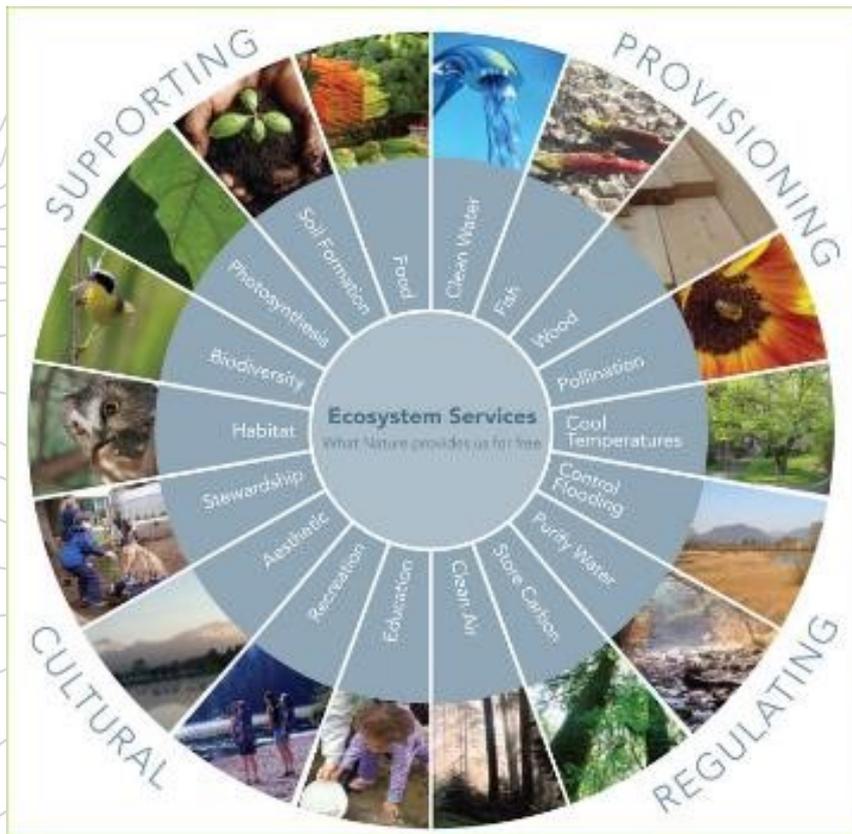


Bellingen Shire Biodiversity Strategy

Bellingen Shire Council



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Abbreviations

Abbreviation	Description
BC Act	Biodiversity Conservation Act
CEEC	Critically Endangered Ecological Community
BEC	Bellingen Environment Centre
BFCEC	Bellingen Floodplain, Coast and Estuary Committee
BLI	Bellingen Landcare Incorporated
BOS	Biodiversity Offsets Scheme
BS Act	Biosecurity Act
BSC	Bellingen Shire Council
BSLA	Bellingen Shire Learning Alliance

Abbreviation	Description
CEL	Centre for Ecological Learning
DCP	Development Control Plan
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning Industry and Environment
DPI - Water	NSW Department of Primary Industries – Water
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW Environment Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	Ecologically Sustainable Development
FM Act	Fisheries Management Act 1995
GANSW	Government Architect NSW
LGA	Local Government Area
LLS	Local Land Services
LLS Act	Local Land Services Act 2013
NCLLS	North Coast Local Land Services
NPWS	National Parks and Wildlife Services
LEP	Local Environmental Plan
LGA	Local Government Area
OEH	NSW Office of Environment and Heritage
PoM	Plan of Management
ROGHD	Regional Operations Group and Heritage Division
SAII	Serious and Irreversible Impacts
SoS	Saving Our Species
TEC	Threatened Ecological Community
VMP	Vegetation Management Plan
WM Act	Water Management Act 2000
WoNS	Weeds of National Significance

Foreword

Bellingen Shire Council acknowledges the traditional custodians of this land, the Gumbaynggirr people, who have cared for this country since the Dreaming (Yuludarla) many thousands of years ago.

We pay our respects to their elders; past, present and emerging, and wish to work together with Gumbaynggirr Custodians towards a shared future of reconciliation and celebration of their deep connection with country and their living culture.

We recognise the Aboriginal songlines that traverse the landscape, which tell of the law, history and culture of Gumbaynggirr Custodians and have been created, maintained and practiced for many thousands of years.

Gumbaynggirr lands extend over a large area of the NSW Mid North Coast, stretching from the Nambucca River in the south up to the Clarence River (Grafton) in the north, across to the Great Dividing Range in the west and east to the Pacific coast.

Many Aboriginal people from Bellingen (Baalijin), Grafton (Jadalmany), Coffs Harbour (Garlambirla), Nambucca (Nyambaga) and inland of these areas identify as Gumbaynggirr (Muurrbay 2019).

The name Bellingen came from the original Gumbaynggirr word Baalijin (meaning Quoll or 'cheeky fellow'). The Gumbaynggirr name for the Bellinger River is Bindaray Yurruun (Bellingen and Urunga Museums 2019).

It is with regard to Gumbaynggirr law, history and culture, that the first action of this strategy has been developed, for Council to engage in Juungambala led by Gumbaynggirr Custodians. Juungambala is about building a living agreement with Gumbaynggirr people and working towards peace together through building mutual understanding and respect. Caring for Country and understanding our connection to the landscape is fundamental in protecting biodiversity and our environment.

Climate Emergency

At its ordinary meeting on March 27th 2019, Bellingen Shire Council resolved to declare a Climate Emergency. The declaration acknowledges that Bellingen Shire is being affected by climate impacts, particularly increasing sea level rise, bushfires, heat waves, severe storms, drought and floods. These threaten our people, plants and animals. Council are committed to the following guiding principles:

- rapidly reduce council's carbon emissions
- support our community to reduce their carbon emissions
- minimize where possible the loss and damage to our community from the unavoidable impacts of climate change.

These principles have been integrated within the development of this document.

Executive Summary

Biodiversity is the variety of life, from vegetation communities to individual species and the genes they contain. Our quality of life depends on maintaining biodiversity so that ecosystem services such as the availability of fresh water, food, and fuel sources remain. The key is to make our use of biodiversity sustainable, so that the social, economic, environmental and health services provided by healthy ecosystems can continue to provide their benefits for current and future generations.

At the local level, the Shire of Bellingen has developed this Biodiversity Strategy to help to ensure that local ecosystem health, including species and their genetic diversity, survive in their natural habitat. The Strategy's vision is that "Bellingen is a community that values, protects, conserves and enhances natural areas and biodiversity in coastal, river and plateau environments". This Biodiversity Strategy is designed to act as an overarching framework that sits within the Bellingen Shire Council (BSC) Community Strategic Plan. It is designed to allow future action plans to be created and implemented and help inform Plans of Management (PoM) for Parks and Reserves. The document will allow for flexibility and provides the ability to measure improvement and better prioritise spending on biodiversity.

The Biodiversity Strategy supports and aggregates existing local biodiversity management plans which include the Gleniffer Reserves PoM, Bellingen Shire Council Coastal Area Koala Management Strategy, Bellinger and Kalang Rivers Health Plans, Bellinger and Kalang River Estuary Management Plan, Bellingen Island Flying-fox Camp Management Plan, Bellinger River Snapping Turtle Management Program and the Coastal Zone Management Plan. The common themes present in all these plans are the management and preservation of natural values. The Koala, Grey-headed Flying-fox and Bellinger River Snapping Turtle management plans have similar objectives, namely to preserve the long-term sustainability of the unique fauna and their habitats. Habitat maintenance, protection and expansion have been identified as fundamental to achieving preservation goals. The river, estuary and coastal management plans identify potential hazards and risks to major water courses in the Bellingen Shire. These plans provide strategic approaches to address impacts such as erosion, sedimentation and pollution, in order to maintain aquatic and riparian biodiversity values.

The Community Strategic Plan sets out the 2027 (Bellingen Shire Council, 2017) vision for the Local Government Area (LGA). To implement the action items of the Community Strategic Plan, the Biodiversity Strategy will link with Council's four-year Delivery Plan, and its one-year Operational Plan. Council will have the ability to prioritise budget allocations based on conservation priorities that have been identified.

This Strategy is based upon seven interconnected key focus areas: working respectfully with land custodians, native vegetation, rivers, corridors and connectivity, public spaces, habitat and species preservation. It is supported by international, national, state and local policy that drives the development of a biodiversity strategy at the local level and provides capacity to reinforce regional connections and enhance local corridors. The Strategy will allow for regional partnerships and is flexible enough to embrace any future infrastructure and development.

Bellingen Shire LGA is located on the Mid North Coast of NSW, midway between Sydney and Brisbane. The total area is 160,205 hectares (ha) which includes 10 kilometres (km) of coastline. The Shire has three broad topographical areas; namely coastal, river and plateau areas. The coastal areas include the

communities of Mylestom, Repton and Urunga; the valley communities are situated along the Bellinger and Kalang rivers; and the plateau area is situated at Dorrigo.

Bellingen Shire has population of 12,668 (ABS 2016) with main employment industries being Health Care and Social Assistance, followed by Agriculture, Forestry and Fishing. Tourism is an important industry, with over 300,000 people visiting the Shire each year.

State Forests and National Parks total an approximate area of 194,000 ha, representing 53 % of Bellingen LGA. The natural environments of State Forests and National Parks support the unique ecological diversity of the area. This Strategy has identified the values and threats to biodiversity values within the Bellingen Shire and has identified wildlife corridors on a local and regional scale. These corridors currently provide a degree of connectivity between bushland reserves; and priority areas have been identified that require revegetation works to link reserves and improve the degree of landscape connectivity.

Biodiversity measures have been listed, so that the actions in this Strategy can be implemented and monitored for successful completion. Each action has been developed based on the literature review, vision and key focus areas of this Strategy. The actions provide a well-informed basis for undertaking works to improve, maintain and ultimately enhance the biodiversity values of the Bellingen Shire.



Image 1: Critically Endangered Lowland rainforest on floodplain: White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion. Photo: Chris Ormond

1. Purpose of the Biodiversity Strategy

The Bellingen Shire Biodiversity Strategy will provide the overarching framework to assist management, enhancement and protection of natural areas and biodiversity in the Bellingen Shire LGA for the next 10 years. This document addresses the need for consideration of biodiversity within the context of Council's management and operations by identifying values and issues and presenting strategies and actions that can be undertaken.

This Strategy has been developed within the context of wider frameworks including neighbouring LGAs, the broader North Coast region, NSW, Australia and internationally. As such, it is also a tool to guide Council in its own activities and in its dealings with organisations that may have an impact on biodiversity in Bellingen.

1.1 Vision

The Bellingen Shire 2027 Community Strategic Plan (Bellingen Shire Council, 2017) outlines five themes for the Shire as a response to the clear and consistent priorities from the community. One of the key themes is the 'Living Environment' and its aspirations are outlined as:

"We protect and enhance our biodiversity; we work together to protect and enhance our environment; we live sustainably and reduce our ecological footprint and contribution to climate change; we have clean water which is protected and used sustainably; our surroundings are quiet and clean and we reduce, reuse, recycle..."

This Biodiversity Strategy is consistent with the communities' vision and outcomes for the region. The vision for this Biodiversity Strategy is:

"Bellingen is a community that values, protects, conserves and enhances natural areas and biodiversity in unique coastal, river and plateau environments"

1.2 Key Focus Areas

The vision for the Bellingen Biodiversity Strategy is supported by the following seven key focus areas, which are all interconnected:

Juungambala and Caring for Country: building a living agreement with Gumbaynggirr custodians

Juungambala is about building a living agreement with Gumbaynggirr people and working towards peace together through building mutual understanding and respect.

Native Vegetation: protecting, managing and restoring native vegetation for current and future generations

Native vegetation provides habitat for plants and animals and is the cornerstone of biodiversity and ecosystem processes across the Bellingen Shire. This includes forests, rainforests, wetlands, marshes, heathlands and grasslands that provide structurally complex habitat elements.

Waterways: managing and conserving river systems, wetlands, riparian land, coastal and estuarine health

Healthy rivers support environmental, social and economic practices in equilibrium so that human activities maintain the preservation of riverine and riparian ecological values. The Bellinger and Kalang river systems are focal points for communities within the Bellingen Shire, and the community seeks to enhance riparian and aquatic habitat values and water quality.

Corridors and Connectivity: enhancing landscape linkages

Corridors connect larger habitat patches allowing movement of species and/or genetic interchange among native flora and fauna, thereby maintaining biodiversity across the landscape. It is important that linkages are recreated to support the movement of flora and fauna in a biodiverse landscape.

Public Spaces: managing our reserves to promote biodiversity and community interaction

Public reserves are a focal point for biodiversity management, places of rest and recreation for the community; and support areas of vegetation in the LGA. They provide opportunities for enhancing habitat for native flora and fauna. Community interaction and volunteer programs provide extensive support to local and state agencies through the provision of weed control and revegetation programs, educational activities and species monitoring.

Habitat: protecting, conserving and managing biodiversity.

Biodiversity connects people with nature and the Bellingen Shire community has a strong connection with the environment. Council and its current and future residents have a responsibility for stewardship of biodiversity, its management and protection. Council will engage with Aboriginal Gumbaynggirr Custodians on biodiversity and culture.

Species preservation: protecting and maintaining habitats of high profile threatened species and provision of education about threats and opportunities for biodiversity programs in Bellingen.

Species preservation within Bellingen is fundamental to ensuring the preservation of unique biodiversity. Initiatives aimed at high profile threatened populations and habitat, strive to educate and manage the long-term sustainability of species and their habitat to create a healthy living environment.



Image 2: The Critically Endangered Bellinger River Snapping Turtle.

Photo: Paul Fahy (courtesy of NSW DPIE)

1.3 Values

Biodiversity is the variety of living things at several scales - from vegetation communities, to the species they contain, to the genetic information contained within each individual. The value of biodiversity includes its intrinsic value as well as economic value, based its contribution towards social, economic, and health measures that equate to a greater quality of life.

The World Health Organization (WHO) has acknowledged that human health ultimately depends upon ecosystem products and services (such as availability of fresh water, food, and fuel sources). It is recognised that biodiversity loss can have significant direct human health impacts if ecosystem services are no longer adequate to meet social needs (WHO 2012).

This Strategy aims to ensure that local ecosystem health, including species and their genetic diversity, survive and thrive in their natural habitat. This will ensure that the social, economic, environmental and health services provided by healthy ecosystems can continue to provide their benefits for current and future generations. This is further outlined in Biodiversity values, concepts and design principles (**Appendix A**).



Image 3: The vulnerable Powerful Owl as a fledgling. Photo: Lachlan Copeland

2. Plan framework

The BSC has obligations and opportunities under international, national and regional planning and policy framework (Figure 1). These agreements, legislation and policies assist in the protection of environmental values and the direction of future conservation and sustainable development.

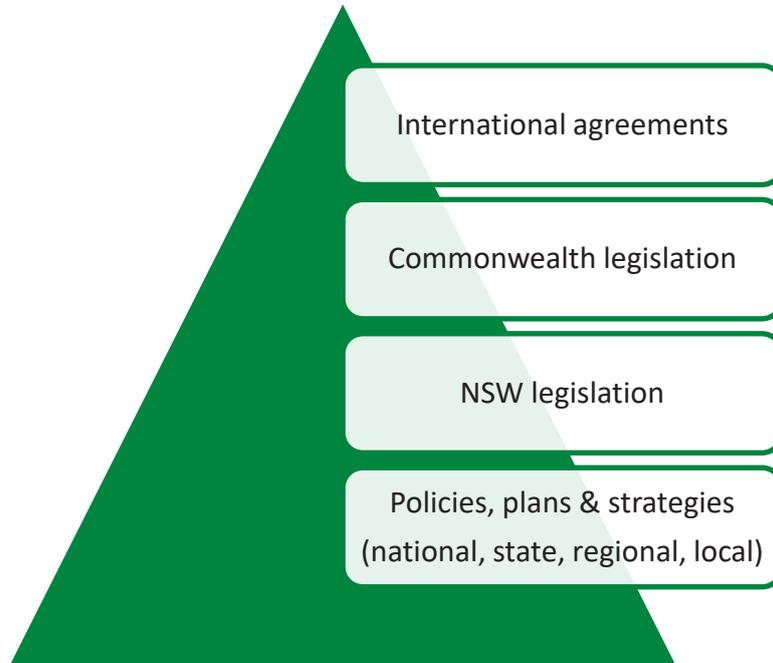


Figure 1: Legislative and planning hierarchy

2.1 International conventions and treaties

The need for biodiversity planning has its origins in a number of international conventions and treaties that Australia signed in the 1990s. These include:

- *1992 Rio Summit* (United Nations Conference on Environment and Development - UNCED) which resulted in the following documents:
 - Rio Declaration on Environment and Development
 - highlighted the importance of Ecologically Sustainable Development (ESD)
 - Agenda 21
 - the global blueprint for sustainability
 - Chapter 28 of Agenda 21 identifies local authorities as the sphere of governance closest to the people, and calls upon all local authorities to consult with their communities to develop and implement a local plan for sustainability - a 'Local Agenda 21'
 - Convention on Biological Diversity
 - a legally binding agreement ratified by Australia in 1993. As a signatory nation, Australia is bound to develop and implement strategies that will ensure the conservation and sustainable use of its biological resources

- Forest Principles
 - a set of guidelines for development of forest policy that form the basis of all later policy developments
- Framework Convention on Climate Change
 - is an intergovernmental treaty developed to address the problem of climate change
- *China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA), Republic of Korea-Australia Migratory Bird Agreement ROKAMBA), and the Bonn Convention:*
 - provide for co-operation between the Governments of Australia, China, Japan and South Korea to protect waterbirds that migrate between these countries.

2.2 National framework

As a result of being a signatory to international treaties and conventions, Australia has taken some significant steps to meet its obligations under these treaties, including the following agreements and strategies:

- *Intergovernmental Agreement on the Environment*
- *Draft National Biodiversity Conservation Strategy 2010-2020*
- *Australia's Biodiversity Conservation Strategy 2010-2030*
- *Australian Weeds Strategy*
- *Australian Pest Animal Strategy*
- *Commonwealth Wetlands Policy*
- *National Water Quality Management Strategy*
- *National Forest Policy Statement*
- *National Koala Conservation and Management Strategy 2009 - 2014*
- *Draft National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus*.*

2.3 NSW framework

2.3.1 Biodiversity Conservation Act 2016

At the state level, the most significant initiative relating to biodiversity protection has been the preparation of the *Biodiversity Conservation (BC) Act 2016*. This legislation guides conservation and sustainable development in NSW, with strategies to minimise and offset impacts to natural resources.

2.3.1.1 Biodiversity Offsets Scheme: Biodiversity Values Map

Under the BC Act, development is required to consider whether clearing triggers the Biodiversity Offsets Scheme (BOS). One of the main triggers for this is the Biodiversity Values Map, that has been updated in 2019 to include wetlands and TECs within the Bellingen Shire (Figure 2).

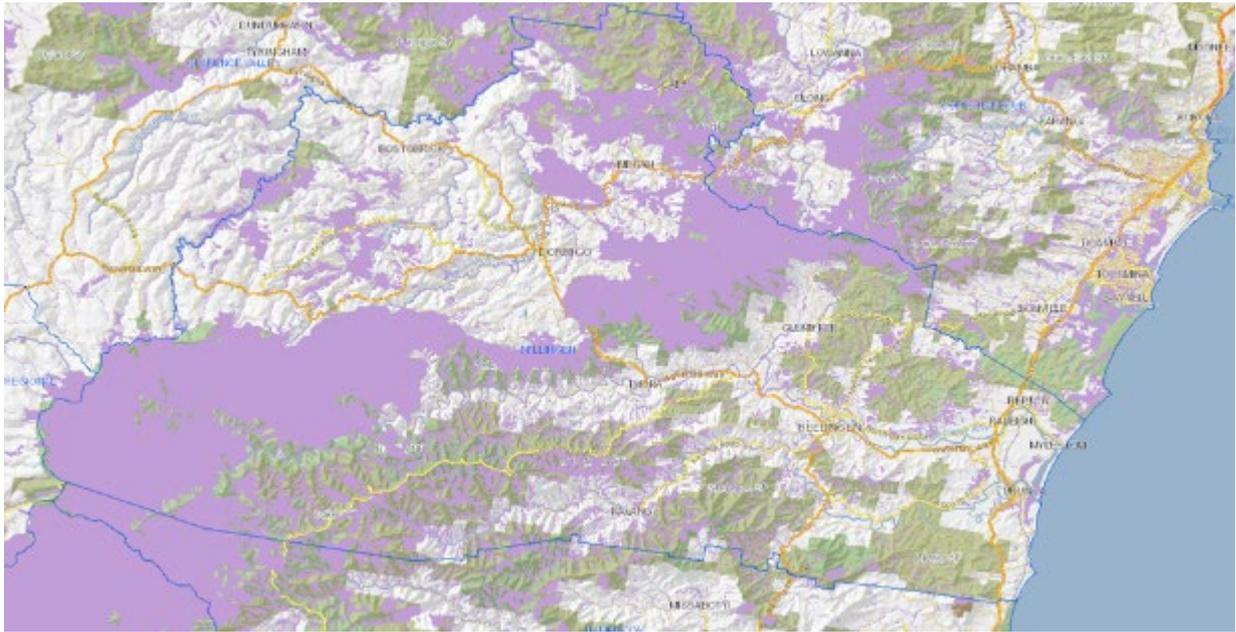


Figure 2: Biodiversity Values Map (June 2019)

2.3.1.2 Updates to the Biodiversity Values Map

From time to time, DPIE will update the BV Map to add or remove areas based on new information. Updates to the BV Map are likely to include targeted reviews of specific data layers or regions. This process may result in inclusion or removal of some lands from the map. DPIE will contact relevant data custodians to request updated or new data.

Local government nominations for additions to the Biodiversity Values Map

DPIE expects to call for local government nominations for land to be included on the map. This will be communicated directly to local government. The Minister for the Environment must be of the view that the nominated land will be of bioregional or state significance. The nominated land must also be approved by the Environment Agency Head.

2.3.1.3 Current Values on the Biodiversity Values Map

Clause 7.3(3) of the *Biodiversity Conservation Regulation 2017* describe types of land the Environment Agency Head can include on the BV Map.

Land types can include:

- Coastal wetlands and littoral rainforest defined by the *Coastal Management Act 2016*.
- Core Koala Habitat identified in a PoM under State Environmental Planning Policy No. 44—Koala Habitat Protection (SEPP 44).
- Declared Ramsar wetlands defined by the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Land containing threatened species or threatened ecological communities (TECs) identified as potential serious and irreversible impacts (SAII) under Section 6.5 of the BC Act.

- Protected riparian land.
- High conservation value grasslands or groundcover.
- Old growth forest identified in mapping developed under the National Forests Policy Statement but excluding areas not meeting the criteria published jointly by the Minister of the Environment and the Minister for Primary Industries.
- Rainforest identified in mapping developed under the National Forests Policy Statement but including areas not meeting the criteria published jointly by the Minister for the Environment and the Minister for Primary Industries.
- Declared areas of outstanding biodiversity value.
- Council nominated areas with connectivity or threatened species habitat that the Minister for the Environment considers will conserve biodiversity at bioregional or State scale.
- Any other land that in the opinion of the Environment Agency Head is of sufficient biodiversity value to be included. These are set out in clause 7.3(3) of the *Biodiversity Conservation Regulation 2017*.

2.3.1.4 Biodiversity Offsets Scheme: Areas of Outstanding Biodiversity Value

Areas of Outstanding Biodiversity Value are special areas with irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. The BC Act gives the Minister for the Environment the power to declare Areas of Outstanding Biodiversity Value (AOBV). AOBV will be a priority for investment in private land conservation. AOBV were formerly known as areas of declared critical habitat.

2.3.1.5 Biodiversity Offsets Scheme: Biodiversity Stewardship Agreements

Biodiversity Stewardship Agreements (BSA) are voluntary in-perpetuity agreements entered into by landholders to secure offset sites. The BC Act also provides for long-term Conservation Agreements or non-permanent Wildlife Refuges (see Appendix A for more detail).

2.3.2 Forestry Act 2012

The Forestry Corporation is required to meet a number of objectives including:

- where its activities affect the environment, to conduct its operations in compliance with the principles of ecologically sustainable development contained in section 6(2) of the *Protection of the Environment Administration Act 1991*
- to be an efficient and environmentally sustainable supplier of timber from Crown-timber land and land owned by it or otherwise under its control or management.

2.3.3 Local Land Services Act: Private Native Forestry

Private Native Forestry is the sustainable management of native forests on private property for timber production. This can include the harvesting of timber for a variety of products such as flooring, construction timber, power poles, furniture and firewood. Local Land Services is responsible for private native forestry advice and approvals. The NSW Environment Protection Authority is responsible for compliance and enforcement of private native forestry.

Private Native Forestry (PNF) Plans now include the former Property Vegetation Plans under the 2016 Land Management Reforms. Other current reforms of the regulatory and policy frameworks governing native forestry in NSW are occurring at the time of writing. This includes a comprehensive review of

Private Native Forestry (PNF) that seeks to balance the sustainable development of the private native timber and agricultural industries while recognising the environmental values of the private forest estate. The changes to PNF legislation are a consequence of the NSW Forestry Industry Roadmap. The Roadmap sets out a range of regulatory reforms to improve how native forestry is regulated in NSW to ensure it delivers ecologically sustainable forest management outcomes. The legislative changes provide a single Act to oversee all land management options for private land and harmonise what allowable activities can be applied on agricultural and forestry land.

2.3.4 Other State documents and frameworks

Other important documents and frameworks at the state level includes:

- *NSW Biodiversity and Climate Change Adaptation Framework 2007-2008*
- *NSW 2021 – NSW State Plan*
- *NSW Estuary Management Policy 1992*
- *NSW Coastal Policy 1997*
- *NSW Biodiversity Conservation Investment Strategy 2018*
- *NSW Draft Biodiversity Strategy 2010-15*
- *Local Land Services Act 2013*
- *NSW Koala Strategy 2018*
- *Bellinger River Snapping Turtle Management Program 2015*
- *NSW North Coast Enabling Regional Adaptation Report 2019.*

2.4 Legislative obligations

Table 1 summarises key National and State biodiversity legislation and their implications for the Bellingen Shire.

Table 1: Key legislation

Act	Summary	Implications for Bellingen
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth) (EPBC Act)	Provides a national scheme for environmental protection and biodiversity conservation. Incorporates referral mechanisms and environmental impact assessment processes for projects of national significance. Triggers for referral to the Commonwealth include significant impacts to listed communities and species.	Endangered Ecological Communities (EECs), Critically Endangered Ecological Communities (CEECs) and threatened species such as Bellinger River Snapping turtle endangered species and JAMBA/CAMBA/ROKAMBA species.
<i>Environmental Planning and Assessment Act 1979</i> (NSW) (EP&A Act).	The principal planning legislation for the State providing a framework for the overall environmental planning and assessment of development proposals.	Drives the planning and development processes in Bellingen. The Act provides for the preparation of a number of environmental planning instruments (including SEPPs and LEPs).
<i>Biodiversity Conservation Act 2016</i> (NSW)	This requires that Councils consider the impact on threatened species and ecological	Management of threatened species and communities on Council owned lands.

Act	Summary	Implications for Bellingen
	<p>communities before approving developments.</p> <p>Key components of the reform include:</p> <ul style="list-style-type: none"> • A new framework for managing native vegetation clearing • An enhanced and strategic approach to private land conservation and threatened species conservation • An expanded biodiversity offsetting scheme 	<p>Development approvals.</p> <p>Fulfil the actions required under priority action statements and recovery plans.</p>
<p><i>Biodiversity Conservation (Savings and Transitional) Regulation 2017</i></p>	<p>BioBanking was a voluntary market-based scheme administered by OEH that provided a streamlined biodiversity assessment process for development, a rigorous and credible biodiversity offsetting scheme, as well as an opportunity for landowners to generate income by managing land for conservation.</p> <p>This regulation explains the transitional arrangement for licences under the <i>Threatened Species Conservation Act 1995</i>.</p>	<p>Any established BioBank sites can be used to generate biodiversity credits to help manage land for biodiversity. This can assist with the ongoing costs for conservation management of the land.</p>
<p><i>Protection of the Environment Operations Act 1997</i> (NSW) (POEO Act)</p>	<p>The POEO Act enables the Government to set out explicit protection of the environment policies (PEPs) and adopt more innovative approaches to reducing pollution through licences and approvals relating to air pollution, water pollution, noise pollution and waste management.</p>	<p>Integration of licensing with the development approval procedures in BSC under the EP&A Act in environmental assessment of activities.</p>
<p><i>Local Government Act 1993</i> (NSW)</p>	<p>Now incorporates Ecologically Sustainable Development (ESD) considerations (including biodiversity conservation) as a key aspect of Council operations.</p> <p>Require the preparation of Plans of Management (POMs) for all Council owned land, and provides for the classification of land into, amongst other things, natural areas and various sub-categories.</p> <p>Additionally, this Act has a range of other provisions that allow for appropriate management of operational land and infrastructure, provide educational services, set rates and charges, issue orders and have a range of enforcement powers.</p>	<p>The Local Government Act was reviewed by the State Government under the Fit for the Future reforms. The first phase of developing new local government legislation is now in place.</p>
<p><i>Local Land Services Act 2013</i> (NSW) and <i>Local Land Services Amendment Bill 2017</i> (NSW)</p>	<p>The Act Provides a framework to ensure the proper management of natural resources in the social, economic and environmental interests of the State</p>	<p>Local Land Services (LLS) manages biosecurity, natural resources and agricultural advisory services. BSC is part of the North Coast LLS and the North Coast Local Strategic Plan 2016-2021 sets the vision and goals for Local Land Services outlines the strategies through which these goals will be achieved.</p>

Act	Summary	Implications for Bellingen
		<p>The Native Vegetation Regulatory Map was prepared under the LLS Act generally covering rural land in NSW and categorises land where clearing of native vegetation can occur without approval.</p> <p>LLS is responsible for Private Native Forestry (PNF) which now include the former Property Vegetation Plans following the 2016 Land Management Reforms.</p>
<p><i>National Parks and Wildlife Act 1974 (NSW):</i></p>	<p>Provides for establishment/management of National Parks historic sites and certain other areas and the protection of certain Aboriginal objects</p>	<p>Bellingen Shire has over 53% of its area covered by State Forests or National Parks. These areas are of high ecological importance and provide habitats for EECs or TECs</p>
<p><i>Crown Lands Management Act 2016 (NSW)</i></p>	<p>The Crown Lands Management Act 2016 governs the planning, management and use of Crown land, including provisions to reserve or dedicate lands for a prescribed public purpose and for leasing and licensing.</p>	<p>The Department of Primary Industries, together with reserve trusts appointed by the Minister, are responsible for the administration and management of the Crown reserve system.</p>
<p><i>Biosecurity Act 2015 (NSW)</i></p>	<p>Provides a streamlined, clear framework for safeguarding primary industries, natural environments and communities from a range of pests, diseases and weeds across NSW.</p>	<p>The North Coast Regional Strategic Weed Management Plan 2017 -2022 lists weeds that are State Priority, Regional Priority and Other Regional Priority. BSC is a Local Control Authority responsible for enforcing weed legislation. This includes:</p> <ul style="list-style-type: none"> • Inspect weeds on public and private property • inspect and control weeds in high risk pathways and sites • education, training and resources for the public and staff on weed management • administer compliance weed regulations • respond to breaches of the Act, and • notify and report weed activities to the Biosecurity Information System (BIS) <p>The North Coast Regional Pest Animal Management Plan 2018-2023 includes management framework, roles and responsibilities and performance measures for priority pest animal species.</p>

Act	Summary	Implications for Bellingen
<i>Fisheries Management Act 1994</i> (NSW)	This Act aims to preserve fish stocks, habitats and species and to maintain and promote ecologically sustainable development whilst ensuring the commercial viability of fisheries. It allows for listing of threatened species, habitat, communities, and processes in a similar manner to the BC Act.	Mangroves, saltmarsh and key fish habitat areas that occur in BSC are protected under this Act.
<i>Coastal Management Act 2016</i>	Replaces the Coastal Protection Act 1979 and establishes a new strategic framework and objectives for managing coastal issues in NSW. The new Act promotes strategic and integrated management, use and development of the coast for the social, cultural and economic wellbeing of the people of NSW.	<p>Its focus is on ecologically sustainable development that:</p> <ul style="list-style-type: none"> protects and enhances sensitive coastal environments, habitats and natural processes strategically manages risks from coastal hazards maintains and enhances public access to scenic areas, beaches and foreshores supports the objectives for our marine environments under the Marine Estate Management Act 2014 protects and enhances the unique character, cultural and built heritage of our coastal areas, including Aboriginal cultural heritage.
<i>Water Management Act 2000</i> (NSW)	This Act controls the extraction of water, how water can be used, the construction of works such as dams and weirs, and the carrying out of activities on or near water sources in NSW	Any works within 40m from the top of bank of a waterway is a controlled activity that requires integrated development approval. Council are exempt from requiring integrated approval.



Image 4: Critically endangered Eastern Curlew at Urunga Lagoon, listed under the EPBC Act. Photo: Lachlan Copeland

2.4.1 Planning strategies and policies

Bellingen is subject to several regional and state-wide planning strategies and policies, particularly through the State Environmental Planning Policies (SEPPs) including:

- *SEPP 44 – Koala Habitat*
- *SEPP - Coastal Management*
- *SEPP – Vegetation in Non-Rural Areas.*

The Bellingen Local Environmental Plan (2010) defines Environmental Heritage Areas in Schedule 5 and maps Natural Resources Sensitivity for watercourse and biodiversity across the Shire that sets planning controls for development on mapped land.

The North Coast Regional Plan 2036 (2017) vision is “to create the best region in Australia to live, work and play thanks to its spectacular environment and vibrant communities”. The plan has four broad goals to achieve the vision:

- the most stunning environment in NSW
- a thriving interconnected economy
- vibrant and engaged communities
- great housing choice and lifestyle.

The North Coast Regional Plan along with the Community Strategic Plan titled “*2027 Our Community Vision; Connected, Sustainable, Creative*”, will guide the future housing, infrastructure and environmental planning in the Bellingen Shire. The Regional Plan seeks to protect and enhance areas of High Environmental Values (HEVs) as integral to maintaining biological diversity. It maps Potential HEVs that include naturally vegetated land including World Heritage Areas, National Parks and Nature Reserves, and State Forests and private land that meet DPIE criteria. The plan aims to map, enhance and avoid impacting areas of potentially high environmental value.

Bellingen is located in the North Coast region of NSW, and is affected by several regional and local planning strategies which include:

- *The North Coast Regional Plan 2036, 2017*
- *Northern Rivers Regional Biodiversity Management Plan 2010*
- *North Coast Regional Strategic Pest Animal Management Plan 2018-2023*
- *North Coast Regional Strategic Weed Management Plan 2017-2022*
- *Northern Rivers Catchment Action Plan 2013-2034*
- *Bellingen Shire Council Climate Action Plan 2012*
- *North East NSW Regional Forest Agreement updated 2018*
- *Bellingen Shire Council Coastal Area Core Koala Habitat Comprehensive Koala Plan of Management 2017.*

2.5 Local framework

The main policies that control biodiversity protection and management within the Bellinghen Shire are the Bellinghen Local Environment Plan 2010 (Bellinghen LEP 2010) and the Bellinghen Development Control Plan (Bellinghen DCP 2017). These documents determine what land use is permissible in particular locations within the LGA and list what requirements must be met to allow a development to be approved. The sections of the LEP and DCP that address biodiversity protection include the following:

- Clause 3.3 LEP - defines an environmentally sensitive area for exempt or complying development
- Clause 5.10 LEP - defines development consents and exceptions for heritage conservation and environmental heritage areas
- Clause 7.4 LEP - defines land within watercourses-tidal or waterways for complying development
- Clause 7.5 LEP and Natural Resources Sensitivity – Water and Natural Resources Sensitivity – Biodiversity Map - defines sensitive land which supports terrestrial and aquatic biodiversity that the consent authority must make when considering a development application
- Chapter 6 DCP - defines the policies for the preservation of trees and vegetation
- Chapter 16 DCP - defines the policies for Koala habitat protection.

Several Council plans and other documents that relate to biodiversity were reviewed in preparation of the Biodiversity Strategy. The Council programs that encourage biodiversity protection and community involvement are also important to the future environmental management of Bellinghen (Table 2). In addition, Council is currently considering preparation of a Growth Management Strategy to examine local housing, rural lands, and employment lands – this should consider interaction with the natural environment especially linkages.

Table 2: Council and local programs that encourage biodiversity protection and community involvement.

Name	Location/Involvement	Summary
Bellinghen Coastal Zone Management Plan (CZMP) (2017)	Bellinghen coastline extending from Oyster Creek in the south to Tuckers Rock in the north.	The CZMP was developed to formally manage the risks from coastal hazards to valuable land and assets at present and in the future, and to preserve the unique natural values of the Bellinghen coastline
Bellinghen Environment Centre (BEC)	Incorporated environmental conservation organisation founded 1990	BEC committee works together to protect the natural environment, protect biodiversity and promote proactive responses to climate change.
Bellinghen Island Integrated Reserve Plan of Management (2012)	The Reserve has been used as a place of biodiversity conservation since early European settlement in the area	Management objectives and actions are based on current social and environmental values, and legislative responsibilities.
Bellinghen Island Flying-fox Camp	The camp constitutes a nationally important Grey-headed flying-fox	The plan has been developed to provide Bellinghen Shire Council (BSC) with a framework to manage current and potential issues associated with the

Name	Location/Involvement	Summary
Management Plan (2017)	roost and is deemed to be roosting habitat critical to the survival of this species	camp, whilst ensuring the flying-foxes and their valuable ecological functions are conserved.
Bellinghen Island Reserve Committee	Bellinghen Island Volunteers meet each Tuesday to conduct weeding and provide maintenance of the rainforest	Local volunteers manage Bellinghen island providing weed management and active monitoring of the GHFF colony
Bellinghen RiverWatch	An initiative of OzGREEN and partners in the Bellinghen and Kalang catchment areas. 32 local community members and five local schools volunteer in this program	Seeking to meaningfully engage the community to provide long-term, scientifically robust water quality data to support recovery actions for the Bellinghen River Snapping Turtle (<i>Myuchelys georgesi</i>) and other threatened species; to educate volunteers and the community in riparian vegetation monitoring, reporting turtle sightings and evidence of turtle nests, conducting water bug surveys, and improving habitat; and to provide access to and communicate data and connect the community with experts.
Bellinghen Shire Learning Alliance (BSLA)	Works at the Bellinghen Sustainability Centre	BSLA is a Shire wide alliance working collectively and independently to create a culture of lifelong learning for sustainability and ecological balance. Includes the Centre for Ecological Learning (CEL)
Bellinghen and Kalang River Health Plans (2010)	Action orientated plan prepared in partnership between DPIE (former OEH, DECC) and BSC	The purpose of the Plan is to document the issues which affect river and health from community and agency perspectives and priorities, and to assess how these impact on water quality and river health. Plans are important historically.
Bellinghen Shire Council Coastal Area Koala Management Strategy (2017)	Koala Planning Areas designated in BSC Adopted under provisions of Clause 13 of SEPP 44	Objectives are to manage long-term sustainability and recovery of Koalas and their habitat, ensure there is no net loss of preferred Koala habitat, maintain and restore Koala habitat connectivity across landscapes, identify preferred food tree species, minimise and manage threats, establish relationships with industry, landholders and the community, provide assessment criteria for the processing of development applications (DAs) and to promote Koalas as an asset for economic development and tourism. Koala Advisory Group has been established. The Koala Strategy provides statutory maps of core koala habitat (which triggers PNF exclusions) and assess DAs north of the Bellinghen and east of the Never Never.
Bellinghen and Kalang Rivers Estuary Management Plan (2008)	Tidal waterways, foreshores and adjacent lands of the Bellinghen and Kalang river estuaries	Management themes of the plan are water quality, bank erosion, habitat management, waterway use, land management, community education, fisheries management (including oyster aquaculture) and tourism management.
Bellinghen Landcare Inc.	Covers thirteen Landcare groups including Friends of the Wonga Forest, Bellinghen Urban Landcare, Bellinghen Island Landcare, Never Never Catchment Group and the Dorrigo Mountain Top	Bellinghen Landcare oversees the following functions representing Landcarers in the Bellinghen – Dorrigo region, provides advice on processes, organisation and legal matters in environmental restoration, liaison between landcarers, government and technical experts, on-ground project management, facilitation of environmental conservation works and projects, school and adult education in environmental issues and best practice management, assistance for landholders and raising awareness in the community on environmental issues and sustainable agriculture.

Name	Location/Involvement	Summary
Bellingher River Snapping Turtle Management Program (2015)	Multi-agency Incident Management Team comprised of specialists from DPIE, NPWS, ROGHD, EPA, DPI, LLS, NSW Health and BSC	Objectives of the management program are to maximise the chances that Bellingher River Snapping Turtle will persist in the wild in the long-term, minimise risks from the spread of any potential pathogen to other wild and domestic animals, industries, communities and other catchments and to ensure the Bellingher and wider communities remain informed and updated about the on-going response.
Centre for Ecological Learning (CEL)	Incorporated registered charity established in 2007 expanded from the original weekend camps and bushwalks into CEL	Fosters ecological wellbeing for ourselves and the planet. They do this by supporting people of all ages to experience Earth-based, immersive, educational experiences that deepen our relationship with ourselves and the natural world.
Dunecare Groups	Several dunecare groups operate under the Landcare family	<ul style="list-style-type: none"> • Wenonah Dunecare • Tuckers Rock Dunecare • Bundagen Dunecare
Gleniffer Reserves – Plan of Management (2019)	Four reserves located in the Gleniffer area	The plan provides BSC and the community with a more comprehensive understanding of the features and values of these four Gleniffer reserves and classifies the reserves and provides management options consistent with Council’s Open Spaces Asset Management Plan (BSC 2012). The plan sets objectives and requirements for future management action/s.
Jaligirr Biodiversity Alliance (JBA)	Jaligirr Biodiversity Alliance is a voluntary partnership between 20 natural resource management stakeholders	JBA activities purpose is to ensure that the biodiversity of the region is maintained in a changing climate – by protecting & enhancing landscape connections from our coastline & along the great escarpment.
Sustainable Schools Network	Nine registered schools	Aims is to “assist, advise and inspire schools to incorporate sustainability education within the curriculum and run projects within the school community.”
Dorrigo National Park	Dorrigo Rainforest Centre	NPWS volunteer program where participants can assist in providing service in the Dorrigo Rainforest Centre shop. Volunteers learn and share information about Gondwana rainforests, the parks activities and Dorrigo.
Sustainable Farm Planning Workshop Program	Landowners	“Program to assist landowners to adopt sustainable agricultural practices”
Community education, including sustainability workshops	Entire BSC	Additional programs targeting food sustainability and composting.
Northern Rivers Regional Biodiversity Management Plan 2010	Department of Environment and Climate Change (Now DPIE) and the Commonwealth Department of the Environment	The plan constitutes the national regional recovery plan under the EPBC Act 1999 for threatened species and ecological communities principally distributed in the Northern Rivers Region seeking to integrate regional recovery and threat abatement planning.



Image 5: The Critically Endangered Beach stone-curlew, Urunga Lagoon. Photo: Lachlan Copeland

3. Existing environmental values

3.1 Physical features

3.1.1 Landscape and topography

Bellingen LGA is located on the North Coast region of NSW and covers a total area of 1,602 km² shown in Figure 3. The landscape covers three broad topographical areas, namely coastal, Bellinger and Kalang river valleys and the Dorrigo plateau. Each landscape type has unique geophysical attributes which influence biodiversity and connectivity. Maps of Mitchell Landscapes and topography are shown in **Appendix B**.

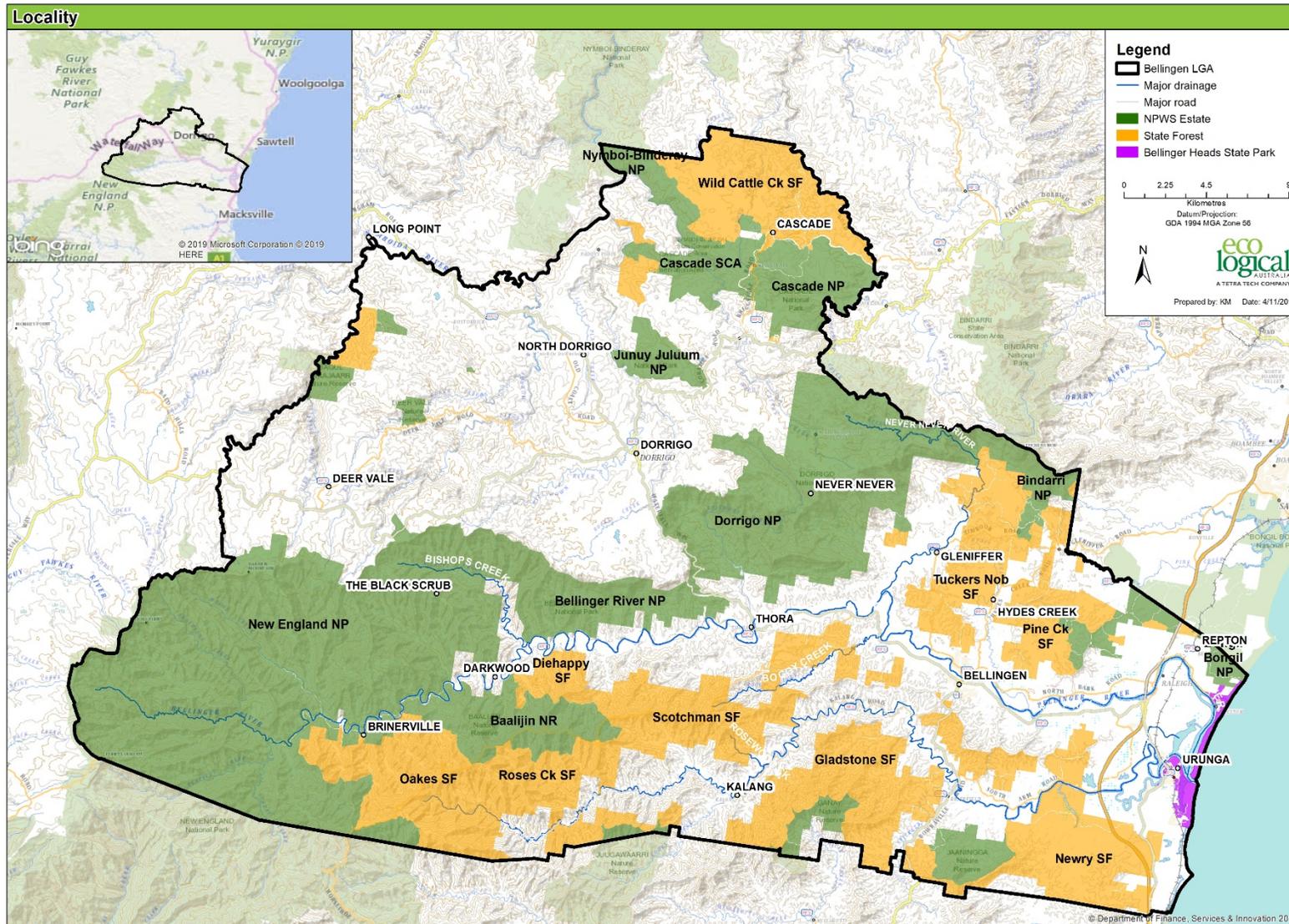


Figure 3: Location of Bellingen LGA

3.1.2 Geology and soils

Geology, soils and landscapes across the Bellingen Shire are provided in Figure 4 and **Appendix B**.

3.1.2.1 *Bellinger and Kalang River Valleys*

The soil landscapes in the Bellinger and Kalang River valleys are highly susceptible to erosion. Bellinger River Slates are dominated by Tertiary Basaltic Volcanics on some escarpment areas. The predominant soil landscape unit is 'Diehappy', a highly erosive colluvial soil associated with sideslopes. Other soil landscape units include 'Pine Creek', 'McAlisters Peak', 'Bellinger' and 'Bundagaree'. The valleys within the Shire are steeply sloped, with over 50 % of slopes in the Bellinger River National Park over 30°. They are mapped as overlying a parent geology of metasediments and clastic sediments.

3.1.2.2 *Dorrigo Plateau*

The Dorrigo Plateau is a remnant of the Ebor volcano and associated basaltic outcrops. The plateau is comprised mainly of Carboniferous metamorphic rocks such as argillite and slates. Soils at higher elevations of the plateau are more acidic due to the chemical interaction between soils and climatic conditions such as high rainfall, cooler temperatures and low humidity. It is mapped as mafic extrusive, mafic intrusive and felsic intrusive parent geologies.

The geology gives rise to lithosols and brown podzolic soils on the higher elevations and alluvial soils in the river beds.

3.1.2.3 *Coastal*

The coastal areas of the Shire support wide valleys, channels, floodplains, swamps, and terraces of the Bellinger and Kalang Rivers. These occur on Quaternary alluvium, with a general elevation from 0 to 50 m, and local relief of 15 m. Dark organic loams and silty clay soils occur on the floodplain, with gradational brown loams and yellow-brown texture-contrast soils on terraces, and organic silty mud in the swamp area.

3.1.3 Drainage and water quality

There are two main river catchments in Bellinghen Shire, the Bellinger and Kalang Rivers. The catchment area for the Bellinger River is approximately 780 km² and for the Kalang River 330 km², making the total catchment area for both rivers 1,110 km², which constitutes 69 % of the Bellinghen Shire.

The Bellinger River originates in the Dorrigo plateau, characterised by steep slopes and high rainfall particularly during the months of December through to April. The river flows south-east until it meets the Pacific Ocean at Urunga. The main tributaries of the Bellinger River are the Never Never River and the Rosewood River. The Kalang River originates in the southern area of the Bellinghen Shire, with the main tributaries being Spicketts Creek and Picketts Creek.

The Bellinger and Kalang rivers join together at Urunga and the Bellinger-Kalang estuary covers an area of 160 km². The geomorphology of the catchment combines steep slopes in the upper catchment with more gentle sloping coastal floodplain, and periods of high rainfall can subsequently impact on the water quality of the Bellinghen Shire.

Major and named watercourses, coastal lagoons, estuarine wetlands and floodplain wetlands within the Bellinghen Shire are identified in Table 3.

Table 3: Major watercourses, floodplain and estuarine waterways and coastal lagoon/lake

Major Watercourses	Floodplain Waterways	Estuarine Waterways	Coastal lagoons and lakes
Bellinger River	Bellinger River	Bellinger River	Urunga Lagoon
Bobo River	Bielsdown Creek	Boggy Creek	
Dalhousie Creek	Bishops Creek	Burdett Park Creek	
Back Creek	Double Creek	Dalhousie Creek	
Bielsdown River	Hydes Creek	Kalang River	
Kalang River	Little Falls Creek	McGraths Creek	
Little Murray River	Little Plain Creek	Mogons Creek	
Little Plain Creek	Nymboida River	Oyster Creek	
Never Never River	Pine Creek	Picket Hill Creek	
Nymboida River	Rocky Creek	Pine Creek	
Picket Hill Creek		Yellow Rock Inlet	
Rosewood River			

The Bellinger River Health Plan (BSC, 2010) and Kalang River Health Plan (BSC, 2010) identified poor water quality in areas of the estuary from diffuse and point sources of pollution resulting in degradation. The reports identified the need for action to improve agricultural practices, riparian and wetland management, on-site sewage management systems (OSMS), boating, tourism and recreational impacts, stormwater, rural roads and bridges, forestry, logging and clearing, oil, diesel and waste spills, waste water treatment plants, and water quality monitoring.

The Regional SOE report (North Coast Region SOE Working Group, 2016) identified for the region that extreme rainfall and widespread flooding cause water quality and river/estuary health issues due to the

high nutrient and sediment loads that enter river systems during floods, and that the trend for the region is a decline in water quality and river health. This report graded river condition (Table 4). It identified that the sewerage of the low-lying areas along the Kalang River allowed the NSW Food Authority to re-assess the water quality with a view to re-opening the area to oyster aquaculture, which was closed in 2008 due to contamination from septic.

Table 4: River condition by grades, Regional SOE 2016

LGA	Year of assessment	Overall grade	Water quality	Riparian	Macroinvertebrate	Trend / Status
Bellingen	2009	B-	A-	C+	B	Riparian vegetation poorest indicator
Bellingen	2009	C+	C+	D	C-	Estuary poorer than freshwater
	2016					In progress

Annual water quality results from 2012 are posted on the BSC website for the Seaboard and Dorrigo, and from Wastewater Treatment Plants at Dorrigo, Bellingen and Urunga <https://www.bellingen.nsw.gov.au/water-sewerage-quality-testing-results>



Image 6: Purple Spotted Gudgeon. Photo: Emily Messer

3.2 Current biodiversity

Bellingen Shire supports has significant large areas of remnant, native vegetation in National Parks and State Forests, with extensive riparian land present along the Bellinger and Kalang Rivers. A summary of the key biodiversity features across the LGA include:

- Approximately 190 km of foreshore along the Bellinger and Kalang Rivers, including important mangrove and saltmarsh habitats protected under the *Fisheries Management Act 1994* (NSW; EPBC Act Protected Matters Report)
- Coastal lagoons, and estuarine and freshwater wetlands
- Habitat for threatened species and listed migratory birds (Figure 6 and Table 5)
- 87 threatened species of fauna listed in NSW, 32 of which are also threatened nationally
- 27 species of threatened flora listed in NSW, 12 of which are also threatened nationally
- 14 migratory birds which are protected under international agreements
- Nine Threatened Ecological Communities (TECs) listed in NSW (Table 5 and Figure 6):
- Dorrigo National Park which is listed as part of the Gondwana Rainforests of Australia World Heritage Area.

Full lists of threatened flora, fauna and ecological communities are located in **Appendices C and D**.

Table 5: Threatened ecological communities (TECs) in Bellingen Shire

TECs in Bellingen Shire	Jurisdictional listing NSW BC Act, Australian EPBC Act
Coastal Saltmarsh	NSW, Australia
Freshwater Wetlands on Coastal Floodplains	NSW
Littoral Rainforest	NSW, Australia
Lowland Rainforest in the NSW North Coast and Sydney Basin bioregions	NSW, Australia
Lowland Rainforest on Floodplain	NSW, Australia
Subtropical Coastal Floodplain Forest	NSW
Swamp Oak Floodplain Forest	NSW, Australia
Swamp Sclerophyll Forest on Coastal Floodplains	NSW
Themeda Grassland on Seacliffs and Coastal Headlands	NSW

3.2.1 Vegetation

Fine-scale vegetation mapping of part of the Bellingen LGA was undertaken by OEH (now DPIE) in 2014 as a collaborative project with BSC. The study area covered 24,326 ha of the Bellingen Shire, and covered private property on the valley floors and Crown land on the coast (excluding State Forests, National Parks and Nature Reserves). The area assessed was attributed to Plant Community Types (PCTs) within the Northern Rivers Vegetation Classification (OEH 2012a). A total of 49 PCTs were mapped across the Bellingen Shire LGA. The study found nine PCTs were wet sclerophyll forests, nine were forested wetlands, seven were dry sclerophyll forests, seven were freshwater wetlands, six were rainforests, six were saline wetlands, four were heathlands and one was a grassland. The total areas of vegetation mapped by formation are shown in Table 6 and Figure 5.

Table 6: Total area (ha) of vegetation mapped by formation (OEH, 2014)

Vegetation formation mapped	Rea mapped in hectares (ha)
Wet sclerophyll forests	6,907
Dry sclerophyll forests	1,375
Rainforest	1,038
Forested wetlands	913
Freshwater wetlands	432
Saline wetlands	275

The 2014 study assessed each PCT for its equivalency to Endangered Ecological Communities (EECs) or Threatened Ecological Communities (TECs) under State and Federal legislation (Table 7). There were 29 PCTs assessed as likely to be equivalent to nine TECs listed under the BC Act and two TECs listed under the EPBC Act (covering an area of 2,508 ha). Note that since the 2014 study additional TECs have been listed under the EPBC Act.

At the time of writing the DPIE have released the first draft map of the Revised Plant Community Types in Eastern NSW for review by local government. This data set could potentially be used to develop fine scale vegetation mapping for the whole of the Bellingen Shire in partnership with DPIE.

Image 7: Cool Temperate Rainforest and old-growth Antarctic Beech. Photo: Annie Stanton, Dandarrga Landcare

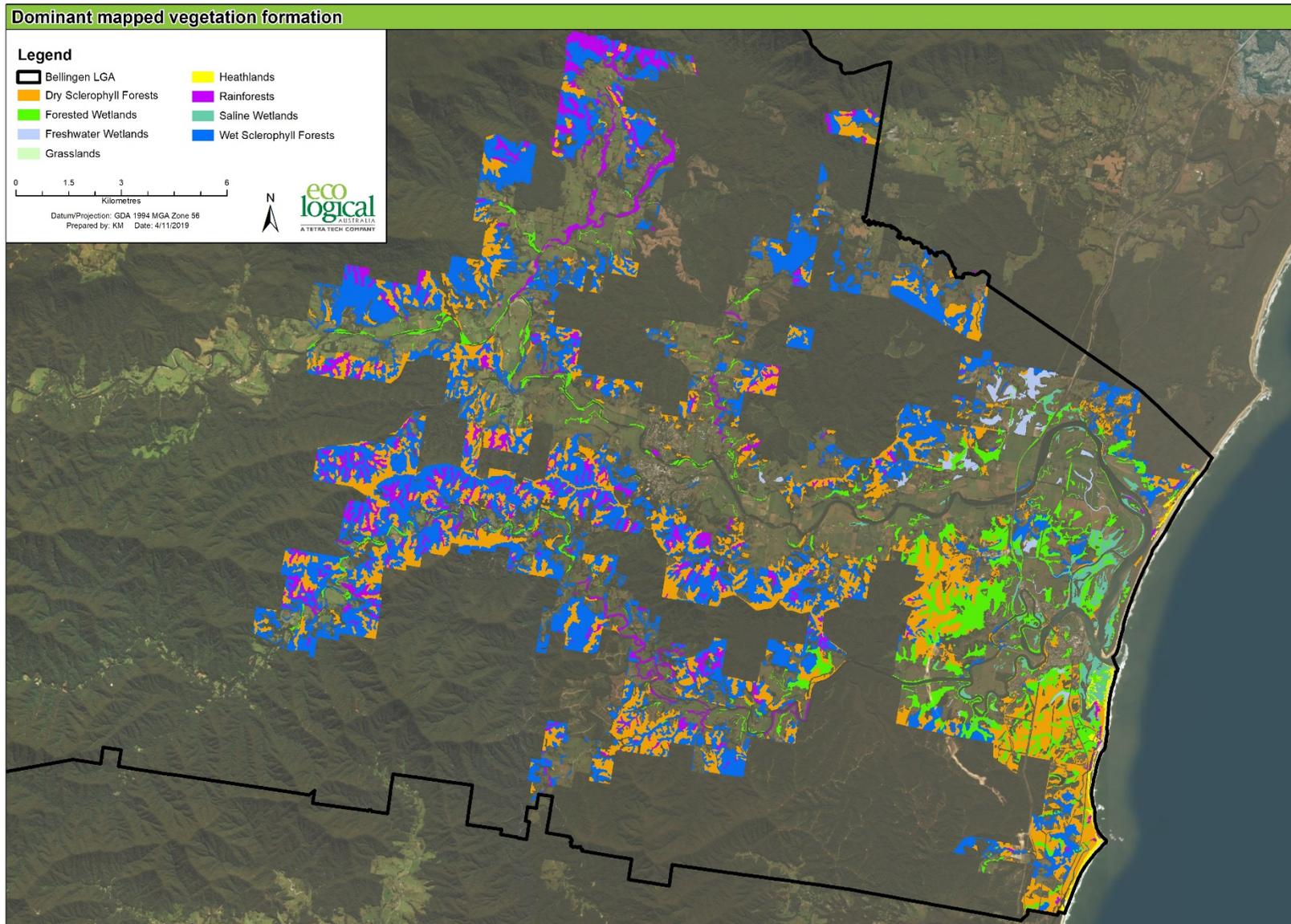


Figure 5: Vegetation mapping in Bellingen Shire by vegetation formation, OEH 2014

Table 7: Area of threatened ecological communities (TECs) mapped in the Bellingen Shire by OEH 2014

Likely Threatened Ecological Communities	Area (ha)
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	129
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC (floodplain only)	432
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	29
Lowland Rainforest in the NSW North Coast and Sydney Basin bioregions EEC	943
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion EEC (floodplain only)	209
Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC (floodplain only)	131
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	209
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC (floodplain only)	434
Themeda Grassland on Seacliffs and Coastal Headlands in the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	1
Total	2,685



Image 8: Critically Endangered Lowland Rainforest on Floodplains - White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion. Photo: Chris Ormond

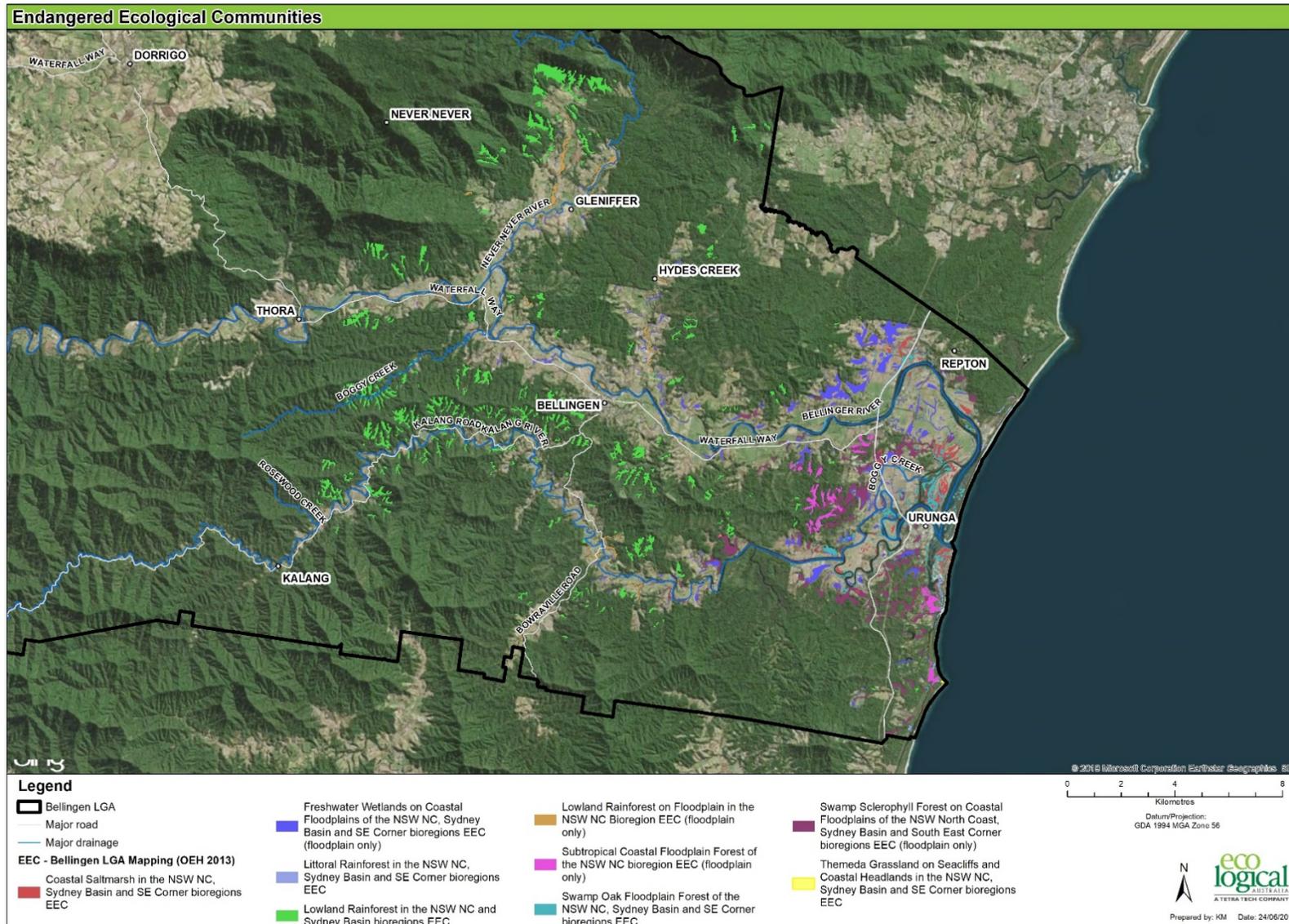


Figure 6: Mapped vegetation in the Bellingen Shire (OEH, 2014)

3.2.2 Fauna

The recorded fauna of the Bellingen Shire includes 87 threatened species of bird, mammal, amphibian, reptile, fish and insects listed under the NSW BC Act 2016 and the NSW Fisheries Management Act, which include:

- 32 threatened species listed under the Federal Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), including:

- Four Critically Endangered species listed under the EPBC Act (some are listed as migratory or under the BC Act):

Critically Endangered Fauna	Status
Bellinger River Snapping Turtle	Australia, NSW (Endangered)
Curlew Sandpiper	Australia (CAMBA, JAMBA, ROKAMBA), NSW (Endangered)
Eastern Curlew	Australia (CAMBA, JAMBA, ROKAMBA)
Regent Honeyeater	Australia, NSW (Critically Endangered)

- Eight Endangered species listed under the EPBC Act, which are also threatened under the BC Act or FM Act:

Critically Endangered Fauna	Status
Giant Barred Frog	Australia, NSW (Endangered)
Loggerhead Turtle	Australia, NSW (Endangered)
Australasian Bittern	Australia, NSW (Endangered)
Hastings River Mouse	Australia, NSW (Endangered)
Southern Pink Underwing Moth	Australia, NSW (Endangered)
Spotted-tailed Quoll	Australia, NSW (Vulnerable)
Eastern (Freshwater) Cod	Australia, NSW (Endangered)
Oxleyan Pygmy Perch	Australia, NSW (Endangered)



Image 9: Giant Barred Frog. Photo: Lachlan Copeland

- Five Vulnerable species listed under the EPBC Act, which are also threatened under the BC Act:

Vulnerable Fauna	Status
Stuttering Frog	Australia, NSW
Green Turtle	Australia, NSW
Koala	Australia, NSW
Long-nosed Potoroo	Australia, NSW
Grey-headed Flying-fox	Australia, NSW

- A further 14 migratory and marine bird species are also listed only under the CAMBA, JAMBA and/or ROKAMBA agreements and the EPBC Act (others are listed above as migratory as well as threatened):

Migratory and Marine	
White-throated Needletail	Common Sandpiper
Cattle Egret	Latham’s Snipe
Rainbow Bee-eater	Pacific Golden Plover
Bar-tailed Godwit	Short-tailed Shearwater
Whimbrel	Wedge-tailed Shearwater
Glossy Ibis	Gull-billed Tern
Caspian Tern	Common Tern

- 56 NSW listed threatened fauna species, one of which is listed as a marine species in Australia:

Threatened Fauna	Status	Threatened Fauna	Status
Beach-stone Curlew	Critically Endangered	Blue-billed Duck	Vulnerable
Black-necked Stork	Endangered	Rufous Scrub-bird	Vulnerable
Little Tern	Endangered	Mangrove Honeyeater	Vulnerable
Purple Spotted Gudgeon	Endangered (FM Act)	Grey-crowned Babbler (eastern subspecies)	Vulnerable
Pied Oystercatcher	Endangered	Varied Sitella	Vulnerable
White-bellied Sea-Eagle	Vulnerable, Aust Marine	Olive Whistler	Vulnerable
Pouched Frog	Vulnerable	Dusky Woodswallow	Vulnerable
Spagnum Frog	Vulnerable	Scarlet Robin	Vulnerable
Green-thighed Frog	Vulnerable	Diamond Firetail	Vulnerable
Glandular Frog	Vulnerable	Brush-tailed Phascogale	Vulnerable
Wallum Froglet	Vulnerable	Common Planigale	Vulnerable
Stephens’ Banded Snake	Vulnerable	Yellow-bellied Glider	Vulnerable
Wompoo Fruit-Dove	Vulnerable	Eastern Pygmy Possum	Vulnerable
Rose-crowned Fruit Dove	Vulnerable	Squirrel Glider	Vulnerable

Threatened Fauna	Status	Threatened Fauna	Status
Superb Fruit Dove	Vulnerable	Parma Wallaby	Vulnerable
Black Bittern	Vulnerable	Red-legged Pademelon	Vulnerable
Eastern Osprey	Vulnerable	Little Bentwing-bat	Vulnerable
Square-tailed Kite	Vulnerable	Eastern Bentwing-bat	Vulnerable
Little Eagle	Vulnerable	Golden-tipped Bat	Vulnerable
Brolga	Vulnerable	Southern Myotis	Vulnerable
Sooty Oystercatcher	Vulnerable	Eastern Freetail-bat	Vulnerable
Comb-crested Jacana	Vulnerable	Eastern False Pipistrelle	Vulnerable
Glossy Black-Cockatoo	Vulnerable	Eastern Long-eared Bat	Vulnerable
Little Lorikeet	Vulnerable	Greater Broad-nosed Bat	Vulnerable
Sooty Owl	Vulnerable	Eastern Cave Bat	Vulnerable
Powerful Owl	Vulnerable	Yellow-bellied Sheath-tail -bat	Vulnerable
Masked Owl	Vulnerable	New Zealand Fur-seal	Vulnerable
Eastern Grass Owl	Vulnerable	Australian Fur Seal	Vulnerable

The high number of threatened and migratory fauna species recorded in the Bellingen Shire LGA highlights Bellingen as a recognised biodiversity hotspot, with many mobile species occurring both within Bellingen and its surrounding areas.



Image 10: Greater Glider. Photo: Lachlan Copeland

3.2.3 Koala

The Bellingen Shire supports significant Koala populations, and the BSC Coastal Area Koala Management Strategy (BSC, 2017) was developed to manage the long-term sustainability and recovery of Koalas and their habitat. Koala populations and habitat across many areas of NSW are in decline and similarly in the Bellingen LGA there is evidence of a decline in habitat range. However, areas exist where Koalas have persisted over the last six generations in the Bellingen Shire. Threats to Koalas include clearing and fragmentation of habitat, attacks from domestic animals such as dogs, vehicle strikes, extreme weather events and disease. Mapping of Koala habitat on the Dorrigo plateau area is a data gap.

3.2.4 Bellinger River Snapping Turtle

The Bellinger River Snapping Turtle (Image 2) is Critically Endangered and is endemic to the Bellinger Catchment, being known only from this single river catchment. Very few adults remain in the wild and are subjected to threats such as disease, hybridisation, feral animal predation and riparian zone degradation. The Bellinger River Snapping Turtle has been assigned to the site-managed species management stream under the Saving our Species program with captive breeding and release of turtles occurring as part of the program in accordance with the Bellinger River Snapping Turtle Management Program (NSW DPI, 2015).

3.2.5 Grey-headed Flying-fox

The Grey-headed Flying-fox (GHFF, Image 13) is listed as Vulnerable under NSW and Federal legislation. The Bellingen Island GHFF camp is a nationally important roosting camp which has been deemed critical to the species' survival. The Bellingen Island GHFF Camp Management Plan was developed to manage current and potential issues associated with this camp and to ensure the conservation of the GHFF. There are three GHFF camps in the Bellingen Shire.

3.2.6 Fish

Three threatened fish species occur in the Bellingen Shire; the Oxleyan Pygmy Perch, the Eastern (Freshwater) Cod and the Purple Spotted Gudgeon (Image 6). Protection of remaining habitat is a priority to ensure survival of these species. Current threats include sedimentation, poor water quality, predation, competition from introduced and loss of riparian vegetation. The Eastern Cod Recovery Plan 2004 was prepared by NSW Fisheries.

Fish monitoring has been specifically assessed for a range of species for the Bellinger and Kalang Rivers across 18 sites in 2009 – 2010 as part of the Ecohealth monitoring program. Results indicated that fish communities in the freshwater reaches were in good health across the coastal plains, in moderate health across the lowlands, and in poor health across the slopes, upland and highland zones (Gilligan, 2010). Only one introduced species was recorded (Eastern Mosquito Fish *Gambusia holbrooki*), however the number of native species recorded was below expected levels. Only 18 of 24 expected species were recorded, with those 18 species found at fewer locations than expected. This indicates that the number of fish species occurring in these rivers is poor.

The common theme present in all these plans is the management and preservation of natural values. The Koala, Grey-headed Flying-fox and Bellinger River Snapping Turtle management plans have similar objectives; to preserve the long-term sustainability of these unique fauna species and their habitats. Habitat maintenance, protection and expansion have been identified as fundamental to achieving preservation goals.

3.2.7 Rawnsley's Bower Bird

Of note is the Rawnsley's bowerbird that was photographed in the Kalang Valley, Bellingen in 2014. The rarely seen Rawnsley's bowerbird is believed to be a hybrid of satin and regent bowerbirds. Photos were captured of the bird in a backyard. In 2016 Clifford Frith published the second observation of a living 'Rawnsley's Bowerbird' at Kalang of an individual very similar to the original specimen collected in 1867 and to the living individual observed in 2003-2004.



Image 11: Regent Bowerbird. Photo: Lachlan Copeland



Image 12: Koala. Photo: Lachlan Copeland Image 13: Grey-headed Flying Fox, Bellingen. Photo: Lachlan Copeland

3.2.8 Flora

There are 27 threatened plant species identified as occurring within the Bellingen Shire by OEH 2014 and in a 2019 BioNet search as identified in Table 8.

There are several flora species which are endemic to NSW (e.g. *Gingidia rupicola*, *Neostelia spectabilis* (Silver Sword Lily), *Gaultheria viridicarpa* subsp. *viridocarpa* (Green Waxberry)), or are known from only very few locations within the Bellingen Shire or have an overall restricted distribution (e.g. *G. rupicola*, *Typhonium* sp. aff. *brownii* (Stink Lily), *N. spectabilis* (Silver Sword Lily), *Olearia flocktoniae* (Dorrigo Daisy Bush), *Kardomia silvestris* (Woodland Babingtonia), *Oberonia titania* (Red-flowered King of the Fairies) etc.), which may have a small population size (e.g. *G. rupicola*, *Marsdenia longiloba* (Slender Marsdenia), *Parsonsia dorrigoensis* (Mily Silkpod), or are threatened by weeds, pathogens, clearing or agriculture (e.g. *M. longiloba*, *Rhodamnia rubescens* (Native Guava).

Of note is the Rare or Threatened Australian Plant (RoTAP) *Hakea ochroptera*, restricted to the east margin of the New England plateau, east of Dorrigo. It is known from about 12 locations, mainly in an area including the Dorrigo National Park known as the Bellingen escarpment on the Dorrigo plateau, but also to the east in the Nymboida River gorge.



Image 14: The Vulnerable *Hicksbeacia pinnatifolia* (Red Boppel Nut) in flower. Photo: Lachlan Copeland

Table 8: Threatened flora species in the Bellingen Shire

Scientific Name	Common Name	BioNet 2019	OEH 2014	NSW Status	EPBC Status
<i>Gingidia rupicola</i>		X		E1,3	E
<i>Marsdenia longiloba</i>	Slender Marsdenia	X	X	E1	V
<i>Parsonsia dorrigensis</i>	Milky Silkpod	X		V	E
<i>Typhonium sp. aff. brownii</i>	Stinky Lily	X		E1,3	
<i>Neoastelia spectabilis</i>	Silver Sword Lily	X		V	V
<i>Olearia flocktoniae</i>	Dorrigo Daisy Bush	X	X	E1	E
<i>Gaultheria viridicarpa</i>	Green Waxberry	X		E1	
<i>Gaultheria viridicarpa subsp. viridicarpa</i>	Green Waxberry	X		V	V
<i>Senna acclinis</i>	Rainforest Cassia	X		E1	
<i>Sophora tomentosa</i>	Silverbush	X		E1	
<i>Acacia chrysotricha</i>	Newry Golden Wattle	X	X	E1	
<i>Kardomia silvestris</i>	Woodland Babingtonia	X		E1	
<i>Rhodamnia rubescens</i>	Scrub Turpentine	X		E4A	
<i>Rhodomyrtus psidioides</i>	Native Guava	X		E4A	
<i>Dendrobium melaleucaphilum</i>	Spider orchid	X	X	E1,P,2	
<i>Oberonia titania</i>	Red-flowered King of the Fairies	X	X	V,P,2	
<i>Sarcochilus fitzgeraldii</i>	Ravine Orchid	X	X	V,P,2	V
<i>Arthraxon hispidus</i>	Hairy Jointgrass	X	X	V	V
<i>Hicksbeachia pinnatifolia</i>	Red Boppel Nut	X	X	V	V
<i>Acronychia littoralis</i>	Scented Acronychia	X	X	E1	E
<i>Boronia umbellata</i>	Orara Boronia	X		V,P	V
<i>Niemeyera whitei</i>	Rusty Plum, Plum Boxwood	X	X	V	
<i>Alexfloydia repens</i>	Floyd's Grass		X	V	
<i>Maundia triglochinosides</i>			X	V	
<i>Tasmannia glaucifolia</i>	Fragrant Pepperbush	X		V	V
<i>Parsonsia dorrigensis</i>	Milky Silkpod		X		
<i>Peristeranthus hillii</i>	Brown Fairy Chain Orchid		X	V	

KEY

Jurisdiction	Abbreviation	Protection status
Commonwealth (EPBC Act)	C	Listed on China Australia Migratory Bird Agreement
	CE	Critically Endangered
	E	Endangered
	J	Listed on Japan Australia Migratory Bird Agreement
	K	Listed on Republic of Korea Australia Migratory Bird Agreement
	V	Vulnerable
	X	Extinct
NSW (BC and FM Acts)	E1	Endangered
	E2	Endangered Population
	E4A	Critically Endangered
	P	Protected
	V	Vulnerable
	2	Sensitivity Class 2 (under the Sensitive Species Data Policy)
	3	Sensitivity Class 3 (under the Sensitive Species Data Policy)



Image 15: *Calanthe triplicata* (Christmas Orchid). Image 16: The Vulnerable *Oberonia titania* (Red-flowered King of the Fairies). Image 17: *Caladenia dorrigoensis* in Dorrigo NP

Photos: Lachlan Copeland

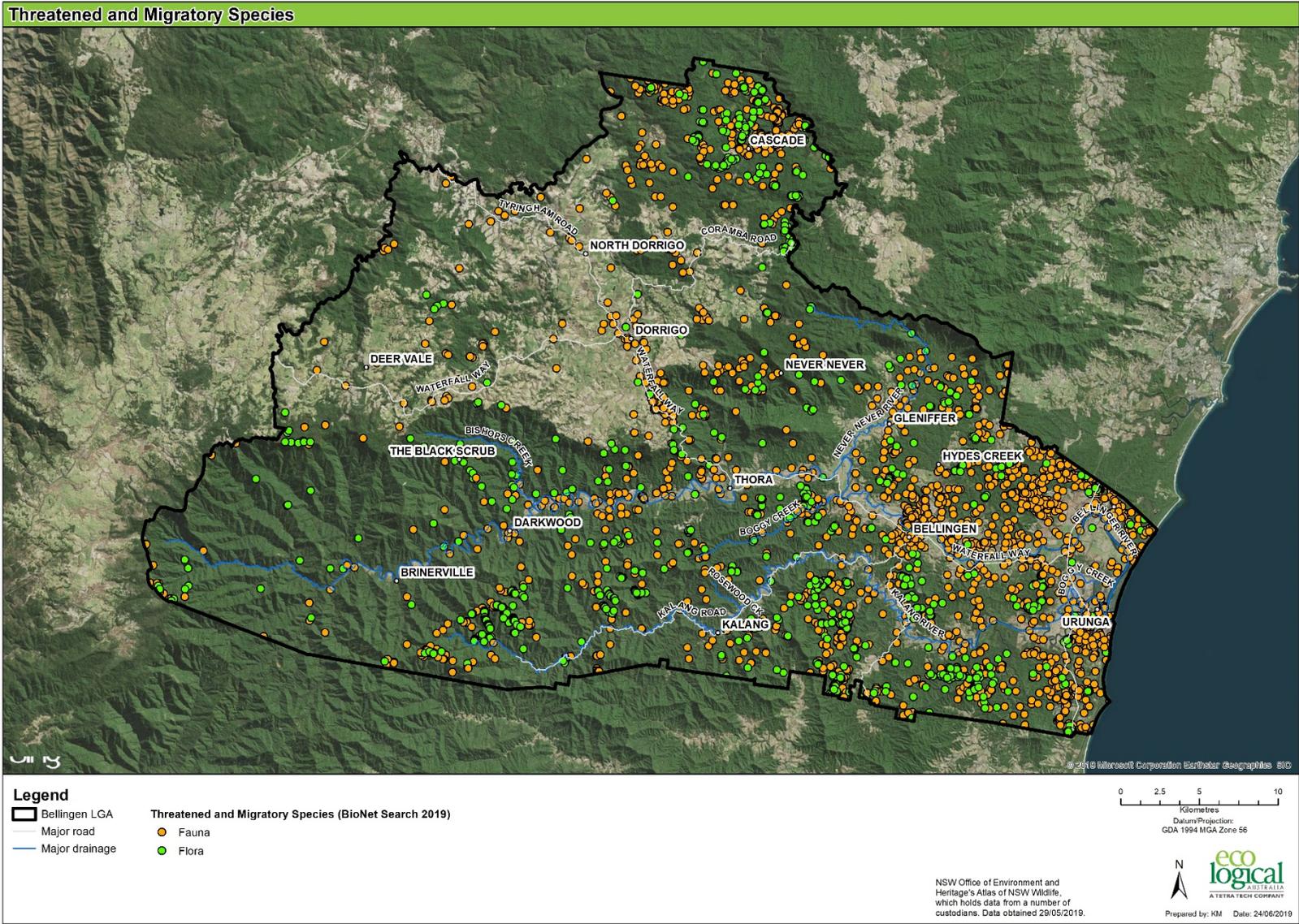


Figure 7: Threatened and migratory species within Bellingen LGA (BioNet search 2019)

3.3 Key habitats and habitat ranking

Existing habitats across Bellingen have been ranked according to mapped vegetation communities and fauna habitats (Table 9), with three levels being broadly defined and ranked as:

- **Core Habitat** – TEC or EEC mapped within the Bellingen LGA vegetation mapping, Koala Habitat Preferred Mapping, Grey-headed Flying-fox (GHFF) camps*, and potential distribution of Eastern Freshwater Cod, Purple Spotted Gudgeon and Oxleyan Pygmy Perch**
- **Significant Habitat** – Native vegetation #
- **Supporting Habitat** – Non-native vegetation ##¹

Figure 8 and Figure 9 show a classification and ranking of habitat across the LGA which maps the extant vegetation as either core or supporting habitat across the LGA. These are small but important areas, with core habitat as the most important, while also recognising that all habitat support an element of ‘natural’ function within the landscape.

Table 9: Areas of mapped key habitats in the Bellingen Shire

Key Habitat Type and Ranking	Area (ha)
Core Habitat (EECs or TECs and habitat for Koala, GHFF camps, Eastern Freshwater Cod, Purple Spotted Gudgeon and Oxleyan Pygmy Perch)	14,532
Significant Habitat (Native vegetation)	110,722
Supporting Habitat (Non-native vegetation and planted native species)	23,918

¹ * GHFF camps were digitised on 2002 extents of permanent camps, with expert advice (Alicia Scanlon, ELA) and using the National Flying-fox monitoring viewer <https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>

** Fish habitat was mapped based on buffered stream orders (Strahler 1957) that correspond with potential distribution. Stream order buffers are 1st = 10 m, 2nd order = 20 m, 3rd = 30 m 4th order and greater = 40 m; based on expert advice (Peter Hancock, ELA) with stream orders 1 and > 7 excluded from the mapping

based on Bellingen LGA mapping, Northern Rivers Catchment Management Authority (NR CMA) mapping and National Parks and Wildlife Service (NPWS) and State Forest (SF) extent https://datasets.seed.nsw.gov.au/dataset/vegetation-map-for-the-northern-rivers-cma-vis_id-524fdb07

based on NR CMA mapping.

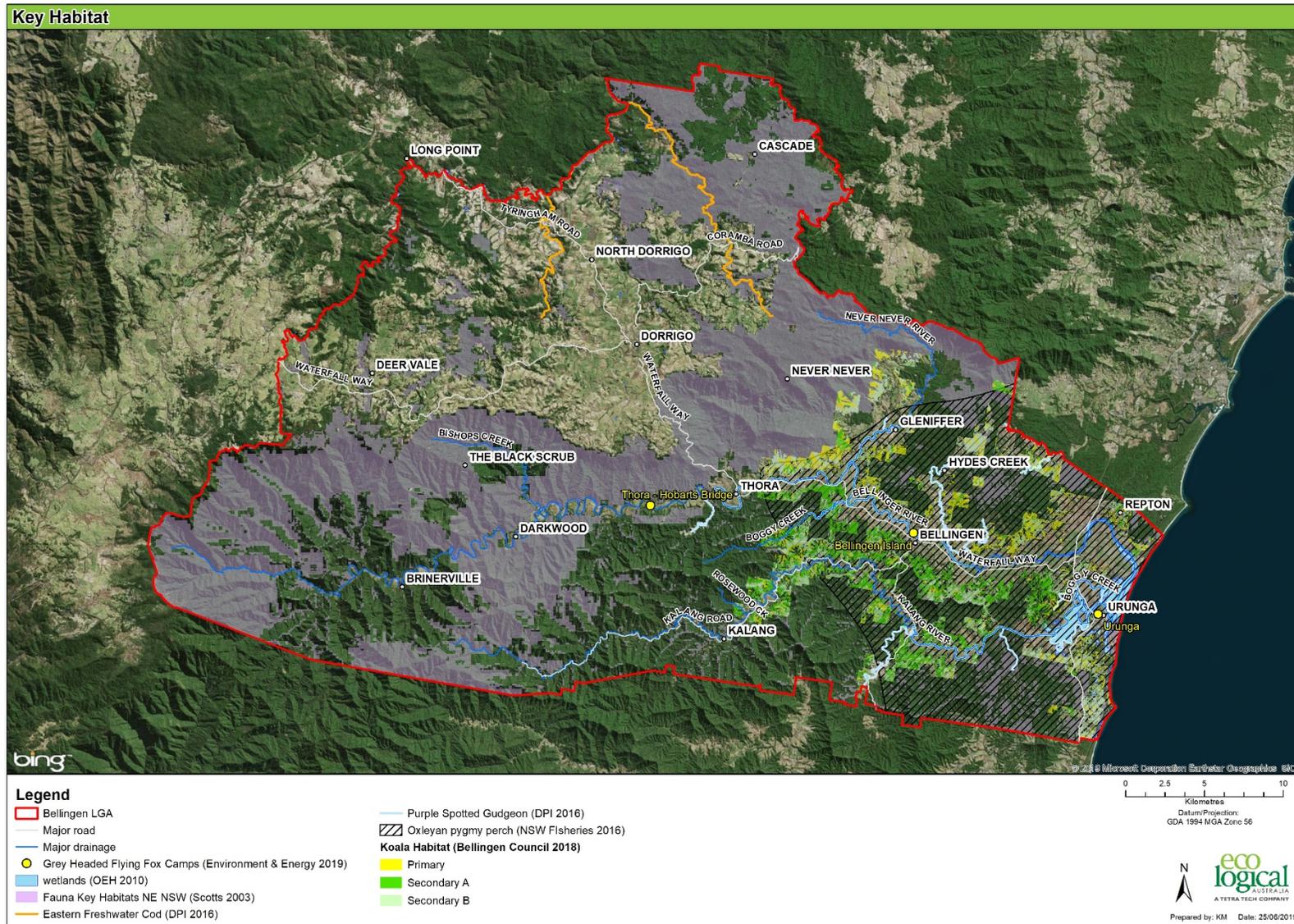


Figure 8: Key habitat types within the Shire of Bellingen

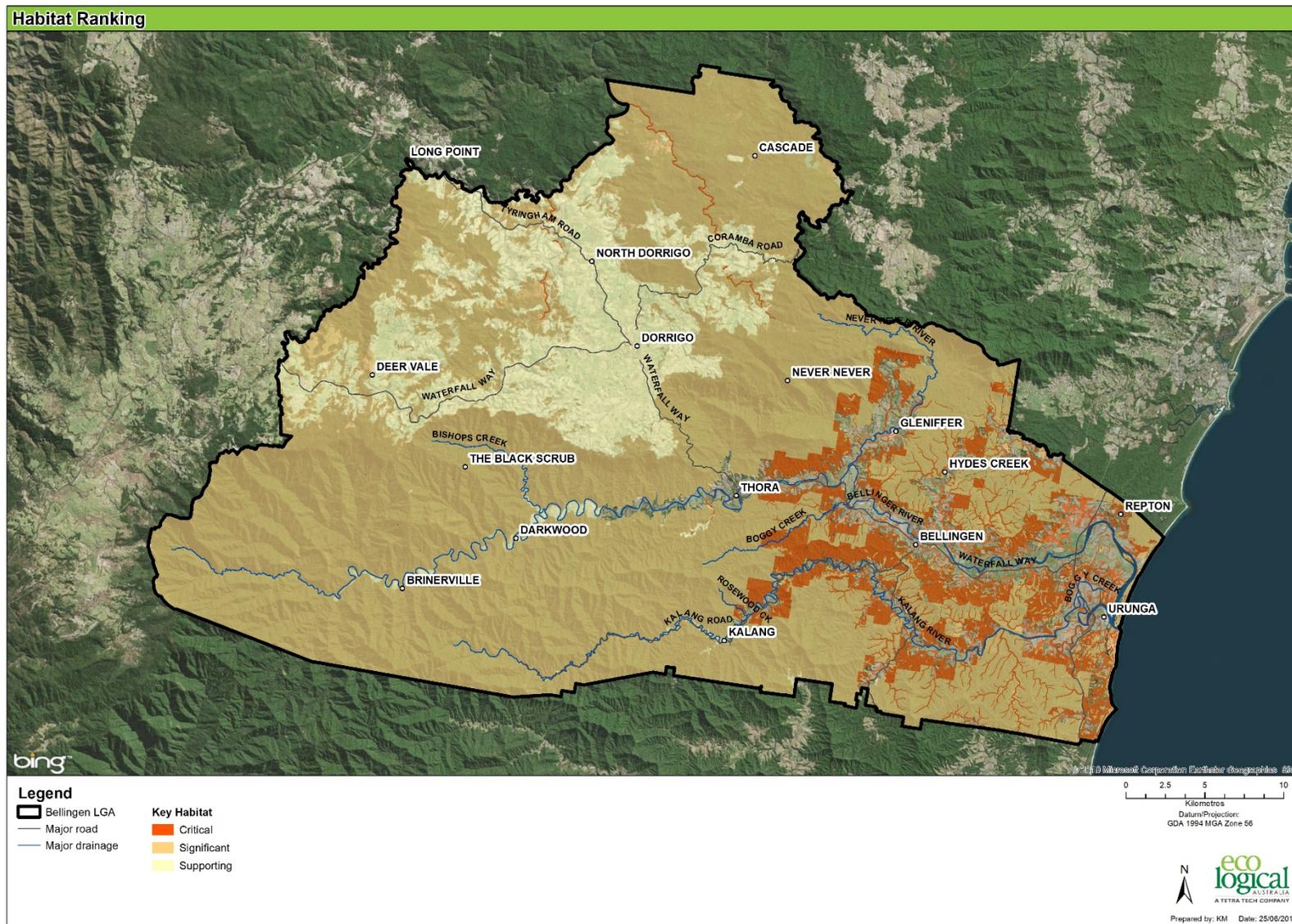


Figure 9: Habitat ranking in Bellingen Shire

3.4 Green spaces and planning

The Bellingen Shire supports 206 ha of parks, open spaces and reserves. The current land zoning for the area is provided in Table 10. Many of the areas zoned as ‘Public Recreation’ or ‘Environmental Conservation’, ‘Environmental Management’ and ‘Environmental Living’ include areas of key habitat. The majority of core habitat occurs within these zones, in addition to the extensive areas of National Park and State Forest in the LGA.

Areas of public land zoned ‘Public Recreation’ include Bellinger River foreshore (Lavenders Bridge), The Point (James Eather Way), Gleniffer and Never Never Reserves, Angel Gabriel Capararo Reserve, Broken Bridge Reserve, Earl Preston Reserve, Arthur Keough Reserve, Tallowood Point, Gleniffer, Wonga Forest Trail, North Bellingen, Ringwood Creek Reserve, North Bellingen, Roses Creek, Kalang, Tuckers Nob, Scotchman, Pine Creek, Mylestom North Beach foreshore, Bellinger River, Mylestom, Tarkeeth, Fernmount, Thora, Darkwood, Raleigh, Yellow Rock, Hungry Head beach foreshore, Dalhousie Creek, Hungry Head, Urunga beach foreshore, Urunga Lido park and boardwalk, Hydes Creek, Wenonah Headland, Tuckers Rock and Bundagen. Public land zoned as National Parks or Nature Reserves includes Dorrigo Mountain and National Park, Bellinger River National Park and the Bellinger Heads State Park.

Table 10: Green spaces in the Bellingen Shire

Zoning Type	Area (ha) in LGA
Environmental Conservation	326
Environmental Management	10,547
Environmental Living	9,460
Forestry	34,485
National Parks, Nature Reserves	52,127
Natural Waterways	190
Private Recreation	24
Public Recreation	206
Total	107,365

Regarding private land conservation in the Bellingen Shire, in 2016 there were 11 in-perpetuity Conservation Agreements (BioBanking Agreements) covering around 592 ha, and eight ongoing Voluntary Conservation Agreements covering around 900 ha. After the BC Act came into effect in 2017, Conservation Agreements include Biodiversity Stewardship Agreements (which continue in perpetuity), Conservation Agreements (ongoing) and Wildlife Refuge Agreements (non-permanent).

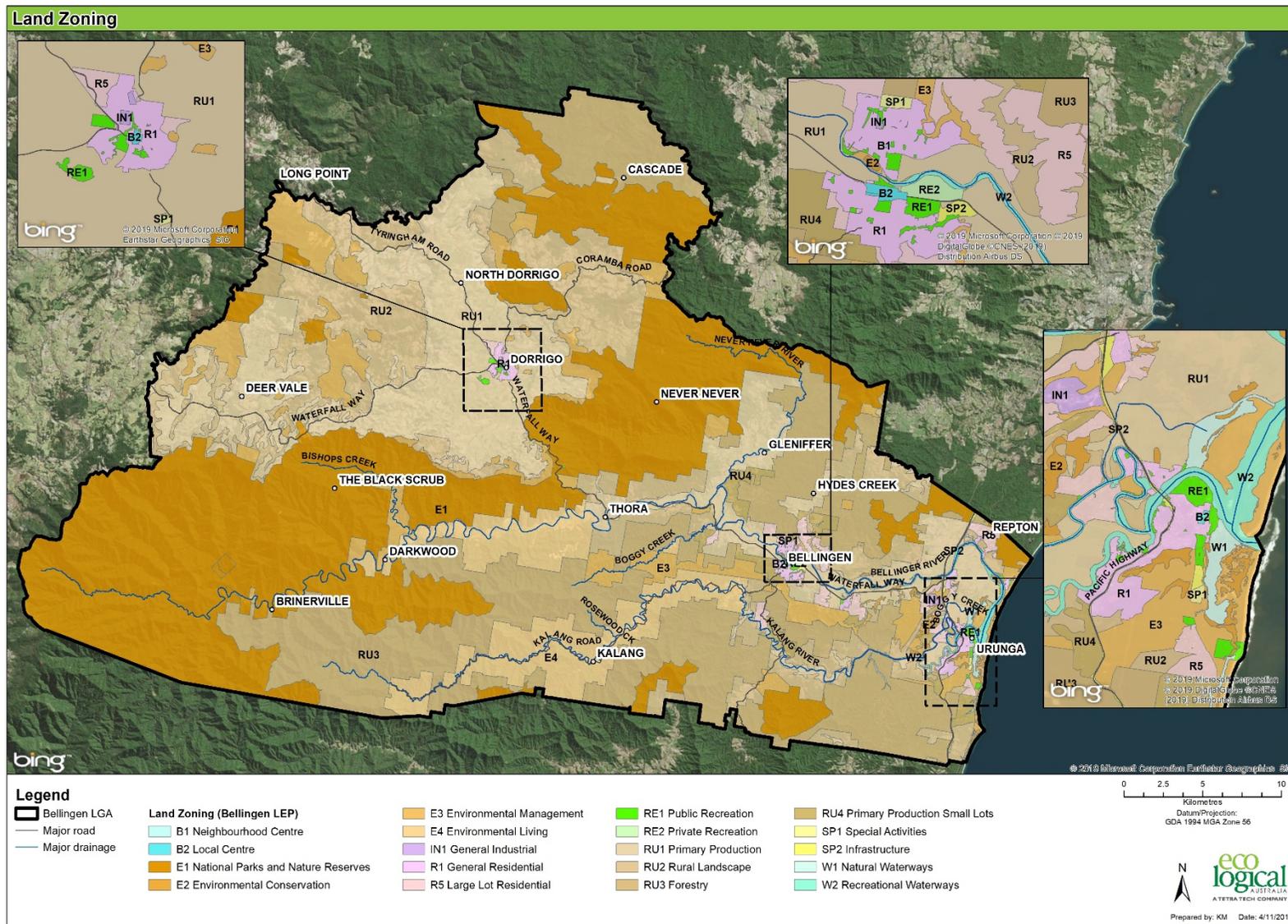


Figure 10: Land zoning of the Bellinghen LGA

3.5 Connectivity and ecological corridors

The Regional SOE (North Coast Region SOE Working Group, 2016) identified that poor habitat connectivity impacts species by limiting their dispersal and restricting population structure and genetic flow between populations. For successful species population expansion and diversity, habitat connectivity must be on a scale that is sufficient to permit gene exchange and range expansion, support trophic (food-web) relationships, accommodate disturbance processes such as climate change, and support river flows that maintain the ecology (hydro-ecological flows) (Whitten et al. 2011).

Within the North Coast region, broad-scale wildlife corridors have been mapped by the Climate Change Corridors project for Coastal North Eastern NSW, (DECC 2007, data updated 2019) <https://data.nsw.gov.au/data/dataset/climate-change-corridors-coastal-habitat-for-north-east-nsw5566b/resource/f3b51b03-b91b-49d8-a656-4e54a595bed6> This project mapped regional scale habitat corridors that are significant for wildlife adaptation to the threatening processes of climate change, as shown in Figure 11.

Habitat connectivity within the Bellingen Shire ranges from very poor to excellent (SOE 2016). Excellent connectivity corresponds closely to areas of National Parks which extend from the south-west region of the Bellingen LGA in the New England National Park, through the Bellinger River National Park and the Dorrigo National Park in the central-northern portion, as shown in Figure 12.

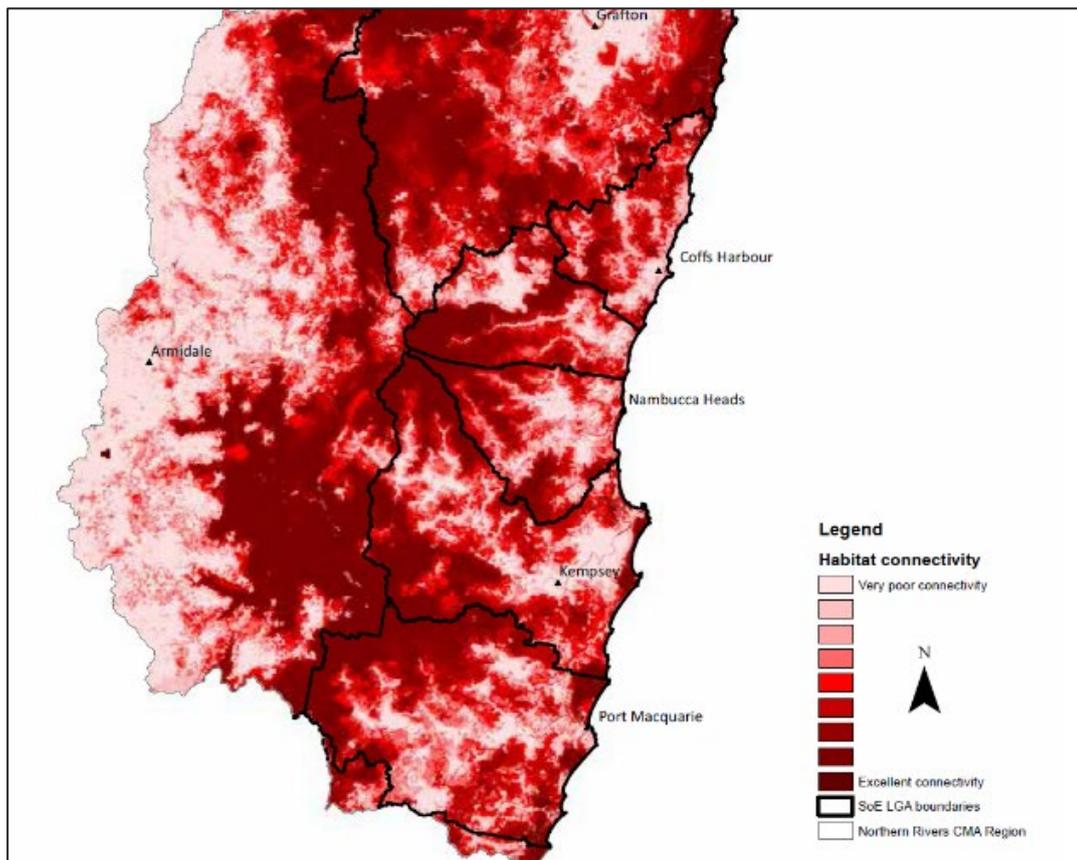


Figure 11: Habitat connectivity within North Coast Region (SOE 2016)

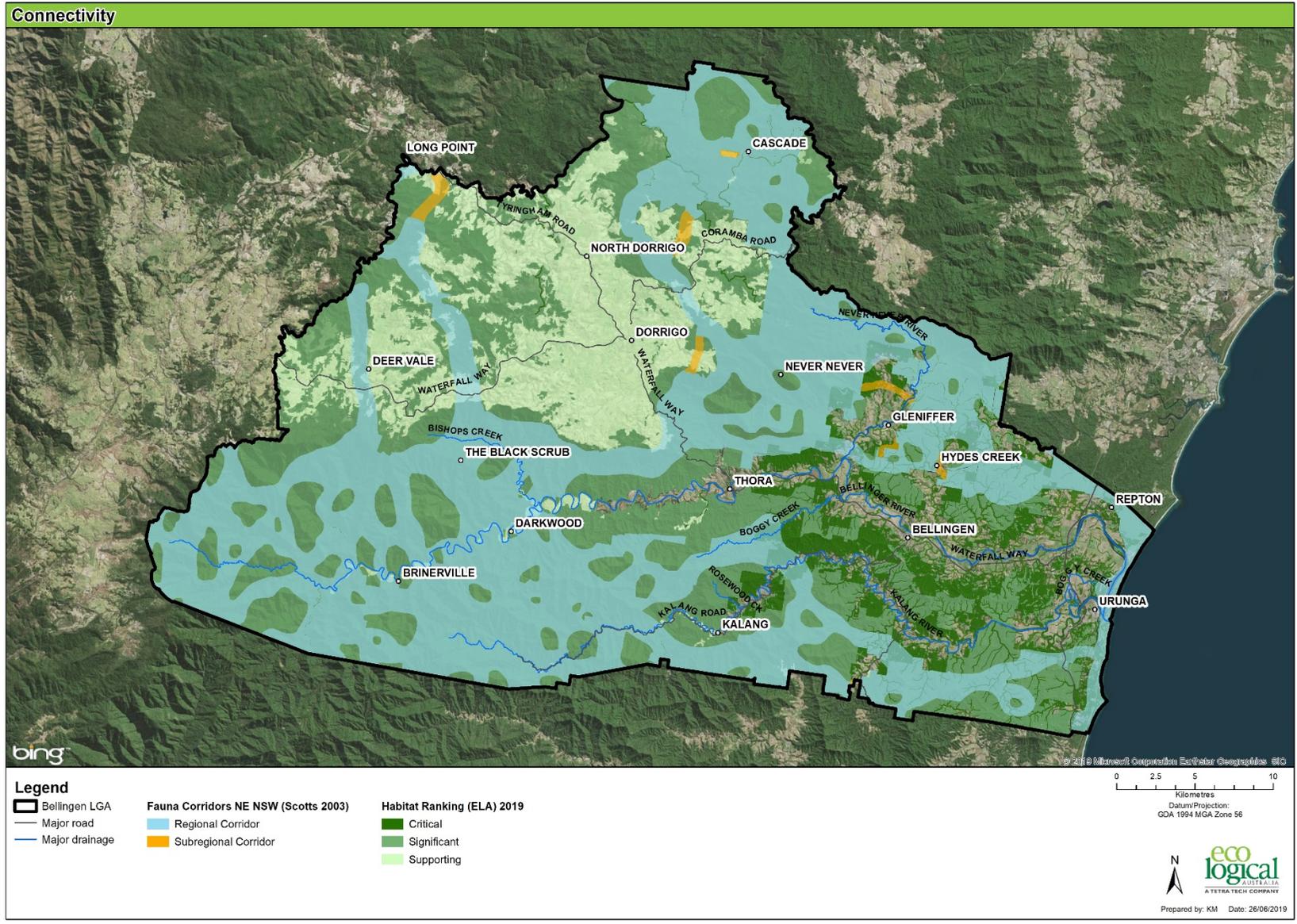


Figure 12: Regional and subregional corridors of the Bellingin Shire

4. Stakeholder consultation

Stakeholder consultation was designed in collaboration with Council staff. Project collaboration included Council's capital works design team and planners and Councillors.

Consultation has involved an online and hard copy survey, Councillor Workshop and Stakeholder Workshop, as well as liaison with agencies. Council has placed the Draft Biodiversity Strategy on exhibition for public comments and will hold a Community Workshop.

4.1 Consultation

Consultation with a wide array of stakeholders is in progress. Consultation questions are included in **Appendix E**.

4.2 Responses

Bellingen Shire Council conducted an online community survey during July and September. The survey was unrestricted and open to all members of the public. Following is a summary of the responses as well as a snapshot of some selected responses:

- 94% of respondents live in Bellingen Local Government Area, 2/3 were above the age of 46 and 3% identified as Aboriginal.
- There was awareness of all the listed environmental projects and groups in the Bellingen Shire. The three projects/groups rating the highest were Bellinger Landcare Inc, Bellingen Environment Centre and Bellingen Riverwatch. Bundagen Dunecare, Tuckers Rock Dunecare and Friends of the Wonga Forest are the least known projects/groups.
- The environmental projects and groups that respondents were most involved with were Bellinger Landcare Inc, Bellingen Environment Centre and Bellingen Riverwater.
- 60% of respondents use Bellingen Shire's open spaces and bushlands areas more than once a week, with a further 21% using the resources once a week.
- Dorrigo Mountain and National Park, Bellinger River foreshore (Lavenders Bridge), Gleniffer and Never Never Reserves, Urunga beach foreshore and Hungry Head beach foreshore were the top five natural areas visited.
- 34% of respondents were neither satisfied or dissatisfied with the Council's management of the Bellingen Shire's natural environment, 30% were satisfied and 26% dissatisfied.
- The most popular activity within Bellingen Shire's natural areas (bushland, beaches, waterways) was walking/hiking/jogging, followed by swimming and family events.
- All the set of actions to enhance and protect Bellingen Shire's biodiversity were rated extremely important by most respondents, apart from providing natural areas for recreation opportunities of which 41% of responses were rated as extremely important. Protecting threatened vegetation communities and creating and enhancing river foreshore and bushland were actions which rated the highest as extremely important. Fencing cattle access off natural waterways was the action with the highest not important rating, representing 8% of responses.
- The biggest threat to Bellingen Shire's natural environment was reported to be clearance of vegetation, followed by weed invasion of bushland, climate change and pest animals (such as foxes, Indian Myna birds, feral cats and dogs).



Image 18: Earl Preston Reserve, Gleniffer. Photo: Liz Brown Image 19: Earl Preston Reserve Gleniffer. Photo: Liz Brown Image 20: Earl Preston Reserve Gleniffer. Photo: Liz Brown

Snapshot of community survey responses: Use of natural areas

“Rest and relaxation! We like to go to Glennifer and just sit on the riverbank soaking up the natural environment. My boys skim rocks on the water and we just spend time there. We also attend lots of birthday parties which are held on the riverbank in town near the bridge and at Connell Park.”

“Just being there as a human being is so valuable to the spirit.”

“Meeting with friends, sunset drinks on the riverbank, Mylestom, reading quietly, 'Forest bathing', meditating, exploring, biophilia, connection to culture, wellbeing.”

“Contemplation, wildlife watching.”

“Kids play and mothers group meet ups. Relaxing, de-stress, thinking, meditation.”

“Connecting with my land.”

“Photography. Butterfly and other invertebrate watching. Relaxation. Nature photography.”

“Admiring the Forest. Forest gives us air we breath, so BREATHING. Health and relaxation, perpetuity of species not extinction , so being a good human and looking after the native animals who live along side us.”

Snapshot of community survey responses: Threats

“Too many people especially in summer, who are disrespectful of the environment and who wreck it with noise, rubbish and activities which interfere with the ecology of the forests and rivers.”

“Forest logging.”

“Over-development leading to altered drainage and increased storm water runoff.”

“Weed infestation of native areas.”

“Development for housing - clearing vegetation, removing trees and understorey, taking away bird, cockatoo, koala and native, threatened and endangered bird and animal habitat.”

“I am opposed to native forest logging in the shire and believe that the mature forest in the proposed compartments should not be logged.”

“Logging, intensive agriculture like blueberries. Pollution in our waterways. Invasive weeds. Climate change. Feral cats.”

“Use of sprays from farmers and residents dealing with weeds enters waterways and pollutes the soil.”

“Fragmentation, overgrazing and building developments on fragile lowland swamplands near waterways and riparian zones potentially effecting aquatic life.”

“Population increase”

Snapshot of community survey responses: Vision for the next 20 years

“Bellingen Shire be the leading Biodiversity Conservation Shire in Australia.”

“Make the environment the priority in any planning.”

“Encourage industries which will respect the environment as a number one priority. Follow the dictates of science in planning, not money.”

“My vision is the removal of camphor laurel and a reduction of prevalence of lantana and small-leaved privet in our native forests and riparian zones. I wish that we could protect and enhance our natural environments to ensure the persistence of our threatened species such as the koala.”

“The Koala park of Bellingen Shire is long established replenishing and maintaining a healthy koala population.”

“The rivers are clean, flowing and teeming with native life”

“I'd like to see the Great Koala National Park go ahead. I'd like to see logging in the Tarkeeth and forests surrounding Bellingen stopped. I'd like to see the health of the Bellingen, Never Never and Kalang Rivers better understood by local people and active participation in looking after the health of these systems.”

“People living in the Shire have a healthy respect for the wonders of nature, and recognise the value of biodiverse, naturally thriving forests, riparian ecosystems and grasslands. Agriculture has become regenerative, rather than destructive, and has diversified to employ more local people. Food supply is mostly locally-sourced and organic.”

“A far better understanding by the community at large of the importance of biodiversity in an ecosystem, leading to an improved desire to conserve the treasures Bellingen Shire has.”

“My vision is to experience the natural environment in a way which is similar to what our first nation's people experienced before European settlement ... because I wonder what that would be like.”

“I'd like to see more trees and better health in the rivers. More trees/bush creates diversity as it allows the natural ecosystems to take place. It's so important for not only animals but humans as well. We are all part of this world and need to take care of it.”

“To keep Bellingen beautiful and stop logging the forests and destroying the native habitat of our native animals particularly Koalas. To keep on educating the local community the importance of sustaining the valley and not polluting it and have education classes in schools to teach the next generation of these things listed above.”

“A balanced range of well managed farm lands, rural and residential property, with plenty of areas for native forests to thrive and offer uncompromising corridors for wild life.”

5. Threats

The Bellingen Shire landscape is diverse and supports a rich array of ecological values, supporting a high level of biodiversity. Threats to biodiversity can be complex, interconnective and widespread or localised to a specific environment that supports vulnerable species such as the Bellinger River Snapping Turtle. The biggest historic threat to fauna has been habitat loss and fragmentation within the coastal valley systems; with Koala populations in the Bellingen Shire identified as being at being at risk from habitat fragmentation and reduced habitat connectivity.

Other key threats to biodiversity include the proliferation of invasive weed species, clearing for agriculture and urban development, pollution, eutrophication, disease, predation and disturbance from feral and domestic animals, altered bushfire regimes and the effects of climate change. The erosion of streambanks caused through increased velocities in runoff due to vegetation clearing has resulted in the loss of trees and vegetation in many riparian zones. Clearing of native understorey, fallen and woody materials (logs and branches), and harvesting of rocks to achieve a 'tidy' look contributes to three key threatening processes under the BC Act listed as 'bushrock removal', 'removal of dead wood and dead trees' and 'clearing of native vegetation'.

Threats to the Bellingen Shire's biodiversity are discussed below and are based on a review of literature, including previous ecological studies, various BSC Plans of Management and consultation with stakeholders.

5.1 Global climate change

Anthropogenic climate change is listed as a key threatening process under the BC Act and will impose major impacts on species and ecosystems, although many of the potential impacts on ecological processes remain poorly understood (Auld and Keith 2009). The means by which global climate change could affect biodiversity include increased frequency of extreme weather events, disrupting the life cycles of flora and fauna, exposure to new pathogens and predators and loss of habitat from sea level rise (Auld and Keith 2009). Examples of the potential impact of climate change in the Bellingen LGA are sea level rise inundating coastal vegetation habitats, destruction of habitats through extreme weather events, impacts of increased storm events on river bank vegetation, and the exacerbation of weed invasion from changed temperature and moisture regimes.

The 2019 IPCC Report on Climate Change found that since the pre-industrial period, the land surface air temperature has risen nearly twice as much as the global average temperature. It found that climate change, including increases in frequency and intensity of extremes, has adversely impacted terrestrial ecosystems and food security as well as contributed to desertification and land degradation in many regions. The report found that climate change creates additional stresses on land, exacerbating existing risks to biodiversity, human and ecosystem health, livelihoods, infrastructure, and food systems. Increasing impacts on land are projected under all future GHG emission scenarios. It states that some regions will face higher risks, while some regions will face risks previously not anticipated. Cascading risks with impacts on multiple systems and sectors also vary across regions.

The 2019 Intergovernmental Platform of Biodiversity Ecosystem Services (IPBES) Global Assessment found that land-use change has had the largest relative negative impact on nature for terrestrial and

freshwater ecosystems, mainly through habitat loss and degradation; whereas in marine ecosystems, direct exploitation of organisms (mainly fishing) has had the largest relative impact, followed by land/sea-use change. The multiple components of climate and atmospheric change (e.g., changing temperature, rainfall and atmospheric CO₂ levels as well as ocean acidification) are already significant drivers of change in many aspects of nature but are not usually the most important drivers at present.

North Coast Enabling Regional Adaptation Report 2019 recognises the region is one of the most biologically diverse in NSW but is increasingly vulnerable to threats from weeds and pests. Responsibilities for biodiversity are fragmented with under-resourced government and with insufficient investment in environmental assets, compounded by thinly spread implementation of funding across agencies and communities, poor integration of planning and administration. It found that there is a need for corridor connectivity, rehabilitation and restoration, and a current focus on management of threatened species. Tourism often has negative impacts on the biodiversity of the region however the general public and communities of the North Coast are engaged and participate in supporting conservation of biodiversity. Despite this, the region is experiencing ongoing loss of biodiversity with flow-on effects to ecosystem services. Threatened species and endangered ecological communities sometimes exist on private property and therefore are outside the reserve system. A transformed biodiversity system would see improved land protection, a state of the environment repository for values mapping of biodiversity, native vegetation regulation, and a single information source with monitoring and evaluation framework embedded within Councils' Integrated Planning and Reporting framework to promote the retention, restoration and enhancement of biodiversity and ecosystems with a strengthened focus on landscapes, rather than species to prioritise high conservation areas.

Bellingen Shire Council has declared a Climate Change Emergency 2019; stating that "we are in a state of emergency that requires urgent action by all levels of government, that human-induced climate change represents one of the greatest threats to humanity, civilisation, and other species, and that it is still possible to prevent the most catastrophic outcomes if, and only if, societies take emergency action now". Council resolved to hold a workshop to examine how its community strategic plan, works program and planning documents can address the climate emergency.

5.2 Weed invasion

Weed invasion has been identified as a major threat to biodiversity across many of the landscapes in BSC including along river corridors and in river valleys, wetlands, islands and coastal dune areas. Weed invasion is a significant and pervasive threat for Bellingen's native vegetation. The resilience or ability of Bellingen's native vegetation to resist and recover from weed invasion has been compromised by a long history of clearing for agriculture and settlement, disturbance, fragmentation, sedimentation from unsealed roads and stormwater run-off. Invasion and establishment of exotic vines and scramblers, lantana and exotic perennial grasses, as well as degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants; are four key threatening processes listed under the BC Act. For example, Madeira Vine, Camphor Laurel, Coral Trees, Lantana, Small-leaved Privet, Wild Tobacco and Trad have been identified as invasive weeds at Bellinger Island and Gleniffer Reserves and occur throughout the Shire.

A number of Council reserves have been worked as a part of an ongoing bush regeneration program for a relatively long period (particularly Bellinger Island which has undergone restoration work since 1984)

and Council staff, contract bush regenerators, Landcare Groups and other community groups currently work in several Council reserves. These groups have made substantial progress, but weed invasion remains a significant problem for vegetation in the LGA.

Pro-active on-going management is required to conserve and maintain the biodiversity values and functions of fragmented remnant vegetation. Areas that receive an inadequate level of management, or no management, will decline; eventually permanently losing their viability and potential for restoration (ability to recover). Council-managed reserves with native vegetation should undergo ongoing bush-regeneration as a high priority, before resourcing revegetation works (areas with no remnant vegetation) in other areas of open space.

Further bush regeneration and weed management opportunities have been documented under Fauna corridors and habitats.

5.3 Edge effects

Edge effects due to weed invasion are a major threat to native vegetation along the riparian zones of Bellinger and Kalang Rivers and coastal wetlands. Weeds impact on the biodiversity values of riparian zones through competition with native vegetation. The long, linear shape of riparian land, and the small size of many reserves creates a high edge to area ratio, so that edge effects such as weed invasion penetrate and proliferate. The native species diversity of most reserves in BSC is currently threatened by edge effects including weed invasion and disturbance. In contrast, larger patches of vegetation such as those in national parks and state forest contain a core of vegetation buffered from impacts by surrounding vegetation.

Edge effects can also include chemical spray.

5.4 Logging

The threat to biodiversity created by logging includes loss of high conservation value forests. Loss of carbon sequestered within forests through logging contributes to release of carbon and impacts of climate change. Logging contributes to the key threatening process 'clearing of native vegetations' under the BC Act. Impacts associated with logging also include roading, creation of disturbances such as log dumps, loss of highly erodible soils from steep lands, impacts on wildlife such as loss of hollow-bearing trees and decrease in water quality. Indirect impacts include the potential increase of bell-miner associated dieback within forests disturbed by logging and decline in fish stocks due to poor water quality.

Consistent strong community opposition has been expressed to forest logging, most recently with protests in the Kalang River headwaters. The Kalang River is surrounded by an extensive forested area consisting of a number of State forests as well as National Parks, privately managed forests.

5.5 Increased runoff, nutrients, sediment and erosion

Clearing of vegetation for agriculture and settlement; and impermeable surfaces in the developed towns of Bellingen, Urunga and Dorrigo (including roads, car parks, paving and the roofs of buildings) increases the velocity and amount of stormwater runoff entering river systems, creeks and drainage lines. This runoff contains nutrients and sediments that change the soil nutrient levels of riparian vegetation and

favours the growth of weeds, causes streambank erosion and sediment deposition. So, in addition to weed invasion from the edges of reserve, the presence of a creek line in many of Bellingen’s reserves provides another source of nutrient and weeds including “garden escapees” from rural and residential areas and a decline in water quality.

High velocity flows during storm events promotes stream bank erosion and damage or loss of riparian vegetation. Sedimentation of streams and wetlands in BSC is a result of vegetation clearing and runoff from unsealed roads within the rural area and State Forests. This contributes to the key threatening process ‘alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands’ under the BC Act. The projected increased intensity of storm events due to climate change is a threat to Bellingen’s biodiversity, particularly where the integrity of riparian zones have been compromised by land use patterns.

5.6 Water pollution

Stormwater polluted with litter, chemicals such as pesticides and oils, nutrients and sediment enter creekline and estuarine ecosystems with a corresponding reduction in aquatic biodiversity. The main pollution types impacting waterways in Bellingen Shire are sediment, nutrients, pathogens, chemicals, acidity, salinity and rubbish. High nutrient loads promote weed growth and algal blooms. In 2006 the Bellinger River was closed to the harvesting of oysters due to high coliform counts.

The major threats in Bellingen include:

- Diesel and animal waste spills on roadways
- Contamination from cattle dips and mines
- Runoff from agricultural land
- Runoff from on-site sewage management systems
- Runoff from acid sulfate soils
- Dredging of estuarine reaches of the Bellinger/Kalang River systems known as the ‘Raleigh Shoal’
- The high flows of nutrients from stormwater drains
- Elevated nutrient (total nitrogen and total phosphorus) concentrations
- Elevated chlorophyll-a levels in the upper reaches of the estuary
- Wave erosion of foreshores caused by boats
- Beach erosion due to short term storm events or storm events in close succession
- Coastal inundation during high tides and exacerbated during storm events
- Decaying green waste siphoning oxygen from the water detrimentally affecting and even killing plants, fish and other animals in the aquatic ecosystem
- Heavy metals and pesticides bio-accumulating in aquatic plants and animals and concentrating up the food chain
- Fishing line and stainless steel or alloy hooks discarded from boats, beaches, jetties or anywhere else remaining in the aquatic environment for very long periods of time continuing to kill or injure marine life.

These all contribute to two key threatening processes under the BC Act, including entanglement in or ingestion of debris in estuarine environments, and alteration to the natural flows of rivers and streams and their floodplains and wetlands.

5.7 Altered bush fire regimes

Fire regimes have a crucial role in the life cycle in many of Bellingen Shire's vegetation communities by stimulating the release or germination of seeds, facilitating the establishment of seedlings by liberating resources and reducing the competition of standing vegetation (Auld and Keith 2009).

Environmental/ecological burns can assist with regenerating bushland, creating patches of differing flora height and density, and allowing fire-adapted species to re-sprout or shoot. On the contrary, areas of bushland that are burnt too frequently will result in the loss of native species richness, particularly from obligate seeders. Obligate seeders are plants which do not re-sprout following fire, but regenerate from seeds buried in the soil or retained in woody fruit. The fire-interval must be long enough to allow such plants to grow and reproduce to produce a seed bank (Gill and Williams 1996).

Fire can also burn and damage vegetation communities such as rainforest that take hundreds of years to recover and kill or injure native fauna. High intensity bush fires which reach the canopy potentially impacts koala populations through smoke inhalation, flame and heat exposure and/or by reducing food source supply. Bushfire has led to past koala population crashes, requiring at least three koala generations to ensure population recovery. The dry sclerophyll forest communities south of the Bellinger and Kalang River historically experience greater fire risk and impact koala communities in these locations.

Ash deposition in waterways from bush fire is a cause of pollution and removal of riparian vegetation from bushfire potentially leads to increases in erosion and sedimentation. There is evidence of deterioration of water quality after bushfire and heavy rainfall resulting in fish kills during the 1920s and 1930s which lead to eastern cod depletion in the nearby Clarence River system.

5.8 Feral animals and domestic pets

Predation, disturbance and destruction of habitat by foxes, rabbits, pigs, cats and dogs is one reason for the significant decline and extinction of mammals, amphibians and reptiles such as the predation on Hastings River Mouse, Long-nosed Potoroo, Giant-barred frog and Loggerhead Turtle. Predation by foxes of Bellinger River Snapping Turtle nesting females and nests have impacted on the recovery of the species.

Several introduced bird species occur in Bellingen, including the ground-foraging granivore Spotted Turtle-Dove, and the omnivores Common Myna and Common Starling. These species are generally exploiting human environments including planted vegetation along streets and parks and in front and rear yards.

Of concern are pet dogs and cats in the LGA, for both predation and disturbance. Dogs off leashes in reserves, or even those on leashes, can scare away or predate native species. Dogs in coastal habitats have been directly observed chasing and scaring resting shorebirds. Vulnerable fauna, such as the Grey-headed Flying-fox and Koala are under significant threat from predatory feral and domestic animals.

Predation and habitat invasion by introduced fish such as the gambusia, redfin perch, tropical banded grunter, goldfish and mosquito fish have impacted on endangered species such as the Stuttering Frog, Purple Spotted Gudgeon, Eastern Cod and Oxleyan Pygmy Perch. Interbreeding and hybridisation with

other species such as the Bellinger River Snapping Turtle and the Murray River turtle is evident, reducing the population of individual species.

5.9 Bell miner dieback

DPIE Bell Miner Dieback Strategy states:

‘Dieback is a condition in which trees progressively die, from the top downward. The condition spreads through the leaves and branches and often the whole plant will eventually die.

‘The hardwood forests of north-east NSW are increasingly suffering from a form of dieback, although not widespread in Bellingen Shire. This type of dieback is strongly associated with sap-feeding insects called psyllids and psyllids are strongly associated with the native bell miner or bellbird. Bell miners are a natural part of eucalypt forests, and they normally have a minor (and positive) impact on forests. However, bell miner populations have increased in size, and the birds have become more widely distributed.

‘Bell miners have been implicated in the spread of dieback, in addition to other factors such as:

- *tree stress,*
- *psyllid infestation,*
- *dense forest understories,*
- *weed invasion, drought,*
- *logging,*
- *road construction,*
- *pasture improvement,*
- *loss of biodiversity (both plants and animals),*
- *soil nutrient changes, changing fire patterns, and*
- *changing grazing regimes.*

‘Bell miner associated dieback is spreading through forests on public and private lands from South-East Queensland to Victoria. These forests are regionally and nationally important for plant and animal conservation, tourism, water catchment management, and the production of honey and timber.’

Many forests in Bellingen are currently in good condition, not greatly affected by bell miner associated dieback, however the disturbance caused by logging and associated heavy machinery may lead to bell miner invasion and subsequent dieback. This may in turn lead to dieback within koala habitats due to logging and clearing disturbances, and colonisation by lantana and other weedy vines that suppress native regeneration and facilitate the spread of sap-sucking insects and bell miners.

5.10 Development and infrastructure

Development and infrastructure works in parks or reserves can impact native vegetation communities through clearing and disturbance. Typical works include maintenance of existing infrastructure, including pathways, adjoining recreational facilities, underground services, powerlines, adjoining roads and stormwater. Similarly, developments occurring on adjoining properties or upstream from parks and reserves can have negative impacts. Poor site management and inadequate sediment controls can lead

to waste material impinging on the reserves as well as increased stormwater, erosion and sediment load.

Road strike is a significant threat to koalas in the Bellingen and surrounding areas. WIRES reported that for the period July 2005 to March 2013, there were 104 reports of road strikes of koalas in the Coffs Harbour and surrounding areas. The Pacific Highway was identified as a significant area of koala mortality particularly during breeding season from August to November.

Urban growth and development put greater pressure on open spaces and natural environments. This is due to increased foot traffic, waste production, potential transport of non-native seeds into new areas, potential increase in domestic pets, increased light pollution, and increased likelihood of informal pathways and vandalism through native areas. It can also lead to demand for additional infrastructure that may directly or indirectly impact areas of high biodiversity values.

5.11 Disease

Disease and infection have been identified as a significant threat to vulnerable flora and fauna species in the Bellingen area. Populations of species such as koala, Grey-headed Flying-fox, Bellinger River Snapping Turtle, fish and native plant communities have been greatly impacted from disease.

Koala populations have a high incidence of diseases such as chlamydia which is a leading cause of koala mortality. Research into understanding impacts from chlamydia, vaccine trialling and potential management strategies is outlined in the *NSW Koala Strategy*. In the Bellingen area sick koalas were leading cause of koala reports to WIRES in the period July 2005 to March 2013.

The population of the critically endangered Bellinger River Snapping Turtle was severely impacted in 2015 from disease which left very few adults in the wild. The disease cause has not been identified and has been associated with a new virus, research into the virus is ongoing. The “Keep a ‘clean’ routine: Bellinger River Snapping Turtle mortality” fact sheet issued by the DPI outlines the risks to the Bellinger River Snapping Turtle and steps to take to reduce the risk when visiting the Bellinger River including cleaning watercraft when moving from affected areas to other waterways.

The Grey-headed Flying-fox carry pathogens including the Australian bat lyssavirus, Hendra virus and Menangle virus, which can cause significant disease to other species if transmitted.

Diseases threatening fish species such as the Eastern Cod include chilodonelliasis and white spot.

Other disease related key threatening processes listed under the BC Act are:

- infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations
- infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae.

6. Opportunities

6.1 Strategic planning and improving connectivity and habitat

One of the overarching goals for biodiversity in Bellingen is the enhancement and connectivity of remnant vegetation and fragmented habitat in the valley floors. The greatest pressure on vegetation in the Bellingen area is from land clearing and runoff, fragmentation and disturbance of remaining vegetation and future development growth. Bellingen comprises a variety of high-value habitats including wet sclerophyll forests, dry sclerophyll forests, rainforest, forested wetlands, freshwater wetlands and saline wetlands. Bellingen LGA has nine Endangered Ecological Communities, listed in Part 2 of Schedule 2 of the *Biodiversity Conservation Act 2016*, these communities are Coastal Saltmarsh, Freshwater Wetlands on Coastal Floodplains, Littoral Rainforest, Lowland Rainforest in the NSW North Coast and Sydney Basin bioregions, Lowland Rainforest on Floodplain, Subtropical Coastal Floodplain Forest, Swamp Oak Floodplain Forest, Swamp Sclerophyll Forest on Coastal Floodplains, Themeda Grassland on Seacliffs and Coastal Headlands. It features Dorrigo National Park which is world heritage listed as part of the Gondwana Rainforests of Australia.

Connectivity in Bellingen ranges from excellent in National Parks and State Forest areas to poor in agricultural and urban land use areas. Improving connectivity in Bellingen for key vulnerable species, such as the koala, requires a multifaceted approach due to the fragmentation and clearing of remaining habitat. Connecting habitats and protecting/enhancing biodiversity should focus on improving habitat in Council reserves. Connecting both public and privately-owned areas can provide important areas of habitat and contribute to linkages to bushland patches. Council should consider strategies for encouraging improved connections and habitat conservation on private lands i.e. in koala corridors or regional wildlife corridors. Council together with DPIE could encourage private land owners in these areas to enter into Voluntary Conservation Agreements, although Council would need to investigate and accept potential loss of rating income.

The Local Environmental Plan (LEP), Development Control Plan (DCP), Plans of Management, Coast and other Management Plans are key mechanisms to implement vegetation controls for protection and enhancement to effectively improve connectivity and native habitat in Bellingen. There is potential for the Biodiversity Strategy to be incorporated into the Councils Local Strategic Planning Statements and for the actions under the Biodiversity Strategy to be integrated into the DCP through inclusion of high environmental values (HEV) as mapped layers. HEVs require mapping validation as they are currently mapped at a regional level.

‘Our vision for the future must encompass all aspects of living and working in our shire, as well as ways in which we are connected beyond our borders - regionally, nationally and globally. Our vision is about protecting the pristine natural beauty of our environment and enhancing our prosperous and safe community where inclusiveness and sustainable living are embraced, so that creativity and cultural activity can flourish.’ (Shire of Bellingen 2027 Community Strategic Plan, updated 2017).

Council managed natural areas within Bellingen could be allocated a natural asset value with recurrent and capital funding, so they can be managed in the same way as other assets within the LGA and valued accordingly. Likewise, enhancement and continuation of the Environmental Levy funds for natural area management is critical, as is increased funding and in-kind support from State and Federal governments.

These would allow better protection and management of the areas. Support for joint projects between Council and Landcare groups is recommended, as it will allow for wider ranging outcomes for the community and the natural areas. This would also increase the opportunities for Council to access more grants and funding for larger projects.

6.2 Climate Change Adaptation Change Model for Biodiversity

The North Coast Enabling Regional Adaptation Plan promotes a new model for adaptation to promote biodiversity conservation:

'A transformed system for biodiversity encompasses connected and functional natural ecosystems (terrestrial, aquatic and marine) 'supporting everything'. Management of threats is deeply interrelated and needs to be considered holistically. Planning and management are informed and governed by 'One map', which incorporates spatial and temporal and 'wet & dry' dimensions. Full costing of ecosystem services and biodiversity is embedded in decision-making and transactions. A network of connected landscapes facilitates adaptation to change allowing species movement among refugia throughout the entire landscape. Resilient, healthy, and novel systems are recognised as important for landscape resilience and incorporate new species, local losses and species change. Integrated decision-making takes place through an independent, non-government biodiversity body. Ecosystem management embraces new approaches to technological and policy innovation, research and development, biotechnology use, and environmental engineering. The reserve system is retained and improved but not relied upon for ecosystem resilience. Knowledge of ecosystems is used in decision-making and ongoing support for biodiversity protection is prioritised. Ecotourism is embedded in the economy of the North Coast, which benefits the biodiversity system. Finally, the community recognises and takes responsibility for their impacts (positive and negative) and understands that biodiversity underpins industry and economic sustainability.'

6.3 Sustainable agriculture and forestry

Agriculture in Bellingen is well established especially the dairy industry which contributes 45% (2016 ABS) of total value of agriculture production in the area. Other agricultural activities include cropping and wool production. Continued incentives by council for landowners to move towards more sustainable farming practices will reduce stress on ecosystems and help to restore water quality. Collaboration between council, landowners and Landcare groups will promote the success of the programs. For example, the Friesians and Fish – Bellinger River Floodplain and Estuary Water Quality Improvement program engages council with the dairy industry to progress towards more sustainable farming practices. Dairies are the dominant land use surrounding the Bellinger estuary.

Forestry activities are another major land use managed under the North East Regional Forest Agreement (RFA) signed by the Australian and New South Wales governments in 2000, updated in 2018 and in place until 2039. This provides the framework for the sustainable management of North East RFA region's forests for long-term resource access for industry, ecologically sustainable management of forested areas and an extensive system of conservation reserves. Opportunities for strategic reservation of catchment headwaters and key movement corridors on Forestry Corporation Estate and linkages to other areas of private or public land, should be considered by the NSW Government together with Council. Other opportunities are discussed in Section 6.2.

The main opportunity for biodiversity is to introduce incentives and programs to address conserve biodiversity and address threats to biodiversity on agricultural private land holdings. These threats include agricultural weeds and exotic animals such as foxes, wild dogs and rabbits. Exotic flora and fauna species compete with and predate native species, subsequently programs aimed at reducing these threats would benefit restoration of biodiversity.

6.4 Fauna corridors and habitat enhancement

There are a number of opportunities to better connect habitats within Bellingen LGA. Corridors and habitat connectivity are recurring themes in the BSC Koala Coastal Area Management Strategy and the Saving our Species program for a numerous threatened species of fauna within the Shire.

The proposed Great Koala National Park proposed by the National Parks Association is an opportunity to secure the habitat of a wild koala populations in NSW, especially for Koalas on the Dorrigo Plateau. Figure 13 shows the National Park proposal and current Forest Management Zones (FMZs), with the majority in the Bellingen Shire being 'General Management Zone'. The establishment of the Great Koala National Park would reduce the impact of threats to koala from habitat loss due to logging and fragmentation coupled with climate change.

The critically endangered Bellinger River Snapping Turtle is endemic to the Bellinger River and prefers habitats with moderate to deep pools with a rock substrate. Preferred habitat areas are becoming unsuitable due increased encroachment from other species and water quality issues. The Saving our Species program has developed strategies to manage the recovery of the Bellinger Snapping Turtle and habitat.

There is opportunity for retention of old trees with hollows that provide habitat for a range of for fauna within Bellingen which has several reserves with hollow-bearing trees. Loss of hollow-bearing trees is a key threatening process under the BC Act. Hollow formation in Eucalypts can take 100 years to form a small hollow, 200 years to form a medium-sized hollow and longer for a large hollow, therefore retention of such trees is critical (Mackowski 1984; Menkorst 1984; and Scotts 1991). Many species of fauna use and are dependent on hollows, including bats, possums, owls, parrots, ducks, rosellas and kingfishers as well as numerous species of snakes, frogs and skinks. Where old trees occur, exclusion zones can be introduced to address safety issues for members of the public where required. Creation of artificial hollows, installation and monitoring of nest boxes, and re-erection of hollows from removed trees should also be considered and implemented where appropriate.

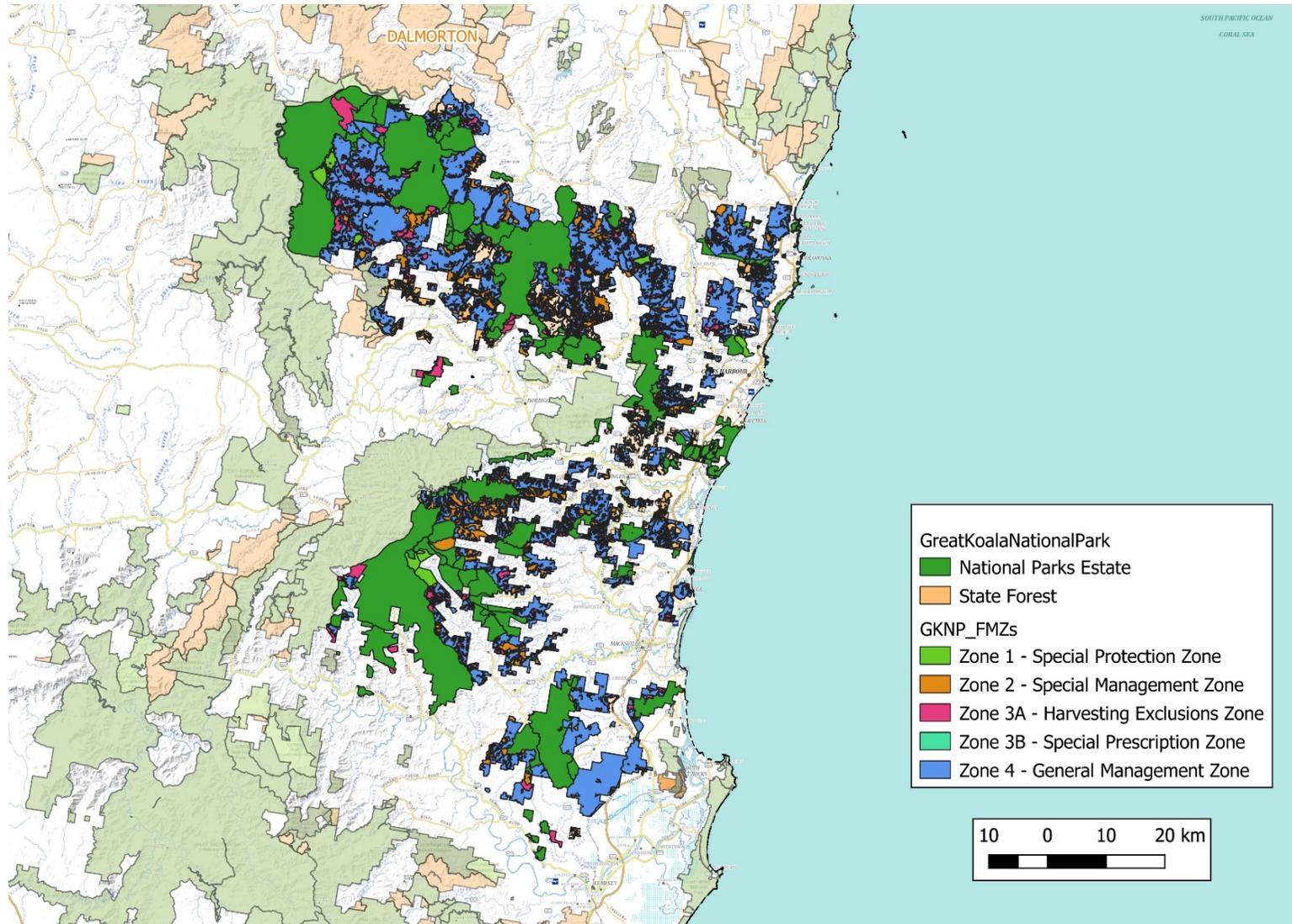


Figure 13: Great Koala National Park showing Forest Management Zones (National Parks Association, 2019)

Many small birds, mammals and reptiles rely on mid-storey and shrubby habitat, both for food resources and protection from predators. Unfortunately, these habitats are often actively removed from parkland and urban habitats due to perceived concerns about security and aesthetics. Where opportunities arise for revegetation in parklands, native plants with attractive flowers should be introduced to draw in a wide variety of pollinators; and plants with spikes will provide shelter for smaller birds. Plant selection should be based on the habitat that is to be created, or if within a threatened ecological community, the species composition for that community, matched to available specialist stock plants from licensed indigenous native plant nurseries.

Revegetation of the riparian zone with higher shrub density and the presence of logs and rock structures would increase the habitat, food availability and provide predation refuge for small birds, mammals and reptiles in the LGA.

In-stream coarse woody debris, hollows, species-specific feed trees should be retained and where possible increased. Rock revetment should be biodiversity friendly maximising microhabitats.

6.5 Run-off and nutrients

The run-off and nutrients entering creeks, rivers and estuaries can be reduced by mitigation measures such as increasing the extent of healthy riparian vegetation, improving river bank works and processes, sustainable management of domestic sewage and wastewater, improve stormwater management, decrease impact from road runoff and scouring from rural roads and bridges, improve logging and clearing practices and improve the management of oil spills. Storm events exacerbate and accelerate erosion leading to increased sedimentation at lower velocity flows.

Bellingen Riverwatch was established after the 2015 mortality event of the Bellinger River Snapping Turtle, at this time a lack of water quality data was identified. The Riverwatch program measures water and air temperature, pH, electrical conductivity, turbidity, available phosphate and dissolved oxygen. Bellingen Riverwatch monitors 24 key areas (Figure 14), along the Bellinger and Kalang River systems helping to identify periods of poor water quality. Additional water quality testing for Faecal Coliform is performed by OzGREEN and the DPIE conducts bi-annual water quality testing.

Additionally, measures can be undertaken to reduce the total sediment and nutrients washed off terrestrial areas. This includes methods such as enforcement of sediment measures in construction sites and educating the public on techniques such as using low-phosphorous fertilisers in gardens.

Other techniques to improve water quality and improve habitat value are to include environmental objectives in the design or retrofitting of flood retention basins on playing fields, to treat water quality as well as quantity.

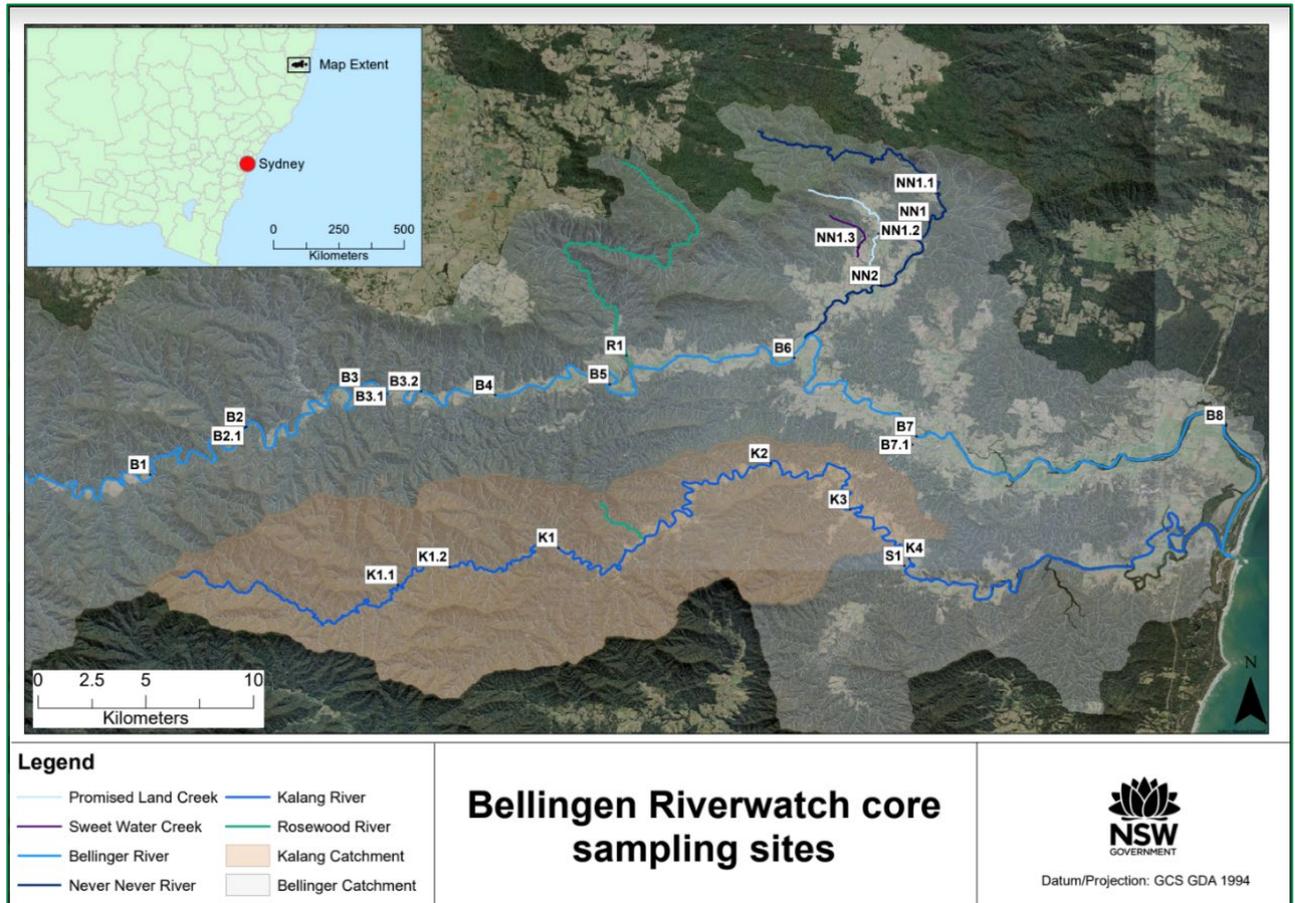


Figure 14: Bellingen Riverwatch sampling sites (Source: Bellingen Riverwatch)

6.6 Supporting and encouraging private native planting

Shrub density can also be provided by private gardens; however, many residents tend to favour a more ordered and tidy aesthetic and are unaware of the importance of dense shrubs to small native birds. Small birds, such as the Superb Fairy-wren are both photogenic and widely valued by the public. These species could be the focus of an educational campaign on encouraging native species in private gardens and an incentive program such as a plant giveaway. There is a strong sense of environmentalism in Bellingen, so a public education program could be very successful, particularly if paired with incentives for planting native shrubs in residential gardens. Small birds represent one of the key areas in biodiversity within the LGA and are widely valued by the community, so could become an icon for promotion and enhancement of biodiversity values within Bellingen.

6.7 Alternative lighting technology

Light pollution impacts on native fauna can be reduced by limiting the duration of spotlight illumination, reducing the brightness of lights where possible, installing shield fixtures to reduce light scattering, and using narrow-spectrum light sources to reduce the wavelengths likely to interfere with animal behaviour (Gaston et al 2012). High priority areas where the implementation of measures to reduce light pollution should be considered would be located adjacent to important habitat. The Bellingen Island GHFF Camp

Management plan recommend landowners turn off lighting at night which may assist GHFF navigation and increase fly-over impacts.

6.8 Landcare groups

Bellingen is fortunate to have many active Landcare groups, consisting of many highly motivated and experienced individuals offering the opportunity for landowners to learn from peers about management of biodiversity on their land. Landcare groups also actively manage weed control and native revegetation works on Council-managed lands. There is opportunity to develop and enhance these groups, particularly with the strong community support that these groups have within the LGA.

Landcare groups require input and support from Council to ensure those volunteering their time feel that it is worthwhile and so that efforts are enhanced rather than duplicated. The amount of time for volunteers to undertake long-term bush regeneration works is substantial, so it is particularly important to support the development and retention of long-term volunteers. It is particularly important to communicate with different community groups to determine the best way to get them involved in environmental projects. Volunteer Landcare groups are an invaluable resource, to maintain programs and initiatives council needs to provide suitable funding levels and support to ensure the continuance of Landcare programs.



Figure 15: The Vulnerable Barking Owl. Photo: Lachlan Copeland

6.9 Schools and community programs

Council has experienced significant success through their Sustainability Schools Network, which provide educational resources for educators, students and the community. Bellingen Shire Council has had

significant community support for events, such as the National Tree Day, Schools Tree Day and Clean Up Australia Day. Further events may be organised community action activities encouraging more regular engagement (such as joining Landcare groups). Bellingin High School students have been involved in environmental activities including RiverWatch. Bellingin High School's Student Environment Council aims include the engagement of students to take action to improve the quality of life through student environmental activities and programs and to represent the school at local, state, national and international environmental programs and meeting; therefore, this may be another opportunity for Council to further encourage.

The Bellingin Bush Tucker School Education Project with Council and Bellingin Urban Landcare was highly successful with the Centre for Ecological Learning bush tucker gardens were created in public places. An online video provides a virtual tour of Bellingin's forageable food and more with their Eat the Street project.

Council should consider community involvement through programs that could include:

- Guided walks along coastal and bushland areas
- Workshops for bee/insect hotel building, or partnership with 'Mens Sheds' located at Dorrig, Bellingin or Urunga to construct bee/insect hotels
- Promoting or offering bush tucker workshops and dining experiences for residents to learn about edible weeds and native plants becoming more engaged with their natural environment and decrease chemical weed control.

6.10 Saving our Species

The Saving our Species (SoS) program aims to secure threatened flora and fauna in the wild in NSW. Using a systematic scientific approach, the Saving our Species program, prioritises and targets projects based on the risk of extinction of species, populations and ecological communities. In the Bellingin Shire there are nine flora species identified, one TEC and one fauna species, the Bellinger River Snapping Turtle, as shown in Table 11. Collaboration between state and federal government agencies, Council, volunteer groups (e.g. Landcare) and stakeholders are required to maximise successful outcomes. Successful preservation of these species enhances the biodiversity values in Bellingin.

Table 11: Threatened Species, populations, ecological communities or key threatening processes in Bellingin

Common name	Scientific name	Type	Management Stream
Woodland Babingtonia	<i>Kardomia silvestris</i>	Shrubs	Site-managed species
Creek Triplarina	<i>Triplarina imbricata</i>	Shrubs	Site-managed species
Little Tern	<i>Sternula albifrons</i>	Birds	Landscape species
Dorrig Daisy Bush	<i>Olearia flocktoniae</i>	Shrubs	Site-managed species
Fragrant Pepperbush	<i>Tasmannia glaucifolia</i>	Shrubs	Site-managed species
Green Waxberry	<i>Gaultheria viridicarpa subsp. viridicarpa</i>	Shrubs	Site-managed species
Newry Golden Wattle	<i>Acacia chrysotricha</i>	Trees	Site-managed species
Stuttering Frog	<i>Mixophyes balbus</i>	Amphibians	Landscape species

Common name	Scientific name	Type	Management Stream
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Threatened Ecological Communities	Ecological community (range-restricted)
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	Threatened Ecological Communities	Ecological community (widespread)
Loggerhead Turtle	<i>Caretta caretta</i>	Reptiles	Partnership (widespread)
Square-stemmed Spike-rush	<i>Eleocharis tetraquetra</i>	Herbs and Forbs	Site-managed species
Silver Sword Lily	<i>Neostelia spectabilis</i>	Herbs and Forbs	Site-managed species
Rainforest Cassia	<i>Senna acclinis</i>	Shrubs	Site-managed species
Green Turtle	<i>Chelonia mydas</i>	Reptiles	Partnership (widespread)
Koala	<i>Phascolarctos cinereus</i>	Marsupials	Iconic species
Bellinger River Snapping Turtle	<i>Myuchelys georgesi</i>	Reptiles	Site-managed species
Gingidia rupicola	<i>Gingidia rupicola</i>	Herbs and Forbs	Site-managed species

Within Bellingen LGA, 13 priority management sites have been identified, with nine sites currently active and four proposed sites (Table 12). BSC is responsible for planning and regulatory activities and public land management which impacts on biodiversity and potentially threatened species. The DPIE has developed resources to allow more easy access to information to assist Councils in understanding their obligations and functions under various Acts relating to biodiversity and threatened species, and to showcase the work of other Councils and the DPIE. These resources include examples of biodiversity surveys and mapping, strategic planning, environmental impact assessment and compliance, and bushland and natural area management.

To assist council in developing biodiversity strategies, the following gaps in mapping have been identified:

- Updated mapping on the Biodiversity Values Map of Critically Endangered Lowland Rainforest – this requires a landowner-initiated review where Council needs to nominate for review and update of mapping for all Lowland Rainforest on Council owned and managed lands, including Crown Lands.
- Field validation and more fine-scale mapping of EEC / CEEC remnants in the Bellingen Shire – especially Lowland Rainforest remnants, which are currently under-mapped on a variety of land tenures (including Council managed land) – to allow them to be better understood, managed and protected. Fine scale mapping of plateau vegetation would support potential extension of the KPOM to protect key areas, therefore making mapping a priority.

Table 12: Key management sites in the Bellingen Shire

Site Name	Threatened species	Status	Site type
Dorrigo area	Dorrigo Daisy Bush (<i>Olearia flocktoniae</i>)	Active	Priority management site
Point Lookout	Fragrant Pepperbush (<i>Tasmannia glaucifolia</i>)	Active	Priority management site
New England National Park Escarpment	Green Waxberry (<i>Gaultheria viridicarpa subsp. viridicarpa</i>)	Proposed	Priority management site
Wild Cattle Creek	Woodland Babingtonia (<i>Kardomia silvestris</i>)	Proposed	Priority management site
Dorrigo National Park	Woodland Babingtonia (<i>Kardomia silvestris</i>)	Proposed	Priority management site
Jaaningga Nature Reserve	Newry Golden Wattle (<i>Acacia chrysotricha</i>)	Active	Priority management site
Nymboida River	Creek Triplarina (<i>Triplarina imbricata</i>)	Proposed	Priority management site
Little Murray Lookout	Silver Sword Lily (<i>Neoastelia spectabilis</i>)	Active	Priority management site
Ambleside	Silver Sword Lily (<i>Neoastelia spectabilis</i>)	Active	Priority management site
Bongil Bongil National Park	Square-stemmed Spike-rush (<i>Eleocharis tetraquetra</i>)	Active	Priority management site
Brinerville	Rainforest Cassia (<i>Senna acclinis</i>)	Proposed	Priority management site
Bellinger Drainage Area	Bellinger River Snapping Turtle (<i>Myuchelys georgesi</i>)	Active	Priority management site
Tuckers Rocks to Bonville Creek	Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions)	Active	Priority management site
Bellingen, Coffs Harbour, and Bongil Bongil National Park	Koala (<i>Phascolarctos cinereus</i>)	Active	Priority management site
North Macleay - Nambucca	Koala (<i>Phascolarctos cinereus</i>)	Active	Priority management site
Point Lookout	Gingidia rupicola (<i>Gingidia rupicola</i>)	Proposed	Priority management site
NSW Eastern Slopes and Ranges	Stuttering Frog (<i>Mixophyes balbus</i>)	Active	Contributing site (funding opportunity)
NSW coast North of Sydney	Green Turtle (<i>Chelonia mydas</i>)	Proposed	Contributing site (funding opportunity)
NSW coast North of Sydney	Loggerhead Turtle (<i>Caretta caretta</i>)	Proposed	Contributing site (funding opportunity)
NSW North Coast	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions)	Proposed	Priority management site
NSW Coast	Little Tern (<i>Sternula albifrons</i>)	Proposed	Priority management site



Image 21: Pink underwing moth adult, larval instars and pupa. Photos: Dave Britton

7. Council funding and programs

7.1 Current funding

Bellingen Shire Council's Delivery Plan for 2017-2021 (BSC, 2017) and Operational Plan for 2018-2019 (BSC, 2018) outline the funding and priorities at the time of writing (June 2018).

The Delivery Plan (Table 13) identified actions relevant to the Biodiversity Strategy under 'Living Environment' under four themes and two Council services, Environmental Protection (EP) and Noxious Plants (NP):

Table 13: Delivery Plan Bellingen Shire 2017-2021

Theme	Action	Environmental Protection	Noxious Plants
We protect and enhance our biodiversity	Our community understands the value of biodiversity	High	Medium
	Biodiversity is managed and protected for future generations	High	High
	Threats to biodiversity are identified and mitigated	High	High
We work together to protect and enhance our environment	The guidance of the custodial people is recognised	Low	Low
	Our community is informed and educated on environmental issues, threats and opportunities	High	High
	The contribution of our community groups is fostered, supported and celebrated	Medium	Medium
	Our natural environment is valued, protected and enhanced	High	High
We have clean water which is protected and used sustainably	Our waterways are valued, protected and enhanced	High	Medium
We have a diversity of beautiful spaces that foster community happiness and wellbeing	We have a variety of passive recreation spaces including riversides, parks and reserves	High	Low

7.1.1 Environmental Levy and grants

The Environmental Levy funding is delivered annually in accordance with the Council Operational Plan, prioritising projects that address actions in existing priority plans such as:

- North Coast Weeds Action Program
- NSW Invasive Species Plan
- Bellinger and Kalang Rivers Estuary and Health Management Plans
- Bellingen Emission Reduction Plan (BERP)
- Bellingen Coastal Zone Management Plan (CZMP)
- BSC Coastal Area Koala Management Strategy

- the Plans of Management of both the Dangar Falls and Bellingen Island Integrated Reserve.

Projects with funding in 2018/19 include:

- Dalhousie Creek Entrance Management Strategy
- Sustainability and Climate Change Projects (implementation of recommendations from the CZMP with a focus on coastal monitoring. BERP – next stage of solar PV system installations; as well as implementation of the Cities Power Partnership action pledges)
- Environmental Levy Community Fund – support eight community grants of up to \$5,000 for sustainability projects
- Bellinger-Kalang Coastal Management Program
- Protecting Bellingen’s Koalas through responsible dog ownership
- Seed funding for potential projects
- Weeds Action Program 1520 – funds to implement the NSW Invasive Species Plan
- Ongoing bush regeneration at six sites
- River and Biodiversity Community support and assistance (Riverwatch)
- Bellingen Shire Biodiversity Strategy
- Fish Habitat Action Grant implementation support (Newry Island Foreshore, Kalang River Estuary)
- Bellinger Riverwatch ‘Our River, Our Future’ – Citizen Science Program supporting volunteers and schools
- Bellinger Landcare Incorporated and Bellingen Urban Landcare support

The Operational Plan (BSC, 2018) outlines additional Service Change Projects for completion during the year, including:

- BSC Roadside Environmental Management Plan
- Continue restoring public reserves of the Never Never, Gleniffer funded project
- Progress Gleniffer Reserves Plan of Management (ELA 2018), implement Vegetation Management Plans (VMPs) for each Gleniffer Council-managed reserve (ELA 2019).
- Progress Gleniffer Master Plan – Restore river bed and banks – instream realignment: Arthur Keough Reserve.

The Environmental Levy and other Council funds (general, restricted, revolving and Special Variation) form ‘seed funding’ for many State and Commonwealth Government Grants. State grants include Estuary, Coastal and Floodplain Management Program, Environmental Trusts, Fish Habitat, Saving our Species, and Community Building Partnerships, etc. Commonwealth grants include Financial Assistance, Regional Growth Fund, Community Development, Regional Jobs and Investment Packages, Regional Development Australia (Mid-North Coast). Future opportunities could include Developer Contributions under Sections 7.11 and 7.12 of the EP&A Act (former Section 94 and Section 94A) arising from development growth around Bellingen, Dorrigo and Urunga to fund the upgrade of walking tracks and facilities in Council managed natural areas.



Figure 16: Volunteer planting at Dangar Falls

7.2 Current and previous programs

Council programs are derived from Council’s website, are described in **Appendix F** and outlined in Table 14 below:

Table 14: Outline of current and previous Council programs

Current and Previous Council Programs	Description
Habitat Restoration	Council undertakes native vegetation restoration through Saving our Species (SoS), North Coast LLS projects, NSW Environmental Trust and Habitat Rehabilitation Grants; through Council’s environmental levy and general funds to match grant applications; and with landholders who actively restore their properties and monitor projects with agencies
Koala Management	Bellingen Shire Coastal Area Koala Management Strategy (BSC, 2017) is implemented for the community and landholders to sustainably manage the nationally significant Koala population in the coastal area. The Koala Advisory Group (KAG) has been set-up to implement the Strategy with local and state government and community members. The KAG will monitor and report on actions in the plan and other required actions, and actions will be integrated into Council’s Delivery and Operational Plans. Protection of Bellingen’s Koalas through encouraging responsible dog ownership was funded in 2018-2019. Current funding includes \$20,000 Council for investigations into feasibility of koala habitat being registered as Biodiversity Stewardship Sites.
Weed Action	Council is a local management authority under the BS Act and implements the NSW Invasive Species Plan (NSW DPI, 2018), North Coast Weeds Action Program (NSW DPI, 2015), and the North Coast Regional

Current and Previous Council Programs	Description
	Strategic Weed Management Plan 2017-2022 (NSW, LLS, 2017) which identifies state, regional and other regional priority weeds and actions. Projects are funded under the Weed Action Plan.
River Rehabilitation	Council provides support to projects that address problems such as weed invasion, lack of native tree cover, erosion and sedimentation, that enable Council to work with the community to ensure healthy rivers are maintained and improved now and into the future. Council's river rehabilitation projects are funded through external grants, often with matching contributions from Council's Environment Levy and/or private landholders.
Newry Island Foreshore	Council is implementing a Fish Habitat Action Grant for Newry Island Foreshore in the Kalang River Estuary, to stabilise 500 m of eroding river bank using rock revetment and rock and timber fillets incorporating re-used root balls and tree trunks from Pacific Highway upgrade clearing, fencing the river bank to exclude stock access, planting native trees, encouraging mangrove recruitment and managing weeds to improve the condition of areas of the EEC Swamp Oak Floodplain Forest.
Friesians and Fish	Bellinger River Floodplain and Estuary Water Quality Improvement through the DPIE Estuary Management Program includes Council working to improve water quality and contribute to more sustainable farming practices, with dairies around the estuary. Incentive funds are to implement priority actions in voluntary assessments by eleven farms through a partnership between Council, North Coast Local LLS, multiple industry groups and Bellinger Landcare Inc.
Rock Fillets for Fish	Bellinger Estuary river health project at Mylestom and Repton stabilised the river bank with 'rock fillets' to protect the banks from erosion, dissipate wave energy, encourage sediment deposition and mangrove regeneration; artificial 'reef balls' to improve fish habitat; weed control and revegetation along the river banks; and has multiple project partners from government, commerce, industry and the community.
Bellinger Island River Bank Stabilisation	River bank stabilisation works installed wooden pin groynes, log and rock revetment and native seedlings to the west of the Island. Project partners included North Coast LLS, contractors and Bellinger Urban Landcare (BULC) with ongoing bush regeneration work by Council and two Landcare groups.
River Health Monitoring	Bellinger and Kalang Rivers were comprehensively assessed in 2009-10 with State government and UNE. Bellinger and Kalang Rivers Estuary and Health Management Plans were created with report cards to document river health issues and recommend priority actions.
Wild Creek Antimony Monitoring	Council undertakes water quality testing of antimony in Wild Cattle Creek and the Bielsdown River, prior to any further mining being undertaken
Water Quality Monitoring	Water quality is monitored in the Bellinger and Kalang Rivers
River Rehabilitation Fact Sheets	A range of fact sheets have been prepared relating to river rehabilitation
Bellinger Shire Estuary Inundation Mapping Study	The study describes tidal inundation extents for both typical ocean conditions and severe storm events under existing and future mean sea level conditions for each estuary along the coast, maps and recommends management actions for all areas under tidal influence within the Bellingen Shire including a proactive response to future sea level rise and tidal inundation using a risk-based approach.
Estuary Action Plans	Bellinger River Action Plan Stage One (2011) assessed riparian land condition, recommended actions and costs to improve river health. On-ground works have been implemented for the majority of the 54 public and private properties from Lavender's bridge Bellinger downstream to Mylestom.

Current and Previous Council Programs	Description
	Bellinger and Kalang Rivers Estuary Action Plan Stage Two (2014) include one site further downstream in the lower Bellinger estuary and five additional sites along the Kalang estuary based on priority areas in the Bellinger and Kalang River Estuaries Erosion Study, landholder interest and capacity.
Bellinger and Kalang Estuaries Erosion Study	The comprehensive study identified priority erosion areas in the estuary for action.
Bellinger and Kalang Rivers Estuary Management Plan	Management objectives for the estuaries were developed through consultation with the community and stakeholder organisations and review of specific scientific investigations and other information. Major concerns identified were water quality, bank erosion, habitat management, waterway use, land management, the need for community education, fisheries and tourism management. As such, the plan proposes measures for the protection of estuarine habitats and ecosystems in the long-term, including maintenance in each estuary of the necessary hydraulic regime; conservation of the aesthetic values of estuaries and wetlands; prevention of further estuary degradation; repair of damage to the estuarine environment; and sustainable use of estuarine resources, including commercial and recreational uses.
Bellinger Coastal Zone Management (CZM)	The Bellingen CZMP 2014 was prepared to preserve the high quality of environmental, recreational, cultural and economic values associated with the open coast and provides practical actions for managing threats from coastal hazards to the coastal zone in the Bellingen Shire. To update the plan and address the new Coastal Protection legislation, Council is currently preparing a CZMP for the next 10 years, initially through preparation of a scoping study Guided by the NSW Coastal Management Manual
Bellinger Emissions Reduction Program	Bellingen Shire Emission Reduction Program Council is committed to reducing its contribution to climate change and to this end, has initiated the Bellingen Shire Emission Reduction Program (BERP). Bellingen Council was originally signed up to the Cities for Climate Protection (CCP) program, but since the CCP lost federal funding in June 2009, Council has elected to continue with the BERP which is based on the milestone approach of the CCP. The BERP now addresses the Climate emergency
Bellinger Growth Management Strategy	Chapter 11.1.6 Ecological Management and Biodiversity has the objective to ensure that the ecological integrity of the rural lands are enhanced and maintained. It contains implementation strategies, policy actions, responsibility and timeframes
Draft Housing Strategy	The Draft Housing Strategy is a plan to provide high-quality homes to all residents of Bellingen Shire and to make sure housing meets the needs and desires of our community, to guide development, decision-making and infrastructure priorities for the next 20 years. It contains key elements relating to 'Aboriginal Connections to Country and Community' and to 'Support Biodiversity in our Backyards and Neighbourhoods'.
Bellinger SandWatch	Monitoring of beach profiles and coastal erosion on a regular basis to measure trigger points for the implementation of management actions in the CZMP. The profiles align to data collected since the 1950s, to form the excellent basis for tracking changes in the beaches over time.
Plans of Management (PoMs) and Bush Regeneration	Bush regeneration occurs at Dangar Falls, Bellingen Island Integrated Reserves and Arthur Keogh Reserves in accordance with PoMs. A raised timber walkway (the Labyrinth) was also constructed by Council and the community constructed the Labyrinth, a winding paved pathway. The Open Spaces Management Plan (OSMP, BSC 2012) which identifies some pathways occurring within Natural Parklands reserves that require renewal and maintenance.
Jaliigirr landscape connections	The project is restoring connections and protecting 10 biodiversity conservation sites in priority connectivity areas of Coffs–Bellinger–Dorrigo section of the Great Eastern Ranges Corridor. Council is part of the Jaliigirr Biodiversity Alliance (JBA) partnership with 20 organisations working together across land tenures including public (Dorrigo National Park in the Gondwana Rainforests of Australia World Heritage

Current and Previous Council Programs	Description
	Area) and private (Landcare and Land for Wildlife members) land. The project includes bush regeneration and revegetation to restore habitats for forest-dependent fauna, complemented by capacity-building.
Bellingen Shire Roadside Environmental Management Plan	The Plan is in preparation including mapping areas of environmental significance within Council’s Roadside Reserves, management actions, priorities, resourcing, as well as training for Council staff, preparation of guidelines roadside management, road construction and maintenance. Priority actions will be included in Integrated Planning and Reporting framework for implementation.
Environmental Levy Community Fund	This provides eight community grants of up to \$5,000 for sustainability projects throughout the Bellingen Shire.
Bellinger Riverwatch	Council supports the Bellinger Riverwatch ‘Our River, Our Future’ – Citizen Science Program supporting volunteers and schools, providing river and biodiversity community support and assistance
Landcare	Council invests in an annual Landcare budget, and provides small grants and support to the Bellinger Landcare Incorporated (BLI) and Bellingen Urban Landcare (BULC) groups. There are 11 Landcare Groups in the Bellingen Shire under the banner of BLI.
Sustainable Schools	Nine schools are registered with this program designed to educate students in sustainable living and protecting the environment.



Figure 17: Dandarrga Native Nursery in Dorrigo run by volunteers under NSW Landcare with Council support

8. Biodiversity measures

Strategic biodiversity measures are necessary to assess the performance of the Biodiversity Strategy. Priority programs for the Bellinghen Shire have been identified based on the relationship of the vision and key focus areas for this Strategy, along with the BSC identified values.

The broad key focus areas, programs and actions identified in this Strategy are aligned with the Bellinghen Community Strategic Plan (CSP) 2027 theme of our living environment, with the vision:

‘Our vision for the future must encompass all aspects of living and working in our shire, as well as ways in which we are connected beyond our borders – regionally, nationally and globally. Our vision is about protecting the pristine natural beauty of our environment and enhancing our prosperous and safe community where inclusiveness and sustainable living are embraced, so that creativity and cultural activity can flourish.’

This Biodiversity Strategy is to be implemented through being incorporated into the Council’s Operational and Delivery Plans.

Table 15: Biodiversity Strategy programs by key focus areas

Key Focus Area	Programs
Juungambala and Caring for Country: building a living agreement with Gumbaynggirr custodians	1.1: Engage in Juungambala and Caring for Country
Native Vegetation: protecting, managing and restoring Bellinghen’s native vegetation	<p>2.1: Endeavour to protect 100% of native vegetation in Council Reserves</p> <p>2.2: Improve vegetation within core habitat areas that are considered to have opportunities for connectivity</p> <p>2.3: Retain the maximum amount of native vegetation across development, infrastructure and high impact landuse zones</p> <p>2.4: Roll-out biodiversity education for residents and Council staff</p> <p>2.5: Maintain and improve the condition of vegetation in Council reserves</p>
Waterways: managing and conserving river systems, wetlands, riparian land, coastal and estuarine health	<p>3.1: Measurable improvement in water quality across Bellinghen waterways</p> <p>3.2: Protect foreshores, coastal lagoons, significant wetlands and Coastal Saltmarsh</p> <p>3.3: Restore the ecological function of core habitat, waterways and wetlands</p> <p>3.4: Develop community education programs and engage schools, community groups and residents in restoring the biodiversity along the rivers and coastal foreshores.</p>
Corridors and Connectivity: enhancing landscape linkages	<p>4.1: Measurable increase in connectivity between reserves</p> <p>4.2: Increase in numbers and density of trees, shrubs and understorey across BSC</p> <p>4.3: Measurable increase in habitat coverage within and adjacent to identified priority for regional connectivity /climate change connectivity</p>
Public Spaces: managing our reserves to promote biodiversity and community interaction	<p>5.1: Actions identified in Plans of Management for reserves and the Biodiversity Strategy are implemented</p> <p>5.2: All recreational activities in reserves with a conservation objective are compliant with biodiversity protection and increase people’s interaction with nature</p>

Key Focus Area	Programs
<p>Habitat: protecting and managing biodiversity across the landscape</p>	<p>6.1: Maintain and improve native species richness of flora and fauna in Council reserves</p> <p>6.2: Decrease in populations of pest fauna species in reserves</p> <p>6.3: Ensure weed density is managed in core habitat areas to ensure protection of significant areas in Council reserves</p> <p>6.4: Establish and implement monitoring of condition and values within core habitat areas</p> <p>6.5: Increase participation numbers in Landcare groups and community programs that educate about biodiversity</p> <p>6.6: Increase biodiversity habitat & protection on private land</p>
<p>Species preservation: protecting and maintaining habitats of high profile threatened species and provision of education about threats and opportunities for biodiversity programs in Bellingen</p>	<p>7.1: Protect and maintain habitats and protect high profile species in the Bellingen Shire</p> <p>7.2: Increased community involvement in biodiversity education programs</p> <p>7.3: Improve Council performance in biodiversity conservation</p> <p>7.4: Increased Council knowledge and partnerships for biodiversity conservation</p>



Figure 18: Yellow Carbeen trees Dorrigo National Park. Photo: Mick Phil

9. Action plan

To achieve the outcome of conserving Bellingen Shire's species, populations and communities of native flora and fauna, an Action Plan has been developed to guide biodiversity conservation outcomes. The process will be based on six key focus areas including protecting, managing and restoring native vegetation; restoring and conserving river systems, wetlands, riparian land, coastal and estuarine health; enhancing landscape linkages of corridors and connectivity; managing public spaces to promote biodiversity and community interaction; protecting habitat and managing biodiversity in the across the landscape; and preserving species and maintaining habitats of high profile threatened species and provision of education about threats and opportunities for biodiversity programs in Bellingen. Annual action plans will be derived from this action plan and integrated into Council's operational and delivery plans. The success of the strategy is dependent on budget allocation and staff resources to implement the works outlined.

- Priority actions
 - H – High to commence within first year of the plan for completion within 5 years
 - M- Medium to commence within first three years of the plan for completion within 7 years
 - L – Low to commence within five years of the plan
- Budgets are broad estimates separated into capital expenditure and operational works
 - H – High > \$50 000
 - M – Medium <\$50 000 and >\$10 000
 - L – Low < \$10 000

9.1 Key Focus Area 1: Juungambala and Caring for Country: building a living agreement with Gumbaynggirr custodians and understanding our connection to the landscape

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
1.1: Engage in Juungambala and Caring for Country	<ul style="list-style-type: none"> Council to engage in Juungambala led by Gumbaynggirr custodians – Juungambala is about building a living agreement with Gumbaynggirr people and working towards peace together through building mutual understanding and respect 	H	H	M
	<ul style="list-style-type: none"> Investigate opportunities to better understand develop and foster connection to the landscape 		M	M
	<ul style="list-style-type: none"> Discuss cultural mapping projects, or exploring songlines with Gumbaynggirr community 		M	M
	<ul style="list-style-type: none"> Consult on a regular basis with all relevant Local Aboriginal Land Councils within the Bellingin LGA regarding environmental planning and biodiversity 		L	L

9.2 Key Focus Area 2: Native Vegetation: protecting, managing and restoring Bellingin’s native vegetation

Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
2.1: Endeavour to protect and conserve 100% of native vegetation in Council reserves.	<p>For Council reserves containing TECs, habitat for threatened fauna and remnant vegetation:</p> <ul style="list-style-type: none"> Ensure that TECs are being actively restored through increasing resources for bush regeneration and where required, that revegetation is undertaken using locally sourced stock from agreed planting list Where priorities allow, restoration should occur in all native vegetation communities Field validation and more fine-scale mapping of TECs on Council reserves to allow them to be better understood, managed and protected 	H	H	M

Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	<ul style="list-style-type: none"> • Conduct regular targeted field surveys of TECs to identify and monitor condition • Identify threats to vegetation communities and incorporate into future reserve plans of management (specific or generic) • Where projects occur, firstly avoid impacts on native vegetation, next minimise impacts and finally offset any residual impacts through compensatory planting • Control and regulate access with fencing / delineation and signage particularly to TECs subject to high levels of disturbance • If required, investigate opportunities for ecological burning of vegetation compliant with Mid North Coast Bush Fire Risk Management Plan (BFRMP 2017) DPIE Guidelines, Bush Fire Environmental Assessment Code for NSW, Restoring Natural Areas in Australia and Standards for Pile Burning. 			
2.2 Improve vegetation within core habitat areas that are considered to have opportunities for connectivity.	Look for opportunities to expand and/ or restore remnant vegetation and create Council managed habitat components within reserves, particularly for areas with opportunities for connectivity	M	M	M
	Expand and/ or consolidate vegetation restoration areas along the linear edges of TECs where possible i.e., Gleniffer Reserves, Bellingen Island Integrated Reserves		M	L
	Identify opportunities for Council planning controls to provide greater provision for protection of native vegetation and habitat (e.g. inclusion of core habitats, wetlands and priority areas as E2, E3 or E4 or Natural Resources Sensitivity in the LEP, and update clauses, maps or overlays within LEP and DCP). E2 or E3 proposed zoning is to be based on validated ecological evidence of HEVs (DPIE Northern Councils E Zone Review Final Recommendations Report).		L	NA
2.3: Retain the maximum amount of native vegetation across future development growth, infrastructure and high impact landuse zones	Field validation and more fine-scale mapping of all TECs, habitats and corridors across the Shire to allow them to be better understood, managed and protected. This should be done as HEV mapping in partnership with DPIE and Forestry Corporation, that can be incorporated into the LEP or DCP	H	H	NA
	Council to consider TECs, connectivity and protection of validated HEVs when reviewing and developing controls and policies for growth management and requirements for planning proposals		L	L
	Review any standard conditions of consent to include biodiversity consideration in development particularly for TECs, core habitats or connectivity areas, with the aim to avoid impacts on validated HEVs		L	L

Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	If required, develop an offsets or tree replacement policy for inclusion into the DCP to compensate the loss of vegetation on public and private land, where impacts fall below the BAM threshold.		L	L
2.4: Roll-out biodiversity education for residents and Council staff.	Develop and maintain a standardised environmental data collection process (templates) and information repository (natural assets database) for use by Council staff, consultants and volunteers	M	L	NA
	Continue to tie in to research by local schools, agencies, universities and community to determine ecological processes within reserves containing TECs and core habitat, including fauna recovery, soil seedbank, fragmentation, response to disturbance and recovery of TECs		L	L
	Review Council’s revegetation planting scheme for TECs and remnant native vegetation to ensure the correct species are being used for rehabilitation work in line with Council priorities		L	NA
	Establish a regular update and review of flora and fauna survey mapping approximately every 10 years.		H	L
2.5: Maintain and improve the condition of vegetation in Council reserves	Review and expand the bush regeneration program to ensure the highest priority areas are being actively managed in conjunction with procurement processes	H	L	NA
	Identify new sites of TECs/ core habitat that would benefit from establishment of a new Landcare group where interest has been identified by the community		M	L
	Prepare a Priority Weed Management Strategy (incorporating both private and public lands) which ensures the consideration of impacts on TECs and riparian vegetation for WoNS and priority weeds and undertaking weed control. The strategy should include Regulatory, Educational and On-ground related actions and activities as well as be consistent with current Landcare programs, bush regeneration and weed control activities		L	L
	Monitor impacts on biodiversity of exotic and pest species and pathogens (including Phytophthora and Myrtle Rust) and undertake control where required		NA	NA
	Investigate appropriate fire management practices for ecological burns to maintaining maximum plants species richness and regeneration where feasible		L	L
	Consider and investigate opportunities to establish Biodiversity Stewardship Sites or other incentives to help manage land for biodiversity and serve as a funding source.		M	L

9.3 Key Focus Area 3: Waterways: managing and conserving river systems, wetlands, riparian land, coastal and estuarine health

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
3.1: Measurable improvement in water quality across Bellingen waterways	Continue to undertake water quality monitoring programs for the consistent range of parameters (i.e. metals, microbiological and physicochemical)	H	M	L
	Continue to reduce sediment inputs through bank stabilisation revegetation works in estuary tributaries		H	M
	Minimise impacts of boating and recreation on seagrass through 'no wash zones, buoy markers, education and other controls		M	NA
	Manage public access at environmentally sensitive foreshore locations. Priority areas may include key habitat and vegetation communities located in areas that are frequented by the public and require detailed design to achieve biodiversity protection		H	M
	Reduce the unauthorised clearing of riparian and estuarine vegetation, impacts of agricultural runoff and use of unsuitable materials for bank stabilisation		NA	L
	Work with agencies and corporations, private landholders and Landcare groups to encourage and assist in the revegetation of riparian areas, and the protection, management and conservation of existing riparian vegetation and catchment headwaters. As a priority, target landholders with ecologically significant vegetation present on their land.		L	L
3.2: Protect foreshores, coastal lagoons, significant wetlands and Coastal Saltmarsh	Validate and update mapping of all coastal, foreshore and wetland TECs and develop a management plan to control/remove any relevant threatening processes.	H	H	L
	Identify opportunities for Council planning controls/ plans of management to provide greater provision for protection of wetlands, mangroves, saltmarsh, seagrasses and migratory and wader bird habitat (e.g. inclusion of core habitats, wetlands, priority areas and validated mapped HEVs as W2, E2, E3, E4 or Natural Resources Sensitivity in the LEP, and update clauses, maps or overlays within LEP and DCP)		L	NA
	Prepare a Council policy to conserve mangroves, mudflats, seagrass, coastal lagoons and shorebird habitat.		L	NA
	Identify site specific threats and implement appropriate management options in accordance with the Bellingier and Kalang Rivers Estuary Management Plan and the Bellingen Coastal Zone Management Plan		H	NA
			H	L

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	Participate in the preparation, implementation and review of Estuary and Coastal Management Plans and the NSW Marine Estate Management Strategy		H	NA
	Ensure that foreshore infrastructure masterplans and implementation protect wetlands, lagoons, saltmarsh, mangroves, seagrasses and migratory bird habitat		H	NA
	Ensure that public and private projects protect foreshore vegetation, mudflats, and where rock revetment/ seawalls are required ensure they are designed as being biodiversity friendly.			
3.3: Restore the ecological function of high priority waterways and wetlands	Protect and restore Council managed land where Key Fish Habitat mapped by NSW DPI Fisheries https://www.dpi.nsw.gov.au/_data/assets/pdf_file/0003/634269/Bellingen.pdf	H	H	L
	Prioritise and protect areas of intertidal saltmarsh, lagoons, coastal foreshore and mangrove to provide habitat for migratory waders		M	L
	Identify opportunities for Council planning controls to provide greater provision for improving water quality and habitat value of waterways through reviewing planning controls/ clauses, maps or overlays within LEP and DCP		L	NA
	Retain and enhance in-stream woody debris and other riparian and aquatic habitat features (hollows, understorey)		L	L
	Conduct regular targeted field surveys of threatened migratory bird species feeding and roosting sites		M	NA
	Restoration works to enhance aquatic habitat (e.g. feeding sites, and native fish habitats) on waterways / corridors		M	L
	Educate internal stakeholders on the importance of coastal and estuarine wetlands and habitats		L	L
	Consider use of constructed wetlands for new development growth areas to improve water quality and expand habitat diversity and foraging opportunities using native plants for biofiltration systems and raingardens		H	L
	Continue river rehabilitation projects			
	Promote off leash dog beaches to draw this recreation activity away and protect sensitive (feeding and nesting) areas for migratory waders		H	M
	Protect nesting, roosting, feeding sites from fox predation.		L	NA
			M	L

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
3.4 Develop education workshops, programs and engage schools, community groups and residents to establish a sense of ownership and participation and restoring the biodiversity along rivers and coastal foreshores.	Target management of threats on coast, wetlands and lagoons e.g. continue and expand project to educate dog owners about protection of Beach Stone-curlew and nests at Urunga Reserve - 'A Dog's Breakfast' through 'Our Living Coast' and include other migratory species and foreshore habitats where there are similar issues	H	L	L
	Consider creation of community education/ signage about mangrove and salt marsh protection/conservation		L	L
	Educate the community on issues about protection of biodiversity, habitat and water quality and the impacts along river and coastal foreshores, including understanding of controlled activities on waterfront land and riparian corridors.		L	L

9.4 Key Focus Area 4: Corridors and Connectivity: enhancing landscape linkages

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
4.1: Measurable increase in connectivity within reserves	Commence and continue targeted restoration (weeding, planting of trees, shrubs and understorey, retention of tree hollows, fallen branches, logs and shrub layer, removal of threats) within reserves to enhance connectivity and habitat values.	H	M	M
4.2: Increase in numbers and density of trees, shrubs and understorey across BSC	<p>Outside of reserves on public land and by agreement on private land, Council to implement a corridor reconstruction program – in particular:</p> <ul style="list-style-type: none"> retain senescent trees as habitat where safe to do so (exclusion zones/ fencing) plan for senescent tree removal and replanting through staged succession planting retain roadside and riparian vegetation corridors plant along habitat corridors plan for development growth areas (Dorrigo, Bellingin and Urunga) to utilise street trees on nature strips along quiet roads using species well-adapted to soil conditions, which are low maintenance and have high fauna habitat values (eg. Melaleuca species provide a dense shrub layers and flowering for native birds; Eucalypt, Angophora and Banksia 	M	M	L

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	species provide both foraging and shelter habitat for a range of fauna species), include stepping stone patches of shrubs and understorey		L	L
	Development conditions should consider inclusion of: <ul style="list-style-type: none"> the use of nest boxes to replace cleared habitat; nest boxes are to be species specific, not encourage undesirable species and to be monitored staged retention and gradual replacement of weedy vegetation being utilised as habitat by native birds and animals consideration of species selection and climate change; Council to provide clear accessible lists of preferred species associated with maps 			
	Work with Bellingher Landcare Inc. and offer 2 free native trees per resident per year for collection from Council for planting in home gardens. Ensure plants are of local provenance and obtain community feedback.		M	M
4.3: Measurable increase in habitat coverage within and adjacent to corridors	Identify opportunities for Council planning controls to provide greater provision for restoration of corridors (e.g. inclusion into E2, E3, E4 or Natural Resources Sensitivity in the LEP, and update clauses, maps or overlays within LEP and DCP), for example developments that intensify land use may be required to revegetate potential corridors or linkages traversing their land	H	L	L
	Collaborate and look for opportunities with other large landholders including National Parks, State Forests, Aboriginal land, golf courses, schools etc. to undertake plantings and restoration work to enhance connectivity. This may include land conservation programs with LLS and BCT or other opportunities		L	L
	Link with other regional corridor projects in adjacent LGA's and across Coastal North Eastern NSW Climate Change Corridors (2018)		M	L
	Provide initiatives for residents to provide habitat on their properties or yards		L	L
	Consider habitat coverage and connection value in reviewing planning controls for properties with or adjacent to native vegetation and current/ proposed corridors		L	NA
	Ensure all applications for development growth in riparian and coastal zones are in accordance with WSUD principles, concepts, designs and technologies and DPI - Water Guidelines		NA	L
	Engage with residents around management and planting of native flora on residential/private land		L	L

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	Engage with schools on issues surrounding biodiversity, native flora and fauna, tree planting, water quality and weed management.		L	L

9.5 Key Focus Area 5: Public Spaces: Managing our reserves to promote biodiversity and community interaction

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
5.1 Actions identified in Plans of Management for reserves and the Biodiversity Strategy are implemented	Undertake an audit of council-managed public land to identify opportunities for enhancement of biodiversity values	H	M	M
	Ensure all appropriate reserve areas are classified as community land and categorised as natural areas according to the Local Government Act 1993 and have a current plan of management that includes actions to protect and restore native vegetation and habitat for threatened flora and fauna		M	L
	Plans of Management should continue to target weeds, bushfire, feral animals, planting and regeneration, retention of hollows, fallen branches and logs, protection of shrubs, particularly within core habitat areas, riparian and coastal land and corridors		H	M
	The Biodiversity Strategy, and works in Plans of Management are programmed when setting annual operational and delivery works plans and budgets		NA	NA
	High priority actions are to be allocated funds for implementation		L	L
	Consider developing specific Plans of Management for the Council reserves.		L	NA
5.2: All recreational activities in reserves are compliant with biodiversity protection and increase people's interaction with nature	Consult with local Aboriginal community when developing plans of management to incorporate Aboriginal cultural heritage values and knowledge regarding biodiversity	H	L	M
	Consider rehabilitation of unmanaged trails as required and encourage community to use formalised walking trails in parks		M	L
	Incorporate biodiversity protection and increasing people's interaction with nature into masterplans for development growth and foreshore areas, recreational and visitor activities, as well as existing and new plans of management and for bushland, parks and reserves. This can be		L	L

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	undertaken by locating access paths, seats and interpretive signs to complement habitat enhancement. Work with Indigenous groups on management, education and interpretation			
	Recreational strategies and masterplans to incorporate habitat linkages as multifunction corridors through, for example, planting for habitat and shade in open space and parks, planting suitable habitat along sections of recreational pathways, etc.		L	L

9.6 Key Focus Area 6: Habitat: Protecting and managing biodiversity across the landscape

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
6.1: Maintain and improve native species richness of flora and fauna in Council reserves.	Retention of dead timber in reserves as habitat for fauna and to create a more complex understory structure and shelter sites from predators. Consider artificial shelters for terrestrial mammals i.e. nest boxes to replace tree hollows for possums and parrots, native bee hotels, etc.	M	L	L
	Development consent for projects on Council managed land should include the use of nest boxes to replace cleared habitat. Nest boxes are to be species specific, not encourage undesirable species and to be monitored		L	L
	Staged retention and gradual replacement of weedy vegetation being utilised as habitat by native birds and animals		L	L
	Consider species selection and climate change. Use clear accessible lists of preferred species associated with maps.		L	L
6.2: Decrease in populations of pest fauna species in reserves	Develop and undertake regular feral animal control programs in conjunction with other land managers (State Forests, Crown Lands, NPWS, LLS) and surrounding local government areas, for pest animals such as rabbits, pigs and foxes particularly in core habitat areas in accordance with the North Coast Regional Pest Animal Management Plan 2018	H	L	L
	Consider implementation of cat control should the problem become more prevalent		L	L
			L	L

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	Investigate opportunities and options to manage the impacts of companion animals (dogs and cats) in core habitat areas, undertake inspections of parks and reserves where companion animal issues have been identified. Increase enforcement of dogs off leads in foreshore bird habitat		L	L
	Restoration of bushland should replace exotic weed species with a diverse and complex mid-storey and understorey of native plant species to discourage aggressive bird species such as noisy miners that prefer a park like environment or canopy with no mid-storey		L	L
	Encourage community, contractors and volunteers to report feral animals (foxes, cats, rabbits, pigs) observed in Council reserves		L	L
	Educate people about feral animal control on private land and about de-sexing pets as per the 'Responsible Pet Ownership Program' on the website.			
6.3: Ensure weed density is managed in core habitat areas to ensure protection of significant areas in Council reserves	Review bush regeneration program to ensure core habitat sites are being actively managed.	H	L	L
	Maintain monitoring and reporting of bush regeneration and Landcare sites.		L	L
	Utilise bushland condition mapping to monitor progress of sites.		L	L
6.4 Establish and implement monitoring of condition and values within critical habitat areas	Increase communication with environment department and educate parks / reserves / operations maintenance and project staff to increase awareness of legislative responsibilities for protection and management of threatened species, populations and ecological communities for staff.	M	M	L
6.5: Increase support of Landcare groups and community programs that educate about biodiversity	Investigate planning and incentives programs to promote and encourage protection and management of EEC's and core habitat on private land including funding sources and incentives.	H	L	L
	Investigate ways to better support existing environmental groups, i.e. coordination, information sharing and taking the lead to coordinate volunteers and practitioners.		L	L
	Engage in ongoing Aboriginal consultation on biodiversity and cultural matters/projects, with Gumbayngirr Custodians as the lead group		L	L

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	Investigate options for funding i.e. mechanisms such as BSAs, Voluntary Conservation Agreements to promote the protection of significant habitat (such as EECs) on non-Council owned land		L	L
	Continue to work with land owners such as schools, with core habitats outside of Council ownership and provide targeted education re values, threats and recommended management of core habitats for these landowners		L	L
	Encourage and promote best-practice management of core habitats through preparation and distribution of fact sheets for EEC's and fauna species and habitat to be distributed to landholders and the website and through Council's Create Bellinghen Shire online community engagement hub.		M	L
	Liaise and support major landholders to protect and manage core habitat through preparation of site-specific Plans of Managements (e.g. Private landholders, Aboriginal land, schools, golf courses, etc.)		L	L
	Develop a brochure to educate residents on the benefits to wildlife of using native plant species in residential gardens		L	L
	Engage residents and extended community through programs and workshops to educate about the benefits of native vegetation on private land.			
6.6: Increase biodiversity habitat & protection on private land	Work with Planning department to develop tools for developers to provide suitable habitat on development growth sites	H	L	L
	Develop planning instruments that ensure development growth areas avoid and minimise impacts to biodiversity and neighbouring bushland		L	L
	Develop tools for assessment officers to assess impacts on biodiversity during the preliminary assessment of a development application, including updating council's development application advice (including DA checklist) to ensure applicants and staff understand the BOS triggers under the BC Act requiring a BDAR to be prepared by an accredited person		L	L
	Engage with applicants in pre-DA lodgement discussions to include biodiversity considerations.		L	L
	Develop and implement native plant give-aways in core habitat areas and corridors		L	L
	Consider species selection and climate change. Provide clear accessible lists of preferred species associated with maps.		L	L

9.7 Key Focus Area 7: Species preservation: protecting and maintaining habitats of high profile threatened species and provision of education about threats and opportunities for biodiversity programs in Bellingen.

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
7.1 Protect and maintain habitats and protect high profile species in the Bellingin Shire	Participate in Saving Our Species Programs within the Bellingin Shire	H	L	L
	Consult with DPIE and undertake a study to identify high profile threatened species within Bellingin Shire and utilise the Saving Our Species Program actions for threat mitigation, recovery and activities to assist these species		M	L
	Undertake actions for high profile threatened species with project partners, specialist consultants and academics to obtain advice or additional resources as needed.		M	L
7.2 Increased community involvement in biodiversity education	Develop threatened species and endangered ecological community interpretive educational materials and conduct educational programs in key reserves.	M	L	L
	Consider developing a Council Guided Walks Program with members of the Gumbayngiir community. Discuss cultural mapping projects, or exploring songlines with Gumbayngiir community		L	L
	Develop training for parks / reserve staff and volunteers in wildlife habitat requirements e.g. retention of shrubs, dead wood and stags, woody debris, weed and native look-alikes, controlling the spread of weed seed, staged removal of lantana to retain habitat for small birds		L	L
	Develop a Community biodiversity education strategy incorporating impacts of dogs on migratory birds, feeding native and feral animals, values of mangroves, plants to attract wildlife to residential gardens, impacts of and alternatives to dumping garden waste, importance of responsible pet ownership, etc.		L	NA
	Promote 'citizen science' activities such as RiverWatch, Birds Australia, ClimateWatch, Australian Museum's FrogID, Habitat Hollows and other activities/ organisations, and promotion of citizen science web portals		NA	L
	Ensure biodiversity achievements and activities are promoted in Councils community newsletters and Annual report		NA	L
	Install regulatory signage at bushland and foreshore reserves and parks to educate visitors about the biodiversity impacts of: <ul style="list-style-type: none"> rubbish dumping and plastic waste 		M	L

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	<ul style="list-style-type: none"> removal of fallen branches and dead wood dogs chasing birds and dog faeces <p>Identify and prioritise sites suitable for corporate planting events / activities</p> <p>Promote and encourage local businesses to participate / sponsor planting events and activities</p> <p>Enhance opportunities for planting events ensuring the sites are sympathetic to prioritisation of natural areas</p> <p>Regularly update Council’s website to reflect current environment projects and opportunities, available resources, how people can help and get involved, and to develop information factsheets on priority threatened and migratory and feral species for distribution to the community.</p>		NA	L
			L	L
			L	L
			L	L
7.3	<p>Improve Council performance in biodiversity conservation</p> <p>Train Council staff (including checklists and reference materials):</p> <ul style="list-style-type: none"> Environmental considerations in concept and detail design of new infrastructure, including options for green infrastructure Environmental considerations for Council's asset maintenance, Create a natural asset register Environmental considerations for Council's purchasing <p>Ensure foreshore pathways, cycling paths, park developments and other infrastructure projects such as constructed wetlands, consider biodiversity protection as a high priority objective</p> <p>Habitat planting in parks, sportsgrounds, road reserves, creeks and SQIDS</p> <p>Focus on sea level rise and the need for wetlands and mudflats to migrate landwards and incorporate into climate change adaptation planning. Continue to improve Council’s carbon reduction actions.</p>	M	M	L
			L	L
			H	M
			M	M
7.4	<p>Increased Council knowledge and partnerships for biodiversity conservation</p> <p>Council staff to maintain professional networks with organisations such as universities, DPIE, DPI, LLS, Landcare and Indigenous groups to:</p> <ul style="list-style-type: none"> coordinate regional actions e.g. migratory bird programs, pest animal and weed control collaborate on grants share specialist resources learn about policy and legislative changes innovate with biodiversity friendly technologies i.e. wildlife friendly lighting 	H	M	L

Priority Programs	Actions	Priority	Budget Estimate	
			Capital	Operational
	<ul style="list-style-type: none"> introduce smart technologies to further enhance community engagement and education on the natural environment, adaptation to climate change, awareness of natural hazards, interpretation and way-finding that respect biodiversity 			
	Participate in committees, studies, plans and programs for Coast, Floodplain and Estuary Management	L		L
	Include relevant clauses within DCP for biodiversity friendly infrastructure (green roofs and walls, SQIDS, etc.)	L		L
	Land use planning to protect and enhance corridor connectivity			
	Council staff to establish contact with agencies, specialist consultants and academics to obtain advice or additional resources as needed.	M		L
		M		L

10. Monitoring, review and reporting

It is essential that actions are monitored and reviewed to determine if they are meeting the strategic and specific objectives. Monitoring and performance reporting is a standard requirement for grant funds and an important way to demonstrate effective use of public funds. The monitoring and reporting requirements for each action will align with the key focus areas.

The Action Plan should be reviewed and updated by Council in five years, and both the Action Plan and Strategy should be reviewed and updated in ten years. Results of performance monitoring should be considered in the reviews.

Council's Annual Report to the community should identify:

- the type and location of actions taken
- lessons learnt for future action
- measurable changes for the year against the strategic objectives
- cumulative changes against the strategic objectives since implementation of the Biodiversity Action Plan commenced.

A regular update and review of vegetation mapping and fauna survey should occur every 10 years. Good baseline data already exists to build on from previous flora and fauna studies with fine-scale mapping in the coastal zone. Standardised data collection templates should be developed and the data for each reserve should be collated by a nominated Council officer to ensure consistency over time.

Consider using survey guidelines and standards developed by DPIE for threatened species and field surveys:

<http://www.environment.nsw.gov.au/surveys/GuidelinesForCarryingOutASurvey.htm>

<http://www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm>

Some of this data can be collected through collaboration with primary, secondary and tertiary educational institutions and community groups, to encourage community involvement and biodiversity education, for example, bird observations, weeds and water quality monitoring.

<http://www.environment.nsw.gov.au/surveys/SurveyParticipation.htm>

<http://www.environment.nsw.gov.au/surveys/CommunityBiodiversitySurveyManual.htm>

Ensure all data captured through flora and fauna assessments and surveys is incorporated into the BioNet Atlas of NSW Wildlife <http://www.bionet.nsw.gov.au/ht>

The flora and fauna review every 10 years should be documented in a separate report that includes the results of the flora and fauna survey and mapping including the extent of vegetation communities and presence/absence of fauna (birds, mammals, reptiles, frogs). Information published needs to be in a form that community can understand with references such as mapping with background imagery and cadastre.

This should inform the review of the Strategy which should include:

- Re-evaluate core habitat assessment using updated information to document changes in threat and management priority over the five-year period
- Action status and any issues towards achievement should be outlined
- Actions that have been executed should be dated with data provided to indicate the success or otherwise of this action.
- Priority programs should be listed along with comments on status and progress as well as any barriers preventing these targets from being met.
- Monitor changes in legislation, policy and information relevant to biodiversity strategy including a discussion of how this changes the priority of actions.

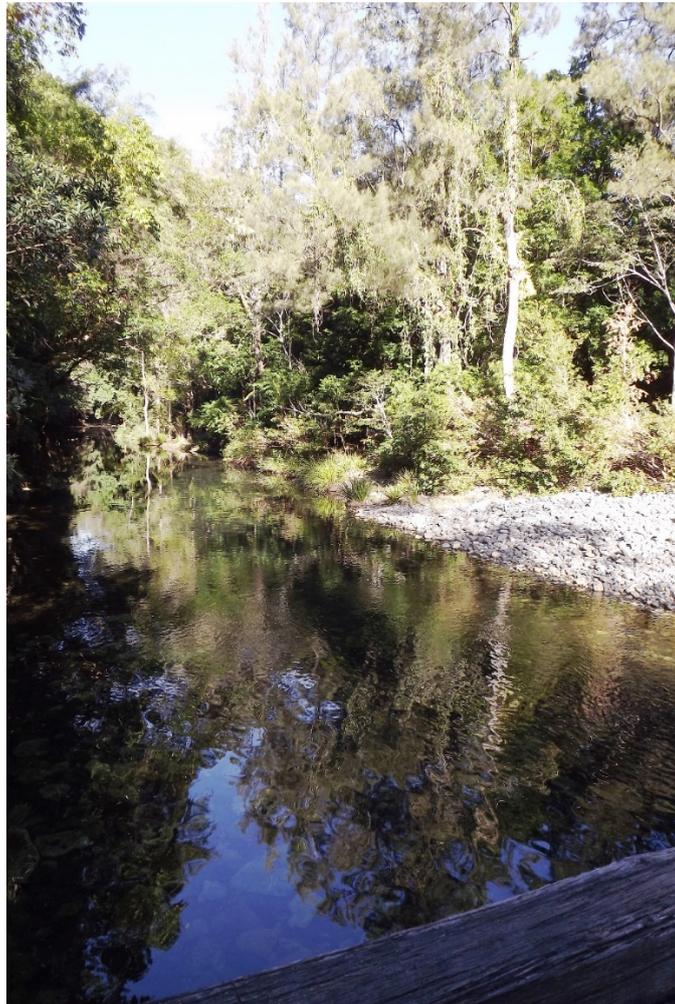


Figure 19: Bellinger River. Photo: Liz Brown

11. References

Auld, T.D. and Keith, D.A. 2009. 'Dealing with Threats: Integrating Science and Management'. *Ecological Management & Restoration* 10. pp. 79-87.

Australian Bureau of Statistics 2016. *Census Quick Stats*
https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA10600

Australian Government 2019 Protected Matters Search Tool
<https://www.environment.gov.au/epbc/protected-matters-search-tool>

Bellingen and Urunga Museums. 2019. Available at:
http://www.bellingenmuseum.org.au/articles_type/origins-of-the-name-bellingen/

Bellingen Shire Council 2019 *Water and Sewerage Quality Testing Results*
<https://www.bellingen.nsw.gov.au/water-sewerage-quality-testing-results>

Bellingen Shire Council 2018 *Bellingen Shire Council Operational Plan 2018-2019*
<https://www.bellingen.nsw.gov.au/sites/bellingen/files/public/images/documents/bellingen/Council/Integrated%20Planning/Operational%20Plan%202018-19.pdf>

Bellingen Shire Council 2017 *Bellingen Shire Council Delivery Program 2017 – 2021 and Operational Plan 2017-2018*

Bellingen Shire Council 2017. *Shire of Bellingen 2027: Our Community Vision – Connected, Sustainable, Creative*. Shire of Bellingen.

Bellingen Shire Council 2017. *Coastal Area Koala Management Strategy*.

Bellingen Shire Council 2017. *Bellingen Coastal Zone Management Plan*.

Bellingen Shire Council 2016. *Gleniffer Reserves Master Plan*. Prepared by Fisher Design + Architecture in consultation with Mackenzie Pronk Architects, Jackie Amos, Caroline Desmond & Associates and Keiley Hunter for Bellingen Shire Council, March 2016.

Bellingen Shire Council 2012. *Bellingen Shire Council Open Spaces Asset Management Plan*.

Bellingen Shire Council 2011. *Bellingen Shire State of the Environment Report 2010/2011*
<https://www.bellingen.nsw.gov.au/sites/bellingen/files/public/images/documents/bellingen/Council/Policies/state%20of%20the%20environment%20report%202010-2011.pdf>

Bellingen Shire Council 2010. *Bellingen Shire Development Control Plan 2010*.

Bellingen Shire Council 2010. *Bellingen Shire Local Environmental Plan 2010*.

Bellingen Shire Council 2010. *Bellinger River Health Plan*. Bellingen Shire Council, NSW.

Bellingen Shire Council 2010. *Kalang River Health Plan*. Bellingen Shire Council, NSW.

BirdLife Australia: *Birds in Backyards n.d. Small insect-eating birds*. Accessed 7/01/2019 <http://www.birdsinbackyards.net/birds/featured/Small-insect-eating-birds>

BMT WBM Pty Ltd 2015. *Bellingen Shire Estuary Inundation Mapping Final Report*. Prepared for Bellingen Shire Council.

BMT WBM Pty Ltd 2014. *Bellingen and Kalang Rivers Estuary Action Plan – Sea Level Rise*. Prepared for Bellingen Shire Council

BMT WBM Pty Ltd 2008. *Bellinger and Kalang Rivers Estuary Management Plan*. Prepared for Bellingen Shire Council.

Buchanan, R. 2009. 'Restoring Natural Areas in Australia', for the Department of Industry and Investment NSW.

Deletic et al. 2014. Biofilters and wetlands for stormwater treatment and harvesting, Cooperative Research Centre for Water Sensitive Cities, Monash University, October 2014.

Department of Environment, Climate Change and Water 2010. *Northern Rivers Regional Biodiversity Management Plan, National Recovery Plan for Northern Rivers Region*.

Department of Environment, Climate Change and Water 2007. *Wildlife Corridors for Climate Change Landscape Selection Process, Key Altitudinal, Latitudinal and Coastal Corridors for response to Climate Change. Priorities for Protected Areas on Private and Other Public Lands*.

Eco Logical Australia 2018. *Gleniffer Reserves - Plan of Management*. Prepared for Bellingen Shire Council.

Eco Logical Australia (ELA) 2019. *Gleniffer Reserves – Vegetation Management Plan*. Prepared for Bellingen Shire Council.

Ecosure 2017. *Bellingen Island Flying-fox Camp Management Plan*. Prepared for Bellingen Shire Council.

Frith, Clifford B. *A second living 'Rawnsley's Bowerbird' - a wild adult male hybrid from a Regent Bowerbird 'Sericultus chrysocephalus' x Satin Bowerbird 'Ptilonorhynchus violaceus' cross* [online]. *Australian Field Ornithology*, Vol. 33, Dec 2016: 14-15.

Gaston, K. J., Davies, T. W., Bennie, J. and Hopkins, J. 2012. 'REVIEW: Reducing the ecological consequences of night-time light pollution: options and developments'. *J Appl Ecol* 49. pp. 1256-1266. doi:[10.1111/j.1365-2664.2012.02212.x](https://doi.org/10.1111/j.1365-2664.2012.02212.x)

GeoLink 2012. Plan of Management: Arthur Keough Reserve. Prepared for Bellingen Shire Council.

Gill, A. Malcolm & Williams, Jann E. 1996. 'Fire regimes and biodiversity: the effects of fragmentation of southeastern Australian eucalypt forests by urbanisation, agriculture and pine plantations'. *Forest Ecology and Management*. 85(1–3) pp. 261-27.

Gilligan D, 2010, The condition of freshwater fish assemblages in the Bellinger Catchment, NSW. A report to the Northern Rivers Catchment Management Authority, November 2010.

Intergovernmental Platform of Biodiversity Ecosystem Services, 2019 The IPBES Global Assessment on Biodiversity and Ecosystem Services. United Nations.

Intergovernmental Panel on Climate Change (IPCC) 2019, IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse gas fluxes in Terrestrial Ecosystems

Larking, J., Lenning, A. and Walker, J. 2002. Bringing back the bush: the Bradley method of bush regeneration.

Local Land Services 2018. North Coast Regional Strategic Pest Animal Management Plan 2018-2023

Mackowski, C.M. 1984. 'The ontogeny of hollows in Blackbutt (*Eucalyptus pilularis*) and its relevance to the management of forests for Possums, Gliders and Timber, Possums and Gliders', A.P. Smith and I.D. Hume (eds.), Australian Mammal Society, Sydney. pp 553-67.

Macreadie, P, Baird M, Trevathan-Tackett, S, Larkum, A and Ralph P 2013. 'Quantifying and Modelling the Carbon Sequestration Capacity of Seagrass Meadows – A Critical Assessment'. *Marine Pollution Bulletin*. August 2013.

Menkhorst, P. W. 1984. 'Use of Nest Boxes by Forest Vertebrates in Gippsland: Acceptance, Preference and Demand'. *Australian Wildlife Research*. 11 pp. 255-264.

Muurrbay Aboriginal Language and Culture Co-Operative (Muurrbay) 2019. Available at: <https://muurrbay.org.au/languages/gumbaynggirr/>

NSW Department of Primary Industries 2015. *Bellinger River Snapping Turtle Management Program*. https://www.dpi.nsw.gov.au/data/assets/pdf_file/0006/559113/bellinger-river-snapping-turtle-management-plan.pdf

NSW Department of Primary Industries 2018. *NSW Invasive Species Plan 2018–2021*

NSW Department of Primary Industries 2018. *NSW Weeds Action Program*. <https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weeds-action-program/overview-nsw-weeds-action-program-2015-2020>

NSW Fisheries 2004. *Eastern Cod Recovery Plan*. NSW Fisheries Threatened Species Recovery Planning Program.

NSW Government 2017. *North Coast Regional Plan 2036* <https://www.planning.nsw.gov.au/-/media/Files/DPE/Plans-and-policies/north-coast-2036-regional-plan-2017.pdf>

NSW Local Land Services 2017. *North Coast Regional Strategic Weed Management Plan 2017-2022*.

NSW National Parks and Wildlife Service 1999. *Conservation Management Note 5 - Natural Tree Hollows* <https://www.environment.nsw.gov.au/resources/nature/Factsheet5TreeHollows.pdf>

NSW Office of Environment and Heritage (OEH) 2014. *Fine Scale Vegetation Map for the Bellingen Shire Local Government Area, Volumes 1 and 2*. Prepared by State of NSW and the Office of Environment and Heritage, NSW Department of Planning and Environment, August 2014.

North Coast Region State of the Environment Report Working Group 2016. *Regional State of the Environment Report for the North Coast Region of NSW*.

Ryder, D. and Mika, S. 2015. *Detecting antimony and arsenic concentrations in the water column of Wild Cattle Creek*. Final Report. University of New England, Armidale.

Ryder, D, Veal, R, Sbrocchi, C and Schmidt, J 2011 *Bellinger-Kalang Rivers Ecohealth Project: Assessment of River and Estuarine Condition 2009-2010*. Final Technical Report to the Bellingen Shire Council. University of New England, Armidale 75pp. Strahler, A. N. 1957. *Quantitative analysis of watershed geomorphology*. Transactions of the American Geophysical Union, 38 (6): 913–920

Scotts, D. J. 1991. 'Old-growth forests: their ecological characteristics and value to forest-dependent vertebrate fauna of south-east Australia, Conservation of Australia's Forest Fauna, Lunney, D. (ed.), The Royal Zoological Society of New South Wales, Sydney. pp 147-159.

Sydney Metropolitan Catchment Management Authority 2015. *Volunteer Coordinators Network Manual, 4th edition*. A guide for managing environmental volunteering programs.

Telfer, D 2010 Bellinger and Kalang River Estuaries Erosion Study. Prepared for Bellingen Shire Council.

The National Trust of Australia (NSW) 2010. Bush Regenerators Handbook. Second edition.

Whitten, S M, Freudenberger D, Wyborn C, Doerr V & Doerr E 2011. *A compendium of existing and planned Australian wildlife corridor projects and initiatives, and case study analysis of operational experience*. A report for the Australian Government Department of Sustainability, Environment, Water, Population and Communities, CSIRO Ecosystem Sciences, June 2011

Willoughby City Council (WCC) n.d. c.2008. *Ecological Burning: Reintroduction of appropriate fire regimes*. Willoughby City Council.

World Health Organisation 2012. Discussion Paper: *Our Planet, Our Health, Our Future – Human Health and the Rio Conventions: biological diversity, climate change and desertification*.

Appendix A Biodiversity values, concepts and design principles

Biodiversity values

Biological diversity, or biodiversity, is the variety of life forms in all terrestrial (land) and aquatic (water) environments on Earth. There are three levels of biodiversity:

- genetic diversity—the variety of genetic information contained in individual plants, animals and micro-organisms
- species diversity—the variety of species e.g. *Eucalyptus pilularis* (Blackbutt) and *E. microcorys* (Tallowwood)
- ecosystem diversity—the variety of habitats, ecological communities and ecological processes. An ecosystem is a dynamic combination of plant, animal and micro-organism communities and their non-living environment (e.g. soil, water and the climatic regime) interacting as a functional unit e.g. Sydney Turpentine Ironbark Forest ecological community.

Biodiversity is interconnected, interdependent and constantly changing. It can be increased by genetic change and evolutionary processes or reduced by threats such as habitat clearing or disease which lead to population decline and extinction.

Biodiversity supports ecosystem products and services which are essential for human survival. Types of ecosystem services are illustrated and discussed in more detail below. The loss of biodiversity directly influences the capacity of an ecosystem to produce and supply essential services, and can affect the ability of ecological, economic and social systems to adapt and respond to pressures.



Figure 20: Ecosystem services (Source TEEB Europe <https://ecology.fnal.gov/ecosystem-services/>)

Economic value of biodiversity

A strong and sustainable economy relies on having healthy ecosystems. However, biodiversity and associated ecosystem services are often regarded as ‘free’ natural capital and are ‘taken for granted’. The economic value of ecosystems may not be realised or appreciated until they are damaged, by contamination or clearing for example, and then require substantial costs for repair or restoration.

Some countries use methods to value biodiversity recognising that natural capital provided by terrestrial ecosystems provide the benefits that underpin our quality of life and that of future generations and that investment in natural capital is, fundamental to a healthy and resilient economy.

Health and wellbeing

Biodiversity is important for the physical and mental health of urban dwellers. For many people, green spaces are the main avenue for direct contact with the natural environment. Interaction with the natural environment contributes to a range of measurable positive benefits at individual and societal levels including:

- general health
- degree of social interaction
- respite from mental fatigue
- opportunities for reflection.

The psychological benefits of green spaces increase with biodiversity (Fuller et al 2007), as green space users can perceive and appreciate species richness, particularly plants and birds. Conserving and enhancing urban biodiversity is therefore not only important for the provision of ecosystem processes but also creates opportunities for increasingly urbanised communities to have contact with nature, thus enhancing societal and community wellbeing.

People living close to trees and green spaces are less likely to be obese, inactive, or dependent on anti-depressants. Overall, nature is an under-recognised healer, offering multiple health benefits from allergy reductions to increases in self-esteem and mental wellbeing (2017 The Health and Social Benefits of Nature and Biodiversity Protection, Institute for European environmental policy).

Community and environmental resilience

Nature and natural infrastructure are critical assets in strengthening cities’ resilience to a broad range of shocks and stresses (Earth Economics 2018). For example, the ability of vegetation to reduce urban heat is well understood and will be increasingly important in protecting communities from extreme heat as the climate changes. A diverse vegetation structure and composition that is suited to its landscape setting will be more resilient to disease and other potential impacts.

Indigenous culture and biodiversity

Indigenous people have an interest in the conservation and sustainable use of native species and environments through their relationship with their traditional lands and waters. The Aboriginal people who inhabited the land refer to themselves as the Gumbaynggirr people. Many Aboriginal people from Bellingen (Baalijin), Grafton (Jadalmay), Coffs Harbour (Garlambirla), Nambucca (Nyambaga) and inland of these areas identify as Gumbaynggirr (Muurrbay 2019).

The Gumbaynggirr nation covers a large area of the mid-north coast of New South Wales, from the Nambucca River northward to the Clarence River, inland to the Northern Tablelands and to the Great Dividing Range in the west and east to the Pacific coast. They are renowned as the ‘sharing people’ because their land was so rich that food and other resources were commonly shared with other nations. The North Coast Region is also known for containing a large number of bora grounds which are important sites due to their role in initiation ceremonies.

Indigenous Protected Areas

Indigenous Australians have managed their country for tens of thousands of years. An Indigenous Protected Area is an area of Indigenous-owned land or sea where traditional owners have entered into an agreement with the Australian Government to promote biodiversity and cultural resource conservation. Indigenous Protected Areas make a significant contribution to Australian biodiversity conservation - making almost 25 per cent of Australia's National Reserve System.

Indigenous Protected Areas deliver environmental benefits; in addition, managing Indigenous Protected Areas helps Indigenous communities to protect their significant cultural values for future generations and receive spin-off health, education, economic and social benefits.

Dorodong Indigenous Protected Area occurs within the Bellingen Shire.

Key concepts

The biodiversity value of an area is determined by the integrity of the vegetation based on its composition, structure and function, and the suitability of habitat. Information is provided below to explain the following concepts relevant to biodiversity:

- connectivity, fragmentation and edge effects
- habitat characteristics
- threatened species, populations and communities
- weeds and pest animals
- green infrastructure.

Habitat

Habitat is the natural home or environment where an organism lives. Examples of habitat available in the Shire of Bellingen LGA include:

- a wide diversity of extensive vegetation communities including rainforests, forests, woodland, heath and grasslands
- hollow bearing trees and stags
- waterways, including lagoons, wetlands and dams
- river banks, estuaries, and foreshores including rock platforms, reefs, rock pools, mud and sand
- dense shrubs, grasses and marshes
- mangroves and saltmarshes
- leaf litter and logs
- built structures such as stormwater culverts and bridges that may have secluded niches
- diverse and healthy soil biota.

Animals may use different habitats for breeding, roosting or foraging (feeding). For example, many parrot species forage in trees that have seeds and fruit but need hollows to nest and breed.

Patch size and edge effects

Increased size of habitat areas enhances available resources and allows more ecosystem niches, therefore supporting more species and larger, more sustainable populations. Larger patches of habitat have a relatively low edge to area ratio, which means the habitat has a higher biodiversity value. Edge effects include weed invasion, spill of artificial lighting, rubbish dumping and vandalism. There is a greater adverse edge effect if the habitat patch has a long linear shape or is fragmented.

Corridors

Biodiversity corridors (also known as wildlife corridors or ecological corridors) are areas of connected habitat across the landscape that:

- allow the movement of animals and the dispersal of plants
- ensure genetic exchange of flora and fauna populations that may otherwise become extinct in the long-term
- allow recolonisation of habitat areas by fauna and flora that have become locally extinct from events such as land clearing, fire, disease, fluctuating food supply and extreme weather
- provide a relatively safe route for the movement of animals across the landscape.

If an event causes local extinction or reduction of the population, complete or partial connectivity of patches allows replenishment and re-establishment of the species. Smaller patches of habitat can link large patches as 'stepping stones' to facilitate movement of more mobile species. Patches of habitat can be terrestrial, aquatic or a combination of both within the urban and riverine environments of Bellingen.

Status of species and ecological communities

The biodiversity value of an area is also affected by the proportions of native and introduced species. Areas of higher biodiversity value are associated with the presence of threatened species and communities. Biodiversity values decrease if weeds and pest animal species are present.

The conservation status of species, populations and communities is determined by scientific committees that advise the NSW Office of Environment and Heritage, the NSW Department of Primary Industries and Commonwealth Department of Environment. Council and the community have no direct role in the process. Further information about the conservation status of species and communities in the Bellingen LGA is provided in Chapter 3.

Green infrastructure

Green infrastructure is defined by the GANSW (2017) as the network of green spaces, natural systems and semi-natural systems that are strategically planned, designed and managed to support a good quality of life in an urban environment. Elements of green infrastructure include residential gardens, local parks, streetscapes, road corridors, waterways, water sensitive urban design features and recreation areas. Figure 21 illustrates some of the benefits of green infrastructure, which include increased biodiversity and improved microclimate.

Green infrastructure that comprises a fully-functioning ecological community that sustains a suite of naturally occurring species, has high biodiversity value. An example to explain this concept is as follows: a streetscape planted with *Eucalyptus pilularis* (Blackbutt), *Lophostemon confertus* (Brush Box), *Syncarpia glomulifera* (Turpentine), *Archontophoenix cunninghamiana* (Bangalow Palm) and *Caldcluvia paniculosa* (Corkwood) which are characteristic species of the community Blackbutt – Turpentine – Brush Box – Bangalow Palm – Corkwood shrubby wet gully forest, NSW North Coast Bioregion., whilst of value to biodiversity is of lower biodiversity value than a large patch of the native vegetation community that is weed-free.

Carbon capture or sequestration is another benefit of green infrastructure. Plants naturally capture carbon from the atmosphere through photosynthesis. Photosynthesis works by combining carbon dioxide together with sunlight in a chemical reaction to produce oxygen and glucose. The carbon is held in the vegetation until the vegetation is burnt or dies and decomposes, thus releasing carbon back to the atmosphere and soil. Vegetation planting and regrowth can help to sequester carbon and thus offset the impacts of emissions that contribute to climate change.

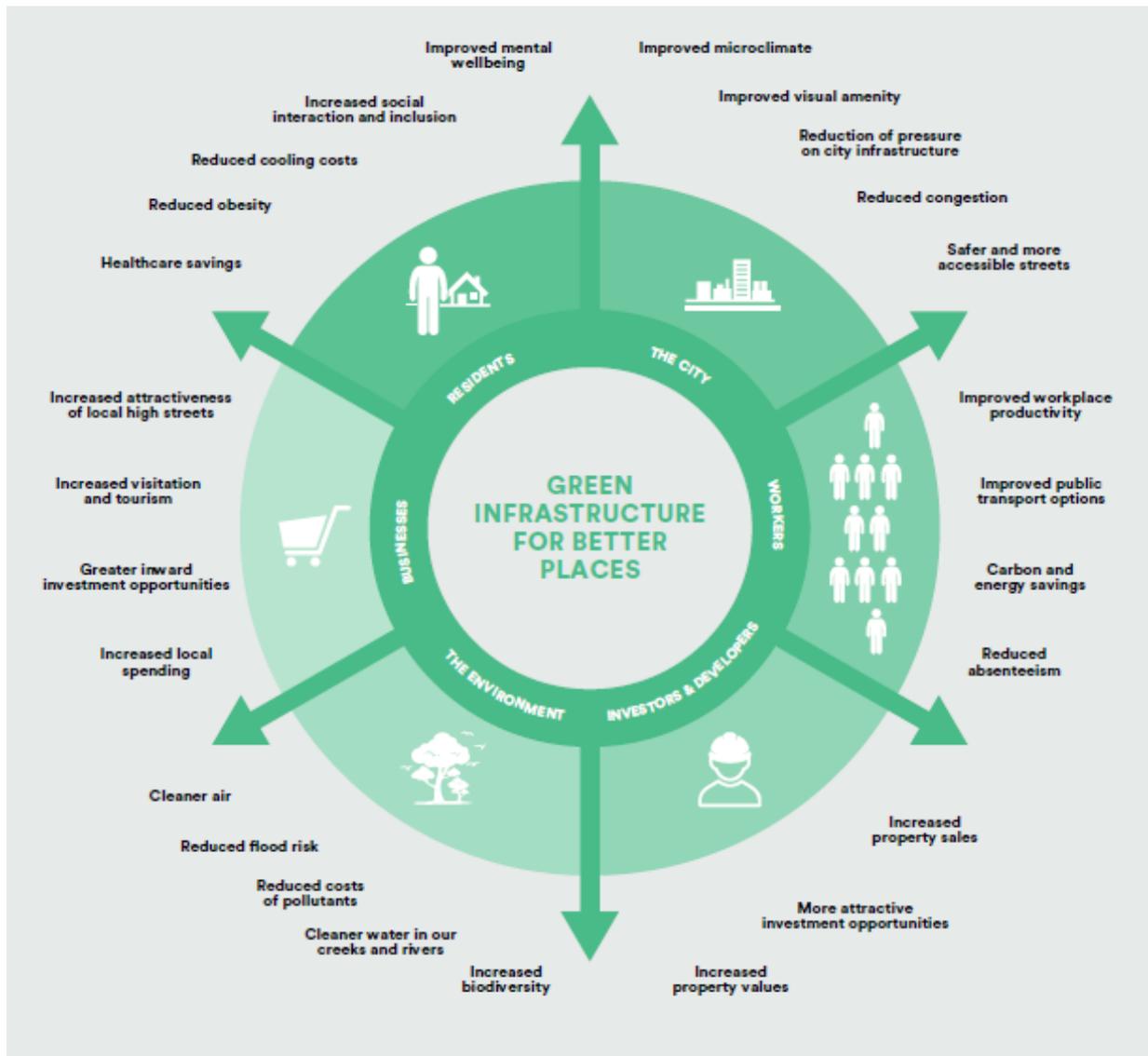


Figure 21: Benefits of green infrastructure in areas such as Bellingen LGA (GANSW 2017)

Design principles

The following biodiversity management and design principles apply to the Bellingen LGA under this Strategy:

- Local corridors along waterways and cycleways should integrate with regional corridors.
- Protect and enhance areas of high biodiversity value and core habitat within the Bellingen LGA. This will involve improving connectivity, reducing fragmentation and increasing the size of habitat patches by regrowth of native species following weed control supplemented by revegetation. The habitat patch size or corridor should be as wide as possible to reduce edge effects.
- Rehabilitate or restore landscapes using bush regeneration techniques consistent with the Bradley Method (Bradley 2002) and the Bush Regenerators Handbook (National Trust, 2010) i.e:
 - Secure and maintain the best areas first by rigorous and timely weed control
 - Minimise disturbance to the natural conditions e.g. soil

- Do not over clear – let the regeneration of the bush set the pace of clearance.
- Plant species that are characteristic of naturally occurring vegetation communities and habitat requirements.
- Introduce aquatic and terrestrial habitat features such as logs and nest boxes where possible.
- Offset any loss of vegetation in accordance with the Biodiversity Offsets Scheme under the *Biodiversity Conservation Act 2016* or other agreed vegetation replacement scheme (see Section Obelow).
- Involve the community in environmental protection, management and monitoring.

Offsets and replacement planting

Developments and activities should be designed and constructed to:

1. avoid environmental impacts
2. minimise environmental impacts
3. ameliorate or mitigate environmental impacts.

As a last resort, consideration should be given to ‘offsetting’ or compensating for an environmental impact. Expert advice should be sought regarding the type of offset scheme, if any, that is applicable. For example, the Biodiversity Offset Scheme Entry Tool can determine if a development will trigger the threshold for offsetting under the BC Act.

Bellingen Council’s roles and responsibilities regarding biodiversity impacts and offsets include:

- as the proponent causing the impact e.g. during asset construction or maintenance
- as the regulator providing advice and approval to developers in the area
- as the owner or manager of public land that:
 - could provide an offset site
 - maintains an offset site.

Key features of biodiversity offset and replacement planting schemes are summarised below. Further advice should be sought from a specialist if Council or another party wishes to be involved in these schemes.

Biodiversity offsets scheme

The Biodiversity Offsets Scheme (BOS) is a market-based scheme established in 2017 that is administered by the Department of Planning Industry and Environment. The BOS creates a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting for development that is likely to have a significant impact on biodiversity. The BOS is a framework for addressing impacts on biodiversity from development and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the BOS for actions triggering entry to the scheme.

The scheme also establishes Biodiversity Stewardship Agreements (BSA), which are voluntary in-perpetuity agreements entered into by landholders to secure offset sites, or long-term Conservation Agreements or non-permanent Wildlife Refuges (under the BC Act, Part 5, Divisions 2, 3 and 4, respectively).

The Biodiversity Conservation Trust, is a statutory not-for-profit agency within the portfolio of the NSW Minister for Energy and the Environment. Under the BC Act, the BCT is to manage and control the

Biodiversity Conservation Fund (BCF). The BCF is used to hold the funds set aside and invested to be used to make annual conservation payments to holders of funded BSAs and CAs.

The BOS enables 'biodiversity credits' to be generated by landowners and developers (including Bellingen Council) who commit to enhancing and protecting biodiversity values on their land through a BSA. The biodiversity credits can then be sold, generating funds for the management of the site. Credits can be used to offset the impacts on biodiversity values that occur from development.

Ecosystem and species credits may only be created where management actions are proposed to be carried out on a biodiversity stewardship site. Where land has an existing conservation obligation, biodiversity credits may only be created where the management actions are additional to any biodiversity conservation measures already being undertaken (see section 13.11.11 of the 2017 Biodiversity Assessment Method). For example, if a conservation obligation under a Council Plan of Management for a reserve expires without having been implemented, then Council could revise the Plan of Management so that it includes a BSA for the site. However, an offset cannot be created on land that has previously been used as an offset site or has been deemed not eligible.

Some impacts cannot be offset because they are likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct. Under Clause 6.7 of the Biodiversity Conservation Regulation 2017 an impact is considered 'serious and irreversible' if:

- 'it will cause a further decline of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline
- it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size
- it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution
- the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.'

Importantly, an offset area would need to be managed for conservation in perpetuity. An example could be where part of a public reserve is dedicated in perpetuity for conservation purposes as an offset site, and other parts of the reserve which are not covered by the BSA are to be used for recreation (e.g. cycleway, sports fields) or other purposes.

To identify and establish an offset site, Council and proponents should refer to the Core Habitats identified in this Biodiversity Strategy. Further analysis of the suitability of priority areas to establish an offset would involve a feasibility assessment by a Biodiversity Assessment Methodology (BAM) Accredited Assessor including review of the land tenure and biodiversity characteristics, as well as consideration of the need to match the species and/or ecosystem being impacted.

Once an offset site is identified, the BAM Accredited Assessor would:

1. undertake a detailed biodiversity assessment to establish the number and types of potential biodiversity credits that could be created
2. prepare an application for a formal BSA to be submitted to the Biodiversity Conservation Trust.

Once the BSA is approved by the Trust and Agreement implemented, the landholder of a stewardship site would receive annual payments from the Trust and be responsible for ongoing management of the site in accordance with the Agreement.

Further information about biodiversity offsetting is on the NSW DPIE website: www.environment.nsw.gov.au/biodiversity.

Carbon Credits

Carbon trading is a market-based approach for reducing greenhouse gas emissions. Carbon accounts measure emissions and operators can seek to reduce their emissions for various reasons which in most cases, the first priority is to reduce emissions internally, by saving energy and improving processes, but if significant emissions remain then carbon trading is an option for reducing a carbon footprint.

Australia established the Carbon Farming Initiative (CFI) to allow farmers and land managers to generate carbon credits through activities such as sequestration and improved farming and land management practices. The Fund (ERF) was established to broaden the range of activities that are eligible to earn carbon credits. It established a reverse auction system for the government to purchase credit units. Both systems have methods consistent with international standards that allow landholders to put projects forward for approval to generate carbon credits. CFI and ERF emission reductions are measured in Australian Carbon Credit Units (ACCUs), each of which represents one tonne of carbon dioxide equivalent (tCO₂e) of greenhouse gas emission reductions.

In 2019 the Australian Government established a Climate Solutions Fund (CSF) to provide an additional \$2 billion to continue purchasing low-cost abatement, build on the success of the ERF to reach Australia's 2030 emissions reduction target. The additional funding ensures Australian farmers, businesses and Indigenous communities continue to have opportunities to undertake emissions reduction projects that provide local benefits.

Activities supported through the ERF provide important environmental, economic, social and cultural benefits for farmers, businesses, landholders, Indigenous Australians and communities. The ERF is established on the principles of reducing emissions at lowest cost and purchasing genuine and additional emissions reductions.

Landholders who want to regenerate native vegetation on land where native forest is being suppressed and earn carbon credits can participate in the scheme to capture carbon by changing land management practices to facilitate regeneration of a native forest. Landholders can assist regeneration through activities such as excluding livestock from the project area, managing the timing and extent of grazing, managing feral animals and non-native plants in the project area and stopping activities such as mechanical destruction of natural regrowth.

Canopy tree replacement

Replacement of individual trees may be needed in urban settlements where a biodiversity offset under the BC Act is not required but should be incorporated into a policy in the DCP to compensate for the many tree removals that lead to 'death by a thousand cuts'. For example, many examples of a single

tree may need to be removed to enable a stormwater pipe to be repaired, a redevelopment or a path to be installed.

Replacement planting at a ratio of three trees to replace every one removed to ensure the many benefits of the urban canopy can be provided long term. Alternatively, a financial contribution could be made to Council to support public tree planting.

The location and species selection for the replacement planting should consider:

- where is the closest suitable position for the planting (consider proximity to built infrastructure such as pavements, buildings, underground pipes and overhead wires)
- what native species would be best suited to the preferred location.

Decisions related to the removal or major pruning of significant trees should be made in consultation with a Consulting Arborist and in accordance with the Australian Standard AS4970 for Protection of Trees on Construction Sites.

Appendix B Mitchell landscapes, topography and geology maps

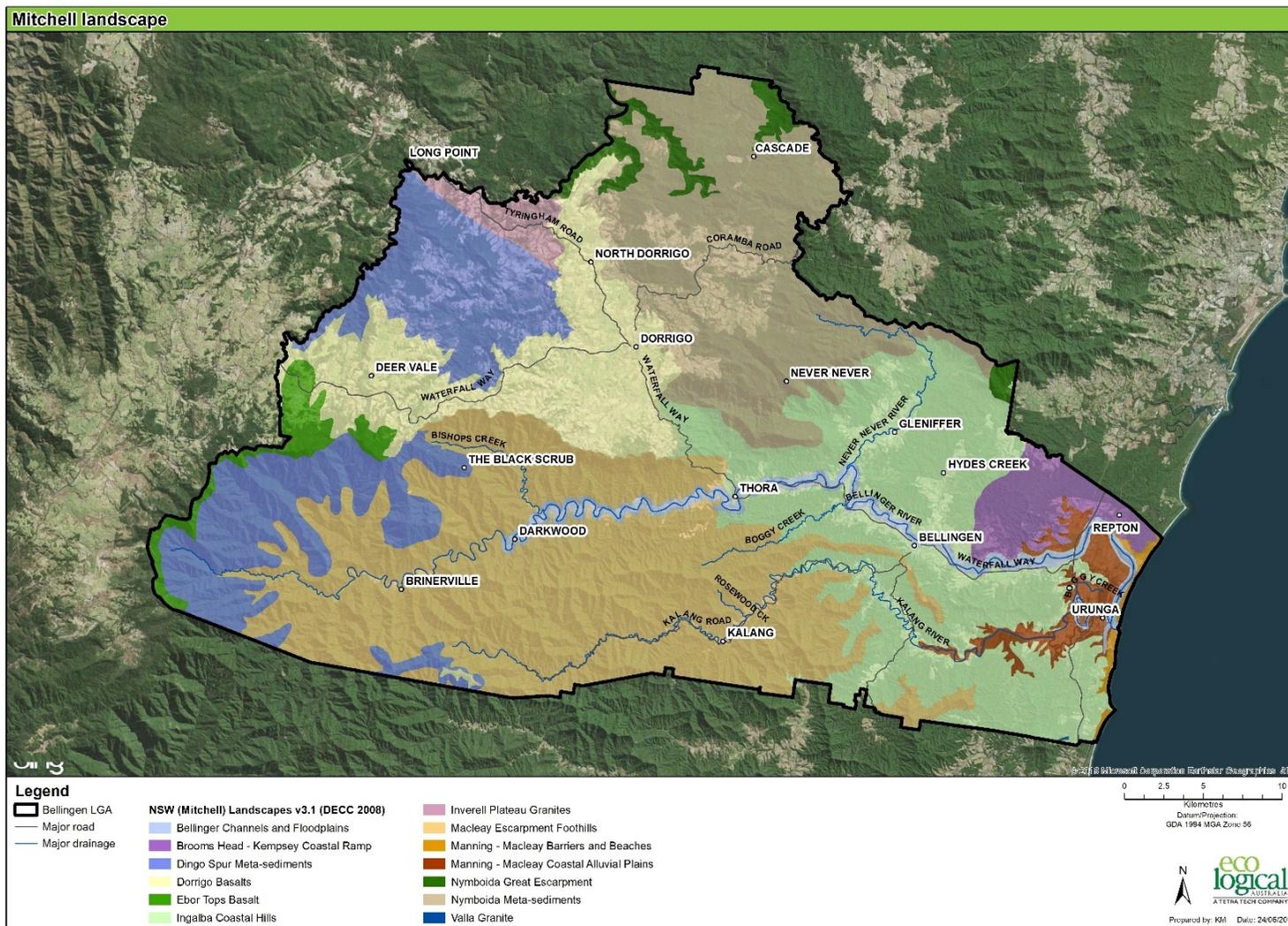


Figure 22: Mitchell landscapes in Bellingen Shire

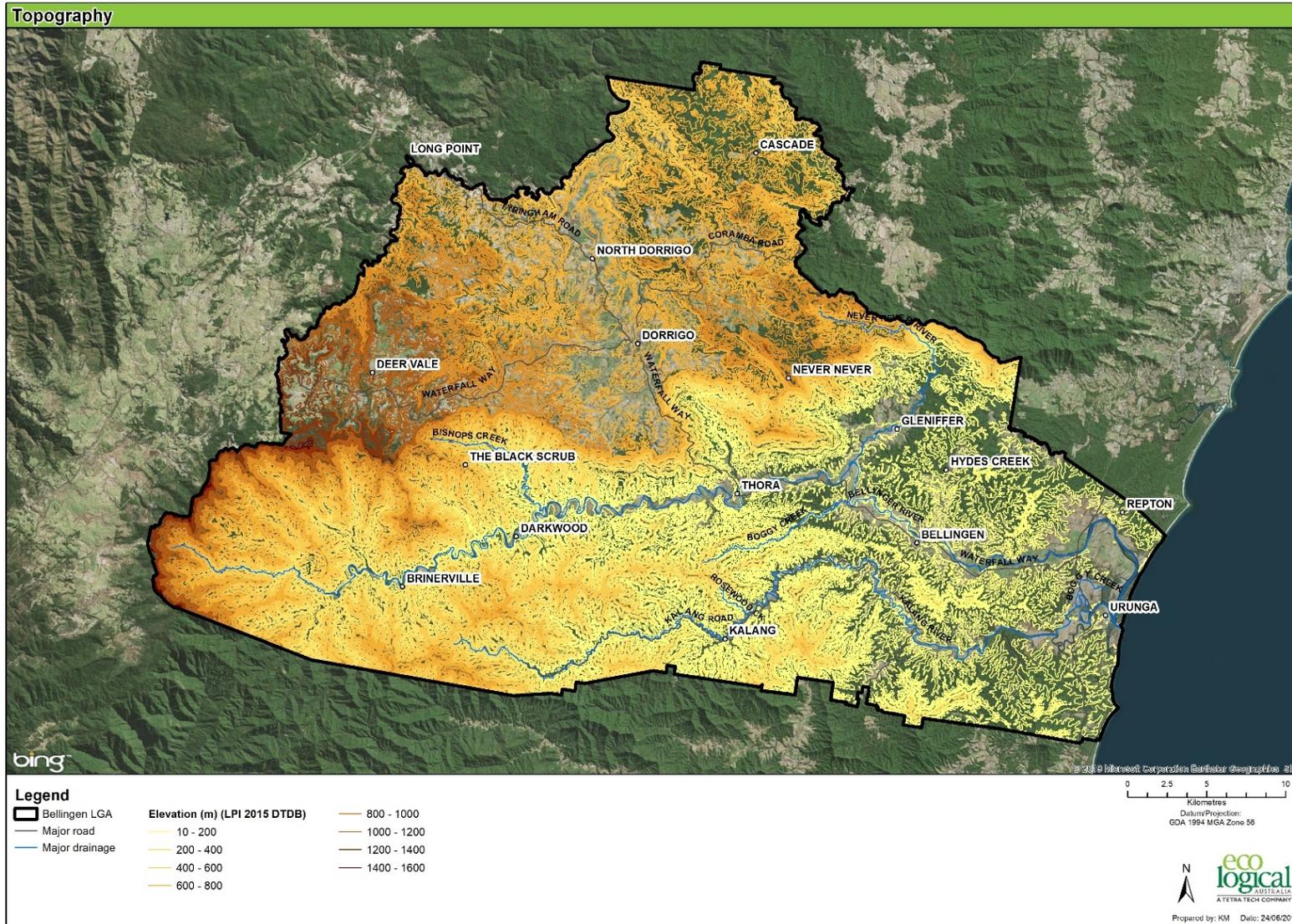


Figure 23: Topographic map of Bellinghen Shire

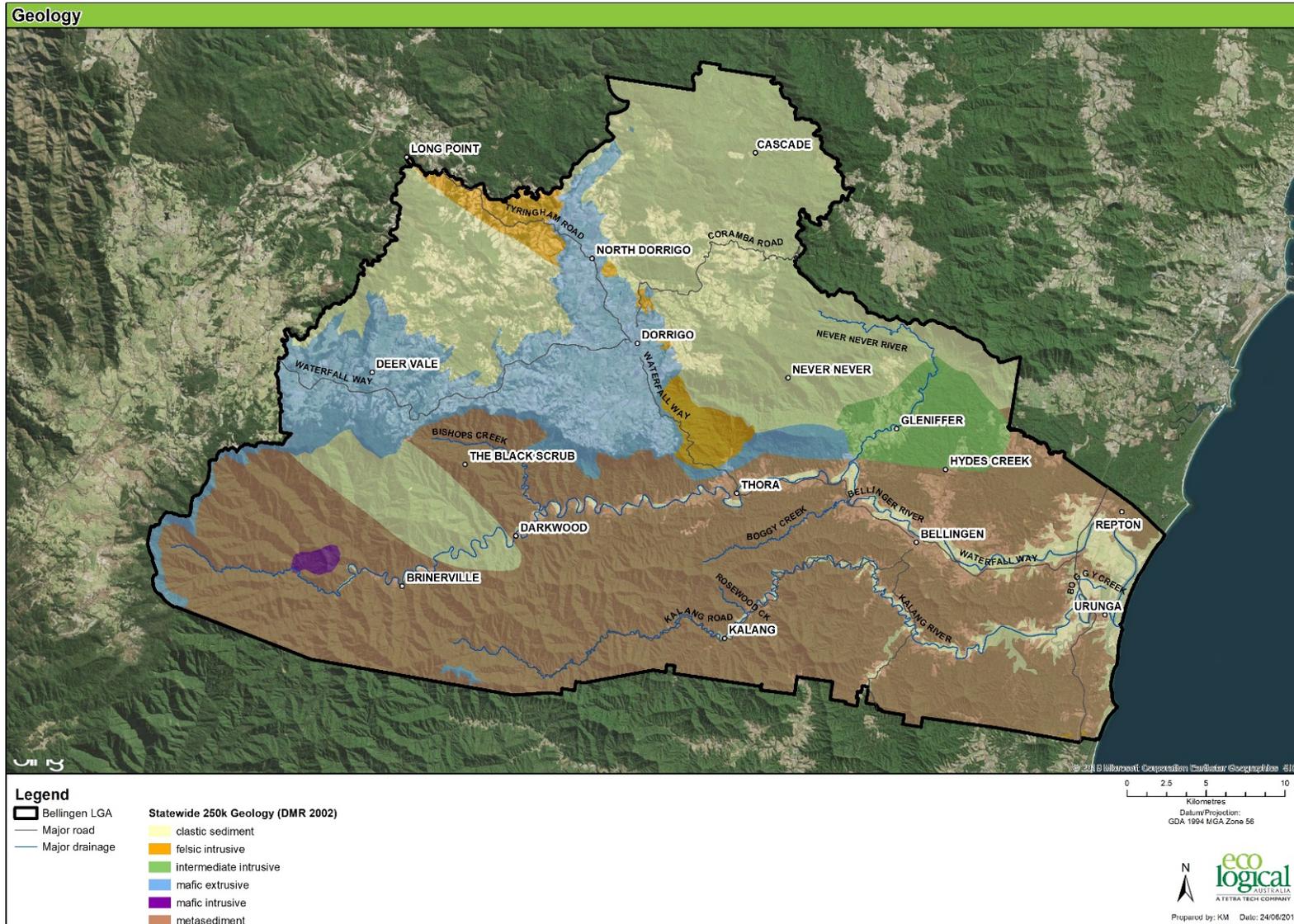


Figure 24: Geology of NSW 1:250,000 series

Appendix C Flora and fauna of the Bellingen Shire

BioNet was accessed 29 May 2019 and 12 June 2019 to derive the following data.

KEY

Jurisdiction	Abbreviation	Protection status
Commonwealth (EPBC Act)	C	Listed on China Australia Migratory Bird Agreement
	CE	Critically Endangered
	E	Endangered
	J	Listed on Japan Australia Migratory Bird Agreement
	K	Listed on Republic of Korea Australia Migratory Bird Agreement
	V	Vulnerable
	X	Extinct
NSW (BC and FM Acts)	E1	Endangered
	E2	Endangered Population
	E4A	Critically Endangered
	P	Protected
	V	Vulnerable
	2	Sensitivity Class 2 (under the Sensitive Species Data Policy)
	3	Sensitivity Class 3 (under the Sensitive Species Data Policy)

Class	Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Amphibia	Myobatrachidae	<i>Assa darlingtoni</i>	Pouched Frog	V,P		18
	Myobatrachidae	<i>Crinia tinnula</i>	Wallum Froglet	V,P		1
	Myobatrachidae	<i>Mixophyes balbus</i>	Stuttering Frog	E1,P,2	V	18
	Myobatrachidae	<i>Mixophyes iteratus</i>	Giant Barred Frog	E1,P,2	E	122
	Myobatrachidae	<i>Philoria sphagnicolus</i>	Sphagnum Frog	V,P		24
	Hylidae	<i>Litoria brevipalmata</i>	Green-thighed Frog	V,P		3
	Hylidae	<i>Litoria subglandulosa</i>	Glandular Frog	V,P		3
Reptilia	Cheloniidae	<i>Caretta caretta</i>	Loggerhead Turtle	E1,P	E	1
	Cheloniidae	<i>Chelonia mydas</i>	Green Turtle	V,P	V	2
	Chelidae	<i>Myuchelys georgesii</i>	Bellinger River Snapping Turtle	E4A,P,2	CE	51

Class	Family	Scientific Name	Common Name	NSW status	Comm. status	Records
	Elapidae	<i>Hoplocephalus stephensii</i>	Stephens' Banded Snake	V,P		19
Aves	Anatidae	<i>Oxyura australis</i>	Blue-billed Duck	V,P		1
	Columbidae	<i>Ptilinopus magnificus</i>	Wompoo Fruit-Dove	V,P		387
	Columbidae	<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V,P		85
	Columbidae	<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V,P		7
	Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail	P	C,J,K	26
	Procellariidae	<i>Ardenna pacificus</i>	Wedge-tailed Shearwater	P	J	3
	Procellariidae	<i>Ardenna tenuirostris</i>	Short-tailed Shearwater	P	J,K	3
	Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E1,P		78
	Ardeidae	<i>Ardea ibis</i>	Cattle Egret	P	C,J	21
	Ardeidae	<i>Botaurus poiciloptilus</i>	Australasian Bittern	E1,P	E	3
	Ardeidae	<i>Ixobrychus flavicollis</i>	Black Bittern	V,P		1
	Threskiornithidae	<i>Plegadis falcinellus</i>	Glossy Ibis	P	C	2
	Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V,P	C	28
	Accipitridae	<i>Hieraetus morphnoides</i>	Little Eagle	V,P		1
	Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite	V,P,3		19
	Accipitridae	<i>Pandion cristatus</i>	Eastern Osprey	V,P,3		38
	Gruidae	<i>Grus rubicunda</i>	Brolga	V,P		3
	Burhinidae	<i>Esacus magnirostris</i>	Beach Stone-curlew	E4A,P		7
	Haematopodidae	<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V,P		4
	Haematopodidae	<i>Haematopus longirostris</i>	Pied Oystercatcher	E1,P		7
	Charadriidae	<i>Pluvialis fulva</i>	Pacific Golden Plover	P	C,J,K	1
	Jacaniidae	<i>Irediparra gallinacea</i>	Comb-crested Jacana	V,P		3
	Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper	P	C,J,K	2
	Scolopacidae	<i>Calidris ferruginea</i>	Curlew Sandpiper	E1,P	CE,C,J,K	1
	Scolopacidae	<i>Gallinago hardwickii</i>	Latham's Snipe	P	C,J,K	1
	Scolopacidae	<i>Limosa lapponica</i>	Bar-tailed Godwit	P	C,J,K	5

Class	Family	Scientific Name	Common Name	NSW status	Comm. status	Records
	Scolopacidae	<i>Numenius madagascariensis</i>	Eastern Curlew	P	CE,C,J,K	5
	Scolopacidae	<i>Numenius phaeopus</i>	Whimbrel	P	C,J,K	4
	Laridae	<i>Gelochelidon nilotica</i>	Gull-billed Tern	P	C	1
	Laridae	<i>Hydroprogne caspia</i>	Caspian Tern	P	C,J	2
Aves	Laridae	<i>Sterna hirundo</i>	Common Tern	P	C,J,K	1
	Laridae	<i>Sternula albifrons</i>	Little Tern	E1,P	C,J,K	3
	Cacatuidae	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V,P,2		341
	Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	V,P		37
	Strigidae	<i>Ninox strenua</i>	Powerful Owl	V,P,3		33
	Tytonidae	<i>Tyto longimembris</i>	Eastern Grass Owl	V,P,3		1
	Tytonidae	<i>Tyto novaehollandiae</i>	Masked Owl	V,P,3		21
	Tytonidae	<i>Tyto tenebricosa</i>	Sooty Owl	V,P,3		63
	Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	P	J	12
	Atrichornithidae	<i>Atrichornis rufescens</i>	Rufous Scrub-bird	V,P		117
	Meliphagidae	<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A,P	CE	2
	Meliphagidae	<i>Lichenostomus fasciogularis</i>	Mangrove Honeyeater	V,P		1
	Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V,P		2
	Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V,P		32
	Pachycephalidae	<i>Pachycephala olivacea</i>	Olive Whistler	V,P		1
	Artamidae	<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V,P		1
	Petroicidae	<i>Petroica boodang</i>	Scarlet Robin	V,P		1
	Estrildidae	<i>Stagonopleura guttata</i>	Diamond Firetail	V,P		1
Mammalia	Dasyuridae	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E	52
	Dasyuridae	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V,P		17
	Dasyuridae	<i>Planigale maculata</i>	Common Planigale	V,P		1
	Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	V,P	V	1208
	Burramyidae	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V,P		8
	Petauridae	<i>Petaurus australis</i>	Yellow-bellied Glider	V,P		66

Class	Family	Scientific Name	Common Name	NSW status	Comm. status	Records
	Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider	V,P		3
	Potoroidae	<i>Potorous tridactylus</i>	Long-nosed Potoroo	V,P	V	3
	Macropodidae	<i>Macropus parma</i>	Parma Wallaby	V,P		3
Mammalia	Macropodidae	<i>Thylogale stigmatica</i>	Red-legged Pademelon	V,P		3
	Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	244
	Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V,P		1
	Molossidae	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V,P		9
	Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V,P		6
	Vespertilionidae	<i>Kerivoula papuensis</i>	Golden-tipped Bat	V,P		29
	Vespertilionidae	<i>Miniopterus australis</i>	Little Bentwing-bat	V,P		73
	Vespertilionidae	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V,P		40
	Vespertilionidae	<i>Myotis macropus</i>	Southern Myotis	V,P		18
	Vespertilionidae	<i>Nyctophilus bifax</i>	Eastern Long-eared Bat	V,P		2
	Vespertilionidae	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		2
	Vespertilionidae	<i>Vespadelus trougtoni</i>	Eastern Cave Bat	V,P		1
	Muridae	<i>Pseudomys oralis</i>	Hastings River Mouse	E1,P	E	2
	Otariidae	<i>Arctocephalus forsteri</i>	New Zealand Fur-seal	V,P		2
	Otariidae	<i>Arctocephalus pusillus doriferus</i>	Australian Fur-seal	V,P		1
Osteichthyes	Eleotridae	<i>Mogurnda adpersa</i>	Southern purple-spotted Gudgeon	E1		NA
	Percichthyidae	<i>Maccullochella ikei</i>	Eastern Freshwater Cod	E1	E	NA
		<i>Nanoperca oxleyana</i>	Oxleyan Pygmy Perch	E1	E	NA
Insecta	Noctuidae	<i>Phyllodes imperialis southern subspecies</i>	Southern Pink Underwing Moth	E1	E	18
Flora	Apiaceae	<i>Gingidia rupicola</i>		E1,3	E	2

Class	Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Flora	Apocynaceae	<i>Marsdenia longiloba</i>	Slender Marsdenia	E1	V	94
	Apocynaceae	<i>Parsonsia dorrigoensis</i>	Milky Silkpod	V	E	379
	Araceae	<i>Typhonium sp. aff. brownii</i>	Stinky Lily	E1,3		15
	Asteliaceae	<i>Neostelia spectabilis</i>	Silver Sword Lily	V	V	3
	Asteraceae	<i>Olearia flocktoniae</i>	Dorrigo Daisy Bush	E1	E	101
	Ericaceae	<i>Gaultheria viridicarpa</i>	Green Waxberry	E1		6
	Ericaceae	<i>Gaultheria viridicarpa subsp. viridicarpa</i>	Green Waxberry	V	V	3
	Fabaceae (Caesalpinioideae)	<i>Senna acclinis</i>	Rainforest Cassia	E1		2
	Fabaceae (Faboideae)	<i>Sophora tomentosa</i>	Silverbush	E1		1
	Fabaceae (Mimosoideae)	<i>Acacia chrysotricha</i>	Newry Golden Wattle	E1		91
	Myrtaceae	<i>Kardomia silvestris</i>	Woodland Babingtonia	E1		47
	Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine	E4A		45
	Myrtaceae	<i>Rhodomyrtus psidioides</i>	Native Guava	E4A		8
	Orchidaceae	<i>Dendrobium melaleucaphilum</i>	Spider orchid	E1,P,2		435
	Orchidaceae	<i>Oberonia titania</i>	Red-flowered King of the Fairies	V,P,2		1
	Orchidaceae	<i>Sarcophilus fitzgeraldii</i>	Ravine Orchid	V,P,2	V	3
	Poaceae	<i>Arthraxon hispidus</i>	Hairy Jointgrass	V	V	71
	Proteaceae	<i>Hicksbeachia pinnatifolia</i>	Red Boppel Nut	V	V	15
	Rutaceae	<i>Acronychia littoralis</i>	Scented Acronychia	E1	E	3
	Rutaceae	<i>Boronia umbellata</i>	Orara Boronia	V,P	V	1
Sapotaceae	<i>Niemeyera whitei</i>	Rusty Plum, Plum Boxwood	V		153	
Winteraceae	<i>Tasmania glaucifolia</i>	Fragrant Pepperbush	V	V	1	

Appendix D Vegetation communities

D1 Threatened Ecological Communities

Vegetation types mapped in the Bellingen Shire generally conformed to PCTs mapped across NSW, but due to a past history of disturbance and some local botanical variations, the PCT descriptions were refined or further described specifically for the Bellingen Shire. These variations have been allocated mapping units specific to the OEH (2014) study and their equivalence to PCTs is described and noted in Volume 2. The PCT name equivalence is listed in the Table 16.

Table 16: Threatened Ecological Communities and Plant Community Types in Bellingen LGA OEH, 2014

Endangered Ecological Community (EEC)	Bellingen Plant Community Type (PCT) Label	PCT Name	Area (ha)	Location in Bellingen Shire
Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC	BELL_DOF06	Swamp Box - Forest Red Gum - Pink Bloodwood seasonal swamp forest on floodplains and low rises	131	Coastal hills between Hungry Head and Wenonah Head and south west of Raleigh
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC (floodplain only)	BELL_ForW01	Swamp Oak - Broad-leaved Paperbark - Willow Bottlebrush floodplain forested wetland	121	Urunga, Kalang River floodplain, Boggy Creek, Raleigh and Manarm Creek
	BELL_ForW02	Swamp Mahogany - Willow Bottlebrush - Broad-leaved Paperbark forested wetland	255	Gullies at South Urunga, Boggy Creek, McGraths Creek, and between Repton and Mylestom
	BELL_ForW03	Broad-leaved Paperbark - Willow Bottlebrush forested wetland of creek channels draining intermittent coastal lakes and lagoons	1	Urunga Lagoon and Mylestom
	BELL_ForW04	Broad-leaved Paperbark - Swamp Oak - Tall Sedge swamp forest on alluvial soils	120	Between Repton and Mylestom, Boggy Creek, South Urunga
	BELL_ForW11	Broad-leaved Paperbark - Bare Twig Rush swamp sclerophyll open forest of coastal swamps	57	McGraths Creek, Dalhousie Creek, Urunga Lagoon, Lower Kalang River and Lower Bellinger River
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	BELL_ForW06	Swamp Oak Forested Wetland of Hind-dunes	21	Sand dunes east of Urunga Lagoon and east of Bellinger River adjacent to North Beach
	BELL_ForW10	Swamp Oak Forested Wetland of Estuaries	179	Urunga Lagoon, Newry Island, Kalang River, Yellow Rock Islet, Urunga

Endangered Ecological Community (EEC)	Bellingen Plant Community Type (PCT) Label	PCT Name	Area (ha)	Location in Bellingen Shire
				Island, Bellinger River, Manarm Creek
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC (floodplain only)	BELL_FW01	Knotweed wet meadow forbland on alluvial soils of coastal floodplains	212	Bellinger River, Hydes Creek, Roses Creek, Boggy Creek, Kalang River
	BELL_FW02	Mud Grass wet grassland meadow on alluvial soils of coastal floodplains	1	School Road (Bongil Bongil), Kalang River
	BELL_FW03	Eleocharis equisetina freshwater wetland of coastal floodplains	1	Bellingen River, Yellow Rock Road, Kalang River, School Road (Bongil Bongil)
	BELL_FW06	Jointed Twig-rush Sedgeland of North Coast Wallum Swamps	13	Freshwater lagoons located in south Urunga Crown land
	BELL_FW07	Tall Spike Rush freshwater wetland of coastal floodplains and depressions in low hills	2	Hyde and Frenchmans Creek
	BELL_FW08	Lagoon forbland freshwater wetlands of coastal floodplains	50	Never Never River, Raleigh, Kalang River, Urunga Lagoon, North Bank, Dalhousie Creek, Newry Island
	BELL_FW10	Juncus rushlands on alluvial floodplains	155	North Bank, Manarm Creek, Raleigh, Boggy Creek
Themeda Grassland on Seacliffs and Coastal Headlands in the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	BELL_H03	Kangaroo Grass sod grassland of North Coast headlands	0.17	Restricted occurrence in the study area at Hungry Head and Wenonah Head
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion EEC (floodplain only)	BELL_RF01	Weeping Lilly Pilly dry riparian rainforest	132	Never Never River, Hydes Creek and upper Kalang River
	BELL_RF03	Giant Water Gum - Rough-leaved Elm - Small-leaved Fig – Hard Quandong subtropical rainforest on coastal floodplains	5	Bellingen Island, Tucker's Island, River Vale
	BELL_RF04	Riparian subtropical rainforest with River Oak emergents on lowland creek flats	70	Kalang and Never Never Rivers
Littoral Rainforest in the NSW North Coast,	BELL_RF07	Tuckeroo - Bird's Eye Alectryon - Beach Acronychia littoral rainforests	16	On hind dunes at Hungry Head, Wenonah Head

Endangered Ecological Community (EEC)	Bellingen Plant Community Type (PCT) Label	PCT Name	Area (ha)	Location in Bellingen Shire
Sydney Basin and South East Corner bioregions EEC	BELL_RF08	Brushbox headland littoral rainforest	6	and Mylestom to Tuckers Rocks South of Tuckers Rocks, Urunga, and at Hungry Head
	BELL_RF11	Maidens Blush - Yellow Carabeen - Native Tamarind - Bangalow Palm subtropical rainforest on floodplains and metasedimentary gullies and foothills	943	Gullies and slopes of the Scotchman Range, Bellinger River and Never Never River Valleys
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	BELL_SW02	Twig Rush saltmarsh of estuaries	11	Urunga Lagoon and west of Repton
	BELL_SW03	Shiny Bog-rush - Club Rush dune soak wetlands on Holocene dunes	18	Sand vegetation east of Urunga Lagoon
	BELL_SW04	Prickly Couch - Sea Rush - Common Couch saltmarsh of saline coastal swamps and flats	0.10	Tuckers Rocks
	BELL_SW06	Sea Rush saltmarsh of estuaries	94	Dalhousie Creek, Urunga Lagoon, Urunga Island, Yellow Rock Islet, Back Creek
	BELL_SW07	Saltwater Couch - Samphire saltmarsh of estuaries	24	Bellinger and Kalang River estuaries and also Urunga Lagoon

D2 Plant Community Types

A total of 13,383 ha and 50 PCTs were mapped by OEH (2014) across the Bellingen Shire study area. The most predominant vegetation formation mapped was Wet Sclerophyll Forests, followed by Dry Sclerophyll Forests, Forested wetlands, Freshwater Wetlands, Saline wetlands, Heathlands and Grasslands.

Vegetation Formation	Number of Plant Community Types within each vegetation formation	Area (ha) of each vegetation formation mapped
Wet Sclerophyll Forests	9	7,457
Dry Sclerophyll Forests	7	1,393
Rainforest	6	1,169
Forested wetlands	9	915
Freshwater Wetlands	7	434
Saline wetlands	6	277
Heathlands	4	73
Grasslands	1	3

Appendix E Stakeholder consultation

E1 Introduction

Bellingen Council is developing a Biodiversity Strategy to enhance and protect biodiversity values within the Local Government Area and to conserve, restore and recreate key linkages to provide connectivity with core habitats throughout the LGA and adjoining land.

Community and stakeholder engagement is important in recognising initial community and stakeholder views early in the project and to assist in mapping ecological values, and identifying threats and opportunities. Community and stakeholder views and values are central to promoting awareness of the Bellingen's biodiversity values, identifying biodiversity enhancement opportunities and potential priority projects, areas of high community recreational use and relevant iconic species. The connection of people to nature in urban areas is an important element of the Biodiversity Strategy, with areas of high community interest and value including popular reserves and locations where community volunteer groups work (e.g. Landcare). This information will be utilised develop community engagement and education programs to connect people to nature.

Eco Logical Australia (ELA) has prepared a Community Engagement Strategy and undertaken surveys with the community and key stakeholders. ELA has held workshops with Councillors and stakeholders to obtain their views on important biodiversity hotspots and issues for management.

E2 Stakeholder Questions

Stakeholders included the following NSW Government agencies and community groups. The following questions were asked in an online survey.

- Are you a resident of the Bellingen Shire Local Government Area (LGA)?

- If you are from an Aboriginal community, what would you like to inform Council on, about the local plans and animals from an Aboriginal perspective

- Are you aware of any of the following environmental projects and groups in Bellingen Shire?
 - Jalogirr Biodiversity Alliance (JBA)
 - Bellinger Landcare Inc (BLI)
 - Dandarrga Landcare (Dorrigo)
 - Friends of Wonga Forest (Bellingen)
 - Bellingen Island Landcare
 - Bellingen Urban Landcare
 - Urunga Landcare
 - Never Never Catchment Group
 - Hydes Creek Landcare

-
- Wenonah Dunecare
 - Tuckers Rock Dunecare
 - Bundagen Dunecare
 - Bellingen Environment Centre (BEC)
 - The Centre for Ecological Learning (CEL)
 - Riverwatch.
-
- Are you (or have you been involved in any of the following environmental projects and groups in Bellingen Shire?)
 - Bellinger Landcare Inc (BLI)
 - Dandarrga Landcare (Dorrigo)
 - Friends of Wonga Forest (Bellingen)
 - Bellingen Island Landcare
 - Bellingen Urban Landcare
 - Urunga Landcare
 - Never Never Catchment Group
 - Hydes Creek Landcare
 - Wenonah Dunecare
 - Tuckers Rock Dunecare
 - Bundagen Dunecare
 - Bellingen Environment Centre (BEC)
 - The Centre for Ecological Learning (CEL)
 - Riverwatch.
-
- How often do you use Bellingen Shire's open spaces and bushland areas?
 - More than once a week
 - Once a week
 - 2-3 times per month
 - Once a month
 - 2-10 times per year
 - Once a year
 - Never
-
- What natural areas in the Bellingen Shire do you visit?
 - Bellinger River foreshore (Lavenders Bridge)
 - The Point (James Eather Way)
 - Gleniffer and Never Never reserves:
 - Angel Gabriel Capararo Reserve
 - Broken Bridge Reserve
 - Earl Preston Reserve
 - Arthur Keough Reserve

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- Tallowood Point, Gleniffer
 - Wonga Forest Trail, North Bellingen
 - Ringwood Creek Reserve, North Bellingen
 - Roses Creek
 - Kalang
 - Tuckers Nob
 - Scotchman
 - Pine Creek
 - Mylestom North Beach foreshore
 - Bellinger River, Mylestom
 - Tarkeeth
 - Fernmount
 - Thora
 - Darkwood
 - Raleigh
 - Yellow Rock
 - Dorrigo Mountain and National Park
 - Bellinger River National Park
 - Bellinger Heads State Park
 - Hungry Head beach foreshore
 - Dalhousie Creek, Hungry Head
 - Urunga beach foreshore
 - Urunga Lido park and boardwalk
 - Hydes Creek
 - Wenonah Headland
 - Tuckers Rock
 - Bundagen
 - Other local park/reserve (please list below)
 - Other high-profile areas
- What is your satisfaction level with Council's management of the Bellingen Shire's natural environment?
 - Very satisfied
 - Satisfied
 - Neither satisfied nor dissatisfied
 - Dissatisfied
 - Very Dissatisfied
 - Please tick which of the following activities you use Bellingen Shire's open spaces and natural areas for:
 - Walking / hiking / jogging
 - Swimming

- Dog walking
 - Picnic / BBQ
 - Bike riding
 - Bird watching
 - Boating
 - Other (please list)
- Council is developing a set of actions to enhance and protect Bellingen Shire's natural environment for the Biodiversity Strategy.

Please rank (1 - 4) the importance of the following actions to manage biodiversity with 1 being the highest and 4 being the lowest rank:

1 Extremely important

2 Very important

3 Important

4 Not important

- Protecting threatened vegetation communities / habitat / plants / animals
 - Controlling weeds in natural areas
 - Controlling pest animals (e.g. foxes and Indian Myna birds)
 - Reducing impact of pollution on local biodiversity
 - Fencing cattle access off natural waterways
 - Native revegetation plantings
 - Coastal and river foreshore erosion
 - Improving water quality of local catchments
 - Reducing negative impacts from development on the natural environment
 - Encouraging community ownership and care for the natural environment
 - Supporting community Landcare volunteers
 - Providing natural area recreation opportunities
 - Creating wildlife habitat outside Council reserves
 - Controlling the impact of domestic dogs and cats on native wildlife
 - Providing environmental education for the community
 - Creating and enhancing river foreshore, bushland and wildlife corridors
 - Other actions
- Please tick what you think are the major threats to the Bellingen Shire's natural environment?
 - Clearance of vegetation

- Weed invasion of bushland
 - Water pollution
 - Cattle access to rivers and creeks
 - Coastal dune erosion
 - Impacts of climate change
 - Rubbish dumping in natural areas
 - Firewood collection
 - Pest animals (foxes, Indian Myna birds, aggressive native birds like Noisy miners)
 - Litter in waterways
 - Other (please list below)
- Have you noticed any changes (positive or negative) to natural bushland and river / ocean foreshore areas in the Bellinghen Shire?
 Location

 Change noticed

 How long ago did you notice the change?
 - Describe your vision for local biodiversity in 20 years' time.
 - *(Optional)*: Please provide any other comments or list any other threats/opportunities relating to Bellinghen Shire's biodiversity.
 - *(Optional)*: Please give your contact details if you are willing to offer further information about the answers provided in this survey or wish to be further involved in the preparation of the Biodiversity Strategy. Your details will not be made public.
 Name/Address/Phone number/Email

STAKEHOLDER WORKSHOP DISCUSSION QUESTIONS

The following questions were used to promote discussion at a Stakeholder Workshop and a Councillor Workshop:

1. What does you or your organisation / group value about Bellinghen Shire's natural areas?
2. Which are the areas with the highest values and why? Are these areas managed by Council?

3. What is your vision/objectives for Bellingen Shire biodiversity in 30-50 years' time?
4. Can you suggest actions to help achieve this vision? What additional information or other resources may be required?
5. What activities is your organisation is undertaking or responsible for in the Bellingen Shire LGA or the local area that may be relevant to the Biodiversity Strategy? Include any specific projects and programs, as well as broader responsibilities that may be relevant
6. What do you see as the main threats/ barriers to conserving Bellingen Shire's natural areas?
7. Are there any opportunities for collaborative or cooperative projects that will improve the biodiversity in adjoining LGAs and across the region?

Appendix F Current and Previous Council programs

The material presented in this section is derived from Council's website.

Habitat restoration

BSC uses a suite of strategies, plans and programs that involve native vegetation restoration. Some of these programs are run by state agencies such as the new Saving our Species (SoS) program by DPIE, the various incentives programs run by North Coast Local Land Services (LLS), the NSW Environmental Trust and Habitat Rehabilitation Grants run by DPI. BSC also provides some funding for habitat rehabilitation, some through an environmental levy raised through rates, and others as part of their standard operations using internal funds to assist with grant funding applications. Landholders make a large contribution to restoration, actively restoring their properties and often working with involved agencies to monitor the success or progress of their projects. Table 17 identifies habitat restoration undertaken in the Bellingen LGA from 2012/13 to 2015/16.

Table 17: Habitat restoration 2012-2016 (Source: SOE 2016)

Year	Area Restored (ha)	Trees Planted	Land Type	Activity	Funding
2012/13	4		Public land	Weed control and planting	Council, Landcare, Community Groups, Environmental Trust
2013/14	4		Public land	Weed control and planting	Council, Landcare, Community Groups, Environmental Trust
2014/15	8		Public land	Weed control on saltmarsh; weed control and planting	Wetland Care Aust, Council, Landcare, Community Groups, Environmental Trust
2015/2016	5	1200	Public land	Weed control and planting	Council, Landcare, Community Groups, Environmental Trust

Koala management program

The Bellingen Shire Coastal Area Koala Management Strategy (BSC, 2017) was prepared for the community and landholders to help in the sustainable management of the nationally significant Koala population that resides within the coastal area. Endorsed by Council, a Koala Advisory Group (KAG) has been established to assist with the implementation of that Strategy and includes representatives from both Local and State Government and members of the community. The KAG will monitor and report on actions in the plan and other required actions. Actions in that Strategy will be integrated into Council's Delivery and Operational Plans. There are 28 actions in the areas of implementation and monitoring,

regulatory processes, communication and education, road and traffic management, dog management, Koala health and welfare, bushfire management, funding and research and advocacy.

A project to protect Bellingen's Koalas through encouraging responsible dog ownership has been funded through the Environmental Levy for 2018-2019.

Weed action program

Council is a local management authority under the BS Act. It operates under the NSW Invasive Species Plan (NSW DPI, 2018), North Coast Weeds Action Program (NSW DPI, 2015), and the North Coast Regional Strategic Weed Management Plan 2017-2022 (NSW, LLS, 2017) which identifies state, regional and other regional priority weeds.

The responsibility for removal of weeds applies to the landholder to ensure that biosecurity risks are prevent, eliminated or minimised so far as is reasonably practicable. Priority weeds in Bellingen Shire targeted for eradication are:

- Tropical Soda Apple
- Seeded Banana
- White Blackberry
- Kidney Leaf Mud Plantain
- Mahonia
- Scotch Broom
- Black Locust
- Japanese Walnut.

Additional funded projects for control of seeded banana, white blackberry, red cestrum, coral tree, Chinese celtis, and tropical soda apple.

Council funds ongoing maintenance of existing project restoration sites:

- Restoring Reserves of the Never Never
- Newry Island Foreshore Rehabilitation
- Environment Levy Community Grants
- Coastal Management Program
- Bellingen Island Flying Fox Camp Management Plan
- Koala Plan of Management
- Dalhousie Creek Entrance Management Plan and littoral rainforest restoration
- Bellingen Riverwatch partnership project

Council also supports projects carried out by Bellinger Landcare, Bellingen Urban Landcare, Jalligir Biodiversity Alliance, Envite, OzGreen and other community groups.

River rehabilitation program

As part of the River Rehabilitation Program, Council provides support to projects that address problems such as weed invasion, lack of native tree cover, erosion and sedimentation, that enable Council to work with the community to ensure healthy rivers are maintained and improved now and into the future. Council's river rehabilitation projects are funded through external grants, often with matching contributions from Council's Environment Levy and/or private landholders. Selection of project sites and activities depends on a range of factors including:

- Grant priorities and eligible activities
- Landholder interest, capacity to provide matching contributions (cash and/or in-kind) and commitment to follow-up maintenance
- Strategic priorities (often guided by management plans, studies and/or condition assessments).

Newry Island foreshore

Council is undertaking a Fish Habitat Action Grant for Newry Island Foreshore, in the Kalang River Estuary, to stabilise 500 m of eroding river bank. Techniques for river bank stabilisation include rock revetment and rock and timber fillets incorporating re-used root balls and tree trunks from Pacific Highway upgrade clearing. This provides a demonstration of best practice resource recovery enabled by effective industry and community engagement through DPIE and Council's former Environment Sustainability Advisory Committee, and the current Bellingen Floodplain, Coast and Estuary Committee. On-ground works include fencing the river bank to exclude stock access, planting native trees, encouraging mangrove recruitment and managing weeds to improve the condition of areas of the EEC Swamp Oak Floodplain Forest.

Friesians and fish - Bellinger River floodplain and estuary water quality improvement

A grant from the NSW DPIE Estuary Management Program (<https://www.environment.nsw.gov.au/topics/water/coasts/coastal-and-estuary-grants>) allows Council to continue its work with the local dairy industry to improve water quality and contribute to more sustainable farming practices, particularly as dairies are the dominant land use surrounding the estuary. The project provides matched incentive funding for implementation of priority actions identified in voluntary assessments by eleven dairy farms. Project planning and implementation is through a partnership between BSC, Bellinger Landcare Inc. and dairy farmers with support from North Coast Local Land Services (LLS), Norco Dairy Cooperative, Urunga Anglers and oyster growers.

Rock fillets for fish fillets

A river health project was implemented in the Bellinger Estuary adjacent to Mylestom Drive at Mylestom and Repton. River bank stabilisation structures called 'rock fillets' were constructed to protect the banks from erosion by dissipating wave energy and providing a slack water environment to encourage sediment deposition and mangrove regeneration. Artificial 'reef balls' were also installed to improve

fish habitat. Weed control and revegetation works were also implemented along the river banks and are regularly maintained to further boost the river health benefits of this project.

NSW Soil Conservation Service managed this project with funding from North Coast Local Land Services, NSW Primary Industries, NSW Recreational Fishing Trust and BSC. Other project partners included OEH, Bellinger Landcare, Lend Lease, Holcim and local landholders. NSW Roads and Maritime (RMS), Urunga Amateur Anglers and the North Beach Community Alliance also provided valuable support throughout the project.

Bellingen Island river bank stabilisation

This project implemented best practice river bank stabilisation works to protect Bellingen Island and its Lowland Subtropical Rainforest EEC. The project installed wooden pin groynes, log and rock revetment work and native seedlings have been planted to stabilise the riverbank to the west of the Island.

The project was completed in partnership with North Coast Local Land Services (design & grant funding), Council's Works Team, private contractors and Bellinger Urban Landcare (BULC).

There is also ongoing bush regeneration work by Council and two Landcare groups. Council maintains the revegetation on the river bank which was undertaken for the project described above. Bellinger Urban Landcare works at the western end of the island and Bellinger Island Landcare Group has been working in the rainforest at the eastern end of the island since 1997.

River health monitoring and river health plans

A comprehensive assessment of the health of the Bellinger and Kalang Rivers was undertaken in 2009-10 (Ryder, et. Al, 2011) with State government and the University of New England (UNE). Data collected was compiled into report card documents, as listed below. BSC undertook a comprehensive process to develop the Bellinger River Health Plan (BSC, 2010) and the Kalang River Health Plan (BSC, 2010):

- Bellinger-Kalang Rivers Ecohealth Project, Assessment of River Condition 2009-2010
- The condition of freshwater fish assemblages in the Bellinger Catchment
- EcoHealth Questions and Answers
- Score Card Calculations
- Bellinger River Health Plan
- Kalang River Health Plan.

The Bellinger and Kalang Rivers Estuary and Health Management Plans are known collectively as the Bellinger River Health Plan (BSC, 2010) and Kalang River Health Plans (BSC, 2010). The Plans document and prioritise river health issues and recommend actions to address those identified issues.

Antimony monitoring at Wild Cattle Creek, Dorrigo

As part of BSC's ongoing water quality monitoring, Council has commenced a water quality testing regime to gather baseline data for the levels of antimony in Wild Cattle Creek and the Bielsdown River, prior to any further mining being undertaken.

There is currently an exploration license for the antimony deposit at Wild Cattle Creek (the Bielsdown Project) which was discovered in the late 1800s and mined on a small scale until the 1970's. At this stage, further operations are in the exploration stage and it has not been confirmed if, or when, any further mining operations may eventuate. The independent water quality data collected by Council will be used to compare data should further mining commence and therefore, will allow the identification of any impact on the tested waterways.

A report was prepared by UNE in June 2015 on Antimony and Arsenic in Wild Cattle Creek (Ryder and Mika, 2015).

Water quality monitoring

Water quality monitoring has been undertaken in the Bellinger and Kalang Rivers, see Section 3.1.3.

River rehabilitation fact sheets

Council has prepared a number of fact sheets relating to river rehabilitation:

- Biodiversity of the Bellinger and Kalang River Systems
- Managing Stock on Waterways and in Wetlands
- Managing Erosion in the Bellinger and Kalang River Systems
- Bellinger Kalang River Estuary Revegetation Guide
- Revegetating Streams in the Bellinger and Coffs Harbour Catchments
- Growing Lomandra from Seed
- Managing River Oaks and other vegetation in Gravel Bed Rivers.

Bellingen Shire estuary inundation mapping study

The Bellingen Shire Estuary Inundation Mapping Study (BMT WBM, 2015) describes tidal inundation extents for both typical ocean conditions and severe storm events under existing and future mean sea level conditions for each estuary along the coast. The study includes maps and recommended management actions for all areas under tidal influence within the Bellingen Shire. This provides Council and the community with important information for a proactive response to future sea level rise and tidal inundation. A risk-based approach (likelihood and consequence) was applied to the study to guide the development of options for infrastructure and ecological assets. With appropriate planning, the level of social disruption, economic loss and environmental impacts can be minimised during future severe storm events.

Estuary action plans

In 2011, Council prepared the Bellinger River Estuary Action Plan (cited in Bellinger Shire SOE 2010-2011) in partnership with the Northern Rivers Catchment Management Authority. This plan includes site action plans for 54 river front properties (on private and public land) from Lavender's bridge in Bellinger downstream along the Bellinger River to Mylestom. Each site action plan includes a description of the condition of the river bank and adjacent land (e.g. erosion, native vegetation, weeds) and recommended actions and cost estimates to improve the health of that riparian zone. On-ground works have been implemented at over half of these sites through grant funded projects.

In 2014, Council completed the Bellinger and Kalang Rivers Estuary Action Plan Stage Two (BMT WBM 2014) with financial assistance from the NSW Government through the OEH. Stage Two extended further downstream to include one site in the lower Bellinger estuary and five additional sites along the Kalang estuary. These six sites were selected strategically, based on priority areas identified in the Bellinger and Kalang River Estuaries Erosion Study (Telfer, 2010) and high levels of landholder interest and capacity.

Bellinger and Kalang estuaries erosion study 2010

The Bellinger and Kalang Estuaries Erosion Study (Telfer, 2010) adopted by Council provides a comprehensive understanding of erosion within the estuaries and identifies priority areas for action. Out of 28 sites with identified significant erosion, five sites were recommended as Highest Priority, four sites as High Priority, with the remainder all considered to be Moderate Priority. The implementation of on-ground work to address erosion in these areas is dependent upon factors such as landholder willingness, available resources, and the ability to remove disturbance factors.

Bellinger and Kalang Rivers estuary management plan

The Bellinger and Kalang Rivers Estuary Management Plan (BMT, WBM, 2007) includes management objectives for the Bellinger and Kalang River estuaries, developed through consultation with the community and stakeholder organisations and review of specific scientific investigations and other existing information. Major concerns identified were water quality, bank erosion, habitat management, waterway use, land management, the need for community education, fisheries and tourism management. As such, the plan proposes measures for the protection of estuarine habitats and ecosystems in the long-term, including maintenance in each estuary of the necessary hydraulic regime; conservation of the aesthetic values of estuaries and wetlands; prevention of further estuary degradation; repair of damage to the estuarine environment; and sustainable use of estuarine resources, including commercial and recreational uses.

The Bellinger River Health Plan (BSC, 2010) identified high priority areas for the remediation of loss of riparian vegetation, biodiversity habitats and weed invasion, including Dorrigo, Bellinger-Thora, Bellinger township, Hydes Creek, Bellinger; medium to high priority areas including Upper Thora and Gleniffer; and medium priority at Raleigh, Raleigh - Repton and Mylestom. The Kalang River Health Plan (BSC, 2010) identified high priority areas for the remediation of loss of riparian vegetation, biodiversity

habitats, weed invasion and wetland management. These areas include Upper Kalang, Middle Kalang, Lower Kalang, Newry Island and Urunga.

A number of strategies are recommended in the action plan for impacts on biodiversity, and impacts such as erosion, sedimentation and pollution, and impacts from boating and recreation.

Bellingen coastal management program

The Bellingen Coastal Zone Management Plan (WBMT, 2014) was prepared to preserve the high quality of environmental, recreational, cultural and economic values associated with the open coast and provides practical actions for managing threats from coastal hazards to the coastal zone in the Bellingen Shire. The plan is funded by the NSW DPIE to comply with NSW State legislative requirements. The natural and undeveloped beauty of the Bellingen coastline is highly valued by visitors and residents alike, and these features make it far more adaptable to coastal hazards such as erosion and future sea level rise than other parts of NSW. Therefore, a key aim of the plan is to preserve its naturalness.

To update the plan and address the new Coastal Protection legislation, Council is currently preparing a Coastal Management Program (CMP) to address key issues within Bellingen Shire's coastal catchments and prioritise management actions to be targeted over the next 10 years. This is a long-term plan to manage the Shire's coastline and estuaries, and Council will be working with the community and NSW government throughout the CMP process.

Stage 1 of the Coastal Management Plan process involves a scoping study Guided by the NSW Coastal Management Manual (<https://www.environment.nsw.gov.au/topics/water/coasts/coastal-management/manual>) which has been funded through the NSW Government Coastal and Estuary Grants scheme and Council's Environment Levy. The aim of this study is to identify stakeholders, establish objectives, determine key coastal management issues and review current arrangements.

Bellingen Emissions Reduction Program

Bellingen Shire Emission Reduction Program Council is committed to reducing its contribution to climate change and to this end, has initiated the Bellingen Shire Emission Reduction Program (BERP). Bellingen Council was originally signed up to the Cities for Climate Protection (CCP) program, but since the CCP lost federal funding in June 2009, Council has elected to continue with the BERP which is based on the milestone approach of the CCP. The BERP now addresses the Climate emergency.

The 2012 BERP Report identifies Bellingen Shire Council leadership to adopt an emission reduction target of 40% on 1990 levels by 2020 in line with recommendations by the Intergovernmental Panel on Climate Change (IPCC). The report identifies and prioritises actions toward meeting the target.

One of the key strategies/ actions identified is Regeneration: a local reforestation project to sequester carbon and enable the trading of carbon offset certificates through carbon emissions trading schemes.

Bellingen Growth Management Strategy

The Bellingen Shire on the Mid North Coast of NSW is characterised by some of the finest natural and cultural landscapes in the region and is one of only a few locations on the North Coast to combine river valley and plateau landscapes. Council has initiated long-term strategic planning towards the achievement of ecologically, socially and economically sustainable development in partnership with the community. One of the key chapters is to combine development with ecological management and biodiversity. It has the objective to ensure that the ecological integrity of the rural lands are enhanced and maintained, and contains implementation strategies, policy actions, responsibility and timeframes.

Draft Housing Strategy

The Draft Housing Strategy is a plan to provide high-quality homes to all residents of Bellingen Shire and to make sure housing meets the needs and desires of our community, to guide development, decision-making and infrastructure priorities for the next 20 years. It contains key elements relating to 'Aboriginal Connections to Country and Community' and to 'Support Biodiversity in our Backyards and Neighbourhoods'.

For the Dorrigo area infill development is mainly planned (245 homes on 66 ha) with some vacant land identified for greenfield development (99 homes on 65 ha). Dorrigo is recognised as a country town and the main centre for people living in the rural areas of the Plateau. Residents of Dorrigo enjoy the highland environment, natural areas (including World Heritage listed rainforests) and productive and picturesque rural landscapes. The Town Centre has historic character and provides day-to-day conveniences and important services. Residents also value strong social ties and the space, slower pace and friendliness of living in a country town.

For the Urunga area whilst infill development is mainly planned (371 homes on 57 ha), a substantial greenfield development is identified (264 homes on 66 ha). Urunga is a coastal town located about 30 km south of Coffs Harbour. Residents of Urunga love being close to the water and enjoy the natural features of the coastline such as the river, wetlands, public foreshore and beaches. Residents and visitors enjoy Urunga's relaxed, outdoor lifestyle and the comfortable-year-round coastal climate.

For the Bellingen area infill development is mainly planned (343 homes on 94 ha), a substantial amount of greenfield development is identified (264 homes on 52 ha). Bellingen is the largest town in the Shire with residents enjoying living close to nature and appreciating the town centre's heritage character, convenience and friendly country town liveliness. Bellingen residents value community connections and many people enjoy and have strong links to arts, music and creative endeavours. Many people migrated to Bellingen in the 1970s and 80s seeking alternative or eco-conscious lifestyles and a strong sense of environmental awareness and activism is common amongst residents today.

Bellingen Shire SandWatch

Council is undertaking the monitoring of beach profiles and coastal erosions as an action in the Bellingen Shire Coastal Zone Management Plan (BMT WBM, 2014). The following beach profiles are measured and updated on a regular basis to monitor trigger points for the implementation of management actions in

the CZMP. The profiles align to data collected since the 1950s, so form an excellent basis for tracking changes in the beaches over time.

Bush regeneration and PoMs for Dangar Falls, Bellingen Island Integrated Reserves, Gleniffer Reserves

Council undertakes ongoing bush regeneration at a number of sites throughout the Bellingen Shire. One site includes the Dangar Falls and Bellingen Island Integrated Reserves to conserve an area of Antarctic Beech Cool Temperate Rainforest. As part of the implementation of the Dangar Falls PoM, a raised timber walkway was constructed by Council and with the community constructed the Labyrinth, a winding paved pathway. Council also undertakes bush regeneration and riparian rehabilitation in accordance with the Arthur Keogh Reserve PoM (GeoLink 2012). BSC has also prepared the Open Spaces Management Plan (OSMP, BSC 2012) which identifies Natural Parklands that are classified as:

- River Foreshore areas.
- Rural Nature Reserves.
- Bridle Trails.
- Regional Conservation Reserves.

The OSMP identifies some pathways occurring within the reserve that require renewal and maintenance.

Jaliigirr project priority corridor connections

The Jaliigirr landscape connections is restoring and protecting 10 biodiversity conservation sites within identified priority areas of the Coffs–Bellinger–Dorrigo region to extend and improve the connectivity and contribute to the Great Eastern Ranges Corridor. Council is part of the Jaliigirr Biodiversity Alliance (JBA) partnership with 20 organisations working together across land tenures. The project includes bush regeneration and revegetation to restore habitats for forest-dependent fauna, complemented by capacity-building activities.

The project has expanded through the addition of two new sites, across four new private properties, that expand the corridor connections of remnant vegetation by 100 ha. The landholders with high-conservation-value remnants intend to create longer-term conservation zones on their properties. One site owned by Bellinger Landcare Inc. members adjoins Dorrigo National Park, which lies within the Gondwana Rainforests of Australia World Heritage Area. The second site is owned by Land for Wildlife members and provides a valuable intact east-west corridor link and buffer between the Bellingen township and state forest areas.

Bellingen Shire Council roadside environmental management plan

The Plan is currently being prepared with funding from the Local Government and Shires Associations https://www.lgnsw.org.au/files/imce-uploads/90/CRR_announcement.pdf. Rapid assessment is being used to identify and map areas of environmental significance within Council's Roadside Reserves and train Council staff. Guidelines will be prepared for roadside management, road construction and

maintenance in Council's Roadside Environmental Management Plan. This plan will identify management actions, priorities, resourcing and will align with Council's Integrated Planning and Reporting framework for implementation.

Environmental Levy community fund

The Environmental Levy Community Fund provides eight community grants of up to \$5,000 for sustainability projects throughout the Bellingen Shire.

Riverwatch

Council supports the Bellinger Riverwatch 'Our River, Our Future' - Citizen Science Program supporting volunteers and schools, providing river and biodiversity community support and assistance.

Landcare

The Bellingen Shire invests in a yearly Landcare budget, and provides small grants and support to the Bellinger Landcare Incorporated (BLI) and Bellingen Urban Landcare (BULC) groups. This budget is then extended by the time and effort of the Landcare community volunteers. The value of Landcare volunteers is estimated at \$30 an hour (Volunteer Coordinators Manual, Sydney CMA, 2015 based on value set by the Australian Government for volunteer work under the Envirofund Grant Program). There are 11 Landcare Groups in the Bellingen Shire under the banner of BLI:

- Dandarrga Landcare (Dorrigo)
- Friends of Wonga Forest (Bellingen)
- Bellingen Island Landcare
- Bellingen Urban Landcare (BULC)
- Mylestom Landcare
- Urunga Landcare
- Never Never Catchment Group (NNCG)
- Hydes Creek Landcare
- Wenonah Dunecare
- Tuckers Rock Dunecare
- Bundagen Dunecare.

Sustainable Schools Network

As mentioned above, nine schools are registered with this program that is designed to educate students in sustainable living and protecting the environment. Many Councils and schools participate in the Network which is part of Sustainable Schools NSW, a non-government organisation managed by the Australian Association for Environmental Education NSW.

