to continue to provide habitat for flora and fauna. The impacts of overuse and incursion of infrastructure and surrounding land management can lead to the degradation of habitat and a consequent loss of bio-diversity. Protecting our national parks means looking after the broader landscape as well.

What is Indigenous Cultural Heritage?

Cultural Heritage is a place of significance to aboriginal people; or a significant object; or evidence, of archaeological or historic significance, of Aboriginal occupation of an area.An area or object is significant because of either or both of the following:

- *Aboriginal or Torres Strait Islander tradition*
- *the history, including contemporary history, of any Aboriginal or Torres Strait Islander party for the area*

The main purpose of the Cultural Heritage Acts is to provide effective recognition, protection and conservation of Aboriginal and Torres Strait Islander cultural heritage.

A duty of care applies to any activity where Aboriginal or Torres Strait Islander cultural heritage is located. This includes cultural heritage located on freehold land and regardless of whether or not it has been identified or recorded in a database. Cultural heritage duty of care guidelines have been developed to help land users in assessing reasonable and practicable measures for meeting the cultural heritage duty of care. Land users should consult the duty of care guidelines before undertaking a land-use activity. Consultation with the Aboriginal party for an area may be necessary if there is a high risk that the activity may harm cultural heritage.

Cultural Heritage

Livingstone Shire lies within the ancestral homelands of the Darumbal peoples and the Barada Kabalbara and Yetimarala peoples on the mainland, and the Woppaburra peoples on the Keppel Islands, and has become home for other Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander peoples. Council values the Darumbal, the Woppaburra and the Barada Kabalbara and Yetimarala peoples' rich contribution and connection to the history, heritage and culture of this region.

Council acknowledges, as part of our services, we hold joint responsibility for public lands, and Darumbal, Woppaburra and Barada Kabalbara and Yetimarala Country. Council will continue to work collaboratively with the Darumbal, Woppaburra and Barada Kabalbara and Yetimarala peoples, as Traditional Owners and Native Title Holders, to protect sites of cultural significance across the Livingstone Shire. Legislation, including the Aboriginal Cultural Heritage Act 2003, Native Title Act (Queensland) 1993, Aboriginal Land Act 1991, Livingstone Shire Council and Darumbal Peoples Indigenous Land Use Agreement 2016, and the Livingstone Shire Council Native Title and Cultural Heritage Policy guide these processes.

Freehold Land and Reserves

Livingstone Shire Council is the manager of many parcels of land including freehold land and reserves. It is also the day-to-day manager of areas of State owned land such as road reserves and esplanades. These reserves often contain biodiversity values and the road reserves support vegetation that may have been cleared from surrounding land. The network of roads, both constructed and unconstructed, provide opportunities for wildlife movement and can form important biodiversity corridors.

AREA OF COUNCIL CONTROLLED LAND, FREEHOLD AND RESERVES
3,961 HA

AREA OF COUNCIL CONTROLLED ROAD RESERVE, INCLUDING UNFORMED
17,487 HA

AREA OF REMNANT VEGETATION ON COUNCIL CONTROLLED LAND
2,491 HA

AREA OF REMNANT VEGETATION ON COUNCIL ROAD RESERVES
7,261 HA

Byfield Fern *(Bowenia serrulata)*

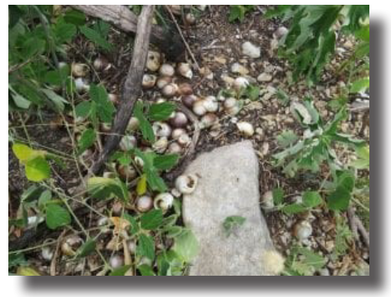
The Byfield fern is unique to the Byfield area of Livingstone Shire. Despite its name and fern like leaves it is not a fern, it is an ancient plant, a member of the Cycad family. Its closest relative is found in the Daintree region of tropical Queensland.

The leaves are glossy and fronds are long-lasting, even out of water, and are popular for the ever fresh green appearance. Byfield Fern is used for decorative purposes such as for cut flowers and wreaths. Permits are required to collect this species for commercial use.

Yeppoon Varicoloured Snail *(Figuladra aureedensis)*

Named because it is unique to the Mt Etna Caves and the greater Yeppoon area is the Yeppoon Varicoloured Snail. This species is present in extremely large numbers in the limestone areas where it has two shell colours: a brown shell with a yellow patch on the base and yellow shell with numerous narrow brown bands.

Land snails are a significant part of the invertebrate fauna and play an important role in the decomposition process. Their food is primarily decaying vegetation, fungus and other biofilm. Their presence is indicative of a healthy environment and potential biodiversity hotspots. However, their greatest threat is habitat loss either through land clearing or fire. A fire that burnt scrub, including vine thicket, in the Mt Etna Caves National Park in 2018, killed thousands of Yeppoon Varicoloured Snails.



Yeppoon Varicoloured snails killed by wildfire

13.0 Biodiversity Threats

Threats to biodiversity may be naturally occurring such as extreme weather events like drought and the environmental pressures of predation and competition. However, these naturally occurring threats are overshadowed by the impact of various human activities. The extent of our impacts threatens the ongoing survival of some species.

There has never been a more important time to think about how we can help nature survive, the extinction rate in Australia is one of the worst in the world with a significant proportion of the surviving animals and plants listed as threatened. Australia is in the top five for extinction of animals and plant species, and the top ten for endangered and threatened species.

1. Urban Development

Conversion of environmental and rural landscapes to urban and industrial uses takes away the habitats that native plants and animals need. Even when we manage to protect natural areas in our urban landscapes the increasing human population causes disturbance to wildlife especially in coastal areas. A good example is the impact of our domestic animals, dogs and cats hunt and chase native birds, reptiles and mammals. If we do not keep dogs on a leash when in natural areas such as beaches they will disturb the native animals. This can be critical for shorebirds that need to feed and gain weight in order to migrate long distances.

2.Tree Clearing

The clearing of forests and woodlands has been ongoing since the arrival of Europeans in Australia to source timber, create grazing pasture and extract minerals. Today, the remaining native habitat is called remnant vegetation because it represents the last stands of natural ecosystems. This loss of habitat is one of the key threatening processes that impacts all native species. Some types of clearing have more impacts than others, for example the removal of old-growth trees that contain hollows, used by many species to nest and breed, can result in a collapse in the local populations of those dependent animals.

Clearing of species that are threatened can result in local extinctions and ultimately the entire species may be lost. Livingstone has species that are endemic, that is, they only occur within our Shire boundaries, if we do not protect their habitats the world will lose these unique species forever.

3. Habitat Degradation and Fragmentation

Remnant habitats that have not been cleared are still degraded by human impacts. Because many of these remnants are small and isolated from other patches of bush, they are vulnerable to further changes. Fragmentation of habitats means they lack connection to other parts of the landscape that form part of their lifecycle, such as access to breeding partners, to water sources and protection from predators. Wildlife need genetic diversity to remain healthy and the isolation of small populations can mean that they will not survive in the long term. An ecosystem needs to have all the component parts working together and when habitats are modified by removing the canopy trees or the understorey plants, the quality of the ecosystem declines especially when this disturbance provides opportunities for introduced species to invade.

4. Introduced Pest Plants and Animals

The introduction of exotic plants and animals to Australia have a major impact on native ecosystems. Invasive species such as feral cats, foxes, pigs and deer have multiple impacts; they predate on native animals, compete for food and shelter and damage the natural vegetation and landscape. Pest plants or weeds have major impacts at the landscape scale. Weed species are vigorous growers and prolific seed producers and are currently occurring in low to high numbers throughout the Shire. The presence of weeds prevents native species from growing, affects natural processes and degrades the resilience of the ecosystem. Weed control in an important activity to reduce the impact on biodiversity however weed control techniques can also have an impact on natural recovery. For example, the use of herbicides and mechanical clearing can be detrimental if best practise techniques are not used to minimise unintended impacts.

Another way that weeds can change ecosystems is by transforming the characteristics of a patch of remnant vegetation. An example of transformer weeds in the Livingstone Shire are high biomass invasive grasses, like guinea grass, which has established in much of the regions coastline. It has a two pronged negative affect; the highly competitive grasses inhibit natural germination of endemic plant species such as Pandanus and in a fire event the invasive grasses dramatically increase fire intensity and spread, causing the death of Pandanus trees and other fire sensitive coastal rainforest flora.

5. Managing Fire in the Landscape

Wildfire is a natural event, ignited by lightning, and has shaped the ecology of many Australian ecosystems. Plants and animals have many adaptions to survive and even thrive after fire. However, fire can also be destructive when it burns fire sensitive communities such as rainforests and coastal ecosystems or when it is so intense that plants and animals do not survive.

People's use of fire is ancient and ongoing. Fire is a tool for managing vegetation and reducing vegetation fuel loads in order to prevent wildfire. Planned burning is used to reduce hazardous fuel loads or to manage fire tolerant vegetation types and it is a complex process that requires careful planning, timing, monitoring and implementation.

The introduction of exotic plants changes ecosystems and their response to fire. High biomass grasses such as guinea grass and molasses grass are fire loving and will burn hotter and replace native plants after fire. These changes together with climatic change are increasing the threat of fire and the impact of fire on natural ecosystems. The Royal Commission into National Natural Disaster Arrangements (2020), noted that the currently observed trend of more intense bushfires that start earlier in the season will continue.

6. Climate Change

Climate change impacts are already being observed, such as in the frequency of extreme weather events. Tropical cyclones cause catastrophic damage to the natural landscape due to strong winds, extreme rainfall and destructive waves.

Currently, Northern Australia experiences on average eleven in a year - current climate research suggests that, while this number may decrease, the intensity of tropical cyclones may increase – that is, become more destructive on an average basis. With a warming climate, they may move further south, affecting the southern Great Barrier Reef and our region. Climate modelling suggests that the Livingstone region will experience increased severity of the dry season – and more heatwaves toward 2100. The Australian Bureau of Meteorology describes a heatwave as three or more days of high maximum and minimum temperatures unusual for a given location. By 2070, a heatwave event may last more than three weeks in the central Queensland region.

Mass fauna mortality can occur in a heatwave. Flying foxes are extremely vulnerable to heatwaves and will die when heat and humidity exceeds their survival thresholds. In the marine environment heat waves cause wildlife mortality too. Coral bleaching occurs when the algae that coexist with coral dies due to periods of high water temperature.

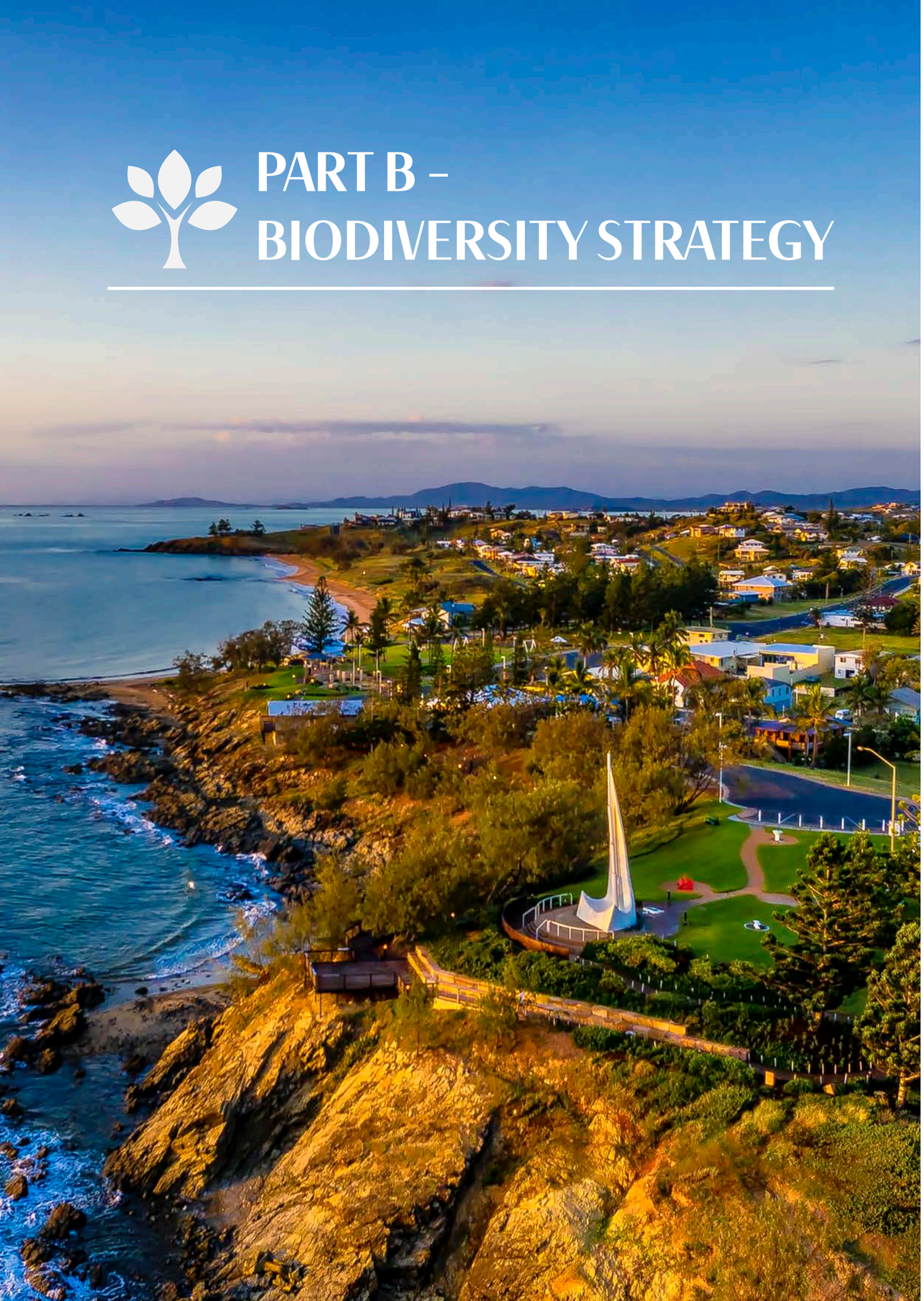
Climate change is going to have a huge impact on biodiversity, for example, we are seeing changes in key indicator species such as birds. Climate change is already causing a decline in bird numbers and it is expected there will be local extinction of some species. The climate change factors that are driving these changes are an increase in average temperature, bushfires, extreme weather events especially drought and sea level rise.

7. Erosion and Sedimentation

Erosion is a natural process. Water and wind erode sand, soil and rock over time; breaking down particles, moving them down slope and depositing sediment downstream. However if the rate of erosion increases; landforms are eroded away too fast and the sediment moving into creeks and lakes starts to smother aquatic ecosystems or introduce too much nutrient.

One of the major threats to the Great Barrier Reef is the movement of sediment, nutrients and other contaminants from the land to marine environments. All waterways carry sediment to the sea and estuaries are ecosystems, which store and stabilise sediments, however the impact of land use in the catchments of these waterways is reducing the vegetation cover, which acts to slow down erosion, so there is more soil being lost from the land than natural systems can cope with.

Soil particles carry nutrients and other contaminants as well. The Fitzroy River transports vast amounts of sediment from its extensive catchment to Keppel Bay when it floods. Local coastal creeks also carry sediment to the coast in weather events.



PART B – BIODIVERSITY STRATEGY

Introduction

Biodiversity Strategy Purpose and Vision

The Livingstone Shire Council Biodiversity Strategy will help guide and support the management, conservation and improvement of the shire's biodiversity.

Community aspirations contained in the *Livingstone Community Plan: Towards 2050* and the strategies reflected in the *Livingstone Corporate Plan 2020-2030*, are the basis for this document. It sets out the actions that Council, community and other organisations can take to protect our shared natural heritage, address threats and enhance its quality.

The strategy takes into account the statutory roles and responsibilities of Council under State and Commonwealth legislation. At the National and State level, biodiversity strategies identify the importance of regional and local action to address threats to native biodiversity.

This strategy will help to implement and inform Council planning and operational activities including the development and implementation of the Planning Scheme. It will assist Council in future decisions, community initiatives and drive a range of targets

The Environmental Sustainability Policy identifies Council's commitment to continually:

- improve its environmental and sustainability performance;
- encourage a culture of environmental sustainability within the organization and in the Livingstone community;
- protect, sustainably manage and enhance the natural assets of the shire; and
- build the long term sustainability and environmental resilience of the region through
- partnerships and collaboration with environmental stakeholders, the community and traditional owners.

This document sets out our vision, objectives and strategies for the next six years, 2021-26.

Our Vision

"To recognise, protect and enhance the Shire's biodiversity."

Biodiversity Strategy Objectives

1. Partner with traditional custodians and facilitate opportunities for co-management
2. Work in collaboration and partnership with our community
3. Understand the values, processes, condition and function of natural ecosystems
4. Identify hazards and threats to biodiversity in order to inform planning and management
5. Prevent and reduce the impacts of pest plants and animals
6. Inform the community about significant environmental areas and their protection
7. Integrate sustainable practices and designs into land and resource management
8. Maintain and enhance the extent, range and richness of biodiversity in strategic locations
9. Prevent and reduce pollution of water, soil and air
10. Reduce the carbon footprint of Council and support community practice change

The Biodiversity Strategy Action Plan sets out how the objectives will be met through the implementation of a suite of actions related to the ten strategies over a six year timeframe.

1.0 Investment

To manage and sustain environmental assets and preserve biodiversity, investment is required. All levels of government have a role in funding projects to protect or enhance biodiversity.

Council's Environmental Levy provides funding for environmental programmes and projects, on Council land and for community benefit including pest and vector control, natural resource management and sustainability initiatives.

Council does not receive rates or levies from land owned by the State or Commonwealth governments. The State Government is responsible for managing National Parks and State land with significant environmental values and the Australian Government is the land manager for the Shoalwater Bay Military Training Area and Great Barrier Reef Marine Park.

Council and community groups may receive funding through external grants to carry out projects that deliver environmental benefits. For example, State government has supported Livingstone Shire to develop and implement bushfire and coastal hazard planning, mitigation and adaption.

Partnerships

Council works collaboratively with not-for-profit community groups, which contribute expertise, funding and in-kind labour. For example, Council together with Capricornia Catchments participated in Twinning with the Sunshine Coast Rivers Initiative, a programme of the International Rivers Foundation.

Fitzroy Basin Association, the regional natural resource management body, has funded local farmers to implement sustainable agricultural practice change and community environmental restoration projects for over twenty years.

Community Groups assist with the management of Council controlled land in many ways. Groups may hold leases or tenure agreements with Council for use and management of land or volunteer with the Community Nursery or Friends of the Beach.

Private Conservation and Sustainability investments

Owners of freehold and leasehold land invest in protecting biodiversity too. It may be voluntary conservation or through a formal agreement on the title of the land, such as a Covenant or Nature Refuge Agreement. It maybe through participation in an accreditation scheme such as the Responsible Wood and Forest Stewardship Council®.

What is Blue Carbon?

Blue carbon is the carbon stored in coastal and marine ecosystems.

Coastal ecosystems such as mangroves, tidal marshes and seagrass meadows sequester and store more carbon per unit area than terrestrial forests and are now being recognised for their role in mitigating climate change.

These ecosystems also provide essential benefits for climate change adaptation, including coastal protection for many communities.However, if the ecosystems are degraded or damaged, their carbon sink capacity is lost or adversely affected, and the carbon stored is released, resulting in emissions of carbon dioxide (CO2) that contribute to climate change.

Dedicated conservation efforts can ensure that coastal ecosystems continue to play their role as long-term carbon sinks.

Further development of the market for environmental and carbon offsets in the future will provide new income streams to support the management and rehabilitation of areas of environmental significance.

Investment: Strategies and Actions

1.1 Develop employment and training opportunities for indigenous people
1.2 Invest and seek external funding opportunities in partnership with community
1.3 Seek opportunities to encourage citizen science initiatives
1.4 Implement “Our Living Coast” Coastal Hazard Adaption Strategy
1.5 Seek external funding for pest management in partnership with community
1.6 Provide interactive mapping on-line, fact sheets, guidelines and further sources of information
1.7 Include environmentally sustainable standard drawings in Capricorn Municipal Development Guidelines
1.8 Seek opportunities to source Environmental and Carbon offsets
1.9 Maintain appropriate expertise and training of Council staff to address pollution events
1.10 Invest and seek external funding for energy efficiency and renewable energy initiatives

2.0 Strategic Planning

It is widely recognised that we are under threat of losing our unique biodiversity if we do not proactively plan for its protection and manage it for resilience. Biodiversity is in decline nationally and internationally.

At the highest level, Australia is a signatory to the United Nations Convention on Biological Diversity. The strategy for biodiversity protection at the national level is Australia’s Strategy for Nature 2019-2030. The Queensland government is preparing a new Biodiversity Conservation Strategy after consultation in 2019.

At the regional level, the Central Queensland Sustainability Strategy 2030, is prepared by the Fitzroy Basin Association, a Natural Resource Management body.

The Livingstone Shire Planning Scheme 2016 is a statutory document to guide the approval and compliance of assessable development within the boundaries of Livingstone Shire. The Planning Scheme has provisions for land use on private land that include biodiversity protection and consideration of natural hazards. The Planning Scheme identifies matters of environmental significance, both at State level such as Fish Habitat Areas and Matters of Local Environment Significance. These areas are mapped in Overlays with associated codes for development assessment.

Council has also developed strategic planning documents to guide responses to natural hazards, such as the Coastal Hazard Adaption Strategy – “Our Living Coast” and the Bushfire Management Plan 2020-22.

Strategic Planning: Strategies and Actions

2.1 Review and develop Indigenous Land Use agreements
2.2 Support and engage in regional approaches to biodiversity planning and projects
2.3 Develop a strategic plan for monitoring biodiversity
2.4 Incorporate environmental risks in Local Disaster Management via the Environmental Taskforce
2.5 Implement and review the Livingstone Shire Biosecurity Plan 2018-2023
2.6 Provide duty planner and advice services
2.7 Develop integrated catchment management plans such as Fig Tree Creek Masterplan
2.8 Update biodiversity mapping of high value and potential offset areas to assist development assessment
2.9 Identify and map contaminated sites to assist future planning and mitigation
2.10 Implement and review the Low Carbon Livingstone Strategy

3.0 Standards, Regulation and Compliance

To ensure biodiversity is preserved for the benefit of the whole community and future generations there is a need to maintain standards of public and private use and enjoyment of natural assets such as beaches, freshwater supplies, fisheries stocks and habitats.

As human population grows and the economy is a vast world-wide marketplace, the impact we have on our natural assets increases. Governments at all levels have regulations to govern the take, use and management of land, water and wildlife. Individuals and businesses need to be aware of relevant regulations that protect native animals and vegetation, watercourses, groundwater, and scenic features. Regulations are also required to provide community protection from natural hazards such as bushfire, landslide, coastal erosion, flooding and storm surge.

The Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 provides protection to Matters of National Environment Significance such as threatened species and ecosystems. The State has legislation for the protection of fisheries, remnant vegetation, native wildlife, and water resources. The State has a regulatory role in the prevention of pollution and regulation of activities that have potential to harm the environment through the Environmental Protection Act 1994. The Queensland Biosecurity Act 2014 sets standards for the prevention and management of weeds and pest animals. The Aboriginal Cultural Heritage Act 2003 provides recognition, protection and conservation of Aboriginal cultural heritage. See a list of relevant legislation in the Appendix.

Local government is devolved responsibilities under State legislation; such as the investigation and compliance of illegal dumping and water contamination under the Environment Protection Act 1994; pest management obligations under the Biosecurity Act and management of urban flying fox roosts under the Nature Conservation Act 1992. Council must also comply with State legislation as a landowner and manager of reserve land.

Council policies and local laws guide the use of public spaces, such as the management of vegetation on Council controlled land, encroachment policies and local laws for Council controlled areas, facilities and roads. Local laws that are designed to protect environmental values include Community & Environmental Management, Animal Management and Waste Management. Council may issue compliance notices and infringements for breaches of local laws.

The Livingstone Shire Planning Scheme has provisions for land use on private land that include biodiversity protection and consideration of natural hazards. The Capricorn Municipal Development Guidelines provide a set of standards for infrastructure, endorsed at the regional level. Together with Australian Standards these guidelines inform public and environmental safety.

Land under the control of Council includes many reserves; some are dedicated for environmental purposes such as beach protection reserves. The network of road reserves, constructed or unconstructed, provides nature corridors through the landscape. The management of these areas is important to biodiversity in the long term as they provide critical linkages for wildlife movement and support remnant vegetation that is lost elsewhere in the landscape.

Standards, Regulation and Compliance: Strategies and Actions

3.1 Raise awareness of State laws for Cultural Heritage protection and Native Title compliance

3.2 Implement and review Local Laws and provide public education to support voluntary compliance

3.3 Monitor water quality and sediment loss on development sites

3.4 Map natural hazards and assets in the Planning Scheme and apply consistent standards for land use

3.5 Maintain a compliance framework under the Biosecurity Act 2014

3.6 Educate the public about biodiversity protection and permit requirements

3.7 Maintain and update policies and procedures for use of public land

3.8 Protect locally significant habitat through use of local laws, planning scheme provisions and covenants

3.9 Comply with State regulations and Local Laws together with public education to support voluntary compliance

3.10 Develop a framework for carbon abatement within the organisation and train staff

4.0 Habitat Restoration and Rehabilitation

Council's Environmental Levy provides funding for environmental programmes and projects, on Council land and for community benefit including pest management, natural resource management and sustainability initiatives.

The Livingstone Shire Community Nursery propagates local native plants that are essential for the restoration and rehabilitation of natural areas. Community volunteers assist in the growing of plants that are adapted to local conditions and some grow only in our Shire. The endemic plants that make up unique ecosystems are vital for maintaining biodiversity.

Council and community groups may receive funding through external grants to carry out projects that deliver environmental benefits. Council works collaboratively with not-for-profit community groups, which contribute expertise, funding and in-kind labour. Groups may hold leases or tenure agreements with Council for use and management of land or volunteers with Council assist to restore public land such as the Friends of the Beach programme.

Fitzroy Basin Association, the regional natural resource management body has funded local farmers to implement sustainable agricultural practice change and community environmental restoration projects for over twenty years. Capricornia Catchments and Capricorn Coast Landcare groups deliver on-ground weed control and revegetation projects.

Habitat rehabilitation may be a condition of developments and mining. The restoration of habitat is a key strategy for slowing the decline of biodiversity and it has many co-benefits. Healthy native vegetation provides protection from erosion and weed invasion, it allows water to infiltrate and filter through the soil providing groundwater recharge and maintaining water quality in creeks and rivers. Native vegetation stores carbon and supports many social, health and wellbeing and cultural needs.

Habitat Restoration and Rehabilitation: Strategies and Actions

4.1 Seek traditional owner involvement in habitat restoration projects

4.2 Facilitate and foster habitat restoration by land managers and community groups

4.3 Undertake monitoring of habitat rehabilitation on council land and as a condition of development approvals

4.4 Undertake trials for management of transformer weeds such as high biomass grasses

4.5 Monitor invasive species and native animals in rehabilitation sites to support pest control efforts

4.6 Promote habitat protection and restoration on private land

4.7 Provide advice and support for best practice methods of managing habitat for biodiversity

4.8 Restore and enhance biodiversity on Council controlled land

4.9 Restore degraded sites to prevent soil erosion and sediment pollution

4.10 Plant vegetation on Council controlled areas for carbon storage and co-benefits such as biodiversity and water quality (and social, cultural and economic values)

5.0 Land and Resource Management

The way we manage land, water and sea affects the survival of the diverse range of plants and animals who share our environment. Our use of resources and landscape can have positive and negative impacts to native wildlife. The landscape is divided into different tenures and unless we work together, the outcomes for biodiversity will continue to decline.

Livingstone Shire contains two internationally significant environmental areas that are managed by the Commonwealth government, the Great Barrier Reef World Heritage Area and the Shoalwater Bay and Corio Bays wetlands of international importance.

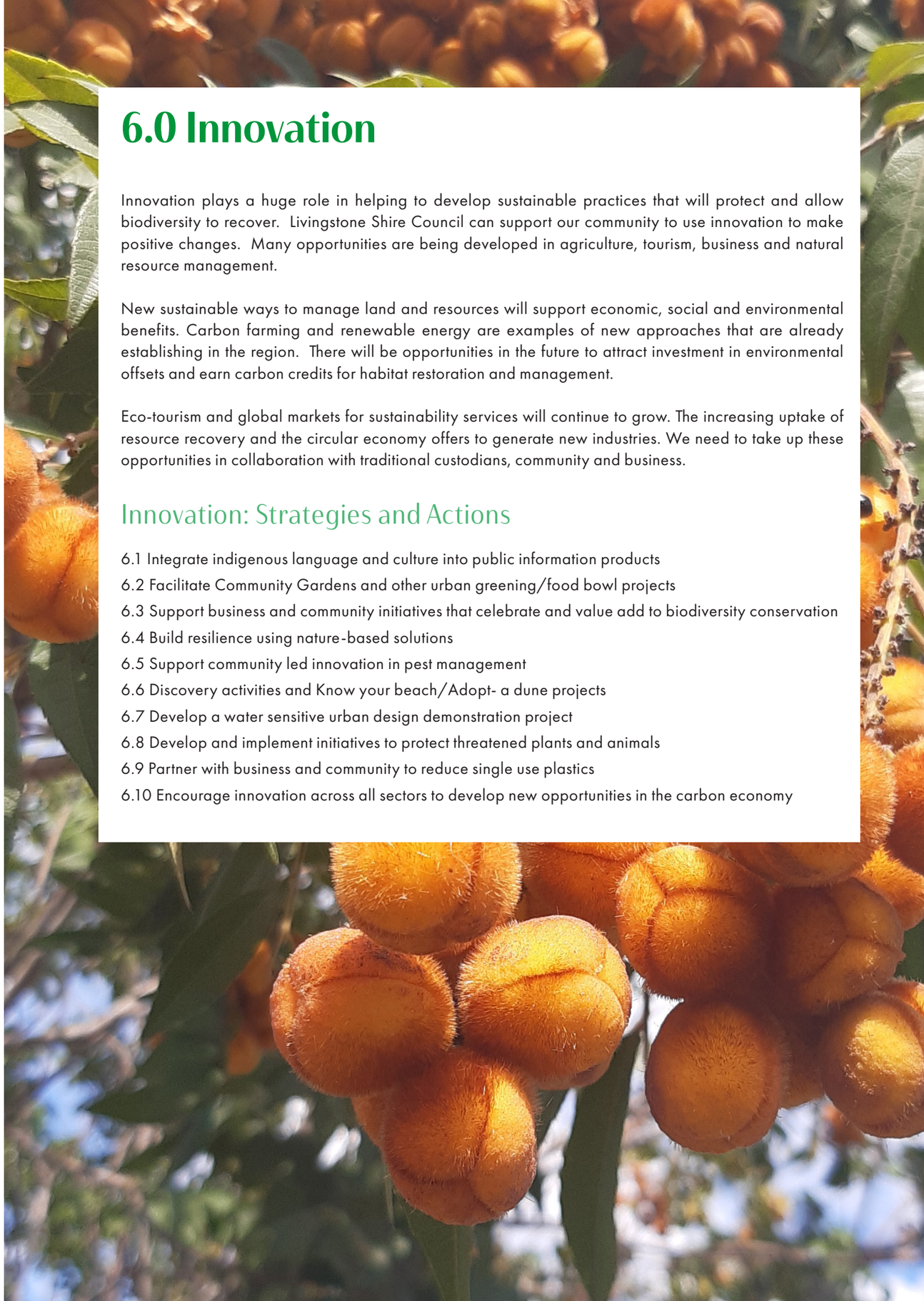
The State government manages National Parks in our region, which are important habitats for wildlife but protected areas cannot maintain our biodiversity in isolation. A network of habitats throughout the landscape is needed and the water catchments need to be healthy to maintain water quality and quantity. That is why we all have a role to play in managing land, water and biodiversity.

Management of land under the control of Local government for biodiversity outcomes can help support native plant and animal populations. Owners of freehold land also have a significant role in maintaining habitat, such as voluntary conservation through the Nature Refuge programme.

The way we use resources and chemicals and how we generate and dispose of waste is having a major impact on the environment. Council has recently developed a Waste Strategy to encourage more sustainable practices and reduce the impacts and costs of waste disposal. The prevention and clean-up of waste and pollution in the environment is vital for the health of ecosystems and communities.

Land and Resource Management: Strategies and Actions

5.1 Develop and implement collaborative projects with traditional custodians
5.2 Participate in local and regional groups and partner to deliver land management outcomes
5.3 Advocate for a waterways Report Card for coastal catchments
5.4 Implement and review the Livingstone Shire Bushfire Management Plan and annual mitigation on Council land
5.5 Facilitate and foster pest management by land managers and community groups
5.6 Promote awareness of successful land and resource management projects
5.7 Implement and review the Livingstone Shire Waste Strategy
5.8 Protect areas from adverse impacts of development and address threatening processes.
5.9 Encourage land and resource practices that minimise use of synthetic materials and chemicals
5.10 Encourage carbon storage in the landscape and reduced CO_2 emissions across all tenures and industries



6.0 Innovation

Innovation plays a huge role in helping to develop sustainable practices that will protect and allow biodiversity to recover. Livingstone Shire Council can support our community to use innovation to make positive changes. Many opportunities are being developed in agriculture, tourism, business and natural resource management.

New sustainable ways to manage land and resources will support economic, social and environmental benefits. Carbon farming and renewable energy are examples of new approaches that are already establishing in the region. There will be opportunities in the future to attract investment in environmental offsets and earn carbon credits for habitat restoration and management.

Eco-tourism and global markets for sustainability services will continue to grow. The increasing uptake of resource recovery and the circular economy offers to generate new industries. We need to take up these opportunities in collaboration with traditional custodians, community and business.

Innovation: Strategies and Actions

6.1 Integrate indigenous language and culture into public information products
6.2 Facilitate Community Gardens and other urban greening/food bowl projects
6.3 Support business and community initiatives that celebrate and value add to biodiversity conservation
6.4 Build resilience using nature-based solutions
6.5 Support community led innovation in pest management
6.6 Discovery activities and Know your beach/Adopt- a dune projects
6.7 Develop a water sensitive urban design demonstration project
6.8 Develop and implement initiatives to protect threatened plants and animals
6.9 Partner with business and community to reduce single use plastics
6.10 Encourage innovation across all sectors to develop new opportunities in the carbon economy

7.0 Awareness, Education and Training

The key to protecting our biodiversity lies in the knowledge and skills of our community. By understanding natural processes and the value of our native plants and animals to our health and wellbeing, to economic prosperity and environmental sustainability, we will look after our natural heritage.

Education is a strong regional focus with the Central Queensland University offering diploma to post graduate degrees in subjects relevant to our sustainable development as a region. Schools are educating the younger generation about sustainable practices and getting involved in environmental monitoring. The North Keppel Island Environmental Education Centre is an award winning facility. Citizen science is emerging as a powerful way to collect and share information about the health of the environment, as more technology and tools become available.

Council can play a role in training its staff, providing opportunities for community awareness and education and giving advice to support sustainable development practices. As population grows we will need to pay greater attention to the impacts we have on the environment in order to preserve our lifestyle and to continue to enjoy the natural assets within the Shire.

Council supports knowledge transfer to residents in many ways; through online and face to face services, fact sheets and guidelines and community workshops. We work collaboratively with not-for-profit community groups and industry to encourage environmental education about pest management, habitat restoration and sustainable practices.

Awareness, Education and Training: Strategies and Actions

7.1 Provide training for Council staff about Native Title and Cultural Heritage
7.2 Participate with other sectors to share training opportunities
7.3 Provide community training opportunities and involvement in monitoring activities
7.4 Raise awareness and skills in environmental management in disaster response and recovery.
7.5 Provide community awareness and training opportunities
7.6 Install information in public places about biodiversity and make available on-line resources
7.7 Deliver Sustainable Livingstone workshop programme
7.8 Provide a voluntary conservation program such as Land for Wildlife
7.9 Provide training to enhance knowledge and skills to prevent pollution such as erosion and sediment control
7.10 Encourage community participation in carbon saving initiatives and programs

Case Study

The North Keppel Island Environmental Education Centre (NKIEEC) is operated by the Queensland Department of Education, for up to 50 students at a time. In 2020, NKIEEC hosted 35 primary school groups and 29 secondary groups from Mackay to South East Queensland and west to Longreach. The centre offers a range of nature- based experiences including coral reef snorkelling, kayaking, bush walking, low ropes, sustainable fishing and drone flying. Students can take marine studies, sustainable living and indigenous history lessons. The centre's boat is named the Gundoo Spirit, celebrating the heritage and ongoing involvement of the Woopaburra people. It facilitates water- based activities and transfers to the mainland and surrounding islands.

The centre runs one of the largest stand-alone renewable energy systems in Australia. The solar panels and wind generator provide the electrical power, along with solar powered street lights and hot water. Waste management is a key issue for sustainability so the centre has a large composting system for food scrapes and composting toilets. Visitors take all plastic and general waste away when leaving the island. As fresh water is a scarce resource at the centre, it relies on visitors' water conserving behaviour.

The NKIEEC is a partner with Queensland Parks and Wildlife Service in the 'Be Pest- free!' program, keeping the island free of cane toads, mice and troublesome ants. The school's P&C help maintain the greenhouse for revegetation of island plants and remove weeds.

NKIEEC highly values the protection of their environment, ensuring they have minimal impact on natural resources and have recently announced a plan to become Carbon Neutral.

8.0 Incentives

To protect biodiversity, people need to become more conscious of the impacts of their own behaviours and lifestyle choices. As a society and as individuals we need to adopt new practices that use less natural resources and as much as possible, regenerate natural resources. Providing incentives for people and businesses to make these positive changes for the environment is a well understood and practised strategy.

Incentives for private property nature conservation may include stewardship payments, fee reductions, grants, extension support, educational workshops or training. Community based, not-for-profit, natural resource management groups; such as Fitzroy Basin Association and Capricornia Catchments; work with landowners to implement practise change and improve environmental outcomes. Projects to repair or enhance natural areas include installing erosion controls, property management infrastructure such as fencing and off-stream water points, weed control and revegetation. Incentives for landholder practise change share the costs of making changes that will lead to environmental improvements.

Council currently offers a rebate on property rates for holders of Nature Refuge Agreements. These voluntary conservation agreements are facilitated through the Queensland government Nature Refuge program. Procurement policies can incentivise private enterprise to invest in sustainability measures and environmental safe guards in order to win contracts.

Incentives: Strategies and Actions

8.1 Explore potential incentives to support traditional custodian land management works for Council
8.2 Maintain rate rebate for Nature Refuge properties
8.3 Provide support for programmes that educate and collect environmental data
8.4 Support training for staff, contractors and volunteers to learn about biodiversity hazards and threats
8.5 Provide support for programmes that educate and collect data to support pest management
8.6 Support accreditation as an Eco-tourism destination
8.7 Implement a co-design project with community to deliver multiple sustainability benefits
8.8 Maintain and develop the Livingstone Community Nursery with the support of volunteers and community groups
8.9 Implement programmes to address illegal dumping and pollution
8.10 Promote Electric Vehicle charging opportunities

The Department of Environment and Science assists landholders to protect significant conservation values on their property under a nature refuge.

National parks alone cannot maintain the diversity of plants, animals and ecosystems found in Queensland. Private landholders can play a vital role in protecting the state's biodiversity by establishing a nature refuge on their property. A nature refuge is a class of protected area under the *Nature Conservation Act 1992 (NCA)*.

Nature Refuges

A nature refuge is a voluntary covenant acknowledging a landholder's commitment to protect significant conservation values on their land. A nature refuge agreement is legally binding, perpetual, negotiated directly with the landholder, and tailored to suit the landholder's management needs.

Benefits

- becomes part of a network of over 541 properties covering more than four million hectares
- contributes to the conservation and protection of Queensland's biodiversity
- balances protection with ecologically sustainable use of the land
- protects the property's conservation value for future generations
- is tailored to suit the management needs of the property
- gives landholders access to conservation management advice from nature refuge officers

Archontophoenix Grove Nature Refuge

The nature refuge contains a relatively undisturbed *Archontophoenix alexandrae* closed palm forest. Typically, a north Queensland community, it is near the southern limit of its geographical range. The remnant is in very good condition and is protected by eucalypt open forest and has areas of semi-evergreen vine thicket.

The *Archontophoenix alexandrae* palm forest is a locally significant remnant of a community, which would once have covered extensive areas along the Keppel coast, but has been cleared for agricultural purposes.

The original landholders of Archontophoenix Grove, Ian and Cathy Herbert, recognised the values of the uncleared remnant vegetation on the property. In 1996, they approached the Department requesting a Nature Refuge Agreement be placed over the seven hectare property. It was one of the first nature refuges declared in Queensland.

Australian native Cordyline manners-suttoniae Photo John McCabe

Archontophoenix alexandrae closed palm forest Photo John McCabe

9.0 Research, Monitoring and Audit

Sustainable management of biodiversity relies on good information about the location and condition of natural ecosystems. To ensure management is effective and adaptive, the strategies and outcomes need to be monitored.

Council can collect information directly and utilise research and data collected by agencies, universities and the community to inform biodiversity management. For example, regular surveys of the condition of pandanus trees on the coastline inform the implementation of biocontrol to address the die back caused by the Pandanus plant hopper.

Community groups undertake projects to survey the natural environment such as the Livingstone Remnant Vegetation Study and Birds Capricornia regular bird surveys. Citizen science is important both as a monitoring tool and as an education opportunity.

Case Study

BirdLife Capricornia works in conjunction with Council and other Natural Resource Management groups such as the Fitzroy Basin Association, Greening Australia and Capricorn Coast Landcare to deliver biodiversity projects. A recent example is; a nest box project where together with Capricorn Coast Landacare volunteers erected 90 nest boxes in the Cobraball area to provide nesting places for bird and animal species that had lost nesting hollows as a result of the Cobraball fires in 2019.

Shorebird surveys and identification of beach stone-curlew nesting locations. Protection of a red-capped plover breeding site at Farnborough beach with the erection of signs funded by Fitzroy Basin Association.

Support for the recovery of the endangered Capricorn yellow chat in the form of a landholders habitat management guide, report into sea level rise mitigation measures and a technical review of the Recovery Plan for the Capricorn yellow chat (funded by Greening Australia).

Research, Monitoring and Audit: Strategies and Actions

9.1 Engage traditional custodians to undertake Cultural Heritage and environmental surveys for relevant projects
9.2 Undertake projects with community to research and monitor environmental conditions
9.3 Develop and implement a Flying Fox Roost Monitoring program
9.4 Collect Coastal Monitoring data to support planning and management
9.5 Undertake mapping of invasive pest species
9.6 Undertake surveys and audits of Council land to identify significant biodiversity values and threats
9.7 Audit the condition of existing covenants to support compliance and restoration activities
9.8 Monitor tree clearing in the Shire to support compliance and restoration activities
9.9 Monitor areas to support compliance and restoration activities
9.10 Undertake regular energy use/carbon auditing of Council facilities and fleet

10.0 Collaboration and Partnerships

Council works in collaboration and partnership with community, traditional custodians, government and industry to plan and deliver projects and programmes to support biodiversity conservation.

Local government is part of a network of organisations that support the management of the Great Barrier Reef through the Reef Guardian Councils programme. We participate in the local advisory groups such as the Local Marine Advisory Committee and the Shoalwater Bay Environmental Advisory Committee.

Membership of organisations and programmes for integrated catchment management and sustainable resource management assist Council to implement practices and support collaborative projects. For example, Fitzroy Basin Association and Climate Resilient Councils.

Council facilitates the Environment and Regulatory Taskforce meetings that support community participation and feedback in the Local Disaster Management framework. Through partnerships and sponsorship Council supports community led initiatives and on-ground projects such as beach clean ups, tree planting and weed control.

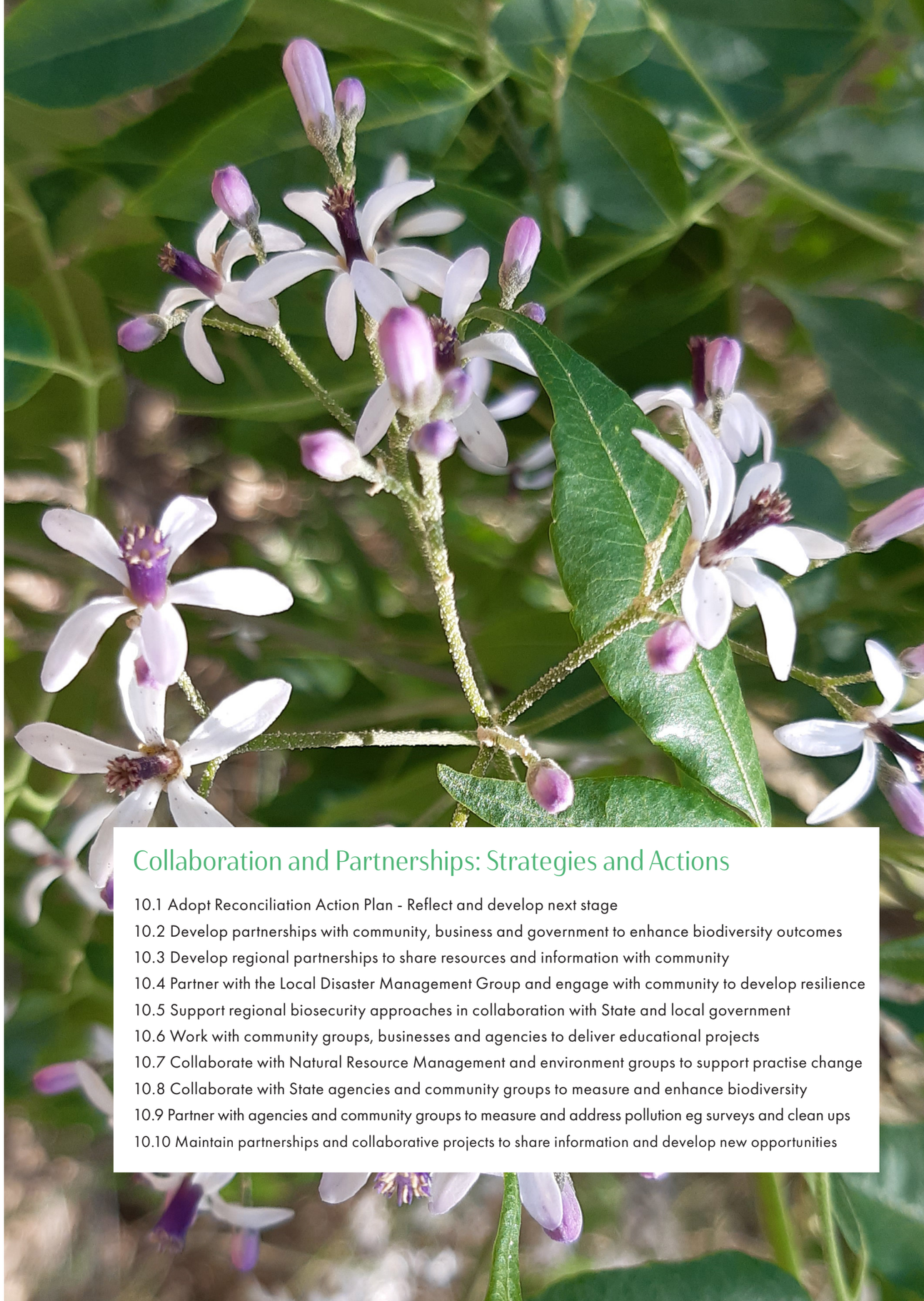
Case Study - Reef Guardian Councils

A collaborative stewardship arrangement between local government and the Great Barrier Reef Marine Park Authority, The Reef Guardian Council program recognises and supports local governments that undertake projects to protect the reef.

The Great Barrier Reef Marine Park Authority launched the programme in 2007 and now nineteen councils have joined, located between Bundaberg and Cooktown in the Great Barrier Reef Catchment, stretching over 300 000 square kilometres and encompassing a population of over a one million.

The councils in the programme serve a crucial role in managing the impacts of development and facilitating sustainable land management. Reef Guardian Councils will often undertake projects and actions relating to waste management, water management, land management, climate change, community education and capacity building.

Annual Reef Guardian Action Plans record the diversity of the council's actions and projects that will contribute to the reef health.



Collaboration and Partnerships: Strategies and Actions

10.1 Adopt Reconciliation Action Plan - Reflect and develop next stage
10.2 Develop partnerships with community, business and government to enhance biodiversity outcomes
10.3 Develop regional partnerships to share resources and information with community
10.4 Partner with the Local Disaster Management Group and engage with community to develop resilience
10.5 Support regional biosecurity approaches in collaboration with State and local government
10.6 Work with community groups, businesses and agencies to deliver educational projects
10.7 Collaborate with Natural Resource Management and environment groups to support practise change
10.8 Collaborate with State agencies and community groups to measure and enhance biodiversity
10.9 Partner with agencies and community groups to measure and address pollution eg surveys and clean ups
10.10 Maintain partnerships and collaborative projects to share information and develop new opportunities

STRATEGIES / OBJECTIVES	1. INVESTMENT	2. STRATEGIC PLANNING	3. STANDARDS, REGULATION AND COMPLIANCE	4. HABITAT RESTORATION AND REHABILITATION	5. LAND AND RESOURCE MANAGEMENT
1. Partner with traditional custodians and facilitate opportunities for co-management	1.1 Develop employment and training opportunities for Indigenous people	2.1 Review and develop Indigenous Land Use agreements	+3.1 Raise awareness of State laws for Cultural Heritage protection and Native Title compliance	4.1 Seek traditional owner involvement in habitat restoration projects	5.1 Develop and implement collaborative projects with traditional custodians
2. Work in collaboration and partnership with our community	1.2 Invest and seek external funding opportunities in partnership with community	2.2 Support regional approaches to biodiversity planning and projects	3.2 Implement and review Local Laws and provide public education to support voluntary compliance	4.2 Facilitate and foster habitat restoration by land managers and community groups	5.2 Participate in local and regional groups and partner to deliver land management outcomes
3. Understand the values, processes, condition and function of natural ecosystems	1.3 Seek opportunities to encourage citizen science initiatives	2.3 Develop a strategic plan for monitoring biodiversity	3.3 Monitor water quality and sediment loss on development sites	4.3 Undertake monitoring of habitat rehabilitation on council land and as a condition of development approvals	5.3 Advocate for a waterways Report Card for coastal catchments
4. Identify hazards and threats to biodiversity in order to inform planning and management	1.4 Implement 'Our Living Coast' Coastal Hazard Adaptation Strategy	2.4 Incorporate environmental risks in Local Disaster Management via the Environmental Taskforce	3.4 Map natural hazards and assets in the Planning Scheme and apply consistent standards for land use	4.4 Undertake trials for management of transformer weeds such as high biomass grasses	5.4 Implement and review the Livingstone Shire Bushfire Management Plan and annual mitigation on Council land
5. Prevent and reduce the impacts of pest plants and animals	1.5 Seek external funding for pest management in partnership with community	2.5 Implement and review the Livingstone Shire Biosecurity Plan 2018-2023	3.5 Maintain a compliance framework under the Biosecurity Act 2014	4.5 Monitor invasive species and native animals in rehabilitation sites to support pest control efforts	5.5 Facilitate and foster pest management by land managers and community groups
6. Inform the community about significant environmental areas and their protection	1.6 Provide interactive mapping online, fact sheets, guidelines and further sources of information	2.6 Provide duty planner and advice services	3.6 Educate the public about biodiversity protection and permit requirements	4.6 Promote habitat protection and restoration on private land	5.6 Promote awareness of successful land and resource management projects
7. Integrate sustainable practices and designs into land and resource management	1.7 Include environmentally sustainable standard drawings in Capricorn Municipal Development Guidelines	2.7 Develop integrated catchment management plans such as Fig Tree Creek Masterplan	3.7 Maintain and update policies and procedures for use of public land	4.7 Provide advice and support for best practice methods of managing habitat for biodiversity	5.7 Implement and review the Livingstone Shire Waste Strategy
8. Maintain and enhance the extent, range and richness of biodiversity in strategic locations	1.8 Seek opportunities to source Environmental and Carbon offsets	2.8 Update biodiversity mapping of high value and potential offset areas to assist development assessment	3.8 Protect locally significant habitat through use of local laws, planning scheme provisions and covenants	4.8 Restore and enhance biodiversity on Council controlled land	5.8 Protect areas from adverse impacts of development and address threatening processes.
9. Prevent and reduce pollution of water, soil and air	1.9 Maintain appropriate expertise and training of Council staff to address pollution events	2.9 Identify and map contaminated sites to assist future planning and mitigation	3.9 Comply with State regulations and Local Laws together with public education to support voluntary compliance	4.9 Restore degraded sites to prevent soil erosion and sediment pollution	5.9 Encourage land and resource practices that minimise use of synthetic materials and chemicals
10. Reduce the carbon footprint of Council and support community practice change	1.10 Invest and seek external funding for energy efficiency and renewable energy initiatives	2.10 Implement and review the Low Carbon Livingstone Strategy	3.10 Develop a framework for carbon abatement within the organisation and train staff	4.10 Plant vegetation on Council controlled areas for carbon stoarge and co-benefits such as biodiversity and water quality	5.10 Encourage carbon storage in the landscape and reduced CO2 emissions across all tenures and industries

STRATEGIES / OBJECTIVES	6. INNOVATION	7. AWARENESS, EDUCATION AND TRAINING	8. INCENTIVES	9. RESEARCH, MONITORING AND AUDIT	10. COLLABORATION AND PARTNERSHIPS
1. Partner with traditional custodians and facilitate opportunities for co-management	6.1 Integrate indigenous lanugage and culture into public information products	7.1 Provide training for Council staff about Native Title and Cultural Heritage	8.1 Explore potential incentives to support traditional custodian land management works for Council	9.1 Engage traditional custodians to undertake Cultural Heritage and environmental surveys for relevant projects	10.1 Adopt Reconciliation Action Plan - Reflect and develop next stage
2. Work in collaboration and partnership with our community	6.2 Develop Community Gardens and other urban greening/foodbowl projects	7.2 Participate with other sectors to share training opportunities	8.2 Maintain rate rebate for Nature Refuge properties	9.2 Undertake projects with community to research and monitor environmental conditions	10.2 Develop partnerships with community, business and government to enhance biodiversity outcomes
3. Understand the values, processes, condition and function of natural ecosystems	6.3 Support business and community initiatives that celebrate and value add to biodiversity conservation	7.3 Provide community training apportunities and involvement in monitoring activities	8.3 Provide support for programmes that educate and collect environmental data	9.3 Develop and implement a Flying Fox Roost Monitoring program	10.3 Develop regional partnerships to share resources and information with community
4. Identify hazards and threats to biodiversity in order to inform planning and management	6.4 Build resilience using nature-based solutions	7.4 Raise awareness and skills in environmental management in disaster response and recovery.	8.4 Support training for staff, contractors and volunteers to learn about biodiversity hazards and threats	9.4 Collect Coastal Monitoring data to support planning and management	10.4 Partner with the Local Disaster Management Group and engage with community to develop resilience
5. Prevent and reduce the impacts of pest plants and animals	6.5 Support community led innovation in pest management	7.5 Provide community awareness and training opportunities	8.5 Provide support for programmes that educate and collect data to suppport pest management	9.5 Undertake mapping of invasive pest species	10.5 Support regional biosecurity approaches in collaboration with State and local government
6. Inform the community about significant environmental areas and their protection	6.6 Discovery activities and Know your beach/Adopt-a dune projects	7.6 Install information in public places about biodiversity and make available on-line resources	8.6 Support accreditation as an Eco-tourism destination	9.6 Undertake surveys and audits of Council land to identify significant biodiversity values and threats	10.6 Work with community groups, businesses and agencies to deliver educational projects
7. Integrate sustainable practices and designs into land and resource management	6.7 Develop a water sensitive urban design demonstration project	7.7 Deliver Sustainable Livingstone workshop programme	8.7 Implement a co-design project with community to deliver multiple sustainability benefits	9.7 Audit the condition of existing covenants to support compliance and restoration activities	10.7 Collaborate with NRM and environment groups to support practise change
8. Maintain and enhance the extent, range and richness of biodiversity in strategic locations	1.8 Seek opportunities to source Environmental and Carbon offsets	7.8 Provide a voluntary conservation program such as Land for Wildlife	8.8 Maintain the Livingstone Community Nursery with the support of volunteers and community groups	9.8 Monitor tree clearing in the Shire to support compliance and restoration activities	10.8 Collaborate with State agencies and community groups to measure and enhance biodiversity
9. Prevent and reduce pollution of water, soil and air	6.9 Partner with business and community to reduce single use plastics	7.9 Provide training to enhance knowledge and skills to prevent pollution such as erosion and sediment control	8.9 Implement programmes to address Illegal dumping and pollution	9.9 Monitor areas to support compliance and restoration activities	10.9 Partner with agencies and community groups to measure and address pollution eg surveys and clean ups
10. Reduce the carbon footprint of Council and support community practice change	6.10 Encourage innovation across all sectors to develop new opportiunities in the carbon economy	7.10 Encourage community participation in carbon saving initiatives and programs	8.10 Promote Electric Vehicle charging opportunities	9.10 Undertake regular energy use/carbon auditing of Council facilities and fleet	10.10 Maintain partnerships and collaborative projects to share information and develop new opportunities

Biodiversity Strategy Action Plan

GREEN BOX SHOWS WHEN OBJECTIVE WILL BE COMPLETED

OBJECTIVES	Actions	1-2 years	3-4 years	5-6 Years
1. Partner with Traditional Custodians and facilitate opportunities for co-management	1.1 Develop employment and training opportunities for indigenous people			
	2.1 Review and develop Indigenous Land Use agreements			
	3.1 Raise awareness of State Laws for Cultural Heritage protection and Native Title compliance			
	4.1 Seek traditional owner involvement in habitat restoration projects			
	5.1 Develop and implement collaborative projects with Traditional Custodians			
	6.1 Integrate indigenous language and culture into public information products			
	7.1 Provide training for Council staff about Native Title and Cultural Heritage			
	8.1 Explore potential incentives to support Traditional Custodian Land Management works for Council			
	9.1 Engage Traditional Custodians to undertake Cultural Heritage and environmental surveys for relevant projects			
	10.1 Adopt Reconciliation Action Plan - Reflect and develop next stage			
2. Work in collaboration and partnership with our community	1.2 Invest and seek external funding opportunities in partnership with community			
	2.2 Support regional approaches to biodiversity planning and projects e.g. Ramsar Advisory Group			
	3.2 Implement and review Local Laws and provide public education to support voluntary compliance			
	4.2 Facilitate and foster habit restoration by land managers and community groups			
	5.2 Participate in local and regional groups and partner to deliver land management outcomes			
	6.2 Develop Community Gardens and other urban greening/food bowl projects			
	7.2 Participate with other sectors to share training opportunities			
	8.2 Maintain rate rebate for Nature Refuge properties			
	9.2 Undertale projects with community to reasearch and monitor environmental conditions			
	10.2 Develop partnerships with community , business and government to enhance biodiversity outcomes			

OBJECTIVES	Actions	1-2 years	3-4 years	5-6 Years
3. Understand the values, processes, condition and function of natural ecosystems	1.3 Seek opportunities to encourage citizen science initiatives			
	2.3 Develop a strategic plan for monitoring biodiversity			
	3.3 Monitor water quality and sediment loss on development sites			
	4.3 Undertake monitoring of habitat rehabilitation on council land and as a condition of development approvals			
	5.3 Advocate for waterways Report Card for coastal catchments			
	6.3 Support business and community initiatives that celebrate and add value to biodiversity conservation			
	7.3 Provide community training opportunities and involvment in monitoring activities			
	8.3 Provide support for programmes that educate and collect environmental data			
	9.3 Develop and implement a Flying Fox Roos Monitoring program			
	10.3 Develop regional partnerships to share resources and information with community			
4. Identify hazards and threats to biodiversity in order to inform planning and management	1.4 Implement 'Our Living Coast' Coastal Hazard Adaptation Strategy			
	2.4 Incorporate environmental risks in Local Disaster Management via the Environmental Taskforce			
	3.4 Map natural hazards and assets in the Planning Scheme and apply consistent standards for land use			
	4.4 Undertake trials for management of transformer weeds such as high biomass grasses			
	5.4 Implement and review the Livingstone Shire Bushfire Management Plan and annual mitigation on Council land			
	6.4 Build resilience using nature-based solutions			
	7.4 Raise awareness and skills in environmental management in disaster response and recovery			
	8.4 Support training for staff, contractors and volunteers to learn about biodiversity hazards and threats			
	9.4 Collect Coastal Monitoring data to support planning and management			
	10.4 Partner with the Local Disaster Management Group and engage with community to develop resilience			

OBJECTIVES	Actions	1-2 years	3-4 years	5-6 Years
5. Prevent and reduce the impacts of pest plants and animals	1.5 Seek external funding for pest management in partnership with community			
	2.5 Implement and review the Livingstone Shire Biosecurity Plan 2018-2023			
	3.5 Maintain a compliance framework under the Biosecurity Act 2014			
	4.5 Monitor invasive species and native animals in rehabilitation sites to support pest control effects			
	5.5 Facilitate and foster pest management by land managers and community groups			
	6.5 Support community led innovation in pest management			
	7.5 Provide community awareness and training opportunities			
	8.5 Provide support for programmes that educate and collect data to support pest management			
	9.5 Undertake mapping of invasive pest species			
	10.5 Support regional biosecurity approaches in collaboration with State and Local government			
6. Inform the community about significant environmental areas and their protection	1.6 Provide interactive mapping online, fact sheets, guidelines and further sources of information			
	2.6 Provide duty planner and advice services			
	3.6 Educate the public about biodiversity protection and permit requirements			
	4.6 Promote habitat protection and restoration on private land			
	5.6 Promote awareness of successful land and resource management projects			
	6.6 Discovery activities and Know Your Beach/Adopt A Dune projects			
	7.6 Install information in public places about biodiversity and make available online resources			
	8.6 Support accreditation as an Eco-Tourism destination			
	9.6 Undertake surveys and audits of Council land to identify significant biodiversity values and threats			
	10.6 Work with community groups, businesses and agencies to deliver education projects			

OBJECTIVES	Actions	1-2 years	3-4 years	5-6 Years
7. Integrate sustainable practices and designs into land and resource management	1.7 Include environmentally sustainable standard drawings in Capricorn Municipal Development Guidelines			
	2.7 Develop integrated catchment management plans such as Fig Tree Creek Masterplan			
	3.7 Maintain and update policies and procedures for use of public land			
	4.7 Provide advice and support for best practice methods of managing habitat for biodiversity			
	5.7 Implement and review the Livingstone Shire Waste Strategy			
	6.7 Develop a water sensitive urban design demonstration project			
	7.7 Deliver Sustainable Livingstone workshop programme			
	8.7 Implement a co-design project with community to deliver multiple sustainability benefits			
	9.7 Audit the condition of existing covenants to support compliance and restoration activities			
	10.7 Collaborate with NRM and environment groups to support practise change			
8. Maintain and enhance the extent, range and richness of biodiversity in strategic locations	1.8 Seek opportunities to source Environmental and Carbon offests			
	2.8 Update biodiversity mapping of high value and potential offset areas to assist development assessment			
	3.8 Protect locally significant habitat through use of local laws, planning scheme provisions and covenants			
	4.8 Restore and enhance biodiversity on Council controlled land			
	5.8 Protect areas from adverse impacts of development and address threatening processes			
	6.8 Develop and implement initiatives to protect threatened plants and animals			
	7.8 Provide a voluntary conservation program such as Land for Wildlife			
	8.8 Maintain the Livingstone Community Nursery with the support of volunteers and community groups			
	9.8 Monitor tree clearing in the Shire to support compliance and restoration activities			
	10.8 Collaborate with State agencies and community groups to measure and enhance biodiversity			

OBJECTIVES	Actions	1-2 years	3-4 years	5-6 Years
9. Prevent and reduce pollution of water, soil and air	1.9 Maintain appropriate expertise and training of Council staff to address pollution events			
	2.9 Identify and map contaminated sites to assist future planning and mitigation			
	3.9 Comply with State regulations and Local Laws together with public education to support voluntary compliance			
	4.9 Restore degraded sites to prevent soil erosion and sediment pollution			
	5.9 Encourage land and resource practices that minimise use of of synthetic materials and chemicals			
	6.9 Partner with business and community to reduce single use plastics			
	7.9 Provide training to enhance knowledge and skills to prevent pollution such as erosion and sediment control			
	8.9 Implement programmes to address illegal dumping and pollution			
	9.9 Monitor areas to support compliance and restoration activities			
	10.9 Partner with agencies and community groups to measure and address polluton eg surveys and clean ups			
10. Reduce the carbon footprint of Council and support community practice change	1.10 Invest and seek external funding for energy efficiency and renewable energy initiatives			
	2.10 Implement and review the Low Carbon Strategy			
	3.10 Develop a framework for carbon abatement within the organisation and train staff			
	4.10 Plant vegetation on Council land for carbon storage and co-benefits such as biodiversity and water quality			
	5.10 Encourage carbon storage in the landscape and reduce CO2 emissions across all tenures and industries			
	6.10 Encourage innovation across all sectors to develop new opportunities in the carbon economy			
	7.10 Encourage community participation in carbon saving initiatives and programs			
	8.10 Promote Electric Vehicle charging opportunities			
	9.10 Undertake regular energy use/carbon auditiing of Council facilities and fleet			
	10.10 Maintain partnerships and collaborative projects to share information and develop new opportunities			

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Livingstone
SHIRE COUNCIL

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