

ATTACHMENTS

GENERAL MEETING

Wednesday 10 March 2021 at 6:30PM



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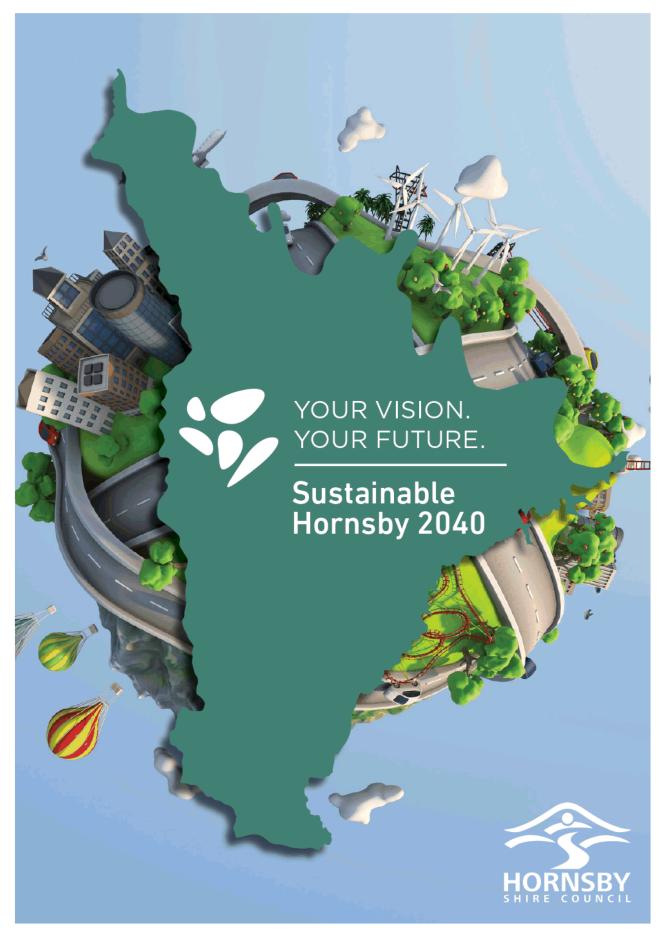
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ATTACHMENT/S

REPORT NO. GM2/21

ITEM 1

- 1. SUSTAINABLE HORNSBY 2040 STRATEGY
- 2. BIODIVERSITY CONSERVATION STRATEGY
 - 3. URBAN FOREST STRATEGY
- 4. WATER SENSITIVE HORNSBY STRATEGY
 - 5. CLIMATE WISE HORNSBY PLAN
 - **6. STRATEGY AMENDMENTS**





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Council recognises the Traditional Owners of the lands of Hornsby Shire, the Darug and Guringai peoples, and pays respect to their Ancestors and Elders past and present and to their Heritage. We acknowledge and uphold their intrinsic connections and continuing relationships to Country.

Indigenous Connections to Country

The Aboriginal heritage of the Hornsby Shire region was at least 15,000 to 20,000 years old by the time European settlers arrived in 1788.

The Hawkesbury River, called Deerubbin, was central to their way of life. Yams, a staple food, grew plentifully along the riverbanks, and both men and women fished for fish, eels, and shellfish within the river. Bark canoes were used for travel and transportation along the rivers and creeks which provided efficient transport routes for the Darug and Guringai people.

Many of the local names reflect this longstanding connection to water, such as Deerubbin meaning "wide, deep water" and Cowan meaning "big water."

There are more than 200 known Aboriginal heritage sites in Hornsby Shire, including rook shelters, middens and engravings. Burial sites are not common, but they are the most sacred sites to Aborigines. Around the year 1900 a burial site was discovered in the Ku-ring-gai Chase National Park, which also contains carvings of many types. Middens and carvings can be found at Bobbin Head and Berowra Waters, while a collection of ceremonial carvings can be found off the Pacific Highway near Berowra.

Cultural heritage is not confined to sites; it also includes peoples' memories, storylines, ceremonies, language and 'ways of doing things' that continue to enrich local knowledge about the cultural landscape. It involves teaching and educating younger generations. It is also about learning and looking after cultural traditions and places and passing on knowledge. It is enduring but also changing. It is ancient but also new (OEH, 2011).

Indigenous cultural knowledge provides crucial links between the past and present and therefore represents an essential part of the identities of Indigenous people and all Australians.





1. Executive summary

Environmental Sustainability underpins the core values of why people live and work in Hornsby. We are known as the Bushland Shire, not only for our abundant bushland but for the biodiversity in flora and fauna, waterways and rural areas. Our natural environment is one of the hallmarks of Hornsby Shire and we need to continue to work collaboratively to ensure a healthy, prosperous and resilient future for all.

The Sustainable Hornsby 2040 Strategy sets the framework for Council and the community as we embark on our journey to embed sustainability into our daily lives. Environmental sustainability underpins the four pillars of our Community Strategic Plan 2018-2028 of liveable, sustainable, productive and collaborative. Sustainable Hornsby 2040 forms the overarching Strategy that brings together the following supporting documents the Waste Matters Strategy, Biodiversity Conservation Strategy, Urban Forest Strategy, Water Sensitive Hornsby Strategy, Climate Wise Hornsby Plan and the Walking and Cycling Strategy. Additionally, Council is developing a draft Bushfire Risk Management Strategy and Coastal Management Program to inform preparedness and emergency response to Natural Hazards. In combination, this strategic work will provide the foundation on which we will work with our community on local responses that connect to global concerns.

In response to the challenges facing our natural environment and supported by our community, we are proud to develop this ambitious Strategy for enhancing environmental sustainability outcomes and increasing ecological, economic and social resilience within our Shire.

Sustainable Hornsby 2040 acknowledges the many challenges posed by climate change, population growth and urban intensification and provides a vision for a sustainable future.

Vision

Our thinking and decision-making will be for the longterm, meeting the needs of the present without compromising the ability of future generations to meet their own needs. This means ensuring that the ways in which we live, work and play will not adversely affect our environment, but offer a more sustainable lifestyle for all members of our community.

Themes and Goals

- Waste Matters
 We will ensure the sustainability of our Shire through better waste management practices
- Biodiversity Conservation
 We are equipped to ensure biodiversity is well-managed, resilient and adaptable to land-use change. The connection and conservation of natural assets will contribute to the community's health and well-being, maintain a sense of place and enhance biodiversity values in the Shire
- Urban Forest
 We will have a healthy, thriving, diverse and valued urban forest that provides shade, cooling and adds colour and life to the Shire
- 4. Water Sensitive We will be a beautiful, green and thriving Shire whose management of water and the environment supports clean waterways, sustainable resource use, and a healthy lifestyle that is connected to nature
- 5. Climate Wise We will mitigate our actions and achieve zero net emissions by 2050. We will adapt to the changing climate
- Walking and Cycling / Active Transport
 We will create an accessible, continuous and safe
 walking and cycling network that connects everyday
 destinations easily, quickly and logically
- 7. Natural Hazards We will assist our community and natural environment to develop a high level of resilience, be better able to withstand shocks and stresses and have an enhanced ability to recover from the residual impacts of natural hazards.

Guiding Principles

The following principles guide the development of Sustainable Hornsby 2040 and its implementation (refer Figure 1)

Delivering multiple benefits – In ecological systems, everything is inter-connected. Delivering on one action can deliver and amplify multiple benefits to the community and make efficient use of finite resources. In addition, a healthy and sustainable environment is not only beneficial, but essential to the health, wellbeing and resilience of communities.

Innovative and creative - To be sustainable Council must drive innovation and creativity.

Leadership – Council has chosen to take a leadership role on sustainability because it embraces its responsibility to future generations of Hornsby residents. A part of leadership will be to advocate to higher levels of government for improvements in both policy and action on sustainability initiatives and climate change. Council's legacy should be a sustainable municipality supported by innovative policies and practices.

Building partnerships – Achieving our targets will require a new approach and there will be many challenges along the way for which we do not yet have all the answers. Council will partner and collaborate with the community and likeminded organisations, businesses and government locally, nationally and internationally to ensure best practice as we move towards a more sustainable future.

Knowledge sharing – Council will share our knowledge and learn from our Indigenous Australian community, scientists, technical experts and our community.

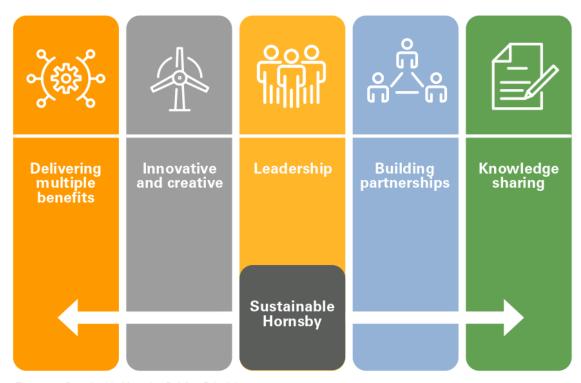


Figure 1 – Sustainable Hornsby Guiding Principles

2. Introduction

Sustainable Hornsby 2040 was developed to support Hornsby's Local Strategic Planning Statement (LSPS) which provides the framework for the current planning context for the next 20 years. The planning priorities identified in the LSPS will help guide land use decisions and local land use plans, strategies and policies, including Sustainable Hornsby 2040.

Council has a strong history of leading its community by example to progress sustainability. Several strategies and plans have been prepared to progress sustainability goals as part of the Local Strategic Planning Statement (LSPS) Future Hornsby 2040 to encourage the development of a sustainable and resilient Shire. This Strategy integrates these documents under the themes of waste, biodiversity conservation, urban forest, water sensitive, climate wise, walking and cycling / active transport and natural hazards. Summaries of each supporting document are provided in the following pages and include what Council is doing now and what Council will do in the future to deliver on the Sustainable Hornsby 2040 Vision.

As with other municipalities around the world, Hornsby faces challenges that call for innovation and decisive action, and every resident and business will play a crucial role in helping us, as a community, to reach our goals.

In response to the challenges facing our natural environment and supported by our community, we are proud to set an ambitious framework for managing environmental sustainability and increasing ecological, economic and social resilience within our Shire. Our Vision, Goals and Guiding Principles are based on the priorities expressed by the community through Future Hornsby 2040 and supported by evidence-based research, risk assessment, experience and best practice.

Climate change has already begun to have measurable impacts on our local communities. Recent bushfires and storm activities are indicators of this. Current climate projections for the Shire indicate overall average warmer and drier conditions with more frequent droughts, bushfires and extreme weather events such as storms, heavy rainfall and extreme heat days. Population growth, urban development and changing community attitudes and perceptions can pose risks for our natural environment.

Sustainability is the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs.

(United Nations World Commission on Environment and Development)

Extensive engagement was undertaken with our community for the development of the Local Strategic Planning Statement and as part of the development of Sustainable Hornsby 2040. The results illustrate that our community is supportive of sustainability initiatives and they want to ensure that our environment is protected and enhanced and that the Shire is working towards social, environmental and climate resilience. The community has a strong preference for maintaining and enhancing a clean, leafy, diverse environment and wants to work alongside Council to actively seek ways to improve a prirent mental sustainability.

As an active member of the Resilient Cities program and a contributor to the development of 'Resilient Sydney', the first resilience strategy for Metropolitan Sydney, we are well positioned to develop Hornsby-specific strategies and actions that align with the call to work as one city to strengthen our ability to survive, adapt and thrive in the face of chronic and acute stresses.

Resilience is the capacity of individuals, communities, businesses and systems within a city to survive, adapt and thrive no matter what kinds of chronic stresses and acute shocks they experience (Resilient Sydney, 2018).





Table 1 – Hornsby's Environmental Snapshot Area of land area is bushland is urban 15% of land area is rural of land area is open space

9.9

Population/Environment/Key issues

Population growth



- Population expected to grow 1 percent per annum from 147,661 people in 2016 to 179,582 in 2036
- Bulk of development to 2036 will be medium to high density residential such as multi-level apartments
- Highest growth areas for residential development are Hornsby Town Centre increasing in population by 14.9 percent, Asquith increasing by 4.5 percent and Waitara increasing by 2.46 percent
- There will be a 26.5 percent increase in retirement aged people living in Hornsby by 2026.

Environment



- Key waterways: Berowra Creek, Hornsby Creek, Cowan Creek, Lane Cove and Hawkesbury River catchments. More than 400 Stormwater Quality Improvement Devices currently protect waterways.
- Plants and Animals: 1,000 native plant species, 338 native vertebrate animal species, 26 threatened plant species and 42 threatened animal species
- Tree cover: 59 percent whole Municipality, 39 percent designated urban area
- Approximately 60,000 public urban street and park trees
- Households generated 62,893 tonnes of waste in 2019/20
- Our community GHG emissions profile for 2016/17 identified that we produce approximately 1.3 million tonnes CO₂-e emissions each year.

Key issues



- 45 percent of all municipal waste is recovered and diverted from landfill
- 26.4 percent of Local Government Area (LGA) has been cleared of forests
- Twelve Threatened Ecological Communities (TECs) exist within the Hornsby Shire
- Three critically endangered TECs are present, being Blue Gum High Forest in the Sydney Basin Bioregion, Sydney Turpentine-Ironbark Forest and Shale/Sandstone Transition Forest in the Sydney Basin Bioregion
- Stormwater flows continue to adversely affect the health and function of our creeks and waterways
- Climate change means that Hornsby will experience a greater number of extreme heat days, more bushfires and more extreme weather events such as storms
- There are 50 threatened fauna species listed to occur in the LGA
- Urban tree canopy is being lost at approximately 3 percent per year, predominantly on private residential land
- 35 percent of all Councils emissions come from street lighting and 35 percent from electricity
- 59 percent of all community emissions come from electricity and 27.7 percent from transport

4 Act locally but think globally

Sustainable Hornsby 2040 is guided by international, federal, state and local government environmental policies, legislation and initiatives that contribute to addressing global and national sustainability challenges facing Hornsby Shire.

Global

- United Nations Sustainable Development Goals (Refer to Figure 2)
- Paris Agreement 2015
- UN Convention on Biological Diversity

National

- Renewable Energy Target ~23.5 percent electricity from renewable sources in 2020
- Australia's 2030 climate change target 26-28 percent emissions reduction by 2030 on 2005 levels
- 2018 National Waste Policy: Less waste, more resources
- Australia's Biodiversity Conservation Strategy 2010-2030
- Commonwealth Environment Protection and Biodiversity Conservation Act 1999
- Creating Places for People An Urban Design Protocol for Australian Cities
- National Climate Resilience and Adaptation Strategy 2015

New South Wales

- Net Zero Plan Stage 1:2020-2030 and zero net emissions by 2050 target
- Biodiversity Conservation Act 2016
- State Environmental Planning Policy, Vegetation in Non-Rural Areas
- National Climate Resilience and Adaptation Strategy
- Threatened Ecological Communities Strategy 2017
- Biodiversity Conservation Investment Strategy 2018
- Rural Fires Act 1997
- Coastal Management Act 2018
- Marine Estate Management Act 2014 and the Marine Estate Management Strategy 2018-2028
- Greener Places
- Bushland and Waterways Guide 2018
- Future Transport 2056

Regional

- Resilient Sydney
- Greater Sydney Commission North District Plan
- Sydney Water
- Northern Sydney Regional Organisation of Councils (NSROC)
- 2017 Metropolitan Water Plan Water for a Liveable, Growing and Resilient Greater Sydney

Local

- Community Strategic Plan 2018-2028
- Future Hornsby Local Strategic Planning Statement
- Hornsby Local Environment Plan
- Hornsby Development Control Plan
- Waste Matters Strategy
- Urban Forest Strategy
- Water Sensitive Hornsby Strategy
- Biodiversity Conservation Strategy
- Walking and Cycling Strategy
- Climate Wise Hornsby Plan
- Natural Hazards planning (Bushfire Risk Management Strategy and Coastal Management Programs under development)

United Nations Sustainable Development Goals (SDGs) are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. The SDGs were agreed and adopted by the United Nations member states, including Australia, in September 2015 as part of the 2030 Agenda for Sustainable Development. (NSW DPIE, 2020)



The 17 Goals (shown above) are underpinned by 169 targets which guide efforts to increase global well-being through addressing some of society's key challenges.

The strategies encompassed by Sustainable Hornsby 2040 are helping to realise global targets through local action, this is shown in Figure 2.



Figure 2 – Sustainable Hornsby 2040 mapped against the UN Sustainable Development Goals

5 What our Community told us

During the development of Council's Local Strategic Planning Statement Future Hornsby 2040, we extensively engaged our local community to determine their views on sustainability values and priorities through:

- A series of pop-up community kiosks. 180 people attended these sessions
- An online community survey via Have Your Say. We received 315 submissions during the 4-week engagement in April 2019
- A survey of residents' perceptions on Hornsby's trees.
 319 people responded to the survey
- A telephone survey that was demographically representative of residents across the Shire. 618 people completed the survey during April 2019
- Individual stakeholder interviews with 10 community group representatives. The purpose of the interviews was to discuss local environmental sustainability challenges and considerations in greater depth with highly engaged and environmentally aware local community members
- An online interactive collaborative mapping tool via Social Pinpoint. We received 392 unique users to the site and 204 comments were received
- Three Biodiversity Conservation Management workshops where 321 people identified the local hazards and threats to biodiversity
- Three workshops on Visioning for a Water Sensitive Hornsby involving 24 specialists benchmarking and visioning Hornsby's water sensitive journey.

We are in the crucial decade to reduce warming. Now is the time to make significant reductions in emissions in order to stop catastrophic climate change. It needs to happen now. Tree canopy cover, waste, green spaces, reducing emissions are all interconnected.

 from Community Representative



Through extensive community engagement, the community prioritised their environmental goals as follows:

1. Climate change

Take action to mitigate the effects of climate change

2. Biodiversity management

- Protect and enhance ecosystems
- Protect and enhance tree cover across the shire

3 Water

- Improve water quality in creeks and rivers
- Upgrade water infrastructure to meet the needs of our growing population

4. Waste

 Minimise waste and resource consumption to keep our environment clean

5. Walking and Cycling / Active Transport

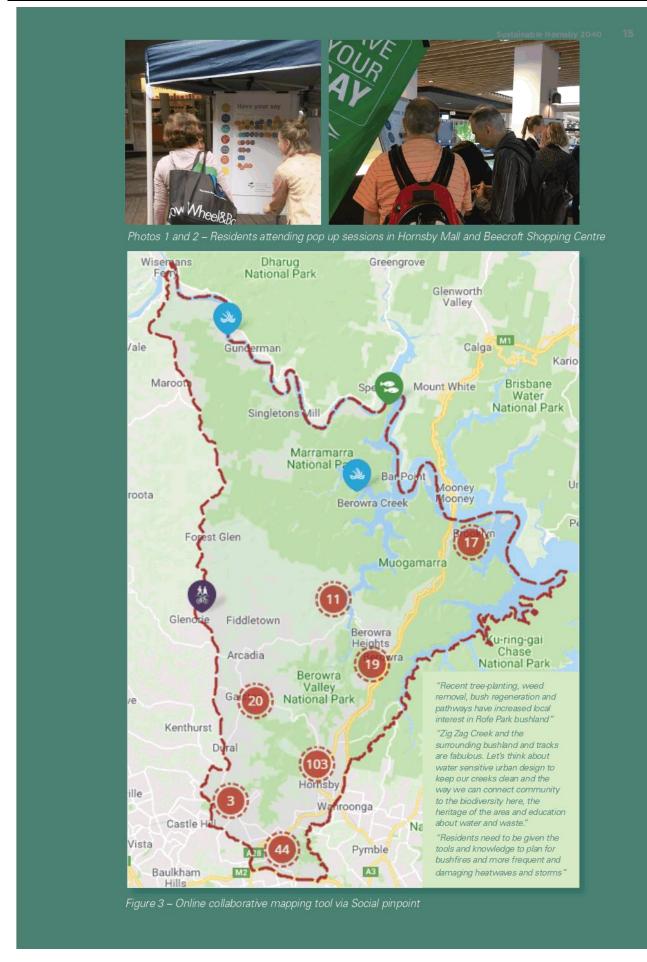
- Increase walking and cycling participation
- Improve active transport connectivity

6. Natural Hazards

■ Improve local resilience to extreme weather events

Of particular interest, the community want to see action on the following:

- Greater protection for our endangered and native species, as well as our urban forest
- New developments that are built with the highest regard to the environment and ongoing sustainability, particularly through the protection and/or appropriate replacement of trees
- Mitigation of the environmental effects of population growth (such as traffic congestion, overcrowded public transport, increased rubbish generation, degradation of walking tracks and parkland) and planning for adequate infrastructure
- Building a safe and connected walking and cycling network across the LGA. Including cycling infrastructure at railway stations such as dedicated bike racks and embracing new technologies such as e-bikes
- Educating the community around sustainable practices such as recycling and reduction in the use of single-use plastics
- Opportunities for the community to be involved in the protection of our natural environment.



6 Future challenges

Climate change

Current climate projections for the Shire indicate warmer and drier conditions with more frequent droughts, bushfires and storms as seen in Figure 4. Extreme weather events, such as storms, heavier rainfall and more extreme heat days, are projected to become more severe each-year over the next 20 years. This will have significant impacts on our environment and our community's health and wellbeing. Council will need to work with both our community and other agencies to improve our environmental resilience.

Major economic shocks

As we have seen historically from natural disasters and pandemics, and the associated economic downturn, our resources are vulnerable to major economic shocks. These events can reduce our resources and finances, which can impact our ability to care for the environment and prevent future economic shocks. It is imperative that our environmental management programs are supported by strong evidence and cost benefit analyses to improve the business case for continuity of resources during these types of shocks and stresses. Recently, the COVID-19 pandemic has demonstrated just how important our local environment is to our mental and physical wellbeing.

Population Growth

The population of Hornsby Shire is forecast to increase by 1 percent per annum, from 147,661 people in 2016 to 179,582 in 2036, requiring an additional 14,879 homes. This growth will mean a greater use of resources within the Shire potentially resulting in higher greenhouse gas production. Population growth puts pressures on our environment with more waste production, traffic and utilisation of bushland and waterways for recreation. Sustainable ways of managing this growth are possible, so that our community emissions profile doesn't grow (as seen in Photo 3).

Land Use Intensification

Population growth is driven predominantly by growth in dwelling stock. The main areas of growth in the short term are Asquith, Waitara and Hornsby (non-Town Centre area). By 2031, population growth is expected to focus in the Hornsby Town Centre in response to Council's commitment to revitalising Hornsby under the Hornsby Town Centre Review.

Urban intensification can have environmental impacts such as vegetation clearing, a reduction in permeability, increases in the urban heat island effect, increases in stormwater run-off into our waterways and further fragmentation of habitat for wildlife.

Legislation and Policy

All councils must comply with legislation and policy, which is constantly under review and subject to change. With government funding being reduced and expectation being placed on councils to fill this gap, ensuring we can survive and thrive in a changing environment will require Council and the community to adapt and consider new ways of managing our natural environment and assets.

Technology

As technology rapidly evolves, our community demands alternative methods for council service delivery. Although it is challenging to keep up with emergent technologies, it is also a great opportunity for innovation in Council. New technology, real-time data and connectivity can help us plan our public spaces to be cooler, water our parks only when needed and transition to a low carbon economy with solar panels and electric vehicle charging stations. As new technology arises, Council will endeavour to integrate this into our Smart Cities initiative.



Figure 4 - Effects of climate change



Photo 3 – Sustainable Design (eg stormwater harvesting and green roof)

6 Environmental sustainability in Hornsby to 2040

The Strategy proposes an innovative mix of leadership and collaboration, direct action and advocacy, education and partnerships. It determines Council's approach to enhancing the bushland shire character, improving local biodiversity, reducing greenhouse gas emissions and waste levels, improving sustainable transport, creating a water sensitive city and hazard mitigation by embedding sustainability into council processes.

Council has chosen to take a leadership role on sustainability because it embraces its responsibility to future generations of Hornsby residents. Council's legacy should be a sustainable municipality supported by innovative policies and practices. Sustainable Hornsby 2040 ensures a consistent and comprehensive approach to meeting these objectives.



SUSTAINABLE HORNSBY 2040















WASTE MATTERS

We contribute to the sustainability of our shire through better waste management practices.

Waste is not simply a product we no longer want; it is a design flaw in the economy that is filled with unintended social and environmental consequences. Given that landfills are Australia's seventh largest source of greenhouse gases, this design flaw needs addressing. We all create waste at home, work and at play. When we throw items away, we not only add to landfill, but lose the value embedded in the materials, create demand to extract more finite natural resources from our planet and sacrifice jobs that would be created if the waste was recycled and processed.

In 2019/20, the Hornsby community generated around 65,708 tonnes of household waste – that included 30,492 tonnes residual waste (red bin), 11,354 tonnes recycling (yellow bin), 17,449 tonnes garden waste (green bin), 931 tonnes metals and 5,482 tonnes bulky clean up waste. We currently recycle around 29,734 tonnes and send the remaining 35,974 tonnes of residual waste to landfill. This means Hornsby Shire is recovering 45 percent of our waste and diverting it from landfill.

Of the waste going to landfill from our red bins it is estimated that up to 80 percent of it could be re-used or recycled. Refer Figure 5 – Hornsby LGA: all waste generation by type.

In a recent community survey, 79 percent of residents surveyed said they are supportive or very supportive of council investing more into improved resource recovery to divert waste from landfill.

However, recent changes have created a high level of uncertainty about where Council can make step changes to improve landfill performance. China's ban on accepting imported recyclables coupled with changes in NSW Government regulation around mixed waste processing plants has left the industry uncertain on where and how best to invest in new technologies and processing plants.

What Council is doing now

Our current three bin collections service model has been proven to deliver the best value for money. Recycling in Hornsby is secure and delivering real diversion from landfill. Our contractor is the Australian market leader and has well developed domestic markets for recycled materials, only exporting what they cannot use onshore, thus reducing their exposure to changes in global commodity markets. Our garden waste is mulched

and composted here in Sydney and sold back to residents, nurseries and landscaping companies. Our red bin waste is bulked into shipping containers and sent to Woodlawn Bioreactor Landfill near Tarago, NSW where any landfill gas produced is converted into green electricity. Our bulky clean up waste goes through a resource recovery transfer station to have valuable resources recovered, including mattresses for recycling, before being landfilled in Western Sydney.

What Council will do

Through our Waste Matters: Interim Waste Management and Resource Recovery Strategy, Council aims to:

- Provide effective, affordable and innovative waste services to reduce domestic waste disposal to landfill, increase resource recovery and protect the environment
- Respond to the community's expectations, needs and requirements within budgetary constraints
- Engage and educate our community on waste matters and desired behavioural changes.

Achieving the 70 percent Resource Recovery Target (as set by NSW Government) will be done through:

- Increasing diversion of organic waste from landfill
- Maximise resource recovery from all waste streams
- Build the capacity of residents to avoid waste and build a reuse culture
- Reduce illegal dumping and littering
- Improve waste management at business, schools and at events
- Support the circular economy
- Encourage development of overarching national and state policies that facilitate optimised waste management outcomes.

Due to a NSW Environment Protection Authority ruling in 2017/18, mixed waste processing (recovering organics and recyclables from the waste stream) is no longer a viable option. The organic materials recovered from this stream, known as Mixed Waste Organic Output (MWOO), can no longer be applied to land in most situations. Council will continue to examine other options for this waste stream.





For example Council has investigated the potential to implement food and garden organics (FOGO) collection systems for single-unit dwellings. This could potentially divert an extra 10 percent from the municipal waste stream, at a cost of \$5.1 million or around \$105 per household per annum. However, implementing a FOGO system also risks contaminating the existing garden organics stream (green bin) which currently has very minimal contamination. In addition, residents may not be receptive to a fortnightly waste (red bin) collection, as is the case in most FOGO systems in NSW.

Separate food organics (FO) collections in multi-unit dwellings remain problematic due to the complexity of sorting, storing and collecting materials while minimising contamination to levels acceptable to organics processors.







Photos 4-9 - Organics through our community.



Figure 5 – Hornsby LGA: all waste generation by type for 2016/17 (Source: Adapted from Resilient Sydney, 2016/17)





BIODIVERSITY CONSERVATION

We are equipped to ensure biodiversity is well-managed, resilient and adaptable to land-use change. The connection and conservation of natural assets will contribute to the community's health and well-being, maintain a sense of place and enhance biodiversity values in the Shire.

Hornsby Shire hosts over 660 fauna species, 1,200 flora species and 90 fungi species, all of which are important contributors to our identity as the Bushland Shire. Hornsby is also home to 12 Ecological Communities that are all under threat from extinction. Hornsby's biodiversity plays a critical role in providing ecosystem services such as clean air, clean water and supporting our food systems. Biodiversity is also critical in supporting community health outcomes.

A high percentage of remnant vegetation occurs on private properties across both rural and urban lands. Increasing evidence suggests that vegetation in urban areas is also vital to maintaining biodiversity in a region. Urban wetlands, waterways, single native and exotic trees, backyard and verge gardens across Hornsby Shire can all support a range of fauna species such as Longnosed Bandicoots (Perameles nasuta), Common Ringtail Possums (Pseudocheirus peregrinus), Swift Parrots (Lathamus discolor) and Grey Headed Flying Fox (Pteropus poliocephalus).

Considering the impacts of rapid land-use change, urban development, population growth and climate change locally and globally, the need to safeguard biodiversity has never been more critical than today. This presents a challenge for Council to carefully meet the needs of a growing community population as well as the protection of biodiversity values in the lands and waters under its management.

Community consultation revealed that the greatest threats to Hornsby's biodiversity are perceived as:

- A lack of clear management, policy, funding and resources to protect and enhance local biodiversity
- Development and land clearing (both regulated and illegal)
- Habitat fragmentation and loss of remnant trees/ hollow bearing trees
- Lack of community knowledge, understanding and empathy for biodiversity.

What Council is doing now

Council and its community are the custodians of our environment and seek to protect and enhance it. We do this by:

- Maintaining a connected network of natural areas
- Improving the current natural resource condition
- Minimising impacts on natural resource condition
- Rehabilitating priority habitats and vegetation communities through bushland restoration
- Applying environmental offsets to compensate for impacts on natural resources that cannot be avoided
- Monitoring catchment health and responding to environmental pollution, public health incidents and informing management priorities
- Undertaking well informed strategic planning activities to enable improved environmental outcomes.





Photos 10 and 11 – Flora and fauna, the richness of the Shire's biodiversity.





What Council will do

Through our Biodiversity Conservation Strategy 2020, Council aims to:

- Protect and conserve ecological values
- Connect urban habitat
- Restore disturbed ecosystems to enhance ecological value and function
- Create new ecosystems
- Connect People to Nature.

By achieving the following outcomes:

- Implement a Green Infrastructure Framework and monitor its progress
- Develop comprehensive biodiversity baseline data and monitoring
- Develop appropriate planning controls and offset mechanisms to support the connection, protection, restoration, enhancement and creation of urban habitat
- Develop incentive mechanisms and implementation plans to prioritise biodiversity conservation
- Address threats and impacts to biodiversity including climate change impacts on vulnerable species
- Implement best practice weed and feral animal control, and management to improve the health of lands, creeks and waterways
- Capture, treat and reuse stormwater to create and improve habitats and waterway condition
- Coordinate community engagement and education programs to improve awareness of biodiversity values
- Forge successful community, agency and institutional partnerships to improve biodiversity outcomes e.g. citizen science engagement programs.



Photo 12 – Sundew Drosera spp. Source Alan Kwok (2019)

URBAN FOREST

We will have a healthy, thriving, diverse and valued urban forest that provides shade, cooling and adds colour and life to the Shire.

The urban forest, comprising of the trees within Hornsby's urban areas and on rural lands, contributes significantly to the liveability, natural environment and prosperity of the Shire. These trees provide a myriad of benefits from shading, carbon storage, air pollution reduction, stormwater interception, habitat and food for wildlife, as well as contributing to the landscape character that the community value so highly. Trees are a very valuable community asset, with large urban trees generating up to \$70,000 in structural and environmental values (Arboriculture Australia, 2020).

The urban forest is facing many challenges including urban densification, a changing climate, urban heat and canopy loss. It is estimated that Hornsby is losing between 2 – 3 percent of its tree canopy cover or approximately 12–15,000 trees each year. This loss is occurring primarily on private land and places increased pressure on the smaller area of public land to protect, grow and enhance the urban forest.

Climate change effects such as drought, extreme heat and bushfires also pose extreme threats to the urban forest. Such challenges require a new approach in how the forest is managed and how it interconnects with Sydney's Green Grid aspirations.

A community survey of residents showed that trees and concern for loss of tree canopy represent one of the most important current and future environmental priorities for the Hornsby LGA. Furthermore, there was a strong feeling of responsibility in providing a greener legacy for future generations and that both Council and the community should together be addressing the issue of canopy decline. However, there is little community support for increasing regulation to protect trees on private property.

What Council is doing now

Council is currently responsible for:

- Implementing Hornsby's Greening our Shire program with 25,000 trees already planted. These trees were grown by volunteers and planted in over 81 community sites
- Actioning customer requests
- Tree removal and tree planting
- Maintenance works
- Reviewing development applications that impact on private and public trees
- Enforcing the Tree Preservation Order for private trees.

What Council will do

Through the delivery of our Urban Forest Strategy 2020, Council aims to:

- Maintain and improve Hornsby Shire's unique character through the urban forest
- Increase community knowledge and connection with the urban forest
- Mitigate and adapt to climate change, including bushfires
- Protect, secure and create habitat
- Showcase integrated and sustainable design
- Provide strong leadership and good tree asset management.

By achieving the following outcomes:

- Maintain tree canopy cover on private land at 33 percent
- Increase tree canopy cover over streets from 39 percent to 50 percent
- Increase tree canopy cover over commercial zones from 11 percent to 15 percent
- Increase biodiversity corridors in streetscapes
- Improve species diversity
- Improve useful life expectancies of street trees.









Photo 13 - Native tree giveaway



Photo 14 – Mayor Philip Ruddock AO with residents planting the 25,000th tree

WATER SENSITIVE

We will be a beautiful, green, and thriving Shire whose management of water and the environment supports clean waterways, sustainable resource use, and a healthy lifestyle that is connected to nature.

Homsby Shire is known for its beautiful and accessible natural environment including its rivers and creeks, such as the Hawkesbury River, Berowra Creek, Cowan Creek and Lane Cove catchments. Feedback often received from the community is that people love living in Hornsby Shire because of its open spaces and the connection to the surrounding bushland and waterways.

However, as with all urban development, the associated land clearing, coupled with densification in urban areas, has and continues to significantly alter natural water flows, causing erosion and water quality impacts on local waterways. Furthermore, the location of Hornsby's urban footprint in the upper reaches of catchments means that these impacts are felt on high ecological-value waterways downstream.

Since the early 1990s, Hornsby Shire Council has led the way in the implementation of water sensitive urban design, largely through the catchment remediation program. Despite this proactive approach, challenges still exist, such as changing government priorities, impacts from existing and future development and increasing pressure on water systems from climate change. Hornsby Shire will need to plan wisely to adequately service a growing population in a warming and drying climate, while ensuring environmental and liveability outcomes for the region.

What Council is doing now

- Removing pollutants from waterways via catchment remediation devices
- Constructing, maintaining and renewing stormwater cleaning and harvesting devices
- Monitoring catchment health and water quality
- Undertaking environmental education and supporting existing community programs, e.g., Bushcare
- Leading the regional development of a Coastal Management Program for the Hawkesbury River.

What Council will do

Through the Water Sensitive Hornsby Strategy 2020, Council will implement strategies and actions to progress our transition to a water sensitive city. This will be done across emerging themes:

- Ensure good water sensitive governance
- Increase community capital
- Increase productivity and resource efficiency
- Improve ecological health
- Ensure quality urban space
- Promote adaptive infrastructure.

By achieving the following outcomes:

- Establish and progress an internal and crossdepartmental working group to oversee implementation of the Water Sensitive Hornsby Strategy
- Ensure water sensitive city outcomes are embedded in policy and planning
- Develop new knowledge for the range of outcomes needed to deliver Hornsby Shire's water sensitive city vision, specifically community and Aboriginal engagement solutions
- Leverage partnerships and project opportunities to demonstrate and build the business case for multifunctional, water sensitive solutions
- Strengthen compliance for environmental and waterway health outcomes.















Figure 6 – Artistic impressions of emerging themes: Hornsby's natural environments are healthy and thriving with biodiversity, Hornsby Shire has engaged, empowered and active communities who value Aboriginal and multi-cultural connections to land and water (Source: Stephen Pym)









Figure 7-10 – Artistic representations of water sensitive city outcomes including urban greening, improved amenity, recreation, and social cohesion (Source: CRCWSC)

CLIMATE WISE

We will achieve net zero emissions by 2050, mitigate our impacts and adapt to the changing climate

Greenhouse gas (GHG) emissions in Hornsby are generated through electricity and gas usage, transport, purchases of materials and waste generation.

In 2019, Council reinforced its desire to take action on climate change by setting a target of net zero emissions by 2050. Becoming a net zero emissions Council and community is a significant task – one which we must work together to reduce our emissions and keep global heating below 2 degrees Celsius.

To understand our greenhouse gas emission profile, Council developed its inventory in line with the National Greenhouse and Energy Reporting Guidelines for corporate emissions reporting. Corporate emission profiles were also prepared in accordance with the international GHG Protocol Corporate Accounting and Reporting Standard, and the National Carbon Offset Standard (NCOS). NCOS allows an organisation, like Council, to measure, reduce, offset, report and audit emissions that occur as a result of its operations. Community carbon emissions have been calculated using the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories. All of these standards classify emissions into three scopes (illustrated in Figure 11).

Scope 1 – direct emissions from the activities of an organisation or under their control, including gas usage in buildings, fuel for vehicles and air-conditioning leaks.

Scope 2 – indirect emissions from electricity purchased and used by the organisation or in assets owned by it.

Scope 3 – all other indirect emissions from activities of the organisation, occurring from sources that they do not own or control, including emissions associated with streetlighting, procurement, waste and water.

During 2017/18, Council's annual emissions were 12,080 tonnes CO₂-e. One third of Council's measured emissions comes from our corporate electricity consumption (35%), while another third comes from electricity consumption from public street lighting (35%). Other emissions of note were transport emissions, the majority of which come from Council fleet (11%), emissions from contractor fuels (9%), and emissions from natural gas consumption (7%). The contribution of emissions from all other sources were minor (3% collectively) as seen in Figure 12.

During 2016/17, community emissions generated 1.3 million tonnes CO₂-e (Resilient Sydney, 2019). This profile figure was generated by the analysis of data on transport, waste and water practices in our municipality. Our community emission total represents 2.7 percent of Greater Sydney's emissions (Resilient Sydney, 2019). Electricity usage was the largest contributor (58.9 percent) at 763,605 tonnes CO₂-e . On average, Hornsby Shire residents used 22kWh of electricity per day per dwelling (7.81 tonnes CO₂-e per year and an average of 2.80 tonnes CO₂-e / capita). Transport was the second largest contributor (25.7 percent), followed by waste (12.2 percent) and gas (3.2 percent) as seen in Figure 13.

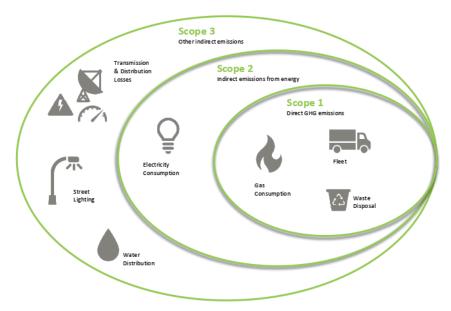


Figure 11 - GHG Emissions Scopes (Source: Adapted from Ironbark Sustainability, 2019)







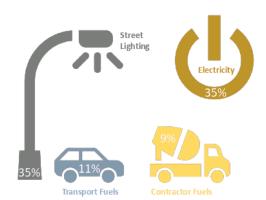




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- Developing and promoting sustainable transport planning and travel modes across the Shire
- Participating in the Resilient Sydney Strategy with 33 other metropolitan Councils
- Installing energy efficiency measures e.g. solar panels and LED lighting
- Implementing our Car Share Policy
- Implementing the Streetlight Improvement Program
- Delivering sustainability education events
- Maintaining and renewing Council owned energy efficient assets
- Continually improving Council facilities to reduce energy use
- Facilitating an Environmental Sustainability Advisory Committee







- Accommodation
 Asphalt
 - FlightsHire cars and taxisLubricants
 - Office Paper
 Stationary fuels
- Figure 12 Hornsby LGA: all Emission by Source for 16-17 2017/18 (Source: Adapted from Resilient Sydney, 2016/2017)

What Council will do

Through our Climate Wise Hornsby Plan 2020, Council aims to:

- Reduce Council's corporate greenhouse gas emissions to 32 percent below 2018 levels by 2025, 53 percent below 2018 levels by 2030 and net zero by 2050
- Support the community in the goal of reaching net zero emissions by 2050 through the delivery of programs and initiatives that further community greenhouse gas emission reduction efforts
- Reduce Council's and the community's vulnerability to a changing climate and implement adaptation measures associated with temperature, hot days, average rainfall, wind, fire weather, sea-level rise and rain intensity.

This will be achieved by:

- Installing energy efficient LED street lighting
- Improving fleet performance and transitioning to low emission vehicles, electric vehicles and new technology hybrid vehicles
- Providing electric vehicle (EV) charging stations
- Improving energy efficiency of Council buildings
- Advocating for public transport
- Increasing diversion of waste from landfill
- Partnering to increase solar installations across the shire
- Advocating for low energy precincts and buildings
- Implementing actions from Council's Climate Change Risk Assessment
- Developing a community resilience program.

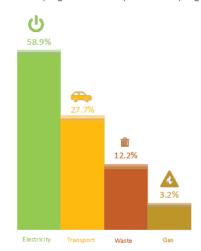


Figure 13 – Hornsby LGA: all Emission by Source for 16-17 2017/18(Source: Adapted from Resilient Sydney, 2016/ 2017)

WALKING AND CYCLING/ ACTIVE TRANSPORT

We will create an accessible, continuous and safe walking and cycling network that connects everyday destinations easily, quickly and logically.

Given that transport is the second largest contributor to Hornsby's greenhouse gas emissions, encouraging residents to reduce vehicle use by opting to walk and cycle is a priority for Council. This has the added benefits of both reducing traffic congestion, but more importantly, improving health and wellbeing outcomes within the community.

However, there is considerably more work to be done to provide attractive and safe options for people to leave their cars at home and travel by foot or bicycle. Convenience, amenity and safety are critical requirements, the latter greatly influencing children's ability to independently walk and cycle to school or for recreation.

What Council is doing now

- Developing and promoting sustainable transport planning and travel modes across the Shire
- Park enhancements, including building and maintaining walking trails and paths
- Construction and maintenance of shared paths, including cycling paths and bushwalking tracks
- Construction of footpaths to connect existing facilities

What Council will do

Through our Integrated Land Use and Transport Strategy 2004 and Walking and Cycling Strategy 2020, Council aims to:

- Promote the benefits of walking and cycling within the Shire
- Create streets and roads that are safe and conducive to walking and cycling
- Improve links to key destinations, including bush walking tracks
- Increase the priority for pedestrians and cyclists relative to vehicular traffic
- Ensure the recommendations of the Hornsby Shire Bike Plan and Pedestrian Access and Mobility Plan (PAMP) are implemented, reviewed periodically and revised
- Develop a formal pedestrian planning strategy for the whole Shire.

By achieving the following outcomes:

- Update the Integrated Land Use Transport Strategy
- Run publicity and promotional events
- Educate the community about the health and environmental benefits of active transport
- Integrate pedestrian and cycling planning priorities into all Council activities
- Establish links and connections between existing facilities
- Provide new facilities.

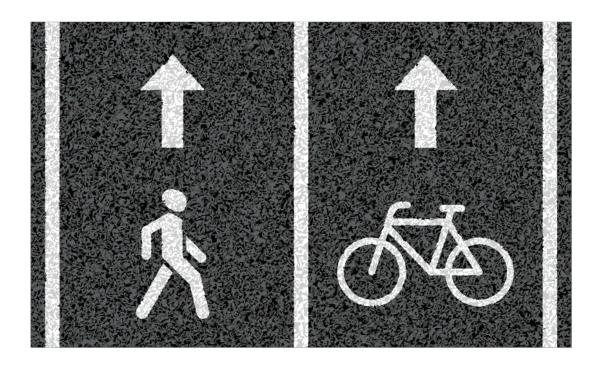


Photo 15 - Example of a shared pathway











NATURAL HAZARDS

We will assist our community and natural environment to develop a high level of resilience, be better able to withstand shocks and impacts and have an enhanced ability to recover from residual impacts of natural hazards.

Homsby is already being impacted by a range of natural hazards such as extreme storm events, bushfires, flooding, drought, urban heat island effect and coastal inundation. Climate change is likely to increase this risk over time causing damage to life and property. AdaptNSW climate data modelling indicates significant challenges for NSW in terms of scenarios for air temperature, rainfall, wind, bushfire incidence and sea level rise. The predictions for the Hornsby region can be seen in Table 2 below.

There is currently 68 percent of Hornsby Shire land classified as Bushfire Prone Land making bushfire the most significant potential natural hazard for the municipality. Many residents within Hornsby Shire live in close proximity to the bush, as it provides aesthetic and recreational opportunities, however such proximity increases the potential risk of bushfire impacting life and property. Over the past two years, Hornsby Shire has experienced several major storm events causing damage, social disruptions and financial costs.

Many low-lying properties in the Hornsby Shire are known to be vulnerable to flood and inundation. To protect property from this risk, restrictions on development consider a 100-year flood events and take into consideration predicted sea level rises.

	Scenario	Projected Future Change		
4	Bushfire Incidence	Increase in severe fire weather. Forest Fire Danger Index (FFDI) is used in NSW to quantify fire weather. The FFDI combines temperature, humidity and wind speed. Fire weather is classified as severe when the FFDI is above 50.		
<u> </u>	Decrease in East Coast Lows (ECLs) during winter and an increase in frequency and of ECLs during the summer months. ECLs impact on dam filling cycles. Projections indicate that there is an expected Sea Level Rise (SLR) of 0.4 metres by 2050 and 0 by 2100.		ct on dam filling cycles. Projections from 2007	
		2030 Projection	2070 Projection	
	Air Temperature	Maximum temperatures to increase by 0.7° C Minimum temperatures to increase by 0.6° C 4 more days above 35° C / year	Maximum temperatures to increase by 1.9° C Minimum temperatures to increase by 2.0° C 11 more days above 35° C / year	
***	Rainfall	Rainfall is projected to decrease in spring and winter.	Rainfall is projected to increase in summer and autumn.	
1	Wind	Change in average wind speed between -5% and +8%	Change in average wind speed between -16% and +24%	

Table 2 – AdaptNSW climate change challenges for Metropolitan Sydney (Source: AdaptNSW, 2019 based on 2014 levels)



Photo 16 - Bureau of Meteorology storm cell radar

Coastal inundation and extreme water levels will also be exacerbated for properties adjacent to the Hawkesbury estuary, as mean sea levels continue to increase. While all risk cannot be eliminated, it is important for Council to undertake precautionary measures to maximise community safety, while also managing the ecological impacts of these events on our natural environment.



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What Council is doing now

- Monitor estuary condition to inform management priorities and actions
- Maintain asset protection zones and help coordinate fire reduction activities with RFS and the community
- Continue to improve our understanding of bushfire, flood and coastal inundation risk to guide appropriate development decisions
- Work collaboratively with combat agencies to improve approaches to emergency preparedness, management and response
- Developing and implementing effective, risk-based land management and planning arrangements and other mitigation activities
- Having effective arrangements in place to inform people about how to assess risks and reduce their exposure and vulnerability to hazards
- Working in a swift, compassionate and pragmatic way to help communities recover from devastation and to learn, innovate and adapt in the aftermath of disastrous events
- Working with our insurers to ensure climate change risks are identified and adaptation strategies developed.



Photo 17 - Bushfire clean up by RFS

What Council will do

Through the implementation of our:

- Bushfire Management Strategies Hornsby Ku-ringgai Bushfire Risk Management Plan and Hornsby Bushfire Risk Management Strategy
- Coastal Management Programs Hawkesbury / Nepean and Sydney Harbour Coastal Management programs
- Flood Plain Risk Management Plan
- Urban Forest Strategy
- Biodiversity Conservation Strategy
- Water Sensitive Hornsby Strategy, and
- Climate Wise Hornsby Plan.

Council aims to:

- Reduce the risk of natural hazards
- Advocate for the undergrounding of overhead power lines
- Maintain infrastructure
- Educate and engage with the community through a community resilience program
- Increase social and ecological resilience to impacts of natural hazards
- Support the community to become more prepared and resilient in living with natural hazards
- Increase our capacity to recover quickly from disruptions.

By achieving the following:

- Adopt best practice methodology to model and analyse natural hazards and risk to community assets
- Continually incorporate best available data
- Determine and prioritise mitigation, adaptation and management responses
- Communicate natural hazard risk to the community at the hazard interface e.g. bushfire, coastal, flooding zone.

6 Integration

Sustainable Hornsby 2040 is based on the interconnection and holistic linking of several key Council documents including:

- Waste Matters Strategy 2019
- Biodiversity Conservation Strategy 2020
- Urban Forest Strategy 2020
- Vision and Transition Strategy for a Water Sensitive Hornsby 2020,
- Climate Wise Plan 2020
- Walking and Cycling Strategy 2020
- Integrated Land Use and Transport Strategy 2004
- Bushfire Management Strategy
- Coastal Management Programs
- Flood Plain Risk Management Plan.

Many of the outcomes and actions of the supporting strategies and plans are complementary and synergistic. For instance: outcomes from the Waste Matters Strategy of reducing illegal dumping and littering and protecting the environment, will strengthen the objectives of the Water Sensitive Hornsby and Biodiversity Conservation Strategies by further protecting the environment and restoring disturbed ecosystems.

The outcomes of the activities of the Coastal and Floodplain Management strategies will result in improved treatment and reuse of stormwater, which will further create and improve habitats and waterway conditions. Both will ensure quality urban space, as will implementation of the actions of the Urban Forest Strategy, Together with the Urban Forest Strategy, Hornsby Shire will see an increase in biodiversity corridors and tree canopy. These strategies also interconnect with the Integrated Land Use and Transport Strategy 2004 and Walking and Cycling Strategy 2020 which plans to establish connections between existing facilities and improve streetscapes to be safe and conducive to walking/cycling. That strategy aims to educate residents of the health and environmental benefits of walking and cycling within the Shire, which aligns well with the Biodiversity Conservation Strategy aim of connecting people to nature and the Climate Wise Hornsby 2020 strategy of reducing greenhouse emissions.

In train, the Climate Wise Hornsby objective of reducing greenhouse gas emissions, will be amplified by the results of the Waste Matters Strategy of reducing domestic waste disposal to landfill, reduced car usage ensuing from the Integrated Land Use Transport Strategy, and reduction of urban heat effects due to the Urban Forest Strategy.

Through the implementation of our Urban Forest Strategy, Water Sensitive Hornsby Strategy, and Climate Wise Hornsby Plan, Council aims to reduce the risk of natural hazards. Council is developing a draft Bushfire Risk Management Strategy and Coastal Management Programs to inform preparedness and emergency response to natural hazards. In combination, this strategic work will provide the foundation (actions and project outcomes) on which we will work with our community.



Photo 18 – Macro and micro the world in every dewdrop.



Photo 19 – Community Collaboration on the Strategy.

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7. Collaboration

We will seek opportunities to leverage external funding sources where possible. We will also leverage our strong and productive relationships with state and local governments, not-for-profit organisations, research organisations and community groups to maximise our combined impact. As shown in Figure 14 we will work with the following agencies on our priorities.

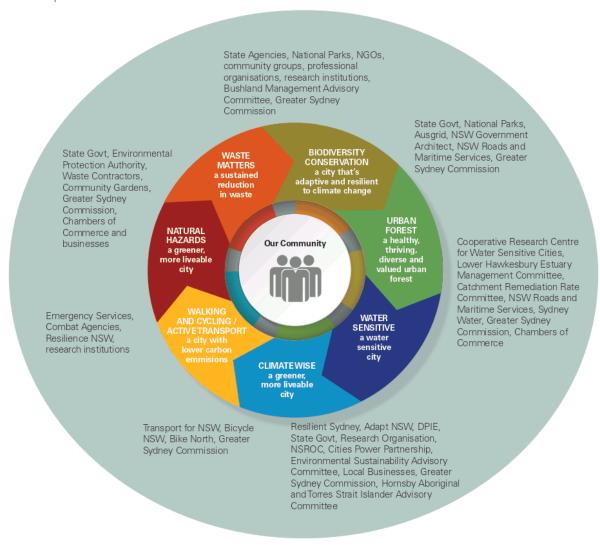


Figure 14 – Collaborators on Sustainable Hornsby 2040 with our community always at the centre.

8. Monitoring and Reporting

Continual monitoring will be undertaken on each theme to report on progress against the delivery of its goals. Every four years, Council will revise this Strategy and the supporting documents and provide appropriate updates.

Updates will be provided through Council's annual reporting process to ensure we adapt to the fast-paced changes in technology, science and the political environment. The implementation of actions/tasks will be subject to the prioritisation and availability of Council staff and financial resources.

The following monitoring will be undertaken at various timepoints to track our progress:

- CRC for Water Sensitive Cities benchmarking
- Public tree audits and tree canopy cover data acquisitions
- Waste audits for the amount of waste collected and recovered
- Greenhouse gas emissions for corporate and community and percent reduction achieved
- Number of actions implemented in the Biodiversity Conservation Strategy
- Establish baseline biodiversity and natural resources monitoring program
- Benchmarking against ICLEI International Covenant of Mayors
- Preparation and delivery of Natural Resource Education, Engagement and Communications Strategy
- Reporting on implementation will also occur through Council's advisory groups.
- A list of key actions and tasks from each strategy can be found in Appendix 1.

Advisory Committees

Council has a number of advisory committees that assist Council with environmental and sustainability matters. These committees include:

Environmental Sustainability Advisory Committee (FSAC)

The purpose of the Environmental Sustainability Advisory Committee is to advise Council on environmental sustainability related issues and be a conduit to the community for engagement on environmental sustainability matters. The Committee particularly advises and participates in the implementation, monitoring and review of Sustainable Hornsby 2040.

The membership of the committee comprises:

- Up to five Councillors
- One senior representative of the Strategy and Place Unit
- Up to seven community representatives as approved by Council that are demographically representative of the Shire
- Membership is also to be offered to relevant government agencies.

Bushland Management Advisory Committee (BMAC)

The purpose of the Bushland Management Advisory Committee is to advise Council on implementation of best practice bushland management, help promote bushland programs and assist in the community engagement of implementation of bushland programs.

The membership of the committee comprises:

- Up to four Councillors
- One senior representative of the Natural Resources Branch
- Up to seven community representatives as approved by Council
- Up to 3 representatives from an organisation related to care or maintenance of bushland
- Membership is also to be offered to relevant government agencies.

Lower Hawkesbury Estuary Management Committee (LHEMC)

The purpose of the Lower Hawkesbury Estuary

Management Committee is to oversee the
implementation of actions and strategies as contained
within the Lower Hawkesbury Estuary Management Plan.

The membership of the committee comprises:

- Up to three Councillors
- Relevant NSW State Government agencies and authorities
- Community representatives (individuals, boating associations, recreational groups, resident progress associations, fishing clubs, etc.)
- Commercial representatives (tourism, fishing, oyster farming, marinas, etc.)
- Central Coast Council.

Hornsby Aboriginal and Torres Strait Islander Consultative Committee (HATSICC)

The purpose of the Hornsby Aboriginal and Torres Strait Island Consultative Committee is provide a vital link between Hornsby Shire Council and the Aboriginal and Torres Strait Islander peoples in the Hornsby LGA, respecting Aboriginal and Torres Strait Islander peoples' right to self-determination and community empowerment. The committee provides advice, input and feedback in Hornsby Shire Council's business and affairs relating to Aboriginal and Torres Strait Islander people within the LGA including appropriate approaches for consultation with the Aboriginal and Torres Strait Islander communities. The committee also provides advice, input and feedback to Council's work to promote an increased knowledge and understanding of Aboriginal and Torres Strait Islander culture and society in the wider community.

The membership of the committee comprises:

- Up to 6 Councillors
- A maximum of 12 community members, and applicants must be:
 - a representative of the Traditional Owners in the Hornsby LGA, that is the Durug and Guringai peoples; or
 - Aboriginal or Torres Strait Islander peoples who live, work, study or have a strong commitment to the Hornsby LGA; or
 - An individual or representative of a local community organisation with a demonstrated commitment, sensitivity to and understanding of issues relating to the local Aboriginal & Torres Strait Islander people.

Council looks forward to working with our community on this integrative and ambitious strategy and to the positive future we can co-create together one step at a time.



References

Arboriculture Australia, 2020, I-Tree Eco, https://arboriculture.org.au/education/i-tree

Adapt NSW, 2019. NSW Climate Change Snapshot. https://climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/Climate-projections-for-your-region/NSW-Climate-Change-Downloads

Forecast id., 2020. Hornsby Shire Council Population summary (derived from the Australian Bureau of Statistics) https://forecast.id.com.au/hornsby/populationsummary

Greater Sydney Commission, 2018. North District Plan. https://www.greater.sydney/north-district-plan

Hornsby Ku-Ring-Gai Bush Fire Risk Management Plan, 2016. http://hkbfmc.org/wp-content/uploads/2017/08/ Hornsby-Ku-ring-gai-Bush-Fire-Risk-Management-Plan-2016-2021_Approved.pdf

Hornsby Shire Council, 2013. Flood Plain Risk Management Plan https://www.ses.nsw.gov.au/ media/1610/plan-hornsby-shire-lfp-june-2013-endorsed.pdf

Hornsby Shire Council, 2004. Integrated Land Use and Transport Strategy

Hornsby Shire Council, 2018. Community Strategic Plan. https://www.hornsby.nsw.gov.au/__data/assets/pdf_file/0016/127141/lowres-spread-Hornsby-Shire-Community-Strategic-Plan-2018-2028-28pp.pdf

Hornsby Shire Council, 2020. Aboriginal Heritage. https://www.hornsby.nsw.gov.au/library/catalogues-and-resources/local-history/aboriginal-

heritage#:~:text=The%20Aboriginal%20heritage%20 of%20the,the%20Hawkesbury%20River%20Vhen%20 Ruphen.

Hornsby Shire Council, 2020. Biodiversity Management Plan

Hornsby Shire Council, 2020. Climate Wise Hornsby

Hornsby Shire Council, 2020.Hornsby Local Strategic Planning Statement. https://shared-drupal-s3fs.s3-ap-southeast-2.amazonaws.com/master-test/fapub_pdf/Local+Strategic+Planning+Statements/LSPS+2020/HSC5432+Hornsby+LSPS+March+2020_v13_S-1036.pdf

Hornsby Shire Council, 2020. Urban Forest Strategy

Hornsby Shire Council, 2020. Vision and Transition Strategy for a Water Sensitive Hornsby

Homsby Shire Council, 2020. Walking and Cycling Strategy

Hornsby Shire Council, 2019. Waste Matter Strategy, http://wastematters.hornsby.nsw.gov.au/

National Climate Change Adaptation Research Facility (NCCARF) 2-2019 https://coastadapt.com.au/sites/default/files/infographics/IS_117_NCCARF_INFOGRAPHICS_2_UPLOADED_WEB%2827Feb%29.pdf

New South Wales Government, 2014. Upper Hawkesbury River Estuary Coastal Zone Management Plan. https://www.hawkesbury.nsw.gov.au/__data/assets/ pdf_file/0006/66084/CZMP-October-2014.pdf

NSW Department of Planning Industry and Environment (DPIE), 2020, Integrating Sustainable Development Goals into Local Government Strategic Planning Processes:A How to Guide

New South Wales Government Coastal Management Framework, 2018 https://www.environment.nsw.gov.au/topics/water/coasts/coastal-management/framework

New South Wales Office of Environment and Heritage, 2011. Operational Policy: Protecting Aboriginal Cultural Heritage, https://www.environment.nsw.gov.au/ resources/cultureheritage/110396oppolach.pdf

Resilient Sydney, 2018. A Strategy for City Resilience, ISBN-13: 978-0-6483332-1-0. https://www.cityofsydney.nsw.gov.au/_data/assets/pdf_file/0013/303700/Resilient-Sydney-A-strategy-for-city-resilience-2018.pdf

United Nations, 2015. Sustainable Development Goals. https://www.un.org/sustainabledevelopment/sustainable-development-goals/

Appendix 1 - Actions / Tasks

Waste Matters Strategy		
ID	Actions / Tasks	Priority High, Medium, Low or Ongoing
WA1	Education on how to effectively use available waste services	Ongoing
WA2	Ensure kerbside recycling services remain viable and strong in the face of global recycling crisis	Ongoing
WA3	Monitor alternative processing options for organic waste recycling	Medium
WA4	Explore options to divert bulky waste into waste to energy processing	Medium
WA5	Ban accepting E -waste in bulky clean up service and promote drop off at Thornleigh CRC	High
WA6	Consider expanding bulky clean up services for 5 storeys and apartments	High
WA7	Consider options to recycle mattresses	High
WA8	Monitor alternative processing options to recover organics and recylables from public place bins	Low
WA9	Investigate expanding problem household waste materials accepted at Thornleigh CRC	High
WA10	Seek expansion to the Return and Earn network for container returns for State Government	High
WA11	Seek EPA Annual Chemical CleanOut service within the Shire	High
WA12	Investigate annual e-waste drop-off event for rural residents	High
WB1	Use multiple communication channels and programs to promote desired waste	Ongoing
WB2	Develop initatives to promote the re-use, repair and repurposing of household items	Medium
WB3	Deliver a targeted units and apartments waste reduction program	High
WB4	Support home composting and worm farming	Ongoing
WB5	Develop a program to help the community reduce plastics consumption and recycle plastics	High
WB6	Provide and promote tenant information packs for renters and new property owners	High

WB7	Promote our local waste champions and help give them a voice to encourage others	Ongoing
WB8	Deter illegal dumping and littering through an integrated approacch of infrastructure, education and compliance.	Ongoing
WB9	Investigate a waste volunteers program	High
WC1	Promote improved waste management and increased uptake of recycling at businesses and schools	Medium
WC2	Encourage businesses to use the NSW EPA's free BinTrim waste audit program	Medium
WC3	Support local community organisations promoting waste messages cuch as home composting, community gardens and the like	Ongoing
WC4	Develop special events waste management guidelines and promote better event waste management	High
WC5	Review Council's sustainable procurement policy to support the purchase of products and materials with recycled content	High
WC6	Ensure Council buildings, operations and activities have best practice waste management	Ongoing
WC7	Develop a Council single use plastics policy	High
WD1	Lobbying and advocacy for policy, regulatory and other reforms to enable whole-of-system action on challenging waste problems including circular economy, responding to the Global Recycling Crisis, regulatory impacts on waste processing options and packaging issues	Ongoing
WD2	Lobby the NSW government to return waste levy funds to support local resource recovery programs	Ongoing
WD3	Actively participate in regional local government forums to identify amd implementregional solutions for North Sydney Region	Ongoing
WD4	Actively explore opportunities to secure improved waste infrastructure and services for the Northern Sydney Region	Ongoing

Biodiversity Conservation		
ID	Actions / Tasks	Priority High, Medium, Low or Ongoing
B1.1.1	Assess and update the 'terrestrial biodiversity' lands coverage to ensure consistency with existing Council biodiversity policies	High
B1.1.2	Implement the revised HLEP 2013 Terrestrial Biodiversity Map	High

B1.1.3	Assess the capacity of local strategic planning instruments (e.g. LEPs, DCPs) and land management documents to support the implementation of a Green Infrastructure Framework	High
B1.1.4	Review current biodiversity conservation management within the HDCP	Medium
B1.2.1	Assess Plans of Management for Natural Areas to enhance biodiversity conservation outcomes	High
B1.2.2	Assess opportunities for the establishment and preservation of buffer zones around TECs, threatened species, remnant vegetation and riparian zones across the Shire	High
B1.2.3	Identify mechanisms to inform residents of significant biodiversity features and remnant vegetation on their land	High
B1.2.4	Assess potential new standards for bird safe buildings, including information material, guidelines for retrofitting and DA assessment	Medium
B1.2.5	Prepare/review guidelines for vegetation management and compliance	High
B1.2.6	Maintain policy position on companion animal management and strengthen delivery if required	Ongoing
B1.2.7	Promote and support Wildlife Protection Areas, Wildlife Refuges and Conservation Covenants on private lands	Ongoing
B1.2.8	Prepare strategies, policies and guidelines that support best practice management of stormwater on Council managed lands	Ongoing
B1.2.9	Maintain green wall and roof provisions for new developments/ retrofits	High
B1.2.10	Assess opportunities to maximise biodiversity on private and public lands	Ongoing
B1.3.1	Identify, promote and implement conservation incentive schemes offered through governments, research institutions and private sector	Ongoing
B1.3.2	Prepare guidelines and identify special incentives to prioritise biodiversity on private lands	Medium
B1.4.1	Assess core, transition and key corridor areas to target management actions that reduces edge effects, and supports-biodiversity enhancement	High
B1.4.2	Prepare strategies that reduce edge effect impacts for biodiversity and wildlife	High

B1.4.3	Assess 'dark sky' policies and develop measures to limit light pollution disturbance to wildlife	Medium
B1.5.1	Prepare a vulnerability assessment to determine future impact of climate change on biodiversity values	High
B1.5.2	Prepare biodiversity adaptation strategy to minimise climate impacts through policy, planning instruments and operational activities	High
B1.5.3	Maintain seed banking program	Ongoing
B1.6.1	Prepare biodiversity monitoring program for council managed lands (as part of a wider Natural Resources Monitoring Program)	High
B1.6.2	Implement monitoring program for council managed lands	Ongoing
B1.6.3	Implement surveys to measure community awareness of local biodiversity values and issues	Ongoing
B1.6.4	Prepare and implement private property surveys to benchmark existing site conditions and gather new data on biodiversity	Ongoing
B1.6.5	Assess and update vegetation mapping (including GIF corridors)	Ongoing
B1.6.6	Establish a monitoring program for fire related activities	High
B1.6.7	Assess the condition and biodiversity value of roadside vegetation	High
B1.6.8	Identify keystone species distribution to guide bushland management prioritisation	Medium
B1.6.9	Assess presence of migratory species and manage potential habitat accordingly	Medium
B2.1.1	Identify a GIF which includes core, transition, and corridor areas	High
B2.1.2	Assess mechanisms to link and identify GIF and conservation values to land title	Ongoing
B2.1.3	Assess the application of the GIF within public domain and precinct planning	Ongoing
B2.1.4	Assess benefits and impacts of GIF on biodiversity	Ongoing
B2.2.1	Review and implement a biodiversity offsets policy to support conservation on private and public land	High
B2.3.1	Assess opportunities for large-scale planning and joint initiatives to link the GIF with protected areas and corridors beyond Council boundaries	Ongoing
B2.3.2	Maintain collaboration with partner land managers and fire agencies to facilitate best practice bushfire management on a landscape scale	Ongoing
B2.3.3	Assess opportunities for reserve network expansion on council managed, other public lands and adjacent estuarine areas	High

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B2.4.1	Prepare a Natural Areas Recreational Strategy	High
B3.1.1	Implement best practice in the application of chemical use in the maintenance of public open space	Ongoing
B3.1.2	Prepare and implement a guide for on ground environmental works	Medium
B3.1.3	Maintain the Bush Regeneration Program on Council-managed lands	High
B3.1.4	Maintain HSC Community Nursery programs and support Native Plant sales and giveaways	Ongoing
B3.1.5	Identify barriers to fauna movement and implement appropriate design solutions	Medium
B3.1.6	Assess and prioritise ecological restoration activities associated with bushfire incidents and mitigation activities	Ongoing
B3.1.7	Maintain a council On Site Sewage Management System inspection program	Ongoing
B3.2.1	Prepare and implement Biosecurity Management policies and plans	High
B3.2.2	Maintain council operations in line with obligations under the NSW Biosecurity Act 2015	Ongoing
B3.2.3	Represent Council at relevant biosecurity related forums, workshops, conventions	Ongoing
B3.2.4	Perform Council's functions under the NSW Biosecurity Act 2015 as the delegated local control authority for weed biosecurity within the Hornsby LGA	Ongoing
B3.2.5	Maintain and improve management of high priority weed species on Council managed lands	Ongoing
B3.2.6	Maintain council membership in the Sydney Weeds Committee and other relevant committees	Ongoing
B3.2.7	Identify opportunities to work with private landholders to control weed species	Ongoing
B3.2.8	Support the implementation of Regional Strategic Pest Animal planning	Ongoing
B3.3.1	Assess feasibility of placing all new infrastructure underground to enable streetscape planting	Ongoing
B3.3.2	Implement guidelines for species selection for public spaces and street tree plantings (i.e. parks, verges & streetscapes) to improve biodiversity on council managed lands	Ongoing

B4.1.1	Prepare Green corridors schematics to demonstrate planning principles in wildlife corridors	High
B4.1.2	Assess potential buy-back arrangements and other enduring protection mechanisms for areas recognised as critical linkages in	Ongoing
B4.2.1	Implement and enforce requirements to include appropriate stormwater treatment, re-use, retention and detention systems on new public domain projects	Ongoing
B4.2.2	Assess adequacy of onsite rain and grey water treatment/reuse devices for existing and new development	Ongoing
B4.2.3	Identify mechanisms and prepare strategy to improve water quality in dams across rural areas	Ongoing
B4.2.4	Maintain monitoring data to inform and prioritise infrastructure renewal for wastewater systems	Ongoing
B5.1.1	Prepare a Natural Resources communication, engagement and education strategy	High
B5.1.2	Assess opportunities for eco-tourism and passive recreation surrounding both aquatic and terrestrial ecosystems	Ongoing
B5.1.3	Prepare interactive mapping/citizen science interface	Ongoing
B5.1.4	Identify regular networking opportunities through program of themed events, film nights, guest speakers and site visits	Ongoing
B5.2.1	Implement staff, contractor and volunteer training as appropriate to increase awareness of biodiversity and conservation values	Ongoing
B5.2.2	Implement community education program in support of natural resources strategic themes	Ongoing
B5.2.3	Identify and expand community and group planting days	Ongoing
B5.2.4	Identify opportunities to partner with NSW Government to deliver workshops for sustainable management of rural land	Ongoing
B5.2.5	Identify opportunities to attract high profile media personalities to workshops	Ongoing
B5.3.1	Identify opportunities to recognise and support individuals, community groups, businesses and schools' efforts and achievements in biodiversity conservation	Ongoing
B5.3.2	Maintain Council's Bushcare program s and related initiatives	Ongoing

B5.3.3	Identify education/monitoring/compliance avenues, for example: campaign for tree protection 'Don't be a Lopper/Dob in a Chopper'	Medium
B5.3.4	Identify suite of citizen science tools with a clear presence on Council's website and Council events which incorporate community partnerships (i.e. Streamwatch, Men's Sheds, Scout groups, etc)	Ongoing
B5.3.5	Identify opportunities for collaboration with local Indigenous communities and consultative bodies	Ongoing
B5.3.6	Identify opportunties to collaborate wth tertiary institutions	Ongoing
B5.4.1	Identify opportunities to promote HSC's ecological research and biodiversity through publishing and conferences	Ongoing
B5.4.2	Maintain communications around Council's biodiversity priorities and action to community and stakeholders	Ongoing

Urban Forest Strategy		
ID	Actions / Tasks	Priority High, Medium, Low or Ongoing
U1.01	Collect current qualitative and quantitative data regarding Hornsby's public urban tree assets, including street trees and trees within community land classified as Community Parkland or Sports field	High
U1.02	Incorporate data from tree inventory into Council's asset management system	High
U1.03	Implement tree management in line with best practice asset management	High
U1.04	Collect and assess knowledge and data from existing and proposed programs to inform the masterplan preparation	High
U1.05	Prepare a Street Tree Master Plan to inform the strategic and operational management of these assets.	High
U1.06	Engage all relevant sections of Council to ensure the Street Tree Master Plan is supported through other works programs.	High
U1.07	Capital and operational expenditure need to be informed by the Masterplan and integrated within Council's community strategic planning process.	High
U1.08	Develop a urban tree management policy that standardises decision making processes against a clear Council objectives all elements of street and park tree management	High

U1.09	Prepare a policy that aligns with the Biodiversity Conservation Strategy 2020 to manage the protection of trees and provide guidance for other practices along rural roads.	High
U1.10	Prepare a yearly schedule of maintenance and management works, based on the results from the street tree data collection, to improve the overall health and amenity of street trees.	High
U1.11	Prepare guidelines that incorporate the working processes, supporting standards, guidelines and preferred species selection list for staff to make daily decisions regarding tree management.	High
U1.12	Update the guidelines regularly to reflect best practice tree management, new evidence and research, Australian standards and other asset guidelines such as water sensitive urban design protocols.	Low
U1.13	Audit all tree management decision making and procedures to identify areas to improve efficiencies and remove duplication and inconsistencies.	Medium
U1.14	Implement changes and solutions to streamline procedures e.g. customer requests, procurement and data management.	Medium
U1.15	Support staff to implement changes and solutions through education and building capacity	Medium
U1.16	Develop a tree valuation methodology, using data captured from the tree inventory, for Hornsby's public trees, including environmental, social and economic benefits of trees.	High
U1.17	Investigate using valuations to implement bonds	High
U1.18	Use valuations to improve education and awareness within Council and the community about the benefits of trees in urban and bushland settings.	High
U1.19	Investigate an appropriate process, using the valuation method, to implement and enforce public tree protection bonds as condition of consent for private development that may impact on public trees.	High
U1.20	Develop a clear and efficient system for real time data updates to the tree database when any staff or contractor complete work on a public street tree.	Medium
U1.21	Incorporate relevant urban forest objectives and make reference to the Urban Forest Strategy when Plans of Management are reviewed and updated.	Medium
U1.22	Continue to work closely with Ausgrid, Sydney Trains and Sydney Water regarding better outcomes for the urban forest in the planning and management of their assets.	Medium

U1.23	Align with NSW Roads and Maritime Services Landscape Design Guidelines 2019: Design guideline to improve the quality, safety and cost effectiveness of green infrastructure in road corridors.	Medium, Low
U1.24	Advocate for aerial cable bundling or undergrounding of powerlines where possible and feasible.	Medium, Low
U1.25	Measure canopy cover every five tree years and evaluate against baseline and intended targets for canopy and diversity	High
U1.26	Review Council's Community Nursery tree production program to ensure it is informed by future street tree masterplans and preferred street and park tree planting lists.	High
U1.27	Explore options where existing and proposed street trees can be provided in conjunction with expanded pathways.	High
U2.01	Measure and identify the change in tree canopy at lot scale across Hornsby's residential zones. Identify where on lots canopy trees are being removed (front, side, rear) and the relationship to other canopy trees in the public and private realm.	High
U2.02	Measure every 2-5 years given the rate of development and tree loss across the Shire.	High
U2.03	Investigate and measure the effectiveness of DCP controls using updated data	High
U2.04	Lobby with other local governments to the State Government to commit to collecting high resolution vegetation mapping for Greater Sydney on a regular basis e.g. every two or five years to provide temporal data set	Medium
U2.05	Engage with local developers to educate them on the importance and benefits of the urban forest, particularly in residential and mixed-use development	Medium
U2.06	Investigate trials or pilot projects, including possible incentives, for those developers interested in seeking better urban greening outcomes.	Medium
U2.07	Review current LEP and DCP controls, with a particular focus on setbacks to enable canopy retention and planting, for exempt and complying development.	High

U2.08	Prepare guidelines for developers for exempt and complying development to support Council's local strategic planning strategy and character statements across the LGA. Controls must be consistent with LEP outcomes and DCP controls.	High
U2.09	Using mapping data review existing canopy cover and explore opportunities to establish a target for rural lands that takes into account rural land use and biodiversity needs. This should include incentive programs for increasing canopy.	High
U2.10	Develop relevant LEP standards (Part 4 of the standard LEP template) to support the protection and management of existing canopy trees and future canopy planting within relevant land use zones and consistent with local character statements	High
U2.11	Review current DCP provisions and consider the hierarchy of protecting, restoring and creating canopy across the local government area consistent with local character statements, tree canopy targets and district planning directions.	High
U2.12	Review and identify state policies and planning instruments that provide significant hurdles to delivering better urban forest outcomes on the ground. These include, but are not limited to: State Environmental Planning Policy, 10/50 Bushfire Clearance Entitlements, Housing targets, Electrical Line Clearance Regulation	High
U2.13	Engage with relevant state government agencies to lobby for policy and planning instrument change because of inconsistencies with greener city objectives as stated in the District Plans and Council strategies.	High
U2.14	Review the future scope of the Green Offset Policy to determine whether it looks to deliver both biodiversity and tree canopy outcomes	High
U2.15	Develop a tree canopy policy to support the LEP and DCP if its determined that the focus of that Green Offset Policy remains primarily biodiversity	High
U2.16	Review compliance procedures in a wholistic manner across the Organisation, to support statutory planners and compliance officers in their ability to audit, enforce conditions of consent and seek prosecution for breaches	High
U2.17	Identify species for private landscaping with consideration for public/ private habitat and amenity linkages, locational characteristics, tree growth and canopy spread and maintenance.	High
U2.18	Prepare planting and establishment technical advice for landowners replacing trees, for developers/homeowners planting new trees and people moving into new developments.	High

U2.19	Develop a set of guidelines and Community Nursery-located examples for high rise residential and/or commercial development to encourage take up and implementation of alternative elements of greening.	High
U2.20	Develop education and awareness campaigns about how individual trees are equally important for the whole forest	Medium
U2.21	Develop recommended tree planting guides and continue free tree giveaways for species of trees less likely to cause future issues	Medium
U2.22	Investigate options to encourage new trees to be planted as part of new developments and explore other greening options for high rise development e.g. green roofs	Medium
U2.23	Develop development guidelines that include lot scale green infrastructure outcomes.	High
U2.24	Lobby with local government groups to develop industry wide housing development guidelines that include lot scale green infrastructure outcomes.	Medium
U2.25	Actively promote and implement Council's free tree giveaway program	High
U2.26	Develop ongoing media and communications pieces talking to the issue of tree canopy loss on private property and what community member can do about it.	High
U2.27	Develop case studies and education collateral	Medium
U2.28	Implement interactive community workshops and forums on trees for wildlife, bushfire and trees, Hornsby's Tall trees, Hornsby's remnant vegetation and green corridors.	Medium
U3.1	Incorporate the Urban forest Strategy targets into Council's operational and delivery plan programs and projects .	High
U3.2	Identify the role that urban trees play within the development of a strategic urban biodiversity framework which includes core, transition, and corridor areas and prioritise these areas for planning	Medium
U3.3	Prepare WSUD policy incorporating guidelines for all stormwater treatment and consistent with urban forest outcomes	Medium
U3.4	Align with Water Sensitive Hornsby project.	Medium
U3.5	Prepare green wall and green roof policy for new developments and retrofits	Medium
U3.6	Engage across the organisation. The group should be multi-disciplinary, have executive support and meet on regular basis to share knowledge and build internal capacity with a focus on integrated design and resilient landscapes.	Medium

U3.7	Develop objectives for the group, including supporting the statutory planners and practioners with tools and evidence to inform their decision making.	Medium
U3.8	Continue to implement tree planting days on Council managed land.	Medium
U3.9	Deliver planting days specific to demographic groups, including culturally sensitive days to encourage greater participation and stewardship from local migrant groups, and youth-specific specific planting days.	Medium
U3.10	Engage and partner with the Guringai and Darug people to raise knowledge and awareness surrounding the cultural value of Hornsby's trees.	High
U3.11	Explore partnerships to develop an indigenous history of Hornsby's trees identify culturally significant trees.	High
U3.12	Develop a suite of engagement tools articles, community workshops, stories, competitions annually to reach out to the broader Hornsby community.	Medium
U3.13	Identify and target particular audiences, including migrant groups, youth, schools, tertiary students	Medium
U3.14	Notify and engage with residents regarding annual tree planting program including renewals.	Medium
U3.15	Explore the use of developing infographic style communications with landowners to demonstrate the importance of their street tree to the whole urban forest.	High
U3.16	Explore issues and confirm policy position regarding trees (existing and proposed) with solar panels	HIgh

Water Sensitive Hornsby Strategy		
ID	Actions / Tasks	Priority High, Medium, Low or Ongoing
WS1.1.1	Develop an online mapping tool and submission form to collect data on local environmental values and conditions	High
WS1.1.2	Create an integrated database of local, state and federal environmental and biodiversity data	Medium
WS1.1.3	Develop and implement a program to assess condition of natural areas and gather baseline data	High
WS1.1.4	Encourage knowledge-sharing between Hornsby, Ku-ring-gai, and other councils with best practice environmental practices	Medium
WS1.2.1	Review compliance procedures and improve internal capacity to take a stricter and more consistent approach	High
WS1.2.2	Review preventative measures through planning controls	High
WS1.2.3	Lobby State Government for stronger biodiversity protection laws through coalition with other councils, industry and community groups	High
WS1.2.4	Engage and lobby State Government for stronger biodiversity protection laws through coalition with other councils, industry and community groups	Medium
WS1.3.1	Develop and implement proactive education programs targeting private landholders about the importance of their local waterway assets, how to protect them and what the compliance measures are	Medium
WS1.3.2	Develop targeted awareness campaigns for developers, business and residents that showcase the benefits of protecting the health of the environment (e.g. property values, business opportunities, health benefits)	Medium
WS1.3.3	Develop and assess incentive programs for enhancing ecological value	High
WS2.1.1	Develop place-based plans that incorporate a strong narrative around the local environmental, historical and indigenous heritage (informed through community engagement) and highlight linkages to other valuable networks	High
WS2.1.2	Examine different mediums to communicate the place-based narrative on-the-ground	High
WS2.1.3	Promote business opportunities in relation to recreational water activities and tourism	Low
WS2.1.4	Develop promotional material on the unique environmental and historical values within Hornsby	High

WS2.1.5	Develop a supporting business case to articulate the economic benefit of water sensitive outcomes (e.g. urban cooling and amenity)	High
WS2.2.1	Assess strategic routes for green and blue corridors	High
WS2.2.2	Capture and communicate lessons from demonstration projects to showcase advantages of place-based planning	High
WS2.3.1	Ensure integration across relevant LSPS strategies	High
WS2.3.2	Review and update existing public domain guidelines and town centre plans	Medium
WS2.3.3	Incorporate green and blue infrastructure targets into review of Development Control Plan and Local Environmental Plan	Medium
WS2.3.4.	Incorporate of natural asset within Council's strategic asset management system	High
WS2.3.5	Investigate the development of catchment specific environmental values and targets to inform the Development Control Plan and Local Environmental Plan	Medium
WS3.1.1	Influence current development of Council's engagement plan to ensure it covers water engagement needs	High
WS3.1.2	Review Hornsby Shire Council website to ensure resources are available and accessible	High
WS3.1.3	Map current community engagement initiatives and who is leading them in order to identify gaps in engagement	Medium
WS3.1.4	Investigate innovative engagement methods and principles through behaviour change research or engagement projects from elsewhere	High
WS3.1.5	Investigate and trial methods to build peoples' connection to water	High
WS3.2.1	Reinstate the education project control group with a clear charter and goal of providing consistent messaging and resources to community	Medium
WS3.2.2	Undertake engagement professional development training internally	Low/Medium
WS3.2.3	Ensure water is in the charter of the Environmental Sustainability Committee (which includes community members)	Low/Medium
WS3.2.4	Develop an Environmental Sustainability Engagement Plan to support Council's broad engagement plan	Medium
WS3.2.5	Consolidate and evaluate lessons from existing community engagement projects to inform future projects and to encourage innovation	High

WS3.3.1	Identify who to engage within the Aboriginal communities (beyond HATSIC) to initiate the conversation around what needs to be done	Medium
WS3.3.2	Expand and progress existing internal commitments around Aboriginal engagement	Low/Medium
WS3.3.3	Undertake aboriginal cultural awareness training for staff	Low/Medium
WS4.1.1	Understand and map existing behaviours among community, business and developers related to water quality	High
WS4.1.2	Identify how council staff and operations can influence behaviours	High
WS4.1.3	Develop a community engagement plan on natural resources management (incorporate into water management)	High
WS4.2.1	Develop catchment models to assess policy settings and development scenarios	High
WS4.2.2	Articulate and refine waterway objectives and values	High
WS4.2.3	Collate monitoring data to support catchment models	High
WS4.2.4	Develop visualisations from catchment models to assist communications and decision-making	High
WS4.3.1	Audit efficiency of planning instruments to restore and protect waterways	High
WS4.3.2	Review and compile lessons learnt from existing Water Sensitive Urban Design projects	High
WS4.3.3	Build expert community of practice to share knowledge and perspectives on water management and to co-create pathways and solutions to improve practices	High
WS4.4.1	Proactive compliance based on best evidence based compliance approaches	High
WS4.4.2	Provide information on Council's website on minimum acceptable practices by industry type	Low
WS4.4.3	Assess Council projects and external proposals for compliance with water sensitive urban design requirements	High
WS4.5.1	Council adopt planning policy to elevate water management in planning	High
WS4.5.2	Outcomes from catchment modelling influences planning	High
WS4.5.3	Develop council systems and processes to ensure integration of Council water strategies and policies outside of LSPS process (e.g. catchment plans)	High
WS5.1.1	Identify appropriate platforms to implement a place-based approach	High

WS5.1.2	Utilise new tools to quantify multiple benefits and develop business cases for water sensitive solutions, including the investigation of alternative water sources	High
WS5.1.3	Advocate for a review of BASIX to include broader planning issues	High
WS5.1.4	Develop precinct plans to deliver multifunctional water infrastructure to highest design standard	High
WS5.1.5	Develop incentives for integrated outcomes	High
WS5.2.1	Explore ideas for how Hornsby Town Centre and other priority planning areas can demonstrate water sensitive city outcomes through a design charrette or similar co-design process	High
WS5.2.2	Identify and implement opportunities through council works projects at the street, park and sub-catchment scale	High
WS5.2.3	Implement asset maintenance and renewal of water sensitive projects to ensure ongoing performance and effectiveness	High
WS6.1.1	Hold internal capacity-building activities to build breadth of knowledge within Council staff	Medium/High
WS6.1.2	Review development approvals process to determine why some elements are ineffective	Medium/High
WS6.1.3	Evaluate the effectiveness of existing collaborative governance solutions and approaches to inform future solutions	Medium
WS6.1.4	Deliver water sensitive city messaging to senior and executive staff	Medium
WS6.1.5	Ensure water is at the forefront of decision-making by making it an agenda item project control groups	Medium/High
WS6.1.6	Establish an informal regional water sensitive cities group that utilises online tools and forums to share knowledge and ideas	Medium
WS6.2.1	Develop theme-based control groups (e.g. water or environmental sustainability) that include officer and senior level staff	Medium/High

Climate Wise Hornsby Plan		
ID	Action / Task	Priority High, Medium, Low or Ongoing
C1.1	Complete the accelerated roll out of LED lighting on residential roads. Work with Ausgrid to install 4267 LED lights	High
C1.2	Complete the accelerated roll out of LED lighting on residential roads. Work with Endeavour Energy to install 50 LED lights	High
C1.3	Undertake roll out of LED lighting on main roads in partnership with Ausgrid	High -Medium
C1.4	Upgrade all parks decorative lighting with LEDs	Low
C1.5	Installation of solar at: Hornsby Aquatic Centre, Admin building, Galston Aquatic, Works depot, Pennant Hills Library, Fire Control, Overhead Bridge, Cherrybrook Community Centre, Recycling Centre, Berowra Library, Beecroft Community Centre, Berowra District Hall, Brooklyn Leisure and Learning, Arcadia Community Hall, Glenorie Community Centre, Hornsby Heights Community Centre, Mount Colah Community Centre, Thornleigh Community Centre and Wisemans Ferry Community Centre	High
C1.6	Replace all old globes with LED	High
C1.7	Purchase of green power or renewable energy through electricity contract 20%, 50%, 100%	High
C1.8	Purchase green offsets when flying	High
C1.9	Investigate installation of Building Management System at Pennant Hills Library, Administration Building and Hornsby Library Ensure appropriate temperature set points	High
C1.1	Undertake energy audit at Hornsby Aquatic Centre Monitor and manage Hornsby Aquatic Centre to optimise consumption utilising the existing Building Management System	High
C1.11	Report target vs actual for energy use for facilities that have +/- 20% variation on contract Active management of high-end electricity users Increase awareness of operators and users of buildings	High
C1.12	Plant trees where feasible to reduce heat load on buildings, winter winds and noise	Medium-low

C1.13	Develop and deliver an education program for fleet drivers to: Ensure that appropriately sized vehicles are used for each load or trip to minimise fuel consumption ensure optimal use of vehicles Regular maintenance ensure vehicle is fit for purpose and utilise more renewable fuels Optimise tyre performance to reduce fuel consumption by selecting lighter wheel and tyre systems and tyres that lower rolling resistance Check tyre wear at least monthly and keep tyres inflated at, or 10% above the recommended level Monitor fuel consumption for each vehicle (e.g. via fuel cards) to identify vehicles with unusually high fuel consumption. High fuel consumption is indicative of possible need for maintenance	Medium
C1.14	Conduct fleet review to optimise and reduce emissions by changing over to hybrid and/ or electric vehicles for Council owned vehicles, where financially feasible.	High
C1.15	For new and old Council owned buildings, augment building envelope where possible: Through proper insulation Reduce heat loss / infiltration through buildings' exteriors Optimise window / blind operation Use double glazing Reduce summer heat with cool roofs Plant a green roof or green wall where feasible	Low
C1.16	Investigate the establishment of a carbon offset program through the planting of 25,000 trees	Medium-low
C1.17	Implement Council's Waste Matters Strategy	High
C1.18	Review, update and implement Council's Sustainable Procurement Determination	High
C1.19	Work with Council's contractors to minimise their carbon emissions and report accurately	High
C2.1	Implement Electric Vehicle (EV) Charging Stations on Public Land Policy	High
C2.2	Support the uptake of electric vehicles, including installation of public charging stations and investigation of planning controls to require charging infrastructure in new developments	Medium
C2.3	Implement Car Share Parking Policy	High
C2.4	Advocate for the reduction in use of private vehicles and increased use of public transport	High – Medium
C2.5	Work with partners to develop a program for Environmental Upgrade Agreements	Medium

C2.6	Work with the community to determine the viability of a community solar farm	High
C2.7	Deliver behaviour change and community education programs on sustainability	High
C2.8	Seek a partnership to test and increase uptake of solar retrofit	Medium
C2.9	Produce a GIS layer of houses within the Shire with rooves unaffected by trees and target solar information to these households	High
C2.10	Advocate to developers for buildings designed to achieve low energy properties and precincts above planning policy regulations	High
C2.11	Lobby State Government to increase BASIX requirements	High
C2.12	Investigate Solar My Schools program or other large-scale community solar roll out	Medium – low
C2.12	Incorporate carbon zero processes into the design, development and ongoing use of town centres i.e. Hornsby Town Centre e.g. building materials, waste generation & disposal, energy production on scale	High
C2.13	Implement the Waste Matters Strategy to increase diversion of waste from landfill	High – Medium
C2.14	Investigate combined solar farm and car parking with EV charging	Medium-Low
C2.15	Advocate to Transport for NSW for the provision of adequate commuter car parking and cycling facilities for customers of the public transport network – rail and ferry	High – Medium

Walking and Cycling Strategy		
ID	Action / Task	Priority High, Medium, Low or Ongoing
	To be added following finalisation of draft Walking and Cycling Strategy	

Natural Hazards		
ID	Action / Task	Priority High, Medium, Low or Ongoing
	To be added following finalisation of draft Bushfire Risk Management Strategy and Coastal Management Program	

NEED HELP?

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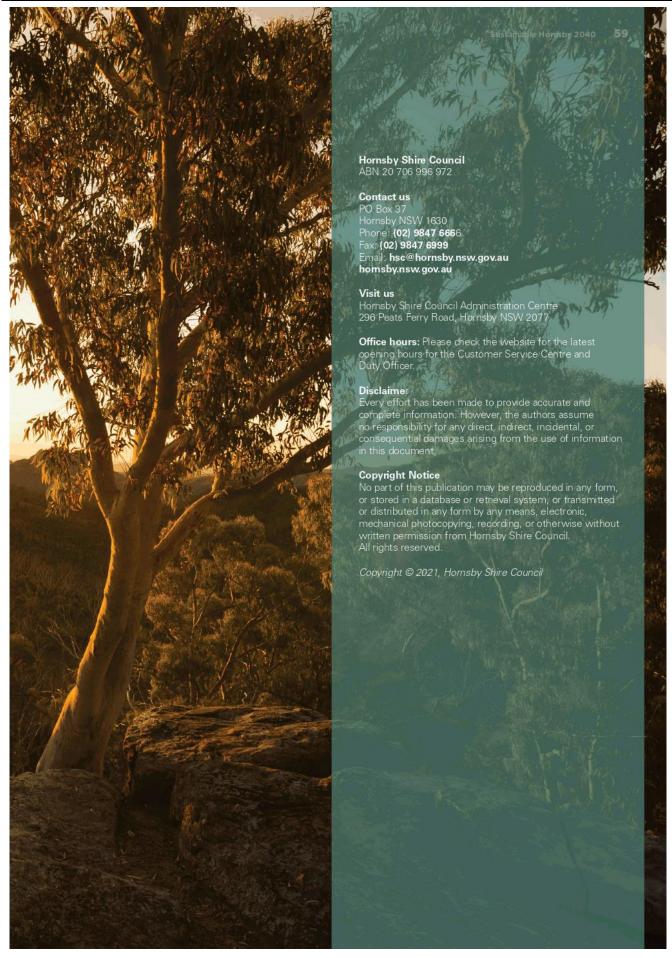
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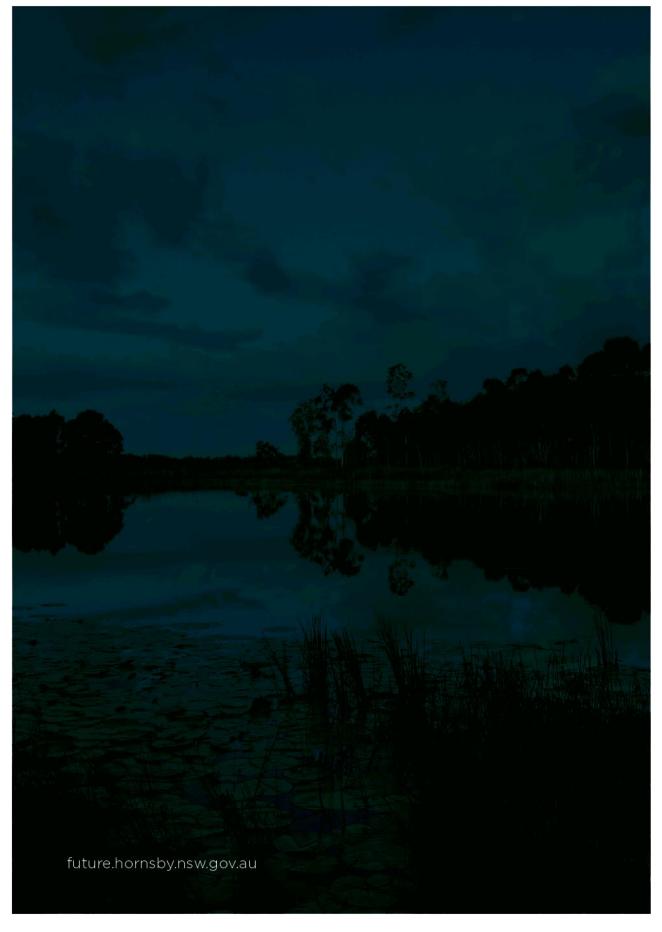
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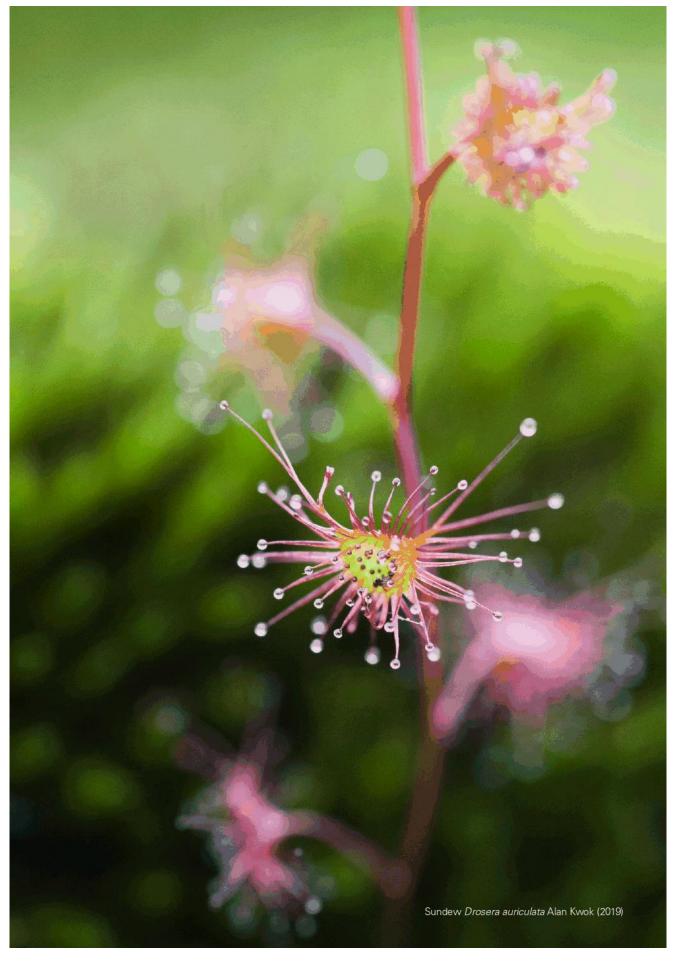
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Hornsby Biodiversity Conservation Strategy 2020

Executive summary

The Hornsby LGA contains a diverse array of landscapes with significant conservation values and hosts a diversity of native flora, fauna and invertebrates – many of which are threatened with extinction. The biophysical qualities of the LGA also contribute to Hornsby's character and identity as the *Bushland Shire*.

Both locally and globally, the need to safeguard biodiversity in light of rapid land-use and climatic change pressures has never been more acute than today – and the next 20 years will be critical. This presents a challenge for Council to carefully balance projected population growth targets and associated development against the protection of biodiversity values in the lands and waters under its management.

Currently, several specific state government initiatives as well as supporting policies at the international, national and regional level suggest a range of measures toward the protection and management of biodiversity. These include the Greater Sydney Commission's *District Plan*, the NSW Government Architect's Office *Greener Places* and a specific focus on Green Infrastructure Networks.

The method that underpinned the *Hornsby Biodiversity Conservation Strategy 2020* relied upon three interlinked stages:

- Review of policies, mapping data and best practice
- Community workshops with a Green Infrastructure focus
- Synthesis and development of recommendations and priorities

As a result of this Strategy the following strategies have been developed including:

Strategy 1: Protect and conserve ecological values

Strategy 2: Connect urban habitats

Strategy 3: Restore disturbed ecosystems to enhance ecological value and function

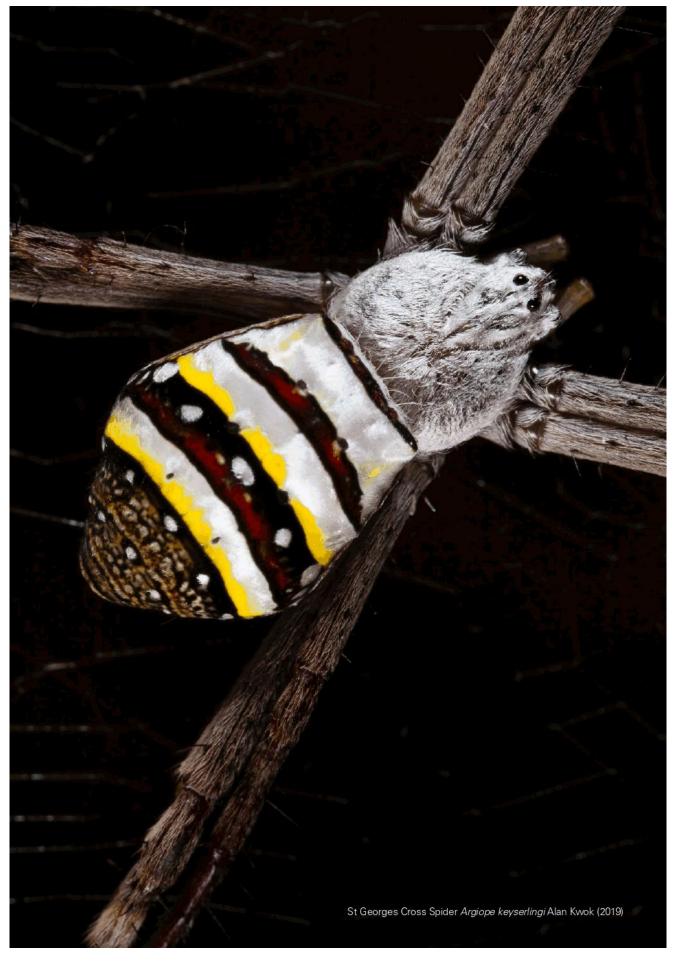
Strategy 4: Create new ecosystems

Strategy 5: Connect people to nature

Importantly, the spatial definition of these recommendations is made through a series of maps that aim to manage long-term threats and challenges as well as potential benefits. Each strategy recommends several actions for implementation by Council in the future as resources become available.

This strategy, the *Hornsby Biodiversity Conservation Strategy 2020*, offers a range of recommended actions that sit alongside several other key strategies prepared in support of a new *Local Strategic Planning Statement*.

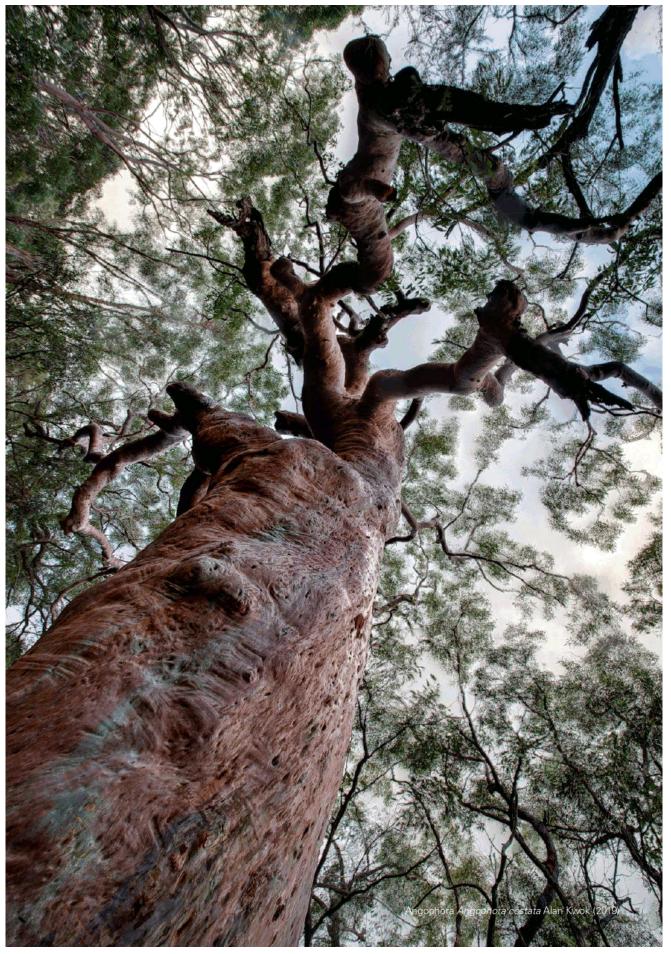
Council recognises the Traditional Owners of the lands of Hornsby Shire, the Darug and Guringai peoples, and pays respect to their Ancestors and Elders past and present and to their Heritage. We acknowledge and uphold their intrinsic connections and continuing relationships to Country.



Hornsby Biodiversity Conservation Strategy 2020

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Hornsby Biodiversity Conservation Strategy 2020

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Hornsby Biodiversity Conservation Strategy 2020

Key terms

Biodiversity – 'the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystem'. [1]

Bushland – 'land on which there is vegetation which is either a remainder of the natural vegetation of the land or, if altered, is still representative of the structure and floristics of the natural vegetation'. [2]

Charrette – 'time-limited, multiparty design event organized to generate a collaboratively produced plan for a sustainable community'. [3]

Corridors – 'Corridors are narrow, linear remnants of habitat that connect otherwise isolated habitat patches' [4] or 'a narrow strip, stepping stone, or series of stepping stones of hospitable territory traversing inhospitable territory providing access from one area to another'. [5, 6]

Green Infrastructure – Green infrastructure is the ecological framework for environmental, social, and economic health – in short, our natural life-support system. [7]

It is important to note that due to longstanding Aboriginal land management practices the Australian landsacpe (and the Hornsby LGA) was subject to a complex human-managed fire-stick farming practice. This means that the term 'natural vegetation' is erroneous, however due to a broad understanding of what the term represents, i.e. pre-European or '1788' vegetation, it is used throughout this Plan. Hornsby Biodiversity Conservation Strategy 2020

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Acronyms

AILA – Australian Institute of Landscape Architects

AILDM - Australian Institute of Landscape Designers and Managers

BCT - Biodiversity Conservation Trust

CAMBA – China-Australian Migratory Bird Agreement

CBD - Central Business District

CBD - Convention on Biological Diversity

CEEC - Critically Endangered Ecological Community

DA - Development Application

DCP - Development Control Plan

EPBC - Environmental Protection Biodiversity Conservation (Act)

ESD - Ecologically Sustainable Development

GI - Green Infrastructure

GIF - Green Infrastructure Framework

GIS - Geographic Information System

GPT - Gross Pollutant Trap

HLEP - Hornsby Local Environment Plan

HSC - Hornsby Shire Council

IBRA – Interim Biogeographic Regionalisation of Australia

JAMBA – Japan-Australia Migratory Bird Agreement

LGA – Local Government Area

LEP - Local Environment Plan

LPI NSW - Land and Planning Information NSW

LSPS – Local Strategic Planning Statement

NPWS - National Parks and Wildlife Service (NSW)

NRS - National Reserve System

NSW – New South Wales

 $\mathsf{OEH}\!-\!\mathsf{The}$ Office of Environment and Heritage

p.a. – per annum

RMS - Roads and Maritime Services (NSW)

SEPP – State Environmental Planning Policy

SGG - Sydney Green Grid

SOS - Save Our Species

STIF - Sydney Turpentine Ironbark Forest

TBD –To Be Determined

TEC – Threatened Ecological Community (includes Endangered and Critically Endangered Ecological communities)

UHI – Urban Heat Island

WWTP - Waste Water Treatment Plant



Fig 1. The Australian Brush Turkey, Alectura lathami, a common visitor to Hornsby bushland and gardens



1. Introducing the Hornsby Biodiversity Conservation Strategy

An overview of the Strategy's vision, goals, approach, study area and timeframes

10

Strategy's vision

The Strategy has been developed to have regard to the challenge set by the Government Architect of New South Wales in its *Greener Places 2020* framework and the supporting *Greener Places Design Guide* [8]. This guide suggests that Local Councils approach the:

"...conservation of urban habitat and biodiversity in a holistic way that not only directs strategic planning but also acts at the management level... in the form of maps identifying core, transition, and habitat connection areas, with development controls and land management provisions suited to the local area' [8]

The 20-year vision proposed through this report is as follows:

Hornsby Shire and its' residents value the ongoing protection and conservation of the natural environment, its biodiversity and protected areas. The area's biodiversity is sustained and enriched through the significant areas of remnant and healthy bushland vegetation, waterways and wetlands, and estuarine habitat that exist within and surrounding the Shire.

Hornsby Shire Council is equipped to ensure biodiversity is well managed, resilient and adaptable to land-use change. Council recognise that the connection and conservation of natural assets will contribute to the community's health and well-being, maintain a sense of place and enhance biodiversity values in the Shire.

This Hornsby Biodiversity Conservation Strategy encourages a balance of the best available scientific knowledge with community feedback to present a suite of recommendations, tools and priorities that are to be integrated into Council operations.

The Strategy is based upon and applies the best

available scientific knowledge and incorporates community contributions as a suite of recommendations, tools and priorities that are integrated into Council operations.

The Hornsby Community Strategic Planis closely aligned with the Greater Sydney Commission's North District Plan (March 2018) [9] and sets the broad strategic direction for Council's operations aligned to a ten-year vision for the LGA (Local Government Area). It is framed through four key themes. These are:

- 1. Liveable
- 2. Sustainable
- 3. Productive
- 4. Collaborative

The Hornsby Community Strategic Plan outlines these four themes in detail to inform Council's delivery program and operational planning, including benchmarks against which goals can be measured over time. Themes relating to biodiversity management and protection include those concerning liveability and sustainability.

Though the productive and collaborative themes don't address biodiversity directly, the report encourages the community to engage in sustainable transport options where possible 'including walking and cycling' and 'promote the Shire's tourist attractions'. Transport infrastructure such as this could also double as biodiversity wildlife corridors, [10]



Fig 2. Rainbow Lorikeet, Trichoglossus haematodus

(1)

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The Strategy's goals

The purpose of this Homsby Biodiversity Conservation Strategy is to guide both Council and the community to conserve and manage Hornsby LGA's biodiversity. The strategy is an umbrella document that brings together a wide range of information on the biodiversity of Hornsby. The strategy considers why biodiversity conservation is important and provides priorities for action. The strategy aims to conserve both terrestrial and aquatic biodiversity and their habitats.

The development of this Hornsby Biodiversity Conservation Strategy will assist Hornsby Shire Council to best protect and conserve, manage and sustain the biodiversity that exists within its boundaries. This will enable Hornsby Shire Council to:

- Conserve, manage and enhance biodiversity upon both public and private lands within the LGA
- Identify 'best practice' methods for managing and conserving biodiversity
- Identify, locate and prioritise a novel Green Infrastructure network across the LGA
- Collect and update biodiversity conservation information
- Ensure environmental planning instruments and processes provide a strategic approach to achieving biodiversity conservation outcomes

The Strategy's approach

This Strategy has been prepared through the following key approaches:

- 1. Ensure review of best practice
- 2. Mapping and data analysis
- Outlining biodiversity values of the LGA
- 4. Engagement with community stakeholders through a series of workshops
- The spatial articulation of biodiversity features, concepts, themes; opportunities and constraints; and threatening processes and challenges

- 6. Specific development of a Green Infrastructure Framework
- 7. Key management recommendations, strategies, tools and actions
- Provide a well-defined vision to guide future key actions, especially those over the next three years

Improving our understanding of biodiversity

Biodiversity monitoring and research is embedded into the Strategy. Monitoring is the process of determining status and tracking changes in living organisms and the ecological complexes of which they are a part. Biodiversity monitoring is important because it is used to evaluate the integrity of ecosystems, their responses to disturbances, and the success of actions taken to conserve or recover biodiversity. Research addresses questions and tests hypotheses about how these ecosystems function and change and how they interact with stressors. Ecological research provides the context for interpreting these monitoring results. Policy and management needs guide the development of monitoring.

An expanded and funded research and monitoring program will provide the necessary information and data baselines to conserve and protect Hornsby LGA's diverse ecosystems and vegetation into the future.

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Study area

The Hornsby Biodiversity Conservation Strategy focuses upon all lands within the Hornsby Shire Local Government Area (LGA). It provides strategic recommendations for the preservation of biodiversity across lands managed and/or owned by Council, Aboriginal groups, National Parks, NSW Government lands, private interests and that which forms part of the NSW Marine Estate.

Timeframe

The Homsby Biodiversity Conservation Strategy provides strategic recommendations that will assist Council to achieve the biodiversity objectives of the Greater Sydney Commission's North District Plan 2018 and the Government Architects Office NSW's Bushland and Waterway Guide. It sets a strategic approach to the management and conservation of biodiversity over a 20-year period, while supporting Council with its decision-making and prioritisation of action.

The final section of this report 'Strategies and Actions for Biodiversity Conservation' documents all actions identified by this Strategy and is prioritised with zero to one year (high), one to four years (medium), four to ten years (low) as well as ongoing actions.

Monitoring, reporting and periodic review

An important purpose of preparing and implementing the *Hornsby Biodiversity Conservation Strategy* is to strengthen the resilience of natural systems and to support sustainable growth across the LGA. To maintain focus, highlight successes and provide early warning of problems, it is important to monitor and review progress towards these outcomes at regular intervals. This approach will also assist in developing and applying an approach

of continuous improvement in biodiversity management.

Council's IP&R reporting system (including annual and longer operational reporting and longer interval strategic reporting) provides the opportunity to formally report on implmentation of this Strategy.

The Hornsby Biodiversity Conservation Strategy will be reviewed within a 10-year period to ensure Council, agencies and community are effectively progressing toward conservation and management of Hornsby Shire's biodiversity. Council will also promote successes in biodiversity management through the education, engagement and communication activities recommended within this Strategy.



Fig 3. Southern Leaf-tailed Gecko Phyllurus platurus

2. Background: The Biodiversity of the Hornsby LGA

Biodiversity is important both for the benefits that it can provide to humans as well as for its own intrinsic value. This section of the report defines this term and introduces some of the noteworthy aspects of biodiversity in the Hornsby LGA. It also situates this report with respect to current and future threats and challenges.

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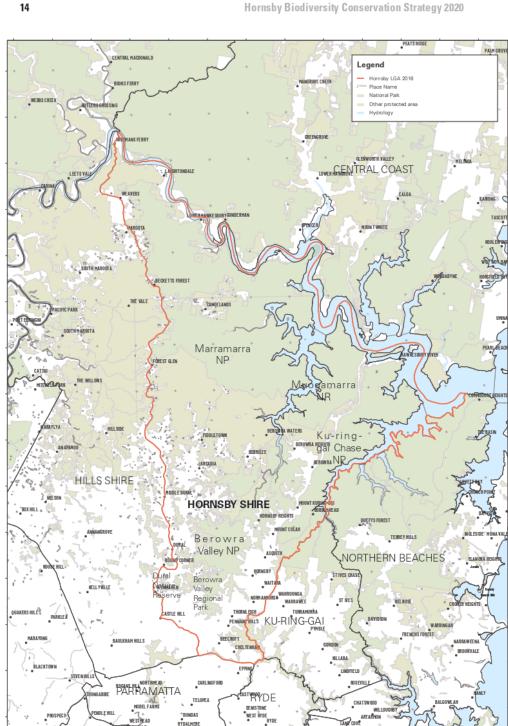


Fig 4. Hornsby Shire Council seen within the Sydney context

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What is biodiversity

Biodiversity has been defined by the Convention on Biological Diversity (CBD) as:

'the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystem'.[1]

Spanning more than 7,500,000 square kilometres the Australian continent possesses a unique biological diversity (referred to hereafter as 'biodiversity') distributed across thirty-three degrees of latitude from the tropics in the north to Tasmania in the south. Across the breadth of this island continent Steffen [12] estimates that Australia comprises between seven and ten per cent of the world's total species, including approximately 200,000 terrestrial species, many unknown to science and significantly endemic [13]. This means that in ecological terms Australia is globally important.

The Hornsby LGA possesses a high degree of biodiversity. This can be attributed to the diversity of habitats within the LGA, as well as the high percentage of vegetation cover – or bushland – within large and representative protected areas, council reserves on lands managed by other agencies (i.e. RMS) and private properties. This biodiversity is a significant and defining feature of the 'Bushland Shire' and one that requires safeguarding for future generations. It also offers an enduring connection and is of continued significant place to the area's Indigenous people to practice their culture.

Indeed, the Hornsby Shire's bushland provides life-sustaining benefits to humans through the transformations of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services (e.g. clean air, water, and food). These

ecosystem services are therefore critical for maintaining the health and wellbeing of Hornsby citizens.

Hornsby LGA overview

Location

The Hornsby LGA is bounded by The Hills Shire, City of Parramatta, City of Ryde and the Ku-ring-gai, Northern Beaches and the Central Coast Councils. Significant portions of the Hornsby Shire are within existing protected areas, the largest of these being Berowra Valley National Park, Ku-ring-gai Chase National Park, Marramarra National Park and Muogamarra Nature Reserve, see Fig 4.

Geology and landform

The Hornsby LGA forms part of the Sydney Basin Bioregion and is located on the geological formation known as the Hornsby Plateau. Lying within the Sydney Basin Bioregion and the Central Coast Botanical Subdivision and thus has characteristics of both across the Hornsby Plateau and Hawkesbury Valley which form the major physiographic regions of the area. The Hornsby Plateau is capped in places by Wianamatta Shales. Further north and east the deeply dissected sandstone Hawkesbury valleys occur which feature the drowned river system of the Hawkesbury River and its tributary creeks, see Fig. 5.

The estuaries were formed during the end of the last ice age and stabilised approximately 6,000 years ago. Berowra Creek is a major tributary of the lower Hawkesbury River, entering the Hawkesbury River some 25 kilometres from the ocean. The estuary itself extends for over 23 kilometres in a southerly direction from the Hawkesbury River to the tidal limit at Rocky Fall hawkesbury River to the tidal limit at Rocky Fall westerly direction from near the confluence of Berowra Creek and the Hawkesbury River for over seven kilometres. Berowra Creek estuary

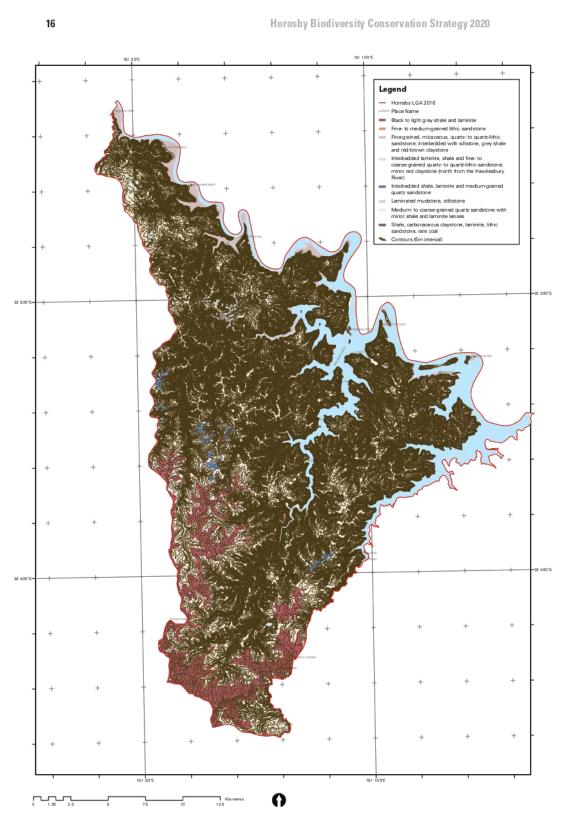


Fig 5. Hornsby Shire Geology and Landform

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is a drowned river valley, comprising steeply incised gorges with surrounding plateau areas. The upper estuary, upstream of the Woolwash, is very shallow with depths often less than 1 metre. The channel becomes deeper and reaches a depth of approximately 7 metres at Berowra Waters. Through the middle estuary, and particularly at Calabash Point, there are a number of deep holes up to 17 metres deep which provide habitats and influence the flushing characteristics of the estuary. The lower estuary is generally around 5 metres deep, although at the Hawkesbury River bar the depth is only 3m. The lower west zone of the estuary, Marramarra Creek, is much shallower with depths of 2 metres or less. The shallow muddy bays provide ecologically productive environments. Big Bay is one such area and has regional significance because of its mangrove community.

The underlying geology of Hornsby LGA is formed predominantly of sandstone, with a capping of shale on the higher ridgelines. Shale capping extends along some of the major road systems including Old Northern Road from Castle Hill to Glenorie, and along Galston, Arcadia and Bay Roads through Galston, to Arcadia and Berrilee. Away from the ridgelines further downslope sandstone geology appears. Towards the northern end of Old Northern Road near Forest Glen, Maroota and Fiddletown, the shale cappings have become discontinuous due to large scale erosion of the shale over millions of years. [14] Several other types of geology occur in very limited areas such as volcanic diatremes around Hornsby and Westleigh, sand deposits at Maroota, and geologies associated with the Hawkesbury River and other riparian areas, namely, Narrabeen shales and alluvial flats.

The changing vegetation patterns of Hornsby

Pre-1788 vegetation patterns reflect land management and burning practices that had taken place for more than 60,000 years. This was vegetation managed in a sustainable manner by Aboriginal people, although their specific fire practices have not been fully understood or well acknowledged until recent years. As such the current vegetation patination - including many fire dependent vegetation communities and species - represents a landscape, flora and fauna that exists in the absence of the firestick farming practices by original inhabitants.

In 1788, shale areas were covered with tall open forest of 30 metres or more in height. To this day. trees suited in these more fertile soils include Grey Ironbarks, Turpentines, White Stringybarks and less commonly Red Mahoganies, with Blackbutts and Sydney Blue Gums growing where conditions were particularly favourable (ranging across an area approximating the contemporary of location of Wahroonga/Hornsby south to the M2 and west to Cherrybrook). In these forests an understorey of smaller trees and shrubs include Forest Oak, Hickory Wattle and Cheese Tree in the drier areas and Sweet Pittosporum trees, vines and ferns in the moister drainage lines. This landscape supports several types of types of Threatened Ecological Community (TEC) including Sydney Turpentine-Ironbark Forest and Blue Gum High Forest [19]. In areas where shale gives way to sandstone on the ridgelines a transitional area often occurs characterised by a distinctive assemblage of species, often including the Grey Gum (the favoured food tree of koalas) and Stringybarks.

Bushland on sandstone country features a tremendous variety of habitats and plant species in a relatively small area of sandstone terrain. The sandstone topography gives rise to a great variety of habitats because of its rugged nature – ridgetops, slopes of varying steepness facing north, east, south or west each with different characteristics of sunlight and moisture availability, gullies and valley floors with varying amounts of deposited soil with differing degrees of shale influence from soil washed down over time from the shale cappings. The variety of habitats includes:

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- woodland on ridgetops and exposed north and west facing slopes;
- open forest on the more sheltered east and south facing slopes and on lower parts of exposed slopes;
- dense open forest where valleys were sheltered and enriched by shalederived soil, for example, Blackbutts and Coachwoods grew at the bottom of Galston Gorge; riparian scrub supporting a distinctive group of species on small sandstone creek lines;
- patches of shrubby heaths and sedge heaths where lenses of shale were found within the sandstone, giving rise to local variation in soil fertility and drainage.

Along the banks of the Hawkesbury River downstream from Wisemans Ferry and along the lower reaches of Berowra and Marramarra Creeks, Narrabeen shales and sandstones appear. Rough-barked Angophora and Forest Oak characterise the open forest on the more fertile Narrabeen-based soils.

The hydrological system of the Hornsby LGA may be divided into four catchments:

- Berowra Creek (Colah Creek, Still Creek, Georges Creek, Pyes Creek, Larool Creek, Waitara Creek, Tunks Creek and Calna Creek)
- Lane Cove River (Terrys Creek, Devlins Creek and Browns Waterhole)
- Cowan Creek (Hornsby Creek, Cockle Creek and Murray Anderson Creek); and
- Hawkesbury River (Some of the creeks include Mill Creek, Dalgety's Creek, Ashdale Creek and Pumpkin Point Creek).

Some creek reaches were characterised by wide, sandy flat-based ponds, or sandstone with cobbles in the cracks at the base of the creek, others featured rapids, riffles, rock chutes, waterfalls and potholes, yet others had boulders with underlying rock shelves, or sand and

mud based streams. Creek characteristics and morphology within each catchment continue to change due to natural processes and accelerated sedimentation through urbanisation.

Estuarine vegetation of the Hawkesbury River, Marramarra, Berowra and Cowan Creeks and other tributaries were characterised by small areas of saltmarsh, stands of mangroves and seagrass beds. Of particular significance were large mangrove forests in Big Bay, Marramarra Creek which feature the Grey Mangrove and River Mangrove. Saltmarshes existed in small pockets above mangrove stands in areas of and that were intermittently inundated by tides. Seagrasses were characterised by Eelgrass (Zostera spp.) in the Hawkesbury, Berowra Creek and Cowan Creek and Strapweed in scattered beds in Cowan Creek.

Contemporary vegetation patterns

Historic patterns of settlement left poor infertile soils of the sandstone country and the inhospitable terrain undeveloped with clearing and farming taking place on gentler topography and more fertile soils.

Many rural properties have an arable area on shale nearest the road and back onto steeper sandstone bushland near creek lines. Hence the plants and animals now remaining on the richer shale soils or flatter land are rare and poorly conservd in Hornsby. As a result of these patterns, over 50% of Hornsby's plant communities are not conserved in any parks or reserves and two other vegetation communities (Swamp Sclerophyll Forest on Coastal Floodplains and Freshwater Swamp) have almost totally been removed through clearing. [16]

Native vegetation that remains on shale is generally as small remnants around the edges of cleared agricultural land or as small backyard patches in urban areas such as Pennant Hills and Beecroft. These small remnants are often invaded by weeds, but each shale vegetation

'About 15% of native vegetation is in close to natural [pre-European] conditions' [15]

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remnant is important because there is so little of this type of vegetation left. In the whole Sydney area, less than 2% remains of the original area of Sydney Turpentine-Ironbark Forest and Blue Gum High Forest remains [127]. Because only small remnants remain, no single remnant of this rare forest is likely to contain representatives of all the plant species native to the shale. Therefore, each remnant patch is valuable for the species it does contain, including the soil seed bank. Some may contain native plant species that occur in very few other places and are often confined to narrow roadsides and although the remnants may be weed infested, all the native smaller trees, shrubs, ground cover plants and grasses in the remnant shale vegetation patches are important, not just canopy trees. [14]

Most of the native vegetation that remains in the rural area is on sandstone. Sandstone terrain is much more rugged than that of the shale, and its soils are sandy, infertile and often very shallow, making them unsuitable for agriculture. It is for these reasons that so much of the sandstone still retains its native vegetation, now extensively protected through Marramarra, Berowra Valley and Ku-ring-gai Chase National Parks.

Two types of sandstone habitat are particularly vulnerable to loss and degradation – ridgetops, likely to be cleared because they are level and easily accessible, and creek banks and valley floors, prone to weed invasion. A number of rare species occur only in the Hornsby area in sandstone habitat, so areas such as these are in need of special consideration for conservation. Creeklines become invaded by weeds when their nutrient-rich soil is washed down by stormwater from developed areas. As such, developments need to be more closely managed to prevent soil erosion, to prevent weed invasion along with other actions that will also protect water quality and aquatic ecosystems.

Transition areas between shale and sandstone are also vulnerable like the other level ridgetop

areas. This habitat is limited in area and is also likely to have Shale/Sandstone Transition Forest, an Endangered Ecological Community, as well as threatened species such as the rare Heartleaved Stringybark on Tunks Ridge. Transition areas, like other ecotones, are highly diverse communities with a mix of shale and sandstone species. Other transition communities include Duffys Forest also an Endangered Ecological Community.

A small number of diatremes or outcrops of volcanic rock occur, namely off Fagans Ridge and Coba Ridge, in Cabbage Tree Hollow, Pyes Creek, Old Mans Valley and within Muogamarra Nature Reserve. Species composition varies between these scattered volcanic outcrops and reflects their greater soil fertility.

The deep sand deposits that are being mined at Maroota are geologically unique within the Sydney area, and, where they remain, support native vegetation with a number of rare or uncommon species.

Smaller areas of alluvial land amongst steep sandstone hillsides along the Hawkesbury River near Wisemans Ferry and downstream support distinctive riparian and wetland groups of plant species – these are vulnerable because of their accessibility for clearing and their limited extent



Fig 6. Waratah, Telopea speciosissima

(2)

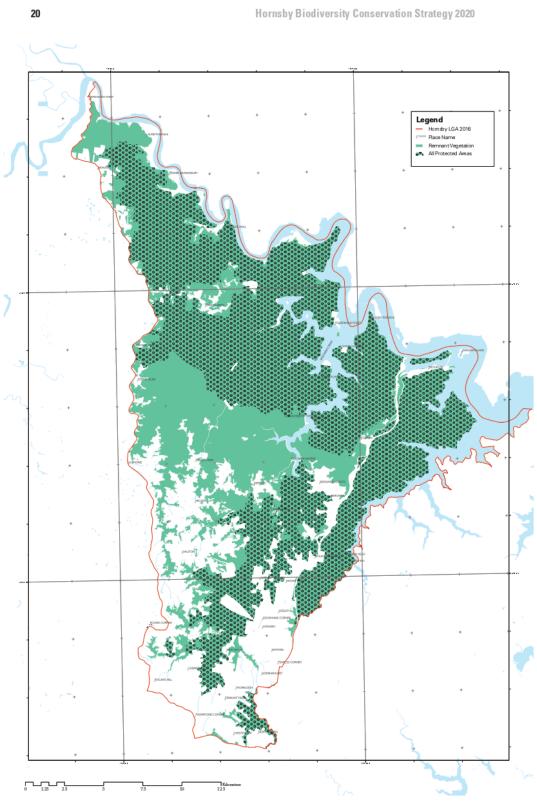


Fig 7. Remnant vegetation of Hornsby Shire

Note: the land

area of the Shire

boundary change

reduced in size

due to LGA

to its current

45503.75 ha in

2016. This has

calculations.

influenced these

Hornsby Biodiversity Conservation Strategy 2020

21

The biodiversity of the Hornsby LGA

The 'Bushland' Shire

The Hornsby LGA is characterised by a matrix of protected areas, vegetated, agricultural, urban and suburban lands. The 2006 Hornsby Biodiversity and Conservation Strategy identified that the percentage of vegetation cover was equal to 69% of the Shire; this percentage is now 73.6%. This is made up of 49.2% Protected Areas and Bushland Reserves, see Fig. 7.

Over 1,000 native vascular plants and 388 terrestrial vertebrate animals are known to occur in the bushland of the Hornsby Shire. The number of invertebrate species is unknown, as is the number of aquatic species, although survey of aquatic bioindicators found 230 discrete taxa of macroinvertebrates and 8 native fish species. [17] According to the Atlas of Living Australia and BioNet recorded data from (2010 – 2019) within the Shire the recorded number of species are more than: 660 fauna species, 1200 flora species and 90 fungi species, refer to Appendix 1.

Ecological communities

Smith & Smith [18] mapped and described Hornsby's ecological communities in 2008 and this fine scale mapping revealed 34 communities,



Fig 8. Sydney Turpentine Synocarpia glomulifera

see Fig 9. These are equivalent to ten vegetation communities as listed in the NSW Biodiversity Act [19], as several have no comparison, e.g. Mangrove Swamp. Of these, 12 are listed TECs of which three are critically endangered: Blue Gum High Forest in the Sydney Basin Bioregion, Sydney Turpentine-Ironbark Forest and Shale/Sandstone Transition Forest in the Sydney Basin Bioregion, see Fig. 10. Council undertook a review and update of vegetation mapping in 2017 to improve accuracy across the LGA, this utilises the descriptions by Smith & Smith. [20]

Listed below are all Threatened Ecological Communities of the Hornsby LGA:

- Blue Gum High Forest in the Sydney Basin Bioregion (CE)
- Sydney Turpentine-Ironbark Forest (CE)
- Duffys Forest Ecological Community in the Sydney Basin Bioregion (E)
- Shale/Sandstone Transition Forest in the Sydney Basin Bioregion (CE)
- Shale Gravel Transition Forest in the Sydney Basin Bioregion (E)
- Coastal Upland Swamp in the Sydney Basin Bioregion (E)
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (E)
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (E)
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Swamp Sydney Basin and South East Corner Forests Bioregions (E)
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Saltmarshes Corner Bioregions (E)
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (E)
- E Endangered; CE Critically Endangered

(4)

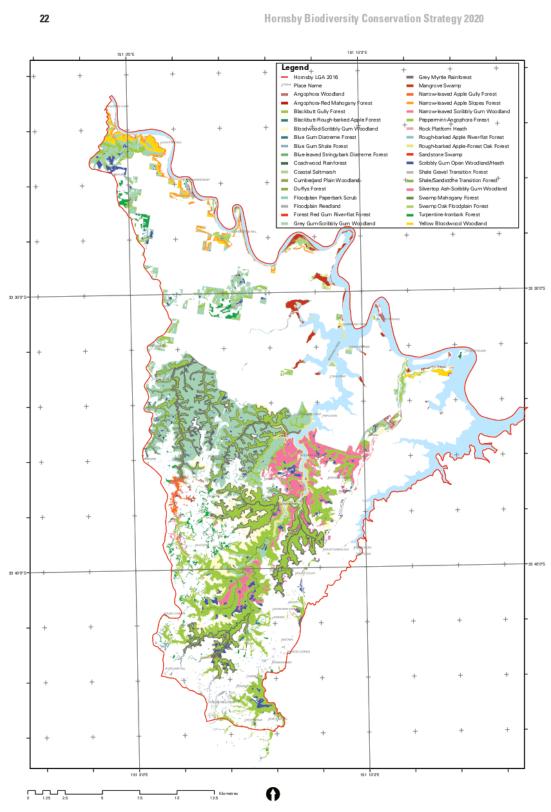


Fig 9. Hornsby's Ecological Communities as described by Smith & Smith



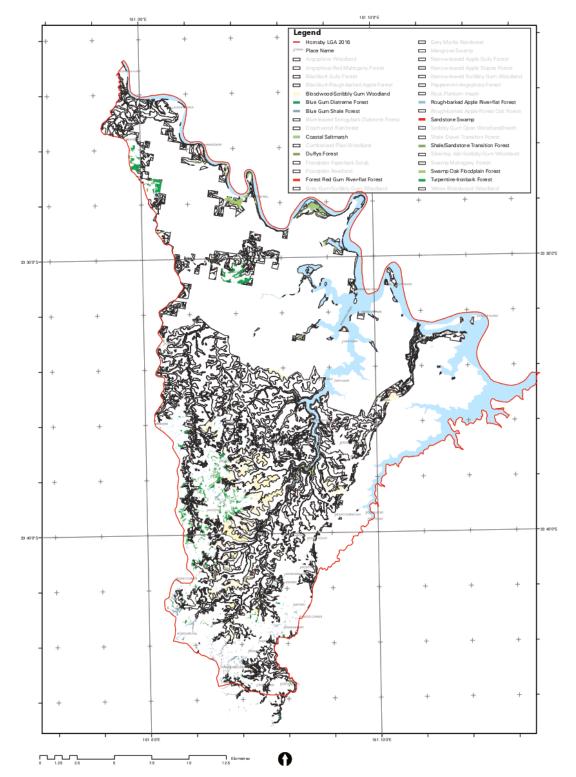


Fig 10. Hornsby's Threatened Ecological Communities

Ecological Community	Significance level					
	National	NSW	Regional	Local	Other	
Blue Gum Shale Forest	Х	X				
Blue Gum Diatreme Forest	Х	X			Ti Ti	
Turpentine-Ironbark Forest	X	X				
Shale/Sandstone Transition Forest	Х	X				
Shale Gravel Transition Forest	Х	Х				
Peppermint-Angophora Forest	Х	X				
Sandstone Swamp	X	X				
Coastal Saltmarsh	X	X			Ti Ti	
Posidonia australis Seameadows	Х	X			T T	
Duffys Forest		X				
Forest Red Gum River-flat Forest		Х				
Swamp Oak Floodplain Forest		X				
Floodplain Paperbark Scrub		X				
Floodplain Reedland		X				
Swamp Mahogany Forest		X				
Freshwater Floodplain Wetlands		X				
Rough-barked Apple River-flat Forest		X				
Coachwood Rainforest			X			
Grey Myrtle Rainforest			X			
Angophora-Red Mahogany Forest			X			
Blue-leaved Stringybark Diatreme Forest			X			
Rough-barked Apple-Forest Oak Forest			X			
Narrow-leaved Apple Slopes Forest			X			
Angophora Woodland			X			
Narrow-leaved Apple Gully Forest			X			
Rock Platform Heath			X			
Seagrass Meadow			X			
Blackbutt-Rough-barked Apple Forest			X			
Blackbutt Gully Forest				X		
Silvertop Ash-Scribbly Gum Woodland				Х		
Mangrove Swamp				Х		
Grey Gum-Scribbly Gum Woodland					Х	
Narrow-leaved Scribbly Gum Woodland					Х	
Scribbly Gum Open-woodland/Heath					Х	
Yellow Bloodwood Woodland					Х	
Bloodwood- Scribbly Gum Woodland					Х	
Narrow- leaved Scribbly Gum Woodland					X	

Table 1. Ecological Communities of the Hornsby LGA and their significance

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In addition, a number of ecological communities have been identified to be locally significant, these are noted alongside their significance at national, state and regional levels, according to Smith & Smith [18] as collated by EcoLogical Australia [20]. Refer to Table 1.

There are currently 497 entities listed under the Biodiversity Conservation Act. Of the 497 NSW listings there are: 215 vulnerable species; 132 endangered species; 33 critically endangered species; 0 extinct species; 35 endangered populations; 50 endangered ecological communities; and, four vulnerable ecological communities'. [21]

Fig 11. Jacky Lizard, Amphibolurous muricatus

'Reductions to the range or abundance of many native species indicate a pattern of overall decline in biodiversity over the long term [15]'

According to the 2006 Hornsby Biodiversity Conservation Strategy:

The NSW Scientific Committee listing of Sydney Turpentine-Ironbark Forest estimated that only 0.05% of the original vegetation community remains. It is important to note that this listing also defines individual remnant trees as being part of the Endangered Ecological Community. Likewise the Scientific Committee listing for Blue Gum High Forest recognised that only 1% of the original forest remains. Note: 'Endangered Ecological Communities' in this 2006 strategy referred to both 'endangered' and 'critically endangered' ecological communities. These are now referred to as

In the 2017 Hornsby Vegetation Map identified 17,003 ha of vegetation. [20] This included 666 ha of TEC and a potential further 151 ha of potential relic TEC (subject to field validation). This accounted for 3.9% of the total LGA's vegetation. For example, only 54 ha of (confirmed) Blue Gum Shale Forest, or 0.32% of all TEC; and 20 ha of (confirmed) Blue Gum Diatreme Forest, or 0.11% of all TEC exist within the LGA, often existing as '...clumps of trees in urban landscapes in less developed sites such as Council reserves, large backyards, creek lines and schoolyards'. In addition, there are only 323 ha confirmed (and a further 143 ha)-of Sydney Turpentine-Ironbark, or 1.89% of all TEC.

Areas such as these are significant as they 'contain genetic material indigenous to the area and provide habitat for native fauna including threatened species and endangered populations [and] form parts of corridors and urban habitat links and contribute to the landscape character of the suburb.' [22]

Annual reporting of current vegetation cover (and resolution of potential relics) across the Hornsby LGA is highly recommended.

Box 1. Threatened Ecological Communities across the Hornsby LGA

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Plant species which only occur at 2% of sites have been classified as regionally and locally significant in that they may become locally extinct in 20 years if not recognised and afforded conservation status and protection [22]. Endangered plant species known to occur in the Hornsby LGA include Bauer's Midge Orchid (Genoplesium baueri) and the Narrow-leaf Finger Fern (Grammitis stenophylla). According to Smith and Smith (1990 & 2006) [16, 18] a number of plant and animal communities are inadequately conserved, even if they may present at all in the major reserves.

'Since 2015, the number of threatened species listings has increased by 3%' [15]

Terrestrial biodiversity outside the reserve system

Currently 26.4% of the Hornsby LGA (or 12,012 ha) has been cleared and a number of plant and animal communities are inadequately conserved. These include two floodplain communities that appear to have been almost completely removed from the Hornsby LGA by previous clearing. Also, remnant bushland on the more fertile Wianamatta Shale, volcanic diatremes and the Hawkesbury River floodplain remain unprotected. Historically, such areas had been extensively cleared due to flat topography and arability and are hence now quite rare. Fig. 13 shows the protected areas, according to Land and Planning Information NSW.

Threatened species

There are 50 threatened fauna species listed to occur in the LGA, these include the endangered Southern Brown Bandicoot (*Isoodon obesulus obesulus*), Dural Land Snail (*Pommerhelix duralensis*) and the migratory Swift Parrot (*Lathamus discolour*), refer to Appendix 1.

Of these, 15 species found in the LGA have a Commonwealth Status, refer to Table 2. Fauna ecology and habitat requirements varies considerably between species, with some requiring tree hollows for nesting i.e. Gang Gangs (Callocephalon fimbriatum) preference is for hollows in eucalyptus (10 cm in diameter or larger and a minimum of 9 m above the ground) while others can require dense vegetation and debris for habitat such as the Red-crowned Toadlet (Pseudophryne australis). Some examples of species habitat and ecology requirements can be found in Appendix 2.



Fig 12. Giant Burrowing Frog, Heleioporus australiacus

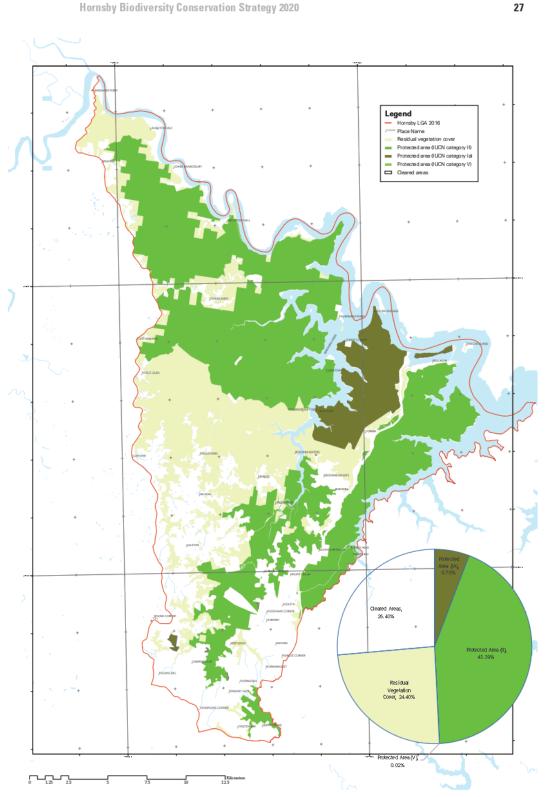


Fig 13. Protected areas in the Hornsby LGA

Scientific Name	Common name	Conservation Status NSW (Biodiversity Conservation Act 2016)	Commonwealth Status (under EPBC ACT)
Anthochaera Phrygia	Regent Honeyeater	Critically Endangered	Critically Endangered
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable
Dasyurus maculatus	Spotted-Tailed Quoli	Vulnerable	Endangered
Dermochelys coriacea	Leatherback Turtle	Endangered	Endangered
Eubalaena australis	Southern Right Whale	Endangered	Endangered
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Vulnerable
Isoodon obesulus	Southern Brown Bandicoot	Endangered	Endangered
Lathamus discolour	Swift Parrot	Endangered	Critically Endangered
Litoria aurea	Green and Golden Bell Frog	Endangered	Vulnerable
Macronectes giganteus	Southern Giant Petrel	Endangered	Endangered
Phascolarctos cinereus	Koala	Vulnerable	Vulnerable
Pommerhelix duralensis	Dural Woodland Snail; Dural Land Snail	Endangered	Endangered
Petauroides Volans	Greater Glider	Not listed	Vulnerable
Pteropus poliocephalus	Grey-Headed Flying-Fox	Vulnerable	Vulnerable
Pseudomys novaehol- landiae	New Holland Mouse	Not listed	Vulnerable

Table 2. Threatened fauna species with commonwealth status

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Migratory species

A comprehensive assessment of migratory species and potential habitat has not been undertaken in the Hornsby LGA and is a high priority, as habitats in Australia form a critical part of a migratory flyway around the world. A number of migratory species listed on the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australian Migratory Bird Agreement (CAMBA) migratory bird agreements annually visit sites in the Hornsby area and rely on these habitats for resting and feeding prior to returning to the northern hemisphere. A number of vagrant or nomadic species occur in Hornsby such as the endangered species including the Swift Parrot (Lathamus discolour) and the vulnerable species Eastern Osprey (Pandion cristatus).

According to the NSW State of the Environment Report 2019: '64% of native mammals for which there are sufficient data have experienced long-term decline in range'[15]

Social and cultural patterns of the Hornsby LGA

The Hornsby Shire Council covers an area of 455km2, contains 142,667 people (2016 census) and is located in Sydney's northern suburbs, approx. 25km from the city centre. The traditional owners of the area are the Darug and Guringai people.

Hornsby LGA is a mix of urban areas with freestanding homes, low rise townhouses and high-rise buildings, large rural areas and a predominance of bushland. According to the Hornsby Shire Community Strategic Plan 2018-2028 'Two-thirds of the Shire comprises national park and bushland, with major waterways and rural landscape in the northern part of the Shire: [10] Indeed, the natural environment is one of the main attractors for residents in the shire. Commonly referred to as the 'Bushland Shire', the vision for the LGA was identified as a 'creating a living environment' and community previously ranked bushland management as the third most important function of council (Customer Satisfaction Survey & Biodiversity Strategy 2005). The zoning for the LGA is shown in Fig. 15.



Fig 14. Short beaked Echidna, Tachyglossus aculeatus

(1)

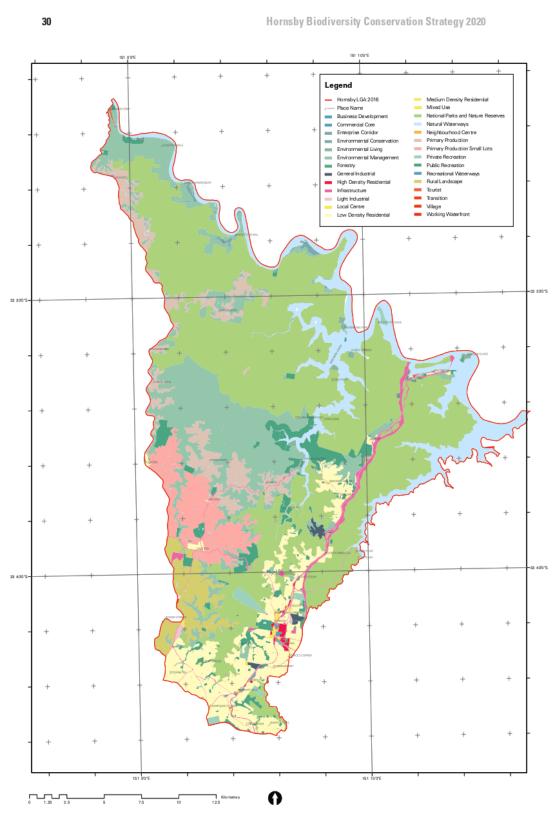


Fig 15. Land use zoning in Hornsby Local Environmental Plan 2013: a matrix of protected areas, vegetated, agricultural, urban and suburban lands

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Environmental threats and challenges

Australia

Australia's biodiversity is on the decline due to the impacts from a range of threats. These include development, land-clearing, land-use change and urbanisation, habitat fragmentation and degradation; invasive species, weeds and exotic and pest species; climate change; and fire and diseases [23-26], refer to Appendix 3 for commonwealth and local threats.

Overall, climate change impacts on biodiversity are considered to be the greatest long-term threat to biodiversity and is recognised as a key threatening process under the NSW Biodiversity Conservation Act 2016 and the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). See Fig. 16.

'Average temperatures for the past decade have been 0.99°C above 1910-1939 levels' [15] 'In the five years to June 2017 the NSW population increased by 550,000 an average annual growth rate of 1.5%' [15]

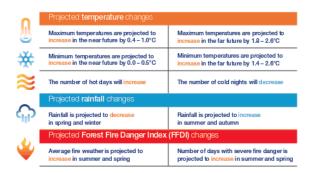


Fig 16. Climate change indicators for NSW [128]

Threats specific to the Hornsby LGA

Greater Sydney continues to grow in size and its population is projected to increase from 4.5 million in 2013 to 7.9 million by 2053 [27]. A target that will be provided for through ambitious residential infill targets, the highest of any Australian capital city at 70%. [28] What does this mean for the management and planning of biodiversity in Hornsby? As population growth continues the LGA will face increasing pressure for additional housing and development.

A number of key threatening processes have been identified in the Pittwater Interim Biogeographic Regionalisation of Australia (IBRA) Subregion [21], see Table 3. Such threats include changing fire, water cycle and hydrologic regimes and the increase of impervious surfaces increase flow intensity, reduces groundwater recharge. Further threats are detailed below.

Terrestrial-aquatic interface threats and challenges

The upper reaches of the Lane Cove River catchment are dominated by housing, commercial areas and Lane Cove National Park bushland lower in the catchment. The creeks are characterised by weed invasion, streambed siltation, rubbish dumping, sewer overflows, bank erosion and poor water quality.

The Cowan Creek catchment, land uses include extensive light industrial areas, large commercial shopping centres and developed urban areas. Ku-ring-gai Chase National Park also covers a large part of the catchment. Some creeks are in very good condition, however, some have been converted to open drains, and others have rubbish dumped along the banks, weed invasion and streambed siltation.

The Hawkesbury River catchment includes the Wisemans Ferry/Maroota region and the Brooklyn area which drains directly to the Hawkesbury River. Landuses include small farming ventures, market gardening, extractive

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industries, housing, marinas, boat ramps, aquaculture and fishing (commercial and recreational).

The Berowra Creek catchment is bounded to the south by Castle Hill Road and Pennant Hills Road, to the west by Old Northern Road, to the north by the Canoelands Ridge and to the east by the Pacific Highway. The catchment is highly developed in the south with the residential, industrial and commercial development of Hornsby and its surrounding suburbs. The north of the catchment is predominantly bushland and comprises Marramarra National Park, Muogamarra Nature Reserve and Berowra Valley Regional Park. The semi-rural areas of Arcadia, Galston and Glenorie are situated to the west of the creek. Some parts of the tributary creeks in the Berowra Creek catchment feature weed invasion, garden plants and waste, streambed siltation, rubbish and gross pollutants from stormwater drains, bank erosion, undercutting, tree death and poor water quality. In general, those catchments with more bushland have better waterway health, and contain a broader section of aquatic macroinvertebrates.

The catchment contains two waste water treatment plants (WWTP), Hornsby Heights WWTP and West Hornsby WWTP. Water quality and aquatic macroinvertebrate indicators of ecosystem health improve with distance downstream from the WWTPs. Some semi-rural areas around Arcadia, Galston and Glenorie remain unsewered and rely on onsite treatment. Galston and Glenorie town centres are now connected to sewer. Many of the river settlements, such as Berowra Waters and Calabash Bay, Neverfail, Coba, Marramarra, Sunny Corner, Milsons Passage, rely on on-site sewage treatment systems and tank water.

Estuarine vegetation in the Hawkesbury River and creeks is being impacted upon by a variety of processes, resulting in loss of saltmarsh due in part to mangrove encroachment (via expansion of mangrove areas due to sediment accretion) and physical damage to seagrass beds due to propellors and outboard motors and anchor damage.

'Under NSW legislation there are currently 1,025 species and 112 ecological communities listed as threatened' [15]



Fig 17. The Grey-Headed Flying Fox, Pteropus poliocephalus, is listed as 'Vulnerable'

Threat	Impact
Habitat Loss/	Alteration of habitat following subsidence due to longwall mining
Change	Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands
	Anthropogenic Climate Change
	Bushrock removal
	Clearing of native vegetation
	High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
	Loss of Hollow-bearing Trees
	Loss or degradation (or both) of sites used for hill-topping by butterflies
	Removal of dead wood and dead trees
Disease	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 Auctiniales pathogenic on plants of the family Myrtaceae
Pest Animal	Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners, Manorina melanocephala (Latham, 1802)
	Competition and grazing by the feral European Rabbit, Oryctolagus curriculus (L.)
	Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758
	Compatition from feral honey beas, Apis mellifera L.
	Herbivory and environmental degradation caused by feral deer
	Importation of Red Imported Fire Ants Solenopsis invictaBuren 1972
	Introduction of the Large Earth Bumblebee Bombus terrestris (L.)
	Invasion and establishment of the Cane Toad (Buto marinus)
	Invasion of the Yellow Crazy Ant, Anopholepis gracilipes (Fr. Smith) into NSW
	Predation and hybridisation by Feral Dogs, Canis lupus familiaris
	Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)
	Predation by the European Red Fox Vulpes vulpes (Linnaeus, 1758)
	Predation by the Feral Cat Felis catus (Linnaeus, 1758)
	Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Limaeus 1758
Weeds	Invasion and establishment of exotic vines and scramblers
	Invasion and establishment of Scotch Broom (Cytisus scoparius)
	Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.
	Invasion of native plant communities by Chrysanthemoides monilifera
	Invasion of native plant communities by exotic perennial grasses
	Invasion, establishment and spread of Lantana (Lantana camara L. sens. Lat)
	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
OtherThreats	Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners

Table 3. Key threatening processes – Pittwater IBRA Subregion

What the community said about biodiversity threats and challenges

The major threats to the conservation of biodiversity in the Hornsby LGA were identified through community and council workshops and are recorded in order of priority, see Fig. 18, refer to Appendix 4. The main areas include:

- Management and Policy: i.e. funding, State and local policies
- Development and Clearing: i.e. pressure of population increase and legal and illegal clearing
- Wildlife and Habitat Impact: i.e. loss of remnant trees/hollow bearing trees, habitat fragmentation
- Values and Education: i.e. lacking knowledge and empathy for biodiversity

Other threats identified during communty workshops:

- Weeds: i.e. dispersal via public lands and waterways, escape from home gardens and domestic dumping
- Pollution: i.e. stormwater/runoff pollution and impacts to water quality
- Feral and domestic animals: i.e. direct impact of feral (e.g. foxes) and domestic animals (e.g. cats) on wildlife
- Climate Change: i.e. migration and adaption of species due to shifting normal range
- Connectivity: i.e. bushland fragmentation and lack of ecological corridors
- Recreation: i.e. Illegal mountain bike/ other access tracks through bushland and protected habitat
- Fire: i.e. mismanaged fire regimes, lack of ecological knowledge used in planning burns.
- Resource extraction: i.e. sand mining

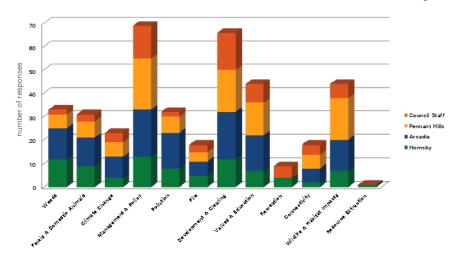


Fig 18. Community and Council staff feedback about the most significant threats and challenges to Hornsby's biodiversity

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Biodiversity management in the Hornsby LGA

A long term, integrated and adaptive approach to manage the broad range of threats is required for the Hornsby LGA.

It is vital that any approach undertaken manages the integrity of biodiversity within the LGA, through the conservation and protection of bushland, reserves, and protected areas. It is important to consider both the biodiversity in terms of protecting ecological patterns and processes, as well as individual species. This means that a management approach needs to ensure the safeguarding and effective management of both the individual species as well as the holistic habitat within which they exist.

'Extra conservation on both Crown and private land supplements the protected area network and provides vegetation corridors linking larger public reserves'[15]

Biodiversity can be conserved and protected within the LGA through a number of techniques and this Strategy outlines five strategies:

Strategy 1: Protect and conserve ecological

Strategy 2: Connect Urban Habitat Strategy 3: Restore disturbed ecosystems to enhance ecological value and function

Strategy 4: Create new ecosystems

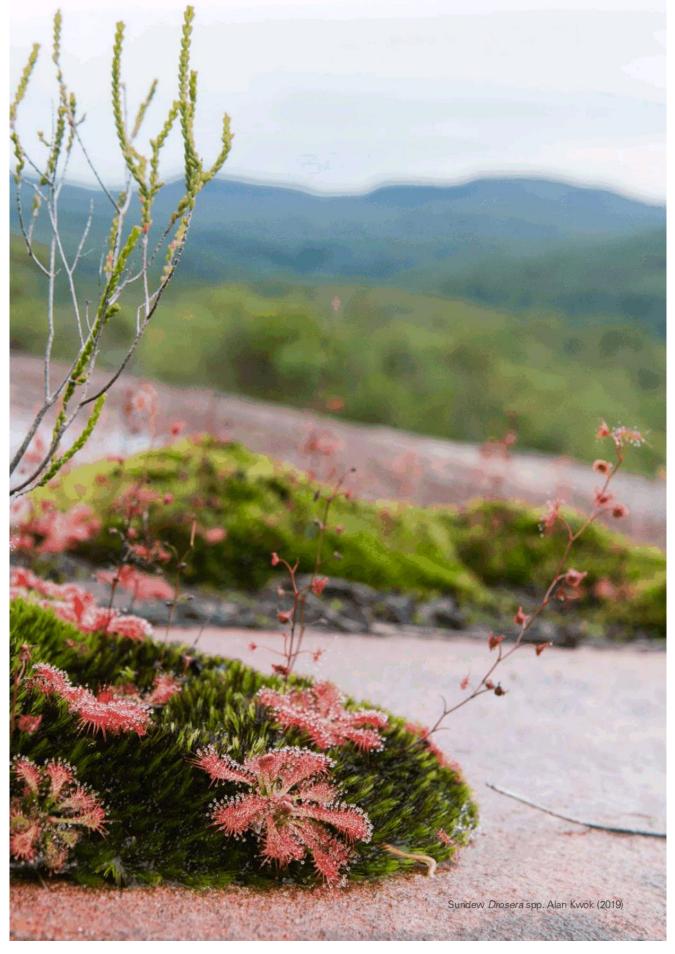
Strategy 5: Connect people to nature

A high percentage of remnant vegetation in the Hornsby LGA occurs on private properties (see Hornsby Urban Forest Strategy) across both rural and urban lands and the conservation and management of biodiversity must be undertaken across both of these. Increasing evidence suggests that urban ecology is also a critical element in maintaining biodiversity in a region. For example, urban wetlands, waterways, remnant vegetation, solitary native and exotic trees, backyard and verge gardens can support a range of fauna species. These include residents i.e. Long-nosed Bandicoots (Perameles nasuta) and Common Ringtail Possums (Pseudocheirus peregrinus), migratory species i.e. Swift Parrot (Lathamus discolor) and transient species i.e. Grey Headed Flying Fox (Pteropus poliocephalus).

To this end, understanding of the broader biodiversity of the region is critical. A good place to start is to understand the existing international, national, regional and local policies.



Fig 19. The Red-Crowned Toadlet, Pseudophryne australis, is listed as 'Vulnerable'



3. Background: policy and planning context

A range of policies exist at the International, National, Regional, and Local scale that influence future biodiversity and its management in the Hornsby LGA.

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Hornsby Biodiversity Conservation Strategy 2020



Fig 20. Diagram of the relationship of criticality of thinking across scales, from global to site

Overview

When considering the development of the Hornsby Biodiversity Conservation Strategy a range of policies and planning approaches were considered, reflecting the approach of the Local Strategic Planning Statement (LSPS). This section will provide an overview of these policies that operate at international, national, regional and local levels.





Fig 21. Peron's tree frog, Litoria peronii, often finds refuge within domestic environments

International and national policies

UN Convention on Biological Diversity

Australia ratified the Convention on Biological Diversity (CBD) in 1993 [1]. The CBD represented a significant achievement internationally in the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of its benefits.

Australia's Biodiversity Conservation Strategy 2010–2030

National biodiversity strategies and action plans are the principal reporting instruments under the CBD. In Australia this occurs through Australia's Biodiversity Conservation Strategy 2010–2030 [29]. This promotes the conservation of biodiversity and ecologically sustainable development through a cooperative approach involving government, community, landholders and Indigenous peoples. Major priorities include the restoration of fragmented landscapes and aquatic systems to improve ecological connectivity and ensure long-term resilience, health, and viability.

Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Environment Protection and Biodiversity Conservation Act (EPBC) [30] provides the highest order of biodiversity protection at the national level. This legal framework seeks 'to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places' of 'national environmental significance' [31] and maintains listings of threatened species and ecological communities as well as threatening processes and long-term trends.

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Hornsby Biodiversity Conservation Strategy 2020

40 year Creater Sydney
Vision
Economic social and
20 year plan
Economic social and
plan
Economic social and
plan
Economic social and
environmental context

COMMUNITY ENGAGEMENT

Creater Sydney
Region Plan
Interstructure
Scientification
Interstructure
Produktivity
Produktivity
Sustainability
Sustainability
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Interperpetation
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Fig 22. Relationship between regional, district and local plans

State and regional legislation and policies

Environmental Planning and Assessment Act 1979

Numerous acts and policies influence the protection and/or management of species, ecological communities and habitat across NSW. The Environmental Planning and Assessment Act (EP&A Act) [11] is the central component of planning law and aims to encourage protection of the environment and ecologically sustainable development under which others follow.

NSW Biodiversity Conservation Act 2017

The Biodiversity Conservation Act 2016 No 63 [19] replaced the NSW Threatened Species Conservation Act [32] in 2017. Both outline the mechanisms through which species, populations and ecological communities may be declared endangered, vulnerable or critically endangered.

Biosecurity Act 2015

This Act provides for the prevention, elimination, minimisation and management of biosecurity risks; and for other purposes. The biosecurity framework and tools safeguard our economy, environment and community. Supporting factsheets provide a summary of management arrangements for weed biosecurity risks in NSW. [36]

State Environmental Planning Policies

A range of State Environmental Planning Policies (SEPPs) also affect the management and planning of biodiversity across NSW. These concern the protection of remnant vegetation, habitat and specific species through wildlife corridors and vegetation links and rules surrounding environmentally sensitive areas. The Coastal Management SEPP updates and consolidates SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal

Protection), including Clause 5.5 of the Standard Instrument - Principal Local Environment Plan. See further information in Appendix 6. Furthermore, planning of biodiversity is subject to the Bush Fire Environmental Assessment Code. [129]

Threatened Ecological Communities Strategy 2017

This document outlines how NSW Government's Saving our Species (SoS) program creates conservation strategies for ensuring the survival of threatened ecological communities. [37]

NSW Government's Biodiversity Conservation Investment Strategy 2018

The NSW Government Biodiversity Conservation Investment Strategy gives actions to the Threatened Ecological Communities Strategy by outlining a range of different actions that are available to landholders, cognisant that much of the land under question is not in the ownership of the Hornsby Shire Council. In the Greater Sydney region, management initiatives focus on both the protection of state and/or nationally listed threatened and endangered ecological communities, and on reinforcing the connections between areas of native vegetation, including urban bushland.

Restoration projects aim to manage threats to these communities such as weed invasion and stock damage, and to restore connections across the landscape by protecting and restoring habitat linkages. Such areas can also provide a focus for tourism and recreation, have cultural significance, and enhance the productivity of our farmlands. [38]

Regional and District Planning

Authored by the Greater Sydney Commission, the *Greater Sydney Regional Plan A Metropolis of Three Cities* [33]:

- sets a 40-year vision (to 2056) and establishes a 20-year plan to manage growth and change for Greater Sydney in the context of social,

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economic and environmental matters

- informs district and local plans and the assessment of planning proposals
- assists infrastructure agencies to plan and deliver for growth and change and to align their infrastructure plans to place-based outcomes
- informs the private sector and the wider community of the growth management and infrastructure investment intentions of government.

The North District Plan [9] is one of five District based documents that provides guidance for implementing the Greater Sydney Plan. This 20-year plan provides a bridge between regional and local planning. It informs local environmental plans, community strategic plans and the assessment of planning proposals. The District Plan also helps council to plan and deliver for growth and change, and to align their local planning strategies to place-based outcomes, see Fig. 22.

Ten key directions and six priorities articulate a planning response and are of direct relevance to this *Hornsby Biodiversity Conservation Strategy* due to their specific focus upon the planning, management and protection of biodiversity. The key relevant objectives include those noted in Box 2.

Greener Places and the Sydney Green Grid 2017

Greener Places, an 'urban green infrastructure' policy produced by the Government Architect's Office NSW provides a useful guide to the planning, design, and delivery of green infrastructure across NSW. Its aim is to showcase how green infrastructure can create healthier, more liveable, and sustainable urban environment with better community access [34]. Four key principles, noted in Box 3, guide its delivery, while Fig. 23 demonstrates the spatial planning of the *Sydney Green Grid*, one that is defined by a layered system of hydrological, ecological and recreational *grids*.

Integration: This involves combining urban, grey and green infrastructure to aid critical ecosystem services.

Connectivity: Involves establishing corridors of connected urban habitat to strengthen and preserve biodiversity.

Multifunctionality: Spaces are to provide not only benefits for social, economic or environmental systems, but to all simultaneously.

Participation: Describes a planning process open to all and incorporating multi-disciplinary knowledge and skills

Box 3. Delivery of Green Infrastructure through the Greener Places document



Fig 23. The Sydney Green Grid

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Objective 27: Biodiversity is protected, urban bushland and remnant vegetation is enhanced This objective is supported by three biodiversity-related actions:

- support landscape-scale biodiversity conservation and the restoration of bushland corridors (66a)
- manage urban bushland and remnant vegetation as green infrastructure (66b)
- manage urban development and urban bushland to reduce edge-effect impacts (66c)

Objective 28: Scenic and cultural landscapes are protected

Objective 29: Environmental, social and economic values in rural areas are protected and enhanced This objective is supported by three biodiversity-related actions:

- Maintain or enhance the values of the Metropolitan Rural Area using place-based planning to deliver targeted environmental, social and economic outcomes. (69)
- Limit urban development to within the Urban Area (70)

Objective 30: Urban tree canopy cover is increased

This objective is supported by three biodiversity-related actions:

- Expand urban tree canopy in the public realm (71)
- Progressively refine the detailed design and delivery of: Greater Sydney Green Grid priority corridors (72a); opportunities for connections that form the long-term vision of the network (72b); walking and cycling links for transport as well as leisure and recreational trips (72c)

Objective 31: Public open space is accessible, protected and enhanced

delivering, or complementing the Greater Sydney Green Grid (73f)

Objective 32: The Green Grid links parks, open spaces, bushland and walking and cycling paths

Appendix 5 contains a copy of planning priorities N15, N16, N17, N18, N19, N20 and N22.

Box 2. Biodiversity-focused objectives from the Greater Sydney Regional Plan: North District Plan

North District: Sydney Green Grid spatial framework and project opportunities 2018

The Sydney Green Grid North District delivers further detail on the Sydney Green Grid at the regional level, including the Hornsby LGA. However, this study is limited and instead suggests that '...reports should be undertaken to assess the future delivery and implementation strategies of Green Grid projects' [35]

The Greener Places 2020 framework and the supporting Greener Places Design Guide.

The Strategy has been developed to have regard to the challenge set by the Government Architect of New South Wales in its Greener Places 2020 framework [8] and the supporting Green Places Design Guide. The Bushland and Waterways Guide is one of several guideline documents included in this framework that support and facilitate implementation of Greener Places. [8] As such it proposes that Councils work to 'provide habitats or establish connections between habitats and populations through green infrastructure planning and design', see Box 4.

STRATEGY 1: Connect urban habitats STRATEGY 2: Protect and conserve

ecological values

STRATEGY 3: Restore disturbed

ecosystems to enhance ecological value and function

STRATEGY 4: Create new ecosystems

STRATEGY 5: Connect people to nature

Box 4. Specific actions mandated for local government from the Bushland and Waterways Guide

Local policies

Hornsby Local Environment Plan

The Hornsby Local Environment Plan [39] or HLEP is the legislated document that guides Council to help maintain, enhance and protect biodiversity values by balancing its protection in light of development and change.

Box 5 provides an overview of the specific Terrestrial Biodiversity objectives.

The HLEP also maintains the Terrestrial Biodiversity Map, see Fig. 25. This is currently based on old and incomplete data and should be updated.

Hornsby Development Control Plan

The Hornsby Development Control Plan (DCP) was made under Section 74C of the Environmental Planning and Assessment Act 1979 (EP&A Act) and was adopted by Council on 19 December 2012 The DCP and came into effect on 11 October 2013. Key objectives of the DCP of direct relevance to this Plan including to: 'protect and enhance the natural and built environment and ensure that satisfactory measures are incorporated to ameliorate any impacts arising from development,' as well



Fig 24. Sulphur-Crested Cockatoo, Cacatua galerita

6.4 Terrestrial biodiversity

- (1) The objective of this clause is to maintain terrestrial biodiversity by: (a) protecting native fauna and flora, and
- (b) protecting the ecological processes necessary for their continued existence, and
- (c) encouraging the conservation and recovery of native fauna and flora and their habitats.
- (2) This clause applies to land identified as "Biodiversity" on the Terrestrial Biodiversity Map.
- (3) Before determining a development application for development on land to which this clause applies, the consent authority must consider:
- (a) whether the development is likely to have:
- (i) any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and
- (ii) any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and
- (iii) any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and (iv) any adverse impact on the habitat elements providing connectivity on the land, and
- (b) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.
- (4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:
- (a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or
- (b) if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or
- (c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

Box 5. The 2013 Hornsby LEP: key objectives

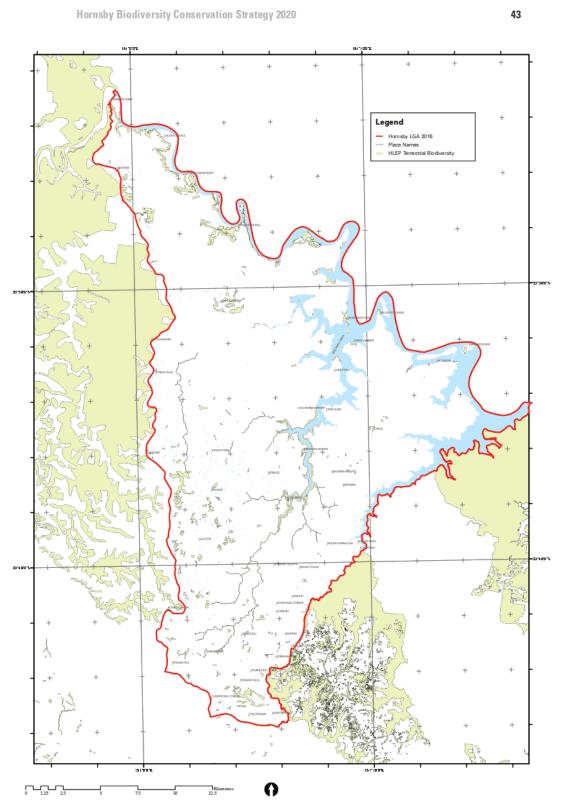


Fig 25. HLEP 'Terrestrial Biodiversity' Map

Hornsby Biodiversity Conservation Strategy 2020



Fig 26. King Parrot, Alisterus scapularis

as ensuring that 'development incorporates the principles of Ecologically Sustainable Development (ESD).' [40]

The DCP specifically aims to:

- achieve an improvement in the quality and extent of existing indigenous vegetation in Hornsby LGA,
- maintain biodiversity on private properties, and
- to conserve and recreate biodiversity connectivity across fragmented Landscapes.

Biodiversity Conservation Strategy

The Hornsby Biodiversity Strategy [22] was prepared in 2006 and has guided Council to date. This provided the basis for planning and policy decisions to date and contained a review of current challenges, relevant international, regional and local. It also collated critical benchmark information about species richness, ecological community diversity and an account of threats and challenges.

Other Hornsby Shire Council planning overlays

A range of other land-use overlays and preservation orders exist across the council including *General* and *Landscape Conservation Areas*; and *Archaeological*, *General* and *Landscape* items. These are mentioned as they offer other examples of types of planning overlays that may be applicable to this report, see Fig. 27.

Hornsby Shire Council Green Offset Code

The *Green Offset Code* provides guidance on the approach undertaken to offset the loss of biodiversity in the Hornsby LGA whilst integrating the regulatory requirements of state planning and environmental legislation. Application of the Code occurs once the development (or

permit) assessment process has considered the biodiversity conservation principles of 'avoid, minimise and mitigate'. The Code is then applied where there is a residual loss of biodiversity and biodiversity values. The existing Code aligns with Council Biodiversity Conservation Strategy 2006, NSW Environmental Planning and Assessment Act 1979, NSW Threatened Species Conservation Act (superseded) 1995 and Environment Protection and Biodiversity Conservation Act 2016, [41, 42]

Local Strategic Planning Statement A Local Strategic Planning Statement (LSPS) is

a pivotal tool for local strategic planning in NSW.

The purpose of a LSPS is to set out:

- the 20-year vision for landuse in the local
- the special characteristics that contribute to local identity
- shared community values to be maintained and enhanced
- how growth and change will be managed into the future

The Sustainable Hornsby 2040 Strategy

The Sustainable Hornsby 2040 Strategy sets the framework for Council and the community as we embark on our journey to embed sustainability into our daily lives. Environmental sustainability underpins the four pillars of our Corporate Framework of liveable, sustainable, productive and collaborative. Sustainable Hornsby 2040 forms the overarching Strategy that brings together the following supporting documents: the Waste Matters Strategy, Biodiversity Conservation Strategy, Urban Forest Strategy, Water Sensitive Hornsby Strategy, Climate Wise Hornsby Plan and the Walking and Cycling Strategy. Additionally, Council is developing a draft Bushfire Risk Management Strategy and Coastal Management Program to inform preparedness and emergency response to Natural Hazards. In combination, this strategic work will provide the foundation on which we will work with our community on local responses that connect to global concerns.

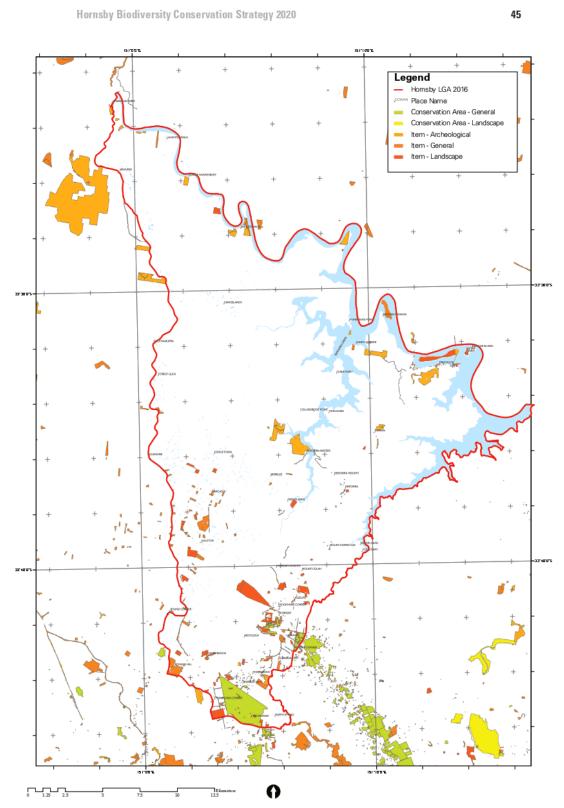
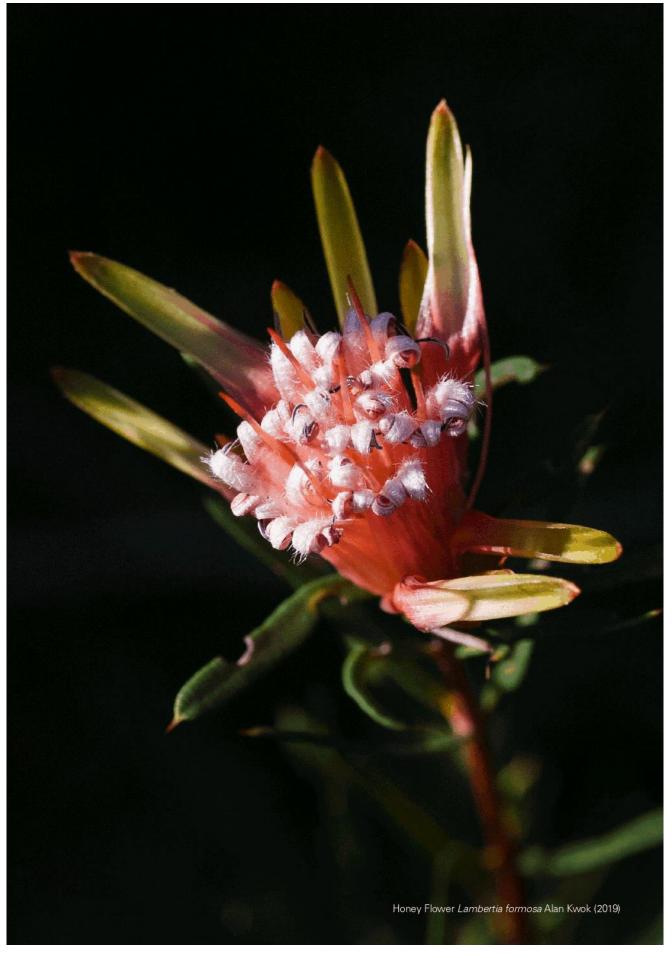


Fig 27. Additional relevant planning controls for the Hornsby Shire



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4. Background: the green infrastructure approach

This section introduces green infrastructure theory and practice. This report makes a case for its usefulness through an examination of its methods, benefits and a range of projects.

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Rethinking infrastructure: from grey to green

Typically we define infrastructure as 'the basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise' [43], often referred to as 'grey' infrastructure. The concept of Critical National Infrastructure is well established: this defines the power, transportation and communications networks, food and water supply systems and other infrastructure components without which basic economic and social systems 'cannot effectively function' [44]. Such infrastructures are often centralised, single purpose and efficiencybased [45] and provide ubiquitous levels of service across regional and urban locations in a systemic and efficient way [45].

While already familiar with grey infrastructure, the idea of green infrastructure is less well known and not something the public may typically appreciate. However, increasingly the adoption of an infrastructural approach to ecological planning and design brings the language and delivery of traditionally recognised grey infrastructures (such as sewers, electricity, roads and rail) to a novel green application as a useful spatial framework through which to consider landscapes across diverse land-uses and scales.

Some diversity and variability in the definition of the term green infrastructure [7, 46-50], see Box 6

Benedict & McMahon:

Green infrastructure is the ecological framework for environmental, social, and economic health
– in short, our natural life-support system. [7]

The Government Architect's Office, NSW:

'Green infrastructure is the network of green spaces, natural systems and semi-natural systems including parks, rivers, bushland and private gardens that are planned, designed and managed to support a good quality of life in an urban environment.' [34] Habitat corridors can be identified along street verges, around ovals and parks, in hospital and school grounds, gardens, and along railway and motorway corridors so that planning controls, management mechanisms, incentives, and education programs can be developed to protect, enhance, and create the opportunities they offer to habitat connectivity.

The Australian Institute of Landscape Architects (AILA):

'residential gardens to local parks and housing estates, streetscapes and highway verges, services and communications corridors, waterways and regional recreation areas'. [51]

Box 6. Definitions and types green infrastructure

Hornsby Biodiversity Conservation Strategy 2020

Trees and Gardens

Street,

Green infrastructure offers a broad range of ecosystem services and benefits, has a variety of types and operates over a range of spatial scales. Types of Green infrastructure may include designs at the continental scale; planning at the regional scale such as National Parks and large urban parks; and local scale including public places and waterfronts; down to the domestic, such as gardens, green roofs and other smaller scale green spaces, see

Green infrastructure also offers a new approach to address environmental challenges and threats, earlier mentioned in this report (see section 2, Background: The Biodiversity of the Hornsby LGA). Green infrastructure is useful for several reasons:

Fig. 28.

- Is policy-ready and offers a way to translate ecological design and planning into spatial reality
- Articulates well-established (best practice) landscape ecological design principles and enables ecological connectivity
- Offers a diverse array of benefits in an ecological, cultural and economic sense



Increasing size and complexity

Fig 28. Example of Green Infrastructure at different scales

Hornsby Biodiversity Conservation Strategy 2020

Green infrastructure is policy ready

Support for green infrastructure already exists in NSW State Planning Policy and the NSW Government has incorporated the concept of 'green infrastructure as essential infrastructure' in the latest Sydney Metropolitan Plan and five District Plans, see Box 7. According to the North District Plan 'green infrastructure is the network of green spaces, natural systems, and semi-natural systems that support sustainable communities'; and 'as our cities grow, Australian governments should focus on maintaining and enhancing green infrastructure and the public realm to ensure they remain liveable'. [9, 34, 52]

Similarly, the *Green Grid, Better Placed* and *Greener Places* policies and accompanying manuals offer guidance on urban tree canopy, open space for recreation and connecting bushland and waterways and offer insights into government and community may collaborate. [8] *Greener Places* notes several desired outcomes relating for biodiversity protection and/or management:

- Protection and enhancement of natural resources and biodiversity by improving the quality of watercourses, creating green habitat corridors and protecting endangered ecological communities
- Promotion of social, cultural, recreational and educational opportunities within natural, cultural and heritage landscapes.
- Restoration and enhancement of wetland habitats and increased accessibility to them
- Creation of new ecosystems that support biodiversity such as constructed wetlands and green roofs. [8]

Greener Places specifically aims to use the green infrastructure to:

- 'create a network of healthy and attractive new and upgraded city environments, sustainable routes and spaces'
- 'perform essential ecosystem services'.
 (p. 24)
- 'protect, conserve and enhance NSW's network of green and open natural and cultural spaces (p. 20) [8]

In addition, The Australian Institute of Landscape Architects (AILA), in their 2009 Green Infrastructure policy [51] suggest that 'an integrated national spatial framework for landscape-scale conservation and regeneration' is necessary and for the inclusion of green infrastructure 'into planning documents to influence land management decisions' and outlines as priority to 'map regional and local opportunities for existing/potential green infrastructure networks ... as a matter of urgency'. This was further re-iterated in 2015.

The earlier 2006 Hornsby Biodiversity Strategy also mentioned that studies that specifically planned for ecological corridors had been proposed [54] and indicated that '...links/ corridors were awaiting work and/or protection during publication of report.'

However, such proposals take time to develop; and, the statutory embrace of green infrastructure and its principles is limited to date. For example, while the *Sydney Green Grid North District* [35] offers a worthy ambition, no further detail for the region in question and minimal suggestions for methodology are provided to assist local governments to enact the next level of planning, the critical step of implementation means that a further step is required, see Box 7, with further information in Appendix 5.

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Planning Priority N16 Protecting and Enhancing bushland and biodiversity

66. Protect and enhance biodiversity by: a. supporting landscape-scale biodiversity conservation and the restoration of bushland corridors

b. managing urban bushland and remnant vegetation as green infrastructure

c. managing urban development and urban bushland to reduce edge-effect impacts. [9]

Planning Priority N18 Better managing rural areas

This offers specific advice toward the 'creation of protected biodiversity corridors, buffers to support investment in rural industries and protection of scenic landscapes' [9] and acknowledges that rural areas – which form a large part of the HSC - are valuable assets to the District and to Greater Sydney. Key relevant actions related to biodiversity protection and/or management for N18 are:

69. Maintain or enhance the values of the Metropolitan Rural Area using place-based planning to deliver targeted environmental, social and economic outcomes.

70. Limit urban development to within the Urban Area. [9]

Planning Priority N19 Increasing urban tree canopy cover and delivering Green Grid connections

This outlines a series of key values for increasing the urban forest with tangible benefits for mitigating the UHI effect, providing amenity and air quality as well as connections to the SGG for both recreational, active transport and biodiversity benefits while acknowledging the pressures on the urban forest by increasing densification and the delivery of grey infrastructure. It also specifies several key projects that directly concern HSC, including Lane Cove National Park and Lane Cove River and the Great North Walk. Key relevant actions related to biodiversity protection and/or management for N19 are:

71. Expand urban tree canopy in the public realm.

- 72. Progressively refine the detailed design and delivery of:
- a. Greater Sydney Green Grid priority corridors

b. opportunities for connections that form the long-term vision of the network

c. walking and cycling links for transport as well as leisure and recreational trips. [9]

Planning Priority N20 Delivering high quality open space

This priority contains specific advice about the benefits of POS as places for nature-based recreation, helping to 'connect communities to the natural landscape' while recognising the simultaneous need to manage to 'minimise impacts on biodiversity' [9].

School grounds and repurposed golf courses

f. delivering, or complementing the Greater Sydney Green Grid. [9]

Planning Priority N22 Adapting to the impacts of urban and natural hazards and climate change

This priority outlines several key risks that face the region. Arguably the most significant of these is the relationship between fire management and biodiversity. Specific considerations toward '...clearing vegetation around developments on bushfire-prone land can help reduce risks from bushfire, but must be balanced with protecting bushland, and its ecological processes and systems' and notes that these challenges 'will be exacerbated by climate change'

Key relevant actions related to biodiversity protection and/or management for N22

80. Support initiatives that respond to the impacts of climate change.

81. Avoid locating new urban development in areas exposed to natural and urban hazards and consider options to limit the intensification of development in existing urban areas most exposed to hazards.

82. Mitigate the urban heat island effect and reduce vulnerability to extreme heat.

Box 7. Support for Green Infrastructure from the North District Plan

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Green infrastructure's environmental benefits

The European Commission [55] suggests the integration of green infrastructure into many other policies including 'agriculture, forestry, water, marine and fisheries, climate change mitigation and adaptation, transport, energy and land use' and specifically names green infrastructure as 'one of the main tools to tackle threats on biodiversity resulting from habitat fragmentation, land use change and loss of habitats'.

The ecological connectivity that green infrastructure facilitates underpins the precautionary principle across numerous policies. This includes planning for corridors across all scales via the National Biodiversity Strategy and Action Plan(s) [57]. Increasing ecological connectivity is an important consideration when considering fragmented landscapes and may help to mitigate species extinction – especially critical in a time of climate change and shifting distributions.

Green infrastructure initiatives may include a spectrum of benefits from small scale insertions of habitat and micro-climatic benefit via green roofs and walls at a local street level [58]; to active transport and recreation at the neighbourhood level; whilst simultaneously benefitting ecological and hydrological systems at regional scales [59]. This may result in increased habitat and ecological connectivity that could simultaneously mitigate urban heat island effects when scaled up across a metropolitan region as:

An interconnected network of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clear air and water, and provides a wide array of benefits to people and wildlife.' [7]

Further benefits include the specific delivery of ecosystem services [60] such as: stormwater management; social vulnerability; green space; air quality; urban heat island amelioration; and, landscape connectivity [61].

Indeed, green infrastructure's multifunctionality is one of its most recognisable qualities [46, 62, 63] and the concept could be considered as 'a melting pot for innovative planning approaches in the field of nature conservation and green space planning' [64]. Further benefits are noted in Box 8.

Green infrastructure offers a range of benefits to 'people, the environment and economy' [8] with key proposed benefits relevant to biodiversity being:

- Enriches soil and provides pollinators (birds and insects) vital to food production Richer biodiversity, genetic variation, and variety of habitats increases resilience to climate change and long-term ecosystem function
- Regulates climate and reduces urban heat-island effect
- Reduces stormwater run-off erosion and flooding, improves water quality in riparian areas and provides non-potable water supply
- Improves air quality and sequesters greenhouse gases [8]

Box 8. Recognised green infrastructure benefits

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Green infrastructure can help articulate landscape ecological principles

Landscape Ecology teaches us of the need to reconnect landscapes and green infrastructure provides a useful mechanism to help facilitate the connectivity that landscapes require. In addition we know that certain patterns and processes facilitate better biodiversity outcomes and for this we need to be familiar with and understand the patch-corridor-matrix typology alongside several guiding principles.

Patch, corridor and matrix

Forman and Godron [65] suggested that: 'every element in a landscape, e.g., from suburbia to forest wilderness, can be readily identified as a patch (wide), a corridor (narrow), or the background matrix'. [66]

A 'patch' can be defined as a 'relatively homogeneous area that differs from its surroundings' [67]. Patches in the Australian context exist as areas of vegetation that remain from a previous extant vegetation cover. When discussing patches both species and location should be specified and Forman & Godron [65] also note that 'the size, shape, and nature of the edge are particularly important patch characteristics'. Patches occur in a variety of sizes and may also be referred to as hubs, nodes or core areas.

'Corridors' have a wider range of definitions: 'corridors are narrow, linear remnants of habitat that connect otherwise isolated habitat patches'. [4] or a 'narrow strip, stepping stone, or series of stepping stones of hospitable territory traversing inhospitable territory providing access from one area to another. [5, 6, 8] Multiple corridors when combined form 'networks' that are distinct from the background matrix.

The 'matrix' refers to the background within which patches and corridors exist and is composed of 'an array of natural and anthropogenically-derived features which tend to act as barriers to, or conduits for, biotic movement' [68]. In ecological planning a simplistic binary notion of landscape as suitable, as hostile or offering a gradient of resistance to connectivity prevails and often guides decision-making and planning.

Guiding principles

Guiding principles drawn from Landscape Ecology permeate the creation of green infrastructure projects. Dramstad, Olson, Forman [69] authored the useful reference guide 'Landscape Ecology Principles in Landscape Architecture and Land-use Planning', which offers a toolkit of approaches and rules of thumb [70], see Fig. 29. These will now be briefly introduced.

Single Large or Several Small

First advocated by MacArthur and Wilson [71] the benefits of larger contiguous patches in lieu of multiple small – known as *Single Large or Several Small* (SLOSS) – was in turn supported by Diamond [72] but contested by Simberloff [73]. The contention here is based upon the principle of minimising the *edge effect* [6], where remnant patches with large perimeter to area ratios are potentially more susceptible to external influences. Such incursions by weeds – and also increased predation from surrounding habitat patches and matrix – may be related to size of patch and the external matrix, with such dynamics commonly referred to as *source-sink* relationship. [6, 74-77]

However a synopsis such as this can be overly simplistic, as many species prefer edge conditions and may benefit from greater access to light (in the instance of primary succession plant colonisation); or, for faunal species, the advantageous foraging patterns associated with such an edge.

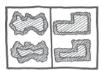
'Weeds and pest animals threaten over 70% of threatened species and endangered ecological communities in NSW' [15]

Hornsby Biodiversity Conservation Strategy 2020

In spite of possessing a potentially undesirable greater area to perimeter ratio as multiple distributed patches, further benefits of several small areas (in lieu of single large) include that these may sample a greater representation of a given landscape. This may ensure potential for independent metapopulations and species longevity in the case of patch extinction or

as a result of catastrophic events (such as fire, disease or land clearing). Furthermore, management actions are more easily coordinated across a small number of areas with low perimeter to area ratio.

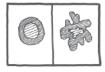
Several figures outlining particular landscape patterns of benefit are consolidated in Fig. 29.



Edge cuvilinearity and width: Curvilinearity and width of an edge combine to determine the total of edge habitat within a landscape.

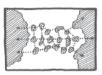


Dispersal and small connected patch:
Small patches or nodes along an existing network
are effective in providing habitat in which
individuals pause and/or breed, resulting in a
higher survival rate for dispersing individuals and,
hence, more dispersing individuals in the network.



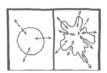
Edge and interior species:

A more convoluted patch will have a higher proportion of edge habitat, thereby slightly increasing the number of edge species, but sharply decreasing the number of interior species including those of conservation importance.

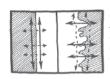


Cluster of stepping stones:

The optimal spatial arrangement of a cluster of stepping stones between large patches provides alternative or redundant routes, while maintaining an overall linearly-oriented array between the large patches.



Interraction with surroundings:
The more convoluted the shape of a patch, the more interaction, whether positive or negative, there is between the patch and the surrounding matrix.



Straight and curvilinear boundaries: A straight boundary tends to have more species movement along it, whereas a convoluted boundary is more likely to have movement across it.



Patch selection for conservation:

The selection of patches for conservation should be based on their: 1) contribution to the overall system, i.e. how well the location of a patch relates or links to other patches within the landscape or region; and, 2) unusual or distinctive characteristics, e.g. whether a patch has any rare, threatened or endemic species present.

Fig 29. Various Landscape Ecology principles spatially explained by Dramstad, Olson and Forman

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Corridor physiology

Ecological *corridors* are simply elongated patches of a particular shape with one distinction: that their *presumed* function is for migration and not habitat, although in a functional (and not structural) sense [78], see Box 9.

While long and thin corridors offer the worst shape with extremely large area to perimeter ratios, corridor width is another area of on-going debate and is of particular interest to those who wish to implement green infrastructure proposals according to the best scientific rationale [79]. Recalling that the intent of corridors is to sustain robust connectivity for genetic material movement [80-83], there is unfortunately no clear consensus regarding neither number, length nor width but rather in much research was dependent upon focal species and geographical location [81, 84-88].

This may therefore mean that the 'wider the better' [89] as multi-functional corridors; long and thin reserves (for example, rivers and linear vegetation strips along roadways) may actually contain 'more vegetation types and habitats than a square reserve of similar area' and thus offer better representation of a landscape and its resident biota [6].Or, that discontinuous or stepping stone linkage types may even preferred by many highly mobile species such as birds, although these vary in their critical distance and are species dependent.

When discussing corridors and the matrix it is also important to distinguish between the structural and functional qualities of corridors. Functional connectivity refers to how the behaviour of a dispersing individual is affected by landscape structure and elements; whereas structural connectivity depends on the spatial configuration of habitat patches in the landscape and is dictated by patch vicinity and the presence of barriers [90]. Correspondingly, corridors may not always be good for biodiversity protection and management (for instance, acting as vectors for disease or weeds) and should always be considered as species-specific.

Box 9. Structural versus Functional connectivity

A review of green infrastructure best practice across scales

Attempts to orchestrate green infrastructure approaches to landscape and biodiversity planning are often referred to as 'ecological', 'landscape' or 'green' networks. Worldwide enthusiasm for this type of planning has grown and a vast range of initiatives, plans and projects that exist at a wide range of scales.

For instance, NSW specifically endorses the concept of connectivity through several key projects [91] that attempt to maintain ecological processes across multiple scales [92] including the *Great Eastern Ranges Initiative* [93], see Fig. 30.

Urban connectivity conservation

Numerous smaller scale connectivity conservation projects of relevance also exist. In Australia and overseas, these operate across predominantly urban areas in limited geographical areas, leading to a finer grain of resolution. Such projects include the *Sydney Green Grid* [94], Fig. 31; the *Perth Biodiversity Network* [95], see Fig. 32 and the *Singapore Park Connectors*, and *The GreenWay* (Inner West Council) see Fig. 33 and 34.

These demonstrate the tractability and appeal of connectivity conservation, even in urban settings and they are also mentioned here as the origins of both lie not with biodiversity protection, but rather take inspiration from urban planning and specifically the *greenway* movement [48, 96]. This is a critical point as biodiversity preservation and enhancement has a symbiotic relationship with green infrastructure, with both benefiting each other, even if the motivations are mixed.

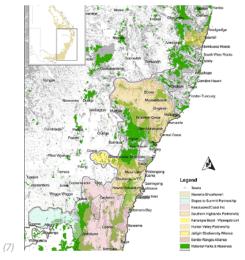


Fig 30. Great Eastern Ranges Initiative



Fig 31. Sydney Green Grid

(9)



Fig 32. Perth Biodiversity Network

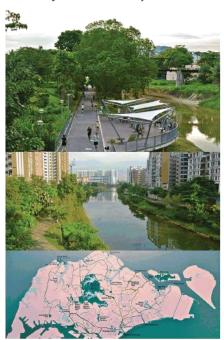


Fig 33. Singapore Park Connectors

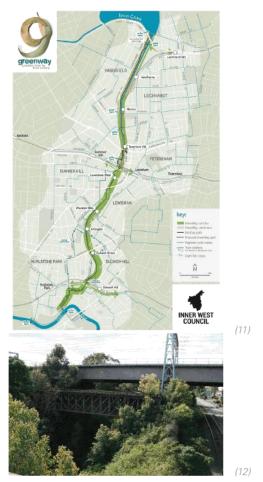


Fig 34. The GreenWay, Inner West Council, NSW

(10)

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Constructed green infrastructure at the smallest scale

The ecological corridors that form green infrastructure networks are considered to be an effective mechanism to maintain the long-term viability of wildlife and remnant vegetation and can play important ecological functions, including: the maintenance of genetic exchange, enabling re-colonisation and providing a route for the dispersal of flora and fauna across inhospitable habitats - including migratory and nomadic species [97]. Several examples are indicated in Fig. 35-39 that demonstrate examples of the types of components that may make up green infrastructure at the smallest scale.

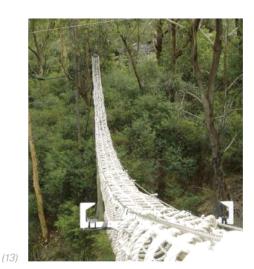


Fig 35. Ku-ring-gai Council - Possum crossing



Fig 36. Ecological corridor/ecoduct – Arnhem, Netherlands

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Fig 37. Ecological corridor/ecoduct – Banff National Park, Canada



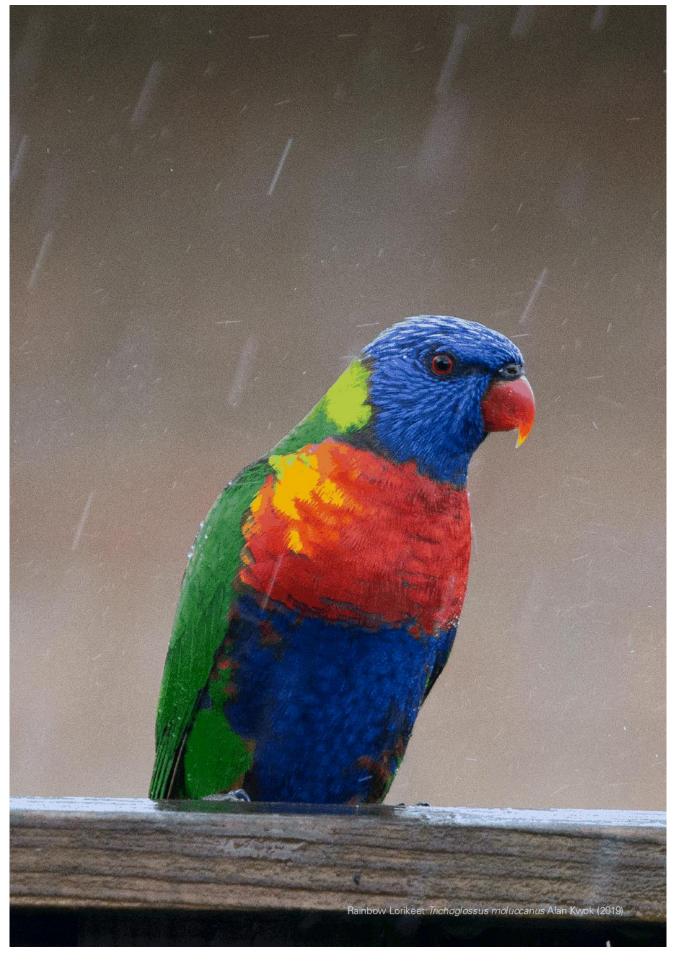
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Fig 38. Christmas Island crab crossing structure



Fig 39. Ecological Corridor/ecoduct -Butterfly bridge New York



5. The development of a Green Infrastructure Framework for Hornsby LGA

This section introduces the development of the Green Infrastructure Framework for Hornsby, accompanied by a series of maps and detailed examples.

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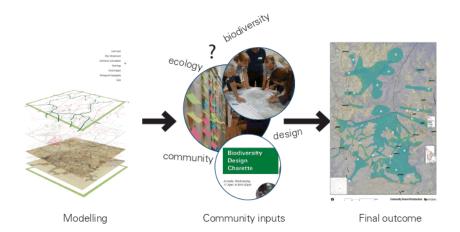


Fig 40. Graphic of the method that led to the Green Infrastructure Framework

The need for precision – from large to small

This report proposes a *Green Infrastructure Framework* for Hornsby LGA. This was developed based on the need to spatially articulate landscape ecological science principles, and to express a response to several specific policies and the commitment of the NSW Government to green infrastructure as a key strategy for the protection of biodiversity and its future in the region.

This report proposes that 'illustration leads to demonstration' [89] and that the strength of the Framework lies partly in its inherent boldness; and its visualisation. There is value in a 'simplistic, pattern-based view of corridors and habitats' as readily accessible visuals. Such visuals hold great appeal and have captured the imagination of ecologists, policy makers and the public alike who are excited by the ability to find solutions to the fragmented landscapes, communities and species on the edge of extinction through bridging scale [98, 99] with positive action.

However, across distance, land-use and tenure green infrastructure often bridges lands in an untested and spatially inaccurate manner. This has led Jongman et al. to consider that the key challenge for connectivity conservation is not ideation but rather scale: 'Ecological networks need to be developed at the field and regional scales, and at the national and trans-national scales'. [100] The real challenge therefore is implementation [101] and a reflection that Sydney's *Green Grid* echoes: 'further detail is required'.

This report will now discuss the method that led to the development of the Framework, see Fig. 40, and begins with the first stage: *Ecological modelling*.

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Land cover Grey infrastructure Land tenure and cadastre Hydrology + Aerial imagery Geology and topography Soils

Ecological modelling

The key to successful ecological performance is actual corridor design [102]. Unfortunately there is no consensus on the best method. metrics, nor modelling from ecological scientists [103] and Diamond reminds us that 'ecology is impossible to predict' [104]. However, numerous Geographical Information System (GIS)-based ecological prioritisation tools and ecological modelling software have been developed to attempt such designs. These programs overlay and analyse multiple data sets and model connectivity conservation designs across landscapes. Such modelling adds the ability to work across scales [103] and often relies upon circuit theory and other approaches from outside the ecological sciences with a typical design process involving GIS, see Fig. 41.

The Green Infrastructure Framework was first developed through a weighted landscape model and the ecological connectivity tool, Linkage Mapper. In this landscape model the higher the value, the more the likelihood of its selection by modelling algorithms as path (or linkage) for connectivity function. Higher value lands included agricultural lands, significant

hydrological features and remnant vegetation. Lower values were assigned to urban areas and other intensive land-uses. This created a modelled green infrastructure design with 100m wide corridors to which the *Sydney Green Grid* [94] was also added as a separate visually accessible layer.

Refining the green infrastructure framework

The second stage sought to adjust the *Green Infrastructure Framework* where local knowledge and skills adjusted the design to better suit both the ecological as well as the cultural landscape within which the proposal would operate.

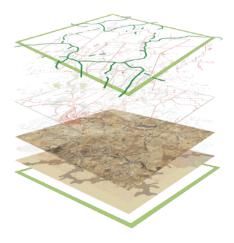


Fig 41. Graphic of the ecological modelling process

Doerr suggests that even if the perfect methodology - or design - could be agreed upon, it is the actual implementation of green infrastructure that is the real challenge [105]. This entails additional buy-in from stakeholders, adjustment to planning policies and mechanisms, sourcing potential avenues for funding and further detailed design to meet landscape specifics. For this reason, community participation was sought as a starting point and used to iteratively adjust and reconfigure the Green Infrastructure Framework. These were then further developed, to create a final, accurate Green Infrastructure Framework, as illustrated in Fig. 42. Here at the largest scale, the Framework knits together stakeholders design efforts and energies, combining biodiversity planning with landscape reality and reconnecting fragmented landscapes and community back together again.

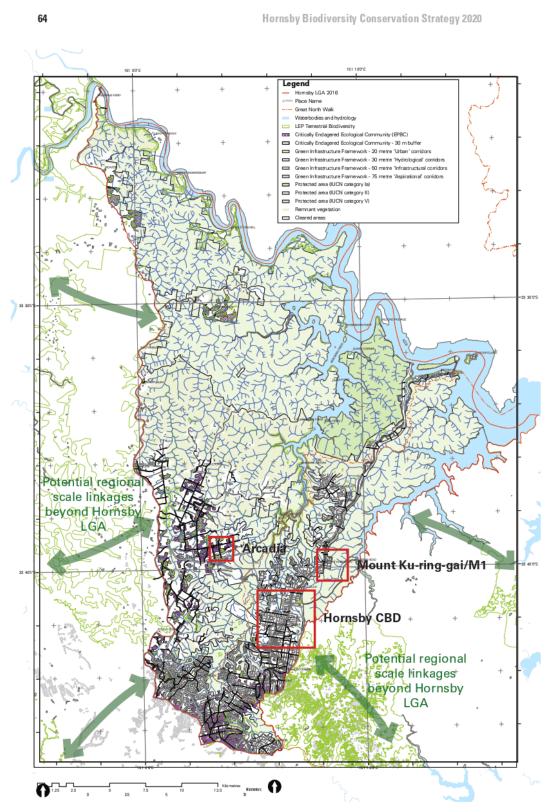
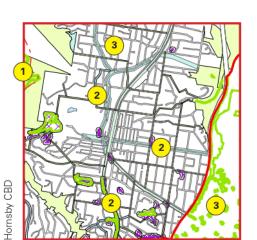
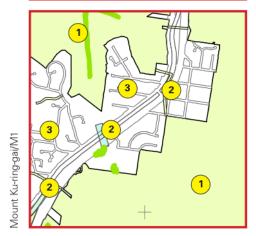


Fig 42. Final Green Infrastructure Framework





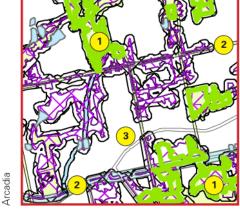


Fig 43. The Framework retains the core-corridor-matrix typology

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The final green infrastructure framework for Hornsby LGA

The final resultant framework is a critical component of this *Hornsby Biodiversity Conservation Strategy*. This framework is typified by a diversity of linkages that visualise potential connections between disparate habitat patches. These vary in size according to the process of refinement by community, staff and external advice.

This framework will still require additional groundtruthing of ideas with relevant stakeholders.

Fig. 43 demonstrates three examples of the Framework in three different locations: Hornsby CBD, Mount Ku-ring-gai and Arcadia. Noticeable is the *core-corridor-matrix* typology of the proposed biodiversity lands in question. It is here that the need for further detail (and relevant Council approvals) are required and planning implications can be further resolved.

This detail will be considered further in the last part of this report, the Recommendations, Strategies and Actions for Biodiversity Management and Protection. While the Case Study section of this report provides further exploration and illustration of these ideas.

For further detail see Appendix 7.





6. Strategies and actions for biodiversity conservation

This section introduces the breadth of recommendations toward biodiversity management and protection in the Hornsby LGA. These tools, strategies and actions were revealed through literature and best practice review, community and Council staff engagement and include a prioritisation of recommendations and related timeframes, including recommendations toward a new Local Strategic Planning Statement process due to conclude in early 2020.

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Recommendations: a matrix of strategies, actions and mechanisms

Council operations, policies, guidelines and development approval processes are critical mechanisms to mitigate threats to biodiversity. Reviewing and developing these in the short and long term and taking positive steps including adopting innovative programs, incentive initiatives and design and development of infrastructure.

A matrix of five interconnected strategies have been identified to assist Hornsby Shire Council and community to meet their broad objectives of biodiversity and conservation management. Beneath these strategies, a range of specific actions have been categorised and assigned a level of priority.

Indicative timeframes are presented in Table 4. The implementation timeframes have been developed to align with Councils Integrated Planning & Reporting framework to integrate with operations and strategic delivery. Implementation will be determined by resourcing availability and priorities set by Council through is operational and delivery programs.

These five strategies align with those outlined in the Bushland and Waterways Guide. [8]

Indicative timeframes are noted as below:

Timeframe for completion	Priority Level
0-1 year	H (High)
1-4 years	M (Medium)
4-10 years	L (Low)
Continuous work	0 (Ongoing)

Table 4. Indicative timeframes for implementation

Strategy 1: Protect and conserve ecological values

The protection and conservation of existing remnant ecosystems is crucial to the prevention of further habitat and biodiversity loss and the viability of green infrastructure. Remnant ecosystems provide important habitat resources for urban biodiversity, and community access to natural landscapes. In addition, ecological values across other land-use types including parks, waterways and restored areas will be increasingly recognised for their ecological

Strategy 2: Connect urban habitat

Species diversity and genetic health relies on the total area of habitat, proximity of habitats, and the capacity of species to move between habitats. Green infrastructure corridors allows plants and animals to recolonise areas where they have become locally extinct so they can be enjoyed by future generations and have long-term viability. They also allow species to find alternative habitat in times of major disasters such as fire or flood, and escape major threats such as clearing or disease. It is important to understand the existing network of green and blue habitats and their links. Where links between existing habitats are incomplete, approaches - such as the Green Infrastructure Framework - are needed that help to restore both corridor and stepping-stone habitat connections. Urban green and blue grid corridors and networks can also provide a range of social benefits including improved recreation opportunities and neighbourhood destinations.

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Strategy 3: Restore disturbed ecosystems to enhance ecological value and function

Where ecosystems have been disturbed, restoration is the preferred option to improve habitat structure and function and support biodiversity. Restoration not only includes bush regeneration and weed management in the reserve system, which is statutorily required, but also refers to urban habitat corridors where the built form as well as gardens, street verges, parks, and large institutional properties etc. can all play a role in improving habitat through the way they are designed and managed. Specific actions will vary depending on location; condition; identified values; past, current, and anticipated pressures; and what is feasible and practical.

Strategy 4: Create new ecosystems

Where habitat linkages are needed within a corridor in areas devoid of habitat, new ecosystems can be created. Green infrastructure and water-sensitive urban design elements, such as green roofs, wetlands, and bio swales, can provide habitats and ecosystem services. More effective urban green spaces can be created when the improvement of the space considers multiple benefits at the design stage including improved economic, social, and environmental outcomes.

Strategy 5: Connect people to nature

People connect with nature through sport, recreation, education, bushwalking, volunteer activities, and health- related activities. Daily exposure to nature can be improved using urban design features such as biodiverse green walls or street trees, and by providing appropriate infrastructure to support sustainable receation in natural areas through the provision of appropriate access such as walking/biking tracks, picnic areas and lookouts. These connections are fundamental to benefit people but also the environment. Improving people's connection to nature may support longer term land management as people are motivated to care for and enhance their natural spaces. A broad education, engagement and citizen science program within the Hornsby Shire Council will support new and existing programs to encourage and enhance biodiversity and conservation management.

These five strategies are expanded in further detail over the following pages and are interspersed with several examples of other practical measures (in boxes).



Fig 44. Bar-sided forest-skink Eulamprus tenuis

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Strategy 1: Protect and conserve ecological values

ID	Task - Description	Indicator(s)	Strategic/ Legislative Driver	Prior- ity	
1.0.0	Strategy 1: Protect and Conserve Ecological Values				
1.1.0	Planning instruments - include LEP and DCP planning controls to connect, protect, restore, enhance and create urban habitat				
1.1.1	Assess and update the 'terrestrial biodiversity' lands coverage to ensure consistency with existing Council biodiversity policies	> Terrestrial biodiversity lands coverage is assessed and updated	EP&A Act	Н	
1.1.2	Implement the revised HLEP 2013 Terrestrial Biodiversity Map	> Terrestrial biodiversity lands coverage within the revised LEP is implemented	EP&A Act	Н	
1.1.3	Assess the capacity of local strategic planning instruments (e.g. LEPs, DCPs) and land management documents to support the implementation of a Green Infrastructure Framework	> The Green Infrastructure Framework is included within the LEP and mapped > Planning mechanisms to support implementation of a GIF are assessed in consultation with DPIE	Northern District Plan, Green Infrastructure Policy	Н	
1.1.4	Review current biodiversity conservation management within the HDCP	> Biodiversity conservation management provisions within HDCP reviewed and updated to consider biodiversity where appropriate	EP&A Act	M	
1.2.0	Management and policy instruments - incorporate	e the goal to protect and conserve biodiversity in all relevant management and policy			
1.2.1	Assess Plans of Management for Natural Areas to enhance biodiversity conservation outcomes	> Plans of Management for Natural Areas assessed	Local Government Act, Crown Lands Act	Н	
1.2.2	Assess opportunities for the establishment and preservation of buffer zones around TECs, threatened species, remnant vegetation and riparian zones across the Shire	> Existing buffer zones reviewed to align with best practice planning measures > opportunities to establish new buffers considered where appropriate	EP&A Act, Biodiversity Conservation Act, EPBC Act	Н	
1.2.3	Identify mechanisms to inform residents of significant biodiversity features and remnant vegetation on their land	> Review property messaging to ensure biodiversity values are adequately identified	EP&A Act, Biodiversity Conservation Act	Н	
1.2.4	Assess potential new standards for bird safe buildings, including information material, guidelines for retrofitting and DA assessment	> Policy and guidelines are assessed	EP&A Act	M	
1.2.5	Prepare/review guidelines for vegetation management and compliance	> Vegetation management guidelines and compliance prepared	EP&A Act, Northern District Plan, Biodiversity Conservation Act	Н	
1.2.6	Maintain policy position on companion animal management and strengthen delivery if required	Strategies for effective pet - biodiversity interactions identified, including: - Policy on micro chipped pets reviewed and maintained - Cat de-sexing program maintained - Opportunity and value of pet exclusion zones/curfews	Companion Animals Act	0	
1.2.7	Promote and support Wildlife Protection Areas, Wildlife Refuges and Conservation Covenants on private lands	> Wildlife Protection Areas, Wildlife Refuges and Conservation Covenants implemented in collaboration with land owners	EP&A Act, Biodiversity Conservation Act	0	
1.2.8	Prepare strategies, policies and guidelines that support best practice management of stomwater on Council managed lands	> WSUD policy reviewed, prepared, and implemented > HSC to capture, harvest, and re-use urban stormwater and wastewater to create new habitat prepared and implemented	Northern District Plan, Water Sensitive Homsby	0	
1.2.9	Maintain green wall and roof provisions for new developments/retrofits	> Green wall and green roof provisions (HDCP 1C.2.9g) assessed > Prepare guidance note for green walls and roofs prepared	Urban Forest	Н	
1.2.10	Assess opportunities to maximise biodiversity on private and public lands	Opportunities to maximise biodiversity on private and public lands assessed including: > Ensure natural assets (bushland, creek lines etc) are managed via a dedicated natural assets management plan which forms part of Councils corporate asset management system > Prepare operational guideline to diversify and augment Council plantings to include under/mid storey spp. > New policies and instruments are prepared > Landscape Plans to include specific controls for ecological focused local provenance planting > Development approvals consider opportunity to support enhancement of the GIF > Lobby government for improved biodiversity considerations in 10/50 legislation > Implement Design Review Panel with knowledge and competence in Biodiversity Conservation and protection	Northern District Plan, Biodiversity Conservation Act	0	

ID	Task - Description	Indica tor(s)	Strategic/ Legislative Driver	Prior- ity
1.3.0	Incentive mechanisms - provide incentive mechan	isms to prioritise biodiversity conservation		
1.3.1	Identify, promote and implement conservation incentive schemes offered through governments, research institutions and private sector	Conservation incentives identified, promoted and implemented Opportunities for incentive schemes focussed on Rural Lands biodiversity protection assessed and promoted Investigate incentives that promote regional connectivity	Northern District Plan, Biodiversity Conservation Act, Open Space Acquisition Strategy	0
1.3.2	Prepare guidelines and identify special incentives to prioritise biodiversity on private lands	> Assess opportunities for rates incentives for Land for Wildlife or Biodiversity Conservation Trust-eligible private lands > Guidelines and incentives prepared to support biodiversity conservation on private lands including habitat for wildlife, pools to ponds and backyard bees program	Northern District Plan, Biodiversity Conservation Act, EPBC Act, Save Our Species Program	М
1.4.0	Minimise edge effects - minimise edge effects on	core, transition and corridor areas		
1.4.1	Assess core, transition and key corridor areas to target management actions that reduces edge effects, and supports biodiversity enhancement	Core, transition and key corridor areas assessed to: > Establish ecological targets to inform corridor establishment > Support biodiversity enhancement	Northern District Plan, Biodiversity Conservation Act, Save Our Species Program	Н
1.4.2	Prepare strategies that reduce edge effect impacts for biodiversity and wildlife	Review of existing DCP controls undertaken Limit private encroachment on public bushland, open space and waterway foreshore areas investigated Fauna-friendly guidelines for fencing (for creek lines and lands adjacent to recognised biodiversity lands) developed	Northern District Plan, Biodiversity Conservation Act, EPBC Act, Save Our Species Program	Н
1.4.3	Assess 'dark sky' policies and develop measures to limit light pollution disturbance to wildlife	Dark sky policy and controls assessed (including council street and facilities lighting and private property) Case study locations identified and investigated	Biodiversity Conservation Act	M
1.5.0	Climate change - manage for species under clima	te change scenarios into the future		
1.5.1	Prepare a vulnerability assessment to determine future impact of climate change on biodiversity values	> Vulnerability assessment prepared	Northern District Plan, Biodiversity Conservation Act	Н
1.5.2	Prepare biodiversity adaptation strategy to minimise climate impacts through policy, planning instruments and operational activities	Biodiversity adaptation strategy prepared Prepare future 'novel ecosystems' through adaptive planning strategies	Northern District Plan, Biodiversity Conservation Act	М
1.5.3	Maintain seed banking program	> Maintain seed bank that is viable, comprehensive and representative of the LGA's species/communities	Save Our Species Program	0
1.6.0	Biodiversity intelligence - develop comprehensive	biodiversity baseline data and monitoring		
1.6.1	Prepare biodiversity monitoring program for council managed lands (as part of a wider Natural Resources Monitoring Program)	Biodiversity monitoring program prepared to include: Understanding and application of best practice approaches to monitoring (what, when, where, how, why and how is the information to be used?) Identify new tools for biodiversity monitoring, planning and management (e.g. Photogrammetry, LIDAR and Artificial Intelligence) Targeted baseline surveys on threatened flora and fauna species and TECs - weed invasion assessments for Council reserves Trends in presence, absence and abundance of threatened, migratory and feral species Condition of remnant vegetation, TECs and threatened species Condition of remnant vegetation, TECs and threatened species Ecohealth program (Physical/Chemical Parameters, macroinvertebrates, geomorphology, riparian vegetation assessments) Water quality monitoring program and contaminated sites Citizen-based science Vegetation Management Plans and biodiversity related consent conditions	Save Our Species Program, Biodiversity Conservation Act	Н
1.6.2	Implement monitoring program for council managed lands	> Annual monitoring program for Council managed lands implemented	Save Our Species Program, Biodiversity Conservation Act	0
1.6.3	Implement surveys to measure community awareness of local biodiversity values and issues	> Resident biodiversity awareness surveys undertaken	Save Our Species Program, Biodiversity Conservation Act	0

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ID	Task - Description	Indicator(s)	Strategic/ Legislative Driver	Prior- ity
1.6.4	Prepare and implement private property surveys to benchmark existing site conditions and gather new data on biodiversity	> Annual surveys to benchmark site conditions implemented	Save Our Species Program, Biodiversity Conservation Act	0
1.6.5	Assess and update vegetation mapping (including GIF corridors)	> Vegetation mapping updated and maintained (including TECs, GIF corridors and weed spp.)	EP&A Act, Biodiversity Conservation Act	0
1.6.6	Establish a monitoring program for fire related activities	Nonitoring plan for fire management activities prepared to include: - identification of resources (\$/staff) - pre/post hazard mitigation works ecological data collection and analysis protocols - Integration with appropriate restoration goals - effectiveness of communication processes NSW RFS reporting on land clearing approvals under the Bushfire Environmental Assessment Code (annual report, application-based notification to Council) Council land clearing approvals on private lands	Rural Fires Act, EP&A Act	Н
1.6.7	Assess the condition and biodiversity value of roadside vegetation	> Roadside vegetation condition and value assessed	Biodiversity Conservation Act	Н
1.6.8	Identify keystone species distribution to guide bushland management prioritisation	> Keystone species presence identified to inform remnant vegetation policy	Biodiversity Conservation Act	М
1.6.9	Assess presence of migratory species and manage potential habitat accordingly	> Presence of migratory species assessed > Habitat and potential habitat of migratory species protected and enhanced	Biodiversity Conservation Act	М

Virtual fencing

Virtual Fencing as a wildlife safety solution are designed to reduce wildlife road collision incidents. It is a proven technology in the USA and Europe for all species and sizes of wildlife (with application since 2003). Currently, a product has been designed and tested to meet Australian wildlife and conditions and is being used in Tasmania and Queensland. It has been found to be an effective measure in reducing wildlife incidents in Australia. '.....While there was no spatial replication in this trial, a reduction in total roadkill rate, and in the most commonly affected species, by 50% suggests that these devices have enormous potential to substantially reduce roadkill rates' [108]

The Virtual Fencing device is activated by approaching headlights, which causes it to emit a combination of sound and light stimuli that alert and repel animals from the road side. This alert system of audible alert and blue and yellow strobe-type LED lights are an innovative concept based on proven technologies. The devices are placed at 25-metre intervals on alternating sides of the road. They are triggered in sequence by the vehicle headlight as a car approaches along the road, forming a virtual fence [109]

Reduction of speed limits between dusk to dawn

Wildlife signage is an international tool used to influence behaviour change and build public awareness of wildlife crossing roads. The installation of signage (advising of dusk and dawn speed limits) at known wildlife crossing hotspots can potentially mitigate roadkill [110]. Flashing lights can also be attached to signage to warn drivers of hotspots for wildlife crossings. [111]





(19)

Box 10. Roadkill & infrastructure mitigation measures

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Strategy 2: Connect urban habitats

ID	Task - Description	Indica tor(s)	Strategic/ Legislative Driver	Prior- ity
2.0.0	Strategy 2: Connect Urban Habitats			
2.1.0	Green Infrastructure Famework (GIF) - collaborate	with NSW GAO's Green Grid initiative and implement across Hornsby Shire, monitor progre	ess	
2.1.1	Identify a GIF which includes core, transition, and corridor areas	> Opportunities for creation of GIF mapped and identified > Work with other landowners to expand GIF within and adjacent to Homsby Shire (i.e. National Park expansion)	Northern District Plan, Green Infrastructure Policy, Sydney Green Grid	Н
2.1.2	Assess mechanisms to link and identify GIF and conservation values to land title	> Mechanisms to link GIF and conservation values to land title are assessed	Northern District Plan, Green Infrastructure Policy, EP&A Act	0
2.1.3	Assess the application of the GIF within public domain and precinct planning	> Consultation with Council staff undertaken regarding potential for application across Council	Northern District Plan, Green Infrastructure Policy	0
2.1.4	Assess benefits and impacts of GIF on biodiversity	> benefits and impacts of GIF on flora and fauna assessed > consider ecological guilds and focus species in corridor implementation	Northern District Plan, Green Infrastructure Policy	0
2.2.0	Biodiversity offsetting - leverage biodiversity offs	etting mechanisms to strategically identify, protect and restore habitat		
2.2.1	Review and implement a biodiversity offsets policy to support conservation on private and public land	> Green offsets policy implemented and reviewed	EP&A Act, BC Act, EPBC Act, Northern District Plan, Green Infrastructure Policy	Н
2.3.0	Regional connection - review operations, policies connection	and guidelines on lands managed by other agencies within and adjacent to the Shire to imp	prove biodiversity and	
2.3.1	Assess opportunities for large-scale planning and joint initiatives to link the GIF with protected areas and corridors beyond Council boundaries	> Opportunities for regional connectivity of HSC GIF are assessed (through economic, social and environmental factors) including: - Lane Cove National Park (via over and underpass bridges) - Ku-ring-gai Chase National Park (via over and underpass bridges) - Cumberland State Forest	Northern District Plan, Green Infrastructure Policy, EP&A Act, Biodiversity Conservation Act, Saving our Species	0
2.3.2	Maintain collaboration with partner land managers and fire agencies to facilitate best practice bushfire management on a landscape scale	Consider biodiversity conservation goals in fire planning, management and hazard reduction activity Aboriginal cultural burning practices be considered in the application of and inclusion in fire management practices maintained Implement bushfire management activities within the framework of the Hornsby Kuring-gai Bushfire Risk Management planning process	Rural Fires Act	0
2.3.3	Assess opportunities for reserve network expansion on council managed, other public lands and adjacent estuarine areas	> Opportunities for reserve network expansion over underrepresented vegetation types and geological features (Volcanic Diatremes, Wianamatta Shale and Hawkesbury River Floodplain) is assessed > Opportunities for protected area establishment in marine areas is considered in liaison with relevant NSW Government Agencies. > Work with other landowners to expand GIF within and adjacent to Hornsby Shire (i.e. National Park expansion)	Biodiversity Conservation Act, National Parks & Wildlife Act Hornsby Open Space Acquisition Strategy	Н
2.4.0	Natural area recreation - provide recreation oppo	rtunities within the GIF that connects people to nature		
2.4.1	Prepare a Natural Areas Recreational Strategy	Natural Areas Recreational Strategy prepared to support: diverse nature-based recreation opportunities are available and accessible community connections with nature through participation in sustainable nature based recreation environmental protection through well managed nature based recreation community awareness of the cultural heritage significance within the Shire's natural areas	Northern District Plan, Walking & Cycling Strategy	Н

Hornsby Biodiversity Conservation Strategy 2020

Strategy 3: Restore disturbed ecosystems to enhance ecological value and function

ID	Task - Description	Indicator(s)	Strategic/ Legislative Driver	Prior- ity
3.0.0	Strategy 3: Restore disturbed ecosystems to enha	ance ecological value and function		
3.1.0	Mitigating threats - address threats and impacts	to biodiversity		
3.1.1	Implement best practice in the application of chemical use in the maintenance of public open space	Opportunities to reduce reliance on chemical application (resolve use of Glyphosate) investigated Best practice for fertiliser/pesticide/herbicide implemented Non-pesticide use overlay for lands with 50m of recognised waterway implemented	Sydney Green Grid, North District Plan, POEO Act	0
3.1.2	Prepare and implement a guide for on ground environmental works	> Guide for on ground site works to support natural regeneration and revegetation (i.e. fencing, planting, weed mats etc) prepared	POEO Act	М
3.1.3	Maintain the Bush Regeneration Program on Council-managed lands	> Ecological restoration of bushland reserves is strategically prioritised > Bush regeneration projects are implemented	Biodiversity Conservation Act, Local Government Act, Sydney Green Grid, North District Plan	Н
3.1.4	Maintain HSC Community Nursery programs and support Native Plant sales and giveaways	> HSC Community Nursery programs maintained	25,000 Trees	0
3.1.5	Identify barriers to fauna movement and implement appropriate design solutions	Barriers to fauna movement are identified and mapped, including: Artificial barriers to fish and aquatic species passage Wildlife canopy and underpass crossings Design solutions implemented where feasible	Sydney Green Grid, North District Plan	М
3.1.6	Assess and prioritise ecological restoration activities associated with bushfire incidents and mitigation activities	> Maintain council obligations under Bushfire Environmental Assessment Code > Prepare general ecological assessment/ evaluation guidelines (identify resources, set priorities and targets according to ecological restoration principles) to inform site-based action plans	Rural Fires Act, Bush Fire Environmental Assessment Code	0
3.1.7	Maintain a council On Site Sewage Management System inspection program	> OSSM inspection, compliance and education program maintained	POEO Act, Local Government Act, North District Plan	0
3.2.0	Implement best practice weed and feral animal o	ontrol and management to improve the health of lands and waterways		
3.2.1	Prepare and implement Biosecurity Management policies and plans	> A Biosecurity Management Policy has been prepared and is reviewed annually	Biosecurity Act	Н
3.2.2	Maintain council operations in line with obligations under the NSW Biosecurity Act 2015	Council operations at risk of breaching biosecurity legislation identified and addressed Relevant biosecurity information is communicated to Councillors, managers, other staff, and the public, and they are made aware of their biosecurity duties Siosecurity content on the Councils website is up-to-date and regularly reviewed Point of contact maintained for Council's compliance with biosecurity orders issued Siosecurity issues outside the scope of Commonwealth, State and Regional biosecurity legislation, policies, and plans, and strategies, that have importance to the LGA or align with strong community expectations (e.g. fox, rabbit or cat control) have been assessed for their significance and appropriate programs implemented Opportunities for Council to partner and collaborate in relation to biosecurity issues, (e.g. regional pest animals projects or local collaborations with NSW NPWS) have been identify and implemented	Biosecurity Act	0
3.2.3	Represent Council at relevant biosecurity related forums, workshops, conventions	> Council's membership and attendance at relevant biosecurity related forums, workshops, conventions etc (e.g. Sydney North Vertebrate Pest Committee; Sydney Weeds Network; National Weed Conference) has been maintained and input provided as necessary	Biosecurity Act	0
3.2.4	Perform Council's functions under the NSW Biosecurity Act 2015 as the delegated local control authority for weed biosecurity within the Hornsby LGA	> The biosecurity officer maintains relevant biosecurity training and certification > Programs of priority weed inspections and surveillance of all land tenures within the LGA, focusing on high risk pathways, sites and assets have been prepared and implemented > Where priority weed species have been located, the landholder has been informed of their legal obligations and regulatory enforcement to ensure compliance has been taken where necessary > Where new weed incursions are identified, the procedures outlined in Greater Sydney Weed Committee New Weed Incursion Plan 2017 – 2022 have been implemented > Opportunities for grant funding to assist in the delivery of Council's functions have been identified and applied for > Records and maps for actions and activities relating to Councils functions under the Biosecurity Act 2015 have been prepared and maintained > Regular reports using required standards and formats have been prepared > A program of capacity building and mentoring within HSC and the community (e.g. community events, displays, demonstrations, workshops, training, conference) has been implemented	Biosecurity Act	0

Hornsby Biodiversity Conservation Strategy 2020

Strategy 4: Create new ecosystems

ID	Task - Description	Indicator(s)	Strategic/ Legislative Driver	Prior- ity	
4.0.0	Strategy 4: Create new ecosystems	Strategy 4: Create new ecosystems			
4.1.0	Implementing GIF in urban areas				
4.1.1	Prepare Green corridors schematics to demonstrate planning principles in wildlife corridors	> Green corridor schematics prepared	Sydney Green Grid, North District Plan	Н	
4.1.2	Assess potential buy-back arrangements and other enduring protection mechanisms for areas recognised as critical linkages in GIF (inclusive of TECs and buffer areas)	> Opportunities and critical linkages are assessed (including Cost Benefit Analysis)	Sydney Green Grid, North District Plan	0	
4.2.0	Catchment remediation - implement projects which capture, treat and reuse stormwater to create and improve habitats and waterway condition				
4.2.1	Implement and enforce requirements to include appropriate stormwater treatment, reuse, retention and detention systems on new public domain projects	New public domain developments consider appropriate stormwater treatment, re-use, retention and detention systems Prepare guidance note for increasing permeable surfaces	Water Sensitive Hornsby, POEO Act, EP&A Act	0	
4.2.2	Assess adequacy of onsite rain and grey water treatment/reuse devices for existing and new development	> Onsite rain and grey water treatment/ reuse devices for existing and new development are assessed	Water Sensitive Hornsby	0	
4.2.3	Identify mechanisms and prepare strategy to improve water quality in dams across rural areas	> Urban dams mapped and strategies prepared as required	Water Sensitive Hornsby	0	
4.2.4	Maintain monitoring data to inform and prioritise infrastructure renewal for wastewater systems	> Monitoring data used to inform renewal of wastewater infrastructure	POEO Act	0	

Hornsby Biodiversity Conservation Strategy 2020

3.2.5 Maintain and improve management of high > Programs of priority weed inspections and surveillance of all land tenures within the Biosecurity Act priority weed species on Council managed LGA are prepared and implemented. > Identify priority weed species on HSC land and implement appropriate control lands measure identify priority weed species on non-HSC land and implement actions to inform the landholder of their legal obligations or implement regulatory enforcement to ensure compliance if necessary identify the presence of new weed incursions and implement the procedures outlined in Greater Sydney Weed Committee New Weed Incursion Plan 2017 - 2022 3.26 Maintain council membership in the Sydney > Maintain HSC representation and membership at relevant biosecurity related forums, Biosecurity Act 0 workshops, conventions etc. and provide input when necessary (e.g. Sydney North Vertebrate Pest Committee; Sydney Weeds Network) Weeds Committee and other relevant committees 3.2.7 Identify opportunities to work with private Methods to work with landholders identified and spatially prioritised (i.e. creek lines. 0 Biosecurity Act 3.2.8 Support the implementation of Regional > Regional Strategic Pest Animal planning supported through implementing HSC's role Save Our Species 0 Strategic Pest Animal planning in the partnership activities nfrastructure management - pri orit 3.3.1 Assess feasibility of placing all new > Assess targeted placement of electrical infrastructure underground on GIF-nominated 0 infrastructure underground to enable streetscape planting Methods to future-proof and consolidate infrastructure and underground services identi fied 3.3.2 Implement guidelines for species selection > Guidelines for plant selection created and implemented Urban Forest, 0 for public spaces and street tree plantings Street Tree Master Plan proposed within the Urban Forest Strategy encourages use of Water Sensitive species and locations that improve local biodiversity
> Plant selection processes that supports threatened fauna species needs (e.g. heavy (i.e. parks, verges & streetscapes) to improve Hornsby biodiversity on council managed lands

Habitat for Wildlife program

This program aims to increase communities, awareness, knowledge and appreciation of wildlife in their urban area and backyards (wildlife, plant populations and communities). This is achieved through delivering a range of education programs and incentives to enable and encourage individuals to make changes at the domestic scale. Examples of the implementation of an urban/backyard program include: the Backyard Buddies program, an education initiative of the Foundation for National Parks & Wildlife; and, the Central Coast 'Habitat for Wildlife' program. [114] According to the Department of Environment (2002) the cumulative effect of individual action can significantly contribute to the overall health of urban ecosystems and to the survival of threatened species and conservation of biodiversity, maintaining that special "living" quality enjoyed in many urban areas of New South Wales" [115].

Incentives program: Green Globe Awards

This program incentivises individuals, businesses and groups to take positive actions to achieve positive change in the environment. A similar small-scale Hornsby Council run program, could provide positive reinforcement to individuals, community organisations and businesses.

'Supporting sustainability leaders across NSW for 20 years, the annual Green Globe Awards are NSW's most respected environmental awards for leadership, commitment and innovation in sustainability. We recognise and celebrate collaboration and partnerships within our communities that encourage others to act and achieve positive change and protect our environment'.

Of most relevance is the Natural Environment Award, which: 'recognises those who are committed to conserving NSW's unique biodiversity". This award recognises and celebrates conservation leadership striving to protect and preserve NSW's precious natural environment, including our ecosystems, threatened species (both plants and animals), natural habitats, land and soil and water resources'. [116]

Box.11 Habitat for Wildlife and incentive programs



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Installation of canopy crossings

Canopy crossings have been designed (i.e. single rope, ladderlike bridges and tunnels shaped bridges) and installed in various locations throughout Australia to enable species to cross roads safely. 'Installation of the canopy crossings was relatively quick and cheap, and it is recommended that they are installed at other locations where ringtail possum roadkill is frequent, particularly if the site is more conducive to such a construction'. [110] Research suggests that canopy bridges can assist with mammals crossing roads and reduce the risk of road-kill and potential for isolation between subpopulations. [112]

Development of large-scale crossing infrastructure

In Banff National Park (Alberta, Canada) six overpasses and 38 underpasses were built to enable the safe passage of bears, moose, deer, wolves, elk, and many other species over the Trans-Canada Highway. An important aspect of this project was the fencing that abuts the road and acts to direct wildlife under (or over) the Highway. Banff offers an internationally recognised example of saving individual animals from road incidents as well as long-term chances of species survival.

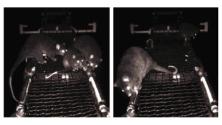
Bird safe building design

Bird collisions with buildings is a growing area of concern. Well-designed buildings in terms of layout, landscaping, lighting and exterior envelope can reduce the rate of bird collisions. Building with extensive glass are more hazardous for birds (for example towers), as they are invisible obstacle with reflective surfaces. Secondly lighting can be an issue for nocturnal and migrating birds (as an attractant). North America is leading the way with nationally accepted standards for bird-safe designs and materials. [113]

Box 12. Connectivity infrastructure



(20)



(21)

Hornsby Biodiversity Conservation Strategy 2020

Strategy 5: Connect people to nature

ID	Task - Description	Indicator(s)	Strategic/ Legislative Driver	Prior- ity
5.0.0	Strategy 5: Connect people to nature			
5.1.0	Community engagement - implement coordinated	community engagement and education to improve awareness of benefits and foster accept	ance of biodiversity val	ues
5.1.1	Prepare a Natural Resources communication, engagement and education strategy	> Natural Resources communication, engagement and education strategy prepared	Sydney Green Grid, North District Plan	Н
5.1.2	Assess opportunities for eco-tourism and passive recreation surrounding both aquatic and terrestrial ecosystems	> Opportunities to provide access to bushland areas, parks and greenspaces are identified	Economic Development & Tourism Strategy, Coastal Management Programs	0
5.1.3	Prepare interactive mapping/citizen science interface	> Interactive mapping/citizen science interface prepared > Innovative technological platforms assessed and maintained	NSW Citizen Science Position Statement	0
5.1.4	Identify regular networking opportunities through program of themed events, film nights, guest speakers and site visits	Opportunities for themed events identified and implemented, including: Events, tours delivered Community and group planting days identified and expanded Council's guided bushwalk program continued	Sydney Green Grid, North District Plan	0
5.2.0	Targeted education - produce targeted education	material and opportunities with several themes		
5.2.1	Implement staff, contractor and volunteer training as appropriate to increase awareness of biodiversity and conservation values	> Internal Council staff training program and materials implemented		0
5.2.2	Implement community education program in support of natural resources strategic themes	> Prepare and implement a 'War on Weeds' program > Prepare and implement a 'River Conscious Resident' program > Maintain and promote Council's local provenance plant species lists/nursery availability and 'Wildlife Friendly Gardens' program > 'Hawkesbury River Day' assessed and implemented	Sydney Green Grid, North District Plan	0
5.2.3	Identify and expand community and group planting days	> Community and group planting days identified, and sites expanded/increased with a diversity of participants involved	BC Act, Sydney Green Grid	0
5.2.4	Identify opportunities to partner with NSW Government to deliver workshops for sustainable management of rural land	> Partnership opportunities are identified	Rural Lands Study	0
5.2.5	Identify opportunities to attract high profile media personalities to workshops	> High profile personalities identified		0
5.3.0	Community partnerships - Identify opportunities t to encourage citizen science engagement prograr	o build greater ecological literacy through partnerships with local and regional primary, secons	ondary and tertiary instit	tutions
5.3.1	Identify opportunities to recognise and support individuals, community groups, businesses and schools' efforts and achievements in biodiversity conservation	> Opportunities for recognition (integration into existing council awards programs) identified	Sydney Green Grid, North District Plan	0
5.3.2	Maintain Council's Bushcare programs and related initiatives	> Council's Bushcare program maintained and related initiatives managed	EP&A Act	0
5.3.3	Identify education/monitoring/compliance avenues, for example: campaign for tree protection 'Don't be a Lopper/Dob in a Chopper'	> Campaigns identified	EP&A Act	M
5.3.4	Identify suite of citizen science tools with a clear presence on Council's website and Council events which incorporate community partnerships (i.e. Streamwatch, Men's Sheds, Scout groups, etc)	> Integration of Citizen Science into Council programs implemented > HSC staff to participate in 'Australian Citizen Science' Association (working groups, regional chapter and conference) identified	Sydney Green Grid, North District Plan	0
5.3.5	Identify opportunities for collaboration with local Indigenous communities and consultative bodies	> Collaborative opportunities identified	Council driven	0
5.3.6	Identify opportunities for collaboration with tertiary institutions	> Collaborative opportunities identified		0

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5.4.0	Accountability - Communication, reporting and dissemination of information			
5.4.1	Identify opportunities to promote HSC's ecological research and biodiversity through publishing and conferences	> Opportunities to promote HSC's ecological research and biodiversity assessed and implemented		0
5.4.2	Maintain communications around Council's biodiversity priorities and action to community and stakeholders	Provision of advice on operations, policies and guidelines maintained for lands managed by other agencies within and adjacent to Shire Biodiversity research and Strategy implementation reported ALA and BioNET data prepared Continue involvement in regional partnership programs	Local Government Act	0

Bushland policy: Bush Forever

The Bush Forever policy, plans to protect the unique biodiversity of Swan Coastal Plain (Western Australia). According to State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region 'The aim of the Bush Forever policy is to provide a policy and implementation framework that will ensure bushland protection and management issues in the Perth Metropolitan Region are appropriately addressed and integrated with broader land use planning and decision-making. This will secure long-term protection of biodiversity and associated environmental values. The policy recognises the protection and management of significant bushland areas as a fundamental consideration in the planning process, while also seeking to integrate and balance wider environmental, social and economic considerations. In general terms, the policy does not prevent development where it is consistent with the measures in this policy, and other planning and environmental considerations'. As a result of this policy, representative sites from each of the 26 vegetation types found around Perth were set aside for special protection. [117]

Additions to 'Areas of outstanding biodiversity values' estate

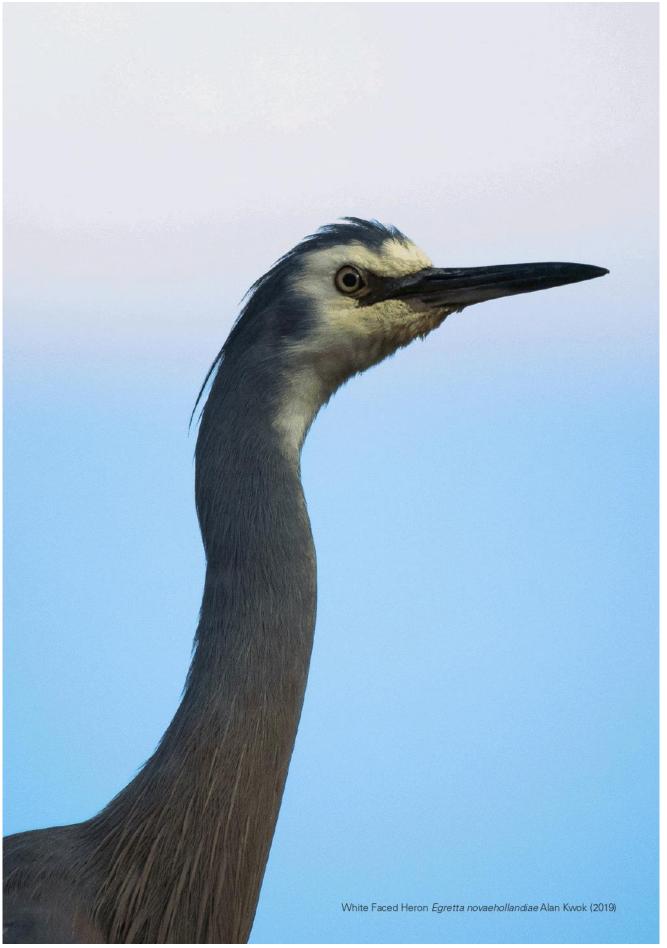
According to the NSW Biodiversity Conservation Act 2016 [19]: Areas of outstanding biodiversity values (3.2) may be declared providing:

- (1) (a) the area is important at a state, national or global scale, and (b) the area makes a significant contribution to the persistence of at least
- one of the following:
 (i) multiple species or at least one threatened species or ecological
- community,
 (ii) irreplaceable biological distinctiveness
- (iii) ecological processes or ecological integrity,
- (iv) outstanding ecological value for education or scientific research.

Unwanted cats on property

The City of Swan (WA) has implemented local laws that 'prohibit cats from entering private property without the property owner/occupier's consent. Cat owners are responsible to ensure that their cats do not enter private property - this can be done by keeping cats inside or within an outdoor cat run'. [118] Furthermore, the 'Cat Act 2011' requires the identification, registration and sterilisation of domestic cats, and gives Local Governments the power to administer and enforce the legislation. The legislation encourages responsible cat ownership and aims to reduce the number of unwanted cats in the community. Microchipping and registration also make it easier to identify the cat and reunite it with its owner'. Furthermore, in accordance with the local law any cats found on private property can be impounded. [119]

Box 13. Policy development



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Appendices

A range of appendices with supporting information accompany this report.

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Appendix 1: Full list of species in Hornsby LGA

Legend

The following legend is applicable to all species lists in the appendix where noted

NSW Status	BIONET				
Code	Definition (Act)				
1	Sensitivity Class 1 (Sensitive Species Data Policy)				
2	Sensitivity Class 2 (Sensitive Species Data Policy)				
3	Sensitivity Class 3 (Sensitive Species Data Policy)				
CH	Critical Habitat (Threatened Species Conservation Act 1995)				
E1	Endangered (Threatened Species Conservation Act 1995)				
E2	Endangered Population (Threatened Species Conservation Act 1995)				
E3	Endangered Ecological Community (Threatened Species Conservation Act 1995)				
E4	Presumed Extinct (Threatened Species Conservation Act 1995)				
E4A	Critically Endangered (Threatened Species Conservation Act 1995)				
E4B	Critically Endangered Ecological Community (Threatened Species Conservation Act 1995)				
FCE	Critically Endangered Fish (Fisheries Management Act 1994)				
FE	Endangered Fish (Fisheries Management Act 1994)				
FEC	Endangered Ecological Community of Fish (Fisheries Management Act 1994)				
FEP	Endangered Population of Fish (Fisheries Management Act 1994)				
FKTP	Key Threatening Process of Fish (Fisheries Management Act 1994)				
FP	Protected Fish (Fisheries Management Act 1994)				
FV	Vulnerable Fish (Fisheries Management Act 1994)				
FX	Extinct Fish (Fisheries Management Act 1994)				
KTP	Key Threatening Process (Threatened Species Conservation Act 1995)				
Р	Protected (National Parks & Wildlife Act 1974)				
V	Vulnerable (Threatened Species Conservation Act 1995)				
V2	Vulnerable Ecological Community (Threatened Species Conservation Act 1995)				
Common- wealth Status					
Code	Definition (Act)				
С	Listed on China Australia Migratory Bird Agreement				
CD	Conservation Dependent (Commonwealth EPBC Act 1999)				
CE	Critically Endangered (Commonwealth EPBC Act 1999)				
E	Endangered (Commonwealth EPBC Act 1999)				
J	Listed on Japan Australia Migratory Bird Agreement				
K	Listed on Republic of Korea Australia Migratory Bird Agreement				
KTP	Key Threatening Process (Commonwealth EPBC Act 1999)				
٧	Vulnerable (Commonwealth EPBC Act 1999)				
Х	Extinct (Commonwealth EPBC Act 1999)				
XW	Extinct in the Wild (Commonwealth EPBC Act 1999)				

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Flora

Scientific Name		Status	Status	
	Common name	NSW	C'wealth	Source
Abutilon spp.	Lantern-bush			BioNet (2010-)
Acacia baileyana	Bailey's Wattle;Cootamundra Wattle			ALA (2010 -);BioNet (2010-)
Acacia binervata				ALA (2010 -)
Acacia binervia	Coast Myall			ALA (2010 -);BioNet (2010-)
Acacia brownii	Heath Wattle			ALA (2010 -);BioNet (2010-)
Acacia buxifolia				ALA (2010 -)
Acacia bynoeana	Bynoe's Wattle	E1	V	ALA (2010 -);BioNet (2010-)
Acacia decurrens	Sydney Green Wattle;Early Black Wattle;Black Wattle			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Acacia echinula	Hedgehog Wattle			ALA (2010 -);BioNet (2010-)
Acacia elata	Cedar Wattle; Mountain Cedar Wattle			ALA (2010 -);BioNet (2010-)
Acacia falcata	Sickle Wattle			ALA (2010 -);BioNet (2010-)
Acacia falciformis	Black Wattle; Broad-leaved Hickory			ALA (2010 -);BioNet (2010-)
Acacia filicifolia	Fern-Leaved Wattle;Fern-leaved Wattle			ALA (2010 -);BioNet (2010-)
Acacia fimbriata	Fringed Wattle			ALA (2010 -);BioNet (2010-)
Acacia floribunda	White Sally Wattle; Gossamer Wattle; White Sally			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Acacia gordonii			E	Species or species habitat likely to occur within area
Acacia hakeoides				ALA (2010 -)
Acacia hispidula				ALA (2010 -);BioNet (2010-)
Acacia implexa	Hickory;Hickory Wattle			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Acacia irrorata	Green Wattle			ALA (2010 -);BioNet (2010-)
Acacia irrorata subsp. irrorata	Green Wattle			BioNet (2010-)
Acacia linearifolia	Narrow-leaved Wattle			ALA (2010 -);BioNet (2010-)
Acacia lineata				ALA (2010 -)
Acacia linifolia	White Wattle			ALA (2010 -);BioNet (2010-)
Acacia longifolia	Sydney Golden Wattle			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Acacia longifolia subsp. Iongifolia	Sydney Golden Wattle			BioNet (2010-)
Acacia longissima	Long-leaf Wattle			ALA (2010 -);BioNet (2010-)
Acacia mearnsii	Black Wattle			ALA (2010 -);BioNet (2010-)
Acacia melanoxylon	Blackwood			ALA (2010 -);BioNet (2010-)
Acacia minyura				ALA (2010 -)
Acacia myrtifolia	Red-stemmed Wattle			ALA (2010 -);BioNet (2010-)
Acacia obtusifolia				ALA (2010 -);BioNet (2010-)
Acacia oxycedrus	Spike Wattle			ALA (2010 -);BioNet (2010-)
Acacia parramatensis	Parramatta Green Wattle			Hornsby Shire Council, 2013

Acacia parramattensis	Parramatta Green Wattle;Parra- matta Wattle			ALA (2010 -);BioNet (2010-)
Acacia parvipinnula	Silver-stemmed wattle;Silver-stemmed Wattle			ALA (2010 -);BioNet (2010-)
Acacia podalyriifolia	Mount Morgan Wat- tle;Queensland Silver Wattle			ALA (2010 -);BioNet (2010-)
Acacia prominens	Golden Rain Wattle; Gosford Wattle			ALA (2010 -);BioNet (2010-)
Acacia pubescens	Downy Wattle, Hairy Stemmed Wattle [18800]		V	Species or species habitat known to occur within area
Acacia schinoides	Green Cedar Wattle			Hornsby Shire Council, 2013
Acacia stricta	Hop Wattle;Straight Wattle			ALA (2010 -);BioNet (2010-)
Acacia suaveolens	Sweet Wattle			ALA (2010 -);BioNet (2010-)
Acacia terminalis	Sunshine Wattle			ALA (2010 -);BioNet (2010-)
Acacia terminalis subsp. angustifolia				BioNet (2010-)
Acacia terminalis subsp. Iongiaxialis				BioNet (2010-)
Acacia terminalis subsp. terminalis			E	Hornsby Shire Council, 2019
Acacia ulicifolia	Juniper Wattle;Prickly Moses			ALA (2010 -);BioNet (2010-)
Acacia vestita	Weeping Boree			ALA (2010 -);BioNet (2010-)
Acer negundo	Ash-Leaved Maple;Box Elder			ALA (2010 -);BioNet (2010-)
Acianthus caudatus	Mayfly Orchid	Р		ALA (2010 -);BioNet (2010-)
Acianthus exsertus	Mosquito Orchid	Р		ALA (2010 -);BioNet (2010-)
Acianthus fomicatus	Pixie Caps	Р		ALA (2010 -);BioNet (2010-)
Acianthus pusillus	Gnat Orchid	Р		ALA (2010 -);BioNet (2010-)
Acianthus sp. A				ALA (2010 -)
Acianthus spp.	Mosquito Orchid	Р		BioNet (2010-)
Acmena smithii	Lilly Pilly			Hornsby Shire Council, 2013;Bi- oNet (2010-)
Acrotriche divaricata				ALA (2010 -);BioNet (2010-)
Actinotus helianthi	Flannel Flower	Р		ALA (2010 -);BioNet (2010-)
Actinotus minor	Lesser Flannel Flower			ALA (2010 -);BioNet (2010-)
Adansonia gregorii				ALA (2010 -)
Adiantum aethiopicum	Common Maidenhair	Р		ALA (2010 -);BioNet (2010-)
Adiantum formosum	Giant Maidenhair	Р		ALA (2010 -);BioNet (2010-)
Adiantum hispidulum	Rosy Maidenhair;Rough Maid- enhair	Р		ALA (2010 -);BioNet (2010-)
Aegiceras corniculatum	River Mangrove			ALA (2010 -);BioNet (2010-)
Agapanthus praecox	African Lily			ALA (2010 -)
Alania cunninghamii				ALA (2010 -)
Alania endlicheri				BioNet (2010-)
Alectryon tomentosus	Hairy Bird's Eye			ALA (2010 -);BioNet (2010-)
Allocasuarina distyla				ALA (2010 -);BioNet (2010-)
Allocasuarina littoralis	Black She-oak;Black She-Oak			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Allocasuarina paludosa				ALA (2010 -);BioNet (2010-)
Allocasuarina torulosa	Forest Oak			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)

Allocasuarina verticillata				ALA (2010 -)
Allocasuarina glareicola	[21932]		Е	Species or species habitat may occur within area
Alocasia brisbanensis				ALA (2010 -);BioNet (2010-)
Alphitonia excelsa	Red Ash			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Alpinia caerulea	Native Ginger			ALA (2010 -);BioNet (2010-)
Alstroemeria psittacina				ALA (2010 -)
Alternanthera denticulata	Lesser Joyweed			ALA (2010 -);BioNet (2010-)
Amperea xiphoclada				ALA (2010 -);BioNet (2010-)
Amperea xiphoclada var. papillata				BioNet (2010-)
Amperea xiphoclada var. xiphoclada				BioNet (2010-)
Amyema congener				ALA (2010 -)
Amyema congener sub- sp. congener				BioNet (2010-)
Amyema miquelii	Box Mistletoe			ALA (2010 -);BioNet (2010-)
Ancistrachne maidenii	Ancistrachne Maidenii		V	ALA (2010 -)
Angophora bakeri	Narrow-leaved Apple			ALA (2010 -);BioNet (2010-)
Angophora costata	Rusty Gum;Sydney Red Gum			ALA (2010 -);BioNet (2010-)
Angophora costata x hispida				BioNet (2010-)
Angophora floribunda	Rough-barked Apple			ALA (2010 -);BioNet (2010-)
Angophora hispida	Dwarf Apple			ALA (2010 -);BioNet (2010-)
Anisopogon avenaceus	Oat Spear-Grass;Oat Spear- grass			ALA (2010 -);BioNet (2010-)
Anredera cordifolia	Madeira Vine			ALA (2010 -);BioNet (2010-)
Anthosachne scabra	Wheatgrass, Common Wheat- grass			ALA (2010 -);BioNet (2010-)
Aotus ericoides				ALA (2010 -);BioNet (2010-)
Aponogeton spp.				BioNet (2010-)
Araucaria cunninghamii				ALA (2010 -)
Archontophoenix cun- ninghamiana	Bangalow Palm	P		ALA (2010 -);BioNet (2010-)
Archontophoenix spp.		P		BioNet (2010-)
Aristida benthamii	Three-awned spear grass			ALA (2010 -);BioNet (2010-)
Aristida benthamii var. benthamii				BioNet (2010-)
Aristida benthamii var. spinulifera				BioNet (2010-)
Aristida echinata				ALA (2010 -);BioNet (2010-)
Aristida jerichoensis var. jerichoensis	Jericho Wiregrass			BioNet (2010-)
Aristida jerichoensis var. subspinulifera	Jericho Wiregrass			BioNet (2010-)
Aristida personata				ALA (2010 -);BioNet (2010-)
Aristida ramosa	Purple Wiregrass			ALA (2010 -);BioNet (2010-)
Aristida spp.	A Wiregrass			BioNet (2010-)
Aristida vagans	Threeawn Speargrass			ALA (2010 -);BioNet (2010-)
Aristida warburgii				ALA (2010 -);BioNet (2010-)
Arthrochilus spp.		Р		BioNet (2010-)

Arthropodium milleflorum	Pale Vanilla-lily			ALA (2010 -);BioNet (2010-)
Arthropodium minus	Small Vanilla Lily			ALA (2010 -);BioNet (2010-)
Asplenium australasicum	Birds-Nest Fern;Bird's Nest Fern	Р		ALA (2010 -);BioNet (2010-)
Asplenium flabellifolium	Butterfly Fern;Necklace Fern			ALA (2010 -);BioNet (2010-)
Asterolasia correifolia				ALA (2010 -);BioNet (2010-)
Asterolasia elegans		E1	Е	ALA (2010 -);BioNet (2010-)
Astroloma humifusum	Native Cranberry			ALA (2010 -);BioNet (2010-)
Astroloma pinifolium	Pine Heath			ALA (2010 -);BioNet (2010-)
Astrotricha floccosa				ALA (2010 -);BioNet (2010-)
Astrotricha latifolia				ALA (2010 -);BioNet (2010-)
Astrotricha ledifolia	Common Star-Hair			ALA (2010 -);BioNet (2010-)
Astrotricha longifolia				ALA (2010 -);BioNet (2010-)
Astrotricha obovata				ALA (2010 -);BioNet (2010-)
Astrotricha sp. Quor- robolong				ALA (2010 -)
Astrotricha crassifolia	Thick-leaf Star-hair [10352]		V	Species or species habitat likely to occur within area
Auranticarpa rhombifolia				ALA (2010 -)
Austromyrtus tenuifolia				ALA (2010 -);BioNet (2010-)
Austrostipa nodosa	Needle Grass;A Speargrass			ALA (2010 -);BioNet (2010-)
Austrostipa pubescens				ALA (2010 -);BioNet (2010-)
Austrostipa ramosissima	Stout Bamboo Grass			ALA (2010 -);BioNet (2010-)
Austrostipa rudis				ALA (2010 -)
Austrostipa rudis subsp. rudis				BioNet (2010-)
Austrostipa spp.	A Speargrass			BioNet (2010-)
Austrostipa verticillata				ALA (2010 -)
Avicennia marina	Grey Mangrove			Hornsby Shire Council, 2013
Avicennia marina subsp. australasica	Grey Mangrove			BioNet (2010-)
Backhousia myrtifolia	Grey Myrtle			ALA (2010 -);BioNet (2010-)
Baeckea brevifolia				ALA (2010 -);BioNet (2010-)
Baeckea diosmifolia	Fringed Baeckea			ALA (2010 -);BioNet (2010-)
Baeckea linifolia	Weeping Baeckea	Р		ALA (2010 -);BioNet (2010-)
Baloskion gracile				ALA (2010 -);BioNet (2010-)
Baloskion tetraphyllum				ALA (2010 -);BioNet (2010-)
Banksia attenuata	Slender Banksia			ALA (2010 -)
Banksia ericifolia	Heath Banksia;Heath-leaved Banksia			ALA (2010 -);BioNet (2010-)
Banksia ericifolia subsp. ericifolia				BioNet (2010-)
Banksia integrifolia	Coastal Banksia;Coast Banksia			ALA (2010 -);BioNet (2010-)
Banksia integrifolia sub- sp. integrifolia	Coastal Banksia			BioNet (2010-)
Banksia marginata	Silver Banksia			ALA (2010 -);BioNet (2010-)
Banksia oblongifolia	Fern-leaved Banksia			ALA (2010 -);BioNet (2010-)
Banksia serrata	Old Man Banksia;Old Man;Old- man Banksia			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Banksia spinulosa	Hairpin Banksia	Р		ALA (2010 -);BioNet (2010-)

Banksia spinulosa var. spinulosa		Р	BioNet (2010-)
Banksia spp.			BioNet (2010-)
Bauera microphylla			ALA (2010 -);BioNet (2010-)
Bauera rubioides	River Rose		ALA (2010 -);BioNet (2010-)
Baumea acuta			BioNet (2010-)
Baumea articulata	Jointed Twig-rush		ALA (2010 -);BioNet (2010-)
Baumea juncea			ALA (2010 -);BioNet (2010-)
Baumea rubiginosa			ALA (2010 -);BioNet (2010-)
Billardiera mutabilis	Apple Berry;Climbing Apple Berry		ALA (2010 -);BioNet (2010-)
Billardiera scandens	Hairy Apple Berry		ALA (2010 -);BioNet (2010-)
Blandfordia nobilis	Christmas Bells	P	ALA (2010 -);BioNet (2010-)
Blechnum ambiguum			ALA (2010 -);BioNet (2010-)
Blechnum camfieldii			ALA (2010 -);BioNet (2010-)
Blechnum cartilagineum	Gristle Fern		ALA (2010 -);BioNet (2010-)
Blechnum contiguum			ALA (2010 -)
Blechnum indicum			ALA (2010 -)
Blechnum neohollandi- cum			BioNet (2010-)
Blechnum nudum	Fishbone Water Fern		ALA (2010 -);BioNet (2010-)
Blechnum spinulosum	Small Rasp Fern		BioNet (2010-)
Blechnum wattsii	Hard Water Fern		ALA (2010 -);BioNet (2010-)
Bolboschoenus fluviatilis	Kukuraho;Marsh Club-rush		ALA (2010 -);BioNet (2010-)
Boronia floribunda	Pale-pink Boronia	P	ALA (2010 -);BioNet (2010-)
Boronia fraseri		P	ALA (2010 -);BioNet (2010-)
Boronia ledifolia	Labrador Tea-Leaved Boroni- a;Sydney Boronia	Р	ALA (2010 -);BioNet (2010-)
Boronia pinnata		P	ALA (2010 -);BioNet (2010-)
Boronia rigens	Stiff Boronia	Р	ALA (2010 -);BioNet (2010-)
Boronia semulata	Rose Boronia	Р	ALA (2010 -);BioNet (2010-)
Bossiaea ensata	Sword Bossiaea		ALA (2010 -);BioNet (2010-)
Bossiaea heterophylla	Variable Bossiaea		ALA (2010 -);BioNet (2010-)
Bossiaea lenticularis			ALA (2010 -);BioNet (2010-)
Bossiaea obcordata	Spiny Bossiaea		ALA (2010 -);BioNet (2010-)
Bossiaea prostrata	Creeping Bossiaea		ALA (2010 -);BioNet (2010-)
Bossiaea rhombifolia			ALA (2010 -);BioNet (2010-)
Bossiaea scolopendria			ALA (2010 -);BioNet (2010-)
Bossiaea spp.			BioNet (2010-)
Bossiaea stephensonii			ALA (2010 -);BioNet (2010-)
Bothriochloa macra	Redleg Grass		ALA (2010 -)
Brachychiton acerifolius	Illawarra Flame Tree		ALA (2010 -);BioNet (2010-)
Brachychiton populneus	Kurrajong		ALA (2010 -);BioNet (2010-)
Brachychiton populneus subsp. populneus			BioNet (2010-)
Brachyloma daphnoides	Daphne Heath		ALA (2010 -);BioNet (2010-)
Brachyloma daphnoides subsp. daphnoides			BioNet (2010-)
Brachyscome angustifolia			BioNet (2010-)
Brachyscome linearifolia			ALA (2010 -);BioNet (2010-)

Breynia oblongifolia	Coffee Bush			ALA (2010 -);BioNet (2010-)
Brunonia australis	Blue Pincushion			ALA (2010 -);BioNet (2010-)
Brunoniella australis	Blue Trumpet			ALA (2010 -);BioNet (2010-)
Brunoniella pumilio	Dwarf Blue Trumpet			ALA (2010 -);BioNet (2010-)
Bryophyllum proliferum				ALA (2010 -)
Bulbophyllum exiguum		Р		ALA (2010 -);BioNet (2010-)
Burchardia umbellata	Milkmaids			ALA (2010 -);BioNet (2010-)
Bursaria spinosa	Native Blackthorn			ALA (2010 -);BioNet (2010-)
Bursaria spinosa subsp. spinosa	Native Blackthorn			BioNet (2010-)
Caesia parviflora var. parviflora				BioNet (2010-)
Caesia parviflora var. vittata				BioNet (2010-)
Caladenia carnea	Pink Fingers	Р		ALA (2010 -);BioNet (2010-)
Caladenia catenata	Pink Fingers;White Caladenia	Р		ALA (2010 -);BioNet (2010-)
Caladenia tessellata	Thick-lipped Spider-orchid, Daddy Long-legs	V,3	V	
Calandrinia pickeringii				ALA (2010 -);BioNet (2010-)
Caleana major	Large Duck Orchid	Р		ALA (2010 -);BioNet (2010-)
Callicoma serratifolia	Black Wattle			ALA (2010 -);BioNet (2010-)
Callisia fragrans				ALA (2010 -)
Callistemon citrinus	Crimson Bottlebrush			ALA (2010 -);BioNet (2010-)
Callistemon linearifolius	Netted Bottle Brush	V,3		Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Callistemon linearis	Narrow-leaved Bottlebrush			ALA (2010 -);BioNet (2010-)
Callistemon rigidus	Stiff Bottlebrush			BioNet (2010-)
Callistemon salignus	Willow Bottlebrush			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Callistemon viminalis	Weeping Bottlebrush			ALA (2010 -);BioNet (2010-)
Callitris muelleri				ALA (2010 -);BioNet (2010-)
Callitris rhomboidea	Oyster Bay Cypress Pine;Port Jackson Pine			ALA (2010 -);BioNet (2010-)
Callitris spp.				BioNet (2010-)
Calochilus campestris	Copper Beard Orchid	Р		ALA (2010 -);BioNet (2010-)
Calochilus paludosus	Copper Beard Orchid;Red Beard Orchid	Р		ALA (2010 -);BioNet (2010-)
Calochilus spp.		Р		BioNet (2010-)
Calochlaena dubia	Rainbow Fern			ALA (2010 -);BioNet (2010-)
Calotis lappulacea	Bur Daisy;Yellow Burr-daisy			ALA (2010 -);BioNet (2010-)
Calyptocarpus vialis				ALA (2010 -)
Calystegia marginata				ALA (2010 -)
Calytrix tetragona	Common Fringe-myrtle			ALA (2010 -);BioNet (2010-)
Carduus nutans	Bastard Scotch Thistle			ALA (2010 -)
Carex appressa	Southern Cutty Grass;Tall Sedge			ALA (2010 -);BioNet (2010-)
Carex fascicularis	Tassel Sedge			ALA (2010 -);BioNet (2010-)
Carex inversa	Creeping Lawn Sedge;Knob Sedge			ALA (2010 -);BioNet (2010-)
Carex pumila				ALA (2010 -);BioNet (2010-)

Caray ann			BioNet (2010-)
Carex spp. Cassinia aculeata	Aveterlier Tevking Delly Buch		· · · ·
Cassinia acuieata	Australian Tauhinu; Dolly Bush		ALA (2010 -);BioNet (2010-)
			ALA (2010 -);BioNet (2010-)
Cassinia spp.	Stirles Consisie		BioNet (2010-)
Cassinia uncata	Sticky Cassinia		ALA (2010 -);BioNet (2010-)
Cassytha glabella			ALA (2010 -);BioNet (2010-)
Cassytha glabella f. glabella			BioNet (2010-)
Cassytha pubescens	Dodder-Laurel;Downy Dod- der-laurel		ALA (2010 -);BioNet (2010-)
Cassytha spp.			BioNet (2010-)
Castanospermum australe	Australian Chesnut;Black Bean		ALA (2010 -);BioNet (2010-)
Casuarina cunninghami- ana	Beefwood		ALA (2010 -)
Casuarina cunninghami- ana subsp. cunninghami- ana	River Oak		BioNet (2010-)
Casuarina glauca	Swamp Oak		ALA (2010 -);BioNet (2010-)
Caustis flexuosa	Curly Wig	P	ALA (2010 -);BioNet (2010-)
Caustis pentandra	Thick Twist Rush	Р	ALA (2010 -);BioNet (2010-)
Caustis recurvata		P	ALA (2010 -);BioNet (2010-)
Cayratia clematidea	Native Grape		ALA (2010 -);BioNet (2010-)
Celastrus australis	Staff Climber		ALA (2010 -);BioNet (2010-)
Cenchrus caliculatus			ALA (2010 -)
Centella asiatica	Arthritis Herb;Indian Pennywort		ALA (2010 -);BioNet (2010-)
Centipeda minima	Sneezeweed		ALA (2010 -)
Centrolepis fascicularis			ALA (2010 -);BioNet (2010-)
Ceratopetalum apetalum	Coachwood		ALA (2010 -);BioNet (2010-)
Ceratopetalum gum- miferum	Christmas Bush (Nsw);Christ- mas Bush		ALA (2010 -);BioNet (2010-)
Cheilanthes austrotenui- folia	Rock Fern		ALA (2010 -);BioNet (2010-)
Cheilanthes distans	Woolly Cloak Fern;Bristly Cloak Fern		ALA (2010 -);BioNet (2010-)
Cheilanthes sieberi	Rock Fern		ALA (2010 -);BioNet (2010-)
Cheilanthes sieberi sub- sp. sieberi	Rock Fern		BioNet (2010-)
Chiloglottis diphylla		Р	ALA (2010 -);BioNet (2010-)
Chiloglottis reflexa		P	ALA (2010 -);BioNet (2010-)
Chiloglottis seminuda	Bare-Tip Wasp-Orchid	Р	ALA (2010 -);BioNet (2010-)
Chiloglottis spp.		Р	BioNet (2010-)
Chiloglottis valida	Alpine Bird-Orchid		ALA (2010 -)
Chloanthes stoechadis			ALA (2010 -);BioNet (2010-)
Chloris truncata	Windmill Grass		ALA (2010 -);BioNet (2010-)
Chordifex dimorphus			ALA (2010 -);BioNet (2010-)
Chordifex fastigiatus			ALA (2010 -);BioNet (2010-)
Choretrum candollei	White Sour Bush		ALA (2010 -);BioNet (2010-)
Christella dentata	Soft Fern		ALA (2010 -)
Cissus antarctica	Kangaroo Vine;Water Vine		ALA (2010 -);BioNet (2010-)
Cissus hypoglauca	Giant Water Vine	 	ALA (2010 -);BioNet (2010-)

Clematis aristata	Old Man's Beard			ALA (2010 -);BioNet (2010-)
Clematis glycinoides	Headache Vine			ALA (2010 -);BioNet (2010-)
Clematis glycinoides var. glycinoides				BioNet (2010-)
Clerodendrum tomen- tosum	Hairy Clerodendrum			ALA (2010 -);BioNet (2010-)
Cololejeunea minutissima				ALA (2010 -)
Comesperma ericinum	Pyramid Flower			ALA (2010 -);BioNet (2010-)
Comesperma sphaero- carpum				ALA (2010 -);BioNet (2010-)
Comesperma volubile				ALA (2010 -);BioNet (2010-)
Commelina cyanea	Native Wandering Jew			ALA (2010 -);BioNet (2010-)
Conospermum ericifo- lium				ALA (2010 -);BioNet (2010-)
Conospermum longifo- lium	Long Leaf Smoke-bush			ALA (2010 -);BioNet (2010-)
Conospermum longifoli- um subsp. longifolium				BioNet (2010-)
Cordyline stricta	Narrow-leaved Palm Lily	Р		ALA (2010 -);BioNet (2010-)
Coronidium elatum				ALA (2010 -);BioNet (2010-)
Coronidium scorpioides	Button Everlasting			ALA (2010 -);BioNet (2010-)
Correa alba var. alba	White Correa			BioNet (2010-)
Correa reflexa	Common Correa;Native Fuschia			ALA (2010 -);BioNet (2010-)
Correa reflexa var. reflexa	Native Fuschia			BioNet (2010-)
Corybas aconitiflorus	Spurred Helmet Orchid	Р		ALA (2010 -);BioNet (2010-)
Corybas fimbriatus	Fringed Helmet Orchid	Р		ALA (2010 -);BioNet (2010-)
Corybas pruinosus				ALA (2010 -)
Corybas undulatus	Tailed Helmet Orchid	Р		ALA (2010 -);BioNet (2010-)
Corymbia citriodora	Lemon-scented Gum			ALA (2010 -);BioNet (2010-)
Corymbia eximia	Yellow Bloodwood			ALA (2010 -);BioNet (2010-)
Corymbia gummifera	Red Bloodwood			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Corymbia maculata	Spotted Gum			ALA (2010 -);BioNet (2010-)
Corymbia spp.				BioNet (2010-)
Cotula australis	Common Cotula			ALA (2010 -);BioNet (2010-)
Crassula sieberiana	Australian Stonecrop			ALA (2010 -);BioNet (2010-)
Crassula spp.	Stonecrop			BioNet (2010-)
Crowea exalata				ALA (2010 -)
Crowea exalata subsp. exalata		Р		BioNet (2010-)
Crowea saligna		Р		ALA (2010 -);BioNet (2010-)
Cryptandra amara	Bitter Cryptandra			ALA (2010 -);BioNet (2010-)
Cryptandra amara var. amara				BioNet (2010-)
Cryptocarya glaucescens	Jackwood			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Cryptostylis erecta	Tartan Tongue Orchid	Р		ALA (2010 -);BioNet (2010-)
Cryptostylis subulata	Duck Bill Orchid;Large Tongue Orchid	Р		ALA (2010 -);BioNet (2010-)
Cryptostylis hunteriana	Leafless Tongue-orchid [19533]		V	Species or species habitat likely to occur within area

Cupaniopsis anacardi- oides	Tuckeroo			ALA (2010 -);BioNet (2010-)
Cuphea hyssopifolia	Elfin Herb			ALA (2010 -)
Cyanthillium cinereum				ALA (2010 -)
Cyathea australis	Rough Treefern	Р		ALA (2010 -);BioNet (2010-)
Cyathea cooperi	Cicatrice Tree Fern;Straw Treefern	Р		ALA (2010 -);BioNet (2010-)
Cyathea leichhardtiana	Prickly Treefern	Р		ALA (2010 -);BioNet (2010-)
Cyathochaeta diandra				ALA (2010 -);BioNet (2010-)
Cyclosorus dentatus	Binung			BioNet (2010-)
Cymbidium suave	Snake Orchid	Р		ALA (2010 -);BioNet (2010-)
Cymbopogon refractus	Barbed Wire Grass			ALA (2010 -);BioNet (2010-)
Cynanchum elegans	White-flowered Wax Plant [12533]		E	Species or species habitat likely to occur within area
Cynodon dactylon	Couch;Common Couch			ALA (2010 -);BioNet (2010-)
Cynodon spp.				BioNet (2010-)
Cyperus exaltatus				ALA (2010 -);BioNet (2010-)
Cyperus gracilis	Slender Flat-sedge			ALA (2010 -);BioNet (2010-)
Cyperus haspan				ALA (2010 -)
Cyperus haspan subsp. haspan				BioNet (2010-)
Cyperus imbecillis				ALA (2010 -);BioNet (2010-)
Cyperus mirus				ALA (2010 -);BioNet (2010-)
Cyperus polystachyos	Bunchy Flat-Sedge			ALA (2010 -);BioNet (2010-)
Cyperus sanguinolentus				ALA (2010 -);BioNet (2010-)
Cyperus spp.				BioNet (2010-)
Cyperus tetraphyllus				ALA (2010 -);BioNet (2010-)
Cyrtostylis reniformis	Gnat Orchid	Р		ALA (2010 -);BioNet (2010-)
Cyrtostylis spp.		Р		BioNet (2010-)
Cytisus scoparius	Broom			ALA (2010 -)
Cytisus scoparius subsp. scoparius	English Broom			BioNet (2010-)
Dampiera purpurea				ALA (2010 -);BioNet (2010-)
Dampiera scottiana				ALA (2010 -);BioNet (2010-)
Dampiera stricta				ALA (2010 -);BioNet (2010-)
Darwinia biflora		V	V	ALA (2010 -);BioNet (2010-)
Darwinia fascicularis				ALA (2010 -);BioNet (2010-)
Darwinia fascicularis subsp. fascicularis				BioNet (2010-)
Darwinia fascicularis subsp. oligantha	Darwinia fascicularis subsp. oligantha	E2		BioNet (2010-)
Darwinia peduncularis	Darwinia Peduncularis	V		ALA (2010 -);BioNet (2010-)
Dar winia procera				ALA (2010 -);BioNet (2010-)
Davidsonia jerseyana				ALA (2010 -)
Daviesia alata				ALA (2010 -);BioNet (2010-)
Daviesia corymbosa				ALA (2010 -);BioNet (2010-)
Daviesia leptophylla				ALA (2010 -);BioNet (2010-)
Daviesia ulicifolia	Gorse Bitter Pea			ALA (2010 -);BioNet (2010-)
Daviesia ulicifolia subsp. ulicifolia				BioNet (2010-)

Dendrobium speciosum	Rock Lily	Р	ALA (2010 -);BioNet (2010-)
Dendrobium speciosum var. speciosum	Rock Orchid	Р	BioNet (2010-)
Dendrophthoe vitellina			ALA (2010 -);BioNet (2010-)
Denhamia silvestris	Narrow-leaved Orangebark		ALA (2010 -);BioNet (2010-)
Desmodium brachy- podum	Large Tick-trefoil		ALA (2010 -);BioNet (2010-)
Desmodium gunnii	Slender Tick-trefoil		ALA (2010 -);BioNet (2010-)
Desmodium rhytidophyl- lum			ALA (2010 -);BioNet (2010-)
Desmodium varians	Slender Tick-trefoil		ALA (2010 -);BioNet (2010-)
Deyeuxia quadriseta	Bent Grass		ALA (2010 -);BioNet (2010-)
Dianella caerulea	Blue Flax-Lily;Blue Flax-lily		ALA (2010 -);BioNet (2010-)
Dianella caerulea var. assera			BioNet (2010-)
Dianella caerulea var. caerulea			BioNet (2010-)
Dianella caerulea var. producta			BioNet (2010-)
Dianella longifolia	Flax-Lily;Blueberry Lily		ALA (2010 -);BioNet (2010-)
Dianella longifolia var. Iongifolia	A Blue Flax Lily		BioNet (2010-)
Dianella prunina			ALA (2010 -);BioNet (2010-)
Dianella revoluta	Black-Anther Flax-Lily;Blueberry Lily		ALA (2010 -);BioNet (2010-)
Dianella revoluta var. revoluta	A Blue Flax Lily		BioNet (2010-)
Dichelachne crinita	Long-Hair Plume Grass;Long- hair Plumegrass		ALA (2010 -);BioNet (2010-)
Dichelachne inaequiglu- mis	Short-Hair Plume Grass		ALA (2010 -);BioNet (2010-)
Dichelachne micrantha	Purple Plume Grass;Shorthair Plumegrass		ALA (2010 -);BioNet (2010-)
Dichelachne parva			ALA (2010 -);BioNet (2010-)
Dichelachne rara	Short-Hair Plume Grass		ALA (2010 -);BioNet (2010-)
Dichelachne sieberiana	Short-Hair Plume Grass		ALA (2010 -);BioNet (2010-)
Dichondra repens	Creeping Dichondra;Kidney Weed		ALA (2010 -);BioNet (2010-)
Dicksonia antarctica	Soft Tree Fern; Soft Treefern	Р	ALA (2010 -);BioNet (2010-)
Dicranopteris linearis var. Iinearis		Р	BioNet (2010-)
Dictymia brownii	Strap Fern		ALA (2010 -);BioNet (2010-)
Dietes bicolor			ALA (2010 -)
Digitaria parviflora	Small-flowered Finger Grass		ALA (2010 -);BioNet (2010-)
Digitaria ramularis	Finger Panic Grass		ALA (2010 -);BioNet (2010-)
Dillwynia acicularis			ALA (2010 -);BioNet (2010-)
Dillwynia elegans			ALA (2010 -);BioNet (2010-)
Dillwynia floribunda			ALA (2010 -);BioNet (2010-)
Dillwynia retorta			ALA (2010 -);BioNet (2010-)
Dillwynia rudis			ALA (2010 -);BioNet (2010-)
Dimorphotheca fruticosa			ALA (2010 -)
Diploglottis australis	Nation Tanada d		ALA (2010 -);BioNet (2010-)
Dipiogrottis australis	Native Tamarind	1 1	ALA (2010 - 1, DIONEL (2010-)

Dipodium roseum			ALA (2010 -)
Dipodium variegatum		Р	ALA (2010 -);BioNet (2010-)
Dodonaea multijuga			ALA (2010 -);BioNet (2010-)
Dodonaea pinnata			ALA (2010 -);BioNet (2010-)
Dodonaea triangularis	Hopbush		ALA (2010 -);BioNet (2010-)
Dodonaea triquetra	Large-leaf Hop-bush		ALA (2010 -);BioNet (2010-)
Doodia aspera			ALA (2010 -)
Doodia australis	Common Rasp Fern		ALA (2010 -);BioNet (2010-)
Doodia caudata			ALA (2010 -)
Doodia linearis			ALA (2010 -)
Doryanthes excelsa	Giant Lily;Gymea Lily	Р	ALA (2010 -);BioNet (2010-)
Doryphora sassafras	Sassafras		ALA (2010 -);BioNet (2010-)
Dracophyllum secundum			ALA (2010 -);BioNet (2010-)
Drosera auriculata			ALA (2010 -);BioNet (2010-)
Drosera binata	Forked Sundew		ALA (2010 -);BioNet (2010-)
Drosera peltata	A Sundew		ALA (2010 -);BioNet (2010-)
Drosera pygmaea	Tiny Sundew;Pymgy Sundew		ALA (2010 -);BioNet (2010-)
Drosera spatulata			ALA (2010 -);BioNet (2010-)
Duboisia myoporoides	Corkwood		ALA (2010 -);BioNet (2010-)
Echinopogon caespitosus	Tufted Hedgehog Grass;Bushy Hedgehog-grass		ALA (2010 -);BioNet (2010-)
Echinopogon caespitosus var. caespitosus	Tufted Hedgehog Grass		BioNet (2010-)
Echinopogon ovatus	Forest Hedgehog Grass		ALA (2010 -);BioNet (2010-)
Echinopogon spp.	A Hedgehog Grass		BioNet (2010-)
Einadia hastata	Berry Saltbush		ALA (2010 -);BioNet (2010-)
Einadia nutans	Climbing Saltbush		ALA (2010 -);BioNet (2010-)
Einadia polygonoides	Knotweed Goosefoot		ALA (2010 -);BioNet (2010-)
Einadia trigonos	Fishweed		ALA (2010 -);BioNet (2010-)
Elaeocarpus eumundi			ALA (2010 -)
Elaeocarpus reticulatus	Blueberry Ash		ALA (2010 -);BioNet (2010-)
Elatostema reticulatum			ALA (2010 -);BioNet (2010-)
Eleocharis pusilla			ALA (2010 -);BioNet (2010-)
Eleocharis sphacelata	Bamboo Spike Sedge;Tall Spike Rush		ALA (2010 -);BioNet (2010-)
Empodisma minus	Wire Rush		ALA (2010 -);BioNet (2010-)
Entolasia marginata	Bordered Panic Grass;Bordered Panic		ALA (2010 -);BioNet (2010-)
Entolasia stricta	Wiry Panic		ALA (2010 -);BioNet (2010-)
Entolasia whiteana			ALA (2010 -);BioNet (2010-)
Entosthodon apophysa- tus			ALA (2010 -)
Epacris crassifolia			ALA (2010 -);BioNet (2010-)
Epacris longiflora	Fuchsia Heath		ALA (2010 -);BioNet (2010-)
Epacris microphylla	Coral Heath		ALA (2010 -);BioNet (2010-)
Epacris obtusifolia	Blunt-Leaf Heath;Blunt-leaf Heath		ALA (2010 -);BioNet (2010-)
Epacris pulchella	Wallum Heath		ALA (2010 -);BioNet (2010-)
Epacris purpurascens			ALA (2010 -);BioNet (2010-)

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Epacris purpurascens var. purpurascens		V		BioNet (2010-)
Epacris spp.				BioNet (2010-)
Epaltes australis	Spreading Nut-heads			BioNet (2010-)
Epilobium hirtigerum				ALA (2010 -);BioNet (2010-)
Eragrostis benthamii				BioNet (2010-)
Eragrostis brownii	Brown's Lovegrass			ALA (2010 -);BioNet (2010-)
Eragrostis leptostachya	Paddock Lovegrass			ALA (2010 -);BioNet (2010-)
Eragrostis parviflora	Weeping Lovegrass			ALA (2010 -);BioNet (2010-)
Eragrostis spp.	A Lovegrass			BioNet (2010-)
Erigeron bonariense				ALA (2010 -)
Erigeron canadensis				ALA (2010 -)
Erigeron sumatrensis				ALA (2010 -)
Eriocaulon australe				ALA (2010 -)
Eriochilus petricola		Р		ALA (2010 -);BioNet (2010-)
Eriochloa procera	Spring Grass			ALA (2010 -);BioNet (2010-)
Eriostemon australasius		Р		ALA (2010 -);BioNet (2010-)
Eucalyptus acmenoides	White Mahogany			ALA (2010 -);BioNet (2010-)
Eucalyptus agglomerata	Blue-Leaved Stringyba- rk;Blue-leaved Stringybark			ALA (2010 -);BioNet (2010-)
Eucalyptus baileyana				ALA (2010 -)
Eucalyptus bakeri				ALA (2010 -)
Eucalyptus beyeriana				ALA (2010 -);BioNet (2010-)
Eucalyptus botryoides	Bangalay			ALA (2010 -);BioNet (2010-)
Eucalyptus burgessiana				ALA (2010 -)
Eucalyptus camfieldii	Heart Leaved Stringybark;Cam- fields Stringybark		V	Hornsby Shire Council, 2013;ALA (2010 -)
Eucalyptus capitellata	Brown Stringybark			ALA (2010 -);BioNet (2010-);Hornsby Shire Council, 2013
Eucalyptus crebra	Narrow-leaved Ironbark			ALA (2010 -);BioNet (2010-);Hornsby Shire Council, 2013
Eucalyptus deanei	Mountain Blue Gum			ALA (2010 -);BioNet (2010-)
Eucalyptus elata	River Peppermint			Hornsby Shire Council, 2013
Eucalyptus eugenioides	Thin-Leaved Stringyba- rk;Thin-leaved Stringybark			ALA (2010 -);BioNet (2010-);Hornsby Shire Council, 2013
Eucalyptus fibrosa	Broad leaf Ironbark;Red Iron- bark			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Eucalyptus globoidea	White Stringybark			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Eucalyptus globulus	Blue Gum			ALA (2010 -);BioNet (2010-)
Eucalyptus grandis	Flooded Gum			ALA (2010 -);BioNet (2010-)
Eucalyptus haemastoma	Broad-leaved Scribbly Gum			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Eucalyptus leucoxylon	Red-Flowered Yellow Gum			ALA (2010 -)
Eucalyptus longiflora	Woollybutt			Hornsby Shire Council, 2013
Eucalyptus luehmanianna	Yellow Top Mallee Ash			Hornsby Shire Council, 2013;ALA (2010 -);BioNet (2010-)
Eucalyptus melliodora	Yellow Box		1	ALA (2010 -);BioNet (2010-)

Eucalyptus microcorys	Tallowwood		ALA (2010 -);BioNet (2010-)
Eucalyptus multicaulis	Whipstick Ash		ALA (2010 -);BioNet (2010-)
Eucalyptus nicholii	Narrow-leaved Peppermint, Narrow-leaved Black Pepper- mint	V	
Eucalyptus obliqua	Messmate Stringybark;Mess- mate		ALA (2010 -);BioNet (2010-)
Eucalyptus oblonga	Common Sandstone Stringy- bark		Hornsby Shire Council, 2013
Eucalyptus paniculata	Grey Ironbark		Hornsby Shire Council, 2013
Eucalyptus paniculata subsp. paniculata			BioNet (2010-)
Eucalyptus pilularis	Blackbutt		Hornsby Shire Council, 2013
Eucalyptus piperita	Sydney Peppermint		Hornsby Shire Council, 2013
Eucalyptus punctata	Gray Gum;Grey Gum		ALA (2010 -);BioNet (2010-)
Eucalyptus racemosa	Narrow-leaved Scribbly Gum		ALA (2010 -);BioNet (2010-)
Eucalyptus radiata	Gray Peppermint;Narrow-leaved Peppermint		ALA (2010 -);BioNet (2010-)
Eucalyptus regnans	Giant Gum		ALA (2010 -)
Eucalyptus resinifera	Red Mahogany		ALA (2010 -);BioNet (2010-)
Eucalyptus resinifera subsp. resinifera			BioNet (2010-)
Eucalyptus robusta	Swamp Mahogany		ALA (2010 -);BioNet (2010-)
Eucalyptus saligna	Sydney Blue Gum		ALA (2010 -);BioNet (2010-)
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum		BioNet (2010-)
Eucalyptus scoparia	Wallangarra White Gum	V	ALA (2010 -)
Eucalyptus siderophloia	Northern Grey Ironbark		Hornsby Shire Council, 2013
Eucalyptus sideroxylon	Mugga Ironbox;Mugga Ironbark		ALA (2010 -);BioNet (2010-)
Eucalyptus sieberi	Black Mountain Ash;Silvertop Ash		ALA (2010 -);BioNet (2010-)
Eucalyptus sp. Cattai	(Gregson s.n., 28 Aug 1954) [89499]	CE	Species or species habitat likely to occur within area
Eucalyptus sparsifolia	Narrow-leaved Stringybark		ALA (2010 -);BioNet (2010-)
Eucalyptus spp.			BioNet (2010-)
Eucalyptus squamosa	Scaly Bark		ALA (2010 -);BioNet (2010-)
Eucalyptus tereticornis	Forest Red Gum		ALA (2010 -);BioNet (2010-)
Eucalyptus umbra	Broad-leaved White Mahogany		ALA (2010 -);BioNet (2010-)
Eucalyptus woollsiana			ALA (2010 -)
Euchiton involucratus	Creeping Cudweed;Star Cudweed		ALA (2010 -);BioNet (2010-)
Euchiton japonicus			ALA (2010 -);BioNet (2010-)
Euchiton sphaericus	Common Cudweed;Star Cudweed		ALA (2010 -);BioNet (2010-)
Euphorbia maculata	Nodding Spurge		ALA (2010 -)
Euphorbia prostrata			ALA (2010 -)
Eupomatia laurina	Bolwarra		ALA (2010 -);BioNet (2010-)
Eurychorda complanata			ALA (2010 -);BioNet (2010-)
Euryomyrtus ramosis- sima	Rosy Baeckea		ALA (2010 -);BioNet (2010-)
Euryomyrtus ramosissi- ma subsp. ramosissima			BioNet (2010-)
Eustrephus latifolius	Wombat Berry		ALA (2010 -);BioNet (2010-)

Exocarpos cupressiformis	Cherry Ballart			ALA (2010 -);BioNet (2010-)
Exocarpos strictus	Dwarf Cherry			ALA (2010 -);BioNet (2010-)
Ficinia nodosa				ALA (2010 -)
Ficus coronata	Creek Sandpaper Fig			ALA (2010 -);BioNet (2010-)
Ficus obliqua	Small-leaved Fig			ALA (2010 -);BioNet (2010-)
Ficus rubiginosa	Botany Bay Fig;Port Jackson Fig			ALA (2010 -);BioNet (2010-)
Fissidens pallidus				ALA (2010 -)
Foeniculum vulgare	Fennel			ALA (2010 -)
Fraxinus angustifolia	Claret Ash			ALA (2010 -)
Freesia leichtlinii				ALA (2010 -)
Fumaria muralis	Scrambling Fumitory			ALA (2010 -)
Gahnia aspera	Rough Saw-sedge			ALA (2010 -);BioNet (2010-)
Gahnia clarkei	Tall Saw-sedge			ALA (2010 -);BioNet (2010-)
Gahnia erythrocarpa				ALA (2010 -);BioNet (2010-)
Gahnia insignis				ALA (2010 -)
Gahnia melanocarpa	Black Fruit Saw-sedge			ALA (2010 -);BioNet (2010-)
Gahnia microstachya	Slender Saw-Sedge			ALA (2010 -);BioNet (2010-)
Gahnia radula	Thatch Saw-Sedge			ALA (2010 -);BioNet (2010-)
Gahnia sieberiana	Red-fruit Saw-sedge	Р		ALA (2010 -);BioNet (2010-)
Galenia pubescens				ALA (2010 -)
Galium australe	Tangled Bedstraw	E1		
Galium binifolium				ALA (2010 -);BioNet (2010-)
Galium propinguum	Maori Bedstraw			ALA (2010 -);BioNet (2010-)
Geitonoplesium cymo- sum	Scrambling Lily			ALA (2010 -);BioNet (2010-)
Genoplesium baueri	Bauer's Midge Orchid; Yellow Gnat-orchid		E	ALA (2010 -);BioNet (2010-)
Genoplesium fimbriatum	Fringed Midge Orchid	Р		ALA (2010 -);BioNet (2010-)
Genoplesium nudis- capum	Dense Midge Orchid	Р		ALA (2010 -);BioNet (2010-)
Genoplesium plumosum	Plumed Midge-orchid, Tallong Midge Orchid		E	
Genoplesium ruppii		Р		ALA (2010 -);BioNet (2010-)
Geranium homeanum	Pinakitere			ALA (2010 -);BioNet (2010-)
Geranium molle	Dove's-Foot Cranesbill			ALA (2010 -)
Geranium solanderi	Matua-Kūmara;Native Gera- nium			ALA (2010 -);BioNet (2010-)
Gibasis pellucida				ALA (2010 -)
Glebionis coronaria				ALA (2010 -)
Gleichenia dicarpa	Matua-Rarauhe;Pouched Coral Fern			ALA (2010 -);BioNet (2010-)
Gleichenia microphylla	Carrier Tangle Fern;Scrambling Coral Fern			ALA (2010 -);BioNet (2010-)
Gleichenia rupestris				ALA (2010 -);BioNet (2010-)
Glochidion ferdinandi var. ferdinandi	Cheese Tree			BioNet (2010-)
Glochidion ferdinandi var. pubens	Hairy Cheese Tree			BioNet (2010-)
Glossodia minor	Small Waxlip Orchid	Р		ALA (2010 -);BioNet (2010-)
Glycine clandestina	Twining Glycine;Twining glycine			ALA (2010 -);BioNet (2010-)

Glycine microphylla	Small-leaf Glycine			ALA (2010 -);BioNet (2010-)
Glycine tabacina	Variable Glycine			ALA (2010 -);BioNet (2010-)
Gomphocarpus physo- carpus	Balloon Cotton Bush			ALA (2010 -)
Gompholobium glabra- tum	Dainty Wedge Pea			ALA (2010 -);BioNet (2010-)
Gompholobium grandi- florum	Large Wedge Pea			ALA (2010 -);BioNet (2010-)
Gompholobium latifolium	Golden Glory Pea			ALA (2010 -);BioNet (2010-)
Gompholobium minus	Dwarf Wedge Pea			ALA (2010 -);BioNet (2010-)
Gonocarpus chinensis				ALA (2010 -)
Gonocarpus chinensis subsp. verrucosus				BioNet (2010-)
Gonocarpus micranthus	Piripiri			ALA (2010 -);BioNet (2010-)
Gonocarpus micranthus subsp. micranthus				BioNet (2010-)
Gonocarpus tetragynus	Poverty Raspwort			ALA (2010 -);BioNet (2010-)
Gonocarpus teucrioides	Germander Raspwort			ALA (2010 -);BioNet (2010-)
Goodenia bellidifolia				ALA (2010 -);BioNet (2010-)
Goodenia bellidifolia subsp. bellidifolia				BioNet (2010-)
Goodenia dimorpha var. dimorpha				BioNet (2010-)
Goodenia hederacea	Ivy Goodenia			ALA (2010 -);BioNet (2010-)
Goodenia hederacea subsp. hederacea				BioNet (2010-)
Goodenia heteromera				ALA (2010 -)
Goodenia heterophylla				ALA (2010 -);BioNet (2010-)
Goodenia heterophylla subsp. heterophylla				BioNet (2010-)
Goodenia heterophylla subsp. montana				BioNet (2010-)
Goodenia ovata	Hop Goodenia			ALA (2010 -);BioNet (2010-)
Goodenia paniculata				ALA (2010 -);BioNet (2010-)
Grammitis billardierei	Finger Fern			BioNet (2010-)
Grammitis stenophylla	Narrow-leaf Finger Fern	E1,3		ALA (2010 -);BioNet (2010-)
Grevillea buxifolia	Grey Spider Flower			ALA (2010 -);BioNet (2010-)
Grevillea buxifolia subsp. buxifolia				BioNet (2010-)
Grevillea caleyi	Caley's Grevillea		CE	
Grevillea juniperina				ALA (2010 -)
Grevillea linearifolia	Linear-leaf Grevillea			ALA (2010 -);BioNet (2010-)
Grevillea longifolia		Р		ALA (2010 -);BioNet (2010-)
Grevillea mucronulata				ALA (2010 -);BioNet (2010-)
Grevillea parviflora				ALA (2010 -)
Grevillea parviflora subsp. supplicans		E1		BioNet (2010-)
Grevillea robusta	Silky Oak			ALA (2010 -);BioNet (2010-)
Grevillea sericea	Pink Spider Flower			ALA (2010 -);BioNet (2010-)
Grevillea sericea subsp. sericea				BioNet (2010-)
Grevillea shiressii		V	V	

Grevillea speciosa	Red Spider Flower			ALA (2010 -);BioNet (2010-)
Gymnoschoenus sphaerocephalus	Button Grass			ALA (2010 -);BioNet (2010-)
Gymnostachys anceps	Settler's Flax;Settler's Twine			ALA (2010 -);BioNet (2010-)
Gynochthodes jasmin- oides	Sweet Morinda			ALA (2010 -);BioNet (2010-)
Haemodorum corymbo- sum				ALA (2010 -);BioNet (2010-)
Haemodorum planifolium				ALA (2010 -);BioNet (2010-)
Hakea bakeriana				ALA (2010 -);BioNet (2010-)
Hakea dactyloides	Finger Hakea			ALA (2010 -);BioNet (2010-);Hornsby Shire Council, 2013
Hakea gibbosa				ALA (2010 -);BioNet (2010-)
Hakea laevipes				ALA (2010 -);BioNet (2010-)
Hakea laevipes subsp. laevipes				BioNet (2010-)
Hakea propinqua				ALA (2010 -);BioNet (2010-)
Hakea salicifolia	Willow-Leaved Hakea;Willow-leaved Hakea			ALA (2010 -);BioNet (2010-)
Hakea salicifolia subsp. salicifolia				BioNet (2010-)
Hakea sericea	Needle Bush;Needlebush			ALA (2010 -);BioNet (2010-)
Hakea teretifolia	Dagger Hakea;Needlebush			ALA (2010 -);BioNet (2010-)
Hakea teretifolia subsp. teretifolia				BioNet (2010-)
Haloragis exalata subsp. exalata	Wingless Raspwort, Square Raspwort	V	V	
Haloragodendron lucasii		E1	E	
Hardenbergia violacea	Purple Coral Pea;False Sarsa- parilla			ALA (2010 -);BioNet (2010-)
Harmogia densifolia				ALA (2010 -);BioNet (2010-)
Hemarthria uncinata	Matgrass			ALA (2010 -);BioNet (2010-)
Hemarthria uncinata var. uncinata				BioNet (2010-)
Hemigenia purpurea				ALA (2010 -);BioNet (2010-)
Hibbertia acicularis				ALA (2010 -);BioNet (2010-)
Hibbertia aspera	Rough Guinea Flower			ALA (2010 -);BioNet (2010-)
Hibbertia aspera subsp. aspera				BioNet (2010-)
Hibbertia bracteata				ALA (2010 -);BioNet (2010-)
Hibbertia cistiflora				ALA (2010 -)
Hibbertia cistiflora subsp. cistiflora				BioNet (2010-)
Hibbertia crinita	Mount Hope Guinea-Flower			ALA (2010 -)
Hibbertia dentata	Twining Guinea Flower			ALA (2010 -);BioNet (2010-)
Hibbertia diffusa	Wedge Guinea Flower			ALA (2010 -);BioNet (2010-)
Hibbertia empetrifolia				ALA (2010 -)
Hibbertia empetrifolia subsp. empetrifolia				BioNet (2010-)
Hibbertia hypericoides				ALA (2010 -)
Hibbertia linearis				ALA (2010 -);BioNet (2010-)
Hibbertia monogyna	Leafy Guinea-Flower			ALA (2010 -);BioNet (2010-)

Hibbertia obtusifolia	Grey Guinea-Flower;Hoary Guinea Flower			ALA (2010 -);BioNet (2010-)
Hibbertia puberula	Hibbertia Puberula			ALA (2010 -)
Hibbertia riparia				BioNet (2010-)
Hibbertia scandens	Guinea Flower;Climbing Guinea Flower			ALA (2010 -);BioNet (2010-)
Hibbertia spanantha	Julian's Hibbertia	E4a	CE	ALA (2010 -)
Hibbertia superans		E1		BioNet (2010-)
Hibiscus heterophyllus				ALA (2010 -)
Hibiscus heterophyllus subsp. heterophyllus	Native Rosella			BioNet (2010-)
Histiopteris incisa	Histiopteris;Bat's Wing Fern			ALA (2010 -);BioNet (2010-)
Homalanthus populifolius	Bleeding Heart Tree			ALA (2010 -);BioNet (2010-)
Hovea linearis				ALA (2010 -);BioNet (2010-)
Hovea longifolia	Rusty Pods			ALA (2010 -);BioNet (2010-)
Howea forsteriana	Thatch Palm;Kentia Palm	P		ALA (2010 -);BioNet (2010-)
Hybanthus monopetalus	Slender Violet-bush			ALA (2010 -);BioNet (2010-)
Hybanthus vernonii				ALA (2010 -);BioNet (2010-)
Hybanthus vernonii sub- sp. vernonii				BioNet (2010-)
Hydrocotyle hirta	Hairy Pennywort			ALA (2010 -);BioNet (2010-)
Hydrocotyle laxiflora	Stinking Pennywort			ALA (2010 -);BioNet (2010-)
Hydrocotyle sibthorpi- oides				ALA (2010 -);BioNet (2010-)
Hydrocotyle tripartita	Pennywort			BioNet (2010-)
Hymenophyllum cupres- siforme	Common Filmy Fern			ALA (2010 -);BioNet (2010-)
Hymenosporum flavum	Australian Frangipani;Native Frangipani			ALA (2010 -);BioNet (2010-)
Hypericum gramineum	Rolled-Leaf Hypericum;Small St John's Wort			ALA (2010 -);BioNet (2010-)
Hypericum japonicum	Matted Saint John's Wort			ALA (2010 -);BioNet (2010-)
Hypolaena fastigiata				ALA (2010 -);BioNet (2010-)
Hypolepis muelleri	Harsh Ground Fern			ALA (2010 -);BioNet (2010-)
Imperata cylindrica	Blady Grass			ALA (2010 -);BioNet (2010-)
Indigofera australis	Australian Indigo			ALA (2010 -);BioNet (2010-)
Indigofera decora	Chinese Indigo			ALA (2010 -)
Inga edulis	Icecream Bean			ALA (2010 -)
Isolepis inundata	Club-rush			ALA (2010 -);BioNet (2010-)
Isopogon anemonifolius	Broad-leaf Drumsticks	Р		ALA (2010 -);BioNet (2010-)
Isopogon anethifolius	Narrow-leaf Drumsticks	P		ALA (2010 -);BioNet (2010-)
Jacksonia scoparia	Dogwood			ALA (2010 -);BioNet (2010-)
Jasminum mesnyi	Primrose Jasmine			ALA (2010 -);BioNet (2010-)
Juncus continuus				ALA (2010 -);BioNet (2010-)
Juncus kraussii subsp. australiensis	Sea Rush			BioNet (2010-)
Juncus mollis				ALA (2010 -);BioNet (2010-)
Juncus pauciflorus	Common Rush			ALA (2010 -);BioNet (2010-)
Juncus planifolius	Flat-Leaved Rush			ALA (2010 -);BioNet (2010-)
Juncus prismatocarpus	Angled-Fruit Rush			ALA (2010 -);BioNet (2010-)
Juncus spp.	A Rush			BioNet (2010-)

Juncus usitatus	Common Rush			ALA (2010 -);BioNet (2010-)
Kennedia rubicunda	Dusky Coral Pea			ALA (2010 -);BioNet (2010-)
Kunzea ambigua	Tick Bush	Р		ALA (2010 -);BioNet (2010-)
Kunzea capitata		Р		ALA (2010 -);BioNet (2010-)
Kunzea rupestris		V	V	ALA (2010 -);BioNet (2010-)
Lachnagrostis filiformis	New Zealand Wind Grass			ALA (2010 -);BioNet (2010-)
Lactuca sativa	Lettuce			ALA (2010 -)
Lagenifera stipitata	Blue Bottle-daisy			BioNet (2010-)
Lagenophora gracilis	Slender Lagenophora			ALA (2010 -);BioNet (2010-)
Lagenophora stipitata	Common Lagenophora			ALA (2010 -);BioNet (2010-)
Lambertia formosa	Mountain Devil			ALA (2010 -);BioNet (2010-)
Lasiopetalum ferrugine- um	Rusty Velvet-Bush			ALA (2010 -);BioNet (2010-)
Lasiopetalum ferrugine- um var. ferrugineum				BioNet (2010-)
Lasiopetalum joyceae		V	V	ALA (2010 -);BioNet (2010-)
Lasiopetalum macrophyl- lum	Shrubby Velvet-bush			ALA (2010 -);BioNet (2010-)
Lasiopetalum rufum				ALA (2010 -);BioNet (2010-)
Lastreopsis decomposita	Trim Shield Fern			ALA (2010 -);BioNet (2010-)
Lastreopsis microsora				ALA (2010 -)
Lastreopsis microsora subsp. microsora	Creeping Shield Fern			BioNet (2010-)
Laxmannia compacta				ALA (2010 -);BioNet (2010-)
Laxmannia gracilis	Slender Wire Lily			ALA (2010 -);BioNet (2010-)
Leionema dentatum	Toothed Phebalium			ALA (2010 -);BioNet (2010-)
Lemna trisulca				ALA (2010 -)
Lepidium pseudohysso- pifolium	Peppercress			ALA (2010 -);BioNet (2010-)
Lepidosperma concavum				ALA (2010 -);BioNet (2010-)
Lepidosperma elatius				ALA (2010 -);BioNet (2010-)
Lepidosperma filiforme				ALA (2010 -);BioNet (2010-)
Lepidosperma gunnii				ALA (2010 -);BioNet (2010-)
Lepidosperma latens				ALA (2010 -);BioNet (2010-)
Lepidosperma laterale	Sword Sedge;Variable Sword- sedge			ALA (2010 -);BioNet (2010-)
Lepidosperma neesii	Stiff Rapier-Sedge			ALA (2010 -);BioNet (2010-)
Lepidosperma uropho- rum				ALA (2010 -);BioNet (2010-)
Lepidosperma viscidum	Sticky Sword-Sedge			ALA (2010 -);BioNet (2010-)
Lepironia articulata				ALA (2010 -);BioNet (2010-)
Leptocarpus tenax				ALA (2010 -);BioNet (2010-)
Leptomeria acida	Sour Currant Bush			ALA (2010 -);BioNet (2010-)
Leptospermum arach- noides				ALA (2010 -);BioNet (2010-)
Leptospermum deanei	Deane's Tea-tree		V	Hornsby Shire Council (2019)
Leptospermum grandi- folium	Woolly Teatree			ALA (2010 -);BioNet (2010-)
Leptospermum juniper- inum	Prickly Tea-tree			ALA (2010 -);BioNet (2010-)
Leptospermum laevig- atum	Coastal Tea Tree; Coast Teatree			ALA (2010 -);BioNet (2010-)

Leptospermum parvifo- lium				ALA (2010 -);BioNet (2010-)
Leptospermum peter- sonii	Lemon-Scented Tea Tree;Lemon-scented Teatree		1	ALA (2010 -);BioNet (2010-)
Leptospermum polyan- thum			,	ALA (2010 -);BioNet (2010-)
Leptospermum polygal- ifolium	Tantoon		,	ALA (2010 -);BioNet (2010-)
Leptospermum polygal- ifolium subsp. polygali- folium				BioNet (2010-)
Leptospermum squar- rosum				ALA (2010 -);BioNet (2010-)
Leptospermum trinerv- ium	SlenderTea-tree		1	ALA (2010 -);BioNet (2010-)
Lepyrodia muelleri				ALA (2010 -);BioNet (2010-)
Lepyrodia scariosa				ALA (2010 -);BioNet (2010-)
Leucopogon affinis				ALA (2010 -)
Leucopogon amplexi- caulis	Beard-heath		1	ALA (2010 -);BioNet (2010-)
Leucopogon appressus				ALA (2010 -);BioNet (2010-)
Leucopogon ericoides	Pink Beard-heath			ALA (2010 -);BioNet (2010-)
Leucopogon esquamatus	Swamp Beard-Heath			ALA (2010 -);BioNet (2010-)
Leucopogon juniperinus	Prickly Beard-heath			ALA (2010 -);BioNet (2010-)
Leucopogon lanceolatus				BioNet (2010-)
Leucopogon lanceolatus var. lanceolatus				BioNet (2010-)
Leucopogon microphyllus	Hairy Beard-Heath			ALA (2010 -);BioNet (2010-)
Leucopogon microphyllus var. microphyllus				BioNet (2010-)
Leucopogon muticus	Blunt Beard-heath			ALA (2010 -);BioNet (2010-)
Leucopogon setiger				ALA (2010 -);BioNet (2010-)
Leucopogon spp.	A Beard-heath			BioNet (2010-)
Lindsaea linearis	Screw Fern			ALA (2010 -);BioNet (2010-)
Lindsaea microphylla	Lacy Wedge Fern			ALA (2010 -);BioNet (2010-)
Lissanthe strigosa subsp. subulata	Peach Heath			BioNet (2010-)
Livistona australis	Australian Fan Palm;Cabbage Palm	Р	1	ALA (2010 -);BioNet (2010-)
Lobelia anceps	New Zealand Lobelia			ALA (2010 -);BioNet (2010-)
Lobelia dentata				ALA (2010 -);BioNet (2010-)
Lobelia pedunculata				ALA (2010 -)
Logania albiflora				ALA (2010 -);BioNet (2010-)
Logania pusilla	Tiny Logania			ALA (2010 -);BioNet (2010-)
Lomandra brevis				ALA (2010 -);BioNet (2010-)
Lomandra confertifolia	Matrush			ALA (2010 -);BioNet (2010-)
Lomandra confertifolia subsp. rubiginosa				BioNet (2010-)
Lomandra cylindrica	Needle Mat-Rush			ALA (2010 -);BioNet (2010-)
Lomandra filiformis	Wattle Matt-rush		1	ALA (2010 -);BioNet (2010-)
Lomandra filiformis sub- sp. coriacea	Wattle Matt-rush			BioNet (2010-)

Lomandra filiformis sub- sp. filiformis				BioNet (2010-)
Lomandra fluviatilis			1	ALA (2010 -);BioNet (2010-)
Lomandra glauca	Pale Mat-rush			ALA (2010 -);BioNet (2010-)
Lomandra gracilis				ALA (2010 -);BioNet (2010-)
Lomandra longifolia	Spiny-Headed Mat Rush;Spiny-headed Mat-rush			ALA (2010 -);BioNet (2010-)
Lomandra micrantha				ALA (2010 -)
Lomandra micrantha subsp. tuberculata	Small-flowered Mat-rush			BioNet (2010-)
Lomandra multiflora				ALA (2010 -)
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush			BioNet (2010-)
Lomandra obliqua				ALA (2010 -);BioNet (2010-)
Lomatia myricoides	River Lomatia			ALA (2010 -);BioNet (2010-)
Lomatia myricoides x silaifolia				BioNet (2010-)
Lomatia silaifolia	Crinkle Bush	Р		ALA (2010 -);BioNet (2010-)
Lonicera sempervirens				ALA (2010 -)
Lophostemon confertus	Brisbane Box;Brush Box			ALA (2010 -);BioNet (2010-)
Lotus angustissimus	Slender Birdsfoot Trefoil			ALA (2010 -)
Ludwigia peploides	Primrose Willow			ALA (2010 -)
Lunularia cruciata				ALA (2010 -)
Lycopodiella lateralis	Slender Clubmoss			ALA (2010 -);BioNet (2010-)
Lycopodium deuteroden- sum	Puakarimu;Bushy Clubmoss	Р		ALA (2010 -);BioNet (2010-)
Lyperanthus suaveolens	Brown Beaks	Р		ALA (2010 -);BioNet (2010-)
Lythrum hyssopifolia	Hyssop Loosestrife			ALA (2010 -)
Macadamia integrifolia	Smooth-Leaved Queensland Nut			ALA (2010 -)
Macadamia tetraphylla	Californian Nut			ALA (2010 -)
Macrozamia communis	Burrawang	Р		ALA (2010 -);BioNet (2010-)
Macrozamia flexuosa		Р		ALA (2010 -);BioNet (2010-)
Macrozamia spiralis		Р		ALA (2010 -);BioNet (2010-)
Malus pumila				ALA (2010 -)
Marchantia berteroana				ALA (2010 -)
Marsdenia rostrata	Milk Vine			ALA (2010 -);BioNet (2010-)
Marsdenia suaveolens	Scented Marsdenia			ALA (2010 -);BioNet (2010-)
Marsdenia viridiflora				ALA (2010 -)
Marsdenia viridiflora subsp. viridiflora	Native Pear			BioNet (2010-)
Melaleuca armillaris				ALA (2010 -)
Melaleuca armillaris subsp. armillaris	Bracelet Honey-myrtle			BioNet (2010-)
Melaleuca biconvexa	Biconvex Paperbark	V	V	Hornsby Shire Council (2019)
Melaleuca deanei	Deane's Paperbark	V	V	ALA (2010 -);BioNet (2010-)
Melaleuca decora	White feather honey-myrtle			Hornsby Shire Council, 2013
Melaleuca ericifolia	Swamp Paperbark			ALA (2010 -);BioNet (2010-)
Melaleuca hypericifolia	Hillock bush			ALA (2010 -);BioNet (2010-)
Melaleuca linariifolia	Flax-leaved Paperbark			ALA (2010 -);BioNet (2010-)
Melaleuca quinquenervia	Broad-leaved Paperbark			ALA (2010 -);BioNet (2010-)

Melaleuca sieberi				ALA (2010 -);BioNet (2010-)
Melaleuca styphelioides	Prickly-leaved Tea Tree			ALA (2010 -);BioNet (2010-)
Melaleuca thymifolia				ALA (2010 -)
Melia azedarach	Bead Tree;White Cedar			ALA (2010 -);BioNet (2010-)
Melianthus major	Cape Honey Flower			ALA (2010 -)
Melichrus procumbens	Jam Tarts			ALA (2010 -);BioNet (2010-)
Melichrus urceolatus	Urn Heath			ALA (2010 -);BioNet (2010-)
Micrantheum ericoides				ALA (2010 -);BioNet (2010-)
Microlaena stipoides	Meadow Rice Grass;Weeping Grass			ALA (2010 -);BioNet (2010-)
Microlaena stipoides var. stipoides	Weeping Grass			BioNet (2010-)
Micromyrtus blakelyi		V	V	ALA (2010 -);BioNet (2010-)
Micromyrtus ciliata	Fringed Heath-Myrtle;Fringed Heath-myrtle			ALA (2010 -);BioNet (2010-)
Microtis parviflora	Slender Onion Orchid	Р		ALA (2010 -);BioNet (2010-)
Microtis rara	Scented Onion Orchid	Р		ALA (2010 -);BioNet (2010-)
Microtis unifolia	Common Onion Orchid	Р		ALA (2010 -);BioNet (2010-)
Mirbelia rubiifolia	Heathy Mirbelia			ALA (2010 -);BioNet (2010-)
Mirbelia speciosa				ALA (2010 -)
Mirbelia speciosa subsp. speciosa				BioNet (2010-)
Mitrasacme pilosa				BioNet (2010-)
Mitrasacme polymorpha				ALA (2010 -);BioNet (2010-)
Monotaxis linifolia				ALA (2010 -);BioNet (2010-)
Monotoca elliptica	Tree Broom-heath			ALA (2010 -);BioNet (2010-)
Monotoca scoparia				ALA (2010 -);BioNet (2010-)
Muehlenbeckia gracillima	Slender Lignum			ALA (2010 -);BioNet (2010-)
Muellerina celastroides				ALA (2010 -);BioNet (2010-)
Muellerina eucalyptoides				ALA (2010 -);BioNet (2010-)
Musa x paradisiaca				ALA (2010 -)
Myoporum acuminatum	Boobialla			ALA (2010 -);BioNet (2010-)
Myoporum montanum	Boobialla			ALA (2010 -)
Myrsine howittiana	Brush Muttonwood			ALA (2010 -);BioNet (2010-)
Myrsine variabilis				ALA (2010 -);BioNet (2010-)
Nematolepis squamea subsp. squamea	Satinwood			BioNet (2010-)
Nephrolepis cordifolia	Erect Sword Fern;Fishbone Fern			ALA (2010 -);BioNet (2010-)
Notelaea longifolia	Large Mock-olive			ALA (2010 -);BioNet (2010-)
Notelaea longifolia f. Iongifolia				BioNet (2010-)
Notelaea ovata				ALA (2010 -);BioNet (2010-)
Notogrammitis billardierei				ALA (2010 -)
Notothixos subaureus	Golden Mistletoe			ALA (2010 -);BioNet (2010-)
Ochrosperma lineare				ALA (2010 -)
Olax stricta				ALA (2010 -);BioNet (2010-)
Olearia cordata			V	Hornsby Shire Council, 2019
Olearia microphylla				ALA (2010 -);BioNet (2010-)
Olearia tomentosa	Toothed Daisy Bush;Toothed Daisy-bush			ALA (2010 -);BioNet (2010-)

Omalanthus populifolius	Bleeding Heart			Hornsby Shire Council, 2013
Omphacomeria acerba				ALA (2010 -);BioNet (2010-)
Onopordum acanthium	Cotton Thistle			ALA (2010 -)
Opercularia aspera	Coarse Stinkweed			ALA (2010 -);BioNet (2010-)
Opercularia diphylla	Stinkweed			ALA (2010 -);BioNet (2010-)
Opercularia hispida	Hairy Stinkweed			ALA (2010 -);BioNet (2010-)
Opercularia varia	Variable Stinkweed			ALA (2010 -);BioNet (2010-)
Ophioglossum lusitan- icum				ALA (2010 -)
Oplismenus aemulus				ALA (2010 -);BioNet (2010-)
Oplismenus hirtellus				ALA (2010 -)
Oplismenus imbecillis				BioNet (2010-)
Oplismenus spp.				BioNet (2010-)
Orthoceras strictum	Bird's-mouth Orchid	Р		ALA (2010 -);BioNet (2010-)
Osteospermum fruti- cosum				BioNet (2010-)
Oxalis chnoodes				ALA (2010 -);BioNet (2010-)
Oxalis exilis	Creeping Oxalis			ALA (2010 -);BioNet (2010-)
Oxalis perennans	Woody-Root Oxalis			ALA (2010 -);BioNet (2010-)
Oxalis rubens	Wood Sorrel			ALA (2010 -);BioNet (2010-)
Ozothamnus diosmifolius	White Dogwood			ALA (2010 -);BioNet (2010-)
Palmeria spp.				BioNet (2010-)
Pandorea pandorana	Lance Wood;Wonga Wonga Vine			ALA (2010 -);BioNet (2010-)
Pandorea pandorana subsp. pandorana	Wonga Wonga Vine			BioNet (2010-)
Panicum simile	Two-colour Panic			ALA (2010 -);BioNet (2010-)
Paraserianthes lophantha	Brush Wattle			ALA (2010 -)
Parsonsia straminea	Common Silkpod			ALA (2010 -);BioNet (2010-)
Paspalidium criniforme				ALA (2010 -);BioNet (2010-)
Paspalidium distans				ALA (2010 -);BioNet (2010-)
Passiflora herbertiana				ALA (2010 -);BioNet (2010-)
Passiflora suberosa	Corky Passion Flower;Cork Passionfruit			ALA (2010 -);BioNet (2010-)
Passiflora subpeltata	White Passion Fruit;White Passionflower			ALA (2010 -);BioNet (2010-)
Passiflora tarminiana	Banana Passionfruit			BioNet (2010-)
Patersonia fragilis	Swamp Iris			ALA (2010 -);BioNet (2010-)
Patersonia glabrata	Leafy Purple-flag			ALA (2010 -);BioNet (2010-)
Patersonia longifolia				BioNet (2010-)
Patersonia sericea	Silky Purple-Flag			ALA (2010 -);BioNet (2010-)
Pelargonium inodorum	Kõpata			ALA (2010 -);BioNet (2010-)
Pellaea falcata	Australian Cliff Brake;Sickle Fern			ALA (2010 -);BioNet (2010-)
Persicaria decipiens	Slender Knotweed			ALA (2010 -);BioNet (2010-)
Persicaria hydropiper	Water Pepper			ALA (2010 -);BioNet (2010-)
Persicaria lapathifolia	Pale Knotweed			ALA (2010 -);BioNet (2010-)
Persicaria strigosa				ALA (2010 -);BioNet (2010-)
Persoonia hirsuta	Hairy Geebung	E1	Е	
Persoonia isophylla		Р		ALA (2010 -);BioNet (2010-)

Persoonia lanceolata	Lance Leaf Geebung	Р		ALA (2010 -);BioNet (2010-)
Persoonia laurina	Laurel Geebung	Р		ALA (2010 -);BioNet (2010-)
Persoonia laurina subsp. laurina		Р		BioNet (2010-)
Persoonia levis	Broad Leaved Gee- bung;Broad-leaved Geebung	Р		ALA (2010 -);BioNet (2010-)
Persoonia linearis	Narrow-leaved Geebung	Р		ALA (2010 -);BioNet (2010-)
Persoonia mollis				ALA (2010 -)
Persoonia mollis subsp. maxima		E1,P	E	BioNet (2010-)
Persoonia pinifolia	Pine-leaved Geebung	Р		ALA (2010 -);BioNet (2010-)
Persoonia mollis sub- sp. maxima	[56075]		E	Species or species habitat known to occur within area
Petalostylis labicheoides				ALA (2010 -)
Petrophile pedunculata		Р		ALA (2010 -);BioNet (2010-)
Petrophile pulchella	Conesticks	Р		ALA (2010 -);BioNet (2010-)
Petrophile sessilis		Р		ALA (2010 -);BioNet (2010-)
Phebalium squamulosum	Scaly Phebalium	Р		ALA (2010 -);BioNet (2010-)
Phebalium squamulosum subsp. argenteum		Р		BioNet (2010-)
Phebalium squamulosum subsp. squamulosum		Р		BioNet (2010-)
Philotheca buxifolia		Р		ALA (2010 -);BioNet (2010-)
Philotheca buxifolia sub- sp. obovata		Р		BioNet (2010-)
Philotheca hispidula		Р		ALA (2010 -);BioNet (2010-)
Philotheca myoporoides	Long-leaf Wax Flower	Р		ALA (2010 -);BioNet (2010-)
Philotheca salsolifolia		Р		ALA (2010 -);BioNet (2010-)
Philotheca salsolifolia subsp. salsolifolia		Р		BioNet (2010-)
Philydrum lanuginosum	Frogsmouth			ALA (2010 -);BioNet (2010-)
Phragmites australis	Common Reed			ALA (2010 -);BioNet (2010-)
Phyllanthus gunnii				ALA (2010 -)
Phyllanthus hirtellus	Thyme Spurge			ALA (2010 -);BioNet (2010-)
Phyllota grandiflora	Heath Phyllota			ALA (2010 -);BioNet (2010-)
Phyllota phylicoides	Heath Phyllota			ALA (2010 -);BioNet (2010-)
Pimelea curviflora	Rice Flower			ALA (2010 -);BioNet (2010-)
Pimelea curviflora var. curviflora		V	V	BioNet (2010-)
Pimelea latifolia				ALA (2010 -);BioNet (2010-)
Pimelea linifolia	Slender Rice Flower			ALA (2010 -);BioNet (2010-)
Pimelea linifolia subsp. caesia				BioNet (2010-)
Pimelea linifolia subsp. linifolia				BioNet (2010-)
Pimelea spicata	Spiked Rice-flower [20834]		E	Species or species habitat may occur within area
Pittosporum multiflorum	Orange Thorn			ALA (2010 -);BioNet (2010-)
Pittosporum revolutum	Rough Fruit Pittosporum			ALA (2010 -);BioNet (2010-)
Pittosporum undulatum	Australian Daphne;Sweet Pittosporum			ALA (2010 -);BioNet (2010-)
Plantago debilis	Shade Plantain			ALA (2010 -);BioNet (2010-)

Plantago gaudichaudii	Swamp Plantain;Narrow Plantain			ALA (2010 -);BioNet (2010-)
Platanus hispanica				ALA (2010 -)
Platycerium bifurcatum	Elk's-Horn Fern;Elkhorn Fern	Р		ALA (2010 -);BioNet (2010-)
Platylobium formosum				ALA (2010 -);BioNet (2010-)
Platylobium formosum subsp. formosum				BioNet (2010-)
Platylobium parviflorum	Small-flowered Flat-pea			ALA (2010 -);BioNet (2010-)
Platysace clelandii				ALA (2010 -);BioNet (2010-)
Platysace ericoides				ALA (2010 -);BioNet (2010-)
Platysace lanceolata	Shrubby Platysace			ALA (2010 -);BioNet (2010-)
Platysace linearifolia				ALA (2010 -);BioNet (2010-)
Plectorrhiza tridentata	Tangle Orchid	Р		ALA (2010 -);BioNet (2010-)
Plectranthus parviflorus	Cockspur			ALA (2010 -);BioNet (2010-)
Plectranthus spp.				BioNet (2010-)
Plumbago auriculata	Cape Leadwort			ALA (2010 -)
Poa affinis				ALA (2010 -);BioNet (2010-)
Poa labillardierei var. labillardierei	Tussock			BioNet (2010-)
Podocarpus elatus	Brown Pine (Aust.)			ALA (2010 -)
Podocarpus spinulosus	Spiny-leaf Podocarp			BioNet (2010-)
Polyscias sambucifolia	Elderberry Panax			ALA (2010 -);BioNet (2010-)
Polyscias sambucifolia subsp. sambucifolia				BioNet (2010-)
Pomaderris discolor	Eastern Pomaderris			ALA (2010 -);BioNet (2010-)
Pomaderris elliptica sub- sp. elliptica				BioNet (2010-)
Pomaderris ferruginea				ALA (2010 -);BioNet (2010-)
Pomaderris intermedia	Lemon Dogwood			ALA (2010 -);BioNet (2010-)
Pomaderris lanigera	Woolly Pomaderris			ALA (2010 -);BioNet (2010-)
Pomaderris ligustrina	Privet Pomaderris			ALA (2010 -);BioNet (2010-)
Pomaderris ligustrina subsp. ligustrina				BioNet (2010-)
Pomax umbellata	Pomax			ALA (2010 -);BioNet (2010-)
Poranthera corymbosa				ALA (2010 -);BioNet (2010-)
Poranthera ericifolia				ALA (2010 -);BioNet (2010-)
Poranthera microphylla	Small Poranthera			ALA (2010 -);BioNet (2010-)
Portulaca oleracea	Purslane;Pigweed			ALA (2010 -);BioNet (2010-)
Posidonia australis	Strapweed	E (local)	E (local)	ALA (2010 -)
Prasophyllum petilum	Petite Leek-Orchid			ALA (2010 -)
Pratia pedunculata	Matted Pratia			BioNet (2010-)
Pratia purpurascens	White Root;Whiteroot			ALA (2010 -);BioNet (2010-)
Prostanthera denticulata	Rough Mint-bush			ALA (2010 -);BioNet (2010-)
Prostanthera howelliae	Prostanthera			ALA (2010 -);BioNet (2010-)
Prostanthera linearis	Narrow-Leaved Mint-Bush;Nar- row-leaved Mint-bush			ALA (2010 -);BioNet (2010-)
Prostanthera ovalifolia				ALA (2010 -);BioNet (2010-)
Prostanthera spp.				BioNet (2010-)

Prostanthera junonis	Somersby Mintbush [64960]		Е	Species or species habitat may occur within area
Prunus avium	Cherry			ALA (2010 -)
Pseuderanthemum variabile	Pastel Flower			ALA (2010 -);BioNet (2010-)
Pseudognaphalium Iuteoalbum	Pukatea;Jersey Cudweed			ALA (2010 -);BioNet (2010-)
Psidium guajava	Yellow Guava			ALA (2010 -)
Psilotum nudum	Skeleton Fork Fern;Skeleton Fork-Fern			ALA (2010 -);BioNet (2010-)
Pteridium esculentum	Austral Bracken;Bracken			ALA (2010 -);BioNet (2010-)
Pteris tremula	Australian Bracken;Tender Brake			ALA (2010 -);BioNet (2010-)
Pteris vittata	Chinese Brake			ALA (2010 -);BioNet (2010-)
Pterostylis acuminata	Pointed Greenhood	Р		ALA (2010 -);BioNet (2010-)
Pterostylis chlorogramma				ALA (2010 -)
Pterostylis curta	Blunt Greenhood	Р		ALA (2010 -);BioNet (2010-)
Pterostylis grandiflora	Cobra Greenhood	Р		ALA (2010 -);BioNet (2010-)
Pterostylis longifolia	Tall Greenhood	Р		BioNet (2010-)
Pterostylis nana				ALA (2010 -)
Pterostylis nigricans				
Pterostylis nutans	Nodding Greenhood	Р		ALA (2010 -);BioNet (2010-)
Pterostylis parviflora	Tiny Greenhood	Р		ALA (2010 -);BioNet (2010-)
Pterostylis spp.	Greenhood	Р		BioNet (2010-)
Pterostylis saxicola	Sydney Plains Greenhood [64537]		Е	Species or species habitat may occur within area
Ptilothrix deusta				ALA (2010 -);BioNet (2010-)
Pultenaea blakelyi	Blakely's Bush-Pea			ALA (2010 -);BioNet (2010-)
Pultenaea daphnoides	Pultenaea;Large-leaf Bush-pea			ALA (2010 -);BioNet (2010-)
Pultenaea ferruginea				ALA (2010 -);BioNet (2010-)
Pultenaea flexilis				ALA (2010 -);BioNet (2010-)
Pultenaea hispidula				ALA (2010 -)
Pultenaea linophylla				ALA (2010 -);BioNet (2010-)
Pultenaea mollis	Guinea Flower Bush Pea, Soft Bush-Pea			ALA (2010 -);BioNet (2010-)
Pultenaea paleacea	Spreublutige;Chaffy Bush-pea			ALA (2010 -);BioNet (2010-)
Pultenaea polifolia	Dusky Bush-Pea;Dusky Bush- pea			ALA (2010 -);BioNet (2010-)
Pultenaea retusa	Mt Kaye Bush-Pea			ALA (2010 -);BioNet (2010-)
Pultenaea rosmarinifolia				ALA (2010 -);BioNet (2010-)
Pultenaea scabra	Rough Bush-Pea			ALA (2010 -);BioNet (2010-)
Pultenaea stipularis				ALA (2010 -);BioNet (2010-)
Pultenaea tuberculata				ALA (2010 -);BioNet (2010-)
Pultenaea villosa	Hairy Bush-pea			ALA (2010 -);BioNet (2010-)
Pyrrosia rupestris	Rock Felt Fern			ALA (2010 -);BioNet (2010-)
Ranunculus inundatus	River Buttercup			ALA (2010 -);BioNet (2010-)
Ranunculus plebeius	Forest Buttercup			ALA (2010 -);BioNet (2010-)
Rapanea variabilis	Muttonwood			Hornsby Shire Council, 2013
Rhizanthella slateri	Eastern Underground Orchid [11768]		Е	Species or species habitat may occur within area
Rhodamnia rubescens	Scrub Turpentine	CE		Hornsby Shire Council, 2013

Rhododendron indicum	Azalea		ALA (2010 -)
Rhytidosporum procum- bens	White Marianth		ALA (2010 -);BioNet (2010-)
Ricinocarpos pinifolius	Wedding Bush		ALA (2010 -);BioNet (2010-)
Rorippa spp.			BioNet (2010-)
Rosmarinus officinalis	Rosemary		ALA (2010 -)
Rubus anglocandicans	Blackberry		ALA (2010 -);BioNet (2010-)
Rubus parvifolius	Native Raspberry		ALA (2010 -);BioNet (2010-)
Rumex brownii	Hooked Dock;Swamp Dock		ALA (2010 -);BioNet (2010-)
Rumex spp.	Dock		BioNet (2010-)
Russula flocktoniae			ALA (2010 -)
Rytidosperma fulvum	Wallaby Grass		ALA (2010 -);BioNet (2010-)
Rytidosperma pallidum	Redanther Wallaby Grass; Silvertop Wallaby Grass		ALA (2010 -);BioNet (2010-)
Rytidosperma racemo- sum var. racemosum	Wallaby Grass		BioNet (2010-)
Rytidosperma tenuius	A Wallaby Grass		ALA (2010 -);BioNet (2010-)
Sacciolepis indica	Indian Cupscale Grass		ALA (2010 -);BioNet (2010-)
Sambucus spp.			BioNet (2010-)
Samolus repens	Māakoako;Creeping Brook- weed		ALA (2010 -);BioNet (2010-)
Sannantha pluriflora			ALA (2010 -);BioNet (2010-)
Sarcochilus australis	Butterfly Orchid	Р	ALA (2010 -);BioNet (2010-)
Sarcopetalum harveya- num	Pearl Vine		ALA (2010 -);BioNet (2010-)
Scaevola ramosissima	Purple Fan-flower		ALA (2010 -);BioNet (2010-)
Schefflera arboricola	Miniature Umbrella Tree		ALA (2010 -)
Schelhammera undulata	Lilac Lily		ALA (2010 -);BioNet (2010-)
Schizaea bifida	Forked Comb Fern		ALA (2010 -);BioNet (2010-)
Schizaea dichotoma	Fan Fern;Branched Comb Fern		ALA (2010 -);BioNet (2010-)
Schizaea rupestris			ALA (2010 -);BioNet (2010-)
Schizomeria ovata	Crabapple		ALA (2010 -);BioNet (2010-)
Schoenoplectus mucro- natus			ALA (2010 -);BioNet (2010-)
Schoenus apogon	Fluke Bogrush		ALA (2010 -);BioNet (2010-)
Schoenus brevifolius			ALA (2010 -);BioNet (2010-)
Schoenus ericetorum			ALA (2010 -);BioNet (2010-)
Schoenus imberbis	Beardless Bog-Rush		ALA (2010 -);BioNet (2010-)
Schoenus maschalinus	Dwarf Bog Rush		ALA (2010 -);BioNet (2010-)
Schoenus melanostachys			ALA (2010 -);BioNet (2010-)
Schoenus moorei			ALA (2010 -);BioNet (2010-)
Schoenus turbinatus			ALA (2010 -);BioNet (2010-)
Schoenus villosus			ALA (2010 -);BioNet (2010-)
Selaginella uliginosa	Swamp Selaginella		ALA (2010 -);BioNet (2010-)
Senecio bathurstianus	1 .		ALA (2010 -);BioNet (2010-)
Senecio behrianus			ALA (2010 -)
Senecio bipinnatisectus	Australian Fireweed		ALA (2010 -);BioNet (2010-)
Senecio diaschides	Fireweed		ALA (2010 -);BioNet (2010-)
Senecio hispidulus	Fireweed;Hill Fireweed		ALA (2010 -);BioNet (2010-)
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Senecio macranthus			ALA (2010 -)
Senecio madagascar- iensis	Fireweed		ALA (2010 -);BioNet (2010-)
Senecio prenanthoides			ALA (2010 -);BioNet (2010-)
Senecio quadridentatus	Cotton Fireweed		ALA (2010 -);BioNet (2010-)
Senecio tenuiflorus	A fireweed		ALA (2010 -);BioNet (2010-)
Sigesbeckia orientalis subsp. orientalis	Indian Weed		BioNet (2010-)
Smilax australis	Lawyer Vine		ALA (2010 -);BioNet (2010-)
Smilax glyciphylla	Sweet Sarsparilla		ALA (2010 -);BioNet (2010-)
Solandra maxima	Cup of Gold		ALA (2010 -)
Solanum americanum	Poroporo;Glossy Nightshade		ALA (2010 -);BioNet (2010-)
Solanum aviculare	Bullibul;Kangaroo Apple		ALA (2010 -);BioNet (2010-)
Solanum prinophyllum	Forest Nightshade		ALA (2010 -);BioNet (2010-)
Solanum pungetium	Eastern Nightshade		ALA (2010 -);BioNet (2010-)
Solenogyne bellioides	Solengyne		ALA (2010 -);BioNet (2010-)
Spathodea campanulata	African Tulip Tree		ALA (2010 -)
Sphaerolobium minus			ALA (2010 -);BioNet (2010-)
Sphaeromorphaea australis			ALA (2010 -)
Sphagnum falcatulum			ALA (2010 -)
Sporobolus creber	Slender Rat's Tail Grass		ALA (2010 -);BioNet (2010-)
Sporobolus elongatus	Slender Rat's Tail Grass		ALA (2010 -);BioNet (2010-)
Sporobolus virginicus	Seashore Dropseed		ALA (2010 -);BioNet (2010-)
Sprengelia incarnata	Pink Swamp Heath	Р	ALA (2010 -);BioNet (2010-)
Stackhousia nuda			ALA (2010 -);BioNet (2010-)
Stackhousia viminea	Slender Stackhousia		ALA (2010 -);BioNet (2010-)
Stellaria flaccida			ALA (2010 -);BioNet (2010-)
Stenocarpus salignus	Scrub Beefwood		ALA (2010 -);BioNet (2010-)
Stenocarpus sinuatus	FireTree;FirewheelTree		ALA (2010 -);BioNet (2010-)
Stephania japonica var. discolor	Snake Vine		BioNet (2010-)
Sticherus flabellatus			ALA (2010 -)
Sticherus flabellatus var. flabellatus	Umbrella Fern	Р	BioNet (2010-)
Sticherus lobatus	Spreading Fan Fern;Spreading Shield Fern		ALA (2010 -);BioNet (2010-)
Stylidium graminifolium	Grass Triggerplant		ALA (2010 -);BioNet (2010-)
Stylidium lineare	Narrow-leaved Triggerplant		ALA (2010 -);BioNet (2010-)
Stylidium productum			ALA (2010 -);BioNet (2010-)
Styphelia angustifolia			ALA (2010 -);BioNet (2010-)
Styphelia laeta			ALA (2010 -)
Styphelia laeta subsp. laeta			BioNet (2010-)
Styphelia triflora	Pink Five-Corners		ALA (2010 -);BioNet (2010-)
Styphelia tubiflora	Red Five-Corner		ALA (2010 -);BioNet (2010-)
Syncarpia glomulifera	Turpentine Tree; Turpentine		ALA (2010 -);BioNet (2010-)
Syncarpia glomulifera subsp. glomulifera			BioNet (2010-)
Synoum glandulosum			ALA (2010 -)

Synoum glandulosum subsp. glandulosum	Scentless Rosewood			BioNet (2010-)
Syzygium australe	Brush Cherry			ALA (2010 -);BioNet (2010-)
Syzygium oleosum				ALA (2010 -)
Syzygium paniculatum	Brush Cherry;Magenta Lilly Pilly	E1	V	ALA (2010 -);BioNet (2010-)
Syzygium smithii				ALA (2010 -)
Tasmannia insipida	Brush Pepperbush			ALA (2010 -);BioNet (2010-)
Telmatoblechnum indicum	Swamp Water Fern			BioNet (2010-)
Telopea speciosissima	New South Wales Wara- tah;Waratah	Р		ALA (2010 -);BioNet (2010-)
Tetragonia tetragonioides	New Zealand Spinach			BioNet (2010-)
Tetragonia tetragonoides	New Zealand Spinach			ALA (2010 -)
Tetraria capillaris				ALA (2010 -);BioNet (2010-)
Tetrarrhena juncea	Wiry Ricegrass			ALA (2010 -);BioNet (2010-)
Tetratheca ericifolia				ALA (2010 -);BioNet (2010-)
Tetratheca glandulosa	Tetratheca Glandulosa	V		ALA (2010 -);BioNet (2010-)
Tetratheca thymifolia	Black-eyed Susan			ALA (2010 -);BioNet (2010-)
Thelionema caespitosum	Tufted Blue-lily			ALA (2010 -);BioNet (2010-)
Thelionema umbellatum	Clustered Lily			ALA (2010 -);BioNet (2010-)
Thelymitra carnea	Tiny Sun Orchid	Р		ALA (2010 -);BioNet (2010-)
Thelymitra ixioides	Small Spotted Sun-Orchid			ALA (2010 -)
Thelymitra ixioides var. ixioides	Dotted Sun Orchid	Р		BioNet (2010-)
Thelymitra spp.		Р		BioNet (2010-)
Themeda triandra	Kangaroo Grass			ALA (2010 -);BioNet (2010-)
Thesium australe	Austral Toadflax, Toadflax [15202]		V	Species or species habitat may occur within area
Thysanotus juncifolius				ALA (2010 -);BioNet (2010-)
Thysanotus tuberosus	Common Fringe-lily			ALA (2010 -);BioNet (2010-)
Thysanotus tuberosus subsp. tuberosus				BioNet (2010-)
Tillandsia usneoides	Spanish Moss			ALA (2010 -)
Todea barbara	Hard Todea;King Fern	Р		ALA (2010 -);BioNet (2010-)
Toona australis	Red Cedar			Hornsby Shire Council, 2013
Toona ciliata	Red Cedar			ALA (2010 -);BioNet (2010-)
Trema tomentosa var. aspera	Native Peach			BioNet (2010-)
Tricoryne elatior	Yellow Autumn-lily			ALA (2010 -);BioNet (2010-)
Tricoryne simplex				ALA (2010 -);BioNet (2010-)
Tricostularia pauciflora	Needle Bog-Rush			ALA (2010 -);BioNet (2010-)
Trifolium arvense	Haresfoot Clover			ALA (2010 -)
Triglochin striata	Streaked Arrowgrass			ALA (2010 -);BioNet (2010-)
Tristania neriifolia	Water Gum			ALA (2010 -);BioNet (2010-)
Tristaniopsis collina	Mountain Water Gum			ALA (2010 -);BioNet (2010-)
Tristaniopsis laurina	Kanooka			ALA (2010 -);BioNet (2010-)
Trochocarpa laurina	Tree Heath			ALA (2010 -);BioNet (2010-)
Tylophora barbata	Bearded Tylophora			ALA (2010 -);BioNet (2010-)
Typha domingensis	Cumbungi;Narrow-leaved Cumbungi			ALA (2010 -);BioNet (2010-)

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Typha orientalis	Broadleaf Cum- bungi;Broad-leaved Cumbungi			ALA (2010 -);BioNet (2010-)
Urtica incisa	Ongaonga;Stinging Nettle			ALA (2010 -);BioNet (2010-)
Utricularia lateriflora	Small Bladderwort			ALA (2010 -);BioNet (2010-)
Velleia lyrata				ALA (2010 -);BioNet (2010-)
Verbena rigida	Creeping Verbena			ALA (2010 -)
Vernonia cinerea	Ironweed			ALA (2010 -);BioNet (2010-)
Vernonia cinerea var. cinerea				BioNet (2010-)
Veronica plebeia	Australian Speedwell;Trailing Speedwell			ALA (2010 -);BioNet (2010-)
Viminaria juncea	Native Broom			ALA (2010 -);BioNet (2010-)
Viola hederacea	Australian Native Vio- let;lvy-leaved Violet			ALA (2010 -);BioNet (2010-)
Viola silicestris				ALA (2010 -)
Vittadinia cuneata	Purple Fuzzweed			ALA (2010 -)
Wahlenbergia communis				ALA (2010 -)
Wahlenbergia gracilenta				ALA (2010 -)
Wahlenbergia gracilis	Sprawling Bluebell			ALA (2010 -);BioNet (2010-)
Wahlenbergia luteola	Bluebell			ALA (2010 -);BioNet (2010-)
Washingtonia robusta	Skyduster;Washington Fan Palm			ALA (2010 -);BioNet (2010-)
Westringia fruticosa	Coastal Rosemary			ALA (2010 -);BioNet (2010-)
Wikstroemia indica				ALA (2010 -);BioNet (2010-)
Woollsia pungens				ALA (2010 -);BioNet (2010-)
Xanthium strumarium	Burweed			ALA (2010 -)
Xanthorrhoea arborea		Р		ALA (2010 -);BioNet (2010-)
Xanthorrhoea concava		Р		ALA (2010 -);BioNet (2010-)
Xanthorrhoea latifolia		Р		ALA (2010 -);BioNet (2010-)
Xanthorrhoea macrone- ma		Р		ALA (2010 -);BioNet (2010-)
Хапthorrhoea media		Р		ALA (2010 -);BioNet (2010-)
Xanthorrhoea minor		Р		ALA (2010 -);BioNet (2010-)
Xanthorrhoea minor subsp. minor		Р		BioNet (2010-)
Xanthorrhoea resinosa		Р		ALA (2010 -);BioNet (2010-)
Xanthosia pilosa	Woolly Xanthosia			ALA (2010 -);BioNet (2010-)
Xanthosia tridentata	Hill Xanthosia;Rock Xanthosia			ALA (2010 -);BioNet (2010-)
Xylomelum pyriforme	Woody Pear	Р		ALA (2010 -);BioNet (2010-)
Xyris bracteata				ALA (2010 -);BioNet (2010-)
Xyris gracilis				ALA (2010 -);BioNet (2010-)
Zieria involucrata		E1	V	ALA (2010 -);BioNet (2010-)
Zieria laevigata	Smooth Zieria			ALA (2010 -);BioNet (2010-)
Zieria pilosa	Pilose-leafed Zieria			ALA (2010 -);BioNet (2010-)
Zieria smithii	Sandfly Zieria			ALA (2010 -);BioNet (2010-)

Hornsby Biodiversity Conservation Strategy 2020

Fauna

		Status		
Scientific Name	Common name	NSW	C'wealth	Source
Acanthagenys rufogularis	Spiny-Cheeked Honeyeater			ALA (2010 -)
Acanthiza apicalis	Inland Thornbill			ALA (2010 -)
Acanthiza pusilla	Brown Thornbill	Р		ALA (2010 -);BioNet (2010-)
Acanthiza chrysorrhoa	Yellow-Rumped Thornbill	Р		ALA (2010 -);BioNet (2010-)
Acanthiza reguloides	Buff-Rumped Thornbill	Р		ALA (2010 -);BioNet (2010-)
Acanthiza lineata	Striated Thornbill	Р		ALA (2010 -);BioNet (2010-)
Acanthiza nana	Yellow Thornbill	Р		ALA (2010 -);BioNet (2010-)
Acanthophis antarcticus	Common Death Adder	Р		ALA (2010 -); BioNet (2010-)
Acanthorhynchus te- nuirostris	Eastern Spinebill	Р		ALA (2010 -); BioNet (2010-)
Accipiter fasciatus	Brown Goshawk	Р		ALA (2010 -);BioNet (2010-)
Accipiter novaehollandiae	Grey Goshawk	Р		ALA (2010 -);BioNet (2010-)
Accipiter cirrocephalus	Collared Sparrowhawk	Р		ALA (2010 -);BioNet (2010-)
Achaearanea decorata				ALA (2010 -)
Acosmeryx anceus				ALA (2010 -)
Acritoscincus platynotus	Red-Throated Skink			ALA (2010 -)
Acrobates pygmaeus	Feathertail Glider	Р		BioNet (2010-)
Acrocephalus australis	Australian Reed Warbler			ALA (2010 -)
Adelotus brevis	Tusked Frog			ALA (2010 -)
Aegotheles cristatus	Australian Owlet-Nightjar	Р		ALA (2010 -);BioNet (2010-)
Aenetus tegulatus				ALA (2010 -)
Aeolochroma metarho-				
data				ALA (2010 -)
Agarista agricola				ALA (2010 -)
Agrotis infusa	Bogong Moth			ALA (2010 -)
Agrotis munda				ALA (2010 -)
Alectura lathami	Australian Brush-turkey	P		ALA (2010 -); BioNet (2010-)
Aleeta curvicosta				ALA (2010 -)
Alisterus scapularis	Australian King-Parrot	P		ALA (2010 -); BioNet (2010-)
Amalosia lesueurii	Lesueur's Velvet Gecko	P		ALA (2010 -); BioNet (2010-)
Amata nigriceps				ALA (2010 -)
Amegilla bombiformis				ALA (2010 -)
Amegilla chlorocyanea	Blue Banded Bee			ALA (2010 -)
Amegilla cingulata				ALA (2010 -)
Amphibolurus muricatus	Jacky Lizard	P		ALA (2010 -); BioNet (2010-)
Anas platyrhynchos	Mallard Duck			ALA (2010 -)
Anas superciliosa	Pacific Black Duck	P		ALA (2010 -);BioNet (2010-)
Anas castanea	Chestnut Teal Chestnut Teal			ALA (2010 -)
Anas gracilis	Grey Teal			ALA (2010 -)
Anguilla reinhardtii	Longfin Eel			ALA (2010 -)
Anhinga novaehollandiae	Australasian Darter	Р		BioNet (2010-)
Anilios nigrescens	Blackish Blind Snake	Р		ALA (2010 -); BioNet (2010-)
Anilios sp.	blind snake	Р		BioNet (2010-)
Anomalopus swansoni	Punctate Worm-Skink			ALA (2010 -)
Anoplognathus viriditarsis				ALA (2010 -)

Antechinus stuartii	Brown Antechinus	Р		ALA (2010 -); BioNet (2010-)
Antechinus swainsonii	Dusky Antechinus	P		BioNet (2010-)
Antechinus swainsonii Anthochaera chrysoptera	Little Wattlebird	P		ALA (2010 -);BioNet (2010-)
Anthochaera lunulata	Western Wattlebird			ALA (2010 -), BIONEL (2010-)
Antinochaera lunulata	vvestern vvattiebird			ALA (2010 -); ALA (2010 -);ALA (2010 -);
Anthochaera carunculata	Red Wattlebird	Р		BioNet (2010-)
Anthochaera paradoxa	Yellow Wattlebird			ALA (2010 -)
Anthochaera phrygia	Regent Honeyeater	E4a	CE	HSC (2013)
Anthophiloptera dryas				ALA (2010 -)
Anthus novaeseelandiae	Australian Pipit	Р		ALA (2010 -);BioNet (2010-)
Aphis nerii	Oleander Aphid			ALA (2010 -)
Apiomorpha sessilis				ALA (2010 -)
Apis mellifera	Honey Bee			ALA (2010 -)
Apolinus lividigaster				ALA (2010 -)
Aprosmictus erythrop- terus	Red-Winged Parrot			ALA (2010 -)
Apus pacificus	Fork-Tailed Swift			ALA (2010 -)
Aquila audax	Wedge-Tailed Eagle	Р		ALA (2010 -);BioNet (2010-)
Arachnura higginsi				ALA (2010 -)
Araneus albotriangulus				ALA (2010 -)
Arasia mollicoma				ALA (2010 -)
Archimantis latistyla				ALA (2010 -)
Ardea pacifica	White-Necked Heron	P		ALA (2010 -):BioNet (2010-)
Ardea ibis	Cattle Egret	P	C,J	ALA (2010 -);BioNet (2010-)
Ardea modesta	Eastern Great Egret		-,-	ALA (2010 -)
Ardea alba				ALA (2010 -)
Argiope keyserlingi		1		ALA (2010 -)
Argiope mascordi				ALA (2010 -)
Argyrodes rainbowi				ALA (2010 -)
Arhodia lasiocamparia				ALA (2010 -)
Aridaeus thoracicus		1		ALA (2010 -)
Arkys lancearius				ALA (2010 -)
Artamus cyanopterus	Dusky Woodswallow	T _V		ALA (2010 -)
Artoriopsis expolita	Businy vvocasvanov	+		ALA (2010 -)
Asteron hunti		+		ALA (2010 -)
Asura lydia		+		ALA (2010 -)
Athetis tenuis				ALA (2010 -)
Atractomorpha australis	Australian Grass Pyrgomorph	+		ALA (2010 -)
Atrapsalta corticina	, assanan Grass Fyrgornorph			ALA (2010 -)
Atrapsalta encaustica	Black Squeaker			ALA (2010 -)
Atrax robustus	Sydney Funnel-Web Spider			ALA (2010 -); BioNet (2010-)
Austracantha minax	Gydney i dilitel-tveb Spidel			ALA (2010 -), BioNet (2010-)
Austracantna minax Australomimetus mac-		+		VPV (5010 -)
ulosus				ALA (2010 -)
Australomisidia pilula				ALA (2010 -)
Austroagrion watsoni				ALA (2010 -)
Austroargiolestes icteromelas				ALA (2010 -)
Austroargiolestes isa- bellae				ALA (2010 -)

Chalinolobus dwyeri	Large-eared Pied Bat	V, P	T _V	
Chalcophaps indica	Emerald Dove		1	ALA (2010 -)
Ceyx azureus	Azure Kingfisher		1	ALA (2010 -)
Cernuella virgata	Vineyard Snail		1	ALA (2010 -)
Cercophonius squama	7,0 7		1	ALA (2010 -)
Cercartetus nanus	Eastern Pygmy-Possum	V,P	+	ALA (2010 -); BioNet (2010-)
Centropus phasianinus	Pheasant Coucal		1	ALA (2010 -)
Centroina kota			+	ALA (2010 -)
Celaenia excavata			+	ALA (2010 -)
Cebysa leucotelus	Lichen Case Moth		+	ALA (2010 -)
Camponotus nigriceps			+	ALA (2010 -)
Camponotus consobrinus			+	ALA (2010 -)
Camponotus aeneopi-	Tellow-falled black-cockatoo			ALA (2010 -)
Calyptorhynchus lathami Calyptorhynchus funere- us	Glossy Black-Cockatoo Yellow-Tailed Black-Cockatoo	V,F,2		ALA (2010 -);BioNet (2010-)
Calyptorhynchus banksii	Red-Tailed Black Cockatoo	V,P,2		ALA (2010 -) ALA (2010 -); BioNET (2010-); HSC (2013)
Callocephalon fimbriatum	Gang-Gang Cockatoo	V,P,3	-	ALA (2010 -); BioNET (2010-);
Caligavis chrysops	Yellow-Faced Honeyeater	P	-	ALA (2010 -); BioNet (2010-)
Cacophis squamulosus	Golden-Crowned Snake	P	+	ALA (2010 -); BioNet (2010-)
Cacomantis pallidus	Pallid Cuckoo		+	ALA (2010 -)
Cacomantis flabelliformis	Fan-Tailed Cuckoo	P	+	ALA (2010 -);BioNet (2010-)
Cacomantis variolosus	Brush Cuckoo		+	ALA (2010 -)
Cacatua tenuirostris	Long-Billed Corella	P	+	ALA (2010 -);BioNet (2010-)
Cacatua sanguinea	Little Corella	P	+	ALA (2010 -);BioNet (2010-)
Cacatua galerita	Sulphur-Crested Cockatoo	P		ALA (2010 -);BioNet (2010-)
Butorides striatus	Striated Heron			ALA (2010 -)
Burhinus grallarius	Bush Stone-Curlew			ALA (2010 -)
Brevicoryne brassicae	Cabbage Aphid			ALA (2010 -)
Bradybaena similaris				ALA (2010 -)
Bolemoreus frenatus	Bridled Honeyeater			ALA (2010 -)
Boiga irregularis	Brown Tree Snake	Р	1	BioNet (2010-)
Biziura lobata	Musk Duck			ALA (2010 -)
Bembicium nanum	Striped-Mouth Conniwink			ALA (2010 -)
Battalus rugosus			1	ALA (2010 -)
Battalus adamparsonsi				ALA (2010 -)
Badumna longinqua	Grey House Spider			ALA (2010 -)
Badumna insignis	Black House Spider			ALA (2010 -)
Aythya australis	Hardhead			ALA (2010 -)
Aviceda subcristata	Pacific Baza	Р		ALA (2010 -);BioNet (2010-)
Austrosalomona falcata				ALA (2010 -)
Austropyrgus nepean- ensis				ALA (2010 -)
Austronomus australis	White-Striped Freetail-Bat	Р		ALA (2010 -); BioNet (2010-)
Austrolestes leda			1	ALA (2010 -)
Austrolestes cingulatus				ALA (2010 -)
	Sydney Bristle Snail			ALA (2010 -)

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Chalinolobus gouldii	Gould's Wattled Bat	Р	ALA (2010 -); BioNet (2010-)
Chalinolobus morio	Chocolate Wattled Bat	Р	ALA (2010 -); BioNet (2010-)
Chauliognathus lugubris	Plague Soldier Beetle		ALA (2010 -)
Chelepteryx collesi			ALA (2010 -)
Chelodina longicollis	Eastern Long-Necked Turtle		ALA (2010 -)
Chelodina expansa	Broad-Shelled Turtle		ALA (2010 -)
Chelodina longicollis	Eastern Snake-neckedTurtle	Р	BioNet (2010-)
Chelonia mydas	Green Turtle		ALA (2010 -)
Chenonetta jubata	Australian Wood Duck	Р	ALA (2010 -); BioNet (2010-)
Chondropyga dorsalis	Cowboy Beetle		ALA (2010 -)
Chroicocephalus novae- hollandiae	Silver Gull	Р	ALA (2010 -); BioNet (2010-)
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo		ALA (2010 -)
Chrysococcyx lucidus	Shining Bronze-Cuckoo	P	ALA (2010 -);BioNet (2010-)
Chrysodeixis argentifera			ALA (2010 -)
Chrysolopus spectabilis	Diamond Weevil		ALA (2010 -)
Cinclosoma punctatum	Spotted Quail-Thrush	P	ALA (2010 -);BioNet (2010-)
Circopetes obtusata			ALA (2010 -)
Circus approximans	Swamp Harrier		ALA (2010 -)
Cisticola exilis	Golden-Headed Cisticola		ALA (2010 -)
Climacteris picumnus	Brown Treecreeper	V	ALA (2010 -)
Clubiona cycladata			ALA (2010 -)
Coccinella transversalis			ALA (2010 -)
Coelophora inaequalis	Variable Ladybird		ALA (2010 -)
Coequosa triangularis			ALA (2010 -)
Colluricincla harmonica	Grey Shrike-Thrush	Р	ALA (2010 -);BioNet (2010-)
Columba livia	Rock Pigeon		ALA (2010 -)
Columba leucomela	White-Headed Pigeon	Р	ALA (2010 -);BioNet (2010-)
Comptosia neosobria	-		ALA (2010 -)
Concinnia tenuis	Barred-Sided Skink	Р	ALA (2010 -);BioNet (2010-)
Conocephalomima barameda			ALA (2010 -)
Coptotermes acinaci- formis	Subterranean Termite		ALA (2010 -)
Coptotermes frenchi			ALA (2010 -)
Coracina novaehollandiae	Black-Faced Cuckoo-Shrike	P	ALA (2010 -);BioNet (2010-)
Coracina papuensis	White-Bellied Cuckoo-Shrike	P	ALA (2010 -);BioNet (2010-)
Corcorax melanorham- phos	White-Winged Chough		ALA (2010 -)
Cordulephya pygmaea			ALA (2010 -)
Cormobates leucophaea	White-Throated Treecreeper	Р	ALA (2010 -); BioNet (2010-)
Cormocephalus west- woodi			ALA (2010 -)
Cornu aspersum			ALA (2010 -)
			ALA (2010 -); BioNet (2010-)
Corvus coronoides	Australian Raven	P	ALA (2010 -), BIONEL (2010-)
Corvus coronoides Corvus mellori	Australian Raven Little Raven	P	ALA (2010 -)
		P	
Corvus mellori	Little Raven	P	ALA (2010 -)
Corvus mellori Corvus orru	Little Raven Torresian Crow	P	ALA (2010 -) ALA (2010 -)

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Cracticus nigrogularis	Pied Butcherbird	Р		ALA (2010 -); BioNet (2010-)
Cracticus tibicen	Australian Magpie	Р		ALA (2010 -); BioNet (2010-)
Cracticus torquatus	Grey Butcherbird	P		ALA (2010 -); BioNet (2010-)
Crinia signifera	Common Eastern Froglet	P		ALA (2010 -); BioNet (2010-)
Crocothemis nigrifrons				ALA (2010 -)
Cruria synopla				ALA (2010 -)
Cryphaea xylina				ALA (2010 -)
Cryptachaea gigantipes				ALA (2010 -)
Cryptoblepharus pulcher	Elegant Snake-Eyed Skink			ALA (2010 -)
Cryptoblepharus virgatus	Striped Snake-Eyed Skink- Cream-striped Shinning-skink	Р		ALA (2010 -); BioNet (2010-)
Ctenotus inomatus	Bar-Shouldered Ctenotus			ALA (2010 -)
Ctenotus robustus	Robust Ctenotus	Р		ALA (2010 -); BioNet (2010-)
Ctenotus taeniolatus	Copper-tailed Skink	Р		BioNet (2010-)
Cuculus optatus	Oriental Cuckoo			ALA (2010 -)
Cyclochila australasiae	Masked Devil			ALA (2010 -)
Cygnus atratus	Black Swan			ALA (2010 -)
Cylindrococcus spiniferus	Casuarina Gall			ALA (2010 -)
Cymbacha ocellata				ALA (2010 -)
Cyprinus carpio	European Carp			ALA (2010 -)
Cystosoma saundersii	Bladder Cicada			ALA (2010 -)
Dacelo leachii	Blue-Winged Kookaburra			ALA (2010 -)
Dacelo novaeguineae	Kookaburra			ALA (2010 -)
Dacelo novaeguineae	Laughing Kookaburra	Р		BioNet (2010-)
Dapanoptera richmon- diana				ALA (2010 -)
Daphoenositta chrysop- tera	Varied Sittella	V,P		ALA (2010 -);BioNet (2010-)
Dasypodia selenophora	Moon Moth	1		ALA (2010 -)
Dasyurus maculatus	BindjulangSpotted-tailed Quoll	V,P	E	ALA (2010 -); BioNet (2010-)
Deinopis subrufa				ALA (2010 -)
Delias nigrina	Black Jezebel			ALA (2010 -)
Demansia psammophis	Yellow-Faced Whip Snake	Р		ALA (2010 -); BioNet (2010-)
Dendrelaphis punctulatus	Common Tree Snake	Р		ALA (2010 -); BioNet (2010-)
Dermochelys coriacea	Leatherback Turtle	E1, P	E	OEH
Dicaeum hirundinaceum	Mistletoebird	Р		ALA (2010 -);BioNet (2010-)
Dicrurus bracteatus	Spangled Drongo			ALA (2010 -)
Dideopsis aegrota				ALA (2010 -)
Didymuria violescens				ALA (2010 -)
Diphlebia lestoides	+			
				ALA (2010 -)
Diplacodes bipunctata				ALA (2010 -) ALA (2010 -)
Diplacodes bipunctata				
-				ALA (2010 -)
Diplacodes bipunctata Diplacodes haematodes				ALA (2010 -) ALA (2010 -)
Diplacodes bipunctata Diplacodes haematodes Diplacodes melanopsis	Nobbi Dragon			ALA (2010 -) ALA (2010 -) ALA (2010 -)
Diplacodes bipunctata Diplacodes haematodes Diplacodes melanopsis Diplopseustis perieresalis	Nobbi Dragon			ALA (2010 -) ALA (2010 -) ALA (2010 -) ALA (2010 -)
Diplacodes bipunctata Diplacodes haematodes Diplacodes melanopsis Diplopseustis perieresalis Diporiphora nobbi	Nobbi Dragon Dugong	E1, P		ALA (2010 -)
Diplacodes bipunctata Diplacodes haematodes Diplacodes melanopsis Diplopseustis perieresalis Diporiphora nobbi Dolichoderus doriae		E1, P		ALA (2010 -)

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Egretta garzetta	Little Egret			ALA (2010 -)
Egretta novaehollandiae	White-faced Heron	Р		ALA (2010 -); BioNet (2010-)
Egretta sacra	Eastern Reef Egret			ALA (2010 -)
Elanus axillaris	Black-shouldered Kite	Р		ALA (2010 -); BioNet (2010-)
Elhamma australasiae				ALA (2010 -)
Ellipsidion humerale				ALA (2010 -)
Entometa fervens				ALA (2010 -)
Entomyzon cyanotis	Blue-Faced Honeyeater			ALA (2010 -)
Eolophus roseicapillus	Galah	Р		ALA (2010 -); BioNet (2010-)
Eopsaltria australis	Eastern Yellow Robin	Р		ALA (2010 -);BioNet (2010-)
Eopsaltria georgiana	White-Breasted Robin			ALA (2010 -)
Ephippiorhynchus asi-				
aticus	Black-Necked Stork			ALA (2010 -)
Epicoma melanospila				ALA (2010 -)
Erigone prominens				ALA (2010 -)
Eriophora transmarina				ALA (2010 -)
Eubalaena australis	Southern Right Whale	E1,P	E	OEH (2004)
Eucalyptolyma maideni				ALA (2010 -)
Eudynamys orientalis	Pacific KoelEastern Koel	Р		ALA (2010 -); BioNet (2010-)
Eulamprus quoyii	Eastern Water-skink	Р		ALA (2010 -); BioNet (2010-)
Eumerus argyrogaster				ALA (2010 -)
Eupoecila australasiae	Fiddler Beetle			ALA (2010 -)
Eurostopodus mystacalis	White-Throated Nightjar	Р		ALA (2010 -);BioNet (2010-)
Eurymela rubrolimbata				ALA (2010 -)
Eurynassa australis				ALA (2010 -)
Euryopis superba				ALA (2010 -)
Eurystomus orientalis	Dollarbird	Р		ALA (2010 -); BioNet (2010-)
Eutane terminalis				ALA (2010 -)
Falco longipennis	Australian Hobby			ALA (2010 -)
Falco peregrinus	Peregrine Falcon	Р		ALA (2010 -);BioNet (2010-)
Falco subniger	Black Falcon			ALA (2010 -)
Falco cenchroides	Nankeen Kestrel			ALA (2010 -)
Falco hypoleucos	Grey Falcon	E1, P		
Falcunculus frontatus	Crested Shrike-Tit			ALA (2010 -)
Falcunculus frontatus				
frontatus	Eastern Shrike-tit	Р		BioNet (2010-)
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		ALA (2010 -); BioNET (2010-); HSC (2013)
Fodina ostorius				ALA (2010 -)
Fulica atra	Eurasian Coot	Р		ALA (2010 -); BioNet (2010-)
Galanga labeculata	Double-Spotted Cicada			ALA (2010 -)
Gallinago hardwickii	Latham's Snipe	Р	C,J,K	ALA (2010 -);BioNet (2010-)
Gallinula tenebrosa	Dusky Moorhen	Р		ALA (2010 -);BioNet (2010-)
Gallirallus philippensis	Banded Rail			ALA (2010 -)
Gastrimargus musicus	Yellow-Winged Locust			ALA (2010 -)
Carriaglia faccionadaria				ALA (2010 -)
Gavicalis fasciogularis	Mangrove Honeyeater		1	, ,
Geitoneura acantha	Mangrove Honeyeater Ringed Xenica			ALA (2010 -)
	· ·	P		

Gerygone fusca	Western Gerygone			ALA (2010 -)
Gerygone levigaster	Mangrove Gerygone	Р		BioNet (2010-)
Gerygone mouki	Brown Gerygone	Р		ALA (2010 -); BioNet (2010-)
Gerygone olivacea	White-throated Gerygone	Р		ALA (2010 -); BioNet (2010-)
Glenoleon pulchellus				ALA (2010 -)
Gliciphila melanops	Tawny-Crowned Honeyeater			ALA (2010 -)
Glossopsitta concinna	Musk Lorikeet	Р		ALA (2010 -); BioNet (2010-)
Glossopsitta pusilla	Little Lorikeet	V, P		OEH (2017)
Goniaea australasiae	Gumleaf Grasshopper			ALA (2010 -)
Grallina cyanoleuca	Magpie-lark	Р		ALA (2010 -); BioNet (2010-)
Graycassis chichester				ALA (2010 -)
Grus rubicunda	Brolga			ALA (2010 -)
Haemopsalta rubea				ALA (2010 -)
Haliaeetus leucogaster	White-Bellied Sea-Eagle	V,P	С	ALA (2010 -);BioNet (2010-)
Haliastur indus	Brahminy Kite			ALA (2010 -)
Haliastur sphenurus	Whistling Kite	Р		ALA (2010 -); BioNet (2010-)
Halmus chalybeus	Steelblue Ladybird			ALA (2010 -)
Haritalodes derogata				ALA (2010 -)
Harmonia conformis	Large Spotted Ladybird			ALA (2010 -)
Harmonia testudinaria				ALA (2010 -)
Heleioporus australiacus	Giant Burrowing Frog	V,P	v	ALA (2010 -); BioNET (2010-); HSC (2013)
Hemiaspis signata	Black-Bellied Swamp Snake	Р		ALA (2010 -); BioNet (2010-)
Hemibelideus lemuroides	Lemuroid Ringtail Possum			ALA (2010 -)
Hemicordulia australiae				ALA (2010 -)
Hemidactylus frenatus	House Gecko			ALA (2010 -)
Henicopsaltria eydouxii	Razor Grinder			ALA (2010 -)
Hesperilla mastersi	Master's Skipper			ALA (2010 -)
Heteromicta pachytera				ALA (2010 -)
Heteronympha merope	Common Brown			ALA (2010 -)
Heteronympha mirifica	Wonder Brown			ALA (2010 -)
Heteropoda longipes				ALA (2010 -)
Heterotermes ferox				ALA (2010 -)
Hieraaetus morphnoides	Little Eagle	V,P		ALA (2010 -);BioNet (2010-); HSC (2013)
Hirundapus caudacutus	Spine-Tailed SwiftWhite-throated Needletail	Р	C,J,K	ALA (2010 -); BioNet (2010-)
11'1		_		ALA (2010 -);ALA (2010 -);
Hirundo neoxena	Welcome Swallow	P		BioNet (2010-)
Hoggicosa bicolor				ALA (2010 -)
Homo sapiens		-	+	ALA (2010 -)
Hylacola pyrrhopygia	Chestnut-Rumped Heathwren			ALA (2010 -)
Illeis galbula	W. 5 5			ALA (2010 -)
Intellagama lesueurii	Water DragonEastern Water Dragon	Р		ALA (2010 -); BioNet (2010-)
Intruda signata				ALA (2010 -)
Iridomyrmex purpureus				ALA (2010 -)
Ischnura aurora	Australian Damselfly			ALA (2010 -)
Ischnura heterosticta				ALA (2010 -)
Isidorella newcombi				ALA (2010 -)

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Isoodon obesulus	Southern Brown Bandicoot	E1,P	E	ALA (2010 -), HSC (2013)
Isopedella pessleri				ALA (2010 -)
Ixobrychus flavicollis	Black Bittern	V, P		OEH (2018)
Ixodes holocyclus				ALA (2010 -)
Jalmenus evagoras	Imperial Hairstreak			ALA (2010 -)
Junonia villida	Meadow Argus			ALA (2010 -)
Kaiya terama				ALA (2010 -)
Kongobatha diademata				ALA (2010 -)
Lampona braemar				ALA (2010 -)
Lamprolina aeneipennis				ALA (2010 -)
Lampromicra aerea				ALA (2010 -)
Lampropholis delicata	Dark-Flecked Garden Sunskink	Р		ALA (2010 -); BioNet (2010-)
Lampropholis guichenoti	Pale-Flecked Garden Sunskink	Р		ALA (2010 -); BioNet (2010-)
Lampropholis sp.	unidentified grass skink	Р		BioNet (2010-)
Lathamus discolor	Swift Parrot		CE	ALA (2010 -); BioNET (2010-); HSC (2013)
Latrodectus hasseltii	Redback Spider			ALA (2010 -)
Leioproctus boltoni				ALA (2010 -)
Leptomyrmex erythro- cephalus				ALA (2010 -)
Leptomyrmex wiburdi				ALA (2010 -)
Leucauge dromedaria				ALA (2010 -)
Leucauge granulata				ALA (2010 -)
Leucosarcia melanoleuca	Wonga Pigeon	Р		ALA (2010 -); BioNet (2010-)
Lewinia pectoralis	Lewin's Rail			ALA (2010 -)
Lialis burtonis	Burton's Snake-lizard	Р		ALA (2010 -); BioNet (2010-)
Lichenostomus melanops	Yellow-Tufted Honeyeater	Р		ALA (2010 -); BioNet (2010-)
Lichmera indistincta	Brown Honeyeater			ALA (2010 -)
Limax maximus	Leopard Slug			ALA (2010 -)
Limnodynastes dumerilii	Eastern Banjo Frog	Р		ALA (2010 -); BioNet (2010-)
Limnodynastes peronii	Brown-striped Frog	Р		ALA (2010 -); BioNet (2010-)
Liopholis whitii	White's Skink	Р		ALA (2010 -); BioNet (2010-)
Litoria aurea	Green and Golden Bell Frog	E	V	ALA (2010 -)
Litoria caerulea	Green Tree Frog	Р		ALA (2010 -); BioNet (2010-)
Litoria dentata	BleatingTree Frog	P		ALA (2010 -); BioNet (2010-)
Litoria ewingii	Brown Tree Frog			ALA (2010 -)
Litoria fallax	Eastern Dwarf Tree Frog	Р		ALA (2010 -); BioNet (2010-)
Litoria lesueuri	Lesueur's Frog	Р		ALA (2010 -); BioNet (2010-)
Litoria peronii	Peron's Tree Frog	Р		ALA (2010 -); BioNet (2010-)
Litoria phyllochroa	Leaf-green Tree Frog	Р		ALA (2010 -); BioNet (2010-)
Litoria raniformis	Southern Bell Frog			ALA (2010 -)
Litoria verreauxii	Verreaux's Frog	Р		ALA (2010 -); BioNet (2010-)
Litoria wilcoxii	Wilcox's Frog			ALA (2010 -)
Lonchura punctulata	Nutmeg Munia			ALA (2010 -)
Lophochroa leadbeateri	Major Mitchell's Cockatoo			ALA (2010 -)
Lophoictinia isura	Square-tailed Kite	V,P,3		ALA (2010 -); BioNet (2010-)
Lopholaimus antarcticus	Topknot Pigeon			ALA (2010 -)
Lyramorpha rosea	Litchi Stink Bug			ALA (2010 -)
Macquaria colonorum	Estuary Perch			ALA (2010 -)

Macronectes giganteus	Southern Giant Petrel	E1	E	OEH (2017)
Macropus giganteus	Eastern Grey Kangaroo	Р		ALA (2010 -); BioNet (2010-)
Macropus rufogriseus	Red-necked Wallaby	Р		ALA (2010 -); BioNet (2010-)
Macropygia amboinensis	Brown Cuckoo-Dove	Р		ALA (2010 -);BioNet (2010-)
Macrotristria angularis	Cherrynose			ALA (2010 -)
Malurus lamberti	Variegated Fairy-Wren	Р		ALA (2010 -);BioNet (2010-)
Malurus pulcherrimus	Blue-Breasted Fairy-Wren			ALA (2010 -)
Malurus cyaneus	Superb Fairy-Wren	Р		ALA (2010 -);BioNet (2010-)
Manorina melanophrys	Bell Miner	Р		ALA (2010 -);BioNet (2010-)
Manorina flavigula	Yellow-Throated Miner			ALA (2010 -)
Manorina melanocephala	Noisy Miner	Р		ALA (2010 -);BioNet (2010-)
Maratus rainbowi				ALA (2010 -)
Maratus volans	Peacock spider			ALA (2010 -); BioNet (2010-)
Maroga melanostigma				ALA (2010 -)
Megadolomedes austra-				
lianus				ALA (2010 -)
Megalurus gramineus	Little Grassbird			ALA (2010 -)
Meliphaga lewinii	Lewin's Honeyeater	Р		ALA (2010 -);BioNet (2010-)
Melithreptus brevirostris	Brown-Headed Honeyeater			ALA (2010 -)
Melithreptus gularis	Black-Chinned Honeyeater			ALA (2010 -)
Melithreptus lunatus	White-Naped Honeyeater	Р		ALA (2010 -);BioNet (2010-)
Menura novaehollandiae	Superb Lyrebird	Р		ALA (2010 -);BioNet (2010-)
Meranoplus minor				ALA (2010 -)
Meridolum middenense	Mona Vale Woodland Snail			ALA (2010 -)
Merops omatus	Rainbow Bee-Eater			ALA (2010 -)
Methana marginalis				ALA (2010 -)
Microcarbo melanoleu- cos	Little Pied Cormorant	Р		ALA (2010 -); BioNet (2010-)
Microeca fascinans	Jacky Winter	Р		ALA (2010 -); BioNet (2010-)
Miniopterus australis	Little Bentwing-Bat	V,P		ALA (2010 -); BioNet (2010-)
Miniopterus schreibersii	Bent-Wing Bat			ALA (2010 -)
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		BioNet (2010-); HSC (2013)
Mituliodon tarantulinus				ALA (2010 -)
Mixophyes fasciolatus	Great Barred Frog			ALA (2010 -)
Mixophyes iteratus	Giant Barred Frog			ALA (2010 -)
Mnesampela lenaea				ALA (2010 -)
Molycria mammosa				ALA (2010 -)
Monarcha melanopsis	Black-Faced Monarch	Р		ALA (2010 -);BioNet (2010-)
Monteithiella humeralis				ALA (2010 -)
Morebilus plagusius				ALA (2010 -)
Morelia spilota	Carpet Python	Р		ALA (2010 -); BioNet (2010-)
Morelia spilota spilota	Diamond Python	P		BioNet (2010-)
Mormopterus ridei	Ride's Free-Tailed Bat			ALA (2010 -)
		1		-,,
Mormopterus norfolken- sis	Eastern Free-tailed Bat	V, P		BioNet (2010-); HSC (2013)
Mormopterus norfolken- sis		V, P		BioNet (2010-); HSC (2013) BioNet (2010-)
Mormopterus norfolken-	Eastern Free-tailed Bat			BioNet (2010-); HSC (2013) BioNet (2010-) ALA (2010 -)

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Myiagra cyanoleuca	Satin Flycatcher		ALA (2010 -)
Myiagra rubecula	Leaden Flycatcher	Р	ALA (2010 -);BioNet (2010-)
Myiagra inquieta	Restless Flycatcher		ALA (2010 -)
Myotis macropus	Southern Myotis	V,P	ALA (2010 -); BioNet (2010-) HSC (2013)
Myrmecia forficata			ALA (2010 -)
Myrmecia gulosa			ALA (2010 -)
Myrmecia nigrocincta			ALA (2010 -)
Myrmecia pilosula			ALA (2010 -)
Myrmecia tarsata			ALA (2010 -)
Myzomela obscura	Dusky Honeyeater		ALA (2010 -)
Myzomela sanguinolenta	Scarlet Honeyeater	Р	ALA (2010 -);BioNet (2010-)
Naupactus leucoloma	White-Fringed Weevil		ALA (2010 -)
Nausinoe pueritia			ALA (2010 -)
Neato kioloa			ALA (2010 -)
Neochmia temporalis	Red-Browed Finch	P	ALA (2010 -);BioNet (2010-)
Neophema pulchella	Turquoise Parrot	V, P	ALA (2010 -)
Neorrhina punctatum			ALA (2010 -)
Neotemnopteryx aus- tralis			ALA (2010 -)
Nephila edulis	Golden Orbweb Spider		ALA (2010 -)
Nephila pilipes	Giant Wood-Spider		ALA (2010 -)
Nephila plumipes	Humped Golden Orb-Weaving Spider		ALA (2010 -)
Nesoptilotis flavicollis	Yellow-Throated Honeyeater		ALA (2010 -)
Nesoptilotis leucotis	White-Eared Honeyeater	Р	ALA (2010 -); BioNet (2010-)
Nicodamus peregrinus			ALA (2010 -)
Ninox connivens	Barking Owl	V,P,3	ALA (2010 -), HSC (2013)
Ninox novaeseelandiae	Southern Boobook	Р	ALA (2010 -);BioNet (2010-)
Ninox strenua	Powerful Owl	V,P,3	ALA (2010 -), HSC (2013)
Norfolius howensis			ALA (2010 -)
Notarcha aurolinealis			ALA (2010 -)
Nycticorax caledonicus	Nankeen Night-Heron	P	ALA (2010 -); BioNet (2010-)
Nyctophilus geoffroyi	Lesser Long-eared Bat	Р	BioNet (2010-)
Nyctophilus gouldi	Gould's Long-Eared Bat	P	ALA (2010 -); BioNet (2010-)
Nymphes myrmeleonoi- des			ALA (2010 -)
Nyssus albopunctata			ALA (2010 -)
Nyssus coloripes			ALA (2010 -)
Nyssus jaredwardeni			ALA (2010 -)
Ocyphaps lophotes	Crested Pigeon	Р	ALA (2010 -); BioNet (2010-)
Oecobius navus			ALA (2010 -)
Omoedus orbiculatus			ALA (2010 -)
Oncodamus bidens			ALA (2010 -)
Opisthoncus mordax			ALA (2010 -)
Opisthoncus parceden- tatus			ALA (2010 -)
Opisthoncus polyphemus			ALA (2010 -)
Orectolobus maculatus	Spotted Wobbegong		ALA (2010 -)
Origma solitaria	Rockwarbler		ALA (2010 -)

Oriolus sagittatus	Olive-Backed Oriole	P		ALA (2010 -);BioNet (2010-)
Orthetrum caledonicum				ALA (2010 -)
Orthetrum villosovittatum				ALA (2010 -)
Orthodera ministralis	Green Mantid			ALA (2010 -)
Orthogonis ornatipennis				ALA (2010 -)
Oxyopes gracilipes				ALA (2010 -)
Pachycephala rufiventris	Rufous Whistler	Р		ALA (2010 -);BioNet (2010-)
Pachycephala melanura	Mangrove Golden Whistler			ALA (2010 -)
Pachycephala pectoralis	Golden Whistler	P		ALA (2010 -)
Pandion cristatus	Eastern Osprey	V,P,3		BioNet (2010-); HSC (2013)
Papilio aegeus	Orchard Swallowtail Butterfly			ALA (2010 -)
Paraembolides boycei				ALA (2010 -)
Paramatachia ashton- ensis				ALA (2010 -)
Paraphilaeus daemelii				ALA (2010 -)
Parasesarma erythodac- tyla				ALA (2010 -)
Parasteatoda tepidario- rum				ALA (2010 -)
Pardalotus striatus	Striated Pardalote	P		ALA (2010 -);BioNet (2010-)
Pardalotus punctatus	Spotted Pardalote	P	1	ALA (2010 -);BioNet (2010-)
Parvipsitta pusilla	Little Lorikeet	V,P		ALA (2010 -);BioNet (2010-); HSC (2013)
Pauropsalta mneme	Ticker	+	1	ALA (2010 -)
Pediana regina	110101		1	ALA (2010 -)
Pelecanus conspicillatus	Australian Pelican	P		ALA (2010 -); BioNet (2010-)
Perameles nasuta	Long-nosed Bandicoot	P		ALA (2010 -); BioNet (2010-)
Perga affinis	Long nood Bandroot	+	+	ALA (2010 -)
Petauroides volans	Greater Glider	P	T _V	OEH (2004)
Petaurus breviceps	Sugar Glider	P	+	ALA (2010 -); BioNet (2010-)
Petrochelidon nigricans	Tree Martin	<u> </u>		ALA (2010 -)
Petrochelidon ariel	Fairy Martin	1	1	ALA (2010 -)
Petroica rosea	Rose Robin	_		ALA (2010 -)
Petroica goodenovii	Red-Capped Robin	+	+	ALA (2010 -)
Petroica boodang	Scarlet Robin	V,P	+	OEH (1993)
Petroica phoenicea	Flame Robin	V,P	+	OEH (1989)
Phalacrocorax carbo	Great Cormorant		+	ALA (2010 -)
Phalacrocorax sulcirostris	Little Black Cormorant	+	+	ALA (2010 -)
Phalaenoides glycinae	Grapevine Moth			ALA (2010 -)
Phaps chalcoptera	Common Bronzewing	P	+	ALA (2010 -);BioNet (2010-)
Phaps elegans	Brush Bronzewing	+	+	ALA (2010 -)
Phascogale tapoatafa	Brush-tailed Phascogale	V,P	+	OEH (2009)
, nascogaie tapoatara	Didon-taned i naocogare	V, I	+	ALA (2010 -); BioNET (2010-);
Phascolarctos cinereus	Koala	V,P	V	HSC (2013)
Philemon citreogularis	Little Friarbird			ALA (2010 -)
Philemon comiculatus	Noisy Friarbird	P		ALA (2010 -);BioNet (2010-)
Philoponella congrega- bilis				ALA (2010 -)
Pholcus phalangioides	Daddy Longlegs Spider			ALA (2010 -)
Pholodes sinistraria				ALA (2010 -)

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Phonognatha graeffei				ALA (2010 -)
		+	-	ALA (2010 -)
Phrissogonus laticostata Phylidonyris niger	White-Cheeked Honeyeater	P		ALA (2010 -); ALA (2010 -);BioNet (2010-)
Phylidonyris novaehol-	vvnite-Cheeked Honeyeater	P		ALA (2010 -);BloiNet (2010-)
landiae	New Holland Honeyeater	P		ALA (2010 -);BioNet (2010-)
Phyllurus platurus	Broad-Tailed Gecko	Р		ALA (2010 -); BioNet (2010-)
Pieris rapae	Cabbage White Butterfly			ALA (2010 -)
Planigale maculata	Common Planigale			ALA (2010 -)
Platalea regia	Royal Spoonbill			ALA (2010 -)
Platybrachys decem-				
macula				ALA (2010 -)
Platycercus elegans	Crimson Rosella	Р		ALA (2010 -);BioNet (2010-)
Platycercus eximius	Eastern Rosella	Р		ALA (2010 -);BioNet (2010-)
Plebs eburnus				ALA (2010 -)
Plecia dimidiata				ALA (2010 -)
Pluvialis squatarola	Grey Plover	Р	C,J,K	BioNet (2010-)
Podacanthus typhon	Large Pink-Winged Stick-Insect			ALA (2010 -)
Podargus strigoides	Tawny Frogmouth	P		ALA (2010 -); BioNet (2010-)
Poecilipta kgari				ALA (2010 -)
Poecilipta venusta				ALA (2010 -)
Poecilometis parilis				ALA (2010 -)
Poecilopachys australasia	Two-Spined Spider			ALA (2010 -)
Pogona barbata	Bearded Dragon	Р		ALA (2010 -); BioNet (2010-)
Poliocephalus polioceph- alus	Hoary-headed Grebe	Р		BioNet (2010-)
Polyrhachis ammon				ALA (2010 -)
Polyrhachis semiaurata				ALA (2010 -)
Polyzosteria limbata				ALA (2010 -)
Pomatostomus tempora- lis temporalis	Grey-crowned Babbler (eastern subspecies)	V,P		OEH (2005)
Pommerhelix duralensis	Dural Woodland Snail/Dural Land Snail	E1	E	ALA (2010 -); BioNet (2010-)
Popplepsalta notialis				ALA (2010 -)
Porcellio scaber				ALA (2010 -)
Porphyrio porphyrio	Purple Swamphen	Р		ALA (2010 -);BioNet (2010-)
Porzana tabuensis	Spotless Crake			ALA (2010 -)
Pristhesancus plagipen- nis	Bee-Killer			ALA (2010 -)
Procambridgea grayi				ALA (2010 -)
Prostheclina pallida				ALA (2010 -)
Psaltoda harrisii	Yellowbelly			ALA (2010 -)
Psaltoda moerens	Redeye			ALA (2010 -)
Psaltoda plaga	Black Prince			ALA (2010 -)
Psednura musgravei	Musgrave's Psednura			ALA (2010 -)
Psephotus haematonotus	Red-Rumped Parrot			ALA (2010 -)
Pseudagrion microceph- alum				ALA (2010 -)
Pseudechis porphyriacus	Red-Bellied Black Snake	Р		ALA (2010 -); BioNet (2010-)
Pseudocheirus peregri- nus	Common Ringtail Possum	Р		ALA (2010 -); BioNet (2010-)

Pseudomantis albofim- briata				ALA (2010 -)
Pseudomys gracilicau- datus	Eastern Chestnut Mouse	V,P		OEH (2000)
Pseudomys novaehol- landiae	New Holland Mouse	Р	V	OEH (1973)
Pseudonaja textilis	Eastern Brown Snake	Р		ALA (2010 -); BioNet (2010-)
Pseudophryne australis	Red-Crowned Toadlet	V,P		ALA (2010 -); BioNet (2010-) HSC (2013)
Pseudophryne bibronii	Bibron's Toadlet	Р		BioNet (2010-)
Psophodes olivaceus	Eastern Whipbird	Р		ALA (2010 -);BioNet (2010-)
Pteropus alecto	Black Flying-Fox			ALA (2010 -)
Pteropus poliocephalus	Grey-Headed Flying-Fox	V,P	v	ALA (2010 -); BioNET (2010-); HSC (2013)
Ptilinopus superbus	Superb Fruit-Dove	V,P		OEH (2018)
Ptilonorhynchus violaceus	Satin Bowerbird	Р		ALA (2010 -); BioNet (2010-)
Ptilotula fusca	Fuscous Honeyeater			ALA (2010 -)
Ptilotula penicillata	White-Plumed Honeyeater	Р		ALA (2010 -);BioNet (2010-)
Pungalina plurilineata				ALA (2010 -)
Pycnoptilus floccosus	Pilotbird			ALA (2010 -)
Pygopus lepidopodus	Common Scaly-Foot	Р		ALA (2010 -); BioNet (2010-)
Rattus fuscipes	Bush Rat	Р		ALA (2010 -); BioNet (2010-)
Rattus lutreolus	Swamp Rat	Р		ALA (2010 -); BioNet (2010-)
Rhantus suturalis				ALA (2010 -)
Rhinolophus megaphyllus	Eastern Horseshoe-bat	Р		ALA (2010 -); BioNet (2010-)
Rhinotia hemisticta				ALA (2010 -)
Rhipidura rufifrons	Rufous Fantail	Р		ALA (2010 -);BioNet (2010-)
Rhipidura albiscapa	Grey Fantail	Р		ALA (2010 -);BioNet (2010-)
Rhipidura leucophrys	Willie Wagtail	Р		ALA (2010 -);BioNet (2010-)
Rhytidoponera metallica				ALA (2010 -)
Rodolia cardinalis	Cardinal Ladybird			ALA (2010 -)
Rutilia cingulata				ALA (2010 -)
Saccolaimus flaviventris	Yellow-Bellied Sheathtail-Bat	V,P		ALA (2010 -); BioNet (2010-)
Saiphos equalis	Three-toed Skink	Р		ALA (2010 -); BioNet (2010-)
Saltuarius swaini	Southern Leaf-Tailed Gecko			ALA (2010 -)
Saproscincus mustelinus	Weasel Skink	Р		ALA (2010 -); BioNet (2010-)
Schedorhinotermes intermedius				ALA (2010 -)
Scolopendra morsitans				ALA (2010 -)
Scolypopa australis	Passionvine Hopper			ALA (2010 -)
Scopula rubraria				ALA (2010 -)
Scoteanax rueppellii	Greater Broad-Nosed Bat	V,P		ALA (2010 -); BioNET (2010-); HSC (2013)
Scythrops novaehol- landiae	Channel-Billed Cuckoo	Р		ALA (2010 -); BioNet (2010-)
Sericomis magnirostra	Large-Billed Scrubwren			ALA (2010 -)
Sericomis frontalis	White-Browed Scrubwren	P		ALA (2010 -);BioNet (2010-)
Sericulus chrysocephalus	Regent Bowerbird			ALA (2010 -)
Servaea incana				ALA (2010 -)
Servaea villosa				ALA (2010 -)
Sidymella trapezia				ALA (2010 -)

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Smeringopus natalensis		1	ALA (2010 -)
Smicromis brevirostris	Weebill		ALA (2010 -)
Sondra aurea			ALA (2010 -)
Speiredonia spectans			ALA (2010 -)
Sphecotheres vieilloti	Australasian Figbird	P	ALA (2010 -); BioNet (2010-)
Spilosoma canescens			ALA (2010 -)
Spodoptera exempta			ALA (2010 -)
Spodoptera litura	Tropical Armyworm		ALA (2010 -)
Spodoptera picta			ALA (2010 -)
Stagonopleura guttata	Diamond Firetail	V,P	
Stenoderus suturalis			ALA (2010 -)
Stephanopis barbipes			ALA (2010 -)
Stiphidion facetum	Crinoline Spider, Sombrero Spider, Hammock-Web Spider		ALA (2010 -)
Stipiturus malachurus	Southern Emu-wren	Р	BioNet (2010-)
Stizoptera bichenovii	Double-Barred Finch	Р	ALA (2010 -);BioNet (2010-)
Stomiopera flava	Yellow Honeyeater		ALA (2010 -)
Strepera fuliginosa	Black Currawong		ALA (2010 -)
Strepera graculina	Pied Currawong	Р	ALA (2010 -);BioNet (2010-)
Streptopelia chinensis	Spotted Dove		ALA (2010 -)
Sylvicola dubius			ALA (2010 -)
Tachybaptus novaehol-			
landiae	Australasian Grebe	P	ALA (2010 -); BioNet (2010-)
Tachyglossus aculeatus	Short-Beaked Echidna	P	ALA (2010 -); BioNet (2010-)
Taeniopygia guttata	Zebra Finch		ALA (2010 -)
Taiwanassiminea affinis			ALA (2010 -)
Tamasa tristigma	Brown Bunyip		ALA (2010 -)
Tamopsis brisbanensis			ALA (2010 -)
Tamopsis eucalypti			ALA (2010 -)
Tamopsis platycephala			ALA (2010 -)
Tectocoris diophthalmus	Cotton Harlequin Bug		ALA (2010 -)
Telephlebia godeffroyi			ALA (2010 -)
Tenodera australasiae	Purplewinged Mantid		ALA (2010 -)
Testacella haliotidea	Shelled Slug		ALA (2010 -)
Tetragnatha demissa			ALA (2010 -)
Tetragonula carbonaria			ALA (2010 -)
Tetramorium confusum			ALA (2010 -)
Thalasseus bergii	Crested Tern		ALA (2010 -)
Theridion pyramidale			ALA (2010 -)
Theridion theridioides		+	ALA (2010 -)
Theseus modestus		1	ALA (2010 -)
Thopha saccata	Double Drummer		ALA (2010 -)
		P	
Threskiomis molucca	Australian White Ibis	+	ALA (2010 -); BioNet (2010 -)
Threskiomis spinicollis	Straw-Necked Ibis	P	ALA (2010 -); BioNet (2010-)
Tibellus tenellus	China la Bank		ALA (2010 -)
Tiliqua rugosa	Shingle-Back	1_	ALA (2010 -)
Tiliqua scincoides	Eastern Blue-Tongue	P	ALA (2010 -); BioNet (2010-)
Tisiphone abeona	Swordgrass Brown	1-	ALA (2010 -)
Todiramphus sanctus	Sacred Kingfisher	P	ALA (2010 -);BioNet (2010-)

Torbia perficita			ALA (2010 -)
Toxopsoides kathleenae			ALA (2010 -)
Toxorhynchites speciosus			ALA (2010 -)
Trachycosmus sculptilis			ALA (2010 -)
Trapezites praxedes	Southern Silver Ochre		ALA (2010 -)
Tregellasia capito	Pale-Yellow Robin		ALA (2010 -)
Triboniophorus graeffei	Red-Triangle Slug		ALA (2010 -)
Tribonyx mortierii	Tasmanian Native-Hen		ALA (2010 -)
Trichoglossus chlorolepi- dotus	Scaly-breasted Lorikeet	Р	ALA (2010 -); BioNet (2010-)
Trichoglossus haema- todus	Rainbow Lorikeet	Р	ALA (2010 -); BioNet (2010-)
Trichoglossus haemato- dus moluccanus		Р	BioNet (2010-)
Trichosurus cunninghami	Mountain Brushtail Possum	Р	BioNet (2010-)
Trichosurus vulpecula	Australian Brushtail Possum/ Common Brushtail Possum	Р	ALA (2010 -); BioNet (2010-)
Tyto novaehollandiae	Masked Owl	V,P,3	ALA (2010 -);BioNet (2010-)
Tyto tenebricosa	Sooty Owl	V,P,3	ALA (2010 -);BioNet (2010-)
Tyto alba	Barn Owl		ALA (2010 -)
Tyto javanica	Eastern Barn Owl	Р	BioNet (2010-)
Underwoodisaurus milii	Thick-tailed Gecko	Р	ALA (2010 -); BioNet (2010-)
Uperoleia laevigata	Smooth Toadlet	Р	ALA (2010 -); BioNet (2010-)
Vanellus miles	Masked Plover		ALA (2010 -)
Vanellus miles	Masked Lapwing	Р	BioNet (2010-)
Vanessa itea	Yellow Admiral		ALA (2010 -)
Vanessa kershawi	Australian Painted Lady		ALA (2010 -)
Varanus gouldii	Gould's Goanna	Р	ALA (2010 -); BioNet (2010-)
Varanus rosenbergi	Heath MonitorRosenberg's Goanna	V,P	ALA (2010 -); BioNet (2010-)
Varanus varius	Lace Monitor	Р	ALA (2010 -); BioNet (2010-)
Venatrix pictiventris			ALA (2010 -)
Vespadelus darlingtoni	Large Forest Bat	Р	ALA (2010 -); BioNet (2010-)
Vespadelus pumilus	Eastern Forest Bat	Р	ALA (2010 -); BioNet (2010-)
Vespadelus regulus	Southern Forest Bat	Р	ALA (2010 -); BioNet (2010-)
Vespadelus vultumus	Little Forest Bat	Р	ALA (2010 -); BioNet (2010-)
Wallabia bicolor	Swamp Wallaby	Р	ALA (2010 -); BioNet (2010-)
Wingia aurata			ALA (2010 -)
Xanthagrion erythro- neurum			ALA (2010 -)
Xanthotis macleayanus	Macleay's Honeyeater		ALA (2010 -)
Yoyetta celis			ALA (2010 -)
Yoyetta repetens			ALA (2010 -)
Zelotypia stacyi			ALA (2010 -)
Zonopetala clerota			ALA (2010 -)
Zoothera lunulata	Bassian Thrush		ALA (2010 -)

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Fungi

Species Name	Common Name	Source
Agaricus rotalis		ALA (2010 -)
Amauroderma rude		ALA (2010 -)
Aseroe rubra	Puapua a Autahi	ALA (2010 -)
Asteromella pistaciarum		ALA (2010 -)
Battarrea phalloides		ALA (2010 -)
Botryobasidium subcoronatum		ALA (2010 -)
Botryosphaeria rhodina		ALA (2010 -)
Candida boleticola		ALA (2010 -)
Cantharellus concinnus		ALA (2010 -)
Cladophialophora chaetospira		ALA (2010 -)
Cladophialophora potulentorum		ALA (2010 -)
Cladosporium langeronii		ALA (2010 -)
Cladosporium sphaerospermum		ALA (2010 -)
Clonostachys rosea		ALA (2010 -)
Cochliobolus eragrostidis		ALA (2010 -)
Cortinarius abnormis		ALA (2010 -)
Cortinarius ardesiacus		ALA (2010 -)
Cortinarius argyrionus		ALA (2010 -)
Cortinarius austrocyanites		ALA (2010 -)
Cortinarius eutactus		ALA (2010 -)
Cortinarius kula		ALA (2010 -)
Cortinarius picoides		ALA (2010 -)
Cortinarius rotundisporus		ALA (2010 -)
Cortinarius vibratilis		ALA (2010 -)
Cortinarius walpolensis		ALA (2010 -)
Cryptococcus dimennae		ALA (2010 -)
Cryptococcus podzolicus		ALA (2010 -)
Cryptococcus terreus		ALA (2010 -)
Cuphophyllus pratensis (Fr.) Bon (Pers.)		ALA (2010 -)
Cytospora eucalypticola		ALA (2010 -)
Cytospora variostromatica		ALA (2010 -)
Davidiella tassiana		ALA (2010 -)
Diaporthe nothofagi		ALA (2010 -)
Entoloma chalybeum		ALA (2010 -)
Entoloma nothofagi		ALA (2010 -)
Epicoccum purpurascens		ALA (2010 -)
Flavoparmelia caperata		ALA (2010 -)
Fusarium oxysporum		ALA (2010 -)
Geastrum pectinatum		ALA (2010 -)
Gliomastix murorum		ALA (2010 -)
Gymnopus luxurians		ALA (2010 -)
Hyphodontia abieticola		ALA (2010 -)
Hypomyces chrysospermus	Bolete Mould	ALA (2010 -)
lleodictyon gracile		ALA (2010 -)
Inocybe emergens		ALA (2010 -)
Laccaria lateritia		ALA (2010 -)

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Lactarius clarkeae		ALA (2010 -)
Mortierella humilis		ALA (2010 -)
Mortierella parvispora		ALA (2010 -)
Neurospora terricola		ALA (2010 -)
Omphalotus nidiformis		ALA (2010 -)
Paecilomyces cameus		ALA (2010 -)
Paecilomyces leycattanus		ALA (2010 -)
Paraconiothyrium variabile		ALA (2010 -)
Penicillium citreonigrum		ALA (2010 -)
Penicillium resedanum		ALA (2010 -)
Penicillium spinulosum		ALA (2010 -)
Penicillium velutinum		ALA (2010 -)
Pestalotiopsis trachycarpicola		ALA (2010 -)
Phaeohelotium succineoguttulatum		ALA (2010 -)
Phaeothecoidea minutispora		ALA (2010 -)
Phlebopus marginatus		ALA (2010 -)
Phlogicylindrium eucalyptorum		ALA (2010 -)
Pisolithus albus		ALA (2010 -)
Pisolithus marmoratus		ALA (2010 -)
Psathyrella candolleana	Pale Brittlestem	ALA (2010 -)
Psilolechia lucida		ALA (2010 -)
Pycnoporus coccineus		ALA (2010 -)
Readeriella tasmanica		ALA (2010 -)
Rhodotorula nothofagi		ALA (2010 -)
Serendipita vermifera		ALA (2010 -)
Spiromastix warcupii		ALA (2010 -)
Sporidiobolus johnsonii		ALA (2010 -)
Sydowia eucalypti		ALA (2010 -)
Talaromyces coalescens		ALA (2010 -)
Talaromyces flavus		ALA (2010 -)
Talaromyces mimosinus		ALA (2010 -)
Talaromyces pseudostromaticus		ALA (2010 -)
Teratosphaeria associata		ALA (2010 -)
Teratosphaeria complicata		ALA (2010 -)
Teratosphaeria mexicana		ALA (2010 -)
Thanatephorus cucumeris		ALA (2010 -)
Trametes versicolor	Turkeytail	ALA (2010 -)
Trichoderma spirale		ALA (2010 -)
Trichoderma tomentosum		ALA (2010 -)
Trichoderma velutinum		ALA (2010 -)
Trichoderma virens		ALA (2010 -)
Umbelopsis dimorpha		ALA (2010 -)
Umbelopsis fusiformis		ALA (2010 -)
Umbelopsis ramanniana		ALA (2010 -)
Umbelopsis westeae		ALA (2010 -)
Verticillium leptobactrum		ALA (2010 -)

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Appendix 2: Examples of threatened faunal species habitat and ecology requirements [121]

Scientific Name	Common name	Habitat and Ecology
Callocephalon fimbriatum	Gang-Gang Cockatoo	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly boxgum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (Eucalyptus paucillora) woodland and occasionally in temperate rainforests. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.
Calyptorhynchus lathami	Glossy Black-Cockatoo	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, Allocasuaraina diminuta, and A. gymnathera. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.
Cercartetus nanus	Eastern Pygniy-Possum	Found in a broad range of habitats from rainforest through sclerophyll (including Box-tronbark) forest and woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in mainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (Pseudocheirus pereginus) dreys or thickets of vegetation, (e.g. grass-tree skirts), nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Appear to be mainly solitary, each individual using several nests, with males having non-exclusive home-ranges of about 0.68 hectares and females about 0.35 hectares. Young can be born whenever food sources are available, however most births occur between late spring and early autumn. Agile climbers, but can be caught on the ground in traps, pitfalls or postholes; generally nocturnal.
Daphoenositta chrysoptera	Varied Sittella	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Generation length is estimated to be 5 years.
Dasyurus maculatus	Spotted-Tailed Quoll	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastine. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gilders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faces deposited by animals. A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home ranges up to a bout 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along denesty vegetated creeklines. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibemates in winter. Females are pregnant in late spring to early summer.
Halia eetus leucogaster	White-Bellied Sea-Eagle	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vininity of freshwater swamps, lakes, reservoirs, bilabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tail open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat, consists of mature tail open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are bypically large emergent euclapts and other have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. Hunts its prey from a perch or whilst in flight (by circling slowly, or by sailing along 10–20 m above the shore). Prey is usually carried to a feeding platform or (if small) consumed in flight, but some items are eaten on the ground. May be solitart, or live in pairs or small family groups consisting of a pair of adults and dependent young. Typically lays two eggs between June and September with young birds remaining in the nest for 65-70 days.

Heleioporus australiacus	Giant Burrowing Frog	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow site, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04 ha in size. Individuals move into the breeding site either immediately before or following heavy rain and occupy these sites for up to 10 days. Most individuals will not attempt to breed every year. The Gaint Burrowing Frog has a generalist diet and studies to date indicate that they eat mainly invertebrates including ants, beeles, cookroaches, spiders, centipedes and scorpions. When breeding, frogs will call from open spaces, under vegetation or rocks or from within burrows in the creek bank. Males show strong territoriality at breeding sites. This species breeds mainly in autumn, but has been recorded calling throughout the year. Egg masses are foarny with an average of approximately 500-800 eggs and are laid in burrows or under vegetation in small pools. After rains, tadpoles are washed into larger pools where they complete their development in ponds or ponded areas of the creekline. Tadpole development under small roots where they complete their development in ponds or ponded areas of the creekline. Tadpole development when warmer temperatures return. Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water.
Hieraaetus morphnoides	Little Eagle	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrior.
Isoodon obesulus	Southern Brown Bandicoot	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrior.
Lathamus discolor	Swift Panot	Migrates to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogary (Eucalyptus robusta), Spotted Gum (Corymbia maculate), Red Bloodwood (C. gummiferal, Forest Red Gum (E. tereticomis), Mugga Ironbark (E. sideroxylon), and White Box (E. albens). Commonly used lerp infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana, Blackbutt E. pilularis, and Yellow Box E. melliodora. Return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum Eucalyptus globulus.
Lophoictinia isura	Square-tailed Kite	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.
Miniopterus australis	Little Bentwing-Bat	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentving-bats roots in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may from mixed clusters. In NSV the largest materity colony is in close association with a large materiary colony of Eastern Bentwing-bats (Miniopterus schreibersil) and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites /maternity colonies are known in Australia.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops.
Myotis macropus	Southern Myotis	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by taking their feet across the water surface. In NSW temales have one young each year usually in November or December.
Ninox connivens	Barking Owl	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g., western NSW due to the higher density of prey on these fertile injoint and its Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can eath bats and moths on the wing, but typically hunts by sallying from a lip perch. Requires very large permanent temitories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares being more typical in NSW habitats. Two or three eggs are laid in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predictors (e.g. goannas). Nesting occurs during mid-mother and spring, being variable between pairs and among years. As a rule of thimb, laying occurs during August and fledging in November. The female incubates for 5 weeks, roosts outside the hollow when chicks are 4 weeks old, then fledging occurs 23 weeks later. Young are dependent for several months. Territorial pairs respond strongly to recordings of Barking Owl calls from up to 6 km away, though humans rarely hear this response farther than 1.5 km. Because disturbance reduces the pair's foraging time, and can pull the female off her eggs even on cold nights, recordings should not be broadcast unnecessarily nor during the nesting season.

Ninax (Rhabdoglaux) strenua	Pawerful Owl	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and trainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Europenine Syncaping oliginal fields. She-oak Alack She-oak She
Pandion cristatus	Eastern Osprey	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. Incubation of 2-3 eggs, usually by the female, is about 40 days. Female remains with young almost until they fly, usually after about nine weeks in the nest.
Glossopsitta pusilla	Little Lorikeet	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertifity and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletce, and only rarely in orchards Gregarious, travelling and feeding in small flocks (< 10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past entruies. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2-15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina. Nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledgings is unknown.
Phascolarctos cinereus	Koala	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.
Pommerhelix duralensis	Dural Woodland Snail; Dural Land Snail	The species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris. It favours sheltering under rooks or inside curled-up bank. It does not burrow nor climb. The species has also been observed resting in exposed areas, such as on exposed rook or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris. Migration and dispersal is limited, with ovemight straight-line distances of under 1 metre identified and limited and stodies. The species is active from approximately one hour after dusk until dawn and no confirmed diumal activity is reported. It exhibits no root-state behaviour. The species is known to aestivate, and secretes an epiphragm to protect against dessication. The main food sources are hyphae and fruiting bodies of native fungi. It is possible other detritus may be consumed. Reproduction rates are very low, with few eggs (about 32) per season. Mortality is 90% in the first year, and 99.8% within four-five years.
Pseudophryne australis	Red-Crowned Toadlet	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Red-crowned Toadlets have not been recorded breeding in waters that are even mildly polluted or with a pH outside the range 5.5 to 6.5. Eggs are laid in moist leaf litter, from where they are washed by heavy rain; a large proportion of the development of the tadpoles takes place in the egg. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter. Red-crowned Toadlets are quite a localised species that appear to be largely restricted to the immediate vicinity of suitable breeding habitat. Red-crowned Toadlets are usually found as small colonies scattered along ridges coinciding with the positions of suitable erliges near breeding sites. Due to this tendency for discrete population to concentrate at particular sites, a relatively small localised disturbance may have a significant impact on a local population if it occurs on a favoured breeding or refuge site.
Pteropus poliocephalus	Grey-Headed Flying-Fox	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high, some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.

Saccolaimus flaviventris	Yellow-Bellied Sheath- tail-Bat	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country, Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.
Scoteanax rueppellii	Greater Broad-Nosed Bat	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.
Tyto novaehollandiae	Masked Owl	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.
Tyto tenebricosa	Sooty Owl	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (Pseudocheirus peregrinus) or Sugar Glider (Petaurus breviceps). Nests in very large tree-hollows.
Varanus rosenbergi	Heath Monitor; Rosen- berg's monitor	Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Individuals require large areas of habitat. Feeds on carrion, birds, eggs, reptiles and small mammals. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. Runs along the ground when pursued (as opposed to the Lace Monitor, which climbs trees). Lays up to 14 eggs in a termite mound; the hatchlings dig themselves out of the mounds. Generally slow moving; on the tablelands likely only to be seen on the hottest days.
Anthochaera phrygia	Regent Honeyeater	The Regent Honeyeater is a flagship threatened woodland bird whose conservation will benefit a large suite of other threatened and declining woodland fauna. The species inhabits dry open forest and woodland, particularly Box-knobak woodland, and riparian forests of River Sheeak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species nichness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistetoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogary and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast. In the last 10 years Regent Honeyeaters have been recorded in urban areas around Albury where woodlands tree species such as Mugga Irorbark and fellow Box were planted 20 years ago. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalyst species include Mugga Irorbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. Flowening of associated species such as Thin-64 Stringybark Ecualyptus eugenioidesand other Stringybark species, and Broad-leaved Ironbark E. fibrosa can also contribute important nectar flows at times. Nectar and fruit from the mistletoes Amyema miquelii. A. pendula and A. cambagei are also utilised. When nectar is scarce leng and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of restlings. Colourbanding of Regent Honeyeater has shown that the species can undertake large-scale nomadic movements in the order of hundreds of kilometres. However, the exact nature of these movements is still poor

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Appendix 3: Threatening processes

Key Threatening Processes to biodiversity as listed by the NSW Biodiversity Conservation Act 2016 [19] Schedule 4 (Section 4.31)

Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners, Manorina melanocephala (Latham, 1802)

Alteration of habitat following subsidence due to longwall mining

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (as described in the final determination of the Scientific Committee to list the threatening process) Anthropogenic Climate Change

Bushrock removal (as described in the final determination of the Scientific Committee to list the threatening process)

Clearing of native vegetation (as defined and described in the final determination of the Scientific Committee to list the key threatening process)

Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)
Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758

Competition from feral honey bees, *Apis mellifera* L.

Death or injury to marine species following capture in shark control programs on ocean beaches (as described in the final determination of the Scientific Committee to list the key threatening

Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments (as described in the final determination of the Scientific Committee to list the key threatening process) Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners

Habitat degradation and loss by Feral Horses (brumbies, wild horses), Equus caballus Linnaeus 1758

Herbivory and environmental degradation caused by feral deer

High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition

Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972

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

Introduction of the Large Earth Bumblebee Bombus terrestris (L.)

Invasion and establishment of exotic vines and scramblers

Invasion and establishment of Scotch Broom (Cytisus scoparius)

Invasion and establishment of the Cane Toad (Bufo marinus)

Invasion, establishment and spread of Lantana (Lantana camara L. sens. lat)

Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex

Invasion of native plant communities by Chrysanthemoides monilifera

Invasion of native plant communities by exotic perennial grasse

Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW

Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

Loss of hollow-bearing trees

Loss or degradation (or both) of sites used for hill-topping by butterflies

Predation and hybridisation by Feral Dogs, Canis lupus familiaris

Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish) (as described in

the final determination of the Scientific Committee to list the threatening process) Predation by the European Red Fox Vulpes vulpes (Linnaeus, 1758)

Predation by the Feral Cat Felis catus (Linnaeus, 1758)

Predation by the Ship Rat Rattus rattus on Lord Howe Island

Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758

Removal of dead wood and dead trees

(Those most relevant to HSC in **bold**)

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Appendix 4: Detail of community and council derived threats & challenges

Community and stakeholder engagement approach

In order to clearly identify the concerns and vested interests of the community in conservation and biodiversity management of the Hornsby LGA, three community engagement workshops were completed at Hornsby, Arcadia and Pennant Hills.

Three community engagement workshops were held in Hornsby, Arcadia and Pennant Hills in April 2019 to assist in the formulation of the Hornsby Biodiversity Conservation Strategy. The workshops enabled participants to clearly provide their knowledge of the Hornsby LGA through a series of hands-on tasks and general discussion.

Information gathered, and maps developed, through the course of these workshops was then coupled with input from Council's Natural Resources staff.

Through this process, the following topics were considered:

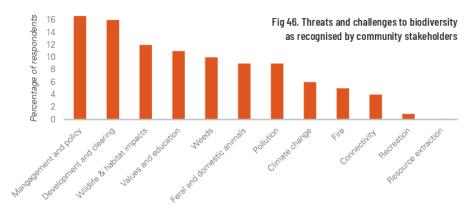
- Identifying and locating points of ecological significance
- Brainstorming threats and challenges to Hornsby Shire Council biodiversity
- Re-designing green infrastructure models and identifying priority areas for management
- Devising management techniques for conserving biodiversity

A total of 321 responses were provided by community at the three workshops held at Hornsby, Arcadia and Pennant Hills, identifying the threats and challenges citizens considered to be of concern to maintaining biodiversity values of the LGA. Refer to Fig. 46 for community stakeholder's response to threats and challenges to biodiversity.

The response to threats and challenges varied amongst the localities (refer to Figure 12).

- The Hornsby workshop participants identified the most common concern to biodiversity to be Management and Policy (16%) and equally weighted concerns for Weeds (14%) and Development and Clearing (14%).
- 'The Arcadia workshop participants identified Development and Clearing and Management and Policy to of equal concern (15%) to biodiversity, followed by Values and Education (12%) and Pollution (12%).
- Pennant Hills identified the most common concern to biodiversity to be Management and Policy (20%), Development and Clearing (17%); followed by Wildlife and Habitat Impacts (17%).
- The response from NRM council staff was similar.

The workshops identified priority areas for managing biodiversity (and threats) within the Shire, identified and tested green infrastructure networks and underpinned the prioritisation action matrix. Overall key findings from the workshops identified that council land, private lands (semi-rural and urban) and other government lands (National Parks and other State managed lands i.e. transport corridors – railway, motorway) are all significant to the conservation of biodiversity. This highlights the importance of Hornsby Shire Council working in partnership with all landholders and land managers within and adjacent to the Shire.



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Appendix 5: North District Plan priorities

Planning Priority N15 Protecting and improving the health and enjoyment of Sydney Harbour and the District's waterways

This relates to catchment-scale co-ordination of water quality and water way health as well as recreation and aquaculture opportunities and the 'management of waterways as green infrastructure'. [9] Key relevant actions related to biodiversity protection and/or management for N15 are:

- 62. Protect environmentally sensitive areas of waterways and the coastal environment areas.
- 63. Enhance sustainability and liveability by improving and managing access to waterways, foreshores and the coast for recreation, tourism, cultural events and water-based transport.
- 64. Improve the health of catchments and waterways through a risk-based approach to managing the cumulative impacts of development including coordinated monitoring of outcomes.
- 65. Work towards reinstating more natural conditions in highly modified urban waterways

Planning Priority N16 Protecting and enhancing bushland and biodiversity

This promotes the value of bushland and biodiversity for its contribution to safeguarding threatened species, investing in 'connected bushland corridors and protecting large pockets of remnant vegetation' whether in council owned or private land through a range of incentives including 'biodiversity stewardship agreements, conservation agreements and wildlife refuge agreements' and 'strengthening the protection of bushland in urban areas will help to conserve the District's biodiversity, preserve its scenic landscape, and enhance its tourist and recreational values.' [9] It also advocates that 'remnant vegetation should be recognised as an asset ...incorporated into the planning and design.' [9] Key relevant actions related to biodiversity protection and/or management for N16 are:

66. Protect and enhance biodiversity by:

- a. supporting landscape-scale biodiversity conservation and the restoration of bushland corridors
- b. managing urban bushland and remnant vegetation as green infrastructure
- c. managing urban development and urban bushland to reduce edge-effect impacts.

Planning Priority N17 Protecting and enhancing scenic and cultural landscapes

This priority outlines the importance of the value of scenic and cultural landscapes as central and complementary to the protection of the region's 'biodiversity and habitat' and 'links to Aboriginal cultural heritage'. Key relevant actions related to biodiversity protection and/or management for N17 are: 67. Identify and protect scenic and cultural landscapes.

68. Enhance and protect views of scenic and cultural landscapes from the public realm.

Planning Priority N18 Better managing rural areas

This offers specific advice toward the 'creation of protected biodiversity corridors, buffers to support investment in rural industries and protection of scenic landscapes' [9] and acknowledges that rural areas – which form a large part of the HSC - are valuable assets to the District and to Greater Sydney. Key relevant actions related to biodiversity protection and/or management for N18 are:

69. Maintain or enhance the values of the Metropolitan Rural Årea using place-based planning to deliver targeted environmental, social and economic outcomes.

70. Limit urban development to within the Urban Area.

Planning Priority N19 Increasing urban tree canopy cover and delivering Green Grid connections

This outlines a series of key values for increasing the urban forest with tangible benefits for mitigating the UHI effect, providing amenity and air quality as well as connections to the SGG for both recreational, active transport and biodiversity benefits while acknowledging the pressures on the urban forest by increasing densification and the delivery of grey infrastructure. It also specifies several key projects that directly concern HSC, including Lane Cove National Park and Lane Cove River and the Great North Walk. Key relevant actions related to biodiversity protection and/or management for N19 are:

- 71. Expand urban tree canopy in the public realm.
- 72. Progressively refine the detailed design and delivery of:
- a. Greater Sydney Green Grid priority corridors
- b. opportunities for connections that form the long-term vision of the network
- c. walking and cycling links for transport as well as leisure and recreational trips.

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Planning Priority N20 Delivering high quality open space

This priority contains specific advice about the benefits of POS as places for nature-based recreation, helping to 'connect communities to the natural landscape' while recognising the simultaneous need to manage to 'minimise impacts on biodiversity' [9]. Key relevant actions related to biodiversity protection and/or management for N20 are:

73. Maximise the use of existing open space and protect, enhance and expand public open space by: a. providing opportunities to expand a network of diverse, accessible, high quality open spaces that respond to the needs and values of communities as populations grow

b. investigating opportunities to provide new open space so that all residential areas are within 400 metres of open space and all high density residential areas (over 60 dwellings per hectare) are within 200 metres of open space

c. requiring large urban renewal initiatives to demonstrate how the quantity of, or access to, high quality and diverse local open space is maintained or improved d. planning new neighbourhoods with a sufficient quantity and quality of new open space

e. delivering shared and co-located sports and recreational facilities including shared school grounds and repurposed golf courses

f. delivering, or complementing the Greater Sydney Green Grid

g. providing walking and cycling links for transport as well as leisure and recreational trips.

Planning Priority N22 Adapting to the impacts of urban and natural hazards and climate change This priority outlines several key risks that face the region. Arguably the most significant of these is the relationship between fire management and biodiversity. Specific considerations toward '...clearing vegetation around

developments on bushfire-prone land can help reduce risks from bushfire, but must be balanced with protecting bushland, and its ecological processes and systems' and notes that these challenges 'will be exacerbated by climate change'. [9]

Key relevant actions related to biodiversity protection and/or management for N22 are:

80. Support initiatives that respond to the impacts of climate change.

81. Avoid locating new urban development in areas exposed to natural and urban hazards and consider options to limit the intensification of development in existing urban areas most exposed to hazards. 82. Mitigate the urban heat island effect and reduce vulnerability to extreme heat.

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Appendix 6: SEPPs relating to biodiversity management and protection

State Environmental Planning Policy No 19—Bushland in Urban Areas

This policy applies to the Hornsby Shire Council area, though does not apply to areas that fall under the National Parks and Wildlife Act 1974, or the Forestry Act 1916.

The general aim of this Policy is to protect and preserve bushland within urban areas. Specifically it aims:

- (a) to protect the remnants of plant communities which were once characteristic of land now within an urban area
- (b) to retain bushland in parcels of a size and configuration which will enable the existing plant and animal communities to survive in the long term,
- (c) to protect rare and endangered flora and fauna species,
- (d) to protect habitats for native flora and fauna,
- (e) to protect wildlife corridors and vegetation links with other nearby bushland,
- (f) to protect bushland as a natural stabiliser of the soil surface,
- (g) to protect bushland for its scenic values, and to retain the unique visual identity of the landscape.
- (h) to protect significant geological features, (i) to protect existing landforms, such as natural drainage lines, watercourses and foreshores
- (j) to protect archaeological relics,
- (k) to protect the recreational potential of bushland, (I) to protect the educational potential of bushland,
- (m) to maintain bushland in locations which are readily accessible to the community, and
- (n) to promote the management of bushland in a manner which protects and enhances the quality of the bushland and facilitates public enjoyment of the bushland compatible with its conservation.

State Environmental Planning Policy No 44 - Koala Habitat Protection [123]

The State Environmental Planning Policy No 44—Koala Habitat Protection was initially prepared on 13 February 1995 and aims to establish controls to manage and conserve koala habitat to reverse the current trend of koala population decline. This requires management plans for development consent in core koala habitat areas, encourages identification of such areas and encourages the inclusion of these areas in environmental protection zones. It does not apply to land dedicated or reserved under the National Parks and Wildlife Act 1974 or to land dedicated under the Forestry Act 1916 as a State forest or flora reserve.

A council requires information 'from a person who is qualified and experienced in tree identification' before determining potential koala habitat and requires information 'from a person with appropriate qualifications and experience in biological science and fauna survey and management' before determining a core koala habitat. (State Environmental Planning Policy No 44-Koala Habitat Protection, 1995 p. 4)

State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017

This policy aims to 'protect the biodiversity values of trees and other vegetation in non-rural areas of the State', and 'to preserve the amenity of non-rural areas of the State through the preservation of trees and other vegetation.' [124]

The clearing of vegetation in non-rural areas can be allowed both with and without certain consents from governing authorities. Depending on the case, this authority can be given through council permit, or by authority of the Native Vegetation Panel. In either case clearing must be in accordance with the terms setout by the approval.

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State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

This policy provides development codes for NSW in order to assess development applications in accordance with environmental impacts. The policy includes a definition of an *environmentally sensitive area* as:

(g) land identified in this or any other environmental planning instrument as being of high Aboriginal cultural significance or high biodiversity significance [125]

Division 2 of Part 1 of the document provides general conditions for exempt and complying development. The key requirement for exempt development relating to biodiversity is that development:

(b1) must not be carried out on land that is a declared area of outstanding biodiversity value under the Biodiversity Conservation Act 2016 or declared critical habitat under Part 7A of the Fisheries Management Act 1994, [125]

For complying development, the key general requirement relating to biodiversity is that development must not:

(e) except as otherwise provided by this Policy, be on land that is within an environmentally sensitive area. [125]

To be complying development specified for the Housing Code, the Low Rise Medium Density Housing Code, the Rural Housing Code or the Greenfield Housing Code, the development must not be carried out on:

(d1) land that is subject to a private land conservation agreement under the Biodiversity Conservation Act 2016 or that is a set aside area under section 60ZC of the Local Land Services Act 2013, or

(e) land identified by an environmental planning instrument as being:

(iii) within an ecologically sensitive area, or (iv) environmentally sensitive land,[125]

Complying development for the Commercial and Industrial (New Buildings and Additions) Code, the development must not be carried out on:

(d1) land that is subject to a private land conservation agreement under the Biodiversity Conservation Act 2016 or that is a set aside area under section 60ZC of the Local Land Services Act 2013, or

(e) land that is subject to a biobanking agreement under Part 7A of the Threatened Species Conservation Act 1995 or a property vegetation plan approved under the Native Vegetation Act 2003, or

(f) land identified by an environmental planning instrument as being:

(iii) within an ecologically sensitive area, or (iv) environmentally sensitive land, or [125]

Setbacks of industrial buildings that fall under the Commercial and Industrial (New Buildings and Additions) Code where adjacent to an environmentally sensitive area must be 'at least 10m and an area of at least 3m in width of that setback must be a landscaped area.' [125]

State Environmental Planning Policy (Infrastructure) 2007

This Policy aims to 'facilitate the effective delivery of infrastructure across the State.' [126] Relating to biodiversity, this policy categorises infrastructure into different environmental assessment categories, and also identifies where certain development can be exempt where environmental impact is minimal.

State Environmental Planning Policy (Coastal Management) 2018

The aim of this Policy is to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the Coastal Management Act 2016, including the management objectives for each coastal management area, by—

- (a) managing development in the coastal zone and protecting the environmental assets of the coast, and
- (b) establishing a framework for land use planning to guide decision-making in the coastal zone, and
- (c) mapping the 4 coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the Coastal Management Act 2016.

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Appendix 7: Overview of the Green Infrastructure Framework - case studies and illustrations

The following pages show a range of preliminary studies that demonstrate the potential of the five strategies in action across several different locations in the Hornsby LGA.

The Green Infrastructure Framework sets out a vision for the longevity of the biodiversity of the Hornsby LGA through three key steps:

- Halting clearing and the protection of lands including potential new conservation estate and conservation buffers around recognised TECs
- Creation of a network of corridors of various widths, depending on location
- Reliance on future commitment to explore the Green Infrastructure Framework's detailed design and further planning with local stakeholders at the local scale (i.e. implementation at the scale of the garden, street and neighbourhood)

Proposed ecological corridors will connect through and beyond the Hornsby LGA. These will stitch fragmented ecologies back together again as well as providing a mechanism to deal with issues including WSUD, urban heat island, active transport and recreation. In addition to 30 metre buffers around recognised TECs, five corridor types and widths are proposed:

- 20 metre 'urban' corridors
- 30 metre 'hydrological' corridors
- 50 metre 'infrastructural' corridors
- 75 metre 'aspirational' corridors

TECs + 30 metre buffers

Buffers around TECs have been set as 30 metres in line with relevant environmental protection advice. [120] This is suggested as the minimum distance to help protect existing vegetation root structure. Buffers will be ground-truthed on site to ensure flexibility and possible exemptions, e.g. buffers that exist within existing parks and playgrounds and sports infrastructure.

20 metre 'urban' corridors

The 20 metre 'urban' corridors reflect the average width of Council-managed streets. These streets could be populated with a range of street-tree plantings and understorey, inclusive of road and verge space. In addition, WSUD and permeable paving interventions could also harvest rainwater and filter pollutants before they are slowly released into the ground and adjacent waterways. Set backs in these streets could be generous to facilitate more urban green, while road width and traffic calming measures might also be narrowed to create a more secluded environment. Overhead powerlines could be placed underground to help build the urban canopy.

30 metre 'hydrological' corridors

The 30 metre 'hydrological' corridors are based upon the minimum offset set for creeklines in rural areas throughout NSW. Both rural and urban creeklines should be granted similar protection and could be correspondingly be 'daylighted' (or uncovered as open creekbeds) to better demonstrate the hydrological system. Additional habitat through revegetation and artificial wetlands could also help to slow and purify these waters.

Hornsby Biodiversity Conservation Strategy 2020

50 metre 'infrastructural' corridors

The 50 metre 'infrastructural' corridors are associated with major road and rail routes and correspondingly have different stakeholders. Elsewhere in Australia (e.g. Perth) rail reserves have simultaneously been used for biodiversity protection and as thickly densely planted spaces offer shaded locations for active transport (i.e. cyclepaths). Barrier mitigation within these corridors would need to be carefully considered to reduce wildlife imapcts.

75 metre 'aspirational' corridors

The 75 metre 'infrastructural' corridors are indicative of the scale of corridors that could provide regional scale connectivity to fragmented landscapes. Captured through separate planning overlay, these may be associated with dedicated fauna overpasses and underpasses at key barriers; while where intersecting with the urban fabric a spectrum of approaches could be considered over a long time period. These could include targeted increase to urban forest canopy, adjusting of fences and the creation of microhabitats. Education and behavioural change regarding pet ownership could also be considered; while long term acquisition of key properties could also be an option.

Case studies

Five case studies serve as examples of the potential of the Green Infrastructure Framework and give spatial form to the idea. Annotated drawings provide a tangible link back to relevant recommendations, potential management and also illustrate other relevant planning instruments including existing HELP and heritage and landscape overlays. The five case study areas are:

- Hornsby
- Pennant Hills
- Cherrybrook
- Galston
- Berowra Heights/Motorway

Appendix 8 provides a full map set of the Green Infrastructure Framework across the total Council area, combined with other relevant conservation or land protection-focused designations.

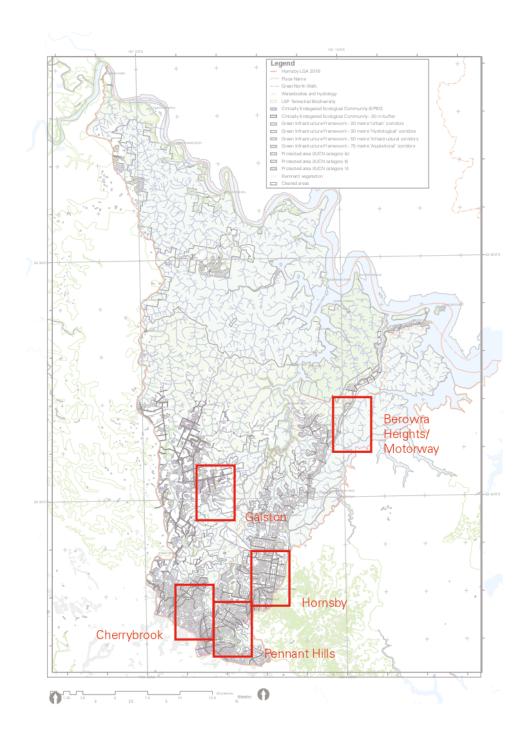
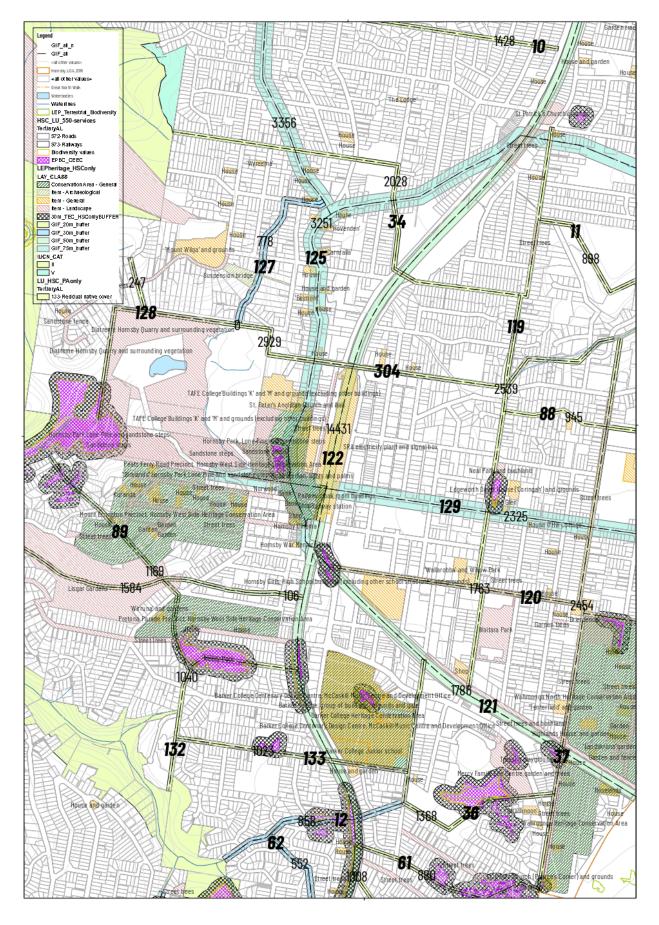


Fig 45. Green Infrastructure Framework overview



Hornsby Biodiversity Conservation Strategy 2020

Hornsby case study

The Hornsby case study demonstrates a range of actions in an urban context. The GIF provides the armature to increase urban canopy, the potential to ameliorate water quality and increase available habitat and ecological connectivity through a network of green spaces and linkages. Sites such as the old quarry are also recognized as potential major ecological assets. The proposed increase in urban canopy brings the possibility to mitigate the urban heat island and its impacts on health and biodiversity alike.

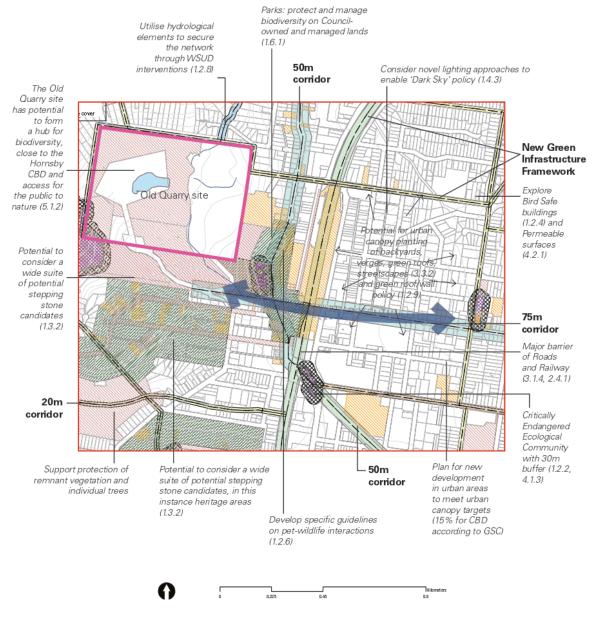
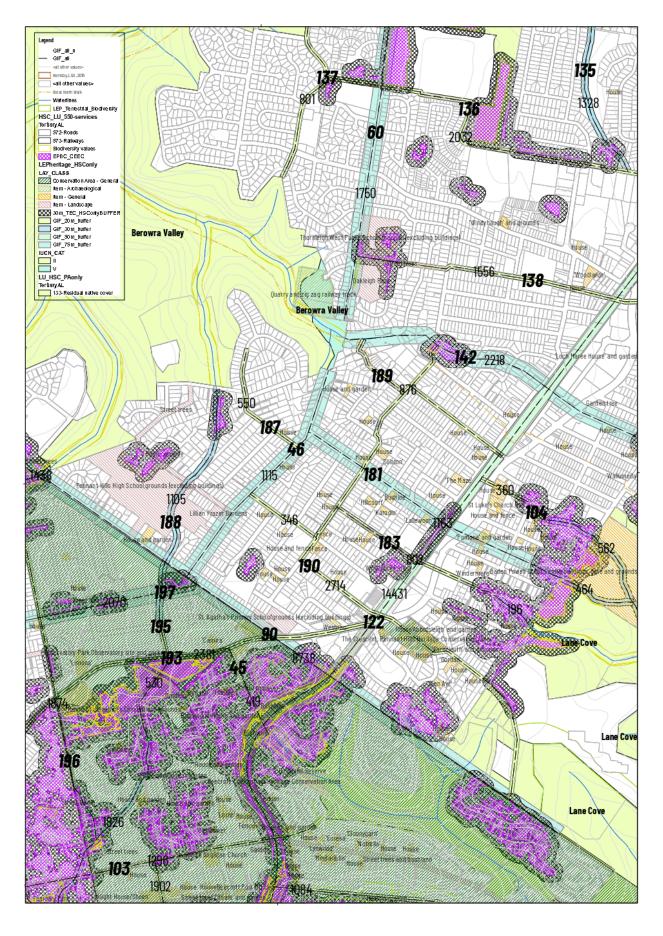


Fig 47. Hornsby case study



Hornsby Biodiversity Conservation Strategy 2020

Pennant Hills case study

The Pennant Hills case study illustrates the complexity and potential mechanisms to reconnect two expansive natural areas - Lane Cove River and Berowra Valley National Parkswith a vegetated corridor(s) of regional significance. In this highly built up area, barriers such as Pennant Hills Road and the railway would require further design consideration; while in the suburbs a range of urban forest and street tree plantings could help provide the valuable stepping stones for ecological movement.

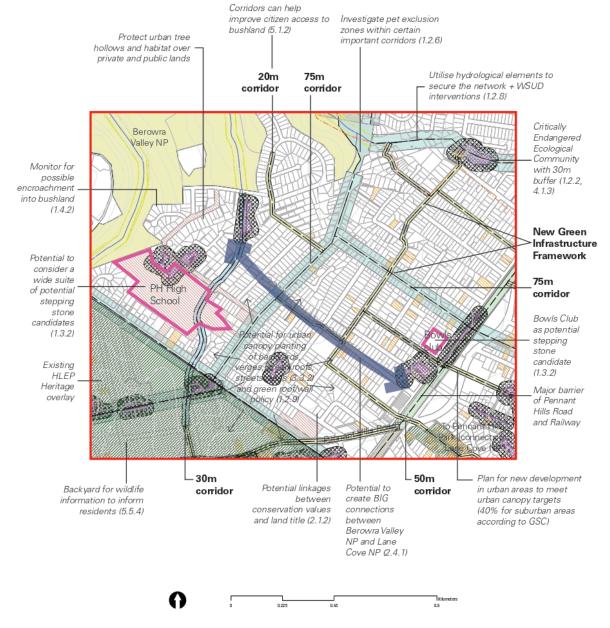
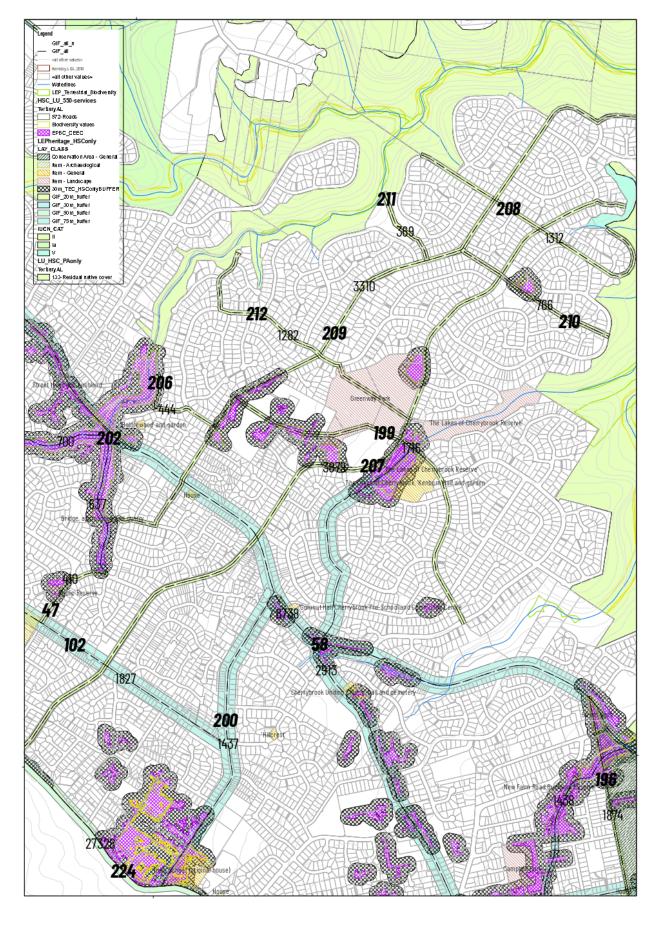


Fig 48. Pennant Hills case study



Hornsby Biodiversity Conservation Strategy 2020

Cherrybrook case study

The Cherrybrook case study highlights the potential to retrofit a suburban area to better facilitate biodiversity outcomes. In this location a range of corridors of varying widths stitch back together the fragmented ecology and enable the protection of habitat in the Bushland Shire. A targeted education approach with the area's residents could help guide a range of biodiversity-focused actions at the local scale while contributing to the network as a whole while also contributing to the local sense of place.

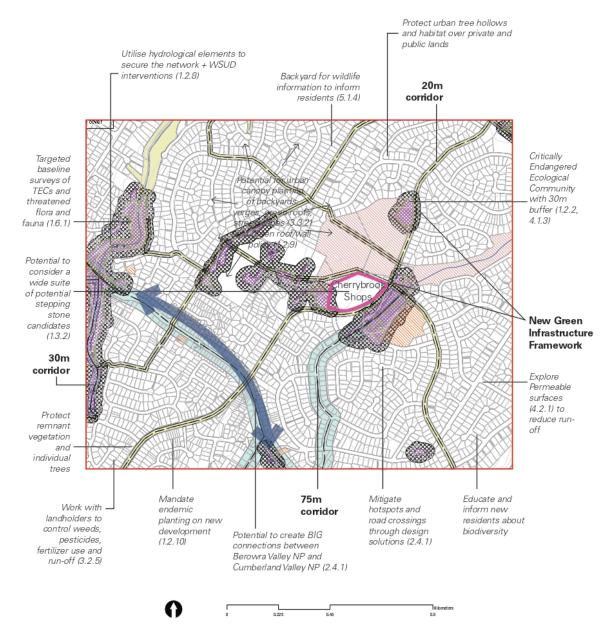
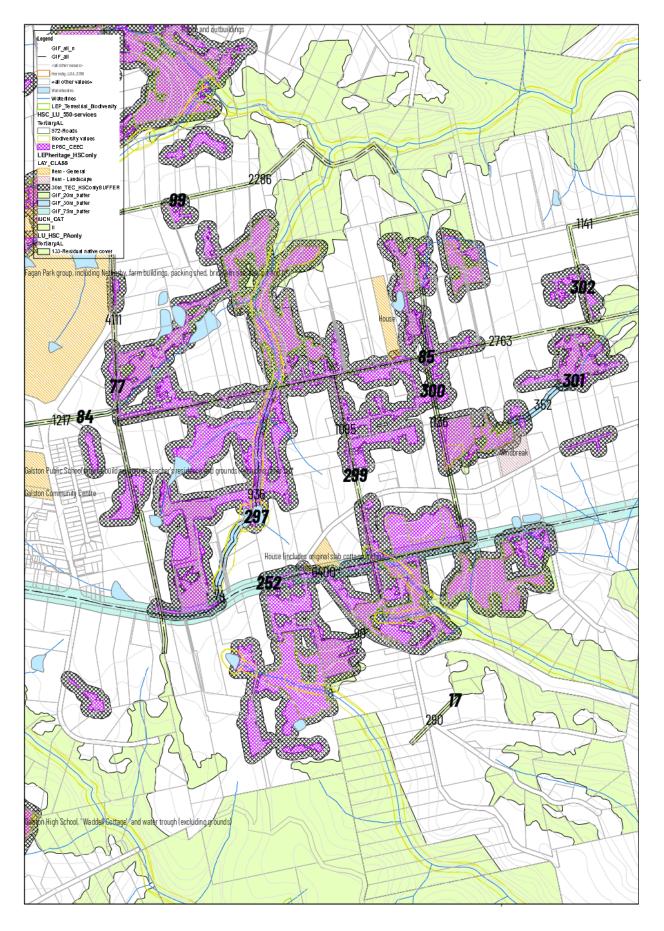


Fig 49. Cherrybrook case study



149

Galston case study

In this rural part of the Hornsby Shire, the GIF works to connect the substantial remaining TECs that exist through the buffering of remaining patches and through the interconnection of the landscape via rural roads and hydrological features. A range of other potential actions work in unison with this approach including the introduction of paddock trees and hollows protection, the potential introduction of stocking rates, working more closely with landholders with weeds and trialing virtual fencing. Such measures will assist both biodiversity as well as waterway amelioration.

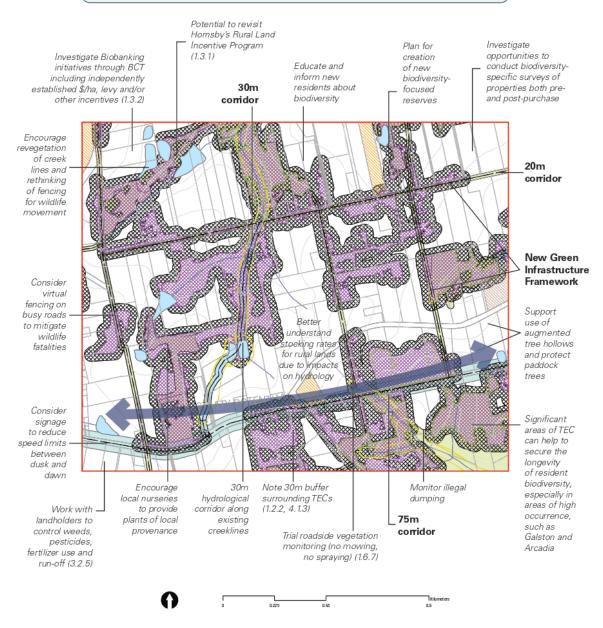
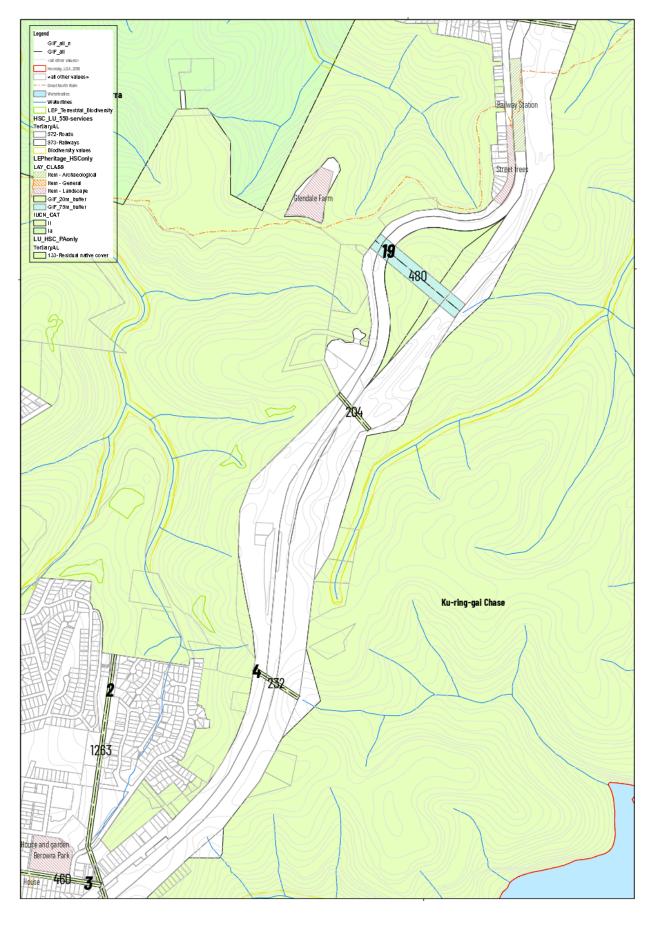


Fig 50. Galston case study



Hornsby Biodiversity Conservation Strategy 2020

Berowra Heights/Motorway case study

The primary objective of this case study is to demonstrate the potential to reconnect the large bushland/national park areas that are currently bisected by the motorway and rail corridor. This barrier prevents the potential for genetic exchange between sub-populations on either side and also results in animal collisions. This new green linkage could take the form of tunnel or eco-duct (wildlife bridge) and become an icon for the Bushland Shires appreciation of its bush and wildlife.

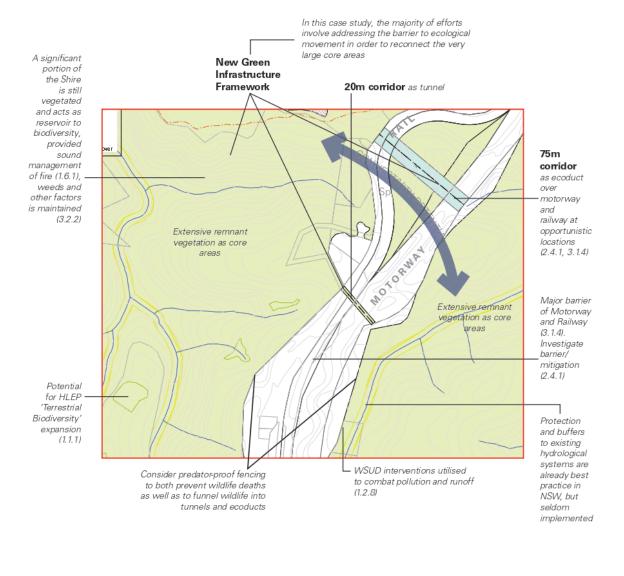


Fig 51. Berowra Heights/Motorway case study

20 metre 'urban' corridors

Eldridge Street

RHIZOME **ATTACHMENT 2 -**Hornsby Biodiversity Conservation Management Plan - Green Infrastructure Framework Visualisations - 20 metre corridor

particularly well when cansidering biodiversity. Poor habitat includes large expanses of lawn reliant on fertiliser and pesticides that make their way into streams and creeks. A lack of shade trees contribute to the urban heat island, while understorey is often absent. Roaming dogs and cats can also reduce Many suburban housing lots do not perform metre 'urban' corridors reflect the average width þe

Example location: Shepherd Drive, Cherrybrook

This corridor example is located in a suburban contr where improvements to biodiversity will entail work closely with existing landholders as well as several I

Interconnect street canopy by filling vacant street tree sites with appropriate endemic species and retaining and actively managing habitat trees via street tree planting plan

Protect and enhance front setbacks through DCP and apply

impervious surfaces with additional trees and vegetation and increase opportunities for deep soil/associated planting zones carparks, driveways and Select replacement of impervious surfaces with

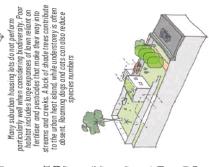
Targeted road narrowing and strategic installation of WSUD approaches to include additional shade trees and vegetation understorey to augment micro and macrohabitat Increase faunal movement through redesign of fencelines (e.g. WE replacement Work with AusGrid for aerial cable bundling/undergrounding o powerlines to facilitate urban canopy growth Potential to collaborate with landholders and community groups to increase urban forest, support and encourage local residents to join the Gardens for Wildlife program

Reinvigorate Tree Protection Orders to effctively safer mature habitat and hollow-bearing trees on private lands

safequard

landscaping, cat and dog control, fertiliser and pesticide use to improve stream and invertebrate health and change

e corridor, the greening of roofs and the walls is encouraged beyond the



carefully selected street trees that are replanted in available locations to consider both resident biodiversity and amenity. Green roofs and walls could Removing powerlines leaves additional space for also be applied where practical

Fences and other barriers are removed and a wide diversity of habitat and undestraept-einstraed. Lawn area and corresponding pestacle and fertiliser use is reduced. Ponds and faund frendly pet practices are introduced to the suburban garden to provide more space for biodiversity.

1





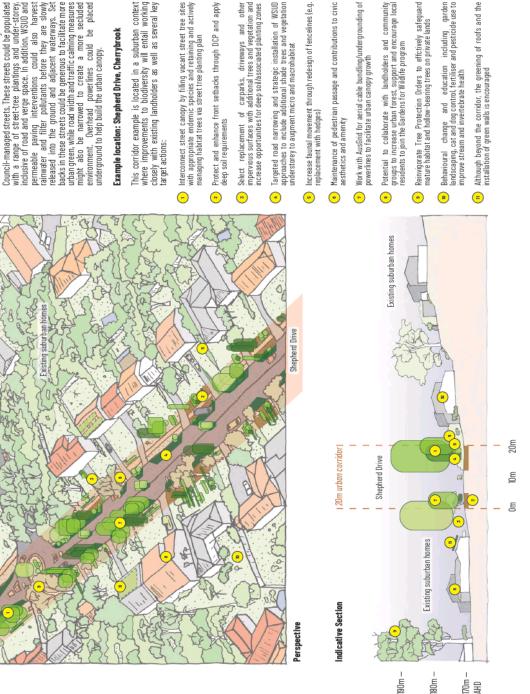


Fig 52. Green Infrastructure Framework visualisation: 20 metre 'urban' corridor

RHIZOME **ATTACHMENT 2 -**

urban waterways

Carparks and roadways contain minimal habitat for biodrersity, are significant contributors to urban heat island effect and source of often polluted run off into

role

s (i.e. road and rail) as reconfigured odiversity. This will include both is as well as potential actions with od other stakeholders e.g. Pennant ф private landholders and other stakeholders e.g. Hills Bowling Club and Sydney Trains. Key actions: the potential -managed roads as well as landholders and other stake location highlights This location infrastructurals green spaces spaces

- Interconnect street canopy by filling vacant street tree sites with appropriate endemic species and retaining and actively managing habitat trees via street tree planting plan
- Protect and enhance front setbacks through DCP and apply deep soil requirements
- impervious surfaces with additional trees and vegetation and increase opportunities for deep soil/associated planting zones carparks, driveways and Select replacement of impervious surfaces with

other

Increase faunal movement through redesign of fencelines (e.g. replacement with hedges) and support green-blue infrastructure in public and private realm e.g. raingardens, narrowing and strategic installation of WSUD include additional shade trees and vegetation approaches to include additional shade trees ar understorey to augment micro and macrohabitat road

Fig 53. Green Infrastructure Framework visualisation: 50 metre 'infrastructural' corridor

Maintenance of pedestrian passage and contributions to civic aesthetics and amenity, potential cycle route along rail corridor small-scale wetlands •

Removing powerlines leaves more space for street trees and swales and microhabitat are created in place of impervious surfaces

- aerial cable bundling/undergrounding of powerlines to facilitate urban canopy growth Work with AusGrid for (<u>-</u>)
- Potential to collaborate with landholders and community groups to increase urban forest, support and encourage local residents to join the Gardens for Wildlife program •
- Reinvigorate Tree Protection Orders to effctively safeguard mature habitat and hollow-bearing trees on private lands (P)
- Behavioural change and education including garden landscaping cat and dog control, fertiliser and pesticide use to improve stream and

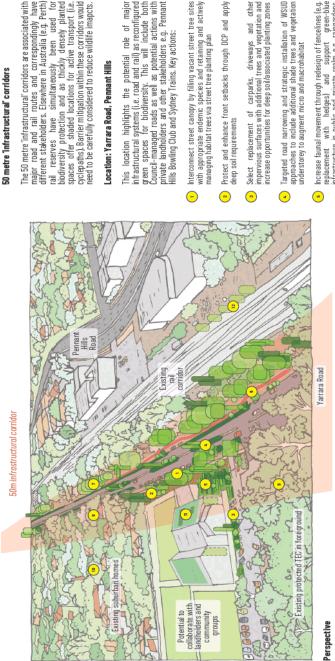
E

The greening of roofs and the installation of green walls is encouraged pursuant to the development of relevant Council policy and position











Hornsby Biodiversity Conservation Management Plan - Green Infrastructure Framework Visualisations - 50 metre corridor

General Meeting 10 March 2021

18 E

ATTACHMENT 2 -

RHIZOME



Future redevelopment to the rear of the lot creates alternative green space and deep soil zone adjacent to the GIF corridor

Future redevelopment to the front of the lot creates areen space and deep soil zone further from the GIF

other

driveways and

carparks,

vegetation and

additional trees and

Targeted road narrowing and strategic installation of WSUD approaches to include additional shade trees and vegetation and vegetation increase opportunities for deep soil/associated planting zones

Work with AusGrid for aerial cable bundling/undergrounding of powerlines to facilitate urban canopy growth

Potential to collaborate with major landholders and community groups to increase urban forest Green roofs/walls and bird firendly building design will be encouraged through the development of relevant Council policy

1

Work with Sydney trains to identify parcels of land that support and maintain for biodiversity and rail safety outcomes

<u>-</u>

80m 70m 60m

75m aspirational corridor 50m

40m 30m

20m 10m E O

75 metre 'aspirational' corridors

5m aspirational corridor

The 75 metre infrastructural corridors are indicative of the scale of corridors that could provide regional scale connectivity to fragmented landscapes. Captured through separate planning overlay, these may be associated with dedicated fauna overpasses and underpasses at key barriers; while where intersecting with the unban fabric a spectrum of approaches could be considered over a long time period. These could include targeted increase to urban forest canopy, adjusting of fences and the creation of microhabitas. Education and behavioural change regarding pet ownership could also be considered; while long term acquisition of key properties could also be an

Location: Burdett Street, Hornsby CBD

infrastructure above and below ground to create additional space for street trees, understorey biodiversity planting and WSUB

Varrowing of road and movement of services and

green space for biodiversity could be considered through selective road arravining, the installation of permeable surfaces and WSUD, green roofs and walks as well as particular considerations and planning provisions surrounding land-use change and redevelopment. For instance particular development controls could facilitate the retention and expansion of urban vegetation through as well as specific attention to the creation of understorey. Further biodiversity benefits through working closely with existing landholders are noted below: dense urban environment includes tall buildings and large areas of roads and impervious parking surfaces. Potential specific set-back and deep soil requirements and will ikely require engineered solutions for trees - tree pits structural soils for street trees to interconnect tree canopy This central Hornsby location exemplifies the potential design in a contested urban context. corridor

zones to consider new provisions around both permeability and great netcos with developments dependent upon point-based assessment for urban bindiversity and greening, i.e. Graund based landscaping, retention of existing vegation, deep soil zones, green walls and roots.

Medium-high density residential and commercial

Interconnect street canopy and support biodiversity by filling vacant street tree sites with mix of species appropriate for highly constrained urban environment and retaining a actively managing habitat trees via street tree planting plan

d enhance front setbacks through DCP and apply requirements for commercial and med-high deep soil requirements for commercial and med-ing residential supported by solid landscape character statement Protect and ~

replacement of ous surfaces with Select m

4

Existing bui

180m 190m

문

ndicative Section

220m ·

Perspective

Fig 54. Green Infrastructure Framework visualisation: 75 metre 'aspirational' corridor

(s)

<u>-</u>

George Street Existing 'Avanti' apartment building Burdett Hornsby Inn gs and planting 100 WA OCCURBD

Hornsby Biodiversity Conservation Management Plan - Green Infrastructure Framework Visualisations - 75 metre corridor

Dano

roofs and

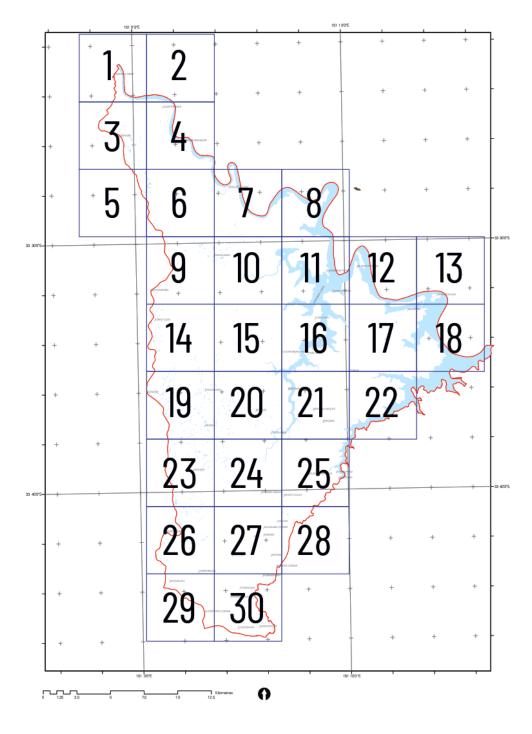
Hornsby Biodiversity Conservation Strategy 2020

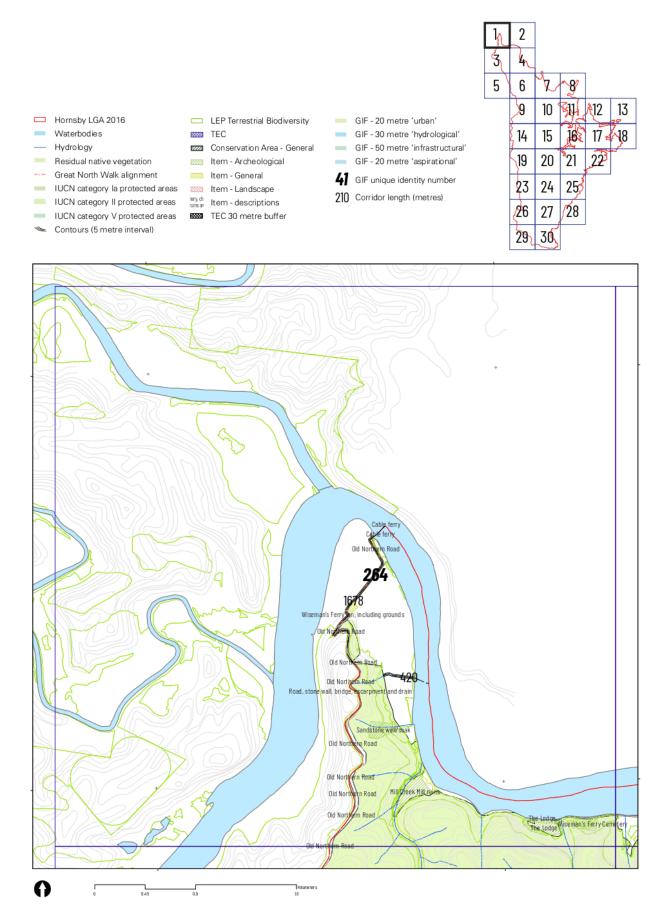
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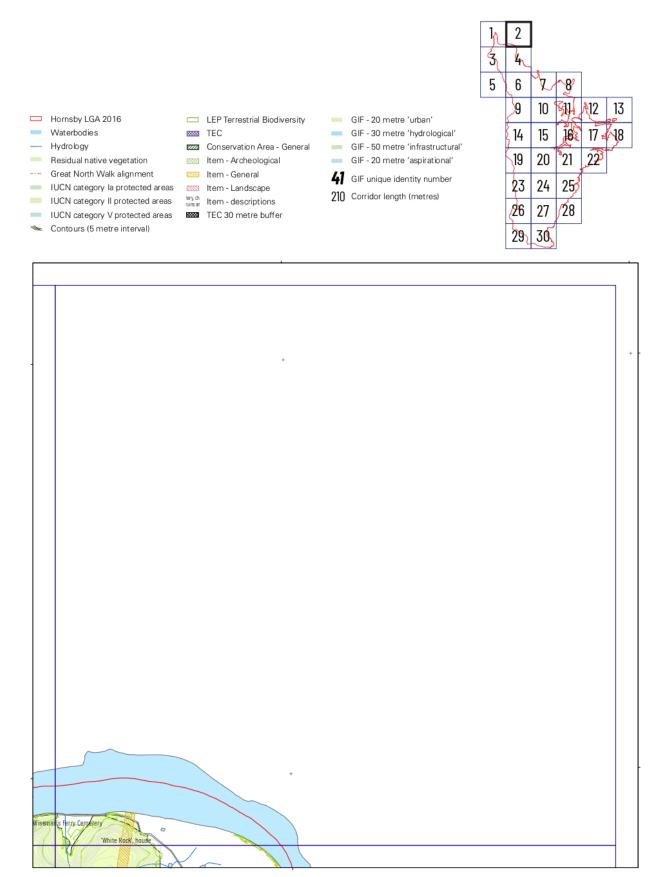
Appendix 8: Green Infrastructure Framework map set

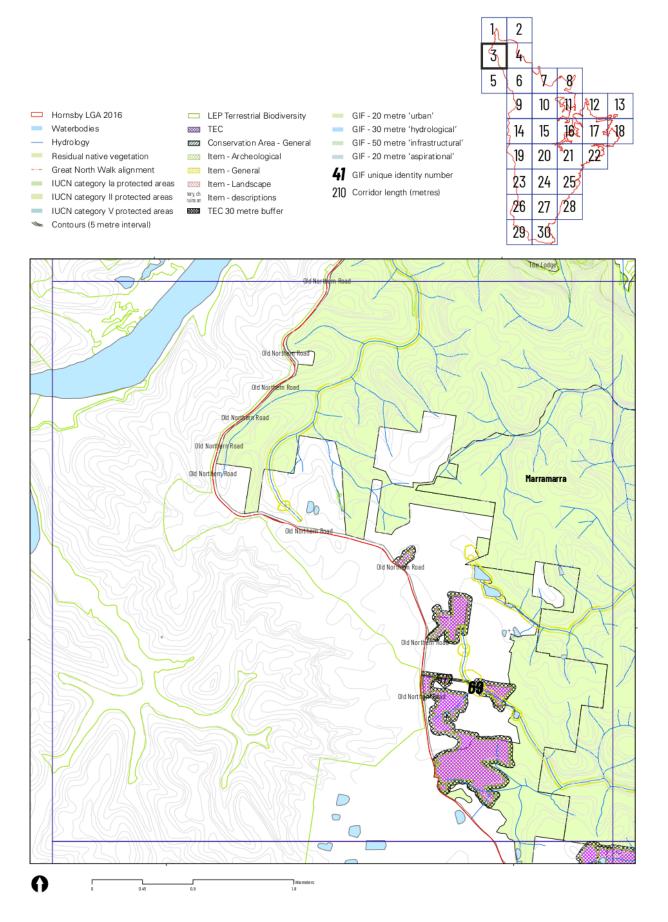
Green Infrastructure Framework

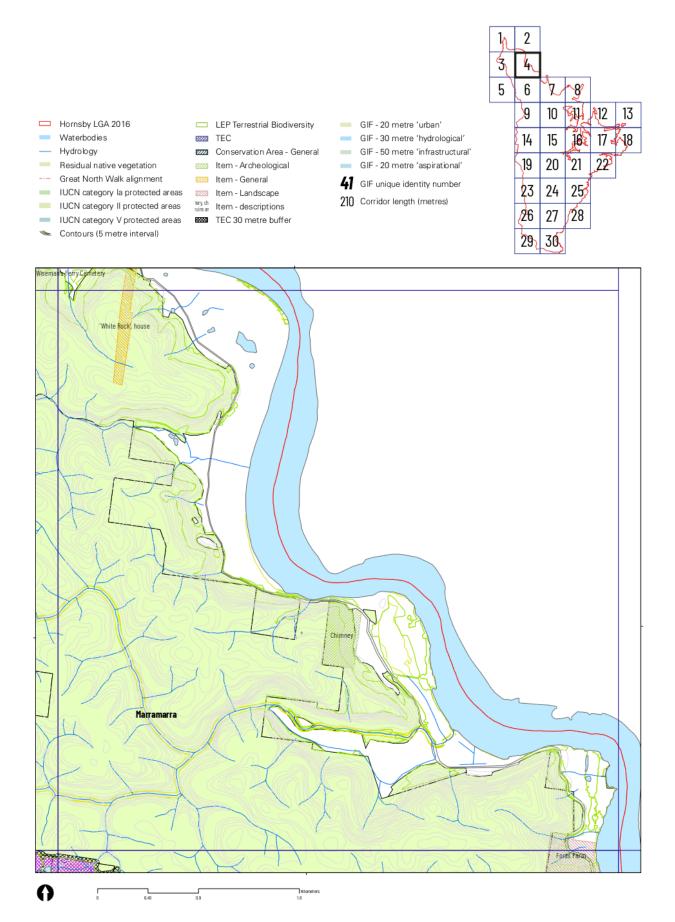
Please refer to the key map on this page when using the the *map set* that details the proposed GIF across the Hornsby LGA (the following 30 pages).

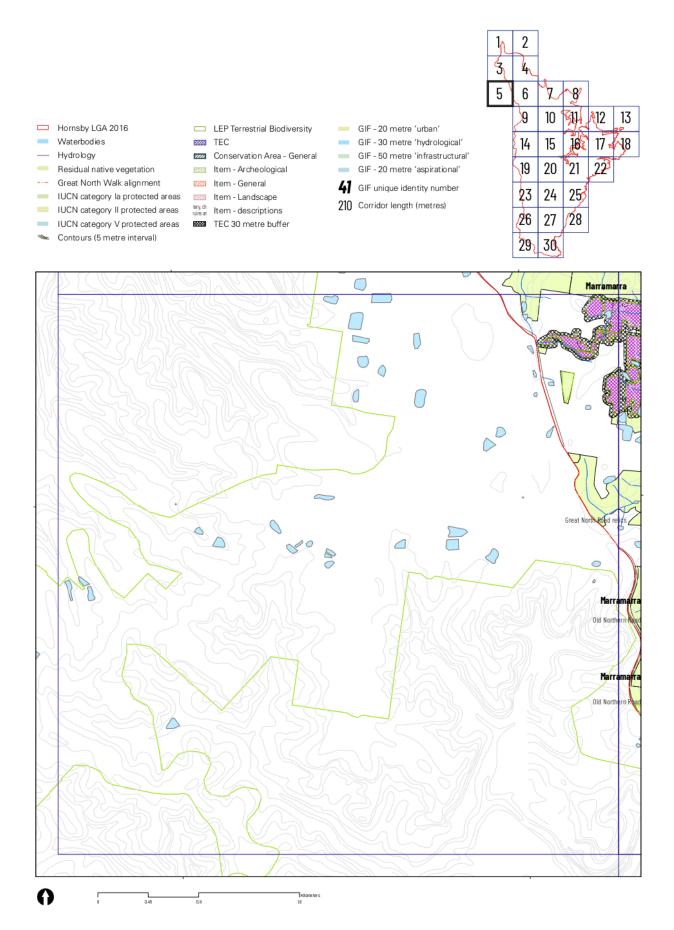


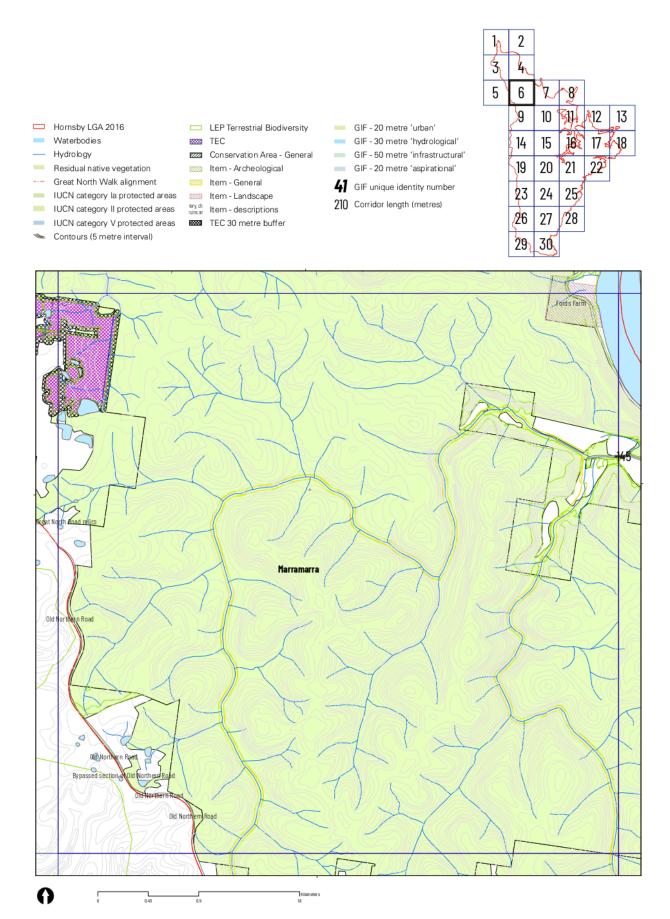


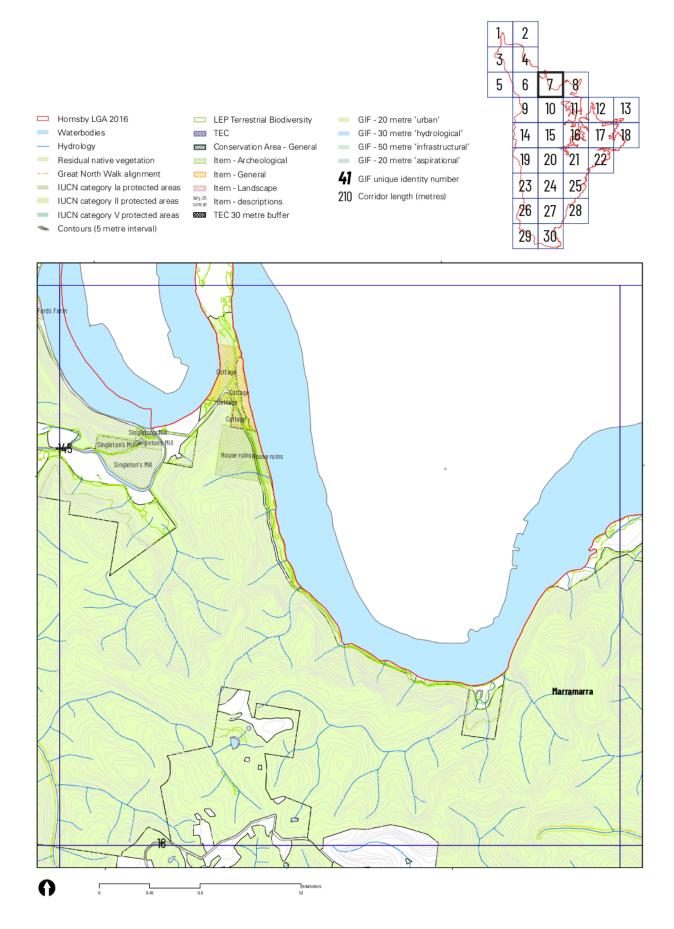


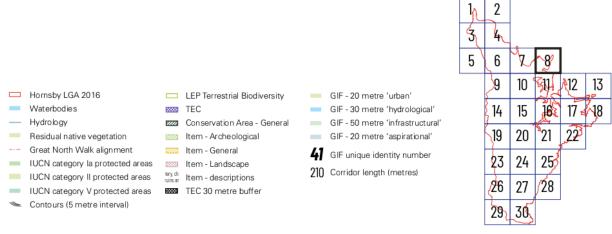


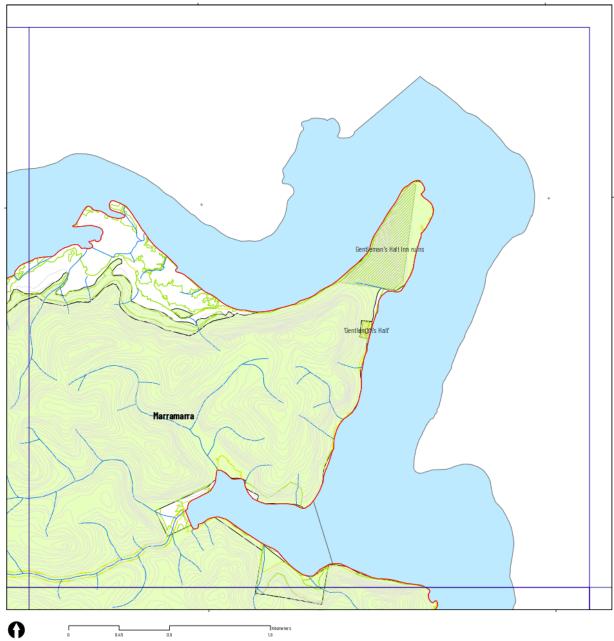


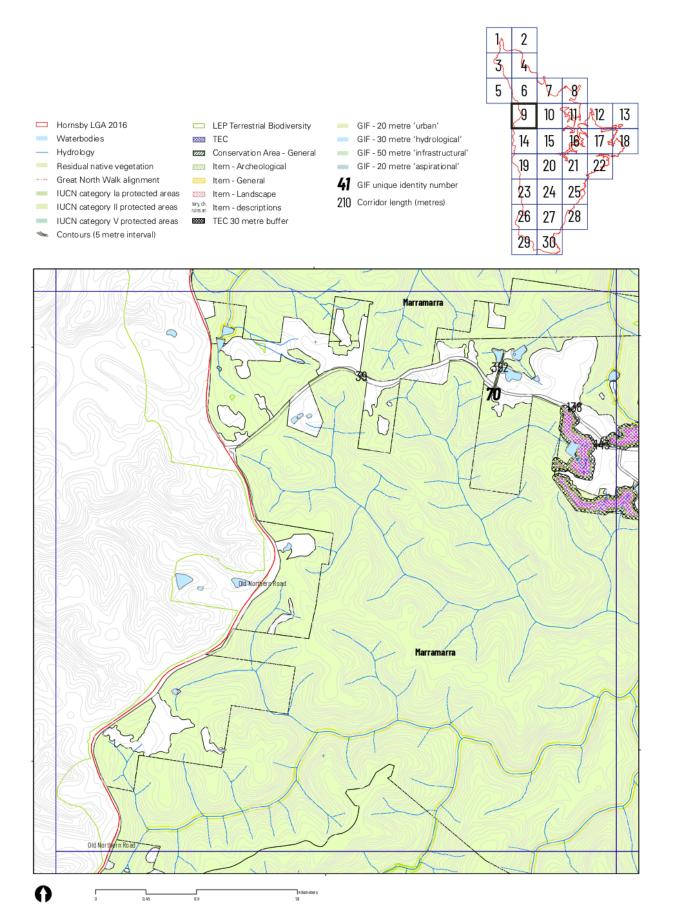


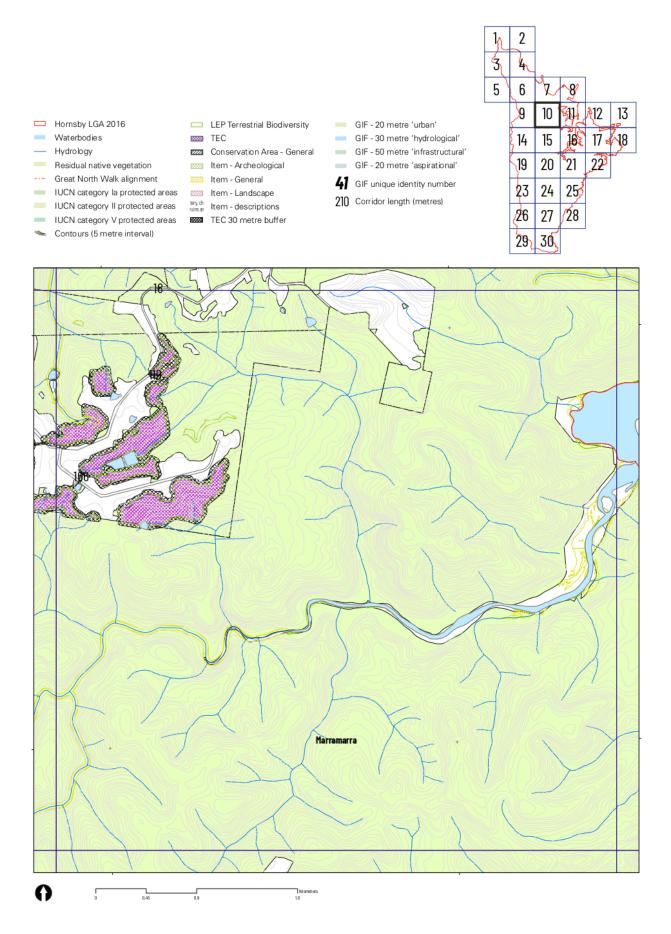


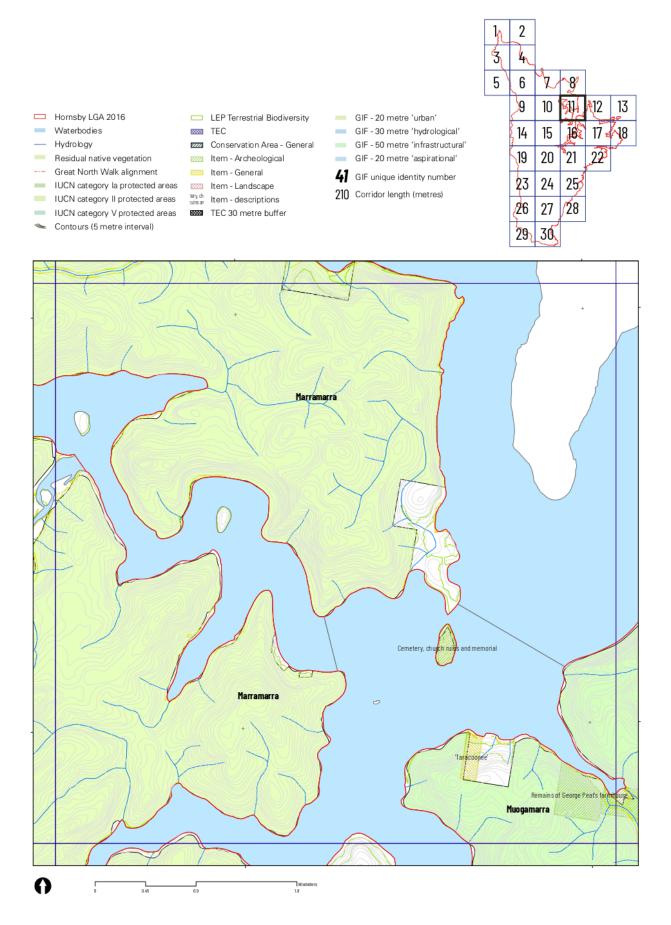


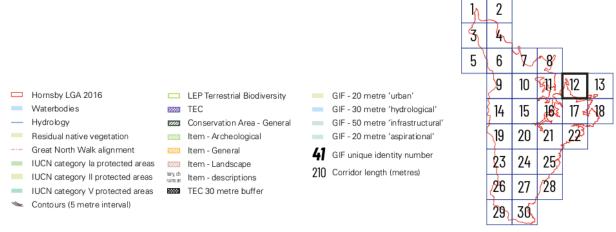


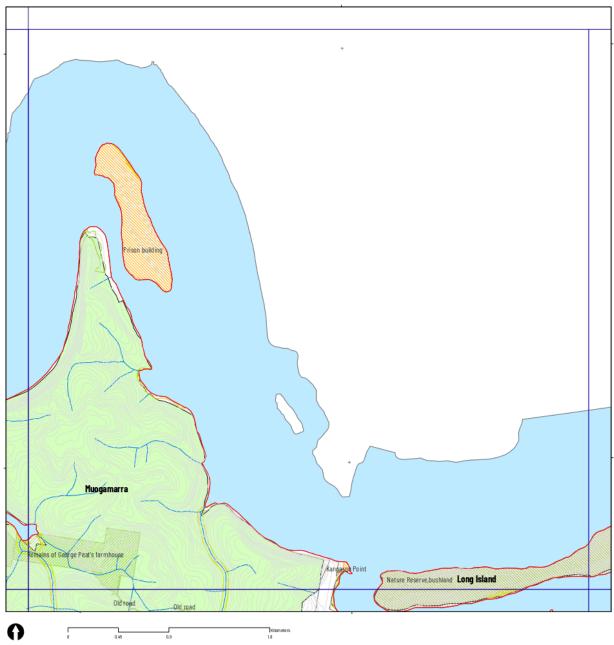


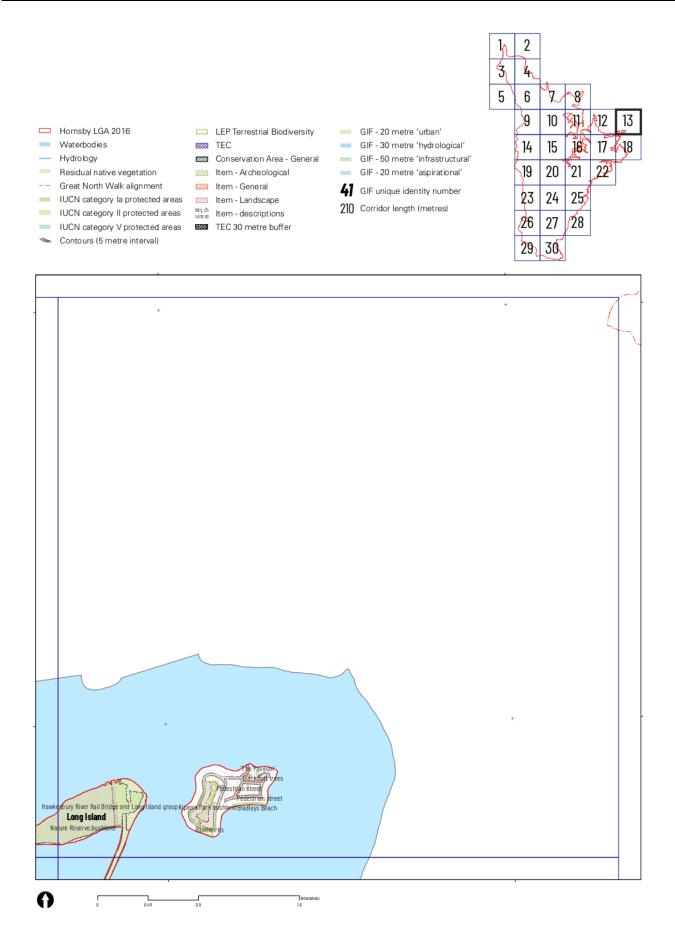


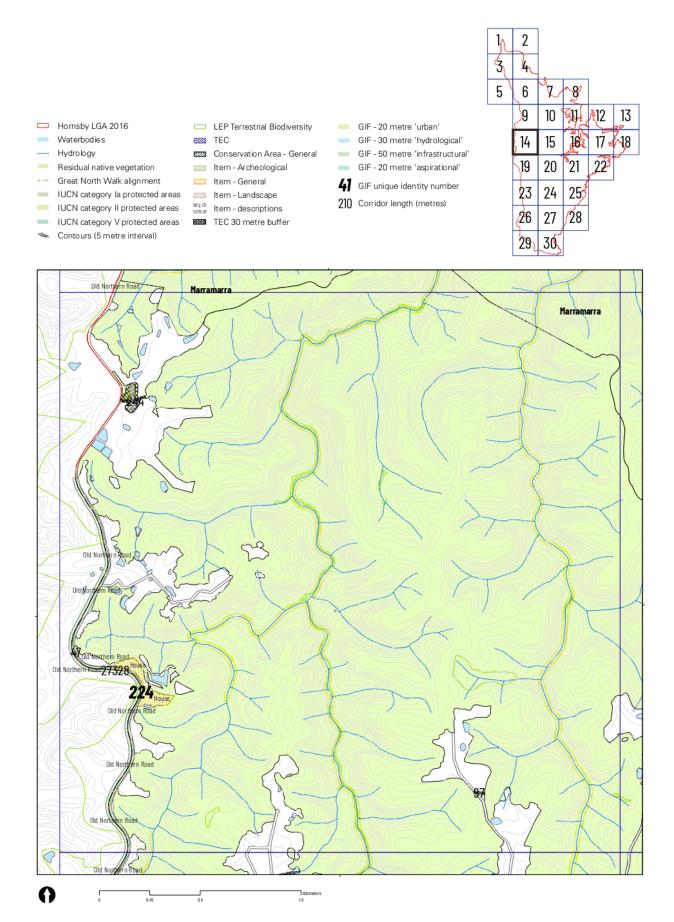


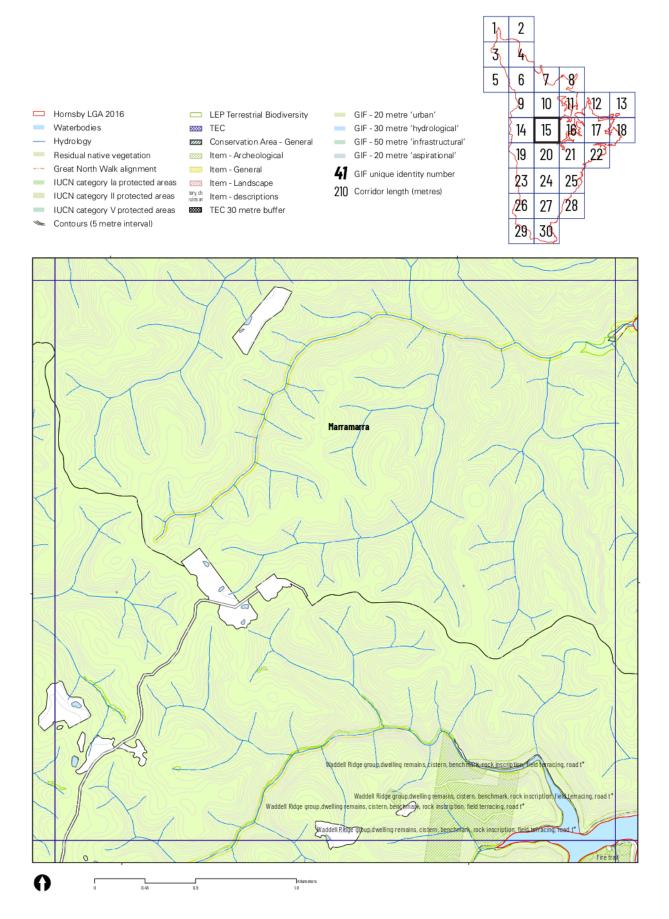


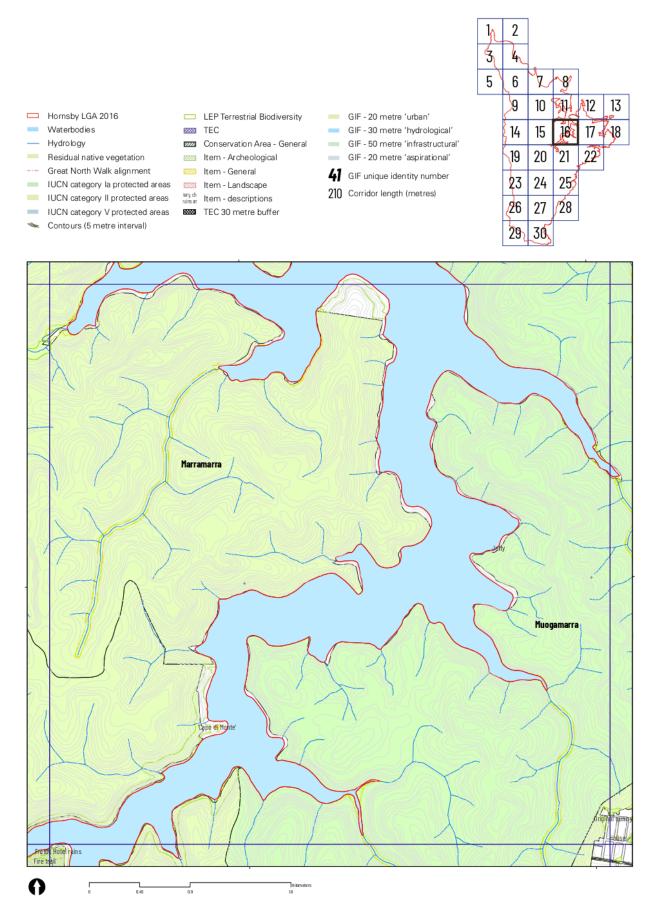


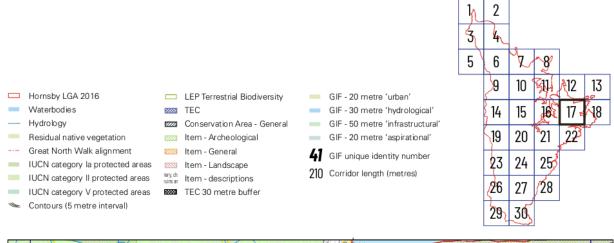


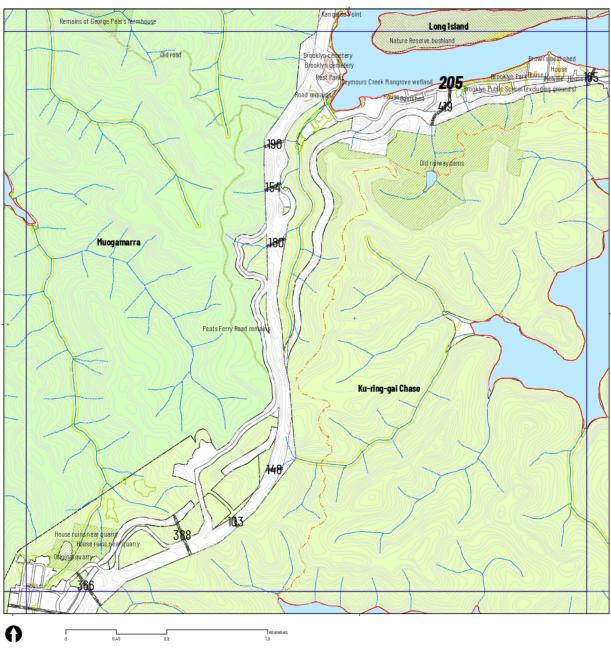


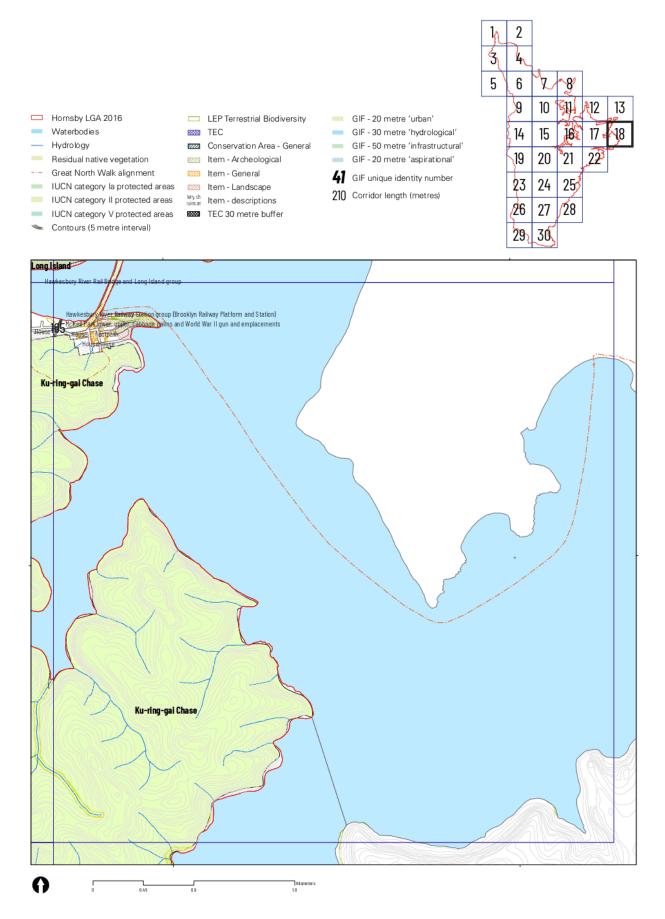


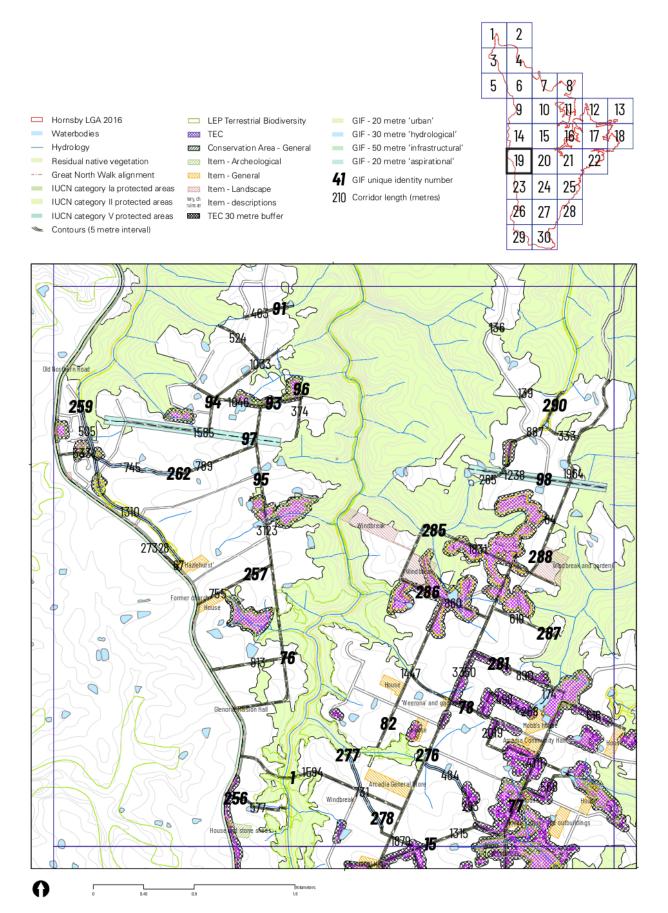


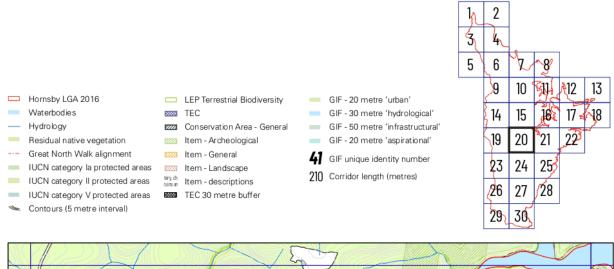


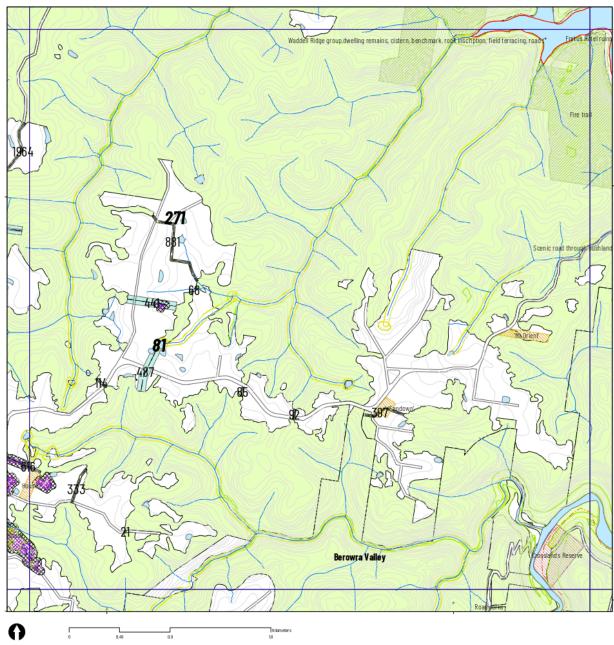


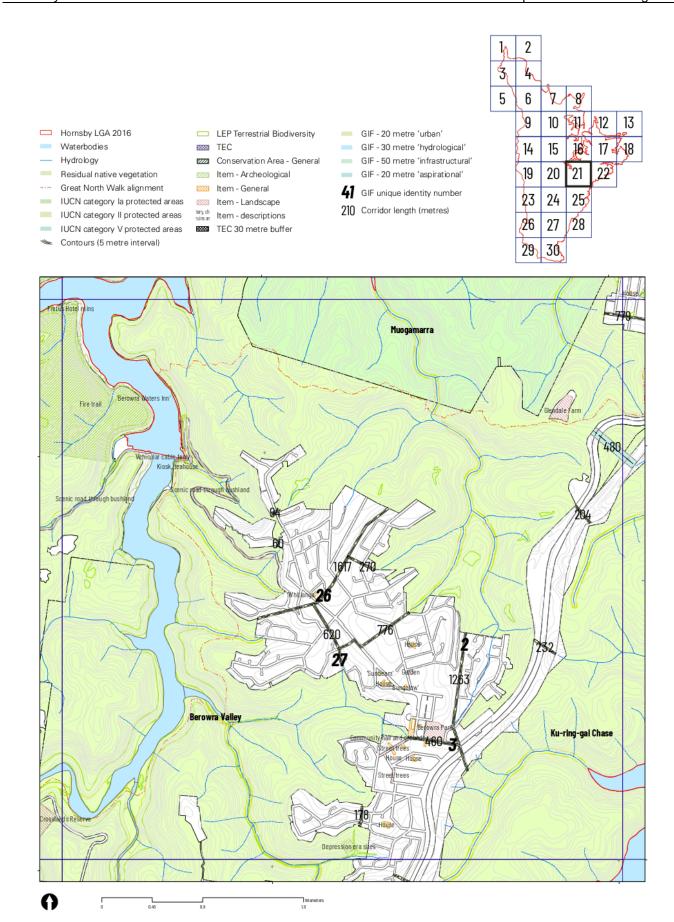


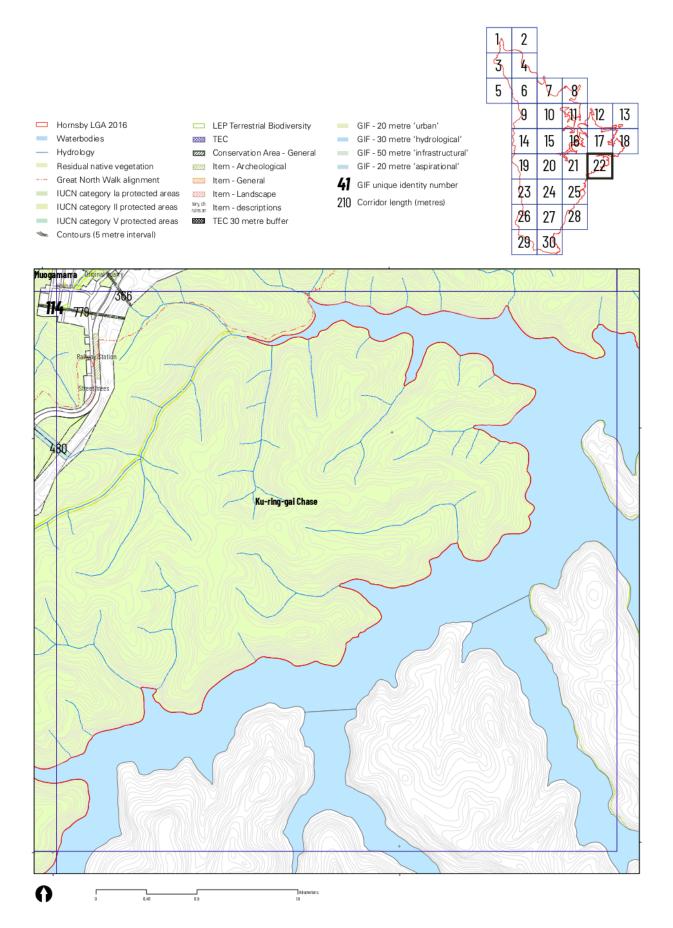


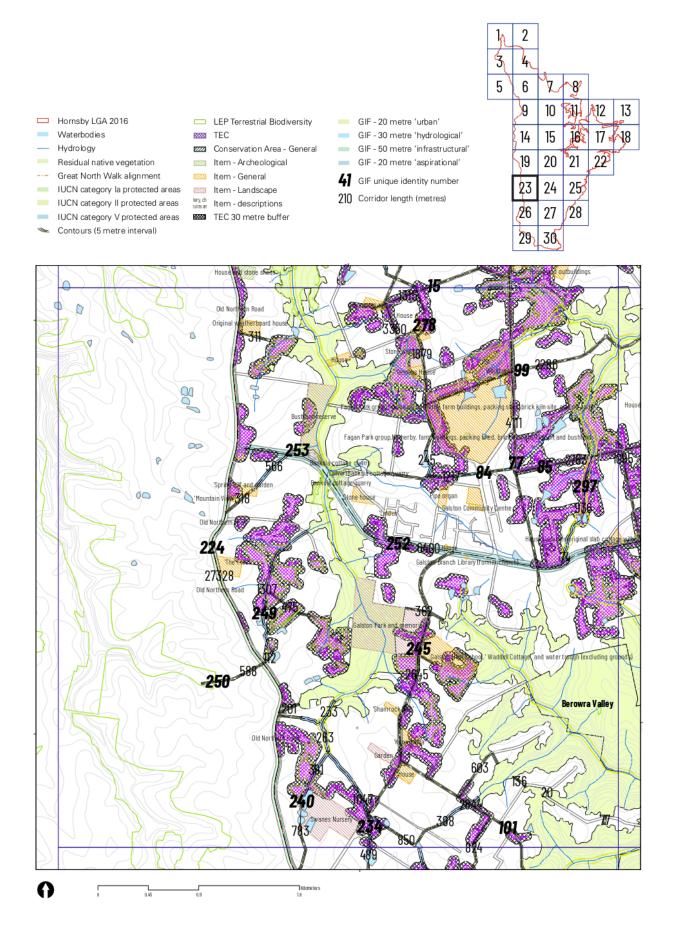


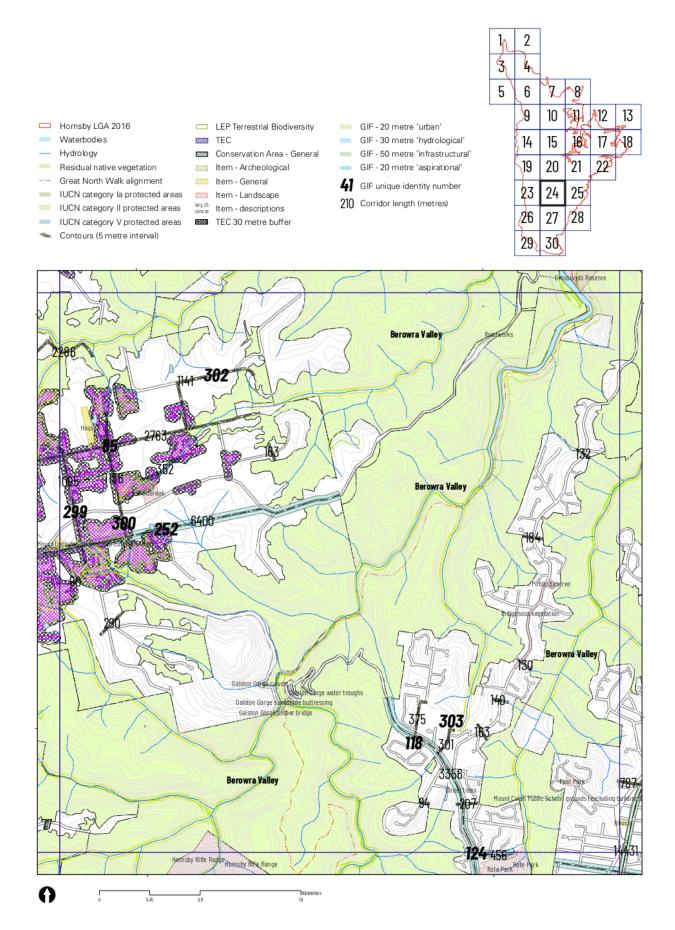


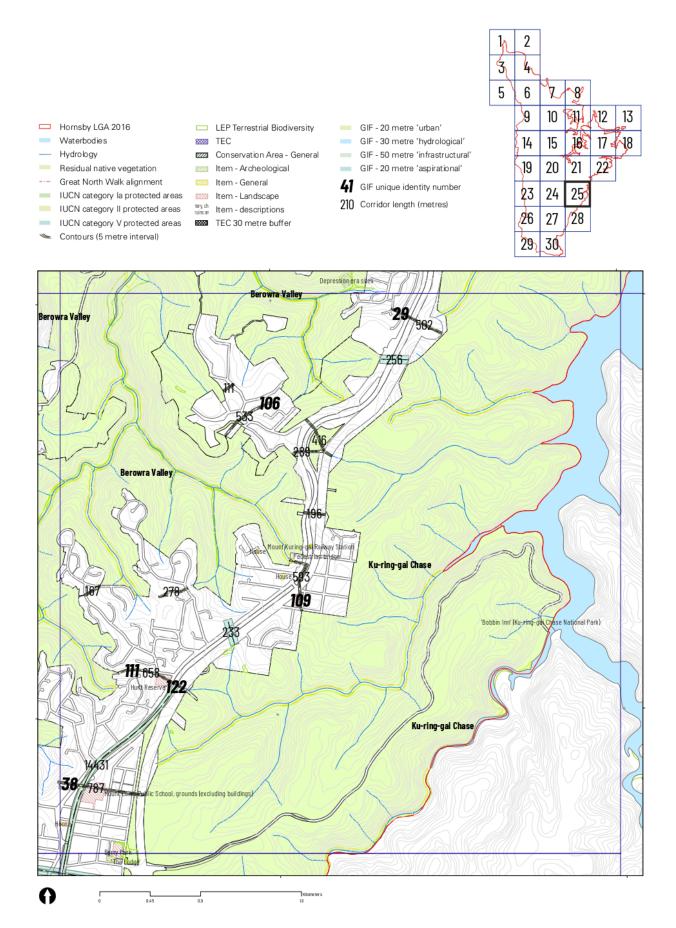


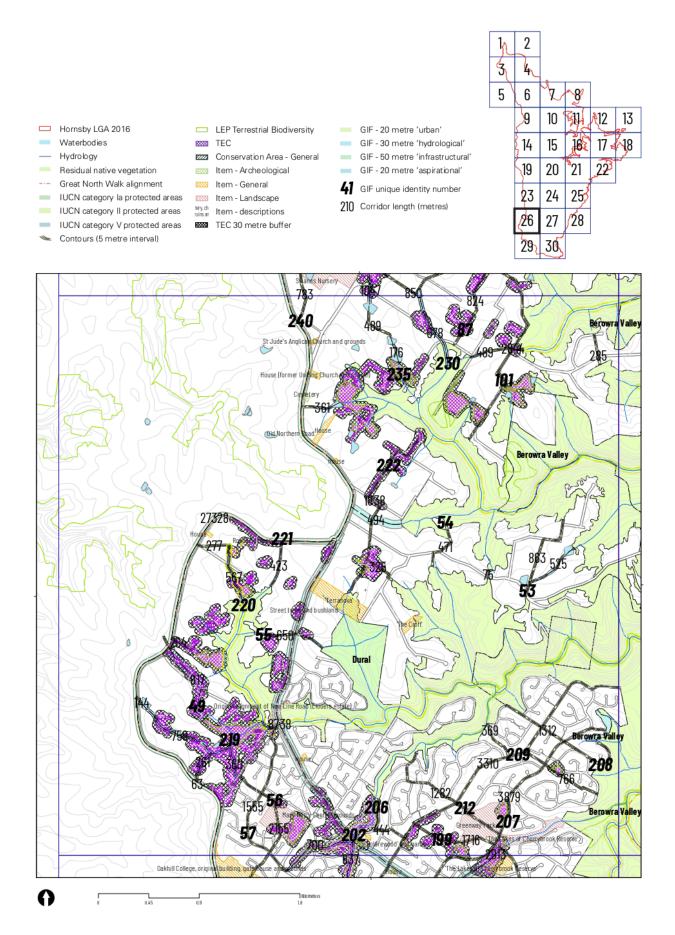


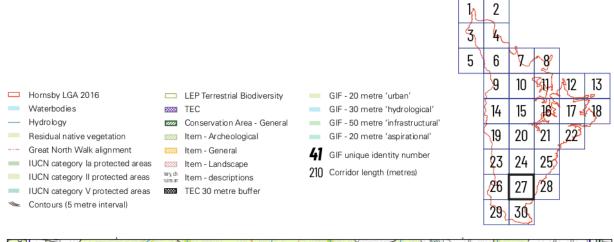


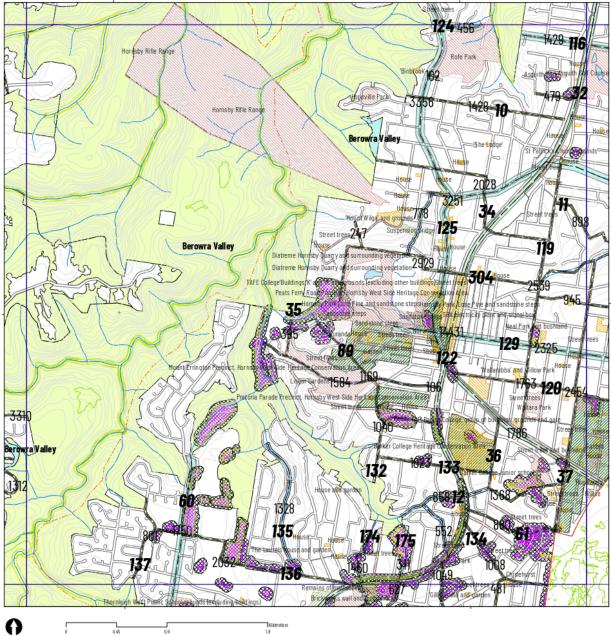


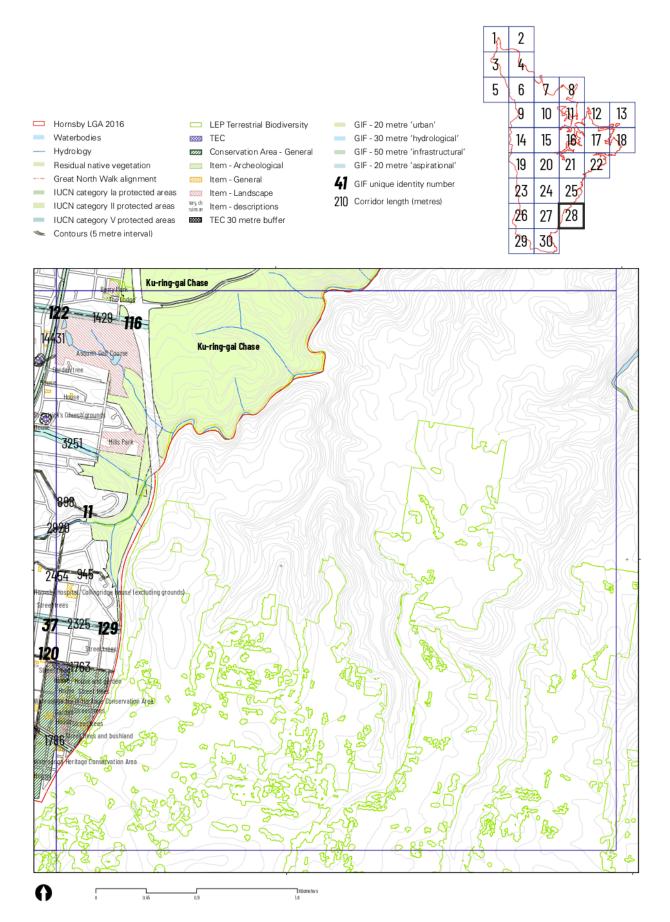


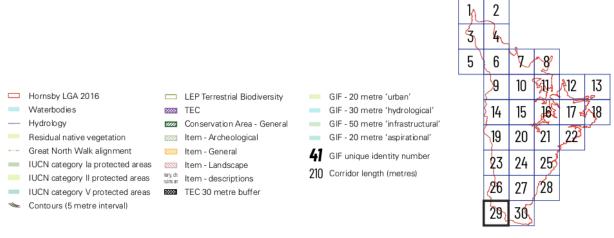


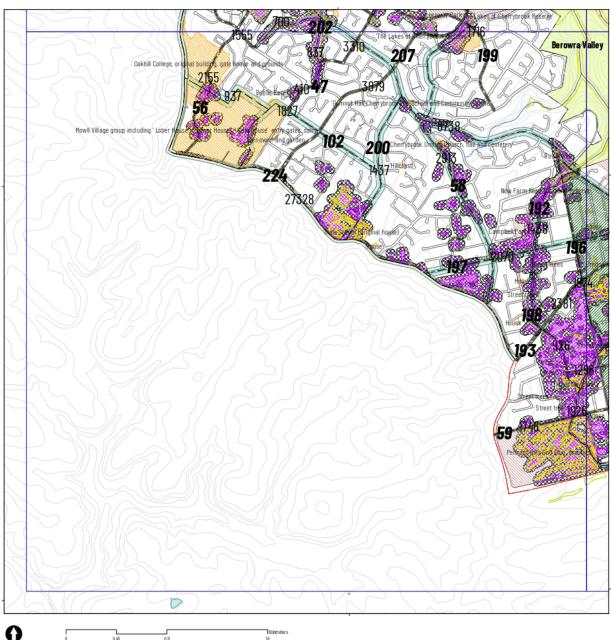


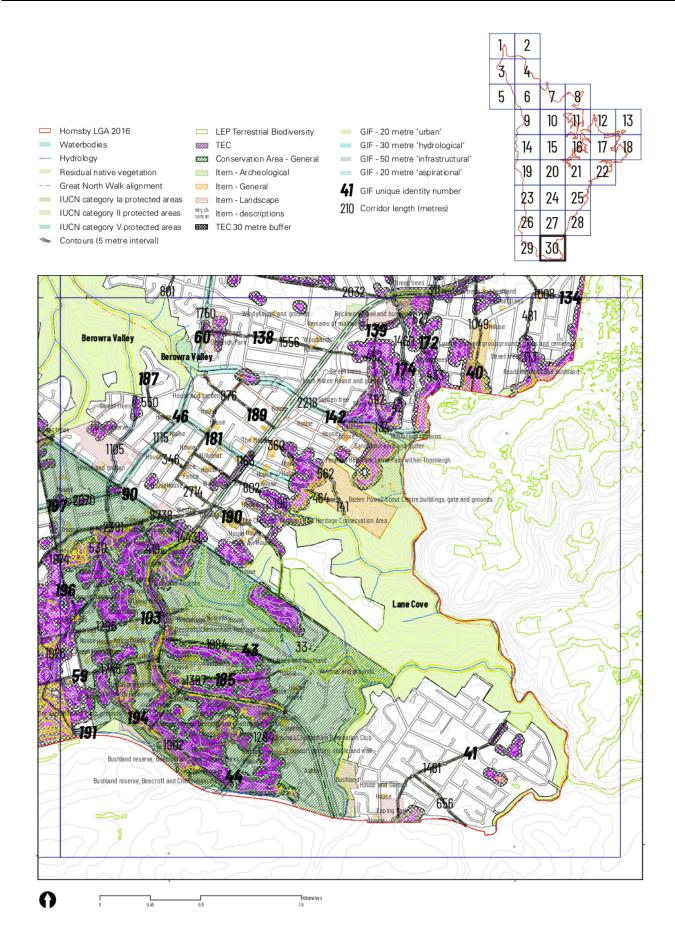












This table documents the GIF unique identity numbers, types and corridor lengths as found on the individual pages of the map set.

no.	Туре	Length (m)	no.	Туре	Length (m)	no.	Туре	Length (m)	no.	Туре	Length (m)	no.	Туре	Length (m)	no.	Туре	Length (m)
1	GIF_20m	1594	53	GIF_20m	863	105	GIF_20m	178	157	GIF_30m	6	209	GIF_20m	3310	261	GIF_20m	333
2	GIF_20m	1263	54	GIF_20m	471	106	GIF_20m	533	158	GIF_30m	13	210	GIF20m	766	262	GIF_20m	789
3	GIF_20m	460	55	GIF_20m	650	107	GIF_20m	Ш	159	GIF30m	6	211	GIF_20m	389	263	GIF_20m	67
4	GIF_20m	232	56	GIF_20m	2155	108	GIF_20m	289	160	GIF30m	6	212	GIF_20m	1282	264	GIF_20m	1678
5	GIF_20m	204	57	GIF_20m	1555	109	GIF_20m	593	161	GIF30m	8	213	GIF30m	48	265	GIF_20m	420
6	GIF_20m	184	58	GIF_75m	2913	110	GIF_75m	233	162	GIF30m	9	214	GIF30m	261	266	GIF_20m	145
7	GIF_20m	130	59	GIF_20m	1746	П	GIF_20m	658	163	GIF30m	9	215	GIF30m	182	267	GIF_20m	138
8	GIF_20m	163	60	GIF_75m	1750	112	GIF_20m	278	164	GIF_30m	18	216	GIF30m	759	268	GIF_20m	143
9	GIF_20m	207	а	GIF_20m	880	113	GIF_20m	167	165	GIF30m	7	207	GIF_20m	144	269	GIF_20m	166
10	GIF_20m	1428	62	GIF_30m	552	114	GIF_20m	779	166	GIF_30m	1	218	GIF_20m	63	270	GIF_75m	441
11	GIF_20m	898	63	GIF_20m	102	115	GIF_20m	388	167	GIF30m	6	219	GIF.30m	380	271	GIF_20m	881
12	GIF.30m	858	64	GIF_75m	256	116	GIF_75m	1429	168	GIF_30m	7	220	GIF_20m	567	272	GIF_20m	68
13	GIF_20m	92	65	GIF_20m	60	117	GIF_75m	3356	169	GIF_30m	7	221	GIF_20m	423	273	GIF_20m	397
14	GIF_20m	85	66	GIF_20m	94	118	GIF_20m	375	170	GIF_30m	7	222	GIF_20m	1838	274	GIF_20m	21
15	GIF_20m	1315	67	GIF_20m	270	119	GIF_20m	2539	171	GIF_30m	433	223	GIF_75m	494	275	GIF_20m	616
16	GIF_20m	163	68	GIF_20m	165	120	GIF_20m	1763	172	GIF_30m	627	224	GIF.50m	27328	276	GIF_20m	3350
17	GIF_20m	290	69	GIF_20m	572	121	GIF.50m	1786	173	GIF.20m	215	225	GIF_20m	325	277	GIF_30m	73
18	GIF_20m	90	70	GIF_20m	392	122	GIF.50m	14431	174	GIF30m	1460	226	GIF_20m	525	278	GIF_20m	1879
19	GIF_75m	480	77	GIF_20m	119	123	GIF_20m	140	175	GIF_30m	311	227	GIF_20m	361	279	GIF_30m	484
20	GIF_20m	366	72	GIF_20m	18	124	GIF_75m	456	176	GIF30m	313	228	GIF_20m	285	280	GIF_20m	293
21	GIF_20m	103	73	GIF_20m	39	125	GIF_75m	3251	177	GIF_20m	48	229	GIF_20m	489	28	GIF_20m	890
22	GIF_20m	148	74	GIF_20m	244	126	GIF.30m	0	178	GIF_30m	М	230	GIF30m	678	282	GIF_30m	174
23	GIF_20m	190	75	GIF_20m	47	127	GIF.30m	778	179	GIF_30m	562	231	GIF.30m	398	283	GIF_30m	268
24	GIF_20m	154	76	GIF_20m	813	128	GIF_20m	247	180	GIF_30m	464	232	GIF.30m	263	284	GIF_20m	498
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26	GIF_20m	1617	78	GIF_20m	2019	130	GIF 20m	1584	182	GIF_30m	196	234	GIF.30m	1047	286	GIF_20m	860
77	GIF 20m	620	79	GIF 20m	333	131	GIF 20m	106	183	GIF 20m	807	235	GIF_20m	176	287	GIF_20m	619
28	GIF_20m	776	80	GIF_20m	114	132	GIF_20m	1040	184	GIF.20m	33	236	GIF.30m	233	288	GIF_20m	1964
29	GIF_20m	502	8	GIF_75m	487	133	GIF_20m	1023	185	GIF20m	1397	237	GIF.30m	391	289	GIF_20m	265
30	GIF 20m	416	82	GIF 20m	1447	134	GIF 20m	1008	186	GIF 20m	346	238	GIF 20m	489	290	GIF 20m	887
31	GIF_20m	196	83	GIF_20m	566	135	GIF.30m	1328	187	GIF_20m	550	239	GIF_20m	208	291	GIF_20m	139
32	GIF_20m	479	84	GIF_20m	1217	136	GIF_20m	2032	188	GIF_30m	1105	240	GIF_20m	783	292	GIF_20m	333
33	GIF_20m	94	85	GIF_20m	2763	137	GIF_20m	801	189	GIF_20m	876	241	GIF_20m	850	293	GIF_20m	136
34	GIF_20m	2028	86	GIF_20m	201	138	GIF_20m	1556	190	GIF_20m	2714	242	GIF_20m	20	294	GIF_20m	97
35	GIF_20m	395	87	GIF_20m	824	139	GIF_20m	452	191	GIF_30m	1926	243	GIF_20m	603	295	GIF_20m	84
36	GIF_20m	1368	88	GIF_20m	945	140	GIF.30m	392	192	GIF30m	1438	264	GIF_20m	136	296	GIF_30m	245
37	GIF_20m	2454	89	GIF_20m	1169	141	GIF.30m	134	193	GIF_20m	238	245	GIF_20m	2645	297	GIF_30m	936
38	GIF_20m	787	90	GIF_75m	8738	142	GIF_75m	2218	194	GIF.20m	1902	246	GIF_20m	362	298	GIF_30m	74
39	GIF_20m	132	9	GIF_20m	463	143	GIF.30m	9	195	GIF_20m	530	247	GIF_20m	186	299	GIF_20m	1095
40	GIF_20m	1049	92	GIF_20m	524	144	GIF.30m	9	196	GIF20m	1874	248	GIF_20m	475	300	GIF_20m	136
41	GIF_20m	1461	95	GIF_20m	1046	145	GIF.30m	9	197	GIF.75m	2070	249	GIF30m	1307	301	GIF_30m	352
42	GIF_20m	656	94	GIF_20m	1033	146	GIF.30m	9	198	GIF.20m	926	250	GIF_20m	588	302	GIF_20m	141
43	GIF 20m	1084	95	GIF_20m	3123	147	GIF 30m	9	199	GIF 20m	776	250	GIF 20m	112	303	GIF_20m	301
44	GIF_75m	1284	96	GIF_20m	374	148	GIF.30m	10	200	GIF.75m	1437	252	GIF_75m	6400	304	GIF_20m	2929
45	GIF_20m	419	97	GIF_75m	1585	149	GIF.30m	42	201	GIF.75m	937	253	GIF.30m	588	TOTAL	5 - 20II	275832
46	GIF_ZUM	1115	98	GIF_75m	1238	150	GIF.30m	7	202	GIF_30m	637	253	GIF_20m	318	IUIAL		2/5002
47	GIF_20m	410	99	GIF_20m	2286	151	GIF.30m	13	203	GIF30m	700	255	GIF_20m	311	1		
48	GIF_20m	92	100	GIF_20m	77	152	GIF.30m	6	203	GIF_30m	143	256	GIF_20m	577			
49	GIF_20m GIF_75m	817	101	GIF_20m	77	153	GIF30m	6	205	GIF_30m	419	250	GIF_20m		-		
50	GIF_75m	277	102	GIF_2Um GIF_75m	1827	154	GIF.30m	17	205	GIF20m	444	258	GIF_30m	755	1		
51	GIF 20m	204	103	GIF 20m	1996	109 155	GIF 30m	1/	200	GIF 20m	3879	258	GIF 30m	505	-		
21																	

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Hornsby Biodiversity Conservation Strategy 2020

References and cited works

This section contains all of the works and images cited in the creation of this report

Hornsby Biodiversity Conservation Strategy 2020

188

- United Nations. Convention on Biological Diversity (CBD). 1992 24 November 2011]; Available from: www.cbd.int/.
- Nature Conservation Council NSW. Nature Conservation Council of NSW Urban Bushland Policy 2002.
- Condon, P.M., Design charrettes for sustainable communities. 2008, Washington, DC: Island Press.
- Nicholls, A.O. and C.R. Margules. The design of studies to demonstrate the biological importance of corridors. in Nature conservation – the role of corridors. 1991. Surrey Beatty & Sons.
- Dendy, T. The value of corridors (and design features of same) and small patches of habitat. in Nature conservation: the role of remnants of native vegetation. 1987. Chipping Norton, NSW: Surrey Beatty.
- Saunders, D.A., R.J. Hobbs, and C.R. Margules, Biological consequences of ecosystem fragmentation: a revew. Conservation Biology, 1991. 5(1): p. 18–32.
- Benedict, M.A. and E. McMahon, Green infrastructure: linking landscapes and communities. 2006, Washington, DC: Island Press.
- Government Architect New South Wales, *Draft Greener Places Design Guide*, Government Architect New South Wales, Editor. June, 2020: Sydney.
- Greater Sydney Commission, Our Greater Sydney 2056 North District Plan - connecting communities, State of NSW through the Greater Sydney Commission, Editor. 2018: Sydney.
- Hornsby Shire Council, Your Vision
 Your Future: Hornsby Shire Community
 Strategic Plan 2018-2028, 2018.
- 11. New South Wales Government, Environmental Planning and Assessment Act 1979 No 203.
- Steffen, W., Australia's biodiversity
 and climate change, ed. CSIRO. 2009,
 Collingwood, Victoria: CSIRO Publishing.
- Chapman, A.D. and Australian Biological Resources Study Australia, Numbers of living species in Australia and the world.
 2009, Department of the Environment, Water, Heritage and the Arts: Canberra.
- 14. Howell, J., Bushland in the Hornsby Shire and its significance. 2000, Homsby Shire Council: Royal Botanical Gardens. A brief summary prepared for Hornsby Shire's Rural Lands Incentive Program.
- Government of New South Wales, NSW State of the Environment. 2019: Sydney.
- Smith, P. and J. Smith, Hornsby Shire Bushland Survey. Report prepared for Hornsby Shire Council. P&J Smith Ecological Consultants, Blaxland. 1990.

- Tuft R, et al., Aquatic Bioindicator Survey for Hornsby Shire Council. 2000, Robyn Tuft & Associates, WS Rooney & Associates, Woodlots & Wetlands, Canonical Solutions, UBMC and The Australian Museum, Sydney.
- Smith, P. and J. Smith, Native Vegetation Communities of Hornsby Shire 2008 Update. 2008, P & J Smith Ecological Consultants: Blaxland.
- New South Wales Government, Biodiversity Conservation Act 2016 No 63. 2016.
- Ecological Australia, Hornsby Vegetation Map Update 2017 Prepared for Hornsby Shire Council. 2017.
- NSW Office of Environment and Heritage. Threatened Species found in Pittwater IBRA sub-region, 2019
- Hornsby Shire Council, Biodiversity
 Conservation Strategy. 2006: Hornsby.
- WJ Jackson, et al., Australia State of the Environment 2016. 2016.
- Office of Environment and Heritage, Saving our Species Key Threatening Processes Strategy. 2017 State of NSW and Office of Environment and Heritage, 2017
- Department of Environment Climate Change and Water NSW, Climate change how will it affect NSW, 2009.
- Office of Environment and Heritage, Key threatening processes. 2019, NSW Government: Sydney.
- Australian Bureau of Statistics. Population projections, Australia, 2012 (base) to 2101.
- 28. NSW Department of Planning,

 Metropolitan Plan for Sydney 2036, 2010
- Metropolitan Plan for Sydney 2036. 2010.

 National Resource Management
- Ministerial Council (Australia) and
 National Resource System Task Group
 (Australia), Australia's Biodiversity
 Conservation Strategy 2010-2030.
 2010, Canberra: Australian Government,
 Department of Sustainability,
 Environment, Water, Population and
 Communities.
- Commonwealth of Australia, Environment Protection and Biodiversity Conservation Act 1999, in C2014C00140. 1999, ComLaw.
- Australian Government. About the Environment Protection and Biodiversity Conservation Act. 2019
- New South Wales Government, Threatened Species Conservation Act. 1905
- Greater Sydney Commission, Greater Sydney Regional Plan: A Metropolis of Three Cities. 2018.
- 34. Government Architect NSW, Greener

189

ATTACHMENT 2 - ITEM :

Hornsby Biodiversity Conservation Strategy 2020

- Places Discussion Draft. 2017.

 Tyrrell Studio, North District. Sydney
 Green Grid spatial framework and project
 opportunities, Department of Planning and
 Environment in association with the Office
 of the Government Architect, Editor. 2017.
 Sydney.
- Government of NSW, Biosecurity Act, in No 24, Contents and Page, Editors. 2015.
- Government of New South Wales, Saving our Species: Threatened ecological communities strategy, O.o.E.a. Heritage, Editor. 2017, 978 1 76039 893 4: Sydney.
- New South Wales Government and Office of Environment and Heritage, Biodiversity Conservation Investment Strategy, Office of Environment and Heritage, Editor. 2018: Sydney.
- Government of New South Wales, Hornsby Local Environmental Plan 2013
 - NSW Legislation, in 2013-569, Hornsby Shire Council, Editor. 2013: Sydney.
- Hornsby Shire Council, Hornsby Development Control Plan. 2013.
- Hornsby Shire Council Environment & Human Services Division, Green Offsets (Proposed), H.S. Council, Editor. 2018.
- Hornsby Shire Council Environment & Human Services Division, Green Offsets Code, H.S. Council, Editor. 2015.
- Oxford Dictionaries. Definition of infrastructure in English: infrastructure. 2012.
- Davies, C., McGloin, C., MacFarlane, R.
 & Roe, M. Green infrastructure planning guide project: final report. 2006, North East Community Forests: Annfield Plain.
- Hung, Y.-Y. and G. Aquino, eds.
 Landscape infrastructure: case studies by SWA second and revised edition. ed. SWA. 2013. Birkhauser: Basel.
- Ahern, J., Green infrastructure for cities: the spatial dimension, in Cities of the future towards integrated sustainable water and landscape management, Vladimir Novotny and Paul Brown, Editor. 2007, IWA Publishing: London, UK.
- Allen, W.L., III, Environmental reviews and case studies: advancing green infrastructure at all scales: from landscape to site. Environmental Practice, 2012.
 14(1): p. 17–25.
- Fabos, J.G. and J. Ahern, Greenways: the beginning of an international movement.
 1995, Amsterdam; New York: Elsevier.
- Mell, I.C. Green infrastructure concepts and planning. FORUM E Journal, 2008.
- Wright, H., Understanding green infrastructure: the development of a contested concept in England. Local Environment, 2011. 16(10): p. 1003–1019.

- Australian Institute of Landscape
 Architects. Green infrastructure position statement. 2019
- Infrastructure Australia, Future Cities: Planning for our growing population. 2018.
- Beck, A., et al., 15 Year infrastructure plan for Australia submission by Australian Institute of Landscape Architects. 2015.
- Faulding, M., et al., Fauna corridors and vegetation links in the Hornsby Shire. Report by Land and Environment Planning for Hornsby Shire Council. 1994: Sydney.
- 55. European Commission and Directorate-General of the Environment. *Green* Infrastructure. 2010
- United Nations. Tenth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 10): meeting documents. 2010
- Australian Government Department of the Environment, Australia's Fifth National Report to the Convention on Biological Diversity, Department of the Environment, Editor. 2014: Canberra.
- Tóth, A., D. Halajová, and P. Halaj, Green infrastructure: a strategic tool for climate change mitigation in urban environments. Journal of International Scientific Publications, 2015. 9: p. 132–138.
- Matthews, T., A.Y. Lo, and J.A. Byrne, Reconceptualizing green infrastructure for climate change adaptation: barriers to adoption and drivers for uptake by spatial planners. Landscape and Urban Planning, 2015. 138: p. 155–163.
- McPhearson, T., et al., Resilience of and through urban ecosystem services.
 Ecosystem Services, 2015. 12: p. 152-156.
- Meerow, S. and J.P. Newell, Spatial planning for multifunctional green infrastructure: Growing resilience in Detroit. Landscape and Urban Planning, 2017. 159: p. 62-75.
- Tzoulas, K., et al., Promoting ecosystem and human health in urban areas using green infrastructure: a literature review. Landscape and Urban Planning, 2007. 81(3): p. 167–178.
- Kilbane, S., Green infrastructure: planning a national green network for Australia. Journal of Landscape Architecture, 2013. 8(1): p. 64–73.
- Hansen, R. and S. Pauleit, From Multifunctionality to Multiple Ecosystem Services? A Conceptual Framework for Multifunctionality in Green Infrastructure Planning for Urban Areas. AMBIO, 2014. 43(4): p. 516-529.
- Forman, R.T.T. and M. Godron, Landscape ecology. 1986, New York: Wiley.

Hornsby Biodiversity Conservation Strategy 2020

190

- Forman, R.T.T. Landscape corridors: from theoretical foundations to public policy. in Nature conservation 2 – the role of corridors. 1991.
- Forman, R.T.T., Land mosaics: the ecology of landscapes and regions. 1995, New York: Cambridge University Press. 632.
- Murphy, H.T. and J. Lovett-Doust, Context and connectivity in plant metapopulations and landscape mosaics: does the matrix matter? Oikos, 2004. 105(1): p. 3–14.
- 69. Dramstad, W.E., Olson, James D., and R.T.T. Forman, Landscape ecology principles in landscape architecture and land-use planning. 1996, Washington, DC: Harvard University Graduate School of Design, Island Press, American Society of Landscape Architects.
- Rowe, P.G., A priori knowledge and heuristic reasoning in architectural design. Journal of Architectural Education, 1982.
 36(1): p. 18–23.
- MacArthur, R.H. and E.O. Wilson, The theory of island biogeography. 1967, Princeton, NJ: Princeton University Press.
- Diamond, J.M., The island dilemma: lessons of modern biogeographic studies for the design of natural reserves. Biological Conservation, 1975. 7(2): p. 129–146.
- Simberloff, D., Refuge design and island biogeographic theory: effects of fragmentation. American Naturalist, 1982.
 120(1): p. 41–50.
- Boitani, L., et al., Ecological networks as conceptual frameworks or operational tools in conservation. Conservation Biology, 2007. 21(6): p. 1414–1422.
- Simberloff, D. and J. Cox, Consequences and costs of conservation corridors. Conservation Biology, 1987. 1(1): p. 63–71.
- Soulé, M.E. and M.E. Gilpin, The theory of wildlife corridor capability, in Nature conservation 2: the role of corridors, D. Saunders, Editor. 1991, Surrey Beatty & Sons: Chipping Norton, NSW. p. 3–8, 442.
- Hobbs, R.J., The role of corridors in conservation: solution or bandwagon?
 Trends in Ecology & Evolution, 1992.
 7(11): p. 389–392.
- Ignatieva, M., G.H. Stewart, and C. Meurk, Planning and design of ecological networks in urban areas. Landscape and Ecological Engineering, 2011. 7(1): p. 17-25.
- Noss, R.F., Corridors in real landscapes: a reply to Simberloff and Cox. Conservation Biology, 1987. 1(2): p. 159–164.
- Beier, P., D.R. Majka, and W.D. Spencer, Forks in the road: choices in procedures

- for designing wildland linkages.
 Conservation Biology, 2008. **22**(4): p. 836–851.
- 81. Del Marco, A., Local government biodiversity planning guidelines for the Perth Metropolitan Region. 2004, Western Australian Local Government Association: West Perth. W.A.
- Harrison, R.L., Toward a theory of interrefuge corridor design. Conservation Biology, 1992. 6(2): p. 293–295.
- Heller, N.E. and E.S. Zavaleta, Biodiversity management in the face of climate change: a review of 22 years of recommendations. Biological Conservation, 2009. 142(1): p. 14–32.
- Mech, S.G. and J.G. Hallett, Evaluating the effectiveness of corridors: a genetic approach. Conservation Biology, 2001. 15(2): p. 467–474.
- Wickham, J.D., et al., A national assessment of green infrastructure and change for the conterminous United States using morphological image processing. Landscape and Urban Planning, 2010. 94(3-4): p. 186-195.
- 86. Robichaud, I., M.-A. Villard, and C. Machtans, Effects of forest regeneration on songbird movements in a managed forest landscape of Alberta, Canada. Landscape Ecology, 2002. 17(3): p. 247–262.
- Tewksbury, J.J., et al., Corridors affect plants, animals, and their interactions in fragmented landscapes. Proceedings of the National Academy of Sciences of the United States of America, 2002. 99(20): p. 12923–12926.
- Weber, T., A. Sloan, and J. Wolf, Maryland's green infrastructure assessment: development of a comprehensive approach to land conservation. Landscape and Urban Planning, 2006. 77(1–2): p. 94–110.
- Pungetti, G. and R.H. Jongman, Ecological networks and greenways: concept, design implementation.
 Cambridge studies in landscape ecology, ed. G. Pungetti and R.H. Jongman. 2004, New York: Cambridge University Press.
- Baguette, M. and H. Van Dyk, Landscape connectivity and animal behavior: functional grain as a key determinant for dispersal. Landscape Ecology, 2007.
 22(8): p. 1117–1129.
- Mackey, B., et al., Connectivity conservation and the Great Eastern Ranges corridor. 2010, Sydney, NSW: DECCW
- 92. Crooks, K.R. and M.A. Sanjayan,

 Connectivity conservation. 2006,
 Cambridge: Cambridge University Press.
- 93. New South Wales Government. Great

191

Hornsby Biodiversity Conservation Strategy 2020

Tasmania. Australian Mammalogy, 2018	3.
AM18012	

- Wildlife Safety Solutions. Roadkill Mitigation. 2019 13 May 2019]; Available from: www.wildlifesafetysolutions.com.
 - 110. Zoë Magnus, L.K.K., Nicholas J. Mooney & Menna E. Jones, Reducing the incidence of wildlife roadkill: improving the visitor experience in Tasmania. 2004: CRC Sustainable Tourism.
 - 111. ABC News. Alarm system to reduce tasmanian devil roadkill shows promise.
 2015 8th May 2019]; Available from:
 www.abc.net.au/news/2015-12-09/
 alarm-system-to-reduce-tasmanian-devilroadkill-shows-promise/7013558
 - Weston, N.G., Miriam & Marsh, Helene & Cohen, Martin & Wilson, Robyn, Using canopy bridges to link habitat for arboreal mammals: Successful trials in the Wet Tropics of Queensland. Australian Mammalogy, 2011 33. 93-105. 10.1071/AMI1003.
 - City of Toronto, Bird Friendly Development Guidelines. 2007.
 - 114. Community Environment Network.

 Projects. 2019 [cited 2019 13/05/19];

 Available from: https://www.cen.org.au/projects
 - NSW National Parks and Wildlife Service, *Urban Wildlife Renewal: Growing* Conservation in Urban Communities, W. Research, Editor. 2002.
 - 116. Office of Environment and Heritage.

 Green Globe Awards. 2019; Available
 from: https://www.environment.nsw.
 gov.au/funding-and-support/awards-and-recognition/green-globe-awards
 - Department of Planning Lands and Heritage. Bush forever. 2019
 - City of Swan. Cats. 2019 1st June 2019];
 Available from: https://www.swan.wa.gov.au/Services-support/Animals/Cats
 - 119. Department of Local Government
 Sport and Cultural Industries. *Dogs and cats*. 2019–13th May 2019]; Available
 from: https://www.dlgsc.wa.gov.au/localgovernment/forcommunity/Pages/Dogs-and-Cats.aspx.
 - 120. NSW Government, Environment
 Protection and Biodiversity Conservation
 Act 1999 (EPBC Act) Approved
 Conservation Advice (including listing
 advice) for Shale Sandstone Transition
 Forest of the Sydney Basin Bioregion
 (EC25R). 2014.
 - 121. Office of Environment and Heritage.

 Threatened biodiversity profile search.
 2019 1st May 2019]; Available from:

 https://www.environment.nsw.gov.au/threatenedSpeciesApp/.

- Eastern Ranges Initiative a continental scale lifeline to engage people with nature. 2010
- Office of the Government Architect NSW. Sydney Green Grid. 2013
- West Australian Local Government Authority, Perth Biodiversity Project, WALGA, Editor. 2009: Perth.
- Little, C.E., Greenways for America.
 John Hopkins Paperbacks ed. ed. 1995,
 Baltimore: Johns Hopkins University
 Press.
- Russell, T.C., et al., The incidence of road-killed possums in the Ku-ring-gai area of Sydney. Australian Journal of Zoology, 2013. 61(1): p. 87-94.
- Chetkiewicz, C.-L., C. St Clair, and M. Boyce, Corridors for conservation: integrating pattern and process. Annual Review of Ecology, Evolution, and Systematics, 2006. 37(1): p. 317–342.
- Goodwin, B.J., Is landscape connectivity a dependent or independent variable? Landscape Ecology, 2003. 18(7): p. 687–699.
- Jongman, R., et al., The Pan European Ecological Network: PEEN. Landscape Ecology, 2011. 26(3): p. 311–326.
- 101. Kilbane, S., R. Weller, and R. Hobbs, Beyond ecological modelling: groundtruthing connectivity conservation networks through a design charrette in Western Australia. Landscape and Urban Planning, 2017
- 102. Johnson, E. and M.W. Klemens, eds. Nature in fragments: the legacy of sprawl. Ecology, ed. E. Farnsworth. 2005, Columbia University Press: New York.
- 103. Calabrese, J.M. and W.F. Fagan, A comparison-shopper's guide to connectivity metrics. Frontiers in Ecology and the Environment, 2004. 2(10): p. 529-536
- Diamond, J.M., Collapse: how societies choose to fail or succeed. 2005, New York: Viking
- Doerr, V., et al., Designing landscapes for biodiversity under climate change. 2013, National Climate Change Adaptation Research Facility (NCCARF): Gold Coast. p. 260.
- 106. Department of Environment and Conservation (NSW), Environmental Management on the Urban Fringe:
 Economic incentives for environmental management. 2004.
- Orr, D.W., Ecological literacy: education and the transition to a postmodern world.
 1992, Albany: State University of New York Press.
- 108. Fox, S., et al., Roadkill mitigation: trialing virtual fence devices on the west coast of

Hornsby Biodiversity Conservation Strategy 2020

192

- 122. Government of Australia. EPBC Listed
 Key Threatening Processes. 2019 6th
 March 2019]; Available from: https://
 www.environment.gov.au/biodiversity/
 threatened/key-threatening-processes
- 123. Government of New South Wales, State Environmental Planning Policy No 19— Bushland in Urban Areas, in 1986-014. 2018, NSW Parliamentary Counsel's Office.
- Government of New South Wales,
 State Environmental Planning Policy
 (Vegetation in Non Rural Areas), in 2017-454. 2018.
- Government of New South Wales, State Environmental Planning Policy (Exempt and Complying Development Codes), in 2008-572, 2019.
- 126. Government of New South Wales,

 State Environmental Planning Policy
 (Infrastructure), in 2007-641. 2018, NSW
 Parliamentary Counsel's Office.
- 127. NSW Department of Planning, Industry and Environment, NSW Threatened Species Scientific Committee final determination, Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion critically endangered ecological community listing, 2019
- Office of Environment and Heritage NSW, New South Wales Climate change snapshot, 31 May 2019. ISSN 1837-5650
- NSW Rural Fire Service, Bush Fire Environmental Assessment Code 2006

Hornsby Biodiversity Conservation Strategy 2020

193

Photography and figures used in this report

All photographic images of animals and plants are attributed to Alan Kwok (2019) unless noted; all figures in the report were developed by Rhizome unless noted:

- (1) Rhizome
- (2) https://upload.wikimedia.org/wikipedia/commons/0/02/Waratah %28339570006%29.jpg accessed 01 May 2019
- (3) https://www.flickr.com/photos/arthur_chapman/7916648670/ accessed 09 May 2019 (4) https://www.flickr.com/photos/macleaygrassman/29550673168 accessed 07 April 2019
- (5) www.westernsydneyparklands.com.au/ assets/ resampled/resizedimage600400-P-Hwest.jpg accessed 01 Jan 2017
- (6 https://worldlandscapearchitect.com/hntbmvva-win-arc-wildlife-crossing-competition/#. XPSGOC9L3UI accessed 01 May 2019
- (7) http://www.environment.nsw.gov.au/ger/ partners.htm accessed 09 May 2017
- (8) https://www.greater.sydney/file/ northfigure21png accessed 09 May 2019
- (9) West Australian Local Government Authority (Cartographer). (2009). Perth Biodiversity Project
- (10) https://sportifycities.com/ singapore-parkconnectors/ accessed 01 May 2019
- (11) https://www.greenway.org.au/about/greenway-map_accessed 07 April 2019
- (12) https://www.bing.com/images/
- (13) Weston, N. G., Miriam & Marsh, Helene & Cohen, Martin & Wilson, Robyn. (2011). Using canopy bridges to link habitat for arboreal mammals: Successful trials in the Wet Tropics of Queensland. *Australian Mammalogy*, 33. 93-105. 10.1071/AM11003.
- (14) https://twistedsifter.com/2012/07/animalbridges-around-the-world/ accessed 09 April 2019
- (15) Banff National Park https://commons.wikimedia.org/ accessed 07 April 2019

- (16) Christmas island crab- https://www.gizmodo.com.au/2014/03/these-incredible-man-made-highways-are-built-just-for-animals/
 (17) https://www.pinterest.com.au/pin/16607092346058028/accessed 30 April 2019
- (18) https://architectureau.com/articles/nataliejeremijenko/ accessed 30 April 2019 (19) https://www.abc.net.au/news/2015-12-09/ alarm-system-to-reduce-tasmanian-devilroadkill-shows-promise/7013558. (20) https://www.tranbc.ca/2015/08/19/whywe-use-wildlife-overpasses-on-bc-highways/ 5th May 2019
- (21) https://natureconservation.pensoft.net/ article/4385/ accessed 30 April 2019 (22) https://www.cen.org.au/projects accessed 13 May 2019
- (23) https://www.environment.nsw.gov.au/ funding-and-support/awards-and-recognition/ green-globe-awards_accessed 13 May

All mapping data was sourced from Hornsby Shire Council (2019), except for: Fig. 5 (GeoScience Australia) and Fig. 13 (Commonwealth of Australia's CAPAD database)

> Back cover image: Blue Toungue Lizard Tiliqua scincoides Alan Kwok (2019)

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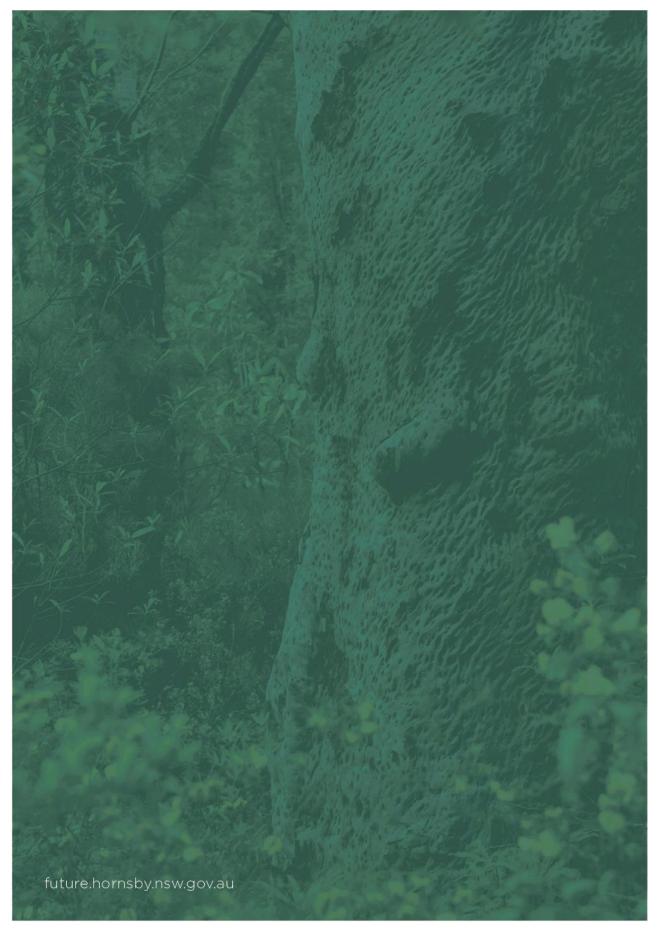
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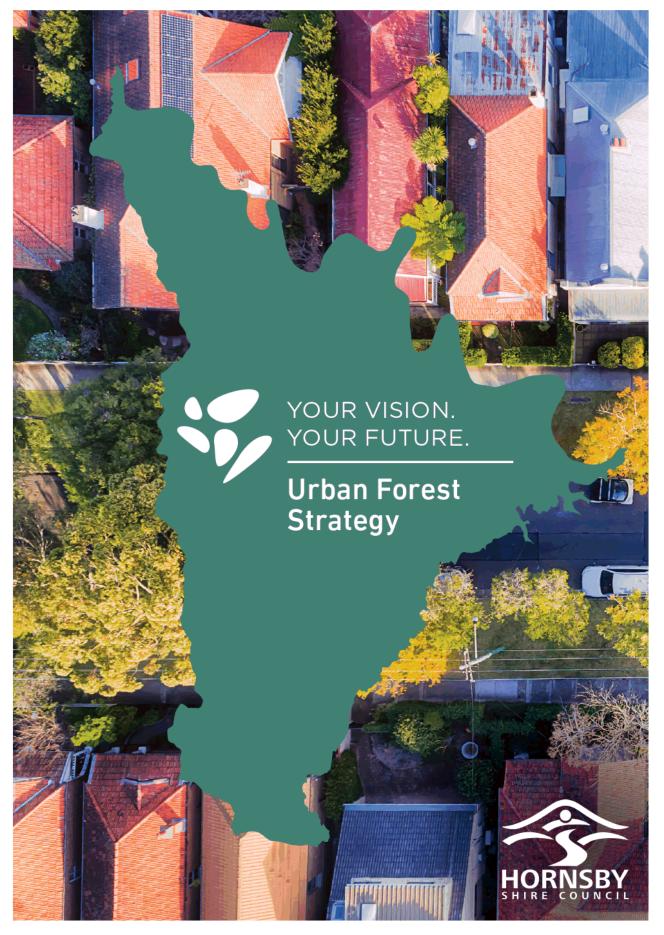
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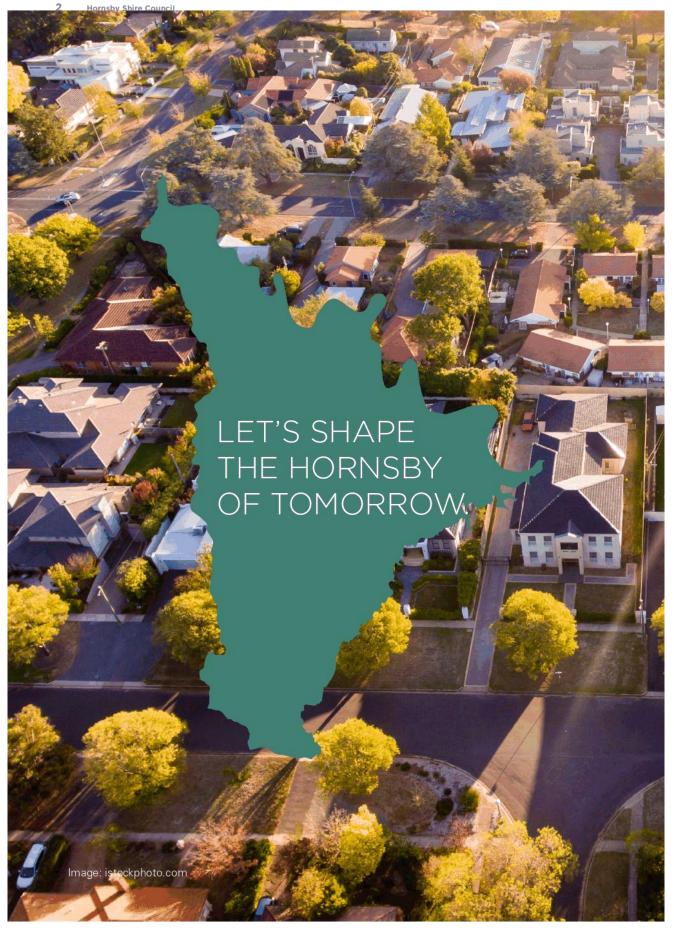
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Urban Forest Strategy

Prepared For: Consultant Urban Forest Consulting ABN 24 514 864 213 Subconsultants Macquarie University lan Shears Consultant Dr Joe Hurley Environment & Land Management Pty Ltd (ES) Disclaimer The information contained in this document has been carefully compiled by Urban Forest Consulting who takes no responsibility for any loss or liability of any kind suffered by any party, not being the intended recipient of this document, in reliance upon its contents whether arising from any error or inaccuracy in the information or any default, negligence or lack of care in relation to the preparation of the information in this document.

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Council recognises the Traditional Owners of the lands of Hornsby Shire, the Darug and Guringai peoples, and pays respect to their Ancestors and Elders past and present and to their Heritage. We acknowledge and uphold their intrinsic connections and continuing relationships to Country.

1. Executive summary

Hornsby Shire Council's urban forest is one of the core components of the Shire's green infrastructure network. The urban forest, which are the trees within Hornsby's urban areas and on rural lands, contributes significantly to the liveability, environment and prosperity of the Shire. These trees provide a myriad of benefits from shading, carbon storage, air pollution reduction, stormwater interception, habitat and food for wildlife as well contributing to the landscape character that the community value so highly.

The urban forest is facing a number of challenges including urban densification, a changing climate, urban heat and canopy loss. It is estimated that each year Hornsby is losing between 2 – 3 percent or approximately 12 – 15,000 trees of its tree canopy cover primarily on private land (Smith et al, 2017). This places increased pressure on the smaller area of public land to protect, grow and enhance the urban forest.

A changing climate also poses a number of threats for the urban forest making it vulnerable. Such challenges require a new approach in how the forest is managed, how it interconnects with Sydney's Green Grid aspirations and Hornsby's biodiversity framework so that future vulnerability can be minimised, and benefits maximised. The proposed framework for Hornsby's future urban forest is:

Vision

Homsby Shire Council will have a healthy, thriving, diverse and valued urban forest that provides shade, cooling and adds colour and life to the Shire.

Objectives

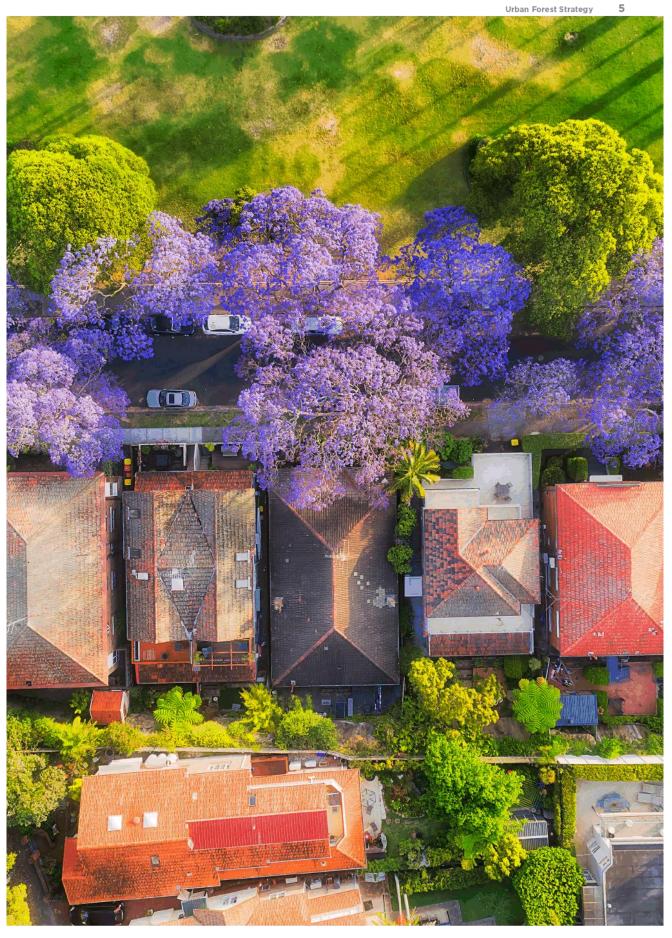
In order to build a thriving, healthy and diverse urban forest the key objectives are to:

- Maintain and improve Hornsby Shire's unique character
- Increase community knowledge and connection with the urban forest
- Mitigate and adapt to climate change
- Protect, secure and create habitat
- Showcase integrated and sustainable design
- Provide strong leadership and good asset management

Targets

- The targets proposed to achieve these objectives are:
- Maintain canopy cover on private land at 33 percent
- Increase canopy cover over streets from 39 percent to 50 percent
- Increase canopy cover over commercial zones from 11 percent to 15 percent
- Increase biodiversity corridors in streetscapes
- Improve species diversity
- Improve useful life expectancies of street trees.

Meeting these targets will provide many benefits. Most importantly they will ensure that we will adapt our urban forest for predicted climate change, manage the health of our trees and provide the community with the benefits of public health and wellbeing for the environment.



2. Introduction

In 40 years' time the character of the Hornsby Shire will be significantly different and reflect a landscape typical of an inner-city local government area.

,,

Hornsby's trees make one of the most important contributions to the landscape character and attractiveness of the region highlighting why Hornsby Shire, the Bushland Shire, is seen as a sanctuary away from inner city Sydney. But these trees do much more for the liveability, health and wellbeing of our community than many realise. They provide many environmental, economic and social benefits. For these reasons, Hornsby Shire Council has set a clear mandate to not only protect but increase its tree canopy cover. This mandate will help Council better plan and manage trees throughout its urban and rural environments.

Homsby Shire Council is currently developing a range of policies, plans and strategies to inform the future of the Shire. This Urban Forest Strategy, which is the first of its kind for Council, provides guidance on the future care and management of Hornsby's urban forest. The outcomes of this Strategy are designed to integrate with other local and regional management priorities such as biodiversity, water, climate change, active living, public domain planning and community health.

Through their canopies, trees cover almost 59 percent of the entire local government area, which is one of the highest canopy cover percent ages within Greater Sydney. Canopy cover over Hornsby's urban area, excluding National Parks and rural lands, is 39 percent. Benchmarked against the average local government canopy cover across Sydney of 26 percent (Amati, et al, 2016), Hornsby's canopy cover is high and only just short of Greater Sydney Commission's target of 40 percent. Hornsby Shire Council's urban forest is one of the biggest contributors of tree canopy to the Greater Sydney Region, making it a valuable asset for all of Sydney.

ATTACHMENT 3 - ITEM 1

However, despite this important contribution, it is estimated that the urban area of Hornsby Shire is losing between 2-3 percent of its tree canopy cover, or 12-15,000 trees, every year (Smith et al, 2017). If this trajectory continues and the urban forest is not properly managed, in 40 years' time the character of the Hornsby Shire will be significantly different and reflect a landscape typical of an inner-city local government area. Residential zoned land contributes almost half of all urban tree canopy cover and it is this zoned land that is experiencing the bulk of tree loss. Protecting trees and regulating their renewal on private land is not a simple task nor is it one that Hornsby Shire faces alone. Canopy loss in the private realm is being experienced across many parts of Sydney and other major global cities. While development related canopy loss continues, there are no single or clear solutions on how to stop the loss. For this reason, this strategy recommends multiple approaches.

Beyond the private realm, the public trees across
Hornsby Shire's streets and parks will also require a
stronger best practice management approach. A history
of reactive works and battles against the impacts of
development, infrastructure, utilities and community
perceptions means there is significant opportunity for an
improved, robust and evidence based public tree
management program.

Despite these issues, there is significant opportunity for Hornsby Shire to take a clear leadership role in the management of its urban forest and empower all landholders to consider their influence on one of Hornsby's greatest assets. The Greening Our Shire program is a step in the right direction and this Urban Forest Strategy will provide the much-needed legacy for transitioning this program into an ongoing best practice urban forest program for the Shire

Councils Community Strategic Plan supports this by aiming to ensure that the natural environment is well cared for and protected. As a result, Council has committed to valuing green and open spaces.



Figure 1: Hornsby shire has a high canopy cover across the Municipality

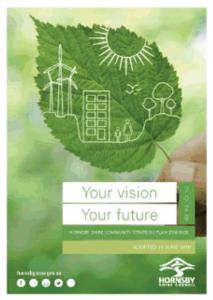


Image 2: Hornsby Community Strategic Plan aims to ensure that the natural environment is well cared for

3 What is Hornsby's Urban Forest

Definition

Tree

A tree is defined as a long lived woody perennial plant with one or relatively few main stems with the potential to grow to a height greater than 3 metres (Hornsby Development Control Plan 2019).

Urban Forest

Hornsby's urban forest is the sum of all vegetation, the soil and water that support it across the Shire, excluding National Parks and bushland reserves. It is one of the core components of Hornsby's green infrastructure network.

It is made up of trees and other vegetation in urban streets, parks, in resident's back and front yards, on commercial and industrial land, within the rural villages dotted throughout the rural living zone, on rural land, along rural roads and river communities. It is estimated that there are 30,000 street trees across Hornsby (excluding rural roads) and about 50-60,000 park trees. The number of trees in bushland reserves and on privately owned land is unknown. It is further estimated that there are 30,000 vacant street tree sites across urban Hornsby Shire which could be planted with street trees.

While the urban forest is the sum of all vegetation it is the trees that are the most dominant element. They are the most iconic and provide the greatest community, environmental and economic benefits. As such, this strategy focuses on their protection, management and expansion.

Rural Lands

While the definition of Urban Forest focuses on the urban area, Hornsby's unique landscape includes valuable rural areas. Trees on private rural land are important connectors between National Parks and urban areas. As such, this Strategy includes all trees on rural lands as well.

National Parks and Bushland Reserves

Whilst the National Parks and bushland reserves are not considered to be part of the urban forest, our urban trees are important connectors, buffers and protectors of the vegetation within these important areas as demonstrated in Council's Biodiversity Conservation Management Plan, 2019. The Bushland Shire title, as Homsby Shire is commonly known, stems from the relationship that Hornsby's urban forest has with its National Parks, bushland reserves and waterways.

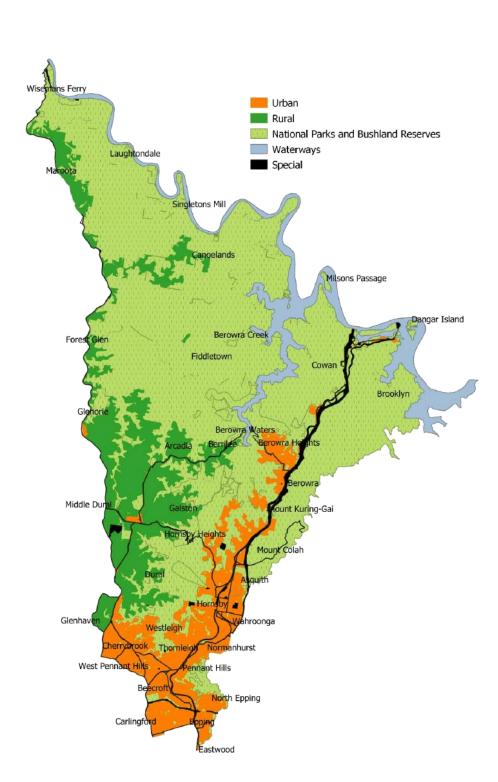


Figure 3: Boundaries between urban, rural and national park/bushland reserve for Hornsby Shire

Benefits of Urban Forests

Hornsby Shire's urban forest is a vitally important part of the urban and rural landscape for a range of reasons that benefit the community, the environment and also the economy.

Community Benefits

- Urban trees can make you feel 7 years younger and \$10,000 richer (Karden, et al 2015)
- Access to urban trees for play, improves childhood development and resilience (Gull et al, 2018)
- Reduces UV exposure through shading (Heisler, 2000)
- Leafy streets encourage people to walk and cycle more, improving physical health (Giles Corti, 2005)
- Green landscapes improve mental wellbeing, reduce stress and can aid in the recovery from depression (Mullaney et al, 2015)
- The urban forest allows people to connect more with nature and build social cohesion (Godfrey-Faucett, 2016)
- Reduction in a variety of health issues, such as respiratory diseases (including asthma) and skin cancer (Lovasi, et al 2008)
- Reduced crime rates, fewer acts of domestic violence and aggression (Kuo, et al 2001)
- Reduced air temperatures, lower surface temperatures (Norton et al, 2013)
- Better air quality (Nowak et al, 2008)
- Less motor vehicle accidents due to reduced speeds along avenues and boulevards (Harthoorn, 2018) (Naderi et al, 2008).

Environmental Benefits

- Trees reduce air pollution one large tree can absorb up to 60-70 times more air pollution than a smaller tree (Nowak et al, 2008)
- Habitat provision for local wildlife (Mullaney et al, 2015)
- Connectivity and buffer of areas of biodiverse value (Mata et al, 2015)

- Improves soil health (Mullaney et al, 2015)
- Urban trees are one of the most efficient and cost-effective mechanisms for adapting to climate change and mitigating urban heat (Norton et al, 2013)
- Filter stormwater pollution and mitigate storm water runoff (Gill et al, 2007)
- Perceived reduction in noise particularly from traffic (Mullaney et al, 2015)
- Storing and sequestering carbon (Nowak et al, 2008).

Economic Benefits

- Well treed and landscaped retail areas can generate up to 20 percent more productivity – people spend more time, and more money (Wolf, 2005)
- Street trees can add up to 15 percent to residential property values (Plant, 2016) (Pandit, 2013)
- Enhance sense of place, landscape character and city branding (Wolf, 2005)
- Marketing and bolstering city image and profile (Konijnendijk, 2005)
- Shading can reduce need for mechanical cooling in summer (Nowak et al, 2008)
- Increase the number of green jobs for those managing the urban forest
- Tree Shade can prolong the life of hard infrastructure from UV exposure damage (Mullaney et al, 2015).

Strategic Context

The management of the urban forest is nested within Council's existing programs and priorities. Figures 4 and 5, show how and where the urban forest is identified within both State and Council planning documents.

This Urban Forest Strategy aims to provide a clear line of sight between Council's urban forest vision objectives and the State planning framework.

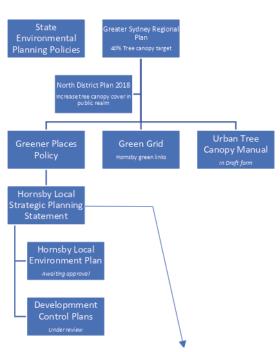


Figure 4: Strategic planning hierarchy in NSW and the connection to the protection and management of urban trees

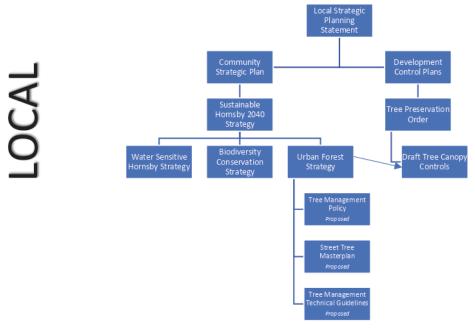


Figure 5: The integration of plans, policies and controls to protect and manage Hornsby Council's urban canopy



The Hornsby Shire was originally occupied by the Aboriginal people of the Darug, Gu-ring-gai and Darkingung language groups.

History of Hornsby's Forests

Landscape

Hornsby's natural backdrop is an ancient landscape with great variety in landforms and vegetation. The Shire consists of gorges, floodplains, estuaries, stepped hill slopes, cliffs and steep hills with narrow ridgetops and broader plateau tops that are interspersed with urban development. These variations in landforms give rise to an incredibly diverse range of vegetation species, including trees.

Much of Hornsby's sandstone landscape still retains its native vegetation due to its unsuitability for large scale development as it is more rugged and infertile as compared to shale. This includes smooth-barked apple *Angophora costata*, red bloodwood *Eucalyptus gummifera*, thin-leaved stringybark *E. eugenioides* and scribbly gum *E. haemastoma*.

In contrast, the more fertile shale soils were extensively cleared by early settlers for animal grazing and food production. These areas provided flatter topography suitable for development which now forms the present-day Hornsby. Interspersed amongst residential housing within our suburbs, patches of remnant vegetation house one of Hornsby's greatest assets, Blue Gum High Forest and Sydney Turpentine Ironbark Forest , with species such as turpentine *Syncarpia glomulifera*. The sheer size of these trees is simply breathtaking, and they remain some of the last reminders of Hornsby's original landscapes.

People

The Hornsby Shire was originally occupied by the Aboriginal people of the Darug, Gu-ring-gai and Darkingung language groups. Many significant artefacts of their culture remain today including engravings on sandstone ridges, cave paintings and scarred trees. Some of these relics date back at least 22,000 years.

In 1788, the first European explorers voyaged up the Hawkesbury River. Many of the initial settlers were farmers and orchardists, followed by timber-getters from 1816. The timber-getters removed the valuable timber which allowed the farmers to cultivate the land (https://www.hornsby.nsw.gov.au/council/about-council/history). The timber-getters, who were mostly convicts, penetrated much of the upper reaches of Hornsby's creeks and rivers in their quest for Sydney Blue Gums and Blackbutts. Local builders also used the resources of the area to supply cut stone and Sheoak shingles to Sydney builders. Hornsby's substantial timber resources undoubtedly helped generate part of the riches used to expand Sydney.

As early as the 1880's, residents were attracted to the bushland setting of suburbs across Hornsby to benefit from the 'healthy climate'. Early residents aspired to the bush lifestyle of big homes amongst the trees with an easy rail commute to the city. They also benefited from the public open spaces that were set aside for recreational use. This lifestyle has continued well into current times.

As Sydney and the Hornsby Shire grew, hardwood timbers continued to be sought, cut and milled generating significant economic benefits for the local community. However, the depletion of these resources has rendered both the Blue Gum High Forest and the Sydney Turpentine Ironbark Forest critically endangered.

There is approximately 37 hectares of Blue Gum Forest remaining in Hornsby Shire in areas such as Hornsby, Epping, Pennant Hills, Thornleigh and Beecroft. Whilst these forests have been modified, they still provide natural heritage significance as they are remnants of past vegetation.

Around 195 hectares of The Sydney Turpentine Ironbark Forests including Sydney Turpentine, Grey Ironbark and Sydney Redgum remain, mostly within urban, rural and roadside areas. These forests provide habitat for native fauna and importantly, contain genetic material indigenous to the area. They also form nature corridors and urban habitat links and contribute to the landscape character of Hornsby.

These two forest types are now key influencers towards Hornsby's urban character and neighbourhood sense of place. They are interspersed with a diversity of tree species, indigenous, native and exotic which all contribute to the status of the urban forest today and will continue to do so into the future.

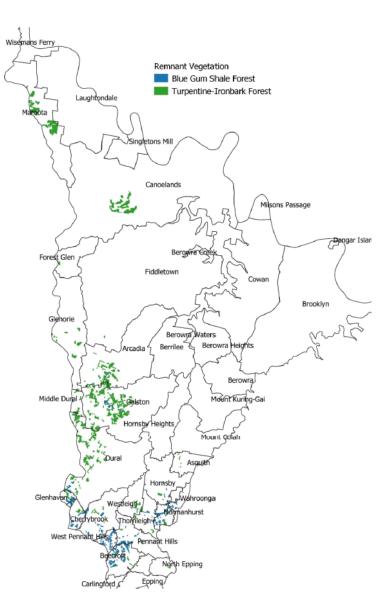


Figure 6: Distribution of Hornsby's remnant forest types, Blue Gum and Turpentine Ironbark

Hornsby's Urban Forest Today

The urban forest can be studied in a number of ways. In order to best manage existing vegetation, and to guide the development of the forest of the future, extensive mapping of various elements of the urban forest has been done. This includes tree canopy cover, ecological connectivity, large and significant trees, diversity and species composition and useful life expectancy of Council owned trees. The mapping provides key indicators to enable benchmarking of the forest, setting future targets and monitoring and evaluation over time.

1. Tree Canopy Cover

Hornsby Shire Council has an enviable level of tree canopy cover that many other local governments can only aspire to. Canopy cover for the whole local government area (LGA) is 59 percent and is distributed unevenly across the LGA (Figure 7). The total canopy cover far exceeds the 40 percent tree canopy target as set by the Sydney Commission and is the third highest canopy cover across Metropolitan Sydney. The Office of Environment and Heritage has invested in high resolution vegetation mapping across Metro Sydney, which allows land managers to measure their tree canopy cover as at 2016 and compare areas across their LGA as well as compare to other LGAs.



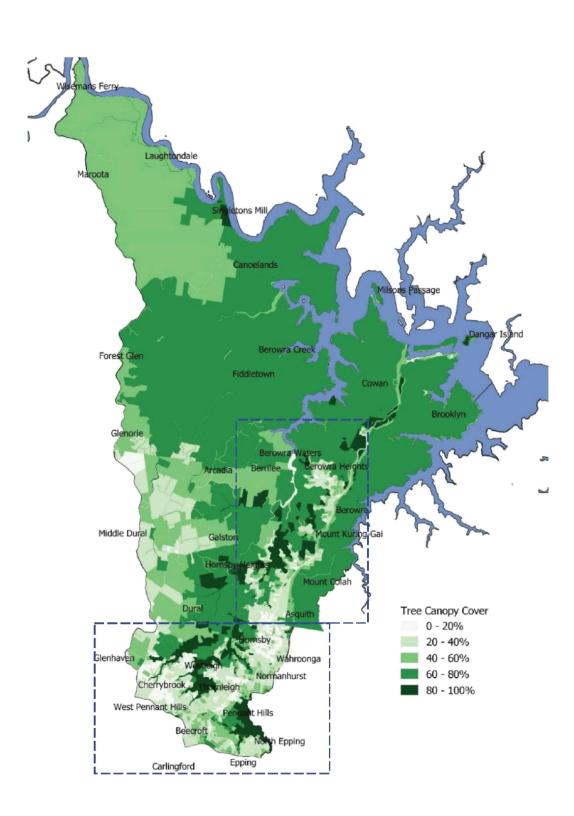


Figure 7: Tree Canopy distribution across the whole shire. Source: OEH, 2019.

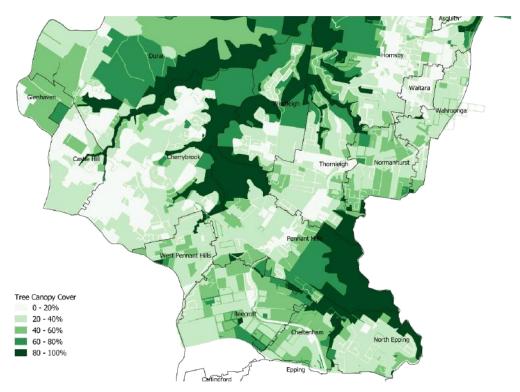


Figure 8: Tree canopy cover for southern section of Hornsby Shire. Source: OEH, 2019

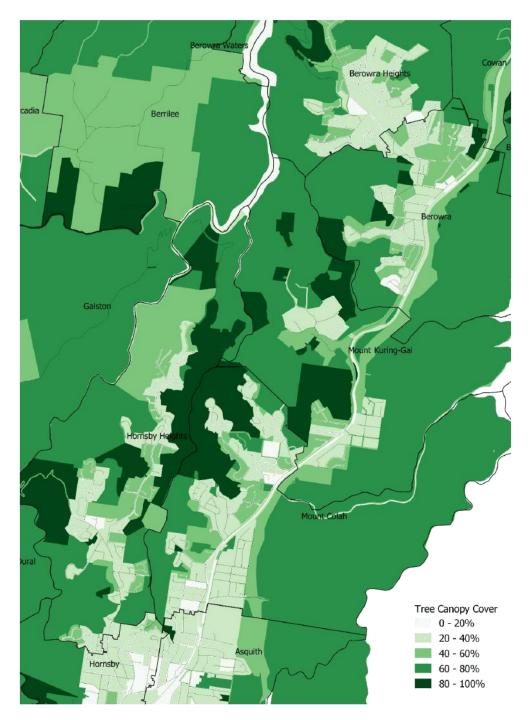


Figure 9: Tree canopy cover for southern section of Hornsby Shire. Source: OEH, 2019

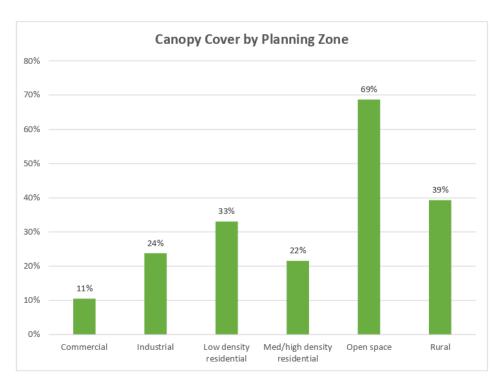


Figure 10: Tree Canopy Cover by Land Use. Source: OEH, 2019

Whilst 59 percent is high, canopy cover varies depending on the type of land in which it sits (Figure 10). Open space which includes National Parks, has 69 percent tree canopy cover. Commercial and industrial zoned land on the other hand, have the lowest with 11 percent and 24 percent respectively. Different residential zones have marked differences within their canopy cover. Rural and low-density residential lands have similar canopy cover (39 percent and 33 percent) while medium-high residential is much lower at only 22 percent. This is to be expected as both medium and high density residential tend to include underground carparks and additional utility services, reducing available planting space for trees.

Tree canopy cover over urban roads sits at 39 percent (Figure 12), again with similar disparities between suburbs as the overall canopy per suburb graph. Waitara, Castle Hill and Cherrybrook have the least amount of tree canopy over their road reserves, highlighting the opportunity for a street tree planting program in these suburbs. Rural roads in comparison maintain almost twice as much canopy cover with an average of 62 percent .

County Drive in Cherrybrook and James Street in Hornsby are examples of road reserves with very low tree canopy.





Image 11: Example of medium and high -density residential areas where tree canopy cover is low. Ref: Parramatta Urban Design Guidelines, 2015

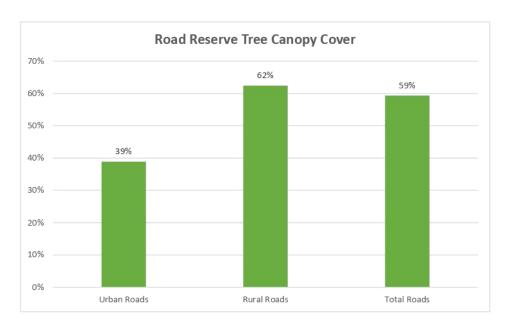


Figure 12: Road Reserve Tree Canopy Cover. Source: OEH, 2019



Image 13: County Drive in Cherrybrook shows very low levels of canopy, this section only 5.9 percent tree canopy cover.



Currently the only canopy on the roadway is provided by an avenue of small growing ornamental pears and Crepe Myrtle.



The image above illustrates greater canopy cover provision arising from the provision of larger growing tree species.

Urban Forest Strategy

ITEM

ATTACHMENT 3 -



Image 14: James Street in Hornsby has only 3.8 percent tree canopy cover over its road reserve. Malton Road Beecroft and Treetops Road in Cherrybrook are examples of good road tree canopy cover



Image 15: Malton Road in Beecroft has optimum tree canopy cover at 51.1 percent.



Image 16: Treetops in Cherrybrook has optimum tree canopy cover at 58.2 percent

Urban Tree Canopy

It is noted that two thirds of the Shire are designated National Park and rural land. This means that the 59 percent figure doesn't represent true canopy cover over the urban area, where people live and work and where tree canopy cover is critical for the benefit of people. When looking at canopy levels by suburb (Figures 17 and 18), there are clear differences that may reflect past or present development patterns and pressures, the character of these areas or values of the residents.

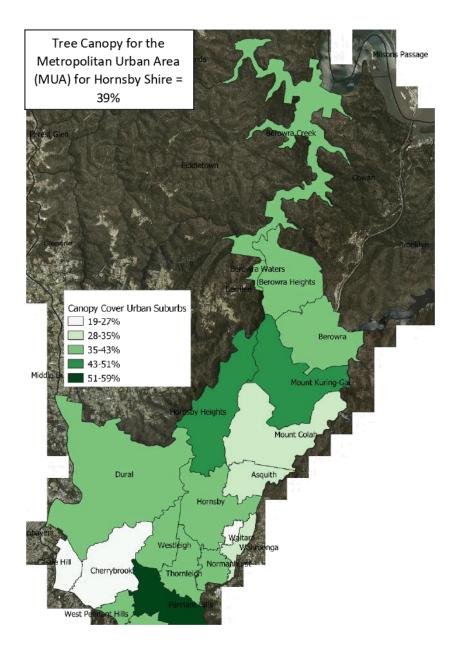


Figure 17: Tree Canopy distribution across the urban area of the Shire. Source: OEH, 2019.

Canopy cover of the designated urban area (defined by The Greater Sydney Commission) is 39 percent . This figure is still quite high when considering canopy levels across other Municipalities where the New South Wales urban average is 26 percent (Amati et al, 2016), highlighted in red in Figure 18 below.

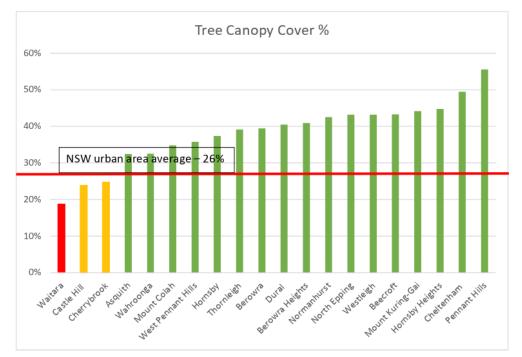


Figure 18: Urban Tree Canopy distribution by suburb in urban areas. Source: OEH, 2019.

The lowest canopy cover is recorded in Waitara (19 percent), Castle Hill (24 percent) and Cherrybrook (25 percent) which all record canopy cover lower than 30 percent .

At the other end of the scale, Normanhurst, Beecroft, Cheltenham and Pennant Hills still have very high tree canopy cover with Pennant Hills recording the highest at 56 percent .

Urban Forest Strategy

Figure 19: Urban Tree Canopy by land use contribution. Source: OEH, 2019.

Figure 19 demonstrates that almost half (48 percent) of Hornsby's urban tree canopy cover sits on residential zoned land, making it the biggest contributor to Hornsby's urban forest. This is not surprising given that 56 percent of Hornsby Shire is zoned residential land. Parkland contributes 34.5 percent of total canopy cover, despite only representing 19 percent of land area. Streets and roads contribute 11.9 percent of total tree canopy and make up 17 percent of Hornsby's land area. This highlights three important factors.

- 1. In terms of impact, the Shire relies heavily on private residential land to provide the overall benefits from the urban forest.
- 2. Parkland already takes more responsibility for providing tree canopy cover than its land area allows for.
- 3. Given that tree canopy cover over both urban/rural roads and parkland is already high, it would be impossible to compensate for the loss of canopy from residential areas within public areas alone.

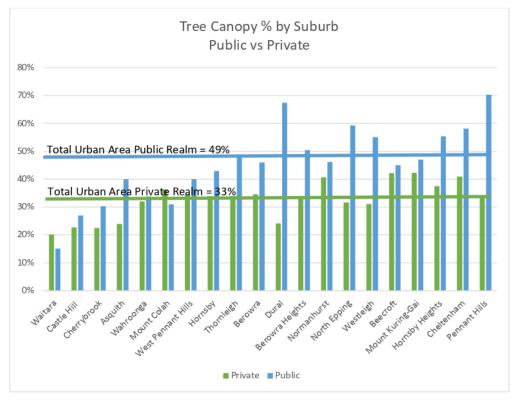
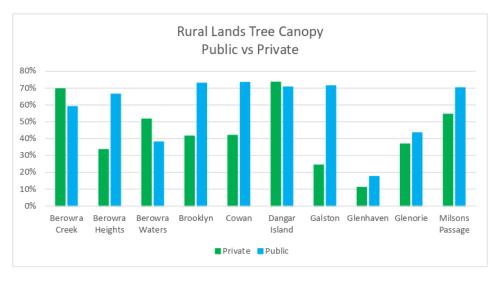
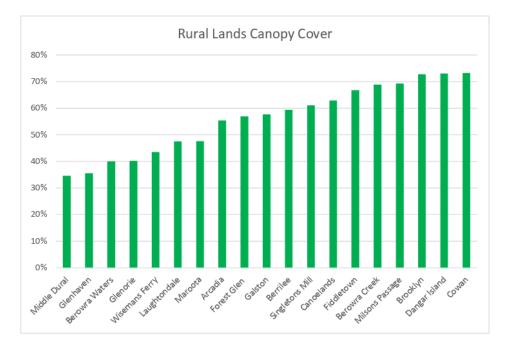


Figure 20: Public vs Private Tree Canopy by Suburb. Source: OEH, 2019

Despite half of Hornsby's urban forest being located on residential land, it would appear that the public realm more often than not, has higher percentages of canopy cover than the private realm within the same suburb (Figure 20). As shown in Figure 20, apart from Waitara and Mt Colah, the public realm, predominantly parks and streets, have higher percent ages of canopy cover than the private realm does. In essence, this places more responsibility on a smaller area of land to provide the much-needed benefits of the urban forest.

Figure 21: Public vs Private Tree Canopy by Rural area





Overall, tree canopy cover is much higher in rural lands than on urban lands as would be expected due to its undeveloped nature. Apart from Berowra Creek, Berowra Waters and Dangar Island, the public owned land has higher tree canopy than its private counterpart.

2. Ecological Connection

The urban forest plays a critical role in connecting areas of ecological value and habitat. Figure 22 shows the distribution of remnant trees i.e. those with significant local ecological value, across the urban area. These trees should be protected within urban forest policy and looked to be supported and enhanced by streetscape, open space and private tree plantings.



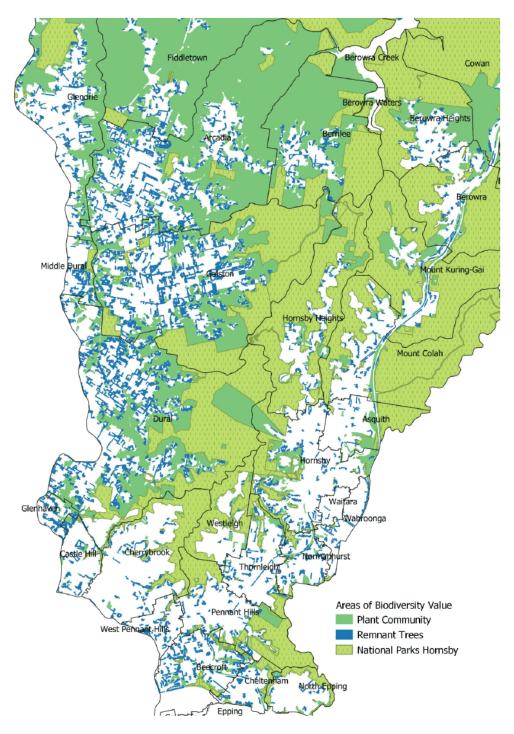
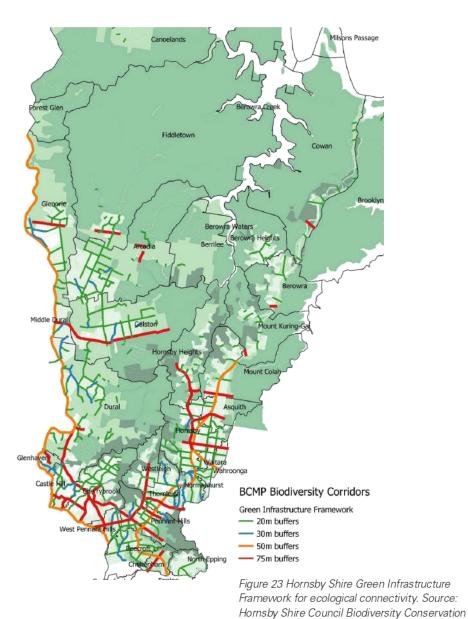


Figure 22: Distribution of remnant trees with high conservation and biodiversity value across the urban and rural landscapes of the shire. (Hornsby Shire Council GIS, 2019)



Council's Biodiversity Conservation Strategy 2020 (BCS) identifies the prospective role that a green infrastructure approach can take towards improving ecological outcomes. This approach also aligns with State Government planning around the green grid approach for Greater Sydney. A street tree masterplan will need to acknowledge these linkages and seek to plant street and park trees that support the corridor functions.

The BCS used ecological modelling of agricultural lands, significant hydrological features and remnant vegetation to define a modelled Green Infrastructure network with 100m corridors for Hornsby Shire (Figure 23).

Strategy.



The North District Green Grid Plan was overlaid onto the Hornsby Green Infrastructure Framework, including opportunities for Hornsby Open Space and Green Links (no 27 in figure 24) and the Northern Rail line Linear Open Spaces (no 23 in Figure 24). From there, local knowledge was sought to adjust the design detail of corridors so as to reconnect fragmented landscapes.

Figure 24: Green Grid Project Opportunities, specifically project opportunities 23 and 27. Source: North District Green Grid Plan, 2017

3. Tall and Significant Trees

State government vegetation mapping allows for the extraction of vegetation heights. Figure 25 identifies land parcels where there are concentrations of large trees in the urban areas. These trees are highly influential for setting Hornsby's landscape character and provide vital biodiversity links. Further detailed analysis of the data is needed to understand the predominant species within these areas including their contribution to endangered ecological communities and as food or habitat for native species. Based on their location as representative of pre-European remnant forest communities, they are likely to consist of Sydney Turpentine Ironbark and Blue Gum Forest trees. Given the length of time of development that has occurred across Hornsby, many of these trees are also likely to be exotic species.

Figure 25 reveals parts of the LGA where taller trees (over 15m in height) are concentrated within the major suburbs including Pennant Hills, Castle Hill, Beecroft, Cherrybrook, Westleigh and Thornleigh. Notably, the locations of many of these concentrations of tall trees often corresponds with the locations of council bushland sites. These tall trees are critical for supporting Hornsby's biodiversity and ecological systems and should, where possible, be managed for risk minimisation and ongoing protection from removal. Council will need to continue efforts to preserve space for these large trees, especially in larger public parks and reserves. Tall, ecologically valuable trees on private land are also very important, however are more susceptible to risk management. Sound decision making is required to preserve and manage these trees going forward but also to account for any risks to land-owners. There are various mechanisms that could be explored by Council to incentivise landowners to protect and care for these large trees on their properties and minimise the need for removal.

Further height stratified vegetation mapping data is required to differentiate the locations of these tall trees between council and private land. There is also a need to identify any topographic or habitat preferences for tall trees e.g. gullies, steep land or on certain slopes and soil types so that these areas can be prioritised for housing Hornby's tall trees.



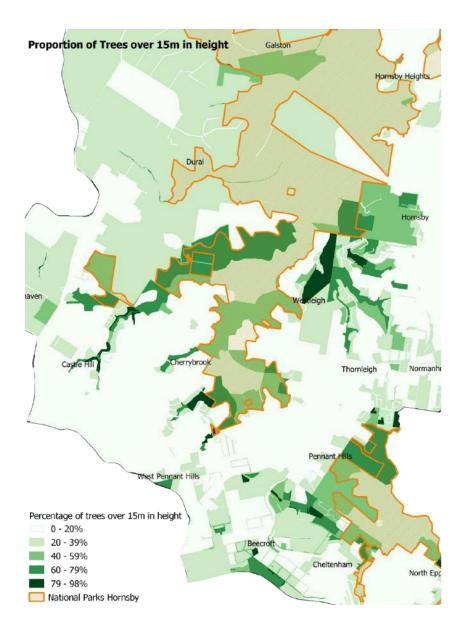


Figure 25: Areas where taller trees (over 15m) are concentrated. Source: OEH, 2019

4. Street Tree Diversity

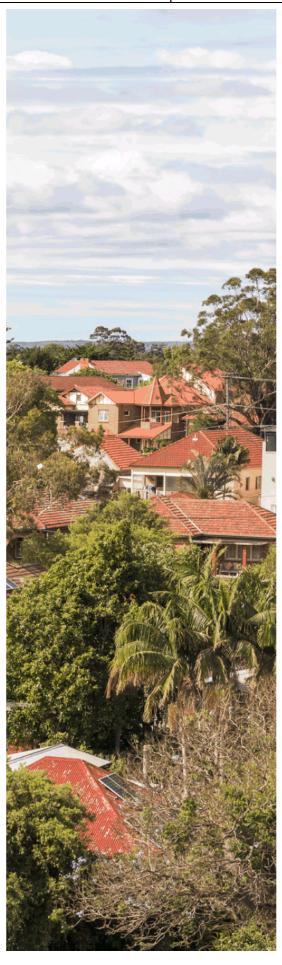
A sample tree survey was conducted on Hornsby's street trees in 2013 (Figure 14). The extensive survey measured a range of attributes for 21,550 street trees.

Whilst this survey is now 6 years old and some of these trees may have been removed and new ones planted, the data still holds valuable overall themes for the urban forest

Key points of the 2013 tree survey data:

- The survey recorded an extremely high number of species. Over 480 different street tree species alone were recorded in this survey which suggest that Hornsby's urban forest is extremely diverse
- However, there continue to be only a few species that dominate the landscape. The most common species recorded in the survey were Callistemon viminalis Bottlebrush (10 percent of the survey population), Jacaranda mimosifolia Jacaranda (8 percent) and Lophostemon confertus Queensland Brushbox (3 percent). At 10 percent for one species, this would suggest an overrepresentation of Callistemon viminalis within Hornsby's streetscapes.
- Cumulatively, 14 percent of the surveyed trees were from the Genus Callistemon, which is considered high.
- Climate vulnerability of species is currently being researched by Macquarie University. Callistemons are deemed to be highly vulnerable to climatic changes
- Over 70 percent of the assessed trees had a useful life expectancy (ULE) less than 15 years. 10 percent had an ULE less than 5 years. This is an extremely high figure and requires further analysis to validate if in fact so many trees are reaching the end of their useful lives.
- 57 percent of the trees surveyed had a low visual and functional amenity which is comparatively high
- 91 percent of the assessed trees were in acceptable health.
- 6 percent were in declining health.

Given these findings, more up to date information is required for Hornsby's street trees, particularly in relation to useful life expectancy. If the majority of Hornsby's street trees do in fact have low useful lives, then many of these trees may need to be considered for removal and replacement so as to properly manage the landscape amenity. This renewal is critical to support a healthy, resilient, dynamic and long-lived urban forest.



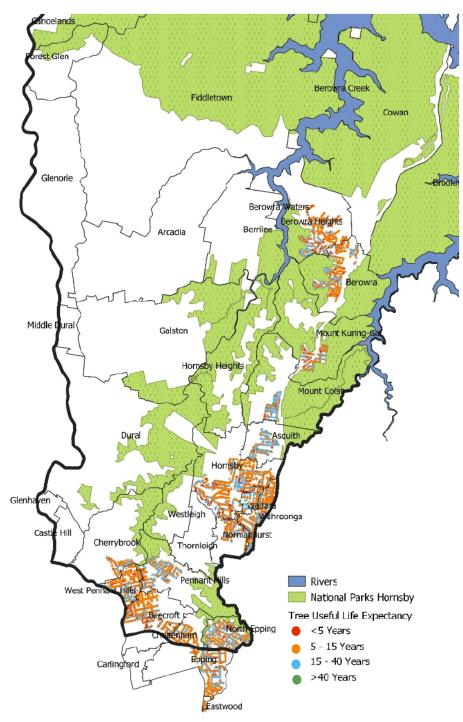


Figure 26: Distribution of the 21,550 street trees survey, colour coded based on useful life expectancy. Red is less than 5 years, orange is 5-15, light blue is 15-40 years and green = over 40 years. (Hornsby Shire Council GIS, 2019)

5. Soils and Water

Soil and water are extremely important components of the urban forest that need to be considered for supporting long term health and viability of tree canopy cover.

The southern, or more urban areas of the LGA typically compose of sandstone and clay soils. The clay soil types are dominated by Glenorie Soil Landscape which is described (DECC, 2008) as an underlying geology of Wianamatta shale. Having vegetation that has experienced extensive clearing of tall open forests. Dominant tree species on Glenorie soil landscapes include Sydney Blue Gum Eucalyptus saligna and Blackbutt E. pilularis.

Transitional soil types typically have a geology of shale and Hawkesbury Sandstone. Within the LGA the most predominant transitional soil landscape is Lucas Heights which typically occurs on ridge and plateau areas around Berowra and within Berowra Valley. Transitional soil vegetation is dominated by turpentine *Syncarpia glomulifera*, smooth-barked apple *Angophora costata*, red bloodwood *Eucalyptus gummifera*, thin-leaved stringybark *E. eugenioides* and scribbly gum *E. haemastoma*.

Urban Hornsby has a range of native and imported soils. Urban soils are generally altered, of poorer quality and in locations where development or past land filling has occurred, yet, are able to support development and urban greening. Any future tree planting should consider the existing soil type as well as the appropriate soil volume in selecting the right tree.

Water, also a fundamental input into the urban forest, is being considered in more detail for Hornsby as part of the Water Sensitive Hornsby Strategy The strong links between water and urban vegetation will be identified, strengthening the concept of the need for integration between all physical aspects of the public and private domain and the urban forest.

The draft vision for a Water Sensitive Hornsby is that: Hornsby Shire is a beautiful, green, and thriving shire whose management of water supports pristine waterways, sustainable resource use, and a lifestyle that is connected to nature. With the emerging themes relevant to the urban forest being:

- Hornsby and its villages are full of beautiful blue and green spaces that connect people to their surrounding environment and local community
- Sustainable resource use is supported by integrated, multi-functional infrastructure

A Water Sensitive Hornsby will seek to develop and promote a network of green and blue corridors, open space and streetscapes that enables all residents to recognise and acknowledge the benefits vegetation and water provides to local liveability. This will translate into smarter and more effective growing conditions for urban trees e.g. stormwater collection and harvesting to passively water street trees.



Figure 28: Vision Theme - Hornsby and its villages are full of beautiful blue and green spaces that connect people to their surrounding environment and local community (Draft Water Sensitive Hornby Strategy 2020)

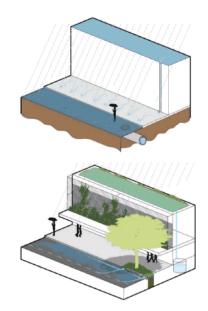


Figure 29: Collecting stormwater can have added benefits to street trees and therefore people. Source: CRC for Water Sensitive Cities

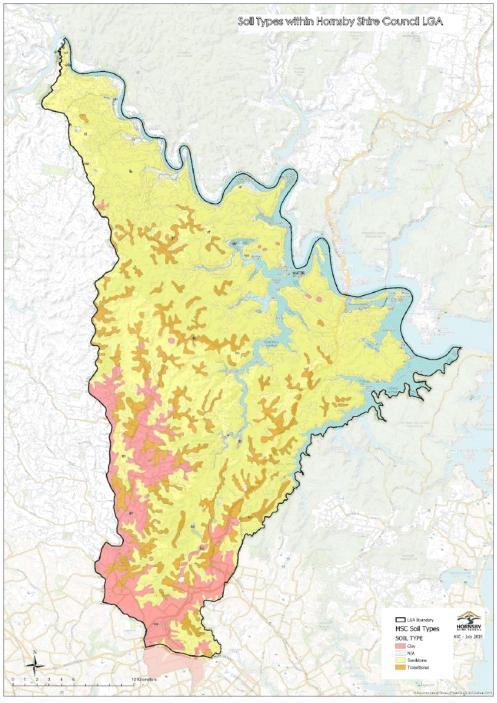


Figure 27: Hornsby's soil types (Hornsby Shire GIS, 2019)

6. Community Perceptions of the Urban Forest

Conversations with the Hornsby Shire community during the development of the Community Strategic Plan in 2017, identified the very high values placed on the natural landscape by the community. Results from the 2019 community engagement for the Environmental Sustainability Strategy revealed the following:

- Over 90 percent of respondents thought that tree canopy cover was very or somewhat important environmental aspects for Hornsby Shire
- 70 percent of respondents felt very or somewhat satisfied with current tree canopy cover
- One of the biggest concerns for respondents on the environment was over development (the biggest concern was traffic congestion)
- The engagement shows that trees (and concern for loss of tree canopy) represent one of the most important current and future environmental priorities for the Hornsby LGA.
- There were recognised concerns about climate change, water and biodiversity however they were not seen as a top priority for the community
- Active transport was rated as one of the lowest concerns for the community
- While tree loss and over development were key concerns, detail around this issue was mixed. Some consider that regulation of tree protection is excessive while others feel that there is not enough tree protection on private land.
- Particular mention was made to conserve both the Blue Gum and Turpentine Ironbark forests.

Specific actions for Council to consider include:

- Increasing the number of trees planted
- Adequate building setback requirements to allow for tree planting
- Seeking out opportunities to align tree planting with active transport networks
- Preserve native/indigenous species
- Reduce amount of tree loss due to apartment developments.

From these results, a targeted tree survey was conducted within the community to understand in more detail, how trees fit in to this inherent value of Hornsby's landscapes. The results are extremely important in

providing the evidence needed to develop appropriate policies and regulation for both public and private trees.

The survey revealed the following:

- Certain benefits of trees are more widely recognised by the community than others e.g. contribution to local neighbourhood character, provision of biodiversity/habitat and providing colour and shade to the urban environment were well recognised benefits of trees. Less recognised were the value that trees contribute to residential property prices, their ability to shade and cool houses and their contribution to health and wellbeing.
- There is a strong feeling of responsibility in providing a greener legacy for future generations and that both Council and the community should together be addressing the issue of canopy decline
- The majority of respondents want the same or a greater number of trees across the Shire than there are now
- There was strong recognition and support for PUBLIC tree management, including protection and renewal especially through the payment of fines or bonds if damage to public trees occurs during development
- However, there was much less support for regulation or penalties for non-approved removals of PRIVATE trees
- Despite support for a greener legacy, half of the respondents thought they should be able to do whatever they liked on their own property regarding trees
- Respondents supported the idea of offsets for removed private trees being planted nearby but did not support property owners paying Council to replant trees on public land
- Over half of the respondents felt that Council should focus more on tree planting in the public domain, not the private
- Common ideas for retaining and planting trees on private property included education and awareness campaigns, financial assistance or subsidy from Council to help support maintenance of private trees, free or subsidised arboricultural advice for landowners, recommended tree planting guides for species of trees less likely to cause future issues, free tree giveaways, ensuring that new trees are planted as part of new developments, reducing the

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amount of development overall and including other greening options for high rise development e.g. green roofs

- The main reasons people remove trees from their properties are due to old age, poor health, storm damage and concern about limbs dropping.
- Of those who removed trees, only half replanted a tree/s
- Trees were not replaced because there was not enough space, other types of vegetation were planted instead or there were simply enough trees on the property already.

These findings are important for two reasons:

- They validate the need for a robust, adequately funded, best practice public tree management program
- 2. Any mechanism to stem the loss of tree canopy on private land will need careful consideration and likely require a suite of tools. Regulation, while broadly unpalatable to the general public, will still be required but will need to be supported by other mechanisms such as education, incentives and access to good arboricultural advice.

How is Hornsby's Urban Forest Managed?

1. Urban Street and Park Trees

Public urban trees and those within the rural villages are managed by the Tree Management Team of Hornsby Shire Council. Within this program, Council must adhere to various pieces of legislation, such as the Electricity Supply Act 1995, Electricity Supply (Safety and Network Management) Regulations, 2008, and various environmental and planning laws as well as Australian Standards for the management of urban trees.

Currently, Council removes around 300-400 street and park trees per year (excluding post storm events) and guarantee that they replant more trees each year than they remove.

It is estimated that there are potentially 50-60,000 public urban trees including an estimated 30,000 street trees in Hornsby Shire. There is a further estimated 30,000 vacant street tree sites across the Shire. Given there is only data for a third of the estimated street tree population, it is difficult to identify broader themes and

issues. The paucity of data also means it is difficult to plan and strategically manage the street and park tree assets.

The Tree Management Team are responsible for:

- Actioning customer requests
- Tree removal and tree planting
- Maintenance works
- Reviewing development applications that impact on private and public trees
- Enforcing the Tree Preservation Order for private trees

Due to the bulk of the team's work stemming from customer requests and development applications, there has been no opportunity or pathway to deliver a strategic tree management program. While tree works are carried out to best practice standards, the lack of robust asset planning and future works, means that there are gaps in best practice asset management and alignment with other streetscape planning and works.

2. Rural Roads

Council's Parks, Trees and Recreation and Natural Resources Branch's jointly respond to management issues regarding trees on rural roads. Given the lower density of residents in these areas, customer requests for trees on rural roads are much lower than for those in the urban area

Some rural roads house protected ecological vegetation communities and as such are managed by the Natural Resources Team. There is, however, no overarching set of principles that dictate the management of these areas, no detailed data showing the quality and quantity of trees and no formal policy for their ongoing management.

3. Bushland Trees

Council's Natural Resources teams respond to management issues regarding trees in Bushland Reserves. Many of the customer requests for trees in these areas relate to properties on the interface of residential areas and bushland.

As much of the vegetation on the interface represent remnant vegetation communities, and are therefore often of high ecological values, e.g., Endangered Ecological Communities (EECs), the management response to trees in these areas prioritises ecological arboriculture practises.

4. Other public land trees

State Government Agencies are also responsible for managing trees on their own land. This includes larger landholders such as the Department of Primary Industry and Environment, including Crown lands, Departments of Education, Family and Community Services as well as agencies such as Sydney Water Corporation, Transport for NSW, Sydney Trains, Roads and Maritime amongst others. Each of these have their own guidelines regarding tree management, particularly regarding the risk trees place on their own assets.

Greening Our Shire program

The public tree management program has been boosted significantly with one-off funding for the delivery of the Hornsby 30,000 by 2021 trees program. This program will see 10,000 more street trees planted over the 2019-2021 period, which is a huge boost to the street tree population. An ongoing urban forest management program will need to pick up the legacy left by this 30,000 Trees program by continuing to manage all the trees planted under this program, fill remaining vacant street tree sites across the Shire and continuing to engage and involve the local community.

5. Private Trees

Trees in front and back yards, on rural properties and on commercial and industrial owned land are managed by their respective landowners and are accountable under the existing Hornsby Local Environment Plan and Development Control Plan.

The NSW planning code, which is essentially controlled and directed by the NSW government through Local Environment Plans (LEP) sets the boundaries for how development can occur within a region. At a local level, Council has the ability, through its Development Control Plan (DCP) to seek protection of certain trees. Complying and exempt development also require a permit or development consent for removal or pruning of trees.

6. Other influencing agencies

The ongoing management and renewal of infrastructure and services also influences and impacts on urban trees. Ausgrid is required to keep electricity lines safe by clearing any vegetation within a certain area of the line. This is a legislative requirement that must be maintained, but which regularly impacts on both the extent and quality of the tree canopy across, not only Hornsby, but across Greater Sydney. Also, the NSW Rural Fire Service, which administers the 10/50 vegetation clearing scheme

provides a mechanism for private property tree and vegetation removal without requiring approval or reporting.

7. Traditional Owners

There is very little known about the current cultural values of Hornsby's trees and their meaning for traditional owners. It is likely that some trees remain which form part of indigenous history, yet more research and collaboration is needed to identify these and link them into cultural story telling. Traditional owner values have an equal place in the ongoing management of the urban forest yet are largely a silent voice, except for specific project-based consultation, e.g., Environmental Sustainability Strategy, undertaken with the Hornsby Aboriginal and Torres Strait Islander Consultation Committee (HATSICC).

Key Challenges

1. Canopy loss

202020 Vision in collaboration with The Royal Melbourne Institute of Technology (RMIT) undertook some baseline tree canopy mapping comparing the years between 2009 and 2016. This analysis suggested that tree canopy cover across Hornsby Shire Council reduced by 5 percent during that seven-year period (Amati et al, 2016).

More detailed analysis with Hornsby Shire was conducted to try to understand these causes and locations of loss. The report by Smith et al, (2017) found that the Hornsby Shire is more likely losing canopy in urban areas at approximately 3 percent each year. This is equivalent to 12,000 to 15,000 trees each year across the public and private realm.

There are multiple reasons that have and continue to contribute to the canopy loss across Hornsby. On private land, Smith et al. (2017), reported three reasons:

- 1. general removal of trees and non-replacement
- 2. clearing directly associated with urban development and renewal
- 3. the impact of clearing within bushfire prone areas.

Trees are being removed either with or without approval under the Council's requirements set in the Hornsby Development Control Plan. The research by Smith et al (2017) further suggests that once trees are removed, they are not replaced. RMIT's tree canopy cover change mapping suggests the same.

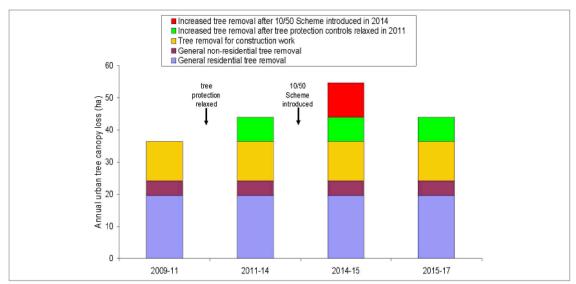


Figure 30: Proportional canopy loss each year by tree removal "activity" across the Hornsby local government between 2009-2017 (Smith et al 2017).

If this trajectory of loss continues, Hornsby's urban forest could be significantly diminished within a 40 year period.

The issues of both clearing for bushfire and urban development are discussed in their own sections below (sections 4 and 5 respectively).

It is yet unknown if tree canopy cover is increasing or decreasing on public land. It is likely there are considerable losses attributed to road, drainage and utility (including electricity and telecommunication) works as well as extreme weather events such as

storms and heatwaves. However, it is possible that these losses may be compensated for by the annual growth in remaining tree canopy across the public realm. Further detailed canopy change analysis is required to understand the change in canopy cover across the public realm to understand if it is reducing, remaining stable or increasing.

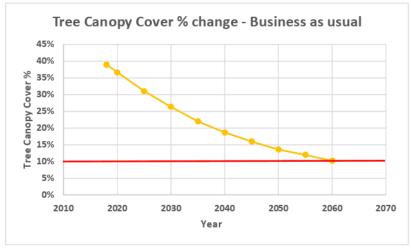


Figure 31: Trajectory of canopy cover change if Hornsby continues to lose 3 percent of its total canopy each year

2. Data, Evidence and Knowledge

Robust data, evidence and science is now the necessary foundation required for any new government policy. Understanding the extent, quality and change of the urban forest asset is required in order to make good decisions.

Added to this, consistent and accurate data is paramount. The Office of Environment and Heritage, following suit of other State Governments across Australia, recently invested in high resolution spatial vegetation mapping. This data provided the basis for the detailed baseline canopy mapping for this Strategy. From here though, regular snapshots of this data will be paramount for measuring the change in canopy at scales which can inform land use planning i.e. where exactly are trees being lost and why. Without this data, there is still a major gap in understanding Sydney wide what the changes are.

Further to this, the collection of detailed tree inventory data for Council's managed trees is expensive and time consuming. Maintaining the data integrity of this data base poses challenges for staff and data management systems. A more efficient method of updating this tree data coupled with a streamlined tree assessment program should be explored to overcome this issue.

The emergence of new and cheaper technologies for gathering remote spatial data means that this regular data capture will be possible. When combined with an improved tree data management system, the ability to track change, monitor success and loss is tremendous. This data could also help Council to monitor illegal tree removals, helping compliance and enforcement of regulation.

3. Trees on Private Property

In Hornsby, the evidence strongly points to canopy loss predominantly occurring on private land which therefore raises high expectations of land use planning. The NSW planning code, which is essentially controlled and directed by the NSW government through Local Environment Plans (LEP) sets the boundaries for how development can occur within a region. At a local level, Council has the ability, through its Development Control Plan (DCP) to seek protection of certain trees through its Tree Preservation Order.

This is largely a merit-based assessment process that applies to any tree as defined by the Council. Notable, however, is that Council has changed its definition of a tree three times within the period 2000 to 2018. Tree loss between 2011-2018 can be attributed to a very narrow definition made up entirely of only trees that are indigenous to the Hornsby Shire. This narrow definition in effect permitted the removal without approval of all other trees. Amendments in 2018 have addressed this shortcoming.

What is less certain is the extent to which residents are aware of and follow the new provisions that requires an application, fee and determination by Council. While Council has broadened its definition of a tree in the DCP, 60-70 percent of applications for tree removal or pruning are approved.

Results from the Community Tree Survey in June 2019 overwhelmingly show that while people want to leave a greener legacy and support Council to better manage trees in the public realm, they feel they should be able to determine what happens on their own land. However, as the canopy statistics show, relying on public realm tree canopy is simply not enough for Hornsby. What happens on private land is important, meaning that regulation is still likely to be a useful tool as part of an integrated suite of solutions.

Table 1 Hornsby Shire Council's changing Definition of a Tree

Tree Preservation Order	2000	2011	2018 (DCP definition)
General definition of a tree (noting that within the TPO there are specific exemptions and provisions)	'tree' shall mean a single or multi-trunked wood perennial plant having a height of not less than 3 metres and which develops many branches, usually from a distance of not less than 1 metre from the ground, but excluding any plant which, in its particular location, is a noxious plant declared as such pursuant to the Noxious Weeds Act 1993. This definition of 'tree' includes any and all types of Palm trees	Trees that are indigenous to Hornsby Shire and greater than 3 metres	A tree is defined as a long lived woody perennial plant with one or relatively few main stems with the potential to grow to a height greater than 3 metres

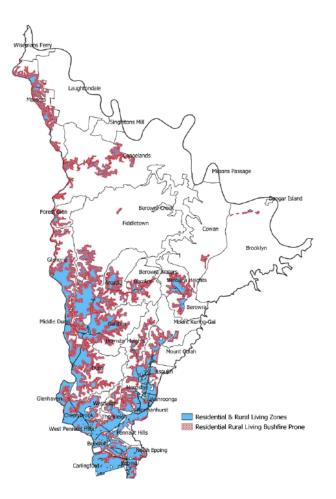
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4. Bushfire

Approximately half of the populated areas (i.e. designated residential or rural living zones) across Hornsby are prone to bushfire (Figure 31. These zones are also regulated by the 10/50 vegetation clearance entitlements.

Tree removal for the purpose of managing bushfire risk, known as the 10/50 Vegetation Clearing Scheme, is another driver for loss. In 2014 an amendment to the Rural Fires Act 1997 and introduction of the 10/50 Scheme resulted in a spike in tree removal in the period 2014-2015. As Hornsby Shire is Sydney's most vulnerable Council to bushfire risk (Hannam, 2016) this loss is not surprising. What is notable as part of the analysis of canopy loss between 2009 and 2017 is that properties within the Bushfire Prone Lands area, and therefore subject to the 10/50 Vegetation Clearing, have reported no additional clearing of canopy since 2015. This suggests residents living in these areas took advantage of the entitlement early on (2014-2015) as an opportunity to clear land. As demographic and land use density changes continue and the likelihood of bushfires increase it is likely that further canopy loss within bushfire prone lands will continue due to clearing.

Figure 31: Bushfire planning map of the Hornsby Shire



The urban forest has two key considerations in the issue of bushfire. The first is the perceived or real risk of urban trees contributing to bushfire. The second is the evidence and data that suggests that urban trees can play a key role in buffering urban areas from bushfire, using exotic species less prone to burning and the increased use of irrigation and water sensitive urban design in the landscape. (Driscoll, 2013). Smooth barked trees have proven to be effective in reducing the impact and distance of embers and therefore severity of bushfire. (CFA, 2011). Further to this, recent research suggests that land clearing actually contributes to increased bushfire by altering the climate, reducing soil moisture and losing windbreaks (Maron et al, 2019).

Research suggests that majority of bushfires are started by people, not weather, so good urban planning and tight regulations and prosecution of those lighting fires should be given greater priority than removal of urban trees. Fire safety is about urban planning, managing vegetation right next to houses, implementing bushfire survival plans, e.g., leaving early, prevention and rapid suppression, house construction standards and insurance (Driscoll, 2013).

Further to this, there is much work to be done in educating the community about bushfire, the actual risks, how best to prevent it around the property and responses for managing property in a bushfire situation. The aim of an educational component would be to understand the very real fear that the community has about bushfire and discuss best practice ways of managing its risks, including the role that the urban forest plays.



5. Growth, Development and the Shrinking Backyard

While the benefits of urban forests are widely recognised, they continue to remain a low investment priority when compared with both urban development and grey infrastructure. Over the past three decades the Hornsby local government area has increased the area of developed land through the opening of new subdivisions and increased urban density. In the recent decade this has been directly attributed to meeting state government housing targets. These targets however did not include any corresponding canopy or vegetation retention targets or expectations, unlike the current North District Plan. Cumulatively, past development decisions have contributed to a de-valuation of trees and therefore existing trees have been lost and new ones not planted. Development has also resulted in a corresponding need for enabling infrastructure, such as new roads, telecommunications, water, gas and electricity that collectively have led to the clearing of many canopy trees. The actual attribution to canopy loss as a result of the various forms of infrastructure is complex. Similarly, it is also simplistic to suggest that slowing the rate or type of development and having more effective policy and enforcement will alone successfully stop the decline.

Increasing residential development across the Hornsby Local Government Area has been enabled through State-wide, metropolitan, district, local housing and development targets. Changes in zoning, increasing urban densities, and the impacts of complying development and other state planning policies collectively contribute to lesser soft landscape areas and consequently the area required to support canopy trees. In essence, Australia is facing the issue of the shrinking backyard which has been well documented across Australia (Hall, T. 2010)

The need for more housing and therefore services to accommodate a growing population will be a constant factor in Hornsby's future decision making. Hornsby's population is predicted to grow at 1 percent per annum to 2036 (https://profile.id.com.au/hornsby, 2019). This population growth will essentially be driven by the existence of new dwellings. Dwelling numbers are likely to increase in the areas of Asquith, Waitara and Hornsby where medium and high-density residential development are focussed whereby associated infrastructure for services will also be required. Relying solely on street trees to provide the requisite canopy cover for these areas will be inadequate. These developments in medium-high density areas will need to contribute properly their share of tree canopy cover. This means that tree protection, onsite tree planting and deep soil requirements will need to be applied within these development zones.

As a result, the way in which this new housing is built must instead include better landscaping, trees and broadly urban greening outcomes (such as green roofs and undergrounding of overhead power lines) if the character of the Shire and the objective of liveability and climate change adaptation are to be met. An important first step will be to place appropriate values on both existing and future trees. Homsby will then need to better integrate infrastructure and building design with urban greening outcomes, including adequate space for street trees.

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Figure 32: Urban trees face an array of challenges including competition for space Source: City of Melbourne Tree Diversity Guidelines, Aspect Studios, 2011

6. Trees on Public Land

Trees on public land face a constant range of hardships and conflicts that require ongoing assessment and management. Competition for space with services and utilities, traffic, footpaths means that trees in public spaces are often compromised. Severe pruning of canopies to abide by electrical line clearance guidelines or air space for overhead trainlines, roots being cut to make way for new underground services as well as compaction from cars and heavy traffic make for fairly tough growing conditions. There are many practices that tree managers can now follow to improve these impacts on trees of which Council follow many already. Given the population growth, increased densification and urbanisation set to occur in Hornsby Shire, these practices will need to be embedded as business as usual so as to improve the outlook for many of the public urban trees.

7. Large and Significant Trees

Hornsby is home to large and significant trees, on both private and public land. They contribute enormously to the distinct character of Hornsby Shire and its local biodiversity. However, Hornsby faces a clear tension between these trees and the residents who live underneath them. The perceived and real risks of large trees in urban environments influence personal decisions often leading to tree removal for reasons such as safety, development, bushfire or simply that the tree has or is perceived to be at end of its life.

While there is clear recognition that large trees are very important in urban environments, appropriate recognition must be given to the real and perceived issues of living underneath one. Council will need to carefully negotiate between these two ideals e.g. establish robust protocols to retain or remove trees based on sound principles of risk management whilst taking into account the broader regional benefits of the tree.

8. Climate Change

The climate is changing and while in Hornsby this may not be readily felt by the community as it is in Western Sydney, this will mean some significant challenges for Hornsby Shire, its community and environment.

Warmer temperatures, increased occurrence of storm events and potentially lower average rainfall will have deep impacts on the urban forest. Research suggests that many endemic or indigenous tree species across Australia will simply not cope with increases in temperature or lower rainfall. The latest research from Macquarie University shows that the two dominant species of street trees in Hornsby, Callistemons and Jacaranda's are not likely to thrive under Sydney's modelled climate scenarios (Burley et al, 2019). Increased storm events will see greater damage being caused by high winds and heavy rain. This means that any species of tree planted in Hornsby need to be considered for their resilience in the face of climate change and a preferred species list constantly reviewed and updated based on the latest research.

While the urban forest is one of the most efficient and cost-effective mechanisms for adapting to climate change, there is a caveat. Hornsby's Urban Forest must be resilient, healthy, diverse and well managed. And this requires robust planning and annual investment in a strong tree management program.



Hornsby's Future Urban Forest

Hornsby's future urban forest will continue to be a valuable asset and integral to maintaining Hornsby's character, but only if the appropriate processes and programs are put in place now. Strategies will be required for all land: public and private. Vacant street and park tree sites will be filled with resilient, healthy and diverse trees. Existing trees will be managed for their useful lives and renewed when needed. Some locations across the Shire will have more vacant sites than others, while other locations will continue to maintain very high levels of tree canopy cover. Appropriate species will be selected for their ability to thrive and be supported in their individual locations. Species will also be resilient and diverse.

It will not be possible to compensate for the existing loss of canopy only within public areas. As a result, Council will also need to implement the most appropriate and robust planning tools with support mechanisms to deal head on with the loss of tree canopy in the private realm.

And this will all be driven by the recognition that it is everyone's responsibility to be stewards for the future urban forest, led by Council and supported by landholders and agencies across the Shire.

Hornsby's Future Urban Forest will be built around three strong opportunities:

1. Leadership

Hornsby Shire Council, in developing its first Urban Forest Strategy, is able to set a strong policy framework to guide the future character and liveability of the Shire and to define its role as a regional leader.

Leading by example with the community is critical for raising awareness, knowledge, connectedness, and stewardship amongst those living, working and visiting in the Shire. Leading policy and strategy implementation through innovation, science-based evidence and community empowerment is critical for a thriving future urban forest that will provide guidance and an inspiration for other local governments.

Leadership is multifaceted and incorporates small scale changes. This can range from better decision making around trees to larger scale transformation in amended DCP controls and advocacy with the state government around consistent regional data and delivery of multi-government urban forest outcomes for the Sydney

region.

By ensuring that its policy, programs and projects reflect best practice urban tree management, Hornsby Shire has the opportunity to be a leading exemplar for urban forest management for bushland and peri-urban municipalities.

2. Developing a clear, integrated urban narrative with the community

Council has developed a Local Strategic Planning Statement. This includes the development of a narrative and principles to guide the future of Hornsby. It is imperative that the urban forest vision and objectives as set in this Strategy are embedded in this. A strong shared vision will enable better decision making, more meaningful outcomes and a thriving future.

In setting this narrative, the needs of current and future communities as well as the highly valued environment need to be considered alongside economic development, housing and population growth. This means engaging, educating and advocating more with the community to understand what their desires and aspirations are.

There is also a clear opportunity to integrate all elements of planning, policy and implementation across Council to enable good urban design, outcomes with multiple benefits, and the realisation of a connected, healthy and thriving future urban forest.

3. Empowerment

All landholders in the Shire have responsibility for the future of Hornsby's urban forest. By providing leadership and developing a strong narrative for Hornsby, Council can enable, empower and inspire all landholders, including residents, state government, businesses and developers to contribute to the growth of a thriving future Hornsby Shire and its urban forest.

Vision

Hornsby Shire Council will have a healthy, thriving, diverse and valued urban forest that provides shade, cooling and adds colour and life to the Shire. Emerging themes are as follows:

- Maintain and improve Hornsby's unique character
- Retain and value the strong green and leafy character in our suburbs
- Protect and value existing trees, renew the ageing trees and increase tree numbers on public and private land
- Increase community knowledge and connection with the urban forest and the surrounding bushland
- Engage and educate the community by encouraging participation and stewardship
- Embed the Shire's goals and objectives into a better community understanding of the importance of the urban forest and its evolution
- Mitigate and adapt to climate change
- Build a resilient urban forest, reduce urban heat island, design for health and wellbeing, improve water sensitivity
- Protect, secure and connect urban habitats and surrounding bushland
- Improve the functionality of the urban forest to deliver higher conservation, habitat and connectivity values through a thriving urban ecology
- Showcase integrated and sustainable design
- Ensure sustainable green development in public and private realm through integrated place making, urban design and housing development
- Strong leadership and good asset management
- Provide leadership in urban forestry and adopt and adhere to professional standards and best practice asset management
- Acknowledge the importance of the urban forest as a critical asset class.

Targets

By 2040:

- 1. Tree Canopy Cover over private residential areas will be maintained at 33 percent to ensure no net loss
- 2. Tree Canopy cover over Hornsby's urban road network will increase from 39 percent to 50 percent .
- 3. Tree canopy cover over commercial zones will increase from 11 percent to 15 percent
- 4. Increase the number of streetscapes incorporating biodiversity corridors
- 5. Improve the species diversity and useful life expectancy distribution of Hornsby's street trees

The Draft UrbanTree Canopy Guide (NSW Government Architect, 2019) has been used to set these proposed targets: "The percent age of canopy cover in areas identified as priority links within the Sydney Green Grid aligns with the urban tree canopy targets: > 15 percent in CBD, > 25 percent in medium to high-density areas, and > 40 percent in suburban areas." The guide has been developed to accompany the Greater Sydney Commission's District Plans.

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Action Plan

In achieving the vision and targets, Council will need to focus on managing trees on public land, regulating and influencing tree canopy on private land and empowering the community.

All are equally important in ensuring that Hornsby retains its aspirational canopy cover so as to continue to provide the wealth of benefits it provides. In framing the implementation plan, the following hierarchy of priorities are proposed. These reflect the ecological and landscape values of the existing large canopy trees. Given the rate of canopy loss across the Shire it is also critical to undertake additional tree planting, noting that the canopy benefits of this part of the strategy will take many years to achieve the desired canopy levels.

The implementation of the Urban Forest Strategy is framed within a conventional management response.

- and operational plan
- Implement policy, controls, actions and enforcement. This will have a dual focus on the management of canopy across public and private land and how the policy and actions are framed, simply as regulatory or voluntary
- Monitor and evaluate policy/actions and enforcement. This turns on internal and external data, systems and reporting processes.

Coordination and governance

Urban forest management is broader than just street and park tree management. Implementation of this Strategy will require resources above the current tree management program. Urban forest management will require ongoing internal planning and collaboration with planners, natural resource management, biodiversity, community engagement, engineering and risk teams to fulfil the actions listed below. It will also require strategic

Urban Forest Priorities

Protect and conserve large, healthy canopy trees – this should extend to all trees, whether indigenous, native or exotic, as defined by Council's DCP, to provide ecological habitats and support a contribution to the urban greening character of the area.

Replace canopy trees lost on public and private land through required planting, education and incentives targeted at property landowners and developers. Some trees will need to be removed for various reasons including to manage risk and to balance individual and institutional concerns of trees in poor health or within inappropriate locations. However, it is important that this canopy is reinstated to maintain vigour and dynamism of the urban forest.

Create new canopy opportunities - for new development areas and street scapes with little canopy there are opportunities to create new areas of urban tree cover. This can integrate with the outcomes of other council and district plans and policies to support urban greening and to make more liveable and sustainable suburbs.

There are four types of recommended actions:

- Develop and refine policy and associated actions. This process must involve internal and external consultation and is the focus of this document and is central to the development of Hornsby Shire's Local Strategic Planning Statement.
- Design budgetary, program, regulation and enforcement processes. This step needs to have an emphasis on the internal capacity and political priority to ensure policy outcomes remain a priority. This should link to the Council's community strategic planning process and the annual budget

liaison and education with external agencies and the community so as to integrate the canopy concerns across public and private realm, regardless of landholder. This will mean the procurement or restructuring of role/s to build the requisite knowledge and skills for coordination and governance.

Priority Action:

Investigate resources required to progress actions

A dedicated resource/s will be needed to implement this Strategy. The resource will need to work closely with all relevant Council Branches as well as external agencies. They will need to regularly ensure that the urban forest is part of the planning and implementation of all projects and programs across the Council area.

The dedicated resources will also need to reconcile and adopt the huge amount of work already undertaken for the Greening Our Shire project and transition it into an annual tree planting and management program, including ongoing community engagement.

Implementation of actions will be dependent upon the availability of Council resources (staff and financial). Where possible, Council will realise opportunities through alternate funding pathways by working in collaborative partnerships and applying for grants.



Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Public Tree Management	1.01	Prepare a street tree database and inventory	Collect current qualitative and quantitative data regarding Hornsby's public urban tree assets, including street trees and trees within community land classified as Community Parkland or Sports field (Refer to Appendix 1 for details)	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Public Tree Management	1.02	Manage street trees through Council's asset management system	Incorporate data from tree inventory into Council's asset management system	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Public Tree Management	1.03	Manage street trees through Council's asset management system	Implement tree management in line with best practice asset management	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, EP&A Act, HSC DCP	I
Public Tree Management	1.04	Prepare a Street Tree Masterplan	Collect and assess knowledge and data from existing and proposed programs to inform the masterplan preparation	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP	I

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Action	uo	Task	Strategic/ Legislative Driver	Priority
1.05 Prepare a Street Tree the the the the the the the the the t	0 0 0	Prepare a Street Tree Master Plan to inform the strategic and operational management of these assets.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Eng Prepare a Street Tree ens Sup		Engage all relevant sections of Council to ensure the Street Tree Master Plan is supported through other works programs.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Cap Establish an annual be i tree planting budget with		Capital and operational expenditure need to be informed by the Masterplan and integrated within Council's community strategic planning process.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP	I

Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Public Tree Management	1.08	Develop a public urban tree management policy	Develop a urban tree management policy that standardises decision making processes against a clear Council objectives all elements of street and park tree management	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP, HLEP	I
Public Tree Management	1.09	Prepare a Rural Roads/ Roadside Remnant Vegetation Monitoring and Management policy	Prepare a policy that aligns with the Biodiversity Conservation Management Plan 2020 to manage the protection of trees and provide guidance for other practices along rural roads.	North District Plan, BC Act	I
Public Tree Management	1.10	Develop a schedule of 1.10 tree maintenance works	Prepare a yearly schedule of maintenance and management works, based on the results from the street tree data collection, to improve the overall health and amenity of street trees.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Public Tree Management	1.11	Prepare technical tree management guidelines	Prepare guidelines that incorporate the working processes, supporting standards, guidelines and preferred species selection list for staff to make daily decisions regarding tree management.	North District Plan, Green Infrastructure Policy, Community Strategic Plan	I

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Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Public Tree Management	1.12	Prepare technical tree management guidelines	Update the guidelines regularly to reflect best practice tree management, new evidence and research, Australian standards and other asset guidelines such as water sensitive urban design protocols.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	١
Public Tree Management	1.13	Review tree management procedures and workflows	Audit all tree management decision making and procedures to identify areas to improve efficiencies and remove duplication and inconsistencies.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Public Tree Management	1.14	Review tree management procedures and workflows	Implement changes and solutions to streamline procedures e.g. customer requests, procurement and data management.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Public Tree Management	1.15	Review tree management procedures and workflows	Support staff to implement changes and solutions through education and building capacity	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ

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Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Public Tree Management	1.16	ldentify and adopt a tree valuation method	Develop a tree valuation methodology, using data captured from the tree inventory, for Hornsby's public trees, including environmental, social and economic benefits of trees.	North District Plan, Green Infrastructure Policy, Community Strategic Plan	Ŧ
Public Tree Management	1.17	Identify and adopt a tree valuation method	Investigate using valuations to implement bonds	North District Plan, Green Infrastructure Policy, Community Strategic Plan	Ŧ
Public Tree Management	1.18	ldentify and adopt a tree valuation method	Use valuations to improve education and awareness within Council and the community about the benefits of trees in urban and bushland settings.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Public Tree Management	1.19	Investigate the functionality of public tree protection bonds for use by Council	Investigate an appropriate process, using the valuation method, to implement and enforce public tree protection bonds as condition of consent for private development that may impact on public trees.	North District Plan, Green Infrastructure Policy, Community Strategic Plan	I
Public Tree Management	1.20	Develop procedures for ongoing street tree data collection	Develop a clear and efficient system for real time data updates to the tree database when any staff or contractor complete work on a public street tree.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ

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Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Public Tree Management	1.21	Review Plans of Management	Incorporate relevant urban forest objectives and refer to the Urban Forest Strategy when Plans of Management are reviewed and updated.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, EP&A Act	Σ
Public Tree Management	1.22	Liaise and work collaboratively with utility and external service providers	Continue to work closely with Ausgrid, Sydney Trains and Sydney Water regarding better outcomes for the urban forest in the planning and management of their assets.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Public Tree Management	1.23	Liaise and work collaboratively with utility and external service providers	Align with NSW Roads and Maritime Services Landscape Design Guidelines 2019: Design guideline to improve the quality, safety and cost effectiveness of green infrastructure in road corridors.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Public Tree Management	1.24	Liaise and work collaboratively with utility and external service providers	Advocate for aerial cable bundling or undergrounding of powerlines where possible and feasible.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	M, L

Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Public Tree Management	1.25	Monitor and evaluate canopy cover at regular time intervals into the future	Measure canopy cover every five tree yeas and evaluate against baseline and intended targets for canopy and diversity	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Public Tree Management	1.26	Prioritise Council's Community Nursery as the primary source of public tree stock	Review Council's Community Nursery tree production program to ensure it is informed by future street tree masterplans and preferred street and park tree planting lists.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Public Tree Management	1.27	Provide options for street trees and shared pathways	Explore options where existing and proposed street trees can be provided in conjunction with expanded pathways	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Private Tree Management	2.01	Assess lot scale canopy cover change through digital mapping	Measure and identify the change in tree canopy at lot scale across Hornsby's residential zones. Identify where on lots canopy trees are being removed (front, side, rear) and the relationship to other canopy trees in the public and private realm.	Green Infrastructure Policy, Community Strategic Plan	π

Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Private Tree Management	2.02	Assess lot scale canopy cover change through digital mapping	Measure every 5 years given the rate of development and tree loss across the Shire.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Private Tree Management	2.03	Assess lot scale canopy cover change through digital mapping	Investigate and measure the effectiveness of DCP controls using updated data	HSC DCP HELP	I
Private Tree Management	2.04	Engage with the State Government to secure local government area and suburb vegetation mapping	Lobby with other local governments to the State Government to commit to collecting high resolution vegetation mapping for Greater Sydney on a regular basis e.g. every two or five years to provide temporal data set	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Private Tree Management	2.05	Engage and advocate with developers regarding the benefits of tree retention and planting	Engage with local developers to educate them on the importance and benefits of the urban forest, particularly in residential and mixeduse development	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Private Tree Management	2.06	Engage and advocate with developers regarding the benefits of tree retention and planting	Investigate trials or pilot projects, including possible incentives, for those developers interested in seeking better urban greening outcomes.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ

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Priority	Ξ	π	Ξ
Strategic/ Legislative Driver	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP, HLEP
Task	Review current LEP and DCP controls, with a particular focus on setbacks to enable canopy retention and planting, for exempt and complying development.	Prepare guidelines for developers for exempt and complying development to support Council's local strategic planning strategy and character statements across the LGA. Controls must be consistent with LEP outcomes and DCP controls.	Using mapping data review existing canopy cover and explore opportunities to establish a target for rural lands that takes into account rural land use and biodiversity needs. This should include incentive programs for increasing canopy
Action	Develop assessment protocols for vegetation management for exempt/complying development	Develop assessment protocols for vegetation management for exempt/complying development	Investigate the establishment of a canopy target for rural lands similar to those for urban areas
	2.07	2.08	2.09
Strategy	Private Tree Management	Private Tree Management	Private Tree Management

Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Private Tree Management	2.10	Develop Local Environment Plan standards	Develop relevant LEP standards (Part 4 of the standard LEP template) to support the protection and management of existing canopy trees and future canopy planting within relevant land use zones and consistent with local character statements (Refer to Appendix 1 for details)	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP, HLEP	Ξ
Private Tree Management	2.11	Revise Development Control Plan provisions	Review current DCP provisions and consider the hierarchy of protecting, restoring and creating canopy across the local government area consistent with local character statements, tree canopy targets and district planning directions. (Refer to Appendix 1 for details)	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP, HLEP	π
Private Tree Management	2.12	Liaise and lobby the relevant state government agencies	Review and identify state policies and planning instruments that provide significant hurdles to delivering better urban forest outcomes on the ground. These include, but are not limited to: - State Environmental Planning Policy - 10/50 Bushfire Clearance Entitlements - Housing targets	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	π

Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Private Tree Management	2.13	Liaise and lobby the relevant state government agencies	Engage with relevant state government agencies to lobby for policy and planning instrument change because of inconsistencies with greener city objectives as stated in the District Plans and Council strategies.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Private Tree Management	2.14	Review and update Green Offset Policy	Review the future scope of the Green Offset Policy to determine whether it looks to deliver both biodiversity and tree canopy outcomes (Refer to Appendix 1 for details)	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Private Tree Management	2.15	Review and update Green Offset Policy	Develop a tree canopy policy to support the LEP and DCP if its determined that the focus of that Green Offset Policy remains primarily biodiversity	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP HLEP	I

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Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Private Tree Management	2.16	Review compliance procedures relating to unauthorised tree removal	Review compliance procedures in a wholistic manner across the Organisation, to support statutory planners and compliance officers in their ability to audit, enforce conditions of consent and seek prosecution for breaches	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, EP&A Act, HSC DCP, HELP, HSC Enforcement Policy and Guideline (to be developed)	π
Private Tree Management	2.17	Develop species planting guidelines	Identify species for private landscaping with consideration for public/private habitat and amenity linkages, locational characteristics, tree growth and canopy spread and maintenance.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Private Tree Management	2.18	Develop species planting guidelines	Prepare planting and establishment technical advice for landowners replacing trees, for developers/homeowners planting new trees and people moving into new developments.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I
Private Tree Management	2.19	Develop green roof and wall guidelines	Develop a set of guidelines and Community Nursery-located examples for high rise residential and/or commercial development to encourage take up and implementation of alternative elements of greening.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I

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Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Private Tree Management	2.20	Investigate an education and incentives program to encourage tree retention on private land	Develop education and awareness campaigns about how individual trees are equally important for the whole forest	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Private Tree Management	2.21	Investigate an education and incentives program to encourage tree retention on private land	Develop recommended tree planting guides and continue free tree giveaways for species of trees less likely to cause future issues	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Private Tree Management	2.22	Investigate an education and incentives program to encourage tree retention on private land	Investigate options to encourage new trees to be planted as part of new developments and explore other greening options for high rise development e.g. green roofs	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Private Tree Management	2.23	Prepare Housing Development Guidelines that incorporate urban greening	Develop development guidelines that include lot scale green infrastructure outcomes.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I

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Priority	Σ	T	Σ	Ŧ	
Strategic/ Legislative Driver	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	
Task	Lobby with local government groups to develop industry wide housing development guidelines that include lot scale green infrastructure outcomes.	Actively promote and implement Council's free tree giveaway program	Develop ongoing media and communications pieces talking to the issue of tree canopy loss on private property and what community member can do about it.	Nort Gree Develop case studies and education collateral Com	
Action	Prepare Housing Development Guidelines that incorporate urban greening	Support tree giveaways program	Develop a Urban Forest Community Education Program	Develop a Urban Forest Community Education Program	
	2.24	2.25	2.26	2.27	
Strategy	Private Tree Management	Private Tree Management	Private Tree Management	Private Tree Management	

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Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Private Tree Management	2.28	Develop a Urban Forest Community Education Program	Implement interactive community workshops and forums on trees for wildlife, bushfire and trees, Hornsby's Tall trees, Hornsby's remnant vegetation and green corridors.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Governance and Engagement	3.1	Align urban forest strategy vision and objectives with related Council strategies, plans and programs	Incorporate the Urban forest Strategy targets into Council's operational and delivery plan programs and projects.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Ŧ
Governance and Engagement	3.2	Support the development of strategic urban biodiversity framework	Identify the role that urban trees play within the development of a strategic urban biodiversity framework which includes core, transition, and corridor areas and prioritise these areas for planning	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Governance and Engagement	3.3	Prepare a Water Sensitive Urban Design (WSUD) Policy that incorporates urban forest outcomes	Prepare WSUD policy incorporating guidelines for all stormwater treatment and consistent with urban forest outcomes	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ

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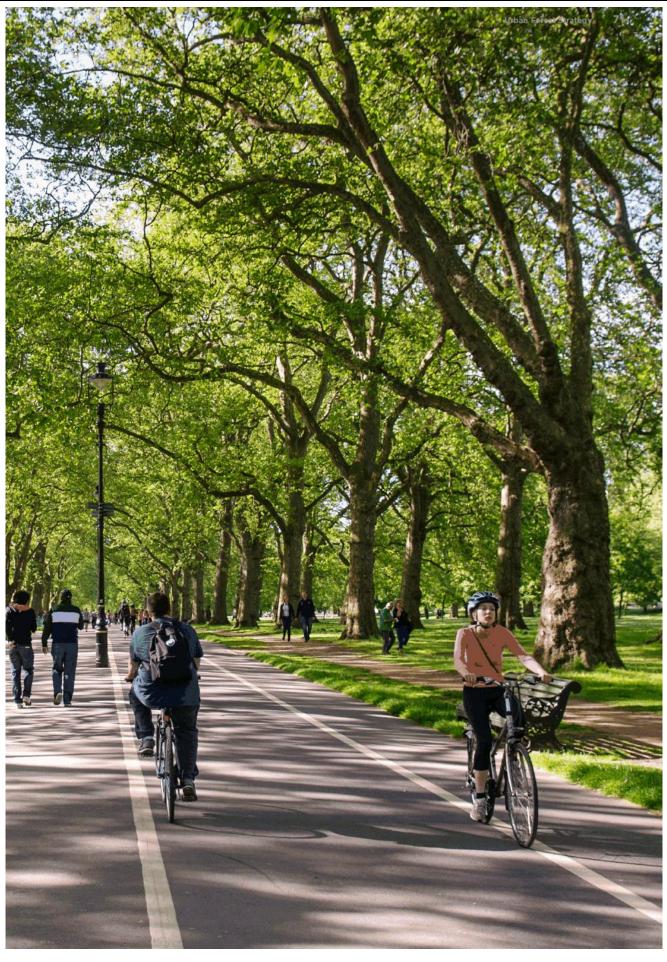
Action			Task	Strategic/ Legislative Driver	Priority
Prepare a Water Sensitive Urban Design 3.4 (WSUD) Policy that incorporates urban forest outcomes		ΞĘ	Align with Water Sensitive Hornsby project.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
3.5 Develop Green wall Prepare gand roof policy new deve		80 9	Prepare green wall and green roof policy for new developments and retrofits	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan, HSC DCP	Σ
Establish an Urban should be m should be m support and support and Landscapes internal focus on int working group landscapes.	=	ac be ta dg	Engage across the organisation. The group should be multi-disciplinary, have executive support and meet on regular basis to share knowledge and build internal capacity with a focus on integrated design and resilient landscapes.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Establish an Urban Develop or Supportir Supportir Landscapes internal practition working group inform the	=	등 등 등 등	Develop objectives for the group, including supporting the statutory planners and practitioners with tools and evidence to inform their decision making.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
3.8 Community Tree Council m		i e	Continue to implement tree planting days on Council managed land.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ

Urban Forest Strategy

ATTACHMENT 3 - ITEM

Priority	Σ	Ŧ	Ŧ	Σ	
Strategic/ Legislative Driver	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	
Task	Deliver planting days specific to demographic groups, including culturally sensitive days to encourage greater participation and stewardship from local migrant groups, and youth-specific specific planting days.	Engage and partner with the Guringai and Darug people to raise knowledge and awareness surrounding the cultural value of Hornsby's trees.	Explore partnerships to develop an indigenous history of Hornsby's trees identify culturally significant trees.	Develop a suite of engagement tools articles, community workshops, stories, competitions annually to reach out to the broader Hornsby community.	
Action	Implement Community Tree Planting Days	Engage with local Indigenous Groups	Engage with local Indigenous Groups	Prepare annual urban forest communication campaign	
	3.9	3.10	3.11	3.12	
Strategy	Governance and Engagement	Governance and Engagement	Governance and Engagement	Governance and Engagement	

Strategy		Action	Task	Strategic/ Legislative Driver	Priority
Governance and Engagement	3.13	Prepare annual urban forest communication campaign	Identify and target particular audiences, including migrant groups, youth, schools, tertiary students	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Governance and Engagement	3.14	Prepare annual urban forest communication campaign	Notify and engage with residents regarding annual tree planting program including renewals.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Governance and Engagement	3.15	Prepare annual urban 3.15 forest communication campaign	Explore the use of developing infographic style communications with landowners to demonstrate the importance of their street tree to the whole urban forest.	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	Σ
Governance and Engagement	3.16	Develop Policy 3.16 position regarding trees vs. solar panels	Explore issues and confirm policy position regarding trees (existing and proposed) with solar panels	North District Plan, Green Infrastructure Policy, Biodiversity Conservation Strategy, Community Strategic Plan	I



8. Glossary

Biodiversity: the variety of all living things including different plants, animals and micro-organisms, the genetic information they contain and the ecosystems they form

Climate change adaptation: actions undertaken to reduce the adverse consequences of climate change, as well as to harness any beneficial opportunities

Ecological arboricultural practices: urban tree management techniques that favour biodiversity or ecological outcomes above others e.g. retaining stag trees, planting indigenous species, cutting hollows in tree trunks etc.

Micro-climate: Microclimate is the complex of environmental variables, including temperature, radiation, humidity and wind, to which the plant is exposed.

National Parks: Natural areas of land and/or sea, designated to

(a) protect the ecological integrity of one or more ecosystems for present and future generations,

(b) exclude exploitation or occupation inimical to the purposes of designation of the area and

(c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally compatible. (World Conservation Union (IUCN)

Remnant Trees: Those trees that remain in the landscape following widespread clearance of native vegetation.

Resilience: Urban resilience is typically understood as the capacity of cities to bounce back or even bounce forward from a disturbance or crisis event.

Tree: A tree is defined as a long lived woody perennial plant with one or relatively few main stems with the potential to grow to a height greater than 3 metres

Tree canopy cover: The extent of tree canopy over 3 metres in height over a land area expressed as a percent age of the land area.

Urban heat island effect: Where a city or urban area experiences hotter temperatures than nearby rural areas. It is caused by the heat stored by hard surfaces such as asphalt which is then radiated out. Anthropogenic heat which is created by machines such as cars and air-conditioners, contributes to the urban heat island effect too.

Urban forest: Hornsby's urban forest is the sum of all vegetation, the soil and water that support it across the Shire, excluding National Parks and bushland reserves. It is one of the core components of Hornsby's green infrastructure network.

Water Sensitive Urban Design: is an approach to planning and designing urban areas to make use of stormwater and reduce the harm it causes to surrounding waterways

References

Abhijith, KV., Kumar P., Gallagher, J., McNabola, A., Bauldorf, R., Pilla, F., Broderick, B., Di Sabatino, S., Pulvirenti, B. (2017). "Air Pollution abatement performances of green infrastructure in open road and built-up street canyon environments – A review." Atmospheric Environment 162, 71-86

Amati, M. Boruff, B. Caccetta, P. Devereux, D. Kaspar, J. Phelan K. and Saunders, A. (2017). Where should all the trees go? Investigating the impact of tree canopy cover on socio-economic status and wellbeing in LGA's prepared for Hort Innovation by the Centre for Urban Research, RMIT University

Burley H, Beaumont L, Ossola A, Baumgartner J, Gallagher R, Laffan S, Esperon-Rodriguez M, Manea A, Leishman M. 2019. "Substantial declines in urban tree habitat predicted under climate change." Science of The Total Environment, Volume 685, Pages 451-462, ISSN 0048-9697

City of Melbourne, 2011. Tree Diversity Guidelines, prepared with Aspect Studios https://www.melbourne.vic.gov.au/ SiteCollectionDocuments/urban-forest-diversity-guidelines.pdf

City of Sydney, 2013. Urban Forest Strategy. https://www.cityofsydney.nsw.gov.au/__data/assets/pdf_file/0003/132249/ Urban-Forest-Strategy-Adopted-Feb-2013.pdf

Clark J.R., N.P. Matheny, G. Cross and V. Wake, 1997. A model of urban forest sustainability. Journal of Arboriculture. 23(1):17-30.

CFA, 2011. Landscaping for Bushfire: Garden Design and Plant Selection. https://www.cfa.vic.gov.au/documents/20143/72271/landscaping_for_bushfire.pdf/1c6084e1-159e-a820-b0b3-6dc077e661c0

DECC, 2018. Soil and Land Resources of the Hawkesbury-Nepean Catchment. Parramatta, N.S.W.: NSW Dept. of Environment and Climate Change.

Driscoll, D. 2013. Is Melbourne's urban sprawl creating more bushfire risk? Deakin University https://this.deakin.edu.au/society/is-melbournes-urban-sprawl-creating-more-bushfire-risk

Dunn, J. (2016) Improved neighbourhoods generate higher property prices. Australian Financial Review, 5 Feb. http://www.afr.com/news/special-reports/202020-vision/generating-higher-property-prices-through-improved-neighbourhoods-20160204-gmlsxf

(http://friendsberowravalley.org.au/html/story_of_the_park.html).

Giles-Corti, B., et al. 2005. Articles: Increasing walking. How important is distance to, attractiveness, and size of public open space? American Journal of Preventive Medicine. 28(Supplement 2): p. 169-176.

Gill, S., Handley, J., Ennos, R., & Pauleit, S. (2007). Adapting cities for climate change: the role of the green infrastructure. Built Environment 33(1): 115–133.

Godfrey-Faussett, K.,2016. A counselling psychology approach to reconnecting with urban nature for personal and societal wellbeing. City, University of London

Greater Sydney Commission, 2018. Greater Sydney Region Plan, A metropolis of three cities – connecting people, Objective 30, Urban Tree Canopy Cover is increased. https://www.greater.sydney/metropolis-of-three-cities/sustainability/city-its-landscape/urban-tree-canopy-cover-increased

Gull, C., Levenson Goldstein S., Rosengarten, T. 2017. Benefits and risks of tree climbing on child development and resiliency. International Journal of Early Childhood Environmental Education Copyright © North American Association for Environmental Education ISSN: 2331-0464 (online

Hall, T. 2010. The life and death of the Australian backyard, CSIRO Publishing, ISBN: 9780643098169.

Hannam, P. 2016. The 10 Sydney Regions most exposed to bushfire. Sydney Morning Herald, 8 Nov. https://www.smh.com.au/environment/the-10-sydney-regions-most-exposed-to-bushfire-risk-20161107-gsk08y.html

Harthoorn, M. 2017 "Influence of Street Trees on Roadway User Safety". Community and Regional Planning Program: Student Projects and Theses. 46. http://digitalcommons.unl.edu/arch_crp_theses/46

Heisler, Gordon M.; Grant, Richard H. 2000. Ultraviolet radiation, human health, and the urban forest. Gen. Tech. Rep. NE-268. Newtown Square, PA: U. S. Department of Agriculture, Forest Service, Northeastern Research Station. 35 p.

Hornsby Shire Population Projections Report 2016-2036, .id the population experts, April 2019

https://www.hornsby.nsw.gov.au/environment/flora-and-fauna/bushland-management/threatened-forests-and-fauna)

Jacobs, B., Mikhailovich, N., and Delaney, C. (2014) Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment, prepared for Horticulture Australia Limited by the Institute for Sustainable Futures, University of Technology Sydney.

Kardan, O. et al. Neighborhood greenspace and health in a large urban center. Sci. Rep. 5, 11610; doi: 10.1038/srep11610 (2015).

Kenney, W.A. & Wassenaer, Phillip & Satel, A.L. (2011). Criteria and indicators for strategic urban forest planning and management. Arboriculture and Urban Forestry. 37. 108-117.

Klein, Ryan & Koeser, Andrew & Hauer, Richard & Hansen, Gail & Escobedo, Francisco. (2018). A Review of Tree Risk Assessment and Risk Perception Literature Relating to Arboriculture and Urban Forestry. 10.13140/ RG.2.2.29977.06240. Konijnendijk, C.C., 2005. Urban Forestry Branding & The Celje, Slovenia Experience. City Trees, Journal of the Society of Municipal Arborists. Nov/Dec pp 22-25

Kuo, F. E., and W. C. Sullivan. (2001) "Aggression and Violence in the inner City: Effects of Environment Via Mental Fatigue." Environment and Behaviour 33.4, 543 – 571.

Lovasi, G. S., J.W. Quinn, K. M. Neckerman, M. S. Perzanowski, and A. Rundle. "Children Living in Areas with More Street Trees Have Lower Prevalence of Asthma." Journal of Epidemiol Community Health 62 (2008): 647 – 49.

Maron M, Griffin A, Reside A, Laurance B, Drsicoll D, Ritchie E, Turton S, 2019. To reduce fire risk and meet climate targets, over 300 scientists call for stronger land clearing laws. The Conversation, March 11. https://theconversation.com/to-reduce-fire-risk-and-meet-climate-targets-over-300-scientists-call-for-stronger-land-clearing-laws-113172

Mata, L., Ives, C. D., Morán-Ordóñez, A., Garrard, G. E., Gordon, A., Cranney, K., Smith, T. R., Backstrom, A., Bickel, D. J., Hahs, A. K., Malipatil, M., Moir, M. I., Plein, M., Porch, N., Semeraro, L., Walker, K., Vesk, P. A., Parris, K. and Bekessy, S. A. 2015. The Little Things That Run the City – How Do Melbourne's Green Spaces Support Insect Biodiversity and Ecosystem Health? RMIT University. Melbourne

McManus, R., Nicholson, L., Hammer, K., and Khoshdooz, N., (2019). Water Sensitive Cities Benchmarking and Assessment: Hornsby Shire Council, New South Wales. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities,

Miller, R. W., Hauer, R. J., & Werner, L. P. (2015). Urban forestry. Planning and managing urban greenspaces. Third edition. Waveland Press, Inc.

Moore, G. 2014. Defending and expanding the urban forest: opposing unnecessary tree removal requests. The 15th National Street Tree Symposium. 70-76.

Mullaney J, Lucke T, Trueman SJ (2015) A review of benefits and challenges in growing street trees in paved urban environments. Landscape and Urban Planning 134 157-166

Naderi JR, Kweon BS, Maghelal P. 2008. The Street Tree Effect and Driver Safety. The Journal on the Web, https://www.naturewithin.info/Roadside/Tree&Driver_ITE.pdf

Norris, M. (2007). Tree Risk Assessments – What Works – What Does Not – Can We Tell? In: International Society of Arboriculture Australian Chapter Conference 2007. Perth: International Society of Arboriculture Australian Chapter.

Norton B, Coutts A, Livesley S, Williams N, (2013). Decision Principles for the selection and placement of green infrastructure to mitigate urban hotspots and heatwaves, Victorian Centre for Climate Change Adaptation Research

Norton, B., Bosomworth K, Coutts A, Williams N, Livesley S, Trundle A, Harris R, McEvoy D (2013). Planning for a Cooler Future: Green Infrastructure to Reduce Urban Heat, Victorian Centre for Climate Change Adaptation Research

Nowak, D.J., and D.E. Crane, Stevens, J.C., Hoehn, R.E., Walton, J.T., and Bond, J., 2008. A Ground-Based Method of Assessing Urban Forest Structure and Ecosystem Services. Arboriculture & Urban Forestry 34(6): November 2008. International Society of Arboriculture.

Office of the NSW Government Architect, 2017. North District Sydney Green Grid Spatial Framework and Project Opportunities, https://www.governmentarchitect.nsw.gov.au/resources/ga/media/files/ga/plans/sydney-green-grid-plan-6-north-district-2017.pdf

Pandit, R, Polyakov, M., Tapsuwan, S., Moran, T. (2013) The effect of street trees on property value in Perth, Western Australia. Landscape and Urban Planning. Volume 110, February 2013, Pages 134–142

Plant, L. (2016) The economic value of greenspace. Real Green –The Brisbane Experience Case Studies

Richards, N.A., (1993). Reasonable guidelines for street tree diversity. Journal of Arboriculture 19(6). 344-350.

Rosenzweig, C., Solecki, W.D., Parshall, L., Lynn, B., Cox. J., Goldberg, R. Hodges, S., Gaffin, S., Slosberg, R.B., Savio, P., Dunstan, F. and Watson, M. (2009). Mitigating New York City's heat island. Bulletin of the American Meteorological Society 90: 1297-1312

Simpson, J. R. and E. G. McPherson (1996). "Potential of tree shade for reducing residential energy use in California". Journal of Arboriculture 22 (1): 10-1

Santamour, Frank S., Jr. (1990). Trees for Urban Planting: Diversity, Uniformity, and Common Sense. Conference Proceedings 7th. Metropolitan Tree Improvement Alliance (METRIA) 7:57-65.

van Wassenaer, P. J. E., Satel, A. L., Kenney, W. A., & Ursic, M. (2011). A framework for strategic urban forest management planning and monitoring. Trees, people and the built environment. Proceedings of the Urban Trees Research Conference 13–14 April 2011

Which Plant Where: https://www.whichplantwhere.com.au/

Wolf, K. L. (2005). "Business district streetscapes, trees and consumer response." Journal of Forestry 103 (8): 396-400.



Urban Forest Strategy

Appendix 1 - Action Plan Details

Task ID	Task	Details
1.04	Collect and assess knowledge and data from existing and proposed programs to inform the masterplan preparation	Knowledge and data should include (but not limited to): - results from the Environmental Sustainability Strategy engagement, specially requests for trees in particular locations - future community surveys - the identification and planting of vacant street tree sites as part of the Greening Our Shire program - tree inventory data, specifically ULE, amenity and species distribution - actions and identification of biodiversity areas from the Biodiversity Conservation Management Plan 2020
1.05	Prepare a Street Tree Master Plan to inform the strategic and operational management of these assets.	The plan should identify (but not be limited to): - the preferred character statements for each street/precinct/suburb including a species list - opportunities for tree planting - schedules for renewal - integrate within future development and infrastructure planning.
2.10	Develop relevant LEP standards (Part 4 of the standard LEP template) to support the protection and management of existing canopy trees and future canopy planting within relevant land use zones and consistent with local character statements	Controls should relate to (but not be limited to): - Floor space ratio to enable deep soil planting areas; - Setbacks to support integrated canopy outcomes between neighbouring properties and the street verge; and - Building height to ensure canopy plantings are appropriate to the scale of the proposed zoning.
2.11	Review current DCP provisions and consider the hierarchy of protecting, restoring and creating canopy across the local government area consistent with local character statements, tree canopy targets and district planning directions.	Controls must account for various landscape character types (town centre, bushfire prone, high density, medium density, low density and environmental protection) that: - Encourages retention of existing canopy - Mandates deep soil plantings - Mandates replacement canopy cover
1.01	Collect current qualitative and quantitative data regarding Hornsby's public urban tree assets, including street trees and trees within community land classified as Parkland or Sports field	Data collected should contain similar fields to the 2013 survey: - location - species - height - canopy spread - significance -age - useful life expectancy - amenity - health/condition - structure - required works

Appendix 2 – DCP and Green Offset Policy

Recommended DCP detail for planning review:

Revise and develop DCP provisions to reinforce the hierarchy of protecting, restoring and creating canopy across the local government area. Controls must account for various landscape character types (town centre, bushfire prone, high density, medium density, low density and environmental protection) that:

- Encourages retention of existing canopy
- Mandates deep soil plantings
- Mandates replacement canopy cover

Recommended controls, that would form the basis of conditional consents, must accord with the Newbery test (Newbury District Council v Secretary of State for the Environment [1981] AC 578 at 607) in that the control/condition:

- must have a planning purpose (thus ensuring that it is consistent with the planning Act and vertically to the LEP and District Plan including a contribution to LGA canopy targets);
- must relate to the permitted development to which it is annexed (that is the site so limiting the application of the borrowed canopy idea);
- and be reasonable and implementable (for example must relate to the capacity of the site to accommodate the conditioned landscaping)

Establish prescriptive standards as the basis of the controls (as below) but allow for developers to adopt a performance-based approach that can respond to specific characteristic of a site or land use.

Prescriptive Standards:

1. Enable front set-backs, relative to lot size, dimensions and zoning, to support a minimum of one canopy tree forward of the main building on the site for land zones as R2, a minimum of 2 canopy trees for land zoned as R3 and a minimum of 3 canopy trees for land zoned as R4.

The location of the front landscape area, and related to the setback, should complement current and future street tree planning and be of sufficient dimension to support a canopy tree relevant to the lot and local character statement. Performance based controls may be used to vary the minimum canopy requirements where other parts of the site can be used to support current and future canopy outcomes.

 Deep soil planting zones are required to protect existing mature trees and enable the planting of future canopy trees. Deep soil areas also improve infiltration of water on the site providing stormwater benefits.

The dimensions of the deep soil area at a minimum must support the size of current or future canopy tree for the lot. Ideally these should amount to an area one-third the size of the future canopy area and be at least one metre in depth. To support a small tree (3-8 metres) the minimum area should be 9m3, medium trees (8-10 metres) 16m3 and for larger trees (greater than 10 m) 25m.

- Promote planting in rear setbacks and in common areas for larger projects and in carparks for commercial and residential.
- 4. Integrate canopy planting outcomes with water sensitive urban design policies, in particular the maximising of deep soil landscaping and bio-retention controls
- 5. Location and integration of overhead and underground services to minimise future impacts on trees and canopy
- 6. Location and limit in number of crossovers/driveways per property
- 7. Consideration of Solar PV access

Green Offsets Policy Review:

Principles:

The Biodiversity Offsets policy is based on the Council's Biodiversity Strategy 2006. The principles that underpin the policy are avoid, minimise and mitigate, and achievement of net gain for ecological condition. These principles are common to biodiversity strategies and are well-accepted.

The Urban Forest Strategy has a broader scope compared to the Biodiversity Strategy; however, the two approaches will overlap because the DCP controls (proposed) will likely use a similar hierarchy of avoid, minimise, mitigate (replace). There may be a broader range of trees to be protected (e.g. exotic species) and like-with-like species replacement needs to be explored in these cases.

Operation:

The Green Offsets policy requires the applicant or property owner to submit their minimise/mitigate response to proposed vegetation removal. First preference is replacement of vegetation on the site, however if this is not possible, public lands are acceptable offset locations. Council will review and accept/modify the response with agreed outcomes becoming a condition of a planning consent.

A proposal is initially assessed on its merits, with offsetting as the final step in the assess, minimise and mitigate approach. The policy provides clear multipliers reflective of vegetation categorisation for public and private land. Like-for-like replacement of vegetation strata is preferred but may be varied to achieve a positive biodiversity outcome. Should a proposal involve an impact resulting in a net loss of biodiversity or inadequate consideration of the principles of the DCP, Council can refuse the development application under its merit assessment process.

The policy contains a guide to fees and charges for offsetting on public land, which may be implemented if an appropriate offset cannot be achieved on the site. The applicant / property owner must enter into a Voluntary Planning Agreement to offset on public land, involving the payment of the calculated offset fee plus a management fee.

'Offsetting on public land' payments under a voluntary planning agreement:

Under 'Calculating the offset value' in the policy, there are standard fees to be applied for the offset area per hectare and canopy area. This makes the Green Offsets policy robust and transparent.

Conclusion

To conserve the urban forest it's important that strategies for trees, urban canopy and biodiversity conservation are aligned. To compliment these strategies an Offsets Policy is implemented to support these strategy objectives. The offset policy has been designed based on the key principal of net gain, to seek like for like tree replacement (with associated multipliers) as the priority and where site constraints will allow. If like for like tree replacement cannot be achieved, then a net gain improvement in biodiversity is achieved on site. Where there are significant site constraints the Policy then allows for off-site offsetting, which is only considered where a net gain in canopy and biodiversity is not achievable. It is recommended for ease and efficiency of documentation and usability by the community to have one Offsets policy that seeks to achieve both onsite biodiversity and urban forest outcomes.

NEED HELP?

This document contains important information. If you do not understand it, please call the Translating and Interpreting Service on 131 450. Ask them to phone 9847 6666 on your behalf to contact Hornsby Shire Council. Council's business hours are Monday to Friday, 8.30am-5pm.

Chinese Simplified

需要帮助吗?

本文件包含了重要的信息。如果您有不理解之处,请致电131 450联系翻译与传译服务中心。请他们代您致电9847 6666联系Hornsby郡议会。郡议会工作时间为周一至周五,早上8:30 - 下午5点。

Chinese Traditional

需要幫助嗎?

本文件包含了重要的信息。如果您有不理解之處,請致電131 450聯繫翻譯與傳譯服務中心。請他們代您致電9847 6666聯繫Hornsby郡議會。郡議會工作時間爲周一至周五,早上8:30 - 下午5點。

German

Brauchen Sie Hilfe?

Dieses Dokument enthält wichtige Informationen. Wenn Sie es nicht verstehen, rufen Sie bitte den Übersetzer- und Dolmetscherdienst unter 131 450 an. Bitten Sie ihn darum, für Sie den Hornsby Shire Council unter der Nummer 9847 6666 zu kontaktieren. Die Geschäftszeiten der Stadtverwaltung sind Montag bis Freitag, 8.30-17 Uhr.

Hindi

क्या आपको सहायता की आवश्यकता है?

इस दस्तावेज़ में महत्वपूर्ण जानकारी दी गई है। यदि आप इसे समझ न पाएँ, तो कृपया 131 450 पर अनुवाद और दुभाषिया सेवा को कॉल करें। उनसे हॉर्न्सवी शायर काउंसिल से संपर्क करने के लिए आपकी ओर से 9847 6666 पर फोन करने का निवेदन करें। काउंसिल के कार्यकाल का समय सोमवार से शुक्रवार, सुबह 8.30 बजे-शाम 5 बजे तक है।

Korean

도움이 필요하십니까?

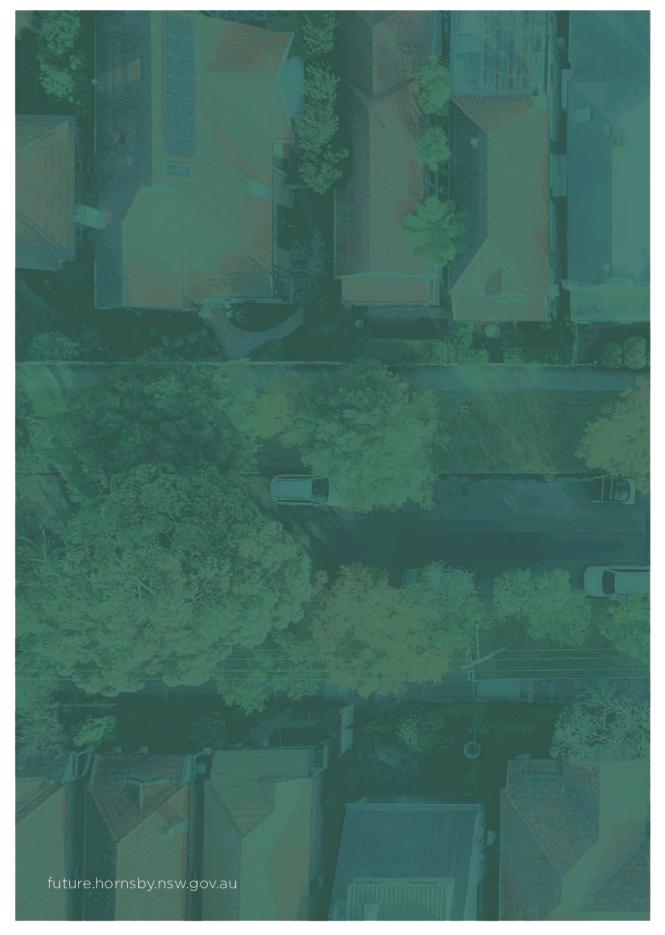
본 문서에는 중요한 정보가 포함되어 있습니다. 이해가 되지 않는 내용이 있으시면, 통역번역서비스(Translating and Interpreting Service)로 전화하셔서(131 450번) 귀하를 대신하여 혼즈비 셔 카운슬에 전화(9847 6666번)를 걸어 달라고 요청하십시오. 카운슬의 업무시간은 월요일~금요일 오전 8시 30분~오후 5시입니다.

Tagalog

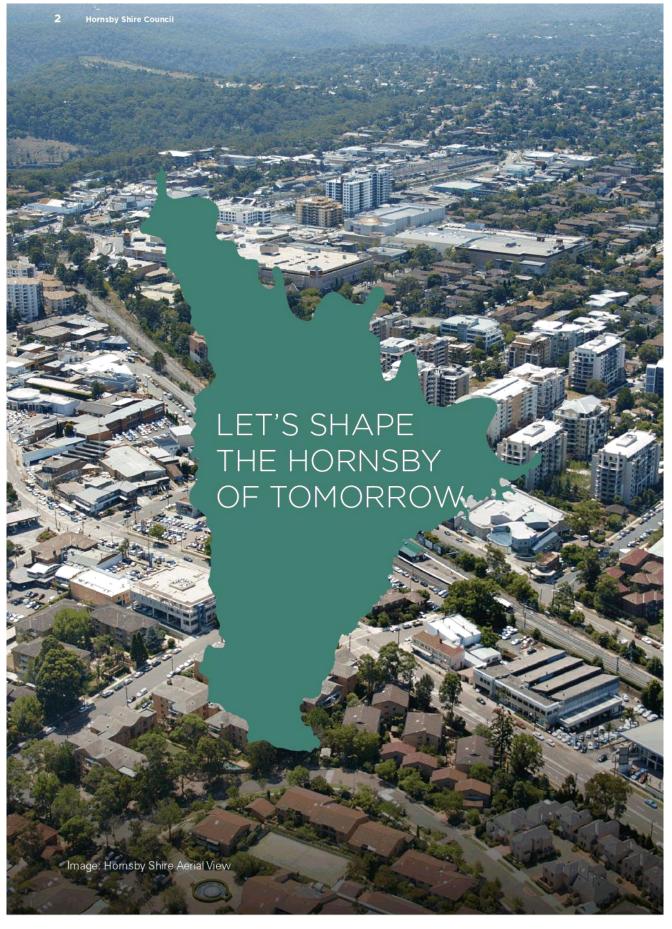
Kailangan ng tulong?

Itong dokumento ay naglalaman ng mahalagang impormasyon. Kung hindi ninyo naiintindihan, pakitawagan ang Serbisyo sa Pagsasalinwika at Pag-iinterprete (Translating and Interpreting Service) sa 131 450. Hilingin sa kanilang tawagan ang 9847 6666 para sa inyo upang kontakin ang Hornsby Shire Council. Ang oras ng opisina ng Council ay Lunes hanggang Biyernes, 8.30n.u.-5n.h.

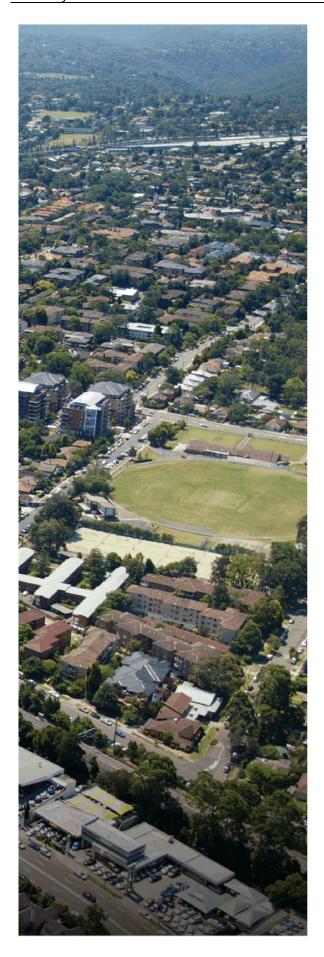








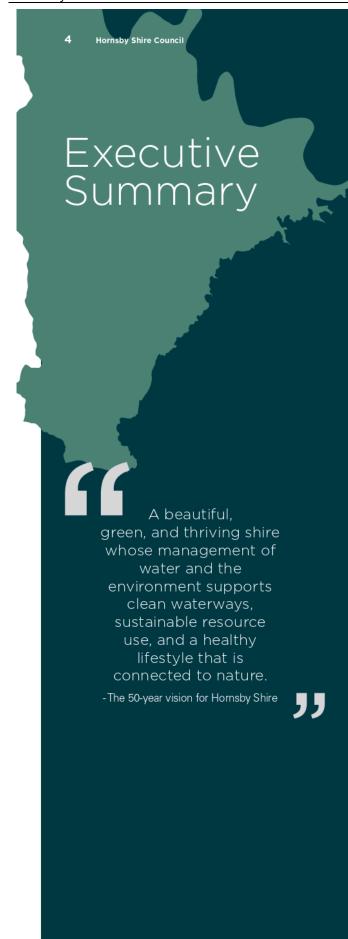
Water Sensitive Hornsby Strategy



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Council recognises the Traditional Owners of the lands of Hornsby Shire, the Darug and Guringai peoples, and pays respect to their Ancestors and Elders past and present and to their Heritage. We acknowledge and uphold their intrinsic connections and continuing relationships to Country.



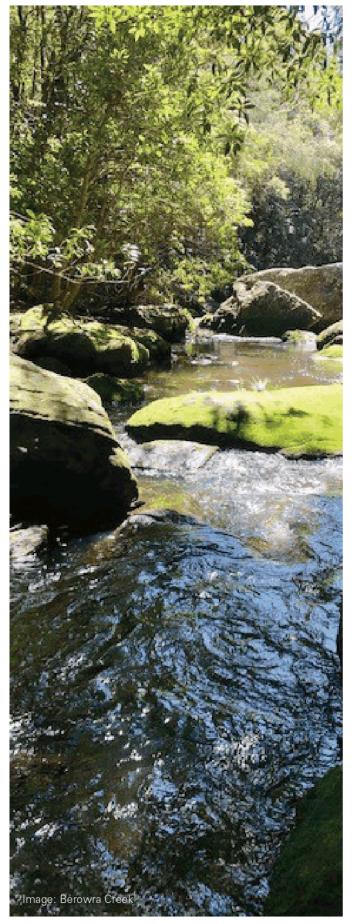
The Vision and Transition Strategy for a Water Sensitive Hornsby defines a vision of a water sensitive future for Hornsby Shire, and outlines the broad steps Hornsby Shire should take to enable a transition towards its future. It is the outcome of ten months of research, analysis and engagement with 24 community champions and 34 leading thinkers from across water, planning, development and environment sections in Hornsby Shire Council.

The project developed and applied methods and tools of the Cooperative Research Centre for Water Sensitive Cities (CRCWSC) designed to consider a city's long-term water aspirations, benchmark current water sensitive performance and explore strategic priorities for the short- to medium-term that will be important in pursuing its water sensitive city vision. These approaches have helped situate Hornsby Shire on its water sensitive city transition journey and identified the critical interventions to enable progress.

Hornsby Shire's water story

Hornsby Shire is known for its beautiful and accessible natural environment; including bushland and national parks, rivers and creeklines, and native plants and wildlife. People have long been attracted to this environment, dating back to Aboriginal communities who thrived off the plentiful resources, and European settlers who utilized the land for farming and other industries. As the region became more developed, the once-pristine natural environment started to become degraded. Waterways, in particular, saw a decline in water quality and modifications to natural flow patterns due to rapid development. Beginning in the 1970s, local residents became active in voicing concerns around waterway health, commitments from Council and other organisations to take action on improving water quality as seen through the historic Statement of Joint Intent and implementation of the Catchments Remediation Rate. Hornsby Shire Council is now seen to be leading the way in implementation of water sensitive urban design. Despite this proactive approach, Hornsby Shire will need to plan wisely to adequately service a growing population in a warming and drying climate, while ensuring environmental and liveability outcomes for the region.

Water Sensitive Hornsby Strategy



Hornsby Shire's water sensitive vision

The 50-year vision for Hornsby Shire is to be a beautiful, green, and thriving shire whose management of water and the environment supports clean waterways, sustainable resource use, and a healthy lifestyle that is connected to nature. The vision encompasses six statements that define the outcomes to be ensured:

- Hornsby's natural environments are healthy and thriving with biodiversity
- Hornsby and its villages are full of beautiful blue and green spaces that connect people to their surrounding environment and local community
- Hornsby Shire has engaged, empowered and active communities who value Aboriginal and multi-cultural connections to land and water
- A strong focus on water management supports safe communities and healthy, clean rivers and creeks
- **5.** Sustainable resource use is supported by integrated, multi-functional infrastructure
- Integrated and inclusive governance arrangements deliver a holistic approach to water management while meeting the challenges of growth



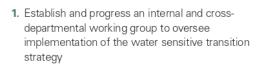
Current water sensitive performance

Hornsby Shire's current water sensitive performance was benchmarked using the CRCWSC's Water Sensitive Cities Index. Hornsby Shire's performance in the Index suggests it is strongest in the goal *Equity of essential services*. Its relative weaknesses are in the goals of *Improve productivity and resource efficiency*, and *Increase community capital*.

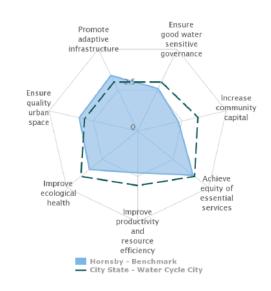
Interpreting these results against the six city-states of the Urban Water Transitions Framework highlights Hornsby Shire's high performance in the provision of water supply and sewerage. Beyond these, Hornsby Shire has shown good progress in drainage (83%), water way management (96%), water cycle management (47%) with room for further innovation to increase these ratings as it becomes more water sensitive.

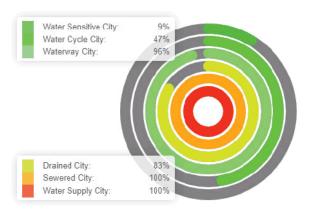
Transition assessment and strategic recommendations

Hornsby Shire has a strong history of collaboration to support waterway health outcomes, underpinned by an engaged and active community and supportive Council. This foundation puts Hornsby Shire in a strong position in achieving more water sensitive outcomes. Nevertheless, for Hornsby Shire to achieve its 50-year water sensitive vision, greater emphasis will be needed on improving practices and processes for achieving integrated outcomes on the ground. To successfully progress Hornsby Shire's water sensitive city transition, 18 strategies across the six vision themes are recommended. The short-to-medium term transition needs of Hornsby Shire can be summarised by the following five overarching strategies:



- 2. Ensure water sensitive city outcomes are embedded in policy and planning
- Develop new knowledge for the range of outcomes needed to deliver Hornsby Shire's water sensitive city vision (in particular community and Aboriginal engagement solutions)
- Leverage partnerships and project opportunities to demonstrate and build the business case for multifunctional, water sensitive solutions
- **5.** Strengthen compliance for environmental and waterway health outcomes





Acronyms

CRR: Catchments Remediation Rate

HATSIC: Hornsby Aboriginal and Torres Strait Islander

Advisory Committee

WSC: Water Sensitive City

WSUD: Water Sensitive Urban Design

CRCWSC: Cooperative Research Centre for Water

Sensitive Cities

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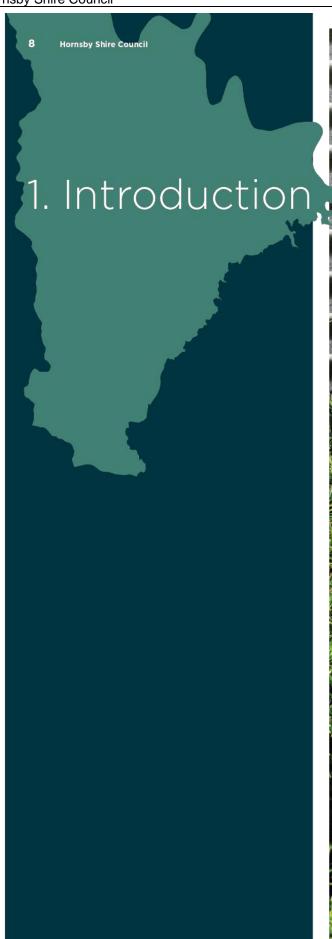
The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) was engaged by the Hornsby Shire Council to support the Council's development of this Water Sensitive Hornsby Strategy. The version of the report provided by the CRCWSC may have been modified subject to final review and approval by Hornsby Shire Council. The CRCWSC makes no guarantee to the accuracy of this report and accepts no liability if this report is used for an alternative purpose from which the original was intended, nor to any third party in respect of this report.

Acknowledgements

The CRCWSC and Hornsby Shire Council would like to acknowledge Stephen Pym Creations for creating the vision illustrations in Section 3. Visual interpretations of Hornsby Shire's water sensitive city vision are important for driving people's connection to and understanding of the vision, and the authors thank Stephen for bringing the vision to life.



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Water Sensitive Hornsby Strategy

1.1 About this report

The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) was invited to develop a water sensitive city vision and transition strategy for Hornsby Shire. The project involved applying the CRCWSC's Transition Planning Process (Figure 1) which involves a series of workshops with participants from Hornsby Shire Council, Sydney Water, and the Office of Environment and Heritage. The process for Hornsby Shire also involved a parallel community visioning process which involved three workshops with community participants.

The CRCWSC is part of the Commonwealth Government's Cooperative Research Centre Program. It partners with research, government and industry organisations around Australia in delivering its mission to help change the way urban areas are designed, built and managed with water sustainability and productivity as a central driver. The CRCWSC envisions future cities and towns, and their regions, to be sustainable, resilient, productive and liveable.

This report presents the key outputs of the process. Its purpose is to provide a framework for orienting and coordinating strategic action across the many different stakeholders who will need to collaborate for Hornsby Shire's envisioned water future to be achieved. This

document provides a snapshot of Hornsby Shire's performance and transition progress at this point in time. The strategies and actions in this report are designed to progress Hornsby Shire's transition towards a water sensitive city. It is intended that the Strategy will be re-assessed in 3-5 years to determine the impact of implemented strategies and actions, and to identify new strategies and actions to continue to advance Hornsby's water sensitive city transition. The CRCWSC is developing the tools and processes to assist with this monitoring and re-assessment.

It is anticipated that this document can be used as a resource to inform the design and implementation of strategic and operational programs of action within Council, key agencies and community groups. The outcomes of this process will also inform the ongoing development of Hornsby Shire Council's Local Strategic Planning Statement.

This report is complemented by a companion document, Shaping a Water Sensitive Hornsby Shire: Outcomes from a community visioning process, which documents the process, ideas and outputs of the community workshop series.

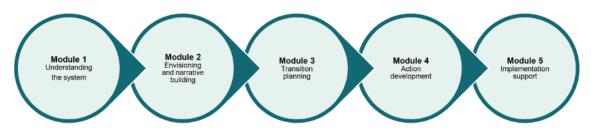


Figure 1: Description of the CRCWSC's Transition Planning Process

1.2 What are water sensitive city transitions?

As cities and towns globally are grappling with the challenges of climate change and rapid urbanisation, communities and governments are recognising the importance of water in supporting urban liveability, sustainability and resilience for a city's long-term prosperity.

In Australia, the concept of the water sensitive city (WSC) is now widely used to represent an aspirational state in which efficient, sustainable and productive water use and management is integrated throughout the urban system. Originally the concept was coined to refer to metropolitan areas but is equally relevant to regional cities. In a WSC, people can enjoy reliable water supplies, resource-efficient sanitation, protection from environmental threats, healthy ecosystems, beautiful landscapes, new business opportunities, and cultural and recreational pursuits that help build community resilience.

AWSC incorporates innovative infrastructure, design and governance solutions. For example, water recycling at different scales through wastewater recovery and stormwater harvesting provides a diversity of water sources and improves the health of downstream rivers and creeks by reducing pollution and flow impacts. Water Sensitive Urban Design (WSUD) integrates nature-based infrastructure into the landscape to provide hydraulic and water treatment functions, as well as amenity benefits such as an aesthetic environment and mitigation of urban heat island effects. Integrated and collaborative land use and water planning results in catchment-scale approaches to enhancing flood resilience and connecting areas of green and blue to create ecosystem and recreation corridors throughout the city. Citizens are active in caring for water and the environment as their sense of place and collective identity is nurtured through their connection with water.









Figure 2: Artistic representations of water sensitive city outcomes including urban greening, improved amenity, recreation, and social cohesion

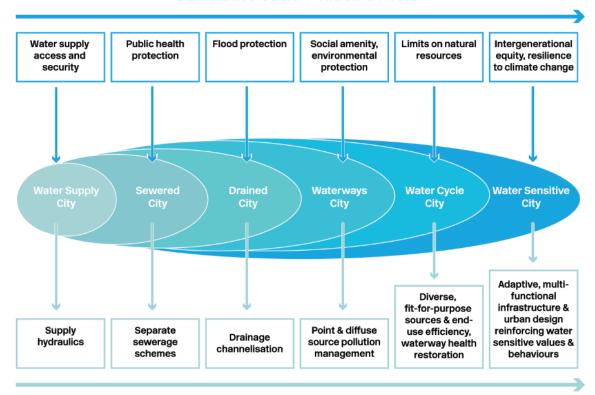
Source: CRCWSC

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Water Sensitive Hornsby Strategy

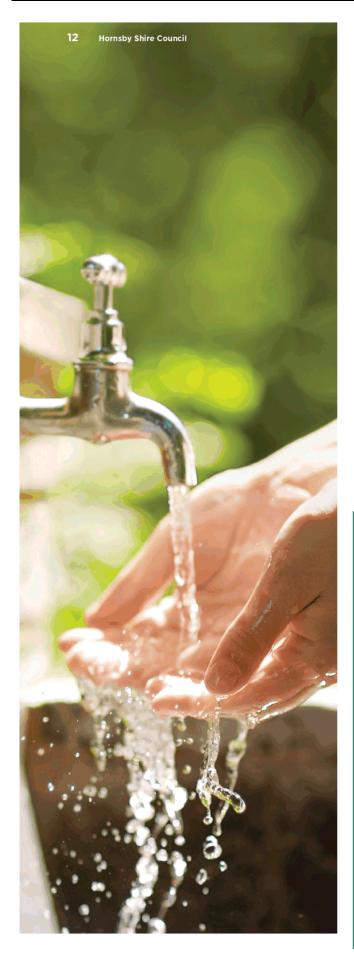
Many places are starting to articulate aspirations represented by the WSC concept (Figure 2). Becoming a WSC involves significant changes from the conventional way of providing water services. In Australia this is characterised by centralised infrastructure that typically manages water as separate streams for supply, wastewater and stormwater. These traditional water systems have given us critical benefits such as clean water, safe sanitation and effective drainage, and this mode of servicing is still an important part of a WSC. These water systems are also jointly managed by a number of agencies and service providers, adding complexity in progressing WSCs. We now recognise that adaptations are needed to address key social and environmental vulnerabilities such as degraded waterways, uncertain and extreme rainfall patterns and growing community expectations for improved liveability. The Urban Water Transitions Framework presented in Figure 3 depicts the evolution in water system servicing as these drivers unfold. Most cities in the world would appear somewhere on this continuum, however, a city's journey from a water supply city through to the aspirational WSC is not linear. Australian cities are typically somewhere between a Drained City and a Water Cycle City, with observable features across all six of the city-states. Where Hornsby Shire sits within this continuum is identified in Section 4 – Assessing Hornsby Shire's current water sensitive performance.

Cumulative Socio-Political Drivers



Service Delivery Functions

Figure 3: Urban Water Transitions Framework (Brown, Keath & Wong, 2009)



As a city moves from left to right along the Urban Water Transitions Framework, it observes a shift from traditional water management reliant on large-scale, centralised water infrastructure to a more integrated, decentralised approach involving many different types of stakeholders. Figure 4 and Figure 5 below show what a city looks like if it is in the first three phases (Water Supply, Sewered and Drained Cities) versus what it would look like if it were in the later three stages (Waterway, Water Cycle, and Water Sensitive Cities).

Becoming a WSC requires significant changes in policy and practice as the water servicing system moves through different city-states. A successful transition will therefore rely on commitment and alignment amongst many different people and organisations. Developing a shared perspective of water today, a compelling vision for the future and a framework to guide coherent strategic action is critical for establishing the understanding, motivation and capacity amongst stakeholders to drive their WSC transition. This WSC Vision and Transition Strategy for Hornsby Shire documents these elements and provides strategic guidance for stakeholders wanting to progress Hornsby Shire's WSC transition.

What is Blue-Green Infrastructure?

Blue-green infrastructure (BGI) in urban areas is designed to successfully incorporate natural systems that provide the ecological and amenity value associated with urban greening as well as providing stormwater management. Historically, "green" assets (trees, parks, gardens) and "blue" assets (Water Sensitive Urban Design, drainage and flood storage) have been planned separately. However, often the same asset can provide multiple services that benefit both "green" and "blue" objectives. The guiding principles of BGI aim to use nature in cities at a range of scales to control the quantity; manage quality; provide water resources and prevent pollution and utilise the wider opportunities this brings to create and sustain better places for people and pature.

Source: Victorian DELWP (2017), CRCWSC (2016)

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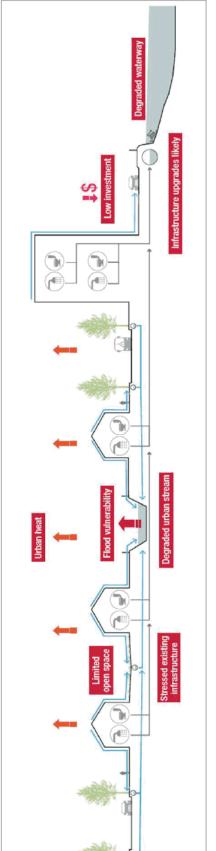


Figure 4: Profile of a city that has achieved the Water Supply, Sewered and Drained Cities (CRCWSC, 2016)

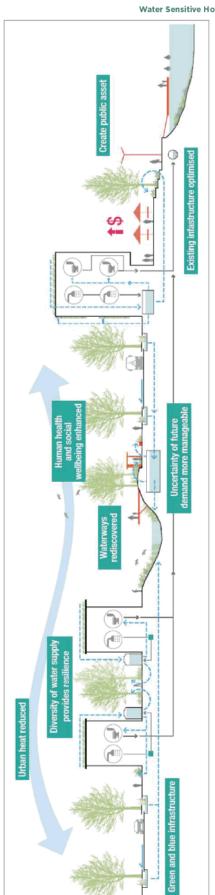


Figure 5: Profile of a city that has achieved the Waterway, Water Cycle and Water Sensitive Cities (CRCWSC, 2016)

Hornsby Shire Council 2. Hornsby's Water Story

2.1 Looking from the past to today

When preparing for future changes, it is helpful to look to the past and learn from patterns of change and previous responses to trends and events. Engagement with both Council staff and community workshop participants focused on building a collective timeline of people's historical knowledge and experiences with water across Hornsby Shire. The following commentary is a summary of the workshop discussions, synthesised into key periods that articulate Hornsby's historical water story.

Aboriginal country (pre-1800)

For tens of thousands of years prior to European settlement, numerous Aboriginal tribes including the Gu-ring-gai and Darug people lived and thrived in the Homsby region. The Hawkesbury River, which they called Deerubbin, was central to their way of life. Yams, a staple food, grew plentifully along the riverbanks, and both men and women fished for fish, eels, and shellfish within the river. Bark canoes were used for travel and transportation along the rivers and creeks which provided efficient transport routes between regions.

Many of the local names reflect this early connection to water, such as Deerubbin meaning "wide, deep water" and Cowan meaning "big water." A multitude of middens, engraving sites, grinding grooves and cave paintings were created along local waterways, many of which still exist today in over 200 recorded Aboriginal heritage sites.

Early European Settlement (1800 - 1950)

The Hawkesbury River was one of the first regions explored by Governor Phillip in 1789, where the rich soil seemed promising for a farming settlement. By 1794, a small settlement of 70 farmers was established in the Hawkesbury Region. The clearing of land for farming disrupted the local food supplies along with the traditional Aboriginal ways of life. The construction of farm dams also altered creeklines and natural water flow paths. Around 1800, Europeans began logging for timber, felling blue gums and ironbark's that grew along the ridges and transporting them along the river.

There were conflicts between European settlers and Aboriginal groups over land, crops and livestock.

These conflicts, coupled with the introduction of diseases such as smallpox and influenza, resulted in the loss of both Aboriginal and European lives and the removal of Aboriginal groups from their native lands.

People were drawn to the Hornsby region because of its plentiful resources and beautiful natural environment. Fertile soils, timber, land for livestock, plentiful fish and oysters, and easily navigable waterways helped support growing industries. Two ferries began to operate to help transport people across the Hawkesbury River, and the construction of roads such as the Great North Road began to expand the connection with other settlements. The arrival of the railway in the late 1880s saw a rapid increase in population, growing to 4,700 people in 1900. People were drawn to the region due to its opportunities for work, and also for the natural beauty of the rivers and creeks. Brooklyn in particular became well-known for hosting a number of prominent ships including the Lucinda, on which the Australian constitution was written, and a royal yacht hosting the Duke and Duchess of York in 1901. It became so well-known that an image of the view of the Hawkesbury River from Brooklyn was used on the Federation of Australia's five-pound note (Figure 4) in 1913.



Figure 6: Five Pound note with image of the Hawkesbury River

Hornsby Council was officially established in 1906, when the first council election was held. A number of schools, churches, and the post office were constructed, creating the beginnings of modern-day Hornsby. As the town continued to grow, the night soil man or "Pan Man" provided waste collection services. However, as the population continued to grow, there was a need for more reliable and large-scale services. The early 1900s saw the construction of the first reticulated water supply and sewerage system, requiring digging and laying of pipes along Peats Ferry Road.

People continued to enjoy the beautiful natural environment for recreation such as swimming, boating and fishing in the Hawkesbury River, Berowra Creek and Fishponds Waterhole. Houses were being built along the water with access to creeks to support their desired lifestyle. Connection to creeks and waterways continued to build as more and more people were able to experience and enjoy the natural environment. The significance of the natural environment was realised and led to the creation of Ku-ring-gai Chase National Park in 1894 and the Muogamarra Nature Reserve in 1934.

Impacts on the natural environment (1950 - 2000)

The post-World War II population boom saw Hornsby council's population rise to 39,500 by 1950. Because of the population boom, the region saw a dramatic rise in land clearing and creek piping for residential development, including more roads and an overall increase in impervious surfaces. The majority of the development happened along the ridgelines, and modification to the natural topography affected the overland water flow and quality. Several large flooding events (e.g. at Crosslands, Galston Gorge) led to the construction of stormwater pipes in the 1960s to help mitigate future destructive flooding events.

As Greater Sydney continued to grow, the Water Board (now Sydney Water) expanded the infrastructure networks to meet the growing population. However, a number of wastewater treatment plants within the shire (West Hornsby Sewage Treatment Plant and Hornsby Heights Sewage Treatment Plant) were discharging effluent with high loads of nutrients, nitrogen and phosphorous into the waterways. While the urban areas were connected to the sewerage system, rural properties and townships relied on septic disposal systems, which also created issues of waterway pollution when not maintained properly. The discharge of waste and nutrients saw a dramatic decline in the water quality of the Berowra Creek, causing it and other downstream waterways to not be fit for swimming.

All of the development and infrastructure saw severely negative impacts on the once beautiful and pristine rivers and waterways. Urban development caused an increase in sediment flowing into the waterways, significantly impacting the depth of Berowra Creek. Toxic and nontoxic algal blooms and fish kills became more and more common into the 1990s, along with the presence of faecal bacteria and elevated heavy metals in marine life. The community observed this decline in waterway

and some of the more serious events were highlighted in the press, creating public awareness around the issue. The community started to demand action around water quality in the region, first by writing letters to Councillors and Ministers and then turning to a more integrated community approach. Individuals such as Ritz Schroeder were instrumental in providing evidence and data and driving the community activism. Other active community members throughout the 1970s-1990s include Roger Campbell, Ana Pollak, Lyn & Jean Bolton, Michael Dean and Dr. David Hughes. A number of grassroots lobbying groups and progress associations such as the Association for Berowra Creek Inc., Berowra Waters Progress Association and Save the Hawkesbury's Unique River Environment (SHURE) continued to advocate for improved water quality in the region.

The Catchment Management Act 1989 established several committees across NSW to focus on integrated catchment management. The Berowra Catchment Management Committee was established in 1994 to focus on the specific needs of the Berowra Catchment.

The government soon recognised the severity of the waterway health issue and a Statement of Joint Intent was created and signed in 1994 between Hornsby Shire Council, NSW Government, Environmental Protection Agency, (Sydney) Water Board, and the Hawkesbury-Nepean Catchment Management Trust. The statement



acknowledged the significant contribution of primary treated wastewater and urban runoff to the health of downstream waterways, and instigated a number of key actions to reduce pollution entering the region's waterways. These included the upgrade of wastewater treatment plants and Council programs to manage diffuse stormwater pollution: installation of catchment remediation devices, sediment control compliance, policy and development controls, education, catchment surveys and monitoring.

There is still significant concern from the community around the scale of development happening in Hornsby, especially the number of mid-to-high rise buildings. Residents staged a number of protests, including the 1997 Landcom protests which saw local residents blockade bulldozers beginning work on a large proposed subdivision in bushland in Berowra Valley. Council recognised the importance of retaining green space within urban spaces, and established policies to compliment the Tree Preservation Order that had been in place since 1960.

Environmental and waterway focus (2000 - 2010)

Water quality has improved dramatically since the signing of the Statement of Joint Intent. Actions undertaken include sewerage treatment plant upgrades to address point source pollution, implementation of a Catchments Remediation Rate (CRR) in Council, and the construction of water sensitive urban design features (e.g., raingardens, wetlands, biofilters) throughout the council area. Other action funded through the CRR included a dedicated water quality monitoring program and catchments education officers within Council to ensure outcomes were being achieved. Homeowners are now encouraged to install rainwater tanks on their property. Research informed a number of studies and plans conducted and developed in the early 2000s (including estuary management plans, stormwater management plans, climate adaptation strategies, total water cycle management strategy and stormwater policies) to ensure protection into the future. Council also began to look at innovative and sustainable water solutions such as stormwater harvesting systems for irrigation (e.g. Council's Community Nursery at Pennant Hills and numerous sports fields).

Although water quality improved significantly because of these actions, there has been minimal reductions in nutrients entering waterways since the wastewater treatment plants were upgraded in the 1990s (Hornsby

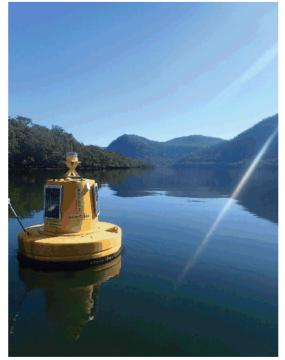
Water Sensitive Hornsby Strategy

Shire Council, 2019). This indicates that water improvement measures being implemented by Council has offset the impacts of development over the same period. However, Hornsby Shire still faces ongoing challenges regarding impacts from new and existing development on the waterways.

One of the things people love about Hornsby Shire is that there is enough space to have large lots and spacious homes. However, this peri-urban development and the associated land clearing significantly alters natural water flows, causing hydrologic and (to a lesser extent) water quality impacts on local waterways.

Future liveability (2010 - 2021)

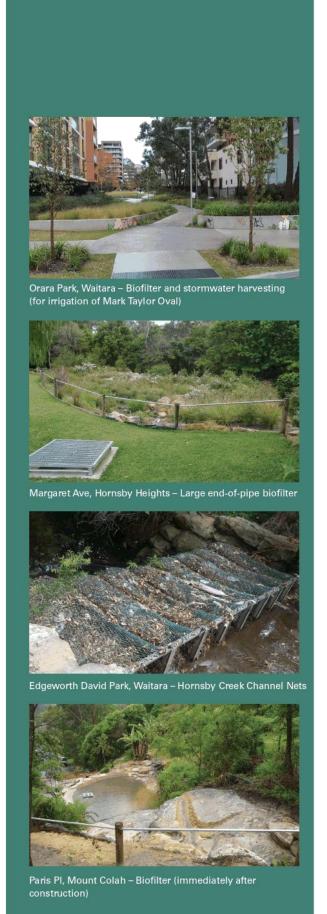
While Hornsby has been seen as a leader in the environmental and water space, it will continue to face situations that will challenge the progress that has been made. Changing government priorities, along with increasing pressure on water systems from more extreme storm events and rapid development, will require the people of Hornsby to work together in order to find new solutions to these challenges. Although the total urban area is small compared to other councils in Sydney, the location of Hornsby in the upper catchment means that unmanaged impacts will manifest within downstream high ecological value waterways. New urban development patterns such as high-rise apartment blocks are changing the character of the area and bring more diverse demographics. Urban heat within Hornsby town centres will also become a challenge as global temperatures continue to rise. While Hornsby Shire Council has already made significant advancements in the stormwater space, further action will need to be taken to ensure the region remains liveable and beautiful for its residents and that resources are managed sustainably for future generations.



Water Quality Monitoring Buoy - Calabash Point

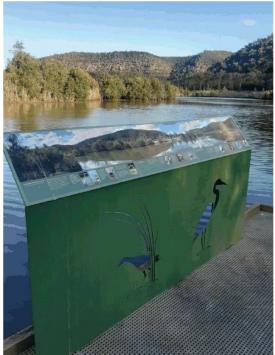


Water Quality Monitoring - Berowra Creek





Coronation St, Hornsby – Tree pit biofilter (artwork by Stephen Pym)



Interpretive signage – One Tree Reach Wetland, Laughtondale

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The gas mask fish - Stormwater awareness campaign



The Clean4Shore program – Value-adding estuary foreshore clean-ups with catchment education and stormwater pollution awareness – Asquith Girls High School



Tankscape program – Rainwater tanks and water conservation themed murals in schools – Normanhurst Public School



Catchment Tour – Stormwater and Catchments Remediation Rate awareness



EnviroMentors – Keeping Waterways Clean school incursion – Glenorie Public School

2.2 Looking ahead to Hornsby's water future

Hornsby Shire is currently experiencing rapid population growth and urban development, causing a shift in demographics and character of the region. The population of Hornsby Shire is forecast to increase from 147,000 people in 2016 to 180,000 by 2036, with the main driver being migration from other areas. There will be an increase in dwellings, specifically high to medium density housing to accommodate the population growth. Increased development will impact local habitats and biodiversity corridors, along with stormwater quality and flows

The projected population growth for Greater Sydney will have significant impacts upon Hornsby Shire through tourism, jobs, infrastructure, and other areas. A large portion of Greater Sydney's future development is expected to occur in the upstream catchments of Hornsby Shire, which will lead to significant waterway health impacts. The overall increase in people and development in the region will be a major threat to Hornsby Shire's ecosystems in the future.

The Greater Sydney region is already experiencing the impacts of climate change. Days are becoming hotter and drier, with urban heat being a major concern and its impact on people's health and wellbeing. Higher intensity storms and rainfall events will increase the risk of flash flooding, coupled with Hornsby Shire's dramatic topography could lead to significant downstream impacts. Longer periods of hot, dry weather will increase the bushfire risk in natural areas.

While these drivers are a challenge for the existing water system, they also present an opportunity to change the business-as-usual approach to water management. Hornsby Shire residents are passionate about preserving the character and lifestyle of the shire that make it a great place to live. People living in the Hornsby region love being close to nature and value the large amount of bushland and its accessibility for activities such as bushwalking. The nearby Hawkesbury River, Berowra Creek, Berowra Valley, Ku-ring-gai Chase and Lane Cove National Parks and Muogamarra Nature Reserve offer ample opportunities for people to enjoy and experience the beautiful surrounding natural environment. The rivers and creeks provide opportunities for recreation such as kayaking, boating and camping. People love the rich biodiversity of the region, especially the birdlife.

The lifestyle of the region is also a major drawcard for residents. People cherish the proximity to the city, beaches, and the mountains, along with the diversity of both urban and rural land uses. There is more open space than the city, allowing people to have bigger houses and yards, which are also more affordable. The multiculturalism and diversity of people brings rich character and vibrancy to the region. There is a strong sense of community within Hornsby and its villages, promoted through festivals, markets, and other events. A number of good cafes and restaurants add to Hornsby's vibrancy. There is strong Indigenous and European heritage in the region, with one of the largest clusters of Aboriginal carvings in Australia.

The Hornsby community values having a Council that is active in protecting the environment and having Councillors that are engaged with the community. The facilities such as schools, sports fields, play grounds and parks such as Fagan Park are valued and it is seen to be a safe area for families and children. People value the cleanliness of the region, with minimal rubbish and clean, non-polluted air. There are also many active bushcare groups and other community groups who are active in protecting the natural environment.

Water Sensitive Hornsby Strategy

3. Hornsby Shire's Water Sensitive Vision

Hornsby Shire
is a beautiful, green, and
thriving shire whose
management of water
and the environment
supports clean
waterways, sustainable
resource use, and a
healthy lifestyle that is
connected to nature.

-The overall water sensitive vision for Hornsby Shire



The 50-year water sensitive vision for Hornsby Shire aims to orient and align the actions of stakeholders over the long-term. The aspirations of project participants for their region's water future are expressed as a suite of outcome statements with accompanying rich descriptions. The 50-year timeframe enables people to stretch their ambitions beyond today's systems and constraints to reflect on the transformative change that is possible over such a period.

The overall water sensitive vision for Hornsby Shire is presented below:

Hornsby Shire is a beautiful, green, and thriving shire whose management of water and the environment supports clean waterways, sustainable resource use, and a healthy lifestyle that is connected to nature.

The six emerging themes are as follows:

- Hornsby's natural environments are healthy and thriving with biodiversity
- Hornsby and its villages are full of beautiful blue and green spaces that connect people to their surrounding environment and local community
- Hornsby Shire has engaged, empowered and active communities who value Aboriginal and multicultural connections to land and water
- A strong focus on water management supports safe communities and healthy, clean rivers and creeks
- Sustainable resource use is supported by integrated, multi-functional infrastructure
- **6.** Integrated and inclusive governance arrangements deliver a holistic approach to water management while meeting the challenges of growth

The following section outlines each individual vision outcome in more detail, providing a rich narrative that helps readers visualise what it is like in Hornsby Shire if the WSC vision is achieved. The illustrations (one per vision outcome) were designed and produced by Stephen Pym Creations and were co-developed with workshop participants.

1. Hornsby's natural environments are healthy and thriving with biodiversity

Hornsby residents are surrounded by healthy bushland that supports diverse native flora and fauna. Habitats, parks and reserves are distributed throughout urban areas and connected for habitat corridors, providing safe passages for wildlife. Native aquatic species are plentiful in waterways. Programs are in place for the protection of all native species and ecosystems. Feral animals are managed appropriately in order to protect native species. People appreciate and value the biodiversity of the area and actively take part in protecting and enhancing it. Waterways are rehabilitated and protected to ensure healthy creeklines, riverbanks and riparian vegetation. Natural bushland is protected from development to ensure sanctuaries for plants, animals and natural processes. Hornsby's natural environment is supported by a biodiversity strategy underpinned by community values and reflected in local planning and legislation.



2. Hornsby and its villages are full of beautiful blue and green spaces that connect people to their surrounding environment and local community.

Homsby and its villages are filled with networks of blue and green spaces that keep people cool, comfortable, healthy and connected. People experience and value the connection of ridgelines and valleys unique to Hornsby Shire. Streets and parks are lined with trees that provide shade and urban cooling. Water is seen and used in the landscape through fountains, ponds and vegetation so people can experience and enjoy it. A network of walkways and cycleways promote recreation and connect people to bushland, waterways and parklands for outdoor recreation. Facilities are available for people to actively use the rivers and creeks (e.g. kayaking, paddle boarding and other waterway activities). Innovative and best practice urban design creates spaces in developed areas that people want to spend time in.



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3. Hornsby Shire has engaged, empowered and active communities who value Aboriginal and multi-cultural connections to land and water

The Hornsby community is committed to sustainability which is made evident through environmentally conscious behaviours. People understand the water cycle and care about their local waterways and bushland corridors. The community is an active and valued partner in water planning and decision-making and there are processes that enable community voices to be heard. Councillors and Council staff support community aspirations and continuously engage with diverse community groups. People value the Aboriginal heritage of the area and appreciate the many diverse cultural connections to waterways. Local Aboriginal communities are appropriately engaged to share knowledge and stories, and to form ongoing relationships in working together to achieve positive outcomes for the region.



4. A strong focus on water management supports healthy, clean rivers and creeks

Hornsby's rivers and creeks are clean, swimmable, and highly valued. Because of the clean water, people visit the rivers and creeks for recreation and amenity. The high value of waterways means innovations and technologies regarding water quality treatment and flow are realised and incentivised. River-based industries (e.g. oyster farming, estuary prawn trawlers) are thriving. The quality of water, including groundwater, is continuously improved and protected by effective catchment management, water sensitive urban design, and robust recycling programs, and is facilitated through multistakeholder and agency collaboration. There are minimal water quality related warnings and human-induced algal blooms, and fish and crustaceans are safe to eat. Flooding is minimised through appropriate measures that include the capture and reuse of stormwater. Everyone within Hornsby takes responsibility for and is accountable for their actions towards good waterway health outcomes (including urban and rural communities, businesses, and industries). Education programs help build community resilience and provide information on how people can help improve the health of their local waterways.



5. Sustainable resource use is supported by integrated, multifunctional infrastructure

Hornsby's water infrastructure is designed to meet the needs of both people and the environment. Infrastructure systems exist at multiple scales to deliver place-based solutions. The delivery of multiple benefits (e.g. greening, water quality, cooling) beyond traditional water services is taken into account in infrastructure design. Planning supports integration of green infrastructure with traditional grey infrastructure. Hornsby's water supply utilises diverse sources that are fit-for-purpose, which include harvested stormwater and recycled wastewater. Community members support using recycled water for household use. Innovative asset ownership models are utilised for ongoing management and maintenance. System modelling informs intelligent and real-time operation of infrastructure networks that can react to forecasted weather patterns (e.g. purging of water storage facilities when heavy rain is predicted to provide flood storage).



6. Integrated and inclusive governance delivers a holistic approach to water planning and management while meeting the challenges of growth

There is a united and shared responsibility for Hornsby's water resources and environmental health, with alignment across levels of government and across agencies. Water is managed in an integrated manner across sectors, organisations, and stakeholders, who work together to drive collaborative outcomes using the latest available technology. Internal collaboration within Council is efficient and streamlined, leading to a range of positive outcomes for Hornsby Shire and supporting the aspirations of the community.



Water Sensitive Hornsby Strategy

Assessing
Hornsby
Shire's
current
water
sensitive
performance

Planning Hornsby Shire's transition to its water sensitive city vision requires a detailed understanding of its current performance in relation to its aspirations. The CRCWSC's Water Sensitive Cities (WSC) Index is a benchmarking tool designed for this purpose. It articulates seven WSC goals, which organise 34 indicators representing the major attributes of a WSC. These indicators are also mapped to the idealised city-states represented in the Urban Water Transitions Framework (Figure 3, page 5) to provide a benchmarked city-state.

While a city's local WSC vision may not emphasise all indicators of the WSC Index to the same degree, the tool enables diagnosis of key areas of strength and aspects for improvement. These insights can then inform the prioritisation of actions and provide a framework for ongoing monitoring and evaluation of a city's water sensitive performance.

4.1 Hornsby Shire's WSC Indicator scores

The WSC Index was applied to Hornsby Shire to benchmark current water sensitive performance. The benchmarking workshop was delivered in February 2019 and included 34 participants from a wide range of departments within Council, along with external organisations (including Sydney Water, NSW Local Land Services, and a number of neighbouring Councils). Figure 8 below illustrates the WSC Index goal results for Hornsby Shire (shown by the shaded blue area). Table 1 below provides the individual scores for each goal.

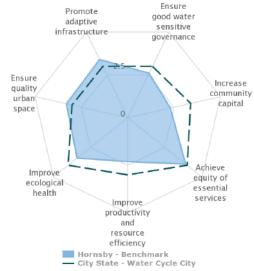


Figure 8: Hornsby Shire's WSC Index goal scores (ideal scores for a water sensitive city would be shown by a graph that fully extends to the outer edges)

WSC Index Goal and Indicators	Score /5
1. Ensure good water sensitive governance	2.6
1.1 Knowledge, skills and organisational capacity	2.0
1.2 Water is key element in city planning and design	3.0
1.3 Cross-sector institutional arrangements and processes	3.0
1.4 Public engagement, participation and transparency	2.5
1.5 Leadership, long-term vision and commitment	3.0
1.6 Water resourcing and funding to deliver broad societal value	3.0
1.7 Equitable representation of perspectives	1.5
2. Increase community capital	2.3
2.1 Water literacy	2.5
2.2 Connection with water	3
2.3 Shared ownership, management and responsibility for water assets	2.5
2.4 Community preparedness and response to extreme events	2.5
2.5 Indigenous involvement in water planning	1
3. Achieve equity of essential services	3.9
3.1 Equitable access to safe and secure water supply	4.5
3.2 Equitable access to safe and reliable sanitation	4
3.3 Equitable access to flood protection	3.5
3.4 Equitable and affordable access to amenity values of water-related assets	3.5

WSC Index Goal and Indicators	Score /5
4. Improve productivity and resource efficiency	2.3
4.1 Benefits across other sectors because of water-related services	3
4.2 Low GHG emission in water sector	2.5
4.3 Low end-user potable water demand	2
4.4 Water-related commercial and economic opportunities	2
4.5 Maximised resource recovery	2
5. Improve ecological health	3.4
5.1 Healthy and biodiverse habitat	3
5.2 Surface water quality and flows	3.5
5.3 Groundwater quality and replenishment	3
5.4 Protect existing areas of high ecological value	4
6. Ensure quality urban space	3.3
6.1 Activating connected urban green and blue space	3.5
6.2 Urban elements functioning as part of the urban water system	2.5
6.3 Vegetation coverage	4
7. Promote adaptive infrastructure	3.4
7.1 Diverse fit-for-purpose water supply system	2.5
7.2 Multi-functional water system infrastructure	3.5
7.3 Integration and intelligent control	4
7.4 Robust infrastructure	4
7.5 Infrastructure and ownership at multiple scales	3.5
7.6 Adequate maintenance	3

Water Sensitive Hornsby Strategy

4.2 Hornsby's benchmarked city-state

Figure 9 summarises the city-state benchmarking results for Hornsby Shire, which interprets the scores in Table 1 against the modelled requirements for the six phases of the Urban Water Transitions Framework (Figure 3). Percentage attainment for each city-state ranged from 100% of a Water Supply City and Sewered City to 9% as a WSC. This section summarises the key elements that contribute to the overall percentage attainment of each city-state.

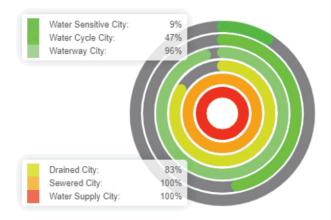


Figure 9: Hornsby Shire's WSC Index progress mapped to the idealised city-states of the urban water transitions framework

100% Water Supply City and Sewered City

Hornsby scored 100% as a Water Supply City and Sewered City. The performance assessment demonstrated that the community in the Council area has equitable and safe access to water supply and wastewater services. These services are provided by Sydney Water who operate externally under an operating license to maintain services to all customers. Some residents who live rurally or remotely along the river have access to town water and onsite systems.

While access and quality of these services were scored highly, it was noted that a small proportion of residents rely on septic tanks (mainly in rural areas and river settlements) which can fail if not properly maintained.

83% Drained City

Hornsby scored 83% as a Drained City. Much of Hornsby is located relatively high in the catchment, resulting in a more localised flood risk than other lower lying communities in Sydney.

Drainage infrastructure is generally in a good condition and their statuses are accurately captured within GIS; however, Council has faced budgetary issues with upgrading undersized assets and largely focuses on basic maintenance rather than proactive replacement. In large storm events, nuisance flooding can cause temporary disturbance for residents and aging drainage infrastructure is very sensitive to overloading. Stormwater Management Plans have been prepared to help identify works to alleviate these disturbances.

Stormwater detention in some locations also assists in managing localised runoff. There is a gap in assessing stormwater asset compliance within private developments. An adopted Flood Management Plan would help provide strategic direction for planning and proactive replacement and redesign which is limiting the score for this measure.

To fully achieve a Drained City, scores for the following indicators will need to be improved:

Goal 3: Achieve equity of essential services

3.3 Equitable access to flood protection

96 % Waterway City

Hornsby scored 96% as a Waterway City. The Waterway City ideally provides social amenity and environmental protections through water management to support environmental health, stormwater quality/WSUD, river water quality, connectivity of blue/green assets and community connection to natural areas

The Catchments Remediation Rate (CRR), established more than twenty years ago, has played a major role in Council undertaking on-ground projects and education programs with the community, for example by participating in community-based catchment care activities.

Hornsby has a high quality and functioning network of creeklines with mostly intact corridors. These corridors are protected through geography and planning which

precludes development in steep riparian / bushland areas. There continues to be a high level of investment into catchment planning and habitat and biodiversity management with local residents and adjacent councils through reports such as the 2007 Biodiversity Conservation Strategy and the Bushland and Biodiversity Annual Reports.

The topography and large number of private landholders located adjacent to these corridors present ongoing challenges for the Council in terms of managing pest and invasive species, and in enabling public access and connection. Council continues to face land clearing through development which has spurred a renewed interest in recent years in providing adequate management and compliance policies for protecting critical habitats.

Council acknowledges that this is an area for improvement and is a driving force in its commitment to providing sustainable development including minimising its impact on the natural water cycle.

Working with private development industry stakeholders continues to be a challenge especially with regards to ensuring the intent of Council's DCP requirements around WSUD elements are met with private certification.

Greater Council involvement in state government led district level planning, and the planning of State Government infrastructure projects such as schools, would drive enhanced collaboration and ownership of significant community infrastructure projects. The relationships with adjacent councils are also positive, but ad hoc.

Local waterways are in relatively good condition and vary across the LGA spatially and seasonally. For the last two decades Council has provided good quality data regarding the condition of the key waterways and catchments within the LGA as part of the water quality monitoring program. Recent reports state that Council manages:

- Over 400 stormwater quality improvement devices (SQIDs) with active, best practice implementation and monitoring of new assets.
- Eight stormwater harvesting and reuse schemes across a variety of open spaces including sporting ovals, parks and a local community nursery.

This array of stormwater treatments, pollutant management and catchment monitoring are a strong marker for Hornsby's high score within the Waterway

City metric. To fully achieve a Waterway City, community understanding of water and their role in water management will need to be expanded to be beyond just waterway health. It should include understanding of the entire water system (both built and natural water systems) and their role within it (e.g. capturing stormwater on private land, reducing water use, etc.)

To increase percentage attainment of a Water Cycle City, scores for the following indicators will need to be improved:

Goal 2: Increase community capital

2.1 Water literacy

47% Water Cycle City

Hornsby scored 47% as a Water Cycle City. The Water Cycle City transitions from the Waterway City by focusing more on the whole of water cycle approach, taking into account collaboration across organisations and stakeholders, community literacy of the entire water cycle and opportunities for engaged and active citizens, resource recovery (including water recycling) and potable water demand, and economic and business opportunities.

Water is seen as a moderate priority for the area, with some examples of policy and development controls in place (within Council's control). Hornsby has amongst the highest water consumption per dwelling for LGAs in the Greater Sydney region. External water used in gardens on large blocks and pools has a significant influence on the increased-water use.

State agencies and Sydney Water acknowledge that there is generally a lack of strategic collaboration, with the majority of interactions with the Council being ad hoc and on a case-by-case basis. One exception to this is local disaster planning where very strong and collaborative relationship exist across a diverse number of regional stakeholders.

Water-related plans, including estuary and integrated water cycle management plans, provide constantly evolving knowledge of the water system. The Catchments Remediation Rate provide strategic guidance and resources to ensure the continual maintenance of Hornsby's stormwater system. Council also plays an active role in implementing innovative projects to help reduce flooding and prevent pollutants entering local waterways.

The community has relatively high levels of trust and

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communication with the Council. Council invests heavily in understanding the perspectives of the community to inform decision making, including for local public projects. There are a number of established community reference groups, progress association and advisory committees. Not all of the community feels empowered to engage in key projects or issues unless there is a direct and generally negative impact on the individual. Some community feedback has indicated that many interactions with the community focus on short-term goals rather than a longer term vision. This is in part due to the geographical disconnection of residents to most key water assets within the shire, as many of the sites such as Bobbin Head are far removed from the primary urban and commercial centres.

Internally, the Council has a high level of water literacy of water quality management encompassed in several roles including a Water Quality Officer and WSUD Assets

While the broader community is generally well educated and has a strong connection to the 'green' image of Hornsby, the local population is growing and the demographic slowly changing is presenting new challenges for Council. Conversations with the community identify that there are relatively low levels of knowledge of different aspects of the water cycle, as well as low citizen understanding of some of the newer WSUD features and initiatives being undertaken. This is impacted by the relatively low rate of urban greenery and waterways within central districts of the Shire, a phenomenon which is common throughout Sydney's urban areas.

Local residents and the business community are reported to be gradually recognising the wider value of water and the benefits provided by the landscape, including cooling and liveability, however these actual benefits have not been quantified or regularly included in business case development.

Council has actively undertaken a range of stormwater harvesting and investigating sewer mining projects which have contributed to building local and regional knowledge and capacity. There has also been widespread adoption of rainwater tanks in new residential developments, in part driven through BASIX. Council has implemented several stormwater reuse systems, but these are sensitive to rainfall shortages and generally rely on potable supplies to maintain volume requirements.

Green infrastructure solutions have also been

implemented by the Council, despite the local steep topography in many locations constraining opportunities and public access. An emphasis on improving the density and coverage of urban green environments has been captured in the 25,000 Trees by 2020 initiative to "further strengthen our reputation as the Bushland Shire and to invest in the environment for future generations" (Mayor Philip Ruddock).

To increase percentage attainment of a Water Cycle City, scores for the following indicators will need to be improved:

Indicators to be improved:

Goal 1: Ensure good water sensitive governance

1.1 Knowledge, skills and organisational capacity

Goal 2: Increase community capital

- 2.1 Water literacy
- 2.2 Connection to water
- 2.3 Shared ownership, management and responsibility of water assets

Goal 4: Increase productivity and resource efficiency

- 4.2 Low GHG emissions
- 4.4 Water-related commercial and economic opportunities
- 4.5 Maximised resource recovery

Goal 5: Improve ecological health

- 5.1 Healthy and biodiverse habitat
- 5.2 Surface water quality and flows
- 5.3 Groundwater quality and replenishment

Goal 6: Ensure quality urban space

6.2 Urban elements functioning as part of the urban water system

Goal 7: Promote adaptive infrastructure

7.1 Diverse fit-for-purpose water supply system

9% Water Sensitive City

Hornsby scored 9% as a Water Sensitive City, providing a sound foundation for future initiatives. Hornsby Council has a strong organisational culture underpinning their commitment to WSCs with identifiable leaders within the organisation willing to advance processes such as the benchmarking workshop. The Council has proactively sought to use science to inform the planning and management of its natural resources. There are examples of collaboration across Council, for example, between architects, scientists and engineers, on several water-related projects. WSUD and broadly liveability and resilience initiatives are considered generally as primary benefits such as stormwater treatment and tend to be implemented on an ad-hoc, isolated basis.

Hornsby proudly recognises themselves as the "Bushland Shire" of Greater Sydney, with approximately 70% of their total land area (the largest LGA in Greater Sydney), including national parks, comprising of bushland. The community has a very strong affiliation with the vegetation in the region which constantly rates highly in terms of value in local community surveys.

This high community value and a common view that the green environment of Hornsby should not only be protected but expanded upon in urban areas has helped to drive a large number of policies to ensure their protection, including the current reviews and discussions regarding Development Control Plans and urban greening programs.

Population growth and urban intensification continues to place pressure on regulatory controls to ensure the long-term protection of the vegetation communities and their role in providing urban cooling and liveability.

The lack of higher-level strategic planning, placement and multi-purpose analysis of water sensitive assets is a major contributing factor to the overall score for this marker. Active planning and consideration of the wide range of benefits to social wellbeing, urban cooling, resilience and economic development from water sensitive designs will greatly improve Council's transition into this state.



Water Sensitive Hornsby Strategy

5. Advancing Hornsby Shire's Water Sensitive City Transition

Homsby Shire's transition towards a WSC will require significant changes across the structures, cultures and practices of urban and water system planning, design, management, engagement and decision-making.

These changes are likely to happen over a long timeframe, as new water sensitive practices are established and replace old practices. CRCWSC research has identified water sensitive transitions unfold over six phases: (1) issue with old practice emerges and (2) becomes more defined; people develop (3) shared understanding and agreement about the issue; (4) knowledge about solutions is disseminated; and new solutions are (5) diffused through policy and practice, and eventually (6) embedded as new mainstream practice (Figure 10).

As a city moves through each phase sequentially, enabling conditions are established to support its trajectory towards its WSC vision and avoid the risk of change pathways that reflect lock-in, backlash or system failure patterns (Figure 11).

Actions to orient and drive change towards a city's envisioned water sensitive future need to progressively establish these enabling conditions. Actions with the most impact during the early phases of transition will be different from those during the later phases. It is critical to identify a city's current phase of change to ensure that actions are prioritised according to the effectiveness they will have in accelerating the WSC transition.

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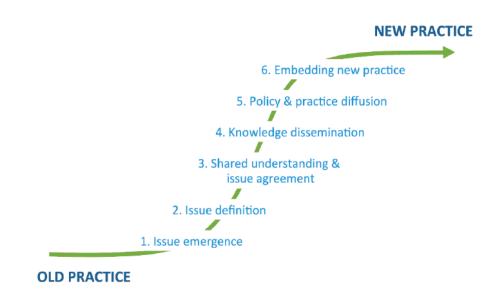


Figure 10: Six phases of change during the transition to a new practice (Brown et al., 2017)

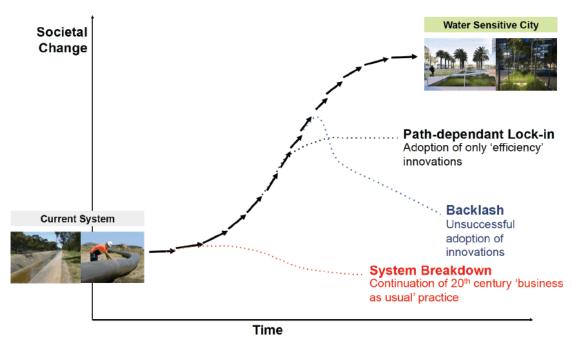


Figure 11: Transition pathways: successful transition, lock-in, backlash and system breakdown (Brown et al., 2017)

Water Sensitive Hornsby Strategy

The CRCWSC's Transition Dynamics Framework sets out five types of enabling factors that help to drive progress through these phases of change: **champions**, **platforms for connecting**, **science and knowledge**, **projects and**

Together, these five factors create an enabling environment for a WSC transition and, mapped against the six transition phases, they create a matrix (Figure 12) for a deeper understanding of the current transition phase for each vision outcome.

applications, and practical and administrative tools.

	Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
	1. Issue emergence	Issue activists		Issue highlighted	Issue examined	
Workshop discussions	2. Issue definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	
	3. Shared understanding & issue agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
Desktop review	4. Knowledge dissemination	Influential champions	Building broad support	Solutions advanced	Solutions demonstrated at scale	Refined guidance and early policy
	5. Policy and practice diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
	6. Embedding new practice	Multi- stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Figure 12: Transition Dynamics Framework (adapted from Brown et al., 2016; Brown et al., 2017)

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Definitions and examples of enabling factor types (Brown et al., 2017)

Champions refers to individual people, organisations, and/or networks that are involved in and advocating for water sensitive cities. Over time, champions expand from individual activists to scientists who expose and define key issues; then to a network of specialists who are implementing solutions on the ground; and finally to policy and decision-makers who have the power to institutionalise new practice.

Platforms for connecting refers to the structures and processes that facilitate collaboration across science, policy, and industry. Early in transitions, platforms help deepen understanding of the problem, and evolve to support implementation of solutions. Some examples of platforms include capacity building programs, internal seminar series, informal knowledge-sharing networks, or even specific projects that require a range of stakeholders.

Knowledge refers to the scientific understanding of the problem and solutions. Early transition phases involve scientific studies to define the issue, and evolve into piloting and testing potential solutions. Later transition phases involve tailoring solutions to local contexts and capacity building.

Projects and applications refers to on-ground experiments, trials and demonstrations that test and prove the viability of solution options. In early transition phases these could look like development of prototypes and evolve into on-ground demonstration projects that serve as proof-of-concept and build trust and capacity to deliver throughout the sector.

Tools and instruments such as guidelines, policies, and regulatory and legislative instruments help to structure and embed the new practice. Early tools and instruments (beginning in Phase 3 Shared understanding and issue agreement) focus on delivering practice guidance, and evolve to focus on compliance and enforcement.

The Transition Dynamics Framework was used as a diagnostic tool to assess the presence or absence of enabling factors as an indicator of progress towards Hornsby's aspired change in practice as it advances towards its water sensitive city vision. A range of desktop and engagement activities provided data on Hornsby's enabling environment to apply the Framework.

The Framework provides a checklist of the factors that should be deliberately and sequentially built up to inform the prioritisation of strategies and actions.

Building the momentum for transition will require a diverse range of strategies and actions that progressively establish these enabling conditions. Strategies and actions with the most impact during the early phases of transition will be different from those during the later phases. It is critical to identify a city's current transition progress to ensure that actions are prioritised according to the effectiveness they will have in accelerating the WSC transition

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5.1 Assessing Hornsby Shire's WSC transition progress

This section presents recommended strategies for advancing Hornsby Shire's water sensitive transition based on analysis of the city's current transition progress. These strategies are designed to address the most critical elements for advancing practice at this point in time, and it is recommended that Hornsby re-assesses transition progress in 3-5 years. Strategies are identified to advance the overall water sensitive Hornsby vision, as well as its individual thematic elements.

The overall transition progress assessment for Hornsby Shire (Table 2) suggests that significant advancements have been made towards its water sensitive vision. However, it is at risk of stagnation if critical enabling conditions are not established to shore up Phase 2 Issue Definition and start pushing into Phase 3 Shared Understanding and Issue Agreement. A brief explanation and justification of the transition assessment follows.

	Enabling factors				
Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Significant solution demonstrations	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Green boxes indicate the enabling factor is fully present in Hornsby and regression into the previous phase is unlikely. Yellow boxes indicate some presence of the enabling factor, however they are vulnerable to regressing to the previous phase.

Table 2: Overall transition progress assessment for Hornsby Shire

Red boxes indicate a complete absence of the enabling factor, and that progression is unlikely.

Grey boxes indicate the enabling factor is not yet relevant due to absence of preceding enabling factor.

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The overall assessment for Hornsby Shire suggests fairly consistent progression through the transition phases for each of the enabling factors that support change in practice.

Internal champions recognise the need for a water sensitive Hornsby Shire and the need to deliver more integrated solutions. However, this recognition has not yet expanded broadly within council and is only starting to occur with individuals in external agencies such as Sydney Water and across the Department of Planning, Industry and Environment (DPIE).

While there is some leadership on environmental issues from Councillors in the current Council, this does not yet represent the full range of WSC outcomes and can be at risk of changing when new Councils are elected (every four years), which may have differing priorities.

Collaboration to deliver broad outcomes is beginning to occur at the project level. However, further transition may be vulnerable without institutionalised alignment and other mechanisms for coherence across stakeholders. Platforms for connecting both internal and external stakeholders that create more consistent and coordinated alignment are needed to enable delivery of a water sensitive agenda in Hornsby Shire. These platforms can be formal (internal and external interdisciplinary working groups, funding for internal seminars and capacity building sessions) or informal (communities of practice or issue-specific networks) in nature.

While Hornsby Shire has a history of successful implementation of solutions for water quality, there is not yet an understanding of, or commitment for, pursuing broad solutions associated with the range of WSC outcomes. For example, solutions for engaging with diverse and changing community groups, engaging with local Aboriginal communities, mitigating downstream impacts of higher density developments, and innovative urban design. In some of these areas, there is little knowledge or data to understand why it is an issue or what needs to be done to address it. There is also the need for a business case and supporting narrative for pursuing some of these solutions.

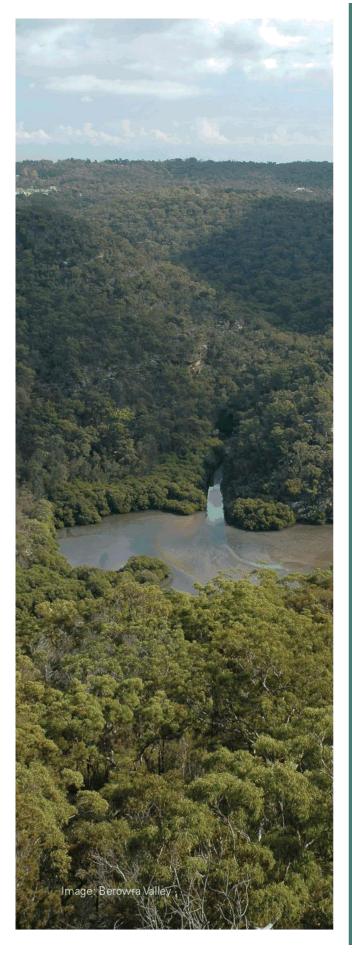
There is currently a large opportunity to embed water sensitive principles in policy and planning through the current development of the Hornsby Local Strategic Planning Statement and the review of the Development Control Plan and Local Environment Plan. Influencing these policies and planning controls will require a strategic approach to ensure water sensitive outcomes

are embedded. This also presents an opportunity to strengthen compliance levers to ensure implementation of best practice solutions.

Based on the assessment of Hornsby Shire's overall transition progress (which is only summarised in this report) five overarching recommendations have been identified to advance Hornsby Shire's WSC transition. These recommendations are not focused on one specific outcome but are needed across the entire organisation to advance more water sensitive practice and should be considered in water planning and decision-making. The recommendations are as follows:

- Establish and progress an internal and crossdepartmental working group to oversee implementation of the water sensitive transition strategy
- Ensure water sensitive city outcomes are embedded in policy and planning
- Develop new knowledge for the range of outcomes needed to deliver Hornsby Shire's water sensitive city vision (in particular community and Aboriginal engagement solutions)
- Leverage partnerships and project opportunities to demonstrate and build the business case for multifunctional, water sensitive solutions
- Strengthen compliance for environmental and waterway health outcomes

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5.2 Strategies and actions for advancing individual vision themes

Workshop discussions focused on discussing the enabling factors that are currently present for each vision outcome both within Hornsby Shire Council and also externally that would support Council's transition. Subsequent to the workshop, the CRCWSC team undertook a Transition Dynamics Framework analysis to determine the recommendations going forward. This section outlines the practice change that is required for each vision theme, a narrative around the enabling factors present or absent, and recommended strategies and actions for advancing Hornsby Shire's transition. For the detailed Transition Dynamics Framework analysis, see Appendix B.

1. Hornsby's natural environments are healthy and thriving with biodiversity

Hornsby Shire, known as the Bushland Shire, is very proud of and connected to its existing native bushland, much of which is protected in National Parks. However, as the Greater Sydney population continues to grow and development typologies shift to more urban centres, action will need to be taken to protect these natural areas of high value. To achieve Hornsby's vision of healthy and biodiverse environments, natural assets will need to be integrated into the water management system so their management can be adequately planned and resourced for the future.

Currently in Hornsby Shire there is broad understanding of the range of pressures its natural environments face – pressures from population growth and urban development. There is less known, however, on the current state of local ecosystems and the necessary responses that will need to be undertaken to ensure healthy environments for the future. A lot of this knowledge is currently being investigated through the current development of a range of strategic documents, including the Biodiversity Conservation Plan 2019, Ecohealth Catchment Monitoring and the Hawkesbury River Coastal Management Plan. There is work being done on waterway and ecological values mapping, along with monitoring programs of native flora and fauna. Work

will need to be done to consolidate and update existing biodiversity and ecological health data to form a comprehensive snapshot of current challenges and opportunities (Strategy 1.1).

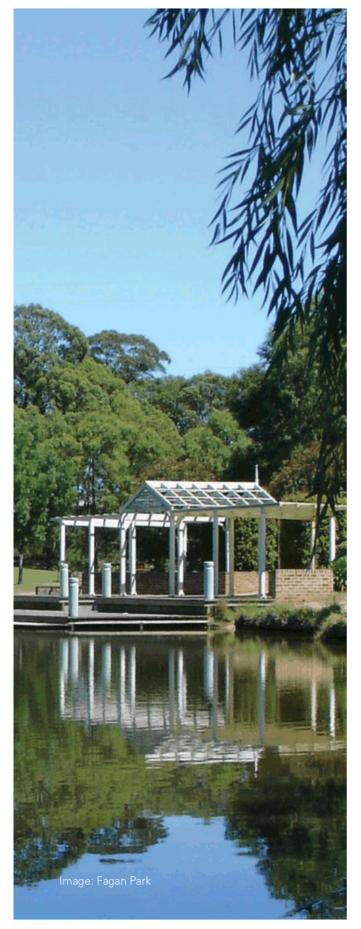
There are many community groups who advocate for environmental protection such as Hornsby Conservation Society, Climate Change Action Group, Berowra Waters Progress Association, bushcare groups and recreation clubs. Councillors are championing environmental health. Externally, the Department of Planning, Industry and Environment (DPIE) plays an active role on collecting

environmental data at a state level. While planning controls are in place, there are often issues with compliance due to the challenges associated with resourcing and the prevalence of private certification. To achieve ecological health outcomes, compliance will need to be strengthened (Strategies 1.2 and 1.3). Further challenges exist in prioritising actions spatially while linking action with monitoring, compliance, education and strategic planning.

The following strategies and actions are recommended to advance more water sensitive practice:

Strategy	Actions	Outcome
1.1 Review, consolidate and update existing biodiversity and ecological health data to form a comprehensive snapshot of current challenges and opportunities	1.1.1 Develop an online mapping tool and submission form to collect data on local environmental values and conditions 1.1.2. Create an integrated database of local, state and federal environmental and biodiversity data 1.1.3. Develop and implement a program to assess condition of natural areas and gather baseline data 1.1.4. Encourage knowledge-sharing between Hornsby, Ku-ring-gai, and other councils with best practice environmental practices	A comprehensive understanding to inform context-specific solutions and responses
Develop and strengthen compliance measures at the local levels and seek to influence positive changes in state compliance measures	1.2.1. Review compliance policy procedures 1.2.2. Engage staff to improve internal capacity to fully apply legislation in a consistent manner 1.2.3. Review conditions of consent and related compliance and enforcement measures that address environmental impacts at both the construction and operational phase of development 1.2.4. Engage and lobby State and Commonwealth Government for stronger biodiversity protection laws through coalition with other councils, industry and community groups	Better compliance amongst residents and industry
Build understanding among industry (specifically developers) and residents about the importance of ecological and waterways health and incentivise compliance	1.3.1. Develop and implement proactive education programs targeting private landholders about the importance of their local waterway assets, how to protect them and what the compliance measures are 1.3.2. Develop targeted awareness campaigns for developers, business and residents that showcase the benefits of protecting the health of the environment (e.g. property values, business opportunities, health benefits) 1.3.3. Develop and assess incentive programs for enhancing ecological value	Better compliance amongst residents and industry

Water Sensitive Hornsby Strategy



2. Hornsby and its villages are full of beautiful blue and green spaces that connect people to their surrounding environment and local community

While Hornsby Shire has plentiful native bushland, increasing urban development means that care needs to be taken to ensure the urban environments are cool, comfortable, and support health and liveability outcomes. The conventional approach to urban design typically considers water systems and the built form separately, often compromising liveability outcomes (such as aesthetic, green, cool and healthy urban environments) which rely on synergies between the built form and water system services. Achieving the vision of blue, green, cool, aesthetic and connected urban spaces require water system planning and urban planning to be more integrated and collaborative so that outcomes that link to a broader vision of urban liveability can be achieved (Strategy 2.1).

Recent organisational changes have seen a greater emphasis being given to place-based strategic outcomes. Numerous teams within Council are now championing the delivery of quality urban spaces, and often guide engineers and other Council staff to ensure multiple benefits are delivered. The current elected Council also supports urban greening and liveability, as seen through the 25,000 Trees Program, however there is a risk of this support being lost when Council changes. The community is also starting to call for more water play and recreation opportunities within the urban context, but there is no one driving green infrastructure such as green walls and roofs as they are not seen as a priority. Overall, ensuring quality urban spaces is beginning to take a whole of Council approach (including elected officials) as ensuring liveability in the face of increased development is now a high priority in Hornsby Shire. While there is increased support for liveability outcomes, implementation could be strengthened through better integration within Council policy and planning (Strategy 2.3).

Knowledge on walkability, cycling, heat and climate change is being investigated in Hornsby through the current development of a range of new strategies. Valuable knowledge is also brought in through consultants who are seen to challenge current practice and bring external knowledge. Platforms such as the Northern Sydney Regional Organisation of Councils (and corresponding executive group) support knowledge-sharing around ideas such as sporting grounds. While

there are several stormwater harvesting schemes for parks and ovals through the Catchments Remediation Rate program, there has been no focus on revitalising town centres for liveability outcomes through water. Projects (such as streets) are generally still done by rules and requirements rather than by ensuring place-based outcomes. To demonstrate how integrated outcomes can

be achieved on the ground, more trials and demonstrations for blue-green urban spaces will need to be implemented (**Strategy 2.2**).

The following strategies and actions are recommended to advance more water sensitive practice:

Strategy	Actions	Outcome
2.1 Develop and communicate a compelling narrative around the importance of a place-based and outcomes focused approach to urban design, integrating blue and green spaces	2.1.1. Develop place-based plans that incorporate a strong narrative around the local environmental, historical and indigenous heritage (informed through community engagement) and highlight linkages to other valuable networks	Councillors and staff understand the importance of a place-based approach
and groom spaces	2.1.2. Examine different mediums and platforms to communicate the importance of a place-based approach to deliver water sensitive outcomes	
	2.1.3. Promote business opportunities in relation to recreational water activities and tourism	
	2.1.4. Develop promotional material on the unique environmental and historical values within Hornsby	
	2.1.5. Develop a supporting business case to articulate the economic benefit of water sensitive outcomes (e.g. urban cooling and amenity)	
2.2 Implement trials and demonstration projects that promote connectivity of green and blue spaces	2.2.1. Assess strategic routes for green and blue corridors and ensure integration with other Council place-based strategies (e.g., Walking and Cycling Strategy, Public Domain Strategies)	Demonstration of how integrated outcomes can be delivered
	2.2.2. Capture and communicate lessons (through case studies) from demonstration projects to showcase advantages of place-based planning	
2.3 Identify and strengthen integrated outcomes through Council policy and planning	2.3.1. Ensure integration across relevant LSPS strategies	Improved implementation for integrated, place-based outcomes
	2.3.2. Review and update existing and future public domain guidelines and town centre plans to be consistent with water sensitive outcomes	
	2.3.3. Incorporate green and blue infrastructure targets into review of Development Control Plan and Local Environmental Plan	
	2.3.4. Incorporate of natural asset within Council's strategic asset management system	
	2.3.5. Investigate the development of catchment specific environmental values and targets to inform the Development Control Plan and Local Environmental Plan	

ATTACHMENT 4 - ITEM :

Water Sensitive Hornsby Strategy

3. Hornsby Shire has engaged, empowered and active communities who value Aboriginal and cultural connections to land and water

By their nature, local governments are close to their community and engage across a broad range of issues. It has been noted that the community's knowledge of, connection with, and sense of responsibility for water as individuals and as part of the broader community has significant influence on a city's transition towards its water sensitive city vision. A successful transition will therefore require community engagement practices to be meaningful and transparent, focusing on empowering people to have the interest, capability and opportunity to be active partners in achieving water sensitive outcomes.

Hornsby Shire has a strong history of community activism, especially around water quality of the local rivers and creeks which led to a number of major policy and infrastructure improvements. There are a number of highly active environmental and bushcare groups including Streamwatch. Council runs several community engagement programs (such as tours and events, workshops, water quality reports) which mainly focus on waterway and ecosystem health and protection. More recently, Hornsby Shire Council has begun to engage with the community around the broader range of water sensitive city outcomes through processes such as the CRCWSC water sensitive city visioning workshops.

While there are good programs in place, these programs are only reaching a small group of highly motivated and committed individuals, and not successfully engaging the diverse communities that now make up Hornsby Shire. While it is recognised that the shire's demographics are changing, there is not yet an understanding of how to engage these diverse communities around a broad range of water sensitive outcomes. New solutions and processes will need to be developed to ensure messages are reaching the diversity of community groups now present within Hornsby Shire (Strategy 3.1). A strategic approach to community engagement across all Council activities is also needed to ensure it receives dedicated attention and is not done ad-hoc (Strategy 3.2).

While Hornsby Shire has many culturally significant water sites, the knowledge and connection amongst the broader community is generally low.

The importance of understanding Aboriginal communities' water knowledge and values in water planning and decision-making has become increasingly recognised across Australia. However, current water governance systems and processes lack the mechanisms necessary to recognise and incorporate this knowledge and values into water system services. Coupled with this is the lack of understanding of how to effectively and meaningfully engage with local Aboriginal communities. The Hornsby Aboriginal and Torres Strait Islander Advisory Committee (HATSIC) also exists to consider matters involving Aboriginal heritage or culture. This provides a good underpinning and opportunity to leverage for water related matters.

There has previously been grant funded Indigenous Officer roles within Council with a specific project delivery focus (including a cultural calendar and videos on local Aboriginal stories). Council participates in various NAIDOC week events to promote cultural connections. These existing connections or activities will need to be leveraged to identify meaningful ways of engaging with Aboriginal communities around water in Hornsby Shire (Strategy 3.3).

The analysis of enabling conditions for this vision theme shows that Hornsby Shire is more advanced in its transition towards community engagement and empowerment, and less advanced in its transition towards meaningful engagement with Aboriginal communities. Therefore, two separate Transition Dynamics Framework matrices have been developed.

The following strategies and actions are recommended to advance more water sensitive practice:

Strategy	Actions	Outcome
3.1 Develop solutions for effectively engaging Hornsby Shire's diverse community groups	3.1.1. Collaborate on development of Council's engagement plan to ensure it covers water engagement needs 3.1.2. Review Council's website to ensure water sensitive resources (e.g. education, guidelines, references) are available and accessible 3.1.3. Map current community engagement initiatives to identify gaps in engagement 3.1.4. Investigate innovative engagement methods and principles through behaviour change research or engagement projects from elsewhere 3.1.5. Investigate and trial methods to build peoples' connection to water	Tailored engagement strategies that are appropriate for the range of demographics within Council
3.2 Build on existing platforms to ensure community engagement is embedded across all council activities	3.2.1. Reinstate the education and events project control group with a clear charter and goal of providing consistent messaging and resources to community 3.2.2. Undertake staff engagement training (e.g., IAP2) to build internal capacity 3.2.3. Ensure water sensitive outcomes are in the charter of the Environmental Sustainability Committee 3.2.4. Develop an Environmental Sustainability Engagement Plan to support and provide guidance on community engagement activities. 3.2.5. Consolidate and evaluate lessons learnt from existing community engagement projects to inform future projects and to encourage innovation	A strategic approach to community engagement across all Council activities
3.3 Develop new knowledge about how to effectively and meaningfully engage with Indigenous communities and why it is important to do so through better engagement with HATSIC and other Aboriginal communities	3.3.1. Identify who to engage within the Aboriginal communities (beyond HATSIC) to initiate the conversation around what engagement should be undertaken 3.3.2. Expand and progress existing internal commitments around Aboriginal community engagement 3.3.3. Undertake aboriginal cultural awareness training for staff	An understanding of how to effectively engage with Aboriginal communities and why it is important to do so

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Community engagement tools and examples

Hornsby Shire has a diverse community made up of different demographics and levels of engagement with water and sustainability outcomes. The CRCWSC has undertaken a number of research projects that developed tools and guidance for creating community engagement activities that are tailored to the local community context. A number of resources are available on the CRCWSC website including:

- Principles for engaging communities in water sensitive city transitions
- A "Water Words and Visuals" tool to assist councils in using and choosing water terminology
- A guide to promoting water sensitive behaviours
- Community profiles of engagement with water to assist in identifying targeted engagement activities
- Community Engagement in the Water Sector highlights various approaches and evaluates the effectiveness of different ways of engaging with communities

There are also a number of case studies across Australia that demonstrate exemplar community engagement to achieve water sensitive outcomes on the ground. Some of these include:

- Enhancing the Dandenong Creek revitalising the Dandenong Creek for best community outcomes (VIC)
- Josh's House providing a demonstration side to inform communities on how to implement water sensitive urban design at the residential scale (WA)
- Inner West Council Community Leaders in Sustainability Course – to enable residents to develop community-based solutions to climate change and other environmental issues (NSW)
- Reimagining Bendigo Creek Plan collaborative process to develop a vision and action plan for revitalising Bendigo Creek, grounded Dja Dja Wurrung culture and values (VIC)

4. A strong focus on water quality supports healthy, clean rivers and creeks

Homsby Shire is seen to be leading the way in water quality management, as demonstrated through the signing of the Statement of Joint Intent in 1994 and subsequent Wastewater Treatment Plant upgrades, establishment of the Catchments Remediation Rate, implementation of WSUD, and formation of community reference groups. While these actions had significant impact on water quality within the creeks and rivers, there is still work to be done in mainstreaming this practice beyond the core group of water quality champions and ensuring everyone plays their part.

The Natural Resources Team within Council is championing waterway health and currently supported by the elected Council. The team is responsible for planning and implementing water sensitive urban design projects. There are a number of technical workshops and trainings to build capacity of staff to implement water sensitive urban design. While water sensitive urban design is being implemented across council (rain gardens, stormwater harvesting), there are some instances of failure, such as the La Mancha Estate in Berowra, due to the lack of long-term compliance and poor community engagement to foster ownership. These examples can be studied to ensure the success of future water sensitive urban design projects (Strategy 4.3). Specific staff within Sydney Water also support water quality solutions. Community groups such as Streamwatch are also seen as champions. People who live along the creeks and rivers also feel very connected to the waterways as they are a crucial element of their lives. More work can be done to build the community's capacity to participate in water management and implement water sensitive solutions on private property (Strategy 4.1).

There is a lot known about waterway impacts close to the source and the impacts of some land uses as outlined in the Waterway Health Review 1995-2017 (Hornsby Shire Council 2019). This review details findings from Hornsby Shire's water quality monitoring program, one of the most intensive monitoring programs undertaken by any NSW local government. The review states that some long-term improvements in water quality have been achieved, however nutrient loads continue to be an issue from upstream development and also treated wastewater discharge. Water quality probes provide real-time data on water quality throughout the catchment which allows Council to communicate to

residents on current conditions and to respond to quick environmental changes (e.g. algal blooms, impact from stormwater runoff on swimming sites). There is also work being done in understanding community values around waterways. Less is understood about impacts of higher density developments, and impacts further down the catchment, which will need to be further explored (Strategy 4.2). There is also high uncertainty around potential future solutions, including things such as climate change, community sentiment, and resourcing. The actions within the current Total Water Cycle Management strategy are being progressed, and while there are compliance programs

in place, insufficient resourcing has resulted in the lack of adequate implementation (**Strategy 4.4**). Delivery of improved water outcomes will also require water management to be positioned at the forefront of Council policy and planning (**Strategy 4.5**). While there is a lot of action happening to ensure good water quality of the region, more can be pursued in the areas of groundwater monitoring, environmental flows and utilising smart technology

The following strategies and actions are recommended to advance more water sensitive practice:

Strategy	Actions	Outcome
4.1 Build on existing platforms to support knowledge-sharing with the community around how their behaviours can influence water quality	4.1.1. Understand and map existing behaviours among community, business and developers related to water quality 4.1.2. Identify how council staff and operations can influence the community's water sensitive behaviour 4.1.3. Develop a community engagement plan on natural resources management (incorporate into water management) 4.1.4. Develop specific education and engagement programs to address behaviours and outcomes	The broad community understands their role in improving water quality and undertakes behaviours to support this
4.2 Develop understanding of downstream cumulative impacts of different land uses (e.g. high density development)	4.2.1. Develop catchment models to assess policy settings and development scenarios 4.2.2. Engage with the community and state agencies to articulate and refine waterway objectives and values 4.2.3. Engage with state agencies to collate monitoring data to support catchment models 4.2.4. Develop visualisations from catchment models to assist communications and decision-making	An understanding of how certain development scenarios will impact downstream environments
4.3 Learn from previous successes or failures to inform implementation of water sensitive projects	4.3.1. Review and audit the effectiveness of planning instruments (e.g., DCP provisions) to restore and protect waterways 4.3.2. Review and compile lessons learnt from existing Water Sensitive Urban Design projects 4.3.3. Build expert 'communities of practice' to share knowledge and perspectives on water management and to co-create pathways and solutions to improve water management practices	An understanding of how to strategically implement water sensitive city projects (including incorporating the necessary community engagement around the solutions)
4.4 Develop and strengthen compliance measures at state and local levels	4.4.1. Implement a proactive education and compliance program to target industries and activities identified as having the potential to harm waterway health 4.4.2. Provide information on Council's website on minimum acceptable practices by industry type 4.4.3 Assess Council projects and external proposals for compliance with water sensitive urban design requirements	Improved compliance for waterway health outcomes
4.5 Prioritise water management at the forefront of Council policy and planning	4.5.1. Review and adopt planning policies, including targets, that elevate water management in planning decisions 4.5.2. Engage with strategic planning to ensure outcomes from catchment modelling to influence planning decisions 4.5.3. Review council systems and processes to ensure integration of Council water strategies and policies outside of LSPS process (e.g., catchment plans)	A supportive policy and planning environment for implementation of water sensitive outcomes

Water Sensitive Hornsby Strategy



5. Sustainable resource use is supported by integrated, multifunctional infrastructure

The traditional approach to water infrastructure focuses on conveyance of water through a city without exploring opportunities for localised reuse and alternative water supplies. A more intelligent, multi-functional approach to water infrastructure will require highly collaborative systems and processes to enable the sharing of costs, benefits and data. This approach can also help take advantage of synergies across water, energy, food, nutrients and waste to maximise outcomes for a place.

The Natural Resources Team and Parks Team within Council have begun to work together on delivery of stormwater harvesting projects for irrigation of sports fields. The recently established Strategy and Place team is now looking at place-based projects for better integration. Opportunities or forums to explore how a place-based approach can deliver broad outcomes should be identified (Strategy 5.1) and demonstrated on the ground (Strategy 5.2). There is real-time monitoring of stormwater harvesting data to inform irrigation however this information is not accessible to parts of Council. There is also monitoring of water quality through the water quality probes, which informs communications with residents around water quality warnings.

There is seen to be a disconnect between traditional water infrastructure and WSUD, because of the fact that the funding comes from different resources. While there are eight stormwater harvesting projects throughout Council, these have been implemented because of the link to water quality and impact on waterways. The resources are not currently available (however could be grant funded) for projects that expand beyond water quality. BASIX has overall driven positive outcomes for greenhouse gas emissions and water performance compared to other states, however it could be strengthened to address broader planning issues around urban heat and water sensitive urban design. Council should therefore advocate for a review of BASIX to expand its performance criteria to capture these issues and to improve its usefulness as a tool for broader community education and awareness on sustainable and water sensitive housing.

The following strategies and actions are recommended to advance more water sensitive practice:

Strategy	Actions	Outcome
5.1 Establish a forum for exploring how a place-based approach can deliver broad outcomes (e.g. LSPS development process)	5.1.1. Identify appropriate platforms to implement water sensitive solutions in place-based planning	Understanding of why a place-based approach is important for ensuring broad outcomes
	5.1.2. Use tools to quantify multiple benefits and develop business cases for water sensitive solutions, including the investigation of alternative water sources	
	5.1.3. Advocate for a review of BASIX to include broader planning issues	
	5.1.4. Identify opportunities to deliver multifunctional water infrastructure to the highest design standard as part of future precinct plans or place plans	
	5.1.5. Investigate incentives for the community and developers to develop integrated water sensitive outcomes on private land.	
5.2 Explore opportunities to demonstrate how existing and new water management projects can deliver broad benefits by engaging with	5.2.1. Investigate how HornsbyTown Centre and other priority planning areas can demonstrate water sensitive outcomes through co-design with the community	Demonstration of how water quality projects can contribute to broad water sensitive outcomes
community values	5.2.2. Identify and implement opportunities for water sensitive solutions through council works projects at the street, park and sub-catchment scale	
	5.2.3. Implement asset maintenance and renewal of water sensitive projects to ensure ongoing performance and effectiveness	

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6. Integrated and inclusive governance arrangements delivers a holistic approach to water management while meeting the challenges of growth

Water quality and environmental health have historically been strong drivers for Hornsby Shire, as seen through the establishment of the Statement of Joint Intent and the Catchments Remediation Rate and corresponding delivery team. While these arrangements have led to positive water quality outcomes for the region, they do not address the broad range of outcomes that are present in Hornsby Shire's WSC vision. In order to transition to a WSC, broad water outcomes will need to be integrated into Council's planning and decisionmaking at multiple levels and the focus shifted from water quality to holistic water cycle management, with water management embedded into all decision-making.

The need for more integrated water governance has been recognised, and is being implemented through project control groups on significant projects within Council. A number of programs and committees also exist that promote collaboration such as the current development of the Local Strategic Planning Statement, the community groups instrumental in the Statement of Joint Intent (e.g. Berowra Water Progress Association), and various external committees such as StormwaterNSW and the CRCWSC Regional Advisory Panel. While collaboration is recognised as important, there are not yet the mechanisms for ensuring collaborative and integrated approaches beyond specific projects. These opportunities will need to be investigated (Strategy 6.1), particularly building off existing mechanisms for collaboration (Strategy 6.2).

The following strategies and actions are recommended to advance more water sensitive practice:

Strategy	Actions	Outcome
6.1 Investigate and explore options to implement collaborative governance (both formal and informal) beyond project-specific activities	6.1.1. Implement internal capacity-building activities to build breadth of knowledge within Council staff 6.1.2. Review development approvals process to ensure water sensitive planning requirements are being applied consistently and effectively 6.1.3. Evaluate the effectiveness of existing collaborative governance solutions and approaches in delivering good water sensitive solutions 6.1.4. Deliver water sensitive city messaging to senior and executive staff and Councillors 6.1.5. Ensure water sensitive outcomes are at the forefront of decision-making by making it a mandatory in agenda item for all relevant project control groups	The mechanisms and processes exist to support collaboration beyond individual projects
	6.1.6. Establish an informal regional water sensitive cities group that utilises online tools and forums to share knowledge and ideas	
6.2 Build on existing platforms for collaboration beyond specific place-based projects	6.2.1. Develop theme-based control groups (e.g. water or environmental sustainability) that include officer and senior level staff	The project control group model is elevated to the program level to ensure consistency and longevity

6.
Community
Ideas for
a Water
Sensitive
Hornsby
Shire

The community workshop series identified a number of ideas for achieving Hornsby Shire's WSC vision. These ideas were organised into five pathways for action, which collectively guide change to achieve the vision. The five pathways include 1) improving water quality and flows, 2) informing and educating citizens, 3) connecting people and place, 4) greening urban areas, and 5) creating healthy habitats. There were 28 ideas generated that range in scope and scale (a full list can be found in Appendix E). Four actions emerged as priorities for the next 1-2 years, which include:

- Provide financial incentives (e.g. rebates, subsidies) to implement water sensitive urban design solutions on private property;
- Create community gardens and urban gardens to support knowledge sharing and a sense of community;
- Develop education programs for different parts of the community that outline what actions they can take to conserve water in the home and live more sustainably; and
- **4.** Link schools and groups (e.g. Scouts) to local environmental projects.

Achieving the vision for a water sensitive Hornsby Shire will require Council, community members, and other agencies to work together to implement the actions in this strategy. The community workshop participants began to identify how the necessary stakeholders can begin to work together to get these priority actions implemented over the next few years.



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What can the community do?

- Advocate for WSUD solutions (e.g. rainwater tanks, rain gardens) and incentive programs;
- Perform home inspections to ensure water systems are not leaking and that rainwater is utilised for appropriate uses;
- Advocate for community gardens to be implemented in schools so that children can participate and learn about the environment;
- Share information on water sensitive behaviours through personal networks (e.g. using buckets to collect water when the shower is warming up);
- Keep up-to-date with local projects and if they are suitable for schools;
- Stay informed on local community group interests; and
- Approach Council to support implementation of environmental and waterway health projects.

What can Council and the community work together to deliver?

- Develop an incentive program for WSUD and communicate it to the community;
- Council provide resources to help the community identify and implement water solutions for the WSUD incentive program;
- Allow and promote verge gardens that incorporate WSUD elements;
- Promote existing volunteer programs to include environmental and water projects;
- Council provide resources and education materials to the community to help identify and implement water efficient/saving solutions;
- Provide a point of contact within Council that provides advice and information on water efficiency solutions;
- Hold events that showcase water-related projects and promote education (e.g. morning teas, barbeques);
- Determine the most appropriate communication methods for diverse community groups;
- Undertake and support citizen science projects;
- Take advantage of windows of opportunity for community capacity building;
- Utilise billboards for emotive water messages and water campaigns or slogans;

- Offer sprinkler swaps and shower timer giveaways;
- Encourage people to act on and report illegal dumping or littering;
- Council continuously fund environmental community projects, e.g. water efficiency, to ensure longevity and success of projects;
- Provide resources and support for environmental projects (e.g. guest speakers);
- Work actively with community groups to promote and encourage grants for projects.

How can Council and other external organisations enable the implementation of these actions?

- Develop a coordinated incentive program across Council, Sydney Water, and private contractors;
- Engage with Department of Education to incorporate community gardens and environmental projects in schools;
- Link with existing groups such as Lions Club and Rotary;
- Link with research around behaviour change (e.g. CRCWSC research) to create targeted and effective messages around WSCs;
- Coordinate messaging and communication channels across organisations;
- Work with and identify projects with the National Parks and Wildlife Service;
- Utilise existing groups such as Rotary, Lions Club, Men's Sheds, Country Women's Association, Rural Fire Service:
- Council works with Government agencies to create an Environment Day dedicated to working on environmental community projects.

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7. Conclusion

Hornsby Shire has a strong foundation in its WSC transition, as seen through its history of community activism and action on waterway health. People value the "Bushland Shire" and feel a strong connection to their surrounding environment and waterways. In the face of a changing climate, rising population and urban development, Hornsby aspires to retain these values and to continue being a liveable and sustainable region in the future. Ensuring these outcomes over the long-term requires action to be taken now to avoid negative trajectories and to steer Hornsby Shire's development towards its future WSC vision.

This report marks the culmination of a workshop series that brought together 20 community champions and 25 leaders and strategic thinkers from across Hornsby Shire Council, Sydney Water and Department of Planning, Industry and Environment. The workshops aimed to explore current water issues and opportunities within Hornsby Shire, understand the region's unique water story, envision a future water sensitive Hornsby Shire and develop the transition strategies and actions that will need to be pursued to progress their WSC transition.

This vision and transition strategy is intended to provide a framework for Hornsby Shire Council to guide its action and implementation. The CRCWSC can assist Hornsby Shire in this next implementation phase through the provision of tools, strategic advice, facilitation of further processes and sharing of lessons from other places. Specific ideas for this can be found in Section 6.

Workshop participants from both industry and the community demonstrated openness, motivation and commitment for water sensitive outcomes and collective action. Building on this momentum and broadening industry and public support will put Hornsby Shire in a strong position to accelerate its ongoing transition to achieve its water sensitive vision and support the region's future liveability, sustainability, productivity and resilience.

References

Berowra Catchment Management Committee and Hawkesbury Nepean Catchment Management Trust (1998). A new legend: the story of the Berowra Creek Community Contract. CultureShift.

Brown, R.R., Keath, N., & Wong, T.H.F. (2009). Urban water management in cities: Historical, current and future regimes. Water Science & Technology, 59(5), 847-55.

Brown, R.R., Rogers, B.C., & Werbeloff, L. (2016). Moving toward Water Sensitive Cities: A guidance manual for strategists and policy makers. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities

Brown, R.R., Rogers, B.C., &Werbeloff, L. (2017). A framework to guide transitions to water sensitive cities. Chapter 9 in Moore, T., de Haan, F.J., Horne, R. & Gleeson, B. (Eds) Urban Sustainability Transitions: Australian Cases – International Perspectives. Springer, Japan.

Cooperative Research Centre for Water Sensitive Cities (2016). Opportunities for a Water Sensitive Greater Sydney: the importance of water in our city's future. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

Cooperative Research Centre for Water Sensitive Cities (2016). Green-blue infrastructure for sustainable cities: Innovative socio-technical solutions bringing multifunctional value. Melbourne, Australia.

Hammer, K., Rogers, B.C., Chesterfield, C., Church, E., and Gunn, A. (2018). *Vision and Transition Strategy for a Water Sensitive Greater Sydney*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities. Hornsby Shire Council.

Hornsby Shire Timeline. Retrieved May 2019. https://www.hornsby.nsw.gov.au/library/catalogues-and-resources/local-history/history-of-hornsby-shire

Hornsby Shire Council (2019). Waterway Health Review Hornsby Shire Council (1995-2017). Report prepared by the Natural Resources Branch of Hornsby Shire Council.

Victorian Department of Environment, Land, Water and Planning (DELWP) February (2017). Planning a Green-Blue City



Appendix A - Workshop Methodology

Workshop 1 - Benchmarking

Workshop 1 was held on 19th February 2019 and aimed to benchmark Hornsby Shire's current water sensitive performance using the WSC Index. The WSC Index benchmarking workshop was delivered by the CRCWSC and Alluvium Consulting. The WSC Index consists of seven goals and 34 indicators that define what it means to be a water sensitive city, along with rating guides to score each indicator from 1-5. The workshop worked through each indicator for Goal 6 Quality Urban Space as a whole group, then split into two concurrent sessions where one room scored the biophysical goals (Ecological health, Productivity and resource efficiency, and Adaptive Infrastructure) and the other room scored Socio-political goals (Community capital, Equity of essential services, and Good water sensitive governance). At the end of the workshop, the scores were presented to the group.

Workshop 2 - Visioning and narrative building

Workshop 2 was held on 30th April 2019 and aimed to develop a shared water story and 50-year future vision for Hornsby Shire. The first activity for participants involved identifying key moments that have shaped Hornsby's water story, whether in the form of changes to technical systems, developments in policy, programs or laws, environmental events, community trends, or personal memories or anecdotes. Participants identified these through a large timeline on the wall and sticky notes.

The envisioning activity began with a group discussion of what participants love about living in the Hornsby region, then explored the possible futures for Hornsby through a creative activity involving writing newspaper headlines to accompany a profile of Hornsby. These headlines were either positive and desirable, or undesirable and were grouped into themes by the facilitators as they were submitted. The final activity of the workshop involved expanding on the thematic vision statements of the previous activity with annotations regarding what the daily experiences of living in this image of the future might be.

Workshop 3 - Exploring priorities and strategies

Workshop 3 was held on 8th August and focused on refining and validating the water story and vision, and identifying the priority focus areas for Hornsby's water sensitive city transition. The first activity involved reviewing and refining the draft vision at tables, focusing on making the vision more relevant to Hornsby Shire and ensuring all ideas were captured.

The second half of the day focused on reviewing transitions theory and analysing the enabling environment for progressing the vision. Tables were split into vision outcomes and participants explored the presence or absence of enabling factors: champions, platforms for connecting, science and knowledge, projects and demonstrations, and tools and instruments.

Workshop 4 - Action planning

Workshop 4 was held on 10th September and focused on reviewing and refining the recommended transition strategies, and developing actions for implementation. The first activity re-visited the vision and made minor adjustments to the high level statements. The transitions analysis was then presented along with the recommended transition strategies. The rest of the workshop day focused on developing actions associated with the transition strategies, along with roles and responsibilities, timeframe, anticipated cost and impact of each action.

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Appendix B Transition Dynamics Framework analysis: benchmarking, evidence collecting and action setting

This appendix presents the Transition Dynamics
Framework (TDF) process that underpins the analysis
and development of strategies and actions for each
vision theme presented in Section 5. The process for
undertaking the Transition Dynamics Framework consists
of the following steps:

Identify practice change

The practice change was discussed and identified for each vision theme during small group discussions in the Council staff workshop. In order to determine the practice change, each group first identified what the issue with current practice was that prevented the vision theme from being achieved. The group then articulated what needs to change about that practice in order to

2. Map WSC Index indicators to vision themes

WSC Index indicators are mapped against the vision themes to articulate how the strategies and actions can progress both the vision themes and the WSC Index indicators. While both the vision and WSC Index are useful frameworks, the WSC Index is more useful when measuring short-to-medium term progress, and the vision is more useful in generating commitment and buy-in.

3. Collect evidence for Transition Dynamics Framework analysis

Evidence for the Transition Dynamics Framework was collected in workshop discussions. These involved both the WSC Index benchmarking discussions, along with more targeted discussions that focused on identifying the enabling factors that were present (e.g. for Vision Theme 1, the group first discussed what champions were present for that practice change. Then the group discussed the platforms for connecting that were present, etc.)

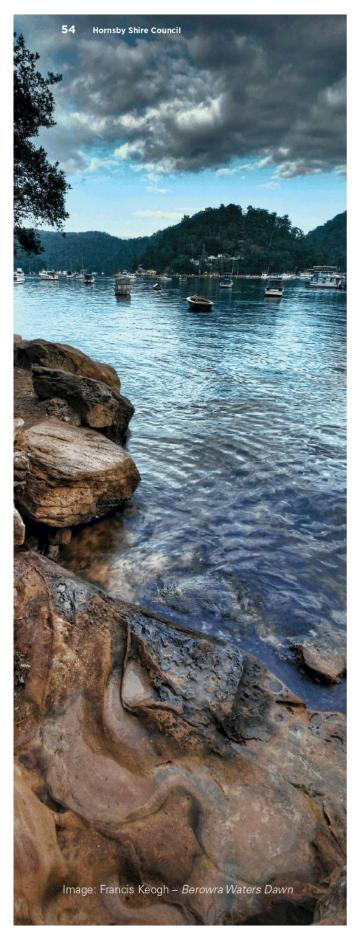
4. Conduct Transition Dynamics Framework assessment

The TDF assessment was conducted by the CRCWSC team. A matrix was applied to each vision theme, and the team undertook the traffic light assessment for each of the enabling factor columns. The specific evidence from the workshop discussions was used for this analysis.

5. Determine priority strategies and actions based on Transition Dynamics Framework Assessment

The CRCWSC team then identified priority strategies for each vision theme that would address the missing enabling conditions (i.e. the yellow boxes) that if established, would further the practice change. Strategies are formulated based on what needs to happen to establish the missing enabling condition, and what makes most sense for the local context. While strategies are developed specific for individual places, the CRCWSC has started to create a database of strategy types that are used to address specific enabling factors.

This appendix walks through the analysis for each vision theme.



Vision theme 1: Hornsby's natural environments are healthy and thriving with biodiversity

1. Articulate the issue and practice change required to achieve the vision theme

Issue: Water supply, sewerage and drainage systems do not traditionally consider environmental health and biodiversity objectives as a primary concern, and sometimes cause negative impacts.

Practice change: The characteristics, functions, conditions and values of ecosystems need to be better understood and respected, and the impacts of urbanisation and pollution will need to be managed. Achieving these outcomes will require natural assets to be integrated into the water management system so their management can be adequately planned and resourced.

2. Map WSC Index indicators to vision themes

The indicators relating to vision theme 1 are shown below, with scores for Hornsby in parentheses:

Goal 5: Improve ecological health

- 5.1 Healthy and biodiverse habitat (3.0)
- 5.4 Protecting areas of high ecological value (4.0)

3. Collect evidence for Transition Dynamics Framework analysis

The table below summarises evidence used for the TDF analysis for vision theme 1. The evidence in this table was gathered from transition workshop discussions around the presence or absence of enabling factors for vision theme 1.

Champions Platforms Kr	nowledge	Projects	Tools
Civic trust Tree nursery community volunteers Byles Creek Alliance Commercial industries (oyster) Hornsby Conservation Society STEP Natural recreation clubs (Berowra Runners) Councillors Climate Alliance Mayor and GM Climate Change Action Group (Hornsby) 3 Landcare groups (Streamwatch) Bushland Management Advisory Committee (BMAC) Catchment Remediation Rate (CRR) Panel Berowra Waters Progress Association Natural Resources groups (Screamwatch) Social media (council Facebook page) Community workshops Face-to-face talking to groups (no	ridging gap between chnical and general nowledge onnection to issues and knowledge anslation – need to better) ressure (high inderstanding), state of as high inderstanding), sponse (low inderstanding), sowledge of cosystem in the sociations apping, known apped vegetation or munities apping, known apped vegetation or munities apping in the sociations apped vegetation or munities apping in the sociations apped vegetation or munities appears a	Monitoring of biodiversity loss and gain through development applications/changes 25,000 trees CRR program Ecohealth program (landcare group) Data gathering/ monitoring at state level (what data, and is this used/made accessible to council?) OEH Save our species program Community nursery (only a few people use it) Bushcare program Clean4Shore Estuary programs coordinated across councils Land acquisition strategy reserve management Absence: Good education programs	DCP/LEP review Aus/NZ guidelines (water quality) Planning instruments (S88B) POE act CRR Biobanking and green offset policy (OEH) Guidelines for development adjoining national parks Coastal management program (state level) EPA licensing Catchment models/monitoring programs Compliance (and lack of) Water quality probe tool Plans of management (quality objective) Interpretive signage Too much leeway in planning controls Biodiversity strategy (draft)

4. Conduct Transition Dynamics Framework Assessment

The following matrix outlines the TDF analysis for vision theme 1 based on the scores from the WSC Index indicators along with the collated evidence from workshops with internal and external participants (table above). Green boxes indicate the enabling factor is fully present; yellow boxes Cindicate some presence of the enabling factor, however they are vulnerable to regressing to the previous phase; red boxes indicate a complete absence of the enabling factor and that progression is unlikely; and grey boxes indicate the enabling factor is not yet relevant due to absence of preceding enabling factor.

Enabling Factors					
Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Significant solution demonstrations	Refined guidance and early policy
5. Policy & Practice Diffusion	S 1. Government agency champions (OEH)	S 1.3 Expanding the community of practice	Capacity building	Widespread implementation and learning	S 1.2 S 1.3 Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation

Water Sensitive Hornsby Strategy

The WSC Index indicators (red box below) that are relevant to this vision theme can then be mapped to the transition phase identified in the TDF analysis.

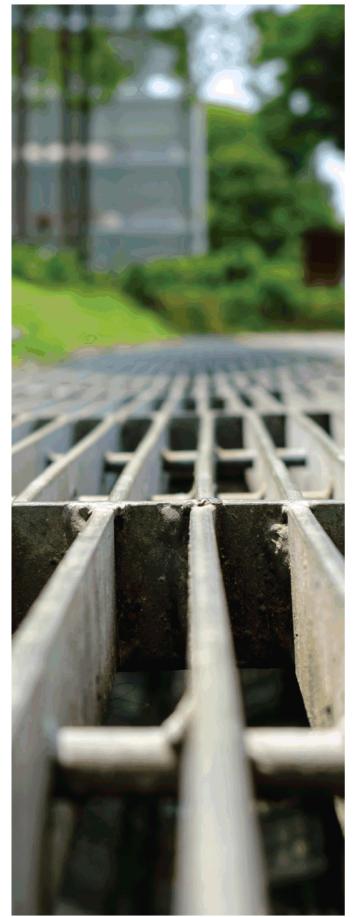


5. Determine priority strategies and actions based on the TDF analysis

Based on the above analysis, the following strategies and actions are recommended to advance more water sensitive practice. The strategies (blue arrows in matrix) were determined based on what would influence the yellow enabling factors (above) and what is a high priority for Council.

Strategy	Actions	Outcome
1.1 Consolidate and update biodiversity and ecological health data to form a comprehensive snapshot of current challenges and	1.1.1 Develop an online mapping tool and submission form to collect data on local environmental values and conditions	A comprehensive understanding to inform context-specific solutions and responses
opportunities	1.1.2. Create an integrated database of local, state and federal environmental and biodiversity data	
	1.1.3. Develop a program to assess condition of natural areas and gather baseline data	
	1.1.4. Encourage knowledge-sharing between Hornsby, Ku-ring-gai, and other councils with best practice environmental practices	
1.2 Develop and strengthen compliance measures at the local levels and seek to influence positive changes in state compliance measures	1.2.1. Review compliance procedures and improve internal capacity to take a stricter and more consistent approach	Better compliance amongst residents and industry
	1.2.2. Review preventative measures through planning controls 1.2.3. Lobby State Government for stronger biodiversity	
	protection laws through coalition with other councils, industry and community groups	
1.3 Build understanding among industry (specifically developers) and residents about the importance of ecological and waterways health and incentivise compliance	1.3.1. Develop and implement proactive education programs targeting private landholders about the importance of their local waterway assets, how to protect them and what the compliance measures are 1.3.2. Develop targeted awareness campaigns for	Better compliance amongst residents and industry
esavas estripiurise	developers, business and residents that showcase the benefits of protecting the health of the environment (e.g. property values, business opportunities, health benefits) 1.3.3. Develop and assess incentive programs for	
	enhancing ecological value	





Vision theme 2: Hornsby and its villages are full of beautiful blue and green spaces that connect people to their surrounding environment and local community

1. Articulate issue and practice change required to achieve the vision theme

Issue: The conventional approach to city planning and design typically considers water systems and the built form separately, which leads to liveability outcomes (such as aesthetic, green, cool urban environments) not being optimised.

Practice change: Water system planning and urban planning will need to be more integrated and collaborative so that standards and service outcomes that link to a broader vision of urban liveability can be achieved.

2. Map WSC Index indicators to vision themes

WSC Index indicators are mapped against the vision themes. The indicators relating to vision theme 2 are shown below, with scores for Hornsby in parentheses:

Goal 6: Ensure quality urban space

- 6.1 Activating connected urban green and blue space (3.5)
- 6.2 Urban elements functioning as part of the urban water system (2.5)
- 6.3 Vegetation coverage (4.0)
- Goal 3: Achieve equity of essential services
- 3.4 Equitable and affordable access to amenity values of water-related assets (3.5)

3. Collect evidence for Transition Dynamics Framework analysis

The table below documents the evidence used to inform the TDF analysis for vision theme 2. The evidence in this table was gathered from transition workshop discussions around the presence or absence of enabling factors for vision theme 2.

Champions	Platforms	Knowledge	Projects	Tools
Natural Resources team working with engineering team Current elected council (changes with one council to the next) Internal resources keeping track of innovation in WSUD Recent loss of team member w/ significant role in research Community groups Community – water play, recreation Absence: No one championing green walls/roofs	Berowra Water Progress Association (BWPA) Civic trust NSROC (sports grounds) – knowledge sharing, joint strategies, guidelines BMAC DPIE- funding case studies? Internal – project based meetings Delivery program outlines council's projects/funding/ priorities	External conferences (SIA) Studies for current development of strategies: walking, cycling, heat, climate change etc. Consultants bring knowledge, challenge current practice, councillors may listen to them	25,000 trees CRR Stormwater harvesting in parks and ovals Waitara – 20 years wait for green area Town centre revitalisation – need funding Projects not done according to best outcomes for a place, done by rulebook (e.g. traffic rules) Absence: Demonstrations of green infrastructure (green walls/roofs) in urban areas because no champion, not on agenda, no budget in projects and no driving need	New environmental strategies being prepared State Government policies BASIX WSUD policy in DCPs (out of date) Guidelines prepared for town centres – no outcomes yet Public domain guidelines exist (no implementation) HornsbyTown Centre plan exists

Water Sensitive Hornsby Strategy

4. Conduct Transition Dynamics Framework Assessment

The following matrix outlines the TDF analysis for vision theme 2 based on the scores from the WSC Index indicators along with the collated evidence from workshops with internal and external participants. Green boxes indicate the enabling factor is fully present; yellow

boxes indicate some presence of the enabling factor, however they are vulnerable to regressing to the previous phase; red boxes indicate a complete absence of the enabling factor and that progression is unlikely; and grey boxes indicate the enabling factor is not yet relevant due to absence of preceding enabling factor.

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
Knowledge Dissemination		Building broad support		Significant solution demonstrations	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation



5. Determine priority strategies and actions based on the TDF analysis

Based on the above analysis, the following strategies and actions are recommended to advance more water sensitive practice. The strategies were determined based on what would influence the yellow enabling factors (above) and what is a high priority for Council.

Strategy	Actions	Outcome
2.1 Develop and communicate a compelling narrative around the importance of a place-based and outcomes focused approach to urban design integrated blue and green spaces	2.1.1. Develop place-based plans that incorporate a strong narrative around the local environmental, historical and indigenous heritage (informed through community engagement) and highlight linkages to other valuable networks	Councillors and staff understand the importance of a place-based approach
and green spaces	2.1.2. Examine different mediums to communicate the place-based narrative on-the-ground	
	2.1.3. Promote business opportunities in relation to recreational water activities and tourism	
	2.1.4. Develop promotional material on the unique environmental and historical values within Hornsby	
	2.1.5. Develop a supporting business case to articulate the economic benefit of water sensitive outcomes (e.g. urban cooling and amenity)	
2.2 Implement trials and demonstration projects that promote connectivity of green and blue spaces	2.2.1. Assess strategic routes for green and blue corridors	Demonstration of how integrated outcomes can be delivered
a. a blad speeds	2.2.2. Capture and communicate lessons from demonstration projects to showcase advantages of place-based planning	
2.3 Strengthen integrated outcomes through Council policy and planning	2.3.1. Ensure integration across relevant LSPS strategies	Improved implementation for integrated, place-based outcomes
	2.3.2. Review and update existing public domain guidelines and town centre plans	
	2.3.3. Incorporate green and blue infrastructure targets into review of Development Control Plans and Local Environmental Plan	
	2.3.4. Incorporate of natural asset within Council's strategic asset management system	
	2.3.5. Investigate the development of catchment specific environmental values and targets to inform the Development Control Plan and Local Environmental Plan	

ATTACHMENT 4 - ITEM 1

Water Sensitive Hornsby Strategy

Vision theme 3: Hornsby Shire has engaged, empowered and active communities who value Aboriginal and cultural connections to land and water

1. Articulate issue and practice change required to achieve the vision theme

Two separate issues exist within vision theme 3:

Issue 1: Conventional water servicing defines the role for the community as customers who pay utilities to provide water system services. This is a relatively simple transaction that does not utilise the community's potential in being active water stewards.

Practice change 1: Community engagement practices will need to be meaningful and transparent, focused on empowering people to have the interest, capability and opportunity to be active partners in achieving water sensitive outcomes. For example, community expectations for liveability can inform water servicing and management, and more decentralised solutions can be incorporated into the system to be managed by households and neighbourhoods.

Issue 2: Aboriginal water knowledge, values and ways of thinking offer significant promise in guiding community stewardship; however, it is not yet understood how to best engage with Aboriginal communities to understand and embed these values

Practice change 2: Opportunities to share cultural values and connections will be needed to ensure a full diversity of values is considered and incorporated in decision-making.

2. Map WSC Index indicators to vision themes

WSC Index indicators are mapped against the vision themes. The indicators relating to vision theme 3 are shown below, with scores for Hornsby in parentheses:

Goal 2: Increase community capital

- 2.1 Water literacy (2.5)
- 2.2 Connection with water (3.0)
- 2.3 Shared ownership and management of water-related assets (2.5)
- 2.4 Community preparedness and response to extreme events (2.5)

3. Collect evidence for Transition Dynamics Framework analysis

The table below documents the evidence used to inform the TDF analysis for vision theme 3 (both practice changes):

(there was) news – council cultural connections disser preference, limited (particularly Aboriginal	shops ral calendar (old) OC week events training (being	Acknowledgement to country Environmental Education Strategy Various engagement strategies (project specific) Brochures/videos
Natural resources Hornsby Aboriginal and Torres Strait Islander Committee (HATSIC) Hornsby Aboriginal and Torres Strait Islander Committee (HATSIC) Workshops – community, swimming maps Community Community Estuary Management development officers Media personnel (print Bushwalk and catchment Community engagement Effectively – council doesn't have an internal community engagement team Council recognises this is an issue, but doesn't have the "how to" solutions to community engagement Tours	v council gement team considered of Sydney water es (available but	produced by (former) Aboriginal officer (grant funded) External database on indigenous cultural heritage matters Cultural burns

Water Sensitive Hornsby Strategy

4. Conduct Transition Dynamics Framework Assessment

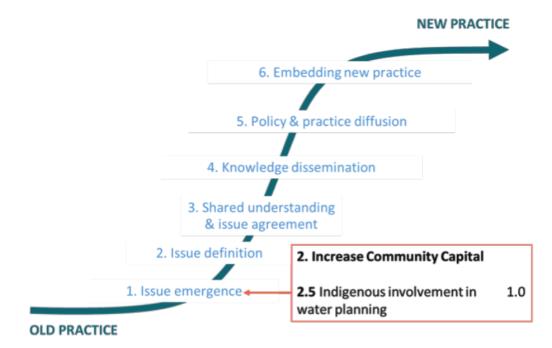
The following matrix outlines the Transition Dynamics Framework analysis for broad community engagement (practice change 1):

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice		Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Significant solution demonstrations	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation



The following matrix outlines the Transition Dynamics Framework analysis for engagement with Aboriginal water knowledge and values (practice change 2):

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Significant solution demonstrations	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation



Water Sensitive Hornsby Strategy

5. Determine priority strategies and actions based on the TDF analysis

Based on the above analysis, the following strategies and actions are recommended to advance more water sensitive practice. The strategies were determined based on what would influence the yellow enabling factors (above) and what is a high priority for Council.

Strategy	Actions	Outcome
3.1 Develop solutions for effectively engaging Hornsby Shire's diverse community groups	3.1.1. Influence current development of Council's engagement plan to ensure it covers water engagement needs 3.1.2. Review Hornsby Shire Council website to ensure resources are available and accessible 3.1.3. Map current community engagement initiatives and who is leading them in order to identify gaps in engagement 3.1.4. Investigate innovative engagement methods and principles through behaviour change research or engagement projects from elsewhere 3.1.5. Investigate and trial methods to build peoples' connection to water	Tailored engagement strategies that are appropriate for the range of demographics within Council
3.2 Build on existing platforms to ensure community engagement is embedded across all council activities	3.2.1. Reinstate the education project control group with a clear charter and goal of providing consistent messaging and resources to community 3.2.2. Undertake engagement professional development training internally 3.2.3. Ensure water is in the charter of the Environmental Sustainability Committee (which includes community members) 3.2.4. Develop an Environmental Sustainability Engagement Plan to support Council's broad engagement plan 3.2.5. Consolidate and evaluate lessons from existing community engagement projects to inform future projects and to encourage innovation	A strategic approach to community engagement across all Council activities
3.3 Develop new knowledge about how to effectively and meaningfully engage with Indigenous communities and why it is important to do so through better engagement with HATSIC and other indigenous groups	3.3.1. Identify who to engage within the Aboriginal communities (beyond HATSIC) to initiate the conversation around what needs to be done 3.3.2. Expand and progress existing internal commitments around Aboriginal engagement 3.3.3 Undertake aboriginal cultural awareness training for staff	An understanding of how to effectively engage with Indigenous communities and why it is important to do so



Vision theme 4: A strong focus on water quality supports healthy, clean rivers and creeks

1. Articulate issue and practice change required to achieve the vision theme

Issue: Water system services (particularly drainage) have traditionally not considered downstream impacts as a primary focus, often leading to poor waterway health outcomes. While the removal of pollution from wastewater treatment plant discharges has become standard practice, the treatment of diffuse pollution and management of hydraulic impacts has proven more challenging.

Practice change: The characteristics, functions, conditions and values of waterways need to be better understood and respected, and the impacts of urbanisation and pollution will need to be managed. Achieving these outcomes will require natural water assets (waterways, aquifers) to be integrated into the water management system so their management can be adequately planned and resourced.

2. Map WSC Index indicators to vision themes

WSC Index indicators are mapped against the vision themes. The indicators relating to vision theme 4 are shown below, with scores for Hornsby in parentheses:

Goal 5: Improve ecological health

5.2 Surface water quality and flows (3.5)

5.3 Groundwater quality and replenishment (3.0)

Goal 3: Achieve equity of essential services

3.3 Equitable access to flood protection (3.5)

3. Collect evidence for Transition Dynamics Framework analysis

The table below documents the evidence used to inform the TDF analysis for vision theme 4:

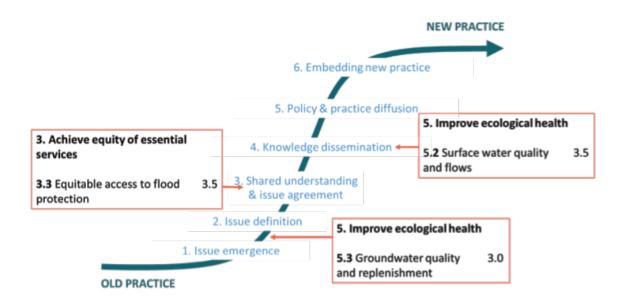
Water Sensitive Hornsby Strategy

Champions	Platforms	Knowledge	Projects	Tools
Landcare groups (Streamwatch)	River networks (informal)	Community doesn't have knowledge to value water quality	Monitoring projects (ecological health, public health,	Risk-based tools, frameworks and policies
Floating landcare group	Social media Community	– knowledge sharing gaps	environmental intelligence)	CRR
Byles Creek Alliance	workshops	Process studies (estuaries and creeks	CRR (stormwater harvesting and reuse)	Lacking Water Sensitive policy
Professional fishers/ commercial industries	Water quality probes Swimming maps	 lots of base knowledge) 	Estuary programs	Aus/NZ water quality
(oyster) Tourism (some	Pollution compliance	Community values around waterways	Research/ management of algal	guidelines NWQ framework
operators are champions, others hinder)	(face to face interaction after the fact)	(data collected) Experiments (cause	blooms Absence:	LEP/DCP planning instruments (e.g. to protect seagrass)
Riverside settlements	University research	and effect)	"Smart" estuaries utilising artificial	Community incentives
BWPA	Conferences	Uncertain future (climate change, political will, how they	intelligence e.g. drones looking for oil	(to do WSUD and septic)
Natural resources Councillors (tend to be	Internal workshops CRCWSC	impact funding)	spills	Compliance programs
bushland focused), depends on wards (e.g. estuaries)	OEH (DPIE) relationship with	Groundwater gap Manuals (bioretention basins) technical/	Groundwater monitoring (only done for private industries)	Total Water Cycle Management Strategy
Specific staff in Sydney Water	council GSC	workshops Issues (videos) other councils are facing		EPA licensing – gap in compliance- ineffective
Dangar Island league (some issues)	Absence: professional	Industry forums / knowledge (e.g.		Natural resources regulator referral for development
Prominent locals	discussion forums (online, interactive)	commercial fishers)		(potentially state level)
Estuary committee (residents and council)		Know well – close to source, impacts of		Offsetting tools
CRR team		some land uses Less known – high		Water quality probe (tool)
		density development, impacts further down the system		Catchment models and monitoring programs
		Cost-benefit knowledge is limited		
		Scale (actions of individuals? Vs catchment		
		Understanding pressure-state- response		
		Process studies completed		

4. Conduct Transition Dynamics Framework Assessment

The following matrix outlines the Transition Dynamics Framework analysis for vision theme 4:

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Significant solution demonstrations	Refined guidance and early policy
	S 4.1	S 4.1	S 4.2 S 4.3	S 4.3	
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation S 4.4 S 4.5



Water Sensitive Hornsby Strategy

5. Determine priority strategies and actions based on the TDF analysis

Based on the above analysis, the following strategies and actions are recommended to advance more water sensitive practice. The strategies were determined based on what would influence the yellow enabling factors (above) and what is a high priority for Council.

Strategy	Actions	Outcome
4.1 Build on existing platforms to support knowledge-sharing with the community around how their behaviours can influence	4.1.1. Understand and map existing behaviours among community, business and developers related to water quality	The broad community understands their role in improving water quality and undertakes behaviours
water quality	4.1.2. Identify how council staff and operations can influence behaviours	to support this
	4.1.3. Develop a community engagement plan on natural resources management (incorporate into water management)	
	4.1.4. Develop specific education and engagement programs to address behaviours and outcomes	
4.2 Develop understanding of downstream cumulative impacts of different land uses (e.g. high density development)	4.2.1. Develop catchment models to assess policy settings and development scenarios4.2.2. Articulate and refine waterway objectives and values	An understanding of how certain development scenarios will impact downstream environments
	4.2.3. Collate monitoring data to support catchment models	
	4.2.4. Develop visualisations from catchment models to assist communications and decision-making	
4.3 Learn from previous successes or failures to inform implementation of water sensitive projects	4.3.1. Audit efficiency of planning instruments to restore and protect waterways 4.3.2. Review and compile lessons learnt from existing WSUD projects	An understanding of how to strategically implement water sensitive city projects (including incorporating the
	4.3.3. Build expert community of practice to share knowledge and perspectives on water management and to co-create pathways and solutions to improve practices	necessary community engagement around the solutions)
4.4 Develop and strengthen compliance measures at state	4.4.1. Proactive compliance based on best evidence based compliance approaches	Improved compliance for waterway health
and local levels	4.4.2. Provide information on Council's website on minimum acceptable practices by industry type	outcomes
	4.4.3 Assess Council projects and external proposals for compliance with water sensitive urban design requirements	
4.5 Position water management at the forefront of Council policy	4.5.1. Council adopt planning policy, including targets, to elevate water management in planning	A supportive policy and planning environment for
and planning	4.5.2. Outcomes from catchment modelling influences planning	implementation of water sensitive outcomes
	4.5.3. Develop council systems and processes to ensure integration of council water strategies and policies outside of LSPS process (e.g. catchment plans)	

ATTACHMENT 4 - ITEM 1

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Vision theme 5: Sustainable resource use is supported by integrated, multi-functional infrastructure

1. Articulate the issue and practice change required to achieve the vision theme

Issue: The conventional mode of providing water system services typically delivers large-scale centralised infrastructure designed to meet singular objectives, under a set of relatively narrow assumptions about parameters such as future rainfall, population and urbanisation patterns. They also tend to prioritise cost efficiency over resource efficiency. This means opportunities to efficiently recover and reuse resources are missed, along with broader liveability and economic benefits for sectors beyond water (health, recreation and tourism)

Practice change: A more adaptive water servicing approach will be needed with greater integration of multi-functional systems across scales. Water systems will also need to be designed to take advantage of the synergies and connections between water, energy, food and land resources. The planning, design, management and maintenance of such an approach will need to be highly collaborative, with systems and processes in place to enable the sharing of risks, costs, benefits, data and lessons

2. Map WSC Index indicators to vision themes

WSC Index indicators are mapped against the vision themes. The indicators relating to vision theme 2 are shown below, with scores for Hornsby in parentheses:

Goal 4: Improve productivity and resource efficiency

- 4.1Benefits across other sectors because of water-related services (3.0)
- 4.2Low GHG emissions in the water sector (2.5)
- 4.3Low end-user potable water demand (2.0)
- 4.4Water-related commercial and economic opportunities (2.0)
- 4.5 Maximised resource recovery (2.0)

Goal 7: Promote adaptive infrastructure

- 7.1 Diverse fit-for-purpose water supply system (2.5)
- 7.2 Multi-functional water system infrastructure (3.5)
- 7.3 Integration and intelligent control (4.0)
- 7.4 Robust infrastructure (4.0)
- 7.5 Infrastructure and ownership at multiple scales (3.5)
- 7.6 Adequate maintenance (3.0)

3. Collect evidence for Transition Dynamics Framework analysis

The table below documents the evidence used to inform the TDF analysis for vision theme 5:

Water Sensitive Hornsby Strategy

Champions	Platforms	Knowledge	Projects	Tools
Natural resources and Engineering teams are becoming better linked Trees – greater awareness Engineering involve Natural Resources when specific blue/ green elements needed Strategy and Place team – now looking at place-based projects and more integration (6 months old) CRR team	Project level Project control groups for projects over \$1M Strategy and Place team CRR team Group that gets together internally to plan multi-functional projects – informal Parks and Natural Resources joined on projects (stormwater harvesting) Online monitoring data systems – real time, remote sensing (however not available internally or publically)	Stormwater harvesting – good monitoring data Irrigation- optimising, based on experience of when to irrigate Water conservation – harvesting Water quality monitoring and probes Irrigation controlled remotely, but no soil moisture sensors Tried to do sewer mining, too costly No funding for recreational opportunities	10 stormwater harvesting systems in place Hornsby quarry – potential 25,000 trees Disconnect between traditional water infrastructure and water quality, funding separate Projects not done according to best outcomes for a place, done by rulebook (e.g. traffic rules) Pennet Hills golf course – greywater use Failed project in the La Mancha Estate Berowra – WSUD taken out	Stormwater harvesting- online remote sensed monitoring of storages/use Asset management systems WSUD policy

4. Conduct Transition Dynamics Framework Assessment

The following matrix outlines the Transition Dynamics Framework analysis for vision theme 5:

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice	Solutions developed	Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Significant solution demonstrations	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation



5. Determine priority strategies and actions based on the TDF analysis

Based on the above analysis, the following strategies and actions are recommended to advance more water sensitive practice. The strategies were determined based on what would influence the yellow enabling factors (above) and what is a high priority for Council.

Strategy	Actions	Outcome
5.1 Establish a forum for exploring how a place-based approach can deliver broad outcomes (e.g. the Local Strategic Planning Statement development process)	5.1.1. Identify appropriate platforms to implement a place-based approach 5.1.2. Utilise new tools to quantify multiple benefits and develop business cases for water sensitive solutions, including the investigation of alternative water sources 5.1.3. Advocate for a review of BASIX to include broader planning issues 5.1.4. Develop precinct plans to deliver multifunctional water infrastructure to highest design standard 5.1.5. Develop incentives for integrated outcomes	Understanding of why a place-based approach is important for ensuring broad outcomes
5.2 Explore opportunities to demonstrate how existing and new stormwater harvesting projects can deliver broad benefits by engaging with community values	5.2.1. Explore ideas for how Hornsby Town Centre and other priority planning areas can demonstrate water sensitive city outcomes through a design charrette or similar co-design process 5.2.2. Identify and implement opportunities through council works projects at the street, park and sub-catchment scale 5.2.3 Implement asset maintenance and renewal of water sensitive projects to ensure ongoing performance and effectiveness	Demonstration of how water quality projects can contribute to broad water sensitive outcomes

Water Sensitive Hornsby Strategy

Vision theme 6: Integrated and inclusive governance arrangements delivers a holistic approach to water management while meeting the challenges of growth

Issue: Typical urban water governance structures and processes for conventional water systems include large centralised institutions with responsibilities for policy, planning, delivery and regulation of single-objective water system services. In the face of climate change and urbanisation, the community's expectations for outcomes delivered by the water system are evolving further, and now reflect a broader agenda for water to support a city's liveability and resilience.

Practice change: Governance structures, processes and capacities will need to enable and drive integrated, long-term, cross-sector and inclusive planning and design decisions in order to deliver water sensitive outcomes for the community.

2. Map WSC Index indicators to vision themes

WSC Index indicators are mapped against the vision

themes. The indicators relating to vision theme 4 are shown below, with scores for Hornsby in parentheses:

Goal 1: Ensure good water sensitive governance

- 1.1 Knowledge, skills and organisational capacity (2.0)
- 1.2 Water is key element in city planning and design (3.0)
- 1.3 Cross-sector institutional arrangements and processes (3.0)
- 1.4 Public engagement, participation and transparency (2.5)
- 1.5 Leadership, long-term vision and commitment (3.0)
- 1.6 Water resourcing and funding to deliver broad societal value (3.0)
- 1.7 Equitable representation of perspectives (1.5)

3. Collect evidence for Transition Dynamics Framework analysis

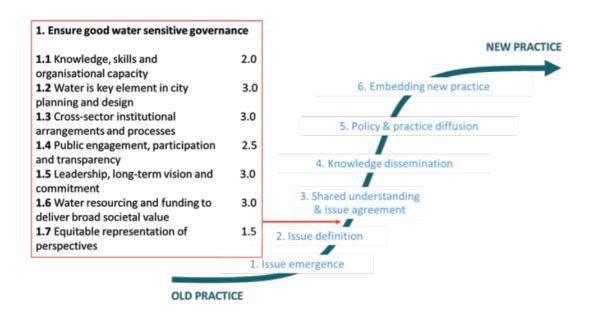
The table below documents the evidence used to inform the TDF analysis for vision theme 6:

Champions	Platforms	Knowledge	Projects	Tools
Council GMs Executive committee Project control groups Design Excellence Group Natural Resources team Councillors Community champions – CRR committee, estuary committee, progress societies CRC Splash GSC Sydney Water OEH (DPIE) Stormwater NSW	SOJI's various community committees Legal/regulatory requirement (limited) Project control groups Conferences Project management plan and project control groups Co-locating work teams	Recognise need for integrated governance Project control groups Industry associations (Stormwater NSW, CRC RAP) – info on better governance Courses on better governance Position descriptions and KPIs to drive integrated governance – outcome driven (not happening, potential solution)	LSPS (GSC driven, happening now) WS Hornsby project Every Drop Counts (water conservation) partnership (State Government and LGAs – drought response) Committees: estuary, CRR – includes external reps (e.g. Sydney water) OEH risk-based framework implementation 25,000 trees program Requires multiple departments to implement	BASIX District plans (GSC) Council's DCP LSPS – strategies Council's project management policy (resulted in project control groups) Eastern Sydney Regional Masterplan (Sydney Water) Hawkesbury Nepean nutrient modelling project (Sydney Water) Licensing /offsets framework (EPA) SOJI

4. Conduct Transition Dynamics Framework Assessment

The following matrix outlines the Transition Dynamics Framework analysis for vision theme 5:

Transition phase	Champions	Platforms for connecting	Knowledge	Projects and applications	Tools and instruments
1. Issue Emergence	Issue activists	N/A	Issue highlighted	Issue examined	N/A
2. Issue Definition	Individual champions	Sharing concerns and ideas	Causes and impacts examined	Solutions explored	N/A
3. Shared Understanding & Issue Agreement	Connected champions	Developing a collective voice		Solutions experimented with	Preliminary practical guidance
4. Knowledge Dissemination	Aligned and influential champions	Building broad support	Solutions advanced	Significant solution demonstrations	Refined guidance and early policy
5. Policy & Practice Diffusion	Government agency champions (GSC)	Expanding the community of practice	Capacity building	Widespread implementation and learning	Early regulation and targets
6. Embedding New Practice	Multi-stakeholder networks	Guiding consistent application	Monitoring and evaluation	Standardisation and refinement	Comprehensive policy and regulation



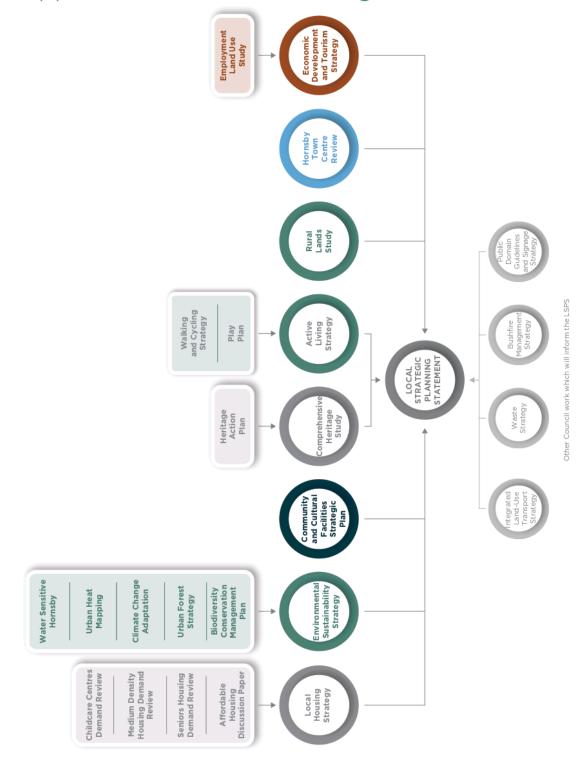
Water Sensitive Hornsby Strategy

5. Determine priority strategies and actions based on the TDF analysis

Based on the above analysis, the following strategies and actions are recommended to advance more water sensitive practice. The strategies were determined based on what would influence the yellow enabling factors (above) and what is a high priority for Council.

Strategy	Actions	Outcome
6.1 Investigate and explore options to implement collaborative governance (both formal and informal) beyond project-specific activities	6.1.1. Hold internal capacity-building activities to build breadth of knowledge within Council staff	The mechanisms and processes exist to support collaboration beyond individual projects
	6.1.2. Review development approvals process to determine why some elements are ineffective	
	6.1.3. Evaluate the effectiveness of existing collaborative governance solutions and approaches to inform future solutions	
	6.1.4. Deliver water sensitive city messaging to senior and executive staff	
	6.1.5. Ensure water is at the forefront of decision-making by making it agenda item in project control groups	
	6.1.6. Establish an informal regional water sensitive cities group that utilises online tools and forums to share knowledge and ideas	
6.2 Build on existing platforms for collaboration to be beyond projects	6.2.1. Develop theme-based control groups (e.g. water or environmental sustainability) that include officer and senior level staff	The project control group model is elevated to the program level to ensure consistency and longevity

Appendix C - Council strategies



Water Sensitive Hornsby Strategy

Appendix D - Community ideas for action

1. Improving water quality and flows

No.	Ideas	Supporting detail
1.1	Implement green infrastructure along transport corridors (major roads, minor roads, railway line) to improve water quality and reduce flooding impacts	 Peats Ferry Road and cycleway E.g. raingardens, swales Use railway tracks and verges for water treatment
1.2	Encourage stakeholders to invest in rain gardens on private land (see action 2.4)	
1.3	Review process for monitoring and maintaining on-site sewage management systems	
1.4	Implement oil and litter traps for stormwater	
1.5	Monitor, report on and publicise polluted stormwater discharge to waterways	To identify pollution sources and hold people accountable
1.6	Identify new opportunities to recycle stormwater for irrigation	Parks and sports fields
1.7	Recycle wastewater treatment plant discharge for irrigation	
1.8	Provide financial incentives (e.g. rebates, subsidies) to implement water sensitive urban design solutions on private property	E.g. rainwater tanks, rain gardens, and other water sensitive urban design features

2. Informing and educating citizens

No.	Ideas	Supporting detail
2.1	Develop education programs for different parts of the community that outline what actions they can take to conserve water in the home and live more sustainably	 Actions for people in high rises will be different to actions for people with land People should consider what they put into their drains (e.g. household products, car washing)
2.2	Promote Council water sensitive urban design projects with signage, posters and other methods of information sharing	So the community understands and appreciates the benefits of water sensitive urban design
2.3	Re-implement stencilling program on stormwater drains so the community understands where stormwater goes and their impact on downstream waterways	■ Engage community groups to do the stencilling
2.4	Develop guidance and provide materials for people who want to build rain gardens on their property	"Build your own rain garden" kitsNative plant giveaways
2.5	Develop a community award or other recognition for community contributions	 Recognise people who build rain gardens or rainwater tanks

3. Connecting people and place

No.	ldeas	Supporting detail
3.1	Create an urban beach so people in urban areas can enjoy amenity and recreation benefits of water	■ E.g. at Brooklyn or the Hornsby Quarry
3.2	Review access to riverside areas to promote ideas for greater accessibility	Provide shuttles or transport options for uphill journeys Create more walkways with information stations
3.3	Link schools and groups (e.g. Scouts) to local environmental projects	E.g. local Habitat for Humanity projects

4. Greening urban areas

No.	ldeas	Supporting detail
4.1	Incorporate plants and green infrastructure into traffic islands and roundabouts	
4.2	Encourage and incentivise rooftop gardens and green walls on high-rise buildings	■ E.g. learn from Central Park in Sydney
4.3	Encourage residents to implement balcony and verge gardens	Best balcony/verge garden" competitions Promote urban food production
4.4	Council buildings lead by example with green walls and vertical gardens	
4.5	Create community gardens and urban gardens to support knowledge sharing and a sense of community	

5. Creating healthy habitats

No.	ldeas	Supporting detail
5.1	Identify areas for seagrass and mangrove planting to improve river habitats	
5.2	Identify areas of salt marsh for protection	
5.3	Encourage a diverse range of people to get involved in bushcare groups	Especially youth and people in high rises
5.4	Encourage bush regeneration groups to eliminate invasive weeds	■ E.g. Lantana, Privet
5.5	Promote knowledge of native bush species so weeds can be identified	
5.6	Continue anti-litter campaigns	■ E.g. Clean Up Australia, KESAB
5.7	Encourage rehabilitation of eroded riverbanks	

NEED HELP?

This document contains important information. If you do not understand it, please call the Translating and Interpreting Service on 131 450. Ask them to phone 9847 6666 on your behalf to contact Hornsby Shire Council. Council's business hours are Monday to Friday, 8.30am-5pm.

Chinese Simplified

需要帮助吗?

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Chinese Traditional

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German

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Hindi

क्या आपको सहायता की आवश्यकता है?

इस दस्तावेज़ में महत्वपूर्ण जानकारी दी गई है। यदि आप इसे समझ न पाएँ, तो कृपया 131 450 पर अनुवाद और दुभाषिया सेवा को कॉल करें। उनसे हॉर्न्सवी शायर काउंसिल से संपर्क करने के लिए आपकी ओर से 9847 6666 पर फोन करने का निवेदन करें। काउंसिल के कार्यकाल का समय सोमवार से शुक्रवार, सुबह 8.30 बजे-शाम 5 बजे तक है।

Korean

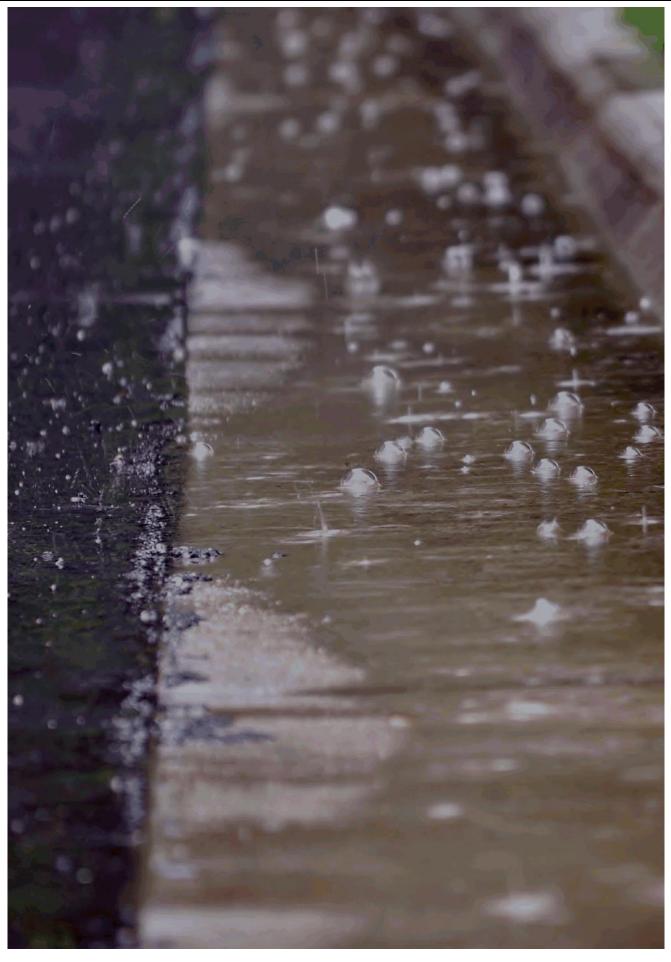
도움이 필요하십니까?

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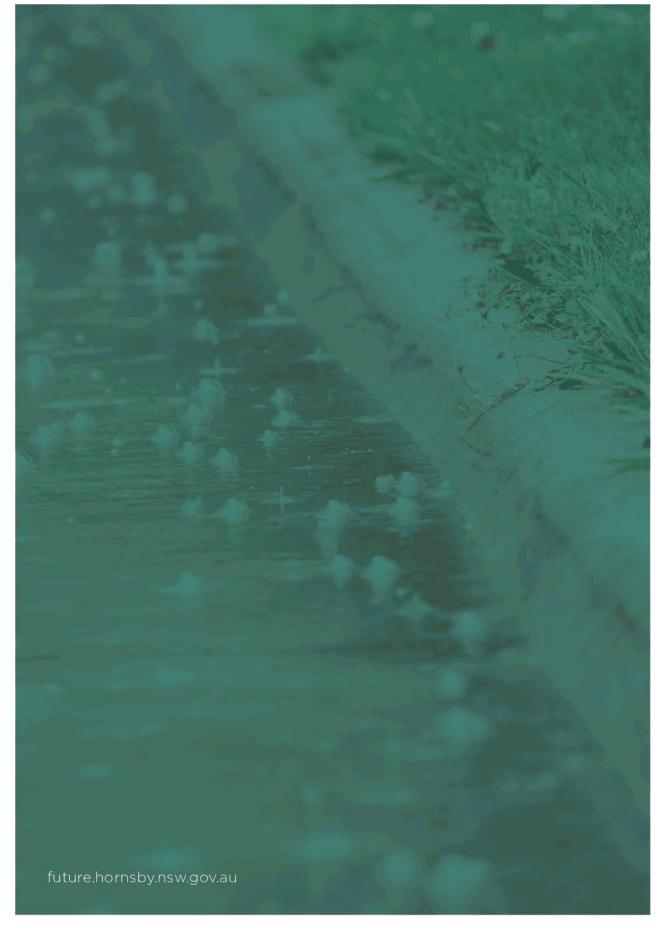
Tagalog

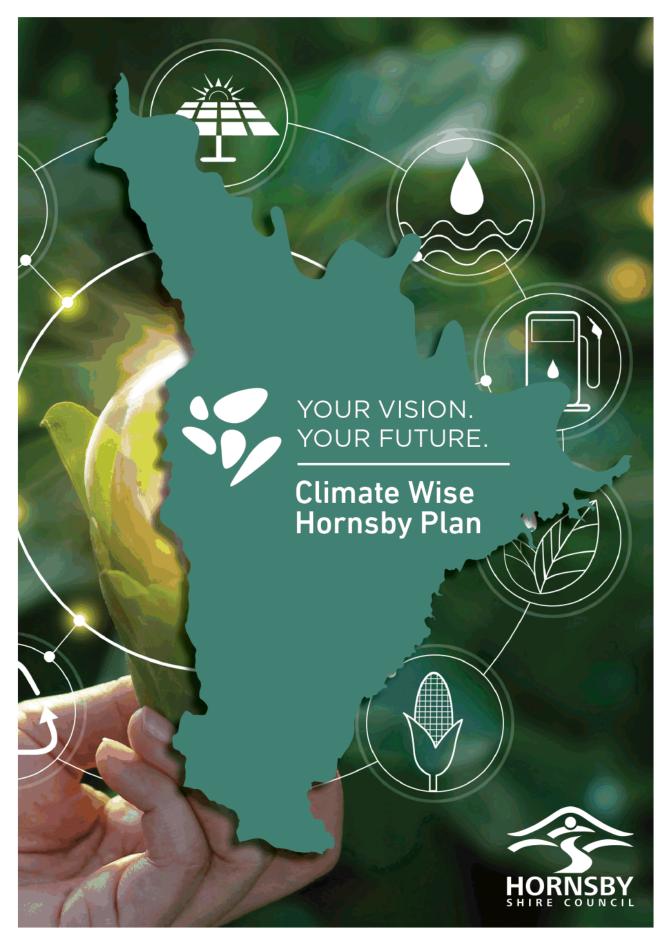
Kailangan ng tulong?

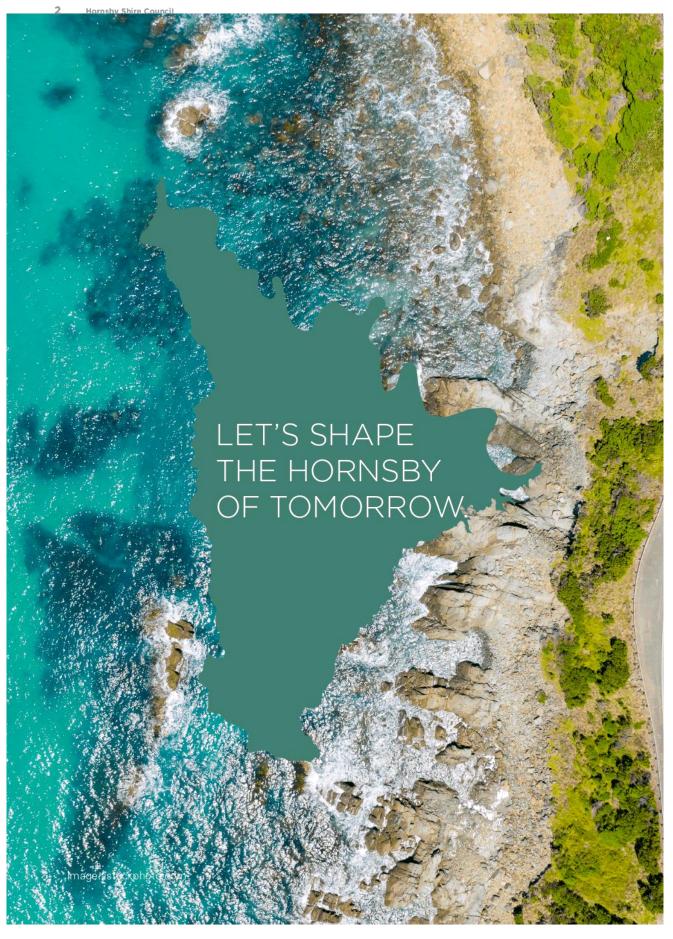
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Climate Wise Hornsby Plan



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Council recognises the Traditional Owners of the lands of Hornsby Shire, the Darug and Guringai peoples, and pays respect to their Ancestors and Elders past and present and to their Heritage. We acknowledge and uphold their intrinsic connections and continuing relationships to Country.

Figure 3: Social Pinpoint mapping tool and community engagement sessions

Figure 5: Hornsby Shire Council's Emissions Profile by Sector 2017/18 (Source: Adapted from Ironbark Sustainability, 2019, Corporate Greenhouse Gas Emissions Inventory, p18)

Figure 10: Hornsby LGA: all waste generation by type for 2016/17 (Source: Adapted from Resilient Sydney, 2016/2017)

Figure 11: All Water Use by Sector for 2016/17 (Source: Adapted from Sydney Water 2016/2017)

Figure 17: Impact by Success Criteria (Source: Jardine Lloyd Thompson (2019) Climate Change Risk Assessment Adaptation

Figure 18: Impact by Functional Area (Source: Jardine Lloyd Thompson (2019) Climate Change Risk Assessment Adaptation Report)

Figure 19: Engagement Cycle for Climate Change Adaptation (Source: Smith, T., A. Leitch, and D. Thomsen, 2016: Community Engagement. CoastAdapt Information Manual 9, National Climate Change Adaptation Research Facility, Gold Coast)

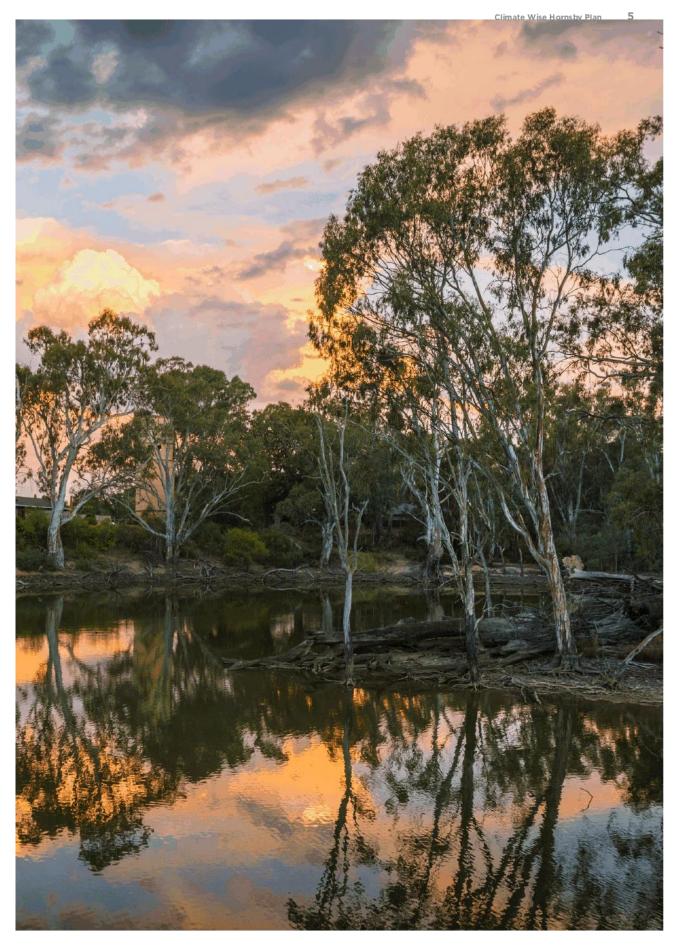
(Source: AdaptNSW, 2019)

Table 2: Hornsby LGA: Corporate Greenhouse Gas Emissions Inventory for the 2017/18 Financial Year (Source: Ironbark Sustainability, 2019 Corporate Greenhouse Gas Emissions Inventory, p31)

Table 4: Impact Rankings by Scenario (Source: Jardine Lloyd Thompson (2019) Climate Change Risk Assessment Adaptation Report)

Table 5: Organisational Structure of Functional Areas (Source: Jardine Lloyd Thompson (2019) Climate Change Risk Assessment Adaptation Report)





1. Executive summary

Hornsby Shire Council recognises that climate change is a global issue that requires significant and immediate action. Climate actions have often fallen into one of two categories: mitigation efforts to lower or remove greenhouse gas emissions from the atmosphere, and adaptation measures to reduce our vulnerability to the effects of climate change. Both approaches are needed, and Council will continue to implement mitigation and adaptation measures to reduce and manage the risks of climate change and play a leading role in the community.

This Climate Wise Hornsby Plan sets out the future direction for Council as we embark on our journey to operate as a low carbon organisation and community that is resilient to climate impacts. This plan outlines immediate actions to be taken as well as a monitoring pathway, between now and 2050, to enable us to adapt to evolving data and projections.

During the planning process, Council has determined that bold actions are required if we are to meet our target of net zero emissions by 2050. We will need to reduce our corporate emissions by 32% from 2018 levels by 2025 and 53% by 2030. Our community are tasked to reduce their emissions by 31% from 2017 levels by 2025 and 53% by 2030.

Our intention is to embed considerations of climate change into every day practices from 2020 onwards so that it becomes 'business as usual' across the organisation. The Climate Wise Hornsby Plan fits under Council's Environmental Sustainability Strategy - Sustainable Hornsby 2040 and Sustainability theme of the Community Strategic Plan. Implementation of the Plan will be dynamic, collaborative and flexible to respond to changes and learn from experiences.

Climate Wise Hornsby Plan

Building Climate Resilience

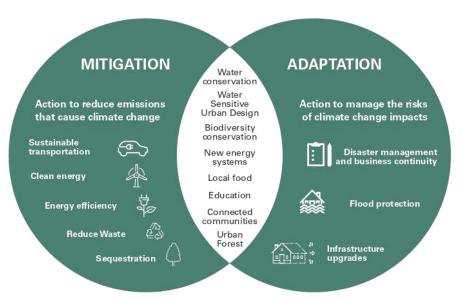


Figure 1: Building Climate Resilience

By addressing climate change mitigation and adaptation Council is contributing to the development of co-benefits such as cleaner air, resource efficiency, economic security and the sustainability of ecosystems.



2. Introduction

Resilience is the capacity of individuals, communities, businesses and systems within our Shire to survive, adapt and thrive no matter what kinds of chronic stresses and acute shocks we experience

- Resilient Sydney, 2018

Hornsby Shire Council Local Government Area (LGA) is home to just over 150,000 residents which is expected to increase to around 179,500 by 2036 (.id community, 2018). Adding to the pressure of population growth, the Shire will be challenged by a changing climate, with projected warmer and drier conditions, increased frequency and intensity of storm events and more frequent droughts and bushfires over the next 20 years (Jardine Lloyd Thompson, 2019).

Anthropogenic greenhouse gas (GHG) emissions drive modern climate change with emissions being generated through electricity and gas usage, transport, purchases of materials and waste generation. In 2019, Council reinforced its commitment to act on climate change by setting a target of net zero emissions by 2050. Council also worked with its insurer Statewide Mutual and Jardine LloydThompson to undertake a climate change risk assessment (JLT).

Net zero emissions means all greenhouse gas emissions will be balanced by carbon storage. The more emissions are reduced, the less sequestration is needed to achieve net-zero (Office of Environment and Heritage, 2016). Although Council will work towards mitigating future impacts on climate change we are currently experiencing a changing climate both locally and globally. Council needs to prepare for and adapt to this changing climate to ensure our buildings, assets, infrastructure, natural environments and community are well placed to withstand these future impacts.

Becoming a net zero emissions Council and community is a significant task. The risk of not acting will have significant social, economic and environmental implications. Achieving our targets will require a new approach and there will be many challenges along the way for which we do not yet have all the answers. Council will partner and collaborate with like-minded organisations locally, nationally and internationally to ensure best practice projects and programs as we move towards a more sustainable future and limit global heating to well below 2 degrees Celsius as outlined in the Paris Agreement (United Nations / Framework Convention on Climate Change, 2015).

To identify opportunities and to drive change, Council is actively reviewing its community and corporate emissions, taking stock of energy consumption, waste production and internal procedures. Council and the community need to be resilient and able to mitigate against and adapt to a changing climate.

This Climate Wise Hornsby Plan (the Plan) outlines our emissions reduction action plan (Appendix 1 and 2) to mitigate accelerated climate change and our climate change risk assessment to prepare for and/or adapt to the changing climate (Appendix 3). The completion of these actions will be dependent upon the availability of Council resources. Where possible, Council will realise opportunities through alternative funding pathways, by working in collaborative partnerships and applying for grants. We will also leverage our strong and productive relationships with state and local governments, not-for-profit organisations, research organisations and community groups to maximise our combined impact.

2.1 Objectives

The objectives of the Climate Wise Hornsby Plan are to

- Reduce Council's greenhouse gas emissions to net zero by 2050
- Support the community in the goal of reaching net zero emissions by 2050 through the delivery of programs and initiatives that further community greenhouse gas emission reduction efforts
- Reduce Council's and the community's vulnerability to a changing climate and implement adaptation measures associated with temperature, hot days, average rainfall, wind, fire weather, sea-level rise and rain intensity.

2.2 Guiding Principles

The following principles guide the development of our Climate Wise Hornsby Plan and its implementation:

- Factor climate change into decision making and operations – Factor the consideration of mediumand long-term climate change projections in investment and planning decisions
- Mitigation / adaptation balance Consider climate change mitigation as we develop adaptation solutions, to reduce our greenhouse gas emissions and reduce our vulnerability to a changing climate
- Start to act, even with uncertainty Act now on measures that can be implemented without being certain about all dimensions of future climate change
- Build regular reviews as a core part of the Plan

 Implementation of the Plan will be dynamic,
 collaborative and flexible to respond to changes and
 learn from experiences. Emerging information and
 technologies will be considered throughout
 implementation to ensure Council continues to
 implement the Plan in the most effective way
- Involve all those who are impacted by climate change – Recognise the importance and necessity of all areas of Council in implementing mitigation and adaption measures. Communicate, educate and engage with the community to help them mitigate and adapt.

3 Act locally but think globally

Climate change impacts are not confined by local government boundaries. We therefore need to act locally but think globally.

Intergovernmental Panel on Climate Change

The United Nations Intergovernmental Panel on Climate Change states, 'Climate change represents an urgent and potentially irreversible threat to human societies and the planet' (IPCC, 2018). The role of the Panel is to function as the United Nation's body to regularly assess the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation (IPCC, n.d).

2015 Paris Agreement

Australia is a signatory to the Paris Agreement. The Paris Agreement 'brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects...' (United Nations Climate Change, 2020). It aims to pursue efforts to limit temperature to well below 2 degrees Celsius above pre-industrial levels; to pursue efforts to limit the increase to 1.5 degrees Celsius and to achieve emissions globally by the second half of the century.

United Nation's Sustainable Development Goals

The United Nations have developed 17 Sustainability Goals. These goals provide a blueprint to focus on developing an improved and more sustainable future (United Nations, n.d.). Actions contained in this Plan support the United Nation's Sustainability Goals of Affordable and Clean Energy (Goal 7); Industry, Innovation and Infrastructure (Goal 9); Sustainable Cities and Communities (Goal 11); Responsible Consumption and Production (Goal 12); Climate Action (Goal 13) and Partnerships for the Goals (Goal 17).

















National

The Federal Government has committed to reducing greenhouse gas emission to 26-28% below 2005 levels by 2030 and has a National Climate Resilience and Adaptation Strategy.



State

The New South Wales (NSW) State Government has an aspirational target of reaching net zero emissions by 2050 and has identified this commitment within its NSW Climate Change Policy Framework and its Net Zero Plan Stage 1: 2020-2030. The AdaptNSW website provides a portal for residents with information on climate change and its effects in NSW (AdaptNSW, 2020).

Region

The Greater Sydney Commission's Our Greater Sydney 2056, North District Plan (2018) is a 20-year plan to manage growth in the context of economic, social and environmental matters to achieve the 40-year vision for Greater Sydney.

Council is committed to the Resilient Sydney Strategy and Program. We are one of 33 councils across metropolitan Sydney working together to strengthen our ability to survive, adapt and thrive in the face of increasing global uncertainty and local shocks and stresses

Local

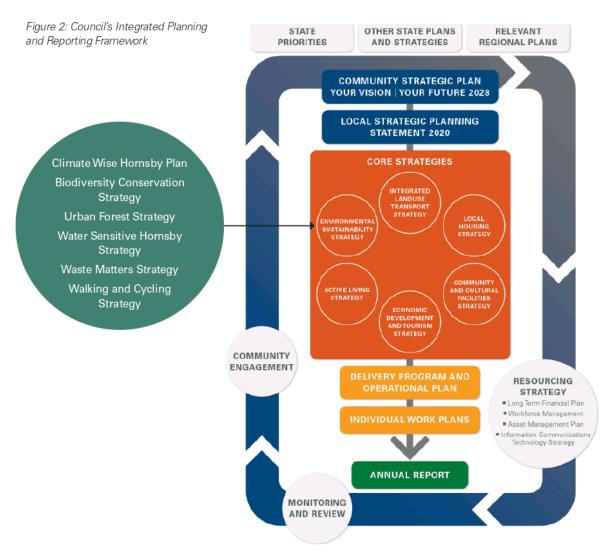
On 18 September 2019, Council adopted a target of net zero emissions by 2050, for Council and the community. The 2017/18 baseline for emissions from Council operations and 2016/17 baseline emissions for the community's activities will be used as a benchmark against which our progress will be measured.

The Hornsby Shire Council Community Strategic Plan 2018-2028 (CSP) demonstrates Council's commitment to addressing climate change by identifying the need for the Shire to be resilient and have the ability to respond to climate change events and stresses through mitigation and adaptation efforts. There are several core strategies and plans which will assist Council to deliver on this Plan as outlined below:

- The Local Strategic Planning Statement (LSPS) Our 20-year vision for land use; the special character and values that are to be preserved; shared community values; and how Hornsby Shire Council will manage growth and change. The LSPS provides a link between the State Government's strategic plans, Council's land use guidelines and our CSP.
- Environmental Sustainability Strategy (ESS) Our approach to environmental sustainability over the next 20 years, to ensure our environment is strong, resilient and adaptable into the future.

Climate Wise Hornsby Plan

■ Supporting plans and strategies – Council will cross-reference this Plan in other strategic documents to ensure that its aims and objectives are consistently applied across all service areas. Focus areas such as the Biodiversity Conservation Strategy, Urban Forest Strategy, Water Sensitive Hornsby Strategy, Waste Matters Strategy, Coastal Management Program, Emergency Management Plans, Bushfire Management Strategy, Walking and Cycling Strategy, Integrated Land Use Transport Strategy and flood mitigation will be integral to the success of climate change adaptation within Council and the community.



4 What the science is telling us

Australian and International research bodies have been building a comprehensive evidence base to understand how our climate is already changing. Climate is the set of averages, variations and extremes of weather in a region over long periods of time and varies from place to place (AdaptNSW, 2020). Since the start of the Industrial Revolution in about 1750, human activities such as the burning of fossil fuels, including coal and oil, have dramatically increased the concentration of greenhouse gases (GHG) in our atmosphere. As a result, the rate of heat-loss from the Earth has slowed, creating a warming effect (AdaptNSW, 2020).

The main GHGs in the Earth's atmosphere are water vapour, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂0) and ozone. The global warming impact of each different greenhouse gas can be expressed in terms of the equivalent amount of CO₂ (CO₂-e) that would create the same amount of warming. CO₂-e, or carbon dioxide equivalent, is a standard unit for measuring carbon footprints.

Human activities are estimated to have caused approximately 1 degree Celsius of global warming above pre-industrial levels, with a likely range of 0.8 degree Celsius to 1.2 degrees Celsius (IPCC 2019) Global warming is likely to reach 1.5 degrees Celsius between 2030 and 2052 if it continues to increase at the current rate (IPCC 2019). There is a global imperative to limit warming to within two degrees Celsius to prevent and withstand even more dangerous climate change. Many scientists and policy makers believe that this should be 1.5 degrees, to further reduce the risk of 'tipping points' being reached, and insurmountable climate change effects being experienced.

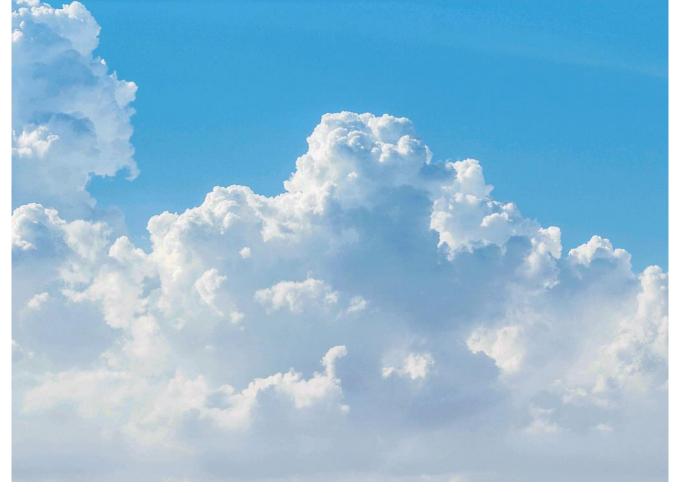
AdaptNSW climate data modelling indicates significant challenges for NSW in terms of scenarios for air temperature, rainfall, wind, bushfire incidence and sea level rise. The predictions for the Hornsby region can be seen in Table 1.

Continued changes to the global and local climate will have wide reaching negative impacts on the natural environment and damage to the built environment. In the past year alone, the country has seen drought, bushfires and floods. There is urgency in acting now to mitigate these impacts. Council must also adapt to the changing climate and in 2019 identified fifty-six (56) High and five (5) Extreme rated climate impact risks for all climate change scenarios which included temperature, hot weather, rainfall, wind, fire weather, sea level rise and extreme rainfall / rain intensity (Jardine Lloyd Thompson, 2019). The full list of climate impact risks for Council can be seen in Appendix 3.

As our climate changes consideration will also need to be given to disease vectors and other direct health impacts in relation to climate risks. Council will continue to monitor this situation and act accordingly.

Table 1.

	Scenario	Projected Future Change				
4	Bushfire Incidence		er Index (FFDI) is used in NSW to quantify fire weather. ind speed. Fire weather is classified as severe when the			
<u>~</u>	Sea Level Rise	Decrease in East Coast Lows (ECLs) during winter and an increase in frequency and intensity of ECLs during the summer months. ECLs impact on dam filling cycles. Projections from 2007 indicate that there is an expected Sea Level Rise (SLR) of 0.4 metres by 2050 and 0.9 metres by 2100.				
		2030 Projection	2070 Projection			
<u>[</u>	Air Temperature	Maximum temperatures to increase by 0.7° C Minimum temperatures to increase by 0.6° C 4 more days above 35° C / year	Maximum temperatures to increase by 1.9°C Minimum temperatures to increase by 2.0°C 11 more days above 35°C / year			
	Rainfall	Rainfall is projected to decrease in spring and winter.	Rainfall is projected to increase in summer and autumn.			
A	Wind	Increase in average wind speed between -5% and +8%	Increase in average wind speed between -16% and +24%			





I would challenge Council to be proactive on sustainability and climate change and excel beyond state and national objectives.

- Future Living Summit

Participant

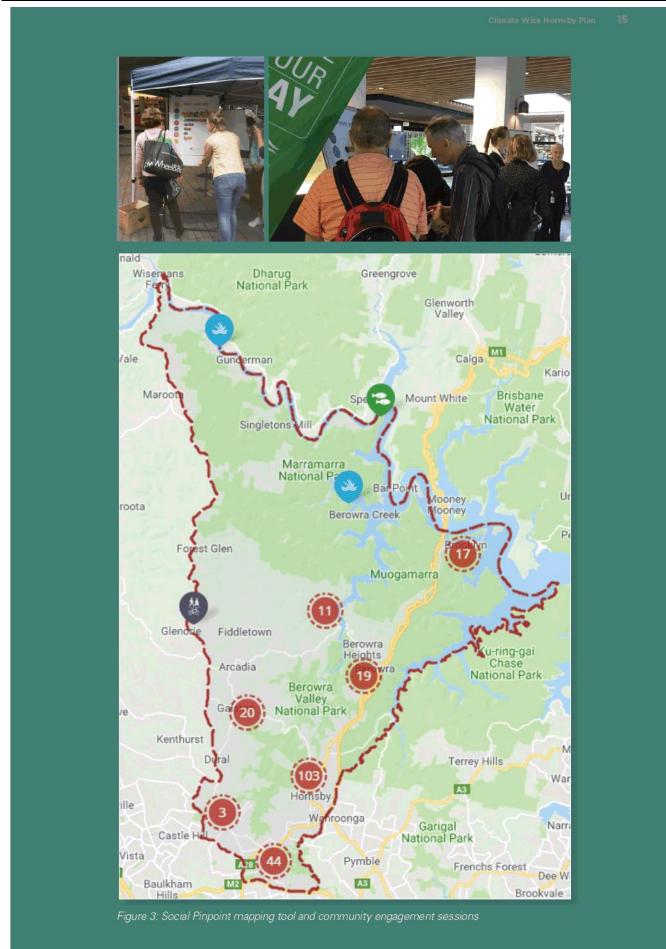


5 What our community told us

During the development of Council's Local Strategic Planning Statement Future Hornsby 2040, we extensively engaged our local community to determine their views on sustainability values and priorities through:

- A series of pop-up community kiosks. 180 people attended these sessions
- Internal workshops to harness the diverse expertise across all divisions of our organisation
- An online community survey via Have Your Say.
 We received 315 submissions during the 4-week engagement in April 2019
- A telephone survey that was demographically representative of residents across the Shire. 618 people completed the survey during April 2019
- Individual stakeholder interviews with 10 community group representatives. The purpose of the interviews was to discuss local environmental sustainability challenges and considerations in greater depth with highly engaged and environmentally aware local community members
- An online interactive collaborative mapping tool via Social Pinpoint. We received 392 unique users to the site and 204 comments

Across all engagement modes residents identified a strong preference for maintaining and enhancing a clean, leafy and biodiverse environment actively seeking out ways to improve environmental sustainability. This included the need to urgently address climate change, and/ or mitigate its effects, and build community resilience to environmental changes and risks. Of those who indicated in a survey response they were 'concerned' about the environment, 79 percent indicated that they had some level of 'concern' about the effects of climate change. A slightly lower proportion (73 percent) indicated they were 'concerned' about the effects of extreme weather events.



6 Greenhouse Gas Emissions Profiles

According to the IPCC, the world's carbon budget is 1,701 Gt CO₂-e to meet the Paris Climate Change Agreement's goal of limiting global temperature rise to under 2 degrees Celsius by 2050. The Australia Climate Change Authority has recommended a national carbon budget of 10.1 Gt CO₂-e. As at July 2018, 7.5 Gt CO₂-e of this national budget remains (Ironbark, 2019).

To understand our greenhouse gas emission profile, Council has developed its inventory in line with the National Greenhouse and Energy Reporting Guidelines for corporate emissions reporting. Corporate emission profiles were also prepared in accordance with the international GHG Protocol Corporate Accounting and Reporting Standard, and the National Carbon Offset Standard (NCOS). The NCOS provides guidance on how to measure, reduce, offset, report and audit emissions that occur from the operations of an organisation. Community carbon emissions have been calculated using the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories. These standards both classify emissions into three scopes (illustrated in Figure 4):

Scope 1 – direct emissions from the activities of an organisation or under their control, including gas usage in buildings, fuel for vehicles and air-conditioning leaks.

Scope 2 – indirect emissions from electricity purchased and used by the organisation or in assets owned by it.

Scope 3 – all other indirect emissions from activities of the organisation, occurring from sources that they do not own or control, including emissions associated with street lighting, procurement, waste and water.

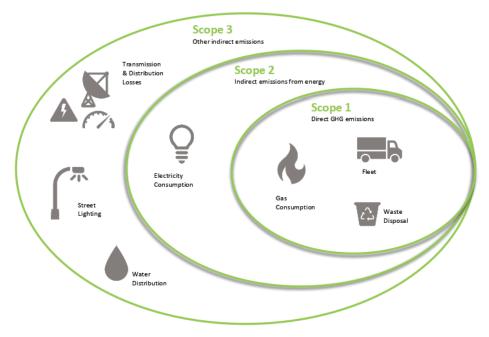


Figure 4: GHG Emissions Scopes (Source: Adapted from Ironbark Sustainability, 2019)

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In 2019 Council engaged Ironbark Sustainability to prepare emissions inventories for Council's operations for the financial years 2016/17 and 2017/18. Overall Council's emissions remained stable between the two reporting periods and the 2017/18 inventory is considered the more complete of the two inventories and will form Council's baseline moving forward.

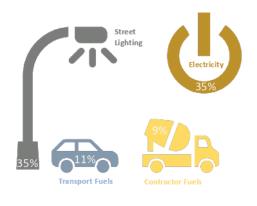
Table 2 outlines the National carbon budget and our Corporate Greenhouse Gas Emissions Inventory for the 2017/18 financial year. During 2017/18 Council's annual emissions were 12,080 tonnes $\rm CO_2$ -e, if Council were to keep emitting at this level, Council will expend our carbon budget of 143.3 kt $\rm CO_2$ -e in 12 years or by the year 2030 – we have termed this duration *Council's carbon "Runway."* In order to meet our targets, we will need to reduce our emissions by 509 tonnes $\rm CO_2$ -e each year.

Calculation of Budget	National	Council Corporate	Units
Total Carbon Budget	5,554,964	143.3	kt CO ₂ -e
Annual Emissions	420,226.0	12.1	kt CO ₂ -e
Runway	13.2	11.9	years
Required per annum reduction rate	15,894,782	509	tonnes CO ₂ -e/ year

Table 2: Hornsby LGA: Corporate Greenhouse Gas Emissions Inventory for the 2017/18 Financial Year (Source: Ironbark Sustainability, 2019 Corporate Greenhouse Gas Emissions Inventory, p31)

6.2 Corporate Emissions Profile Summary by Sector - 2017/18

Figure 5 provides a breakdown of Council's GHG emissions by sector as a percentage. One third of Council's measured emissions comes from our corporate electricity consumption (35%), while another third comes from electricity consumption from public street lighting (35%). Other emissions of note were transport emissions, the majority of which come from Council fleet (11%), emissions from contractor fuels (9%), and emissions from natural gas consumption (7%). The contribution of emissions from all other sources were minor (3% collectively).



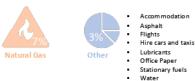


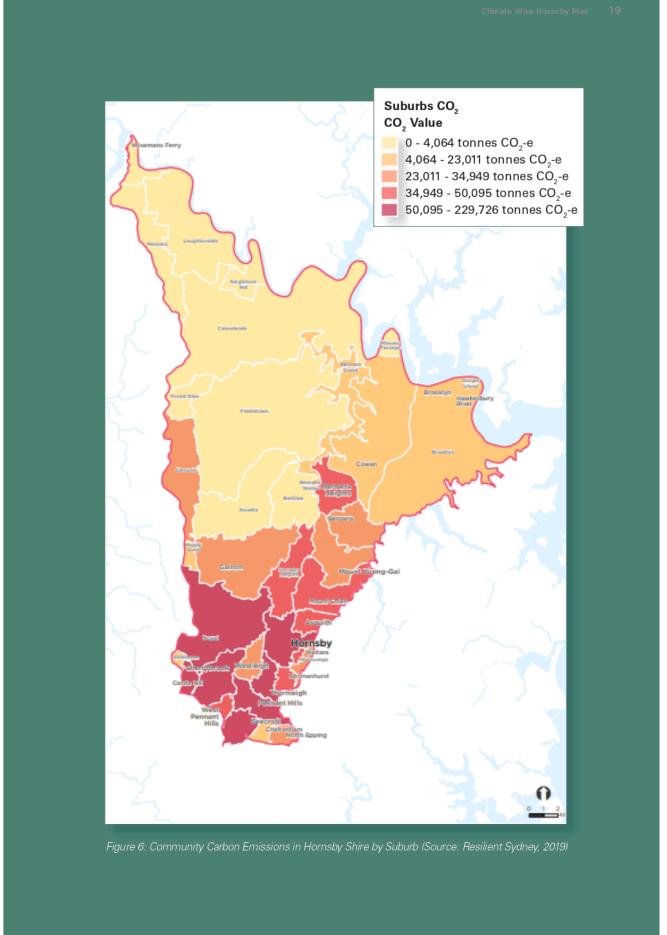
Figure 5: Hornsby Shire Council's Emissions Profile by Sector 2017/18 (Source: Adapted from Ironbark Sustainability, 2019, Corporate Greenhouse Gas Emissions Inventory, p18)

6.3 Community Emissions Profile

In partnership with Resilient Sydney, Council is participating in Action 13 - Measure Metropolitan Emissions and report on progress. This Action is listed under the 'Live with our Climate' section of Resilient Sydney - a Strategy for Resilient Sydney 2018. Resilient Sydney have used a baseline year of 2016/17 and this will form the baseline for our community emissions profile.

Our community GHG emissions profile for 2016/17 identifies that we produce 1.3 million tonnes CO₂-e emissions each year (Resilient Sydney, 2019). This profile has been informed by data on transport, waste and water practices in our LGA. Our community emission total represents 2.7% of Greater Sydney's emissions (Resilient Sydney, 2019).

Figure 6 identifies the distribution of our community emissions profile for each suburb across the LGA. The darker shaded areas include the suburbs of Hornsby, Dural, Thornleigh, Pennant Hills, Beecroft, Castle Hill and Cherrybrook and represent the areas with the highest emission levels.



6.4 Sources of Community Emissions

Figure 7 identifies sources of community carbon emissions for the year 2016/17. Electricity usage was the largest contributor (58.9%) at 763,605 tonnes $\rm CO_2$ -e. On average, Hornsby Shire residents used 22 kWh of electricity per day per dwelling (7.81 tonnes $\rm CO_2$ -e per year and an average of 2.80 tonnes $\rm CO_2$ -e/capita). Transport was the second largest contributor (25.7%), followed by waste (12.2%) and gas (3.2%).

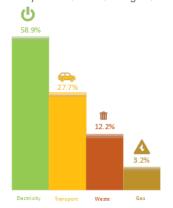


Figure 7: Hornsby LGA: all Emission by Source for 2016/17 (Source: Adapted from Resilient Sydney, 2016/17)

6.4.1 Community Energy Usage

Figure 8 shows the distribution of energy use (i.e. gas and electricity) by sector for 2016/17, and identifies that residents of Hornsby, residing in detached housing, are the largest contributors to emissions at 1.6B Megajoules (MJ) per year representing 46% of all energy use.

The retail sector is our second largest energy consumer, contributing 439.7 MJ per year representing 12.5% of all energy use.



Figure 8: Hornsby LGA: all Energy Use by Sector for 2016/17 (Source: Adapted from Resilient Sydney, 2016/17)

6.4.2 Community Transport

Transport was the second largest contributor (25.7%) to the total carbon emissions in 2016/17, at 333,489 tonnes CO₂-e. Our community travelled 1.8B km during 2016/2017, across various transport modes.

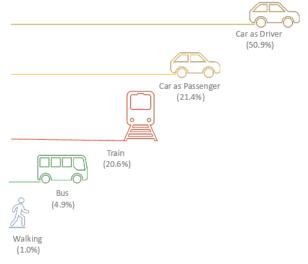


Figure 9: Hornsby LGA: resident transport mode travelling to work for 2016/17 (Source: Adapted from Resilient Sydney, 2016/17)

Our Shire's preferred mode of transport is by car, as shown in Figure 9. Car ownership totalled 48,447 vehicles in 2016/17. According to 2016/17 data, 37,157 residents travelled to work via private vehicle or taxi. In 2016 a total of 923,386,855 km were travelled by car drivers.

Public transport was the second largest contributor to transport CO₂-e emissions at 25.5%. Of this percentage, 19,217 residents travelled to work via public transport including train, bus, tram and ferry.

6.4.3 Community Waste

The third largest emission source for our Shire in 2016/17 was waste. Figure 10 identifies the percentage of emissions generated by waste type. During 2016/17 recycling of waste accounted for 158,005 tonnes CO₂-e representing 40.4% of emissions from our total waste stream. Commercial and industrial waste has the second largest contribution, accounting for 38.3% of emissions. For further information regarding the Shire's waste profile, refer to the Waste Matters Strategy 2020.



Figure 10: Hornsby LGA: all waste generation by type for 2016/17 (Source: Adapted from Resilient Sydney, 2016/17)

6.4.4 Community Water Storage

As shown by Figure 11, the largest water users in our Shire are residents of detached dwellings representing 9,710,947.8 kL or 64.2% of the Shire's total water consumption. Residents residing in multi-units are the next largest water consumers using 2,605,303.9 kL or 17.2% of the total consumption. The carbon emissions resulting from water usage are associated with hot water supply as well as the process of delivering water to the user, such as water treatment and pumping facilities.

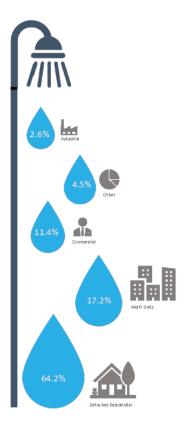


Figure 11: All Water Use by Sector for 2016/17 (Source: Adapted from Sydney Water 2016/17)

7 Climate Change Mitigation - aiming for Net Zero emissions by 2050

7.1 Overview of Corporate Emissions Reduction Measures

Council has been working to actively reduce our corporate carbon emissions since 1998/99, when we joined the Cities for Climate Protection (CCP) Program to implement and support our GHG emission reduction initiatives.



2003: Energy Performance Contract (EPC)

Council was a national leader in its reduction of GHG emissions and energy use and was one of the first councils to implement an Energy Performance Contract. The Contract led to the successful implementation of water and energy conservation measures across 250 Council buildings and park sites. The conservation measures included modification to improve the efficiency of air conditioning, energy and lighting systems, PV system installations, and rainwater tanks for park irrigation. The EPC resulted in annual reduction in Council's energy by 24%, water use by 5.4%, CO₂-e emissions by 22%, and cost savings of approximately \$180,000.



2004 - 2010: Cogeneration Project Trial

Our pioneer research project in partnership with the CSIRO to trial an innovative power generation and air conditioning system for Hornsby Library. The system involved a microturbine which produced greener electricity, in combination with a dehumidifier, heat exchanger and evaporative cooler to cool and heat the Library's air supply. When in operation, the system reduced electricity demand for cooling and heating of the building.



2003-2007: Green Power and Efficient Office Equipment

Council purchased 10% of its electricity supply for its major sites in the form of Green Power and replaced office equipment and computers with more efficient models and Energystar-enabled monitors.



2009: Sustainable Purchasing Project Recognition

The International Council for Local Environmental Initiatives (ICLEI) - Local Governments for Sustainability awarded Council Milestone 5 for ongoing sustainable procurement initiatives.



2009: Cowan Wind Turbine and Solar PV

Council installed a wind turbine and solar photovoltaic (PV) system at the Fire Control Centre at 1049 Pacific Highway, Cowan. The wind turbine has been designed to provide 30% (approximately 27,000 kWh pa) of the Centre's electricity requirements, consistent with our Sustainable Energy Policy for New Council Assets. The Proven Energy 15 kW wind turbine has a 3 bladed, 9 metre diameter rotor mounted upon a 25-metre galvanised steel tower pole and is connected to the national electricity grid. The 3kW solar PV system provides power during times of low wind speed.



2011 – 2015: Hornsby Library's Solar PV

In 2015, Council mounted a 78.1kW solar panel system at Hornsby Library adding to the existing 20.21kW system that was installed in 2011. The Library was chosen as an ideal site as it was a popular community use building that was open almost every day of the year. The solar panels generate around 135,000kWh of electricity annually, reducing the need for coal generated electricity. These systems are saving approximately 112 tonnes CO₂-e emissions and \$30,000 a year in electricity costs.

We prioritise our corporate measures according to a cost benefit analysis, importance in addressing each source of emissions and their potential to promote community awareness and participation. We have been innovators in trialling new sustainability concepts in our Shire, through partnering with research groups and utilising Council owned assets. Some of our exemplary initiatives include:

2018: Cities Power Partnership

Council joined Cities Power Partnership and pledged to implement five actions to support and promote energy saving and climate change mitigation initiatives. These actions were: 1) Provide Council resources to educate and support the uptake of renewable energy 2) Install renewable energy (solar PV and battery storage) on Council buildings 3) Adopt best practice energy efficiency measures across all Council buildings, and support community facilities to adopt these measures 4) Rollout energy efficient public lighting (particularly street lighting) across the Shire as public lighting can use a large proportion of a council's energy budget and 5) Implement an education and behaviour change program to influence the behaviour of council officers, local residents and businesses within the Shire to drive the shift to renewable energy, energy efficiency and sustainable transport.



2018 - 2019: Internal Lighting Initiative

Council installed custom-tailored LED lighting within the Administration Building. Each individual light can be tailored improving the comfort of staff and reducing energy requirements of the previous system.



2019: Street Lighting Improvement (SLI) Program

Council partnered with SSROC and Ausgrid to upgrade over 4,000 streetlights to more efficient LEDs. The upgrade forms part of Ausgrid's program to accelerate the replacement of inefficient older residential street lights across LGAs in their network. The new LEDs are 18% more energy efficient and will reduce our corporate emissions by an estimated 1,120 tonnes CO₂-e a year and provide an annual energy saving of over \$460,000 each year.



2019 - 2020: Greening our Shire

Council has committed to planting 30,000 trees and greening the Shire. To date over 25,000 trees have been planted and it is anticipated that 30,000 trees will be planted by September 2020. Trees remove carbon dioxide from the atmosphere and store the carbon in their leaves, branches, stems, bark and roots.



2020: Net Zero by 2050

In September 2019 Council endorsed a Net Zero Emissions by 2050 target. This Plan promotes further actions to reduce Council's corporate greenhouse gas emissions. Actions include the continued roll-out of energy efficient lighting, opportunities to transition to 100% renewable, project support through partnerships with the community, improvements to the resource efficiency of procurement services and Council assets. A full list of actions is detailed in Appendix 1 and 2.



7.2 Corporate Emissions Reduction Pathway

To build on our past work and to reach our goal of net zero emissions by 2050 Council has developed a corporate emissions reduction action plan (Appendix 1). Actions have been assigned different priority status ranging from the short, medium, to long term. Completion of actions will be dependent upon the availability of Council's resourcing and budget. Where possible, Council will realise opportunities through alternate funding pathways by working in collaborative partnerships and applying for grants.

Appendix 1 lists and prioritises actions that can be undertaken by Council to help reduce our emissions profile. The Plan is based on 2017/18 emissions which totalled 12,080 CO₂-e. Our target is to reduce emissions by 509 tonnes CO₂-e per year. Figure 12 provides an overview of these initiatives as part of our emissions reduction pathway to meet our corporate target of net zero emissions by 2050. Council has also set interim targets of 32% reduction from 2018 levels by 2030.



Figure 12: Corporate Emissions Reduction Pathway

7.3 Overview of Community Emissions Reduction Measures

Council is part of Resilient Sydney's online benchmarking platform which provides data for councils across Metropolitan Sydney detailing community emission profiles and science-derived reduction targets. The data is prepared and managed by Kinesis and provides a holistic overview of carbon emission performance across the Sydney region.



Figure 13: Typical Residential Solar PV Installation in the Shire (Source: Johnson, D, 2020)

In 2019 Council also engaged Ironbark Sustainability to provide a more detailed insight into our community carbon emissions. Our community reduction target has been calculated from the remaining 7.5 Gt $\rm CO_2$ -e national carbon budget. The target identifies that as a Shire, we need to reduce our emissions by 4.4% each year until 2050, equivalent to around 68,000 tonnes $\rm CO_2$ -e, which is the same as removing 15,827 medium-sized vehicles off the road each year.

By increasing renewable energy generation, such as community rooftop solar as seen in Figure 13, we will see the greatest reduction in community emissions. It is encouraging to see that there has been a strong growth in solar photovoltaic (PV) installation across residential rooftops in the Shire (Resilient Sydney, 2016/17). The number of PV systems has steadily increased every year since 2013, as shown in Figure 14. As at 30 September 2020 over 8100 systems had been installed, which represents 18.2% of total households in our LGA and generates 38,356 kW of electricity per year (Australian PV Institute, 2020).

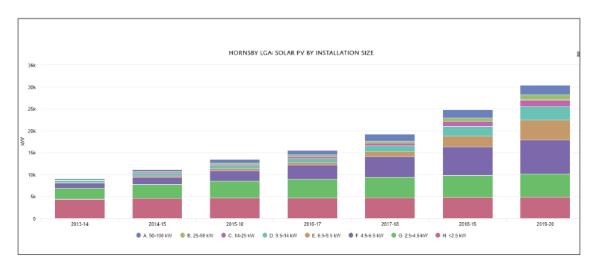


Figure 14: Hornsby LGA: Solar Take-Up by Installation Size, 2013 onward (Source: Resilient Sydney, 2016/17)

Other community emission reduction measures include walking, cycling, public transport and waste minimisation. Council will work with the community to reduce emissions across all emission sources.

7.4 Community Emissions Reduction Pathway

Council's sphere of influence on the community varies. However, we can play a key role in reducing barriers, influencing resident's attitudes and transforming behaviours to facilitate change in reducing GHG emissions. As shown in Figure 15, Council will continue to seek out opportunities through advocacy, leading by example, engagement with the community, funding and partnerships, pushing our strategy levers and education initatives.

Council will implement an emissions reduction program to reduce Shire-wide emissions, which totalled ~1.2 million tonnes CO₂-e in 2016/17. Appendix 2 lists projects that will contribute to the interim community targets of 31% reduction from 2017 levels by 2025 and 53% reduction from 2017 levels by 2030.

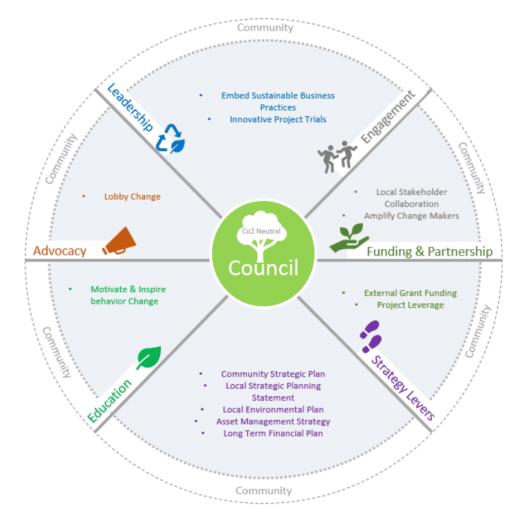


Figure 15: Council's Sphere of CO, Adaptation influence

Climate Wise Hornsby Plan

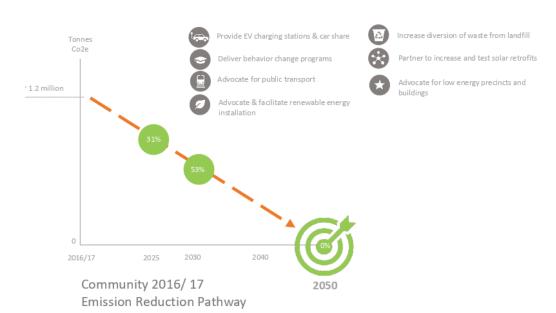


Figure 16: Community Carbon Reduction Pathway

Figure 16 provides an overview of these initiatives as part of our emissions reduction pathway to meet our community goal of net zero emissions by 2050.

In addition to these efforts Council will work with the community to increase canopy cover and sequester carbon through our urban forest. Hornsby Shire Council has an enviable level of tree canopy cover that many other local governments can only aspire to. Canopy cover for the whole local government area (LGA) is 59% and is distributed unevenly across the LGA. The total canopy cover far exceeds the 40% tree canopy target as set by the Sydney Commission and is the third highest canopy cover across Metropolitan Sydney.

Although we have a large canopy cover 202020 Vision in collaboration with The Royal Melbourne Institute of Technology (RMIT) undertook some baseline tree canopy mapping comparing the years between 2009 and 2016. This analysis suggested that tree canopy cover across Hornsby Shire Council reduced by 5% during that seven-year period (Amati et al, 2016). More detailed analysis was conducted to try to understand these causes and locations of loss. The report by Smith et al, (2017) found that the Hornsby Shire is more likely losing canopy in urban areas at approximately 3% each year. This is equivalent to 12,000 to 15,000 trees each year across the public and private realm.

While the urban forest is one of the most efficient and cost-effective mechanisms for adapting to climate change, there is a caveat: Hornsby's Urban Forest must be resilient, healthy, diverse and well managed. Warmer temperatures, increased occurrence of storm events and potentially lower average rainfall will have deep impacts on the urban forest. Research suggests that many endemic or indigenous tree species across Australia will simply not cope with increases in temperature or lower rainfall. The latest research from Macquarie University shows that the two-dominant species of street trees in Hornsby, Callistemons and Jacaranda's are not likely to thrive under Sydney's modelled climate scenarios (Burley et al, 2019). Increased storm events will see greater damage being caused by high winds and heavy rain. This means that any species of tree planted in Hornsby needs to be considered for their resilience in the face of climate change and a preferred species list constantly reviewed and updated based on the latest research.

8 Climate Change Adaptation - reducing vulnerability and increasing resilience to a changing climate

8.1 Corporate Adaptation

In addition to undertaking actions to reduce carbon emissions Council must work to monitor and report on performance, assess emergent technologies and solutions and regularly review hazards and risks to responsibly prevent and mitigate climate risks and adapt to our changing climate. In 2008 Council partnered with the CSIRO and the Sydney Coastal Councils Group (SCCG) in a vulnerability study (Preston et al 2008). The results of this vulnerability assessment formed the basis of Council's first Climate Change Adaptation Strategic Plan in 2009 (Aurecon, 2009). The Plan focused on five key impact areas identified as relevant for the Shire including: heat, bushfires, ecosystems, rainfall and sea level rise. The Plan assisted Council by:

- Generating information about the likely impacts of climate change (e.g. flooding, coastal erosion and temperature increase) and feasible adaptation strategies (e.g. capital works, education, and planning) in the Sydney region
- Deepening the understanding of the likely impacts of climate change, and resulting adaptation options in the Sydney region through integration of existing

- models, vulnerability mapping, and an analysis of adaptive capacity
- Building the capacity of stakeholders in the Sydney region to implement, and monitor the success of, adaptation strategies (e.g. for infrastructure, health, and biodiversity)
- Working with stakeholders to build adaptation strategies into institutional structures and processes (e.g. asset management plans, coastal management plans, estuary management plans, floodplain management plans, local environment plans, and regional environmental plans).

Further work was undertaken in 2011 with Council's insurer Statewide Mutual and Echelon Australia Pty Ltd with a risk assessment undertaken to determine the potential impacts on Council operations, asset management and corporate vulnerability. This assessment applied the same CSIRO climate change scenarios for NSW and included temperature, hot days, average rainfall, wind, fire weather, sea-level rise and rain intensity.

In 2019 Council reassessed our climate risks with Statewide Mutual and Jardine Lloyd Thompson (JLT) for climate change impacts now, in the near future (by 2030) and the far future (by 2070). The climate change risk assessment models the likelihood of future climate hazards and the potential impacts of these hazards on the Shire and our residents, as seen in Table 3. The risk review identified a total of 86 risks across seven risk scenarios as seen in Table 4. Each impact was ranked against Council's Risk Matrix to identify a risk rating of Extreme, High, Medium or Low (Hornsby Shire Council Enterprise Risk Management Determination, 2017).

				CONSEQUENC	E	
		Insignifi- cant	Minor	Moder- ate	Major	Cata- strophic
	Almost Certain	MEDIUM	HIGH	HIGH	EX- TREME	EXTREME
po	Likely	MEDIUM	MEDI- UM	HIGH	HIGH	EXTREME
Likelihood	Possible	LOW	MEDI- UM	HIGH	HIGH	HIGH
	Unlikely	LOW	LOW	MEDIUM	MEDIUM	HIGH
	Rare	LOW	LOW	MEDIUM	MEDIUM	HIGH

Table 3: Risk Matrix (Source: Hornsby Shire Council Enterprise Risk Management Determination, 2017)

Five (5) Extreme and fifty-six (56) High rated climate impact risks form the focus of proposed adaptation strategies to be given further consideration through Council's mid to long-term planning. The full list can be found in Appendix 3. All risks including Low and Medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified.

	Temperature	Hot Days	Rain	Wind	Fire Weather	Sea Level	Rain In- tensity	Ranking a pacts Total	ll lm-
Extreme	0	1	0	0	3	0	1	Extreme	5
High	8	10	6	4	8	7	13	High	56
Medium	3	4	2	2	4	3	7	Medium	25
Low	0	0	0	0	0	0	0	Low	0
Total	11	15	8	6	15	10	21	86	86

Table 4: Number of risks by Scenario (Source: Jardine Lloyd Thompson (2019) Climate Change Risk Assessment Adaptation Report)

The purpose of adaptation is to prepare Council and the community for the inevitable changes to the climate that are at this stage unavoidable. In adapting to changes in the climate, Council will employ best practice and a 'pathways' approach that are deemed appropriate and utilised by industry professionals (NCCARF, 2021). These will be founded on prevailing scientific data and methods, and Council will respond to emergent technologies and practices to improve performance. Council assessed the risks against a 'Success Criteria', as defined in Climate Change Impacts & Risk Management A Guide for Business, Australian Greenhouse Office 2006.

Each risk considered the impact of Climate Change in terms of Council's ability to:

- A. Maintain public safety
- B. Protect and enhance the local economy
- C. Protect existing community structures and the lifestyle enjoyed by the people in the region
- D. Sustain and enhance the physical and natural environment
- E. Ensure sound public administration.

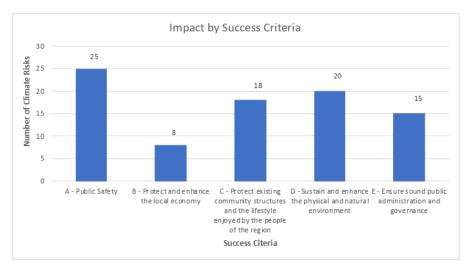


Figure 17: Impact by Success Criteria (Source: Jardine Lloyd Thompson (2019) Climate Change Risk Assessment Adaptation Report)

The greatest number of impacts relate to Council's ability to "Maintain Public Safety", representing 29% of total impacts or 25 out of 86 risks. This is followed by Council's ability to "Sustain and enhance the physical and natural environment" at 23% (20 out of 86 risks) and 'Protect existing community structures and the lifestyle enjoyed by the people of the region' at 21% (18 out of 86 risks).

8.2 Climate Change Adaptation Roles and Responsibilities

Climate change impacts affect all functional areas of Council and require collaborative efforts across Council and community to ensure mitigation and adaptation actions succeed. Infrastructure & Assets, Community Services, Land-Use Planning & Development, Emergency Management & Natural Disaster Preparedness along with Corporate Services are identified as the Council responsibilities most impacted by this plan. These functional areas fall across various divisions within Council (as seen in Table 5 below) and project control groups will be established to ensure strong collaboration and accountability.

Roles and responsibilities of asset managers are also outlined further in Council's Asset Management Determination.

The greatest number of hazards and risks are attributed to the area of Infrastructure & Assets; representing 38% of the total, with 33 potential impacts out of a total 86 risks identified.

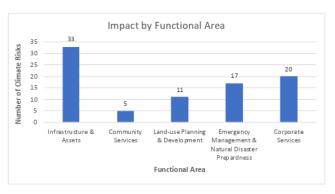


Figure 18: Impact by Functional Area (Source: Jardine Lloyd Thompson (2019) Climate Change Risk Assessment Adaptation Report)

	Infrastructure & Assets	Community Services	Land-use Planning & Development	Emergency Mgt & Natural Disaster pre- paredness	Corporate Services
	(1)	(CS)	(L)	Е	(CO)
Division Involved	Corporate Support	Corporate Support	Planning and Compli- ance	Community and Environ- ment	Corporate Support
	Community and Envi- ronment	Community and Envi- ronment	Strategy and Place	Infrastructure and Major Projects	Community and Environ- ment
	Infrastructure and Major Projects	Infrastructure and Major Projects	Infrastructure and Major Projects	Corporate Support	Infrastructure and Major Projects
	Strategy and Place	Strategy and Place		Risk Audit and Business Improvement	Planning and Compliance
				Strategy and Place	Risk Audit and Business Improvement
					Strategy and Place

Table 5: Organisational Structure of Functional Areas (Source: Jardine Lloyd Thompson (2019) Climate Change Risk Assessment Adaptation Report)

ATTACHMENT 5 - ITEM 1

8.3 Community Adaptation

A number of our residents, communities, businesses and visitors will be familiar with existing hazards and after recent years have some capacity to cope with impacts. This resliience was demonstrated in the recent bush fires in late 2019 and early 2020, and the storm events felt across the Shire during 2018 and 2019. Further work will be required to enable stakeholders to meet future climate and environmental related challenges.

Climate related impacts are not evenly distributed across the Shire and marginalised communities are often over-represented in flood, fire or drought prone areas. They are often the last to receive meaningful support and the most affected by the disaster. Council will need to engage with our community with social and ecological justice in mind and will use the five types of engagement: inform, consult, involve, collaborate and empower to ensure that all our constituents are protected, supported and enabled to contribute to a brighter future.

To build resilience and assist our residents to adapt Council will use a cycle of engagement consisting of seven steps:

- 1. Map existing networks
- 2. Identify key champions within networks
- 3. Support engagement by key champions
- 4. Support adaptation initiatives
- 5. Monitor and evaluate effectiveness
- 6. Share innovations and lessons
- Celebrate successes to build momentum and joyful connection leading to new and more meaningful networks, projects and outcomes.

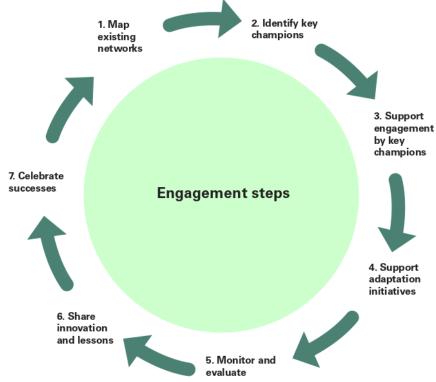


Figure 19: Engagement Cycle for Climate Change Adaptation (Source: Smith, T., A. Leitch, and D. Thomsen, 2016: Community Engagement. CoastAdapt Information Manual 9, National Climate Change Adaptation Research Facility, Gold Coast)

9 Monitoring and Reporting

Every four years, Council will revise the actions in this Plan and identify new ones. As part of this review, Council will identify and update actions that have not yet been implemented but remain effective ways to achieve the objectives of the Plan. This revision process will include a review and analysis of the opportunities and challenges to achieving the 2050 net zero target and the interim goal of reducing carbon emissions by 32% below 2018 levels by 2025 and 53% by 2030.

Our comprehensive annual GHG inventories will continue and we will report our progress in Council's Annual Report. We will also include initiatives from the emission reduction action plan and climate change adaptation plan and recommendations of other supporting studies in Council's Delivery Program and Operational Plan and will report back quarterly to the executive team and 6 monthly to the community via the Annual Report and Half Yearly Report. Regular updates will also be provided to the Environmental Sustainability Advisory Committee which will oversee the implementation of this Plan.

Implementation of the Plan will be dynamic, collaborative and flexible to respond to changes and learn from experiences which may occur at any time. Emerging information and technologies will be considered throughout implementation to ensure Council continues to implement the strategy in the most effective way.

Council will also periodically review climate modelling data to ensure the most up to date data is being used for risk assessments and future emission targets.

Council will report on: Number of days over 35 degrees, % of solar within the shire, annual CO₂ consumption, progress towards achieving net zero emissions by 2050, car ownership, resident travel mode and active transport.



10 Appendix 1 – Corporate Emissions Reduction Action Plan

The following table outlines key actions Council could take to reduce corporate emissions. Council will strive to reduce emissions where possible and will need to offset the remaining emissions to be net zero by 2050.

20							
t Zero by 20	Responsibility	Strategy and Place	Strategy and Place	Strategy and Place	Parks, Trees and Recreation	Strategy and Place & Building Services	Strategy and Place and Building Services
0 and Ne	Priority High(1- 2yrs) Med (3-5yrs) Low (5- 10yrs)	High	High	High - Med	Low	High	High
on by 203	Status	Existing	Existing	New	New	New	New
% reduction	Funding	Funded	Funded	Unfunded	Unfunded	Unfunded or Power Purchase Agreement	Unfunded or Power Purchase Agreement
2025, 53%	Payback period	5yrs	4yrs	5.4yrs	Unknown	5.6yrs if purchase outright Or 15-year Power Purchase Agreement	2.7 years if purchase outright Or 3years under Power Arreement Arreement
luction by	Resource Type	€	€	€9	\$ and staff time	\$ and staff time	₩
s. 32% rec	Estimated CO ₂ -e reduction (tonnes)	1135	17	1054	2	1305	295
CORPORATE – 2017/18 emissions tCO _{2-e} - 12,080 tonnes. 32% reduction by 2025, 53% reduction by 2030 and Net Zero by 2050.	Action	Complete the accelerated roll out of LED lighting on residential roads. Work with Ausgrid to install 4267 LED lightings	Complete the accelerated roll out of LED lighting on residential roads. Work with Endeavour Energy to install 50 LED lights	Undertake roll out of LED lighting on main roads in partnership with Ausgrid	Upgrade all parks decorative lighting with LEDs	Installation of solar at Homsby Aquatic Centre, Admin building, Galston Aquatic, Works depot, Pennant Hills, Library, Fire Control, Overhead Bridge, Cherrybrook Community Centre, Recycling Centre, Berowra Library, Beecroft Community Centre, Berowra District Hall, Brooklyn Leisure and Learning, Acadia Community Hall, Glenorie Community Centre, Hornsby Heights Community Centre, Mount Colah Community Centre, Thorrleigh Community Centre and Wisemans Ferry Community Centre	Replace all old globes with LED
ATE - 201	Category	Operations	Operations	Operations	Operations	Operations	Operations
CORPOR	Emission	Public Lighting / Electricity	Public Lighting / Electricity	Public Lighting / Electricity	Public Lighting / Electricity	Electricity Generation / Renewable Energy	Electricity / Buildings
	<u></u>	1.7	1.2	1.3	1.4	1.5	9.

Responsibility	Strategy and Place & Procurement	Strategy and Place & Learning and Development	Building Services and Strategy and Place	Infrastructure & Recreation	Strategy and Place	Natural Resources, Parks, Trees and Recreation and Building Services	Strategy and Place & Governance and Administration
Priority High(1- 2yrs) Med (3-5yrs) Low (5- 10yrs)	High	High	High	High	High	Med-low	Med
Status	New	New	New	Existing	Existing	New	New
Funding Source	Unfunded	Unfunded	Funded	Funded	Funded	Unfunded	Unfunded
Payback period	TBA	0	4.8yrs	10	0	0	1.3
Resource Type	\$	∽	\$ and staff time	\$ and staff time	Staff time	\$ and staff time	\$ and staff time
Estimated CO ₂ -e reduction (tonnes)	1,505, 3764, 7,528	6.85	54	36	N/A	Unknown	o
Action	Purchase of green power or renewable energy through electricity contract 20%, 50%, 100%	Purchase green offsets when flying	Investigate installation of Building Management System at Pennant Hills Library, Administration Building and Hornsby Library Ensure appropriate temperature set points	Undertake energy audit at Hornsby Aquatic Centre Monitor and manage Hornsby Aquatic Centre to optimise consumption utilising the existing Building Management System	Report target vs actual for energy use for facilities that have +/- 20% variation on contract Active management of high-end electricity users Increase awareness of operators and users of buildings	Plant trees where feasible to reduce heat load on buildings, winter winds and noise	Develop and deliver an education program for fleet drivers to: • Ensure that appropriately sized vehicles are used for each load or trip to minimise fuel consumption ensure optimal use of vehicles. • Regular maintenance ensure vehicle is fit for purpose and utilise more renewable fuels. • Optimise tyre performance to reduce fuel consumption by selecting lighter wheel and tyre systems and tyres that lower rolling resistance.
Category	Operations	Operations / Policy	Operations	Operations	Operations	Operations	Education and Engagement
Emission Source	Electricity	Procureme nt / Flights	Electricity / Buildings	Gas / Buildings	Electricity / Buildings	Electricity / Buildings	Fleet / Transport fuel
<u> </u>	1.7	1.8	1.9	1.10	1.	1.12	1.13

Climate Wise Hornsby Plan

Responsibility		Governance and Administration	All staff	Strategy and Place, Natural Resources	Waste Management	Governance and Administration, Strategy and Place	Strategy and Place, Governance and Administration
Priority High(1- 2yrs) Med (3-5yrs) Low (5-		High	Low	Med-Low	High	High	High
Status		New	New	New	Existing	Existing	Existing
Funding Source		Unfunded	Funded	Unfunded	Funded	Pepung	Pepung
Payback period		TBA	Depends on building type	None	None	None	ТВА
Resource Type		\$ and staff time	\$ and Staff time	\$ and Staff time	\$ and Staff time	\$ and Staff time	\$ and Staff time
Estimated CO ₂ -e reduction (tonnes)		30	15	Unknown	TBA	ТВА	ТВА
Action	 Check tyre wear at least monthly and keep tyres inflated at, or 10% above the recommended level Monitor fuel consumption for each vehicle (e.g. via fuel cards) to identify vehicles with unusually high fuel consumption. High fuel consumption is indicative of possible need for maintenance 	Conduct fleet review to optimise and reduce emissions by changing over to hybrid and/ or electric vehicles for Council owned vehicles, where financially feasible. Also implement actions to reduce operational fuel consumption.	For new and old Council owned buildings, augment building envelope where possible: Through proper insulation Reduce heat loss / infiltration through buildings' exteriors Optimise window / blind operation Use double glazing Reduce summer heat with cool roofs Plant a green roof or green wall where feasible	Investigate the establishment of a carbon offset program through the planting of 25,000 trees. Undertake an ITree Eco Assessment to calculate carbon sequestration on significant park planting.	Implement Council's Waste Matters Strategy	Review, update and implement Council's Sustainable Procurement Determination	Work with Council's contractors to minimise their carbon emissions and report accurately
Category		Procurement	Operations	Operations	Operations	Procurement	Operations
Emission Source		Fleet / Transport fuel	Gas / Buildings	All emission sources	All emission sources	All emission sources	All emission sources
Q		1.14	1.15	1.16	1.17	1.18	1.19

ATTACHMENT 5 - ITEM 1

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Appendix 2 – Community Emissions Reduction Action Plan

COMMUNITY - 2016/17 Community emissions totalled ~1.2 million tonnes CO_{2-e}. Stretch target of 55% reduction by 2036

	Emission	Category	Description	Resource	Funding	Status	Priori	Responsibility
	Source			Type	Source		ty	
2.1	Transport	Policy	Implement Electric Vehicle (EV) Charging Stations on Public Land Policy	Staff time	Funded	Existing	High	Strategy and Place
2.2	Transport	Administration and Strategy	Support the uptake of electric vehicles, including installation of public charging stations and investigation of planning controls to require charging infrastructure in new developments	\$ and Staff time	Unfunded	New	Med	Strategy and Place
2.3	Transport	Policy	Implement Car Share Parking Policy	Staff time	Funded	Existing	High	Strategy and Place
2.4	Transport	Advocacy and Education	Implement the Walking and Cycling Strategy and advocate for the reduction in use of private vehicles and increased use of active and public transport	Staff time	Unfunded	New	High - Med	Strategy and Place, Infrastructure and Major Projects
2.5	Electricity / gas	Administration and strategy	Work with partners to develop a program for Environmental Upgrade Agreements	\$ and Staff Time	Unfunded	New	Med	Strategy and Place & Finance
2.6	Electricity	Administration and strategy	Work with the community to determine the viability of a community solar farm, local energy power production and microgrids	\$ and Staff time	Unfunded	New	High	Strategy and Place
2.7	Electricity / Gas / Waste	Education	Deliver behaviour change and community education programs on sustainability, including solar, battery storage, energy efficiency for households, apartment buildings and businesses	\$ Staff Time	Funded	Existing	High	Strategy and Place
2.8	Electricity	Facilitation	Seek a partnership to test and increase uptake of solar retrofit	\$ and Staff time	Unfunded	New	Med	Strategy and Place
2.9	Electricity	Advocacy	Produce a GIS layer of houses within the Shire with rooves unaffected by trees and target solar information to these households and businesses. Investigate solar PV mapping tools.	\$ and Staff time	Unfunded	New	High	Strategy and Place & Natural Resources
2.10	Electricity / Gas / Water	Advocacy	Advocate to developers for buildings designed to achieve low energy properties and precincts above planning policy regulations	\$ and Staff time	Onfunded	New	High	Strategic Planning
2.11	Electricity / Gas / Water	Advocacy	Lobby State Government to increase BASIX requirements	Staff time	Unfunded	New	High	Strategy and Place
2.12	Electricity	Facilitation	Investigate Solar My Schools program or other large-scale community solar roll out	\$ and Staff Time	Unfunded	New	Med - low	Strategy and Place
2.12	Electricity / Gas / Water / Waste	Strategic Planning	Incorporate carbon zero processes into the design, development and ongoing use of town centres i.e. Hornsby Town Centre e.g. building materials, waste generation & disposal, large scale energy production	\$ and Staff time	Funded	Existing	High	Strategic Planning & Strategy and Place
2.13	Waste	Administration and Strategy	Implement the Waste Matters Strategy to increase diversion of waste from landfill	\$ and Staff Time	Funded	Exiting	High - Med	Waste
2.14	Electricity / Transport	Strategic Planning	Investigate combined solar farm and car parking with EV charging	\$ and Staff Time	Unfunded	New	High	Strategy and Place
2.15	Transport	Strategic Planning	Advocate to Transport for NSW for the provision of adequate commuter car parking and cycling facilities for customers of the public transport network – rail and ferry	\$ and Staff Time	Unfunded	New	High - Med	Strategy and Place
2.16	Transport	Strategic Planning	Finalise and implement the Walking and Cycling Strategy to increase participation in and improve infrastructure for walking and cycling	\$ and Staff Time	Unfunded	New	High	Infrastructure and Major Projects
2.17	Electricity / Gas / Water	Strategic Planning	Prepare homes for extreme weather and energy efficiency at the same time	\$ and Staff Time	Unfunded	New	High	Strategic Planning & Strategy and Place
2.18	Electricity	Advocacy	Lobby State and Federal Government to green the electricity grid	\$ and Staff Time Unfunded	Unfunded	New	High	Strategy and Place

ATTACHMENT 5 - ITEM

12 Appendix 3 – Climate Change Risk Assessment

12.1 Temperature

Scenario for (Scenario for (Average) Temperature	Wii	l impac	t in our	Will impact in our ability to:	*	Area	Current Controls	ontrols		Risk Rating			
By 2030 may are projected and continue By 2030 min are projected and continue	By 2030 max average temperatures are projected to rise by 0.7 degrees C and continue to rise by 1.9 degrees C by 2070. By 2030 min average temperatures are projected to rise by 0.6 degrees C and continue to rise by 2 degrees C by 2070.	oildu9 nistnisM - A γtehs∂	B - Protect and Enhance Local	C - Proted Community Structures and Lifestyle	D - Physical and Natural Environment	E - Sound Public Administration and Governance	Functional	Current	Adequacy of Controls	Likelihood	Consequence	Risk Rating	Future Adaptations (for risk rated HIGH and EXTREME)	
Increased average annual temperature will cause de ecosystems resulting in the biota within the natural em	Increased average annual temperature will cause dedine to ecosystems resulting in threats to biota within the natural environment				×		& Assets	Maintenance program of natural assets (also condition based)	3- Adequate Mitigation	Almost	Moderate	Ξ.	1) Implement Urban Forest Strategy 2) Implement Biodiversity Conservation Plan 3) Implement Water Sensitive Hornsby Strategy 4) Prepare a vulnerability assessment to determine future impact of climate change on biodiversity values 5) Prepare biodiversity adaptation strategy to minimise climate impacts through policy, planning instruments and operational activities 6) Maintain seed bank program and identify secondary seed bank storage 57 Establish partnerships with industry leaders such as Royal Botanic Gardens, Australian Plant bank at Mount Annan	
Increased av temperature decline in the public assets usability of C	Increased average annual temperature will cause a possible decline in the integrity of Council's public assets resulting in reduced usability of Council fadiities			×			& Assets	Proactive Asset Management Planning (condition based) Maintenance program of natural assets (condition	3- Adequate Mitigation	Possible	Minor	Medium	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	Climate Wise Hornsby Plan

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1) Implement Urban Forest Strategy 2) Apply for exemptions with Sydney Water during times of drought 3) Investigate development of Urban Heat Policy with NSROC 4) Implement Play Plan 5) Implement Water Sensitive Hornsby Strategy	1) Review, update and implement Sustainable Energy for New Council Assets Policy 2) Review top 10 consuming facilities annually 4) Transition to 100% renewable energy and low carbon economy 5) Participate in Action 13 Resilient Sydney Strategy – Measure metropolitan carbon emissions and report on progress	Continue to implement Biosecurity Act Implement Biodiversity Conservation Plan 3) Develop an education program for residents on weeds and pest 4) Investigate the expansion of the Bushcare Volunteer Program 5) Establish a pest, weed, diseases monitoring program	1) Investigate mapping of all trees in public areas with condition assessment (inventory) 2) Prioritisation of risk areas 3) Investigate proactive inspection and maintenance - asset management plan to consider surrounding precinct not just built asset 4) Implement Urban Forest Strategy (including appropriate species selection) 5) Implement Biodiversity 5) Implement Biodiversity 6) CRM system to link with Asset Management Plan (including trees) 7) Review Statewide Mutual Visitation manual guideline - Signs used for Remote
high	High	High	High H
Moderate	Minor	Moderate	Major
Likely	Almost Certain	Likely	Possible
2-Some Benefit	2-Some Benefit	2-Some Benefit	2-Some Benefit
Proactive Asset Management Planning (condition based) Maintenance program of natural assets (condition basset)	- Monitoring systems - Sustainable Energy for New Council Assets Policy - Renewable Assets i.e. PV and wind turbine	Maintenance program of matural assets (condition based) - Implement Biosecurity Act	- Proactive maintenance of trees around Council's built assets - Informal monitoring of park assets - CRM system used to respond to customer complaints
& Assets & Assets	Infrastructure & Assets	Assets & Assets	Corporate Services
	×		
×		×	
			×
Increased average annual temperature will cause a possible decline in the integrity of Council's open space, reserves and recreational assets resulting in reduced usability of Council facilities	Increased average annual temperature will cause an increase in Coundi's greenhouse gas emissions due to higher energy usage within Coundi from increased use of air conditioners and electricity, affecting Coundi's carbon footprint	Increased average annual temperature will cause an increased success and distribution of weed, disease and pest species resulting in the threat to or loss of blota within the natural environment and the associated cost of resources to Council to manage the impact	Increased average annual temperature will cause increased property damage or personal injury as a result of falling limbs and trees.
1013	TEI4	TDIS	TACO6

Climate Wise Hornsby Plan

Supervision. 8) Investigate proactive monitoring of areas of high vegetation density and/or large trees.	Review of budget for maintenance and utility costs Review irrigation practises and design (including moisture sensors)	1) Development and implementation of Coastal Management Program for the Hawkesbury 2) Ongoing monitoring and water quality sampling 3) Improved education and compliance activities for on-site sewage systems	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified
	High	High	Medium	Medium
	Minor	Minor	Insignificant	Minor
	Almost Certain	Almost Certain	Almost Certain	Likely
	2-Some Benefit	2-Some Benefit	2-Some Benefit	2-Some Benefit
	Responsive maintenance program - Irrigation initiatives	- Remote water quality monitoring - Ability to notify community for public safety - Algalert	Storrwater harvesting Control Plan provisions on private property - BASIX - Mandatory water restrictions	- Annual Food Shop inspection regimes, - Council staff / volunteers
	Infrastructure & Assets	Infrastructure & Assets	Infrastructure & Assets	Community Services
		×		
	×			
			×	×
	Increased average annual temperature may increase maintenance costs for parks and reserves due to increased length of growing season, pests and disease and irrigation demands.	Increased average annual temperature may increase the occurrence of algal blooms and aquatic weeds and pests resulting in a reduction water quality and risk to public safety	Increased average annual temperature may lead to increased water consumption on both private and public land and an increased utilisation of Council stand pipes for water supply to private property.	Increased average annual temperature may lead to increasing illnesses due to the abundance of ticks, mosquitos and other insects along with food bome illnesses.
	TCI7	TD18	TAI9	TACS10

4	10		Н	or	nsk	у :	Shi	ire	Co	ur	ncil	
Investigate employment of a Grants Officer	2) Investigate alternative funding	sources for Climate Change	3) Apply for grant funding where	possible	4) Investigate the allocation of	Developer Contributions	5) Integrate strategies to align with	Long Term Financial Plan (QBL	and business case development)	6) Delivery Program and	Operational Plan to identify	regional project opportunities
						1	LIB L					
						Moderate	Moderate					
						Almost	Certain					
2-Some Benefit												
- Long Term Financial	Planning		Development	Contributions	- Grant	funding						
Corporate Services												
						>	<					
				_				_	_	_		
TECS11 There is a risk that Council will not have the financial capacity to fund the	works required in the future, including:	the development of identified	strategies, and in managing the	community expectations associated	with the impacts of an increase in the	average annual temperature						
TECS 11												

ATTACHMENT 5 - ITEM

12.2 Hot Weather

			Future Adaptations (for risk rated HIGH and EXTREME)
Diek Dating	KISK Kating	Consequence Rating	
		Likelihood	
		Adequacy of S Controls	
		Current	
		Functional	
in our ability to	ability to:	D - Physical and Natural Environment E - Sound Public Administration and Governance	
	will impact in our	B - Protect and Enhance Local Economy C - Protect Community Structures and Lifestyle	
5	>	A - Maintain Public Safety	
	Scenario for Hot Weather (Heat)	By 2030 Metropolitan Sydney is projected to experience an average of 4 more days above 35 degrees C per year and continue to increase by 11 days per year by 2070. By 2030 Western Sydney and the Hawkesbury is projected to experience an additional 5 to 10 days above 35 degrees C per year and increasing to over 10 to 20 additional hot days per year by 2070.	
KISK ID	Ø		HWAE1 Increased number of hot days above 35 degrees

42	Hornsby :	Shire Coun	cil						
11) Participate in Get Prepared – Action 23 Resilient Sydney Strategy 12) Continue to share	important health information from state organisations including: i. NSW Health information on Beat the	Heat. ii. Air pollution ratings from NSW Department of Planning, Industry and	Environment. III. Fire risks from the Rural Fire Service. Iv. Storm and flood risks from the State Emergency	Service. 13) Partner with SES to create pre-planning resilience for those who may not have access to a car in	a disaster and/or may need assistance with evacuating. 14) Promote community resilience and community	participation by involving residents in climate adaptation decision making. It is particularly important to involve population groups at involve population groups at	higher risk e.g. with pre- existing medical conditions, people with a disability and older people.	security to adapt and mitigate climate change impacts: I. Support the retail industry to transition to solar panels, reduce waste and source sustainable	materials. ii. Encourage schools to apply for solar panel grants and the Cooler Classrooms program. Advocate for community gardens and active travel to school days. iii. Encourage community groups to create community gardens to create community gardens to create community gardens.

ATTACHMENT 5 - ITEM

	I		e Wise Hornsby Plan
iv. Collaborate with organisations to be open later in the summer heat e.g. charities for the homeless. v. Seek partnerships with energy companies to get these at a bulk rate or give subsides for the community. vi. Collaborate with the community to encourage them to switch to solar, prepare for climate disasters, establish vegetables gardens, create high quality housing and benefit from initiatives like Return and Eam. vii. Increase the capacity of pet owners and individuals with livestock, to prepare for different climate impacts e.g. flood, drought, heatwaves and bushfires. viii. Advocate to developers about sustainable housing solutions/design and land use and built environment planning.	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	
	Medium	Medium	
	Minor	Minor	
	Likely	Possible	
	2-Some Benefit	2-Some Benefit	
	- Public notifications via social media on transport delays - Proactive maintenance regimes for Council assets	- Proactive maintenance regimes	
	& Assets	Community	
	×	×	
	Increased number of hot days above 35 degrees could cause loss/damage to transport infrastructure (including railway lines and roads), affecting Council's public assets, businesses, residents and general commuters within the Hornsby Shire	Increased number of hot days above 35 degrees could cause a possible decline in the integrity of Coundi's public assets resulting in a reduced usability of Council's facilities	
	HWGI2	HWCCS3	

44 Hornsby Shire	Council	
All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	1) Implement Urban Forest Strategy 2) Review WHS controls for confrort factor rather than just temperature specific, include for some personal variations 3) Develop pre-established alternative tasks and inhouse training ready for hot days 4) Review consistency in management and volunteers with Council's heat policy for events and event management 6) Petablish a Hot Weather Policy for events and event management 6) Petapared – Action 23 Resilient Sydney Strategy
Medium	Medium	High
Minor	Minor	Minor
Likely	Possible	Almost Certain
		2-Some
	- Public facilities such as libraries used as refuge during hot weather	- WHS protocols for working in hot weather and personal protective equipment (PPE) - Alternate working hours - Volunteers policy for working in hot weather
Emergency Mgt & Natural Disaster preparedhess	Emergency Mgt & Natural Disaster preparedness	Corporate Services
		×
	×	
×		
Increased number of hot days above 35 degrees could cause loss/damage to utility infrastructure including water supply, telecommunications, electricity supply and gas supply, affecting residents and barisesses within the Hornsby Shire due to possible power outages/interruptions, damage to electricity supplier's infrastructure, etc.	Increased number of hot days above 35 degrees could cause an increase in the number of local emergencies within the Hornsby Shire resulting in an increased strain on Council services, resources and staff	Increased number of hot days above 35 degrees could cause reduced productivity and workplace health and safety issues for Council workers and contractors
HWAE4	HWCES	HWECOB

	Climate Wise Hornsby Plan
1) Monitor facilities to identify trends and inefficiencies 2.) Review, update and 2.) Review, update and Careful for the capex review from \$5million of the capex review from \$5million of rifle cycle analysis to \$5 million or large capital items. 4) Include climate change projections in project management framework and asset management framework and asset management plans. 5) Investigate alternative water supplies 6) Re-evaluate NSROC Renewable Energy Master Plan	1) Investigate mapping of all trees in public areas with condition assessment (inventory) 2) Prioritisation of risk areas 3) Investigate proactive inspection and maintenance 4) Asset Management Plans to consider surrounding precind not just built asset 5) Implement Urban Forest Strategy (including appropriate species Strategy (including appropriate species selection) 5) Implement Biodiversity Conservation Plan 7) CRM system to link with Asset Management Plan (including trees) 8) Link to Statewide Mutual Visitation manual/guideline - Signs used as Remote Supervision pertaining to ongoing landscape maintenance plans required for mediumhigh developments
Hg.	E E
Minor	Major
Almost	Likely
2-Some Benefit	2-Some Benefft
- Sustainable Energy for New Council Assets Policy and maintenance regimes - Stormwater harvesting	- Proactive maintenance of trees around Council's built assets - Informal monitoring of park assets - CRM system used to respond to customer complaints - Insurance
Services Services	Services Services
×	
	×
	Increased number of hot days above 35 degrees could cause increased property damage or personal injury as a result of falling limbs and trees.
ниесот	HWACO8

46 н	ornsby Shire Council	
10) Investigate proactive inspections to ensure landscape maintenance plans are being adhered to	1) Investigate employment of a Grants Officer 2 Investigate alternative funding sources for Climate Change 3) Apply for grant funding where possible 4 Investigate the allocation of Developer Contributions 5) Integrate strategies to align with Long Term Francial Plan (QBL and Francianal Plan to identify regional project	1) Investigate cost recovery to cover maintenance increases 2) Investigate development of a community resilience program (include reviews of increased opening hours of facilities, staffing impacts etc) 3) Investigate development controls to allow for extended operating hours above DA consent conditions for public facilities 4) Investigate an Emergency Management Heatware Response Plan 5) Investigate an Emergency Management Heatware Response Plan 5) Investigate backup power supply for key Council facilities 6) Investigate development of NSROC Urban Heat Policy 7) Establish links with BOM and Local Area Health Service 8) Implement Urban Forest Strategy
	E E	H. H
	Moderate	Minor
	Almost Certain	Almost
	- Long Tem Financial Planning Development Contributions - Grant funding	
	Corporate Services	A Assets
	×	
		×
	There is a risk that Council will not have the financial capacity to fund the works required in the future, including; the development of identified strategies, and in managing the community expectations associated with the impacts of an increase in the number of Hot Days above 35 degrees.	Increased number of hot days above 35 degrees could cause increased demand on Council's facilities, such as pools, refuges (buildings), riverside parklands and boat ramps,
	HWECO9	HWCi10

1) Develop a community resilience program 2) Investigate an 2) Investigate an 3) Investigate backup power supply for key Council facilities 4) Investigate backup power supply for key Council facilities 5) Investigate development of NSROC Urban Heat Policy 5) Establish links to BOM and Local Area Health Service 6) Create resilient open spaces in public domain planning (green and blue spaces) 7) Building design to include shade opportunities 6) Mulding design to include shade opportunities 7) Building design to include shade opportunities 8) Implement Urban Forest Strateav	1) Complete Rural Lands Study 2) Develop a community resilience program 3) Promote adaptive land use partnerships with DPI 4) Implement Urban Forest Strategy	Develop a community resilience program Promote Homsby Localised program to shop local Implement Urban Forest Strategy	1) Implement Play Plan and Public Domain Strategies 2) Implement Urban Forest Strategy 3) Asset Management Plans to include dimate change projections 4) Implement Hornsby Town Centre Review 5) Update Development S) Update Development Control Plan provisions	
High	High	High	High	
Minor	Minor	Minor	Minor	
Almost	Almost Certain	Almost Certain	Almost Certain	
			2-Some Benefit	
			- Planting of shade trees - 25,000 tree program	
Land-use Planning & Development	Land-use Planning & Development	Land-use Planning & Development	Infrastructure & Assets	
×			×	
	×	×		
Increased number of hot days above 35 degrees may cause increased Urban heat impacts resulting in a reduced use of public places	Increased number of hot days above 35 degrees may sause impacts on economic viability of the rural areas	Increased number of hot days above 35 degrees could cause reduced productivity and workplace health and safety issues for businesses in the Hornsby Shire	Increased number of hot days above 35 degrees may cause increased demand for shading on urban spaces	
HWGL11	HWBL 12	HWBL13	HWC114	

HWDE15 High Subversity a bowe 35 degrees Teaching 35 degrees and above above 35 degrees and above
Increased number of hot days above 35 degrees may cause increased impact of heatstroke or heat related illness in animals ie flying foxes.
Increased number of hot days above 35 degrees may cause increased impact of heatstroke or heat related illness in animals ie flying foxes.
Increased number of hot days above 35 degrees may cause increased impact of heatstroke or heat related illness in animals ie flying foxes.
Increased number of hot days above 35 degrees may cause increased impact of heatstroke or heat related illness in animals ie flying foxes.
Increased number of hot days above 35 degrees may cause increased impact of heatstroke or heat related illness in animals ie flying foxes.
Increased number of hot days above 35 degrees may cause increased impact of heatstroke or heat related illness in animals ie flying foxes.
Increased number of hot days above 35 degrees may cause increased impact of heatstroke or heat related illness in animals ie flying foxes.
HWDE15

Climate Wise Hornsby Plan

ATTACHMENT 5 - ITEM 1

12.3 Rainfall

2.50												
2		Will impact in our ability to:	ct in ou	r abilit	v to:					Risk Rating		
	Scenario for Rainfall	1		3	i .					8		
	Projections for the regions annual average rainfall range from a decrease (drying) of 13% to an increase (wetting) of 18% by 2030 and still span both drying and wetting scenarios (-9% to +24%) by 2070. By 2030 rainfall is projected to increase during autum and decrease in spring across the region. By 2070 rainfall increases are projected for Summer, Autumn and most of the region during Spring. In the near future (2020-2039): Summer (-14% to +15%); Autumn (-22% to +43%); Winter (-19% to +23%); Spring (-27% to +17%). In the far future (by 2060-79): Summer (-7% to +28%); Autumn (-15% to +42%); Winter (-38% to +38%); Spring (-14% to +37%).	A - Maintain Public Safety	C - Protect Community Structures and Lifestyle	D - Physical and Natural Environment	bns noitatainimbAoildu9 bnuo2 - ∃ eonsmevoĐ	Functional	Current	Adequacy of Controls	Likelihood	Consequence	Risk Rating	Future Adaptations (for risk rated HIGH and EXTREME)
RDI1	Decrease in the annual rainfall level may cause a change in the ecosystem that may result in the loss of trees, plant and animal species within the physical and natural environment			×		M Assets	- Seed collection of local resilient species		Almost Certain	Moderate	High	In Implement Urban Forest Strategy Implement Biodiversity Conservation Management Plan Implement Water Sensitive Homsby Strategy
RCI2	Decrease in the annual rainfall level may see a reduction in the functionality of Council's recreational facilities, particularly Council's parks and reserves which may cause an increased strain on Council funds due to the financial costs with the upkeep of such fadilities		×			& Assets	- Proactive maintenance regimes	2-Some Benefit	Almost Certain	Minor	High	1) Implement Urban Forest Strategy 2) Apply for exemptions with Sydney Water during times of drought 3) Investigate development of Urban Heat Policy with NSROC 4) Implement Play Plan 5) Implement Play Plan 5) Implement Water Sensitive Homsby Strategy - WSUD installations
RDI3	Decrease in the annual rainfall level may cause variations in the environmental flows which may affect water dependent ecosystems			×		A Assets	- Eco Health Program		Possible	Moderate	High	Work with Sydney Water and other organisations to monitor stream flow Continue to implement Eco Health Program Develop and implement a Coastal Management Program

50 Hornsby Shire Council	
1) Continue to implement Biosecurity Act 2) Investigate an education program for residents on weeds and pest 3) Prepare a vulnerability assessment to determine future impact of climate change on biodiversity values 4) Prepare biodiversity adaptation strategy to minimise climate impacts through policy, planning instruments and operational activities	1) Mapping of all trees in public areas with condition assessment (inventory). 2) Prioritisation of risk areas, 3) Proactive inspection and maintenance at Asset management plan to consider surrounding precinct not just built asset. 5) Implementation of Urban Forest Strategy (including appropriate species selection), 6) Link to biodiversity management plan. 7) CRM system to link with Asset Management Plan (including trees). 8) Link to Statewide Mutual Visitation manual/ guideline - Sins used as Remote Sins used as Remote Sins used as Remote plans for medium-high density developments, and associated resources to regulate ongoing maintenance of vegetation.
High	H. Co.
Moderate	Major
Almost	Possible
& Assets	Services Services
×	
	×
Decrease in the average annual rainfall level may result in an increased success of weed and pest species resulting in the threat to or loss of plant and animal species within the natural environment and the associated cost of resources to Council to manage the impact	Decrease in the average annual rainfall may cause increased property damage or personal injury as a result of falling limbs and trees caught by droughts, fire and storms
RD14	RACOS

1) Investigate employment of a Grants Officer 2) Investigate alternative funding sources for Climate Change 3) Apply for grant funding where possible 4) Investigate the allocation of Developer Contributions 5) Integrate strategies to align with Long Term Financial Plan (QBL and business case development) 6) Delivery Program and Operational Plan to identify regional project opportunities	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified
H BH	Medium	Medium
Moderate	Minor	Minor
Almost Certain	Likely	Possible
2-Some Benefit		
- Long term financial planning Development Contributions - Apply for grant funding		
Corporate Services	Corporate Services	Corporate Services
×		
	×	×
There is a risk that Council will not have the financial capacity to fund the works required in the future, induding the development of identified strategies, and in managing the community expectations associated with the impacts of a decrease in the average annual rainfall level.	Decrease in the average annual rainfall, may cause increased impact on private properties and businesses who are reliant on non-mains water supply.	Decrease in the average annual rainfall, may cause increased impact on businesses dependent on healthy waterways.
RECO6	RCCO7	RBCO8

Hornsby Shire Council

2.4 Wind

	2000											
Risk ID	Scenario for Wind	Will impa	impact in our ability to:	ability t	ö					Risk Rating		
	(NO RECENT PROJECTION) 2010 Scenario - There is a risk that there will be an increase in average daily wind speed between-5% and +8% by 2030 and an increase of -16% and +24% by 2070.	A - Maintain Public Safety B - Protect and Enhance Local Economy	C - Protect Community Structures and Lifestyle	D - Physical and Natural Environment	E - Sound Public Andinistration and	Functional	Current	Adequacy of Controls	Likelihood	Consequence	Risk	Future Adaptations (for risk rated HIGH and EXTREME)
Wal1	An increase in average daily wind speed could cause increased property damage or personal injury as a result of falling limbs and trees caused by droughts, fire and storms	×				& Assets	- Proactive maintenance of trees aroundis council's built assets - Informal monitoring of park assets - CRM system used to response to customer complaints	2-Some Benefit	Possible	Major	High	1) Investigate mapping of all trees in public areas with condition assessment (inventory) 2) Prioritisation of risk areas 3) Proactive inspection and maritenance of Council assets 4) Asset Management Plans to consider surrounding precinct not just built asset 5) Implement Urban Forest Strategy (induding appropriate species selection) 6) Implement Blan Management Plan Management Plan Management Plan (including appropriate species selection) 6) Implement Plan Anagement Plan Management Plan (including trees) 8) Link to Statewide Mutual Visitation manual/ guideline - Signs as Remote Supervision
WDI2	An increase in average daily wind speed could cause increased damage to ecosystems			×		& Assets			Possible	Moderate	High	1) Implement Urban Forest Strategy 2) Implement Biodiversity Conservation Plan 3) Implement Water Sensitive Hornsby Strategy

53

4) Prepare a vulnerability assessment to determine future impact determine future impact of dimate change on biodiversity values 5) Prepare blodiversity adaptation strategy to minimise climate impacts through policy, planning instruments and operational	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	1) Investigate education program to reinforce the value of trees in the community and context of risk 2) Appropriate tree selection - the right free in the right place 3) Implement Urban Forest Strategy
	Medium	Medium	H Egg
	Minor	Minor	Minor
	Possible	Possible	Almost Certain
	Infrastructure & Assets	Emergency Mgt & Natural Disaster preparedness	Corporate Services
	×		
			×
		×	
	An increase in average daily wind speed may cause increased impact on existing built infrastructure.	An increase in average daily wind speed could cause impacts on transport, electrical supply, telecommunications	An increase in average daily wind speed may cause an increase in negative public perception of the risks of trees and bushland on public and private land, result in increased clearing of trees
	WEI3	WAE4	WDCO5

Hornsby Shire Council

1) Investigate	employment of a Grants	Officer	2) Investigate	alternative funding	sources for Climate	Change	3) Apply for grant	funding where possible	4) Investigate the	allocation of Developer	Contributions	5) Integrate strategies to	align with Long Term	Financial Plan (QBL and	business case	development)	6) Delivery Program and	Operational Plan to	identify regional project	opportunities
										High										
										Moderate										
									Vimont	AllTost	Certain									
2-Some	Benefit																			
- Long term	financial	planning		Development	Contributions	- Apply for	grant funding													
Corporate	Services																			
										×										
WECO6 There is a risk that Council will not have the	financial capacity to fund the works required	in the future, including: the development of	identified strategies, and in managing the	community expectations associated with the	impacts of an increased average daily wind	speed.														
90																				

12.5 Fire Weather

г			Climate Wise Hornsby Plan
		Future Adaptations (for risk rated HIGH and EXTREME)	1) Develop a community resilience program (include education on insurance) 2) Implement Homsby Ku-ring-gai Bush Fire Risk Management Plan 3) Develop a Hornsby Bushfire Management Strategy 4) Lobby RFS for ongoing improvements to education and community engagement programs 5) Lobby RFS to confirm their position on development North of Asquith (6) Investigate Digital Signage Strategy (Smart Cities) 7) Improve linkage to Emergency warnings for Council communications and alert systems 8) Continue to fund emergency management response 9) Advocate and lobby Ausgrid to ensure assets are maintained 10) Investigate Development Control Plan provisions for undergrounding power lines 11) Investigate Development Control Plan provisions for undergrounding of private electricity connections 12) Investigate alternative water storage areas and supply data to RFS 14) Update/maintain bushfire mapping on Council's internal mapping on Council's internal mapping on Council's internal mapping on Storage areas and supply internal mapping on Council's internal mapping on Council's internal mapping on Storage areas and supply and storage areas and supply and storage areas and supply and storage areas and supply data to RFS
		Risk Rating	Extreme
0 100	KISK Kating	Consequence	Catastrophic
		Likelihood	Almost
		Adequacy of Controls	2-Some Benefit
		Current	- Funding for the RFS (12 fire stations maintenance and running costs, plus fire seducation programs Hazard mitigation programs Hazard mitigation program, collaboratively working with fire services and other land managers, Bushfire mapping, Planning controls
		Functional	Services
3	ny to:	noisensinimbA pullo Pulo - 3 ennemevo Dons	
1	rability	D - Physical and Natural Environment	
1	Will impact in our abil	C - Protect Community Structures and Lifestyle	
	штра	B - Protect and Enhance Local Economy	
-	>	Yələs əliduq nistnisM - A	×
	Scenario for Fire Weather	Metropolitan Sydney is expeded to experience an increase in average and severe fire weather in the near future (by 2030) and the far future (by 2070). Forest Fire Danger Index (FFDI) is used in NSW to quantify fire weather. The FFDI combines observations of temperature, humidity and wind speed. Fire weather is classified as severe when the FFDI is above 50.	Increased number of FFDI days may cause an increased risk to the general safety of the community which could result in an increased risk of injury or loss of life, and / or ongoing trauma recovery and community resilience
Risk ID			FWACO1

56 Hornsby Shire	Council		
15) Update Development Control Plan provisions 16) Partner with RFS to create preplanning resilience for those who may not have access to a car in a disaster and/or may need assistance with evacuating 17) Investigate cultural burning practices being introduced to certain areas	assessment and restoration action plan to ensure timely assessment and treatment of environmental issues post incident 2) Implement Blodiversity Conservation Management Plan 3) Advocate and lobby Ausgrid and Endeavour to ensure assets are maintained 4) Investigate under grounding power filmes 5) Investigate and endeavounding of private electricity connections 6) Investigate alternative water supply and storage options 7) Mapping of water storage areas and supply data to RFS so Consider increased wildlife fatalities and need to support wildlife carers, install watering stations, etc.	1) Undertake resilience program 2) Complete Rural Land Study 3) Complete the Local Housing 3) Extragy 4) Lobby RFS for position on rezoning in high risk areas 5) Site specific firefighting equipment 6) Update Development Control Plan	Implement Urban Forest Strategy Investigate development of monitoring programs 3) Improve reporting to account for community anomalies Assess and facilitate approval to bum process
	H G	H Egi	High
	Maj or	Moderate	Minor
	Likely	Almost	Almost Certain
		2-Some Benefit	
	- Hazard reduction burn planning and buffers	- Planning controls - LEP, DCP - Planning for bushfire - Planning Certificates	
	& Assets	Land-use Planning & Development	Corporate Services
	×		
			×
	Increased number of FFDI days may cause dhanges to the natural and reased fisk to ecosystems and an increased cost to Council to manage or reverse impacts	Increased number of FFDI days may cause certain land use paractioss to change, affecting paractics to change, affecting and businesses within the Hornsby Shire	Increased number of FFDI days may cause an increased level of greenhouse gas emissions due to bushfire smoke entering the atmosphere due to fire events
	FWDI2	FWCL3	FWCC 04

	Climate Wis	e Hornsby Plan
All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	1) Develop a community resilience program (include education on insurance) 2) Implement planning for bushfire protection provisions 3) Develop a Homsty Bushfire Management Strategy 4) Lobby RFS for ongoing improvements to education and community angagement programs 5) Investigate improved linkage to Emergency warnings for Council communications and alert systems 6) Continue to fund emergency management response 7) ARAs to undertake proactive inspections of APZs required to be maritained in perpetuity pursuant to DA consent condition requirements 9) Identify if there is a need to include a positive covenant on the title of all development conditioned to hold an APZ in perpetuity (currently subdivision consents are the only ones that have this on the title of all development conditioned to hold an APZ in perpetuity (currently subdivision consents and the only ones that have this on the title) 10) Review with a view to amend/update planning controls for amend/update planning controls for amend/update planning controls for devacuation plans 11) Lobby Ausgrid and State Government to underground power lines. 12) Partner with RFS to create preplanning resilience for those who may not have access to a car in a disaster and/or may need assistance with evacuating	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified
Medium	Extreme	Medium
Minor	Catastrophic	Minor
Possible	Almost	Possible
2-Some Benefit	2-Some Benefit	
- Insurance, - Emergency response plans, - Resource - Local emergency services	- Resource local emergency services, - Bushfire education programs, - Planning controls, - Bushfire mitgation programs	
Infrastructure & Assets	Emergency Mgt & Natural Disaster preparedness	Infrastructure & Assets
		×
×	×	
Increased number of FFDI days may cause loss/damage to public property and Council assets due to fire, fallen trees etc.	Increased number of FFDI days may cause loss/damage to private property including residential and businesses due to fire, fallen trees, accidents due to smoke reducing visibility levels	Increased number of FFDI days may cause a reduction in the use of certain Council facilities due to a decline in the integrity of the facilities from fire related damage or threat
FWAI5	FWAE6	FWCI7

58 Hornsby Shire Co	58 Hornsby Shire Council		
Update Community and Cultural Facilities Plan (include actions for use during emergencies, refuges opening hours) Review and update Hornsby EMP	1) Investigate employment of a Grants Officer 2) Investigate alternative funding sources for Climate Change 3) Apply for grant funding where possible 4) Investigate the allocation of Developer Contributions 5) Integrate strategies to align with Long Term Financial Plan (QBL and business case development) 6) Delivery Program and Operational Plan to identify regional project opportunities	Investigate development of community resilience program Investigate Digital Signage Strategy (Smart Cities) Improve linkage to Emergency warnings for Council communications and alert systems	Continue water quality monitoring program and report on results Dimplement Water Sensitive Hornsby Strategy Implement Blodiversity Conservation Plan A) Investigate sediment and erosion control plans for use after fire events.
High	<u>r</u> Fo	High	High
Minor	Moderate	Moderate	Minor
Almost	Almost	Almost Certain	Almost Certain
2-Some Benefit		2-Some Benefit	2-Some Benefit
- LEMP - Supporting emergency services - Disaster Relief Funding	- Long term financial planning - Development Contributions - Apply for grant funding	- Notification of Hazard reductions - Traffic controls	- Hazard reduction bum planning and buffers
Emergency Mgr & Natural Disaster preparedness	Corporate Services	Emergency Mgt & Natural Disaster preparedness	Land-use Planning & Development
×	×		
			×
		×	
Increased number of FFDI days may cause an increase in the number of local emergencies within the Homsby Shire resulting in an increased strain on Council services, resources and staff	There is a risk that Council will not have the financial capacity to fund have the financial capacity to fund the works required in the future, including: the development of identified strategies, and in managing the community expectations associated with the impacts of an increase in the number of FEDI days.	Increased number of FFDI days will cause an increased risk of air pollution due to bushfire smoke pertering the atmosphere which may affect the health of the public and natural environment	Increased number of FFDI days will cause an increase in water cause an increase in water pollution due to sediment entering waterways as a result of erosion, which may threaten ecosystem health
FWEE8	FWECO9	FWAE10	FWDL11

1) Additional effort to reinforce the value of fees in the community and context on the risks. 2) Appropriate tree selection - right tree in the right location 3) Implement Urban Forest Strategy. 4) Lobby State Govt to review 10:50 legislation. 5) Advocate for improved reporting on RFS approvals for hectares of clearing on RFS approvals for hectares of clearing on Residual as the consequences of unauthorised tree removal. 7) The Appropriate Regulatory Authority undertake proactive inspections of Asset Protection Zones required to be maintained in perpetuity pursuant to DA consent	Investigate development of community resilience program	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified
n Xtrenne	High	Medium	Medium
Major	Minor	Minor	Minor
Almost	Almost Certain	Possible	Possible
		2-Some Benefit	
		- LEMP - Maintenance and Access to Neighbourhood safe places	
Corporate Services	Corporate Services	Emergency Mgt & Natural Disaster preparedness	Emergency Mgt & Natural Disaster preparedness
×			
			×
	×	×	
Increased number of FFDI days increases negative public perception of the risks of trees and bushland on public and private land, result in increased clearing of trees.	Increased number of FFDI days may impact on viability of businesses due to increase insurance costs	Increased number of FFDI days may cause increased demand on Council properties for residents seeking refuge	Increased number of FFDI days may cause potential conflict between the need to access to natural water courses for heat relief and pressures to close these public facilities due to public safety risks
FWDC012	FWBCO13	FWAE14	FWCE15

ATTACHMENT 5 - ITEM 1

12.6 Sea Level Rise and Coastal Inundation

6	0 F	Hornsby Shire Council		
		Future Adaptations (for risk rated HIGH and EXTREME)	1) Ensure planning controls refer to NSW coastal management areas and DCP controls developed. 2) Ensure sea level rise is included in the Coastal Management Program 3) Work collaboratively with neighbouring councils to complete the Coastal Management Program and develop a Coastal Management Plan A) Prepare a vulnerability assessment to determine (future impact of climate change on biodiversity values 5) Prepare biodiversity values 5) Prepare biodiversity values 5) Prepare biodiversity values 5) Prepare olimate impacts through policy, planning	
		Risk	Ξ. Fo	
	Risk Rating	Consequence	Moderate	
		Likelihood	Possible	
		Adequacy of Controls		
		Controls	- No spedito controls. We have completed a past research project on the impads of sea level rise on macrophytes in the estuary	
		Functional	& Assets	
	ty to:	E - Sound Public Administration and Governance		
	ll impact in our ability to:	D - Physical and Natural Environment	×	
	ct in o	C - Protect Community Structures and Lifestyle		
	III impa	B - Protect and Enhance Local Economy		
	W	ν θ σ σ σ σ σ σ σ σ σ σ σ σ σ σ σ σ σ σ	8 5	
	Scenario for Sea Level Rise	Future projections indicate that there will be a decrease in East Coast Lows (ECLs) during winter and an increase in frequency and intensity of ECLs during the summer months. ECLs impact on the dam filling cycles. (2007 projections – expected SLR of 0.4 metres by 2050 and 0.91 mis by 2100). (IPCC 5th Assmmt Rpt - 2013) likely mean seal level rise range by 2100: - 0.28 - 0.61 m if Emissions (RCP 2.6) are significantly reduced: - 0.52 - 0.86 m if Highest Emissions (RCO 8.5) They also suggest the possibility of up to several tens of centimetres above these values if marine-based sectors of the Antarctic ice sheet collapse. Beyond 2100, the IPCC concludes that it is virtually certain that global mean sea level will continue to rise for many centuries owing to thermal expansion of the oceans. Data provided by the IPCC also indicate that sea level rise along the east coast of Australia might be 0% to 10% above the global average by 2100 (relative to 1986–2005), with higher rates offshore	An increase in sea level may cause a loss or changes to key ecosystems which could impact on tree, plant and animal species and may reduce ecosystem services such as nutrient and sediment removal, fish production, etc from wetland areas	
	Risk ID		SLD11	

Climate Wise Hornsby Plan

instruments and operational activities	1) Continue funding of floating Landcare and current revegetation project 2) Investigate and partner with researchers on the effects of east coast lows to quantify the issue and impacts 3) Ensure planning coatros align with NSW coatrols align with NSW coatrols align with NSW Coastal Management framework and NSW Coastal Management Areas 4) Ensure sea level rise and coastal inundation are included in the development of the Coastal Management Program	i regarding the impacts and no forthe trainline the estuary all emergency sent evacuation ocalised flooding Investigate tent of ty resilience by resilience as sea level rise is all into asset and management and management	1) Review information on 10.7 Certificates and 10.7 Certificates and of
	Į.	<u>i</u> Eg	High
	Moderate	Moderate	Moderate
	Likely	Possible	Possible
	Revegetate and protect riparian vegetation - Floating - Landcare - Reactive approaches	- Current asset and maintenance schedule	
	A Assets	A Assets	Land-use Planning & Development
	×	×	
			×
	An increase in East Coast Lows and coastal inundation events may result in impacts on coastal nature reserves, beaches, natural public recreational sites, roads, carparks, jettles foreshore/ coastal natural walking paths (erosion) – loss of foreshore vegetation, beaches, boats moored closed to shore.	An increase in sea level may cause loss/damage to coastal transport infrastructure (including roads, wharfs, jetties carparks and bridges) affecting Council assets, businesses and residents	An increase in sea level may cause changes to private and public land use due to erosion and salinisation, affecting landholders, residents and businesses within the Hornsby Shire
	SLCIZ	SLCI3	SLBL4

62 Hornsby Shire Council	
3) Investigate development of community resilience program 4) Ensure sea level rise is integrated into asset design and management Protection of existing mangroves to act as sea level rise buffers slowing down erosion/inundation 6) Create a buffer zone to a refreet	information on 10.7 Certificates and controls in the DCP to ensure best practice 2) Planning control requirements for existing structures existing structures e.g. retrofits/ extensions 3) Investigate installation of environmentally friendly sea walls 4) Protection of environmentally friendly sea walls friendly sea walls 6) Drotection of existing mangroves to act as sea level rise buffers- slowing down for at as sea level rise buffers- slowing down for at as sea level rise buffers- slowing down for at sea level rise buffers- slowing down for at sea level rise buffers slowing down for at sea level rise buffers for at sea level rise with Martitire and Fisheries to address potential sea level rise for Liaise with Martitire and Fisheries to address potential sea level rise fevel rise
	High
	Moderate
	Possible
	- Sea level inse controls in DCP - Exiting notations on 10.7 Certificates apply
	Land-use Planning & Development
	×
	An increase in sea level may cause loss/damage to private property, particularly coastal properties due to erosion, re-alignment of shores, increased flooding, etc
	SLAL5

SLU: An increase in sea level may impact water quality date in the final could impact and more contact making an increase in sea level may route possible and increase in sea level may route possible to the more possibl				
An increase in sea level may cause load-drange to public properly including Cancila seast state to a control seast state to be natural ending that the salinisation of coasts frestwaters and the natural environment of how the natural environment of control causes in coast increase in sea level may impact water quality due to the salinisation of coasts frestwaters and the management of managem	8) Investigate additional resources for proactive compliance inspections of properties under construction and located on/near waterways	1) Planning control requirements for existing structures e.g. retrofits/ extensions 2) investigate installation of sea walls 3) Protection of existing mangroves to act as sea level rise buffers- slowing down erosion/ inundation 4) Consider the accumulative impacts of increase boat use/ boat wash in addition to sea level rise and Fisheries to address potential sea level rise issues/ impacts 6) I Laise with Maritime and Fisheries to address potential sea level rise issues/ impacts 6) Investigate development of community resilience	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified
An increase in see level may cause loss/damage to public property including Council seeds day of the public property including Council seeds day to erosion, re-alignment of aboves increased for office and increases in see level may impact on Council's services to the public council inpact on the service of seeds and council inpact on the public council inpact on council inpact on council inpact on the public council inpact of council inpact on the public council inpact on the public council inpact of council inpact on the public council inpact of council inpact on the public council inpact of council inpact o		Ę	Medium	Medium
An increase in see level may cause loss/damage to public confidence of manger and public increase in see level may impact water quality due public or maniformed or maniformed and manger and the introduced or maniformed and manger and the introduced or maniformed and maniformed and manual and contaminants to learly introduced and matural environment or maniformed and matural environment in the physical and natural environment in the physical and natural environment in the programment in the programment in the physical and natural environment in the physical env		Moderate	Minor	Minor
An increase in see level may cause loss/damage to public property including Council assets due to erosion, re-alignment of stores and from the public and impact on Council's services to the public public and increase in see level may impact water quality due to the salinisation of coastal freshwaters and the inundation of mangoves which could cause to the salinisation of mangoves which could cause damage/loss to the natural environment and increase in see level may cause possible soil contaminants to leach thin goundwater resulting in changes to the physical and natural environment and changes to the physical and natural environment and the contaminants to leach thin goundwater resulting in the physical and natural environment.		Possible	Possible	Possible
An increase in see level may cause loss/damage to public property including Council assets due to erosion, re-alignment of stores and from the public and impact on Council's services to the public public and increase in see level may impact water quality due to the salinisation of coastal freshwaters and the inundation of mangoves which could cause to the salinisation of mangoves which could cause damage/loss to the natural environment and increase in see level may cause possible soil contaminants to leach thin goundwater resulting in changes to the physical and natural environment and changes to the physical and natural environment and the contaminants to leach thin goundwater resulting in the physical and natural environment.				
An increase in see level may cause loss/damage to public property including Council assets due to erosion, re alignment of shores, increased flooding, etc., which could impact on Council's services to the public. An increase in see level may impact water quality due to the salinisation of coastal freshwaters and the inundation of mangroves which could cause damage/loss to the natural environment An increase in see level may cause possible soil contaminants to leach into groundwater resutting in changes to the physical and natural environment An increase in see level may cause possible soil contaminants to leach into groundwater resutting in changes to the physical and natural environment		- Current asset and maintenance schedule		
An increase in sea level may cause loss/damage to public property including Council assets due to erosion, re-alignment of shores, increased flooding, etc., which could impact on Council's services to the etc., which could impact on Council's services to the etc., which could impact on Council's services to the other and inspect on Council's services to the to the sailnisation of coastal freshwaters and the inrundation of mangroves which could cause damage/loss to the natural environment. An increase in sea level may cause possible soil contaminants to leach into groundwater resulting in changes to the physical and natural environment		& Assets	Land-use Planning & Development	Land-use Planning & Development
An increase in sea level may cause loss/damage to public property including Council assets due to erosion, re-alignment of shores, increased flooding, etc., which could impact on Council's services to the etc., which could impact on Council's services to the etc., which could impact on Council's services to the other and inspect on Council's services to the to the sailnisation of coastal freshwaters and the inrundation of mangroves which could cause damage/loss to the natural environment. An increase in sea level may cause possible soil contaminants to leach into groundwater resulting in changes to the physical and natural environment				
			×	×
		×		
SLAI6 SLDL7 SLDL8		An increase in sea level may cause loss/damage to public property including Council assets due to erosion, re-alignment of shores, increased flooding, etc, which could impact on Council's services to the public	An increase in sea level may impact water quality due to the salinisation of coastal freshwaters and the inundation of mangroves which could cause damage/loss to the natural environment	An increase in sea level may cause possible soil contaminants to leach into groundwater resulting in changes to the physical and natural environment
		SLAI6	SLDL7	SLDL8

64	64 Hornsby Shire Council	
Undertake further research and monitoring		Develop a community resilience program Adequately consider and assess financial implications of managing coastal hazard through coastal management planning
	High	High
	Moderate	Moderate
	Likely	Almost Certain
		2-Some Benefit
- Current planning controls		- Long term financial planning Development Contributions - Apply for grant funding
Land-use Planning & Development		Corporate Services
	×	×
An increase in sea level may cause uncertainty in decision making around coastal planning and development resulting in legal liability or loss of reputation		SLECO10 There is a risk that Council will not have the financial capacity to fund the works required in the future, including 1th development of identified strategies, and in managing the community expectations associated with the impacts of an increase in the sea level.
SLEL9		SLECO10

ATTACHMENT 5 - ITEM

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	Future Adaptations (for risk rated HIGH and EXTREME)	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	1) Investigate mapping of all trees in public areas with condition assessment (inventory) 2) Prioritisation of risk areas 3) Proactive inspection and maintenance maintenance states and a seconsider surrounding precinct not just built asset 5) Implement Urban Forest Strategy (including appropriate species selection) 6) Implement Biodiversity Conservation Management Plan 7) CRM system to link with Asset 77 CRM system to link wi	Hornsby Plan
	Risk	Medium	High	
Risk Rating	Consequence	Minor	Major	
	Likelihood	Likely	Possible	
	Adequacy of Controls	2-Some Benefit	2-Some Benefit	
	Current Controls	- Proactive maintenance asset management, - Flood risk management plan, - Land use planning, - Safety by design in new assets.	- Around Council's built assets there is proactive maintenance of trees Some informal monitoring of park assets CRM system used to respond to customer complaints Insurance Disaster Relief Funding.	
	Functional	Emergency Mgt & Natural Disaster preparedness	Emergency Mgt & Natural Disaster preparedness	
ability to:	D - Physical and Natural Environment E - Sound Public Administration and Governance			
Will impact in our ability to:	C - Protect Community Structures and Lifestyle	×		
m i	B - Protect and Enhance Local Economy			
8	yfels Salduq nisintsim - A		×	
	Rainfall extremes are projected to increase in the near future (by 2030) and the far future (by 2070). The increases in the near future are not considered to be significant. However, in the far future, significant increases in several rainfall indices are projected for some regions of NSW. 2010 Scenario - There is a risk that the number of days annually when the total rainfall is defined as 1 in 40-year intensity will change by -3% and 12% by 2030 and -7% and +10% by 2070.	An increase in the number of extreme rainfall/storm events may increase the risk of damage to Council, private assets and infrastructure which will affect Council Services	An increase in the number of extreme rainfall/storm events may cause loss/damage to public property induding loss/damage to to fallen trees, accidents due to intense rain periods, etc, which could impact on Council's services to the public	
Risk ID		ERCE1	ERAE2	

66 Hornshy Shire Council	
1) Implement Flood Planning and Mitigation 2) Work with other Councils to improve upstream development 3) Participate in Hawkesbury River Flood Management Studies 4) Implement Water Sensitive Homsby Strategy (sensitivity analysis) 5) Deploy flow gauges 6) Update Development Control Plan 7) Investigate Onsite Stormwater Detention requirements and landscaped area review based on size of development RNR works 9) Continue to implement CRR works 9) Develop catchment spedific targets - sub catchment amanagement plans 10) investigate resourcing of enforcement and compliance to enable proadtive inspection regimes of development sites (appropriate and maintained sediment and erosion control measures)	1) Review Councils flood planning and control measures 2) OSD requirements and landscaped area review based on size of development 3) Investigate resourcing of enforcement and compliance to enable proactive inspection regimes of development sites 4) Extreme erosion index 5) Utilise data to improve planning controls for reduction of stream erosion 6) Maintain water quality monitoring program 7) Implement Eco health (riparian areas) 8) Proactive capital works to milgate erosion in creeks 9) Implement Biodiversity Conservation Management Plan and Water Sensitive Hornsby Strategy
High	I E G
Moderate	Moderate
Likely	Likely
2-Some Benefft	2-Some Benefft
- WSUD, - Stormwater detention - Planning controls - Water quality monitoring buoys in the river	- Existing capital works program, - Conditions of consent
& Assets	Assets & Assets
×	×
An increase in the number of extreme rainfall/storm events may cause variations in environmental flows which may affect the natural ecosystems	An increase in the number of extreme rainfall/storm events may cause increased rates of erosion which may result in surface runoff and stormwater pollution, affecting the natural and physical environment within the Hornsby Shire
ERDI3	ERDI4

				Climate Wise Hornsby Pla
Undertake Groundwater assessment Subdate DCP to include groundwater report for developments doing excavations 3) Layer on Intramaps of contaminated sites. Review DCP controls for water quality	Participate in local emergency response and clean-up Investigate development of community resilience program including proactive communications of storm events Work with local oyster farmers to monitor the impact on harvesting	Proactive maintenance of assets	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	1) Record Sydney Water notifications for bypass and overflow 2) Quantify impact and report on licensing conditions 3) Lobby Sydney Water and EPA about licensing and to upgrade facilities 4) Investigate resource for enforcement and compliance to underfake proactive management of onsite waste water treatment systems 5) Consider fees and charges for inspection regimes (lost recovery) 6) Update OSSM Strategy to incorporate proactive inspection regime (lost regime) for underfake proactive inspection regime (lost recovery) 6) Update OSSM Strategy to incorporate proactive inspection regime (lost regime) for mapove)
High	High	High	Medium	High
Moderate	Minor	Minor	Minor	Minor
Likely	Almost Certain	Almost Certain	Possible	Almost Certain
2-Some Benefft	2-Some Benefft	2-Some Benefit	2-Some Benefft	2-Some Benefit
- Planning certificates	- Local emergency response and clean up	- Proactive maintenance of assets	- Public notifications on transport delays Proactive maintenance regimes for Council assets Insurance	- Licensing - Public notifications - Water quality monitoring sensors - Conditions of consent - Proactive investigation of source pollution (bacto)
Infrastructure & Assets	Emergency Mgt & Natural Disaster preparedness	Community Services	Infrastructure & Assets	Assets
*		×		×
			×	
	×			
An increase in the number of extreme rainfall/storm events may cause possible soil contaminants to leach into groundwater resulting in changes to the physical and natural environment	An increase in the number of extreme rainfall/storm events may cause an increased risk to the general safety of the community	An increase in the number of extreme rainfall/storm events may cause a reduction in the use of certain Council facilities due to water related damage or threat	An increase in the number of extreme rainfall/storm events may cause (oss/damage to transport infrastructure (including roads, wharfs, jetties, train lines and bridges) affecting Council assets, businesses, residents and general commuters within the Hornsby Shire	An increase in the number of extreme rainfall/storm events may impact the water equality of water catchments within Homsby Shire due to surface runoff and sewer overflows, onsite waste water treatment systems entering the stormwater system and affecting creeks, wildlife and the natural environment
ERCIS	ERAE6	ERCCS 7	ERBI8	ERDI9

68 Hornsby Shire Council		I	
1) Education 2) Provide residents with recommended trees species list 3) implement Urban Forest Strategy - share species lists as part of conditions of consent 4) Tree protection plans for new developments 5) Update LEP and ensure Council undertakes adequate flood planning activities in line with the NSW Flood Prone Lands Policy with regards to Flood Mapping. 6) Advocate/ lobby state govt to require private certifiers to certify landscape plans 7) Investigate resource to continuing monitoring of landscape plans 8) Implement Water Sensitive Homsby Strategy	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	Emergency response communications Proactive updates to Councils website and social media to inform residents on actions Nuvestigate development of community resilience program
Extreme	Medium	Medium	High
Major	Minor	Minor	Moderate
Almost	Likely	Likely	Likely
2-Some Benefft	2-Some Benefit	2-Some Benefit	
- Planning controls and conditions of consent, - Education on tree selection	- Disaster relief funding, - Support local emergement (as per management (ire financial support)	- Asset management planning, - Readive response	
Emergency Mgf & Natural Disaster preparedness	Corporate Services	& Assets	Emergency Mgt & Natural Disaster preparedhess
	×	×	
			×
×			
An increase in the number of extreme rainfail/storm events may cause loss/damage to private property due to possible flooding, fallen tree branches, etc, affecting residents and businesses	An increase in the number of extreme rainfall/storm events may cause an increased strain on Emergency Services (RFS and SES) possibly resulting in an increased strain on Coundi's resources	An increase in the number of extreme rainfall/storm events may increase the risk of loss of public utility services (electricity, water, gas, telecommunications, etc) which will cause for power outages/interruptions to Council buildings and services caused by damage to electricity suppliers' infrastructure during periods of extreme rainfall periods and impacting on air-conditioning, communications, equipment, IT, lighting, etc	An increase in the number of extreme rainfall/storm events may increase the risk of loss of public utility services (electricity, water, gas, telecommunications, etc) which will cause for power outages/interruptions to private properties and businesses
ERAE 10	11	EREI12	ERBE13

1) Proactive Asset Management Plans (AMPs) 2) Map current vulnerability, and AMPs review to include assessment of risks from landslips and landslides 3) Additional submission requirements for developments assessments relating to allapidation reports and construction vehicle plans of management Plans to the Asset Management Plans to incorporate climate change projections and risk assessment	Investigate development of community resilience program Seducation on emergency management plans and Hornsby Local Emergency Plan (smaller and larger plans) Asset Management Plans to incorporate climate change projections and risk assessment	1) Investigate employment of a Grants Officer 2) Investigate alternative funding sources for Climate Change sources for Climate Change possible to the source of the sourc	1) Additional effort to reinforce the value of tees in the community and account of the contact
High	High	H Egi	High
Major	Major	Moderate	Minor
Possible	Possible	Almost	Almost Certain
2-Some Benefit		2-Some Benefit	2-Some Benefit
- Risk assessments undertaken on vulnerable assets, - Asset management system - Conditions assessments	- Resource emergency services (as Forest Fire Index) - Mapping of steep land - Notified via planning certificates	- Long term financial planning - Development Contributions - Apply for grant funding	- Community education on benefits of trees, - Insurance
& Assets	Emergency Mgt & Natural Disaster preparedness	Corporate Services	Land-use Planning & Development
		×	
			×
×	×		
An increase in the number of extreme rainfall/storm events may increase damage to properties, roads and bridges from landslips and landslides	An increase in the number of extreme rainfall/storm events may increase damage to private properties, roads and bridges from landslips and landslides	There is a risk that Council will not have the financial capacity to fund the works required in the future, including: the development of identified strategies, and in managing the community expectations associated with the impacts of an increase in the number of extreme rainfall/storm events.	An increase in the number of extreme rainfall/storm events increases negative public perception of the risks of trees and bushland on public and private land, result in increased clearing of trees.
ERAI14	ERAE 15	16 16	ERDL17

70 Horn	sby Shire Council		
All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified	All risks including low and medium risks are to be reviewed on a regular basis to ensure any new impacts or risks are identified. 1) Development of Emergency Management and Community Resilience Plan including community resilience programs 2) Opening Council facilities during times of orlsis as a refuge	Undertake community resilience programs, including proactive communications of health warnings Strengthen relationships with BOM and Local District Health Services
Medium	Medium	Medium	High
Minor	Minor	Minor	Major
Possible	Likely	Likely	Possible
	- Drop off centre established at Community Recycling Centre for spoiled food	Council opened libraries and aquatic centres for showers and charging devices	
Emergency Mgt & Natural Disaster preparedhess	Corporate Services	Emergency Mgt & Natural Disaster preparedhess	Community Services
×	×	×	×
An increase in the number of extreme storm events may cause increased risk of damage to infrastructure or wild fires due to lightning strike.	An increase in the number of extreme rainfall storm events may cause an increased pressure on waste services as a result of storm.	An increase in the number of extreme rainfall' storm events may cause an increased demand for use of council facilities as refuges and for access to electricity and water	An increase in the number of extreme rainfall, storm events may cause an increased impact on public health (asthma etc) due to storm events
ERAE 18	ERACO 19	ERAE20	ERACS 21

13 References and Further Resources

AdaptNSW (2020). NSW Government Action on Climate Change. Retrieved 20 February, 2020 from: https://climatechange. environment.nsw.gov.au/About-climate-change-in-NSW/NSW-Government-action-on-climate-change

Aurecon (2009) Hornsby Shire Council Climate Change Adaptation Strategic Plan

Australian Bureau of Statistics (2016) Census Data. Retrieved 20 February, 2020 from: https://quickstats.censusdata.abs.gov.au/ census_services/getproduct/census/2016/quickstat/ LGA14000?opendocument

Australian Government (2015) Australia's 2030 climate change target. Department of Agriculture, Water and the Environment. Retrieve 20 February, 2020 from: https://www.environment.gov. au/climate-change/publications/factsheet-australias-2030-climatechange-target

Australian PV Institute (2020) Mapping Australian Photovoltaic Installations, Retrieved 12 May 2020 from https://pv-map.apvi. org.au/historical#10/-33.7791/151.1005

Australian Government (2015) National Climate Resilience and Adaptation Strategy. Retrieved 20 February, 2020 from https:// www.environment.gov.au/climate-change/adaptation/strategy

CSIRO and Bureau of Meteorology (2007) Climate Change in Australia. Australian Climate Change Science Programme. Retrieved 20 February, 2020 from: http://ccia2007. climatechangeinaustralia.gov.au/documents/resources/ Summary_brochure.pdf

Greater Sydney Commission (2018) Greater Sydney Region Plan: A Metropolis of Three Cities - connecting people. Retrieved 20 February 2020 https://www.greater.sydney/metropolis-of-threecities

Greater Sydney Commission (2018) Our Greater Sydney 2056: North District Plan - connecting communities. Retrieved 20 February 2020 from https://www.greater.sydney/north-districtplan

Hornsby Shire Council (2017) Enterprise Risk Management Determination, 2017

Hornsby Shire Council (2020) Waste Matters Strategy, https:// www.hornsby.nsw.gov.au/__data/assets/pdf_file/0016/147112/ Final-Waste-Matters-Strategy-Report-Digital.pdf

.id community. (2018). Hornsby Shire Council Community Profile. Retrieved 20 February, 2020 from: https://profile.id.com.au/ hornsby

ICLEI Local Governments for Sustainability. Retrieved 20 February 2020 https://iclei.org/

Ironbark Sustainability (2019) Hornsby Shire Council Corporate Greenhouse Gas Emissions Inventory

Ironbark Sustainability (2019) Science Derived Targets for Greenhouse Gas Emissions

International Panel on Climate Change (IPCC). (n.d) IPCC website. Retrieved 20 February, 2020 from: https://www.ipcc.ch/ International Panel on Climate Change (IPCC). (2007) AR4 Climate Change 2007: Synthesis Report. Retrieved 20 February, 2020 from: https://www.ipcc.ch/report/ar4/syr/NSW Government, Office of Environment and Heritage. (2013). Metropolitan Sydney Climate change snapshot.

Intergovernmental Panel on Climate Change (2018) Special Report: Global Warming Of 1.5OC. Accessed at: https://www. ipcc.ch/sr15/

International Panel on Climate Change (IPCC), 2019: Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. In press.

Jardine Lloyd Thompson (2019) Climate Change Risk Assessment Adaptation Report.

JOC Consulting, 2019, Local Strategic Planning Statement Community Engagement Outcomes Report

National Climate Change Adaptation Research Facility (NCCARF), 2021, Coast Adapt, Retrieved 6 January 2021 from https:// coastadapt.com.au/pathways-approach

Office of Environment and Heritage, 2016, website, retrieved 9 March 2020 from: https://www.environment.nsw.gov.au/-/media/ OEH/Corporate-Site/Documents/Climate-change/achieving-netzero-emissions-by-2050-fact-sheet-160604.pdf

Preston et al (2008) Mapping Climate Change Vulnerability in the Sydney Coastal Councils Group. Prepared for the Sydney Coastal Councils Group and the Australian Government Department of Climate Change

Resilient Sydney (2018). Resilient Sydney - A Strategy for City Resilience 2018. Retrieved 20 February, 2020 from: https://www. cityofsydney.nsw.gov.au/vision/sustainable-sydney-2030/ resilient-sydney

Smith, T., A. Leitch, and D. Thomsen, 2016: Community Engagement. CoastAdapt Information Manual 9, National Climate Change Adaptation Research Facility, Gold Coast.

United Nations. (n.d.) Sustainable Development Goals. Retrieved 20 February, 2020 from: https://sustainabledevelopment.un.org/

United Nations / Framework Convention on Climate Change (2015) Adoption of the Paris Agreement, 21st Conference of the Parties, Paris: United Nations

United Nations Climate Change (2020). The Paris Agreement. Retrieved 20 February, 2020 from: https://unfccc.int/processand-meetings/the-paris-agreement/the-paris-agreement

World Green Building Council. (n.d.). Website. Retrieved 27 February, 2020 from: https://www.worldgbc.org/ thecommitment

NEED HELP?

This document contains important information. If you do not understand it, please call the Translating and Interpreting Service on 131 450. Ask them to phone 9847 6666 on your behalf to contact Hornsby Shire Council. Council's business hours are Monday to Friday, 8.30am-5pm.

Chinese Simplified

需要帮助吗?

本文件包含了重要的信息。如果您有不理解之处,请致电131 450联系翻译与传译服务中心。请他们代您致电9847 6666联系Hornsby郡议会。郡议会工作时间为周一至周五,早上8:30 - 下午5点。

Chinese Traditional

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German

Brauchen Sie Hilfe?

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Hindi

क्या आपको सहायता की आवश्यकता है?

इस दस्तावेज़ में महत्वपूर्ण जानकारी दी गई है। यदि आप इसे समझ न पाएँ, तो कृपया 131 450 पर अनुवाद और दुभाषिया सेवा को कॉल करें। उनसे हॉर्न्सवी शायर काउंसिल से संपर्क करने के लिए आपकी ओर से 9847 6666 पर फोन करने का निवेदन करें। काउंसिल के कार्यकाल का समय सोमवार से शुक्रवार, सुबह 8.30 बजे-शाम 5 बजे तक है।

Korean

도움이 필요하십니까?

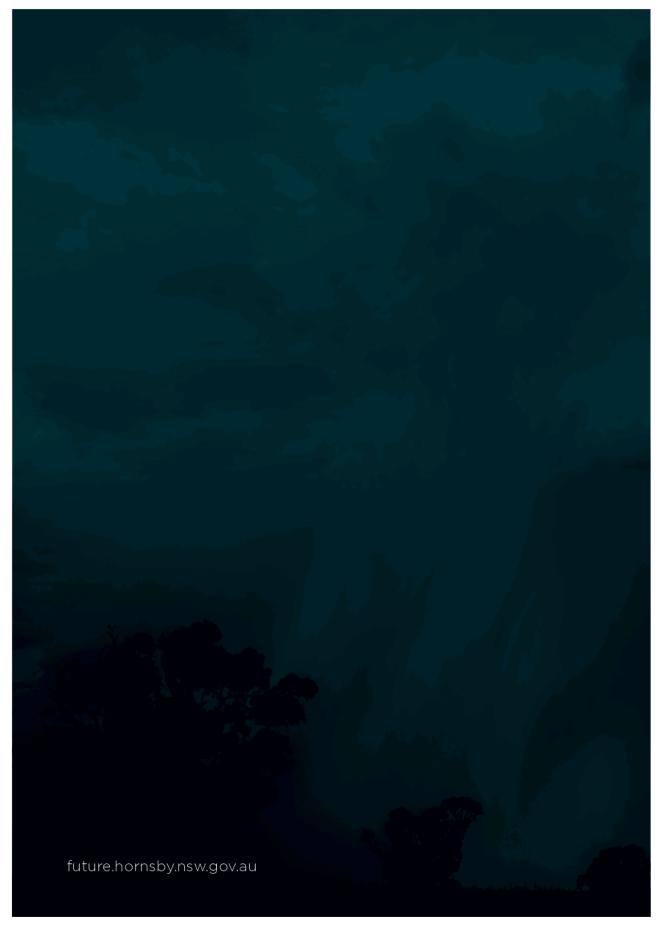
본 문서에는 중요한 정보가 포함되어 있습니다. 이해가 되지 않는 내용이 있으시면, 통역번역서비스(Translating and Interpreting Service)로 전화하셔서(131 450번) 귀하를 대신하여 혼즈비 셔 카운슬에 전화(9847 6666번)를 걸어 달라고 요청하십시오. 카운슬의 업무시간은 월요일~금요일 오전 8시 30분~오후 5시입니다.

Tagalog

Kailangan ng tulong?

Itong dokumento ay naglalaman ng mahalagang impormasyon. Kung hindi ninyo naiintindihan, pakitawagan ang Serbisyo sa Pagsasalinwika at Pag-iinterprete (Translating and Interpreting Service) sa 131 450. Hilingin sa kanilang tawagan ang 9847 6666 para sa inyo upang kontakin ang Hornsby Shire Council. Ang oras ng opisina ng Council ay Lunes hanggang Biyernes, 8.30n.u.-5n.h.





Strategy Amendments

Sustainable Hornsby 2040

Amendments consistent with those identified below for supporting strategies.

Biodiversity Conservation Strategy

Action ID	Action	Amendment
1.2.2	Assess opportunities for the establishment and preservation of buffer zones around TECs, threatened species, remnant vegetation and riparian zones across the Shire	Medium to High priority action
1.2.3	Identify mechanisms to inform residents of significant biodiversity features and remnant vegetation on their land	Medium to High priority action
1.2.9	Maintain green wall and roof provisions for new developments/retrofits	Medium to High priority action
1.3.2	Prepare guidelines and identify special incentives to prioritise biodiversity on private lands	Reword second KPI to: 'Guidelines and incentives prepared to support biodiversity conservation on private lands including habitat for wildlife, pools to ponds and backyard bees program'
1.4.1	Assess core, transition and key corridor areas to target management actions that reduces edge effects, and supports-biodiversity enhancement	Medium to High priority action
1.4.2	Prepare strategies that reduce edge effect impacts for biodiversity and wildlife	Medium to High priority action
1.4.3	Assess 'dark sky' policies and develop measures to limit light pollution disturbance to wildlife	Low to Medium priority action
1.5.2	Prepare biodiversity adaptation strategy to minimise climate impacts through policy, planning instruments and operational activities	Remove the following KPI: 'Assess translocation, reintroduction of species/communities e.g. Koalas in areas previously inhabited (includes post-introduction monitoring)'
1.5.2	Prepare biodiversity adaptation strategy to minimise climate impacts through policy, planning instruments and operational activities	Medium to High priority action
1.5.3	Maintain seed banking program	Remove the following KPI: 'Consider fire management implications from a biodiversity perspective'
1.5.3	Maintain seed banking program	Reword KPI 'Maintain seed bank that is viable, comprehensive and representative of the LGA's species/communities
1.6.1	Prepare biodiversity monitoring program for council managed lands (as part of a wider Natural Resources Monitoring Program)	Amend KPI to: -'Trends in presence, absence and abundance of common, threatened, migratory and feral species'

1.6.6	Establish a monitoring program for fire related activities	Medium to High priority action
1.6.7	Assess the condition and biodiversity value of roadside vegetation	Medium to High priority action
1.6.8	Identify keystone species distribution to guide	Amend KPI to 'Keystone species
	bushland management prioritisation	presence identified to inform remnant
		vegetation policy'
1.6.9		Add additional action in Action 1.6.9:
		Assess presence of migratory species
		and manage potential habitat accordingly
		- Medium
2.1.4		Add additional action 2.1.4: 'Assess
		benefits and impacts of GIF on
		biodiversity'
		Include the following KPIs:
		- benefits and impacts of GIF on flora and
		fauna assessed
		- consider ecological guilds and focus
		species in corridor implementation
2.3.2	Maintain collaboration with partner land managers	Add new KPI (and include first): 'Consider
	and fire agencies to facilitate best practice bushfire	biodiversity conservation goals in fire
	management on a landscape scale	planning, management and hazard
		reduction activity'
2.4.1	Prepare a Natural Areas Recreational Strategy	Amend KPIs to: Natural Areas
		Recreational Strategy prepared to
		support:
		- diverse nature-based recreation
		opportunities are available and accessible
		- community connections with nature
		through participation in sustainable
		nature-based recreation
		- environmental protection through well
		managed nature-based recreation
		- community awareness of the cultural
		heritage significance within the Shire's
		natural areas.
		natural areas.

Urban Forest Strategy

Action ID	Action	Amendment
2.06.1	Develop relevant LEP standards (Part 4 of the standard LEP	Medium to High priority action
	template) to support the protection and management of	
	existing canopy trees and future canopy planting within	
	relevant land use zones and consistent with local character	
	statements	
2.07.1	Revise and develop DCP provisions to reinforce the	Medium to High priority action
	hierarchy of protecting, restoring and creating canopy	

	across the local government area consistent with local	
	character statements, tree canopy targets and district	
	planning directions.	
2.08.1	Identify state policies and planning instruments that provide	Medium to High priority action
	significant hurdles to delivering better urban forest outcomes	
	on the ground. These include, but are not limited to:	
	- State Environmental Planning Policy	
	- 10/50 Bushfire Clearance Entitlements	
	- Housing targets	
	- Electrical Line Clearance Regulation	
2.08.2	Engage with relevant state government agencies to lobby	Medium to High priority action
	for policy and planning instrument change because of	
	inconsistencies with greener city objectives as stated in the	
	District Plans and Council strategies.	
2.09.2	Develop a tree canopy policy to support the LEP and DCP if	Medium to High priority action
	its determined that the focus of that Green Offset Policy	
	remains primarily biodiversity	
2.10.1	Review compliance procedures in a wholistic manner across	Medium to High priority action
	the Organisation, to support statutory planners and	
	compliance officers in their ability to audit, enforce conditions of consent and seek prosecution for breaches	
2.14.1	Develop development guidelines that include lot scale green	Medium to High priority action
	infrastructure outcomes.	
2.16.1	Develop ongoing media and communications pieces talking to the issue of tree canopy loss on private property and what	Medium to High priority action
	community member can do about it.	
3.1.2	Incorporate the Urban forest Strategy targets into Council's	Medium to High priority action
	operational and delivery plan programs and projects.	
3.8.1	Engage and partner with the Guringai and Darug people to raise knowledge and awareness surrounding the cultural	Medium to High priority action
	value of Hornsby's trees.	
3.8.2	Explore partnerships to develop an indigenous history of	Medium to High priority action
4.40.4	Hornsby's trees identify culturally significant trees.	
1.19.1		Add additional action – 1.19.1 - Explore options design options
		where existing and proposed
		street trees can be provided in
		conjunction with expanded pathways.
3.10.1		Add additional action – 3.10.1 -
		Explore issues and confirm policy
		position regarding trees (existing
		and proposed) with solar panels

Water Sensitive Hornsby Strategy

Action ID	Action	Amendment
4.4.3		Add additional action - 4.4.3
		Assess Council projects and
		external proposals for compliance
		with water sensitive urban design
		requirements
5.2.3		Add additional action - 5.2.3
		Implement asset maintenance

		and renewal of water sensitive
		projects to ensure ongoing
		performance and effectiveness
5.2.2	Identify opportunities for water sensitive solutions through	Identify and implement
	council works projects at the street, park and sub-	opportunities for water sensitive
	catchment scale	solutions through council works
		projects at the street, park and
		sub-catchment scale
5.1.2	Use tools to quantify multiple benefits and develop	Use tools to quantify multiple
	business cases for water sensitive solutions.	benefits and develop business
		cases for water sensitive
		solutions, including the
		investigation of alternative water
		sources
4.5.1	Review and adopt planning policies that elevate water	Review and adopt planning
	management in planning decisions	policies, including targets, that
		elevate water management in
		planning decisions
3.1.2	Review Council's website to ensure water sensitive	Review Council's website to
	resources are available and accessible	ensure water sensitive resources
		(e.g. education, guidelines,
		references) are available and
		accessible
1.3.2	Develop targeted awareness campaigns for developers	Develop targeted awareness
	and residents that showcase the benefits of protecting the	campaigns for developers,
	health of the environment (e.g. property values, business	business and residents that
	opportunities, health benefits)	showcase the benefits of
		protecting the health of the
		environment (e.g. property
		values, business opportunities,
		health benefits)
4.1.1	Understand and map existing behaviours among	Understand and map existing
	community and developers related to water quality	behaviours among community,
		business and developers related
		to water quality
2.1.3	Promote business opportunities in relation to recreational	Promote business opportunities
	water activities	in relation to recreational water
		activities and tourism

Action ID	Action	Amendment
1.7	Purchase of green power or renewable energy through electricity contract 20%, 50%, 100%	Medium to High priority action
1.14	Conduct fleet review to optimise and reduce emissions by changing over to hybrid and/ or electric vehicles for Council owned vehicles, where financially feasible.	Medium-Low to High priority action

1.17		Add additional action 1.17 - Implement Council's Waste Matters Strategy - High
1.18		Add additional action 1.18 - Review, update and implement Council's Sustainable Procurement Determination - High
1.19		Add additional action 1.16 - Work with Council's contractors to minimise their carbon emissions and report accurately - High
2.6	Work with the community to determine the viability of a community solar farm	Medium-Low to High priority action
2.9	Produce a GIS layer of houses within the Shire with rooves unaffected by trees and target solar information to these households	High -Medium to High priority action
2.10	Advocate to developers for buildings designed to achieve low energy properties and precincts above planning policy regulations	Medium to High priority action
2.11	Lobby State Government to increase BASIX requirements	High-Medium to High priority action

Urban Forest Strategy

Action ID	Action	Amendment
1.27	Provide options for street trees and shared pathways. Explore options where existing and proposed street trees can be provided in conjunction with expanded pathways.	Inserted new High priority action
2.07	Review current LEP and DCP controls, with a particular focus on setbacks to enable canopy retention and planting, for exempt and complying development.	Added words Current LEP and DCP
2.10	Develop relevant LEP standards (Part 4 of the standard LEP template) to support the protection and management of existing canopy trees and future canopy planting within relevant land use zones and consistent with local character statements (Refer to Appendix 1 for details)	Medium to High priority action
2.11	Review current DCP provisions to consider the hierarchy of protecting, restoring and creating canopy across the local government area consistent with local character statements, tree canopy targets and district planning directions.	Amended wording to Review current DCP. Changed to a High priority action
2.12	Review and identify state policies and planning instruments that provide significant hurdles to delivering better urban forest outcomes on the ground. These include, but are not limited to: - State Environmental Planning Policy - 10/50 Bushfire Clearance Entitlements - Housing targets - Electrical Line Clearance Regulation	Amended wording to "Review and identify" Medium to High priority action
2.13	Engage with relevant state government agencies to lobby for policy and planning instrument change because of inconsistencies with greener city objectives as stated in the District Plans and Council strategies.	Medium to High priority action

2.15	Develop a tree canopy policy to support the LEP and DCP if its determined that the focus of that Green Offset Policy remains primarily biodiversity	Medium to High priority action
2.16	Review compliance procedures in a holistic manner across the Organisation, to support statutory planners and compliance officers in their ability to audit, enforce conditions of consent and seek prosecution for breaches.	Medium to High priority action
2.23	Develop development guidelines that include lot scale green infrastructure outcomes.	Medium to High priority action
2.27	Develop case studies and education collateral	Medium to High priority action
3.1	Incorporate the Urban forest Strategy targets into Council's operational and delivery plan programs and projects.	Medium to High priority action
3.10	Engage and partner with the Guringai and Darug people to raise knowledge and awareness surrounding the cultural value of Hornsby's trees.	Medium to High priority action
3.11	Explore partnerships to develop an indigenous history of Hornsby's trees identify culturally significant trees.	Medium to High priority action
3.16	Develop Policy position regarding trees vs. solar panels. Explore issues and confirm policy position regarding trees (existing and proposed) with solar panels.	Inserted new High priority action

ATTACHMENT/S

REPORT NO. CS2/21

ITEM 2

- 1. JERSEY LANE EXTENSION CONCEPT DRAWINGS
- 2. PROPOSED BUS NETWORK FOR HORNSBY TOWN CENTRE













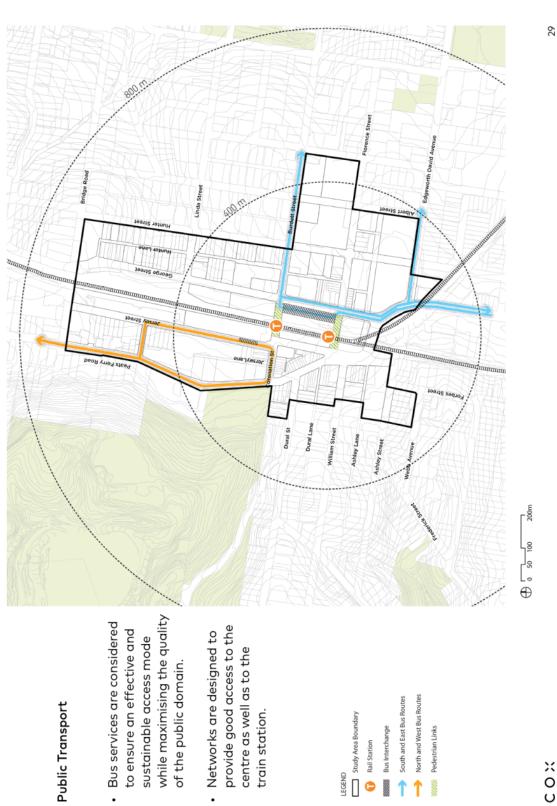




JERSEY LANE, HORNSBY PROPOSED EXTENSION TO JERSEY STREET SITE PHOTOS

Horneby Stive Council 288 Facilic Highway, Horneby FO Box 37, Horneby NSW 1630 Telephone 9847 5956 8 30am Spm Monday to Friday





HUNTER ST.

ITEM **ATTACHMENT 2 -**

30

Hornsby Town Centre Review

Movement and Place

PEATS FERRY RD. Public Transport Interchange

North Bus Services to West

side of Jersey St. north of interchange to eastern Northern Bus Services Coronation Street.

South and Eastern Bus Services to East

corridor and George Street Utilise space between rail alongside current station platform.

BURDETT ST. FLORENCE ST. GEORGE ST. SOUTH AND EAST BUS PICKUP AND DROP OFF NORTH AND WEST BUS PICKUP AND DROP OFF JERSEY ST. CORONATION ST. WILLIAM ST. DURAL ST.

× 0 0

ATTACHMENT/S

REPORT NO. CS8/21

ITEM 3

- 1. HSC BORROWINGS SCHEDULE 31 JANUARY 2021
 - 2. HSC INVESTMENTS SUMMNARY REPORT 31
 JANUARY 2021

ATTACHMENT 1 - ITEM 3

HORNSBY SHIRE COUNCIL SCHEDULE OF BORROWINGS AS AT 31 JANUARY 2021

1. LOANS			000.\$	\$.000	\$,000	\$.000	\$:000	000,\$
Lender	Date Drawn	Maturity Date	Amount Borrowed	01/07/2020 Opening Balance	New Loan	- "	Closing Balance	Fixed Interest Rate %
National Australia (50)	27-Jun-11	28-Jun-21	1,000	138		67	70	7.68
Westpac(51)	26-Jun-13	25-Jun-23	2,000	727		112	614	5.89
*T0TAL			3,000	864	0	180	684	6.07%

* Average weighted interest rate based on principal balances outstanding is

6.07%

Shall ichange the name from Macquarie Equipment Finance to Vestone Capital Pty Ltd

\$,000 100 42 348 83 768 Repaym 2020/202 237 \$,000 New 01/07/2020 138 25 128 4 1,005 51 411 53 95 Total Lease 2,334 109 444 545 242 632 32 22 15-Aug-22 15-Aug-22 15-May-23 15-Aug-22 15-Aug-23 15-May-24 15-May-23 15-Aug-21 15-Aug-20 15-Aug-22 15-Aug-23 15-Nov-21 15-Aug-18 22-Sep-17 15-Aug-18 15-Feb-19 15-May-19 Date Executed 15-Nov-18 15-Feb-19 23-Aug-19 15-Feb-20 restone Capital Pty Ltd - previously known as Macquarie Equipment Finance (113) estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (115) estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (114) (estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (109) restone Capital Pty Ltd - previously known as Macquarie Equipment Finance (105) restone Capital Pty Ltd - previously known as Macquarie Equipment Finance (108) estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (110) estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (111) estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (112) estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (116) estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (101) estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (103) estone Capital Pty Ltd - previously known as Macquarie Equipment Finance (106) restone Capital Pty Ltd - previously known as Macquarie Equipment Finance (107) TOTAL anon Finance Australia Pty Ltd **OPERATING LEASES**

3. DEBT SERVICE RATIO	Ratio %
Year ending Jun 20	0.61
Year ending Jun 19	0.78
Year ending Jun 18	1.08
Year ending Jun 17	1.73

 Year ending Jun 18
 1.08

 Year ending Jun 17
 1.73

 Debt Service Ratio
 Debt Service Cost

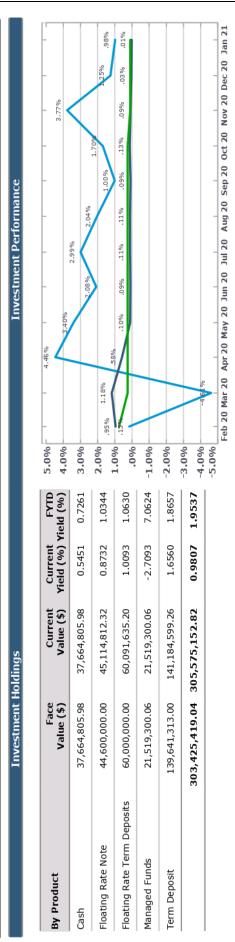
 Revenue from Continuing Operations excluding Capital Items & Specific Purpose Grants/Contributions

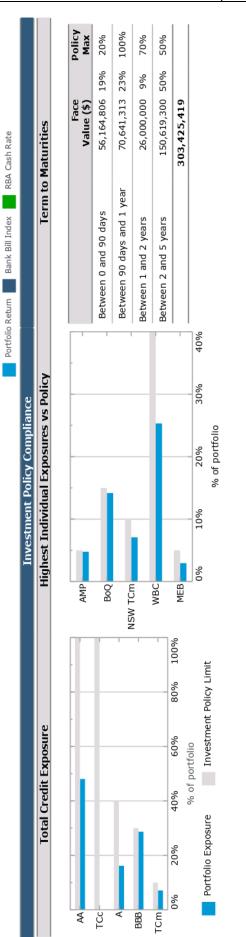


Investment Summary Report January 2021

ATTACHMENT 2 - ITEM 3

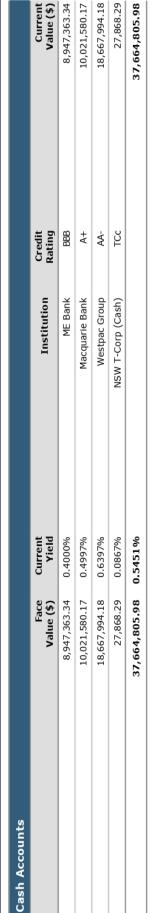
Hornsby Shire Council Executive Summary - January 2021







Investment Holdings Report - January 2021 **Hornsby Shire Council**



	Current Value (\$)	21,519,300.06	21,519,300.06	
	Fund Name	Medium Term Growth Fund		
	Credit Rating	TCm		
	Institution	NSW T-Corp (MT)		
	Current Yield	-2.7093%	-2.7093%	
	Face Value (\$)	21,519,300.06	21,519,300.06	
Managed Funds				

Term Deposits	ts							
Purchase Date	Maturity Date	Term Days	Face Value (\$)	Rate	Institution	Credit Rating	Book Value (\$)	Current Value (\$)
30-Jan-19	3-Feb-21	735	3,000,000.00	2.9000%	Bank of Queensland	BBB+	3,000,000.00	3,000,715.07
12-Aug-20	10-Feb-21	182	2,000,000.00	0.8000%	Bank of Queensland	BBB+	2,000,000.00	2,007,583.56
28-Feb-19	17-Feb-21	720	4,000,000.00	2.8100%	Rural Bank	BBB+	4,000,000.00	4,104,393.42
27-Feb-19	24-Feb-21	728	2,000,000.00	3.0000%	Defence Bank	888	2,000,000.00	2,055,890.41
14-0ct-19	7-Apr-21	541	2,500,000.00	1.6000%	AMP Bank	888	2,500,000.00	2,512,054.79
14-Oct-20	14-Apr-21	182	5,000,000.00	0.5500%	National Australia Bank	AA-	5,000,000.00	5,008,287.67
10-May-18	12-May-21	1098	3,000,000.00	3.2000%	Bank of Queensland	BBB+	3,000,000.00	3,069,961.64
19-Jun-19	12-May-21	693	5,000,000.00	2.3000%	Westpac Group	AA-	5,000,000.00	5,071,520.55
19-Jun-19	19-May-21	700	5,000,000.00	2.3000%	Westpac Group	AA-	5,000,000.00	5,071,520.55
3-Jun-19	2-Jun-21	730	5,000,000.00	2.2400%	Bank of Queensland	BBB+	5,000,000.00	5,074,564.38
12-Jun-19	16-Jun-21	735	3,000,000.00	2.2000%	Westpac Group	AA-	3,000,000.00	3,042,312.33





Hornsby Shire Council Investment Holdings Report - January 2021

Term Deposits	ts							
Purchase Date	Maturity Date	Term Days	Face Value (\$)	Rate	Institution	Credit Rating	Book Value (\$)	Current Value (\$)
9-Sep-20	8-Sep-21	364	3,000,000.00	0.7800%	National Australia Bank	AA-	3,000,000.00	3,009,295.89
19-0ct-20	19-0ct-21	365	50,000.00	0.6000%	Westpac Group	AA-	50,000.00	50,086.30
27-Nov-19	17-Nov-21	721	2,000,000.00	1.6000%	ING Bank (Australia)	A	2,000,000.00	2,005,786.30
17-Nov-20	17-Nov-21	365	12,000,000.00	0.5900%	Commonwealth Bank of Australia	AA-	12,000,000.00	12,014,741.92
18-May-20	21-Nov-21	552	2,500,000.00	1.4500%	AMP Bank	BBB	2,500,000.00	2,525,722.60
27-Nov-19	23-Nov-21	727	2,000,000.00	1.6000%	ING Bank (Australia)	A	2,000,000.00	2,005,786.30
27-Nov-19	24-Nov-21	728	3,000,000.00	1.6000%	ING Bank (Australia)	A	3,000,000.00	3,008,679.45
19-Nov-20	1-Dec-21	377	2,500,000.00	0.6000%	Westpac Group	AA-	2,500,000.00	2,503,041.10
1-Dec-20	1-Dec-21	365	10,000,000.00	0.5900%	Commonwealth Bank of Australia	AA-	10,000,000.00	10,010,021.92
16-Dec-20	15-Dec-21	364	3,000,000.00	0.5500%	Bank of Queensland	BBB+	3,000,000.00	3,002,124.66
15-Dec-20	15-Dec-21	365	91,313.00	0.3500%	Westpac Group	AA-	91,313.00	91,355.03
5-Feb-20	9-Feb-22	735	3,000,000.00	1.6500%	ING Bank (Australia)	A	3,000,000.00	3,049,093.15
12-Feb-20	14-Feb-22	733	5,500,000.00	1.6000%	Westpac Group	AA-	5,500,000.00	5,585,589.04
22-Feb-19	22-Feb-22	1096	3,000,000.00	3.0500%	Newcastle Permanent Building Society	888	3,000,000.00	3,085,984.93
8-Jul-20	8-Jul-22	730	2,500,000.00	1.2000%	AMP Bank	BBB	2,500,000.00	2,517,095.89
12-Aug-20	10-Aug-22	728	3,000,000.00	1.0000%	Bank of Queensland	BBB+	3,000,000.00	3,014,219.18
9-Sep-20	7-Sep-22	728	4,000,000.00	0.9500%	Bank of Queensland	BBB+	4,000,000.00	4,015,095.89
26-Sep-19	21-Sep-22	1001	5,000,000.00	1.8000%	Bank of Queensland	BBB+	5,000,000.00	5,121,808.22
14-Sep-20	15-Mar-23	912	5,000,000.00	1.0000%	Bank of Queensland	BBB+	5,000,000.00	5,019,178.08
24-Sep-20	29-Mar-23	916	5,000,000.00	0.9500%	Bank of Queensland	BBB+	5,000,000.00	5,016,917.81
1-0ct-20	4-0ct-23	1098	5,000,000.00	0.9500%	Bank of Queensland	BBB+	5,000,000.00	5,016,006.85
19-Mar-19	6-Mar-24	1814	10,000,000.00	3.0000%	Rabobank Australia	A+	10,000,000.00	10,262,191.78



ATTACHMENT 2 -





Term Deposits	S							
Purchase Date	Maturity Date	Term Days	Face Value (\$)	Rate	Institution	Credit Rating	Book Value (\$)	Current Value (\$)
19-Mar-19	13-Mar-24	1821	9,000,000.00	3.0000%	Rabobank Australia	A+	9,000,000.00	9,235,972.60
			139,641,313.00	1.6560%			139,641,313.00	141,184,599.26

Floating Rate Term Deposits	Term Depos	its						
Purchase Date	Maturity Date	Term	Face Value (\$)	Current Rate	Security Name	Credit Rating	Book Value (\$)	Current Value (\$)
3-Sep-18	3-Sep-23	1826	15,000,000.00	1.0000%	Westpac Group BBSW+0.98%	AA-	15,000,000.00	15,024,657.53
4-Sep-18	4-Sep-23	1826	15,000,000.00	1.0166%	ANZ Banking Group BBSW+1.00%	AA-	15,000,000.00	15,024,649.07
10-Sep-18	11-Sep-23	1827	15,000,000.00	1.0000%	Westpac Group BBSW+0.98%	AA-	15,000,000.00	15,021,780.82
12-Sep-18	12-Sep-23	1826	15,000,000.00	1.0204%	ANZ Banking Group BBSW+1.00%	AA-	15,000,000.00	15,020,547.78
			60,000,000.00	1.0092%			00'000'000'09	60,091,635.20

Floating Rate Notes	Notes							
Purchase Date	Maturity Date	Term	Face Value (\$)	Current Rate	Security Name	Credit Rating	Book Value (\$)	Current Value (\$)
10-Sep-18	10-Sep-21	1096	7,000,000.00	1.1000%	AMP Snr FRN (Sep21) BBSW+1.08%	BBB	7,000,840.00	7,022,590.82
19-0ct-18	19-Jan-22	1188	2,500,000.00	1.0219%	BEN Snr FRN (Jan22) BBSW+1.01%	BBB+	2,512,350.00	2,520,609.91
26-Sep-18	26-Sep-23	1826	9,000,000.00	%0056.	NAB Snr FRN (Sep23) BBSW+0.93%	AA-	9,120,960.00	9,188,684.38
16-Nov-18	16-Nov-23	1826	7,000,000.00	%0026.	WBC Snr FRN (Nov23) BBSW+0.95%	AA-	7,100,450.00	7,166,084.11
24-0ct-19	24-0ct-24	1827	1,500,000.00	1.1303%	CUA Snr FRN (Oct24) BBSW+1.12%	888	1,490,610.00	1,526,800.15
4-Feb-20	4-Feb-25	1827	4,200,000.00	1.1489%	NPBS Snr FRN (Feb25) BBSW+1.12%	BBB	4,166,778.00	4,294,884.00
2-Dec-20	2-Dec-25	1826	3,400,000.00	.5384%	BEN Snr FRN (Dec25) BBSW+0.52%	BBB+	3,400,000.00	3,406,459.29
9-Dec-20	9-Dec-25	1826	10,000,000.00	%0005.	MAC Snr FRN (Dec25) BBSW+0.48%	A+	10,000,000.00	99.669'886'6





PRUDENTIAL INVESTMENT SERVICES CORP

Hornsby Shire Council

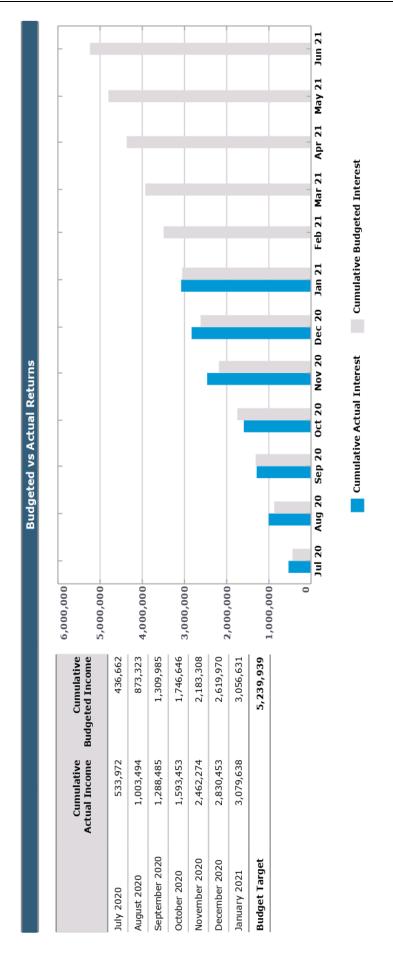
Investment Holdings Report - January 2021

loating Rate Notes	otes							
Purchase Date	Maturity Date	Term	Face Value (\$)	Current Rate	Security Name	Credit Rating	Book Value (\$)	Current Value (\$)
			44,600,000.00	.8732%			44,791,988.00	45,114,812.32
Fotal Investments	ıts							
			Face Value (\$)					Current Value (\$)
			303,425,419.04					305,575,152.82

PRUDENTIAL INVESTMENT SERVICES CORP

Hornsby Shire Council

Budget vs Actual Income Report - January 2021



PRUDENTIAL INVESTMENT SERVICES CORP

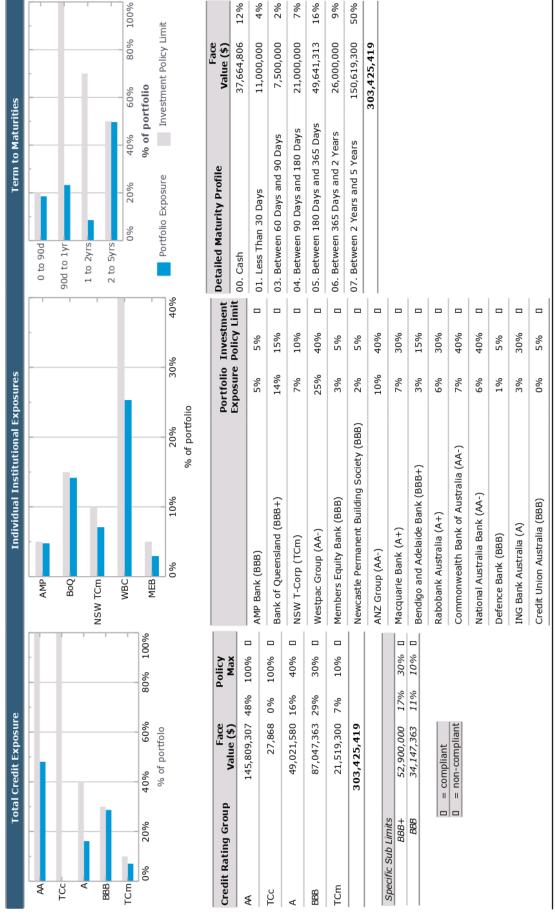
Hornsby Shire Council

Environmental Commitments Report - January 2021



Hornsby Shire Council Investment Policy Compliance Report - January 2021



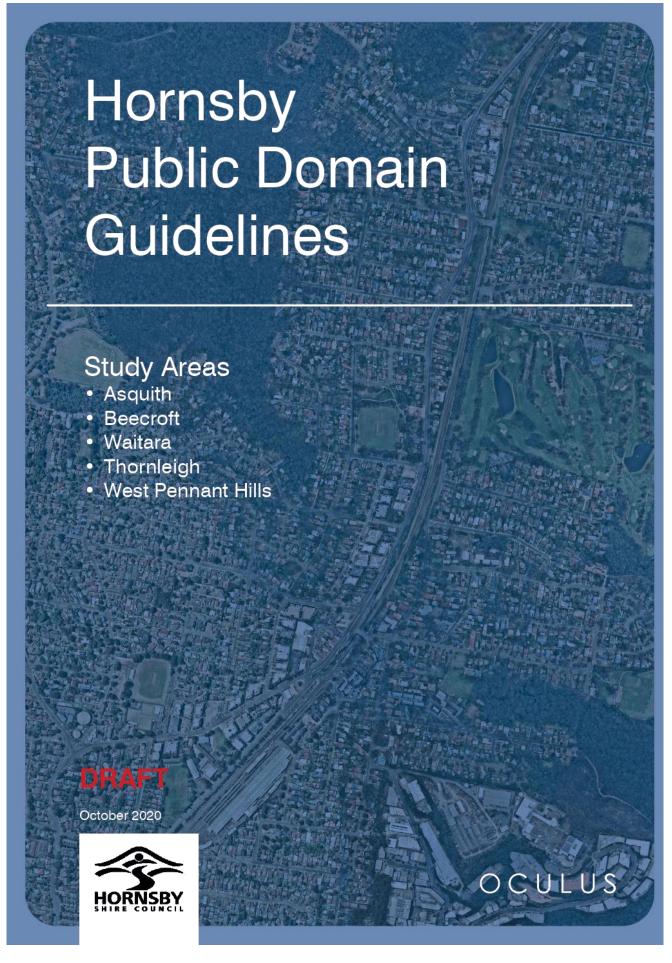




ATTACHMENT/S REPORT NO. IM1/21

ITEM 4

1. PUBLIC DOMAIN GUIDELINES



Hornsby Public Domain Guidelines

Draft Report

Project Number: S18-037

Project Address: Hornsby Shire Council

Revision	Issue	Date	Ву	Checked
А	Draft for Comment	19.12.19	WW	GM/ST
В	Draft for Comment	21.02.20	WW	GM/ST
С	Draft for Review	27.03.20	WW	GM/ST
D	Draft for Approval	08.05.20	WW	KS/SB
Е	Draft for Approval	21.08.20	WW	ST/KS
F	Draft for Approval	27.10.20	WW	ST/KS
G	Final Issue	20.01.21	ZW	ST/KS

OCULUS

Landscape Architecture

Urban Design

Environmental Planning

Level 1, 5 Wilson Street, Newtown, NSW, 2042

PO BOX 307

p. 02 9557 5533

e. australia@oculus.info

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Executive Summary

Hornsby Shire has experienced rapid growth and development over the last decade, particularly in key high-density housing strategy precincts.

There are numerous challenges in achieving high quality, consistent public domain outcomes during this period of rapid growth. As such, there is a requirement for additional guidance in the design and delivery of the future public domain in Hornsby's key development areas.

Coupled with this is the recognition that various villages and town centres require upgrades to improve quality, amenities and to better respond to future needs and challenges.

As a result, the following Public Domain Guidelines have been prepared with a focus on five key project areas identified for growth and enhancement over the coming years. To ensure that all future development and upgrades of the Public Domain provide good design quality, consistent solutions should respond to the growing needs of the Shire's community, while also respecting the Bushland Shire character that makes Hornsby what it is. These guidelines describe the minimum standards for the design and Development Assessment of future public domain proposals within the Shire. The Principles and requirements outlined in this document shall be used as guidance for the assessment and preparation of public domain plans related to all areas across Hornsby Shire Council including areas where Key Project plans have not yet been prepared.

In developing these Guidelines, existing planning controls and policies were reviewed to determine their effectiveness in permitting appropriate urban design outcomes and public domain upgrades.

Local community consultation was conducted to understand the current uses, needs and deficiencies of each of the key areas, along with a site analysis of each of the five key project areas. The findings collected provided a good understanding of these areas and their needs, which has driven the proposed design visions and improvements for each of the key project areas.

Proposed improvements including new plazas, dedicated cycleways and shared paths, footpath widening, pedestrian links, shared zones and new trees aim to secure good public domain outcomes for Hornsby Shire

and set the standard for all future improvements. Part F of these guidelines further explores these components.

The preparation of the Public Domain Guidelines also provides an opportunity to address priority actions in the Greater Sydney Commission's North District Plan, the Resilient Sydney Strategy and other associated policies including the State Government's Greener Places - Green Infrastructure Policy and other referenced documents including Council policies.

These guidelines have been developed in close consultation with Hornsby Shire Council, Council stakeholders, and the community via community consultation [PDG engagement yet to occur].

In parallel with the Public Domain Guidelines, a shire-wide Signage Strategy has been developed, providing a hierarchy and palette of outdoor identification, wayfinding / directional and interpretive signage to be used to identify suburbs, community centres, parks and roads. The signage palette accompanied by the palette of public domain elements, provided within this document, create a complete guide to the public domain.



Image B.1: Hornsby Town Centre, Hornsby

PART A – Introduction

A.1 Purpose

The Hornsby Public Domain Guidelines provide a set of specific objectives and technical information to guide the design and construction of the public domain within the key project areas identified for Hornsby Shire. The guidelines shall also be used in the preparation and assessment of public domain proposals that apply to projects outside of the nominated study areas.

The public domain encompasses all publicly accessible, shared spaces. This includes streets, lanes, squares, parks and pedestrian connections, as well as verges, vegetation, footpaths, cycleways, furniture, lighting and signage. These spaces ensure amenity and safety for the public is maintained, as well as creating an attractive and healthy environment.

The Guidelines provide consistent standards to manage the integration of all public domain components to assist Council's ongoing management and approval of developments, upgrading works and maintenance, ensuring design quality with a vision to achieve a cohesive Hornsby Shire character.

Scope

The key study areas to which these guidelines apply are identified in Figure A.1 and Figure A.3, and noted below:

- Asquith
- Beecroft
- Waitara
- Thornleigh, and
- West Pennant Hills.

These areas, as defined within this document, demonstrate the application of the Guidelines across various town centre typologies within the Shire. The use of the guidelines is not limited to the nominated Study Areas and identified Key Projects. The guidelines shall also inform proposed upgrades to the public domain elsewhere in the Hornsby Shire Council area including areas where site-specific requirements have not been documented.

User

These Guidelines are to be used by all stakeholders involved in the planning, design and approval of public domain works throughout the key project areas nominated in this document including designers, utility providers, other public authorities, private developers and residents to ensure uniformity across the different stages of growth and development.



Image A.1: Peats Ferry Road, Hornsby

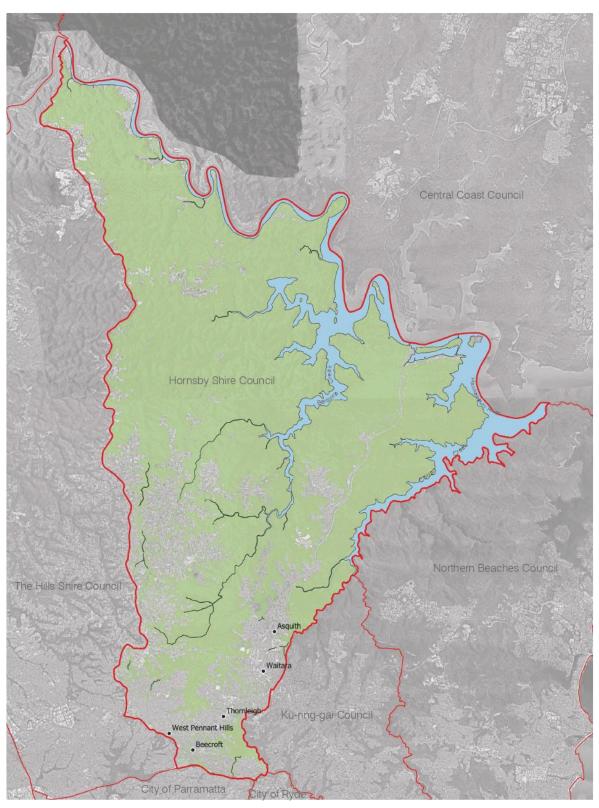


Figure A.1 Project Context

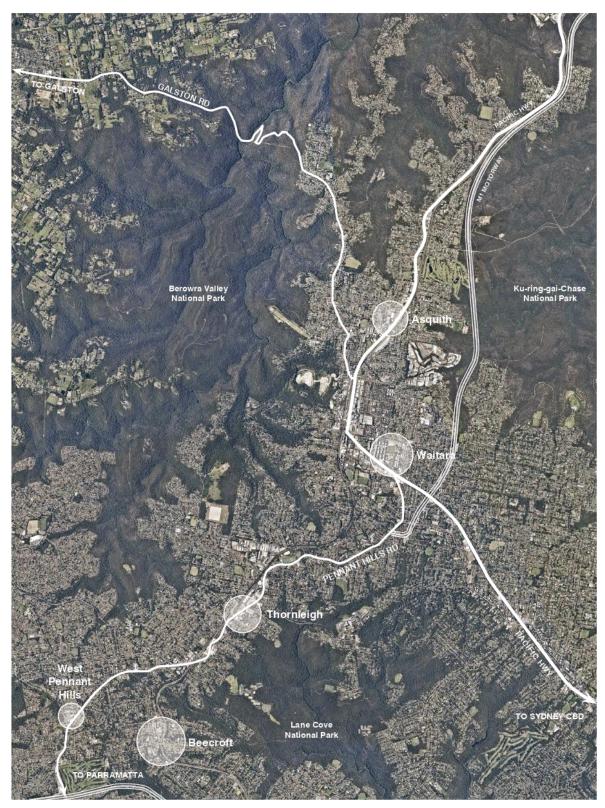


Figure A.3 Study Areas where Key Projects are Located

A.2 How To Use This Document

Document Structure

This document is broken down into sections based on relevant planning conditions and community needs guiding the assessment of street design and local conditions and the application of a coordinated materials palette to specific projects. The guidelines explain the considerations for the public domain at four levels from the macro to the fine grain.

Part A - Introduction

The requirements of the public domain are guided by community needs identified through consultation and collaboration, and statutory planning policy, site conditions and industry best practice. Firstly the document identifies the existing supporting documents and planning framework, secondly it explains the consultation undertaken to identify community needs.

Part B - Approach

Planning and community requirements are distilled into four principle pillars; Biodiversity, Connectivity, Programming and Use, Character and Aesthetics, of the public domain to be implemented by Council.

Part C - Street Design

This section, analyses street design and the composition of elements within the public domain. Street and footpath typologies are examined against the preceding needs providing design objectives and essential considerations for public domain upgrades.

Part D - Materials Palette and Application

The materials palette defines the materials, street furniture and planting to be used across character areas within the key projects. The Signage and Way-finding Strategy should also be referenced.

Part E - Key Project

Key projects consolidate and demonstrates the application of the previous sections as they apply to five nominated study areas across Hornsby Shire Council Asquith, Waitara, Thornleigh, Beecroft and West Pennant Hills.

STEP 1

With reference to Part A 'Overview' and Part B 'Approach', determine public domain requirements in relation to the subject development



STEP 2

With reference to Part C 'Street Design', undertake a street design assessment in relation to the subject development



STEP 3

With reference to Part D 'Materials Palette and Application', determine the materials, furniture and planting required for the subject development



STEP 4

With reference to Part E 'Key Projects', understand how the street design and materials palette should be applied to the subject development



A.3 Defining the Character of Hornsby

Hornsby Local Government Area in 2020

The Hornsby Shire Local Government Area is the northernmost municipality of the Greater Sydney metropolitan area. The Hawkesbury River bounds the Shire to the North, Old Northern Road to the West and Ku-ring-gai Chase National Park to the East.

Hornsby Shire is characterised by vast tracts of National Parks and pristine bushland, a range of diverse residential housing each with their own unique local village centres and a large proportion of productive rural properties.

Hornsby Shire represents a unique blend of protected bushland and rapidly developing urban areas typifying the Sydney Basin character. The National and State Parks and Reserves are central to the community's identity and lifestyle. Major transport infrastructure connects many of these village centres, with the T1 Northern Train line, Pacific Highway and Pennant Hills Road, NorthConnex and M2 delivering vast numbers of people to the various centres and surrounding suburbs.

The Hawkesbury Sandstone geology characterises the landform of the shire with large ridge-lines falling steeply into gorges and lower river systems. Much of the density of the urban fabric is located along these ridge-lines, adjacent to major transport routes.

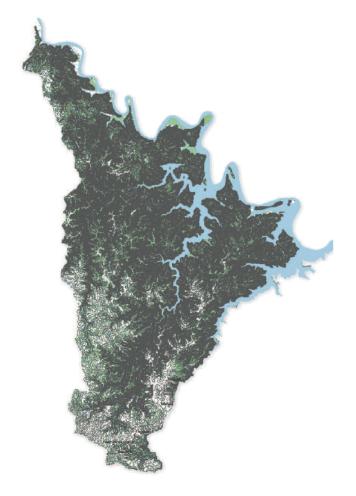


Image A.2: Hornsby Shire Local Government Area



Image A.3: Crosslands Reserve, Hornsby Heights

Environment

Hornsby Shire Council is directly responsible for 2,000 hectares of bushland. Seventy per cent of the Shire is vegetated of which 50 per cent are protected areas (eg, National Parks) and bushland reserves. Council manages policies, strategies and operates programs to ensure that the bushland and waterways, as well as the flora and fauna that live in them, are protected. Regarded as "The Bushland Shire", the natural environment plays a vital role in the identity of the Hornsby Shire Council Local Government Area.

Lifestyle

Well known for its bushland and waterways along with vibrant commercial centres, many sporting facilities and parks, Hornsby Shire offers a diverse and active lifestyle.

This active lifestyle is supported by major National Parks and more than 180 parks, 135 playgrounds, 40 sports grounds plus 31 community centres and libraries supporting the arts and culture.



Image A.4: Storey Park Community Centre, Asquith



Image A.5: Sunset Sessions, Hornsby Mall

Community

Hornsby Shire is a shire of cultural diversity and strong community. With higher than national average homeownership, and over 30 per cent of households with children and 35 per cent of residents born overseas, Hornsby is a family orientated welcoming community. Between 2019 and 2036, the community is expected to grow by an estimated 21 per cent*.

Business

Hornsby Shire is estimated to contribute 1.22 per cent or \$7.28b in Gross State Product. Hornsby Shire's unemployment is lower than the national average, with 59.5 per cent of the Shire's resident workers having a tertiary qualification.



 * Population data estimate correct on October 2020 from profile.id.com.au

Image A.6: Westfield, Hornsby

A.4 Developing the Guidelines

Guidelines Development Process

The development process of the guidelines follows on from an understanding of planning policies, controls and context within which these guidelines sit.

Commencing with a site analysis of each study area and in general, Hornsby Shire, an understanding of the Shire's character and each project area was obtained as well as the current treatment of the public domain areas. Observed primarily within the key project areas was the functionality of the spaces, existing amenities, circulation, connections, zoning, built-form and vegetation to ascertain the needs of each area. Building upon the observations, community consultation was undertaken with the local community in each area, as well as consultation with local community groups and stakeholders. With a strong understanding of how these areas functioned and their needs, the information was distilled down and organised into categories which informed the approach to the design, which are represented by design principles and pillars later described in this document. The principles and pillars stand to guide the designs and to allow a crosscheck of the designs as they evolved to ensure that they remain in-line with the needs and objectives of the project.

Concept designs were then developed, followed by these guidelines, which will then go out to further consultation. This process of development and review ensures a high quality document.

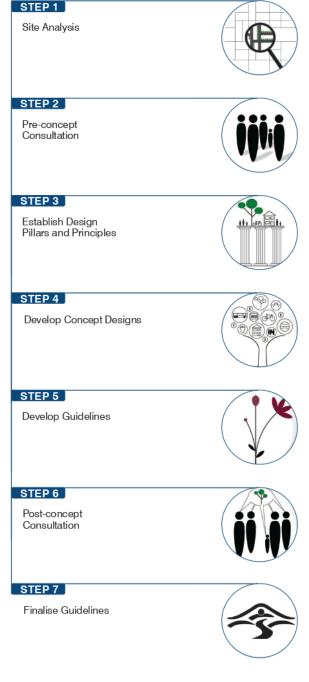


Figure A.4 Guideline development process

HORNSBY PUBLIC DOMAIN GUIDELINES | PART A - INTRODUCTION

Community Consultation

Consultation with the local community has been pivotal in understanding the needs of each project area, as well as highlighting the strengths, opportunities and constraints that exist. More importantly, this process ensured that the community was engaged in the process of developing these guidelines.

The objectives of the consultation process were to:

- Build community awareness of the project and interest in participating in the development of the strategies;
- Provide opportunities for inclusive participation, including diverse ages, cultures and languages;
- Deliver innovative and experiential consultation activities that capture community perceptions and ideas for main street improvements, public domain guidelines and signage; and
- Reach a broad range of community members and stakeholders.

Consultation for the guidelines was undertaken in two phases being; 'pre-concept design' and 'post-concept design' (these draft guidelines). The pre-concept design community consultation was undertaken in March 2019, with the post-concept design consultation going out for exhibition on completion of the current final draft guideline.

Consultation was undertaken by various means to ensure maximum outreach and feedback, including online surveys, workshops and on-street pop-ups and intercept events set up in the key project areas.

Workshops were undertaken with the following community groups:

- Beecroft Cheltenham Civic Trust
- Arcadia Galston Residents Association
- Hornsby Chamber of Commerce
- Hornsby Aboriginal and Torres Strait Islander Committee

Overall, approximately 420 people participated in the initial consultation process.

PLANNING

Community engagement plan Councillor briefing



PRE-CONCEPT CONSULTATION

Information and communications Online community survey On-street engagement for Waitara, Thornleigh and West Pennant Hills Pop-up engagement for Beecroft Community Workshops



POST-CONCEPT

Information and Communications Online community survey Internal stakeholder workshop Community workshops Councillor briefing



PUBLIC EXHIBITION

Draft strategy Final strategy



Figure A.5 Consultation approach overview

A.5 Reference Documents

Related Documents and Policies

This document is to be read in conjunction with supporting local and regional planning policies and documents as shown in Figure A.6 and Figure A.7, including:

State and Regional:

- North District Plan, Greater Sydney Commission
- Greener Places, NSW Government Architect
- Better Placed, NSW Government Architect
- Resilient Sydney Strategy, City of Sydney
- Roads and Maritime Services Water Sensitive Urban Design Guideline
- The 202020 Vision Plan

Local - Hornsby Shire Council:

- Draft Bike Plan Review 2019
- Draft Public Art Policy 2015
- Socio Cultural Community Consultation Report 2014
- Active Living Hornsby Strategy 2016
- Water Conservation Policy
- Water Sensitive Urban Design Guidelines 2015
- Draft Walking and Cycling Strategy
- Outdoor Dining Code
- Draft Sustainable Hornsby 2040 Strategy
- Draft Urban Forest Strategy
- Draft Water Sensitive Hornsby Strategy
- Draft Biodiversity Conversation Strategy
- Draft Climate Wise Hornsby Plan
- Integrated Land Use Transport Strategy (ILUTS) 2004
- Draft Hornsby CBD Public Domain Plan
- Draft Hornsby Quarry Masterplan
- Greening the Shire Program



Figure A.6 Reference documents

HORNSBY PUBLIC DOMAIN GUIDELINES | PART A - INTRODUCTION

A.6 The Guidelines in Context

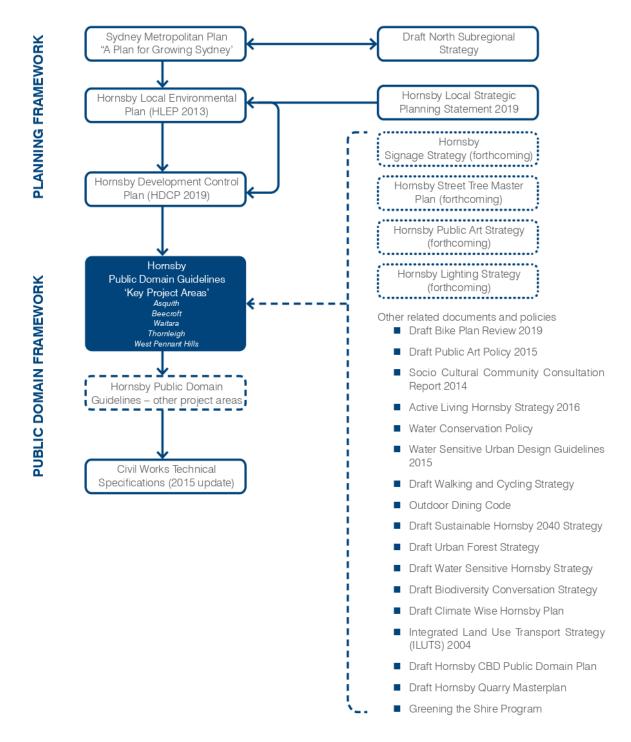


Figure A.7 Document Context Diagram

HORNSBY PUBLIC DOMAIN GUIDELINES | PART A - INTRODUCTION

A.7 Approvals Process

Public Domain Guidelines and Development Control Plan

These Public Domain Guidelines have been formulated as an outcome of the planning policies and controls as noted in Sections A.5 and A.6 whereby they aim to provide a further layer of detail on how to realise the policies in future developments within the public domain.

These guidelines, along with all documents listed, are crucial in aiding Council in providing advice on proposed developments, as well as conducting Development Assessments and providing approvals.

Applications for new development in the study areas to which this guide applies will require an Alignments Plan demonstrating levels, gradients and alignments of new and altered buildings and a Public Domain Plan to be prepared and submitted for approval, reflecting the public domain elements as outlined in the Public Domain Guidelines.

Preliminary advice from Council in relation to requirements for public domain works may be obtained through a DA Pre-Lodgement Application.

Once a DA is lodged, Council will assess the plans and documentation provided to ensure consistency with the Public Domain Guidelines. If the development is approved the development consent will include conditions of consent and there may be inspections throughout construction process to ensure the development occurs in accordance with the Public Domain Guidelines and approved plans.

HORNSBY PUBLIC DOMAIN GUIDELINES | PART A - INTRODUCTION

A.8 Glossary of Terms

Alignment Plan	Plans demonstrating the levels, alignments and gradients of introduced or altered buildings entries, driveways and footpaths in the public domain associated with development
AS1428.1	Australian Standard 1428.1: Design for Access and Mobility Series
Blue Infrastructure	Refers to hydrological (water) systems and, in-particular, the ways urban environments can capture, store, clean, divert and use for irrigation
Council	Hornsby Shire Council
DCP	Hornsby Shire Council's Development Control Plan
Deep Soil	Is an area of natural ground with a relatively natural soil profile. It excludes areas where there is a structure underneath or above, and non-permeable paved areas. However, it can include areas of porous paving and essential accessible paths, up to 1.2m wide, providing there is deep soil area to one side that is level with the footpath or paving
Green Infrastructure	Relates to flora (trees and plants) and open spaces. These include parks, street trees and planting, bushland, rooftop gardens, private back yards, schools
Key Project	Key projects are defined public domain upgrades with clear design controls and outcomes. They are located within Study Areas
Public Domain	Refers to areas of the Shire in which access to and use of is available for any member of the public. Public domain typically includes parks, plazas, footpaths and streets. Public domain elements of the Shire are typically controlled by Hornsby Shire council
Sight Line	Is a line extending from an observer's eye to a viewed object
Study Area	Study areas refer to a defined zone within Hornsby Shire Council local suburbs and determines the extent to which this document applies
TfNSW	Transport for New South Wales
Wayfinding	A term used to describe the ease of navigating through a the public domain with the aim of reaching a pre-selected destination
WSUD	Water Sensitive Urban Design

PART B – Approach

HORNSBY PUBLIC DOMAIN GUIDELINES | PART B - APPROACH

B.1 Pillars and Principles

Defining Pillars and Principles

A set of pillars and principles have been established to help provide an overarching guide for the design and decision making processes for the public domain.

These pillars set out the vision for Hornsby Shire moving forward and have been developed through reviewing existing policies and principles, site investigations, site analysis, community consultation and workshops with various consultants.

Each of these principles are explained and expanded upon in the following pages.



1. Biodiversity

'Stitching the green and blue' by utilising biodiversity to stitch together the public domain remnant vegetation and town centres*.



2. Connectivity

'Linking the Centres' to unite with each other and provide connections for users.



3. Programming and Use

'Activating the Centres' to ensure safer and lively public spaces



4. Character and Aesthetics

'Embracing identity' of the Bushland Shire and individual centres. *Note: 'Blue' infrastructure refers to hydrological (water) systems and, in-particular, the ways urban environments can capture, store, clean, divert and use stormwater irrigation. These systems are often interconnected with much larger catchment systems (creeks, rivers, lakes etc.)

'Green' infrastructure relates to flora (trees and plants) and open spaces. These include parks, street trees and planting, bushland, rooftop gardens, private back yards, schools. Like blue infrastructure, these pockets are often interconnected with much larger systems like National Parks.

These systems are important parts of our natural environment which support native fauna (animals) and biodiversity, which contribute to a great place to live.

HORNSBY PUBLIC DOMAIN GUIDELINES | PART B - APPROACH



Pillar 1: Biodiversity – Stitching the Green and Blue key aims include:

- Build on Hornsby's existing and cherished green and blue assets recognising the interrelationship and codependency of green and blue infrastructure
- Enhance the quality and provision of green and blue infrastructure, including bushland and parks
- Enhance the quality and use of blue infrastructure including, rivers and wetlands and their integration with green infrastructure
- Develop the 'green and blue grid' and 'green and blue corridors' to enable connections between places for both people and wildlife
- Infill gaps in vegetation to create new green pockets and ensure a connected green system for both the public and private domain
- Maintain and enhance existing biodiversity through the restoration of disturbed ecosystems to enhance ecological value and function and to create new ecosystems
- Use native plants to provide food and shelter for fauna while contributing to the established local flora
- Integrate and enhance the surrounding bushland into the urban and suburban areas to maintain and strengthen Hornsby's "Bushland Shire" character
- Create beautiful places that will continue to evolve through time and for future generations

Note: Refer Council's Biodiversity Conservation Strategy for further information



Image B.1: Hannah Street, Beecroft



Pillar 2: Connectivity – Linking the Centres key aims include:

- Create new, and enhance existing connections to and from as well as within and around centres
- Create continuous, safe and legible pedestrian and cycle connections between commercial centres and public transport nodes, as well as within the suburban finer grain
- Enhance signage and way-finding to effectively direct people to, from and within connections and linkages
- Prioritise pedestrian safety by ensuring linkages are well lit and defined, including increasing safe crossings and connections across and over streets, roads and highways
- Create where needed, a hierarchy of movement corridors, prioritised as follows:
 - 1. Pedestrian
 - 2. Cycle
 - 3. Public and Shared Transport
 - 4. Private Vehicles
- Develop cycleway infrastructure, networks and connections
- Promote active transport to support community health and well-being, as well as reducing traffic congestion & pollution
- Design compliant accessible connections that are comfortable and well maintained



Image B.2: Hunter Street, Hornsby

HORNSBY PUBLIC DOMAIN GUIDELINES | PART B - APPROACH



Pillar 3: Programming and Use – Activating the Centres key aims include:

- Program building and public space use to promote continuing community events
- Create spaces in town centres that allow for unprogrammed activities, such as everyday community interaction
- Create inviting and safe places and spaces
- Create beautiful spaces and ambient environments
- Ensure that public spaces and amenities are easily maintained
- Enhance and create new amenities to support activation such as toilets, furniture and canopy shade
- Implement signage and way-finding to make public spaces easy to navigate



Pillar 4: Character and Aesthetics – Embracing identity key aims include:

- Embrace and build upon the positive aspects of each area's identity rather than impose an identity
- Strengthen expressions of the core identity of the Bushland Shire
- Utilise signage and furniture to express the Bushland Shire identity
- Strengthen a sense of community by creating community hubs and spaces as opportunities for the local community to meet and socialise
- Identify, enhance and create landmarks to establish a sense of place
- Embrace and express the identity and culture of Hornsby through public art



Image B.4: Rouse Hill Town Centre



Image B.3: Peats Ferry Road, Hornsby

PART C – Street Design

C.1 Street Composition

Street Layout

This section looks at the different street typologies across the Shire and their spatial composition. It shows how the allocation of space within a road reserve can create good, accessible design that balances the needs of users with specific social and environmental considerations.

The key considerations for street layout are:

- Creating a safe, accessible and comfortable pedestrian space that promotes public life and vitality;
- Accommodating required paths of travel for all users including pedestrians, cyclists, public transport users and vehicles;
- Providing a clear and direct composition that reinforces the major design elements and reinforces street hierarchy;
- Including components which can be located consistently throughout the public domain to reflect the overall unique character including furniture and lighting;
- Providing additional footpath space for public seating and outdoor dining in streets with high activity and food and beverage uses;
- Providing green and blue infrastructure maximising the provision of street trees and planting to mitigate urban heat island effects, promote connectivity with the natural environment increase biodiversity, cleanse stormwater mitigate flooding and improve aesthetics of the urban environment.

Many competing factors need to be considered when allocating space, including:

- Available pedestrian and vehicle movement through space;
- Anticipated pedestrian volumes;
- Expected traffic volumes and speeds;
- Safety and accessibility for all users;
- Transportation routes and locations of shelters and transfer points;
- The location and layout of existing and proposed underground services e.g. stormwater, electrical, gas and communications;
- Future projections for cycleway users;
- Anticipated shared pedestrian and cycle zones;
- Necessary street infrastructure; and,
- Soil zones for tree planting

All these factors need to be considered when creating a street layout and making space allocation decisions. However, each street will vary depending on its associated functional requirements and will require individual assessment and approval by the Council.

A typical street can be broken down into:

- 1. Footpath Zone;
- 2. Carriageway;
- 3. Building Zone;
- 4. Overhead Zone;
- 5. Underground Zone.

Each zone has been allocated a specific function and associated recommended widths.

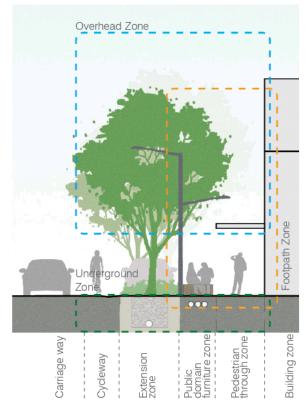


Figure C.1 Typical Street Layout Section

1. The Footpath Zone

The footpath zone extends from the property boundary to the road and can further be broken down into the Pedestrian Through Zone and a Public Domain Furniture Zone.

Pedestrian Through Zone

This zone provides for accessible pedestrian travel and must be clear of obstacles, including street furniture, street trees, outdoor seating and driveway ramping. It should be well lit and meet accessibility standards. To provide the minimum required widths for the Pedestrian Through Zone, the narrowing of parking lanes may be required to accommodate the expanded through zone.

The area provides room for pedestrian movement at building entries and enough space for people to slow down and engage with their immediate environment and each other.

When reconstructing the Pedestrian Zone and relocating utilities, all access points must be located outside of the Pedestrian Zone where possible.

Recommended width:

- All streets require a minimum 1.2m Pedestrian Through Zone
- Provide a minimum of 1.8m to allow for two pairs of people to pass each other comfortably, or a wheelchair and a person to pass each other
- Where high volumes of pedestrians are expected, provide 3m or wider

Public Domain Furniture Zone

The public domain furniture zone acts as a buffer between the street traffic and providing an area for pedestrian respite. Consolidate street trees, landscaping, street lights, site furnishings, traffic and parking poles and equipment, utility poles in this zone. This area also has the potential for outdoor dining.

Recommended width:

- Elements in this zone should be set back a minimum of 600mm from the kerb face. An absolute minimum width of this zone for placement of outdoor seating is 1.2m
- Note: Widening footpaths may require significant changes to the drainage infrastructure as well as the relocation of utilities and must be reviewed on an individual project basis
- Where possible, the widening of footpaths may be achieved by narrowing and/or removing vehicular travel lanes or parking lanes, or establishing setbacks as part of redevelopments
- Council recommends a more comfortable width of at least 1.5m
- If the footpath does not meet the minimum 1.5m in areas of high pedestrian activity then a shared path must be considered
- Where space is restricted, 1.2m is the absolute minimum, with frequent 1.8m wide passing opportunities for people in wheelchairs

STREET TYPES		PUBLIC DOMAIN FURNITURE ZONE	PEDESTRIAN THROUGH ZONE
Arterial Roads		2m	2.5m
Collector Roads Type A (bus route)	(low-mid activity streets)	1.5m	2.5m
Collector Roads Type B	(low-mid activity streets)	1.5m	3.0m
Local Street Type A	(mid-high activity streets)	1.5m	2.0m
Local Street Type B	(low activity streets)	2.3m	1.5
Village Streets	(high activity streets)	2.5m	3.5m
Shared Zones		2.0m	2.8m
Laneways		Shared Zone	Shared Zone 1.5

Table C.1 Public Domain Zone Widths

Note:

Widths are desired Council dimensions for providing better pedestrian comfort and amenity and full inclusion for street trees, verge landscaping and public domain furniture.

*Refer Guide to Road Design Part 6A, Paths for Walking and Cycling.

2. The Carriageway

The carriageway refers to the area used by various forms of movement including motor vehicles, public transport and cyclists. This zone can be two-way, one-way, or become part of a shared environment. The aim for motor vehicle movement is to provide the minimum possible space to support through movement while enticing safe traffic speeds. On-site private parking and loading zones need to be considered in areas for local business, retail and residential.

Recommended width:

Carriageway widths should be appropriate to the particular context and use of the street.

Key factors to take into consideration include:

- The volumes of vehicular traffic and pedestrian activity;
- Traffic composition;
- The demarcation, if any between carriageway and footpath (kerb, street trees or planting and public domain furniture);
- Whether parking will be in the carriageway. If so, consider the distribution, arrangement, frequency of occupation, and the likely level of parking enforcement;
- The design speed;
- The streets curvature is to accommodate the swept path;
- Any intention to include one-way streets, or stretches of single lane in each direction within two- way streets;
- Local linkages and movement patterns; and,
- Allowing for footpath extensions to accommodate outdoor dining areas, landscape treatments and street furniture where appropriate.

Refer to Figure C.2 for preferred vehicle lane and cycleway widths.

In streets with low traffic, carriageways may be narrowed as a traffic calming function. Presence of heavy vehicles is a consideration when using minimum carriageway widths. Wider lane widths are appropriate in locations with high volumes of heavy vehicles. A collaborative judgement between Planners, Designers, and Engineers is necessary to make final determinations regarding lane widths.

Cycleway

A cycleway refers to the area dedicated for cyclists to provide a safe on-street environment for the movement of cyclists. A dedicated cycleway is only considered for streets that are designated for such treatments.

Extension Zone

The extension zone refers to the specific condition where the footpath extends into the parking lane through either permanent kerb extensions or removable bollards, flexible use of parking lanes, bicycle parking, tree planting and WSUD. The extension zone may accommodate landscape treatments, seating, street furniture, play and outdoor dining to free up the footpath for pedestrian through travel.

Where parallel parking is included in this zone, there needs to be an allowance of 1.2m for door swing. The allowance is a minimum of 600mm between the Extension Zone and the kerb face, and 600mm from the kerb face to the Public Domain Furniture Zone.

3. The Building Zone

The building zone forms a transition from public to private. The design of the interface directly influences the public domain experience and requires careful consideration to integrate with the footpath design and form.

In some places buildings are aligned with a zero setback from the property boundary and in other places buildings are set back some distance to provide a landscaped or paved place between the footpath zone and the buildings. Where identified this setback area can perform a number of functions that serve to enhance the public realm that provides a key opportunity in public domain planning.

Consider the arrangement of new and existing utilities, and blue infrastructure elements such as WSUD devices and drainage.

Figure C.1 is an indicative section illustrating the relationship between these zones and their contribution to the quality of the overall public domain.

TfNSW Classification	Primary Traffic lane	Additional Traffic Lanes	Parking	Carriageway Width	Road Reserve Width		
ARTERIAL ROADS							
Includes bus/heavy vehicle routes (assumes multiple lanes of traffic in each direction)	3.5m	3.0m	3.0m (existing) 2.8m (proposed)**	13.0m	20-30m		
COLLECTOR ROADS							
Type A – One lane of traffic in each direction	3.5m (existing) 3.2m (proposed)	None	3.0m (existing) 2.8m (proposed)**	13.0m (existing) 12.0m (proposed)	20.0m		
Type B – One lane of traffic in each direction	3.0m (existing)	None	3.0m (existing) 2.5m (proposed)**	12.0m (existing) 11.0m (proposed)	20.0m		
LOCAL STREETS	LOCAL STREETS						
Type A & B – One lane of traffic in each direction	3.0m (existing)	None	2.1m	9.0m	16.0m		
Single lane, bi- directional streets and lanes (passing bays required in parking zones)	3.2m	None	2.1m ^	Varies	Varies		
Single lane, one-way streets and lanes (or adjacent to median)	3.0m	None	2.1m^	Varies	Varies		
VILLAGE STREETS	3.5m	None	3.0m	7.0m	20.0m		
SHARED ZONE	2.8m (min.) - 3.2m (buses)	None	Varies	Varies	Varies		

Table C.2 Preferred Maximum Vehicle Lane Widths

	Minimum Lane Width	Minimum Kerb Width
SEPARATED BI- DIRECTIONAL CYCLEWAY	2.5m	0.4m
ON-STREET PAINTED CYCLE LANE	1.4m*	n/a
SHARED PATH (cycle and pedestrian)	2.5m	n/a

Table C.3 Preferred Minimum Cycleway Widths

^{*} For mixed traffic in low speed environments, the painted on-street cycle lane should accommodate suitable width to allow for deflection of a parked car door swing.

^{**} Proposed narrowing of parking lane to accommodate expanded Pedestrian Through Zone.

[^] Decisions regarding parking lane width when adjacent to bike lanes should consider parking turnover rates and vehicle types.

3. The Overhead Zone

The overhead zone refers to the space above the public domain where various elements compete for space including, tree canopies, building facade and awnings, overhead power lines and lighting. This area plays an important role in the aesthetics of the public domain with local tree species providing shade , adjacent to architectural façades enhancing the streetscape character. Urban heat, air quality, water retention and management systems are also located in this important but often overlooked zone.

As space is limited in this zone, relocating existing elements such as overhead power lines underground should be explored. This zone should be considered throughout the streetscape design.

Key factors to take into consideration include:

- Explore relocation of overhead power lines underground;
- Clearance between elements such as tree branches and foliage to vehicles;
- Tree canopy density, dimensions, and proximity to adjacent buildings or services;
- Location and type of lighting and shadow effect from adjacent elements;
- Extent and articulation of building awnings and façades.

5. The Underground Zone

One of the most restricted zones with a high number of elements competing for a limited amount of space is the underground zone. This zone may contain existing services which may impact the location and inclusion of surface level elements.

Key factors to take into consideration include:

- Existing services which may be managed by other asset owners;
- New services such as overhead powerlines which may increase competition for space;
- Existing geology and soils which may impact WSUD design and plant species selection
- Existing location of manholes and pits and their location in the footpath or cycleways

Street Typology

Street types are generally defined by their major uses and requirements for pedestrian, cycle, transit and vehicle movement. The following street types can be found in the character areas outlined in Part D – Materials Palette and Application and demonstrated in the key projects in Part E – Key Projects:

- 1. Arterial and Sub-arterial Roads
- 2. Collector Roads Type A & B
- 3. Village Streets
- 4. Local Streets Type A & B
- 5. Laneways
- 6. Shared Zones

The following sections outline preferred typical street layouts, showing zones, footpath widths, carriageway widths and arrangement of urban elements for each of the designated street types.

These street designs require adjustments to the existing street arrangement and kerb alignment to be realised. These street types are to be implemented when the Council proposes significant changes to existing streets or in association with major redevelopment on adjacent properties.

Note: Refer to Hornsby DCP for classified and un-classified roads within Hornsby Shire. For further information on roads classification, refer Austroads 'Responsibilities for Local Roads'.

Arterial and Sub-arterial Roads

Arterial and sub-arterial roads are main or major routes through an area that are characterised by high volume vehicular traffic, increased speeds, signalised intersections and wider carriageways. Arterial roads are generally classified roads, and sub-arterial roads can be either classified or unclassified.

Arterial and sub-arterial Roads are State Owned roads, differentiated from other General Street types by having the highest volume of vehicular traffic. The vehicle and pedestrian zones are separated, and the street character and physical appearance vary due to land use context.

The inclusion of shared pedestrian/ cycle footpaths is only relevant in locations proposed by the Council's 'Walking and Cycle Strategy'.

Design Objectives:

- Accommodate relatively high traffic volumes, speeds and public transport, while providing for adequate and safe movement functions for pedestrians and cyclists.
- Promote walkability on street edge footpaths and provide the opportunity for street furniture and outdoor dining where there are a mix of retail, commercial and residential uses.
- Provide cycleways consistent with the Draft Bike Plan Review 2015.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.1: Example of Arterial Road Cleveland Street, Redfern

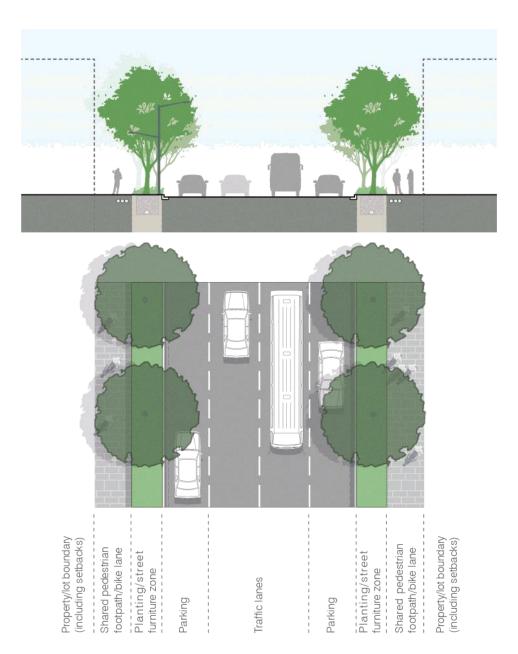


Figure C.2 Arterial and sub-arterial road section and plan

Collector Roads Type A & B

Collector Roads are the primary circulation and access routes through a neighbourhood. They serve as the secondary vehicular through routes/ linkages, connecting the sub arterial roads to the local system in developed areas. Type A collector roads carry more traffic, and/ or form part of a bus route.

The vehicle and pedestrian zones are separated and the street character and physical appearance vary due to land use context

On-road cycleways may sometimes differentiate a Collector Road. An on-road cycleway is only considered for streets that are designated as such in the Draft Bike Plan Review 2015.

Design Objectives:

- Support a high level of vehicular traffic and public transport, while providing for adequate and safe movement functions for pedestrians and cyclists.
- Promote walkability on street edge footpaths and provide an opportunity for street furniture and outdoor dining where there are a mix of retail, commercial and residential uses.
- Provide cycleways where consistent with the Draft Bike Plan Review 2015.
- Provide visual interest with street landscaping in the Public Domain Furniture Zone, the architectural detail of the residential entryways and building frontages.
- Enhance lower ground level landscaping through understorey planting and water sensitive urban design, e.g. bioswales and rain gardens.
- Enhance green and blue infrastructure to increase street tree canopy to reduce the heat island effect and supplement biodiversity.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.2: Example of a collector road, The Comenarra Parkway

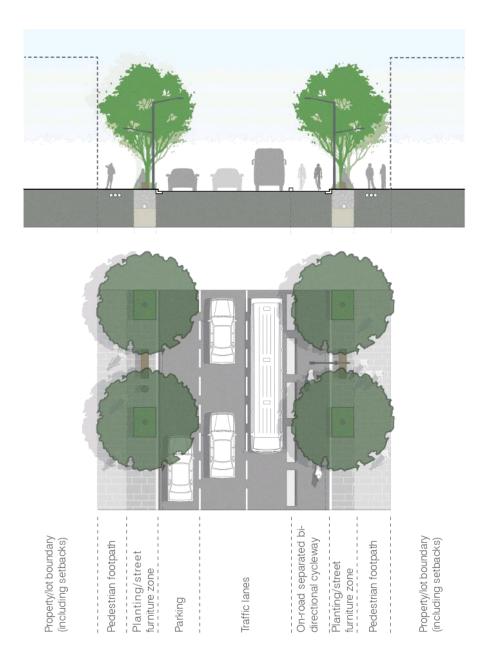


Figure C.3 Collector roads Type A and B including cycleway (medium density residential)

Local Streets Type A (mid-high activity street)

Type A Local Streets, similar to Village Main Streets, support a balanced movement function between traffic and pedestrians. They serve as the tertiary vehicular and primary pedestrian/cycle through routes/ linkages, providing improved access for the medium density residential mixed-use areas with local retail and commercial uses.

When Type A Local streets may are nominated as a cycle route, consider a marked on-street cycleway or shareway. Refer to the Draft Bike Plan Review 2015.

Design Objectives:

- Support a balance of function between pedestrian, cyclists, public transport and vehicular movement.
- Promote walkability on street edge footpaths to provide for safe and legible connections from public transport to residential dwellings.
- Provide cycleways where consistent with the Draft Bike Plan Review 2015;
- Provide visual interest with street landscaping in the Public Domain Furniture Zone, the architectural detail of the residential entryways and building frontages.
- Enhance lower ground level landscaping through understorey planting and water sensitive urban design, e.g. bioswales and rain gardens.
- Provide planting to soften the streetscape, informal plaza spaces and building entries.
- Enhance green and blue infrastructure to increase street tree canopy to reduce the heat island effect and supplement biodiversity.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.3: Example of a local street type A, George Street, Redfern



Figure C.4 Local streets type A (mid-high activity streets)

Local Streets Type B (low-mid activity street)

Type B Local Streets support a balanced movement function between traffic and pedestrians. Traffic volumes are generally lower than a Type A Local street and primarily provide access to low-density residential areas.

Visual interest is provided by street landscaping within the Public Domain Furniture Zone. Lower ground-level landscaping can be enhanced through under-storey planting and water sensitive urban design e.g. bioswales and rain gardens.

When Type B Local streets are nominated to include a cycle route, a marked on-street cycleway may be considered. Refer to the Draft Bike Plan Review 2015.

Design Objectives:

- Support a balance of function between pedestrian, cyclists and vehicular movement.
- Promote walkability on street edge footpaths to provide for safe and legible connections from public transport to residential dwellings.
- Provide cycleways where consistent with the Draft Bike Plan Review 2019
- Provide visual interest with street landscaping in the Public Domain Furniture Zone, the architectural detail of the residential entryways and building frontages.
- Enhance lower ground level landscaping through understorey planting and water sensitive urban design, e.g. bioswales and rain gardens.
- Provide planting to soften the streetscape, informal plaza spaces and building entries.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.4: Example of a local street Type B, Thornleigh Street, Thornleigh

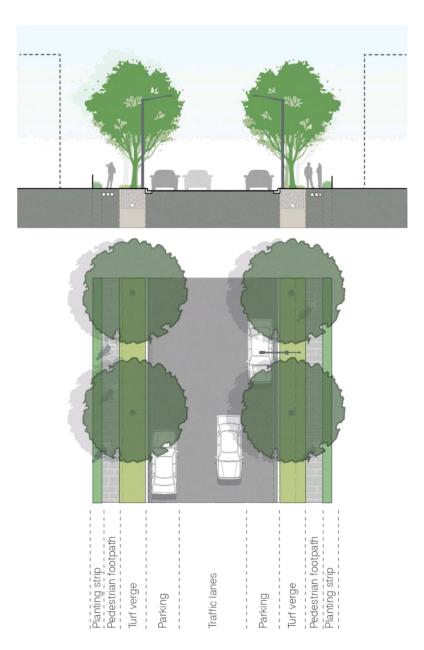


Figure C.5 Local streets Type B (low-mid activity streets)

Village Streets

Village Streets utilise extensive traffic calming measures with reduced speed limit signage to discourage vehicular throughtraffic and encourage slower vehicular speeds. These measures allow for increased green landscape opportunities to create a comfortable environment for pedestrian and bicycle movement.

High levels of pedestrians characterise Village Streets, requiring the provision of a wide Pedestrian Zone. The vehicle and pedestrian zones are separated, and the street character and physical appearance respond to varying land use with a high volume of active retail and commercial frontages.

Widened footpath areas into the Extension Zone can be utilised as an extended Public Domain Furniture Zone, including removable cafe tables and chairs, permanent seating, the opportunity for bicycle parking and planted areas creating meeting places for locals.

Design Objectives:

- Support a balance of function between pedestrian, cyclists, public transport and vehicular movement.
- Promote walkability through the widening of footpath zones and provide the opportunity for street furniture, planting and outdoor dining.
- Inclusion for traffic-calming measures and reduced speed limits to 40km/hr.
- Promote through traffic to bypass village streets in order to reduce congestion and prioritise pedestrian activity.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.5: Example of a village street, Rouse Hill Town Centre



Figure C.6 Village street

Laneways

Laneways are small scale streets that typically carry low numbers of vehicles and are mostly for local access only. Laneways can be used solely for service functions or they may have a partial, or full closure to vehicular traffic and/ or lowspeed restrictions in a dedicated shared zone environment.

Typically Pedestrian Zones are narrower in pathway width between the property boundary and kerb-line, however, when upgrades occur, provision for a wider Pedestrian Zone should be considered where possible. Laneways can also serve as a valuable public space and should be designed with street furniture and lighting to maximise comfort and experience.

Design Objectives:

 Use seating, landscaping, and pedestrian lighting to create safe, attractive and usable spaces.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.6: Example of a laneway, Factory Street, Haymarket

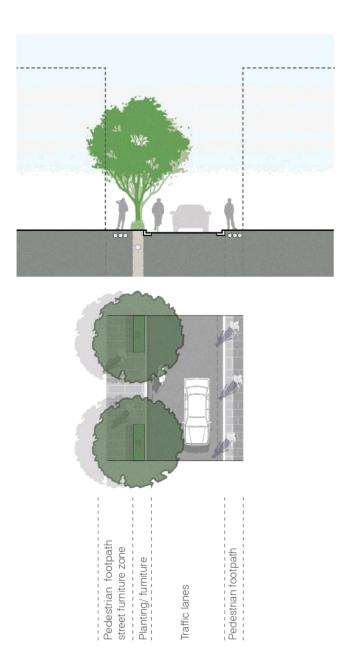


Figure C.7 Laneway

Shared Zones

A Shared Zone is a street shared safely by vehicles and pedestrians. It has a low-speed limit of 10km/hr and is design to support pedestrian and public life. The use of alternative paving materials, removal of raised kerbs, footpath extensions and thresholds, seating, landscape treatments, and pedestrian lighting together, differentiate shared zones from traditional vehicle priority streets. These differences remind drivers that they should proceed cautiously and slowly, refer TfNSW Technical Direction for shared zones.

Shared Zones are often kerb-less, providing a flush environment for pedestrians, cyclists, and low-speed vehicles to share the same space. Depending on the width of the street, public transport and local vehicular movements can still be accommodated within a high quality paved pedestrian/cycle zone. Special consideration needs to be given to the provision of adequate tactile indicators or other aid devices for visually impaired people including options for 'safe' spaces (normally along the building line) if a traditional kerb line is not provided.

Design Objectives:

- Promote safe primary access for pedestrians and cyclists in a shared environment.
- Provide inclusive access requirements as a priority to ensure safe navigation of the street.
- Coordinate street elements through movement zones to reduce clutter and improve legibility.



Image C.7: Example of a shared zone, Greville Street, Prahran

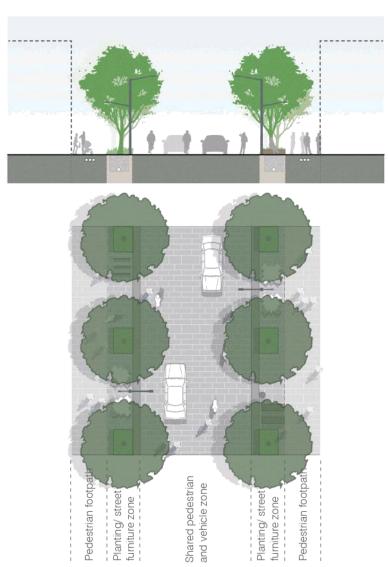


Figure C.8 Shared Zones

Footpath and Cycleway Typology

Footpaths and cycleways are generally defined by the adjacent road type, requirements for pedestrian and cycle movement and the space available. The following footpath and cycleway types can be found in the character areas outlined in Part D - Materials Palette and Application and demonstrated in the key projects in Part E – Key Projects:

- 1. Urban footpath
- 2. Shared footpath
- 3. Minor footpath
- 4. Separated cycleway

The following section outlines preferred typical footpath zone layouts as identified in the streetscape typologies.

To implement the following footpath and cycleway designs requires adjustments to the existing street arrangement and kerb alignment. These footpath types are to be implemented when the Council proposes changes to existing streets or in association with major redevelopment on adjacent properties.

Urban Footpaths

Urban footpaths are typically located in town centres or sections of road or street which have higher volumes of pedestrian and/ or cycle traffic. This is due to their proximity to public transport such as train stations or are adjacent to active commercial frontages.

Two types are available; those with street tree plantings sited to avoid any awnings with a solid grate tree pit (refer Figure C.9), and, those with similarly sited trees with understorey mass planting (refer Figure C.10). The decision to include mass planting should consider outdoor dining and spacings with street furniture.

Design Objectives:

- Provide a wide and generous footpath to maximise pedestrian comfort and circulation.
- Improve street aesthetics with street trees and mass planting.
- Create a high-quality landmark quality footpath with high-quality materials and finishes.

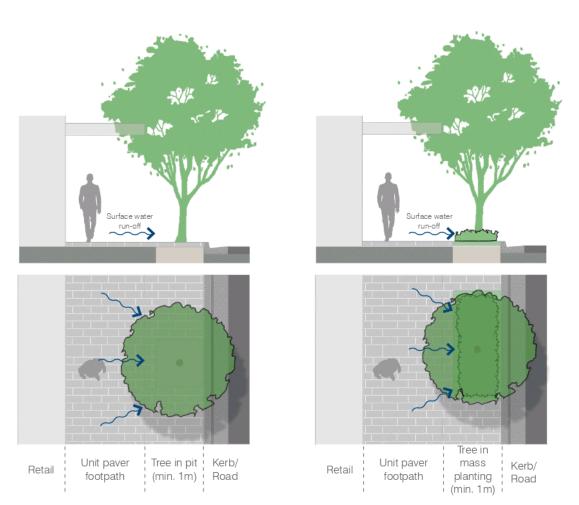


Figure C.9 Fully paved footpath (back of kerb to boundary) with tree pit $\,$

Figure C.10 Fully paved footpath (back of kerb to boundary) with mass planting to base of tree

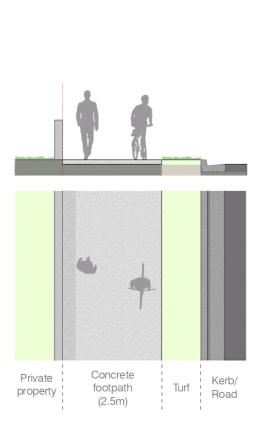
Shared Footpaths

Shared paths appear as widened footpaths with a minimum width of 2.5m. They provide enough space for both pedestrians and cyclists to travel in both directions on the street verge separated from vehicle traffic. Typically these occur where a separated cycle lane on the road may not be viable. Shared paths will typically include a grass verge with street trees from back of kerb to the footpath (refer Figure C.11) or a planted verge with street trees (refer Figure C.12).

Shared footpaths form part of the Hornsby Shire-wide cycle network and are a vital footpath type when implementing the network.

Design Objectives:

- Promote cycling in local areas through a connected, shared path and cycleway network.
- Provide a generous footpath to maximise pedestrian comfort and circulation and reduce conflict with cyclists.
- Improve street aesthetics with street trees and mass planting.



Private property

Concrete footpath (2.5m)

Tree in mass Kerb/ Road min. 1

Figure C.11 Shared path with grass verge

Figure C.12 Shared path with planted verge

Note: Where width allows, provide 600mm turf or planted edge between footpath and property boundary. Refer to Table C.3 for preferred minimum cycleway widths.

Minor Footpaths (Local Streets)

Minor footpaths are located on local streets which do not form part of the cycle network but form part of the Hornsby Shire's footpath network. The path is offset from both kerb and private boundary to allow for turf or mass planting against private properties with either street tree planting and turf (refer Figure C.13), or street tree planting and mass planting (refer Figure C.14).

Design Objectives:

- Provide clear, connected links of pedestrian links applying kerb ramps and tactiles to ensure the safety of all users.
- Clearly define connections with the shared path cycle network through signage which promote cooperation of users.
- Maximise street tree and mass plantings where possible.
- Provide consistent alignments without abrupt changes in direction.

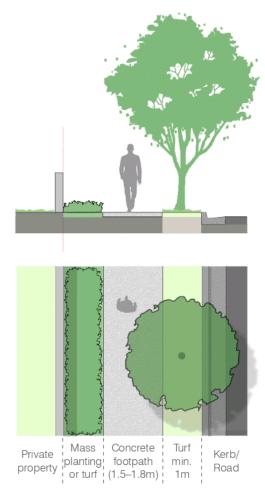


Figure C.13 Minor footpath with grass verge

Note: Refer to Table C.3 for preferred minimum cycleway widths





Figure C.14 Minor footpath with planted verge

Separated Cycle Lane

Separated cycle lanes can occur on both arterial and collector road types. They provide clear and safe paths of travel for cyclists with a high pedestrian, cyclist and vehicular flow. Cycle paths can be either single lane located either side of the vehicle carriageway (refer Figure C.15) or as a dual cycle lane located on one side only of the vehicle carriageway (refer Figure C.16). The type used is dependant on the road reserve dimensions and edge conditions, refer Austroads Guidelines for cycleways.

TfNSW provide design options for separated cycle lanes at intersections. Consider the use of the shared environment intersection without (refer Figure C.17) or with (refer Figure C.18) a continuous footpath. Refer TfNSW Technical Direction TTD 2020/03 'Shared environment intersection treatment'.

Design Objectives:

- Provide broken median strip kerb to allow for road drainage.
- Ensure cycle lanes are consistent, reduce unnecessary changes in cycleway conditions such as crossing to the other side of the road or using multiple cycleway types.
- Clearly define entries to cycle lanes from pedestrian footpaths and vehicle carriageways, with signage, lane painting and markings.

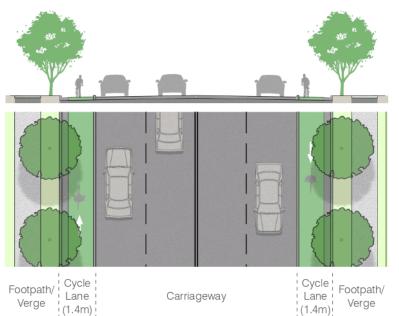


Figure C.15 Single lane on-road separated cycle lane

Dedicated single separated cycle lane with concrete barrier kerb. For use in urban areas with high pedestrian/cycle flow paths.

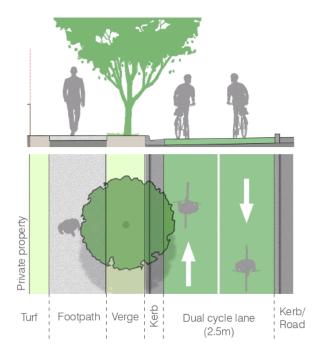


Figure C.16 Dual lane on-road separated cycle lane

Dedicated separated cycle lane with concrete barrier kerb. For use in urban areas with high pedestrian/cycle flows.

Note: Refer to Table C.3 for preferred minimum cycleway widths

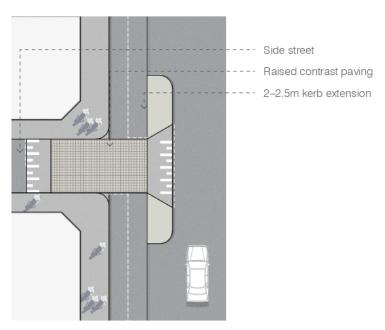


Figure C.17 Shared environment intersection treatment

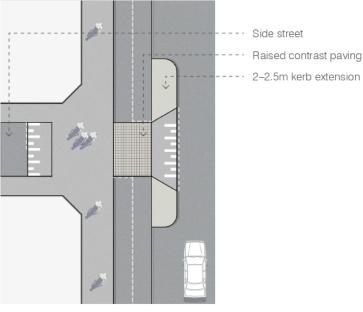


Figure C.18 Shared environment treatment with continuous footpath

Refer TfNSW Technical Direction TTD 2020/03 'Shared environment intersection treatment'.

C.2 Streetscape Elements

Key Design Principles

The physical components and elements within the street such as street trees, furniture, outdoor seating, lighting, paving, kerbs, corner junctions, kerb extensions, driveways, pedestrian ramps, crossings and share ways all require a carefully coordinated design approach to maintain a consistent, legible and safe pathway for pedestrians.

Urban elements contribute significantly to the character and appearance of a place as well as providing a safe and comfortable public domain. A well-designed street will encourage people to use the footpath.

Footpath Components



Footpaths and Kerbs

Footpaths and kerbs delineate the areas of pedestrian priority and define space for passive activities such as eating, sitting and socialising.

The character and width of footpaths can vary widely depending on local context and accommodate different movement functions and various degrees of prominence in each Street Type. Refer to Figure C.1 for footpath widths in relation to street types.

Key Considerations:

 Retain and consolidate existing kerbs in-situ and match adjacent kerbs to create continuous sections of kerb material.

Corner Treatments





The design of a footpath junction and where the change in pavement material occurs emphasizes the hierarchy within street types.

Pavement material of the priority street is to continue around the corner of a block to strengthen the connection across the roadway. Logical termination of paving types can be the radius transition point or building property line. See diagrams below: (Refer to technical specifications).

Footpath and Kerb Extensions

Kerb extensions are the expansion of the footpath and kerb line into the adjacent road lane (typically a parking lane) for a portion of a block either at the corner or mid-block. (Refer to Figure C.19)

Key Considerations:

- Generous kerb extensions may allow opportunities for landscaping, seating, outdoor dining, bicycle parking and stormwater management as well as enhance pedestrian safety by increasing pedestrian visibility, slowing turning vehicles and visually narrowing the roadway.
- Must be constructed according to an overall street plan that takes into account the relevant urban design, heritage, and traffic issues.
- Materials should form a seamless whole matching existing features and materials of the footpath environment. The length of the footpath extensions vary and depend on the different conditions of the intersection and must be assessed on a project by project basis.
- Widening footpaths may require significant changes to drainage infrastructure as well as the relocation of utilities. Where possible the widening of footpaths should be achieved by the narrowing or removal of vehicular travel lanes or parking lanes or establishing setbacks as part of redevelopments.

(Refer to technical specifications).

Kerb Radii

Minimise kerb radii while accommodating the turning movements of vehicles anticipated to shorten crossing distances, increase pedestrian visibility and slow turning traffic.

Key Considerations:

- Corner design must balance the needs of the pedestrians and vehicular movement.
- Assess the specific kerb radii on a site-specific basis due to different vehicle access requirements.
- Use swept paths to determine minimum dimensions.

(Refer to technical specifications).

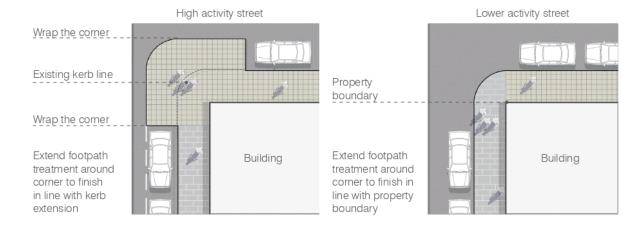


Figure C.19 Footpath material junction with kerb extension

Figure C.20 Footpath material junction without kerb extension

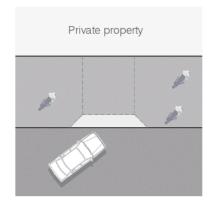
Driveways

Minimise the location and widths of driveways along pedestrian priority streets to maintain footpath continuity and avoid impacts on existing or potential streetscape elements such as street trees

Key Considerations:

- Driveways should not interrupt the footpath so that ease of pedestrian movement and visual continuity is maintained.
- Footpath pavements should be continuous across the driveway rather than emphasise vehicle priority, refer Figure C.21

(Refer to technical specifications).



Extend footpath treatment across driveways to prioritise pedestrians

Figure C.21 Footpath driveways crossings

Kerb Ramps

Install pedestrian ramps must in the direct line of travel at all intersections and mid-block locations where pedestrian crossings exist. The orientation of ramps must meet AS1428 accessibility standards to ensure the safe passage of persons with visual or physical impairments across the street.

Key Considerations:

- At intersections, locate kerb ramps within the corner area of the footpath, aligned with the street wall and set at a straight angle to the street alignment.
- Minimise the depth of the kerb ramp to reduce insertion into the footpath environment. Where a conflict occurs between the direct line of travel and existing physical elements such as a stormwater pit, the pit must be relocated clear of the crossing point.

(Refer to technical specifications and the application of tactile finishes to guide visually impaired in accordance with Australian Standards).

Raised Pedestrian Crossings



Raised pedestrian crossings make crossing easier and safer for pedestrians by increasing the visibility of the crossing for drivers and requiring vehicles to slow down. When used in combination with kerb extensions, the crossing width is also reduced, refer Figure C.22.

Key Considerations:

- Utilise raised crossings at unsignaled mid-block locations as gateway treatments in Village centres and slow zone areas.
- A change in paving unit and/or colour should be used to enhance the contrast between the carriageway and raised crossing.
- Paving applications must be consistent with the Character Area palettes (Refer to Part D – Materials Palette and Application).
- The design must comply with current TfNSW design guidelines.
- The design of raised threshold crossings should accommodate storm water drainage with prioritising a smooth and accessible pedestrian movements over vehicle movements.
- WSUD planting and elements to be used wherever possible

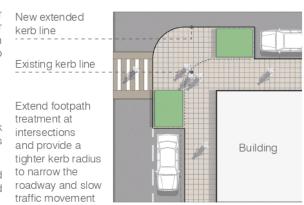


Figure C.22 Raised Pedestrian Crossing and Kerb Extensions



Image C.8: Example of raised pedestrian crossing, Bourke Street, Redfern

Shared Zones





The Shared Zone is a dedicated shared traffic environment for pedestrian, cyclists and vehicle movement. When there are low volumes of traffic assessed and a lack of space separation for balance between pedestrian and vehicle movement, a change in street type can be considered, refer TfNSW Technical Direction for shared zones.

Key Considerations:

- Remove kerbs and gutters in shared zones where possible to remove any ambiguity as to where a pedestrian should walk.
- Carefully consider the sighting and location of elements, pavements and material changes.
- If retaining kerbs and gutters require an entrance treatment (at the start of the zone) to ensure motorists are aware that they are in a significantly different road environment. (Refer to technical specifications).
- Create a self-enforcing road environment to support the implementation of the shared zone and reinforce that pedestrians have the right of way.
- To ensure that the safety of pedestrians and their priority is maintained, traffic flows must be below the designated volume as stated in the TfNSW policy.



Image C.9: Example of shared zone, The Levee, Maitland

Street Trees and Planting







Trees and planting add vibrancy and diversity to the street. Street tree canopies provide shade improving pedestrian comfort and reduce the heat island effect. Varied species selection and mass planting improve the public domain aesthetics and increase biodiversity.

Key Considerations:

- Provide permanent planting within the street furniture zone.
- Provide street trees to provide environmental quality, enhance visual continuity and unity, and reinforce local identity and character.
- Provide tree planting in roadways to increase the tree canopy, particularly in situations where awnings or overhead wires constrain the establishment of medium to tall trees on the footpaths.
- Design special applications to passively irrigate urban landscapes using water sensitive urban design to accommodate rain gardens or bio-filtration swales to collect and treat stormwater from surrounding roads and footpaths for re-use or discharge to promote growth and a comfortable microclimate.

For further information regarding street trees and planting, refer to Section 2, Part E and Hornsby's Urban Forest Strategy.

Siting and Spacing

The siting and spacing of street trees and planting is a combination of street composition and planting factors required by plant species selected.

Key Considerations:

- Locate street tree planting to create a continuous tree canopy along the corridor to provide a visually attractive setting. Spacing will vary depending on tree species selection, adjacent land use, proximity to active street entries, parking zones and distance from other streetscape elements such as lighting (Refer to technical specifications).
- Setout street trees to maximise canopy cover and allow the for the maximum growth potential of the species to meet or exceed the Greater Sydney Commission's target of 40 per cent canopy cover and to meet targets outlined in Hornsby's Urban Forest Strategy.
- Trees planted in co-ordination with parallel parking bays, the size of the tree pit and the location of the central planting must consider car overhangs and allow for enough space not to disturb the tree (Refer to technical specifications).
- Street trees to be located within the Public Domain Furniture Zone and the Extensions Zones of the street and located a minimum of 600mm from the kerb edge.



Image C.10: Example of Street tree planting, Abercrombie Street, Chippendale



Image C.11: Example of street furniture siting and spacing, Kent Street, Sydney

Street Tree Selection

Appropriate tree selection, location and installation treatment will ensure healthy growth and long term benefits for the streetscape.

Key Considerations:

- Environmental conditions, physical constraints and functional requirements.
- Based on aesthetic criteria consider include flowering and deciduous tree species to bring life and vitality to the street.

Trees should be:

- Low maintenance and robust;
- An appropriate scale for their location;
- Not susceptible to pests and diseases;
- Tolerant of Paving over the root zone (where applicable);
- Suitable to the local microclimate, soils and drainage conditions:
- Quick growing with a long life;
- Visually interesting and reflective of local character;
- Suitable for fauna and flora linkages; and
- Not likely to damage drainage utilities and pavements.

Tree Base Treatments

Tree base treatments will vary according to location and context of the surrounding footpath material palette. Tree base treatments should be optimised to ensure tree health, minimise root interference and consider providing trafficable area around tree base through the use of porous pavements and grills to capture stormwater. (Refer to Technical Specifications)

Key Considerations:

- Standard tree base treatments include tree grates (for Town Centre and Activity Strips Areas), porous pavements, decomposed granite, mass planting or turf (for Local Areas). For tree base material palette selection refer to the Part D – Materials Palette and Application.
- Tree guards are to be used only in situations where the protection of the tree is necessary and is a temporary measure only until the tree is established.
- Use mass planted tree base options where possible to increase vegetation in the streetscape.
- Implement Water Sensitive Urban Design bio-retention tree pits (infiltration) where appropriate levels and drainage fall occurs to receive water runoff from surrounding roads, properties and footpaths and to treat stormwater for reuse and/or discharge to receiving waters.
- Use Water Sensitive Urban Design passive irrigation street tree pits wherever possible.



Image C.12: Example of street tree selection for colour and canopy, McDougall Street, Kirribilli



Image C.13: Installed bioretention tree grate in brick paving Coronation Street, Hornsby

Verge Planting

Planted verges reduce the extent of the paved surfaces and provide separation between the footpath and the roadway—verge planting design to be approved by Council before installation.

Key Considerations:

- The location of planted verges needs consideration to ensure access to parked cars and utilities is maintained.
 Where in association with parallel parking it must be long stay parking.
- Prioritise permanent in-ground planting over containerised planting.
- Containerised treatments should be limited to Town Centres and Activity Strips. The placement of planter boxes must not obstruct pedestrian access and flow.
- The position of planter boxes must be in the Public Domain Furniture Zone.
- Implement WSUD treatments where appropriate

Refer to Technical Specifications and Council's Urban Forest Strategy for further information.

Water Sensitive Urban Design

WSUD not only addresses the issue of discharging stormwater pollutants into our waterways but also provides the benefits of contributing to cooler microclimates and biodiversity of plant species. Several devices and means can be used to achieve water sensitive design objectives. Examples of such devices include:

- Permeable pavers;
- Verge gardens and nature strips;
- Rain gardens (bio-retention units and filtration); and
- Bio-retention tree pits.

Key Considerations:

- Preference rain gardens (also known as bio-retention devices) when using WSUD streetscape devices. They are practical to integrate into the streetscape but also facilitate the physical, chemical and biological breakdown of pollutants.
- Use WSUD tree pits where design levels and drainage permit to receive water runoff from surrounding roads, properties and footpaths and to treat stormwater for reuse or discharge to receiving waters.

Refer to Technical Specifications and Hornsby Shire WSUD Guidelines for further information.



Image C.14: Example of verge planting, Gerard Street, Alexandria



Image C.15: Example of water sensitive urban design, Wolseley Grove, Zetland

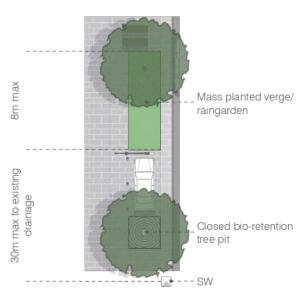


Figure C.23 Village streets

Note: Developers are to provide raingardens/bio-retention tree pits where the edge of the property boundary is >30m from any existing stormwater drainage. New developments which satisfy this criterion should provide WSUD devices to treat all stormwater discharge from the site and link devices to existing stormwater infrastructure.

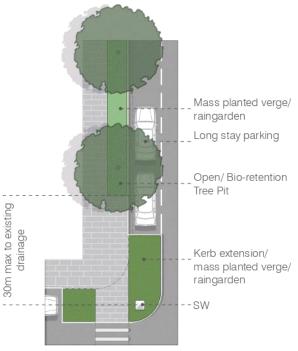


Figure C.24 Local street type A/ collector roads

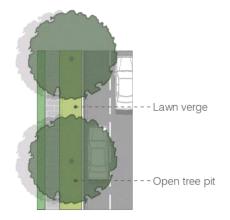


Figure C.25 Local streets type B

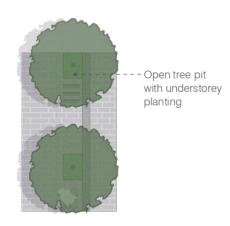


Figure C.26 Shared zone

Planted Medians

A central planted median can increase the streets aesthetics as well as narrow the carriageway, to reduce vehicle speeds and improve the pedestrian amenity. They provide an opportunity to further enhance the streetscape by introducing green elements and provide additional stormwater control and treatment. Where suitable, planted medians can be designed as WSUD devices.

Key Considerations:

- Median widths must meet minimum dimensions to enable appropriate planting objectives, depending on street tree type and size, root control and drainage. Carefully consider maintenance requirements and regimes.
- Footpaths should not be reduced in width to provide space or additional width for medians.
- Wherever safe and feasible, use permeable surfaces, street trees, understorey plantings and drought-tolerant plants.

Refer to Technical Specifications.



Image C.16: Example of planted median, Gipps Street, East Melbourne

Cycleways

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Hornsby Shire Council is developing a bicycle network to provide facilities for cyclists of all abilities. The range of bicycle infrastructure to be rolled out, which has implications on street layout, and design includes:

- Separated bi-directional bicycle lanes;
- Shared paths;
- Marked lanes on roads;
- Bicycle parking; and,
- Future hire schemes.

Key Considerations:

The selection of appropriate treatment types for routes is a function of several parameters including carriageway width, anticipated bicycle volumes, vehicle traffic volume and local conditions.

Only consider a dedicated cycleway for streets designated for such treatments. Refer to the Draft Bike Plan Review 2019.

Refer to Technical Specifications and Austroads Cycleway Guidelines.



Image C.18: Example of separated cycle path, Bourke Street, Surry Hills.



Image C.17: Merri Creek Trail shared path, Victoria.

Public Domain Furniture



Street furniture forms an integral part of the public domain identity, reinforce the public domain character, provide essential amenities for pedestrians and add functionality and vitality to the public realm. They include seats, bubblers, bicycle racks, bollards, kiosks, rubbish bins, parking meters, public art, streetscape signage, traffic and parking signs, among other elements.

The public domain furniture needs to use a consistent design language including colour, form and detailing to read as a coordinated family of elements and achieve a coherent streetscape character.

For furniture, palette refer to Part D – Materials Palette and Application.

For all detailing, fixing and technical specifications, refer to the Technical Specifications.

Key Considerations:

- Consider the siting and Spacing of street furniture.
- Consider the robustness, durability and maintenance of street furniture when selecting for use.
- Design seats and benches for comfortability, allowing for a range of settings.

Locate custom furniture elements may at key points in the street to define existing garden beds, help direct pedestrian movement as well as providing opportunities for social gathering.



Image C.19: Example of custom furniture, Darling Quarter



Image C.20: Example of public domain seating suite Lonsdale Street, Dandenong

Siting and Spacing

All elements of public domain furniture must be sited within the Public Domain Furniture Zone.

Key Considerations:

- All furniture must be located a minimum of 600mm from the street kerb face; seating is preferable to be located 1m from the kerb face for safety.
- Typical distances between elements are; Seating located every 100-250m with max. 30-50m spacing along main Village Streets; bubblers should be located every 500-800m on Village Streets.
- Light poles should not impede into the Pedestrian Zone. Maintain appropriate clearances between all other street elements, including street trees and public domain furniture.
- Locate seating as units or as singular elements where possible near street trees for public amenity.
- Bollards must be limited in use to minimise visual clutter on the street and should be used only where necessary and must comply with access and safety requirements; provide a minimum of 1000mm clear opening with 1.8m clear preferred.

- Use adjacent public spaces, including street closures, parks, and urban spaces to extend the use of public furniture.
- Co-locate pedestrian facilities at gathering and resting places rather than haphazardly spread along a street.
- Siting and spacing of elements near car parking must be compliant and not impede the provision of parking requirements as outlined in AS2890.
- Provide minimum bicycle parking facilities as outlined in AS2890.3.
- Location of bus stops and rubbish bins to bicycle parking to be as per AS2890.



Image C.21: Example of well spaced public domain elements Wulugul Walk, Barangaroo

Signage and Wayfinding







Street Lighting







A coordinated suite of signage is an essential component of achieving a legible and quality public domain. There are three types of public domain signage;

- Wayfinding information displays that map key locations within the city;
- 2. Regulatory signage; and,
- 3. Street and place name signs.

Key Considerations:

- Locate all signage within the street furniture zone, with consideration for facilitating pedestrian movement around all sides.
- Attach signage where possible to existing poles and structures to reduce clutter;
- Site wayfinding signage in areas of high pedestrian traffic and usage such as gateways, entry points, traffic junctions or similar.

Council is in the process of developing a Shire-wide Signage and Wayfinding Strategy.

Street Lighting works in conjunction with street trees as an organising element to establish the rhythm of the streetscape. Street lighting includes roadway, pedestrian and cycleway lighting and helps define a positive urban character and supports night time activities.

Key Considerations:

- Improve pedestrian amenity through lighting footpaths and cycleways.
- Choose energy-efficient light fittings such as LED.
- Select light fittings that minimise light spill and glare.
- Reduce visual clutter in streets by locating on existing poles.
- Consider the use of standard lighting fixtures as used by electricity service authorities, provided they are evaluated as meeting aesthetic design objectives
- Choose a light fitting that is an appropriate scale for pedestrian areas.
- Comply with Australian Standards for footpath lighting.

Developments should facilitate the placement of powerlines underground on the road reserve at the front of the site as well as within the site boundaries.

Refer Sections 3.2.10, 3.3.10, 3.4.10 and 3.5.10 of the HDCP.

Refer to Part D – Materials Palette and Applications and Technical Specifications for proposed light fitting and lighting levels and technical applications for lighting luminaries and required lighting levels.



Image C.22: Example of public signage and wayfinding Dandenong, Victoria

Public Art



Utilities



Public Art is an essential aspect of major streetscape design projects. On a large scale, Public Art can unify a district with a theme or identify a neighbourhood gateway. At a pedestrian scale, it can assist in wayfinding and provide visual interest to passers-by.

Public Art can imbue beauty and symbolic meaning as both independent installations or as functional objects such as seats, bus shelters, grates and railings to create a sense of place and identity.

Interactive Public Art also has the potential to bring together members of the community to participate actively and engage with each other within the public realm.

Key Consideration:

Public Art proposals shall respond to the Public Art Masterplan (currently being developed) and comply with the Public Art Policy.

Utilities in the streetscape consist of utility poles, overhead wires, surface pits and electricity kiosks.

Key Considerations:

- Efficiently locate utilities to minimise the impact on other existing or potential streetscape elements, maintain necessary access and maintenance requirements.
- Under-grounding of overhead services should be carried out where feasible to main streets to reduce visual intrusion and provide optimum conditions for street trees to reduce the impact on the tree canopy.
- Pit lids should consist of paving inserts consistent with the paved footpath finish in the Town Centre and on all main streets.
- Realign pits to match with pavers where possible.
- Above ground utilities such as traffic signal boxes, electrical MSB's and communications pillars should be coordinated and consolidated to reduce visual intrusion and maintain paths of travel.

(Refer to Technical Specifications).



Image C.23: Example of public art, Huntley Street, Alexandria Image C.24: Pitt Street Mall, Sydney



Outdoor Dining and Barriers



Inclusive Access Applications



Council encourages outdoor dining as a key component of delivering a lively and engaging city.

Key Considerations:

- Carefully design barriers to provide inclusive access and high design quality.
- Locating all outdoor dining furniture in the Street\ Furniture Zones or as directed by the Council.
- Maintain a clear, unobstructed footpath zone for pedestrian through movement.

Refer to Technical Specifications.

the relevant legislation and Australian Standards 1428.1.

 Provide clear and legible paths of travel in accordance with AS 1428.

Inclusive access applications are required in compliance with

- The provision of luminance contrast at stairs and falls.
- The provision of bollards and safety railing.
- The provision of tactile paving treatments.
- Tactile Ground Surface Indicators (TGSIs) where appropriate.
- The provision of pram ramps.
- The Alignment of path of travel and pram ramps.
- Removed kerb edges to shared traffic zone treatments require a change in the surface pavement.
- Slip resistance.

Key Considerations:

Refer to Technical Specifications.



Image C.25: Example of outdoor dining, Barangaroo Avenue, Barangaroo



Image C.26: Example of Braille street sign, Wynyard Park, Sydney

Dementia Friendly Design



The public domain is to be designed for the widest range of users possible. Dementia friendly design goes beyond the application of inclusive access applications and Australian Standards to provide functional, legible and safe environments for all abilities.

Key Design Considerations:

- Provide acoustic barriers to reduce background noise, such as planting and fencing.
- Use clear large signage with clear colour contrast for wayfinding to toilets and destinations.
- Provide obvious and easy access to shaded areas, with adequate seating.
- Provide seating design which is clearly a seat, avoid abstract furniture design.
- Provide sufficient parking and easy access to parks, shops and public facilities.
- Ensure changes in ground levels are clearly marked and well-lit, with compliant handrails, tactiles, and appropriate contrast and non-glare surfaces.
- Ensure clear visibility from top step to bottom step.
- Provide sensory stimulation in gardens and parks using varied colours, scents, textures and sounds.
- Ensure main paths of travel are enough for two users to walk side-by-side or use wheelchairs.
- Ensure entry and exit signs are clear and obvious.
- Avoid structures, such as pergolas, or lighting which cast complex contrasting shadows, these may be interpreted as depth changes.
- Ensure undercover areas are provided in parklands for access in all weather conditions.
- Utilise visual landmarks to assist with wayfinding such as water features or murals.
- Ensure bus shelters are enclosed and have adequate seating.

Refer to Alzheimer's Australia's "Guidelines for the Development of Friendly Communities" and Local Government Toolkit.

Maintenance of the public domain is equally as important as its design. The public domain infrastructure must be actively monitored and rectification of issue sought as soon as possible.

Key Maintenance Considerations:

- Repair trip hazards caused by cracks, tree root up-heaving, unstable pavers, potholes and other depressions.
- Repair or replace damaged infrastructure.
- Repainting of surfaces, and line marking to maintain compliant luminance contrast.
- Cleaning of surfaces to removing debris and spills which may cause slip hazards.
- Tree and plant pruning and maintenance to prevent obstructions to a continuous path of travel, restricting of lighting or access to building entries and exits.

PART D – Materials Palette and Application

D.1 Character Areas

This section defines different character areas that make up the urban realm of Hornsby Shire. The zones are defined by location and function and form the basis of the material palette selections.

Town Centre and Activity Strips

Town centres and activity strips are typically areas of high daily visitation focused around commercial and retail business activity. These areas often have high pedestrian activity with direct access to public transport.

These areas are comprised of public spaces offering a civic place for play, learning and cultural events with direct links to public transport modes. Surrounding the civic space is an area of retail and restaurants.

Heritage Town Centre and Activity Strips

Similar to Town Centres and Activity Strips, Heritage Town Centres retain and celebrate historical urban design elements. They exemplify the heritage of Hornsby villages through materiality, architecture and scale. The distinct features of Heritage Town Centres enrich and define the local community's identity and lifestyle.

Local Areas

Local areas include a variety of street types, comprised of medium and low density suburban areas with the primary land use being residential. Within the study areas covered by these guidelines they form part of the local pedestrian network that links local amenities and destinations such as schools, parks, community centres, retail and commercial services, and public transport services.



Image D.1: Peats Ferry Road, Hornsby

Town Centre and Activity Strips

These centres provide a focus around which daily community life is organised. A high quality and robust materials palette and street furniture selection are used in the streetscape and public space areas to respond to high pedestrian use, and amenity associated with local commercial, retail and business activity and public transport uses throughout Hornsby Shire.

A distinct palette of streetscape elements is used along the activity strips leading away from and towards Railway Stations to acknowledge its significance both as a local transport hub and gateway into Town Centres.

Streetscape elements within the existing streetscape including bus stops, telephones, bins, seats, dining barriers, pedestrian lighting, cycle racks, bubblers and tree guards provide the tools for demonstrating these as visually distinct places in the local government area.

These occur in Asquith, Waitara, Thornleigh, West Pennant Hills.



Image D.2: Example of retail activity strip, Scotch Row, Barangaroo



Image D.3: Example of high quality public domain in town centres, Rouse Hill Town Centre, Rouse Hill

Heritage Town Centres and Activity Strips

Heritage town centres maintain, protect and celebrate their history and character through architecture and materiality. A distinct palette of heritage streetscape elements are chosen to be used along the heritage activity strips leading away from and towards Railway Stations in order to acknowledge its significance both as a local transport hub and gateway into Town Centres.

These centres function similar to other town centres providing a focus around which daily community life is organised. A high quality and robust palette of materials and street furniture is used in the streetscape and public space areas. The palette responds to high pedestrian use and amenity associated with local commercial, retail and business activity and public transport uses throughout Hornsby Shire.

Streetscape elements within the existing streetscape including bus stops, telephones, bins, seats, dining barriers, pedestrian lighting, cycle racks, bubblers and tree guards are to be updated so as to respond to the local heritage. Heritage materials such as brick, are to be used as paving specific to the street types. Areas such as Beecroft, have a fine grain heritage architecture and urban form, these should inform the streetscape design and layout.



Image D.4: Example of retained fine grain heritage architecture, Argyle Street, Camden

Local Areas

Local areas consist primarily of low-medium density residential areas. They require a simple, durable and robust palette of materials that responds to the existing fabric and offers an opportunity for expression of individual neighbourhood character.

Within the local area network, some areas accommodate a higher level of pedestrian activity associated with retail, commerce and transportation links between destinations. In contrast, some residential areas have lower levels of pedestrian activity.

The street network within the Local Areas provides pedestrian connections to local amenities and destination such as schools, parks, community facilities, retail and commercial services, and the public transport network.

The streets with the higher level of pedestrian activity provide the opportunity to use a higher standard of materials and street furniture to enhance legibility and identity within the streetscape. These elements include bus stops, telephones, pedestrian lighting, bins, seats, cycle racks and tree guards.

The paving palette for the Local Areas currently includes in situ concrete as the primary material for footpaths. However, consideration of local context, fabric and potential heritage value may provide an opportunity to highlight main pedestrian links and local hubs with brick paving/ granite setts. There is an opportunity for these footpaths to be widened that link key places.



Image D.5: Station Street, Thornleigh



Image D.6: Peats Ferry Road, Asquith

D.2 Public Domain Palette

Materials Palette

A consistent palette of paving and kerb materials creates a clear, coherent public domain structure and unified, recognisable character as well as accentuates the visual continuity of the street. Complimentary to these ground materials are elements such as street furniture and lighitng. This section provides reference tables for the materials palette and their application. Key considerations include materials selection, excellent attention to detailing and quality installation: these components work together to form robust, slip-resistant, stable and durable public spaces.

The aims of the materials and furniture palette are to:

- Provide a simple, durable, manageable and consistent palette that is appropriate to different character zones and street types;
- Consider sustainability objectives in material selections including embodied energy, life cycle costing and provenance; and
- Use this palette to design a public domain that unifies street types, while allowing variations in some elements to distinguish the different character zones and reinforce local identity.

The design principles for the choice of materials and street furniture include:

- Sustainable, high durability, low embodied energy;
- Flexible and easy to remove and re-lay:
- Create a high-quality pedestrian environment with materials that are robust, durable and easy to maintain;
- Reinforce streetscape hierarchy and character;
- Reduce the use of asphalt;
- Relate to streetscape context and existing pavement type; and
- Consider the use of temporary materials in street design for low-cost variations, such as paint and planter boxes.

Use a combination of the above design principles to ensure the use of the most appropriate materials to maximise accessibility, ease of maintenance, are aesthetically appropriate, economically beneficial, sustainable in choice and durable.

Design feature paving to unite and provide a continuous and identifiable element in the Town Centre.

For further information the Technical Specification and Materials Performance Specification.

Paving

Туре	Description					Application	Image
	Product	Colour	Finish	Dimensions	Setout	1	
In-situ concrete	In-situ concrete	Natural Portland Grey	Broom finished, no trowel edge	Widths varies, refer path network diagram	Control and expansion joints to engineers design	Local streets	
Brick Paving	Claypave or equivalent	Monarch Tan	N/A	230 x 115 x 50mm	Herringbone, laid 45 degrees to street	Heritage Town Centres and Activity Strips	
Granite Setts	Granite cobbles	Adelaide Black	Flame exfoliated	105 x 105 x 80mm	Stack bond	Town Centres and Activity Strips, Local Areas	
Granite paver	Granite Flagstone	Raven Black, Adelaide Black	Flame exfoliated	Type A: 900 x 450mm Type B: 600 x 450mm	Stack bond Stretcher bond, perpendicular to path of travel*	Town Centres and Activity Strips	
Granite (Special Application)	Special appli different pavi			one paving incl	uding inlays of	Town Centres and Activity Strips	
Permeable paver (road)	Ecotrihex	Charcoal	N/A	188 x 92 x 60mm	As per manufactures specification	WSUD roads/ parking	
Permeable paver (shared)	Ecopave80	Charcoal	N/A	226 x 111 x 80mm	Herringbone	WSUD shared zones	
Permeable Paving (Special Application)	Porous Asphalt, Concrete & Aggregate with Epoxy. Future use is subject to Council approval based on further research on availability and application. Town Centres and Activity Strips and Local Areas						
Asphalt	and to meet	TfNSW Tech	nical Guide	ned and approvi s and Standard cled glass mate	s, and RMS	Roads and foo approved.	tpaths where

Table D.1 Paving type materials palette

Note: Concrete must comply with the technical specification for sustainability, Special consideration is to be given regarding the inclusion of recycled glass components in concrete and asphaltic pavements in line with Council MOU with SSROC.

Refer to Technical Specification and Materials Performance Specification

Seating

The intent of the site furnishings is a palette of considered design elements that use a consistent aesthetic design with individual elements relating to each other in form, appearance and materials.

Note: The furniture selections are subject to further aesthetic and asset management investigations and subject to change.

Туре	Description				Application	Image
	Product	Material	Dimensions	Supplier		
Contemporary Seat Suite	Oxley Furniture Suite: seat, bench, corner bench, platform	Powdercoated steel and hardwood timber	Seat: 1800L x755Wx620D mm Bench: 1800Lx 420H x530Dmm Corner bench: 1200W x430H x1200Dmm Platform: 1800W x430H x1800D	MOS Urban	Town centre streetscape upgrades, parks and plazas	
Custom Seating	and plaza upg	rades. Custom fu	ck rests to be used urniture should be attens and steel fra	high	Town centre, plazas, parks, malls and shared zones	

Table D.2 Seating type palette

^{*}Refer to Technical Specification

^{**} Refer Materials Performance Specification

Bike Parking

Туре	Description				Application	Image
	Product	Colour	Dimensions	Supplier	1	
Retro-fit Bike Hoop	Cycla Pole Mounted Retro-fit	Galvanised steel	650 x 650mm	Civiq	Town centres and local areas where bike parking required to affix to existing poles	
Local Bike Hoop	Semi Hoop	Galvanised Steel	845L x 120W x 850H mm	Street Furniture Australia	Local areas	
Urban Bike Hoop	Semi Hoop	316 Stainless steel	845L x 120W x 850H mm	Street Furniture Australia	Town Centres and Activity Strips	

Table D.3 Bike parking type palette

Waste Collection

Туре	Description			Application	Image	
	Product	Colour	Dimensions	Supplier		
Co-mingle Bin	National Park Range	304 Stainless steel frame, roof, chutes and panels. Panels feature full colour UV digital printed educational material	240L	Source Separation Systems	Streetscape upgrades, parks and plazas.	
Separated Waste	National Park Range	304 Stainless steel frame, roof, chutes and panels. Panels feature full colour UV digital printed educational material	2 x 240L, 3 x 240L	Source Separation Systems	Streetscape upgrades, parks and plazas.	CANADA TORONO

Table D.4 Waste collection type palette

^{*}Refer to Technical Specification

^{**} Refer Materials Performance Specification

Bollards

Туре	Description		Application	Image		
	Product	Colour	Dimensions	Supplier		
Existing Bollard	Slimline 150NB removable (SSP150RB)	304 Stainless steel	168.3mm	LEDA	Town Centres, Parks, Plazas, Malls	

Table D.5 Bollard type palette

Bubblers

Туре	Description				Application	Image
	Product	Colour	Dimensions	Supplier]	
Bubbler/ re-fill	Aquafil, 1500/2100 high Refill Station with Drinking Fountain, Type C	316 Stainless steel	1500mm, 2100mm	Aquafil	Town Centres, Parks, Plazas, Malls	
Bubbler	Aquafil Bold	316 Stainless Steel	850(h)	Civiq	Streetscape upgrades, parks and plazas.	
Bubbler with dog bowl	Aquafil Bold with dog bowl	316 Stainless steel	850(h)	Civiq	Streetscape upgrades, parks and plazas.	Starting day desting total option

Table D.6 Bubbler type palette

^{*}Refer to Technical Specification

^{**} Refer Materials Performance Specification

Tree Base Treatments

Туре	Description					Application	Image
	Туре	Materials	Supplier	Dimensions	Notes		
Turf	Spade cut edge in turf with mulch	N/a	N/a	N/a	N/a	Local street verge planting	
Decomposed Granite	Cement Stabilised Decomposed Granite	Decomposed Granite decomposed granite	N/a	N/a	N/a	General Streets with in-situ concrete footpaths	
Mass Planting	Hardwood timber edge to turf. Steel edge to paving	Mass planting	N/a	N/a	Understorey planting at base of tree subject to council approval	Town Centre and Activity Strips Local Areas	
Raingraden	Broken kerb with planting and filtration media	Rain gardens v infiltrate throug before it drains	h planting n	nedia and treat	stormwater	Town Centre and Activity Strips Local Areas	
Roadway / Bioretention	Resin-bound aggregate (e.g. terrabond)	Epoxy bound aggregate (no-fines), and concrete wheel stops (type 1)	n/a	1985 x 1490mm	Ensure aggregate is no-fines to allow water per permeation	Village Streets and Laneways Tree protection measures such as wheel stops to be considered	
Tree grate	Laser-Cut Slotted Steel Grate with support frame	Painted mild steel	Furphy Foundry	1985 x 1490mm	Grate in frame set flush with road surface to encourage infiltration	Village Streets and Laneways	

Table D.7 Tree base treatment type palette

Refer to Technical Specification and Material Performance Specification. Refer to best practice tree placement guidelines: https://watersensitivecities.org.au/content/trees-cool-city-guidelines-optimised-tree-placement/

Barriers

Туре	Description					Application	Image
	Product	Materials	Finish	Dimensions	Supplier	1	
TfNSW Barrier	TfNSW Pedestrian Fencing – Type 1	Painted Mild Steel	Painted steel	Varies	ENCAT	As required by TfNSW ^	

Table D.8 Barrier type palette

Refer to Technical Specification
Refer Materials Performance Specification
^Where possible planting should be prioritised in place of a barrier

Lighting

Note: The lighting selections are subject to further aesthetic, asset management and electrical service authority lighting standards/ fixture investigations and are subject to change. All electrical cabling to be underground. All existing and new street lighting to be LED, refer Ausgrid LED roll out program. Refer Ausgrid network standard, Public Lighting Design and Construction document.

Туре	Description				Application	Image
	Product	Height	Supplier	Description]	
EA Pole – Replace with LED as per Ausgrid	Energy Australia Timber or Steel pole	N/a	Energy Australia	Hardwood Timber / Galvanised Steel	Retain where existing in streetscape	
Smart Pole Series	Smart Pole	13.7m	HUB	Stainless Steel	Streetscape upgrades, parks, and plazas in civic heart sites and associated main streets	
Pedestrian Street Lighting on Stand- alone pole	Pole-top luminaire with asymmetrical flat beam light	4.5m	BEGA / Zumtobel Group	Graphite	New pedestrian pole where stand alone light is required, streets, malls and laneways	
Contemporary Lighting	Pole-top luminaire with symmetrical flat beam light	4.5m	BEGA / Zumtobel Group	Graphite	New pedestrian pole where stand alone light is required, streets, malls and laneways	
Other lighting fixtures (special applications)		elements for	street poles,	wall mounted fix	are constantly chan stures and other ap	

Table D.9 Lighting type palette

Refer to Technical Specification Refer Materials Performance Specification

Kerbs

Туре	Description		Application	Standard	
	Material	Dimensions	1		
Dish Crossing	Concrete ^	900 x 190mm	Vehicle crossing	Refer to Technical Specification	
Mountable Kerb	Concrete ^	210 x 260mm	Local areas	Generally, continue use of predominant kerb material and type of street	
Roll-kerb	Concrete ^	760 x 250mm	Local areas	^ Sandstone to be used in place of	
Barrier Kerb	Concrete ^	600 x 150mm	Town Centres and Activity Strips	concrete in Heritage Town Centres	
Broken Kerb	Concrete ^	Varies	Town Centres, Local Areas, WSUD		
Wheel stop Type 1	Concrete	90-100H x Min. 2000L mm	Local Areas, Town Centres and Activity Strips	Refer to Technical Specification	

Table D.10 Kerb type palette

TGSI

Туре	Description			Application	Standard	Image
	Material	Description	Supplier			
Warning	316 Stainless Steel	316 Stainless steel tactile with slip resistant engraved sides and mill top finish	DTAC or similar	As required by standards	TGSI to be tested for LRV prior to installation at each application.	
Directional	316 Stainless Steel	316 Stainless steel tactile with slip resistant engraved sides and mill top finish	DTAC or similar	As required by standards		

Table D.11 TSGI type palette

^{*}Refer to Technical Specification

^{**} Refer Materials Performance Specification

Shelter and Kiosk Types

Туре	Description	1				Application	Image
	Product	Materials	Finish	Dimensions	Supplier		
Telephone	TELSTRA	I	e required (reet Furniture Zo determined in co	Town Centre and Activity Strips Local Areas		
Kiosks				ject to EOI. mined in conjun	ction with	Town Centre and Activity Strips Local Areas	
Existing Bus Shelter	To be retain	ed where exist	d where existing in streetscape Adshel				
Contemporary Bus Shelter	Metro Bus Shelter		hatter Resistant Glass nd Painted steel 3500L x 1700W x 2300H			Town Centre and Activity Strips Local Areas	

Table D.12 Shelter and Kiosk type palette

^{*}Refer to Technical Specification

^{**} Refer Materials Performance Specification

Character Areas Material Palette Application Summary Table

Street Type	Villa	age (Stree	ets	Sha	red	Zones	Lar	ewa	ys
Example Street Name	Pacific Hwy	Pennant Hills Rd	Waitara Ave, Waitara		Railway Ave, Thornleigh	Park Ln, Waitara		Park Ln, Waitara	Wattle St, Asquith	

FOOTPATHS

Paving Type	Granite Flagstone (Raven Black, Adelaide Black)	Special Applications – Granite Flagstones	Granite Stone Sett Paving, Permeable Ecopave (Asphalt where approved)			
Kerb / Gutter	Concrete	Concrete	Concrete			
Dish Drain	Concrete	Granite Paving Segments	N/A			
Parking Bays / Threshold	Granite Stone Sett Paving (Asphalt where approved)	Special Applications – Granite Stone Sett, Permeable Ecotrihex	N/A			
Wheel stops	Concrete					
Kerb Ramps	Concrete	Concrete				
Driveway	To match footpath/shared way/ laneway material Type 316 Stainless Steel tactiles					
TGSIs (Tactiles)						
Service Pit Lids	Infill to match paving					

STREET TREES

Pot Size	400L
Min. Soil size	Small tree 9m3 (<5m Mature Canopy)
per tree	Medium tree 35m³ (<10m Mature Canopy)
	Large tree 150m³ (>10m Mature Canopy)

TREE BASE TREATMENTS

Tree Pits Tree Grate, WSUD	Mass Planting, WSUD	Tree Grate, WSUD
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STREET FURNITURE

Seat	Contemporary Seat and Bench 1 & 2, Custom Designed Seating				
Bollard	Existing Bollard - LEDA, Contem	porary Bollard			
Bubbler	Contemporary Bubbler		N/A		
Re-fill Station	Aquafil Re-fill Station N/A				
Rubbish Bin	Contemporary Rubbish Bin				
Bike Rack	Contemporary Cycle rack, 'O' Rir	ng attached to pole			
Barrier	TfNSW Barrier N/A N/A				
Telephone	TELSTRA				
Kiosk	New Kiosk to future specification subject to EOI N/A				
Bus Shelter	Contemporary Bus Shelter				

LIGHTING

Street Lighting	Smart Pole Series	N/A		
Pedestrian Lighting	Pedestrian Street Light on Stand-alone Pole			
Plaza Lighting	Contemporary Lighting	N/A		

Table D.13 Town Centres and Activity Strip materials application table

Street Type	Vill	age :	Stree	ts	Sha	ared Zones	La	neways
Example Street Name	Hannah St, Beecroft	Beecroft Rd, Beecroft	Wongala Cres, Beecroft		Hannah St , Beecroft		Future Laneways	
FOOTPATHS								
Paving Type	Brio	k Pa	ving		Brick Paving, Permeable			ck Paving, Permeable

Paving Type	Brick Paving	Brick Paving, Permeable Ecopave	Brick Paving, Permeable Ecopave			
Kerb / Gutter	Sandstone					
Dish Drain	Concrete	Concrete	N/A			
Parking Bays / Threshold	Brick Paving (Asphalt where approved)	Special Applications – Granite Stone Sett	N/A			
Wheel stops	Sandstone					
Kerb Ramps	Brick Paving					
Driveway	To match footpath/shared way/ laneway material					
TGSIs (Tactiles)	Type 316 Stainless Steel tactiles					
Service Pit Lids	Infill to match paving					

STREET TREES

Pot Size	400L
Min. Soil size	Small tree 9m³ (<5m Mature Canopy)
per tree	Medium tree 35m³ (<10m Mature Canopy)
	Large tree 150m³ (>10m Mature Canopy)

TREE BASE TREATMENTS

1	01	F.:-+: D-	-i				
	STREET FURNITURE						
ļ	Tree Pits	Tree Grate, WSUD	Mass Planting, WSUD	Tree Grate, WSUD			

Seat	Existing seating, Custom Designed Seating					
Bollard	Existing Bollard - LEDA, Cor	ntemporary Bollard				
Bubbler	Contemporary Bubbler		N/A			
Re-fill Station	Aquafil Re-fill Station N/A					
Rubbish Bin	Contemporary Rubbish Bin					
Bike Rack	Contemporary Cycle rack, 'C	Contemporary Cycle rack, 'O' Ring attached to pole				
Barrier	TfNSW Barrier	N/A	N/A			
Telephone	TELSTRA					
Bus Shelter	Contemporary Bus Shelter	Contemporary Bus Shelter				

LIGHTING

Street Lighting	Smart Pole Series	N/A	
Pedestrian Lighting	Pedestrian Street Light on Stand-alone Pole		
Plaza Lighting	Contemporary Lighting	N/A	

Table D.14 Heritage Centres and Activity Strips material application table

Street Type	Arterial Roads			Collector Roads - Type A & B		Local Streets Type A		Local Streets Type B										
Example Street Name	Pacific Hwy	Pennant Hills Rd	Beecroft Rd	Cumberland Hwy		Peats Ferry Rd, Asquith	Wongala Crs, Beecroft	The Comenarra Pky, Waitara		Bouvardia St, Waitara	Kirkham St, Beecroft	Station St, Thornleigh		Gardenia St, Asquith	Chapman Ave, Beecroft	Orara St, Waitara	Wood St, Thornleigh	

FOOTPATHS

Paving Type	In-situ Concrete	In-situ concrete, Granite, Flagstone Setts (Raven Black, Adelaide Black)	In-situ concrete, Granite, Flagstone Setts (Raven Black, Adelaide Black)	In-situ Concrete				
Kerb	Concrete	Concrete						
Gutter	Concrete							
Dish Drain	N/A							
Kerb Ramps	Concrete							
Driveway	To match footpath material							
Service Pit Lids	Concrete							

STREET TREES

Pot Size	400L
Min. Soil size	Small tree 9m³ (<5m Mature Canopy)
per tree	Medium tree 35m³ (<10m Mature Canopy)
	Large tree 150m³ (>10m Mature Canopy)

TREE BASE TREATMENTS

Tree Pits	Decomposed granite, Mass Planting, WSUD

STREET FURNITURE

Seat	Contemporary Sea	N/A				
Bubbler	N/A	Contemporary Bubbler	N/A			
Rubbish Bin	N/A	Contemporary Rubbish Bin	N/A			
Bike Rack	N/A	Contemporary Cycle rack, 'O' Ring attached to pole	N/A			
Barrier	TfNSW Barrier	TfNSW Barrier	N/A			
Telephone	TELSTRA	TELSTRA				
Bus Shelter	Existing Bus Shelter	Contemporary Bus Shelter	Existing Bus Shelter			

LIGHTING

Street Lighting	Ausgrid Lighting		
Pedestrian	N/A	Pedestrian Street Light on Stand-alone	N/A
Lighting		Pole	

Table D.15 Local area material application table

D.3 Materials for a Sustainable Public Domain

Performance Specification

This section outlines best practice guidelines for the design, procurement, construction and maintenance of public domain elements. The following performance specifications form the basis of using sustainable practices and materials and assist throughout the life-cycle of the public domain.

Practices for Sustainable Sites

The following are key best practices, which where possible should be incorporated into the design, construction and maintenance of a sustainable public domain:

Materials or Products That Reduce Resource Use

- Use no new materials, don't rebuild;
- Reuse existing structures in place;
- Reduce materials use;
- Use durable materials;
- Reclaim and reuse materials or products in the whole form:
- Use reclaimed material from other sources;
- Reprocess existing structures and materials for use on-site:
- Use reprocessed materials from other sites;
- Specify materials and products with reuse potential and design for disassembly;
- Specify recycled-content materials and products;
- Use materials and products with recycling potential;
- Specify materials and products made from renewable resources; and
- Specify materials or products from manufactures with product take-back programs.

Materials or Products That Minimise Environmental Impacts

- Use sustainably harvested or mined materials;
- Use certified wood;
- Use minimally processed materials;
- Specify low embodied energy materials;
- Specify materials produced with energy from renewable sources;
- Use local materials;
- Specify low-polluting materials; and
- Specify low-water-use and low-water-polluting materials.

Materials or Products That Assist with Sustainable Site Design Strategies

- Products that promote a site's hydrological health;
- Materials and products that sequester carbon:
- Products that reduce the urban heat island effect:
- Products that reduce the energy consumption of site operation;
- Products that reduce the water consumption of site operations.

For further information refer Calkins, M. (2009) Materials for Sustainable Sites

Sustainable Material Performance

Concrete

As the worlds most frequently used construction material, concrete also rates as one of the worst contributors to greenhouse gas emissions. Sustainable use of concrete in construction should consider:

- Efficient structure design to reduce material volume
- The mix of fly ash and other alternatives
- Substituting natural aggregate with recycled materials
- Efficient reinforcing and alternative materials

Earthen Materials

Often easy to source locally and flexible use cases across a project, including reusing existing site materials, earthen materials are sustainable construction materials and should be considered for structural use. Construction methods include adobe bricks, compressed earth blocks, rammed earth, cob, and earth-bags. Additionally, consider the technical performance of earthen structure finishes and waterproofing.

Masonry

Traditionally, clay bricks materials have a high embodied energy. However, a considered approach to the life cycle of bricks can improve the sustainability of the material. With the potential to be used in more than one project. When using bricks, consider the following:

- Efficient wall design to reduce quantities
- Cement mortar efficiency and cement mix
- Possible second life of brick after the current project
- Using recycled bricks

Asphalt

Asphalt, an impermeable co-product of petroleum production and comprised of heavy hydrocarbons, can negatively impact both environmental and human health. Considerations to reduce the environmental impacts of asphalt include:

- Using warm or cold-mix asphalt
- Using recycled aggregates and/or reclaimed asphalt
- Using high-albedo paving materials and/or surfaces

Alternatives to asphalt as a surface vary, including other materials in this section, or permeations of their use such as porous asphalt or permeable paving.

Wood and Wood Products

Although inherently a natural renewable resource, wood as a sustainable material is only as good as its supply chain and processing. Consider the following when using wood:

- Use the lowest grade of wood for application
- Build smaller and more efficiently
- Build for disassembly
- Use of recycled wood or engineered wood products
- Use FSC certified wood
- Use natural low-volatile organic compound finishes

Metals

Due to the multiple stages of raw materials acquisition and processing, metals have a generally high level of embodied energy. However, it can be an efficient structural material which can be reused or recycled. The various properties of metals and alloys impact not only their sustainability but their weathering and durability performance. Sustainable finishes practices should be used, such as factory finishing and specifying powder coating over solvent-based coatings.

Plastics and Rubber

Plastics fill a unique role construction, with potential uses as both a construction material such as pipe, or secondary product such as plastic packaging of other materials. A holistic approach to sustainable site management is essential to a truly sustainable project. Projects should reduce plastic use in construction and where possible reuse and recycle. When using plastics, consider the type of plastic to have the lowest environmental and human health impacts as possible, and their ease of recycling.

Biobased Materials

Produced from organically based renewable animal and plant parts, biobased materials are a more sustainable alternative than petroleum-based materials. Common biobased materials include jute, coir, straw and recycled organic fibres for erosion control, revegetation and mulching. Another is bamboo and bamboo-based products which have various structural and non-structural applications. Biobased materials have applications in other materials mentioned in this part as sustainable substitutes in part or whole.

D.4 Public Domain Water Sensitive Urban Design

The Water Cycle of Hornsby

Dominated by the Hawkesbury River catchment, Hornsby Shire displays common characteristics of shires within the Sydney Basin and Metropolitan Region, refer Figure D.1. Such characteristics include hydrological influences from both natural inputs; rainfall, rivers, and aquifers, and human inputs; piped potable water, urban and industrial run-off, treated and untreated sewage. Water within Hornsby drains into either the Hawkesbury River catchment or Lane Cove River catchment. The topography of Hornsby Shire has been carved throughout its geological history resulting, in the deposition of alluvial soils to most of the Shire, refer Figure D.9. The combination of topography, soil types and development within the Shire has resulted in the vegetation communities remaining in most difficult to develop areas refer Figure D.10.

Hornsby's water uses are diverse, combining urban, suburban and agricultural. This diverse use of water requires a considered approach to water treatment to reduce negative impacts on the environment and damage to property. The peri-urban waterways are strongly valued by the community and contributing to the outdoor lifestyle and environmental identity. With an average rainfall of 1229mm, Water Sensitive Urban Design is crucial to supporting a sustainable environment and protecting land and marine flora and fauna.

Hawkesbury River Catchment

The Hawkesbury River catchment is a dominantly tidal drowned valley estuary with an open entrance at Broken Bay. The majority of the Hornsby Shire resides within the catchment to the exception of the lower portion south of Pennant Hills Road draining into the Lane Cove River catchment. The catchment shares Hornsby Shire's boundary along Castle Hills Road, which borders the Parramatta River catchment located within The Hills Shire Council local government area. Of the key projects addressed in this document, Asquith, Waitara and West Pennant Hills are entirely located within the Hawkesbury River Catchment, including the northwestern half of the Thornleigh project area, refer Figure D.1.

Lane Cove River Catchment

The Lane Cove River catchment is a dominantly tidal drowned valley estuary with an open entrance connecting into the Parramatta River and Upper Sydney Harbour. The catchment area totals 95.4 km2, of which approximately the upper third is located within Hornsby Shire Council. Within Hornsby Shire Council the catchment is bounded by the Cumberland Highway/ Pennant Hills Road to the north-west, M2 Motorway to the south-west, and the Pacific Highway to the northeast. Of the key project areas addressed in this document, Beecroft is located wholly within the catchment, including the southeastern half of the Thornleigh project area, refer Figure D.1.



Image D.7: Berowra Creek, Berowra National Park, a tributary of the Hawkesbury River

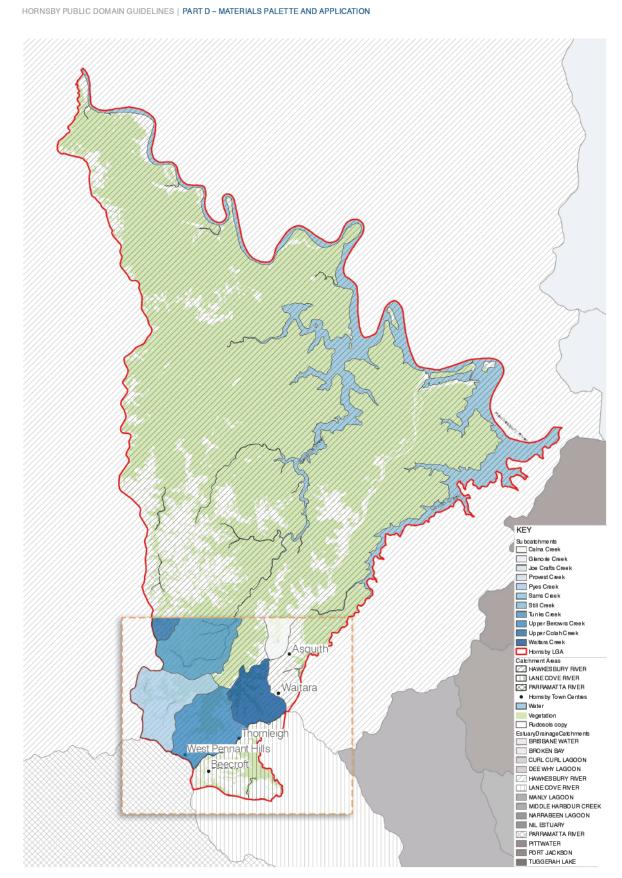


Figure D.1 Hornsby Catchments

Water Sensitive Urban Design

The increasing proportion of hard surfaces in urban areas has increased rainwater runoff, putting pressure on stormwater networks while transporting chemicals and toxic materials directly into natural water systems.

Water Sensitive Urban Design (WSUD) is an essential tool in urban design which serves the purpose of capturing, treating and reusing stormwater before it has the chance to pollute and degrade our creeks and rivers.

The following section provides design guidance during the upgrading of existing infrastructure as well as the introduction of new infrastructure, as well as the application of different WSUD devices. Read this conjunction with the Hornsby Shire Council WSUD Guidelines.

Key benefits of WSUD include:

- Reducing the volume of stormwater runoff;
- Improving the quality of stormwater runoff;
- Assisting the restoration and protection of creeks and rivers;
- Improving biodiversity;
- Improving the appearance of streets and parks; and
- Reducing the urban heat island effect through the increased tree canopy and reduced hard surfaces.

Types of WSUD applicable to the Hornsby public domain areas include:

- Tree pits;
- Tree pit with storage;
- Street tree with storage;
- Bio-retention systems (raingarden);
- Permeable pavers;
- Passive irrigation;
- Gross Pollutant Trap (GPT);
- Rainwater harvesting; and
- Stormwater harvesting.



Image D.8: Example of WSUD device Dyuralya Square, Waterloo

WSUD Elements and Scenarios in the Public Domain

The following section acts a supplementary guide to the WSUD elements and scenarios to which they apply further those in the Hornsby Shire WSUD Reference Guidelines, as relevant to the public domain areas covered in these guidelines.

The proposed scenarios and elements identified across the following pages include rooftop water and general runoff collection for use in passive irrigation of public domain trees and planting. While these scenarios are provided as guidance each situation will have site specific design requirements.

Scenario # 1: No adjustment to existing roadway or footpath:

Tree pits or street trees with passive irrigation typically require means for drainage (to avoid waterlogging the tree) such as a subsoil outlet connection to the stormwater pit and pipe network. Thus it may be preferable for trees to be planted in the existing verge or in small areas of 'cut' in the roadway (noting use of street trees rather than tree pits). In these instances, consider how to improve plant health through passive irrigation which is dependant on in situ soil type such as:

- Sandy or high infiltration (top 100mm has infiltration rate of >20mm/hr) = no need for subsoil drainage/outlet
- Clayey or low infiltration: either subsoil drainage outlet pipe OR plant tree ball above the extended detention zone.

Refer Figure D.2 for typical detail.

Scenario # 2: New or adjusted roadway or footpath:

New or adjusted roadways or footpaths are an ideal opportunity to construct more comprehensive street tree systems with well developed passive irrigation as there is a corresponding disturbance to surrounding surfaces and likely earthworks involved. In this instance, there are more options with regards to WSUD elements that can be installed, with some more appropriate depending on particular site and catchment characteristics, as follows:

- The first preference is to construct a streetscape bioretention system (providing the greatest improvement to water quality) either a standalone vegetated bio-retention system for catchments >500m 2 (e.g. blister or set back in verge) or a tree pit for smaller road catchments.
- Street trees with structural soil storage (primarily if poor drainage in natural soils) this provides enhanced passive irrigation through the inclusion of a storage cell adjacent or below the tree planting. Various configurations depend on street composition but are most appropriate in locations where there are significant changes to the roadway or footpath due to earthworks. There is greater ease in installing drainage of these systems, which improves their performance. Refer Figure D.3 and Figure D.4 for typical detail and plan.

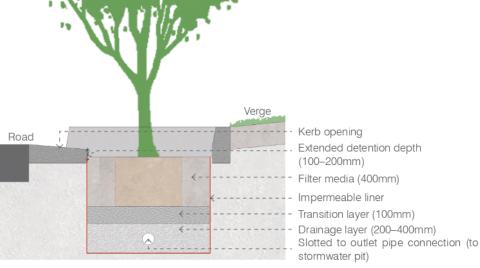
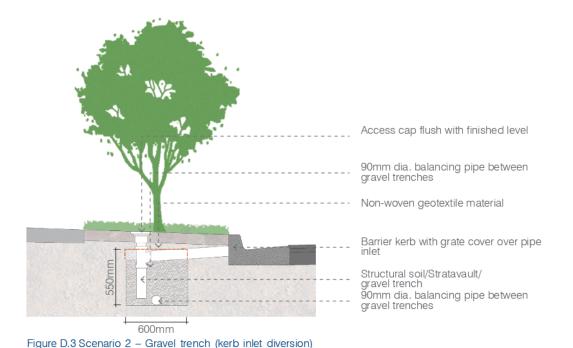


Figure D.2 Scenario 1 - Tree pit with kerb opening - Section



Footpath
90dia. balancing pipe between gravel trenches
Access cap flush with finished level
Gravel trenches
Structural soil/Stratavault/ gravel trench
Drainage to existing strormwater pit
Barrier kerb with grate cover over inlet pipe

Figure D.4 Scenario 2 - Soil storage (downpipe diversion) - Plan

- Section

Scenario # 3: Building runoff and permeable paving in civic centres:

Permeable paving can be used to both improve infiltration of a site and also serves as a visual marker for a changed surface and use (e.g. pedestrian zone in the plaza). However, it may not be the preferred finished surface for all sites and does impose a higher maintenance demand, but it is the most effective in the form of pavement infiltration. Thus, the following guides on how to incorporate permeable paving and how its use influences other WSUD elements.

Permeable paving increases infiltration to the subsurface, especially in areas of higher infiltration capacity (locations with sandy soils are most appropriate to incorporate permeable paving). When installing permeable paving in locations of high infiltration, tree plantings do not require additional grading of the surface to direct runoff to them, or additional subsurface storage or drainage, for passive irrigation. Refer Figure D.5.

- When not using permeable paving, and concrete paving are installed, there should be consideration of design options to create passive irrigation of trees, significant planted areas and turf. As an alternative, consider the following options should:
- Grading of surrounding surfaces to direct runoff to green spaces.
- Installation of structural soil for water storage.
- Connection of nearby building roof drainage to a subsoil drainage connection to tree plantings (with allowance for design of diversion of low flows only or inclusion of high flow bypass) refer Figure D.6 and Figure D.7.

Note the above options may require an outlet subsoil drainage connection to the stormwater infrastructure to allow drainage and prevention of waterlogging most notably in poor drainage soils such as clays (typical of the Hornsby Local Government Area).

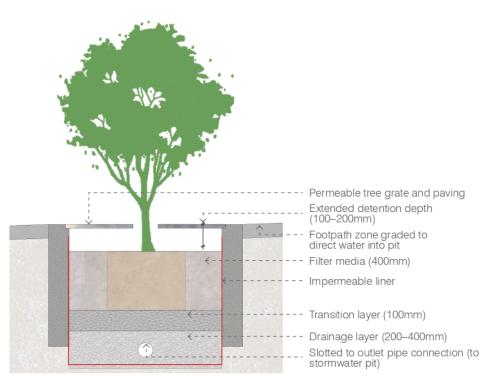


Figure D.5 Scenario 3 - Tree pit in footpath zone - Section

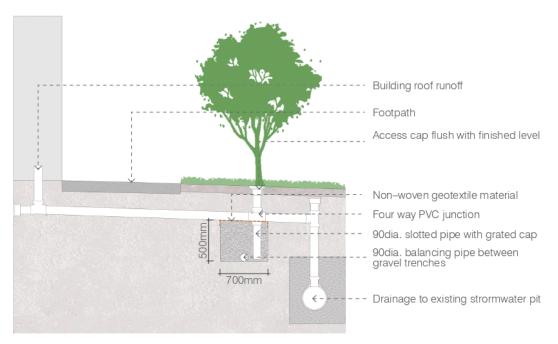


Figure D.6 Scenario 3 - Soil storage (downpipe diversion) - Section

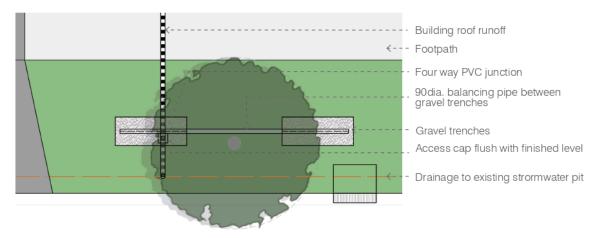


Figure D.7 Scenario - Soil storage (downpipe diversion) - Plan

WSUD Element Selection

The following decision tree and table aim to guide the process of selecting an appropriate selection of WSUD elements within the different public domain areas.

The decision tree, refer Figure D.8 below, shows the parameters of selecting and use of either street trees or bio-retention cells for existing, new and upgraded footpaths.

In addition to this, a matrix is provided, refer Table D.16, to guide the application of the WSUD elements, identifying the nine applicable WSUD elements and their use across eight public domain and streetscape situations.

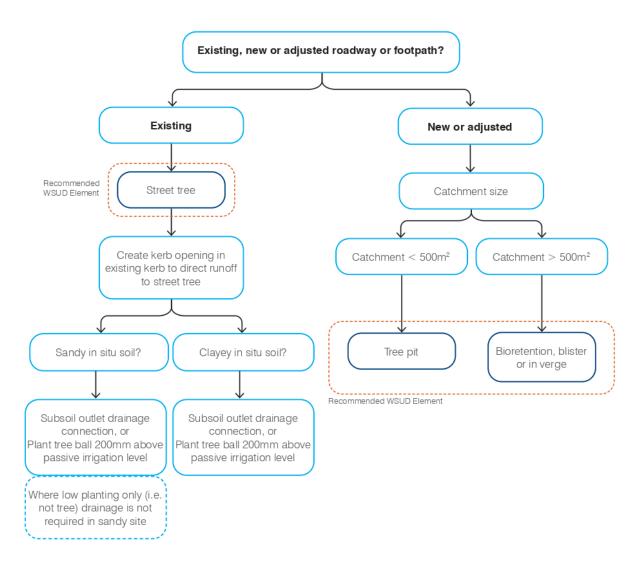


Figure D.8 Street tree bioretnetion decision tree

WSUD Element Application

	Footpath/ verge new	Footpath/ verge existing	Carpark	Street parking
Tree pit	Ideal to incorporate	Ideal to incorporate	Ideal in buffer zones between rows of car spaces	Ideal as breaks between car spaces
Tree pit with storage	Combine with passive irrigation	Combine with passive irrigation	Combine with passive irrigation	Combine with passive irrigation
Street tree with storage	Combine with passive irrigation	Combine with passive irrigation	Combine with passive irrigation	Combine with passive irrigation
Bio-retention system (raingarden)	Streetscape blisters or set back in verges	Streetscape blisters or set back in verges	Linear bio-retention, blisters	Streetscape blisters
Permeable pavers	Use in pedestrian zones. Combined with tree pits or facilitate passive irrigation	-	Use mitigation measures to reduce pollution loads and main permeability	Use mitigation measures to reduce pollution loads and main permeability
Passive irrigation	Kerb openings for vegetated median strips. Combine with tree pits with storage	Kerb openings for vegetated median strips	Kerb openings for vegetated median strips	Kerb openings for vegetated median strips
GPT	Use as required	Use as required	Use as required	Use as required
Rainwater harvesting	-	-	-	-
Stormwater harvesting	-	-	Ideal for use at car park perimeter	-

Table D.16 WSUD Element application

	Roadway (centre)	Plaza	Park/	Buildings	Recommended
			open space		location
Tree pit	Linear systems (with trees)where road is being regraded direct road grade to centre	Use of formal grated 'lid' to minimise land take. Combine with passive irrigation	-	-	Asquith Beecroft Waitara Thornleigh
Tree pit with storage	-	Combine with passive irrigation	Combine with passive irrigation if nearby source of runoff	-	Asquith Beecroft Waitara Thornleigh
Street tree with storage	-	Combine with passive irrigation	-	-	West Pennant Hills
Bio-retention system (raingarden)	Linear systems where road is being regraded direct road grade to centre	Larger systems (>10m2) ideal in parks and open spaces	Larger systems (>10m 2) ideal in parks and open spaces	-	Asquith Beecroft Waitara Thornleigh West Pennant Hills
Permeable pavers	-	Use in pedestrian zones. Pavers also create visual separation in zoning/use.	-	-	Asquith Beecroft Thornleigh West Pennant Hills
Passive irrigation	Kerb openings for vegetated median strips	Surfaces can be graded to feed adjacent green spaces or 'formal' tree pits	-	Roof drainage to passive irrigation of trees and veg plantings.	Asquith Beecroft Thornleigh West Pennant Hills
GPT	Good location for GPT maintenance access	-	Good location for GPT maintenance access with formal track	-	Waitara
Rainwater harvesting	-	-	-	Rainwater tank to collect runoff -Internal reuse (toilet flushing) -Irrigation of planted areas	Thornleigh West Pennant Hills
Stormwater harvesting	-	-	-	-	Waitara

^{*}Refer Hornsby Shire Council Water Sensitive Reference Guidelines

D.5 Public Domain Green Infrastructure

Hornsby Shire Biodiversity

Spanning more than 7,500,000 square kilometres the Australian continent possesses a unique biological diversity (referred to hereafter as 'biodiversity') distributed across thirty-three degrees of latitude from the tropics in the north to Tasmania in the south. Across the breadth of this island continent Steffen estimates that Australia comprises between seven and ten per cent of the world's total species, including approximately 200,000 terrestrial species, many unknown to science and significantly endemic. This means that in ecological terms Australia is globally important.

The Hornsby LGA possesses a high degree of biodiversity. This can be attributed to the diversity of habitats within the LGA, as well as the high percentage of vegetation cover – or bushland – within large and representative protected areas, council reserves on lands managed by other agencies (i.e. RMS) and private properties. This biodiversity is a significant and defining feature of the 'Bushland Shire' and one that requires safeguarding for future generations. It also offers an enduring connection and is of continued significant place to the area's Indigenous people to practice their culture.

Indeed, the Hornsby Shire's bushland provides life-sustaining benefits to humans through the transformations of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services (e.g. clean air, water, and food). These ecosystem services are therefore critical for maintaining the health and wellbeing of Hornsby citizens.

Importance of Bushland Across Our Shire

The role of bushland and waterways in making our urban areas more liveable and supporting biodiversity cannot be overstated. Urban habitat that is well-preserved, maintained, and connected contributes to making NSW a healthier, more enjoyable, and prosperous place to live. Biodiversity loss is one of the greatest threats worldwide and needs attention. Despite the pressures of urbanisation on biodiversity, green places in urban areas can be home to a significant number of species, offering biodiversity protection and nature experience for people.

Green infrastructure planning and design seeks to contribute to biodiversity conservation by providing habitats or establishing connections between habitats and populations. It is imperative that we support biodiversity networks from large areas such as national parks and forests to networks within more built-up urban systems. Urban biodiversity is more than just threatened species – it is all the plants, animals, and microorganisms that live in our cities. Biodiversity can exist in our streets, in our gardens, in brownfield sites, and in other unexpected places.

Rethinking infrastructure

Green infrastructure offers a broad range of ecosystem services and benefits, has a variety of types and operates over a range of spatial scales. Types of Green infrastructure may include designs at the continental scale; planning at the regional scale such as National Parks and large urban parks; and local scale including public places and waterfronts; down to the domestic, such as gardens, green roofs and other smaller scale green spaces. Increasing size and complexity Green infrastructure also offers a new approach to address environmental challenges and threats.



Image D.9: St. George's Cross spider



Image D.10: Australian Brush Turkey

Strategies for urban bushland

Council's (draft) Biodiversity Strategy promotes five key strategies to connect, protect, restore, enhance, and create urban habitat as an integral part of how urban areas are planned, constructed, and maintained. The strategies apply to remnant, transition, and urban environments that provide connections between core habitat. This approach recognises the important role of integrating nature into urban areas and the lives of people, not just protecting selected sites and landscapes.

1. Protect and conserve ecological values

The protection and conservation of existing remnant ecosystems is crucial to the prevention of further habitat and biodiversity loss and the viability of green infrastructure. Remnant ecosystems provide important habitat resources for urban biodiversity, and community access to natural landscapes.

2. Restore disturbed ecosystems to enhance ecological value and function

Where ecosystems have been disturbed, restoration is the preferred option to improve habitat structure and function and support biodiversity. Restoration not only includes bush regeneration and weed management in the reserve system, which is statutorily required, but also refers to urban habitat corridors where the built form as well as gardens, street verges, parks, and large institutional properties etc. can all play a role in improving habitat through the way they are designed and managed. Specific actions will vary depending on location; condition; identified values; past, current, and anticipated pressures; and what is feasible and practical.

3. Create new ecosystems

Where habitat linkages are needed within a corridor in areas devoid of habitat, new ecosystems can be created. Green infrastructure and water-sensitive urban design elements, such as green roofs, wetlands, and bioswales, can provide habitats and ecosystem services. More effective urban green spaces can be created when the improvement of the space considers multiple benefits at the design stage including improved economic, social, and environmental outcomes.

4. Connect people to nature

People connect with nature through sport, recreation, education, bushwalking, volunteer activities, and health-related activities. Daily exposure to nature can be improved using urban design features such as biodiverse green walls or street trees, and by providing infrastructure to facilitate access such as walking tracks, picnic areas, and lookouts. These connections are fundamental to benefit people but also the environment. Improving people's connection to nature may support longer term land management as people are motivated to care for and enhance their natural spaces.

5. Connect urban habitats

Species diversity and genetic health relies on the total area of habitat, proximity of habitats, and the capacity of species to move between habitats. Corridors allow plants and animals to recolonise areas where they have become locally extinct, so they can be enjoyed by future generations and have long-term viability. They also allow species to find alternative habitat in times of major disasters such as fire or flood and escape major threats such as clearing or disease. It is important to understand the existing network of green and blue habitats and their links. Where links between existing habitats are incomplete, approaches are needed that help to restore both corridor and steppingstone habitat connections. Urban green and blue grid corridors and networks can also provide a range of social benefits including improved recreation opportunities and neighbourhood destinations.

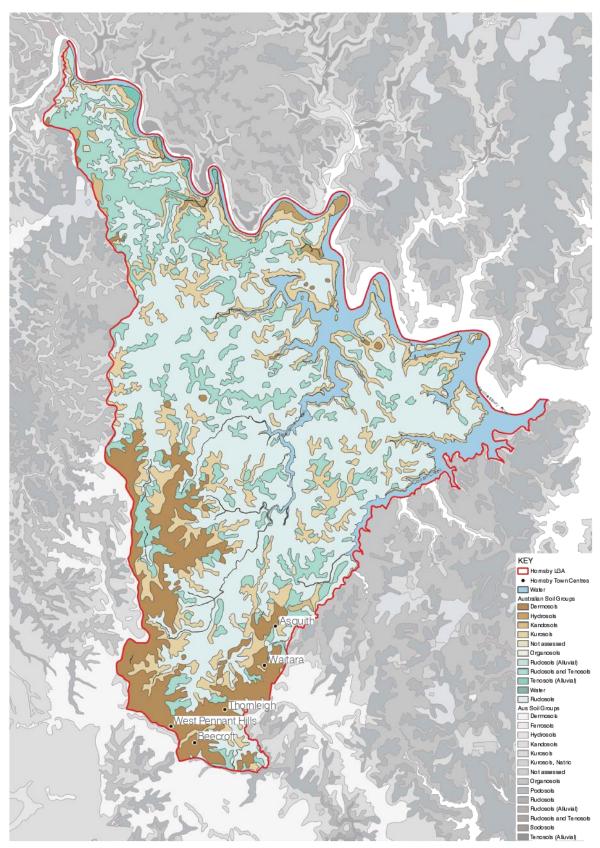


Figure D.9 Hornsby soils typologies

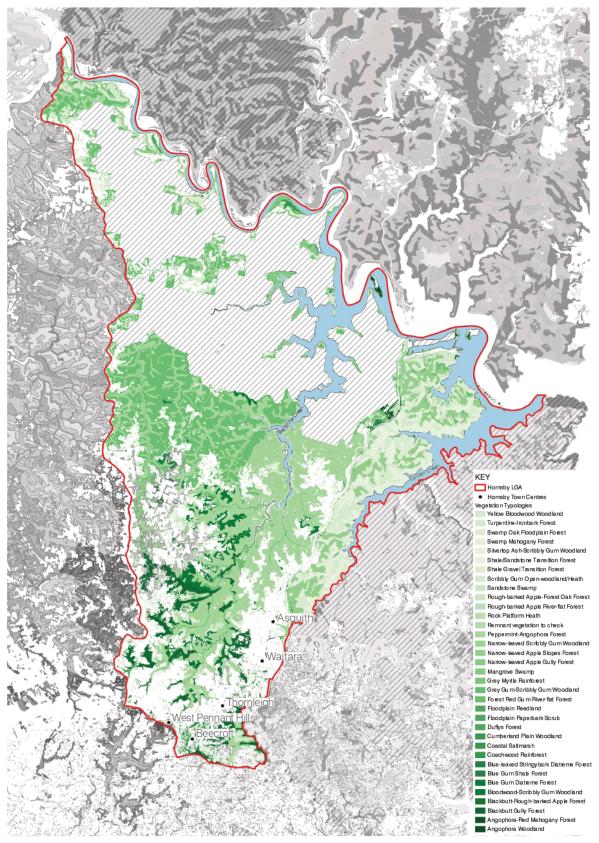


Figure D.10 Hornsby vegetation typologies 104

Tree species and plant selection

Street trees play an important role in the public domain at a micro scale on the street individual level up to the macro scale as an urban forest. The species selection of street trees should be informed by the existing conditions of the street and local area. However, the installation of trees can change and improve the quality and character of the street. A long-term vision is essential to realising an effective street tree program.

Key considerations when selecting a street tree species:

- Mature growth height and width of the canopy and trunk
- Minimum spacings between plantings based on canopy width
- Canopy cover and density and adjacent street elements such as building façades lighting and powerlines
- Frangibility of branches when planted directly adjacent carriageways
- Available soil volume base on mature tree size and ensuring there is adequate volume for the species selected
- Soil type and hydraulic conditions, and whether additioanl green or blue infrastructure can be installed to improve exsiting conditions

Botantcal Name

Syncarpia glomulifera
Eucalyptus paniculata
Eucalyptus haemastoma
Corymbia gummifera
Acmena smithii
Banksia serrata
Ceratopetalum gummifera
Acacia floribunda
Allocasuarina torulosa
Elaeocarpus reticulatus

Common Name

Turpentine
Grey Ironbark
Scribbly Gum
Red Bloodwood
Lillypilly
Old Man Banksia
NSW Christmas Bush
White Sallow Wattle
Forest Oak
Blueberry Ash

Note: All species are indicative only and subject to coordination with Council

PART E – Key Projects

E.1 Study Area Guideline Application

Study Areas

The following section demonstrates the application of the guidelines across five study areas. It provides overarching guidance to achieve a cohesive and high-quality public domain. Typologies and treatments are applied to specific areas to inform the implementation of future public works projects and public domain upgrades.

The following areas, as shown in Figure E.1, have been identified by Hornsby Shire Council to be study areas:

- Asquith (Town Centre, Mount Colah and Peats Ferry Road), refer Figure E.2
- Beecroft, refer Figure E.3
- Waitara, refer Figure E.4
- Thornleigh, refer Figure E.5
- West Pennant Hills, refer Figure E.6



Figure E.1 Project locations across Hornsby

Legend Study Areas

Suburb Study Areas



Figure E.2 Asquith Study Area



Figure E.3 Beecroft Study Area



Figure E.4 Waitara Study Area



Figure E.5 Thornleigh Study Area



Figure E.6 West Pennant Hills Study Area

Legend O Study Areas

Asquith

Study Areas

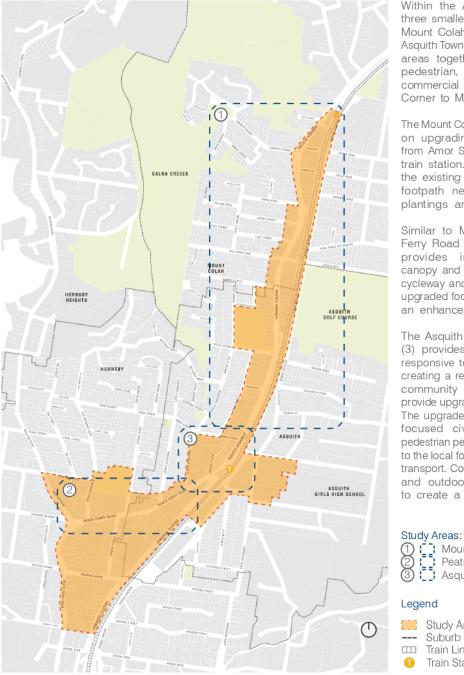


Figure E.7 Project locations across Asquith

Within the Asquith study area are three smaller study areas, these are Mount Colah, Peats Ferry Road and Asquith Town Centre. These three study areas together create a revitalised pedestrian, cyclist, vegetation and commercial corridor from Hookhams Corner to Mount Colah train station.

The Mount Colah study area (1) focuses on upgrading the Pacific Highway from Amor Street to the Mount Colah train station. The upgrade improves the existing and new cycleway and footpath network, new street tree plantings and incorporated WSUD.

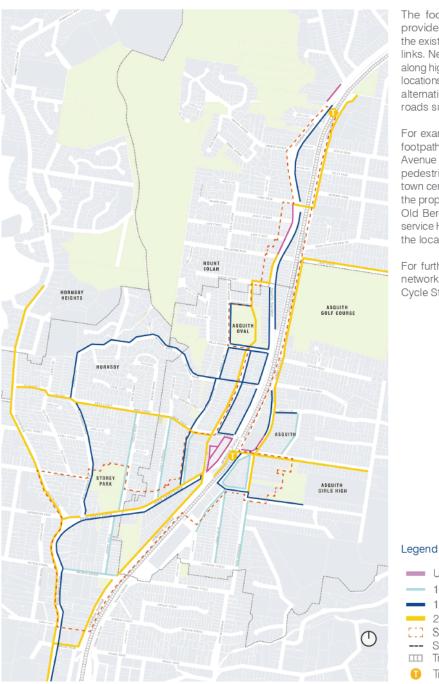
Similar to Mount Colah, the Peats Ferry Road study area (2) upgrade provides increased street tree canopy and WSUD. Additionally, new cycleway and pedestrian connections, upgraded footpaths and lighting create an enhanced and safe experience.

The Asquith town centre study area (3) provides a new public domain responsive to its future urban design creating a revitalised commercial and community hub. Four key projects provide upgrades to the public domain. The upgrades focus on a pedestrianfocused civic heart with greater pedestrian permeability and connections to the local footpath network and public transport. Commercial active frontages and outdoor dining are prioritised to create a vibrant public interface.





Footpath Network



The footpath network upgrades will provide important new extensions of the existing network with new paths and links. New footpaths are to be provided along high activity routes and connect key locations in the local area. To provide safe alternative routes off high traffic volume roads such as Pacific Highway.

For example, the upgrading of existing footpaths to shared paths along Lords Avenue creates a safe and comfortable pedestrian connection from the Asquith town centre to Asquith Oval. Additionally, the proposed new 1.8m wide footpath to Old Berowra Road and Mittabah Road service Hornsby North Public School and the local community.

For further information on the footpath network, refer to Council's Walking and Cycle Strategy.

 Urban Footpath 1.2m Footpath 1.8m Footpath 2.5m Shared path Study Area Suburb Boundary □ Train Line Train Station

Figure E.8 Asquith and Mount Colah footpath network

Cycle Network

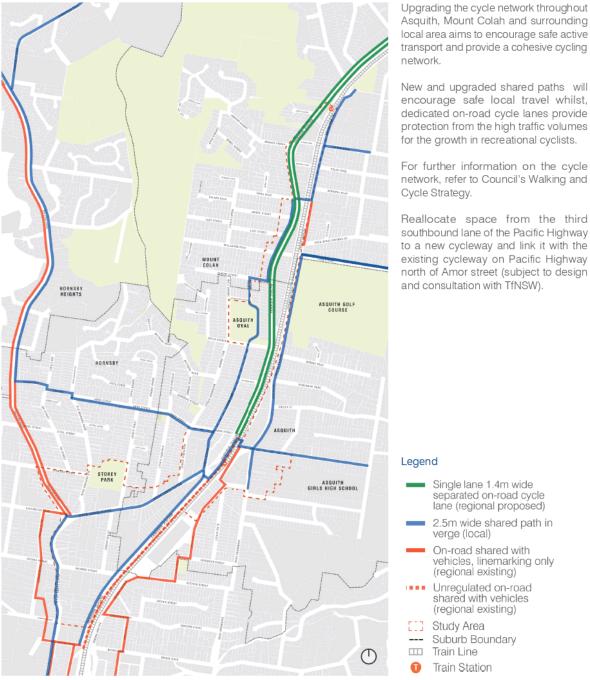


Figure E.9 Asquith and Mount Colah cycleway network

Upgrading the cycle network throughout Asquith, Mount Colah and surrounding local area aims to encourage safe active transport and provide a cohesive cycling

encourage safe local travel whilst, dedicated on-road cycle lanes provide protection from the high traffic volumes for the growth in recreational cyclists.

For further information on the cycle network, refer to Council's Walking and

southbound lane of the Pacific Highway to a new cycleway and link it with the existing cycleway on Pacific Highway north of Amor street (subject to design

Asquith Study Area #1 - Mt Colah Town Centre

Public Domain Upgrades

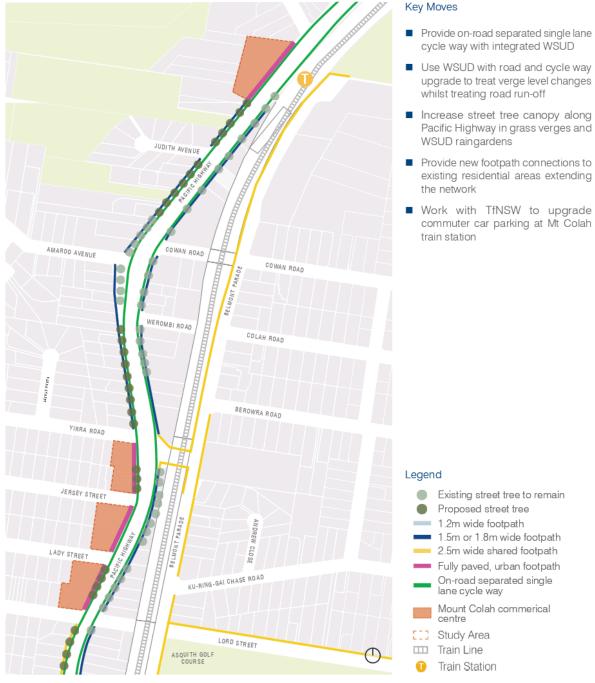


Figure E.10 Asquith to Mount Colah public domain upgrade plan

Asquith Study Area #2 - Peats Ferry Road

Public Domain Upgrades



Figure E.11 Peats Ferry Road public domain upgrade plan

Key Moves

- 39 new trees (19 in central median and 20 street trees)
- Retain existing trees where possible
- New 2.5m wide shared pathway to northern side of Peats Ferry Road
- New 1.8m wide footpath to southern side
- Raingardens to capture and clean road run-off
- Speed limit reduced to 50km/hr
- Undergrounding of existing powerlines and installation of replacement Ausgrid street lighting being investigated
- Provide min. 58 parallel parking to both sides of Peats Ferry Road subject to TfNSW approval

Legend

- Existing street tree to remain
- Proposed street tree
- 1.2m wide footpath
- 1.5m or 1.8m wide footpath
- 2.5m wide shared footpath
- WSUD rain garden
- Street mass planting

Asquith Study Area #3 - Asquith Town Centre

Asquith Town Centre Public Domain Upgrades



Figure E.12 Asquith town centre public domain upgrades plan

Key Moves

- Two-way vehicle connection extending from Wattle Street north connecting to Amor St with a new roundabout
- A civic heart with open green passive space, play and public art
- Active retail frontages focused westward
- Re-alignment and pacification of Wattle Street, dual carriage to new Wattle Lane
- Pedestrian overpass connection from station to Asquith town centre
- Active retail frontages and through site link connecting overpass to civic heart

- Improved pedestrian connection from commuter carpark to station
- Blister footpaths at key pedestrian crossings
- Integrate broken kerbs and bioretention capture elements
- WSUD Roof run-off capture and reuse

The Asquith Town Centre is a gateway town centre linking northern suburbs along the Pacific Highway to Hornsby Town Centre. Pedestrian connections to the community and station to the east are limited. Additionally, the shop fronts face outwards towards the Highway, and there is a lack of a civic heart. There are opportunities to re-focus the commercial shop fronts inwards and create a safe and pedestrian-friendly community centre along Wattle Street.

Legend

- Shared zone paving
- Town Centre Plaza Paving
- Ammenities Kiosk
 - Custom Seating
- Passive Open SpaceWSUD
- Existing Trees
 - Existing frees
 - Proposed Trees
 - ---- Active Frontages
- ★ Public Art
- Train Station
- [] Key Projects
- Study Areas
- On-road separated single lane cycle way
- Future Development

Key Projects

- Wattle St. extension to Amor St.
 Asquith town centre civic plaza
- (3) New pedestrian overpass
- (4) New gateway park
- 5 Asquith to Mount Colah public domain upgrade, refer Figure E.10
- 6 Peats Ferry Road public domain upgrade, refer Figure E.11

Public Space and Vehicle Network



Figure E.13 Asquith public space and vehicle network plan

Key Elements and Design Controls

- 1 Wattle St. extension proposed as two-way connection to Amor St.
- 2 Provide traffic calming and prioritise pedestrian activity along Wattle Street
- Lords Avenue, Amor Street and Wattle Street intersection to become roundabout intersection
- Pacific Highway and Amor Street to be left in, left out only to reduce conflict by right hand turns
- S Vehicular entry to future development basements and services to occur on Wattle Street and Amor Street only

Legend

Arterial/Sub-arterial RoadCollector Road

Local Road

Village StreetShared zone

Plaza

Future Development

→ Traffic Direction

Train Station

Verge Treatments, Tree planting and WSUD



Figure E.14 Asquith verge treatments, planting and WSUD

Key WSUD Elements:

- Bioretention system to Wattle
 St catchment connecting to the existing stormwater network;
- Tree pits: kerb opening with set down planting to allow larger offtake of gutter runoff.
- ③ Install storage for passive irrigation with new road upgrade;
- A Roof runoff to passively irrigate trees;
- Permeable paving and grading to direct local runoff to green spaces;
- Bioretention system upstream of the existing pit;
- (7) Kerb openings along Wattle St to provide passive irrigation for trees, consider soil water storage for passive irrigation

Legend

- Urban Footpath
 - 1.2m Footpath
 - 1.8m Footpath
- 2.5m Shared path
- Existing TreesProposed Trees
- Open Space
- WSUD
- Shared zone paving
- Plaza
- Future Development
 - Train Station

Notes

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species.
- Mass planting design and species to be approved by Hornsby Shire Council prior to installation.

Asquith WSUD Study Area Analysis

Asquith Town Centre straddles the catchments of Calna and Cockle Creeks. The majority of runoff drains north-west of the precinct to Calna Creek, through the existing stormwater network on local streets. Due to its large traffic volumes, the Pacific Highway will produce relatively large loads of pollutants in its runoff, and drains east off the precinct boundary.

A well-developed catchment, Asquith Town Centre will benefit greatly from WSUD interventions that target the higher pollutant loads of the Pacific Highway for water quality treatment, and contribute to the health and vitality of the civic heart open space with infiltration measures.

Topography of the precinct provides ideal grade to daylight stormwater pipes for above ground treatment in bioretention systems. The development of the open space centre of the precinct and Wattle Street extension will provide an opportunity to daylight the existing stormwater infrastructure and treat the 0.8 ha upstream catchment in a bioretention system (1).

Development on the eastern portion of the precinct will have drainage connections to the adjacent open green space, providing sub-surface passive irrigation to the street trees in this plaza. Roof runoff will feed these subsurface drainage points, improving plant health, cooling the local environs and reducing peak flow volumes into Calna Creek.

The limited drainage infrastructure on the Pacific Highway provides an opportunity to intercept and direct road surface runoff to the new commuter park, on the eastern side of the highway. A bioretention system, set back from the roadway will target treatment of the polluted road runoff and integrate with the proposed green link from the carpark. Potentially, a high foot-traffic zone, interpretative signage in this location may maximise the impact of education.

Amor Street's verges provide the ideal location for tree pits due to their greater width and limited number of constraining overhead electrical cables. Lining Amor Street with a number of tree pits amongst street trees will provide passive irrigation opportunities of surrounding street trees with the use of subsurface drains. Connecting new street trees with subsurface drainage will increase the impact of the tree pits as they capture road runoff that can then drain downstream and be taken up by regular street trees.

Wherever possible, kerb openings are to be created on the road edges with the installation of new street trees, to provide passive irrigation.

Key Project #1 - Wattle Street Extension to Amor Street

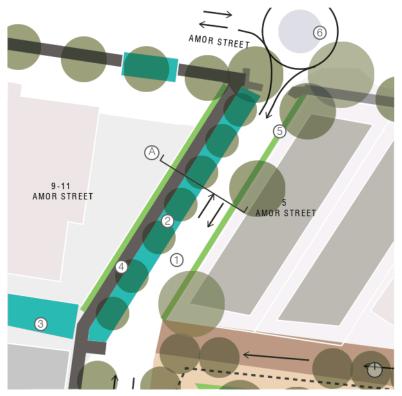


Figure E.15 Wattle Street extension concept plan



Figure E.16 Wattle Street extension - Section A

Key Plan



The Wattle Street extension will be a twoway important local connection off the busy Pacific Highway. This link prioritises pedestrian and cyclist movement to the greater Asquith network, particularly to Asquith Oval. It also provides direct access into the town centre for traffic from the north.

Blue green infrastructure is also prioritised using new street trees and WSUD rain gardens to reduce and treat local run-off. The WSUD extends west on the Council owned land behind Coles to the treat run-off from the town centre.

Legend

- 2.5m Shared Path
 - 1.8m Footpath
- Turf Verge
- WSUD
- Existing Trees
- Proposed Trees
- Shared zone paving
- → Traffic Direction

Key Elements and Design Controls

- 1 Two-way lane southward off Amor St 2 WSUD planted rain garden capturing
- local road run-off

 WSUD planted rain garden capturing
- run-off from town centre plaza, roads and footpaths
- 4 2.5m wide shared path connecting off-street cycling from Peats Ferry Rd to Lords Avenue
- 5 Turf verge
- 6 Lords Avenue / Amor Street intersection to become roundabout
- *Consider passive irrigation to trees from road, refer kerb inlet
- ^ Limited planting opportunity

Key Project #2 - Asquith Town Centre Civic Plaza



Shared zone paving

1.8m Footpath

Urban Footpath

2.5m Shared Path

Figure E.17 Asquith town centre plaza concept plan

Legend

Town Centre Plaza Paving

Ammenities Kiosk

Custom Seating

Passive Open Space

- WSUD

Existing Trees

Proposed Trees

---- 2.5m Clear Path of Travel

3m Outdoor Dining Space

----- Active Frontages

* Public Art

→ Traffic Direction

Key Plan



The town centre civic plaza is a new green passive open space and active urban heart for Asquith. It provides a central community space linking the future developments on Wattle Street and Pacific Highway.

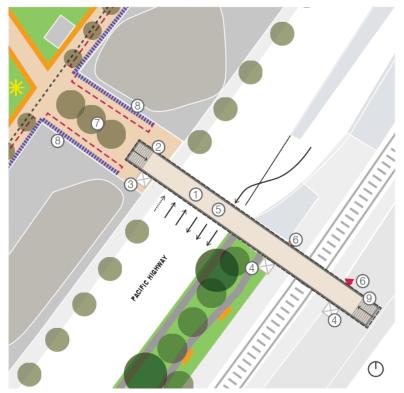
High quality materials and planting will provide continuity between the highly permeable public domain. The civic plaza provides active commercial and retail opportunities whilst providing a key open space for community events.

The calming of Wattle Street prioritises pedestrians and active transport. The plaza and through-site link form an extension to the future pedestrian overpass inviting residents and visitors into the community.

Key Elements and Design Controls

- 1 850-950m² passive open space turf or paved area
- (2) Perimeter seating
- Pedestrian connection to Amor St and Lord Ave
- 4 Street tree planting
- (5) WSUD corridor on Council lot connecting to Bouvardia Street
- 6 Amenities kiosk
- Public art opportunity to provide visual anchor to proposed throughsite link
- (8) 2.5m wide clear path of travel
- Min. 3m wide outdoor dinning area
- Timed parking
- (1) One-way shared zone Wattle Ln.
 - 12m wide through-site link to Pacific Highway and train station overpass connection
- (3) Vehicle access to future development basement

Key Project #3 - Asquith Train Station Pedestrian Overpass



Key Plan



The pedestrian overpass connecting Asquith train station and the town centre provides a vital community link. The overpass will create a safe and direct connection for existing and future residents.

Landing in the town centres 12m wide through site link, active frontages provide increased social and commercial opportunities. Outdoor dining, public seating, trees and planting should emphasise the green link to the Civic Plaza.

The pedestrian overpass will be high quality, wide, well lit, covered with clear sight lines to enhance the pedestrian comfort.

Figure E.18 Asquith train station pedestrian overpass concept plan

Legend

- Pedestrian Overpass
- Town centre plaza paving
- Stair Access
- Passive open space
- WSUD
- Existing Trees
- Proposed Trees
- ----- Active Frontages
- 3m Outdoor Dining Space
- → Traffic Direction
- Limited Parking/Active Lane
- Park Seating
- 1.8m Wide Footpath
- ▶ Train Station Entry

120

Key Elements and Design Controls

- 3.5 4.5m wide high quality covered pedestrian overpass to incorporate CPTED
- ② Stair access from town centre to overpass
- 3 Lift access from town centre to overpass
- 4 Lift access from platforms to overpass
- 5 Provide lighting on overpass for access and wayfinding
- Level pedestrian access from street to platforms to remain
- 12m wide through-site link to Pacific Highway and train station overpass connection
- 8 Active frontages to through-site link
- Stair access from Haldane St to overpass

Key Project #4 - Asquith Gateway Park



Figure E.19 New Asquith gateway park concept plan

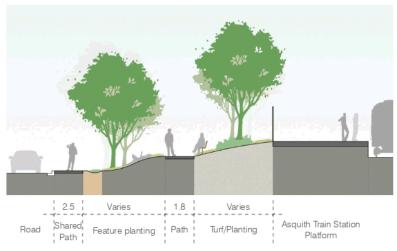


Figure E.20 New Asquith gateway park - Section A

Note: This project is on TfNSW land and subject to endorsement and coordination.

Key Plan



The new Asquith gateway park creates a valuable pocket park with safer access to Asquith train station and future pedestrian overpass. Enhanced blue green infrastructure will treat road and park run-off while increasing the tree canopy area.

Legend

- Passive open space
- WSUD
- Existing Trees
- Proposed Trees
- Park Seating
- 2.5m Wide Footpath
- Pedestrian Overpass
- Train Station Entry
- → Traffic Direction

Key Elements and Design Controls

- Min. 1300m² new linear park to rail corridor
- ② Min. 1.8m wide secondary footpath through park
- New tree and mass planting to create landmark gateway and provide shade
- 4 Level park seating for short term park use
- (5) WSUD bioretention basin treating park and road run-off
- 6 Lighting, circulation and sight lines to meet CPTED guidelines
- Consider secondary southern platform entry/exit to commuter carpark
- 8 Retain existing concrete path
- Bike locker and casual bike parking
- (10) Retain existing high quality trees

Beecroft

Study Area

Located between Beecroft Station and Beecroft Road, Beecroft town centre is an excellent example of Hornsby's heritage. Anchored to the north by its main street of Hannah Street, the heritage town centre is an example of Sydney North Shore style villages with fine-grain architecture and a strong community feel. These distinct heritage qualities need to be retained and celebrated. There is an opportunity to create a vibrant pedestrian focused heritage town centre which prioritises pedestrian movement over vehicular, and provides an urban civic heart which allows for the expression of the local cultural heritage through public art, and space for community gatherings. Beyond the Hannah Street precinct, pedestrian and bike routes are to connect to the greater Hornsby network.

Copeland Road splits the precinct running between the heritage urban town centre to the north and Beecroft Village Green to the south. The Village Green is a vital community green open space, offering areas and infrastructure for large gatherings, family barbecues and play. It is a visually prominent corridor of open space running alongside Beecroft Road. It offers a green space that is important to setting the character of the suburb but is constrained by limited safe access from the north and south and the barrier of the railway to the east and a busy road to the west. Upgrading the park aims to make this parkland more attractive to visit and improve accessibility.

Key projects to be undertaken to achieve the vision of Beecroft include:

- Upgrading of Hannah Street to partial share zone;
 Development of Beecroft civic heart plaza on private land;
 - Wongala Crescent upgrade;
- Upgrading of Beecroft Village Green.

Considerations

- Consideration of existing heritage elements/ items needs to be taken in any future development
- Consider precinct wide through site pedestrian connections in village centre
- Consideration of traffic management elements and pedestrian flows to prioritise pedestrian movement on Hannah Street
- Consider community needs of open space facilities in Beecroft Village Green
- Consider the relationship between tree canopy and open space in the Village Green to optimise solar access and understorey plant growth
- Integration of WSUD elements



Figure E.21 Beecroft Heritage Town Centre

Objectives

- Protect and celebrate the heritage character of the Town Centre and retain community identity
- Pacify Hannah Street to prioritise pedestrian movement over vehicles
- Public domain frontages should maximise activity facing all streets, walkways and piazzas by siting lower storeys with minimal setback from boundaries
- Provide a central public plaza or square for public use
- Encourage new mid-block pedestrian connections with active frontages, solar access and protection from traffic noise
- Encourage community use of Beecroft Village Green and Beecroft Station Gardens for organised and impromptu events

Design Controls

- An absolute minimum central civic plaza of 500m² (excluding setback areas around the primary building envelope) is required. This shall include; a high quality soft landscape area, public seating and street furniture and public art.
- Plaza to comprise of minimum 50% softscape of turf and mass planting
- Hardscape to provide 2.5m clear accessible path of travel to active frontages and entry points to plaza
- 3m wide outdoor dining seat to comply with Council's Outdoor dining code

Verge Treatments, Tree planting and WSUD



Figure E.22 Beecroft verge treatments, tree planting and WSUD

Key WSUD Elements:

- Bioretention system or bio-tree pit upstream of existing stormwater
- Daylight existing stormwater pipe to new bioretention system in pocket park;
- 3 New trees to Hannah St to be in
- pits to capture street runoff;
 Bioretention system to treat
 Beecroft Rd catchment. Outlet to
 connect into existing stormwater
 pit near Copeland St/Wongala
 Cres intersection;
- (5) Permeable paving and regrading to green spaces and tree pits with subsoil drainage;

- Planted beds to reduce overland flow/runoff;
- Planted area set down with sandy loam planting media and formal drainage connection to existing stormwater network.

Notes:

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species.
- Mass planting design and species to be approved by Homsby Shire Council prior to installation.

Legend

- Urban Footpath
 - 1.2m Footpath
- 1.8m Footpath
- 2.5m Shared path
- Existing Trees
- Proposed Trees
- Open Space
- WSUD
- Plaza
- Future Development
 - Existing Building
 - Train Station

Beecroft WSUD Study Area Analysis

Integration of WSUD into the Beecroft precinct is opportunistic due to the limited availability of space for installation of stormwater treatment assets in the commercial domain. The strategy for this precinct seeks to support the development of the heritage portion of the site with streetscape bioretention systems and tree pits that will enhance Hannah Street with well supported vegetation and street trees. Fewer WSUD interventions are planned for the Village Green which has well established canopy cover – management of overland flows and local drainage within the green space are the focus in this portion of the precinct.

A section of Beecroft Road catchment is targeted for treatment in a single bioretention system (4) positioned near the junction of Copeland Road, and will utilise the fall in grade to drain to the existing stormwater drainage network. This location has the potential to drain and treat runoff from the adjacent carpark in addition to road runoff.

Development of land to the west of Hannah Street provides the opportunity to daylight the existing stormwater pipe that drains the upper portion of the precinct's catchment of Chapman Avenue. This 1 ha catchment would drain to a bioretention system located adjacent to Wongala Crescent (2).

Adjustments to the roadway of Hannah Street are to incorporate passive irrigation modifications to the kerb and gutter where possible. Street trees that line Hannah Street can receive runoff through a combination of road grading and kerb openings to direct stormwater flows into tree/planter beds for irrigation. Constructed tree pits with stratavault storage have the capacity to capture, store and make use of larger volumes of runoff and should be installed in locations that maximise the catchment area (i.e. upstream of existing stormwater pits).

Beecroft Village Green is a well-established green space with great coverage of tree canopy. Construction of large WSUD assets are not recommended in this location to avoid tree loss or impact on their root zone (with construction of stormwater diversion pipes). Addressing local park drainage is a part of the overall stormwater management strategy for Beecroft that will encourage infiltration and reduce the impact of ponding that can reduce utility and enjoyment of open, green spaces. A planted, infiltration bed is proposed at the low point of the park, parallel to the adjacent train line (7 on Figure E.22). The infiltration bed is to be set down and sandy loam planting media will assist in draining the local area . This infiltration bed would connect to the existing stormwater infrastructure to ensure discharge from the site.

Study Areas



Figure E.23

Beecroft Study Areas

- Beecroft Heritage Commercial Area
- (2) Beecroft Village Green

Legend

Heritage Brick Paving
Town Centre Plaza Paving
Passive Open Space
Existing Trees
Proposed Trees
Existing Playground
Study Area
Future Development
Existing Building

Train Station

Beecroft Study Area #1 - Beecroft Town Centre

Beecroft Town Centre Heritage Commercial Area Public Domain Upgrades



Figure E.24 Beecroft Heritage Commercial Area plan

The two key projects identified within the Beecroft heritage commercial area aim to provide a high quality community heart. Upgrades to Hannah Street prioritise pedestrian movement north south activating the public domain with outdoor dining. A new civic plaza creates a key community passive space.

Key Moves

- Expand pedestrian circulation opportunities
- Use of heritage herringbone brick paving along activity strips
- Green plaza to Wongala Avenue to celebrate heritage setbacks
- Integration of regional shared path network
- New civic heart and through site link to Wongala Crescent

- Extend pedestrian links from the northern precinct developments through built form into the southern precinct
- Increase street tree canopy cover on Hannah Street
- Blister footpaths at key pedestrian crossings
- Integrate broken kerbs and bioretention capture elements where possible
- WSUD Roof run-off capture and reuse

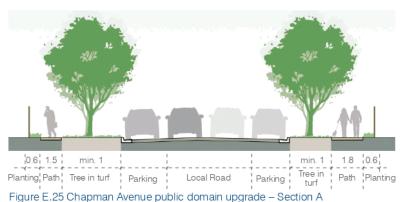
Key Projects

- Hannah Street upgradeBeecroft Civic plaza
- 3 Wongala Crescent upgrade
- (A(B) Refer next page for sections

Legend

- Heritage Brick Paving
- Town Centre Plaza Paving
- Custom Seating
- Passive Open Space
- Existing Trees
- Proposed Trees
- ----- Active Frontages
- WSUD
- → Traffic Direction
- () Key Projects
- Future Development
- Existing Building
- Train Station

Public Domain Street Upgrades



Public domain upgrades to Chapman Avenue are to include the planting of street trees in turf and implement the upgraded footpath network to include 1.8m wide footpaths.

2.5 2.1 2.1 min.1 1.8 0.6 Shared path Parking Local Road Parking in turf Path Planting

Wongala Crescent is a vital vehicle and active transport road. Upgrades to the public domain include the 2.5m wide shared path from Chapman Avenue to Copeland Road using the heritage brick paving to highlight the Beecroft Town Centre. Footpaths on the southern side outside of the urban-footpath area to be 1.8m wide brick paving with new street tree plantings.

Figure E.26 Wongala Crescent public domain upgrade - Section B

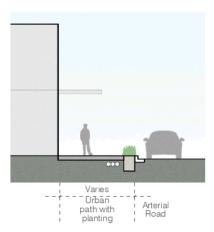


Figure E.27 Beecroft Road public domain upgrade - Section C

As an arterial TfNSW-route Beecroft Road experiences high vehicular traffic volumes whilst forming the western boundary to the Beecroft heritage-precinct. As a prominent urban interface the public domain should be upgraded to promote the heritage nature of the area and provide a high quality pedestrian experience.

Future developments are to underground powerlines. The footpath is to be heritage brick paving from kerb to boundary or from planting to boundary were possible. Mass planting should be provided where possible to act as a soft barrier between vehicles and pedestrians.

Key Project #1 - Hannah Street Upgrade



Figure E.29 Hannah Street upgrade plan

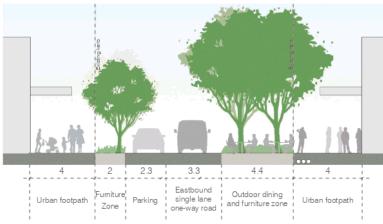


Figure E.28 Hannah Street upgrade - Section A

*Refer Council's Outdoor Dining Code

Centrally located in the heritage precinct, Hannah Street is a landmark connector between the train station and key community destinations. The upgrades require the exploration of a shareway, reducing speed and frequency of vehicular movements and encouraging outdoor dining in the adjacent plaza spaces. Future developments should explore opportunities for outdoor dining. Future detailed design shall investigate the direction of one-way traffic on Hannah Street, implications of the Hannah Street development on local bus routes and the inclusion of a scatter crossing pedestrian management device at the intersection of Hannah Street and Wongala Crescent.

Legend

- Heritage Brick Paving
- Town Centre Plaza Paving
 - Custom Seating
- Passive Open Space
- WSUD
- Existing Trees
- Proposed Trees
- Existing Playground
- Upgraded Planted Blister
- New Planted Blister
- 3m Outdoor Dining Space
- ----- Active Frontages
- * Public Art
- → Traffic Direction

Key Elements and Design Controls

- 1 Min. 2.5m clear path of pedestrian travel*
- Outdoor dining min. 600mm offset from kerb*
- New street trees in extension zone, refer Fig C.1 maintaining clear path of travel
- (4) Narrow Hannah Street to prioritise pedestrians, reduce traffic volume and slow vehicular movement
- (5) Enhance existing active frontages to Hannah Street
- 6 Re-locate taxi rank to Wongala Crescent
- Timed parallel parking
- 8 Beecroft Civic Plaza key project, refer Figure E.31
- Station entry upgrade by TfNSW
- Attenuate cross falls to create level areas for outdoor dining

Key Project #2 - Beecroft Civic Plaza



Figure E.31 Beecroft Civic Plaza concept plan

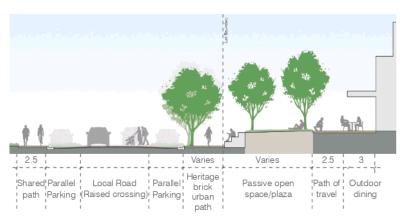


Figure E.30 Wongala Crescent and Civic Plaza - Section A

Beecroft Civic Plaza is a new plaza area currently occupied by on-grade parking. This project is an opportunity to work with future developments providing a urban retail and community space. A new passive green heart with new trees, active frontages and public art respecting the heritage of the town centre.

Legend

- Heritage Brick Paving
- Town Centre Plaza Paving
- Custom Seating
 - Passive Open Space
- WSUD
- Existing Trees
- Proposed Trees
- ----- 2.5m Clear Path of Travel
- [] 3m Outdoor Dining Space
- ----- Active Frontages
- * Public Art
- → Traffic Direction

Key Elements and Design Controls

- ① Civic Plaza min. total area to be 500m²
- Min. 3m wide outdoor dining area to active retail frontages
- 3 Provide clear path of travel from Hannah Street to Wongala Crescent pedestrian crossing
- 4 Explore options for pedestrian crossing or refuge island
- High quality town centre plaza paving
 Trees species to provide shade protection and visual interest
- 7 Provide passive green open space
- Landmark public art
- Oustom public seating
- Hannah Street pacification upgrade, refer Figure E.29
- 1 Terracing/bleacher transition down to Wongala crescent grade

Key Project #3 - Wongala Crescent Upgrade

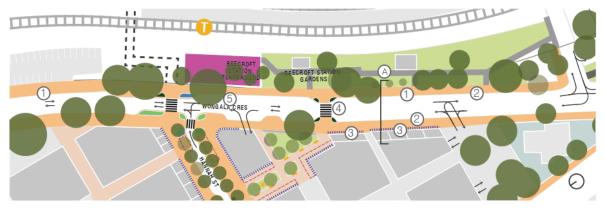


Figure E.32 Wongala Crescent Upgrade

Wongala Crescent plays an important role in Beecroft acting as a key pedestrian link between the heritage town centre and Beecroft Village Green. Upgrades to Crescent are to reinforce it as an active transport connector linking into the regional cycle path network.

Pedestrian comfort is to be prioritised, adjustment to kerb alignment and height are required to ensure sufficient path widths and compliant path crossfalls.

Key Elements and Design Controls

- Min. 2.5m wide shared path to provide sufficient path of travel for cyclists and pedestrians connecting to the wider cycle path network, consider kerb adjustments to ensure sufficient widths
- (2) Parallel parking to remain
- Zero setback shop frontages
- Explore options for pedestrian crossing or refuge island
- Provide sufficient space for bus stop as required by TfNSW

Legend

- Heritage Brick Paving
- Town Centre Plaza Paving1.8m Footpath
 - Custom Seating
 - Passive Open Space
- WSUD
- Existing Playground
- Existing Trees
- Proposed Trees
- Upgraded Planted Blister
- New Planted Blister
- ----- 2.5m Clear Path of Travel
- [] 3m Outdoor Dining Space
- ----- Active Frontages
- * Public Art
- → Traffic Direction



Figure E.33 Wongala Crescent Upgrade - Section A

Beecroft Study Area #2 - Beecroft Village Green

Beecroft Village Green - Key Project #1 - Park Upgrades



Figure E.34 Beecroft Village Green plan

Beecroft Village Green is a linear green link and community open space bookended by the Community Centre and tennis club providing a strong visual reference for the suburb and for people driving past. Upgrades to the Green's infrastructure are required including the internal footpath network, playground, shelters and toilets block.

Improvements to the Green's blue green infrastructure should focus on WSUD and tree quality. The tree canopy density should be managed to increase solar access and promote the growth of turf.

Key Elements and Design Controls

- ① Upgrade existing north south footpath to 2.5m wide shared path connecting to walking and cycle network
- 2 Mass planting to enhance Village Green Environmental performance and visual character
- Beecroft Rd footpath widened to min. 1.8m
- Provide formal WSUD sub-surface drainage connecting to existing stormwater network to improve drainage in park low point, consider WSUD raingarden planting
- S Arborist review of existing tree canopy for opportunities to increase solar access into park

- Planted beds to reduce overland flow/runoff
- New tree planting to screen rail infrastructure

Legend

- 1.8m Footpath
- 3m Shared Path
- Passive Open Space
- WSUD
- Proposed Mass Planting
- Existing Trees
- Proposed Trees
- → Traffic Direction
- Existing Playground

Waitara

Study Area

The scope of these guidelines for the Waitara study area focuses on the residential area bounded to the north by Edgeworth David Avenue and the south by the rail line. Waitara has recently seen significant development and has become the most densely populated area in Hornsby Shire with much of this occurring west of Mark Taylor Oval. This increase in density requires an upgraded and high-quality public domain to support the growing community.

Future development opportunities exist in the eastern half of the precinct which provides opportunities to coordinate public domain upgrades. As this precinct increases its density the role of high quality and high-performance public domain is key to a sustainable community.



Figure E.35 Waitara Study Area

Study Area

Objectives

- Create a pedestrian and cycle friendly precinct by providing wider paths and additional tree planting
- Improve the retail offering to cater to the increased density
- Maximise street tree plantings where possible
- Underground powerlines

Considerations

- Consideration of existing heritage elements/ items needs to be taken in any future development
- Encourage ground level active frontages in the Alexandria Parade and Waitara Avenue area opposite the station entry
- Integration of WSUD elements

Waitara Public Domain Upgrades



Figure E.36 Waitara Public Domain Upgrades Plan

Key Moves

- Create a new urban gateway precinct at Alexandria Parade and Waitara Avenue
- Prioritise pedestrians along Park Lane and reinforce as a key link
- Continue share path connections along Park Lane, Waitara Avenue, Romsey Street to Edgeworth David
- Retain and enhance existing tree planting along Edgeworth David Avenue

- Improve pedestrian connections from commuter car parks to train station
- Blister footpaths at key pedestrian crossings
- Integrate broken kerbs and bioretention capture elements where possible
- WSUD Roof run-off capture and re-

encouraging active transport, prioritising pedestrian movement throughout the local community and adding to the existing network of street trees.

- Town Centre Plaza Paving
 - **Existing Street Trees**
 - Proposed Street Trees
 - Open Space
- Future Development
- Existing Building
- Train Station
- - Key Projects

Key Projects

- Waitara Retail Gateway
- Waitara Avenue street upgrade
- Edgeworth David Avenue verge upgrade
- Park Lane shareway

Public Space and Vehicle Network



Figure E.37 Waitara public space and vehicle network plan

Key Elements and Design Controls

- 1 Treat Park Lane with paint finish, graphic or coloured asphalt to highlight shared zone
- ② In-road blisters to calm traffic and provide better pedestrian connectivity with raised thresholds at intersections.

Legend

Arterial/Sub-arterial Road
Collector Road
Local Road
Shared zone
Open Space
Future Development
Existing Building
→ Traffic Direction
Train Station

Cycle Network



Figure E.38 Waitara cycle network plan

Urban Footpath 2.5m Shared path Shared zoi On-road shared with vehicles, linemarking only Open Space Future Development

Existing Building
Train Station

Legend

Verge Treatments, Tree planting and WSUD



Figure E.39 Waitara verge treatment, tree planting and WSUD plan

Key WSUD Elements:

- Off-take for stormwater harvesting and reuse for irrigating of Orara Park;
- Existing Gross Pollutant Trap and basin;
- Additional street trees to include kerb openings, and structural soil for passive irrigation,
- Bioretention system setback in verge or blister into street. Tree pits to be upstream of existing pits;
- Bioretention system blister upstream of existing pit;
- (6) Kerb openings with structural soil for street trees. Subsoil drainage along Balmoral St and Park Ave.

Legend

Urban Footpath

1.2m Footpath

1.8m Footpath

2.5m Shared pathExisting Street Trees

Proposed Street Trees

WSUD

Future Development

Existing Building

Train Station

Notes:

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species.

Waitara WSUD Study Area Analysis

The Waitara precinct WSUD strategy focuses on passive irrigation of the tree-lined residential streets, delivering significant urban cooling benefits, and proposes a stormwater harvesting scheme – possible at this precinct due to its topography and the size of the upstream catchment.

Passive irrigation of street trees and treatment of road runoff with bioretention systems and tree pits are recommended wherever possible on each of the residential streets. Prioritising increased urban tree canopy in the Waitara precinct will benefit a large number of residents due to the medium density residential development within the precinct.

There is existing WSUD infrastructure in this precinct, in Orara Park (2 – GPT, basin and storage tank). A stormwater harvesting scheme in Waitara Park could supplement this infrastructure to provide additional storage and reuse capacity. In total, there is an upstream catchment of approximately 32 ha that drains to the northern end of Waitara Park, at Edgeworth David Avenue. This sized catchment, with an offtake and underground storage at Waitara Park, would provide increased water security for irrigation of the oval and reuse for internal use at the PCYC and tennis facilities (e.g. toilet flushing) located at either end of the park. The scheme's eastern 20 ha catchment that drains to Park Street can be pre-treated with the construction of a GPT within the reserve area, upstream of an offtake at the junction of the two stormwater mains.

Treatment of the large 20 ha eastern catchment with a GPT will provide one of the more substantial water quality improvements across Hornsby due the catchment size being treated, and is recommended as a standalone measure that can later be incorporated in a harvesting scheme, if staging is preferred.

Key Project #1 - Waitara Retail Gateway



Figure E.40 Waitara retail gateway plan

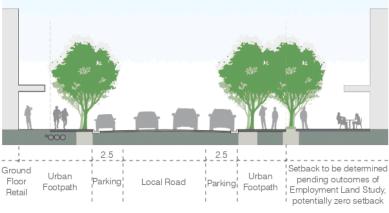


Figure E.41 Waitara retail gateway - Section A

Key Plan



The Waitara retail gateway creates an enhanced landmark entry with new retail opportunities opposite Waitara train station. The retail gateway responds to Waitara's increasing population density, providing the opportunity for an activated and diverse retail centre. New high quality urban footpaths and street trees prioritise pedestrian comfort and circulation. A 2.5m clear path of travel is to be provided to all active frontages.

Legend

- Town Centre Plaza Paving
- Existing Street Trees
- Proposed Street Trees
- Future Development
- ----- 2.5m Clear Path of Travel
- ----- Active Frontages
- 2.5m Shared Path
- Turf Verge
- → Traffic Direction
- Train Station

Key Elements and Design Controls

- 1 High quality kerb to boundary urban footpath
- Contemporary public furniture seating suite
- 3 Setback to be determined pending outcomes of Employment Land Study, potentially zero setback
- 4 New street trees with tree grates
- Active frontages
- 6 Parallel short stay timed parking
 7 Upgrade pedestrian underpass
- and remove stairs to Pacific Hwy

 8 Improve train station entry paving
- 9 Heritage listed building

Key Project #2 - Waitara Avenue Upgrade



Figure E.42 Waitara Avenue upgrade plan

Key Plan



Waitara Avenue forms the central spine of Waitara linking key community infrastructure such as Waitara Oval and PCYC, train station, football club and retail. Upgrading the avenue reinforces the active transport network and increases the urban tree canopy.

Wide concrete urban footpaths are provided to the eastern side of Waitara Ave, with existing trees to remain and new trees proposed to infill between. A 1.8m wide concrete path with new trees to infill existing are to the western side. Existing parking is to remain, while east west pedestrian connections are to be explored.

Legend

2.5m Shared Path

1.8m Footpath

Street Tree in Planting

> Traffic Direction



Key Elements and Design Controls

- 1.8m wide concrete footpath, with turf to back of kerb, planting to base of trees and boundary edge
- Concrete urban footpath, with turf to back of kerb, planting to base of trees
- New street trees to be planted in mass planting to back of kerb beyond extent of vehicle overhang
- 4 Retain existing 45° angled parking
- Retain existing parallel parking
 Existing pedestrian blisters to remain
- New urban path to match into existing urban path

Key Project #3 - Edgeworth David Avenue Shared Path



Figure E.47 Edgeworth David Avenue west shared path plan



Figure E.44 Edgeworth David Avenue east shared path plan

Key Plan



The Edgeworth David Avenue shared path is an important connection in the cycle network connecting to Palmerston Rd and the Hornsby Hospital.

This section of the shared path references the heritage brick paving outside Hornsby Girls High. Existing street trees are to be retained and prioritised with new street trees infilling the existing canopy.

Legend

- 2.5m Shared Path (Brick)
- Sandstone Retaining Wall
- Existing Street Trees
- Proposed Street Trees
- → Traffic Direction

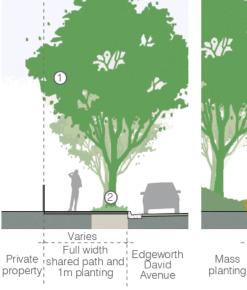


Figure E.45 Edgeworth David Avenue – Section A



Figure E.46 Edgeworth David Avenue – Section B

Key Elements and Design Controls

- Retain existing street trees
- Narrow new shared path at existing trees and supplement with planting at base, as per treatment outside of Hornsby Girls High
- Full width kerb to boundary shared path in heritage brick paving
- 4 2.5m wide shared path in heritage brick paving
- New street trees
- 6 Sandstone log retaining wall to existing planting
- Upgrade traffic signals to include bike lanterns for crossing

Key Project #4 - Park Lane Shareway

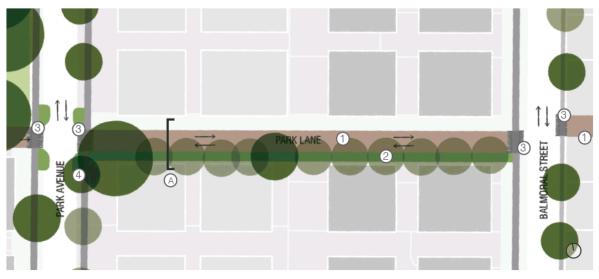


Figure E.48 Park Lane shareway plan

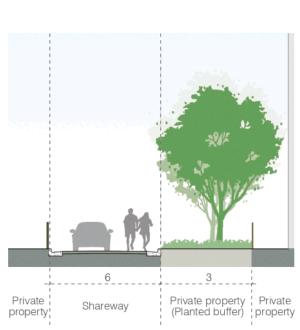


Figure E.49 Park Lane shareway - Section A

Key Plan



The Park Lane shareway forms a critical mid-block link. The shareway is a continuation from Waitara Avenue and should be extended to Myra Street as a critical connection to Waitara Public School.

Use of the painted surface highlights the low speed and shared environment of the lane, with raised crossings at either end.

Key Elements and Design Controls

- Vehicular shareway
 paved with permeable
 paver (shared)
- Continue planted buffer to south side
- Continuous raised footpath treatment
- WSUD Blistered
 planting

Legend



- Future Development
- Existing Building
- → Traffic Direction

Thornleigh

Study Area

Thornleigh straddles Pennant Hills Road, splitting a mix of commercial, existing single dwelling residential houses and new medium density residential developments. Unlike Waitara, Thornleigh is in an earlier stage of development. Similarly, though, the current and future increase in population density requires a public domain which meets the needs of the community. There is an opportunity to create a new retail and pedestrian-focused precinct adjacent to the rail line and Pennant Hills Road. Protection from traffic noise should be prioritised along active frontages to existing roads and new laneways. The proposed key project incorporates an upgraded pedestrian overpass in to future mixed-use developments, train station upgrade and public domain upgrades.



Figure E.50 Thornleigh Town Centre

Study Area

Objectives

- Provide a central civic plaza connecting train station to retail and pedestrian linkages
- Maintain fine grain shop frontages
- Increase street tree planting for shade canopy cover
- Slow down traffic to Railway Parade through traffic calming measures
- Public frontages should maximise activity facing all streets, walkways and piazzas by siting lower storeys with minimal setback from boundaries
- Provide a central public plaza or square for public use
- Encourage new pedestrian prioritised shareway to the train station with active frontages with solar access and protection from traffic noise
- Encourage mid-block pedestrian connections to improve north-south links (through private land)

Considerations

- Consider high volumes traffic along Pennant Hills Road and opportunities for planting and safety measures to improve pedestrian comfort
- Consider creating a central gathering space and consolidating users to a civic heart
- Promote undergrounding of powerlines to improve visual landscape and opportunities for street tree planting
- Consider highlighting the Great North Walk connection
- Breaking up built form of new developments with architectural breaks and pedestrian links
- Integration of WSUD elements into new street plantings, surfaces and stormwater network
- Opportunities to introduce time limited on-street parking at kerb side to encourage on-street activity

Public Space and Vehicle Network



Figure E.51

Key Elements and Design Controls

- (1) Re-surface Railway Parade with permeable trafficable shareway paving
- (2) In-road blisters to calm traffic and provide better pedestrian connectivity

Legend

Arterial/Sub-arterial Road
Collector Road
Local Road
Shared zone
Existing Building
Future Development
→ Traffic Direction
Train Station

Verge Treatments, Tree planting and WSUD

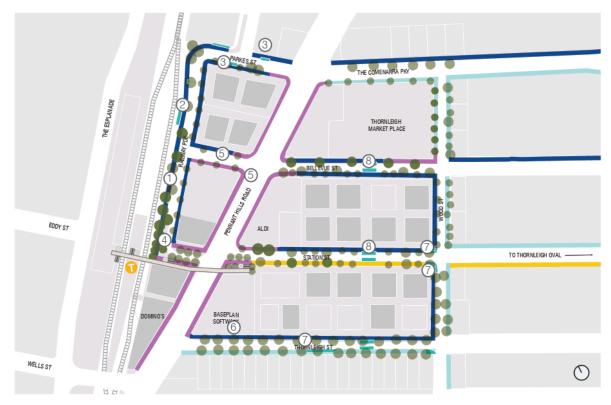


Figure E.52

Key WSUD Elements:

- 1 Trees with kerb openings and subsoil drainage to existing pit;
- Provide tree in blister upstream of existing pit;
- Bioretention systems in verge or blisters;
- Permeable paving and grading to direct local runoff to green spaces, install tree pits with subsoil drainage;
- (5) Install water storage with structural soil under new verge edge to passively irrigate trees;

- Kerb openings to trees for passive irrigation to be installed during street or verge upgrades;
- Bioretention system upstream of existing pit;
- Blistered wombat crossing to be bioretention system or bio-tree pits;
- Shopping centre and car park rainwater/runoff harvesting to be considered to grey water use.

Legend

- Urban Footpath
 - 1.2m Footpath
- 1.8m Footpath
 - 2.5m Shared path
- Existing Street Trees
- Proposed Street Trees
- WSUD
- Train Station

Notes:

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species.

Thornleigh WSUD Study Area Analysis

The topography of the Thornleigh precinct drives the WSUD strategy. Pennant Hills Road divides the precinct and is the boundary of the two catchments which receives flows from the mixed residential-commercial area. The predominantly residential eastern side of Pennant Hills Road drains to Lane Cove River, whilst the more built up, commercial western side drains to Berowra Creek. However, this precinct's location, at the headwaters for both these significant rivers, provides a great opportunity to minimise the impact of densification in urban environments that has the potential to deteriorate the natural drainage links of headwater streams.

A combination of kerb openings for street tree passive irrigation (6) and targeted bioretention systems located upstream of stormwater pits (7) on Thornleigh, Station and Bellvue Streets will reduce peak runoff volumes to the headwater stream of Scout Creek, treat stormwater and support growth and health of the street trees. As Scout Creek is relatively well buffered by a small area of development it is essential to maintain or decrease runoff volumes from this precinct's catchment.

Permeable paving will assist in reducing runoff from the Town Centre Plaza which is at a high elevation, at the top of the precinct and has a limited the ability to capture, treat and use runoff for passive irrigation. The grading of Railway Parade however provides an opportunity direct stormwater into the street trees for treatment and storage with kerb openings and dedicated tree pits and bioretention systems.

The constrained nature of Pennant Hills Road, with no space for verges limits the capacity for installing WSUD stormwater treatment assets. Opportunities for stormwater treatment are thus targeted on the adjacent side street of Parkes Street where two small bioretention systems will treat road runoff. They are to be positioned upstream of the existing stormwater pits to maximise the road catchment area for treatment.

Thornleigh Study Area - Thornleigh Town Centre

Thornleigh Town Centre Public Domain Upgrades



Key Moves

- New civic heart with plaza and activated façades to enable increased permeability and safety
- Upgrade pedestrian overpasses to train station and over highway to be DDA compliant
- Reduce road widths to increase footpath width and increase planting
- Provide cycleway connection along Station Street
- Improve pedestrian connection from commuter carpark to station

- Blister footpaths with planting at key pedestrian crossings
- Integrate broken kerbs and bioretention capture elements where
- Additional street trees and new footpath to southern side of Wood Street
- WSUD roof run-off capture and re-use

Key Project

Station Street Plaza

Public Domain Upgrades - Sections

- A Bellevue Street, refer Figure E.56 Station Street, Figure E.55
- Thornleigh Street, Figure E.54

Public Domain Street Upgrades

Outside of the key project area, three streets have been prioritised for verge upgrades, Bellevue Street, Station Street, and Thornleigh Street. In particular footpaths, street planting and WSUD elements form the public domain upgrades to enhance the pedestrian experience. Additionally road blisters should be implemented to slow traffic and form part of the WSUD strategy.

Other streets within the study area are to be upgraded as per the previous street and public domain network diagrams.

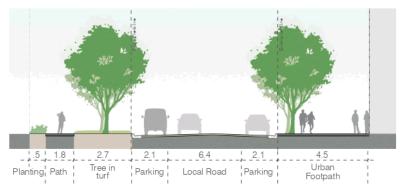


Figure E.56 Bellevue Street - Section A

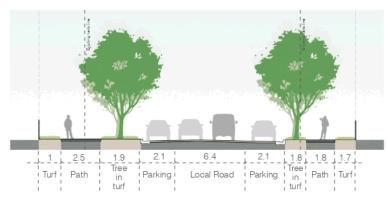


Figure E.55 Station Street - Section B

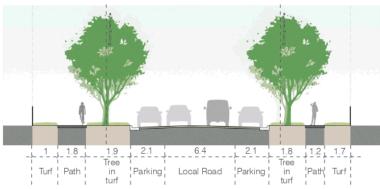


Figure E.54 Thornleigh Street - Section C

Key Project - Thornleigh Train Station Plaza

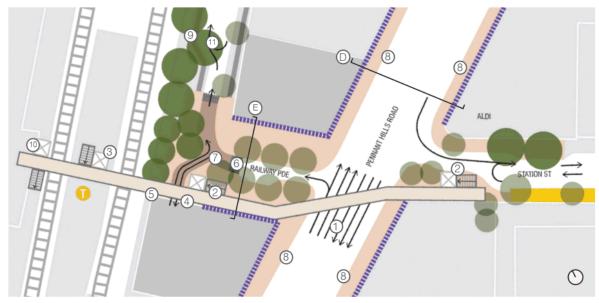


Figure E.57 Thornleigh Train Station Plaza

The new train station plaza on Railway Parade will create a landmark urban entry for Thornleigh. The upgraded pedestrian overpass is a key component of the project and with opportunities to integrate the project delivery with the future developments of private lots and Thornleigh Station upgrade. The overpass is to be re-aligned and extended to provide a linear single level connection from Station Street to The Esplanade.

At the street level, Railway Parade is to become a more passive pedestrian experience. Permeable paving and a narrowing of the road will calm traffic. New retail opportunities are to be provided along active frontages.

Coordination of various authorities and stakeholders is required at the planning level to deliver a coordinated outcome.

Key Elements and Design Controls

- 3.5 4.5m wide covered pedestrian overpass incorporating CPTED principles and universal access
- Stair and lift access from Station Street and Railway Parade to overpass
- Stairs and lift access from train station platforms to overpass as part of station upgrade
- Active frontages to Railway Parade vehicle basement access to future development
- (5) Future development facade to integrate pedestrian overpass, may be structurally separated
- Permeable shared zone paving
- ① Upgraded overpass landing area with trees and planting on Station St.
- Timed parking to Pennant Hills Road
 1.8m wide footpath from commuter parking

- (10) Lift and stair access to car park and The Esplanade as part of overpass and train station upgrade
- 12m diameter turning circle to suit B99 vehicle

Legend

- Town Centre Plaza Paving
- Shared zone paving
- Raised Crossing
- Street Tree
- ____ 2.5m Shared path
- 1.8m Wide Footpath
- Pedestrian Overpass
- Future Development
- ⇒ Existing Building→ Traffic Direction
- Train Station

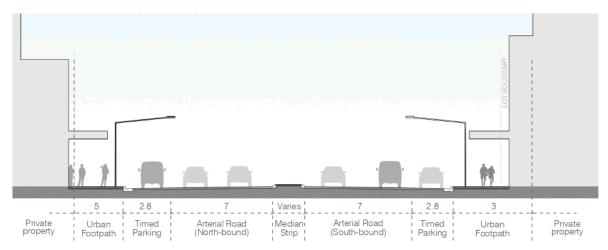


Figure E.59 Pennant Hills Road - Section D

Lighting to be located within designated furniture zone (refer Fig C.2) to create clear path of travel along building line

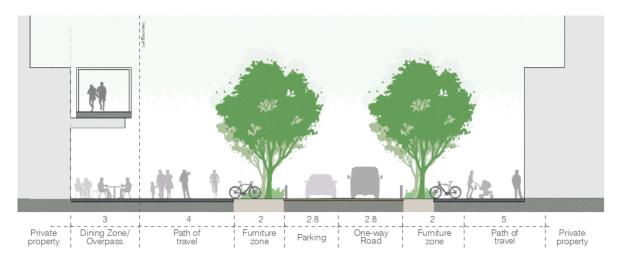


Figure E.58 Railway Street - Section E

The new pedestrian over pass may be delivered together or separately from the building development. However, the design of both must be coordinated to deliver a building facade and overpass which acknowledge each other. The coordinated response to the future development incorporating the pedestrian

overpass should remove overpass structure from the public domain decreasing street clutter and improving sight lines. Additionally, this encourages a coherent architectural and urban design outcome.

West Pennant Hills

Study Area

The West Pennant Hills town centre is located on the landmark Thompson's Corner and acts as the south western gateway to the Hornsby Shire. There is an opportunity to create a unique and iconic entry into the Bushland Shire. Bounded by Pennant Hills Road to the south and West Pennant Hills Public School to the north, the town centre has restricted pedestrian connections.

The West Pennant Hills town centre local shopping village is vehicle dominated. Active frontages are focused outwards towards Pennant Hills Rd while pedestrian connections have been insufficient to encourage walking or social lingering. Increased traffic to Pennant Hills Rd has made the pedestrian experience uncomfortable.

At an urban design scale, the village is to be re-orientated inwards towards a central (north facing) civic plaza prioritising pedestrians and planting. Increased active frontages and widened through-site links increase permeability and activation. The existing central car park is to upgraded re-organising vehicular movement and parking while incorporating WSUD elements.

The existing planting to Thompson's Corner is to be expanded to provide planted barriers to Castle Hill and Pennant Hills Road



Figure E.60 West Pennant Hills Town Centre

Considerations

- Consider options to integrate and expand the pedestrian and cycle connections to the greater surrounding suburb network
- Consider under-grounding car parks under new developments where possible
- Consider opportunities to include public art
- Integrate WSUD elements into new street tree planting and green open spaces

Design Controls

- An absolute minimum central civic plaza of 1100m² (excluding setback areas around the primary building envelope) is required. This shall include; a high quality hard and soft landscape area, public seating and street furniture and public art.
- Plaza to comprise of minimum 70% deep soil softscape of turf and mass planting
- Hardscape to provide 2.5m clear accessible path of travel to active frontages and entry points to plaza
- 3m wide outdoor dinning seat to comply with Councils Outdoor dining code

Objectives

- Re-organise existing buildings to create a landmark destination with arcades, laneways and through-site links to plaza and greater connectivity
- Relocate existing carpark underground
- Establish an internal landscaped street
- Rearrange shopping façades to face civic heart
- Encourage new mid-block pedestrian connections with active frontages with sunlight and protection from traffic noise
- Develop new civic heart as focal point for the community on council land

Public Space and Vehicle Network

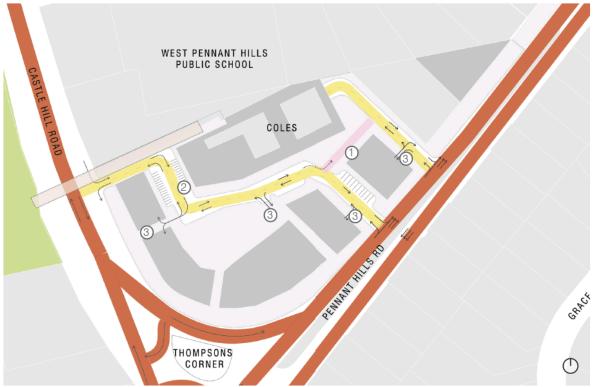


Figure E.61

Key Elements and Design Controls

- Re-surface service road with permeable trafficable shareway paving and limit access to service vehicles only
- Reconfigured carpark to increase space efficiency
- Vehicle access to future development basement

Legend



Verge Treatments, Tree planting and WSUD



Figure E.62

Key WSUD Elements:

- Rainwater harvesting and reuse in grey water system in new developments;
- Tree pits with passive irrigation (assumed clay surface subsurface) subsoil drainage to existing stormwater network:

 Output

 Description:
- Bioretention system collecting runoff from car park connecting to existing stormwater network;
- Roof runoff to subsoil passive irrigation of new proposed trees;
- Permeable paving in pedestrian shareway;
- Grade central plaza to achieve local runoff to turf and planted areas;
- (7) Enlarge existing planter's and create bioretention system connected to existing stormwater network;
- (8) Mass planting barrier to road.

Legend

- Urban Footpath
 - 1.2m Footpath
- 1.8m Footpath
 - 2.5m Shared path
- Existing Street Trees
- Proposed Street Trees
- WSUD
- Street Planting
- Shared zone paving

Notes:

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species

West Pennant Hills WSUD Study Area Analysis

The West Pennant Hills precinct is a part of both the Darling Mills Creek and Devlins Creek catchments, and is located at a high point on this boundary. Due to the developed nature of these catchments surrounding both waterways (especially Devlins Creek) the WSUD priority at this precinct is to utilise runoff for beneficial outcomes on site (through passive irrigation). Whilst this approach will help reduce peak runoff volumes, it is not a priority outcome given the limited ability to impact headwater stream health due to the existing developed nature of Devlins Creek catchment.

Despite its small size West Pennant Hills precinct has a number of effective WSUD interventions that will deliver water quality improvements, reduction in peak flows and contribute to improved vegetation outcomes from passive irrigation.

The large proportion of impervious surfaces in the carpark provide an opportunity to integrate bioretention systems (3) and tree pits (2) in a linear configuration with the design of the carpark, to both intercept and treat sheetflow from the carpark and to provide the physical buffer between car spaces. Subsoil drainage from these WSUD assets can easily connect back to the existing stormwater network on Castle Hills Road.

The size of the verges of Pennant Hills Road limit opportunities for treatment of road run off from this road that would have higher pollutant loads due to large traffic volumes. Development of this side of Pennant Hills Road should incorporate blisters in the verge wherever possible to capture and treat road runoff—having a greater impact on water quality due to the degraded catchment characteristics.

Areas of new development are to incorporate rainwater harvesting where possible (1). The open space of the Town Plaza will be enhanced through passive irrigation of the surrounding street trees. Large areas of development in the Town Centre can direct their roof runoff to the green space centre and to subsoil drains that passively irrigate the street trees, providing local cooling and facilitating improved tree health.

The planted edge of Castle Hill and Pennant Hills Roads further support the WSUD objectives at this precinct, by intercepting runoff in the vegetated perimeter, reducing runoff volumes from this site.

West Pennant Hills Town Centre Public Domain Upgrades



Figure E.63

Key Moves

- Reconfigure existing surface parking with new median island planting integrating WSUD
- Future Coles upgrades to include frontages along south elevation
- Re-alignment and pacification of twoway internal road
- New civic heart with open green passive space, with activated frontages
- Ground level car parking to be reduced and located underground where possible

- Active retail frontages focused northward to engage with new civic heart
- Provide barriers to Pennant Hills Road with either mass planting or engineered barrier
- Architectural breaks to align with pedestrian links
- Thompson's Corner to be retained and celebrated
- Integrate broken kerbs and bioretention capture elements where possible
- WSUD Roof run-off capture and reuse

Legend

- Town Centre Plaza Paving
- Shared zone paving
 - --- Active Frontages
- Existing Street Trees
- Proposed Street Trees
- Street Planting
- Future Development
- Existing Building
- Key Projects

Key Project

1 Town Centre Plaza

Key Project - West Pennant Hills Town Centre Plaza



Figure E.64 West Pennant Hills Town Centre Plaza plan

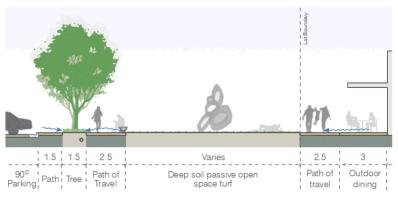


Figure E.65 West Pennant Hills Town Centre Civic Plaza - Section A

The West Pennant Hills key project reorientates the commercial centre to focus on a new civic heart. Future developments will facilitate the reorientation with new active frontages and pedestrian through-site links. New kerbs and carpark configuration clearly delineate vehicle traffic, efficiently creating an active urban heart.

Legend

- Town Centre Plaza Paving
- Shared zone paving
 - Existing Street Trees
- Proposed Street Trees
- 3m Outdoor Dining Space
 - Active Frontages
- * Public Art
- Custom Seating
- Street Planting
- Pedestrian Overpass
- Future Development
- Existing Building
- → Traffic Direction

Key Elements and Design Controls

- New deep soil passive open space to make up min. 70% of plaza
- Site specific landmark public art to be visual centre piece
- Active frontages to new civic heart, Pennant Hills Road and Castle Hill Road
- 4 Future developments to maintain existing through site links
- 5 Basement vehicle entry to future developments
- Permeable paved shareway with restricted vehicle access, service vehicles to Coles
- New WSUD mass planting beds to car park
- 8 Reconfigure carpark
- 9 Pedestrian overpass to remain
- Mass planting barrier to road
- (1) 2.5m clear path of travel
- 3m outdoor dining space

Public Domain Street Upgrades

The existing mass kerbside mass planting at Thompson's Corner is to be extended along Castle Hill and Pennant Hills Road. The planting is to act as a barrier between vehicles and pedestrians whilst softening the street scape through the reduction of hardscape.

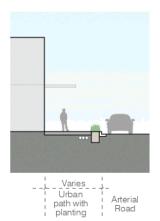


Figure E.66 Castle Hill Road – Section B

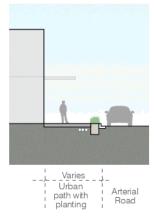


Figure E.67 Pennant Hills Road – Section C