
6 Habitat & migration opportunities for significant flora & fauna

Biodiversity Objective No.3

Protect and enhance the habitat and migration opportunities for locally significant or threatened native species, populations and communities (including the endangered population of Long-nosed Bandicoot), and allow for their continued evolution and survival in and beyond the GreenWay catchment.

6.1 Threatened flora and fauna

No threatened flora species has been identified within the GreenWay, and two threatened fauna species have been recorded (Grey-headed Flying-fox, Eastern Bentwing Bat). As noted, a population of the Long-nosed Bandicoot within the GreenWay and is listed as an endangered population under the *TSC Act 1995*.

Unmodified remnant vegetation characteristic of Endangered Ecological Communities (EECs) does not occur, although modified Swamp Oak Forest at the Cooks River is broadly representative of the EEC 'Swamp Oak Floodplain Forest', while active replanting at bushcare sites has re-created several pockets of the EEC Sydney Turpentine-Ironbark Forest (STIF).

It would be expected that further future fauna survey may identify other threatened fauna species, particularly other species of microchiropteran bat. Threatened fauna identified through database searches within the broader locality (5km radius) may also occur on an opportunistic or seasonal basis.

Due to the significant removal, disturbance and fragmentation of native vegetation within the GreenWay it is doubtful that any naturally occurring threatened flora would occur.

The NSW Government has developed Priority Action Statements (PAS) for Threatened Species and these are outlined in Chapter 8.

6.2 Habitat and Vegetation Management Strategies

As noted, fauna habitat has been significantly affected by the urbanisation and development of the Greenway over time, to the extent that degraded (and primarily weed dominated) land within the railway corridor provides the best area of contiguous connective habitat for poorly mobile fauna such as reptiles and ground-dwelling mammals. Bird species which tend to make small scale movements such as fairy wrens also would use parts of this corridor.

For more mobile fauna such as birds and bats, the GreenWay forms part of a larger foraging area within an urban matrix, where forage and shelter requirements are met by a network of street trees, vegetation within parks and private gardens, drainage canals and infrastructure such as bridges, culverts and drains. Collectively all of these features encompass (albeit highly modified) habitat, with fauna likely to utilise these as stepping stones within the local environment.

Isolated trees may play a significant role for fauna where they provide key resources, eg. fig trees, flowering eucalypts or trees with hollows.

Creation of habitat can be achieved by appropriate vegetation management and restoration. A key feature lacking within the GreenWay are thickets of shrubs and low vegetation – vegetation which affords shelter, nesting and foraging resources to passerine birds such as fairy wrens, finches, fantails and some species of honeyeaters. These species have historically declined in Sydney due to the loss of such habitat, and it is understood that records of such species within the GreenWay are relatively infrequent.

To create habitat thickets, small copses or ‘islands’ can be created using a variety of locally endemic shrubs and small trees planted closely together in areas as little as 9m². Habitat islands can be arranged in irregular rows so some connectivity is maintained with other islands. Mounding these areas and planting edges with native grasses and placement of rocks or logs also provides habitat for reptiles and ground dwelling mammals. Provision of larger habitat areas is likely to benefit a range of fauna, including the Long-nosed Bandicoot. An example of species suited to island plantings is provided within Appendix D, table 15.1.

Vegetation management of weed infested areas also requires consideration with regard to its habitat values (particularly thickets of Lantana), and weed control should be completed so that woody weeds are removed gradually in a patchwork formation so that habitat is not removed in a single action.

7 Community participation in protecting & restoring biodiversity

Biodiversity Objective No.4

Engage and educate residents and the broader community, including local businesses and visitors to the GreenWay, to encourage a sense of ownership and participation in protecting and restoring biodiversity in the GreenWay catchment.

7.1 Community Involvement

Much of the success of an urban biodiversity initiative is provided and determined by the level of community involvement. While the lack of corridors (in a true sense) within the urban environment is an obstacle to biodiversity, it provides an opportunity for Councils and the community to become involved in developing alternative strategies that better fit to the developed urban context. The National Local Government Biodiversity Strategy, (DEWHA) represents an agreed position at the national level on Australia's biodiversity that community education and participation is fundamental in achieving conservation and sustainable use of our natural resources. Community participation initiatives are a critical component of the entire strategy. Potential community participation strategies are:

- Habitat enhancement programs on private lands
- Developing active partnerships with local schools and tertiary institutions
- Developing active partnerships with local businesses and commercial enterprises
- Expanding Councils' existing Bushcare programs.

Community groups including the Inner West Environment Group (IWEG) and the Cooks River Mudcrabs actively undertake ground works at a number of Bushcare sites along the GreenWay and within the catchment. One of the Actions recommended in this strategy (and others) is to increase the number of Bushcare sites. This requires the support and numbers from the community to participate in workdays and become involved in community projects. To maximise resources and outcomes the GreenWay stakeholders should also continue to work with Transport for NSW to maximise opportunities for revegetation and bushcare (Refer to Figure 2-1) as per the current GreenWay Revegetation & Bushcare Plan 2011.

What households do in their own backyards can have a marked effect on urban biodiversity. Planting local native trees, shrubs and ground covers, bringing pets in at night, creating permeable fences to allow animals to pass from one yard to another, keeping gardens chemical free are a few but simple and effective things individuals can do.

Breaking down the catchment into smaller and prioritised areas effectively reduces the catchment down into manageable areas or zones that can be targeted by the representative councils (refer to Figure 7-1). This allows the catchment to be viewed in small parcels rather than entire catchment as a whole. In turn this allows targeted community initiatives to be completed as time and funds become available to achieve the stated objectives, over a long period of time.

This can be achieved using the creation of bio-links as shown in figures 5-3 to 5-6 where priority linkages can be developed through targeted responses related to areas or zones. This idea has been adopted by Marrickville Council in its Marrickville Trellis initiative. A similar program has been adopted in Adelaide called 'The Urban Forest' whereby households were provided seedlings to plant in their yards. This not only provides much needed backyard flora but also a sense of ownership in something much bigger. This concept could have great success if initiated through the participation of local schools.

Community involvement also extends to stakeholder partnerships. Fostering and developing proactive and workable relationships is fundamental to the success of the GreenWay and the catchment in providing a unique, urban biodiversity corridor.

Additional stakeholders in the project include:

- GreenWay Steering Committee
- Cooks River Alliance,
- Office of Environment and Heritage (OEH),
- NSW Maritime,
- Sydney Water,
- Sydney Metropolitan Catchment Management Authority (SMCMA),
- Neighbouring LGAs of City of Sydney, Burwood and Canada Bay,
- Residents within the defined GreenWay catchment area,
- Inner West Environment Group (IWEG),
- Cooks River Mudcrabs,
- GreenWay Biodiversity Strategy Working Group,
- Transport for NSW,
- The light rail operator- Metro Transport Sydney (PLRC),
- Friends of the GreenWay (FoG),
- Roads & Maritime Services
- National Parks & Wildlife Service (NPWS).

The GreenWay Project and partner Councils will continue to work collaboratively with residents, community groups and key stakeholders to ensure the Strategy and Action Plan capture the community's knowledge, experience and priorities and involve the community in protecting and enhancing biodiversity.

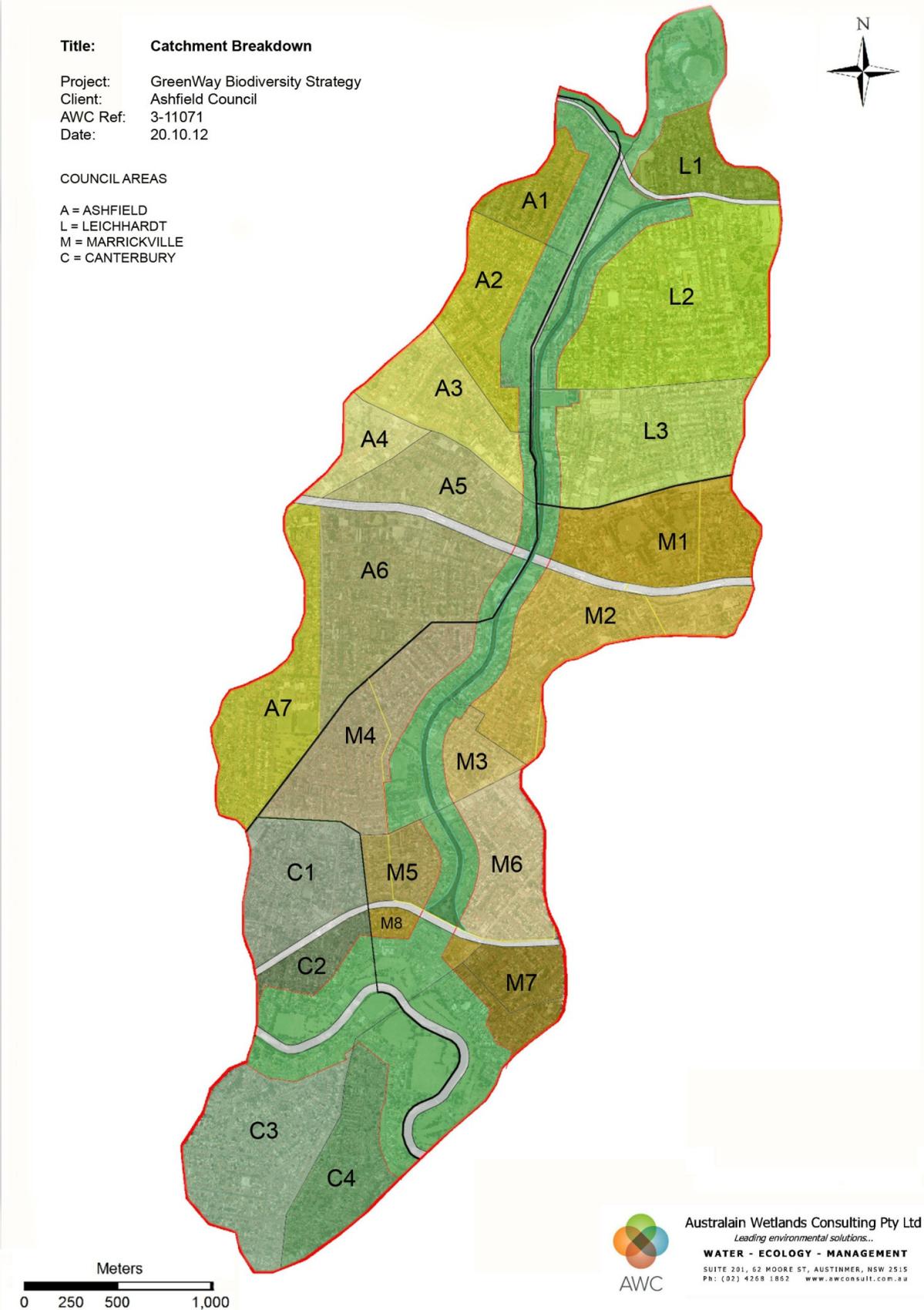


Figure 7-1: Catchment Breakdown

8 Mitigate key threats to biodiversity

Biodiversity Objective No.5

Mitigate key threats to biodiversity to increase the survival and adaptive capacity of species, populations and ecological communities of plants and animals.

8.1 Biodiversity Threats

Threats to native flora and fauna include weed invasion, and impacts from feral fauna. In combination these threatening processes may have significant impacts on vegetation/habitat by competing for resources (light, water, nutrients, breeding/roosting habitat). A range of other threatening processes also operate within the GreenWay and are typical of highly urbanised areas and include: disturbance from increased noise, light, human activity; mortality from vehicles; changed hydrology; and predation/harassment by domestic dogs and cats.

The catchment area supports a small but diverse range of flora and fauna habitat. Numerous open space areas, including sports fields, golf courses and small local parks are scattered throughout the LGAs and, although largely cleared of vegetation, present opportunities to enhance connectivity between these important urban green spaces.

In development of management strategies for the protection and enhancement of biodiversity, it will be necessary to consider the threats to biodiversity values. Primarily, the threats relate to the small size and narrowness of the existing urban green spaces or reserves. Small reserves have a high contact zone with surrounding disturbed areas, which provides multiple entry points for pest plants and animals and people and exposes wildlife to high levels of disturbance from traffic, light and noise. Related impacts include: weed and feral animal invasion, dumping of rubbish and garden waste, mowing and clearing of native understory vegetation, compaction, trampling and track creation.

The location of 'green' spaces within urbanised areas makes them vulnerable to degradation from polluted stormwater runoff and increased nutrient loading. Increased hard surfaces resulting from urbanisation has shifted the hydrology of the catchment from historically slow-flowing surface flows and creeks to systems with piped and channelised flows. The resulting inflow to receiving waters may carry high amounts of nutrients and rubbish and damages habitat values.

The *Threatened Species Conservation Act (TSC) 1995* identifies key threatening processes (KTP) which may negatively impact on biodiversity. The relevant threats applicable to the GreenWay are shown in Table 8-1.

Table 8-1 – TSC Key Threatening Processes

Threatened Species Conservation Act 1995 Schedule 3 Key threatening processes
Anthropogenic Climate Change
Clearing of native vegetation
Competition and grazing by the feral European Rabbit, <i>Oryctolagus cuniculus</i> (L.)
Invasion and establishment of exotic vines and scramblers
Invasion and establishment of Scotch Broom (<i>Cytisus scoparius</i>)
Invasion and establishment of the Cane Toad (<i>Bufo marinus</i>)
Invasion, establishment and spread of Lantana (<i>Lantana camara</i> L. sens. lat)
Invasion of native plant communities by African Olive (<i>Olea europaea</i> L. subsp. <i>cuspidata</i>)
Invasion of native plant communities by exotic perennial grasses
Loss of hollow-bearing trees
Predation and hybridization by Feral Dogs (<i>Canis lupis familiaris</i>)
Predation by <i>Gambusia holbrooki</i> Girard, 1859 (Plague Minnow or Mosquito Fish)
Predation by the European Red Fox <i>Vulpes Vulpes</i> (Linnaeus, 1758)
Predation by the Feral Cat <i>Felis catus</i> (Linnaeus, 1758)
Removal of dead wood and dead trees
Introduction and establishment of Exotic Rust Fungi

8.2 Threats

8.2.1 Habitat Removal and Land Management Practices

Destruction and fragmentation of habitat is the biggest threat to biodiversity, especially in urban environments where habitat opportunities are limited. This may occur through inappropriate zoning (leading to clearing for development), or through inappropriate landscaping or weed-management practices.

8.2.2 Exotic Pests and Companion Animals

Feral cats (*Felis catus*) and foxes (*Vulpes vulpes*) have been recorded in the GreenWay catchment. These pests are common in urban areas and are likely to prey on native mammals, reptiles, birds, amphibians and invertebrates. The Plague Minnow (*Gambusia holbrooki*), an exotic fish species that has had a significant impact on native frog communities through predation of eggs, hatchlings and tadpoles has been recorded in Dibble Ave Waterhole, Marrickville Biodiversity Strategy 2011-2021 (2011). In an urban environment, control of predators such as foxes and cats is particularly problematic and compounded by companion animals which may roam freely. Dogs and cats are common companion animals in urban areas that can impact native animals by disturbance or direct predation. Both cats and dogs are listed as threats to the inner west population of the Long-nosed Bandicoot (DECC 2008b) and are likely to impact urban reptile fauna (Shea 2010) and bird communities (Banks & Bryant 2007).

8.2.3 Native Pests

Some native animals have adapted so well to urban environments it has allowed them to increase their abundance or to extend their range to new areas, which can be detrimental to other native species. A recent comparison of historical and contemporary bird communities of Sydney has shown a decline in smaller species and an increase in larger (including aggressive) species (Major & Parsons 2010).

In particular, the Noisy Miner has consistently been demonstrated to reduce diversity of native bird communities (Debus 2008, (H. Parsons, Major, et al. 2006b) through aggressive exclusion of other birds (Piper & Catterall 2003). The Birds Australia Best Practice Guidelines for Enhancing Bird Habitat Report recommends improving structural diversity of urban plant communities, planting dense shrubs, incorporating shrubs like Acacias (which Noisy Miners do not forage on), and minimising planting of eucalypts (Parsons 2009).

8.2.4 Weed Invasion

Due to high levels of disturbance within the corridor, environmental weeds have invaded areas of remnant vegetation and occupied areas of wasteland and unmaintained land within the railway corridor and road reserves. Some of the more serious environmental weed species include Green Cestrum, Lantana, Large-leaved Privet, Asthma Weed and Asparagus Fern. Both Green Cestrum and Lantana are listed under the *Noxious Weeds Act 1993*.

Weed invasion can impact biodiversity by reducing the species richness of plant communities, which can in turn change the composition of invertebrate communities (Gollan et al. 2010). This has flow on effects for ecosystem resilience, soil composition, and availability of suitable food species for native animals. Scotch Broom, Lantana, African Olive and the invasion of native plant communities by exotic perennial grasses are identified as KTP's.

8.2.5 Light

Within the urban landscape, lighting from street lights, cars, households etc is unavoidable. Lighting along the proposed light rail route is likely to impact on fauna within the corridor. The impacts of lighting on urban biodiversity have been examined in some detail as part of the Marrickville Biodiversity Strategy. Recommendations for biodiversity friendly lighting are provided in the Action Plan.

8.2.6 Noise and Traffic

Noise disturbance has been shown to impact bird and frog communities by interfering with communication (Chan & Blumstein 2011; Slabbekoorn & Peet 2003; Hoskin & Goosem 2010). It is difficult to limit this threat in an urban environment. Road-kill fatalities can impact a range of urban wildlife and is a likely cause of the recorded fatalities of Long-nosed Bandicoot within the catchment area.

8.2.7 Climate Change

Climate change is considered a KTP to biodiversity under the TSC Act, having the potential to impact biodiversity around the world by altering distribution, abundance and available habitat for both native and exotic species. The impact of climate change on the GreenWay catchments biodiversity is as yet, unknown, however continued monitoring of species population and distribution will provide comparable data on the future impacts of threats related to climate change.

8.2.8 Exotic Pests

While the southern distribution of the Cane Toad (*Bufo marinus*) is currently limited northern NSW, the species has recently been recorded in breeding populations in the Sutherland Shire (ABC 2010). Cane Toads prey on a wide variety of fauna poisons native predators which consume them and evicts some bird species from their burrows (Shine 2010). In addition, the Cane Toad is expected to reduce population viability of the Green and Golden Bell Frog and potentially contribute their extinction (DECCW 2006). The Cane Toad is a Key Threatening Processes listed under the TSC Act.

8.2.9 Contamination, Diseases, Pathogens

While not a current threat within the Greenway, Chytrid fungus (*Batrachochytrium dendrobatidis*), and Myrtle Rust (*Uredo rangellii*) propose a future threat to flora and fauna within the catchment. The Chytrid fungus is widespread in Australia and may occur already within the catchment and is listed as Key Threatening Processes listed under the TSC Act.

8.3 Priorities Action Statements (PAS)

The NSW Threatened Species Priorities Action Statements (PAS) are the NSW Government's approach to recover threatened native flora and fauna and to manage the threats faced by these plants and animals. PAS applicable to threatened fauna and communities of the GreenWay are;

- Sydney Turpentine–Ironbark Forest – Endangered Ecological Community
- Grey-headed Flying Fox (*Pteropus poliocephalus*) – Vulnerable
- Eastern Bentwing-bat (*Miniopterus orianae oceanensis*) – Vulnerable
- Long-Nosed Bandicoot (*Perameles nasuta*) - Endangered Population
- Pied Oystercatcher (*Haematopus longirostris*) – Vulnerable

Refer to the action table for the relevant actions associated individuals or communities identified as vulnerable, threatened or endangered.

9 Coordinate biodiversity management across the Region

Biodiversity Objective No.6

Provide strategic guidance to councils, private landowners and major stakeholders on how to coordinate biodiversity management across the four local government areas.

9.1 Ongoing collaboration and implementation

The GreenWay Biodiversity Strategy can be utilised by GreenWay stakeholders, Councils, State Agencies and the community both as a specific resource for the GreenWay as well as inspiration for improving biodiversity throughout the region.

The Strategy consolidates and clearly sets out the community's objectives, as well as recommended actions for achieving the GreenWay vision. It is consistent with the objectives and actions in the GreenWay MasterPlan & Coordination Strategy 2009.

This Biodiversity Strategy is designed to foster both local and regional approaches that will assist in achieving the vision of an indigenous flora and fauna corridor as part of the community's broader GreenWay vision of a "recognisable environmental, cultural and sustainable transport corridor connecting two of Sydney's most important waters". The Strategy can be used to guide the work of Councils as well as community organisations and as a resource to attract future funding and environmental grants.

It is acknowledged that each of the partner Councils and the community are already engaged in or planning and implementing a range of initiatives designed to protect and enhance biodiversity in their communities and throughout their Local Government Area, and some partners Councils have recently developed and adopted Biodiversity Strategies for their LGA.

The Strategy supports the environmental and biodiversity objectives for Councils as outlined in the table below.

All Councils	GreenWay MasterPlan & Coordination Strategy 2009
	GreenWay Sustainability Project Business Plan 2009 - 2012
Ashfield Council	"Ashfield 2022: Our Place, Our Future", Community Strategic Plan – "Living Sustainably".
Leichhardt Council	Leichhardt Council 2020+ Strategic Plan – "A Sustainable Environment"
Marrickville Council	Our Place, Our Vision, Marrickville Community Strategic Plan – KRA 3: A Well-planned, sustainable and accessible urban environment.

	Marrickville Council Biodiversity Strategy & Action Plan 2011 - 2015
City of Canterbury	Imagine Canterbury Community Strategic Plan – Community Priority 3: Sustainable Environment
	City of Canterbury Biodiversity Strategy – Under development 2012

The GreenWay Sustainability Project ran from 2009 - 2012 and was funded by the NSW Government through its Environmental Trust. With significant dedicated resources and budget, including a Biodiversity Officer, the Project was able to harness the support of its partner Councils and develop a range of strategic plans and actions to progress the GreenWay vision, including the Biodiversity Strategy.

Another key aspect of the Project was developing a sustainable governance model for the GreenWay, to allow the corridor and its community to continue to grow the GreenWay vision. It is envisaged that the GreenWay will continue to benefit from dedicated resources focused on regional goals through the employment of a Place Manager, who will continue to work with the partner Councils and the community on the implementation of GreenWay plans and programs.

It is recommended that as part of continued collaboration, information and resource sharing, relevant stakeholders, including Council staff, State Agencies and interested community representatives continue to meet, share learnings and report on the progress of the Strategy implementation.

Some of the recommended actions are regarded as aspirational and unlikely to be achieved during the next five years. However, they have been included to provide a longer-term direction for Councils and State Government agencies to consider in order to realise substantive biodiversity improvements and outcomes.

A key role for the Place Manager is to continue to integrate GreenWay specific actions into Council's existing planning and operational framework. Dedicated funding for the actions in the strategy are unlikely to be available, unless further grant funding is secured. Chapter 9 outlines alternative opportunities which could be explored to progress the implementation of the strategy.

The GreenWay Biodiversity Strategy is available on the GreenWay website at www.greenway.org.au.

10 Actions, costs & prioritisation

The findings of investigations and discussions detailed within this strategy culminate in a table of recommended actions for the consideration of Councils, state agencies and the community in support of the agreed biodiversity objectives for the GreenWay. These actions are also consistent with those outlined in the GreenWay MasterPlan & Coordination Strategy, adopted by the partner Council in 2009.

Actions have been assigned priority based on the severity of the threat the action addresses and the cost of implementing the action. Performance targets or outcomes within the table have, to the greatest extent possible, been made specific and measurable as well as the recommended course of action to pursue this target detailed. Cost estimates are derived from established commercial rates.

The actions are nominated to facilitate and support the stated objectives and also assist in the planning and implementation of on ground works and directives for the recovery of threatened native plants and animals.

The priority rating can be used to guide stakeholders in decision-making for implementation:

1. Immediate/High. These actions should be implemented within the first 1-2 years.
2. Medium. These actions should be implemented within 3-4 years.
3. Long Term. These actions should be considered as achievable within 5 + years.

The strategy has focused strongly on the application and implementation of bio-links across the catchment as a mechanism for improved biodiversity. The initiation of Priority 1 bio-links and community involvement and awareness are seen as the key actions for success.

Where possible, it is proposed that the implementation of recommended actions in the Biodiversity Strategy can be integrated into Council's existing management plans and delivery programs as part of supporting overall biodiversity objectives for the Local Government Area. In many cases the recommendations are consistent with programs and activities already being implemented in Councils. It is envisaged integrating the actions with Council business will be a key role for ongoing GreenWay staff, such as the GreenWay Place Manager.

In addition, the following avenues can be explored to progress the Strategy's implementation:

- Future grant funding
- Community projects
- Student/school projects
- Volunteer organisations eg Conservation Volunteers Australia
- National community events, eg National Tree Day
- Philanthropic donations & corporate sponsorship.

These actions are not to be viewed in isolation and should be read in conjunction with previously completed and adopted management plans where applicable.

Action	Priority	Cost / management area	Outcome / Existing Program	
Objective 1: Create a flora and fauna corridor which supports the original vegetation of the area, provides habitat, and facilitates movement and migration for a wide range of native plant and animal species throughout the GreenWay catchment.				
Existing values	Based on existing knowledge, map the remnant vegetation, condition of vegetation and soil profiles in the GreenWay catchment	High	\$10,000 M4,M5	Increased awareness of, and opportunity for, the success of remnant native flora species in the GreenWay Marrickville Council: Dulwich Hill Railway line (West) indigenous vegetation map
	Protection of remnant vegetation (through Assisted regeneration), soil profiles and seedbanks and existing Bushcare sites where possible	High	M4,M5	Increased resilience and opportunities for the success of remnant vegetation in the GreenWay. Marrickville Council: Dulwich Hill Railway line (West) indigenous vegetation map
	Investigate the feasibility of different sites in the GreenWay catchment along the Cooks River and Iron Cove to rehabilitate and re-construct riparian/estuarine habitats	Long term	\$10,000	Improved habitat value for utilisation by of estuarine/riparian-dependent fauna.
	Install nest boxes, retain woody debris or hollow logs for habitat within the GreenWay corridor and adjacent parks	Long term	\$750/ box plus installation	Improved habitat value for utilisation by native fauna in the GreenWay. Canterbury Council Pruning for habitat retention policy

Action	Priority	Cost / management area	Outcome / Existing Program	
Objective 2: Identify areas within and adjacent to the GreenWay catchment with high biodiversity values that require protection and improve the connectivity between these areas.				
Bio Links	Establish Core corridor by implementing Priority Bio Links 100m either side of the rail corridor and 100m from park boundaries to include residential streets and houses.			Increased habitat availability through the expansion of native vegetation throughout the GreenWay catchment.
	<ul style="list-style-type: none"> • Priority 1 linkages • Priority 2 linkages • Priority 3 linkages 	High	A4, M1 & C4	
	Implement hierarchy of street and road side verge/ nature strip plantings to extend Bio-links at strategic locations across the GreenWay catchment.	Medium	L2, A5 & A6	
Develop a tool kit of common Bio-link landscaping treatments and planting schemes for streets and open space that could be used by councils and implemented at sites across the GreenWay, and tailored to individual streets.	High	\$25,000	Increased habitat availability through the expansion of native vegetation throughout the Greenway catchment. <ul style="list-style-type: none"> • GreenWay Species list • IWEG planting list • Adopt a verge programs –partner Councils 	

Action		Priority	Cost / management area	Outcome / Existing Program
Regional connectivity	Investigate opportunities for habitat connectivity on a regional scale.	med		Increased opportunities for restoration of natural ecological function for urban biodiversity.
Beaman Park	Additional riparian plantings along southern edge of Cooks River to re-instate Swamp Oak (<i>Casuarina glauca</i>) floodplain vegetation community.	High	Canterbury City Council \$45/m2 Management Area C4	Increased riparian buffer and connectivity along the riparian edge as well as increased diversity in the form and species of plants within the park providing habitat for native fauna.
	Installation of small 'island plantings' to create small pockets of bird habitat using a variety of shrubs and native grasses	High	Management Area C4	Improved habitat value for utilisation by native fauna in the GreenWay. <ul style="list-style-type: none"> • 2012 plantings funded by the Greenway USP project.
Ewen Park	Establish significant verge and nature strip planting (Bio Link network) from Ewen Park and Marrickville Golf Course through the under pass at Ewart St connecting to Jack Shanahan Park and the GreenWay corridor.	High	Canterbury City Council, Marrickville City Council \$45/m2 Management Area C2	Increased habitat value and connectivity for utilisation by native fauna
	Undertake realignment of the existing fencing of the Bankstown Line to facilitate fauna movement under the overpass.	Medium	City Rail \$5000 Management Area C2	Increased habitat value and connectivity for utilisation by native fauna

Action		Priority	Cost / management area	Outcome / Existing Program
Richard Murden Reserve and Hawthorne Canal Reserve	Extension of the Bushcare site along the canal (i.e. riparian vegetation re-instated) including the rehabilitation of the existing salt marsh community.		A1/L2	Increased habitat availability through the expansion of native vegetation throughout the GreenWay catchment. Increased resilience and opportunities for the success of protected vegetation in the Greenway.
	Implement understory island plantings within the reserves.	High	A1/L2	Increased habitat value and connectivity for utilisation by native fauna <ul style="list-style-type: none"> • 2012 plantings funded by the Greenway USP project.
	Investigate the hydrology associated with the decommissioning and replacement of sections of existing concrete channel with a 47naturalised creek system.	Long term	Maritime NSW	Increased opportunities for restoration of natural ecological function for urban biodiversity.
Objective 3: Protect and enhance the habitat and migration opportunities for locally significant or threatened native species, populations and communities (including the endangered population of Long-nosed Bandicoot), and allow for their continued evolution and survival in and beyond the GreenWay catchment.				
Traffic & Signage	Install <i>slow go</i> traffic zones on residential streets and signage to facilitate fauna movement particularly in the Bandicoot Protection Area and at strategic locations/ road crossings throughout the catchment.	Long term	\$1500/ sign	Increased community and stakeholder awareness of fauna movements within the catchment. <ul style="list-style-type: none"> • Leichhardt Council Possum crossing signs 2012

Action		Priority	Cost / management area	Outcome / Existing Program
Design Guidelines	Liaise with Transport for NSW and light rail operator to provide advice of significant biodiversity considerations such as lighting of sensitive areas, station landscaping guidance and vegetation management practices.	Medium	NA	Reduction of detrimental effects on native fauna as a result of the light rail construction.
	Establish design criteria for the appropriate use and implementation of lighting adjacent to sensitive areas within the catchment.	Long Term	NA	Reduction of detrimental effects on native fauna as a result of the light rail constructions
	Create a register of significant fauna sightings within the GreenWay catchment		\$20,000	Increased awareness and capacity to appropriately manage GreenWay biodiversity. <ul style="list-style-type: none"> Leichardt Council fauna monitoring record
	Establish baseline dataset of fauna presence and abundance by annual/seasonal surveys and contribute data sets to the Atlas of Living Australia.	Medium	\$20,000 (per yr for 3 years)	Increased awareness and ability to more effectively quantify and manage GreenWay Biodiversity. <ul style="list-style-type: none"> Leichardt Council fauna monitoring record
Objective 4: Engage and educate residents and the broader community, including local businesses and visitors to the GreenWay, to encourage a sense of ownership and participation in protecting and restoring biodiversity in the GreenWay catchment.				
Education	Production of a pamphlet/website resource with information on native gardening including species selections and	Medium	\$50,000	Improved opportunities for community involvement in and continued contribution to the GreenWay.

Action	Priority	Cost / management area	Outcome / Existing Program
alternatives to exotics plant species for both flora and fauna. Free tubestock (1-2 per household) could be provided to initiate ground swell at open days at bushcare sites, community planting events etc., and pamphlets can be distributed in a letter box drop within targeted council areas.			<ul style="list-style-type: none"> GreenWay website www.greenway.org.au GreenWay species list GreenWay “Do you have a bandicoot in your backyard?” brochure
Engage with households around management and planting of native vegetation on private land.	High	NA	Increased habitat availability provided by the expansion of native vegetation throughout the GreenWay catchment through community participation.
Prepare lists of native species appropriate for households to plant in their gardens and locations where these plants are available.	On going	NA	Increased habitat availability provided by the expansion of native vegetation throughout the GreenWay catchment through community participation. <ul style="list-style-type: none"> GreenWay species list
Continue to provide weed management information to GreenWay stakeholders targeting weed identification, removal techniques, alternative replacement with native species etc.	On going	NA	Increased ability for all GreenWay stakeholders to more effectively manage the natural assets of the GreenWay
Undertake education of the community to establish fauna-friendly fencing.	Long term	NA	Increased awareness of and opportunities for restoration of natural ecological function for urban biodiversity.

Action		Priority	Cost / management area	Outcome / Existing Program
	Establish demonstration sites throughout the catchment providing examples of best practice management (Bushcare sites/ community gardens).	On going	NA	Increased awareness of, and opportunities for restoration of natural ecological function for urban biodiversity. • GreenWay bushcare groups
	Encourage and promote participation in Bushcare groups and activities.	Long term	NA	Improved opportunities for community involvement in and continued contribution to the GreenWay.
	Engage with schools' on issues around biodiversity, native flora and fauna, tree planting and water quality.	On going	NA	Increased awareness of and opportunities for restoration of natural ecological function for urban biodiversity.
Bushcare Sites	The establishment of additional Bushcare sites along the GreenWay located as proposed in the GreenWay Revegetation Plan and to coincide with RailCorp's proposed revegetation sites.	Long term	NA	Increased awareness of and opportunities for the realization of the objectives of the GreenWay Revegetation and Bushcare Plan 2011.
	Establishment of new Bushcare sites to coincide with existing remnant vegetation which is to be preserved, maintained and enhanced as required.	Long term	NA	Increased awareness of, and opportunity for the success of remnant native flora species in the GreenWay.

Action	Priority	Cost / management area	Outcome / Existing Program	
Objective 5: Eliminate or mitigate key threats to biodiversity to increase the survival and adaptive capacity of species, populations and ecological communities of plants and animals.				
Priority Action Statements (PAS)	Keep up to date with priority action statements (PAS) for threatened flora and fauna in the GreenWay catchment and incorporate relevant actions into any work that is planned or implemented			The implementation of Refined, legislated management strategies for the protection of vulnerable, threatened or endangered communities or individual species.
Weed Control	Continue to undertake control of noxious and environmental weeds within existing sites and throughout the GreenWay, keeping in mind the guidelines for habitat protection	High	Light rail operator NA	Reduction in dominant weed species along the corridor and control of areas outside the core corridor.
Vertebrate threats	Investigate options for a Red Fox (<i>Vulpes vulpes</i>) control program across the catchment	High	\$15,000	Improved mitigation and management of threats to the native fauna of the GreenWay catchment.
	Public awareness campaign regarding responsible ownership of companion animals	Long term	NA	Increased awareness of the threats to native biodiversity throughout the GreenWay catchment.
Objective 6: Provide strategic guidance to councils, private landowners and major stakeholders to coordinate biodiversity management across the four local government areas.				
	Coordinate GreenWay councils to develop a GreenWay catchment approach to planning	Long term	NA	Increased ability to more effectively manage the natural resources of the GreenWay catchment.

Action		Priority	Cost / management area	Outcome / Existing Program
	and implementing WSUD on-ground works			
	Work with GreenWay councils to develop and implement a comprehensive water and biodiversity GreenWay campaign including a community forum.			Increased ability to more effectively manage the natural resources of the GreenWay catchment.
Monitoring and Evaluation	<p>Develop targets that align with councils' community strategic plans to determine both the success and failure of initiatives and to provide tools for future decision making particularly around the resources of time and funds.</p> <p>Examples include:</p> <ul style="list-style-type: none"> • Water quality • Weed abundance • Native species abundance and diversity • Volunteer participation • Residential native plantings 			Increased ability to more effectively assess the management strategies of the natural resources of the GreenWay catchment.

Action		Priority	Cost / management area	Outcome / Existing Program
Data Management	Development of an on-line database via which completed plans and forms can be uploaded to individual Council websites and linked with <i>www.greenway.org.au</i> with data easily accessed.	Long term	\$5000	Increased accessibility to GreenWay information and resources.
Planning and compliance	Ensure biodiversity principles are included as part of any review of environmental planning instruments (e.g. LEPs, DCPs, environmental overlays) to include provisions that aim to maintain, restore and protect urban biodiversity values giving effect to water quality, river flow, connectivity and habitat objectives, and threatened species and maintenance of fish passage in streams.	High	NA	Through review, update and development of Environmental planning instruments and an Open Space and Recreation Plan within a planning context, biodiversity issues become decision and design criteria not consequences.
	Consider planning based incentives which facilitate developer contributions to broad scale rehabilitation of the GreenWay areas as compensation for increased stormwater run-off or loss of habitat associated with development.	Medium		Increased ability to more effectively manage the natural resources of the GreenWay catchment.

Action		Priority	Cost / management area	Outcome / Existing Program
Open space management	Recommendation that all Council parks & gardens divisions adopt a 'plant natives' policy wherever possible. Master list of species to be produced for dissemination.	High	NA	An increased awareness with Council departments that urban parks provide the last vestige to secure significant, biodiversity objectives and outcomes within the urban landscape.
	Revisit Council parks and examine opportunities for further planting of natives. Consider small island shrub/feature plantings as opposed to ornamental gardens and plants.	Long term		Increased habitat availability through the expansion of native vegetation throughout the GreenWay catchment.
	Ensure that biodiversity Principles are incorporated Plans of Management for parklands within the GreenWay catchment	Medium	NA	Increased ability to more effectively manage the natural resources of the GreenWay catchment.
	Educational programs/seminar for parks staff focused on biodiversity, including weed identification techniques.	Medium		Increased ability to more effectively manage the natural resources of the GreenWay catchment.

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12 Appendix A – What is Biodiversity

What is biodiversity?

“Biodiversity, or biological diversity, is the variety of all life forms”. Australia’s Biodiversity Conservation Strategy 2010-2030

The components of biodiversity include:

- Genetic diversity – the variety of genetic information contained in individual species of plants, animals and micro-organisms
- Species diversity or the variety of species
- Ecosystem diversity - the variety of habitats, ecological communities and ecological processes.
- Biodiversity is fundamental to our physical, social, cultural and economic wellbeing and is fundamental in the provision of ecosystem services that form our natural capital such as fresh water, clean air, fertile soil and biological pest control.

Why is Biodiversity Important?

Biodiversity provides for life’s critical processes such as the pollination of plants that produce oxygen and food. Biodiversity within an urban habitat corridor has the potential to improve recreational potential and general environmental and public amenity. Consolidation of urban biodiversity provides opportunities for recreation, scientific research and education as a source of cultural identity.

It has been recognised that areas of high biodiversity are more resilient to significant environmental variations and disturbances than areas with compromised diversity. In urban developments, plants and the vegetation cover they provide are crucial landscape features. Benefits of vegetation include its roles in the cycles of water, nutrients and energy, as well as the provision of shade, shelter for wildlife, aesthetic appeal and functional roles such as sports fields for human activities. Plant assemblages include both introduced species (alien and exotic) as well as relic indigenous species.

Remnant vegetation provides important “stock” which is adapted to local climatic and soil conditions and provides a continuity of habitat through time for local animal species. The maturity of existing remnant vegetation is impossible to replace and the diversity of natural plant assemblages difficult to emulate. Further, where local species are threatened, there is potential they can be accommodated and conserved in urban areas. Preservation of existing natural and remnant vegetation is the most efficient way to incorporate biodiversity in urban developments.

In addition to remnant vegetation, street trees, grassy parks, vacant lots, flowerbeds and front lawns all contribute to urban biodiversity. These areas can support indigenous species that are adapted to local climatic and soil conditions and provide food and habitat for native wildlife with minimal maintenance requirements. Native Australian species from other localities and exotic species can also make positive contributions to local biodiversity. In some cases these species are better adapted to the conditions of the highly modified environment and may require less water or maintenance, establish more quickly and reduce soil erosion, are likely to become invasive, or be

required to fulfill a specific function – such as hardy grass species utilised in sports fields.

Importantly, urban flora, in conjunction with built structures, provides habitat for a range of fauna. An increase in plant cover and structure in an urban area typically increases the abundance of animal species due to an increase in shelter, nesting, roosting, foraging and breeding habitat. Three terms have been used to describe the strategies of wildlife in response to urban development: avoiders, adapters, and exploiters (Roetman 2008).

Urban avoiders cannot survive in the built environment as they cannot tolerate fragmented habitat, reduced food or shelter resources, environmental pollution, or introduced competition or predation. Large, mammalian predators are usually identified as urban avoiders, in some cases more because people avoid permitting their presence, rather than the animal avoiding urban areas.

Urban adapters benefit from developed environments because there are increased food sources or shelter sites. Australian examples (both native and introduced) are brushtail possums, foxes, blackbirds, magpies and bluetongue lizards. All of these species do well in developed areas, in part due to their generalised life cycle requirements.

Like the adapters, urban exploiters benefit from food sources and shelter sites provided by urban environments, but these species are now so reliant on human activities that they are primarily, if not only, found in dense settlements such as cities. Australian examples are feral pigeons, black rats, redback spiders and spotted turtle-doves.

Benefits of Biodiversity at a Social Level

<http://yourdevelopment.org/factsheet/view/id/51>

The benefits of biodiversity in urban environments include increases to:

- land value,
- marketability,
- amenity,
- conservation of nature, and
- human wellbeing.

Most people prefer to live and socialise in settings that include natural elements: trees, lawns, water and wildlife. Biodiversity adds to a sense of place and builds place identity.

Value

It is difficult to calculate the exact economic value of natural assets. However, it has been shown that people pay more for houses with trees, which are close to parks, and with views of parks or water. There are also benefits in marketability. For example, houses with biodiverse surroundings typically sell faster than those without. This strategy could be used to gain community support and buy in, as much of the community may have a greater understanding of the concept of property value rather than improved biodiversity.

Benefits to society

Biodiversity also benefits society through better environmental functionality. Vegetation provides buffers to noise and smell, diffusion of light, protection from wind, stabilisation of soil, sequestration of carbon, and cleansing of pollutants from the air. Vegetation also slows water flows and increases infiltration and evapotranspiration, assisting stormwater management by reducing peak-flows. Trees shade houses, thereby reducing cooling costs by blocking direct sun and through the cooling effect of evapotranspiration. On a larger scale, increased vegetation reduces the temperature of cities by lessening the heat island effect. Vegetation also provides food and shelter for wildlife, and animals provide environmental services including the disposal and decomposition of wastes, nutrient cycling in soils, and seed dispersal and the pollination of plants.

Sense of place

Biodiversity adds to a sense of place and builds place identity. People identify with their local flora and fauna and rare species are of particular concern. Many endangered species already inhabit urban areas such as the bandicoot which has become the conservation icon of the GreenWay.

Interactions

Urban communities benefit from interaction in, and with the natural environment. Nature can be beautiful, symbolic, calming, challenging, and beneficial for human health. Intellectual stimulation and mental health benefits are derived from recreation and association, by feeling space, exploring natural complexity, and pondering existence. People enjoy socialising in urban environments that include biodiversity, and the more biodiverse an area is, the more people benefit from visiting it. These spaces within the urban fabric may in fact be the only natural interaction that urban dwellers have. The displacement of the natural environment within cities has made many residents physically, intellectually, and emotionally distanced from all but a highly modified form of nature. Further, the environmental attitudes of urban residents are largely formed by interactions with their local environment. Therefore, backyards and suburban parks provide vital access to nature.

In these ways, biodiversity can add value to urban and social development in economic, environmental, and social terms.

13 Appendix B - Bio Links Checklist

NATURAL VALUES/FEATURES	
Vegetation community	If identifiable, list vegetation community present
Pre-clearing vegetation	Note what the original vegetation was if this is evident [eg. from canopy trees]
Vegetation condition	Eg. Cleared mown grassland/ unmaintained grassland & weeds/canopy with cleared understory/canopy & understory present/planted street trees only Weedy/not weedy [if weedy, list dominant spp.]
Habitat features	Tree hollows present Food trees present Understory vegetation present/structural complexity Shelter (rocks, logs, leaf litter etc present)
Drainage/hydrology	Presence of: Ponds / Wetland / Drain / Creek / River
Connectivity	Is the site connected to other areas or isolated? If isolated, is there an opportunity nearby to enhance connectivity (eg. a cleared area that could be rehabilitated)
Site management	Note if the site is: Mown / cleared / weeded / planted / sprayed / trees pruned etc
Barriers	Note features that may impede wildlife movement, eg. Roads/rail lines Extensive urbanised areas/shops Cleared areas Culverts diverting creek flow underground

SOCIAL/HUMAN FEATURES	
Land use	<p>Private: residential/industrial/commercial</p> <p>Public: recreational park/bushland park/treatment wetland/creek/ sports field/transport corridor</p> <p>Recreation: Passive [walking, sitting] or active [eg football, running, golf etc]</p>
Social environment	Proximity to transport characters &/or recreational areas
Safety	<p>Are there any safety issues to consider in proposed works to improve connectivity?</p> <p>[Eg. visibility, open water]</p>
Recreational conflicts	Would improvements for wildlife connectivity conflict with other uses of the corridor (eg. habitat planting may not be compatible with use of grassy open areas for ball games etc)
THREATS	
Weeds	<p>Weed invasion extensive / minimal</p> <p>Note presence of particularly invasive spp.</p>
Pest animals	<p>Evidence of dogs / cats / foxes / rats / Indian mynahs</p> <p>Dogs being walked on/off leash</p>
Human disturbance	Eg: parking / rubbish dumping / weed dumping / vandalism / horses / active recreation
Development/ construction	Any construction occurring
Other	
OPPORTUNITIES	

Revegetation	Any opportunities to enhance linkage through reveg, eg: Street tree planting / canopy tree planting / understory planting Would reveg increase width of linkage / length of linkage / habitat value of linkage
Management	Opportunities to change park/street management to enhance connectivity, eg: Reduced mowing / limited clearing of leaf litter / changes to wetland management / traffic control
Significant species	Opportunities for connecting habitats for particular species
Private opportunities	Opportunities to enhance linkage on private land, eg: Backyard planting / landscaping or planting around offices or shops / planting in private rec areas
Wetland & waterways	Opportunities to reconstruct / replant / retrofit wetlands or drains to improve fauna values. Eg: Habitat pond construction / soft engineering of concrete drains / planting / creating ephemeral wetlands at stormwater overflows / improving flows

14 Appendix C: Methodology and Assessment Criteria for Bio-Links

14.1 Remote Sensing

Linear ecological features such as bio-linkages and corridors can often be most easily identified through use of aerial photography. Viewing the catchment at a landscape scale allows the accurate identification of linkages and potential linkages between the GreenWay and other significant green spaces such as parks, gardens and drainage lines.

Aerial photographs were studied prior to commencing the on-ground assessment to identify linkages requiring further investigation and to plan the most efficient approach for on-ground studies.

14.2 Fieldwork

On-ground surveys of the catchment were conducted over several days during October 2011 to verify linkages identified from literature, stakeholder consultation and aerial photograph studies. During the survey the potential linkages and sites were driven and walked. Particular focus was given to assessment of potential linkages between known areas of significant habitat for rare, threatened or otherwise significant species or ecological communities.

To ensure consistency during on-ground surveys, each site studied was assessed by means of a standardised survey form (Appendix B) to identify particular characteristics, values, constraints and opportunities associated with the linkage. The survey form was designed to assess ecological, physical and social features associated with each site. Social characteristics, including housing, transport corridors, infrastructure and recreational activities, are inextricably linked to ecological functions within urbanised environments and knowledge of these is central to the implementation of successful strategies and actions.

Value	Criteria	
Ecological Values	High or: or: or:	Provides linkage to an area containing one or more rare or threatened or otherwise significant species
		Provides linkage to an area containing one or more rare or threatened ecological community
		Provides linkage to an area of regional biodiversity significance outside of the catchment
		Provides linkage to an area noted as being of high flora or fauna diversity
	Medium or:	Provides linkage between one or more principal areas of natural vegetation
		Provides linkage between two areas containing native bushland, i.e. vegetation in which there is an intact or partially intact canopy <u>and</u> understory
Low or:	Provides linkage between one or more recreational parks or other open space areas that contain occasional native trees or shrubs but lack structurally mature vegetation (i.e. both canopy and understory present)	
	Provides linkage between poorly maintained open space or undeveloped areas that are weed infested or otherwise degraded & lack native vegetation.	
Social Values	High or: or:	Bio-link located in or connected to an area in which there is strong community support for ecological improvement as evidenced by presence of active bush care group or similar.
		Bio-link located along one of the walking trails
		Bio-link located along an area identified by the community or by Council as an important recreational walking route.
	Medium	Bio-link located along a significant recreational corridor used for activities other than passive recreation or walking.
Low	Bio-link lacking any local or regional community value.	
Vulnerability to Threats	High or:	Provides linkage to an area of habitat for a rare or threatened or otherwise significant species which is at threat from further fragmentation, isolation, weed invasion, feral animals or other threatening process.
		Provides linkage to an area occupied by a significant ecological community which is at threat from further fragmentation, isolation, weed invasion, feral animals or other threatening process.

Value	Criteria	
	or:	Provides linkage to an area an area of regional biodiversity significance outside of the catchment, which is at threat from further fragmentation, isolation, weed invasion, feral animals or other threatening process.
	Medium	Connects other principal areas of natural vegetation, which are at threat from further fragmentation, isolation, weed invasion, feral animals or other threatening process.
	or:	Connects two areas of native bushland, including areas where only canopy species remain, which are at threat from further fragmentation, isolation, weed invasion, feral animals or other threatening process.
	Low	Connects bushland reserves, including those providing habitat for rare or threatened or otherwise significant species or ecological communities, which have been rehabilitated &/or are in good condition & not likely to be threatened in the foreseeable future.
Linkage Enhancement Potential	High	Opportunities for enhancement of linkage exist & linkage, if enhanced, would improve connectivity for rare or threatened or otherwise significant species
	or:	Opportunities for enhancement of linkage exist & linkage, if enhanced, would facilitate connectivity between one or more ecologically significant communities.
	Medium	Opportunities for enhancement of linkage exist & linkage, if enhanced, would facilitate connectivity between principal areas of natural vegetation or other bushland reserves containing an intact or partially intact canopy and understory.
	or:	Barriers to connectivity exist but, if removed, would improve connectivity for rare or threatened or otherwise significant species or ecological communities.
	or:	Opportunities for enhancement of linkage exist & linkage, if enhanced may provide social or environmental benefits other than ecological connectivity
	Low	Significant barriers exist that prevent enhancement of ecological connectivity of low to moderate ecological value areas.
	or:	Land tenure prevents enhancement of ecological connectivity.

15 Appendix D - Guidelines for Biodiversity

This section has been prepared to provide guidance for councils and all those associated with the design and construction of wildlife friendly landscapes. It sets guides for the design and construction of elements of landscaping to open space and rehabilitation areas. Design variation and a loose interpretation of the guidelines is encouraged to develop character that expresses the varying sites and ecological communities and also the needs of the fauna species found, to achieve diversity in habitat creation throughout the catchment.

General Fauna Requirements

As indicated previously, the inability to provide an all-encompassing strategy to improve biodiversity for all species should not be considered cause for not undertaking this work. Many species of birds, frogs, insects and reptiles struggle to find a safe haven within the urban landscape. In order to create opportunities for native fauna the general principle is to maximise the diversity of native plant species and habitat features within Council owned lands and in private backyards. A variety of plant species means there are likely to be different plants flowering and fruiting throughout the year to provide continuous food sources. Differing forms of plants and landscape features provide fauna places to shelter, nest and breed.

With the planting of the appropriate ground cover, shrub and trees species for food, shelter and refuge many of the requirements of the local fauna have been met. These areas once established will continue to provide environments where natural, cyclic processes will occur. The provision of a varied landscape with a diverse composition of flora and habitat areas will lead to varied fauna composition. Physical landscape attributes such as shade and light, open and closed spaces down to the placement of rocks, logs and even mulches provide ideal habitat for a large range of fauna species.

Typical fauna requirements are detailed below.

Food

- Native grasses and shrubs –foraging for fallen seeds, and eat from seed pods in low shrub.
- Native trees – a source of seed, pollen and insects.
- Leaf litter and mulched gardens - lizards and insects live and breed here
- Pollen and nectar – their favourite foods are nectar and pollen from native flowers. Nectar gives them energy, and pollen provides protein for healthy feathers. They also feed on fruits and small insects.

Shelter

- Hollows to nest in – typically within very mature gum trees.
- Stout tree branches, as roost sites at night and as guard posts during the day

Refuge

- Safe parks and gardens – where cats and dogs are not a threat.
- Hollow branches – which provide safe and secure nesting sites, beyond the reach of predators.
- A warm spot in a sunny part of your yard, near shelter.
- A safe place to hide, usually in gaps between rocks or bricks, a wood pile, or in a clay pipe.

-
- Food – especially snails, slugs, caterpillars and beetles.
 - Shrubs and rocks, which provide safe paths and protection from predators

Try to:

- Keep large gum trees in backyards, streets and parks, and plant some replacements.
- Use plenty of leaf mulch building up the supply of worms, insects and lizards.
- Leave rocks for blue-tongues to use as shelter.
- Plant low growing shrubs so lizards can move safely around.
- Make gardens along fences to provide safe walkways.
- Feed pets inside or collect uneaten pet food,

Avoid:

- Using pesticides
- Leaving uneaten pet food outside, as it may attract foxes or feral cats.
- Letting your cat or dog roam
- Feeding native animals
- Removing seed heads, especially from native grasses
- Tidying dead branches from trees if there is no safety risk.
- Removing fallen branches from the ground if there is no fire issue

During this assessment of the GreenWay, a total of 28 bird species was recorded, inclusive of four pest species. All species recorded are common in the locality and no threatened species were observed. At most assessment sites between 5 – 10 species were observed, however at Iron Cove 18 species were recorded. This is mostly likely due to the variety of habitats present (well developed native vegetation at the bushcare site, estuarine environments, stands of swamp oak, scattered eucalypts and figs within parklands), with less common species including the Black-faced Cuckoo-shrike, Striated Heron, Willie Wagtail and Fairy-wren (not observed, so species not determined). The contrasting rates of bird records during the assessment was clearly correlated with greater areas and the diversity of native vegetation.

Further plantings of native trees which offer a variety of resources (fruit, nectar, shelter, seed) and consolidation of vegetation within additional bushcare sites will assist on attracting birds into the GreenWay in the future.

Specific requirements for Threatened Species

For the Grey-headed flying fox, no specific requirements are necessary, as the species forages widely and would only use the resources within the GreenWay on an opportunistic basis. Planting of additional figs and eucalypts (eg. ironbark, swamp mahogany) would assist in creating additional foraging resources for the species.

For the Eastern Bentwing-bat (and any other microchipteran bats), habitat enhancement could be achieved by the installation of bat boxes, however these need to be maintained to prevent occupation by feral species and they must also be repaired if damage occurs from storms, tree fall or vandalism.

Landscape Design Considerations

Placement and design of wildlife habitat areas must consider:

- Physical location i.e. coastal, remnant bush, wetland
- Proximity to existing vegetation
- Size of the habitat area
- The need to maintain mown areas such as sports fields, access points
- Preserving desirable views and vistas through the landscape
- Surveillance of open space to reduce vandalism
- Maintaining visibility within open space to ensure user safety
- Screening of undesirable views

Weed Management and Maintenance

The objectives for weed control on all land within the participating Council's area of responsibility include:

- Recognition of the Councils' responsibilities in relation to the *Noxious Weeds Act 1993*
- Recognition of the need to balance the conservation, protection and management of environmental, historical and cultural values;
- Identification of noxious and environmental weeds and implementation of appropriate control methods;
- Identification of keystone (target) and secondary weeds in parkland and remnant bushland areas, which will assist Councils' staff/ Bushcare Groups in planning on-going weed control and rehabilitation programs;
- Determination of priorities for managing all introduced plants wherever possible with a view to habitat restoration;
- Protection and enhancement of habitat for threatened flora and fauna species, populations and communities listed in the schedules of the *Threatened Species Conservation Act 1995*; and
- Initiation of a cost-effective, practical and staged action plan to control noxious and environmental weeds.

Regular Monitoring of Weeds

During the establishment period (12-18 months from plant installation) planted areas should be regularly monitored for both aquatic and terrestrial weeds:

- During the warmer months from late spring to early autumn, areas should be monitored weekly and weeded as required; and
- During the cooler months from mid-autumn to early spring, areas should be monitored and cleared of weeds on a fortnightly basis.

After an area is well established, monthly inspections should be sufficient to monitor and treat weed species. As part of weed control and monitoring activities, records of weed type, location and extent should be kept to assist in prioritising future maintenance activities.

Weed Control Methods

It is preferable to manually remove weeds before abundant growth requires use of herbicides. Residual toxicity of the herbicides also affects fauna on application and its effects are not generally considered. It is noted that there is a large amount of weedy material within the GreenWay corridor and this will continue to be an issue. It must also be noted that although undesirable, weeds provide habitat. Blackberry and Lantana provide thick, protected refuge and feeding areas for both native and exotic fauna species. Gradual and planned removal of structural and habitat weeds is required. For the establishment of ongoing wildlife habitat creation the use of herbicides is not recommended however to control woody species such as privet and green cestrum there is little alternative. Any use of herbicide should be undertaken by trained personnel during appropriate conditions and as per the manufacturer's specifications.

Plant Species Selection Criteria

The following Biological, Functional and Aesthetic selection criteria should be used as the basis of species selection for all sites. (Participating LGA Street Tree Masterplans provide clear guidelines for the use of trees in the landscape and should be referred to in any open space development process).

Biological Criteria

Species should be selected for their tolerance to local soil and climatic conditions. Whilst this may vary slightly between different microclimates throughout the catchment, some generic features can be outlined, including:

- Species should be indigenous to the catchment area and of local provenance where possible
- Tolerant of hot and drying winds
- Able to perform well under local rainfall conditions,
- Tolerant of high summer temperatures, up to 40 degrees Celsius
- Tolerant of seasonally waterlogged soils in winter
- Adapted to local soil types
- Not prone to attack from pests and diseases
- Genetically uniform in growth habit
- Require low maintenance inputs
- Indigenous species which match the existing soil and climatic conditions of their natural habitats
- Indigenous species used in the combinations in which they are found in their natural habitats

Functional Criteria

Functional criteria will be guided by the type of landscape treatment. Functional criteria that plant species must meet include:

- Quick to establish
- Long lived (>20 years for trees, > 10 years for shrubs, > 7 years for groundcovers)
- Ultimate size of species is suitable for the constraints of the planting site
- Does not have the capacity to become urban, environmental or agricultural weed
- Does not require high levels of pruning to maintain vigour and habit
- Provides habitat and or food source to indigenous wildlife where possible and appropriate

Aesthetic Criteria

Aesthetic criteria will be guided by the type of landscape treatment. Some generic aesthetic features that plant material should provide include:

- A healthy, vigorous appearance
- Preference is for evergreen species, where display is based on the colour and texture of the foliage, bark pattern and natural form of the species
- Of secondary importance are seasonal displays (foliage, flowers, fruit, bark), to provide interest
- Uniformity in growth habit

Vegetation Community Criteria

The STIF community has been well replicated at Bushcare sites within the catchment and has utilised a diverse range of native flora associated with this community. Any future Bushcare sites which aim to replicate the STIF community should reference existing sites and/or the Final Determination for the community by the NSW Scientific Committee (as amended 2011). Additional information is provided in Ecological (2001). A species list is also provided within table 8.1.

Plant Materials

At time of installation, **all** plants should meet the following criteria:

Trunks, stems and branches

- Visibly free of pests and pathogens which could, by their presence, induce (or contribute to) the decline of the plant
- Free of conspicuous scarring evidence. No split or broken canes, trunks or branches.
- No dead or dying wood present
- All limbs or trunks to be well formed, sturdy and well rooted; therefore, stable and self supporting in the growing container

Foliage

- Visibly free of pests and pathogens which could, by their presence, induce (or contribute to) the decline of the plant
- Stock must be vigorous health and actively growing
- Colour of foliage must be appropriate for the healthy state of each species
- No stressed plants or plants that have dried out should be used
- Cleaned of all dust and water-borne pesticide and fertiliser residue post planting

Root system and soil mass

- Root systems should be well developed, visibly free of pests and/or pathogens
- Roots should be well distributed throughout the container, extending on all sides to the inside face of the growing container
- Conversely, the root formation within the container, should not have developed to the point where it becomes excessive (i.e. 'pot-bound') and prevents water from permeating to the fine water-absorbing root hairs

Fertiliser

- Fertiliser is recommended for use if planting non-indigenous trees and shrubs to assist with initial establishment
- Fertilisers are particularly recommended for use on soils of low fertility. It is recommended that soil testing be carried out to ascertain soil nutrient deficiencies before fertilisers are applied
- Where fertilisers are used, they should be mixed with soil at manufacturer's recommended rates, and placed at the base of the planting hole before planting, or applied to the soil surface before mulch is laid out
- Granular, pelleted and tablet forms of low release fertiliser will provide establishing plants with a controlled supply of nutrients

Mulch

- Selection of mulching material should consider its ability to suppress weeds, and thus reduce maintenance. Mulch should have the ability to slowly break down over time
- All mulch materials should be aged, to reduce nitrogen depletion from soils due to on site decomposition
- Selection should also consider the site profile in which it is to be used and the aesthetics of the mulch
- Organic mulches that break down rapidly are not suitable
- All mulches must contain less than 0.01% by weight and/or volume of physical impurities including glass, metal, plastics, soil, rock and debris
- Mulch must be free of plant pathogens, growth inhibitors, weeds and syringes
- All organic mulches must be applied at a depth of no less than 75 mm
- Medium to fine milled wood mulches are suitable for general garden bed use
- Mulch to be used on all informal and indigenous plant garden beds, except those in sensitive bushland areas, or on steeper slopes where slippage can occur
- Biodegradable Jute Mat is suitable for use in revegetation treatments and in erosion control on steeper banks and batters. Continuous jute mat rolls should be secured with 150mm long pins on creek banks and 200mm long pins in flood zones. The number of pins per square meter will be site specific, but should be sufficient to secure jute mat over a five year period
- Individual jute mat squares should be a minimum of 600mm x 600mm diameter and secured with a minimum of 8 x 150mm long pins if used on creek banks or railway embankments. All jute mat should be a minimum mass of 700 grams/m²

Tree Stakes and Ties

- Stakes to be durable hard wood, straight, free from knots or twists and pointed at one end
- Tree ties to be woven hessian (50mm wide), tied in a figure eight
- Stakes should be positioned in place without penetrating the root ball of the tree

Plant Installation

Recommendations for successful planting include:

- Plant material should be planted immediately after delivery
- Where this is not possible, ensure plant materials are adequately protected from adverse or damaging climatic conditions

- Plant installation is not to proceed when conditions are adverse to successful plant establishment i.e. When air temperature exceeds 28 degrees Celsius, or when air temperature drops to below 5 degrees Celsius, or in excessively windy weather
- Water plants well immediately before planting
- Before doing any excavation, ascertain location of existing underground services
- Set out plant materials as scheduled to locations and quantities shown on the approved plant layout drawings
- Place containers out on ground in proposed locations of plant pits prior to excavation
- Planting holes for all plants are to be 2 times the width and the same depth as the container
- Incorporate fertiliser and water storing granules into backfill at the manufactures recommended rates
- Remove plant from pot and gently tease out exposed roots. Place plant in planting hole and backfill pit with soil so that plant is planted 40mm below original soil levels in pots
- Gently compact around plant with soil excavated from hole, and remove any debris detrimental to normal plant growth
- For trees, form a bowl around trees by moulding topsoil above finished grade. Bowl must be capable of holding a minimum of 10 litres of clean (potable) water
- Dispose of any excess excavated soil responsibly
- Water plants well immediately after planting
- Stake, tie and mulch plants as detailed above

Table 15-1 – Species schedule for habitat ‘islands’

Scientific name	Common name	Form
<i>Acacia longifolia</i>	Golden Wattle	Shrub
<i>Acacia myrtifolia</i>	Red-stemmed Wattle	Shrub
<i>Acacia suaveolens</i>	Sweet Wattle	Shrub
<i>Acacia ulicifolia</i>	Prickly Moses	Shrub
<i>Alyxia ruscifolia</i>	Alyxia	Shrub
<i>Aristida vagans</i>	Speargrass	Groundcover
<i>Banksia spinulosa</i>	Hairpin Banksia	Shrub
<i>Breynia oblongifolia</i>	Coffee Bush	Shrub
<i>Bursaria spinosa</i>	Blackthorn	Shrub
<i>Cymbopogon refractus</i>	Barbed-wire Grass	Groundcover
<i>Dianella caerulea</i>	Flax Lily	Groundcover
<i>Dichelachne rara</i>	Plume Grass	Groundcover

Scientific name	Common name	Form
<i>Dodonaea triquetra</i>	Hop Bush	Shrub
<i>Leptospermum polygalifolium</i>	Teatree	Shrub/Small Tree
<i>Leucopogon juniperinus</i>	Prickly Beard-heath	Shrub
<i>Lomandra longifolia</i>	Mat-rush	Groundcover
<i>Melaleuca decora</i>	Paperbark	Shrub/Small Tree
<i>Melaleuca styphelioides</i>	Prickly Teatree	Small Tree
<i>Microlaena stipoides</i>	Weeping Grass	Groundcover
<i>Myrsine variabilis</i>	Muttonwood	Small Tree
<i>Pittosporum revolutum</i>	Hairy Pittosporum	Shrub
<i>Pittosporum multiflorum</i>	Orange Thorn	Shrub
<i>Poa affinis</i>	Tussock Grass	Groundcover
<i>Themeda australis</i>	Kangaroo Grass	Groundcover