BIODIVERSITY CHAPTER

Contents

WHA Mountains

1.1 Introduction

Johnstone Shire includes outstanding and ecologically significant areas of biodiversity. The World Heritage Area (WHA) comprises 47% of the land in the Shire. Even this does not contain all of the biodiversity of significance. Ecosystems outside the WHA include those on freehold land and in numerous reserves and other State land, totalling a further 13%. There are a total of 50 different types of regional ecosystems in the Shire, as defined at the beginning of 2005. This is an incredible diversity just in habitat types, and is further reflected by the diversity of flora and fauna that make their homes in these ecosystems.
Efforts by Council, State and Federal organisations, and community groups continue to make positive contributions towards the preservation and restoration of fauna, flora, and natural ecosystem function.

Biodiversity in the Shire faces threats from a range of human activities past and present. Expanding activity by human beings impacts greatly on native flora and fauna, because humans are such heavy resource users, with high demands to maintain a perceived quality of living. Most human activities have associated effects that are, at present, out of balance with maintaining the state of natural ecosystems. The growing population will exacerbate the extent of these effects.
These activities and their effects form a large list, and include the clearing and fragmentation of habitat for agriculture and urban or industrial development, pollution of land, waterways and atmosphere, alterations to drainage systems and water tables, barriers to movement from infrastructure and mortality from traffic, unsustainable harvest of native plants and animals, alterations to ecological processes such as fire, and the invasion of domestic and feral animals, pest plants, and introduced diseases.

These processes threaten the inherent right to existence that all other forms of life have to coexist on this now human-dominated planet. Acceptance of the importance of natural processes is gradually becoming part of the human moral ethos, given that human beings do have the capacity to self-regulate their activity. But, the diversity of interests that humans pursue often acts in opposition to this. As the environmental movement is still in its infancy, it is premature to expect the green philosophy to be incorporated into the majority of people's psychology. Unfortunately, because human beings are interrelated with the natural environment, it has become obvious over the last century that we cannot survive without it. Being such a populous species, damage to the natural environment is starting to break down some of the major processes important to sustaining all life on the planet. Global warming, holes in the ozone layer, desertification, extinction of resource species, contamination of ecosystems; all are having direct effects on the quality of life so ardently pursued by us as individuals.
Whilst in the Johnstone Shire, surrounded by vistas of rainforested hills, it is easy to forget that the integrity of the environment is not as consistent elsewhere. Our local ecosystems form part of the lungs of the greater planet, and therefore our responsibility extends far beyond our local borders.

The Shire is characterised by the Great Barrier Reef, the presence of cassowaries and of crocodiles, as well as rare flora such as the native sugar palm and the ant plant. These residents that live alongside, neighbours in the natural areas, are important to the Shire's identity and to ourselves, as a part of who we are.
The standard of natural values in the Shire will also play an important role in the future as the Shire develops its tourism potential, and visitors from around the world come to briefly appreciate the quality of life, and interaction with the natural environment that we here have learnt to take for granted. It is important therefore that the Shire's community take on the role of guardians of the natural heritage, flora and fauna that is our duty as caretakers of our Shire.

1.2 Major Policies relating to Biodiversity Conservation in the Region and the Shire

National and international recognition of the value of the natural heritage in the Wet Tropics has resulted in major policies for conservation.

Wet Tropics of Queensland - Declaration as WHA
The Wet Tropics of Queensland World Heritage Area is an area of outstanding natural values, meeting all four natural criteria for World Heritage listing and fulfilling the necessary conditions of integrity. The criteria current at the time of listing (December 1988) and specified in the nomination were:

1. Outstanding examples representing the major stages of the earth's evolutionary history
2. Outstanding examples representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment
3. Superlative natural phenomena, formations or features or areas of exceptional natural beauty
4. The most important and significant natural habitats where threatened species of plants and animals of outstanding universal value from the point of view of science and conservation still survive.

(WTMA, 2004)
The Wet Tropics Management Authority's (WTMA) Wet Tropics Management Plan protects the values of the Wet Tropics World Heritage Area. It functions by restricting activities and development that might disturb or otherwise destroy native vegetation, watercourses, or earth. However, the Plan also defines areas where various types of development are appropriate, in order to increase usage and appreciation of the WHA, and to allow for vital infrastructure.
"The four key components of the statutory Plan include:

1. *A zoning scheme*—The Plan divides the Property into four management zones; based on a 'distance from disturbance' model. Zones determine types of activities allowed.
2. *A permit system*—The Plan, while administered by the Authority, also establishes other agencies such as QPWS as permit issuing bodies. The Plan prescribes prohibited activities, allowed activities and activities allowed under permit.
3. *Assessment guidelines and codes of practice*—Decision makers must have regard for Board approved assessment guidelines and codes of practice when issuing a permit or assessing proposals.
4. *Cooperative management agreements*—Voluntary co-operative management agreements are negotiated with landholders who are willing to manage their land in away that will benefit the World Heritage Area."

(WTMA, 2004)

The WTMA released the Wet Tropics Conservation Strategy in 2004. The strategy has been developed to promote cooperative management to ensure the future ecological health of the Wet Tropics WHA. The strategy identifies the need to address the many direct and underlying pressures that threaten the Area's integrity.
"The strategy outlines conservation priorities for the Wet Tropics WHA and emphasises the importance of conservation management both within and outside the Area. The strategy details the natural, cultural and socioeconomic values of the Area. It discusses how best to address the various threats to the Area's health and integrity, covering issues such as weeds, feral animals, forest fragmentation and restoration, endangered species, fire management, climate change and water flows" (WTMA Website, 2005).

The strategy emphasises the need for coordinated management between all stakeholders in order to:

- Identify, conserve and rehabilitate all natural World Heritage values and associated cultural values within the Wet Tropics World Heritage Area.
- Identify, conserve and rehabilitate areas of high biodiversity outside the WHA which contribute to the values and integrity of the Area; and
- Mitigate processes that threaten the integrity and values of the WHA and surrounds.

Wet Tropical Coastal Management Plan

The EPA released the Wet Tropical Coastal Management Plan in December 2003. Local Government must have regard to the plan for developments assessable under the Integrated Planning Act (IPA) or the current Shire Planning Scheme. The aim of the plan is to ensure that decision makers appropriately consider coastal resources and values in planning, development assessment, and coastal management.
The plan identifies five key coastal areas in the Shire - Ella Bay, Innisfail, Moresby, Kurrimine, and Mission Beach. These areas are further subdivided into 14 localities. There are varying pressures on each of these different areas and localities; the Plan describes desired outcomes and response to these pressures.

The Great Barrier Reef - Declaration as World Heritage Area

The Great Barrier Reef (GBR) was nominated as a World Heritage property in 1981, meeting all four of the World Heritage criteria for listing as a natural property.
The Australian Government coordinates the management of the GBRWHA. The Great Barrier Reef Marine Park Authority, the Commonwealth statutory authority responsible for the management of the GBR Marine Park, is also the principal adviser to the Commonwealth Government for the GBR World Heritage Area.
In 1995, the GBR Marine Park Act 1975 was amended to reflect the World Heritage listing of the Great Barrier Reef.
The Great Barrier Reef Marine Park Authority (GBRMPA) has developed a framework for management of the Great Barrier Reef. The action areas include:

- The Management of Land and Coastal Catchments
- The Management of Fisheries
- The Management of Shipping and Ship-sourced Marine Pollution
- Representative Marine Protected Areas
- Resources for Research and Management.

(GBRMPA Website, 2005)

There are now a large number of policies and plans coordinated by various agencies to improve land management and the associated effects on water quality. Work by these agencies is described in the Land Management and Water and Atmosphere chapters.

Johnstone Shire Biodiversity Strategy

Council's strategy for the conservation of Biodiversity in the Shire was implemented in 2003. It is available for download from Council's website - environment pages.
The strategy focuses work by:

- Identifying priority areas for the conservation of biodiversity in the Johnstone shire; and
- Providing a prioritised list that will be recognised by funding bodies as a strategic approach towards conservation of biodiversity in the Johnstone Shire.

The result of this prioritisation has seen the Biodiversity strategy focus future conservation effort into four primary areas - Granadilla/Mission Beach, Basilisk Range/Cowley Defence Reserve, Ninds Creek Catchment, and Nerada/ East Palmerston. Application of the Strategy will provide Council with:

- A strategic approach to conservation of biodiversity for implementation by government agencies and the community
- A link into the regional natural resource management process in regards to conservation of biodiversity
- Conservation of biodiversity within protected areas and on freehold land
- Strategic rehabilitation of degraded areas.

2. Terrestrial Biodiversity
2.1 Ecosystems

Ecosystems include the flora and the fauna that exist in a dynamic web of links between species. Plants are primary producers, they utilise nutrients and sunlight to produce biomass that in turn supports herbivores. Predaceous species in turn depend upon the plant eaters as their food source. The decomposers break it all down again to renew the cycle. Overall, every form of life is certain to depend in some manner upon another.

The interactions between and within all these species are complex, ranging from competition, predation and parasitism, through neutral commensalism, to the more beneficial relationships such as mutualism and symbiosis. Within species, usually amongst closely related individuals, there can be relationships of cooperative kinship and exchanges of altruistic behaviour.

The complexity of all these relationships have evolved together, set against a changing background of landscape, geology, climate, to create the fabulous diversity of life evident throughout the Shire. This biodiversity is the end result of millions of years of evolution and interaction.

Unfortunately, with the introduction of European settlement in the region there are new pressures and introduced species affecting the native ecosystems. These have suddenly threatened the integrity of the region's unique flora and fauna.

The main threats to the representation of ecosystems and species in the Wet Tropics bioregion are posed by continued land clearing, alterations to drainage systems and water tables, inappropriate fire regimes and feral animal and exotic plant invasion (Goosem *et al*, 1999). These activities threaten the integrity and ecological function of our natural ecosystems and the long-term survival of many of our native plant and animal species.

The Apollo Jewel Butterfly, the Ant Plant, and the Australian Golden Ant

Ant Plants *(Myrmecodia beccarii)* are epiphytes that grow on coastal trees, particularly on paperbarks in coastal wetland ecosystems, as well as on mangroves. The plant contains a series of galleries, which form as the plant grows, with tissue dying back to form hollow chambers. These galleries are the home to two kinds of organisms - ants, and the caterpillar of the Apollo Jewel Butterfly *(Hypochrysops apollo apollo)*.

This '*myrmecochorous'* symbiosis between ant and plant is mutually beneficial - the ants receive a home, and the plant benefits from the nutrients in the ant's waste (nutrients are hard to get when you grow on the side of a tree). It is also likely that the ant protects the plant from some insect predators. The ant species known to most commonly live in the ant plant is the Australian Golden Ant *(Iridomyrmex cordatus)*. The Apollo Jewel's caterpillar is not symbiotic with the plant; it also makes its home in the plant's galleries, but spends its time feeding on the ant plant's flesh and occasionally ventures outside at night to snack upon the leaves. Only one caterpillar seems to live in any ant plant.

Interestingly, the ants are little concerned by the caterpillar's presence in their nest. It has been theorised that the ants and the caterpillar also share a relationship. The ants may tolerate, or even actively protect the caterpillar because it helps to hollow out more space in the ant plant. Possibly, the caterpillar's waste provides food for the ants.

All three of these organisms are endangered for a mixture of reasons. Firstly, the habitat the ant plant grows in is threatened by coastal development. Increased protection of remnant habitat and mangroves will hopefully reduce this pressure. Secondly, unscrupulous collectors are removing the ant plant from its little remaining habitat because it is unusual. Thirdly, introduced ants that take over the nest are displacing the native ants. The introduced ants don't respect the caterpillar as a guest, which further endangers the Apollo Jewel butterfly.

2.1.1 Representation and Restoration

Pressure

Land clearing is still occurring across all habitat types on land of more gentle topography. The rate is negligible compared to the original deforestation of the Shire for agriculture and timber. Table 2.1.1a describes land-clearing rates since 1995. Land clearing has continued to slow over the last twelve years. Whilst clearing for crops has slowed, there is a slight increase in clearing for cattle pasture. Native vegetation covers 62.06% of the Shire. This is because large areas are under protection by the WHA, which has an area of 47% of the Shire. Approximately 15% of native vegetation exists outside the WHA on private land; the rest (38%) has been cleared. Compared to other areas in Queensland these figures are very good. However, there are problems with the representation of some endangered ecosystems.

Isolation, Fragmentation and Connectivity

The figures in the Table 2.1.1a do not detail the further effects associated with land clearing - isolation, fragmentation, and connectivity.

The isolation of islands of vegetation amongst cleared land limits the movement of many flora and fauna between areas of remnant vegetation. These species are then subject to pressure from inbreeding, and where localised 'disasters' occur there are no new colonists to replace a lost species. This further affects other species 'on the island' when a lost species was an important part of the ecosystem.

Fragmentation is similarly associated with land clearing. Fragmented vegetation results where in-roads have been made into what used to be a consistent area, resulting in a mosaic of vegetation, much like the strands and patches holding together a very worn piece of cloth. Fragmentation enhances the 'edge effect' on remnant vegetation. Edge effect describes the vulnerability of vegetation to external influences. Some of these influences include; weed invasion, cyclone damage and effects from the adjacent land use. Edge effect is worst where the remnant vegetation has a small area with a long boundary, i.e. where it is thin and spidery as opposed to fat and solid.

Connectivity describes how well the remaining vegetation is linked. Connectivity problems are common in the foothills west of Innisfail where topography has limited land clearing to the flatter areas that are more suitable for agriculture; leaving many of the steep ridges, deep gullies and rocky areas vegetated. Connectivity affects flora and fauna when large areas of cleared land exist, which species are unable to bridge in order to colonise or utilise nearby areas. A lack of connectivity has resulted from land clearing, most obvious in separating the coastal ecosystems from the range. Low connectivity affects genetic exchange between fragmented ecosystems, and can form a barrier in lifecycle events such as the dispersal of progeny or migration.

Condition

Representation of Regional Ecosystems

Whilst there are large areas of protected vegetation in the Shire, there are also a large variety of ecosystem types present. Not all of these ecosystems are represented equally, and some are classified as endangered because there are only small areas left throughout the State.

The EPA has classified native vegetation throughout the State into groups based upon the ecosystem's floristic composition, the underlying geology, and climate.

The types of regional ecosystems and their conservation status are defined under the Queensland Vegetation

Table 2.1.1a - Land Clearing in the Shire

Source: NR&M (2003)

Total Area ~164,000 ha		% Wooded vegetation cover 2001 (WHA = 47%)							% Wooded vegetation cover 2001 (WHA = 47%)	% Total clearing in Qld
Year	New woody regrowth	Pasture	Crops	Forest	Mining	Infra-structure	Settle-ment	Total Cleared		
01-03	nd	22	2	0	0	1	0	25	62.06[2] (15.06)	0.00
99-01	0	15	8	0	0	2	0	25	62.41 (15.41)	0.0043
97-99	2	7	21	1	0	0	0	30	62.43 (15.43)	0.007
95-97	5	7	86	0	0	0	3	96	62.49 (15.49)	0.028
91-95[1]	0	0	120	0	0	2	1	123	62.56 (15.56)	0.042

nd – not determined

[1] Double time period

[2] Updated accuracy of satellite imagery also contributing to this revised figure

Table 2.1.1b - Summary of the Representation of Regional Ecosystems in the Shire Source : Adapted from EPA (2005a)

Vegetation Management Act Status	Number of Shire Regional Ecosystems	Total Area in Shire (ha)	Area outside WHA and Protected Areas (ha)	Area within Reserves (ha)
Sum 'Endangered'	15	4230	609	3621
Sum 'Of Concern'	19	22575	8351	14224
Sum 'Not of Concern'	16	69211	17433	51778

Management Act 1999 (VMA 1999) and subsequent amendment in 2004.
According to the VMA there are three categories, which are based upon mapping of ecosystem types throughout the entire State.
Endangered - Less than 10% of the ecosystem remains
Of Concern - Only 10-30% of the ecosystem remains
Not of Concern - More than 30% of the ecosystem remains
The regional ecosystems are reviewed periodically as more scientific work is conducted. In 2005 the definition of the regional ecosystems will be updated, with a few categories being further subdivided into new regional ecosystems because evidence of unique characteristics has come to light.

As shown in Table 2.1.1b, the Shire has a large number of different regional ecosystems present, the majority of which are 'Of Concern' or 'Endangered'. Fortunately, most have some representation in protected areas (Table 2.1.1c).
There are a small number of 'Of Concern' and 'Endangered' regional ecosystems that are not well represented in protected areas. Particular effort is required to prevent impacts upon these ecosystems where they exist on private land.

Protected Areas
The Shire contains a variety of large protected areas. Most of these are National Parks that are part of the WHA. They act to preserve the integrity of the Shire's ecosystems, as well as creating a resource for recreation and aesthetics. Whilst the areas are protected from clearing and fragmentation, there are other management issues present. Management action can be difficult to implement due to limited access, numbers of staff, and operating funds. Table 2.1.1d lists the protected areas in the Shire.

Council Reserves
Council manages a large number of reserves scattered throughout the Shire for a range of diverse purposes; including drainage, recreation, water resource protection, boat ramps, etc. Many of these reserves have areas of remnant vegetation upon them.
Appendix 6.4 (CD and web versions only) contains a list of Council reserves and the vegetation upon them. Currently there is no active management of these reserves. Passive management is generally sufficient, however impacts from feral animals, weed invasion and altered fire regimes are affecting the ecosystems present at an unknown number of reserves. This requires review.

The vegetation on these Council reserves is not protected from clearing except under legislation affecting ecosystems under the VMA. Some reserves are prescribed as areas for the protection of environmental values (reserves for environmental purposes). These are better protected against clearing.

An audit of the environmental values of Council's reserves is required to determine whether the level of protection afforded properly reflects the environmental values at the site.

Rec: Prioritise restoration where regional ecosystems exist at only a small proportion of their former extent, and where little of the remaining area is within protected reserves - Landcare, Council, Community Revegetation Unit, QPWS

Rec: Identify endangered and of concern RE's on private land not represented in protected areas. Raise awareness of the importance of this habitat through promotion to landholders to assist conservation - Council

Rec: Develop accessible mapping for community groups and landholders showing priorities for remnant areas not well represented in protected reserves - Landcare, Council, Community Revegetation Unit, QPWS

Rec: Develop a management schedule for Council Reserves, to identify and address probable issues, including particularly weed inspection, weed control and fire regimes where practical. Feral animal control may also be appropriate in response to community concerns - Council

Rec: Determine where Council reserves hold especial environmental values and change the land description with NRM to reserves for environmental protection if appropriate; to ensure compatible use with the ecosystems present and to determine the type of management required. This may particularly apply to reserves with recovering vegetation which is not protected under the VMA, but where the site for example supports a species such as cassowaries or plays some other ecological role - Council, NR&M

Rec: Council community revegetation unit staff be trained in controlled burning for ecological maintenance and for weed control - Council

Table 2.1.1c - Regional Ecosystems in the Shire
Source : Adapted from EPA (2005a)
The regional ecosystem numbers shown with ra's and rs's are the same regional ecosystem, but are areas recovering from disturbance. These areas have met the criteria of 'remnant vegetation' in the Vegetation Management Act 1999.
Pre-clearing areas are projections by the EPA based geology, rainfall, and current vegetation.

Regional Ecosystem	Pre-Clearing Area	Area in Shire Now	Area in Protected Reserves in Shire	Description	Veg. Mgt. Act Status
Tidal flats and beaches					
7.1.1	3989	3873	382	Mangrove forests on coastal lowland saline alluvial soils	Not of Concern
7.1.2	53	53	5	Salt meadow/ herbfield on coastal lowland hyper-saline alluvial soils	Of Concern
7.1.3	15	14	13	Bulkuru (Eleocharis dulcis) swamp on poorly drained acid peats	Of Concern
7.1.3rs	1	1	0		
Coastal dunes					
7.2.1	467	238	123	Mesophyll vine forest of very wet coastal lowlands on beach sands	Endangered
7.2.1ra	13	12	0		
7.2.2	145	6	0	Notophyll vine forests with Acacia spp. emergents on moist and dry lowlands on siliceous and calcareous beach sands	Endangered
7.2.2ra	2	2	0		
7.2.3	2416	2132	203	Coastal beach ridge vegetation on dune sands	Not of Concern
7.2.3rs	51	43	0		
7.2.3x2	68	68	21	Casuarina equisetifolia open forest to woodland with Ipomoea pes-caprae and Spinifex sericeus. Occurs on foredunes	Proposed RE
7.2.4	1500	536	63	Old dune ridge open-forest/woodland mosaics on a variety of soils including dark grey sands and grey sandy clay loam	Of Concern
7.2.4rs	52	50	0		
Alluvium (river and creek flats)					
7.3.1	228	227	75	Grassland and sedgeland freshwater swamps (seasonal and permanent) of the coastal plains on humic gley, acid peat and gleyed podzolic alluvial soils	Endangered
7.3.3	385	293	112	Alexandra palm (Archontophoenix alexandrae) swamp vine forest on very wet poorly drained fertile lowlands	Endangered
7.3.3ra	9	9	0		
7.3.4	132	80	73	Fan palm (Licuala ramsayi) swamp vine forest on very wet poorly drained seasonally inundated lowlands	Endangered
7.3.4ra	7	7	0		
7.3.5	4323	2345	1136	Swamp paperbark (Melaleuca quinquenervia) open forest on very wet and wet poorly drained lowlands	Of concern
7.3.5rs	118	112	3		
7.3.6	1522	186	22	Melaleuca leucadendra open forest sometimes with M. quinquenervia and/or M. dealbata, and often with a mesophyll or notophyll vine forest component	Endangered
7.3.6rs	27	27	3		
7.3.7	490	488	319	Coastal floodplains vegetation complex on a variety of alluvial soils	Endangered
7.3.7rs	57	54	7		
7.3.8	948	72	10	Melaleuca viridiflora woodlands and forests occurring on humic gleyed texture contrast soils with impeded drainage generally on the coastal plains.	Not of concern
7.3.10	3613	934	572	Complex mesophyll vine forest of the very wet and wet lowlands on fertile riverine alluvia	Endangered
7.3.10ra	505	479	29		
7.3.11	61	11	0	Mesophyll vine forest with red stringybark (Eucalyptus pellita) emergents on very wet to wet, well drained lowland alluvial soils	Of Concern
7.3.11ra	23	23	0		
7.3.12	3	3	0	Forest red gum (Eucalyptus tereticornis) woodland, or popular gum (E. platyphylla) and Clarkson's bloodwood (Corymbia clarksoniana) woodland on very wet to wet, well drained lowland alluvial soils	Endangered
7.3.17	2559	714	477	Complex mesophyll vine forest on very wet, well drained lowland and foothill piedmont fans	Not of concern
7.3.17ra	383	299	87		
7.3.18	872	92	52	Mesophyll vine forest with pink bloodwood (Corymbia intermedia) emergents on wet to very wet well drained piedmont fans	Of concern
7.3.18ra	151	141	17		
7.3.19	156	155	0	Tall open eucalypt forest/woodland complex (Corymbia spp., Eucalyptus spp.) on moist piedmont fans	Not of concern
7.3.22	1409	1090	89	Mesophyll riparian vine forest on moist well drained lowland alluvial levees	Of concern
7.3.22ra	753	652	50		
7.3.24	2	2	2	Red tea-tree (Melaleuca dealbata) riparian open forest on moist fertile moderately drained lowland alluvia	Endangered
7.3.25	40	40	40	Weeping tea-tree (Melaleuca leucadendra), M. fluviatilis, Moreton Bay ash (Corymbia tessellaris) open forest with notophyll riparian vine forest species, on levees	Of concern
7.3.28	922	907	249	Riparian herbfield/shrubland on river and stream bed alluvia	Endangered

Table 2.1.1c (continued) - Regional Ecosystems in the Shire

Regional Ecosystem	Pre-Clearing Area	Area in Shire Now	Area in Protected Reserves in Shire	Description	Veg. Mgt. Act Status
Basalt plains and hills					
7.8.1 7.8.1ra	17795 1084	12278 1050	11092 104	Complex mesophyll vine forest on very wet, well drained basalt lowlands	Of concern
7.8.2	1780	1780	1776	Complex mesophyll vine forest on very wet basalt uplands	Endangered
7.8.4	259	259	259	Complex notophyll vine forest on cloudy wet basalt uplands and highlands	Endangered
7.8.7	2	2	0	Forest red gum (Eucalyptus tereticornis) tall open forest on moist basalt uplands and highlands	Endangered
Hills and lowlands on metamorphic rocks					
7.11.1 7.11.1ra	30169 3329	28263 3327	19980 1014	Mesophyll vine forest on very wet to wet metamorphic lowlands and foothills	Not of concern
7.11.2 7.11.2ra	6 14	1 14	0 0	Mesophyll vine forest dominated by the fan palm Licuala ramsay occurring on wet foothills and tablelands on humic gley metamorphic-derived soils with seasonally impeded drainage	Endangered
7.11.4 7.11.4ra	813 1172	365 1168	197 173	Mesophyll vine forest dominated by brown salwood (Acacia celsa) on very wet to wet metamorphic lowlands and foothills	Of concern
7.11.5 7.11.5ra	494 81	454 81	135 4	Simple mesophyll vine forest with red stringybark (Eucalyptus pellita) emergents on very wet to wet metamorphic lowlands and foothills	Of concern
7.11.10 7.11.10ra	823 350	809 350	678 276	Notophyll vine forest dominated by brown salwood (Acacia celsa) on very wet to wet metamorphic foothills, uplands and highland ridges	Of concern
7.11.12	4072	4072	4068	Simple notophyll vine forest on cloudy wet metamorphic uplands	Not of concern
7.11.14	37	37	0	Simple notophyll vine forest with rose gum (Eucalyptus grandis) emergents on moist metamorphic uplands	Of concern
7.11.16	254	253	0	Corymbia intermedia, Allocasuarina torulosa, Lophostemon suaveolens open forest to woodland of the moist uplands on metamorphic red and yellow earths	Of concern
7.11.16x1	1	1	0	Eucalyptus portuensis or E. mediocris, E. crebra, Corymbia clarksoniana, C. intermedia, C. citriodora and Lophostemon suaveolens open forest. Occurs on hill slopes on metamorphosed sediments	Of concern
7.11.17rs	9	9	0	Eucalyptus pellita woodland which has previously been disturbed but meets the criteria of remnant vegetation in the Vegetation Management Act 1999. Wet to moist lowlands and foothills	Not of concern
7.11.18	429	428	67	Forest red gum (Eucalyptus tereticornis) woodland on wet to moist metamorphic foothills	Of concern
7.11.19	14	14	19	Pink bloodwood (Corymbia intermedia) woodland on moist to dry metamorphic foothills and uplands	Not of concern
7.11.21 7.11.21rs	74 8	18 8	5 0	Molloy red box (Eucalyptus leptophleba) woodland on dry metamorphic uplands	Not of concern
Hills and lowlands on granite rocks					
7.12.1 7.12.1ra	16445 87	16264 85	15787 7	Mesophyll vine forest on very wet to wet, granite lowlands and foothills	Not of concern
7.12.3	5	4	0	Mesophyll vine forest with forest red gum (Eucalyptus tereticornis) emergents on wet to moist granite foothills	Of concern
7.12.5 7.12.5ra	54 9	42 9	11 0	Simple mesophyll vine forest with red stringy bark (Eucalyptus pellita) emergents on very wet to wet granite lowlands and foothills	Of concern
7.12.9 7.12.9ra	3054 41	2775 33	2685 0	Notophyll/mesophyll vine forest dominated by brown salwood (Acacia celsa) on very wet to wet, granite foothills and uplands	Not of concern
7.12.16	5020	5020	5020	Simple notophyll vine forest on cloudy wet granite and rhyolite uplands and highlands	Not of concern
7.12.19	1882	1882	1882	Simple microphyll vine forest on cloudy wet granite highlands	Not of concern
7.12.24	90	86	19	White mahogany (Eucalyptus portuensis or E. mediocris) woodland on wet to moist granite foothills	Of concern
7.12.29	2	2	1	Pink bloodwood (Corymbia intermedia) woodland on moist to dry, granite foothills and uplands	Not of concern
7.12.37	151	151	151	Mountain rock pavement herbland on cloudy, wet granite uplands and highlands	Not of concern

Table 2.1.1d - The Shire's Protected Areas

Note: Only includes those portions of National Park within the Shire Boundaries
0 hectare figures are rounded down figures from less than half a hectare

Key: - **Endangered Regional Ecosystem**
- **Of Concern Regional Ecosystem**
- Not of Concern Regional Ecosystem

Protected Area	Management Issues				Conservation Significance			
	RE	Area (ha)	RE	Area (ha)	RE	Area (ha)	RE	Area (ha)
Alcock Forest Reserve	Small part in Shire only				Rainforest			
	7.3.10	0	7.11.1	2	7.12.9	4	7.12.19	13
	7.3.17	0	**7.11.4**	0	7.12.16	18	7.12.37	0
	7.8.4	5	7.12.1	12				
Carello Swamp Conservation Area	Weeds - Pond Apple				Wetland swamp with large palm stands Crocodiles			
	7.1.1	5	**7.3.7**	2	**7.3.10**	5	Dist	1
Clump Mountain National Park	Tourism - development on adjoining land. Ferals - pigs, dogs Weeds - bamboo				Lowland tropical rainforest on basalt soil. Cassowary habitat			
	7.3.10	7	7.3.17ra	0	**7.8.1ra**	2	7.12.9	5
	7.3.10ra	0	**7.3.22ra**	0	7.12.1	229	**7.12.24**	12
	7.3.17	5	**7.8.1**	10	7.12.1ra	2	Clear	1
Ella Bay National Park	Fire regime, Feral Pigs				Undisturbed Coastal Swamp Lowland tropical rainforest Cassowaries and Crocodiles			
	7.1.1	14	**7.3.3**	89	**7.3.18**	4	**7.11.5**	1
	7.1.2	1	**7.3.5**	545	**7.3.22**	35	**7.11.10**	2
	7.2.1	5	**7.3.6**	7	7.11.1	1014	**7.11.18**	3
	7.2.2	0	**7.3.7**	49	**7.11.4**	0	Dist	1
	7.2.3	133	**7.3.10**	14	**7.11.4ra**	0	Clear	0
	7.2.3x2	9	7.3.17	36				
Etty Bay Road Conservation Park	Drainage, Fire regime				Last remaining wetland swamp in the Johnstone River Catchment, Cassowary habitat			
	7.2.4	2	**7.3.22**	38	**7.3.6**	0	7.11.12	825
	7.3.1	75	**7.3.22ra**	36	**7.3.7**	6	**7.11.18**	48
	7.3.5	5	**7.3.24**	2			7.12.1	5766
Japoon Forest Reserve	Feral pigs, Weeds - guinea grass				Rainforest, Cassowary habitat			
	7.3.10	365	**7.3.28**	57	**7.11.4**	163	7.12.9	2462
	7.3.10ra	16	**7.8.1**	617	**7.11.4ra**	170	7.12.16	985
	7.3.17	381	**7.8.1ra**	19	**7.11.5**	128	7.12.19	657
	7.3.17ra	82	**7.8.2**	59	**7.11.5ra**	4	7.12.37	150
	7.3.18	48	7.11.1	9809	**7.11.10**	277	Dist	143
	7.3.18ra	17	7.11.1ra	950	**7.11.10ra**	269	Clear	33
Japoon National Park	Feral pigs				Tropical rainforest on basalt			
	7.3.10ra	0	7.11.1ra	32	**7.11.4ra**	3	Dist	0
	7.3.17ra	0	**7.11.4**	1	**7.11.10**	1		
Kurrimine Beach National Park	Fire, Drainage				Coastal wetland on sand swale and dune system			
	7.1.1	73	7.2.3	68	**7.3.5**	521	**7.3.10**	1
	7.1.2	4	7.2.3x2	12	**7.3.6**	2	7.3.17	0
	7.2.1	114	**7.2.4**	57	**7.3.7**	2	Clear	1
	7.2.2	0						
Maria Creek National Park	Fire, Drainage, Saltwater incursion on freshwater wetland system				Coastal wetland, Large expanse of mangroves			
	7.1.1	292	**7.3.4**	2	**7.3.7**	262	**7.3.22**	16
	7.1.3	13	**7.3.5**	59	**7.3.7rs**	7	7.11.1	0
	7.2.1	2	**7.3.5rs**	3	7.3.8	10	7.12.1	1
	7.2.3	2	**7.3.6**	13	**7.3.10**	25	Clear	2
	7.2.4	3	**7.3.6rs**	3	**7.3.10ra**	1		
Meingan Creek Conservation Park								
	7.8.1	26	**7.8.1ra**	41				
Moresby Range National Park	Feral pigs, Tourism development adjoining the park				Spectacular scenic amenity Coastal range lowland rainforest Cassowary habitat.			
	7.1.1	3	**7.3.5**	6	**7.3.10ra**	0	7.11.1	417
	7.2.1	2	**7.3.6**	0	**7.3.11**	0	**7.11.10**	0
	7.2.4	1	**7.3.10**	44	7.3.17	11	**7.11.18**	16
	7.3.3	23						
Mount Mackay Forest Reserve								
	7.11.1	2	7.11.1ra	0				

Table 2.1.1d (continued) - The Shire's Protected Areas

Protected Area	Management Issues				Conservation Significance			
	RE	Area (ha)	RE	Area (ha)	RE	Area (ha)	RE	Area (ha)
Mount Myrtle Forest Reserve								
	7.3.10	0	7.11.1	170	Disturbed	2	Clear	0
	7.3.17	1	**7.11.4**	3				
Palmerston Forest Reserve	Feral pigs, Weeds - guinea grass Tourism visitation				Rainforest, Cassowary habitat			
	7.8.1	4563	7.11.1	722	7.11.12	1616	7.12.16	214
	7.8.1ra	30	7.11.1ra	30	7.11.21	5	7.12.19	1212
	7.8.2	20	**7.11.10**	6	7.12.1	8300	7.12.37	4017
	7.8.4	254	**7.11.10ra**	7	7.12.9	1		
Tam O'Shanter Forest Reserve	Feral pigs, Tourist visitation				Cassowary habitat			
	7.3.4	71	7.3.17ra	5	**7.11.5**	6	**7.12.5**	11
	7.3.8	0	**7.3.22ra**	12	7.11.19	19	**7.12.24**	7
	7.3.10	7	7.11.1	1038	7.12.1	841	7.12.29	1
	7.3.10ra	12	**7.11.4**	25	7.12.1ra	5	Clear	6
	7.3.17	20						
Walter Hill Range Conservation Park								
	7.3.10	10	7.11.1	49	Disturbed	14	Clear	8
	7.3.17	23						
Wooroonooran National Park	Rainforest encroachment and fire management in E. Grandis stands, Feral pigs, Weeds - Harungana, Sanchezie, Lantana, Guinea grass, Thunbergia Tourism visitation				Tropical rainforest on granite and basalt soils, Relict Eucalyptus grandis. Remnant of the Mulgrave river flood plain system Catchment Northern Johnstone River Cassowary habitat			
	7.3.10	99	**7.8.1**	5876	7.11.1ra	2	7.11.21	0
	7.3.22ra	2	**7.8.1ra**	12	**7.11.4**	5	7.12.1	629
	7.3.25	40	**7.8.2**	1697	**7.11.10**	392	Clear	4
	7.3.28	192	7.11.1	6757	7.11.12	1627		
Palmerston Rocks National Park	Feral pigs, Weeds - lantana, guinea grass				Scenic features includes large basalt rocks, waterfall			
	Disturbed	10.03						

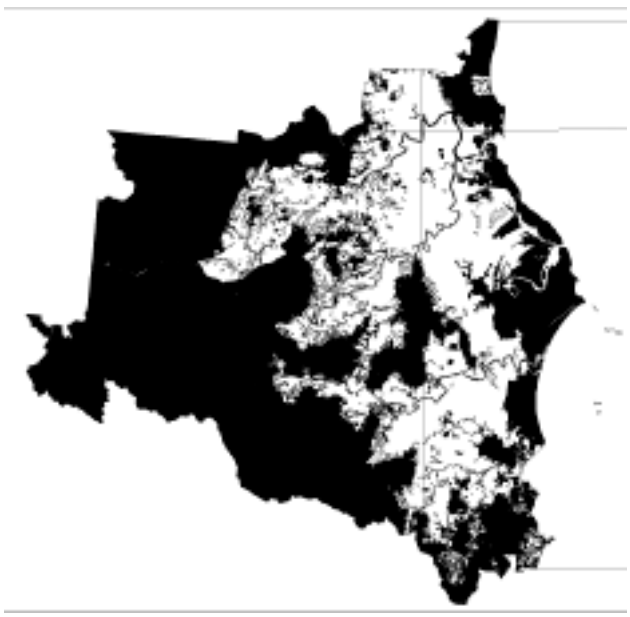
Landscape Connectivity

Connectivity of vegetation is best described visually, as depicted in Figure 2.1.1a. This describes overall connectivity at the large scale of the entire Shire. Within the large scale there are also isolated remnant patches, which are under pressure from fragmentation.

Connectivity in the Shire is very good along the western side; only the Palmerston highway breaks this continuity in the WHA. The eastern edge is also mostly continuous, however there are coastal urban areas that break this up.

A problem for connectivity in the Shire on the large scale is movement from coast to range, and vice versa. Large tracts of agricultural land form formidable barriers to the movement of fauna. The Basilisk Range is a potential stepping-stone which will benefit from revegetation to re-establish connectivity. The Shire's riparian areas are similarly useful to establish linkages between natural areas. Rivers can also be a barrier, but these are passable for many fauna a relatively short distance upstream. Rivers are only a problem for fauna where vegetative connectivity does not exist far enough upstream, for example near Innisfail.

Figure 2.1.1a - Connectivity in the Shire
Source: JSC



The Biodiversity Strategy (2003) describes areas where revegetation and land management can promote connectivity by establishing or maintaining corridors between natural areas.

QPWS have a land acquisition program to purchase land. This is aimed at blocks that expand the existing protected areas, particularly where connectivity is promoted.

Responses to Clearing, Fragmentation and Connectivity

Responses to declining ecosystem areas and integrity take two forms - preservation and restoration.

Preservation

Protected Areas on State Land

National Parks and WHA

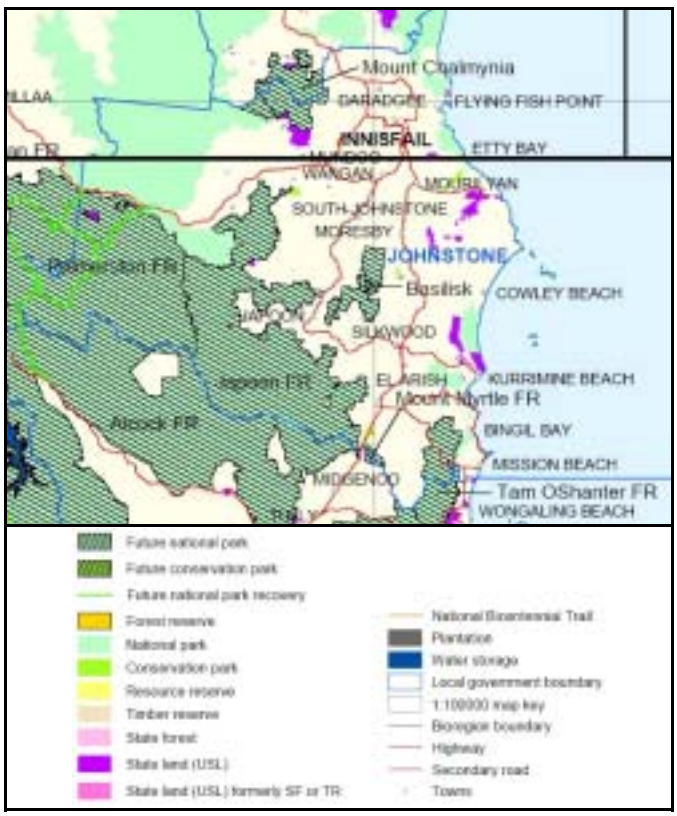
Preservation has been assured for most of the vegetation in the Shire by the creation of the WHA protected areas. QPWS is developing a new maintenance system for the reserves in the region. This plan will identify maintenance areas, in order to better direct funding.

Due to a handover of State Forest Reserves to QPWS (described below) the management required for land areas has effectively doubled, with no extra QPWS staff. Normal QPWS custodial management is expected for these extra areas. Also, increased usage of a number of current visitation sites is expected to rise with the development of the Ma:mu Canopy Walkway.

It is expected that QPWS will have to scale up its workforce in the future in order to deal with these extra management requirements.

Rec: QPWS allocate extra staff in order to increase management capability for additional protected areas - QPWS

Figure - 2.1.1b State Forest Transfer Areas
Source: EPA Website (2005)



Wet Tropics State Forest Transfer

A number of State forests are being handed over to the QPWS for management. Also to be transferred are areas of Unallocated State Land, formerly used for State forest and timber reserve.

In the Shire all these areas will become National Park, but some very small areas for mining extraction (quarries) may still continue to exist. The areas undergoing the changes in the Shire are shown in Figure 2.1.1b and include:

- Alcock Forest Reserve
- The Basilisk Range
- Japoon Forest Reserve
- Mount Myrtle Forest Reserve
- Mt Chalmynia
- Palmerston Forest Reserve
- Tam O'Shanter Forest Reserve

The process represents the finalisation of the process of commitment to conservation of natural areas in the WHA.

"The transfer of the Wet Tropics World Heritage Area state forests will finalise a long-standing commitment by the Queensland Government to provide a secure and high level conservation tenure for the significant lands within and adjacent to the internationally renowned Wet Tropics World Heritage Area" (EPA Website, 2005).

The implications of these changes are the increase in area for management by the QPWS. For the public the activities allowed on these areas of land will change. Horse riding will no longer be allowed in the changed areas except along the Bicentennial National Trail or on gazetted roads through parks.

Council Reserves

No current management is ongoing for ecosystems on Council Reserves. Some protection is afforded under Vegetation Management Act legislation, and the Land Act, which defines the uses allowed on the land. An audit of the environmental values of Council's reserves is required to determine whether the level of protection afforded properly reflects the environmental values at the site. Appropriate management and priorities need to be determined.

Protecting Ecosystem Areas on Private Land

Legislation and a number of programs exist to encourage the protection of native vegetation on private land.

Vegetation Management Act

In 2004 radical steps were taken under legislation to end land clearing in Queensland. The Vegetation Management Act (VMA 1999) underwent amendment through the Vegetation Management and Other Legislation Amendment Act 2004. Previously only vegetation in 'Endangered' and 'Of Concern' regional ecosystems were protected. With the amendment, all remnant native vegetation is protected from clearing, so also includes 'Not of Concern' vegetation.

" The purpose of this Act is to regulate the clearing of vegetation in a way that—

(a) conserves the following—

(i) remnant endangered regional ecosystems;

(ii) remnant of concern regional ecosystems;
(iii) remnant not of concern regional ecosystems; and

(b) conserves vegetation in declared areas; and
(c) ensures the clearing does not cause land degradation; and
(d) prevents the loss of biodiversity; and
(e) maintains ecological processes; and
(f) manages the environmental effects of the clearing to achieve the matters mentioned in paragraphs (a) to (e); and
(g) reduces greenhouse gas emissions."

(VMA, 1999)

Source: WTMA

Johnstone Shire Council has EPA Herbarium mapping of regional ecosystems in the Shire. Council incorporates this information into its Shire Planning and approvals process. Persons can enquire as to the status of vegetation on their property, or on land to be purchased. NR&M are the State body responsible for this role.

Voluntary Conservation Covenants through Council

The Johnstone Shire Council has been actively promoting conservation of native vegetation on private/freehold land through covenants that incorporate incentives such as rate discounts, bonus development rights, and technical assistance from Council staff. The Vegetation Management Act (VMA 1999) status of vegetation determines Council's conservation covenant scheme, though other factors such as cassowary habitat are included. Only defined areas in the Shire are able to access the covenant scheme.

The scheme has always operated to protect only those areas of vegetation that are not already protected under State legislation. With the 2004 amendment to the VMA almost all vegetation is now already protected. Exceptions are regrowth areas, and revegetation areas. New covenants can only be applied to these types of vegetation.

However, it should be noted that the VMA is State legislation and potentially subject to future amendments, particularly with a change of government representing different interests. Council will re-evaluate the covenant system in light of the new VMA legislation during 2004, but current covenants should be maintained in the interest of the spirit of the agreement, which is to ensure that vegetation should be preserved in perpetuity. This is not guaranteed by State legislation.

Table 2.1.1d shows the properties and areas under covenant or bonus development. There is some variation between years, as occasionally properties rescind from the scheme and repay Council the deferred rates. Back pay owing plus interest, to a maximum of ten years, is required.

Table 2.1.1d - Status of Council's Conservation Covenants at the end of 2004

Rate Deferrals	Bonus Development
54 properties	16 properties
1503.4 hectares	399.9 hectares

Rec: Council continue to honour existing covenants and rate deferral agreements with landholders, and operate covenant and bonus development rights where applicable to regrowth vegetation and revegetation initiatives - Council

Rate Discount Conservation Covenant

The Conservation Covenant benefits the landholder by granting a rate deferral on a ten-year rolling amount for the area of land under conservation (to maximum of 90% of the land). The discount varies between 20 – 60% off each year's rates (but only for the percentage of land under covenant), but can go to 100% for areas of exceptional habitat quality or significance. The Program also offers land management assistance to landholders especially with weed management and other natural resource issues such as appropriate fire management.

The % of rate deferral for eligible areas is as follows:
Critical habitat* - 60%
Important habitat - 55%
Important Corridor/linkage - 50%
Potentially Critical/Important - 45%
Natural habitat/corridor and linkage corridor/habitat - 40%
Potential linkage corridor/habitat - 20%
* This may be increased in particular circumstances with Council Approval - for especial sites

Bonus Development Rights

The other aspect of the program is the Bonus Development Rights under the Shire Planning Scheme. A significant initiative of the current Shire Planning Scheme is providing for additional bonus development rights on land in the rural conservation zone. (The rural conservation zones are shown in the Shire Plan - available on the JSC website)

These rights allow appropriate development that is compatible with the conservation value of the land, whilst not restricting the agricultural use if that is the landholder's preference. The program also offers land management assistance to landholders especially with weed management. If a developer has a block that has significant natural habitat on the block (usually classified as Rural/ Conservation), their normal rights are rural (i.e. agriculture) and one house. With bonus development rights they can apply to do more intensive development on the cleared parts of the site by putting the natural habitat under a

conservation covenant.
This can includes examples such as:

- Subdivision one bonus (additional) block per 5 ha of habitat put into conservation to a maximum of 4 bonuses.
- Additional house - again one bonus per 5 ha habitat to a max of four bonuses.
- More intense development - Backpackers, Eco-tourism type development. For example, a rural conservation block in the Mission Beach area put 90% of the block in conservation and developed an Ecotourism type accommodation facility. The area is classified as critical habitat. The remaining 10% was set aside for development but in reality only a quarter of that has actually been used for development.

WTMA Covenants
Two covenants with the Wet Tropics Management Authority (WTMA) exist on properties at Bingil Bay. The area of these is approximately 30 hectares. The WTMA is presently encouraging landowners to utilise the Shire Council for covenants.

Land for Wildlife
Land for Wildlife agreements are another incentive to promote the conservation of vegetation on private land. Landholders receive expert advice to assist them in managing and conserving native vegetation and fauna.
At the end of 2004 there were eight Land for Wildlife properties in the Shire. The total vegetation on this land had an area of 218.9 hectares.

Australian Rainforest Foundation
The Australian Rainforest Foundation is a not for profit organisation that is working towards establishing a continuous length of connectivity between Cairns and Cardwell. So far, two 15 hectare blocks have been purchased at Mission Beach. The blocks have since been sold to private owners, but with over 95% of their areas sealed under State covenants. These covenants completely restrict development in the conservation area and are perpetual.

Restoration

Revegetation and Rehabilitation
The Revegetation Unit is responsible for the majority of revegetation and rehabilitation work conducted in the Shire, either directly, or through the provision of technical advice to landholders. Staff to perform the core duties is provided through Council, but the majority of the wages are funded through the Natural Heritage Trust (NHT). Surrounding the staff are almost a hundred volunteers, willing to assist at the nursery or with planting days.
The NHT has funded the majority of the work currently being undertaken in the Johnstone Shire. Council has undertaken most of this work, along with the invaluable efforts of community group involvement.
In 2004/2005 revegetation projects were undertaken in the following areas:

Projects the Revegetation Unit received funding for:

Revegetation and Rehabilitation

Rehabilitation does not have to specifically deal with traditional revegetation techniques, it can involve a combination of strategies that enhance and promote the establishment of native vegetation. A successful rehabilitation project will almost certainly involve a combination of remnant rehabilitation, enrichment planting, revegetation and promotion of natural regeneration through strategic weed control. An integration of several rehabilitation techniques minimises costs, leads to richer species diversity and quicker site capture.

Costs for traditional revegetation projects average around $15,000 per hectare but can be as little as $6,000 to $7,000. The actual cost ultimately depends on how much in-kind support can be received for the project. In-kind support can be provided by volunteers in the form of labour, or where a landholder undertakes work to prepare or maintain the proposed rehabilitation site.
The more in-kind support received the further the dollar goes. In fact, for every dollar of NHT funding provided there is about two dollars of in kind support provided by the community and/or local government. Without this support, revegetation would simply not occur in the Wet Tropics area.

- Moresby River Catchment (Boogan)
- Sapelli's Riparian reinstatement (Liverpool Creek)
- North Johnstone River Stabilisation (Wadda Plantations)
- South Johnstone River Stabilisation (Kalbo)
- Spurwood Springs Wildlife Corridor (Mena Creek)
- Garners Beach Critical Linkage (Midgeree Bar Road)
- Johnstone Community Vegetation Initiative

Projects undertaken in partnership with community groups:

- McCarthy's Wildlife corridor
- Berner Creek rehabilitation (Nerada/East Palmerston)
- Nawala revegetation project (El Arish)

A large proportion of the work over time has been done within the Liverpool Creek catchment, with a priority being the completion of the Liverpool Creek section of the coastal wildlife corridor. The linkage between the Basilisk Range and Cowley Beach along Liverpool Creek was identified as a priority area in the Wet Tropics Coastal Wildlife Report (2000). It continues to be addressed through Council's Biodiversity Strategy (2003).

In 2005 the revegetation unit will be looking to finish several long-term projects. Funding applications will be submitted to finish the Liverpool Creek section of the Coastal Wildlife Corridor, which when complete will provide an unbroken linkage between coast and the Basilisk range. Work will be continuing in the Moresby catchment to improve water quality and to provide a linkage between Mourilyan Harbour and the Basilisk Range. Work that has been done on Daru Creek and the Moresby River has been highly successful so far and has greatly reduced Para grass infestations in those watercourses.
Another project being developed is a major Stream rehabilitation project between the Johnstone Shire Council, Ma:Mu, Community Development and Employment Program (CDEP), Johnstone Shire River Improvement Trust (JSRIT), the Johnstone River Catchment Management Association (JRCMA), and local landholders. This project will rehabilitate priority areas along Liverpool Creek and the North and South Johnstone Rivers.

Priorities for future revegetation will follow the goals outlined in the Biodiversity Strategy, in order to integrate and coordinate effort.

Rainforest Orchids

Revegetation Nursery and Volunteers:
Volunteer attendance at the Revegetation Nursery has increased, and averages between 20-30 volunteers every Thursday. Volunteers also attend on Wednesdays as part of the Federal Government's Green Reserve Program.
The volunteers have contributed greatly to the revegetation program by propagating large amounts of plants with around 1,800 trees being potted up every Thursday morning, which equates to close to 90,000 trees per year.

Community Support for rehabilitation projects has grown and the majority of landholders are willing to be involved. In the past, property owners were wary of revegetation groups' motives for planting trees. This change is due to the ongoing hard work of Council staff, and of community groups to promote the benefits of protecting and enhancing biodiversity. This has had positive results not only for the environment but also for the landholder. Revegetation can contribute economically to many farms by providing shelter for crops, reducing rat damage, and can be a long-term solution to weed infestations along headlands and areas of unused land.
In this way revegetation has become an incentive due to the large amount of support and interest it has created amongst the local community.

One project that has been instrumental in this paradigm shift is the Johnstone Shire Community Vegetation Initiative. This has been a continuing project that is supported by the Bushcare program, and provides assistance to landholders wishing to undertake small-scale rehabilitation work on their property. The Johnstone Community Vegetation Initiative has entered its fifth consecutive year with some landholders being involved in the project since it was started.

One of the major goals of the vegetation initiative program is to build capacity within the community to undertake rehabilitation projects. The program aims to provide participants with experience in planning and undertaking rehabilitation work on their property. The program addresses revegetation at a property scale where application for government funding would be hardly worthwhile. Sites are approved after assessment by technical staff, to make sure they fit certain criteria. These include the nature of the project and whether it addresses specific environmental issues, and the landholder's ability to undertake and complete revegetation works. Trees will not be provided for amenity plantings, or plantings that are used for profit, eg. windbreaks, timber production.
Revegetation Unit staff provide technical advice on species selection and placement, site preparation, weed management and maintenance. The Revegetation Unit provides no on-ground labour for the establishment of the trees; landholders are encouraged to involve community groups such as LandCare, Revegetation Volunteers or Scouts in their project.

Rec: The revegetation unit continue restoration and rehabilitation according to the objectives outlined in the Biodiversity Strategy - Council

2.1.2 Roads and Infrastructure

Red legged Pademelons at Wildcare Source: Wildcare

Pressure

Roads and infrastructure such as powerlines impact upon floral biodiversity by creating gaps in the connectivity of forests and other ecosystems. This creates an edge to the ecosystem, which alters the microenvironment. Consequently, different species are promoted, which alters the ecosystem's composition. A greater problem is the incursion of weeds and pest animals along the cleared avenue. Further, in some cases endangered species such as cassowaries may be attracted to road verges because of fruiting weeds, placing the species at greater risk of being struck by a car.

Roads can form a significant barrier to the movement of fauna, either because they will avoid the road, or because cars on the road cause mortality, affecting the species' population. Animals may need to cross the road to feed, establish new territories, to breed, or to migrate as part of their lifecycle. Otherwise they may simply encounter road areas randomly during daily movements.

Infrastructure associated with roads can also form a physical barrier to some species, particularly where roads bisect streams. This is the case when stream drainage is diverted through pipes emptying above the downstream water level. This can prevent aquatic species from occupying their full range.

Power line corridors are usually grassed areas where they pass through areas of forest, so that the lines can be accessed for maintenance. The difference in habitat can affect some species, either because they avoid it, or because the open area makes them more vulnerable to predators.

Condition

Detailed information is not collected for the impact of roads on any species except for Cassowaries. C4 and QPWS record cassowary road deaths and map these incidents to identify trouble spots.

Some information is available for other species

- Through Council clean up of large roadkills – mainly kangaroos and wallabies, but also feral pigs - based on reported dead animals by the public.
- Through wildlife care groups who nurse injured animals - when they are reported or brought in.

This information will only be a small subjective sample of actual number of incidents.

WTMA

The only changes that have occurred to maintained roads and their classification under the Wet Tropics Management Plan have been to forestry roads in the Palmerston WHA in 2003.

"These changes were associated with the Misty Mountains Trails project which provides a network of short and long distance walks. Two sections of road were reclassified under the plan to facilitate access to the walking track network including the reopening of 4km of disused forestry road and the reclassifying of 4km of management road to presentation restricted road" (WTMA, 2004).

The impact associated with these changes will be minimal, and will encourage better appreciation and utilisation of the WHA.

Powerlink

Powerlink are replacing the deteriorating power line travelling through the WHA, with a line along the coast through mainly agricultural land. An Environment Impact Assessment (EIA) was conducted, with a balance sought between environmental issues and serious community concerns, as well as the difficulty of maintaining a power line service in the topography of the WHA. The EIA was referred to the Federal Department of Environment and Heritage, who have given Powerlink permission to construct the power line along the coastal route.

"Powerlink expects to acquire easements between Tully and Innisfail by April 2006, with construction expected to commence in May 2006 (subject to suitable weather). Construction should be completed by the second half of 2007" (Powerlink Website, 2005).

Revegetation in the WHA will accompany dismantling of the old infrastructure. These revegetation plans are yet to be developed through community consultation and involvement from WHA stakeholders.

Rec: Powerlink develop a strategic approach to ensure complete revegetation over time and restoration of WHA natural values, upon removal of power line infrastructure in the WHA.

Response

Where it is noted that a road is affecting significant numbers of a species or a number of species, management is required to help prevent the problem. This for example could include changing speed limits, or weed control of road verges.

Mission Beach Wildcare and Wildlife Carers

These organisations tend injured wildlife, and raise orphaned animals. The majority of their work with mammals is due to collisions with cars, though dog attacks are also a factor.

QPWS

QPWS currently manage temporary signage, which is placed where cassowaries are reported to regularly cross a road. This is more effective than permanent signage, as drivers gradually come to ignore such signage when they do not often see a cassowary.

Department of Main Roads
Response from the Department of Main Roads has been exemplary in responding to this conservation issue, with the Mission Beach-El Arish Road undergoing extensive work to minimise the risk of cassowary road death. C4 have reported, upon implementation of these changes, that cassowary mortality on the road was greatly reduced (Hervey, 2003 pers. comm).
The Department of Main Roads have a code of practice for the Wet Tropics to minimise environmental impacts during road maintenance.

Council
Council manages all of the Shire's roads, other than privately owned roads, and State roads such as the highway and major connections.
There have been no new roads created or roads closed in recent years, but Council does continuously upgrade existing roads, within the constraints of its budget. Council also determines speed limits, which can be raised where roads are upgraded. This potentially affects wildlife where roads pass through natural areas.
Council erects cassowary signs and other wildlife signage where appropriate. Further work is required to determine whether there are significant risks to other species in the Shire from roads, but at present this is not considered likely. Action will be required if endangered or otherwise at risk species are identified as affected. There is a need for connectivity between natural areas at a number of critical locations where wildlife corridors are being established. Where these wildlife connective corridors cross roads, work is required to raise driver awareness, reduce speeds or to provide a wildlife tunnel.
Progress is currently ongoing in developing a Wildlife Road Management Plan for Council, to complement the Biodiversity Strategy.

Rec: A Wildlife Road Management Plan be completed by Council, and implemented in conjunction with QPWS, the Department of Main Roads, ERGON, Powerlink, and other stakeholders. Council implement the recommendations determined for Local Government roads - Council, QPWS, Department of Main Roads, ERGON, Powerlink

2.1.3 Alteration to Water Tables and Natural Drainage - Wetland Losses

(Issues affecting stream flow and water levels in the Shire's waterways and watertable are covered in the Water and Atmosphere chapter, section 2 - water quantity and demand.

Pressure
Permanent alteration to the watertable and to natural drainage systems threatens remaining habitats on the coastal plain. This area is naturally poorly drained, properly resulting in wetland ecosystems.
Much of the native vegetation on the coastal plain has been cleared for agriculture and the land has then been subjected to major drainage works. These drainage works have led to alteration of the watertable, which has changed the dynamics of the vegetation. This is unfortunately a common problem throughout coastal Australia.

In Johnstone Shire many of the endangered ecosystems (see Table 2.1.1c) are those that previously covered the lowlands, particularly the wetland ecosystems. A priority exists to protect wetlands against further impacts from drainage alteration, and also from water allocation for human usage. Most of the endangered ecosystems in the Shire are protected in reserves, but these areas can still be affected by changes to upstream drainage and water supply. This also applies to ecosystems on private land.
An associated problem with drainage is acid sulphate soils. These soil become acidic when exposed to the air, for example when the water table is lowered by drainage. The acidity raises pH in receiving waters, which can impact adversely on aquatic organisms.
The absence of regular fire regimes is another factor currently affecting wetland hydrology. Excess build-up of leaf litter over time blocks channels and raises the ground level. When saltwater intrusion occurs, especially during king tides, the salt remains stored in this leaf litter rather than being flushed out again, adversely affecting the freshwater vegetation. Fire events normally remove the excess leaf litter, unclogging the wetland system.

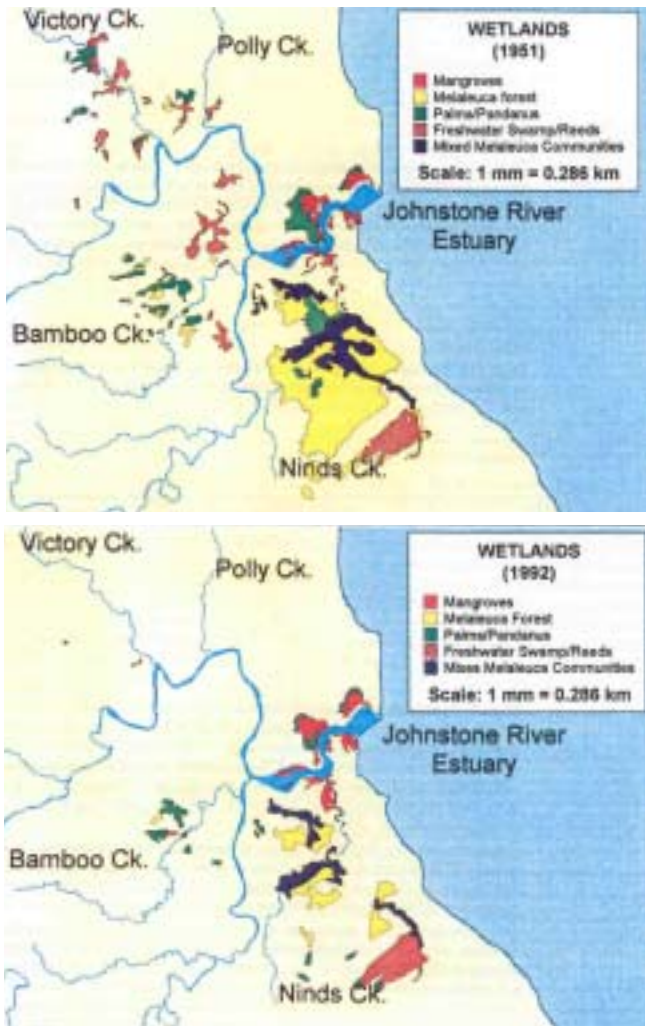
The extent of wetlands in the Shire is very important because


Eubenangee Swamp

of the vital role they play in determining water quality. The Shire's wetlands used to be floodwater retention basins. This meant that they both slowed movement of and stored large volumes of water during excess rainfall, and helped filter sediments and nutrients from the water. Wetlands have further important functions as fishery habitat/nursery areas, and food source areas for fish.

Since their destruction, runoff volumes have increased, and lower reaches of the river are subject to increased sedimentation and increased flooding. The removal of wetlands is an important part of the cause of sediment and nutrient problems affecting the Great Barrier Reef.

Figure 2.1.3a - Changes to Wetlands in the Johnstone Rivers Catchment between 1951 and 1993
Source: Russell and Hales (1993)
Note: Scale depicted in the key does not apply here



Increased sedimentation and flooding have impacts upon the urban riparian areas in the Shire's towns, especially Innisfail, which is now looking at dredging its riverbeds. Historically, these river reaches were deep enough to allow for large shipping. Now these reaches are so shallow they pose flood threats to urban areas.

Condition

Extensive work has been conducted into the historical range of wetlands in the Shire (Russell and Hales 1993, Russell et al. 1996, Russell and Hales 1997). Work was conducted for all four catchments in the Shire.

They estimated the following changes to vegetation in the Johnstone Rivers catchment between 1951/2 and 1992 (Table 2.1.3a). The areas were progressively cleared, drained and utilised for urban areas, agricultural production, and grazing. The changes are also visually represented in Figure 2.1.3a.

Table 2.1.3a - Changes to Wetland Vegetation Types in the Johnstone Rivers Catchment
Source: Russell and Hales (1993)

(Hectares)	1951	1992	% change
Mangroves	176	202	+ 15%
Melaleuca forests	1277	282	- 78%
Mixed Melaleuca communities	462	258	- 44%
Palm/Pandanus	439	160	- 64%
Freshwater swamp/reeds	499	225	- 55%
Total	**2853**	**1127**	**- 60%**

The total area of wetlands in the Johnstone catchment decreased by approximately 60% over the 41 year period. All of the net losses were as the result of the reclamation of freshwater (non-mangrove) wetlands. The most significant losses were of Melaleuca forest (78%) particularly to the south of the estuary, in the Ninds Creek Catchment. Mixed Melaleuca communities also declined about 44%. The other major freshwater wetland categories, palm/pandanus and freshwater swamp/reeds, were reduced by 64% and 55% respectively. Freshwater wetlands to the north and west of the river confluence have almost completely disappeared. There was slight increase in the total area of mangroves due mainly to colonisation on the southern foreshore and at the mouth of Ninds Creek. Drainage and reclamation works continue to threaten the remaining section of the Ninds Creek wetland area.

Figure 2.1.3b - Changes to Wetlands in the Moresby Catchment between 1951 and 1993—Source: Russell and Hales (1996)

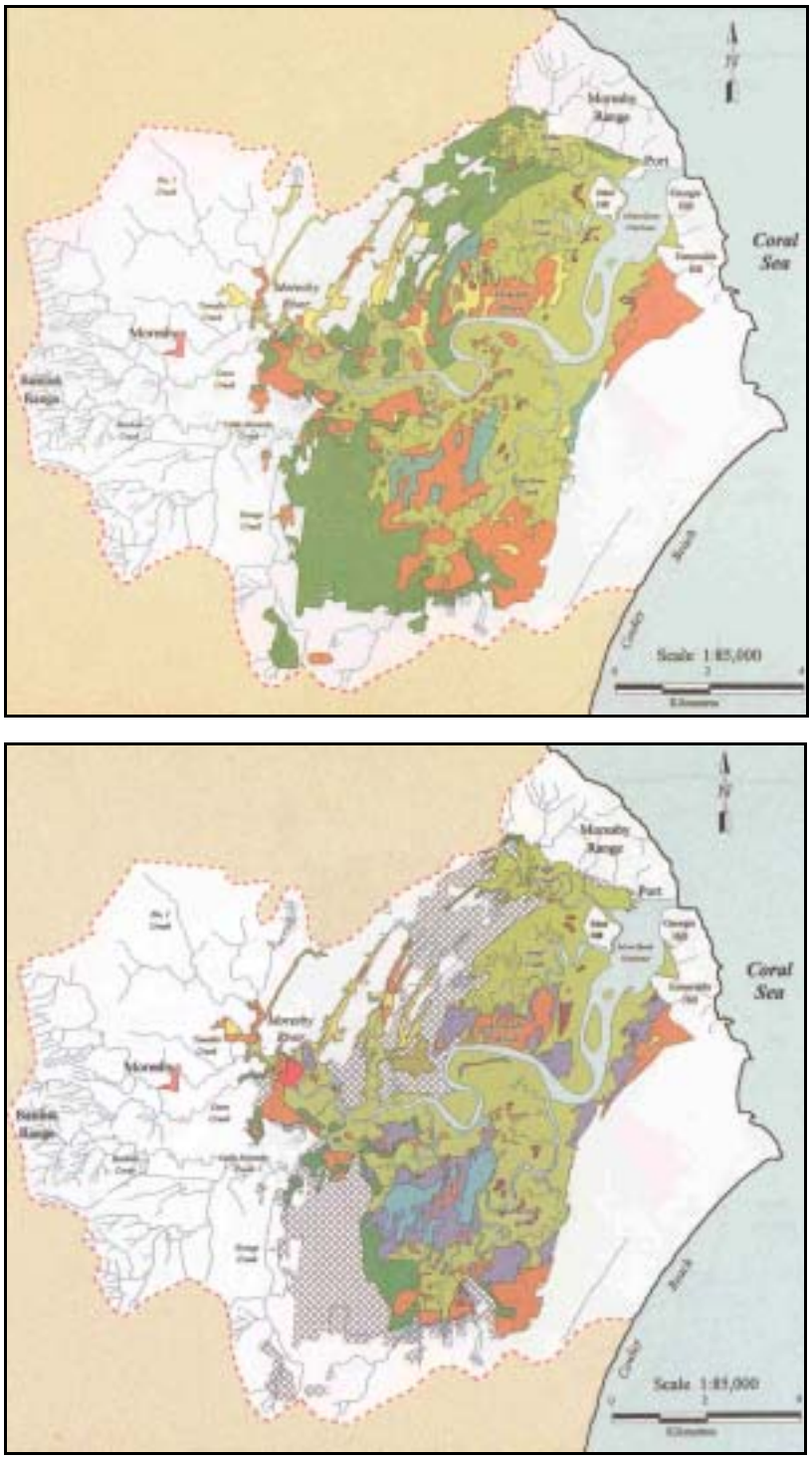


Figure 2.1.3b from Russell and Hales (1996) describes wetland losses between 1951 and 1992 in the Moresby catchment. The most obvious impact is the direct loss of rainforest wetland. Also marked is the loss of freshwater Melaleuca wetland, in this case under transition to mangroves. Wet sclerophyll forest, never extensive, has been reduced by approximately half. There has been a similar loss to the sedge pandanus vegetation.

The phenomenon of freshwater wetlands in transition to estuarine mangroves indicates that the hydrology of the wetland area has been significantly altered, allowing a greater incursion of salt-water conditions. It has been suggested that deepening of the harbour, sedimentation, or changes to land drainage are possible causes.

Russell and Hales (1997) also studied the Liverpool and Maria Creek Catchments. A comparison with records of historical wetlands was not possible. Therefore reduction in the total area of wetlands is not detailed in the study. The lesser extent of transitional wetlands indicates that changes to hydrology in these catchments may not have been as great.

Table 2.1.3c - Wetland Vegetation Types in the Liverpool and Maria Creeks Catchments
Source: Russell and Hales (1997)

	Liverpool (ha)	Maria (ha)
Mangroves	121	407
Saltpan	10	0
Transitional	1	15
Freshwater swamps/ lagoons	74	196
Melaleuca	154	836
Mixed Melaleuca	31	655
Total	**391**	**2109**

Tidal and Freshwater Wetland Vegetation

Very large changes have affected the non-tidal wetland areas of the catchments. These have experienced extensive clearing and drainage for agriculture.

The tidal reach of the rivers has increased, supporting more species such as mangroves and other species tolerant of estuarine water. This is due to lessened areas of tidal catchment, part of which have been sealed off with levees, resulting in tidal saltwater intrusion higher upstream (rather than to what were wide saltwater wetland areas). Decreased flow volumes from agricultural water usage exacerbates this effect, particular during dry periods - allowing extended incursions of salt water further upstream to affect naturally freshwater species. This can be seen in the Shire by the formation of transitional areas (Russell

and Hales 1997) where freshwater Melaleuca stands have died, and mangroves are establishing in amongst the dead trees.
The ecological function of saltwater wetlands compared to freshwater wetlands can also be expected to vary. Saltwater wetlands with mangroves may have different capacities for nutrient recycling than swathes of grass and sedges in freshwater wetlands.

Current Legislation
Most remaining wetlands in the Shire are under protection as remnant vegetation areas. The Water Act (2000) also deems some areas a 'lake' if they have a defined bed and bank, with continual water levels. Work permits are required from NR&M for any alteration to the bed or bank. A few sporadic patches exist that are outside this protection, near Mission Beach and Mourilyan. These are bulkuru wetland sites that do not have well defined bed or banks, and are periodically inundated during the wet season, but are also dry for part of the year. It is possible for local government to nominate a region for declaration as a 'Drainage and Embankment Area' under the Water Act (2000) to further protect wetlands, but aside from the few bulkuru locations on private land, this would have little value in the Shire; most areas are either gone already or are under other protection.
Whilst large areas of the remaining wetlands are within protected areas and cannot be cleared, they are still vulnerable to further changes to drainage. In theory, diversion of water in a catchment may affect the wetland hydrology. There is no regulation preventing alteration of drainage diverting water away from a watercourse. NR&M only regulate drainage causing an impact to the stream bank or vegetation at the location where it empties into the natural stream. QPWS operate on a systems of 'good neighbour' agreements with landholders surrounding the wetland areas.

Water allocation issues will also continue to affect the representation of freshwater wetlands. Water allocation is further discussed in the Water and Atmosphere chapter (link to water allocation). It is important that ecological function of wetland areas be incorporated into water allocation planning.

Rec: Water allocation requires determination with regard to wetland ecosystems in the catchment. A water resource plan be completed by NR&M by 2008 - NR&M

Rec: Council and other groups promote preservation and restoration of wetland ecosystems - Council, Landcare, NR&M, DPI&F, Innisfail City Wetlands Steering Committee, JSRIT, JRCMA

Bulkuru (*Elaeocharis dulcis*) swamp

Response

Council's focus should be to encourage and prioritise the restoration of wetland areas where possible in the Shire. These areas will return great ecological values to the catchments. Benefits will be the provision of additional habitat of this restricted type, of wetland ecological function in reducing pollution to waterways, and also in acting as flood retention areas.
Work by the Innisfail City Wetlands Steering Committee may result in the restoration of natural drainage to restore a wetland area adjacent to the town. Whilst this is a comparatively small area, the project will help to promote further work towards protecting and re-establishing wetland ecosystems elsewhere in the Shire.
To be promoted to landholders, along with development of capacity by Council's revegetation unit, is restoring 'mini-wetland' areas on properties in the Shire. These are envisioned as small-scale lagoons, built at an affordable cost, that provide an ecological role in removing nutrients and sediments from runoff. The area is also beneficial as habitat for wildlife and can provide amenity for recreation and fishing. Where small isolated wetlands do exist on private land in the Shire there is scope for improvement works, and possible linkage connections.
The Innisfail City Wetlands will be of great benefit in providing a pilot model for this type of work.

QPWS
QPWS is active in acquiring private land adjacent to national park or where linkages between natural areas can be created. A particular focus is given to wetland areas in the Shire, due to the number of endangered wetland

Table 2.1.3d - Changes to Catchment Wetland Areas - Tidal and Non-tidal Vegetation
Source: adapted from Zeller (1998) and Russell and Hales (1997)

	Johnstone		Moresby		Year	Liverpool		Maria	
	Non-tidal (ha)	Tidal (ha)	Non-tidal (ha)	Tidal (ha)		Non-tidal (ha)	Tidal (ha)	Non-tidal (ha)	Tidal (ha)
1951/2	2677	176	3363	2233					
1992	925	202	1175	2873					
					1997	259	132	1687	422
Net change	-1752	+26	-2188	+640					
% Change	-65.4%	+14.8%	-65%	+29%					

ecosystems.
A large area was purchased adjacent to Eubenangee Swamp, to increase the wetland. This was previously pastureland and is under restoration with large areas of revegetation. Land containing part of upper Nind's Creek was also purchased, adjacent to the Moresby Range.
QPWS negotiates opportunities to purchase parts of land, or to come to arrangements with landholders where wetlands on private lands require management in tandem with adjacent protected areas. QPWS currently maintain levees downstream from some freshwater wetland parks to maintain the water level.

Rec: Identify critical wetland areas for restoration to assist in floodwater retention and to filter nutrients - Council, JRCMA, JSRIT
Rec: Promote restoration of wetland areas on floodplains by restoring natural drainage and revegetating - Council, JSRIT, Drainage Boards, JRCMA
Rec: Re-establish wetland areas where possible in cooperation with private landholders - Drainage Boards, JSRIT, QPWS, NR&M, Council
Rec Improve protection of the water allocation required for wetland ecosystems - NR&M
Rec: Source funding to establish wetland areas and sediment traps in conjunction with Drainage Boards - Council, JRCMA, Landcare, JSRIT

A magnificent *Eucalyptus grandis* in what is now becoming rainforest. Fire maintains the presence of this type of sclerophyll vegetation.

2.1.4 Inappropriate Fire Regimes

Pressure

Large-scale changes of dry sclerophyll woodland ecosystems to rainforest mesophyll ecosystems are occurring throughout the Wet Tropics bioregion as a direct result of altered fire regimes. Lack of fire has resulted in changes to forest structure and species composition to the extent that some fire dependent habitats and species may become extinct (NRMB, 2000). Many of these changes have occurred in the last 30 years and are often irreversible. To a lesser extent fire has been responsible for loss of rainforest, particularly on steep hill slopes adjoining cultivated or urban areas (Goosem *et al,* 1999). The majority of the endangered ecosystems identified in Council's Biodiversity Strategy (2003) are dependent on fire for natural regeneration.
There are a number of these vegetation types present on private land, especially in the Granadilla Road area and the Basilisk Range. Apart from ecological concerns there are safety concerns - many of these vegetation types are fire promoting, and in the absence of regular burning may pose a significant risk to surrounding properties should fuel loads be allowed to build up to excessive amounts.
The hydrology in wetlands can also be dependent on fire. Fire removes built up leaf litter and organic matter which blocks channels and raises the ground level in the wetland. Nutrients are thus also cycled out of the system - to the atmosphere rather than out to sea. This reduces nutrient export to the reef.
Patches lost to rainforest have serious ecological consequences for small mammal wildlife. Small marsupials and native rodents typically require grasses for seeds. The grasses are shaded out when rainforest replaces the sclerophyll trees like eucalypts and acacias.

Condition

Fire regimes in the Shire have been completely altered since the advent of European settlement. Currently there are no regional fire management plans, though QPWS do conduct periodic burning in some of the National Parks. The need for fire regimes on private land has not been addressed, though this is identified as a priority in Council's Biodiversity Strategy (2003).
A negative perception by the public of controlled burning has been proven during controlled burns by QPWS in 2003-2004. This is in contrast to most other areas in Australia where concern over fuel loads, and awareness of the ecological function of fire is prevalent. Most vegetation in the Wet Tropics is not fire dependent so there has been limited public exposure to controlled burning regimes. Education is required to improve public awareness of the ecological necessity for controlled burning.

Response

QPWS
QPWS conduct prescribed burns in National Park areas where the rejuvenation of vegetation is dependent on fire.

These include areas where rainforest is encroaching on drier forest, and where the ecosystem requires fire to regenerate and reproduce.
QPWS have been focusing fire management in wetland systems including Eubenangee Swamp, and at the back of Maria Creek. These burns are timed to minimise risks, and to maximise the floristic response.
Fire regimes have proved extremely successful at Hull River outside the Shire, with unexpected further benefits. This resulted from the burning away of decades-deep leaf litter in the wetland. As a result the ground level dropped by almost a metre, completely restoring natural hydrology to the area.
The wetland at Kurrimine currently suffers from a similar problem exacerbated by salinity incursion. This is because the compact leaf litter retains salt from king tides. By burning this accumulated material a natural hydrological regime will be re-established to flush salt incursions back out of the system. Fire is an essential component in maintaining both the floristic and hydrological characteristics of some wetland areas in the Shire.
In recent years there has been large public concern about fire management, mainly from local residents when burning is taking place in their area. QPWS plan to promote education on fire regimes and the necessity for fire for sustaining particular ecosystem types.

Council
It is one of the recommendations of the Council's Biodiversity Strategy (2003) that fire management plans are developed for the Shire and appropriate technical advice is sought on appropriate fire regimes for each of the regional ecosystems identified in the Strategy. Coordination with QPWS and Indigenous groups will be required, to establish a strategy that is appropriate in frequency and location. Council revegetation unit staff members require training in controlled burning.
Fire can also be valuable tool in the control of a number of weeds. One example is Pond apple, which is more sensitive to fire than melaleucas and has failed to establish in vegetation communities that are burned regularly (Bell, 1996). This is an advantage for pest management work, where burning can control some introduced species.

Rec: A strategic plan for fire management and regular scheduled controlled burns in the Shire be developed, involving all stakeholders - for vegetation dependent on fire in protected areas, on Council reserves, and on private land - Council, QPWS, Rural Fire-fighters, Indigenous organisations
Rec: Council community revegetation unit staff be trained in controlled burning for ecological maintenance and for weed control - Council
Rec: Wetland system hydrology be maintained where appropriate with fire management regimes to be developed - QPWS, Council
Rec: Fire management requires public engagement beforehand, including promotion and advertisement of the issues through a public medium such as the paper - QPWS, Council

2.1.5 Offshore Ecosystems - the Barnard Islands

The only islands managed by QPWS Cairns Marine Parks in the Johnstone Shire are the Barnard Islands. The islands will soon fall under the jurisdiction of local QPWS marine officers to be based in Innisfail.

Pressure
Pressures on the islands include feral rats, which affect the bird populations, and exotic weed invasion. Visitation to the islands by people also requires some management. The islands are a traditional part of the Ma:mu people's 'sea-country' so management and usage has to be culturally sensitive.

Condition
The islands are recognised as important seabird breeding areas. Recorded numbers have estimated population levels at times in the region of 10,000 bridled terns, 2,000 lesser-crested terns, and 2,000 black-naped terns. A total of 26 species of seabirds has been recorded on and around the islands, including species identified under the Nature Conservation Act such as the Beach Stone Curlew - vulnerable, and Sooty Oystercatcher - rare. The islands have a diversity of floral communities with the likelihood of species of conservation significance amongst them. Surrounding the islands are reefs. The condition of these reefs is discussed in the Aquatic ecosystems section 3.1.

Response
There is an approved management plan by QPWS for all the

North and South Barnard Islands. This management addresses both natural and cultural values.
The purpose of the management plan is:

- To protect and maintain breeding seabirds and their habitats and other island fauna;
- To protect and maintain the diversity of vegetation types, particularly rainforest, woodland, beach strand and mangrove communities;
- To respect the traditions and interests of those Aboriginal and Torres Strait Islander people with affiliations to the islands;
- To control feral animals and noxious plants;
- To maintain the natural surroundings, consistent with a peaceful, low intensity, minimally developed setting; and
- To provide for scientific research.

Major actions are:

- No access areas on Sister Island and part of Stephens Island between September and March to protect breeding terns from disturbance during nesting.
- Monitoring stations on the South Barnards have indicated that the introduced black rat has been eradicated from the islands. Continued monitoring is occurring, as there is potential for re-infestation after wet season from floodwaters out of nearby river systems.
- Continued maintenance of mapped weed control areas.
- Recreational and commercial visitor numbers controlled by permit system based on sustainable numbers identified in management plan.

Two Marine Park positions have recently been advertised and will be based in Innisfail with a small vessel. This will increase the capacity to manage and enforce the additional national park zones in the Marine Park created in July 2004 and provide greater management of island national parks in the area.

Rec: Assist QPWS where required, should management objectives on the Barnard Islands be threatened. Island visitation to be included in an assessment of sustainable tourism for the Shire - Council

2.1.6 Exotic weeds

Pressure

Environmental weeds pose the most immediate threat to biodiversity in the Johnstone Shire. Environmental weeds have the capacity to invade and destroy whole ecosystems. This occurs when weeds out-compete and replace native vegetation over time, or when aggressive species such as vines kill native vegetation by climbing over and shading it out.
In this Shire the main weed threats include Pond Apple (*Annona glabra*) and Harungana (*Harungana madagascariensis*) (Goosem *et al*, 1999). Many of the endangered ecosystems in the Shire are currently under threat from invasion by several environmental weeds particularly Pond Apple and Hymenachne (*Hymenachne amplexicaulis)*.

Hymenachne (*hymenachne amplexicaulis)* is an introduced pasture grass that now threatens waterways and wetlands.

A large number of different weed species are present in the Shire. Control is limited to the most invasive species, and where there is potential for eradication before the weed becomes a serious problem. This prioritisation is necessary due to limited resources. Weed control on private land is more fully examined in the Land Management chapter section 8 - pest management. The impact of weeds on biodiversity is discussed here.

Condition

Table 2.1.1d lists protected areas in the Shire with known exotic weed problems. Council's reserves have the same problems that may be exacerbated by the smaller sizes of these areas. Regular inspection of Council's reserves for weeds does not currently occur.
The Biodiversity Strategy (2003) lists the major weeds affecting biodiversity in four priority regions within the Shire. Several weeds are threatening remnant vegetation in the Granadilla region. In particular the sclerophyll communities appear to be particularly at risk from pasture grasses such as *Brachiaria spp*. Siam Weed (*Chromolaena odorata*) is also present in the Granadilla region and poses a significant risk to native vegetation if left un-checked. Siam weed is classed as one of the world's worst weeds. It seeds prolifically and is extremely difficult to control. Siam Weed has a very similar habit to Lantana in that it forms dense thickets that exclude all other vegetation and can scramble to height of 20m. The main infestations are limited to the Bingil Bay/El Arish area with scattered infestations found throughout the Shire. There are also infestations of Pond apple in the Bingil Bay/Garners Beach area and North and South Maria Creeks. In many cases Pond Apple has invaded relatively undisturbed remnant vegetation. Johnstone Shire Community Revegetation Unit staff have commenced work to eradicate Pond Apple from the North Maria Creek catchment, with scope for work to commence in other areas as funding becomes available.

Weeds are a threat to the vegetation within the area between and including the Basilisk Range and Cowley Defence Reserve. Of significance is the establishment of Pond apple

which has the potential to invade lower wetland ecosystems. Although the infestation at present seems to be fairly sparse and currently is not a major problem, the potential cannot be overlooked.

There are significant infestations of Pond apple in the Ninds Creek catchment. This weed is displacing native wetland vegetation, much of which is 'Endangered' and 'Of Concern'. Another weed of significance within this primary zone is Hymenachne (*Hymenachne amplexicaulis*). Hymenachne was introduced as pasture grass in the Ninds Creek catchment, but unfortunately, it readily invades watercourses and can survive in water up to 4m deep. The ability of Hymenachne to readily invade a wetland area is a major concern, as it has the potential to destroy natural ecosystem functions and displace native vegetation.

Weeds can pose a greater threat in a landscape where the vegetation is fragmented. This is a problem with many remnants in the Nerada and Palmerston regions. Small areas of vegetation are less resilient to weed invasion than larger remnant areas. Small remnants usually have a greater circumference of edge compared to actual total area – known as edge effect. Weeds of significance in this area include *Thunbergia spp* (Blue Trumpet Vine), which usually infests the edge of remnant forest and has the capacity to cause trees to fall. This results in more holes and edges where the vine may establish and severely degrades the forest structure. *Miconia spp*. (Miconia) has also been found in the area, which is worrying when considering the damage it has caused in overseas rainforests.

Response

QPWS

Pest plants targeted are Pond apple and Hymenachne, particularly at Eubenangee swamp and the surrounding catchment. Siam weed is being targeted at Maria Creek, and Miconia at El Arish.

Council

The Johnstone Shire Council Pest Management Plan and the National Weeds Strategy have identified a range of declared and environmental weeds that impact on biodiversity values in the Shire. Council, through its Pest Management Plan, encourages the control of all Declared and Environmental weeds on private land throughout the Shire.

Council does not actively control weeds on its reserves throughout the Shire, although this is required by legislation. Management plans including weed control are required for Councils reserves. Periodic monitoring to identify weed infestations requiring control will be an appropriate response.

The Shire Planning Scheme provides for land in the Conservation Zone to receive Bonus Development Rights or Rate Discounts (amongst other benefits). This process also requires that landowner to enter into a Conservation Covenant with Council. Pest management will form an important part of such agreements where required and place further legal obligation on the landowner to control nominated pest species. Council will endeavour to assist landholders with these agreements to commence control of pest plants on their land (Hyde, 2002).

2.1.7 Feral Animals

Pressure and Condition

Feral animals are a major threat to terrestrial ecosystems in the Johnstone Shire. They damage native vegetation, spread weeds, and prey on native wildlife. Feral animals of major significance in the Johnstone Shire are deer, cane toads, Indian myna birds, cats, wild dogs/dingoes, and pigs. For further information, also refer to the Land Management chapter section 8 - pest management. Impacts to biodiversity are discussed here.

Feral Pigs

Feral pigs are a major concern with regard to biodiversity conservation in the Johnstone Shire. They cause pressure on native fauna by competing for food and through opportunistic predation. Pigs cause particular impact to ground nesting birds such as scrub fowl, brush turkeys and cassowaries. These bird species contribute ecological functions in the rainforest, so there are further effects when their populations are diminished.

Feral pigs impact on large areas of native vegetation when foraging because they dig up understorey plants in forests and wetlands. Further effects result from pig's mud baths. This is worsened when pig activity occurs on riverbanks and in streams. Erosion and sediments impact on the health of waterways.

Pigs also contribute economic impacts, particularly on agricultural land where they consume produce or damage crops. Pigs are also recognised as a vector for the seeds of weed species. They also are vectors for disease such as tuberculosis and foot and mouth, affecting both humans and agricultural stock. Cassowaries have also been found affected by these diseases.

Cats, Wild Dogs/Dingoes

These animals affect native wildlife through predation, and native predator species through competition. Whilst they are all present in the Shire, they are not recognised as a major ecological problem in comparison to their effect in other parts of Australia. Wild dogs and dingoes are not especially common. Feral cats are more common around urban areas, though this may be an artificial conclusion as it is based on the number of complaints from the public.

There is some control by landholders where these animals create a nuisance or threaten stock.

Cane Toads

Cane Toads are an introduced species that affect native wildlife in two ways. Firstly, the toads are poisonous, so they cause mortality to any animal that attempts to eat them. This suppresses the population levels of native predator species. Some native species learn to avoid the toads, whilst a very few other species are immune, or have learnt how to avoid the toad's poison by turning them on their backs and eating everything but the skin and poison

glands. The extent to which cane toads affect different species of native wildlife in the shire is not known. Fortunately, the cane toad prefers open territory, so it is not usually found in rainforest areas.
Secondly, the toads compete with other wildlife for food, particularly with native frog species. "When the toad invades a new area, it eats everything it can find and grows to a large size. Once established, the abundance of its food never seems to reach the pre-toad level. Both food and cane toad growth rates level off with toads usually reaching about 11 cm (4 inches) in length." (WTMA Website 2005b) Native frogs with a similar appearance can be mistaken for cane toads and killed by people.
Anecdotal reports describe the cane toad population to be much reduced since their original infestation of the region. Whilst their numbers are still high, it is thought that disease and possible predation are reducing their numbers. Alternately, the cane toads may now be limited by having reduced the food supply in the Shire. There is some speculation that cane toad numbers are increasing in 2005, due to the return of wetter weather after a number of dry years.

Indian Myna Birds
Indian Myna birds were introduced to Australia in 1862 in order to control insect pests on agriculture. Since this time their populations have soared, which is a problem for other native birds. Myna birds compete for food and are an aggressive species, banding to together to evict other birds from territories, and destroying eggs and chicks. Small arboreal mammals are also affected by the occupation of nesting spaces by Mynas. There have even been reports of Mynas filling neighbouring empty nests with rubbish objects to prevent other birds occupying their territory.
Mynas are common in the Shire, though appear mainly in urban or agricultural areas, but will only occupy the fringes of rainforest. However, they will inhabit open forest ecosystems.
Studies of problems with a similar native bird, though unrelated, the Noisy Miner (*Manorina melanacephala)* have shown that excess populations cause adverse effects to vegetation in their habitat. The Noisy Miners have taken over urban areas where little understorey exists for other native birds to escape their territorial aggression. Consequently, the trees in the area suffer from excess infestations of insects, which would normally be consumed by a diverse bird population. The trees are therefore in poor health and more susceptible to disease and mortality.
Helping to protect native birds in the garden from Indian Mynas can be achieved by planting native shrubs and understorey for shelter.

Feral Deer
Feral Deer in the Wet Tropics are restricted to the Johnstone Shire and immediate surrounds. Mission Beach, East Palmerston and Upper Daradgee all have small populations. There are two species - Rusa deer, which are a declared pest, and Sambar deer. Rusa deer are loose in the Shire, whilst Sambar deer present a risk as escapees from deer farms. Both types of deer have the potential to impact adversely on native vegetation, particularly sclerophyll ecosystems. They will also compete with native fauna for food. Both species are tropical deer, so could potentially thrive in the region.
Whilst there has been control of these deer by members of the local community, as they are valued as game meat, it is recommended by the WTMA that a trapping program be implemented to eradicate the populations whilst they are still small. The deer otherwise have the potential to spread throughout the Wet Tropics region.

Rec: Feral deer control be conducted immediately and systemically to ensure this problem is eradicated before it increases - Far North Queensland Pest Advisory Forum, WTMA, NR&M, Landholders, Council

Pig hunting is a common sport throughout Australia, but makes no real impact on the pig populations.

Response

Pigs
No effective program exists for the eradication of feral pigs. Various control methods are recommended by NR&M including poisoning with pig specific baits, trapping, fencing, and shooting (NR&M Website, 2005). Pig control is the responsibility of private landholders under the Land Protection (Pest and Stock Route Management) Act 2002. They are declared Class 2 pest animals.
Control programs are likely only to be effective in reducing the impacts of feral pigs. Feral pigs are widespread throughout Australia and will readily reinfest an area from uncontrolled areas. Their high rate of reproduction means that any control has to be conducted repeatedly to effectively impact on the overall population.
There are problems with introducing diseases because of domestic pigs, and because feral pigs already do share a few diseases with humans. Any disease control would have to be very specific to prevent a risk to people.

NR&M are conducting research in the Palmerston section of the WHA to determine the ecological impacts that feral pigs have on the rainforest. These results will help determine the requirements for control. Preliminary results have indicated that pigs may not greatly utilise the larger areas of the WHA. It appears that feral pigs mainly utilise the rainforest fringes, such as tracks and edges. This is tremendous news for conservation of the WHA and for controlling feral pigs, but further research is required. The National Park areas are too large and inaccessible to conduct an effective eradication program without exorbitant expense. Baiting with affordable poisons can also affect non-target wildlife. Pig hunting is not permitted in National Parks because of the danger from dogs and irresponsible hunters to wildlife, particularly cassowaries. A low level of illegal hunting in parks does still occur.

Control of pigs in National Parks by QPWS is mainly undertaken opportunistically with shooting when pigs are encountered, or are reported to be causing a problem. QPWS has two eradication programs also operating, at Mission Beach to Kurrimine, and around Josephine Falls to Ella bay, which is through trapping of the pigs in the National parks, and on neighbouring properties.

There has been recent Federal commitment to the control of pigs with the release of the 'Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs' (2005) by the Department of Environment and Heritage (DEH). "Five main objectives are proposed to manage the threat by feral pigs:

1. to prevent feral pigs from establishing in areas where they currently do not occur or are in low eradicable numbers, and where they are likely to pose a threat to biodiversity; especially where they would impact on nationally listed threatened species and ecological communities
2. to integrate feral pig management plans and their implementation into natural resource planning and investment at the regional, state and territory, and national level through consultation and liaison with key stakeholders
3. to increase awareness and understanding of land managers and the general community about the damage that feral pigs cause and management options
4. to quantify the impacts feral pigs have on biodiversity (especially nationally listed threatened species and ecological communities) and determine the relationship between feral pig density and the level of damage
5. to improve the effectiveness, efficiency and humaneness of techniques and strategies for managing the environmental damage due to feral pigs."

(DEH Website, 2005)

Council acknowledges its responsibility to enforce control of pigs under State legislation. Council endeavours to support the Community Feral Pig Trapping Program. This program is currently under review in order to better allocate resources. The traps bought for the program have since been absorbed by the community, and most are no longer at hand for future strategic efforts. Council only has two traps but is planning to purchase two more. Wet Tropics management will also have four traps available.
The main control programs for pigs shall be through trapping, poisoning, hunting and fencing. Particular attention will be paid to the type of attractant used in traps to avoid attracting cassowaries. All traps must be of a Department of Natural Resources and Mines approved type and must also be checked at least daily (Hyde, 2002).
Council provides pig traps to private landholders on request where pigs are coming out of the WHA or from Council land. Pigs on private land are the landholder's responsibility. This aspect of the program is basically to promote community relations.

Cats, Wild Dogs/Dingoes
No control programs are required at present, though reports of these animals should be monitored in case their numbers increase. Exceptions may be warranted in cassowary areas if feral dogs are known to be causing problems.

Cane Toads
Cane Toad control is unlikely to be effective because of toad numbers and the area they are distributed over. Biological control is being researched by the CSIRO.
"CSIRO scientists are working with gene technology to find a biological control method. So far researchers have selected several genes that could be used to interfere with the metamorphosis from tadpole to adult cane toad. They are currently looking at how specific these genes are to cane toads." …
"Australian ranaviruses are naturally-occurring viruses that can infect amphibians and fish. Researchers are working on weakening (attenuating) a ranavirus so that, if infected, other non-target amphibians and fish will not suffer from its effects. Toads themselves will be affected by the response to the toad-gene carried by the virus, rather than by the weakened virus itself." (CSIRO Website, 2005)
As it is vital that toads are the only species affected, it is not expected that any release of such methods will occur for another ten years, assuming that the research is effective. Testing to ensure native species are not affected will be time-consuming.

Indian Myna Birds
No actions exist or are planned in the Shire for Myna birds. Trapping to control the birds has proved unsuccessful in the past. The bird is not declared as a pest, which means there are no control programs in place. There is some public pressure towards getting the bird declared.

Rec: NR&M declare Indian Myna Birds a pest species - NR&M

Indian Myna Bird

2.1.8 Domestic Animals

Pressure

Cats, dogs and other introduced predators kept as pets place pressure on native wildlife where they are allowed to roam and hunt. When they are let loose they may turn feral.

There have been several recorded incidences of cassowaries being attacked and killed by loose dogs in urban areas. This is an issue also due to the use of dogs for pig hunting; they can indiscriminately kill native animals.

Council maintains records of complaints about dogs, both for those involving native animals, and for complaints of roaming dogs. This can be used as an indicator of the pressure likely from dogs in different areas.

Condition

Council picks up or deals with roaming dogs when they are reported (table 2.1.8).

Complaints are more likely in the more heavily populated residential areas so this data will be skewed. The smaller urban areas are not as likely to notice roaming dogs as in Innisfail. However, there do not appear to be great differences over the last two years.

Dogs therefore form a consistent pressure at this time, depending on the population of an area (reflecting dog ownership). Data collected can used to monitor responsible dog ownership - for instance if there are increased complaints in a region this may reflect community attitude to controlling roaming dogs.

Response

Establishing development conditions for properties near significant natural areas may be appropriate to help control dogs. This might take the form of excluding dogs, or enforcing fencing requirements.

Table 2.1.8 - Roaming Dog Complaints
Source: JSC

Area	2003	2004
Bingil bay	15	16
Boogan	1	0
Coquette Point	1	0
Cowley	3	4
El Arish	12	12
Flying Fish Point	25	32
Garradunga	5	10
Innisfail	380	320
Kurrimine	26	22
Mission Beach	19	10
Moresby	5	4
Mourilyan	28	22
Mundoo	2	10
Silkwood	13	17
South Johnstone	18	19
Wangan	20	20
Rural (outside residential areas)	32	36

Council has distributed responsible dog ownership information in the past; this should reoccur periodically and include information relating to cats.

Rec: Council develop conditions to restrict dog ownership in residential developments near significant natural areas - Council

Rec: The Health Department distribute further rounds of information on responsible dog ownership, including information to raise awareness of wildlife issues - Council

2.1.9 Climate Change

Pressure

Climate change is expected to affect biodiversity in the Shire and Worldwide, through the phenomenon of global warming. Changes in temperature, and consequently rainfall, will have the capacity to radically the conditions for, and thereby the extent of ecosystems in the Wet Tropics.

"The Wet Tropics World Heritage Area is especially vulnerable to climate change, being fragmented and surrounded by agricultural and urban development. The Area has a high level of locally endemic and spatially restricted species. These species rely on specialised and isolated habitats such as mountaintops. Models … predict that even minimal global warming of 1^{o} C will have significant consequences within the Area, such as extinction of some plant and animal species" (WTMA, 2004).

Current predictions by the Australian Greenhouse Office (2004) expect that such an average temperature change is probable by 2100, though higher changes are likely. Carbon dioxide and other greenhouse gas concentration levels will rise if current usage of energy inefficient technology continues. Unless whole of community changes occur, the Australian Greenhouse Office predicts that Queensland temperatures will rise above 1990 mean values by 0.3^{o} C to 2^{o} C by 2030, and 0.8^{o} C to 5^{o} C by 2070. Projected changes to rainfall varied in this report, with most research indicating an overall decrease for most years (between +5% to -15% per annum) For Cairns and the adjacent Shires, "the resultant conditions suggest a greater disparity between annual average evaporation and annual average rainfall resulting in a greater incidence of rainfall deficit in this region" Australian Greenhouse Office (2004).

Implications for natural areas are that warming will affect species limited to cool conditions, for example mountain ecosystems, which are extensive in the WHA. Temperature changes to seawater will affect the region's reefs. Changes to rainfall will also change the distribution of ecosystems. Adaptation will not occur rapidly and there will be major effects on the industries based on natural resources.

Changes to ecosystems and ambient conditions will further affect wildlife. It is thought that there will also be increased pest management problems, as introduced species from different climates thrive during the natural environment's decline.

The further effects of these scenarios are currently under research, by bodies such as Rainforest CRC, CRC Reef and AIMS.

Condition

Climate change has not progressed to a stage where there are obvious effects on biodiversity on land in the Shire, although coral bleaching on the reef is a phenomenon currently under investigation. Some species such as frogs in the Shire may be being affected by pollution, but this is not yet determined to be an important component of frog decline in the Wet Tropics.

Response

Current responses to climate change and pollution are discussed in the Water and Atmosphere chapter.

2.2 Flora

2.2.1 Rainforest Dieback

Pressure

Phytophthora cinnamomi is a fungus-like organism responsible for extensive forest dieback in southern and western Australia. It is also a serious economic threat to the forestry and agricultural industries. It is estimated that up to 14% of the Wet Tropics rainforest is potentially at risk, as the fungus is mainly found on granite soils at high altitudes. Two hundred patches have so far been identified in the Wet Tropics, but the disease has not caused any major ecological effects so far.

Condition

While *Phytophthora cinnamomi* is present in the rainforest and is associated with many small notches of dead rainforest, it's not yet known whether the organism poses a serious threat to the Wet Tropics. Research is under way at the Rainforest Cooperative Research Centre, with support from the Wet Tropics Management Authority (WTMA Website, 2005a).

Response

So far studies have found significant correlations between the human walking tracks and roads and distribution of the fungus. Management in the WHA will entail improving drainage, and restricting access along roads and tracks where there is potential for infected soils to be picked up.

Feral pigs and native animals are also considered to be vectors in movement of the disease, but the main cause at present is soil movement through attachment to footwear or on vehicles. QPWS and the WTMA can control potential movement of the disease by closing walking tracks and roads where necessary.

2.2.2 Threatened Flora

There are a number of threatened floral species present in the Shire. A list of these species is included in Appendix 6.2 (CD and Web version only). The appendix describes their classification under the Nature Conservation Act 1992 and the Environment Protection and Biodiversity Conservation Act 1999.

Pressures

Pressures on rare and threatened flora are assumed to be basically the same as for the regional ecosystems of which they are part. No specific pressures are known for any particular species in the Shire, but this is due to the lack of data.

Condition

Unfortunately there is no real data available on the actual distribution of any endangered plant species. Potential ranges according to ecosystem type can be projected, but it is not known how rare and threatened floras in the Shire are faring over time.

Considering the complexity and variety of the rainforest it is likely that the full diversity of flora in the Shire has not even been completely described.

Response

An effort to describe the range of rare or threatened species should be conducted over time. The distribution of important species in key areas should be monitored. Currently, threatened flora species are managed through protection of the regional ecosystems.

Council is able to propagate threatened species and utilise these in revegetation where appropriate.

Rec: QPWS continue to collate data on distributions and monitor threatened flora - QPWS

Rec: The Community Revegetation Unit collect seed and propagate endangered species for inclusion in revegetation work in appropriate areas - Council

2.3 Fauna

The Johnstone Shire contains a remarkable diversity of native wildlife. The Shire is within the Wet Tropics bioregion, which contains 28% of all of Australia's terrestrial vertebrate fauna. The dry sclerophyll forests contain the greatest diversity of vertebrate fauna, with species that are widespread across Australia. The rainforest has a lesser diversity, but many of these species are endemic only to the Wet Tropics.

"23% of all species within the region (143 species) should be regarded as very important species in a conservation sense: that is, they have a rare and threatened ranking and/ or are endemic to the Wet Tropics biogeographic region" (Williams et al. 1996).

Little information is available for invertebrate species. It is certain that there is an incredible diversity of invertebrates in the Shire, many of which have not even been scientifically described.

Pressures

Fauna in the Shire are under pressure from a number of factors. Past land clearing has reduced the habitat available for fauna - particularly on the coastal lowlands. Fortunately there are large reserves for fauna, though habitat in some ecosystems such as coastal wetlands and sclerophyll forest is restricted. Most rainforest ecosystem types are well represented in protected areas. It is not known whether there are any particular fauna with specific endemicity and dependence on any of the endangered ecosystem types. Other pressures on fauna are feral and domestic animals, the connectivity of habitat and barriers from infrastructure. Diseases threaten some animal types such as frogs and cassowaries.

Direct human impacts include destruction or interference

White Lemuroid Ringtail Possum—*Hemibelideus lemuroides*
Source: WTMA

Table 2.3a - Numbers of Species of Fauna in the Shire recorded by WildNet to date (i.e. incomplete listing)
Johnstone Shire - defined as a box with Latitude between: -17.4579 and -17.8819, Longitude between: 145.6855 and 146.1438
Source: Adapted from EPA (2005b)

Fauna in the Shire		Amphibians	Reptiles	Birds	Mammals
Species significance - under either State, National or International Conventions	**NCA**				
	Common	18	37	310	28
	Rare	4	3	11	1
	Vulnerable		2	6	
	Endangered	5		3	
	EPBC				
	Threatened				
	Vulnerable		1	2	1
	Endangered	4		1	
	Critically Endangered				
	Conservation Dependent				1
	Extinct	1			
	Significant Internationally	9	5	70	3
	Introduced	1	1	8	5
Total Number of Species Recorded to date in the Shire (minimum possibly present)		**28**	**43**	**341**	**34**

EPBC - Environment Protection and Biodiversity Conservation Act 1999, NCA - Nature Conservation Act 1992

2.3b - Endemicity of Fauna
Source: Adapted from EPA (2005b)

	Amphibians	Reptiles	Birds	Mammals
Introduced (International)	1	1	8	5
Queensland Endemic	12	15	21	1
Regional Endemic			1	
Intranational	7	21	96	8
Not endemic to Australia	8	6	206	20
Unknown			2	
Vagrant (unknown)			1	

with wildlife - such as shooting or removal. Permits from QPWS are required for any interference with native animals, including fauna on private property.

Condition
The EPA maintains a database for Queensland of positively identified fauna, by location. The database has only been established fairly recently, so it is not yet a complete listing. Table 2.3a describes fauna recorded to date in the Johnstone Shire. Very minimal information is available for insects and freshwater fish and is not yet comprehensive enough to include here. A complete listing of known fauna is included in Appendix 6.1 (CD and Web versions only).
The WildNet database will continue to grow until it eventually provides a comprehensive baseline for the diversity and distribution of species in the Shire.
The Wet Tropics Bioregion contains more known species than shown in Table 2.3a, but includes a variety of habitat types not in the Shire, such as those found on the Tablelands. Williams et al. (1996) define the Wet tropics as lying between Mount Elliot, to just north of Cooktown, and from the coast to the western edge of the wetter sclerophyll forests where they give way to more open drier woodlands. They define 49 frogs, 111 reptiles, 311 birds, and 95 mammals.
A comparison between these two data sources indicates that the number of amphibians, reptiles and mammals in the Shire can be expected to continue to increase as more records are collected.
Endemic describes species that only live within a limited area. Queensland endemic means only found in Queensland, whilst regional endemic means only in the Wet Tropics region. Regional endemicity for species in the Shire from current data appears lower than projected by Williams et al. (1996) who considered that 25% of rainforest vertebrates are endemic in the region. Species appear to be mainly Queensland and Intranational species. Many Wet Tropics species can also be found in Papua New Guinea and other overseas locations, particularly the birds and bats.
Again, the WildNet data is not a complete list of species in the Shire, only those recorded to date.

Response
QPWS
Staff increases in recent times have included a wildlife ranger. This person will specifically conduct a range of work on wildlife issues in the region, including strategic management, response to issues arising, and will be dealing with Damage Mitigation Permits - which are required by any persons needing to move or otherwise interfere with wildlife, even on their own property.

Threatened Species

2.3.1 Mammals

There are three mammals known to be present in the Shire that are classified as threatened species.
All are bats. They include:

- The spectacled flying fox *Pteropus conspicillatus*
- The diadem leaf-nosed bat *Hipposideros diadema reginae*
- The eastern bent-wing bat *Miniopterus schreibersii oceanensis*

Of these, the spectacled flying fox is receiving the most attention. Information for the other two species is not collected in the Shire.
It is not known whether these two species face any pressures in the Shire. Habitat for fauna in the Shire is reasonably well protected, so unless there are other particular pressures, these bats should have locally stable populations.

Spectacled Flying Fox
The spectacled flying fox is classified as 'vulnerable' under Federal legislation, and is considered significant under international agreements also. Colonies are regularly sighted in the Shire, but populations of this flying fox have

Spectacled Flying Fox - *Pteropus conspicillatus*
Source: WTMA

been declining over a number of years. The species is at risk because it is frugivorous and consumes agricultural fruit.
The EPA Threatened Species Unit conducts annual surveys and research. Recent years have seen a reduced but apparently stable population in the region. Stronger protection of the animal may have halted culling by farmers as a fruit crop pest, though there are still reports of tree clearing where the animals set up a roosting colony. This is also illegal under the EPBC Act.

Research is occurring through the Threatened Species Unit to assist in the preparation of management plans to protect this animal, and to find solutions for agriculture.

2.3.2 Frogs

Chytrid fungus
Chytridiomycosis, or chytrid fungus, is a disease of amphibians caused by Batrachochytrium dendrobatidis. The disease was first detected in 1978 in Northern NSW and SE Queensland and reached the Wet Tropics in the early 1990's. It is a contributing factor in what is considered to be a national decline in frogs.
"Several species of locally endemic rainforest stream-dwelling frogs, which were once distributed widely and in high numbers throughout the Wet Tropics, vanished within a very short period of time from altitudes above 300m. Four species, the Northern Tinker frog (*Taudactylus rheophilus*), Sharp-snouted Day frog (*T. acutirostris*), Mountain Mist frog (*Litoria nyakalensis*), and the Armoured Mist frog (*Litoria lorica*) only occurred at high altitudes and are now considered extinct except for the Northern Tinker frog which was rediscovered at two mountaintop locations in late 1996. Another four species, the Common Mist frog (*Litoria rheocola*), Waterfall frog (*L. nannotis*), Australian Lace-lid (*Nyctimystes dayi*) and the Green-eyed Tree frog (*L. genimaculata*) have suffered extensive declines, and are no longer able to be located from their high altitude habitats. However, they still persist in their lower elevation habitats" (WTMA 2004).
The EPA Threatened Species Unit have conducted research into frogs endangered by the fungus at Mission Beach (Lacey Creek), and in the Wooronooran WHA. This is ongoing.

Orange-thighed Tree Frog—*(Litoria xanthomera)* Source: WTMA

2.3.3 Birds

The "State of Australia's Birds" (Birds Australia, 2003) describes a comparison of changes in bird species diversity over the last twenty years. The Johnstone Shire area is one of high bird species richness, and has not demonstrated any change over this recent time frame. Bird species richness fell mainly in areas of Australia where clearing was significant. The bulk of clearing in the Shire occurred more than twenty years ago.
The Shire contains a long list of birds that are significant under various conservation acts - State, National and International. Good information is not available to describe the populations of these species, except for the cassowary, which is the focus of a great deal of management work.
However, bird watchers in the Shire regularly record bird species, so there is active monitoring occurring over time. A database should be established to form an early warning system if there are sudden declines in any bird populations in the Shire.

Sea Birds
Many of the birds listed as significant are migratory sea birds significant under international agreements. Nesting areas in the Shire include the offshore Barnard Islands.
QPWS are engaging additional staff based in Innisfail to manage these islands as well as the marine zones. They will close the islands to visitation during nesting seasons through the establishment of temporary seabird protection zones. Feral animal control on the islands will focus on eradicating rats to further assist in seabird protection and nesting success (see section 2.1.5 - offshore islands).

Rec: Council and QPWS enlist birdwatcher groups to establish an annually comparable database for bird species and locations in the Shire - Council, QPWS, Landcare

Cassowaries
Pressure
The human presence in cassowary habitat areas has brought a number of pressures on these birds. This includes habitat clearing, collisions by vehicles, and attacks by domestic dogs. Feeding of the birds by residents and tourists also occurs and has the disadvantage that it attracts cassowaries to road or urban areas where they more at risk. Also the birds can become 'problem birds' when they become aggressive in demanding food they have been trained to expect.
Introduced feral pigs impact on the birds by consuming eggs and competing for food.

The main pressure acting on cassowaries along the coast is the availability of habitat. Cassowaries occupy territories, as they require large areas to forage successfully. Much of the cassowaries diet is seasonal fruit. Territories are also established as part of mating behaviour. Several males will set up separate territories, which are overlapped by one female's larger territorial range. Territorial border disputes between males during mating season are fierce with extended chases between birds occurring.
Cassowary chicks are raised by the males but are forced to leave the area when they reach maturity. Unless the juvenile birds can find and establish their own territorial areas they do

not survive.
This makes available habitat the key issue in determining cassowary numbers. Further reductions in habitat are a significant hazard to the viability of the cassowary population.
It is likely that the shape and connectivity of habitat will also determine whether cassowaries can successfully utilise it as a territory. Both the extent and structure of habitat remaining is under threat from development.
Dry seasons in the rainforest or cyclone events can also adversely affect cassowaries, when their available food sources from fruit are reduced.
Cassowaries are also affected by disease. It is known that some birds have respiratory diseases. Some birds can survive this, but then pass the disease on. An example is one male bird at Mission Beach known to raise a chick each year that subsequently succumbs to the disease before reaching maturity. Further research is required into the cassowary diseases.

Condition

Cassowary numbers are not known. QPWS have positively identified 25 known birds in the region. C4 estimate a number of approximately 40 adult birds in the Mission Beach area.
Studies carried out in 1992-1998 in the Daintree region determined that most cassowaries maintain a home range of 1-3 km^2 (Moore and Moore, 1998). Similar densities occurred at Mission Beach. Moore and Moore (1998) estimated a population of 76-81 adult birds in the Mission Beach area, from coast through to hinterland, based on survey work and previous studies. They note that habitat clearing has reduced this population from previous levels determined by Bentrupperbaumer (1992).
Whilst there are large natural areas around Mission Beach, the cassowaries do not utilise the parts that are steeply sloped mountainous areas (Allanson, pers comm.). They rely upon a reasonable grade of land, and the types of food-bearing habitat on these areas. They are primarily a coastal species.

A program is under development by the EPA Threatened Species Unit to monitor the population by sampling DNA from cassowary droppings. Unfortunately, some problems have so far held this program back; as a number of rainforest fruits in the bird's diet contain chemicals that degrade the DNA samples.

There is speculation by QPWS that a lack of genetic exchange may be affecting some portions of the cassowary population. Some birds at Etty Bay are showing reduced wattle size, which could be an effect due to inbreeding. However, without genetic sampling over the regional population it is not possible to determine whether inbreeding is occurring.

C4 record the number of sightings reported, mainly by tourists, of cassowaries in the Mission Beach area. The difficulty in interpreting this information is that it does not represent actual numbers, and may be a better indicator of visitor interest. However, the sightings are important in that they provide an early warning system - significant drops in the number sighted will be cause for concern.

Cassowary - *Casuarius casuarius johnsonii* Source: C4

Table 2.3.3a - Cassowary Sightings Source: C4 (2005)
Note that *Sightings* will depend on the response from tourists and locals and will vary according to visitor numbers or community interest.

Recorded Cassowary Sightings—Mission Beach	2001	2002	2003	2004
Adult Males positively identified (i.e. with chicks)	nd	193	118	81
Adults (unidentified sex)	246	188	214	136
Sub adults	112	137	124	68
Chicks	97	264	89	111
Total	**455**	**782**	**545**	**396**

Because the cassowary population is dependent on available territory this is a better descriptor of the likely numbers of birds. A slightly greater number exists than the available habitat can support, due to unnatural food sources. This includes waste fruit at banana plantations or orchards. This means there are some fringe-dwelling cassowaries that do not have established territories. These birds won't breed successfully, but do form a reserve in the case of mortality of established birds.

QPWS record cassowary deaths in the Mission Beach area. Not all incidents are recorded, as birds involved in vehicle collisions and dog attacks usually enter the rainforest, where they eventually succumb to their injuries out of sight.
A total of 14 birds were reported killed in 2004 in the Mission Beach area (Allanson, pers comm.), mostly from road deaths. No dog attacks were reported during the year. It is likely that increased public awareness of the birds has raised the number of deaths being reported (Allanson pers. comm). Table 2.3.3b describes cassowary deaths recorded since 1993 by C4. These are mostly motor vehicle deaths and dog attacks, but also include deaths from malnutrition, which possibly indicate difficulties with successful

Despite cassowary deaths from human causes, it is thought that recruitment of juvenile cassowaries into the population is currently still good. Problems may eventuate where females are lost from isolated populations.

Response

The cassowaries are an iconic species, and their endangered status has resulted in responses from a great number of agencies, and the community.

EPA

The EPA threatened species unit will include cassowaries as a priority in a local area conservation plan for wildlife in the Shire. Cassowary mapping is being updated in 2005 along with better mapping of regional ecosystems. A research project may be initiated to radio track cassowaries and determine their natural ranges and behaviour.

QPWS

QPWS are the lead agency and facilitate most processes regarding cassowaries. QPWS manage the cassowary rehabilitation facility at Garners Beach. Sick and injured birds are kept for a few weeks at the facility until they can be returned to the rainforest. Orphaned chicks can have a longer stay - it can take over a year to raise a cassowary chick to the age where it can fend for itself. Four birds passed through the facility in 2004 - two orphaned chicks and two sick/ injured birds.

The facility will receive increased funding in 2005, with contributions from Australian Geographic and the Department of Main Roads. The facility was initiated with help from funding by the Cassowary Advisory Group (CAG). Development of the facility over time now means that four cassowaries can be housed and managed with minimal risk to the carers, in a revegetated and open environment.

The community responded tremendously well to QPWS's campaign to stop the feeding of cassowaries. QPWS conduct this awareness promotion because fed birds can become aggressive over time, demanding food from humans. Visitor locations and accommodation, shops, schools and individuals were targeted with educational information and signage. Council provided covers for bins at Etty Bay at QPWS's request.

As a result, the number of incidents with cassowaries dropped off dramatically from 155 complaints in 2003 to only one complaint in 2004.

No problem birds needed to be relocated, which is down from 1 bird in 2003. QPWS avoid relocation where able as it is not a good solution for the bird. Modifying their behaviour is the preferred option.

Table 2.3.3b - Recorded Cassowary Deaths Source: C4 (2005)

Year	No.	Notes
2004	9	3 adult females - all motor vehicle 2 subadults - both motor vehicles 4 adult males - 2 motor vehicle, 1 ran into fence/ broke spine, 1 unknown/major injuries
2003	8	5 chicks - 1 killed in a dog attack, 3 of natural causes, and 1 unknown cause 2 sub-adults - both killed in vehicle collisions 1 adult female - unknown causes
2002	4	1 adult 3 sub-adults
2001	6	2 adult females - motor vehicles 4 adult males - motor vehicles
2000	2	1 adult - unknown 1 subadult - unknown/emaciated
1999	10	1 adult - unknown 2 adult females - motor vehicle 1 male adult - malnutrition 4 subadult - motor vehicle, 2 chicks - dog attack/unconfirmed
1998	5	1 adult - motor vehicle 1 adult female - motor vehicle 1 adult male - dog attack 1 subadult - motor vehicle 1 chick - disease
1997	3	1 adult male - motor vehicle 2 subadults - 1 motor vehicle, 1 unknown
1996	4	1 adult - unknown 1 female adult - unknown 2 sudadult - dog attacks
1995	3	1 adult male - motor vehicle 2 subadult - motor vehicles
1993	3	1 adult - unknown 1 adult male - motor vehicle 1 chick - motor vehicle

QPWS managed temporary road signage during 2004. This scheme targets areas where cassowaries have recently been reported crossing roads, or utilising road edges. Drivers are more likely to respond to these signs, as permanent signs lose their effect over time when drivers become complacent after a long period of not sighting a bird near or on the road. Unfortunately, many of the temporary signs have been stolen, most likely as souvenirs. Managing placement of the signs has proven too time-consuming for QPWS. Further plans will be explored in 2005, to potentially involve volunteers in the community

QPWS will continue to educate the public on road awareness in cassowary areas, with a focus on public safety in preventing collisions, as well as to preserve the birds.

Department of Main Roads

The Department of Main Roads completed upgrades of the El Arish-Mission Beach and Tully-Mission Beach roads in 2003. The upgrades have improved visibility and are reported to have reduced collisions with cassowaries. The management plan associated with the road upgrades is geared to respond to reports of hotspots where cassowaries are being killed regularly. Monitoring is being conducted at cassowary crossing areas.

Permanent signs are to be installed at Lacey Creek, where cassowaries have continued to be killed in road incidents. A wildlife culvert has been installed at Lacey Creek, within an existing creek road overpass. A cassowary on the Tablelands has been recorded utilising a wildlife culvert. Monitoring is occurring to determine whether the cassowary in the area will utilise this. So far this has not been the case at Lacey Creek, though the tracks of other wildlife have been recorded in sand pits and through motion detecting cameras.

C4

C4 are able champions of habitat preservation and have demonstrated they are willing to take developers and the Council to court, in order to challenge decisions and preserve the natural values of the Mission Beach area.

It is important that C4 are willing to oppose development decisions in this way, as all too often development goes ahead with little regard for local community opinion. C4 are determined to preserve both the natural environment at Mission Beach, in order to maintain the area's character for residents, to attract sustainable tourism, and to provide habitat for a diverse ecosystem of wildlife.

C4 encouraged the developers of the Oasis Resort to achieve better environmental outcomes by incorporating cassowary management advice from QPWS. These included widening of the original planned cassowary corridor, constraints on domestic cats and dogs belonging to residents, and fencing of the developed area. Council improved the connection to the natural habitat corridor.

Involvement in the drafting of the Shire Plan resulted in good outcomes constraining development at Bingil Bay. Block sizes were kept larger, multi-residential blocks and hatchet shape blocks were no longer included in the plan. Bicton Close became a conservation area.

C4 are still concerned about Council's support for the development of more multi-residential blocks along the Mission Beach foreshore and have courted the Department of Environment and Heritage (DEH) to support them where development decisions are contrary to preservation of the area. This will include lodging for registration of areas under the EPBC Act, though this will formally be subject to further community consultation.

The C4 Centre also plays other roles. The Centre itself is an interpretive centre and gift shop, and includes a nursery for native plants. C4 maintain the Arboretum adjacent to the Centre, which will be further extended northwards through to the bridge. C4 would like to continue this park through to the end of the beach. The Centre and Arboretum receive most tourists passing through Mission Beach, and school groups regularly visit for education and activities. The nursery is extending its range, which consists primarily of cassowary food trees, but also stocks other native plants suitable for gardens in the new residential areas.

Linken is the most recent chick to be rehabilitated at the Cassowary Rehabilitation and Relocation Program. Linken was separated from his parent, a male bird who was having trouble raising his chick. QPWS received numerous calls reporting Linken's father, from residents who were concerned to see this bird limping continually. QPWS rangers investigated and found he was having a hard time keeping up with young Linken, and finding enough food for him. It is thought that he has a form of osteoporosis due to his advanced years. Neither of the birds was expected to survive.

Separating them proved beneficial to both. Linken's father has since recovered his health well, and Linken is growing at a pace under QPWS's care. He will be released to the wild when he reaches suitable maturity as a sub-adult. Previous SoE updates have featured photos of Lucky and Stretch, both of whom have been successfully released to the wild after rehabilitation. Stretch's release was featured in Australian Geographic (Oct - Dec 2004).

Council

Council use critical cassowary habitat mapping to determine conservation covenants and bonus development rights, where cassowary habitat is preserved or restored. Revegetation progresses to re-establish linkages and corridors. Council also maintains cassowary signage on Council roads. A road management strategy for wildlife is in progress

Rec: Council notify C4 of upcoming developments and decisions to better involve them as representatives of the Mission Beach community, and as a resource to Council for community negotiation - Council

Rec: Council provide a number of temporary road signs for Council roads in cassowary areas, to be managed by community volunteers to be sourced by QPWS - Council, QPWS

Rec: Develop a sustainable tourism strategy for the Shire to define development limits and maintain the natural resource - Council, Consultant

Rec: Further extend Mission Beach Park from C4 Centre through to the end of the beach, and integrate with walking tracks. Coordinate with C4 to manage including revegetation and maintenance - Council, C4

Rec: EPA Threatened Species Unit initiate population monitoring of cassowary population - EPA Threatened Species Unit

Rec: Research into cassowaries be encouraged by university groups; including behaviour, the status of populations, inbreeding vulnerability, and diseases - QPWS, EPA Threatened Species Unit

Rec: Restrict urban development and place a population cap on Mission Beach and other coastal areas where significant cassowary populations exist - Council

Rec: Wildlife road management be prioritised in cassowary areas - Council

Boyd's Forest Dragon—*Hypsilurus boydii*

2.3.4 Reptiles

Three exclusively terrestrial reptiles in the Shire are significant under conservation acts. They include:

- The yellow-naped snake Furina barnardi
- Two skinks - Coeranoscincus frontalis and Eulamprus tigrinus

There is no information relating to the distribution of these species within the Shire. It is assumed their populations are reasonably stable within protected areas. No management actions currently occur. Crocodiles are considered under the aquatic reptiles described in section 3.3.2.

Rec: QPWS develop monitoring for conservation significant fauna in the Shire, and identify potential pressures occurring - QPWS

3. Aquatic Biodiversity
3.1 Aquatic Ecosystems

Aquatic ecosystems in the Shire are currently affected mainly by practices on the land, including agriculture and urban development, pollution or water extraction. Fishery harvests, the risk of spills of pollution from shipping, and tourism all impact directly on the water.

3.1.1 Inland Waterways

Pressure

Russell and Hales (1993) identified agricultural chemicals and soil sediments as non-point source pollutants affecting biodiversity in the Shire's waterways. Nutrification can alter waterway ecologies by promoting abnormal algal growth, which lowers oxygen levels for fish and aquatic invertebrates. High sediment loads cause turbidity in waterways, resulting in low light levels, and also clogging the gills of aquatic fauna. Nutrients further affect the ecology of estuaries and coastal waters.

Certain agricultural chemicals can have detrimental effects on species in the aquatic environment, possibly resulting in behavioural abnormalities or reduced reproductive success. Certain species may be lethally affected if the chemical levels are too high.

There is evidence of negative impacts from herbicides on seagrass and mangroves in the estuarine reaches of the Johnstone River (see aquatic flora - section 3.2).

Condition and Response

The condition of waterways is further explored in the Water and Atmosphere chapter section 3, and responses are typically based upon sound Land Management.

No specific information has been collated of any effects on particular species or ecosystems. However, it is obvious that some of the Shire's smaller watercourses are little more than drains and no longer have a natural ecological function.

There is no data yet available to indicate any particular species have been adversely affected. Work by AIMS is currently ongoing to determine the ecotoxicology of waterway pollutants to fish species in the Johnstone River, with a focus on barramundi.

3.1.2 The Great Barrier Reef

The Great Barrier Reef (GBR) was declared a World Heritage Area in international recognition of the extraordinary biodiversity of this ecological natural wonder. The reef is the largest natural feature on earth, stretching 2,300 kilometres from the northern tip of Queensland to just north of Bundaberg.

Pressures

Pressures on the biodiversity of the reef include:

Fishing

Overfishing changes the proportions of fish species present in the ecosystem. This may shift the balance in the favour of certain prey species that in turn further change the balance of the ecosystem. The effect of fisheries on individual species populations is discussed below in section 3.3.3 - aquatic fauna.

Tourism

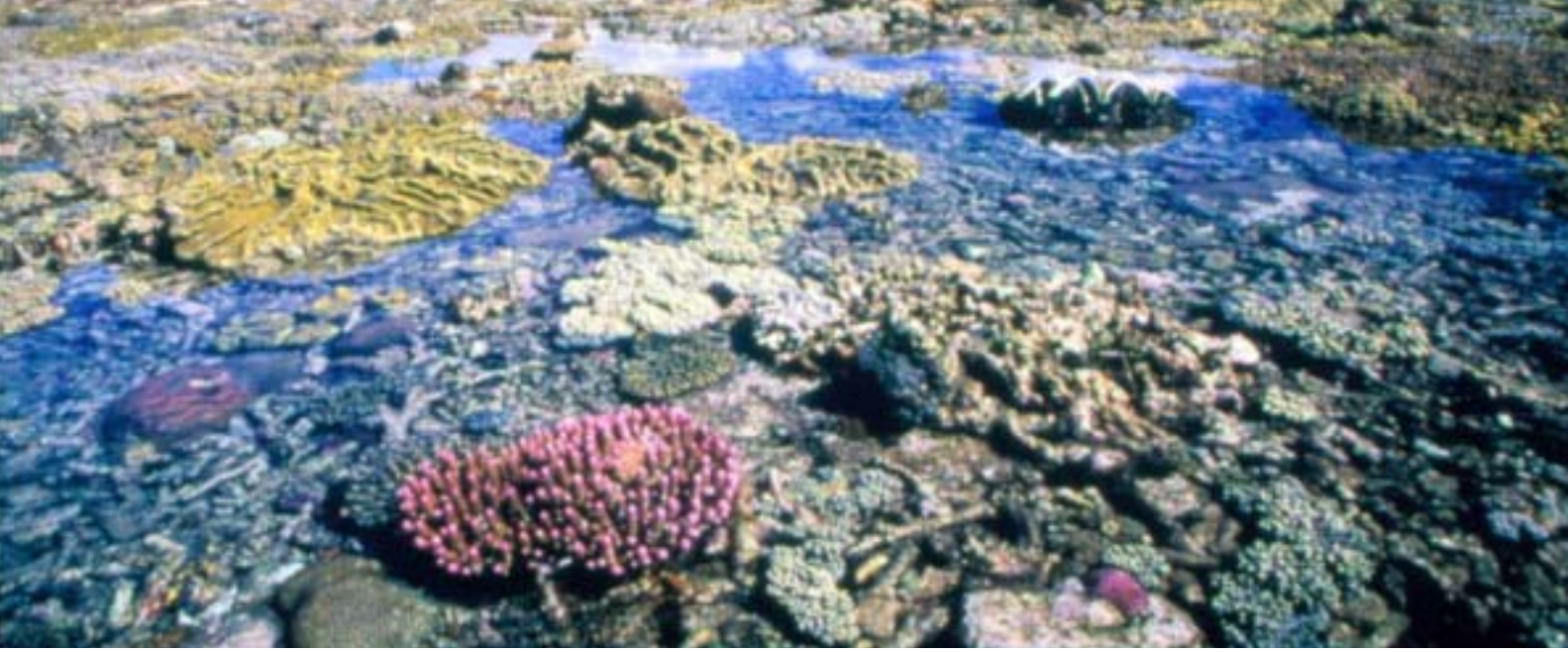
Tourism can impact adversely on the reef when it is badly managed, and an excess of visitors is allowed, which causes damage over time. At present this is not a problem in the Shire, but increases to tourism need to be managed.

Nutrification, Sedimentation and Turbidity

Increased nutrient levels entering coastal waters from poor land management can cause changes to the reef's ecosystem function by promoting the growth of algae and marine plants. This results in other aspects of the ecosystem becoming out of balance.

Sediments affect coastal waters, particularly during flood plume events. Lowered light levels result from a mix of sediments in water - this effect is called turbidity. Excess sediments can also impact by burying sessile marine organisms on the ocean floor. Nutrients such as phosphorous are carried attached to sediment particles.

It is currently expected that nutrients and sediments will most affect the inshore reefs and sea grasses of the GBR, but there is evidence that during flood plume events, sediments can be carried up to 10 kilometres offshore.



Reef at low tide

Crown of Thorns Starfish (COTS)

Crown of Thorns Starfish (*Acanthaster planci*) is the major factor affecting coral coverage in the Innisfail sector, as well as elsewhere on the GBR. The Innisfail sector is currently classified as recovering from COTS outbreaks by the Australian Institute of Marine Science (AIMS Website 2005).

Raised nutrient levels in the ocean from human activities on land have been postulated as a contributor to COTS outbreaks. Nutrient availability promotes the growth of oceanic algae known as phytoplankton. These phytoplankton are food for many reef species at the early stages of development, when they are free-floating oceanic larvae. Increasing the survival rate of larval COTS because of more available food results in greatly increased adult starfish population. Doubling the levels of phytoplankton is estimated to contribute to a tenfold increase in the survival of the COTS larvae.

Conversely, it has been proposed that fishing and shell collection have reduced numbers of COTS predators. Among these predators are the giant triton shell, the humphead Maori wrasse and some emperor fish. In this scenario increased adult survivorship greatly increases the success of the population over time.

Coral Diseases

Coral diseases on the GBR are not as great a problem as on coral reefs elsewhere in the world. Some reefs, such as those in the Caribbean, have been greatly affected by diseases. The AIMS conducts continual monitoring of diseases throughout the GBR.

Coral diseases have been linked to nutrient availability. Studies on Caribbean corals suggest that the infectious agents of coral diseases can utilise the nutrients available in the water (New Scientist Website, 2004a). This increases their survival and their potential to affect corals.

Another effect seen on the Caribbean is the possible effect of sewage as a cause of infectious coral diseases. A study into a coral disease discovered the cause was a bacterium commonly found in the human gut. However, a conclusive link to human pollution has not been established.

The potential for human activities to contribute negatively to reef health through diseases may pass a threshold if sewage pollutants increase in concentration. Sewage treatment at Innisfail will undergo upgrades in 2008, but the majority of rural areas have only septic systems.

Climate Change and Coral Bleaching

Coral bleaching is a world-wide phenomenon. It is thought that climate change and increasingly hot temperatures are raising sea temperatures. Corals are affected when these temperatures exceed the level the coral can tolerate. Corals are a symbiotic lifeform, which depend upon photosynthetic algae called *zooxanthellae* to keep them supplied with nutrients. At higher temperatures these symbiotic algae can die, resulting in the characteristic bleached coral, which has expelled its algal symbionts. High intensity light levels, low salinity and pollutants can also exacerbate coral bleaching.

Historically however, over the last 220 million years corals have continued to exist throughout very varied sea temperatures. There is some evidence to date that corals may form relationships with new, more thermotolerant strains of algal symbionts during elevated sea temperatures (New Scientist Website, 2004b). But, as these symbionts change, there may be radical changes to the composition of coral on the reef.

Unusually high water temperatures in 1998 and 2003 caused bleaching across the GBR. Inshore reefs were the most badly affected.

The bleaching phenomenon is currently under investigation to examine the thermo-tolerance and adaptability of corals to climate change.

Pollutants

There is not a great deal of information on the effects of chemical and heavy metal pollutants upon corals. However, research in 2003 by Clare Bennett of Melbourne University (New Scientist Website, 2003) showed that even low levels of copper (below that previously recorded around inshore reefs in the GBR) could seriously affect the success of coral spawning. Copper levels of only five parts per billion reduced the recruitment of coral larvae maturing into juveniles by 30%. Sources of copper can be found in antifouling paints as well as in industrial runoff.

The effects of other heavy metals on corals have not been extensively studied. Recent studies of water quality in the Johnstone estuary (WBM Oceanics 2005 - see Water and Atmosphere chapter, section 4.6 - sewage treatment plant)

did not find significant levels of heavy metals. Aluminium was only once recorded out of twenty sample sites. However, zinc was generally present at low levels for most sites, and exceeded ANZECC 2000 water quality guidelines at one site. Sediments in the estuary did contain trace amounts of a range of heavy metals, which occasionally exceeded ANZECC guidelines for nickel and chromium.

Shipping Risks and Introduced Organisms

Shipping and mariculture activities cause two potential problems. Firstly there is a risk to the aquatic environment when there are shipping accidents causing spills of pollutants.

Secondly, shipping carries ballast water from around the world - leading to the introduction of exotic species into Australian waters when these ships reduce ballast before entering port.

Flood Plumes and Lowered Salinity

Flood plumes are a natural phenomenon. It is thought that the lowered salinity in the flood plume could place an additional pressure on the inshore reefs when they are already affected by other adverse factors.

Condition

Reef Coral Coverage

The AIMS long-term Coral Coverage Monitoring Program assesses the health of coral reefs along the length of the Great Barrier Reef. The program records the amount of coral present on different reefs and details the affecting factors such as Crown of Thorns Starfish (COTS), as well as coral diseases, and coral bleaching. Whilst the monitoring program also examines trends in the presence of different fish, this work is not conducted in all sections of the reef, and no information is available for the Innisfail section.

Since 1986, reefs in the Innisfail sector have been affected mainly by COTS, and to a minor extent coral bleaching and diseases. Cyclones have also been a lesser contributor to reduction in coral cover.

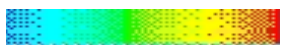
At present, coral coverage in the Innisfail sector is low, the lowest for the entire GBR (Figure 3.1.2a). The sector has had large COTS populations, as well as being part of a mass bleaching event across the GBR in 1998.

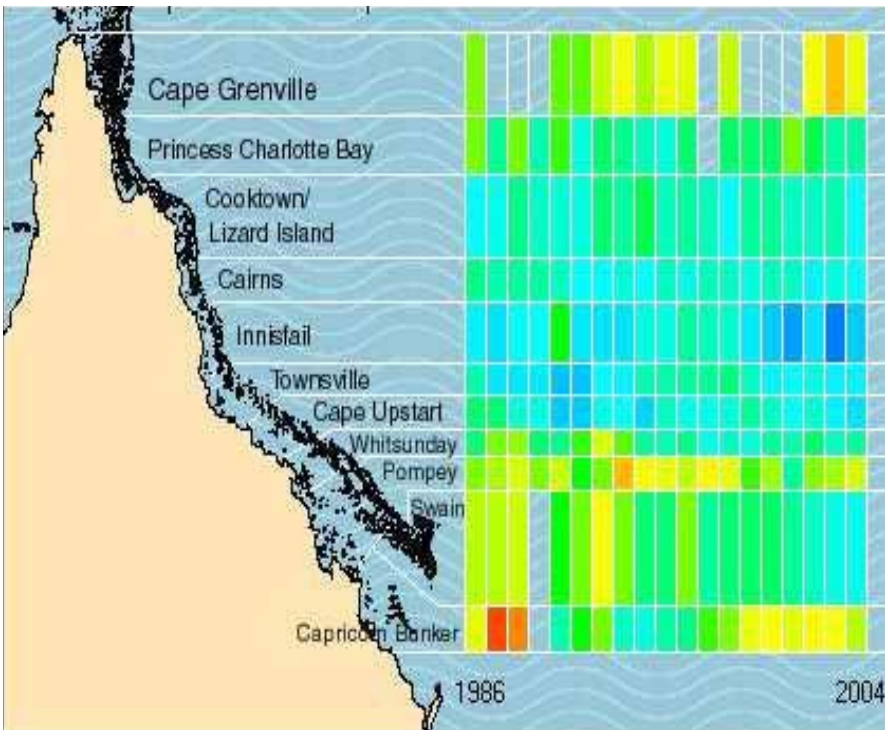
COTS, coral bleaching, and coral disease are no longer problems present in the Innisfail sector. The reefs here are currently classified as recovering in 2004 with reduction in COTS numbers.

It is hoped that improvement in land management practices will become evident over time through improved coral coverage. There have been some major steps taken, such as green trash blanketing on cane farms. This will be particularly evident if COTS outbreaks prove to be nutrient related.

Figure 3.1.2a - Average Percent Cover of Hard Coral (Broadscale survey) for each sector (outer, middle and inner reefs combined) Source: AIMS Website (2005a)

Not all reefs in a sector are surveyed each year.





Appendix 6.3 (CD and Web versions only) includes descriptions of the individual reefs surveyed by AIMS (Sweatman et al. 2003) "Long-term Monitoring of the Great Barrier Reef – Status Report No 6 2003".

Rec: Lobby Reef CRC to establish research in the Shire's coastal waters, possibly utilising facilities at the TAFE - Council, JRCMA, FNQNRM, NR&M, QPWS, TAFE

Marine Water Quality

Water quality varies enormously along the coast during weather events such as cyclones. This is discussed more fully in the Water and Atmosphere chapter. Included are the results of chlorophyll monitoring, as the phytoplankton described by this indicator form a major part of the base of the aquatic food chain. Changes to this trophic level may have repercussions through promotion of some species, which further affects the rest of the ecological web.

Responses

Great Barrier Reef Marine Park Zoning
Significant changes occurred to the protection of the Great Barrier Reef in 2003. The Marine Park Zoning Plan was radically altered to increase the area protected, and to ensure that areas representing all types of biodiversity on the Reef were included. These representative areas include all the differing habitats and species communities of the Reef. A minimum of 20% of each type of representative area will be protected by 'no-take' green zoning which prevents impacts from fishing or other extractive utilisation. Overall, approximately one-third of the Reef is now protected. The zoning plan for the region adjacent to the Shire can be seen at http://www.reefed.edu.au/rap/pdf/mpz_07.pdf.
DPI&F are responsible for patrolling the marine parks, and controlling the commercial and recreational fisheries. QPWS are also employing extra staff to manage the offshore islands, and to help to patrol the Shire's green zones.

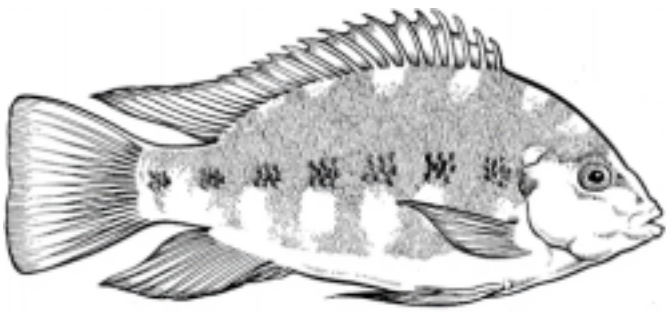
Nutrients and Sediments
Work towards reducing impact from nutrients and sediments is based upon land management practice onshore. These practices are examined in the Land Management chapter, mainly in section 7.

Shipping
Reef CRC have initiated research into organisms introduced to marine environments. The primary goal of this work will be to identify the distribution of introduced organisms, and identification of high-risk taxa. The Ports Authority has response plans in place should there be any release of pollution from a shipping accident.

3.1.3 Introduced Species

Tilapia
Two species of Tilapia fish have been introduced to waterways in Queensland. The Shire has *Tilapia mariae* , a fish which has achieved extraordinary success in the Shire's waterways, being an aggressive species that will chase other fish out of territories it establishes. This exacerbates its effect of competing with native fish for food. Tilapia are omnivorous, mainly eating plants and algae, but will also eat insects and other food.
"Tilapia are sexually mature at three years of age or less in favourable conditions. They are able to reach sexual maturity at small sizes in poor conditions or when they are overcrowded. This is known as 'stunting' and results in large populations of mature fish with small body sizes.
…Tilapia have successfully invaded and dominated many aquatic habitats due to their highly efficient reproductive strategy, simple food requirements and their ability to live in a variety of conditions. Unlike many native freshwater fishes, tilapia are able to retreat downstream into highly saline waters during drought and move back upstream when conditions improve. They affect native species when competing for habitat and food, behaving aggressively and disturbing plant beds when building nests." (DPI&F Website, 2005a).
Because Tilapia are hardy fish, resistant to low oxygen levels and salinity, they are often found in cane drains around the Shire's waterways.

Figure 3.1.3 - Black mangrove cichlid (*Tilapia mariae*)
Source DPI&F Website (2005a)



Movement of Tilapia is restricted by the DPI&F. However, this has not stopped the fish from spreading into other rivers in the region.
"It is illegal to possess, rear, sell or buy Tilapia. It is also an offence to release Tilapia into Queensland waterways or to use them as bait, live or dead. Penalties up to $150 000 apply" (DPI&F Website, 2005a). The fish cannot be used as bait because of the risk that eggs may infest other waterways.

Response
There is no control response currently formulated to deal with Tilapia. These fish are an aquaculture fish in other countries - it has been suggested that placing an economic value on the fish may encourage control. However, this might encourage people to introduce them to un-infested areas. It is possible for individuals to catch large numbers of the fish with minimal effort in a day. A strategy of this nature would have to be rigorously licensed and controlled.
'Muling' the fish by introducing genetically modified males capable of fathering only more male offspring, is a potential solution requiring research.

Rec: DPI&F establish a control and eradication program for Tilapia - DPI&F

3.2 Aquatic Flora

3.2.1 Seagrasses

Seagrasses have undergone a worldwide decline, further affecting the species they support and ultimately industries such as fisheries. Johnstone Shire has significant seagrass areas, it is important that these areas are conserved and protected from adverse human impacts.
Seagrass is important habitat for juvenile prawns, finfish, turtles, and dugong, and hence are an important primary trophic layer for the ecosystems they support. Sea grass beds are considered an important cultural food source area by the Ma:mu people.

Pressure

Seagrass is potentially affected by water quality including turbidity from sediments, which reduces available light levels. This will limit the area seagrass can grow if turbidity persists for extended periods.

Another problem is the potential effect of herbicide concentrations in water, especially persistent herbicides such as Diuron, which can be carried attached to sediments, to settle in river estuaries or further into the GBR lagoon. Research by Haynes et al. (2000) demonstrated that the herbicide Diuron reduces seagrass photosynthesis at levels of concentration significantly lower than those found in the Johnstone estuary; in samples of estuary sediment (measured at 10.1 µg/kg sediment). Diuron is a herbicide utilised extensively in the agricultural industries. It has been under review by the National Registration Authority (NRA) for Agricultural and Veterinary Chemicals (See Land Management chapter, section 3 - pesticides).

The levels of herbicides in waterways need to continue to be monitored in the Shire's waterways. Diuron is commonly detected by Council's Health Department's monitoring in some of the Shire's smaller waterways.

Trawling is another human activity that can negatively impact sea grass meadows. "Most shallow-water seagrass habitat is protected from this potential impact …and dense deepwater seagrass habitat is usually avoided by trawlers because the seagrass fills and clogs the nets. Nevertheless, sparse deepwater seagrass habitat is potentially at risk from damage by trawlers" (GBRMPA, 1998).

A significant pressure that could affect sea grass meadows is proposed dredging of river systems. This can directly affect sea grass meadows if inappropriately located, but also creates sediment plumes that block out the light. Dredging is not a good idea where maintenance of dredged areas requires continual work. Dredging has been proposed for various reaches of the Johnstone River without consideration of further ecological effects.

Condition

Seagrass in the Shire is currently regularly monitored only at Mourilyan Harbour by the Ports Corporation of Queensland (PCQ) as part of the assessment of potential impacts from the Mourilyan Port. The monitoring has been ongoing since 1993. To date there have been no impacts registered that are attributable to the function of the Port.

"The area of seagrass in Mourilyan Harbour typically varies between 65 to 71 ha in summer, and 47 to 68 ha in winter. Meadows in Mourilyan Harbour are mostly low biomass along the shallow banks within the harbour and the periphery of Armit and Walter Creeks. High biomass meadows are located along the Seaforth Valley mangrove fringe, the sand banks between Armit and Walter Creek mouths, and adjacent to Lily and Bradshaw Islands." (PCQ Website 2005).

In December 2002, seagrass monitoring reported a significant reduction in intertidal *Halophila* sea grass on Seaforth Bank. The DPI&F considers this to be due to regional climactic conditions, especially low rainfall. *Zostera* seagrass meadows remained stable and healthy. Results from DPI&F monitoring in 2004 (McKenna et al. 2005) showed that the seagrass meadows had recovered considerably. Monitoring has so far shown that the seagrass meadows are capable of increasing their cover within relatively short periods of time. It is considered that the seagrass meadows are capable of rapid recovery when impact pressures are removed.

Seagrass can be found in patches all along the coast, though only a small percentage has thus far been mapped. Better information currently exists for the estuaries of the Johnstone and Moresby Rivers and Maria Creek, which also support sea grass habitat. Seagrass has been reported as absent from the Liverpool Creek estuarine area (Russell and Hales 1997).

Mapping of seagrass conducted between 1984 and 1988 is available from DPI&F Website (2005b) on the fisheries CHRIS website, (http://chrisweb.dpi.qld.gov.au/). This mapping describes areas of sea grass at Mourilyan and the nearby coast, around the North Barnards, between Kurrimine and the South Barnards, as well as extensive areas around Dunk Island.

Table 3.2.1 - Estuarine Seagrasses in the Shire
Source: Adapted from Zeller (1998)

Estuary	Dominant Seagrass Species	Juvenile Commercial Prawn Species Sampled – Dependent upon sea grass
Johnstone River	*Zostera capricorni*	*Penaeus esculentus, Penaeus semisulcatus, Metapenaeus endeavouri, Metapenaeus ensis, Penaeus latisulcatus, Penaeus monodon*
Moresby River	*Halophila decipiens, Halophila ovalis and Zostera capricorni*	*Penaeus esculentus, Penaeus semisulcatus, Metapenaeus endeavouri, Metapenaeus ensis*
Maria Creek	*Zostera capricorni*	*Penaeus esculentus, Penaeus semisulcatus, Metapenaeus endeavouri, Metapenaeus ensis, Penaeus latisulcatus, Penaeus monodon*

Responses

Current monitoring at Mourilyan will determine if there is cause for concern in the future. Mapping of seagrass areas along the coast and out at sea is being conducted by DPI&F.

Unfortunately, there is no regular testing for Diuron in the Shire's major rivers. Council's Health Department do monitor for the herbicide in a number of smaller waterways. It is hoped that this chemical will be restricted in its commercial usage, as it is especially persistent in soil types common in the west of the Shire. Landholders in the Shire should be educated as to better management of this herbicide.

Rec: An Ecological Impact Assessment be conducted into the proposed dredging of the Johnstone River (or any other waterways) to determine the manner in which to conduct and the timing of such work to minimise impact on seagrass meadows, and to minimise sediment export to coastal waters. Any dredging plans should include mapping of seagrass present to determine impacts over time - Council, consultant

Rec: Council should support the further restriction of the herbicide Diuron in agricultural usage. Alternately usage in the Shire should be better managed, to avoid use around waterways and drains - Council, CANEGROWERS, Growcom, Landholders

3.2.2 Mangroves

The Wet Tropics has a very high diversity of mangroves, including 39 different species. Areas of the Wet Tropics contain representation of all of mangrove species in Australia. Mangroves are important ecologically as fish nursery areas, and for their role in stabilising waterway banks.
It is estimated that 75% of the commercially caught fish and prawns in Queensland spend at least some part of their life cycle living in the mangroves (AIMS Website, 2005b). Mangroves also provide nesting sites and habitat for a variety of birds and terrestrial species.

Mangroves along the Johnstone River

Pressure
Mangroves are now extremely well protected from clearing under the Queensland Fisheries Act (1994) and any activity involving mangroves requires a permit from the DPI&F. Clearing mangroves is subsequently very difficult, other than in exceptional circumstances. However, there are still impacts from illegal clearing occurring in the Shire; generally where residents are not satisfied with their view. This further exacerbates problems with riverbank erosion.
Threats to mangroves are now mainly from pollutants in waterways. Oil spills are a significant risk, as they prevent mangroves obtaining oxygen through their pneumatophore root systems. Some species of mangroves have been determined to be at risk from herbicides including Diuron. Diuron in mangrove mud sediments was proven to be the cause of mangrove dieback in Mackay. "Correlative assessments (at >95% certainty) of mangrove condition and health in the field showed there was one likely agent, namely herbicides (particularly diuron)." (Duke et al. 2003).

A similar correlation is apparent in the Johnstone River. In 2002, where there were high levels of Diuron in sediments, the distribution of *A. marina* mangroves ended. This correlation is not certain, as there is no description of the historical distribution of particular mangroves species in the Shire upon which to base comparative conclusions.

Not all species of mangroves are similarly affected by herbicides, but some have been proved to be at risk.

In the long-term mangroves are considered potentially at risk from climate change - due to projected rises in sea level of 10-80cm by 2100, as well as increasing levels of CO_2.

Condition
The area of mangrove ecosystems has actually increased in comparison to their historical extent. Changes to the hydrology of wetlands in the Shire, including drainage of large freshwater areas for agriculture, has resulted in mangroves encroaching further upstream. Sedimentation or reduced flow rates may be reasons that saltwater is reaching further and creating favourable conditions for the mangroves rather than for freshwater species. Maps of the extent of mangrove encroachment, since 1951, are shown above in the Wetlands section, 2.1.3.

Response
AIMS are conducting research into possible climatic change effects on mangroves, and from sedimentation or erosion of mangrove muds.
Diuron has recently been under review by the AVPMA (See Land Management chapter, section 3 - pesticides). It is proposed that use of the chemical be further restricted. Council conducts monitoring of some of the Shire waterways for herbicides.

Rec: Council find and enforce solutions to prevent illegal clearing of riverbank areas by residents for personal scenic amenity. Solutions may include very large signage or another manner to block the view until revegetation is re-established - Council, DPI&F

3.3 Aquatic Fauna

Clownfish amidst a sea anemone

The Great Barrier Reef is home to thousands of species of fish, and a number of mammals and reptiles. The corals themselves are actually fauna, being formed from colonies of unicellular organisms of the animal kingdom, with animalian cellular features. Corals also form symbiotic relationships with marine algae (*zooanthellae*), in order to benefit from these unicellular plants' ability to photosynthesise. The corals are described in the ecosystem section above.
The estuaries and freshwater reaches of the Shire also contain more fish and feature other impressive fauna such as the estuarine crocodile.

3.3.1 Mammals

Marine mammals utilising the Shire's coastal waters include whales, dolphins and dugongs. Issues affecting these animals relate principally to factors affecting the coastal water quality and the Reef.
QPWS are establishing marine officers based in Innisfail. They will respond to reports of marine animal stranding occurring in the Shire.

Dugongs *(dugong dugon)*
Pressure
Nationally, dugongs are under pressure from reductions in and degradation of the seagrass habitat they require to feed. Other pressures include capture in fishing nets (shark meshing, commercial and illegal) and boat strike. Indigenous cultural harvest of dugongs has also become a concern, because with modern powered boats it is possible to harvest dugongs at higher levels than was traditional.

Condition
Dugongs have declined nationally and internationally over the last 40 years. Dugongs in the Shire have been surveyed but numbers were too low to provide population estimates (Reef Research, 2003). Dugongs are highly migratory so are certain to move through the Shire's coastal waters and utilise seagrass areas. Knowledge of dugong populations in other areas is better, but data is not yet sufficient to determine whether the currently low population level is stable, or whether it is still declining, or the possible rate of decline.

Response
Dugongs are not specifically managed by any agency within the Shire's coastal waters. Instead, regional, State and national management programs are in place. Protected areas for dugongs exist nearby at Hinchinbrook Island, and there are areas of seagrass protected under Great Barrier Reef Marine Park zoning.
The Federal Department of Environment and Heritage (DEH) has drafted the report "Sustainable and legal Indigenous Harvest of Marine Turtles and Dugongs in Australia - A national approach".

The goal is to develop cooperative management of dugong harvest with Indigenous communities to ensure the survival of these species. The policy is not to restrict harvest through policing. Instead a policy of education and cooperation will aim to improve attitudes over time.
There is concern by environmental groups, that given the lack of information on dugong population decline, that the survival of these species may require stricter measures in the immediate short-term (JES, pers comm.).

3.3.2 Reptiles

Aquatic reptiles in the Shire coastal waters include turtles, estuarine crocodiles, and sea snakes. Whilst sea snakes are listed under the Nature Conservation Act, little is known about their distribution and pressures that may affect them. They are occasionally caught in commercial fishing nets, but are likely to be well protected within the GBR Marine Park zoning.

Turtles
Six species of the world's turtles are found on the GBR. They include:

- Green turtles
- Hawksbill turtles
- Loggerhead turtles
- Flatback turtles
- Olive Ridley turtles
- Leatherback turtles

Of these, the Flatback turtle nests only on Australian beaches and is found only on the Australian continental shelf. Australia is also an important area for turtles to breed, and protection here is better than in many other countries. However, because turtles return to lay eggs at the beach they hatched at, regional population losses of any species are not naturally replaced by colonisation from other areas.

Pressures
Turtle numbers around the world have declined due to hunting, and from drowning when they are caught in commercial fishing nets. There is evidence that Loggerhead, Green and Hawksbill turtles are declining in the GBR. Flatback turtle populations appear to be steady.
Indigenous cultural harvest of turtles has also become a concern, because with modern powered boats it is possible to harvest turtles at higher rates than was traditional.

Responses
In 1999 the Flatback turtle was listed as 'vulnerable' and the Olive Ridley turtle's listing increased to 'endangered' under the Endangered Species Protection Act 1992.
Some turtle hunting is allowed within the GBR, but it can only be carried out by Indigenous peoples holding an appropriate permit. Even with a permit, hunting is not allowed in preservation zones of the Marine Park (GBRMPA 2005b).
The fishing industry is introducing turtle exclusion devices to trawling nets, and have guidelines for releasing turtles caught in nets.
QPWS marine officers will be dealing with marine stranding in the Shire, including turtles.
The Federal Department of Environment and Heritage (DEH) has drafted the report "Sustainable and legal Indigenous harvest of Marine Turtles and Dugongs in Australia - A national approach". Comments applicable are the same as for dugongs above.

Estuarine Crocodiles

Estuarine crocodiles (*Crocodylus porosus*) are a high profile species where they occur in Queensland. They benefit the region through tourism, and are an important part of the natural environment as predators at the top end of the aquatic food chain. No freshwater crocodiles are present in the Shire.

Pressure
Crocodile populations face pressure from three concerns:

- The availability of nesting habitat
- Crocodile management tends to target the larger animals, which are the breeders
- Human activities can cause crocodiles to adopt problem behaviour which targets them for removal

Condition
Despite these pressures the population is breeding and there has been some small expansion of crocodiles into areas in which they have not been seen for a long time. Although the species is listed as 'vulnerable' there is presently no significant likelihood of extinction (Read, pers comm.).

Crocodiles are removed by QPWS when they create a problem for people.

Crocodile sightings and removals have not varied greatly over the last four years, though 2004 was an exciting year with a number of crocodiles sighted during movements along the coast, and one found within a stinger net.

Table 3.2.2 - Number of crocodiles sightings and removal from within the Shire Source: JSC

Year	Sightings reported	Removal
2000	-	3
2001	20	3
2002	16	6
2003	13	4
2004	22	1

Note: Not all sightings are reported

Estuarine crocodile - *crocodylus porosus* Source: WTMA

There is still some pressure from public perception of crocodiles as a risk, though killing them is now illegal. Whilst estuarine crocodiles are the most aggressive in the world, since 1985 to 2005 there have been a total of 14 attacks, and only four fatalities. Of these few incidents, almost all have involved alcohol, or swimming in a crocodile inhabited river. Comparatively, more people have been killed in altercations

The results of radio tracking research in 2003 by QPWS indicate that crocodiles have extensive ranges along a river, and along the coast; including excursions to other river systems. This dispels the traditional view that crocodiles are limited to defined territories. Crocodiles in the study moved through one another's foraging ranges daily (Read, pers comm.).
Also, crocodiles displaced to other river systems proved able to navigate long stretches of coastline to return to their original home. One crocodile under study returned from the Gulf to its home on the east coast. All translocated crocodiles studied returned home.
Some unusual results of the tracking showed crocodile travelling hundreds of kilometres along the coast to visit other river systems, and then to return home. The motivation for this behaviour is not yet understood. Potentially it is of benefit for maintaining genetic exchange and breeding success. Considering the crocodile race has been around since the time of the dinosaurs, it is likely that the species will show mechanisms that prevent promote genetic exchanges and prevent inbreeding.

Response
QPWS manage crocodiles in the Shire, with community stakeholder input through the Shire's Crocodile

Management Committee.
Better understanding of crocodile behaviour has led to changes in crocodile management. It is no longer considered feasible to keep an area of a river clear of crocodiles. The presence of crocodiles will prevent certain uses of the river, such as water skiing. The research has also indicated that translocation is no longer an option for management of problem crocodiles.
Crocodile management now focuses on problem animals. Crocodiles are removed only when they adopt behaviour such as frequenting boat ramps or jetties, or when they cause injury to people, domestic animals or stock.
Most problem crocodile behaviour is related to problem human behaviour. QPWS continually promote the CrocWise program, which educates people to prevent them attracting crocodiles to human activity areas. Crocodiles won't frequent boat ramps and jetties unless people are irresponsible and feed them, swim, or leave bait or fish scraps at such locations.
CrocWise signage is established at public areas where there are crocodiles, and promotion is carried out to community groups and schools.

Rec: Investigate potential for local corporate sponsors for radio-tracked crocodiles to increase knowledge of crocodiles in the Shire - QPWS, Crocodile Management Group

Rec: Incorporate improved knowledge of crocodile behaviour into river management planning - Crocodile Management Group, Council

3.3.3 Fish

Freshwater Fish

Pressure

Water quality is a potential factor affecting the Shire's freshwater fish. It is not known to what extent raised levels of nutrients, sediment and chemicals have affected the natural biodiversity of the Shire's aquatic ecosystems since European settlement. It is likely that the smaller creeks and streams will have been the most affected.
There is some pressure from recreational fishing, but again it is not known whether this is ecologically significant.

Condition

A study by Russell and Hayes (1993) identified over 120 fish species in the Johnstone River catchment. Freshwater fish biodiversity is monitored in the Johnstone Rivers by the DPI&F long-term monitoring program (Jebreen et al. 2002, DPI&F 2005). Several sites on the North and South Johnstone Rivers are monitored annually. Appendix 6.5 shows the Rivers' fish diversity (CD and Web versions only).

The most common fish caught in the surveys, in order, were Glassfish (separated into two species in 2004), Rainbow fish, Gudgeon, Sooty Grunter, Narrow-banded Ponyfish, and Silver Biddy. These are averages over the four years that catch per unit effort data was available. There are large variations between years.

In 2004 catch rates for many species were lower than in previous years. This may be due to conditions in the river at the time of sampling. There is a possibility that a massive fish kill event earlier in the year contributed to these reduced numbers.
However, the diversity of the number of species has remained consistent. Continued monitoring will determine whether there are any species losses over time.
Introduced Tilapia are a threat to other freshwater fish species in the Shire's rivers as described in the section 3.1.3 - introduced species. Tilapia are consistently reported in the monitoring.

Response

An ecotoxicology study is presently being conducted by the AIMS. The study is examining freshwater species in the Johnstone River to determine whether there are residues of chemicals from agriculture. The results of this study will demonstrate whether there are any long-term effects that build up in the food chain.

Stocking of Barramundi occurs into the Johnstone River. This may be reflected in the size classes for barramundi shown in the 2001-02 freshwater report (Jebreen et al. 2002), in that all fish caught were within a tight range of 34 - 54cm. No smaller barramundi were caught. However, only 12 barramundi were caught over the two years so this is a low sample size. The monitoring sites may not be far enough upstream to catch the barramundi fingerlings, which grow to maturity in the upper reaches of rivers. Barramundi will reach a size exceeding 30cm in their first year.

Marine Fish

Pressure

Overfishing is a pressure that is a worldwide phenomenon, with Australia no exception. Whilst fish populations can recover given a little time, they are seldom given the opportunity to do so. There are many examples of fisheries industries that have destroyed the harvest, thereby ruining themselves and facing closure.
The harvest of wildlife is an activity that has to be stringently regulated because, when the resource is abundant, additional harvest destroys this abundance. When fish populations are high, letting additional fishing boats join the game ruins the industry for all. The fish need a high population to remain abundant, as well as to be profitable to go after. This is due simply to their breeding success.
Unfortunately, where independent operators work in a competitive industry, cooperative management is often sacrificed in the interest of personal profit. This problem is known as 'the tragedy of the commons' after Hardin's landmark essay in 1968 (see box on page 66) discussing the ethics of human freedom in a world of finite resources.

Other pressures on marine fish include water quality and the state of their ecosystems, such as reefs and seagrass beds, as detailed in the sections above (see aquatic flora, section 3.2).

Condition
The AIMS conducts monitoring of reef fish throughout the GBR, but not specifically within the Innisfail sector. Reef wide fish biodiversity information is available on the AIMS website at http://www.aims.gov.au/monmap/monmap.htm.
A number of species of marine fish have been protected on the GBR with no take policies and annual closures to fishing to protect fish during breeding seasons.

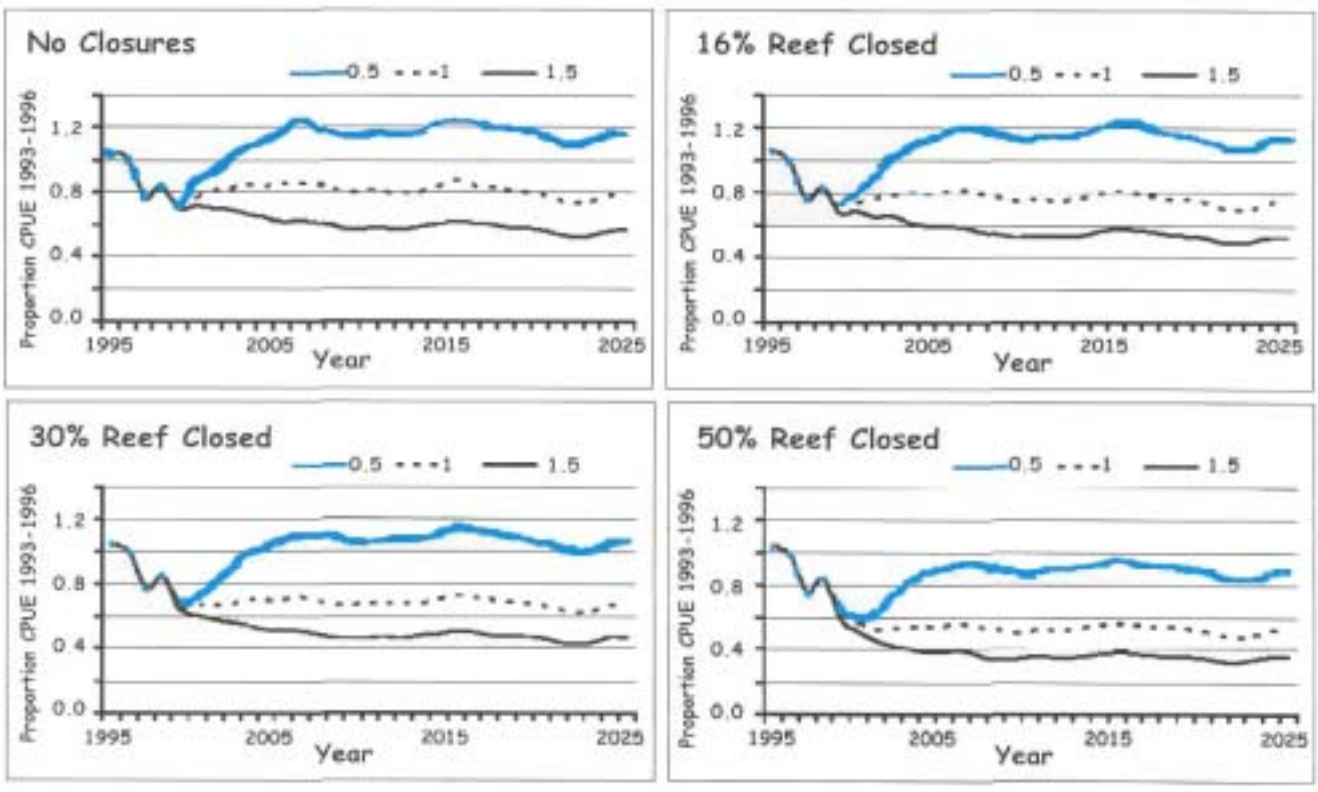
Response
The rezoning of the GBR with additional protected areas will assist in protecting marine diversity and fish stocks. CRC reef has demonstrated this in research work - the Effects of Line Fishing (ELF) experiment. The research also shows that reduced efforts by commercial fishing will be even more effective, resulting in both better fish populations, and better harvests for fishers.

ELF Experiment
The Effects of Line Fishing (ELF) experiment, conducted by the CRC Reef Research Centre demonstrated the potential effectiveness of the GBR rezoning over future years. The project was conducted on 24 reefs throughout the length of the reef, with some reefs normally closed to fishing being opened, and others normally open being closed. The results were as follows.

"Analysis of information from the ELF Experiment up to 2000 shows that reefs closed to fishing can have more and larger coral trout and red throat emperor than reefs that are open to fishing, with this pattern most obvious in areas south of Townsville. There were rapid declines in fish numbers on reefs opened to fishing, which strongly indicated that without protection from fishing, these reefs would have fish populations that are similar to the open reefs around them. In contrast, the research found that fish stocks recovered following closure of reefs to fishing. Also, larger fish populations on closed reefs will most likely have greater spawning capacity than those on surrounding open reefs. This adds support to the argument that green zones are an effective conservation and fisheries management tool.
The research results also show that reducing the level of fishing effort is the strategy most likely to see improvements in a number of indicators of fishery health (such as commercial catch rates and size of fish taken on reefs open to fishing). Effort restrictions and area closures are required to achieve both conservation of fish and satisfactory fishery performance leading to ecological sustainability." (Reef CRC Website, 2005).

Fishing effort describes how easy or difficult it is for commercial fishers to catch fish. It is basically equivalent to how many hours a trawler would have to spend before filling the hold with catch. The ELF experiment shows that the current level of closures (~30%) will slightly reduce fishermen's returns.
But the interesting part of the research is that if commercial fishers started spending less time/effort fishing they would start to make a better profit after only a year.
This means that reducing the effort to catch fish results in the fish population increasing, so that after a short amount of time, more fish are caught for the same amount of fishing. The graphs in Figure 3.3.3 show projections for catch per unit effort.

Figure 3.3.3 - Modelling of Reef Closure and Fishing Effort
Source: Reef CRC Website (2005)



It can be seen from the ELF experiment that the most effective strategy for the fishing industry in all scenarios is to reduce effort by half. This is because the fish populations recover exponentially. If effort is reduced by half, even closures of 30% of the reef do not appreciably affect catch returns. Fifty percent reef closures do have some effect, but the return at half effort is still slightly higher than for no closures with normal effort.

It is obvious that overfishing will ruin the industry and reduce individual profits. Some fishing licences have been removed, but management must ensure fishing effort is restricted.
The fishing industry can only complain about the current level of reef closures if they are determined to continue to conduct poor management of their industry.

The Tragedy of the Commons

"The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.
As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, "What is the utility to me of adding one more animal to my herd?" This utility has one negative and one positive component.
1. The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly + 1.
2. The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision making herdsman is only a fraction of -1.
Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another.... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit -- in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.

A simple incident that occurred a few years ago in Leominster, Massachusetts shows how perishable the knowledge is. During the Christmas shopping season the parking meters downtown were covered with plastic bags that bore tags reading: "Do not open until after Christmas. Free parking courtesy of the mayor and city council." In other words, facing the prospect of an increased demand for already scarce space, the city fathers reinstituted the system of the commons. (Cynically, we suspect that they gained more votes than they lost by this retrogressive act.)

…Likewise, the oceans of the world continue to suffer from the survival of the philosophy of the commons. Maritime nations still respond automatically to the shibboleth of the "freedom of the seas." Professing to believe in the "inexhaustible resources of the oceans," they bring species after species of fish and whales closer to extinction."

*(On managing the commons) "…*What shall we do? We have several options. We might sell them off as private property. We might keep them as public property, but allocate the right to enter them. The allocation might be on the basis of wealth, by the use of an auction system. It might be on the basis of merit, as defined by some agreed upon standards. It might be by lottery. Or it might be on a first-come, first-served basis, administered to long queues. These, I think, are all objectionable. But we must choose -- or acquiesce in the destruction of the commons…"

Excerpt from "The Tragedy of the Commons," by Garrett Hardin (1968)

4. Deficiencies in Data

As noted in the sections dealing with fauna and flora, there is little reliable information for most species present in the Shire. A record of the total diversity of species is not yet complete, and there is no real information on the distribution of species.

This should be improved, but given the number of species in the Shire priority should be for the endangered species, and towards identifying species that may have locally limited distributions. This will assist in further conservation efforts.

Rec: QPWS work towards recording the diversity of species in the Shire - QPWS

Rec: QPWS compile data and mapping of the distribution of conservation significant species in the Shire - QPWS

Rec: Engage university students and other tertiary institutions to conduct research projects on ecosystems, flora and fauna in the Shire - QPWS, Council, TAFE

Rec: Lobby Earthwatch to establish research projects in the Shire - Council

5. References

AIMS Website (2005a) "Interactive data summaries for the Great Barrier Reef" Australian Institute Marine Science, Viewed on 15/1/5, http://www.aims.gov.au/monmap/monmap.htm

AIMS Website (2005b) "A mangrove is more than just a tree ..." Australian Institute of Marine Science, Viewed on 22/8/5, http://www.aims.gov.au/pages/research/project-net/mangroves-01/apnet-mangroves01.html

Allanson S. (2005) Queensland Parks and Wildlife Service, Mission Beach - Personal Communication, May 2005.

ANZECC (2000) "National Water Quality Management Strategy - Australian Guidelines for Water Quality Monitoring and Reporting" Australian and New Zealand Environment and Conservation Council/ Agriculture and Resource Management Council of Australia and New Zealand, October 2000

Australian Greenhouse Office (2004) "Climate change in the Cairns & Great Barrier Reef Region: Scope and Focus for an Integrated Assessment" Australian Greenhouse Office, Commonwealth of Australia. Viewed on 222/8/5, http://www.greenhouse.gov.au/impacts/publications/pubs/gbr.pdf

Bell, R. (1996) "Johnstone River Catchment Revegetation Strategy" Johnstone River Catchment Management Association, Queensland

Bentrupperbaumer J. (1992) "Cassowary monitoring program for the whole of Cardwell and part of Johnstone Shires, North Queensland." Unpublished report to Queensland National Parks and Wildlife Service Grant Scheme for research on Rare and Threatened Species, Wildlife Preservation Society, Tully.

Biodiversity Strategy (2003) "Strategy for the Conservation of Biodiversity in the Johnstone Shire" Dryden, B., Johnstone Shire Council, Innisfail

C4 (2005) Community for Cassowary and Coastal Conservation Inc, Mission Beach

CSIRO Website (2005)"CSIRO cane toad research" Commonwealth Scientific and Industrial Research Organisation, Australia. Viewed on 22/8/5, http://www.csiro.au/index.asp?type=faq&id=CaneToadControl

DEH (2004) "Draft Sustainable and legal Indigenous harvest of Marine Turtles and Dugongs in Australia - A national approach". MACC Taskforce on Dugong and Marine Turtle Populations, Department of the Environment and Heritage, Commonwealth of Australia. Viewed on 22/8/5, http://www.deh.gov.au/coasts/species/turtles/pubs/national-approach.pdf

DEH Website (1999) "Hill acts to protect marine turtles" Department of Environment and Heritage, Commonwealth of Australia. Viewed on 22/8/5, http://www.deh.gov.au/minister/env/99/mr12aug99.html

DEH Website (2005)"Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs" Department of Environement and Heritage, Commonwealth of Australia. Viewed on 12/9/2005, http://www.deh.gov.au/biodiversity/threatened/publications/tap/pig/

DPI&F (2005) "Fisheries Long Term Monitoring Program" Requested data reproduced with permission of Queensland Department of Primary Industries and Fisheries, Copyright State of Queensland, 2005

DPI&F Website (2005a) "Tilapia" Queensland Department of Primary Industries: Brisbane, Viewed on 22/8/5, http://www.dpi.qld.gov.au/fishweb/1406.html

DPI&F Website (2005b) " Coastal Habitat Resources Information System (CHRIS)" Viewed on 18/8/2005, http://chrisweb.dpi.qld.gov.au

Duke N.C., Bell A.M., Pederson D.K. Roelfsema C.M., Godson L.M. Zahmel K.N., Mackenzie J. Bengtson-Nash S. (2003) "Mackay Mangrove Dieback Investigations in 2002 with Recommendations for Further Research, Monitoring and Management - Report to the Queensland Department of Primary Industries, Northern Fisheries Centre and the Community of Mackay Region" Marine Botany Group, Centre for Marine studies. University of Queensland

EPA (2005a) "Regional Ecosystem Database Information" Queensland Herbarium, Environmental Protection Agency, Queensland

EPA (2005b) "Environmental Protection Agency (2005) WildNet Database" Environmental Protection Agency, Queensland, 15 February 2005

EPA Website (2005) "Wet tropics forest transfer" Environmental Protection Agency, Queensland. Viewed on 22/8/5, http://www.epa.qld.gov.au/parks_and_forests/management/forest_transfer_processes_in_queensland/wet_tropics_forest_transfer/

GBRMPA Website (1998) "State of the Great barrier reef World Heritage Area - Seagrass" Available @ http://www.gbrmpa.gov.au/corp_site/info_services/publications/sotr/1998/seagrass_frame.html)

GBRMPA Website (2005a) "Frequently Asked Questions " Viewed on 22/8/5, http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/world_heritage_faq.html#When%20and%20why%20was%20the%20GBRWHA%20listed%20as%20a%20World%20Heritage%20Property

GRMPBA Website (2005b) "State of the Great barrier Reef Marine Heritage Area Report 1998 - Marine Reptiles" Great Barrier Reef Marine Park Authority. Viewed on 22/8/5, http://www.gbrmpa.gov.au/corp_site/info_services/publications/sotr/1998/reptiles_frame.html

Goosem, S., Morgan, G. & Kemp, J.E., (1999) "Conservation Status of Queensland's Bioregional Ecosystems – Wet Tropics" Environmental Protection Agency, Queensland

Hardin, G. (1968) "The Tragedy of the Commons," Science, 162 (1968):1243-1248.

Haynes, D., Ralph, P., Müller, J., Prange, J., Michalek-Wagner, K. and Waterhouse, J. (2000) "The Occurrence and Impact of Herbicides in the Great Barrier Reef, Australia" Reef Research Volume 10 No 2-4 June – December 2000, Great Barrier Reef Marine Park Authority

Hervey, B. (2003) C4, Community for Cassowary and Coastal Conservation Inc - Personal Communication, May 2003

Hyde, M. (2002) "Johnstone Shire Pest Management Plan 2002 –2006", Johnstone Shire Council, Queensland.

Jebreen, E.J., Helmke S.A., Bullock C.L. & Hutchinson M.J. (2002) "Fisheries Long-Term Monitoring Program: Freshwater Report: 2000-2001". Department of Primary Industries, Queensland. DPI QI02058

JES (2005) Johnstone Ecological Society - Personal Communication, June 2005.

McKenna, S., Rasheed, M. and Thomas, R. (DPI&F 2005) "Long-Term Seagrass Monitoring in the Port of Mourilyan" Marine Ecology Group Northern Fisheries Centre Department of Primary Industries Information Serries QI05037 November 2004

Moore L.A. and Moore N.J. (1998) 'Cassowary Conservation Roads - A Cassowary management Strategy and Road Upgrade Assessment for El Arish and Tully-Mission Beach roads, Mission Beach. Report conducted for the Department of Main Roads, December 1998.

Natural Resource Management Board Inc. (2000) "Wet Tropics regional Strategy – Natural Resource Management" Natural Resource Management Board (Wet Tropics) Inc., Queensland

New Scientist Website (2003) "Copper decimates coral spawning" Emma Young in New Scientist, 18 November 2003. Viewed on 22/8/5, http://www.newscientist.com/article.ns?id=dn4391

New Scientist Website (2004a) "Sewage nutrients fuel coral disease" Rachel Nowak in New Scientist, 11 January 2004. Viewed on 22/8/5,

http://www.newscientist.com/article.ns?id=dn4539
New Scientist Website (2004b) "Corals adapt to cope with global warming" Jeff Hecht in New Scientist, 11 August 2004. Viewed on 22/8/5, http://www.newscientist.com/article.ns?id=dn6275
NR&M (2003) "SLATS Land Cover Change in Queensland 1999 - 2001" Statewide Land Cover and Trees Study, Natural Resource Sciences, Queensland Department of Natural Resources and Mines, January 2003. Viewed on 22/8/5, http://www.nrm.qld.gov.au/slats/pdf/slats9901.pdf
NR&M Website (2005) "Control of Feral Pigs" Queensland Department of Natural Resources and Mines, Viewed on 22/8/5, http://www.nrm.qld.gov.au/factsheets/pdf/pest/PA7.pdf
Powerlink Website (2005)"Transmission Projects - Kareeya to Innisfail" Powerlink Queensland, Viewed on 22/8/5, http://www.powerlink.com.au/asp/index.asp?page=transmission&sid=5&cid=4711&gid=197
PCQ Website (2005) "Port of Mourilyan" Ports Corporation of Queensland, Viewed on 22/8/5, http://www.pcq.com.au/2004/ports_mourilyan_community.cfm
Read, M. (2005) Queensland Parks and Wildlife Service, Crocodile Management - Personal Communication, May 2005.
Reef CRC Website (2005) "Effects of Line Fishing (ELF) Project" Cooperative Research Centre for the Great Barrier Reef World Heritage Area. Viewed on 18/8/2005, http://www.reef.crc.org.au/research/fishing_fisheries/elf.html
Reef Research (July 2003) "Reef Research Information Sheet No. 2 - The Status of Dugongs on the Great Barrier Reef and the Southern Coast of Queensland" The Great Barrier Reef Marine Park Authority, Queensland. Viewed on 22/8/5, http://www.gbrmpa.gov.au/corp_site/info_services/publications/newsletters/reef_research_info_sheets/infosheet_2003_07_02.pdf
Russell, D.J. & Hales, P.W. (1993) Stream Habitat and Fisheries Resources of the Johnstone River Catchment, September 1993. DPI Information Series QI93056, Department of Primary Industries: Brisbane
Russell, D.J. Hales, P.W. & Helmke S.A. (1996) Fisheries Resources and Stream Habitat of the Moresby River Catchment, August 1996. DPI Information Series QI96061, Department of Primary Industries: Brisbane
Russell, D.J. & Hales, P.W. (1997) Fish Resources and Stream Habitat of the Liverpool, Maria & Hull Catchments, July 1997. DPI Information Series QI97039, Department of Primary Industries: Brisbane
Sweatman, H., Abdo, D., Burgess, S., Cheal, A., Coleman, G., Delean, S., Emslie, M., Miller, I., Osborne, K., Oxley, W., Page, C., & Thompson, A. (2003) “Long-term Monitoring of the Great Barrier Reef – Status Report No 6 2003”. Australian Institute Marine Science, Viewed on 22/8/5, http://www.aims.gov.au/pages/research/reef-monitoring/ltm/mon-statrep6/statrep6.html
VMA (1999) "Vegetation Management Act" Reprinted as in force on 27 October 2004 (includes commenced amendments up to 2004 Act No. 33) Reprint No. 1F. State of Queensland, October 2004
Water Act (2000) "Queensland Water Act 2000" Reprinted as in force on 1 July 2005 State of Queensland, July 2005
WBM Oceanics (2005) "Ninds Creek STP Environmental Monitoring - Dry Season 2004 Survey" Prepared for Johnstone Shire Council, WBM Oceanics Australia
Williams S.E., Pearson R.G., Walsh P.J. (1996) "Distributions and biodiversity of the terrestrial vertebrates of Australia's Wet tropics: a review of current knowledge", Pacific Conservation Biology, Vol. 2: 327-62, Surrey, Beatty & Sons, Sydney.
WTMA (2000) "Wet Tropics Coastal Wildlife Corridor" Wet Tropics Management Authority, Queensland
WTMA (2004) " Annual Report and State of the Wet Tropics Report 2003–2004" Wet Tropics Management Authority, Queensland. Viewed on 22/8/5, http://www.wettropics.gov.au/pdf/annual_reports/2004a_report.pdf
WTMA Website (2005a) "Pressures on the Rainforest - Fragmentation, fire and exotic species" Wet Tropics Management Authority, Queensland. Viewed on 4/8/5, http://www.wettropics.gov.au/mwha/mwha_exotic.html
WTMA Website (2005b) "Pressures on the World Heritage Area - Cane Toads" Wet Tropics Management Authority, Queensland. Viewed on 22/8/5, http://www.wettropics.gov.au/mwha/mwha_canetoads.html
Zeller, B. (1998) "Queensland's Fisheries Habitats - Current condition and recent trends" DPI Information Series QI98025, Department of Primary Industries, Queensland

6. Appendices

Appendix 6.1 Fauna in the Johnstone Shire

Source: Environmental Protection Agency (2005) WildNet. (Database). Environmental Protection Agency, Brisbane. 15 February 2005
Johnstone Shire - Latitude between: -17.4579 and -17.8819, Longitude between: 145.6855 and 146.1438

NCA Status - Indicates the conservation status of each taxon under the *Nature Conservation Act 1992*.NCA
The codes are - Presumed Extinct (PE), Endangered (E), Vulnerable (V), Rare (R), Common (C) or Not Protected ( ).
EPBC status: Environment Protection and Biodiversity Conservation Act 1999.
The codes are - Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW), Vulnerable (V) and Threatened (includes taxa listed as CD, CE, E, EX, V and XW).

Significant*:* Indicates whether a taxon is conservation significant by the display of a Y (i.e. Yes). Conservation significant species include those that are listed as rare or threatened under the Nature Conservation Act 1992 or threatened under the Environment Protection and Biodiversity Conservation Act 1999, have a management status of rare or threatened, or are listed under an international agreement (such as JAMBA, CAMBA and Bonn Convention).

Endemicity: Queensland Endemic (Q), Intranational (QA), Regional Endemic (QI), Not Endemic to Australia (QAI), Vagrant (International) (VI), Vagrant (Intranational) (VA), Vagrant (Unknown) (VU), Introduced (International) (II), Introduced (Intranational) (IA), Introduced (Unknown) (IU), Exotic (International) (XI), Exotic (Intranational) (XA), Exotic (Unknown) (XU) or Unknown (U).

Amphibians

Class Amphibians						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Bufonidae	Bufo marinus	cane toad				II
Hylidae	Litoria bicolor	northern sedgefrog	C			QAI
Hylidae	Litoria caerulea	common green treefrog	C			QAI
Hylidae	Litoria dentata	bleating treefrog	C			QA
Hylidae	Litoria fallax	eastern sedgefrog	C			QA
Hylidae	Litoria genimaculata	tapping green eyed frog	R		Y	QAI
Hylidae	Litoria gracilenta	graceful treefrog	C			QA
Hylidae	Litoria infrafrenata	white lipped treefrog	C			QAI
Hylidae	Litoria lesueuri sensu lato	stony creek frog	C			QA
Hylidae	Litoria nannotis	waterfall frog	E	E	Y	Q
Hylidae	Litoria nasuta	striped rocketfrog	C			QAI
Hylidae	Litoria nyakalensis	mountain mistfrog	E	E	Y	Q
Hylidae	Litoria rheocola	common mistfrog	E	E	Y	Q
Hylidae	Litoria rothii	northern laughing treefrog	C			QA
Hylidae	Litoria rubella	ruddy treefrog	C			QAI
Hylidae	Litoria xanthomera	orange thighed treefrog	C			Q
Hylidae	Nyctimystes dayi	Australian lacelid	E	E	Y	Q
Microhylidae	Austrochaperina fryi	peeping whistlefrog	R		Y	Q
Microhylidae	Austrochaperina pluvialis	white browed whistlefrog	C			Q
Microhylidae	Austrochaperina robusta	robust whistlefrog	R		Y	Q
Microhylidae	Cophixalus infacetus	creaking nurseryfrog	R		Y	Q
Microhylidae	Cophixalus ornatus	ornate nurseryfrog	C			Q
Myobatrachidae	Limnodynastes convexiusculus	marbled frog	C			QAI
Myobatrachidae	Limnodynastes ornatus	ornate burrowing frog	C			QA
Myobatrachidae	Limnodynastes peronii	striped marshfrog	C			QA
Myobatrachidae	Mixophyes schevilli	northern barred frog	C			Q
Myobatrachidae	Taudactylus acutirostris	sharp snouted dayfrog	E	EX	Y	Q
Ranidae	Rana daemeli	Australian woodfrog	C			QAI

Birds

Class - Birds						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Accipitridae	Accipiter fasciatus	brown goshawk	C			QAI
Accipitridae	Accipiter novaehollandiae	grey goshawk	R		Y	QAI
Accipitridae	Aquila audax	wedge-tailed eagle	C			QAI
Accipitridae	Aviceda subcristata	Pacific baza	C			QAI
Accipitridae	Circus approximans	swamp harrier	C			QAI
Accipitridae	Circus assimilis	spotted harrier	C			QA
Accipitridae	Elanus axillaris	black-shouldered kite	C			QAI
Accipitridae	Erythrotriorchis radiatus	red goshawk	E	V	Y	QA
Accipitridae	Haliaeetus leucogaster	white-bellied sea-eagle	C		Y	QAI
Accipitridae	Haliastur indus	brahminy kite	C			QAI
Accipitridae	Haliastur sphenurus	whistling kite	C			QAI
Accipitridae	Hamirostra melanosternon	black-breasted buzzard	C			QA
Accipitridae	Hieraaetus morphnoides	little eagle	C			QAI
Accipitridae	Lophoictinia isura	square-tailed kite	R		Y	QA
Accipitridae	Milvus migrans	black kite	C			QAI
Accipitridae	Pandion haliaetus	osprey	C			QAI
Aegothelidae	Aegotheles cristatus	Australian owlet-nightjar	C			QAI
Alaudidae	Mirafra javanica	singing bushlark	C			QAI
Alcedinidae	Alcedo azurea	azure kingfisher	C			QAI
Alcedinidae	Alcedo pusilla	little kingfisher	C			QAI
Anatidae	Anas castanea	chestnut teal	C			QA
Anatidae	Anas gracilis	grey teal	C		Y	QAI
Anatidae	Anas superciliosa	Pacific black duck	C			QAI
Anatidae	Aythya australis	hardhead	C			QAI
Anatidae	Chenonetta jubata	Australian wood duck	C			QA
Anatidae	Cygnus atratus	black swan	C			QA
Anatidae	Dendrocygna arcuata	wandering whistling-duck	C			QAI
Anatidae	Dendrocygna eytoni	plumed whistling-duck	C			QA
Anatidae	Malacorhynchus membranaceus	pink-eared duck	C			QA
Anatidae	Nettapus coromandelianus	cotton pygmy-goose	R		Y	QAI
Anatidae	Nettapus pulchellus	green pygmy-goose	C			QAI
Anatidae	Oxyura australis	blue-billed duck	C			QA
Anatidae	Tadorna radjah	radjah shelduck	R		Y	QAI
Anhingidae	Anhinga melanogaster	darter	C			QAI
Anseranatidae	Anseranas semipalmata	magpie goose	C			QAI
Apodidae	Apus pacificus	fork-tailed swift	C		Y	QAI
Apodidae	Collocalia spodiopygius	white-rumped swiftlet	R		Y	Q
Apodidae	Hirundapus caudacutus	white-throated needletail	C		Y	QAI
Ardeidae	Ardea alba	great egret	C		Y	QAI
Ardeidae	Ardea ibis	cattle egret	C		Y	QAI
Ardeidae	Ardea intermedia	intermediate egret	C			QAI
Ardeidae	Ardea pacifica	white-necked heron	C			QA
Ardeidae	Ardea picata	pied heron	C			QAI
Ardeidae	Ardea sumatrana	great-billed heron	C			QAI
Ardeidae	Butorides striatus	striated heron	C			QAI
Ardeidae	Egretta garzetta	little egret	C			QAI
Ardeidae	Egretta novaehollandiae	white-faced heron	C			QAI
Ardeidae	Egretta sacra	eastern reef egret	C		Y	QAI
Ardeidae	Ixobrychus flavicollis	black bittern	C			QAI
Ardeidae	Ixobrychus minutus	little bittern	C			QAI
Ardeidae	Nycticorax caledonicus	nankeen night heron	C			QAI
Artamidae	Artamus cinereus	black-faced woodswallow	C			QA
Artamidae	Artamus cyanopterus	dusky woodswallow	C			QA
Artamidae	Artamus leucorynchus	white-breasted woodswallow	C			QA
Artamidae	Artamus minor	little woodswallow	C			QA
Artamidae	Artamus personatus	masked woodswallow	C			QA
Artamidae	Artamus superciliosus	white-browed woodswallow	C			QA
Artamidae	Cracticus nigrogularis	pied butcherbird	C			QA
Artamidae	Cracticus quoyi	black butcherbird	C			QAI

Class - Birds						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Artamidae	Cracticus torquatus	grey butcherbird	C			QA
Artamidae	Gymnorhina tibicen	Australian magpie	C			QAI
Artamidae	Strepera graculina	pied currawong	C			QA
Burhinidae	Burhinus grallarius	bush stone-curlew	C			QAI
Burhinidae	Esacus neglectus	beach stone-curlew	V		Y	QAI
Cacatuidae	Cacatua galerita	sulphur-crested cockatoo	C			QAI
Cacatuidae	Cacatua roseicapilla	galah	C			QA
Cacatuidae	Calyptorhynchus banksii	red-tailed black-cockatoo	C			QA
Cacatuidae	Nymphicus hollandicus	cockatiel	C			QA
Campephagidae	Coracina lineata	barred cuckoo-shrike	C			QA
Campephagidae	Coracina novaehollandiae	black-faced cuckoo-shrike	C			QAI
Campephagidae	Coracina papuensis	white-bellied cuckoo-shrike	C			QAI
Campephagidae	Coracina tenuirostris	cicadabird	C			QAI
Campephagidae	Lalage leucomela	varied triller	C			QAI
Campephagidae	Lalage sueurii	white-winged triller	C			QAI
Caprimulgidae	Caprimulgus macrurus	large-tailed nightjar	C			QAI
Caprimulgidae	Eurostopodus argus	spotted nightjar	C			QA
Caprimulgidae	Eurostopodus mystacalis	white-throated nightjar	C			QAI
Casuariidae	Casuarius casuarius johnsonii	southern cassowary (southern population)	E	E	Y	Q
Centropodidae	Centropus phasianinus	pheasant coucal	C			QA
Charadriidae	Charadrius leschenaultii	greater sand plover	C		Y	QAI
Charadriidae	Charadrius mongolus	lesser sand plover	C		Y	QAI
Charadriidae	Charadrius ruficapillus	red-capped plover	C			QAI
Charadriidae	Charadrius veredus	oriental plover	C		Y	QAI
Charadriidae	Elseyornis melanops	black-fronted dotterel	C			QAI
Charadriidae	Erythrogonys cinctus	red-kneed dotterel	C			QA
Charadriidae	Pluvialis fulva	Pacific golden plover	C		Y	QAI
Charadriidae	Pluvialis squatarola	grey plover	C		Y	QAI
Charadriidae	Vanellus miles	masked lapwing	C			QAI
Ciconiidae	Ephippiorhynchus asiaticus	black-necked stork	R		Y	QAI
Cinclosomatidae	Psophodes olivaceus	eastern whipbird	C			QA
Climacteridae	Climacteris picumnus	brown treecreeper	C			QA
Columbidae	Chalcophaps indica	emerald dove	C			QA
Columbidae	Columba leucomela	white-headed pigeon	C			QA
Columbidae	Columba livia	rock dove				II
Columbidae	Ducula bicolor	pied imperial-pigeon	C			QAI
Columbidae	Geopelia cuneata	diamond dove	C			QA
Columbidae	Geopelia humeralis	bar-shouldered dove	C			QAI
Columbidae	Geopelia striata	peaceful dove	C			QAI
Columbidae	Lopholaimus antarcticus	topknot pigeon	C			QA
Columbidae	Macropygia amboinensis	brown cuckoo-dove	C			QAI
Columbidae	Ptilinopus magnificus	wompoo fruit-dove	C			QAI
Columbidae	Ptilinopus regina	rose-crowned fruit-dove	C			QAI
Columbidae	Ptilinopus superbus	superb fruit-dove	C			QAI
Columbidae	Streptopelia chinensis	spotted turtle-dove				II
Coraciidae	Eurystomus orientalis	dollarbird	C			QAI
Corvidae	Corvus orru	Torresian crow	C			QAI
Cuculidae	Cacomantis castaneiventris	chestnut-breasted cuckoo	C			QAI
Cuculidae	Cacomantis flabelliformis	fan-tailed cuckoo	C			QAI
Cuculidae	Cacomantis variolosus	brush cuckoo	C			QAI
Cuculidae	Chrysococcyx basalis	Horsfield's bronze-cuckoo	C			QAI
Cuculidae	Chrysococcyx lucidus	shining bronze-cuckoo	C			QAI
Cuculidae	Chrysococcyx minutillus	little bronze-cuckoo	C			QAI
Cuculidae	Chrysococcyx osculans	black-eared cuckoo	C			QAI
Cuculidae	Chrysococcyx russatus	Gould's bronze-cuckoo	C			QAI
Cuculidae	Cuculus pallidus	pallid cuckoo	C			QAI
Cuculidae	Cuculus saturatus	oriental cuckoo	C		Y	QAI
Cuculidae	Eudynamys scolopacea	common koel	C			QAI
Cuculidae	Scythrops novaehollandiae	channel-billed cuckoo	C			QAI
Dicaeidae	Dicaeum hirundinaceum	mistletoebird	C			QAI
Dicruridae	Arses kaupi	pied monarch	C			Q
Dicruridae	Dicrurus bracteatus	spangled drongo	C			QAI
Dicruridae	Grallina cyanoleuca	magpie-lark	C			QAI

Class - Birds						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Dicruridae	Machaerirhynchus flaviventer	yellow-breasted boatbill	C			QI
Dicruridae	Monarcha leucotis	white-eared monarch	C			QA
Dicruridae	Monarcha melanopsis	black-faced monarch	C			QAI
Dicruridae	Monarcha trivirgatus	spectacled monarch	C			QAI
Dicruridae	Myiagra alecto	shining flycatcher	C			QAI
Dicruridae	Myiagra cyanoleuca	satin flycatcher	C			QAI
Dicruridae	Myiagra inquieta	restless flycatcher	C			QA
Dicruridae	Myiagra rubecula	leaden flycatcher	C			QAI
Dicruridae	Rhipidura fuliginosa	grey fantail	C			QAI
Dicruridae	Rhipidura leucophrys	willie wagtail	C			QAI
Dicruridae	Rhipidura rufifrons	rufous fantail	C			QAI
Dicruridae	Rhipidura rufiventris	northern fantail	C			QAI
Falconidae	Falco berigora	brown falcon	C			QAI
Falconidae	Falco cenchroides	nankeen kestrel	C		Y	QAI
Falconidae	Falco longipennis	Australian hobby	C		Y	QAI
Falconidae	Falco peregrinus	peregrine falcon	C			QAI
Fregatidae	Fregata ariel	lesser frigatebird	C		Y	QAI
Glareolidae	Glareola maldivarum	oriental pratincole	C		Y	QAI
Glareolidae	Stiltia isabella	Australian pratincole	C			QA
Gruidae	Grus antigone	sarus crane	C		Y	QAI
Gruidae	Grus rubicunda	brolga	C			QAI
Haematopodidae	Haematopus fuliginosus	sooty oystercatcher	R		Y	QA
Halcyonidae	Dacelo leachii	blue-winged kookaburra	C			QAI
Halcyonidae	Dacelo novaeguineae	laughing kookaburra	C			QA
Halcyonidae	Syma torotoro	yellow-billed kingfisher	C			QAI
Halcyonidae	Tanysiptera sylvia	buff-breasted paradise-kingfisher	C			QAI
Halcyonidae	Todiramphus chloris	collared kingfisher	C			QAI
Halcyonidae	Todiramphus macleayii	forest kingfisher	C			QAI
Halcyonidae	Todiramphus pyrrhopygia	red-backed kingfisher	C			QA
Halcyonidae	Todiramphus sanctus	sacred kingfisher	C			QAI
Hirundinidae	Hirundo ariel	fairy martin	C			QA
Hirundinidae	Hirundo daurica	red-rumped swallow	C			QAI
Hirundinidae	Hirundo neoxena	welcome swallow	C			QAI
Hirundinidae	Hirundo nigricans	tree martin	C			QAI
Hirundinidae	Hirundo rustica	barn swallow	C		Y	QAI
Jacanidae	Irediparra gallinacea	comb-crested jacana	C			QAI
Laridae	Anous stolidus	common noddy	C		Y	QA
Laridae	Chlidonias hybridus	whiskered tern	C			QAI
Laridae	Chlidonias leucopterus	white-winged black tern	C		Y	QAI
Laridae	Larus novaehollandiae	silver gull	C			QAI
Laridae	Stercorarius pomarinus	pomarine jaeger	C		Y	QAI
Laridae	Sterna albifrons	little tern	E		Y	QAI
Laridae	Sterna anaethetus	bridled tern	C		Y	QAI
Laridae	Sterna bengalensis	lesser crested tern	C		Y	QAI
Laridae	Sterna bergii	crested tern	C			QAI
Laridae	Sterna caspia	Caspian tern	C			QAI
Laridae	Sterna fuscata	sooty tern	C			QAI
Laridae	Sterna hirundo	common tern	C		Y	QAI
Laridae	Sterna nilotica	gull-billed tern	C			QAI
Laridae	Sterna sumatrana	black-naped tern	C		Y	QAI
Maluridae	Malurus amabilis	lovely fairy-wren	C			Q
Maluridae	Malurus lamberti	variegated fairy-wren	C			QA
Maluridae	Malurus melanocephalus	red-backed fairy-wren	C			QA
Megapodiidae	Alectura lathami	Australian brush-turkey	C			QA
Megapodiidae	Megapodius reinwardt	orange-footed scrubfowl	C			QA
Meliphagidae	Acanthorhynchus tenuirostris	eastern spinebill	C			QA
Meliphagidae	Certhionyx pectoralis	banded honeyeater	C			QA
Meliphagidae	Entomyzon cyanotis	blue-faced honeyeater	C			QAI
Meliphagidae	Lichenostomus chrysops	yellow-faced honeyeater	C			QA
Meliphagidae	Lichenostomus flavescens	yellow-tinted honeyeater	C			QAI
Meliphagidae	Lichenostomus flavus	yellow honeyeater	C			Q
Meliphagidae	Lichenostomus frenatus	bridled honeyeater	C			QA
Meliphagidae	Lichenostomus fuscus	fuscous honeyeater	C			QA

Class - Birds						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Meliphagidae	Lichenostomus unicolor	white-gaped honeyeater	C			QA
Meliphagidae	Lichenostomus versicolor	varied honeyeater	C			QAI
Meliphagidae	Lichmera indistincta	brown honeyeater	C			QA
Meliphagidae	Manorina melanocephala	noisy miner	C			QA
Meliphagidae	Meliphaga gracilis	graceful honeyeater	C			QAI
Meliphagidae	Meliphaga lewinii	Lewin's honeyeater	C			QA
Meliphagidae	Meliphaga notata	yellow-spotted honeyeater	C			Q
Meliphagidae	Melithreptus albogularis	white-throated honeyeater	C			QAI
Meliphagidae	Melithreptus brevirostris	brown-headed honeyeater	C			QA
Meliphagidae	Melithreptus gularis	black-chinned honeyeater	R		Y	QA
Meliphagidae	Melithreptus lunatus	white-naped honeyeater	C			QA
Meliphagidae	Myzomela obscura	dusky honeyeater	C			QAI
Meliphagidae	Myzomela sanguinolenta	scarlet honeyeater	C			QA
Meliphagidae	Philemon argenticeps	silver-crowned friarbird	C			QA
Meliphagidae	Philemon buceroides	helmeted friarbird	C			QAI
Meliphagidae	Philemon citreogularis	little friarbird	C			QAI
Meliphagidae	Philemon corniculatus	noisy friarbird	C			QAI
Meliphagidae	Phylidonyris nigra	white-cheeked honeyeater	C			QA
Meliphagidae	Ramsayornis fasciatus	bar-breasted honeyeater	C			QA
Meliphagidae	Ramsayornis modestus	brown-backed honeyeater	C			QAI
Meliphagidae	Xanthotis macleayana	Macleay's honeyeater	C			QA
Meropidae	Merops ornatus	rainbow bee-eater	C		Y	QAI
Motacillidae	Anthus novaeseelandiae	Richard's pipit	C			QAI
Motacillidae	Motacilla cinerea	grey wagtail	C		Y	VU
Motacillidae	Motacilla flava	yellow wagtail	C		Y	QAI
Muscicapidae	Zoothera sp.					U
Nectariniidae	Nectarinia jugularis	yellow-bellied sunbird	C			QAI
Neosittidae	Daphoenositta chrysoptera	varied sittella	C			QAI
Oriolidae	Oriolus flavocinctus	yellow oriole	C			QAI
Oriolidae	Oriolus sagittatus	olive-backed oriole	C			QAI
Oriolidae	Sphecotheres viridis	figbird	C			QAI
Orthonychidae	Orthonyx spaldingii	chowchilla	C			Q
Pachycephalidae	Colluricincla boweri	Bower's shrike-thrush	C			Q
Pachycephalidae	Colluricincla harmonica	grey shrike-thrush	C			QAI
Pachycephalidae	Colluricincla megarhyncha	little shrike-thrush	C			QAI
Pachycephalidae	Falcunculus frontatus	crested shrike-tit	C			QA
Pachycephalidae	Pachycephala pectoralis	golden whistler	C			QAI
Pachycephalidae	Pachycephala rufiventris	rufous whistler	C			QAI
Pachycephalidae	Pachycephala simplex peninsulae	grey whistler	C			Q
Paradisaeidae	Ptiloris victoriae	Victoria's riflebird	C			Q
Pardalotidae	Acanthiza katherina	mountain thornbill	C			Q
Pardalotidae	Acanthiza nana	yellow thornbill	C			QA
Pardalotidae	Acanthiza reguloides	buff-rumped thornbill	C			QA
Pardalotidae	Gerygone levigaster	mangrove gerygone	C			QAI
Pardalotidae	Gerygone magnirostris	large-billed gerygone	C			QAI
Pardalotidae	Gerygone mouki	brown gerygone	C			QA
Pardalotidae	Gerygone olivacea	white-throated gerygone	C			QAI
Pardalotidae	Gerygone palpebrosa	fairy gerygone	C			QAI
Pardalotidae	Oreoscopus gutturalis	fernwren	C			Q
Pardalotidae	Pardalotus punctatus	spotted pardalote	C			QA
Pardalotidae	Pardalotus striatus	striated pardalote	C			QA
Pardalotidae	Sericornis citreogularis	yellow-throated scrubwren	C			QA
Pardalotidae	Sericornis frontalis	white-browed scrubwren	C			QA
Pardalotidae	Sericornis keri	Atherton scrubwren	C			Q
Pardalotidae	Sericornis magnirostris	large-billed scrubwren	C			QA
Pardalotidae	Smicrornis brevirostris	weebill	C			QA
Passeridae	Erythrura trichroa	blue-faced parrot-finch	R		Y	QAI
Passeridae	Lonchura castaneothorax	chestnut-breasted mannikin	C			QAI
Passeridae	Lonchura punctulata	nutmeg mannikin				II
Passeridae	Neochmia phaeton	crimson finch	V		Y	U
Passeridae	Neochmia phaeton iredalei	crimson finch (eastern form)	V		Y	Q
Passeridae	Neochmia temporalis	red-browed finch	C			QA
Passeridae	Passer domesticus	house sparrow				II

Class - Birds						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Passeridae	Poephila cincta	black-throated finch	C			QA
Passeridae	Taeniopygia bichenovii	double-barred finch	C			QA
Passeridae	Taeniopygia guttata	zebra finch	C			QA
Pelecanidae	Pelecanus conspicillatus	Australian pelican	C			QAI
Petroicidae	Drymodes superciliaris	northern scrub-robin	C			QAI
Petroicidae	Eopsaltria australis	eastern yellow robin	C			QA
Petroicidae	Eopsaltria pulverulenta	mangrove robin	C			QA
Petroicidae	Heteromyias albispecularis	grey-headed robin	C			Q
Petroicidae	Microeca flavigaster	lemon-bellied flycatcher	C			QAI
Petroicidae	Tregellasia capito	pale-yellow robin	C			QA
Phalacrocoracidae	Phalacrocorax carbo	great cormorant	C			QAI
Phalacrocoracidae	Phalacrocorax melanoleucos	little pied cormorant	C			QAI
Phalacrocoracidae	Phalacrocorax sulcirostris	little black cormorant	C			QA
Phalacrocoracidae	Phalacrocorax varius	pied cormorant	C			QAI
Phasianidae	Coturnix chinensis	king quail	C			QAI
Phasianidae	Coturnix pectoralis	stubble quail	C			QA
Phasianidae	Coturnix ypsilophora	brown quail	C			QAI
Phasianidae	Gallus gallus	red junglefowl				II
Phasianidae	Pavo cristatus	Indian peafowl				II
Pittidae	Pitta versicolor	noisy pitta	C			QAI
Podargidae	Podargus papuensis	Papuan frogmouth	C			QAI
Podargidae	Podargus strigoides	tawny frogmouth	C			QA
Podicipedidae	Podiceps cristatus	great crested grebe	C			QAI
Podicipedidae	Tachybaptus novaehollandiae	Australasian grebe	C			QAI
Procellariidae	Puffinus tenuirostris	short-tailed shearwater	C		Y	QAI
Psittacidae	Alisterus scapularis	Australian king-parrot	C			QA
Psittacidae	Aprosmictus erythropterus	red-winged parrot	C			QAI
Psittacidae	Cyclopsitta diophthalma macleayana	Macleay's fig-parrot	V		Y	Q
Psittacidae	Glossopsitta pusilla	little lorikeet	C			QA
Psittacidae	Platycercus adscitus	pale-headed rosella	C			QA
Psittacidae	Platycercus elegans	crimson rosella	C			QA
Psittacidae	Trichoglossus chlorolepidotus	scaly-breasted lorikeet	C			QA
Psittacidae	Trichoglossus haematodus haematodus	rainbow lorikeet	C			QAI
Ptilonorhynchidae	Ailuroedus melanotis	spotted catbird	C			QAI
Ptilonorhynchidae	Chlamydera nuchalis	great bowerbird	C			QA
Ptilonorhynchidae	Prionodura newtoniana	golden bowerbird	C			Q
Ptilonorhynchidae	Ptilonorhynchus violaceus	satin bowerbird	C			QA
Ptilonorhynchidae	Scenopoeetes dentirostris	tooth-billed bowerbird	C			Q
Rallidae	Amaurornis olivaceus	bush-hen	C			QAI
Rallidae	Fulica atra	Eurasian coot	C			QAI
Rallidae	Gallinula tenebrosa	dusky moorhen	C			QAI
Rallidae	Gallinula ventralis	black-tailed native-hen	C			QA
Rallidae	Gallirallus philippensis	buff-banded rail	C			QAI
Rallidae	Porphyrio porphyrio	purple swamphen	C			QAI
Rallidae	Porzana cinerea	white-browed crake	C			QAI
Rallidae	Porzana fluminea	Australian spotted crake	C			QA
Rallidae	Rallina tricolor	red-necked crake	C			QAI
Recurvirostridae	Himantopus himantopus	black-winged stilt	C			QAI
Scolopacidae	Actitis hypoleucos	common sandpiper	C		Y	QAI
Scolopacidae	Arenaria interpres	ruddy turnstone	C		Y	QAI
Scolopacidae	Calidris acuminata	sharp-tailed sandpiper	C		Y	QAI
Scolopacidae	Calidris canutus	red knot	C		Y	QAI
Scolopacidae	Calidris ferruginea	curlew sandpiper	C		Y	QAI
Scolopacidae	Calidris ruficollis	red-necked stint	C		Y	QAI
Scolopacidae	Calidris tenuirostris	great knot	C		Y	QAI
Scolopacidae	Gallinago hardwickii	Latham's snipe	C		Y	QAI
Scolopacidae	Heteroscelus brevipes	grey-tailed tattler	C		Y	QAI
Scolopacidae	Heteroscelus incanus	wandering tattler	C		Y	QAI
Scolopacidae	Limicola falcinellus	broad-billed sandpiper	C		Y	QAI
Scolopacidae	Limosa lapponica	bar-tailed godwit	C		Y	QAI
Scolopacidae	Limosa limosa	black-tailed godwit	C		Y	QAI
Scolopacidae	Numenius madagascariensis	eastern curlew	R		Y	QAI
Scolopacidae	Numenius minutus	little curlew	C		Y	QAI

Class - Birds						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Scolopacidae	Numenius phaeopus	whimbrel	C		Y	QAI
Scolopacidae	Tringa glareola	wood sandpiper	C		Y	QAI
Scolopacidae	Tringa nebularia	common greenshank	C		Y	QAI
Scolopacidae	Tringa stagnatilis	marsh sandpiper	C		Y	QAI
Scolopacidae	Xenus cinereus	terek sandpiper	C		Y	QAI
Strigidae	Ninox connivens	barking owl	C			QAI
Strigidae	Ninox novaeseelandiae	southern boobook	C			QAI
Strigidae	Ninox rufa queenslandica	rufous owl (southern subspecies)	V		Y	Q
Sturnidae	Acridotheres tristis	common myna				II
Sturnidae	Aplonis metallica	metallic starling	C			QAI
Sturnidae	Sturnus vulgaris	common starling				II
Sylviidae	Acrocephalus stentoreus	clamorous reed-warbler	C			QAI
Sylviidae	Cincloramphus cruralis	brown songlark	C			QA
Sylviidae	Cisticola exilis	golden-headed cisticola	C			QAI
Sylviidae	Megalurus timoriensis	tawny grassbird	C			QAI
Threskiornithidae	Platalea flavipes	yellow-billed spoonbill	C			QA
Threskiornithidae	Platalea regia	royal spoonbill	C			QAI
Threskiornithidae	Plegadis falcinellus	glossy ibis	C		Y	QAI
Threskiornithidae	Threskiornis molucca	Australian white ibis	C			QAI
Threskiornithidae	Threskiornis spinicollis	straw-necked ibis	C			QAI
Turnicidae	Turnix maculosa	red-backed button-quail	C			QAI
Turnicidae	Turnix varia	painted button-quail	C			QA
Tytonidae	Tyto alba	barn owl	C			QAI
Tytonidae	Tyto multipunctata	lesser sooty owl	C			Q
Tytonidae	Tyto novaehollandiae kimberli	masked owl (northern subspecies)	V	V	Y	QA
Tytonidae	Tyto tenebricosa	sooty owl	R		Y	QA
Zosteropidae	Zosterops citrinellus	pale white-eye	C			Q
Zosteropidae	Zosterops lateralis	silvereye	C			QAI

Fish

Class - Fish						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Anguillidae	Anguilla obscura	Pacific short-finned eel				QI
Eleotridae	Hypseleotris compressa	empire gudgeon				QAI
Gobiidae	Glossogobius species 1	false celebes goby				QI
Gobiidae	Schismatogobius species	scaleless goby				Q
Lutjanidae	Lutjanus argentimaculatus	mangrove jack				QAI
Melanotaeniidae	Cairnsichthys rhombosomoides	Cairns rainbowfish				Q
Melanotaeniidae	Melanotaenia maccullochi	McCulloch's rainbowfish				QAI
Melanotaeniidae	Melanotaenia splendida splendida	eastern rainbowfish				Q
Pseudomugilidae	Pseudomugil gertrudae	spotted blue-eye				QAI
Pseudomugilidae	Pseudomugil signifer	Pacific blue-eye				QA
Soleidae	Brachirus selheimi	freshwater sole				QA
Synbranchidae	Ophisternon gutturale	swamp eel				QAI
Terapontidae	Hephaestus fuliginosus	sooty grunter				QA
Toxotidae	Toxotes chatareus	seven-spot archerfish				QAI

Insects

Class - Insects						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Hesperiidae	Chaetocneme porphyropis	purple dusk-flat				Q
Lycaenidae	Hypochrysops apollo apollo	Apollo jewel (Wet Tropics subspecies)	V		Y	Q
Lycaenidae	Philiris diana diana	large moonbeam (Wet Tropics subspecies)				Q

Mammals

Class - Mammals						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Canidae	Canis familiaris	dog				II
Dasyuridae	Antechinus flavipes	yellow-footed antechinus	C			QA
Hipposideridae	Hipposideros ater aruensis	eastern dusky leaf-nosed bat	C			QAI
Hipposideridae	Hipposideros diadema reginae	diadem leaf-nosed bat	R		Y	QAI
Macropodidae	Thylogale stigmatica	red-legged pademelon	C			QAI
Molossidae	Mormopterus beccarii	Beccari's freetail bat	C			QAI
Molossidae	Mormopterus loriae ridei	little north-eastern freetail bat	C			QAI
Muridae	Hydromys chrysogaster	water rat	C			QAI
Muridae	Melomys burtoni	grassland melomys	C			QA
Muridae	Melomys cervinipes	fawn-footed melomys	C			QA
Muridae	Mus musculus	house mouse				II
Muridae	Rattus fuscipes	bush rat	C			QA
Muridae	Rattus leucopus	Cape York rat	C			QAI
Muridae	Rattus norvegicus	brown rat				II
Muridae	Rattus rattus	black rat				II
Muridae	Rattus sordidus	canefield rat	C			QAI
Muridae	Uromys caudimaculatus	giant white-tailed rat	C			QAI
Peramelidae	Isoodon macrourus	northern brown bandicoot	C			QAI
Peramelidae	Perameles nasuta	long-nosed bandicoot	C			QA
Petauridae	Dactylopsila trivirgata	striped possum	C			QAI
Potoroidae	Hypsiprymnodon moschatus	musky rat-kangaroo	C			Q
Pteropodidae	Macroglossus minimus	northern blossom bat	C			QAI
Pteropodidae	Nyctimene robinsoni	eastern tube-nosed bat	C			QA
Pteropodidae	Pteropus alecto	black flying-fox	C			QAI
Pteropodidae	Pteropus conspicillatus	spectacled flying-fox	C	V	Y	QAI
Pteropodidae	Syconycteris australis	eastern blossom bat	C			QAI
Rhinolophidae	Rhinolophus megaphyllus	eastern horseshoe-bat	C			QAI
Suidae	Sus scrofa	pig				II
Vespertilionidae	Miniopterus australis	little bent-wing bat	C			QAI
Vespertilionidae	Miniopterus schreibersii oceanensis	eastern bent-wing bat	C	CD	Y	QAI
Vespertilionidae	Myotis macropus	southern myotis	C			QA
Vespertilionidae	Nyctophilus bifax bifax	northern long-eared bat	C			QAI
Vespertilionidae	Scotorepens sanborni	northern broad-nosed bat	C			QAI
Vespertilionidae	Vespadelus pumilus	eastern forest bat	C			QA

Other Mammals in the Shire—positively identified by QPWS

Family	**Scientific Name**	**Common Name**
Burramyidae	Cercartetus caudatus	long-tailed pygmy possum
Canidae	Canis familarus dingo	dingo
Dasyuridae	Antechinus stuartii	brown antechinus
Dasyuridae	Dasyurus maculatus	spotted-tailed quoll
Emballonuridae	Taphozous georgianus	common sheathtail bat
Felidae	Felis catus	feral cat
Macropodidae	Thylogale stigmatica	red-legged pademelon
Macropodidae	Macropus agilis	agile wallaby
Macropodidae	Dendrolagus lumholtzi	Lumholtz's tree kangaroo
Ornithorhynchidae	Ornithorhynchus anatinus	platypus
Pseudocheiridae	Psuedocheirus herbertensis	Herbert river ringtail possum
Pseudocheiridae	Psuedocheirus archeri	green ringtail possum
Pseudocheiridae	Hemibelideus lemuroides	lemuroid ringtail possum
Rhinolophidae	Rhinolophus philippensis	large-eared horseshoe bat
Tachyglossidae	Tachyglossus aculeatus	short-beaked echidna

Reptiles

Class - Reptiles						
Family	**Scientific Name**	**Common Name**	**NCA**	**EPBC**	**Sig**	**End**
Agamidae	Hypsilurus boydii	Boyd's forest dragon	C			Q
Agamidae	Physignathus lesueurii	eastern water dragon	C			QA
Boidae	Antaresia maculosus		C			QA
Boidae	Liasis mackloti	water python	C			QAI
Boidae	Morelia kinghorni	amethystine python (Australian form)	C			Q
Boidae	Morelia spilota	carpet python	C			QA
Chelidae	Elseya dentata	northern snapping turtle	C			QA
Chelidae	Elseya latisternum	saw-shelled turtle	C			QA
Cheloniidae	Natator depressus	flatback turtle	V	V	Y	QAI
Colubridae	Boiga irregularis	brown tree snake	C			QA
Colubridae	Dendrelaphis punctulata	common tree snake	C			QA
Colubridae	Enhydris polylepis	Macleay's water snake	C			QA
Colubridae	Tropidonophis mairii	freshwater snake	C			QA
Crocodylidae	Crocodylus porosus	estuarine crocodile	V		Y	QAI
Elapidae	Cacophis churchilli		C			Q
Elapidae	Furina barnardi	yellow-naped snake	R		Y	Q
Elapidae	Hemiaspis signata	black-bellied swamp snake	C			QA
Elapidae	Oxyuranus scutellatus	taipan	C			QA
Elapidae	Rhinoplocephalus nigrescens	eastern small-eyed snake	C			QA
Elapidae	Tropidechis carinatus	rough-scaled snake	C			QA
Elapidae	Vermicella annulata	bandy-bandy	C			QA
Gekkonidae	Carphodactylus laevis	chameleon gecko	C			Q
Gekkonidae	Hemidactylus frenatus	house gecko				II
Gekkonidae	Lepidodactylus lugubris	mourning gecko	C			QAI
Gekkonidae	Saltuarius cornutus	northern leaf-tailed gecko	C			Q
Scincidae	Carlia rubrigularis		C			Q
Scincidae	Coeranoscincus frontalis		R		Y	Q
Scincidae	Cryptoblepharus litoralis		C			QAI
Scincidae	Cryptoblepharus virgatus		C			QA
Scincidae	Ctenotus robustus		C			QA
Scincidae	Cyclodomorphus gerrardii	pink-tongued lizard	C			QA
Scincidae	Egernia frerei	major skink	C			QA
Scincidae	Eulamprus quoyii	eastern water skink	C			QA
Scincidae	Eulamprus tigrinus		R		Y	Q
Scincidae	Glaphyromorphus pardalis		C			Q
Scincidae	Gnypetoscincus queenslandiae		C			Q
Scincidae	Lampropholis coggeri		C			Q
Scincidae	Lampropholis delicata		C			QA
Scincidae	Saproscincus basiliscus		C			Q
Scincidae	Saproscincus czechurai		C			Q
Typhlopidae	Ramphotyphlops polygrammicus		C			Q
Varanidae	Varanus gouldii	sand monitor	C			QA
Varanidae	Varanus scalaris	spotted tree monitor	C			QAI

Appendix 6.2—Flora
Rare and Threatened Species List for the Johnstone Shire (1996)

Source: Queensland Biodiversity Network as cited in Bell R., 1996, '*Johnstone River Catchment Revegetation Strategy Appendix 2'*, Johnstone River Catchment Management Association Inc.

Family	Scientific Name	Common Name Status	(QLD Legislation)	Status (Federal Legislation)
Alseuosmiacee	*Crispiloba disperma*		Rare	Not Classified
Annonaceae	*Ancana hirsuta Meiogyne sp.*		Rare	Not Classified
Annonaceae	*Haplostichanthus sp.*		Rare	Not Classified
Annonaceae	*Polyalthia michaelii*		Rare	Not Classified
Annonaceae	*Polylathia sp.*		Rare	Not Classified
Annonaceae	*Pseuduvaria hylandii*		Rare	Not Classified
Annonaceae	*Pseuduvaria mulgraveana*		Rare	Not Classified
Annonaceae	*Pseuduvaria villosa*		Rare	Not Classified
Anonaceae	*Haplostichanthus johnsonii t*		Rare	Not Classified
Anonaceae	*Haplostichanthus sp.*			
Apiaceae	*Oenanthe javanica*		Rare	Not Classified
Apocynaceae	*Alyxia orophila*		Rare	Not Classified
Apocynaceae	*Cerbera inflata*		Rare	Not Classified
Apocynaceae	*Melodinus baccellianus*		Rare	Not Classified
Aponogetonaceae	*Aponogeton bullosus*		Endangered	Not Classified
Aponogetonaceae	*Aponogeton elongatus*		Rare	Not Classified
Aponogetonaceae	*Aponogeton sp. (Innisfail-live bearing)*		Endangered	Not Classified
Aquifoliaceae	*Ilex sp.*		Rare	Not Classified
Araceae	*Pothos brassii*		Rare	Not Classified
Araceae	*Pothos brownii*		Rare	Not Classified
Araceae	*Remusatia vivipara*		Rare	Not Classified
Araceae	*Rhaphidophora pachyphylla*		Rare	Not Classified
Araliaceae	*Aralia macdowallii*		Rare	Not Classified
Araliaceae	*Polyscias bellendenkerensis*		Vulnerable	Vulnerable
Araliaceae	*Polyscias willmottii*		Rare	Not Classified
Araucariaceae	*Agathis atropurpurea*		Rare	Not Classified
Araucariaceae	*Agathis microstachya*		Rare	Not Classified
Areaceae	*Arenga australasica*		Vulnerable	Not Classified
Arecaceae	*Lindospadix palmeriana*		Rare	Not Classified
Arecaceae	*Linospadix microcarya*		Rare	Not Classified
Arecaceae	*Livistona drudei*		Vulnerable	Vulnerable
Asclepiadaceae	*Cryptolepis grayi*		Rare	Not Classified
Asclepiadaceae	*Tylophora rupicola*		Endangered	Endangered
Asclepiadaceae	*Tylophora williamsii*		Vulnerable	Vulnerable
Aspleniaceae	*Asplenium atheronense*		Rare	Not Classified
Aspleniaceae	*Asplenium australiasicum*	Crows Nest or Birds Nest Fern	Common	Not Classified
Aspleniaceae	*Asplenium excisum*		Rare	Not Classified
Aspleniaceae	*Asplenium normale*		Rare	Not Classified
Aspleniaceae	*Asplenium pellucidum*		Vulnerable	Vulnerable
Aspleniaceae	*Asplenium unilaterale*		Rare	Not Classified
Asteraceae	*Peripleura scabra*			
Asteraceae	*Peripleura sericea*			
Asteraceae	*Vittadinia scabra*		Rare	Not Classified
Asteraceae	*Vittadinia sericea*		Rare	Not Classified
Athyriaceae	*Diplazium cordifolium*		Vulnerable	Vulnerable
Athyriaceae	*Diplazium pallidum*		Endangered	Not Classified
Burseraceae	*Canarium acutifolium var. acutifolium*		Vulnerable	Vulnerable
Cabombaceae	*Brasenia schreberi*		Rare	Not Classified
Celastraceae	*Denhamia viridissima*		Rare	Not Classified
Celastraceae	*Hexaspora pubescens*		Vulnerable	Vulnerable
Celastraceae	*Hypsophila halleyana*		Rare	Not Classified

Family	Scientific Name	Common Name Status	(QLD Legislation)	Status (Federal Legislation)
Cesalpinaceae	*Storckiella australiensis*		Rare	Not Classified
Cesalpiniaceae	*Caesalpinia robusta*		Rare	Not Classified
Clusiaceae	*Garcinia gibbsiae*		Rare	Not Classified
Clusiaceae	*Garcinia mestonii*		Rare	Not Classified
Clusiaceae	*Mammea touriga*		Rare	Not Classified
Clusiaceae	*Mesua sp.*		Vulnerable	Vulnerable
Combretaceae	*Dansiea slliptica*		Rare	Not Classified
Combretaceae	*Macropteranthes montana*		Vulnerable	Vulnerable
Commelinaceae	*Cartonema brachyantherum*		Rare	Not Classified
Connoraceae	*Rourea brachyandra*		Rare	Not Classified
Convolvulaceae	*Argyreia soutteri*		Presumed Extinct	Not Classified
Cunoniaceae	*Eratopetalum virchowii*		Rare	Not Classified
Cunoniaceae	*Schizomeria whitei*		Rare	Not Classified
Cupressaceae	*Callitris columellaris*	Bribie Island Cyprus	Common	Not Classified
Cyatheaceae	*Cyathea baileyana*		Rare	Not Classified
Cycadaceae	*Cycas media*	Zamia Nut, Nut Palm	Common	Not Classified
Cyperaceae	*Carex breviscapa*		Rare	Not Classified
Cyperaceae	*Carex rafflesiana Carex cruciata var.*		Rare	Not Classified
Cyperaceae	*Eleocharis retroflexa*		Vulnerable	Not Classified
Cyperaceae	*Fimbristylis adjuncta*		Endangered	Endangered
Cyperaceae	*Gahnia sieberiana*	Sword Grass, Razor Grass	Common	Not Classified
Cytheaceae	*Cyathea celebica*		Rare	Not Classified
Dipteridaceae	*Dipteris conjugaa*		Rare	Not Classified
Droseraceae	*Drosera achizandra*		Vulnerable	Vulnerable
Droseraceae	*Drpsera adelae*	Lance-leaved Sundew	Rare	Not Classified
Dryopteridaceae	*Lastreopsis grayi*		Rare	Not Classified
Dryopteridaceae	*Lastreopsis tinarooensis*		Rare	Not Classified
Dryopteridaceae	*Lastreopsis walleri*		Vulnerable	Vulnerable
Ebenaceae	*Diospyros sp.*		Rare Not	Classified
Elaeocarpaceae	*Aceratium sericoleopsis*		Rare	Not Classified
Elaeocarpaceae	*Elaeocarpus carolinae*		Rare	Not Classified
Elaeocarpaceae	*Elaeocarpus coorangooloo*		Rare	Not Classified
Elaeocarpaceae	*Elaeocarpus grahamii*		Rare	Not Classified
Elaeocarpaceae	*Elaeocarpus hohnsonii*		Rare	Not Classified
Elaeocarpaceae	*Elaeocarpus stellaris*		Rare	Not Classified
Elaeocarpaceae	*Peripentadenia mearsii*		Rare	Not Classified
Elaeocarppaceae	*Aceratium doggrellii*		Rare	Not Classified
Eleaocarpaceae	*Elaeocarpus linsmithii*		Rare	Not Classified
Epacridaceae	*Acrotriche baileyana*		Rare	Not Classified
Epacridaceae	*Dracophyllum sayeri*		Rare	Not Classified
Epacridaceae	*Leucopogon malayanus subsp.*		Rare	Not Classified
Epacridaceae	*Leucopogon spathaceus*		Rare	Not Classified
Epacridaceae	*Trochocarpa bellendenkerensis*		Rare	Not Classified
Ericaceae	*Agapetes meiniana*	Agapetes	Rare	Not Classified
Ericaceae	*Rhododendron lochiae*	Native Rhododendron	Rare	Not Classified
Erythroxylaceae	*Erythroxylum ecarinatum*		Rare	Not Classified
Eucryphiacea	*Eucryphia sp.*		Vulnerable	Vulnerable
Euphorbiaceae	*Actehila foetida*		Vulnerable	Not Classified
Euphorbiaceae	*Austrobuxus nitidus*		Rare	Not Classified
Euphorbiaceae	*Bertya polystigma*		Rare	Not Classified
Euphorbiaceae	*Cleistanthus discolor*		Rare	Not Classified
Euphorbiaceae	*Croton densivestitus*		Rare	Not Classified
Euphorbiaceae	*Euphorbia carissoides*		Vulnerable	Presumed Extinct
Euphorbiaceae	*Fontainea picrosperma*		Rare Not	Classified

Family	Scientific Name	Common Name Status	(QLD Legislation)	Status (Federal Legislation)
Euphorbiaceae	*Glochidion pruinosum*		Rare	Not Classified
Euphorbiaceae	*Omphalea queenslandiae*		Rare	Not Classified
Euphorbiaceae	*Phyllanthus hyposporidius*		Rare	Not Classified
Euphorbiaceae	*Rockinghamia brevipes*		Rare	Not Classified
Euphorbiaceae	*Sauropus macranthus*		Vulnerable	Vulnerable
Euphorbiaceae	*Whyanbeelia terraereginae*		Rare	Not Classified
Fabaceae	*Cajanus mareebensis*		Endangered	Endangered
Fabaceae	*Dioclea reflexa*		Vulnerable	Vulnerable
Fabaceae	*Dioclea hexandra*			
Fabaceae	*Milletia pilipes*		Rare	Not Classified
Fabaceae	*Strongylodon lucidus*		Rare	Not Classified
Fabaceae	*Tephrosia savannicola*		Rare	Not Classified
Flacourtiaceae	*Baileyoxylon lanceolatum*		Rare	Not Classified
Flacourtiaceae	*Casearia grayi*		Rare	Not Classified
Gesneriaceae	*Boea kinnearii*			
Gesneriaceae	*Didymocarpus kinnearii*		Rare	Not Classified
Gesneriaceae	*Lenbrassia australiana*		Rare	Not Classified
Gleicheniaceae	*Diplopterygium longissimum*		Rare	Not Classified
Grammitidaceae	*Ctenopteris walleri*		Vulnerable	Vulnerable
Grammitidaceae	*Grammitis albosetosa*		Rare	Not Classified
Grossulariaceae	*Argophyllum cryptophlebu,*		Rare	Not Classified
Grossulariaceae	*Polyosma rigidiuscula*		Rare	Not Classified
Grossulariaceae	*Quintinia quatrefagesii*		Rare	Not Classified
Hamamelidaceae	*Ostrearia australiana*		Rare	Not Classified
Hamemilidaceae	*Neostrearia fleckeri*		Rare	Not Classified
Hernandiaceae	*Hernandia albiflora*		Rare	Not Classified
Hydrocharitaceae	*Vallisneria gracilis*		Rare	Not Classified
Hymenophyllaceae	*Crepidomanes majoriae*		Rare	Not Classified
Hymenophyllaceae	*Didymoglossum exiguum*		Presumed Extinct	Not Classified
Hymenophyllaceae	*Hymenophyllum gracilescens*		Rare	Not Classified
Hymenophyllaceae	*Hymenophyllum kerianum*		Rare	Not Classified
hymenophyllaceae	*Hymenophyllum lobbii*		Presumed Extinct	Not Classified
Hymenophyllaceae	*Microgonium mindorense*		Rare	Not Classified
Hymenophyllaceae	*Microtrichomanes digitatum*		Rare	Not Classified
Hymenophyllaceae	*Pleuromanes pallidum*		Rare	Not Classified
Hymenophyllaceae	*Reediella endlicheriana*		Rare	Not Classified
Idiospermaceae	*Idiospermum australiense*	Idiot Fruit	Rare	Vulnerable
Lamiaceae	*Hemigenia clotteniana*		Presumed Extinct	Not Classified
Lamiaceae	*Plectranthus gratus*		Vulnerable	Vulnerable
Lamiaceae	*Prostanthera atroviolaceae*		Rare	Not Classified
Lauraceae	*Beilschmiedia oligandra*		Rare	Not Classified
Lauraceae	*Beilschmiedia volckii*		Rare	Not Classified
Lauraceae	*Cinnamomum propinquum*		Rare	Not Classified
Lauraceae	*Cryptocarya bellendenkerana*		Rare	Not Classified
Lauraceae	*Cryptocarya pleurosperma*		Rare Not	Classified
Lauraceae	*Endiandra anthropophagorum*		Rare	Not Classified
Lauraceae	*Endiandra bellendenkerana*		Rare	Not Classified
Lauraceae	*Endiandra dichrophylla*		Rare	Not Classified
Lauraceae	*Endiandra globosa*		Rare	Not Classified
Lauraceae	*Endiandra sideroxylon*		Rare	Not Classified
Lauraceae	*Endiandra xanthocarpa*		Rare	Not Classified
Lauraceae	*Litsea bennettii*		Rare	Not Classified
Liliaceae	*Kuntheria pedunculata*		Rare	Not Classified
Lindsaeaceae	*Lindsea repens var. lingulate lindsea repens*		Presumed Extinct	Not Classified
Lindsaeceae	*Lindsea reprens var. marquesensis lindsea*		Rare	Not Classified
Lomariopsidaceae	*Elaphoglossum callifolium*		Rare	Not Classified

Family	Scientific Name	Common Name Status	(QLD Legislation)	Status (Federal Legislation)
Loranthaceae	*Lysiana filifolia*		Rare	Not Classified
Lycopodeaceae	*Huperzia squarrosa*		Endangered	Endangered
Lycopodiaceae	*Huperzia dalhousieana*		Endangered	Endangered
Lycopodiaceae	*Huperzia lockyeri*		Vulnerable	Vulnerable
Lycopodiaceae	*Huperzia marsupiiformis*		Vulnerable	Vulnerable
Lycopodiaceae	*Huperzia phlegmaria*	Common Tassell Fern	Rare	Not Classified
Lycopodiaceae	*Huperzia phlegmarioides*		Vulnerable	Vulnerable
Lycopodiaceae	*Huperzia prolifera*	Square Tassell Fern	Vulnerable	Vulnerable
Lycopodiaceae	*Huperzia serrata*		Presumed Extinct	Not Classified
Lycopodiaceae	*Lycopodium volubile*		Presumed Extinct	Not Classified
Melastomataceae	*Medinilla ballsheadleyi*		Rare	Not Classified
Meliaceae	*Dysoxylum setosum*		Rare	Not Classified
Menispermaceae	*Carronia pedicellata*		Vulnerable	Endangered
Menispermaceae	*Hypserpa smilacifolia*		Rare	Not Classified
Mimosaceae	*Acacia albizioides*		Rare	Not Classified
Mimosaceae	*Acacia guymeri*		Vulnerable	Vulnerable
Mimosaceae	*Acacia hylonoma*		Rare	Not Classified
Mimosaceae	*Acacia longipedunculata*		Rare	Not Classified
Mimosaceae	*Acacia purpureipetala*		Vulnerable	Vulnerable
Mimosaceae	*Archidendron lucyi*		Rare	Not Classified
Mimosaceae	*Archidendron whitei*		Rare	Not Classified
Monimiaceae	*Palmeria hypotephra*		Rare	Not Classified
Monimiaceae	*Steganthera australiana*		Rare	Not Classified
Monimiaceae	*Wilkiea wardellii*		Rare	Not Classified
Musaceae	*Musa jackeyi*		Rare	Not Classified
Myrsinaceae	*Ardisia bifaria*		Rare	Not Classified
Myrsinaceae	*Embelia grayi*		Rare	Not Classified
Myrtaceae	*Acmena divaricata*		Rare	Not Classified
Myrtaceae	*Austromyrtus lasioclada*		Rare	Not Classified
Myrtaceae	*Backhousia bancroftii*		Rare	Not Classified
Myrtaceae	*Barongia lophandra*		Rare	Not Classified
Myrtaceae	*Eucalyptus lockyeri*		Rare	Not Classified
Myrtaceae	*Eucalyptus pachycalyx*		Rare	Not Classified
Myrtaceae	*Eucalyptus rhodops*		Vulnerable	Vulnerable
Myrtaceae	*Gen.No.*		Vulnerable	Not Classified
Myrtaceae	*Homoranthus porteri*		Vulnerable	Vulnerable
Myrtaceae	*Leptospermum wooroonooran*		Rare	Not Classified
Myrtaceae	*Ristantia gouldii*		Vulnerable	Vulnerable
Myrtaceae	*Ristantia pachysperma*		Rare	Not Classified
Myrtaceae	*Syzygium alatoramulum*		Rare	Not Classified
Myrtaceae	*Syzygium alliiligneum*		Rare	Not Classified
Myrtaceae	*Syzygium boonjee*		Rare	Not Classified
Myrtaceae	*Syzygium sharoniae*		Rare	Not Classified
Myrtaceae	*Syzygium xerampelinum*		Rare	Not Classified
Myrtaceae	*Thaleropia queenslandica*		Rare	Not Classified
Myrtaceae	*Uromyrtus metrosideros*		Rare	Not Classified
Myrtaceae	*Waterhousea hedraiophylla*		Rare	Not Classified
Myrtaceae	*Waterhousea mulgraveana*		Rare	Not Classified
Myrtaceae	*Xanthostemon whitei*		Rare	Not Classified
Orchidaceae	*Acianthus sublestus*		Rare	Not Classified
Orchidaceae	*Acriopsis javanica*		Vulnerable	Not Classified
Orchidaceae	*Appendicula austaliensis*		Rare	Not Classified
Orchidaceae	*Bulbophyllum boonjee*		Vulnerable	Not Classified
Orchidaceae	*Calanthe triplicata*	Christmas Orchid	Common	Not Classified

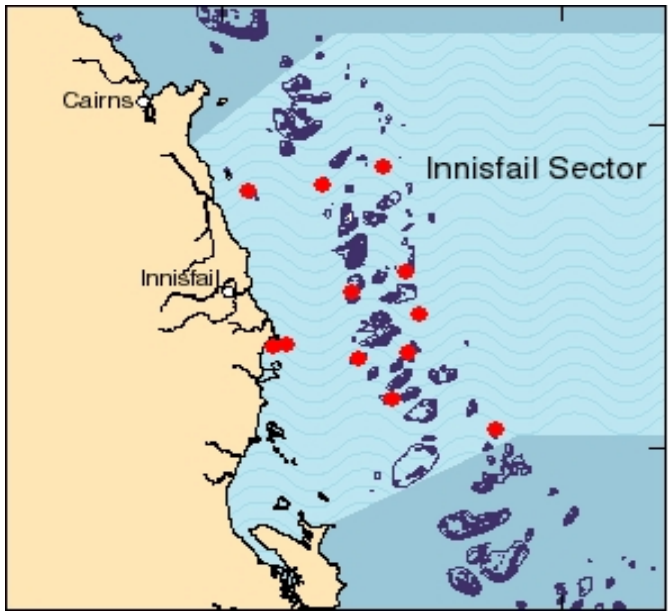
Family	Scientific Name	Common Name Status	(QLD Legislation)	Status (Federal Legislation)
Orchidaceae	*Chiloglottis longiclavata*		Rare	Not Classified
Orchidaceae	*Corybas abellianus*	Nodding Helmet Orchid	Rare	Not Classified
Orchidaceae	*Dendrobium callitrophilum*		Vulnerable	Vulnerable
Orchidaceae	*Dendrobium mirbelianum*	Mangrove	Endangered	Endangered
Orchidaceae	*Dendrobium nindii*	Blue Orchid	Endangered	Endangered
Orchidaceae	*Dendrobium toressae*		Rare	Not Classified
Orchidaceae	*Dipodium ensifolium*	Leafy Hyacinth Orchid	Rare	Not Classified
Orchidaceae	*Diurus oporina*		Rare	Not Classified
Orchidaceae	*Eria dischorensis*		Rare	Not Classified
Orchidaceae	*Eria irukandjiana*		Rare	Not Classified
Orchidaceae	*Gastrodia queenslandica*		Rare	Not Classified
Orchidaceae	*Genoplesium alticola*		Rare	Not Classified
Orchidaceae	*Goodyera grandis*		Rare	Not Classified
Orchidaceae	*Goodyera viridoflora*		Rare	Not Classified
Orchidaceae	*Habenaria divaricata*		Endangered	Not Classified
Orchidaceae	*Malaxis xanthochila*		Rare	Not Classified
Orchidaceae	*Peristylus banfieldii*		Rare	Not Classified
Orchidaceae	*Phaiius tancarvilleae*	Swamp Orchid, Swamp Lily	Endangered	Vulnerable
Orchidaceae	*Phaius pictus*		Vulnerable	Not Classified
Orchidaceae	*Pomatocalpa macphersonii*		Common	Not Classified
Orchidaceae	*Sarcochilus serrulatus*		Rare	Not Classified
Orchidaceae	*Trachoma papuanum*		Rare	Not Classified
Orchidaceae	*Zeuxine polygonoides*		Vulnerable	Vulnerable
Pandanaceae	*Freycinetia marginata*		Rare Not	Classified
Panandaceae	*Pandanus gemmifer*		Rare	Not Classified
Piperaceae	*Peperomia bellendenkerensis*		Endangered	Not Classified
Piperaceae	*Piper mestonii*		Rare	Not Classified
Podocarpaceae	*Podocarpus dispermus*		Rare	Not Classified
Polypodiaceae	*Lemmaphyllum accedens*		Presumed Extinct	Not Classified
Polypodiaceae	*Microsorum membranifolium*		Rare	Not Classified
Proteaceae	*Alloxylon flammeum*		Vulnerable	Vulnerable
Proteaceae	*Austromuellera trinervia*		Rare	Not Classified
Proteaceae	*Darlingia ferruginea*		Rare	Not Classified
Proteaceae	*Grevillea glossadenia*		Vulnerable	Vulnerable
Proteaceae	*Helicia blakei*		Rare	Not Classified
Proteaceae	*Helicia lamingtoniana*		Rare	Not Classified
Proteaceae	*Hollandaea sayeriana*		Rare	Not Classified
Proteaceae	*Macadamia grandis*		Endangered	Not Classified
Proteaceae	*Macadamia heyana*		Rare	Not Classified
Proteaceae	*Catalepidia heyana*			
Proteaceae	*Orites sp.megahertsia amplexicaulis*		Rare	Not Classified
Proteaceae	*Orites sp.Orites Magacarpa*		Rare	Not Classified
Proteaceae	*Stenocarpus cryptocarpus*		Rare	Not Classified
Proteaceae	*Triunia montana*		Rare	Not Classified
Restionaceae	*Restio tetraphyllus*	Foxtails	Common	Not Classified
Rhamnaceae	*Gouania australiana*		Rare	Not Classified
Rubiaceae	*Bobea myrtoides*		Rare	Not Classified
Rubiaceae	*Hydnophytum papuanum*	Ant Plant	Common	Not Classified
Rubiaceae	*Hydnophytum moseleyanum var.*			
Rubiaceae	*Ixora baileyana*		Rare	Not Classified
Rubiaceae	*Myrmecodia beccarii*	Ant Plant, Ant house Plant	Vulnerable	Not Classified
Rubiaceae	*Oldenlandia polyclada*		Rare	Not Classified
Rubiaceae	*Psychatria submontana*		Rare	Not Classified
Rubiaceae	*Psychotria coelospermum*		Rare	Not Classified
Rubiaceae	*Uncaria cordata var. cordata*		Rare	Not Classified
Rubiaceae	*Wendlandia basistaminea*		Rare	Not Classified
Rubiacese	*Hodgkinsonia frutescens*		Vulnerable	Vulnerable
Rutaceae	*Acronychia aberrans*		Rare	Not Classified

Family	Scientific Name	Common Name Status	(QLD Legislation)	Status (Federal Legislation)
Rutaceae	*Acronychia chooreechillum*		Rare	Not Classified
Rutaceae	*Acronychia crassipetala*		Rare	Vulnerable
Rutaceae	*Flindersia oppositifolia*	Mountain Silkwood	Rare	Not Classified
Rutaceae	*Microcitrus indora*		Rare	Not Classified
Rutaceae	*Zieria aspalathoides var. obovata*		Vulnerable	Not Classified
Sapindaceae	*Alectryon semicinereus*		Rare	Not Classified
Sapindaceae	*Dimocarpus liechhardtii*		Presumed Extinct	Not Classified
Sapindaceae	*Diploglottis bracteata*		Rare	Not Classified
Sapindaceae	*Diploglottis harpullioides*		Rare	Not Classified
Sapindaceae	*Diploglottis pedleyi*		Rare	Not Classified
Sapindaceae	*Jagera javanica subsp. australiana*		Vulnerable	Vulnerable
Sapindaceae	*Lepiderma largiflorens*		Rare	Not Classified
Sapindaceae	*Sarcopteryx acuminata*		Rare	Not Classified
Sapindaceae	*Sarcotoechia serrata*	Fern-leaved Tamarind	Rare	Not Classified
Sapindaceae	*Toechima monticola*		Rare	Not Classified
Sapotaceae	*Chrysophyllum spl*		Rare	Not Classified
Sapotaceae	*Planchonella macrocarpa*		Rare	Not Classified
Sapotaceae	*Planchonella singuliflora*		Rare	Not Classified
Simaroubaceae	*Quassia baileyana*		Rare	Not Classified
Solanaceae	*Solanum dimorphispinum*		Rare	Not Classified
Solanaceae	*Solanum hamulosum*		Rare	Not Classified
Sterculiaceae	*Argyrodendron sp.*		Rare	Not Classified
Sterculiaceae	*Brachychiton vitifolius*		Rare	Vulnerable
Sterculiaceae	*Firmiana papuana*		Rare	Not Classified
Symplocaceae	*Symplocos hayesii*		Rare	Not Classified
Symplocaceae	*Symplocos hylandii*		Rare	Not Classified
Symplocaceae	*Symplocos sp.*		Rare	Not Classified
Symplocaceae	*Symplocos stawellii var. montana*		Rare	Not Classified
Thelypteridaceae	*Chingia australis*		Endangered	Not Classified
Thelypteridaceae	*Pneumatopteris costata*		Rare	Not Classified
Tmesipteridaceae	*Tmesipteris lanceolata*		Presumed Extinct	Not Classified
Vittaraceaea	*Antrophyum subfalcatum*		Rare	Not Classified
Vittariacae	*Antrophyum plantagineum*		Rare	Not Classified
Vittariaceae	*Monogramma dareicarpa*	Grass Fern	Presumed Extinct	Not Classified
Winteraceae	*Bubbis queenslandiana*		Rare	Not Classified
Xanthophyllaceae	*Xanthophyllum fragrans*	Fragrant Boxwood	Rare	Not Classified
Zamiaceae	*Bowenia apecabilis*	Zamia Fern	Common	Not Classified
Zamiaceae	*Bowenia serrulata*	Byfield Fern	Common	Not Classified
Zamiaceae	*Lepidozamia hopei*		Common	Not Classified
Zingiberaceae	*Alpinia hylandii*		Rare	Not Classified
Zingiberaceae	*Amomum dallachyi*		Rare	Not Classified

Appendix 6.3—Status of the Shire's Coral Reefs

The following descriptions of reef status are entirely from - Sweatman et al. (2003) "Long-term Monitoring of the Great Barrier Reef – Status Report No 6 2003" Updated information can be viewed directly from the AIMS website (link).
They are presented here as a baseline indicator for comparison in future SoE reports. The reefs described do not correspond exactly to the Shire's boundaries.

Figure 6.3 - Reefs surveyed by AIMS in the Innisfail Sector
Source: AIMS Website 2005



Inner Shelf Reefs

More monitoring of the inshore reefs is planned for the future.

Jessie and Kent Islands
- An inner shelf fringing reef
This reef has been surveyed four times since 1986. Over this time reef-wide live coral cover has remained low (1-10%) with little or no change between survey years. The reef is currently classified as No Outbreak. Records of bleaching and coral disease on this reef in 2002 are not available.

Normanby and Mabel Islands
- An inner shelf submerged reef with an area of 0.4 sq. km.
This reef has been sampled regularly since 1986. No COTS have been recorded in any surveys. Reef-wide live coral cover was initially high (30-50%) before a major decline between 1990 and 1992. The reasons for this drop in coral cover were uncertain but flooding from Cyclone Ivor (March 1990) may have been a factor. There was some recovery of reef-wide live coral up to 1996 before another period of decline. Reef-wide live coral cover was low (1-10%) in 2002 and the reef was classified as No Outbreak. No bleaching was observed and white syndrome disease was restricted to a small number of scattered coral colonies.

Middle Shelf Reefs

Beaver Cay
- A middle shelf reef patches reef with an area of 12.6 sq.km.
Beaver cay has been sampled five times 1988. When originally surveyed, reef-wide live coral cover was low (1-10%) and the reef was classified as Recovering from previous COTS activity. Reef-wide live coral cover then increased to high levels (30-50%) in 1997. Surveys in 2000 found an Active Outbreak with numbers of COTS well in excess of those expected to reduce coral cover. There was a marked decline in reef-wide coral cover to a low level (1-10%) in 2003. No COTS were recorded and there was no coral disease or bleaching. The reef was reclassified as recovering.

Ellison
- A middle shelf crescentic reef with an area of 13.1 sq km.
This reef has been surveyed seven times since 1986. COTS have been seen on this reef in most survey years. Low numbers of COTS were recorded in 1986. The reef wide coral cover was moderate (10-30%) and the reef was classified as Recovering. Small numbers of COTS were seen again in the following year and reef-wide coral cover had continued to decline to a low level (1-10%). Although the COTS density was below that generally expected to cause significant mortality, COTS were the most likely cause of the continued decline. Reef-wide live coral cover increased from 1987, peaking in 1997. Surveys in 2000 showed dramatic increase in COTS activity and the reef was reclassified Active Outbreak. Reef-wide live coral cover declined again to a low level in 2003 due to COTS feeding activity. No COTS were seen in 2003 and the reef was reclassified as Recovering. No bleaching or coral disease was recorded.

Feather
- A middle shelf crescentic reef with an area of 14.1 sq. km.
This reef has been surveyed extensively since 1986. it was initially classified as recovering from previous COTS activity. There was a gradual increase in reef-wide live coral cover to a moderate level during the late 1980's and early 1990's. The recovery of coral cover stalled in the mid 1990's, possibly due to the effects of cyclones (Cyclones Gillian, Ita and Justin were active in the area) and remained at moderate levels (10-30%) through the late 1990's. By 2000, reef-wide coral cover had declined to a low level (1-10%) and there were large numbers of COTS. The reef was reclassified as Active Outbreak. By 2002 COTS numbers had declined and the reef was reclassified as Recovering. Reef-wide coral cover was low in 2003 and the reef remained listed as Recovering. No bleaching or coral disease was observed.

Flora
- A middle shelf crescentic reef with an area of 8.79 sq. km.
This reef has been surveyed eight times since 1986 when it was classified as Recovering from prior COTS activity. Reef-wide live coral cover was initially low (1-10%) and increased gradually to a moderate level (10-30%) by 1996. Surveys in 1999 found a decline in reef-wide live coral cover

to a low level (1-10%). Large numbers of COTS were present and the reef was reclassified as an Active Outbreak. Although COTS certainly played an important role in the decline of live coral cover, bleaching, which was extensive on the GBR in 1998, may have also contributed. Small numbers of COTS were present in 2002. Reef-wide live coral cover was low and the reef was classified as Recovering. No bleaching was observed in 2002 and white syndrome disease was restricted to small numbers of scatted coral colonies.

Outer Shelf Reefs

Gilbey
- An outer shelf crescentic reef with an area of 6.6 sq. km.
This reef has been surveyed five times since 1986 when it was classified as Recovering from COTS activity. Reef-wide coral cover declined and then recovered to a moderate level (10-30%) in 1996. Small numbers of COTS were recorded during surveys in 1996 and 1999. In 2002 there were large numbers of COTS and the reef has been reclassified as an Incipient Outbreak. Reef-wide live coral cover has declined to low levels (1-10%). No bleaching was observed in 2002 and white syndrome disease was restricted to a small number of scattered coral colonies.

Moss
- An outer shelf ribbon reef with an area of 6.2 sq. km.
This reef has been surveyed five times since 1998 when it was classified as No Outbreak. There has been little change in reef-wide live coral cover which has remained at moderate levels (10-30%). No COTS have been observed on this reef during any survey and the reef remained classified as No Outbreak in 2002. No bleaching was observed and white syndrome disease and black band disease were restricted to a small number of scattered coral colonies.

Noggin
- An outer shelf crescentic reef with an area of 9.2 sq. km.
This reef has been surveyed by manta tow seven times since 1986. Reef-wide coral cover has remained moderate (10-30%) with a slight increase in recent years. COTS have been observed on this reef during two surveys. In both instances they were at low densities that should not have caused significant coral mortality. Reef-wide live coral cover was moderate (10-30%) in 2002 and the reef is classified as No Outbreak. No bleaching was observed in 2002 and white syndrome disease was restricted to a small number of scattered coral colonies.

Potter (A)
- An outer shelf submerged reef with an area of 15.7 sq. km.
This reef has been surveyed seven times since 1986 when it was classified as No Outbreak. Reef-wide live coral cover recovered from low to a moderate levels (10-30%) up until 1995, when small numbers of COTS were observed. Surveys in 2000 indicated large numbers of COTS and the reef was reclassified to an Active Outbreak. As a result of COTS activity reef-wide coral cover has declined to the current low level (1-10%). Small numbers of COTS remain, but below outbreak levels and the reef was classified as Recovering in 2002. No bleaching was observed and white syndrome disease was restricted to small numbers of scattered coral colonies.

Wardle
- An outer shelf crescentic reef with an area of 11.8 sq. km.
This reef has been surveyed eleven times since 1986, when it was classified as recovering from COTS activity. There was a gradual recovery of reef-wide live coral cover to a moderate level (10-30%) in 1997. Incipient Outbreak levels of COTS were then recorded in 1998 and by 1999 coral cover had declined to a low level (1-10%). COTS numbers had also declined and the reef was reclassified as Recovering. Reef-wide live coral cover was low in 2003 and no COTS were recorded. No bleaching was seen and white syndrome disease was restricted to a small number of scattered coral colonies.

Appendix 6.4—Council Reserves with Remnant Vegetation

Type	Location		Area (ha)	Composition (REs)
Rsrv for beach protection	McAllister Esplanade	Cowley Beach	16.70	7.1.1, 7.2.3, Dist, Clear
Rsrv for camping & recreation	Quondong Road	Johnstone	20.20	**7.3.22**, **7.3.28**, Clear
Rsrv for camping & recreation	Robert Johnstone Prde	Kurrimine Beach	0.95	**7.2.1**, Clear
Rsrv for camping & recreation	Murdering Point Road	Kurrimine Beach	29.10	7.2.3, 7.2.3rs, **7.2.4**
Rsrv for camping & water	Sandy Pocket Road	Moresby	14.00	**7.3.5**, **7.3.22**, **7.11.10**, Disturbed, Clear
Rsrv for camping purposes	Robert Johnstone Pde	Kurrimine Beach	2.13	7.1.1, Mostly Clear
Rsrv for drainage	Silkwood Japoonvale Rd	Silkwood	0.19	Dist, Clear
Rsrv for drainage	Coquette Point Road	Webb	1.10	**7.3.3**, **7.3.3ra**, **7.3.5**, **7.3.5rs**, Clear
Rsrv for env park	Friday Pocket Road	Friday Pocket	0.61	**7.3.22**, Mostly Clear
Rsrv for env park purposes	Flying Fish Point Rd	Eaton	8.86	7.1.1, **7.3.5**, **7.3.7**, **7.3.10**, Dist, Clear
Rsrv for env park purposes	Fig Tree Beach road	Garners Beach	9.34	7.1.1, 7.2.3, Clear
Rsrv for env park purposes	Fig Tree Beach road	Garners Beach	4.73	7.1.1
Rsrv for env purposes	Banana Island	Webb	6.07	**7.3.22**, Dist
Rsrv for env purposes	Gulland Street	Mourilyan Harbour	1.01	7.11.1, 7.11.1ra, Clear
Rsrv for env purposes	Gulland Street	Mourilyan Harbour	1.47	7.11.1, 7.11.1ra, Clear
Rsrv for env purposes		Coconuts	16.59	7.1.1, **7.3.3**, **7.3.6**, 7.11.1, Clear
Rsrv for env purposes	Palmerston Hwy	Palmerston	0.43	Dist, Clear
Rsrv for env purposes	Bruce Hwy	Cowley	101.00	7.11.1, 7.11.1ra, **7.11.16**, 7.11.21, Dist, Clr
Rsrv for env purposes	Richards Road	Cowley	12.10	7.11.1, 7.11.1ra, Clear
Rsrv for env purposes	Poppi Road	Cowley	39.66	**7.3.10ra**/7.3.17ra, **7.3.5rs**, Dist, Clear
Rsrv for env purposes	Innisfail Japoonvale Rd	Japoon	3.44	**7.3.22**, Clear
Rsrv for env purposes	Utchee Creek Road	Utchee Creek	25.77	7.11.1ra, **7.11.4ra**, **7.8.1**, Clear
Rsrv for gravel	Mourilyan Harbour Rd	Etty Bay	20.50	**7.3.1**, **7.3.5**, **7.3.6**, **7.3.10**, Clear
Rsrv for gravel	Kate Boylan Road	Boogan	2.08	**7.3.28**, Dist, Mostly Clear
Rsrv for gravel	Inarlinga Road	Cowley Beach	11.60	7.1.1, **7.3.5**, Clear
Rsrv for gravel	Stephenson Road	Kurrimine Beach	20.23	**7.2.4**, Clear
Rsrv for gravel	Nyletta Road	No. 4 Branch	5.31	7.3.17/**7.3.10**, Disturbed
Rsrv for gravel	Nyletta Road	No. 4 Branch	2.68	7.11.1, 7.3.17/**7.3.10**, Dist
Rsrv for gravel purposes	Kalbo Road	Pin Gin Hill	5.72	**7.3.28**, Dist
Rsrv for landing ground aircraft	Murdering Point Road	Kurrimine Beach	38.86	7.2.3, 7.2.3rs, **7.2.4**, **7.3.5**, Clear
Rsrv for local govt	Alice Street	Coconuts	2.81	7.1.1, **7.3.7**, 7.11.1, Clear
Rsrv for local govt	Flying Fish Point Rd	Innisfail Estate	0.12	Dist
Rsrv for local govt (boat harbr)	Marine Pde	Mission Beach	144.54	7.1.1, 7.2.3, **7.8.1**, **7.8.1ra**, **7.8.7**, Clr, Water
Rsrv for local govt (Community)	Charles Street	Innisfail	0.73	Dist, Clear
Rsrv for local govt (depot)	McAvoy St	Daradgee	0.08	**7.3.22**, Clear
Rsrv for local govt (depot)	Margaret Street	Silkwood	0.84	Dist, Clear
Rsrv for local govt (forestry)	Bruce Highway	Daveson	11.82	**7.3.3**, Dist, Clear
Rsrv for local govt (gravel)	Coquette Point Road	Coquette Point	9.39	7.11.1, 7.11.1ra, **7.11.18**
Rsrv for local govt (info)	Mission Beach Road	Mission Beach	0.34	7.2.3, Clear
Rsrv for local govt (park)		Coconuts	0.31	Dist, Mostly Clear
Rsrv for local govt (port & hrbr)	Fitzgerald Esplanade	Innisfail	45.00	**7.3.28**, Dist, Clear, Mostly Water
Rsrv for local govt (refuse disp)	Bambarook Road	Cowley Beach	1.68	7.2.3, Clear
Rsrv for local govt (sewerage)	The Corso	East Innisfail	1.33	**7.3.28**, Dist, Mostly Clear
Rsrv for local govt (sewerage)	Coquette Point Road	Webb	1.75	**7.3.10**, Dist
Rsrv for local govt (ste emrgcy)	Margaret Street	Silkwood	0.35	Dist, Clear
Rsrv for local govt (stck contrl)	Palmerston Hwy	Palmerston	2.334	Dist
Rsrv for local govt (water strge)	Maria Street	Flying Fish Point	0.0935	7.11.1, Clear
Rsrv for local govt (water supp)	Experimental Station Rd	South Johnstone	0.54	**7.3.11**, **7.11.5ra**, Dist
Rsrv for local govt (water supp)	El Arish Mission Bch Rd	Djiru	2.08	7.12.1, 7.12.29
Rsrv for local govt (water supp)	El Arish Mission Bch Rd	Maria Creek	0.83	7.3.17, **7.3.10ra**/**7.3.22ra**, Clear
Rsrv for local govt purposes	Clare Street	Innisfail	2.64	Dist, Mostly Clear

Type	Location		Area (ha)	Composition (REs)
Rsrv for local govt purposes	39 Boyett Road	Mission Beach	0.09	**7.8.1**, Clear
Rsrv for local govt purposes			0.10	7.11.1ra, Clear
Rsrv for local govt purposes			0.10	7.11.1ra
Rsrv for local govt purposes			0.10	7.11.1ra
Rsrv for local govt purposes			0.10	7.11.1ra, Clear
Rsrv for local govt purposes			0.10	7.11.1ra, Clear
Rsrv for local govt purposes	Bettridge Road	Daveson	10.91	**7.3.7**, Dist, Clear
Rsrv for park	Porter Promenade	Mission beach	0.59	**7.8.1ra**, Clear
Rsrv for park	Dalrymple Esplanade	Innisfail Estate	3.88	7.1.1, **7.3.28**, Dist
Rsrv for park	Southward Street	Misison beach	0.32	**7.2.1ra**
Rsrv for park	Rainforest Drive	Jubilee Heights	1.01	7.11.1, Clear
Rsrv for park & recreation	Plantation Drive	Bingil Bay	1.37	7.12.1, **7.3.10**/7.3.17, Clear
Rsrv for park & recreation	Etty Bay Road	Etty Bay	3.18	7.11.1, **7.11.10**
Rsrv for park & recreation	Flying Fish Point Rd	Innisfail Estate	4.22	**7.3.28**, Dist
Rsrv for park & recreation	16 McGowan Drive	Innisfail	1.62	Dist, Clear
Rsrv for park & recreation	McGowan Drive	Innisfail	1.36	Clear Dist
Rsrv for park & recreation	Robert Johnstone Pde	Kurrimine Beach	12.20	**7.2.1**, Water
Rsrv for park & recreation	El Arish Mission Bch Rd	Mission Beach	0.27	**7.12.1**, 7.3.17ra/7.11.1ra
Rsrv for park & recreation	Casuarina Crescent	Mission Beach	1.25	**7.2.1ra**, Dist, Clear
Rsrv for park & recreation	Triton Road	Mission Beach	0.40	7.2.3rs, Clear
Rsrv for park & recreation	Palmerston Hwy	Palmerston	1.01	Dist, Clear
Rsrv for park & recreation	El Arish Mission Bch Rd	Maria Creek	1.31	**7.3.10ra**, Clear
Rsrv for park & recreation	Old Tully Road	Maadi	0.63	Dist, Clear
Rsrv for park & rec & drnge	Marty Street	East Innisfail	7.10	**7.3.6**, **7.3.10ra**, Dist, Clear
Rsrv for park & recreation	Coronation Drive	East Innisfail	0.24	**7.3.28**, Dist
Rsrv for parks, garden & rec	Emily Street	Innisfail	17.49	**7.3.10**, **7.3.5**, Mostly Clear
Rsrv for public boat ramp	Bingil Bay Road	Garners Beach	13.56	7.1.1, **7.3.5**, **7.3.6**, Clear
Rsrv for public purposes	Stewart Creek	Basilisk	199.90	**7.3.10ra**/7.3.17ra, **7.3.22ra**/**7.3.10ra**, 7.11.1, 7.11.1ra, **7.11.5**, **7.11.5ra**, **7.11.16**, **7.11.18**, Dist, Clr
Rsrv for quarry (ballast)	Warrabullen road	Goolboo	2.46	Dist, Clear
Rsrv for recreation	Alexander Drive	Bingil Bay	0.24	7.12.1, **7.3.10**/7.3.17
Rsrv for recreation		Cowley beach	38.80	7.2.3, **7.12.24**, Clear
Rsrv for recreation		Cowley beach	4.92	7.2.3, Clear
Rsrv for recreation	Bingil Bay Road	Mission beach	0.12	**7.8.1**, Clear
Rsrv for recreation	Silkwood Japoonvale Rd	Silkwood	17.40	**7.3.7rs**/**7.3.10ra**/**7.3.22ra**, Clear
Rsrv for rec & camping	Bambarook Road	Cowley beach	3.64	7.2.3, Dist, Clear
Rsrv for rec & camping	Porter Promenade	Mission beach	2.41	7.2.3, Clear
Rsrv for rec & camping		Flying Fish Pt East	1.34	7.3.17
Rsrv for rec & sports ground	McAvoy St	Daradgee	2.84	**7.3.22**, **7.3.28**, Clear
Rsrv for Scenic	Jubilee Road	Jubilee Heights	7.28	**7.3.22**, **7.3.28**
Rsrv for Scenic	Patrick Road	East Palmerston	74.50	**7.8.1**, **7.8.1ra**, Dist, Clear
Rsrv for Scenic	Patrick Road	East Palmerston	4.05	**7.8.1**, Clear, Dist
Rsrv for Scenic	Gregory falls Road	East Palmerston	2.47	Dist, Clear
Rsrv for Scenic	Mourilyan Harbour Rd	Etty Bay	6.91	**7.3.1**, **7.3.5**, **7.3.6**, **7.3.10**, Clear
Rsrv for Scenic & Recreation	Camp Creek Road	Mena Creek	3.30	Dist, Clear
Rsrv for Scenic & Recreation	Marine Parade	Mission beach	5.73	**7.8.1ra**, **7.8.7,** Clear
Rsrv for Scenic Camping & Rec	Murdering Point Road	Kurrimine Beach	15.19	7.12.1, 7.12.1ra, Clear
Rsrv for Scenic Purposes	Drew Road	Mena Creek	2.84	Clear, Dist
Rsrv for Scenic Purposes	Old Tully Road	Friday Pocket	22.18	7.11.1, Dist, Clear
Rsrv for Scenic Purposes	Old Tully Road	Friday Pocket	15.05	7.11.1, Dist, Clear
Rsrv for Scenic Purposes	Bruce Hwy	Friday Pocket	4.31	Clear, Dist
Rsrv for Scenic, Camping & Rec	South Johnstone River	Johnstone	1.21	**7.3.28**
Rsrv for Water	Warrakin Road	Japoonvale	8.31	7.11.1, **7.11.10ra**
Rsrv for Water	Nyletta Road	Silkwood	41.48	7.3.17/**7.3.10**, 7.11.1
Rsrv for Water Supply Purposes	Murdering Point Road	Kurrimine Beach	8.40	7.12.1, Clear

Appendix 6.5
Results of DPI&F Long-term Monitoring Program - Freshwater

Source: Jebreen et al. 2002, DPI&F 2005 - Base data reproduced with permission of Queensland Department of Primary Industries and Fisheries - Copyright State of Queensland, 2005.
Note: This does not represent complete diversity, as some species are not susceptible to the electro-fishing method utilised by the QFS. The data presented here details diversity each survey year, and for most species the average catch per unit effort. This is an average of how many fish were caught per half an hour of electro-fishing. Ticks represent species presence, but no catch per unit effort data.

Species	Common Name	2000	2001	2002	2003	2004
Time spent surveying (minutes)		*?*	*?*	*?*	*289.69*	*308.31*
Acanthopagrus australis	yellowfin bream		1.01		0.1	
Acanthopagrus berda	pikey bream	4.92	1.01	a	0.62	0.1
Ambassis agrammus	sail-fin glassfish		1			
Ambassis interrupta	Glassfish					1.75
Ambassis miops	Flag-Tailed Glassfish					3.89
Ambassis spp.	Glassfish	**92.62**	**96.79**	**a**	**13.05**	
Anguilla obscura	South Pacific eel	1.01		a	0.1	
Anguilla reinhardtii	longfin eel	4.45	3.52	a	2.17	4.28
Anguillidae - undifferentiated	freshwater eels	a	a			
Arrhamphus sclerolepis	snubnose garfish	0.98	3.01	a		
Awaous acritosus	roman nosed goby	a	a	a	2.49	6.23
Butis butis	crimsontipped flathead gudgeon		1	a		
Caranx sexfasciatus	bigeye trevally	0.98	2.01	a	0.1	
Chaetodontidae	Pomacanthidae - undifferentiated				0.93	
Chanos chanos	Milkfish					
Clupeidae - undifferentiated	herrings					
Craterocephalus stercusmuscarum	hardyhead	1		a	14.6	2.82
Eleotris fusca	gudgeon	1.01				
Eleotris melanosoma	gudgeon		a			
Eleotris spp	gudgeon			a	0.62	0.68
Gerres filamentosus	silver biddy	**25.35**	**17.1**	**a**	**7.46**	**2.24**
Gerres spp	Silver biddy species	23.82	a	a	20.92	1.36
Glossogobius celebius	Celebes Goby					0.29
Glossogobius circumspectus	Circumspect Goby					1.26
Glossogobius giuris	goby	3.03	a			0.49
Glossogobius sp 1	Anchovy					2.14
Glossogobius sp C	Square Blotched Goby		29.72		1.35	0.58
Glossogobius spp	goby	11.06	7.2	a		0.1
Gobiidae spp.	gobies		1.01	a		
Hemiramphidae - undifferentiated	garfishes	a				
Hephaestus fuliginosus	sooty grunter	**21.56**	**16.52**	**a**	**12.94**	**9.44**
Herklotsichthys castelnaui	southern herring	0.98			1.35	
Hephaestus tulliensis	khaki grunter		a	a	4.04	1.07
Hephaestus spp.	grunter					
Hippichthys heptagonus	Pipefish					0.1
Hypseleotris compressa	gudgeon	**23.61**	**23.33**	**a**	**27.03**	**7.59**
Kuhlia marginata	northern jungle perch (spotted flagtail)	1	1.01			
Kuhlia rupestris	jungle perch	3.2	2.27	a	0.21	0.68
Lates calcarifer	barramundi	2.49	2.27	a	1.04	0.29
Leiognathus equulus	narrow-banded ponyfish	**43.01**	**6.04**	**a**	**3.21**	**0.1**
Leiognathus spp	pony fish		1.01	a	0.41	
Lutjanus argentimaculatus	mangrove jack	1.97	3.52	a	1.66	2.53
Melanotaenia splendida	rainbowfish	**11.79**	**21.12**	**a**	**56.23**	**28.9**
Melanotaenia trifasciata	banded rainbowfish		24.11			
Mesopristes argenteus	silver grunter	1.5	2.01	a	0.31	0.78

Species	Common Name	2000	2001	2002	2003	2004
Time spent surveying (minutes)		*?*	*?*	*?*	*289.69*	*308.31*
Microphis brachyurus	Pipefish					0.1
Monodactylus argenteus	diamondfish			a		
Mogurnda adspersa	northern purple-spotted gudgeon	a				
Mugil cephalus	sea mullet	5.39	3.02	a		
Mugilidae - undifferentiated	mullets			a		0.1
Mugilogobius spp.	Goby	1.01		a	0.1	
Mugilogobius notospilus	Freshwater Mangrove Goby					
Nematalosa erebi	bony bream	8.07	a	a	3.31	0.58
Neosilurus ater	narrow fronted catfish	2.99	4.51	a	0.93	0.1
Neosilurus hyrtlii	hytrls tandan			a		
Notesthes robusta	bullrout	1	1.68	a	0.31	
Ophieleotris aporos	snakeheaded gudgeon	a				
Oxyeleotris gyrinoides	eastern sleepy cod	3.94	3.69	a	0.62	1.75
Oxyeleotris lineolata	Sleepy Cod					0.19
Platycephalus fuscus	dusky flathead			a		
Plotosidae - undifferentiated	eel catfishes			a		
Poecilia reticulata	livebearer	1	1.01	a	0.52	0.1
Porochilus rendahli	catfish		1			
Psammogobius biocellatus	Estuary Goby				0.72	
Pseudomugil signifer	Pacific blue-eye	16.95	20.84	a	6.83	1.75
Redigobius bikolanus	speckled goby	7.07	8.05	a	16.88	7.98
Scatophagus argus	spotted butterfish	1	2.01	a		0.19
Scortum spp.	Scortum species	10				
Tandanus tandanus	freshwater catfish	5.15	4.02	a	0.31	0.29
Tilapia mariae	tilapia	8.03	2.01	a	3.52	0.49
Toxotes chatareus	spotted archerfish		1.01	a	0.1	0.1
Toxotes jaculatrix	archerfish	0.98			0.1	
Toxotidae - undifferentiated	archerfishes	a			0.62	
Unknown Species	Unknown Species	a				0.1
Total Diversity		**43**	**41**	**42**	**40**	**40**