

Earth Environmental
ABN 76 870 019 854

PO Box 802
Mackay
Queensland 4740 Australia

Telephone: 0413019359
Email: earth@mackay.net.au



Mundy Creek Catchment and Riparian Management Strategy

December 2013



Table of Contents

Section	Page
1. Introduction	1
1.1 Creek to Coral Caring for our Country	1
1.2 Rowes Bay and Greater Town Common	1
1.3 Mundy Creek Nature-way Regeneration Project	1
1.4 Mundy Creek Natureway Past Works	4
2. Site Assessment	5
2.1 Background	5
2.2 Regional Ecosystems	5
2.3 Site Visits	8
3. Site Strategies	9
3.1 Identifying Management Options	9
3.2 Land and Water Management Strategies	10
4. Management Plans	17
4.1 Management Units	17
4.2 West Bank (MU4)	19
Appendix A	
West Bank Revegetation	
Appendix B	
Information from Bernadette and Peter, and Russell	
Appendix C	
Mundy Creek Natureway History	
Appendix D	
Chronology and Site Visit Notes	
Appendix E	
Fire Management	
Tables	
Table 2-1 Regional Ecosystem	6
Table 3-1 Tenure Notes (at 2012)	10
Table 3-2 Preliminary Weed Management Method	13
Table 3-3 Initial Species List for the Anti-bird Strike Habitat Corridor	14
Table 4-1 Management Units	17
Table 4-2 West Bank Management Zones	20
Table 4-3 Soil Test Interpretation	B
Table 4-4 Draft Plant List	C
Figures	
Figure 1-1 Mundy Creek Project Context	2
Figure 1-2 Mundy Creek Historically	3
Figure 2-1 Regional Ecosystem Map	5
Figure 3-1 Mundy Creek Project Site	9
Figure 3-2 Castle Hill Connection	10
Figure 3-3 Anti-birdstrike Corridor	11

Figure 4-1 Management Areas	18
Figure 4-2 West Bank Unit 4 Proposed Works	19
Figure 4-3 Mundy Creek West Bank General Management Lines and Zones	20
Figure 4-4 Post Fire	21
Figure 4-5 Grasslands and Lockheed Street Properties	21
Figure 4-6 Management Zones Post Fire and Rain	22
Figure 4-7 Site Preparation Plan	D

Document Control						
						Document ID
Version	Date	Revision Details	Typist	Author	Verifier	Approver
4	January 2013	Final draft	JG	John Gunn	BB	CM
5	June 2013	Fire management (Russell Butler) update to Final draft and assessment and strategies for west bank downstream of the footbridge and the grassland to Lockheed Street houses	JG	John Gunn	BB	CM
6	December2013	Final review including chronology of events 2011-2013	JG	John Gunn	BB	CM

Acknowledgements

Participants involved in the planning and implementation of the Mundy Creek Riparian Management project wish to acknowledge the funding received to implement the project from Creek to Coral through the Australian Government's Caring for our Country program.

Participants would also like to acknowledge the support and contribution made to the project by Townsville City Council – Integrated Sustainability Services, Parks Services and Construction and Maintenance departments.



CARING
FOR
OUR
COUNTRY

1. Introduction

1.1 Creek to Coral Caring for our Country

Creek to Coral is Townsville's healthy waters initiative and is a catchment-based approach to natural resource management in partnership with the community. The Creek to Coral catchment management approach is simple and all encompassing where 'creek' refers to all the freshwater parts of the catchment that eventually flow to estuarine waters and the Great Barrier Reef (GBR), which is the coral.

Creek to Coral is committed to the encouragement, education and involvement of community in integrated catchment and coastal zone management for the benefit of local and regional waterways.

Townsville City Council (TCC), through Creek to Coral, successfully applied for funding through the Australian Government's Caring for our Country (CfoC) 2010-11 Business Plan open call. The project titled **"Increasing community engagement in Townsville coastal catchments for Biodiversity"** provides funding and support for community based natural resource management in the Townsville's coastal catchments. The Mundy Creek catchment community has been a beneficiary of the CfoC project including through the preparation of this management strategy.

1.2 Rowes Bay and Greater Town Common

The Mundy Creek catchment is part of the broader greater Town Common area which has also been supported through the CfoC project. The Common Interest initiative, based on the greater Townsville Town Common area, involves a range of stakeholders including Conservation Volunteers Australia (CVA), Queensland Parks and Wildlife Service (QPWS), Townsville Enterprise Limited (TEL), NQ Dry Tropics, WetlandCare Australia, BirdLife Townsville (formerly Townsville Regional Bird Observers Club), Coastal Dry Tropics Landcare Inc. (CDTLI), Townsville Airport, Department of Defence (Commonwealth) and Townsville Rockwheelers Mountain Bike Club Inc.

A 'Common Interest' community workshop was held in May 2011 (facilitated by CVA and TCC) and a subsequent action was the formation of a working group (QPWS, CVA, TCC, NQDT, TEL, CDTLI, Defence and Townsville Airport) to promote the protection and management of the greater Town Common for recreational and conservation purposes. One of the outcomes was to increase opportunities for nature based recreation including the creation of 'natureways' connecting the Town Common to the Townsville CBD and the expanding urban areas.

The Mundy Creek CfoC project also has significant links with the Rowes Bay to Pallarenda CfoC project, which has been designed to engage Townsville's urban community in coastal management and catchment care activities. Future activities will combine Mundy Creek catchment, Rowes Bay/Pallarenda and the Townsville Town Common communities in combined actions across the greater Townsville Town Common catchments.

1.3 Mundy Creek Nature-way Regeneration Project

Recent activity (2011-2013) has been inspired by Mundy Creek community member Bernadette Boscacci who lives within 100 metres of Mundy Creek on a lot that backs onto native grassland adjacent to Mundy Creek. Bernadette applied for and received a grant to develop a concept plan for Mundy Creek combining art and environment (see text box below).

The Mundy Creek Nature-way Regeneration Project

Project summary: Undertake a community consultation and creative design concept development project for the Mundy Creek Nature-way precinct i.e. Garbutt Skate Park, Mundy Creek footbridge, adjacent grassland, pedestrian and bicycle pathways and potential picnic area on the park side of the creek.

Activities include:

- Working collaboratively with local Traditional Owners, local Indigenous and non-Indigenous artists and young people, environmental consultants and training groups, Townsville City Council staff from the Community Development, Parks and Integrated Sustainability Service departments;
- Linking the Mundy Creek project with the 'Greater Townsville Town Common Concept Plan' project;
- Meeting with parties to discuss and compile ideas, research environmental and cultural heritage history of the area (including previous work projects);
- Collating gathered information to inform (and build upon) the design plan;
- Commission a series of draft public artwork designs from participating artists;
- Develop an overall design plan for an appropriate, site specific, environmental, public art project.

Creek to Coral, through the 'Increasing community engagement in Townsville coastal catchments for Biodiversity' Caring for our Country project committed to assisting Bernadette coordinate natural resource management (NRM) activities along the Mundy Creek natureway including through community events e.g. tree planting, and by the preparation of a riparian management strategy to guide future NRM activities. Mundy Creek is shown in Figure 1-1 with a more detailed view of the project area shown in Figure 3-1.

Figure 1-1 Mundy Creek Project Context



Mundy Creek was realigned in the 1960s as part of the Town Common/Townsville Airport drainage scheme.

The creek used to flow through the Rows Bay wetlands before entering the swale of the foredune where it flowed southeast and northwest to enter Rows Bay near Soroptomist Park and via Three Mile Creek (see Figure 1-2). For more information on the changing face of Mundy Creek see www.creektocoral.org/learnsapes/rowes_bay/mundycreek.htm

Belgian Gardens Cemetery

Tributary (drains from the airport)

Townsville Correctional Centre

Old Town Common Road (to Townsville Airport)

The grassland

Castle Hill Environmental Reserve

The footbridge

PCYC

Tributary

West End

Garbutt

Figure 1-2 Mundy Creek Historically



Note: The base aerial is from 1941. The top inset is 1891 (Census District map) showing Mundy Creek mouth and the tidal extent. The bottom inset is 1938 showing the extensive nature of the 'swamps' associated with Mundy Creek. Rows Bay reserve is red.

1.4 Mundy Creek Natureway Past Works

The history of the Mundy Creek Natureway project (below) has been interpreted from the “Mundy (Melrose) Creek Natureway Proposal” prepared by Townsville City Council and Con Lokkers (Tropical Urban Production and Landcare Group) in 1999.

The Mundy Creek Natureway concept emerged in 1997 through “*the Garbutt Urban Renewal Program, a joint program between Townsville City Council and the Department of Public Works and Housing to revitalise the suburb of Garbutt.*” This program had been underway since 1993.

Mundy Creek (also known as Melrose Creek) “*is a small coastal drainage system running from Melrose Park, Garbutt, to the coast at Rowes Bay. Although substantially modified by human activities over the past century, this creek retains many natural and scenic values. It plays an important role in the drainage and flood mitigation system of Townsville, and flows through numerous well-used parks and open spaces. The creek also provides a popular thoroughfare for people of all ages.*”

The proposal outlined a series of programs to be implemented over 3 years including:

- 1 “*A lighted bikeway/walkway running along the length of the creek, with a bridge near Harold Phillips Park*”;
- 2 “*Interpretive signs along the track to promote the area*”;
- 3 “*The creek banks and surrounding areas revegetated with local native plants to enhance the natural habitats*”;

“*The beginning of the pathway includes a small bridge to the many sporting facilities and social activities held at the Castle Hill Police and Citizens Youth Club.*”

[R]“*vegetation of the area surrounding the pathway is linked to a local community program to “green Garbutt”. Other elements of this program have included tree plantings at Melrose Park, landscaping the Garbutt Neighbourhood House and establishing the community garden and shadehouse at the Garbutt State School. Plants propagated at the Garbutt shadehouse for planting throughout Garbutt, and are available for the revegetation of the proposed pathway.*”

It was intended that the pathway “*connect to the series of bikeways around Townsville and in particular, with the bikeway along the coast to Pallarenda. Users of the pathway will emerge close to Soroptomist Park in Rowes Bay, overlooking the sea.*”

A summary of the works carried out on the Mundy Creek Natureway project is provided in Appendix C along with additional information from the original Mundy Creek Natureway proposal (above). A brief extract from the proposal’s Site Description is provided in the text box below.

Extending approximately 2.2 km, this stretch of the creek flows through a relatively flat coastal plain. Solodic soils dominate the area, with thin A horizons overlying heavy clay subsoils (Murtha and Reid, 1975). This soil type limits development options due to:

- impeded drainage
- low load bearing capacity when wet
- moderate to high salt levels
- low fertility

Areas of alluvial soil are interspersed along the length of the creek. These recently deposited fine silty soils have higher fertility and better drainage, but may still contain moderate salt levels. Some sandy soils, derived from old beach ridges, are found in the lower half of the creek (downstream of Parramatta Street). These soils are characterised by free drainage, poor water holding capacity and low fertility.

Some artificial levee banks, from 1 to 2 metres high, occur along the bottom 500 metres of the creek. These banks limit salt water intrusion into surrounding low-lying coastal flats, and provide soil conditions more favourable for most plant growth.

Tidal gates near Evans Street limit saline inundation during large high tides, and have probably reduced salt levels in the soils upstream over time. Below the tidal gates, the creek banks have been reinforced with rock walls.

2. Site Assessment

2.1 Background

The site has been highly modified since the 1960s (see Figure 1-2). Work has been carried out to restore some of the natural values of the Mundy Creek system including through the Mundy Creek Natureway project. As a main drainage system for Garbutt, and to a lesser extent West End and Castle Hill, the restoration of environmental values has to be weighed up against the reduction of flood risk for these urban areas. As a result any works in the vicinity of Mundy Creek require a coordinated approach between Townsville City Council in conjunction with state government agencies and community.

Modified and constructed drainage tributaries flow into Mundy Creek from the Townsville Airport and the opportunity exists to integrate the water quality and environmental management efforts of Townsville Airport with the Creek to Coral and Garbutt community catchment management efforts (Brodie Akacich 22 June 2012, pers. comm.).

2.2 Regional Ecosystems

Regional ecosystems in the vicinity of Mundy Creek are illustrated in Figure 2-1 and described briefly in Table 2-1.

Figure 2-1 Regional Ecosystem Map



Table 2-1 Regional Ecosystem

RE and Description	VM Status
<p>11.1.1 (Rowes Bay wetlands and northern section)</p> <p><i>Sporobolus virginicus</i> grassland on Quaternary estuarine deposits. <i>Sporobolus</i> spp. usually dominates pure stands although a wide range of other species may be present as scattered individuals including <i>Fimbristylis ferruginea</i>, <i>Cyperus victoriensis</i>, <i>C. scariosus</i>, and sometimes <i>Eleocharis spiralis</i>, <i>Mnesithea rottboellioides</i>, <i>Marsilea mutica</i>, <i>Cynanchum carnosum</i>, <i>Ischaemum australe</i>, <i>Cyperus polystachyos</i>, <i>Ceratopteris thalictroides</i> and <i>Leptochloa fusca</i>. Occasional emergent stunted mangroves, usually <i>Avicennia marina</i> or <i>Ceriops tagal</i>, may occur as isolated individuals or along small channels. There may also be a minor presence of salt-tolerant forbs such as <i>Suaeda australis</i>, <i>S. arbusculoides</i>, <i>Sarcocornia quinqueflora subsp. quinqueflora</i> or <i>Tecticornia australasica</i>. Occurs on supratidal flats, which are often only inundated by highest spring tides. Often occurs on the landward side of intertidal flats; seaward margins irregularly inundated with tidal waters and dissected by small tidal channels. Formed from Quaternary estuarine sediments with deep grey or black and grey saline cracking clays with occasional mottling, minor gilgai occasionally present.</p>	Least Concern
<p>11.2.5 (Adjoining cemetery and Rowes Bay wetlands)</p> <p>Beach ridge woodland with <i>Melaleuca dealbata</i> in swales and <i>Corymbia tessellaris</i> woodland on Quaternary dune systems. Ridges: Usually a woodland to open forest of <i>Corymbia tessellaris</i> with occasional <i>Acacia crassicarpa</i>, <i>Cupaniopsis anacardioides</i>, <i>Pleiogynium timorense</i> and <i>Terminalia muelleri</i>. A sparse to dense shrublayer may include <i>Acacia oraria</i>, <i>A. crassicarpa</i>, <i>Planchonia careya</i>, <i>Alphitonia excelsa</i>, <i>Exocarpos latifolius</i>, <i>Senna surattensis</i> and <i>Dodonaea viscosa</i>. Groundlayer includes <i>Aphyllodium biarticulatum</i>, <i>Themeda triandra</i>, <i>Heteropogon contortus</i>, <i>Elionurus citreus</i>, <i>Aristida holathera</i>, <i>Cymbopogon refractus</i> and <i>Perotis rara</i>. Swales: Open forest of <i>Melaleuca dealbata</i>, (sometimes <i>M. leucadendra</i> or <i>M. viridiflora</i>), <i>Livistona drudei</i> or <i>L. decora</i>, with shrubs of <i>Pandanus spiralis</i>. Groundlayer of <i>Chrysopogon filipes</i>, <i>Imperata cylindrica</i>, <i>Sporobolus virginicus</i> and <i>Lepturus repens</i>. In some areas sedges are common, including <i>Cyperus javanicus</i>, <i>Fimbristylis dichotoma</i>, <i>F. polytrichoides</i>. Small vines are commonly present including <i>Cynanchum carnosum</i>, <i>Abrus precatorius</i>, and <i>Jasminum didymum</i>. Occurs on Quaternary undulating stabilised dunes with narrow linear depressions. Associated soils are generally well drained siliceous sands, swales with humic hydrosols.</p>	Least Concern
<p>11.3.27 (North section)</p> <p>Freshwater wetlands. Vegetation is variable including open water with or without aquatic species and fringing sedgelands and eucalypt woodlands. Occurs in a variety of situations including lakes, billabongs, oxbows and depressions on floodplains.</p> <p>Major vegetation communities include:</p> <p>11.3.27a: Lacustrine wetland (e.g. lake). Vegetation ranges from open water +/- aquatics and emergents such as <i>Chara</i> spp., <i>Nitella</i> spp., <i>Myriophyllum verrucosum</i>, <i>Nymphaea violacea</i>, <i>Potamogeton javanicus</i>, <i>P. crispus</i>, <i>P. tricarinatus</i>, <i>Ottelia ovalifolia</i>, <i>Vallisneria caulescens</i> and <i>Nymphoides indica</i>, A narrow fringing woodland commonly dominated by <i>E. camaldulensis</i> or <i>E. coolabah</i> but also a range of other tree species may be present. Larger ephemeral - permanent water bodies (lakes).</p> <p>11.3.27b: Lacustrine wetland (e.g. lake). Vegetation ranges from open water +/- aquatics and emergents such as <i>Potamogeton crispus</i>, <i>Myriophyllum verrucosum</i>, <i>Chara</i> spp., <i>Nitella</i> spp., <i>Nymphaea violacea</i>, <i>Ottelia ovalifolia</i>, <i>Nymphoides indica</i>, <i>N. crenata</i>, <i>Potamogeton tricarinatus</i>, <i>Cyperus difformis</i>, <i>Vallisneria caulescens</i> and <i>Hydrilla verticillata</i>. Often with fringing woodland, commonly <i>Eucalyptus camaldulensis</i> or <i>E. coolabah</i> but also a wide range of other species including <i>Eucalyptus platyphylla</i>, <i>E. tereticornis</i>, <i>Melaleuca</i> spp., <i>Acacia holosericea</i> or other <i>Acacia</i> spp. Occurs on billabongs no longer connected to the channel flow.</p> <p>11.3.27c: Palustrine wetland (e.g. vegetated swamp). Mixed grassland or sedgeland with areas of open water +/- aquatic species. Dominated by a range of species including <i>Eleocharis</i> spp., <i>Nymphoides</i> spp. and sometimes <i>Phragmites australis</i>. Occurs on closed depressions on alluvial plains that are intermittently flooded in inland parts of the bioregion.</p> <p>11.3.27d: Palustrine wetland (e.g. vegetated swamp). <i>Eucalyptus camaldulensis</i> and/or <i>E.</i></p>	Least Concern

<p><i>tereticornis</i> woodland. A range of sedges and grasses occur in the ground layer including <i>Fimbristylis vagans</i>, <i>Myriophyllum striatum</i>, <i>Nitella pseudoflabellata</i> and <i>Pseudoraphis sp.</i> Occurs fringing large lakes.</p> <p>11.3.27e: Palustrine wetland (e.g. vegetated swamp). Vegetation ranges from open water +/- aquatics sometimes with fringing trees and shrubs. Fringing tree species include <i>Melaleuca dealbata</i>, <i>Nauclea orientalis</i>, <i>M. leucadendra</i>, <i>Lophostemon suaveolens</i> and <i>Corymbia tessellaris</i>. Shrub layers are usually absent although scattered <i>Pandanus spp.</i> may be present. The ground layer is often open water with emergent aquatic species or sedges and grasses including <i>Leersia hexandra</i>, <i>Cyperus dactyloides</i>, <i>Cyperus lucidus</i>, <i>Nymphaea spp.</i> and <i>Gymnanthera oblonga</i>. Occurs on billabongs and oxbows with permanent to ephemeral water regime.</p> <p>11.3.27f: Palustrine wetland (e.g. vegetated swamp). <i>Eucalyptus coolabah</i> and/or <i>E. tereticornis</i> open woodland to woodland fringing swamps. Ground layer and treeless areas range from open water +/- aquatics and emergents such as <i>Potamogeton crispus</i>, <i>Myriophyllum verrucosum</i>, <i>Chara spp.</i>, <i>Eleocharis spp.</i>, <i>Nitella spp.</i>, <i>Cyperus difformis</i>, <i>Hydrilla verticillata</i>. Occurs on closed depressions on floodplains associated with old drainage courses that are intermittently flooded.</p> <p>11.3.27g: Lacustrine wetland (e.g. lake). Lakes with or without fringing <i>Eucalyptus coolabah</i> low open woodland Occurs on closed depressions on floodplains associated with old drainage courses.</p> <p>11.3.27h: Lacustrine wetland (e.g. lake). Lakes with mainly open water or bare lake bed. May be <i>Muehlenbeckia florulenta</i> low shrubland +/- scattered <i>E. coolabah</i> trees fringing or scattered across the area. Occurs on floodplains. Seasonally dry.</p> <p>11.3.27i: Palustrine wetland (e.g. vegetated swamp). <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland to open-woodland with sedgeland ground layer. Other tree species such as <i>E. coolabah</i> and <i>E. largiflorens</i> may be present or locally dominant. Ground layer dominated by sedges, ferns or herbs such as <i>Eleocharis spp.</i>, <i>Juncus spp.</i> and <i>Marsilea spp.</i> Occurs in depressions on floodplains.</p> <p>11.3.27j: Palustrine wetland (e.g. vegetated swamp). <i>Acacia stenophylla</i> and other shrubby species Occurs in frequently flooded depression on floodplains.</p> <p>11.3.27x1a: Palustrine wetland (e.g. vegetated swamp). Sedgelands to grasslands on old marine planes. Often occurs as an <i>Eleocharis spp.</i> (<i>E. dulcis</i>, <i>E. sphacelata</i>) sedgeland but a variety of other species dominate in local areas including <i>Typha orientalis</i>, <i>Cyperus alopecuroides</i>, <i>Phragmites australis</i> and <i>Ludwigia octovalvis</i>. A range of other sedges, grasses small shrubs and herbs (<40 cm) are abundant, and include <i>Ammannia multiflora</i>, <i>Cyperus polystachyos</i>, <i>Sporobolus virginicus</i>, <i>Chloris virgata</i>, <i>Fimbristylis ferruginea</i>, <i>Ceratopteris thalictroides</i>, <i>Phyla nodiflora var. nodiflora</i> and <i>Persicaria attenuata</i>. The vines <i>Passiflora foetida</i> may occur in some areas. Trees and large shrubs are generally absent. Occurs in depressions on Quaternary estuarine deposits which are seasonally inundated with fresh water.</p> <p>11.3.27x1b: Palustrine wetland (e.g. vegetated swamp). Sedgelands to grasslands on Quaternary deposits. Often occurs as an <i>Eleocharis dulcis</i> sedgeland but a variety of other species dominate in local areas including <i>Typha orientalis</i> and <i>Phragmites australis</i>. Trees and large shrubs are generally absent. Occurs on broad drainage depressions situated on old alluvial plains.</p> <p>11.3.27x1c: Palustrine wetland (e.g. vegetated swamp). Sedgeland areas typically dominated by <i>Schoenoplectus littoralis</i> although a range of other sedges and grasses may also dominate localised areas. Other dominant species include the sedges <i>Eleocharis philippinensis</i>, <i>Cyperus alopecuroides</i>, <i>C. scariosus</i> and <i>C. iria</i> and the grasses <i>Phragmites australis</i>, <i>Sporobolus virginicus</i> and <i>Paspalum vaginatum</i>. Other typical species in shallower margins include <i>Fimbristylis ferruginea</i>, <i>Phyla nodiflora</i> and <i>Cyperus polystachyos</i>. Occasional twiners such as <i>Cynanchum carnosum</i> may be present. Occurs in depressions on old Quaternary estuarine deposits. These are seasonally inundated with fresh water but become more brackish as they dry. Dry out completely before the next season's rain.</p>	
<p>11.3.31 (Grasslands) <i>Ophiuros exaltatus</i> and <i>Dichanthium spp.</i> grassland. The ground layer has a variable composition, with drier areas dominated by <i>Ophiuros exaltatus</i>, <i>Iseilema membranaceum</i> or <i>Dichanthium spp.</i> or <i>Brachyachne tenella</i>.</p>	<p>Least Concern</p>

<p>Other common and sometimes dominant grasses include <i>Themeda triandra</i>, <i>Heteropogon contortus</i>, <i>Eulalia aurea</i>, <i>Imperata cylindrica</i>, <i>Eriochloa pseudoacrotricha</i>, <i>Bothriochloa spp.</i>, <i>Panicum decompositum</i> and <i>Sporobolus spp.</i> Other species include <i>Neptunia spp.</i>, <i>Rhynchosia minima</i>, <i>Crotalaria spp.</i>, <i>Euphorbia spp.</i>, <i>Aristida latifolia</i>, <i>Sida spp.</i> and <i>Desmodium spp.</i>. Trees such as <i>Eucalyptus platyphylla</i>, <i>Grevillea striata</i>, <i>Corymbia dallachiana</i> or <i>C. erythrophloia</i> may occur as emergent isolated trees or tall shrubs. Occurs on older floodplain complexes on Cainozoic alluvial plains. Black or dark grey earths or brown clays, in some areas with strong gilgai or debil debil microrelief. Often with self-mulching surface, and alkaline subsoil.</p>	
<p>11.3.35 (Castle Hill lower slopes) <i>Eucalyptus platyphylla</i>, <i>Corymbia clarksoniana</i> woodland. This association usually occurs as woodland of <i>Eucalyptus platyphylla</i> and <i>Corymbia clarksoniana</i> with <i>Corymbia tessellaris</i> occurring in some areas. A low tree layer of species such as <i>Planchonia careya</i>, <i>Pandanus spiralis</i>, <i>Melaleuca viridiflora</i> or <i>M. nervosa</i> and <i>Petalostigma pubescens</i> is often present. The ground layer is usually grassy with common species including <i>Themeda triandra</i>, <i>Heteropogon contortus</i>, <i>Mnesithea rottboellioides</i> and <i>Bothriochloa decipiens</i>, together with herbs or forbs such as <i>Glycine tabacina</i>, <i>Galactia tenuiflora</i> or <i>Sida subspicata</i>. Occurs on Cainozoic alluvial plains. Older floodplain complexes, major stream levees and lighter deltaic deposits.</p>	<p>Least Concern</p>

2.3 Site Visits

A general reconnaissance of the site was undertaken with Bernadette Boscacci on 10 February 2012. Subsequent site visits were carried out on 11 and 17 May 2012 as the basis for preparing this strategy.

A site visit with Bernadette on 1 June 2012 was used to confirm the location of proposed revegetation works and to discuss the potential for implementing a neighbourhood catchment care activity to restore native habitat along the 'new' Mundy Creek while maintaining the hydrological capacity of the system and enabling access to the system for management purposes.

Further site visits have been carried out as part of the CfoC project and subsequently (29/8/12, 10/9/12, 12/10/12, 7/11/12, 9/11/12, 26/11/12, 27/11/12, 9/2/13, 13/3/13, 15/3/13, 27/3/13, 17/4/13, 24/5/13, 20/6/13 and 21/6/13) including for:

- Ongoing planning and coordination with Mundy Creek Catchment Care (MCCC), Townsville City Council (TCC) (Integrated Sustainability Service, Park Services and Construction and Maintenance), Conservation Volunteers Australia (CVA) and Coastal Dry Tropics Landcare Inc. (CDTLI);
- Assessment following changes to site conditions e.g. fire and excavator intervention;
- Establishing management lines and setting up demonstration areas;
- Site management works with CVA (September 2012 to February 2013);
- Awareness and training for community;
- Site monitoring and condition assessment including for CDTLI Landcare days (Saturday afternoon), which commenced 12 January 2013.

A chronology of site visits along with field notes and GPS waypoints is included in Appendix D.

3. Site Strategies

3.1 Identifying Management Options

The first step is to determine what land Council is directly responsible for i.e. owns or manages as trustee, and what neighbours (landowners and residents) need to be partnered with to enable an effective land and urban habitat management plan to be prepared and implemented (at least to some extent).

The flood management needs of the Mundy Creek catchment also need to be determined with an allowance factored in for sea level rise. Flood alleviation options can then be proposed (as per Maunsell 2008 report) with options to increase the retention and/or detention capacity of the system using constructed wetlands/waterholes.

After these two elements have been reviewed and evaluated an integrated land and urban habitat management plan can be prepared in conjunction with the key landowners and land managers. The following proposed actions are based on the assumption that the relevant landowners are working cooperatively to manage the Mundy Creek catchment and is intended as a guide to advance the rehabilitation of this engineered waterway so that it meets flood mitigation requirements and has some habitat values and ecological functions that support native vegetation communities and native fauna.

3.1.1 Tenure

There are 11 different land parcels associated with 'upper' Mundy Creek and these do not all have the same land use purpose. Some of the parcels are obviously related to the drainage network or park recreation while the purpose of others is less obvious. The areas of State land that are significant habitat and/or serve some other purpose associated with environmental infrastructure could be usefully amalgamated into the environmental infrastructure layer and then the management plan could be prepared and updated based on a 'single' block rather than working across multiple blocks each with a 'discrete' purpose and different managers. The blocks of interest are shown in Figure 3-1 with tenure briefly described in Table 3-1

Figure 3-1 Mundy Creek Project Site



Note: Townsville City Council land assets are shown in yellow. Numbers correspond to tenure shown in Table 3-1. Road Reserves are not highlighted.

Table 3-1 Tenure Notes (at 2012)

No.	Lot on Plan	Owner
1	L151 SP232890	VACANT LAND - Crown Land (State) (CCDEU lease)
2	L1 SP232890	VACANT LAND - Crown Land (State)
3	L513 SP232509	PUBLIC UTILITIES - State Government Facilities
4	L377 T118635	VACANT LAND - Crown Land (State)
5	L420 EP1533	VACANT LAND - State Government Facilities
6	L549 EP1533	KINDERGARTEN - PRE-SCHOOL (Private/Church)
Townsville City Council land assets		
T1	L130 EP2324	Mundy Creek below the airport road
T2	L131 EP2324	Mundy Creek above the airport road
T3	L32 EP1533	SPECIAL USES - Parks and Recreation (Reserves)
T4	L	PUBLIC UTILITIES - Townsville City Council (Reserves)
T5	L737 EP1221	SPECIAL USES - Parks and Recreation (Reserves)
T6	L13 T11869	SPECIAL USES - Parks and Recreation (Reserves)
T7	L788 CP855219	Castle Hill
	L61 EP837565	Rowes Bay wetland reserve
	L335 EP698	Mundy Creek mouth

3.2 Land and Water Management Strategies

The long-term strategy is to have a functional urban drainage system that alleviates flood risk while retaining natural values and contributing to the functional network of managed urban 'natural' areas. The Mundy Creek natureway is also the closest (last remaining) link between Castle Hill and other natural areas (Rowes Bay wetlands, Rowes Bay esplanade and the Town Common) (see Figure 3-2). It would make sense to include the marked areas in the environmental infrastructure layer of the Townsville planning scheme and work with landowners to consolidate tenures to reflect the system as a catchment management unit based on hydrological function, habitat, connectivity and amenity restoration, enhancement and management with community.

Figure 3-2 Castle Hill Connection



The main land management and rehabilitation strategies for the Mundy Creek system are discussed below. More detail is provided for the area where works are proposed in the near term. Management areas are illustrated in Figure 4-1

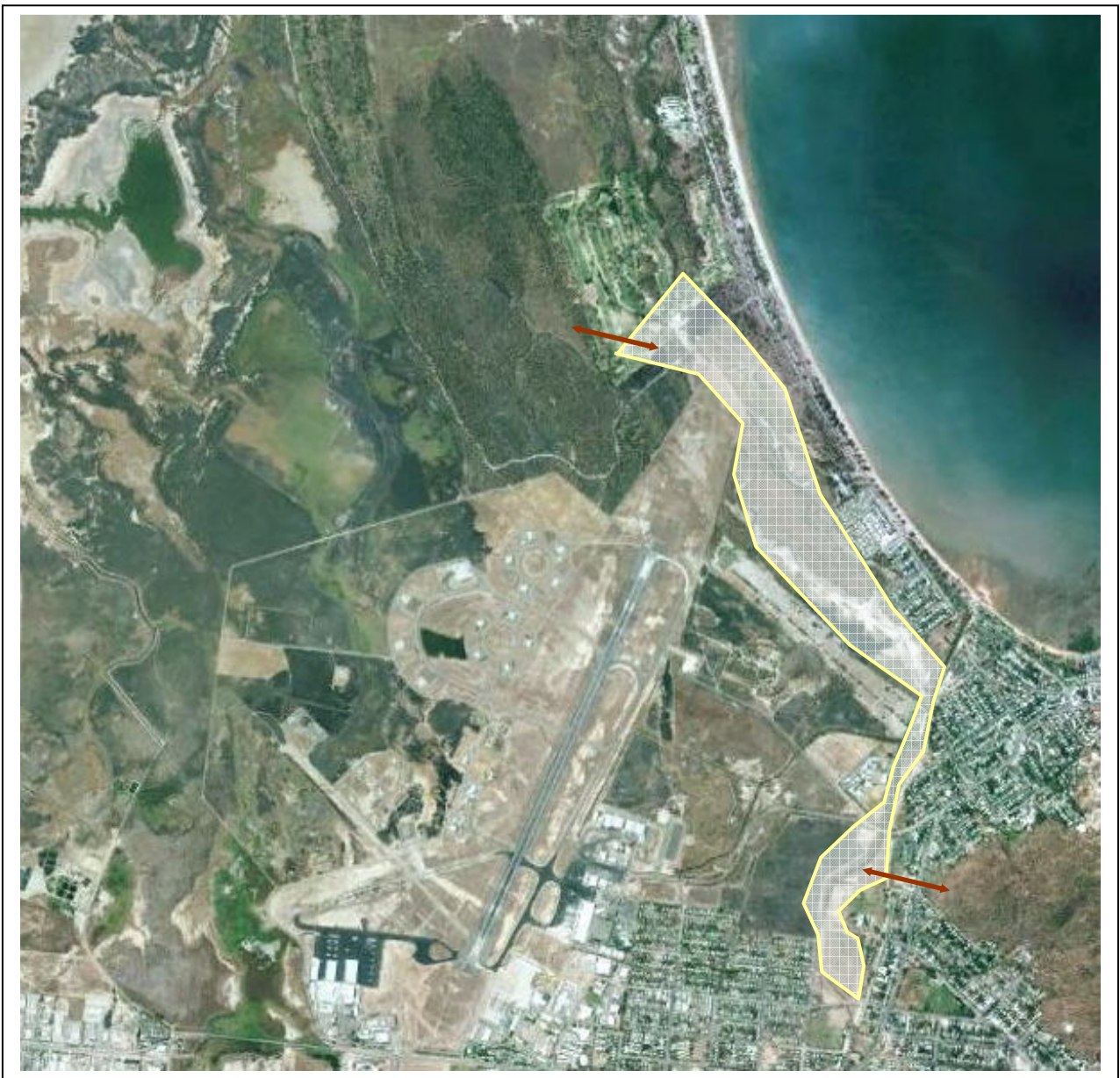
3.2.1 Wildlife management

A coastal dune system, salt pans, wetlands (freshwater and estuarine) and waterways once stretched from Kissing Point to Many Peaks Range at Pallarenda and across to the Bohle River and included the catchments of Mundy Creek and Louisa Creek, which both feed into the Townsville Town Common.

Urban development has reduced the extent of this habitat agglomeration and inadvertently resulted in wildlife management issues including the incompatibility of aeroplanes/jets with certain native animals e.g. birds and bats.

Strategy: Centred on Mundy Creek create a well-defined wildlife corridor (waterways, wetlands and native vegetation) that simultaneously attracts and 'houses' native wildlife due to its habitat values and provides a 'safe' conduit for bird movement away from the airport. The idea is to provide an attractive natural corridor in the urban setting that 'directs' bird traffic around the northern end of the runway where potential issues with air traffic are minimised. The location of the proposed bird movement corridor is shown in Figure 3-3.

Figure 3-3 Anti-birdstrike Corridor



Note: The wildlife (anti-birdlife) corridor is marked in yellow and shaded with connecting links shown by arrows.

3.2.2 Water quality

As mentioned the Mundy Creek catchment and surrounding areas have been extensively modified to facilitate drainage from urban areas including the Townsville Airport (see text box below). Urban areas have a variety of water quality issues that need to be managed prior to stormwater run-off entering natural waterways and wetlands.

Extract from Brodie Akacich email to Bernadette Boscacci:

Sent: Wednesday, 5 December 2012 12:14 PM

From: bakacich@tsvairport.com.au

Subject: RE: Community Meeting - Mundy Creek Natureway Regeneration Project

“Stormwater

The quality of the water in the Mundy Creek catchment was raised in our recent Community Aviation Consultation Group forum in relation to heavy metals. It is well known that the airport arm of the catchment is a heavily urbanised/industrialised catchment with at a quick summary has 3 fuel stations, a concrete works, multiple mechanical and panel-beating workshops and RAAF base and a Civilian Airport prior to joining the main channel of Mundy Creek and out to Rowes Bay. Whilst we take measures to improve stormwater prior to leaving our site and carry out routine monitoring programs we can only manage what occurs on our site and leaves our site.

I believe this natureway project has a real potential to focus on aquatic health as well as terrestrial health of the main Mundy Creek channel (which again is heavily urbanised but with less industry) which could value add to our efforts in John Melton Black Drain (this is our internal name for this arm of the catchment). Our internal flora and fauna study as well as observations from maintenance of Gross Pollutant Traps and during Stormwater Monitoring have found that while Tilapia and Mosquito Fish heavily infest the drainage network significant native species exist in this catchment including:

- Barramundi
- Jungle Perch
- Spotted and Empire Gudgeons
- Tarpon
- Long-finned Eels
- Red Claw yabbies (i'd assume fish tank escapees)
- Freshwater Prawns

Even though the system is heavily disturbed and impacted on its not aquatically dead. My recommendation here would to try and get the council onboard to implement Water Sensitive Urban Design (WSUD) principles in line with the SPP for Healthy Waters that was released last year thus serving a 2 fold function in flood mitigation and improving water quality entering the GBR.”

Brodie Akacich *BAPSci*

Environmental Sustainability and Management Officer

Townsville Airport

Strategy: Work cooperatively with Townsville Airport to determine the condition of waters entering Mundy Creek and the potential for constructing filtering wetlands, and other water sensitive urban design (WSUD) features, to improve the quality of stormwater run-off from Garbutt and the airport environs. The WSUD features need to be easily accessible for management purposes including for periodic cleanouts and weed removal.

3.2.3 Weed management

There are a number of weed management scenarios that need to be dealt with in the Mundy Creek catchment including:

- Three main aquatic scenarios i.e. freshwater and estuarine and the interface between the two;
- Terrestrial and aquatic system interfaces; and
- Terrestrial scenarios.

There is a variety of weed management methods that can be employed depending on a number of factors including; the type/s of weeds and plant biology/ecology, condition of native vegetation and regeneration potential/difficulty, level of infestation, proximity to waterways, soil type and condition, proximity to intact native vegetation, surrounding land use, edge length and weed encroachment, time of year and seasonality, available resources and level of community involvement.

Strategy: Determine the most appropriate weed management methods for each of the management areas and apply these in conjunction with Creek to Coral project partners. A preliminary list of weed management methods and application areas is shown in Table 3-2.

Table 3-2 Preliminary Weed Management Method

Weed Management Method	Application
<p>Preventative weed management Maintaining areas of relatively intact native habitat weed free e.g. areas G and A, requires a monitoring based management regime. Site monitoring and manual weed removal is carried out simultaneously with any seed heads and potential vegetative growth removed from the site. This is not a novice Zen weeder activity as it requires a moderate to high level of plant species knowledge and ecology consciousness. Equipment required includes; an impervious sack/container (to contain any weed seed heads and succulents prone to vegetative regrowth), gloves, secateurs and normal protective equipment (hat, sunscreen, enclosed footwear, long sleeves and long pants). The general method is to work through a site on a 'face' (if a number of people are involved) or use a grid to ensure coverage of the whole area. The whole site doesn't have to be covered in one day however it is more effective if the time between visits is compressed so that the whole site is covered within a few weeks of commencing (dependent on growing conditions).</p>	<p>Relatively intact native habitat – Areas G and A</p>
<p>Retreat weeding (part of the Zen weeding program) This is a simple manual weeding exercise commencing at the edge of intact native habitat/vegetation and retreating into the areas of weed infestation. Weeds are progressively removed from the interface area between the relatively intact native habitat/vegetation making sure that the root structure of the weeds is totally removed. The weed material is thrown/piled/placed in the weed infestation area, which may have had a pre-weed slash/mow/spray. The idea is to increase the competitive advantage of the native vegetation by reducing the competition from weeds in the 'battle' zone. Equipment required includes; gloves, a garden fork or similar (to loosen the soil and enable weed roots to be removed easily) and normal protective equipment (hat, sunscreen, enclosed footwear, long sleeves and long pants). This is a progressive process that depletes weed stocks and builds the resilience of native vegetation. It is best carried out by local community weed vigilantes as it is a medium term strategy requiring a continuity of action to be effective. There is potential to use VRM products in situ to improve soils and increase the level of soil carbon. Terrestrial weeds can be piled on slashed/sprayed weed infestation areas and treated with the product to create a 'compost' use on site.</p>	<p>Interface areas – Areas 3, 4, 6 and B</p>
<p>Slash and spray Slashing/mowing and spraying is appropriate in areas with little or no native vegetation. This is a containment measure and will only be really effective if carried out before seed set to reduce the weed seed bank over time and improve the potential for native vegetation to establish. Slashing is a quick 'broadscale' measure while spraying with herbicide is a more selective process requiring competent operators to attain maximum benefit.</p>	<p>Hard core weed and exotic grass areas – Areas 5, 7 and 8</p>
<p>Burning This can be effective in some situations however is not a practice suited to most urban environments is unlikely to be used in the vicinity of dense residential areas. Mundy Creek has an area of adjoining grassland which does require a fire management plan (see Appendix E).</p>	
<p>Facilitated regeneration A combination of methods may be required for this process including manual weed removal, selective and/or spot spraying, creation of perimeters/buffers, clump planting based around isolated native trees, mulching (using weed material), seed dispersal and monitoring with manual weeding.</p>	<p>Areas of mixed native vegetation and weeds – Area 1, 2 and 8</p>
<p>Excavation Limited application including in waterways where it is impractical to contain water flow</p>	<p>Waterways – Area C</p>

obstructive vegetation with other methods. Periodic cleaning of drainage lines may be required as part of Infrastructure Maintenance (TCC) management of the stormwater drainage system. This needs to be integrated with native habitat management especially where the creek has 'natural' values and provides habitat for native wildlife i.e. selective use of machinery in stream.	
---	--

Earth Environmental in association with Creek to Coral is developing a Zen habitat management and weed removal training and awareness program to assist community groups and individuals manage their local environment and assist native vegetation regeneration (see Table 3-2).

3.2.4 Revegetation

Plant selection and placement for revegetation across the catchment will be designed to create an ecological corridor effect that is attractive as habitat for local birds and also serves as a primary movement corridor rather than a feeding or roosting destination for birds and bats. This functional difference is significant as it has the most potential to enable increased habitat and connectivity without increasing the risk of bird movement across the airport open space and potentially reducing that avifauna traffic. This specifically designed wildlife habitat corridor can achieve significant local ecological and biodiversity outcomes if implemented conscientiously with appropriate ongoing maintenance and management. An initial species list for the corridor is provided in Table 3-3.

Table 3-3 Initial Species List for the Anti-bird Strike Habitat Corridor

Scientific name	Common name	Scientific name	Common name
<i>Acacia holosericea</i>	Silver leaf wattle	<i>Melaleuca dealbata</i>	Grey Paperbark
<i>Aidia racemosa</i>	Native cherry	<i>Melaleuca viridiflora</i>	Broad-leafed paperbark
<i>Alphitonia excelsa</i>	Red ash	<i>Mimusops elengi</i>	Red coonoo
<i>Calophyllum inophyllum</i>	Beach laurel	<i>Nauclea orientalis</i>	Leichardt tree
<i>Canarium australium</i>	Mango bark	<i>Pandanus whitei</i>	Pandanus
<i>Casuarina cunninghamiana</i>	River she oak	<i>Planchonia careya</i>	*Cocky apple
<i>Clerodendrum floribundum</i>	Lolly bush	<i>Pleiogynium timorense</i>	Burdekin plum
<i>Corymbia tessellaris</i>	Moreton Bay ash	<i>Sterculia quadrifida</i>	Peanut tree
<i>Cupaniopsis anacardioides</i>	Tuckeroo	<i>Syzygium austral</i>	*River cherry
<i>Ficus opposita</i>	Sandpaper fig	<i>Terminalia muelleri</i>	Beach damson
<i>Hibiscus tiliaceus</i>	Beach hibiscus	<i>Thespesia populnea</i>	Portia Tre
<i>Macaranga tanarius</i>	Cottonwood	<i>Timonius timon</i>	Tim tam tree, Swizel bush
<i>Mallotus philippensis</i>	Red kamala	<i>Millettia pinnata</i>	Pongamia
<i>Melaleuca viminalis</i>	Weeping Bottlebrush	<i>Bursaria tenuifolia</i>	Mock orange, Prickly pine
<i>Eugenia reinwardtiana</i>	Cedar Bay Cherry	<i>Lomandra longifolia</i>	Spiny-head Mat-rush

Note: Selected species from Table 4.3 \MELROSE1.doc * added from Russell Butler plant list (see Appendix C).

Strategy: In conjunction with Townsville Airport undertake a study of the ecology of key 'bird' strike species to determine the most appropriate tree species and locations with respect to wind direction and fauna attraction to guide optimum ecological corridor design to minimise airport overfly and maximise movement using the corridor.

At the local level the two main revegetation strategies proposed for the Mundy Creek Natureway are:

- Clump/strip planting (West Bank Revegetation Strategy) and;
- Facilitated regeneration.

Clump planting is the 'conventional' method where an area is prepared (weed removal and soil amelioration), native seedlings are planted and the area around the planting is covered with mulch. Weed control is required in the clumps until the seedlings are large enough to shade the area and inhibit weed regrowth.

Remulching may be required to assist with weed control and moisture retention and importantly to add organic matter to the soil. Generally the area surrounding the clump is slashed/mowed up to the edge of the mulch.

Facilitated regeneration predominantly involves weed management to create conditions whereby native seed, from surrounding sources, is able to germinate and grow to maturity without being overwhelmed by competition from exotic species.

Strategy: Expand existing clump plantings in the short term and investigate options for facilitated regeneration in less formal management areas. The West Bank Revegetation Plan (see Appendix A) consists of clump planting in Area 4 in the short term (see Figure 4-2) and some combination of clump planting and facilitated regeneration in Area 3 (after Area 4 is consolidated).

Strategy: Prepare site specific revegetation plans when resources become available.

3.2.5 Creek works and wetlands

As can be interpreted from historic maps and aerial photography (see Figure 1-2) the pre-settlement shape of Mundy Creek was significantly different to the current urban constrained system. There is however enough open space adjoining Mundy Creek to look at the potential for enhancement of the creek system's environmental values by creating wetlands and waterholes, as was the case in the past, while maintaining or complementing the hydraulic capacity of the creek in terms of flood mitigation.

Strategy: Review previous reports and studies and model (catchment hydrology and water quality) various catchment scenarios to determine the benefits and cost effectiveness for multiple outcomes i.e. flood mitigation, environmental values and environmental infrastructure. Scenarios may consist of a series of 'natural' urban sensitive waterway design features with the potential for retrofitting into a catchment based strategic water quality improvement plan. The addition of constructed wetlands was also mooted as part of the Mundy Creek Natureway project (see James Cook University investigations).

Strategy: Remove exotic species and Typha from the creek bed and banks to reduce hydraulic obstructions and enable native species to extend their influence.

3.2.6 Interpretive communications

Interpreting the values of the Mundy Creek catchment will be critical to garner support for ongoing works and to maintain the good work already achieved to date (December 2013). Interpretive communication is based on providing relevant, logically organised and entertaining messages that engage the audience and provoke thought. The message being conveyed by Mundy Creek Catchment Care partners is "We value our urban natural areas and are willing to work together to protect them and make them better".

Strategy: Prepare a Mundy Creek catchment thematic communication strategy based around Mundy Creek Catchment Care key themes and messages. This will include a Mundy Creek catchment web presence as a component of the Creek to Coral Learnscapes web site.

Strategy: Develop signage as an extension of the Mundy Creek Nature-way Creative Design Project in conjunction with Creek to Coral (TCC) and other Mundy Creek project partners and as determined in the Mundy Creek catchment thematic communication strategy. Initial signage suggestions are provided in the text box below.

Initial signage suggestions include:

- No motor vehicles/motorcycles sign at either end of the paths i.e. please help us to make Mundy Creek Natureway safe and friendly;
- About Mundy Creek Natureway interpretive signage with reference to web link (Creek to Coral Learnscapes Mundy Creek catchment webpage will contain ecological (including seasonal, flora, fauna, habitat and ecological communities) and cultural information about the Mundy Creek catchment);
- Small concrete plaques (perhaps with engraved steel plates on top) at the base of significant / established trees;
- Map of Traditional Owner serpent creation story (whole of catchment) showing landmarks;
- Catchment connections and Learnscapes (could be combined with serpent story).

3.2.7 Resources

Resources committed to the Mundy Creek project from 2011 to 2013 included:

- Garbutt (and Townsville) community members time, energy and enthusiasm;
- CfoC Creek to Coral project (*Increasing community engagement in Townsville coastal catchments for Biodiversity*) including land management advice, planning, training and on ground works including CVA international volunteer teams and local volunteers;
- Earth Environmental in-kind support;
- CDTLI including use of equipment and assistance with arranging community events (now an 'official' CDTLI Landcare site);
- TCC/ISS Greening and Waterways Team (GAWT);
- Greater Town Common (Common Interest) project partners.

Strategy: Extend the area of interest to include the Pallarenda to Kissing Point foreshore and smaller catchments flowing to Rowes Bay e.g. 3 Mile Creek. Incorporate Mundy Creek Catchment Care as a community group association to enable the group to apply for funding in its own right.

Strategy: Build on the good work already undertaken, including this strategy, to attract further resources to progress the Mundy Creek Natureway and catchment care vision of protecting and enhancing Mundy Creek natural areas for the benefit of the Townsville community.

4. Management Plans

4.1 Management Units

To assist with the management of the Mundy Creek catchment the area has been divided into management units. Work plans will be developed for each of the units as the project progresses and funds become available. The management units are described in Table 4-1 and shown in Figure 4-1.

Table 4-1 Management Units

Unit	Description	Tenure
1	To be investigated further as a longer-term management project or part of major effort if funds became available. A rehabilitation plan needs to be prepared. West bank weed control (spray) as an interim measure.	L131 EP2324 (TCC)
2	As above	TCC drainage reserve and L377 T118635 (Crown land)
3	Future planting area – stage 2 of the west bank revegetation strategy to be designed after discussion with Wes about expansion lines for Mundy Creek if works went ahead in the future i.e. implications for plantings and revegetation	TCC reserves
4	Stage 1 of the west bank revegetation strategy (see Appendix A). Initial plantings occurred in 1998 (community) and 1999 (Jobs Plan team) and these form the base of extended plantings. In discussion with ISS 'clumped' plantings can be up to 20 metres in length with a 5 metre gap between clumps to allow creek access for maintenance purposes. Plantings need to be set back 3 to 4 metres from the top of the bank to allow access for maintenance. Where previous vegetation clumps exist these can be extended but not towards the creek i.e. maintain clear space between the planting and the creek. Community planting event held in conjunction with TCC and CDTLI April 2013.	TCC reserves
5	Revegetation area previously planted with community circa 2001 [check date]. Enhance these plantings and extend the plantings (clumps) onto the 'park' land. Previous plantings have been part of the tributary drain. Parks permission required to extend the plantings into the park.	TCC drainage reserve and L32 EP1533 (TCC park)
6	Tow of the confluence with tributary from Castle Hill. Weed eradication area focal point to provide a downstream edge for retreat weeding.	TCC drainage reserve
7	Potential native grassland with options for wetland/billabong construction (dependent on modelling). Short term management strategy is slash and contain seed production	L420 EP1533 (State Government Facilities)
8	Main area of terrestrial habitat restoration. Return to native woodland through gradual removal of non-native trees and replacement with regenerating natives seedlings. Some clump planting may be appropriate on the north and east boundaries of the management unit	L420 EP1533 (as above)
G	Grasslands. Retreat weeding on the eastern and southern boundaries and a monitoring program to remove weeds from the grasslands before they seed.	L151 SP232890 (Crown land – under lease)
A	Marine influence. Retreat weeding on the edges. May be some access issues with this area. Would be good to retain it in its current condition (minus a few small internal weed outbreaks) rather than digging this section up)	TCC drainage reserve
B	Transition from marine to freshwater. If retreat weeding is effective in this section it may reduce the need for mechanical 'cleaning'/excavation	TCC drainage reserve
C	Freshwater. Construction and Maintenance/Parks jurisdiction to maintain drainage	TCC drainage reserve

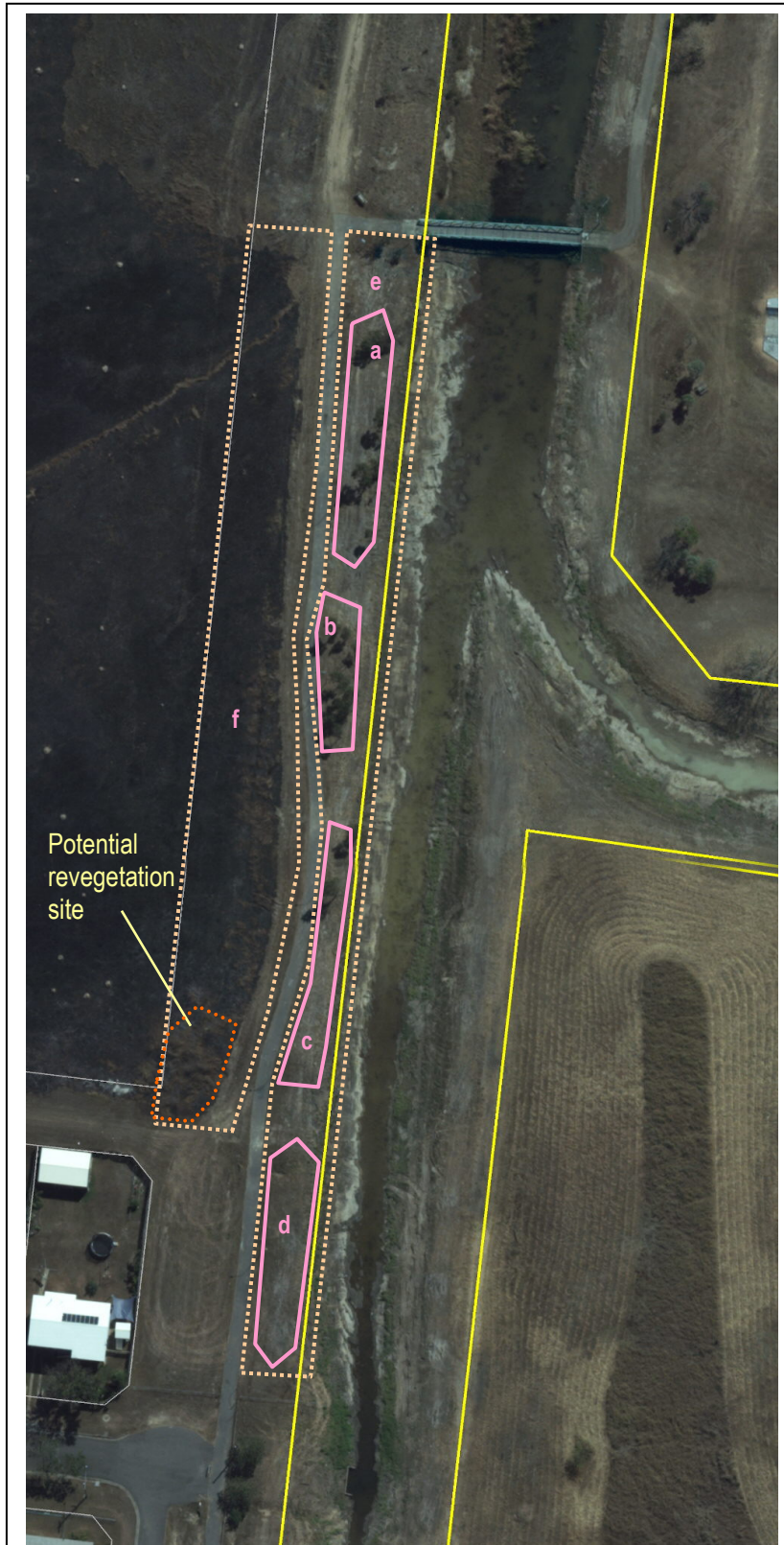
Figure 4-1 Management Areas



4.2 West Bank (MU4)

The west bank (upstream/south of the footbridge) is the first 'natural' area to be rehabilitated through; establishment of management lines and zones, weed control, revegetation and monitoring and maintenance. Management intent, strategies and initial plans for the west bank are provided below. The revised plans for the April 2013 community planting are provided in Appendix A.

Figure 4-2 West Bank Unit 4 Proposed Works



Revegetation (a to d)

Clump style planting utilising existing revegetation (a and b) with expansion areas where minimal vegetation exists at present.

Areas a and b will be defined on the creek side by the existing trees while areas c and d will commence 3-4 metres from the bank/maximum flow line of the creek.

Preparation includes manual control of weeds in the near vicinity of existing native vegetation (planted and regrowth) and sprayout (or weed wand) weeds with Roundup Biactive.

Soil condition improvement will be required prior to planting e.g. addition of gypsum and compost.

Lists of recommended species are included in Appendix B and Appendix C from previous investigations. Species have been selected from these lists with consideration for Townsville Airport comments relating to species preferred/not preferred and site conditions and consultation with other.

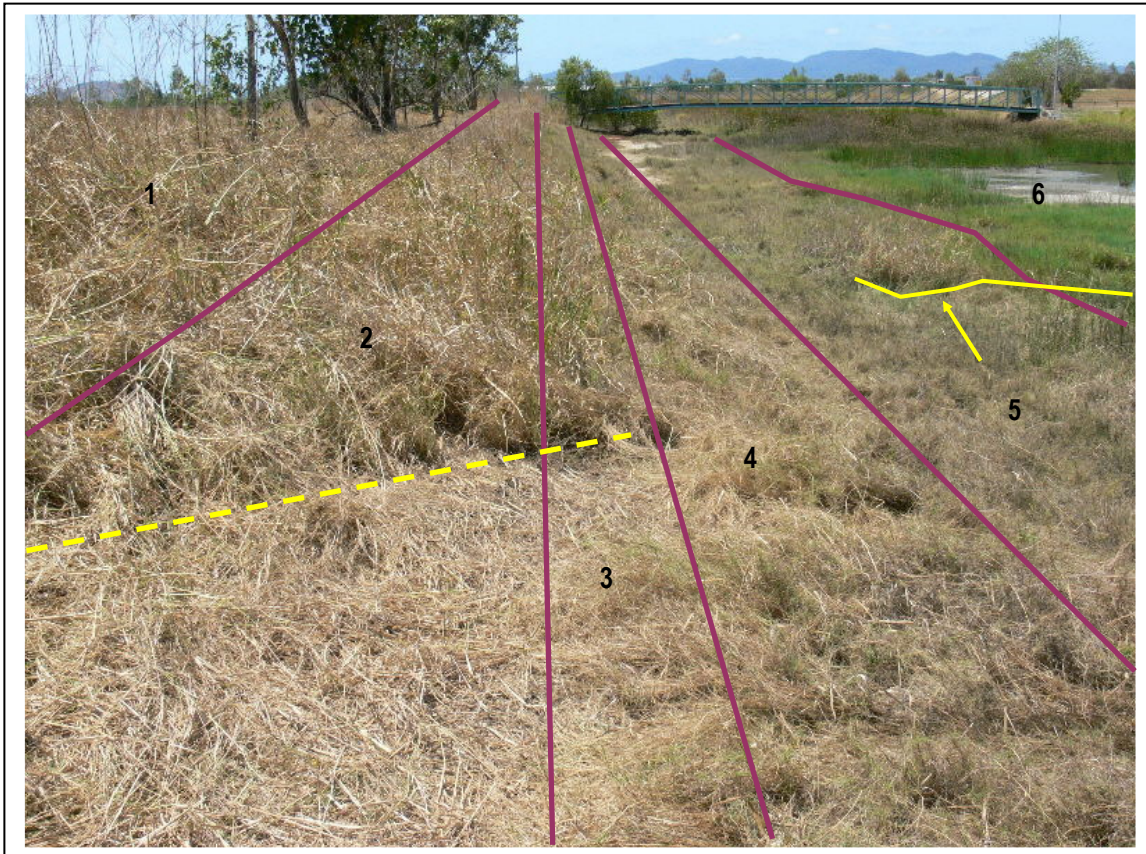
A mulch cover (20cm deep) is to be placed around the plantings to define the clumps, retain moisture and reduce weed regrowth. The mulch will also define the areas to be mown between i.e.

- the walking path and the revegetation clumps; and
- the upper creek bank edge and the southern revegetation areas (c and d)

Weed control (e and f)

Potential planting on the southeast corner of the grassland (orange dotted line) on TCC reserve.

Figure 4-3 Mundy Creek West Bank General Management Lines and Zones



Note: Yellow indicates a lowland management line with the arrow showing the direction of progression of the management line. The upstream area has been cleared of Para Grass and the line indicates the interface between the salt couch (cleared of Para Grass) and the Para Grass patch. The broken yellow line indicates the edge of the access to the interface management line.

Table 4-2 West Bank Management Zones

Zone	Description	Management intent and actions (2012)
1	Revegetation area (past and planned extensions)	Check area for regrowth and expose and mark any native plants prior to any mechanical or chemical intervention Slash/beat down/trample non-native vegetation (weeds) Dig out grass/weeds in strategic/sensitive management areas e.g. around native vegetation Use this area as a stockpile for weed material and VRM trials Test soils for deficiencies and structural issues Condition the soil prior to any further plantings e.g. add and mix in gypsum and compost Some areas trampled and hand slashed. Five regenerating native plants found and immediate area around them cleared (May-October 2012)
2	Containment zone	This is the area where mechanical intervention is used e.g. slashing/brushcutting/herbicide, to arrest the potential progress of vegetation and prevent seed production Check area for regrowth and expose and mark any native plants prior to any mechanical or chemical intervention This area will contract towards Zone 1 over time as native vegetation in Zone 3 becomes established
3	Species interface	This is the transition zone between native vegetation in relatively good condition and the area dominated by invasive species. This is the Zen weeding zone requiring a knowledge of the desirable and undesirable species and a conscious effort to carefully remove undesirables without disturbing desirable species too much Remove by hand (or weed wand) all non-native species to allow native vegetation to advance. This area will gradually expand into Zone 2 over time

4	Creek bank	Contains salt couch in areas with tidal influence (mostly Para grass on PCYC side) and on the west bank upstream of the confluence. Systematic removal (hand and weed wand) required in conjunction with 'cleaning' the species interface (Zone 3). Upstream areas will require a different intervention due to density of Para Grass. Cleaning commenced on west bank side (September 2012)
5	Saltpan and salt couch flats	These areas consist predominantly of salt couch and other marine plants. There are some Para Grass adventurers and small established patches to be removed. Initial sweep from the management line access point towards the footbridge and a management line established (see Figure 4-3) (October 2012) C2C/EE/CVA team removed Para Grass from the vicinity of the footbridge and upstream towards the confluence (19 October 2012) C2C/EE/CVA team raked and removed some of the slashed material and placed it on the Zone 1 and 2 (23 November 2012)
6	Semi-permanent tidal (transition) wetland	Invasive species are slow to establish in this area due to the tidal (saltwater) influence. Maintain free of Para Grass, Cumbungi and other invasive species including wading in wetland areas to remove isolated outbreaks. Cumbungi could be controlled with hand removal if outbreaks are removed before they become established and start to expand. Larger outbreaks can be treated using Swampy (see Tvl Airport) prior to high tides. Saltwater over slashed Cumbungi and Para Grass usually kills it or retards it significantly allowing hand removal of any re-established plants C2C/EE/CVA team removed Para Grass upstream and downstream in the vicinity of the footbridge from the wetland using waders and hand pulling. Material was piled in adjacent Unit 1 areas (19 October 2012)

4.2.1 Unplanned events

A fire swept through the site on 13 November 2012 (see Figure 4-4) removing most of the vegetation in Units 1-3 and in parts of Unit 4 (see Figure 4-3). The grasslands were totally burnt out and there was damage to fences, sheds, vegetation and livestock (chickens) on adjacent properties in Lockheed Street (see Figure 4-5).

Figure 4-4 Post Fire



Figure 4-5 Grasslands and Lockheed Street Properties



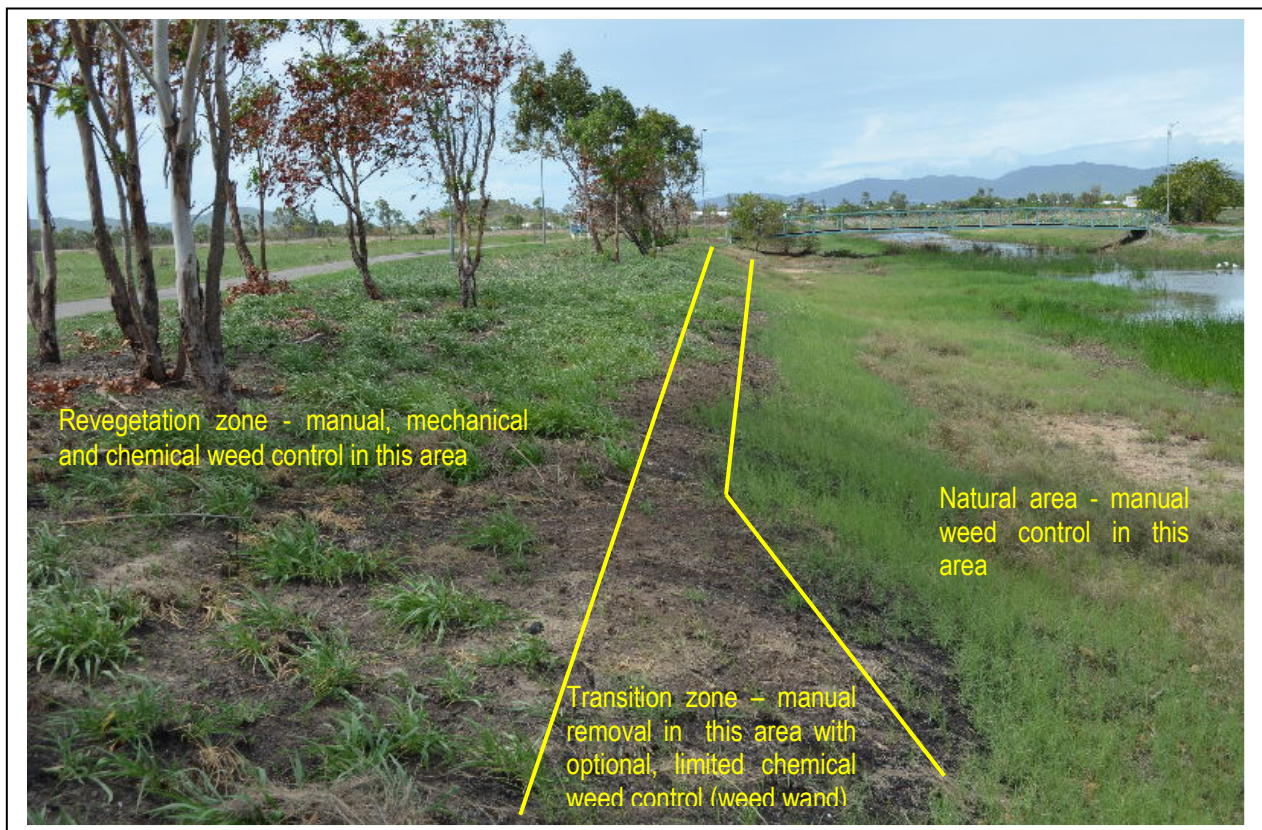
Two weeks later (23 and 26 November) 'routine' pre wet season maintenance of the Mundy Creek 'drain' saw a 20 tonne excavator with a slasher attachment in the creek bed. All vegetation in the creek was slashed down to a height of 15-20cm and the bed of the creek was significantly disturbed by the excavator tracks creating deep troughs and isolated pools. Fish (Barramundi, Tilapia, Mullet and eels) living in the Mundy Creek wetland subsequently died.

These two events have changed the management regime for the site with the excavator causing unnecessary damage to the bed of the section of the creek with the highest environmental values (transition wetland between fresh and saltwater). In addition the material left over from the slashing remains in the creek and where it is concentrated (either side of the footbridge in particular) is smothering the salt couch and other marine plants.

Conversely the fire was advantageous. The fire removed the bulk of the weed species (mostly grasses) that would otherwise have been slashed or sprayed as a precursor to revegetation efforts. With some rainfall in January 2013 plants have started to actively grow again with a stark contrast between the burnt ground and the new growth (see Figure 4-6). This provides almost ideal conditions to remove the new growth in the interface zones and to apply herbicide in the heavily weed infested areas. The only real downside is the loss of the weed mulch which would have been produced by slashing so additional mulch will have to be imported to the site.

The management concepts remain basically the same post fire with the main advantage being that the amount of dry vegetation is reduced which highlights the difference between natural areas and invasive species. This makes the establishment of management lines easier and enables a clear transition zone to be established. Soil moisture makes weed removal easier in what is otherwise a hard setting soil.

Figure 4-6 Management Zones Post Fire and Rain



Note: Photo taken January 2013

Appendix A

West Bank Revegetation

Soil test results and interpretation

Soil samples were taken from the riparian planting area south of the footbridge in the vicinity of areas 3 and 4 (see Figure 4-7). Test results are shown below with interpretation in Table 4-3.



**TOWNSVILLE CITY COUNCIL
TOWNSVILLE LABORATORY SERVICES**
DELIVERY ADDRESS: Douglas Water Plant, Angus Smith Drive, Douglas, Qld 4814
POSTAL ADDRESS: P.O. Box 1268, Townsville, Qld 4810 Ph 07 4727 8666
e-mail labenquiries@townsville.qld.gov.au

Contact:	Andrew Hannay, Chris Pronk	Date Received:	13/11/12
Client:		Date Commenced:	13/11/12
Address:		Date Completed:	27/11/12
Report Code:	MI1706 Mundy Creek.doc	Report Date:	27/11/12
Email:			

CERTIFICATE OF ANALYSIS

Mundy Creek Revegetation

Laboratory Services:
Chemical Laboratory:
Water and Waste:
Water Analysis:
Physical parameters
Carbon/Dissolved
Major metals
Heavy metals
Nutrients
Biological Oxygen Demand
Chemical Oxygen Demand
Chlorophyll
Non Filterable Residue
Total Oil and Grease
Total Organic Carbon
Trihalomethanes formation potential
Water colour and scaling properties
Soil Analysis:
Physical

Parameter	Reveg. 1	Reveg. 2	Reveg. 3	Method Used
Sample Date / Time	02/11/12	02/11/12	02/11/12	
pH	6.96	7.31	6.72	TM-PH
Soil Conductivity, $\mu\text{S}/\text{cm}$	56000	38400	91300	TM-COND
Calcium, soluble mg/kg	15.0	100.4	27.2	TM-ICPMS
Magnesium, soluble mg/kg	7.6	43.2	13.0	TM-ICPMS
Sodium, soluble mg/kg	16.6	39.6	34.1	TM-ICPMS
Potassium, soluble mg/kg	48.8	23.0	47.5	TM-ICPMS
TKN, mg/kg	0.002	0.001	0.002	TM-AM4
Total Phosphorous, mg/kg	0.0003	0.0002	0.0002	TM-TNTPFIA
Sodium Absorption Ratio	0.87	0.83	1.35	Calculation

Table 4-3 Soil Test Interpretation

Parameter	Results	Comments
pH (Acidity/alkalinity)	6.72 to 7.31 (neutral range is 6.7 to 7.3)	No action required to adjust pH levels. pH is in the optimum range for most plants
Soil conductivity	38,400 to 91,300 $\mu\text{S}/\text{cm}$ (38 to 91 dS/m)	High (Range for plant growth without impacts on sensitive crops e.g. beans, is 1-2 dS/m.) (dS/m = mS/cm)
Calcium (soluble)	15 to 100 mg/kg (ppm)	Below optimum range (<400ppm is low) of extractable Ca which is 1000-2000 ppm
Magnesium (soluble)	8 to 43 mg/kg (ppm)	Close to range (extractable Mg 60-180ppm) (<30ppm is low)
Sodium (soluble)	17 to 40 mg/kg (ppm)	Some symptoms of Sodic soil
Potassium (soluble)	23 to 49 mg/kg (ppm)	Below optimum range. Optimum range for extractable K is 150-250ppm. (300lbs/acre required - convert)
Total Kjeldahl Nitrogen (TKN)	0.001 to 0.002 mg/kg (ppm)	Very low. Optimum for ammonium alone is 2-10ppm. N input required.
Total Phosphorous	0.0002 to 0.0003 mg/kg (ppm)	Very low. 20-40ppm is optimum. Addition of P required. (2000lbs/acre required - convert)
Sodium Absorption Ratio (SAR)	0.83 to 1.35	OK. When the SAR rises above 12 to 15, serious physical soil problems arise and plants have difficulty absorbing water.

Notes: Handreck and Black (1994) for pH. TKN is the sum of organic nitrogen, ammonia (NH₃), and ammonium (NH₄⁺). deciSiemen per meter (dS/m), which is numerically the same as mmho/cm or mS/cm.
Reference: Handreck, K. and Black, N. 1994, Growing media for ornamental plants and turf, University of NSW Press.

Revised revegetation site plan

The revegetation plan for the west bank site was revised to allow the areas requiring soil conditioning treatment to be applied (see Figure 4-7). All intended revegetation areas will be treated and then revegetation will occur progressively depending on seasonal conditions and resources including the installation of watering points or temporary irrigation to enable ease of watering for unseasonal plantings.

It is intended to first stabilise and improve the condition of existing native vegetation (weed control, mulching and fertilising). Following the soil conditioning trees and shrubs will be planted and established and then native understorey shrubs, herbs and grasses, including collecting seed and bulbs from the adjoining grasslands, will be gradually introduced to the area in and around the revegetated patches as the soil improves and weeds are controlled/removed.

Site preparation

General site preparation and management/maintenance lines are illustrated in Figure 4-3 and described in Table 4-2. The pre-planting site preparations steps are:

- Establish a management interface zone wide enough to separate native vegetation from weeds (0.5 to 1 metre wide) to allow use of herbicide (spot spray and weed wand) without retarding native vegetation growth (Zone 3);
- Slash/mow and/or spray out the planting areas using Roundup Biactive (Zone 1 and 2);
- Cultivate/rip and apply gypsum and compost if available. Cover the disturbed areas with mulch (Zone 1) (see Figure 4-7).

Planting

Pre planting planning is necessary to ensure good results. The main tasks include:

- Select species (see draft plant list (Table 4-4) for preferred species);
- Move mulch away from the planting holes (1m diameter/0.5 metre all round) if pre mulched;
- Add terracottem and fertiliser pellets to holes, place some soil over the Terracottem and mix and place plants;
- Fill holes and press down soil to firm plants in place and create a shallow well for water retention;
- Apply high N and P fertiliser around plants in the areas cleared of mulch (this may be done at a later stage after establishment of plants);
- Return the mulch to cover the cleared areas and leave a 10-15cm gap unmulched around the stem of the plant to prevent abrasion and collar rot;
- Water in plants i.e. 20 litres per plant.

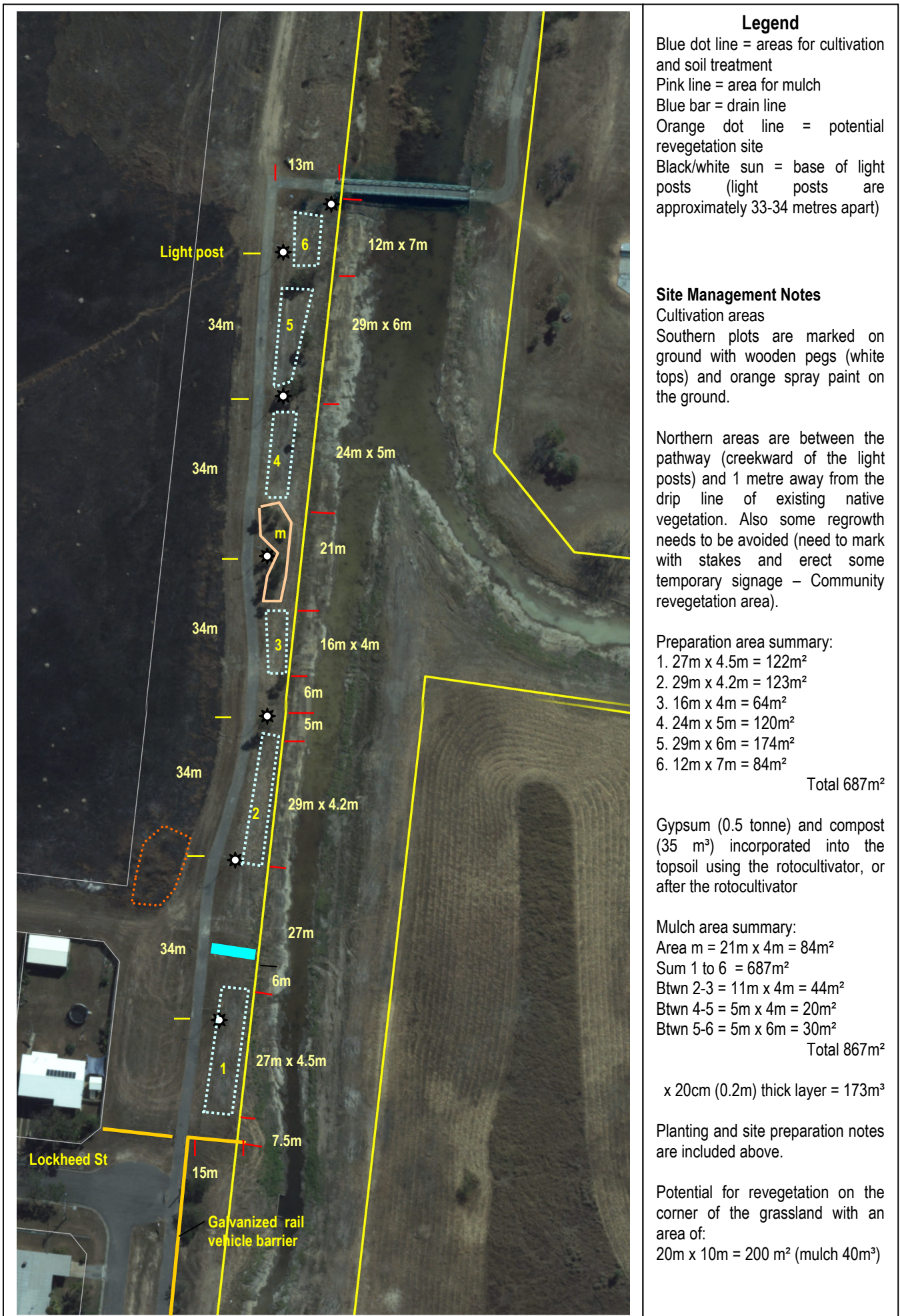
It would be desirable to set up a temporary sprinkler system to wet the whole site (as a simulated rainfall event) one or two days after planting if no rain is likely. An alternative would be a water truck with a side spray (6 metre reach).

Table 4-4 Draft Plant List

Scientific name	Common name	Scientific name	Common name
<i>Acacia holosericea</i>	Silver Leaf Wattle	<i>Mallotus philippensis</i>	Red Kamala
<i>Aidia racemosa</i>	Native Cherry	<i>Melaleuca viminalis</i>	Weeping Bottlebrush
<i>Alphitonia excelsa</i>	Red Ash	<i>Mimusops elengi</i>	Red Coondoo
<i>Calophyllum inophyllum</i>	Beach Laurel	<i>Nauclea orientalis</i>	Leichardt Tree
<i>Canarium australicum</i>	Mango Bark	<i>Pandanus whitei/cookii</i>	Pandanus
<i>Casuarina cunninghamiana</i>	River She-oak	<i>Planchonia careya</i>	*Cocky Apple
<i>Clerodendrum floribundum</i>	Lolly Bush	<i>Premna serratifolia</i>	² Creek Premna
<i>Cupaniopsis anacardioides</i>	Tuckeroo	<i>Sterculia quadrifida</i>	Peanut Tree
<i>Diospyros geminata</i>	² Native Ebony	<i>Thespesia populnea</i>	Portia Tree
<i>Ficus opposita</i>	Sandpaper Fig	<i>Timonius timon</i>	Tim tam tree, Swizel bush
<i>Hibiscus tiliaceus</i>	Beach Hibiscus	<i>Millettia pinnata</i>	Pongamia
<i>Ischaemum australe</i>	² Large Bluegrass	<i>Bursaria tenuifolia</i>	Mock orange, Prickly pine
<i>Lysiphyllum hookeri</i>	² Native Bauhinia	<i>Lomandra longifolia</i>	Spiny-head Mat-rush
<i>Macaranga tanarius</i>	Cottonwood		

Note: Selected species from Table 4.3 \MELROSE1.doc * added from Russell Butler plant list (see Appendix C) ² added from CDTLI list.

Figure 4-7 Site Preparation Plan



Actual preparation

The preparation for planting was adjusted on the day of planting due to rainfall in the preceding days preventing the planned preparation prior to planting day. A rotary hoe was used to cultivate the planting areas and gypsum was spread across the area before a second pass with the rotary hoe to incorporate the gypsum.

The partly decomposed mulch was spread around plantings on the day and on subsequent days to ensure the immediate area around the plantings was covered. Mulch was subsequently spread across the whole planting site. ISS GAWT watered the plants on a weekly basis for three months and then on a fortnightly basis thereafter.

Discussions about plant species with Townsville Airport

Extract from Brodie Akacich email to Bernadette Boscacci:

Sent: Wednesday, 5 December 2012 12:14 PM

Issue: the potential that this project may increase bird activity that transit large open areas, which in turn may cause an increase in bird strikes at the airport.

Dislike

Corymbias, Eucalyptus and Melaleucas – Very attractive to Little Red Flying foxes who transit the airfield and approaches regularly when they move into town. A very serious seasonal problem although the lack of roosting and foraging sites around our airport reduces the issue

Large Grevilleas and Syzygiums (+2m) – Highly attractive to birds, however the smaller varieties should only attract small resident birds in the area already present in the area (Honeyeaters etc). Limit the densities of these species

Terminalia spp - Black Cockatoo's are not on the strike record but are considered a new risk species for the airport as they have been observed in recent months (Sept/Oct) flying out of the Towns Common, across the runway into Garbutt over the Terminal/RAAF base

Heavily fruiting plants or plants with lots of nectar

Like

Casuarinas - male and female plants. Males don't produce fruit? Use non-fruiting so as not to attract Cockatoo

Leichardt trees - attract some species of birds however hopefully not our serious risk species

Kauri Pines due to their resilience to strong winds and aesthetics

Appendix B

Information from Bernadette and Peter, and Russell

Appendix B Information from Bernadette Boscacci and Peter Buosi (2010)

Value	Description of Values	Threats	Recommendations
Egret and Ibis roost	<ul style="list-style-type: none"> The tall eucalypts and melaleucas are a permanent roost site for hundreds of Ibis and Egrets. Kites and White-faced Herons have been recorded breeding there and egrets and ibis probably breed there. 	<ul style="list-style-type: none"> Clearing for development. Regular hot fires that prevent regeneration of native trees and shrubs. Weed ingress including woody, herbaceous and grass species. <p>Note:</p> <ul style="list-style-type: none"> Destruction of the roost site will result in ibis and egrets dispersing elsewhere to roost and may cause a public nuisance. Woody weeds include species Declared under State legislation (e.g. Parkinsonia and Chinese Apple). 	<ul style="list-style-type: none"> Protect remnant patches of tall trees from development (eg via covenants and Land for Wildlife programs). Undertake woody weed control. Assess level of recruitment of native trees and shrubs and if necessary revegetate. Revegetated areas should be protected from hot fires.
Diverse native grassland	<ul style="list-style-type: none"> Native open grasslands are a very rare community in the Townsville region. The native grassland area contains a diversity of species and weed ingress is very low. Given the high level of integrity/condition, diversity of grasses and uniqueness of the community the area is of high conservation value. Marine plants (eg Saltwater Couch) protected under State legislation occur in many areas especially in the north-east of the site. Many fauna species use this area including grassland specialists such as cisticola, quail and wrens. Swamp Harrier, Brolga and Black-necked Stork have also been seen using the area. This is one of the few areas where these birds are found in Townsville 	<ul style="list-style-type: none"> Townsville City Council (TCC) soil stockpiles in north east of site. Illegal motor bike use of area. 	<ul style="list-style-type: none"> TCC to review approval and management requirements for soil stockpiles. Issues to consider include Material Change of Use, soil erosion and impacts on Mundi Creek and downstream environments (including Great Barrier Reef World Heritage Area) and damage to marine plants. Install signage regarding the illegal use of motorbikes. Install gates that restrict motorbike access. Use formed pathways to control public access. Repair existing pedestrian and bicycle paths damaged by TCC and extend pathway to link in with other pathways.
Spring and permanent water source	<ul style="list-style-type: none"> Mundi creek downstream of Dearness St maintains water during most dry seasons. There are anecdotal reports that the pools are fed by a natural spring located near Dearness St. Permanent sources of water act as dry season refugia for a number of plant and animal species and are therefore of high 	<ul style="list-style-type: none"> Recent drainage works has damaged footpaths and banks along Mundi Ck. Maintenance works need to be better managed to reduce impacts; eg provide formed access points to channel and designate temporary soil stockpile sites. Litter thrown in creek. 	<ul style="list-style-type: none"> Repair damaged footpaths. Clear creek of refuse. Investigate option of creating different habitat types within channel; eg sections with deeper pools. The section immediately upstream of the pedestrian bridge is possibly a good place to do this.

potential conservation value.

- Numerous waterbirds forage and congregate in Mundi Ck throughout the year. Ducks, egrets, ibis, lapwings, cisticolas, Black-necked Stork and Brolga are particularly common.
- This is one of the best places to view these species outside of the Town Common.
- A very high diversity of raptors use the wetlands and surrounding grasslands. This diversity of higher order predators is an indicator of the diversity and condition of habitats.



- Investigate ability of creek to act as a wetland filter for waters draining into the GBRMP; e.g. leave sections/bands of Typha within channel and regularly remove accumulated debris and sediments.
- Revegetate more sections along creek channel (both banks) with appropriate locally native plants especially tall trees that provide shade; e.g. *Melaleuca dealbata* and *M. leucadendra*.
- Increase the area and density of native tree plantings on eastern side of Mundi Creek. Again plant locally native species including plants that attract birds and butterflies, plants that provide canopy shade and plants that increase structural diversity.
- Tap into reticulated water supply to increase successfulness of plantings.

Meeting between Russell Butler and Bernadette Boscacci, Garbutt 01/08/11

Springs

Russell spoke of the natural springs in the area - at the corner (Murray and Dearness St) and at Cutheringa Park (nr to Harold and Crauford Sts corner). He said these are creeks from Castle Hill that become subterranean and at these points move close to the surface, as evidenced by their ever greenness & in parts, flooding in the wet and into the early dry seasons.

Russell asked if Council could find out about the pipe at the corner (Murray and Dearness St) of the soccer park in Garbutt and identify where the springs come close to the surface. Russell proposes that Townsville City Council's Town Planning investigate the water flow at this point and look at the feasibility of inserting a bore there. The bore could be redirected to drain directly into Mundy Creek, so that the creek can resume to function as wetland for aquatic bird and other animal and plant species e.g. fish, hyacinth and waterlily. Russell is happy to consult directly with Town Planning on this matter.

Signage

Initially suggested paying artists a commission to design signage... but should we try again? Or leave it? Or instead, hold regular walking tours i.e. TCC fund Mundy Creek Nature Walks for the community i.e. Indigenous Tour Guides be paid to lead regular (or periodical) walking tours instead of outlaying costs for signage? See *Nature Walk flyer – Celebrating Aboriginal and Contemporary Environments of Townsville*. http://www.soe-townsville.org/TCC_pub/mundy_ck.html.

PCYC

How can the PCYC be involved / included / contribute to the project?
PCYC has a nursery at the back of it's building.
Sergeant Dave Goode and Russell Butler are well acquainted.
Russell will speak with Vern Veitch about his ideas to find support for the project.

Vegetation

Suggested planting (along both sides of the creek:

- Weeping Paperbarks (*Melaleuca leucadendra*) - will serve to maintain banks and encourage birdlife, lizards and mammals and bring shade to the water and the pathways.
- Beach Almond (*Terminalia spp*) in cluster plantings to attract and feed the Black Cockatoos
- Cocky Apple (*Planchonia careya*) – bush food and medicine tree
- Macaranga/Heart Leaf (*Macaranga tanarius*) – fast growing and good for birds
- Soap Tree (*Alphitonia excels*)

Link the plantings with the mangrove area would be good to encourage the return of the Scrub Turkeys to help maintain the ground / leaf litter. If we create a corridor from the population near to the cemetery then we may be able to encourage them back to the creek.

Suggested planting:

- *Melaleuca dealbata* - closer to the brackish and saltwater
- Beach Hibiscus (*Hibiscus tiliaceus*) - foreground patches / as understory along the paths, so as to allow for bird corridors and safety zones from predators
- River Cherry (*Syzygium austral*) - bush food tree

Some good references

Australian Medicinal Plants (Lassak and McCarthy)
The Burdekin Delta Tree Guide (Greg Calvert for Lower Burdekin Landcare and others)

References from Uw Oygangand Oyber - Traditional Bush Medicine from the Kunjen Bush Medicine (Alma Luke with Myrtle Luke and Bernadette Boscacci 2011)

Beasley, J. (2009) <i>Plants of Cape York: the compact guide</i> , John Beasley, QLD. Bindon, P. (1996) <i>Useful Bush Plants</i> , Western Australian Museum, Perth, WA. Brock, J. (1993) <i>Native Plants of Northern Australia</i> , Reed Books, Melbourne, VIC. Brooker, I. & Kleinig, D. (1994) <i>Field Guide to Eucalypts</i> , Vol 3, Inkata Press, Sydney, NSW. Calvert, G. (2010) <i>The Burdekin Delta Tree Guide</i> , Lower Burdekin Landcare Association Inc., Ayr, QLD.
--

- Cribb, A.B. & J.W. (1981) *Wild Medicine in Australia*, Fontana/Collins, Sydney, NSW.
- Low, T. (1988) *Wild food Plants of Australia*, Angus & Robertson, Sydney, NSW.
- Melzer, R. & Plumb, J. (2007) *Plants of Capricornia*, Capricorn Conservation Council, Rockhampton, QLD.
- Milson, J (2000) *Trees and Shrubs of North-west Queensland*, Department of Primary industries, QLD.
- Stewart, G. (1992) *People, Plants and Wangarr Wirws*, Kowanyama Aboriginal Land and Natural Resource Management Office, Kowanyama, QLD.
- Townsend, K. (1997) *Field guide to Plants of the Dry Tropics*, Society for Growing Australian Plants, Townsville, QLD.
- White, D., O'Brien, E., Fejo, D., Yates, R., Goodman, A., Harvey, M. & Wightman, G. (2009) *Warray Plants and Animals, Aboriginal flora and fauna knowledge from the upper Adelaide and upper Finnis Rivers, Northern Australia*, Department of Natural Resources, Environment, the Arts and Sport & Diwurruwurru-jaru Aboriginal Corporation, NT.

Appendix C

Mundy Creek Natureway History

Appendix C Information from Mundy Creek Natureway Funding

Community Renewal Program Final Report (1998/1999 Round 3 Grant) 31 January 2001
(Source: \\cfoc\coastal communities implementation 2010-11\BusPlan\sub projects\Mundy Creek\mc natureway\CRP9899rd3 Final Report Mundy Ck Natureway1999)

(from) **Description of Funded Project**

Mundy Creek (also known as Melrose Creek) runs from Melrose Park, Garbutt, to the coast at Rowes Bay. The creek and the area around it have social, historical and environmental significance for local residents, especially Aboriginal and Torres Strait Islander residents. Local Aboriginals used to fish in the creek and lagoons that once existed nearby. Plants and animals provided food, and waterholes were popular swimming spots.

For many years, nearby residents have used tracks beside the creek as a scenic walking and cycling route from Garbutt to the coast at Rowes Bay. The creek has many natural and scenic values and flows through an area with a variety of vegetation types, including open woodland, grasslands, small patches of open forest, mangrove forest areas, and bare salt pan areas. The area attracts many birds, including broilgas, kites, ibises, cormorants, doves and magpie larks. The creek itself is home to local fish, including barramundi, mangrove jack, mullet and rainbow fish. Native animals in the area include water rats, brushtail possums, bandicoots and bats. Sand goannas, carpet pythons, and common tree snakes have also been seen in the area, as have domestic and feral mammals.

The historical and environmental significance of the Mundy Creek Natureway and the need to rejuvenate it emerged through community consultations with Garbutt residents. In 1997, as part of the urban and community renewal process, a proposal for rejuvenating Mundy Creek was prepared by Dr Con Lokkers from Tropical Urban Production and Landcare. The project was included in the Community Action Plan prepared in 1999.

The aim of the Mundy Creek Natureway project has been to provide recreational, visual and educational opportunities for local residents and visitors and to provide a link from Garbutt's residential area to important recreational facilities. The objectives have been to improve amenity and accessibility to Mundy Creek, to make significant public space more accessible, and to increase social and recreational opportunities for young people.

Community activities

Around 30 people/residents participated in community tree planting days in late 1998 with some involved in initial plant propagation.

Many joined in guided walks along Mundy Creek in September 1998 and June 2000 to learn more about the social, historical and environmental significance of the area.

Aboriginal Elders have also been involved in the project as members of a reference group for the development of interpretive signs and artworks to be installed along the Natureway.

Groups and organisations involved

The Greening Garbutt group, the Garbutt Neighbourhood House Group, Aboriginal and Torres Strait Islander Elders, Garbutt State School, the Castle Hill PCYC, Landcare (TUPALG), the Townsville Youth Council and the Soroptimist International Breakwater Club.

Townsville City Council, through its Environmental Planning Section, employed six trainees with the support of funding from the Department of Employment, Training and Industrial Relations (DETIR) under the Community Jobs Plan. These trainees, who were all indigenous and long-term unemployed, carried out revegetation work along Mundy Creek and other environmental sites around Townsville between July 1999 and July 2000

Funded actions

The stage of the project funded under Community Renewal Program 1998/1999 involved the construction of the foot and bike bridge across Mundy Creek and part of the first section of bikeway/walkway from the Garbutt preschool in Douglas Street to the bridge.

The 1998/1999 Round 1 grant of \$30,000 funded the survey work, soil testing, plans and much of the construction costs of the bridge (see Final Report forwarded in November 1999).

The 1998/1999 Round 3 grant of \$30,000 funded the remainder of the construction costs of the bridge, the

building of approaches to the bridge, and some of the costs of the first section of bikeway/walkway.

Further funds provided under the Community Renewal Program in 1999/2000 and 2000/2001 have enabled further work on the Mundy Creek Natureway project, including further work on the bikeway and the production of interpretive signs and artworks as part of the Garbutt Public Art Program.

Chronology of works

- 1997 - community consultations with Garbutt residents as part of the urban and community renewal process;
- 1997 - a proposal for rejuvenating Mundy Creek prepared by Dr Con Lokkers from Tropical Urban Production and Landcare Group (TUPALG);
- 1999 – Mundy Creek Natureway project included in the [Garbutt] Community Action Plan;
- April 1999 - funding agreement (between the Department of Housing and the Townsville City Council) signed and project commenced;
- June 1999 and March 2000 - funds received for Round 3 of the Community Renewal Program 1998/1999;
- July 1999 - Community Jobs Plan trainees (*three) (*Council received \$80,368 in 1999/2000 from the Department of Employment, Training and Industrial Relations (DETIR) to employ six long-term unemployed residents of Garbutt) began work along Mundy Creek in particular revegetation work along the section of Mundy Creek between the residential area of Garbutt and Harold Phillips Park (revegetation work along the creek has included the planting and maintenance of around 1,000 trees);
- Site selection for the bridge across Mundy Creek to Harold Phillips Park;
- Soil testing, survey work, and bridge design were completed by August 1999;
- Tenders sought for bridge construction;
- Mid September 1999 - construction of the bridge commenced;
- Bridge construction completed in late October 1999;
- 21 October 1999- Premier Peter Beattie and Member for Townsville Mike Reynolds MLA visited Mundy Creek to meet with the trainees and with members of the Garbutt community involved in the project;
- Late November and early December 1999 - short approach ramps on either side of the bridge were constructed;
- *January 2000 – a further three Community Jobs Plan trainees commenced work;
- 12 February 2000 - Mike Reynolds MLA and Mayor Tony Mooney officially opened the bridge with an event for young people in Harold Phillips Park;
- February 2000 - detailed planning for the first section of bikeway commenced (a 2.5 metre wide asphalt bikeway/walkway to run from the Garbutt preschool (on the corner of Douglas Street and Dearness Street) to the Mundy Creek bridge);
- *March 2000 - first instalment of \$30,000 received (from Round 1 1999/2000);
- March 2000 - Tenders sought for bikeway construction;
- April 2000 - contractor selected;
- *26 May 2000 – bikeway construction completed;
- *June 2000 - second instalment of \$30,000 received (from Round 1 1999/2000);
- *Installation of lighting for bikeway/walkway from Lockheed Street Garbutt, to Harold Phillips Park to be completed by May 2000;
- *Revegetation of Natureway from Lockheed Street, Garbutt, to Harold Phillips Park to be completed by June 2000;
- *Stage bikeway design split between 99/00 Round 1 (\$1,702.01) and 00/01 Round 1 (\$2,542.06).

The bikeway construction included:

- *Surveying;
- Establishment of camp and provisions for traffic;
- Excavation;
- Supply and placement of 150mm of gravel;
- Placement of 25mm bituminous concrete;
- Installation of pipes and construction of culverts for drainage;
- Installation of traffic control devices (to prevent cars using the bikeway);
- Removal and replacement of signage.

The Citiworks Section of the Townsville City Council managed the construction of the bridge, approaches,

and bikeway/walkway. Council covered most of the planning and management costs of the project.

Note: * denotes additional information extracted from the Community Renewal Program Final Report November 2001 (1999/2000 Round 1 Grant)

(Source: \cfoc\coastal communities implementation 2010-11BusPlan\sub projects\Mundy Creek\mc natureway\CRP9899rd3 Final Report Mundy Ck Natureway1999)

Mundy (Melrose) Creek Natureway Proposal

(Source: \cfoc\coastal communities implementation 2010-11BusPlan\sub projects\Mundy Creek\mc natureway\MELROSE1)

2 Site Description

2.1 Physical

Melrose Creek is a small picturesque drainage system, with both natural and artificial sections, running from Melrose Park, Garbutt, to the coast at Rowes Bay (see map 1). It also connects to the Lakes system in West End, and to small drainages from Castle Hill and Townsville Airport. It plays an important role in flood mitigation for the suburbs of Garbutt, West End, Castle Hill, Belgian Gardens and Rowes Bay.

This proposal covers the section of Melrose Creek (and associated banks) from Melrose Park to the coast at Rowes Bay. Extending approximately 2.2 km, this stretch of the creek flows through a relatively flat coastal plain. Solodic soils dominate the area, with thin A horizons overlying heavy clay subsoils (Murtha and Reid, 1975). This soil type limits development options due to:

- impeded drainage
- low load bearing capacity when wet
- moderate to high salt levels
- low fertility

Areas of alluvial soil are interspersed along the length of the creek. These recently deposited fine silty soils have higher fertility and better drainage, but may still contain moderate salt levels. Some sandy soils, derived from old beach ridges, are found in the lower half of the creek (downstream of Parramatta Street). These soils are characterised by free drainage, poor water holding capacity and low fertility.

Some artificial levee banks, from 1 to 2 metres high, occur along the bottom 500 metres of the creek. These banks limit salt water intrusion into surrounding low-lying coastal flats, and provide soil conditions more favourable for most plant growth.

Tidal gates near Evans Street limit saline inundation during large high tides, and have probably reduced salt levels in the soils upstream over time. Below the tidal gates, the creek banks have been reinforced with rock walls.

2.2 Biological

Melrose Creek flows through a range of vegetation types (map 1), determined by factors including soil type, topography and past and present landuse. A species list for the creek is given in Appendix 4.1, showing their occurrence across vegetation types.

Areas of open woodland are scattered along the length of the creek, in solodic and alluvial soils with better drainage and lower salt levels. The upper canopy is dominated by eucalypts (mostly *Corymbia* (formerly *Eucalyptus*) *tesselaris*), and the understorey contains various grasses and ephemeral herbs.

A number of woody and non-woody weeds have become established, including chinee apple (*Zizyphus mauritiana*), leucena (*Leucaena leucocephala*) and guinea grass (*Panicum maximum*).

Extensive areas of grassland occur along the creek. Some of these areas are artificially maintained by a regular council mowing program, and would naturally support open woodland vegetation. A wide variety of native and exotic grasses have been recorded, along with numerous ephemeral herbs and seedling trees. Some low-lying areas with high salinity are covered with native saltwater couch (*Sporobolus virginicus*).

Some small patches of open forest are found on sand ridges and riparian (creek side) areas. Dominant canopy trees include *Corymbia tessellaris*, *Melaleuca dealbata* and *Alphitonia excelsa*. Midstorey plants include developing trees, sandpaper fig (*Ficus opposita*) and wattles (*Acacia crassicaarpa*, *Ac. holosericea*). The natural understorey of grasses and ephemeral herbs are to a large extent overwhelmed by exotic grasses such as guinea grass and para grass (*Brachiara mutica*).

Mangrove forest is found along much of the lower edges of Melrose Creek, particularly below the tidal gate. These forests are mostly regrowth after previous clearing, and are probably still expanding. The dominant species are grey mangrove (*Avicennia marina*), yellow mangrove (*Ceriops tagal*) and spider mangrove (*Rhizophora stylosa*).

A few areas of bare salt pan occur in low lying areas which are periodically inundated by large tides, and are usually associated with areas of salt water couch grassland and samphire vegetation. Samphire plants are highly salt-tolerant low shrubs, such as *Halosarcia spp.* and *Athrocnemum spp.*, which form a distinctive low shrubland community.

A list of animal species recorded from the site or in studies of nearby sites is given in Appendix 4.2. However, due to time and financial constraints, this list comprises only a fraction of the total fauna. For example, no amphibians, and only some of the more conspicuous reptiles are listed.

Brolgas are often seen grazing in the grasslands of the upper reaches of Melrose Creek. Other commonly observed birds include kites, ibises, cormorants, doves and magpie larks. Numerous fish inhabit the creek, including barramundi, mangrove jack, mullet, rainbow fish, and the exotic tilapia.

An area of leasehold land just upstream of Old Common Road is used for grazing horses. A variety of other domestic and feral mammals are present, such as cats, dogs and mice. Native mammals include water rats, brushtail possums, bandicoots, and bats.

Sand goannas, carpet pythons and common tree snakes have been recorded from this site.

2.3 Cultural, Social and Historical

The Community and Cultural Services Department of Townsville City Council is compiling a social history of the Garbutt area. This document, an integral component of the ongoing Garbutt Urban Renewal Project, draws together information on the various cultural (eg Aboriginal and Torres Strait Islander, European, American) and environmental factors (eg beaches, bushwalking, mosquitoes, floods, cyclones) which have shaped present day Garbutt.

Early Garbutt residents regularly fished in Melrose Creek, Louisa Creek, Geaney's Creek and nearby lagoons on the Town Common, for species such as barramundi and mangrove jack. Waterholes without crocodiles were also popular swimming holes, situated on Melrose Creek Melrose Park, between Hugh, Dearness, Douglas and Chandler streets, was the first parkland gazetted in the Garbutt area, in 1931. Other parks along the Creek include Harold Phillips Park (Hugh and Lower William Street), the Evans Street park (Evans and Hooper Street) and Fantome Street parkland.

Locals have used Melrose Creek as a scenic pedestrian and bicycle thoroughfare from Garbutt to Rowes Bay for many years, with numerous tracks on both banks of the creek. Unfortunately, drainage works, channel excavation and other earthworks have degraded the natural and scenic qualities of the creek. Local residents have planted a variety of native and exotic plants, particularly in the lower reaches of the creek. Numerous organisations, including Townsville City Council, Rotary, Garbutt State School, Greening the Capital, and the Police Youth Club have also planted trees in Harold Phillips Park and Melrose Park.

2.4 Tenure and Landuse

Townsville City Council is the major landholder in the site (map 2), with parks (Melrose Park, Harold Phillips Park, Hooper Street playground) and the drainage reserve. The Department of Natural Resources has tenure of 2 areas, a rectangular block to the north of Harold Phillips Park and a triangular area on the western side of the creek near its mouth. The Department of Education maintains a lease on the land between Harold Phillips Park and Dearness Street. Areas on either side of Old Common Road are leased for grazing purposes. Numerous private residential properties are also adjacent to the proposed site, near Parramatta Street, Hooper Street and Lynham Street.

The site has a wide range of current uses. Melrose Park has a half basketball court and is the home of the Heatley Warriors soccer club. The Castle Hill Police and Citizens Youth Club has a clubhouse in Harold Phillips Park, and is a focal point for many sporting activities in the area. Horses are grazed in a fenced pasture to the south of Old Common Road. The Belgian Gardens Scout group have a clubhouse between Evans Street and the creek.

A system of well-used walking and cycle tracks allow local residents to travel from Melrose Park to Rowes Bay, or enjoy a scenic walk along the creek. Current uses of this thoroughfare include:

- children travelling to school and the Police Youth Club
- people travelling to work, sporting venues and Pallarenda
- people exercising, fishing and enjoying the natural scenery

2.5 Values

Melrose Creek already displays a number of practical and aesthetic values, which could be both enhanced and expanded with appropriate works.

(a) Flood mitigation

Melrose Creek and associated drainage systems are an important component of flood mitigation in low lying areas of Garbutt, West End, Belgian Gardens and Rowes Bay. The tidal gates at Evans Street are used to reduce saltwater intrusion and pooling during very high tide events, while allowing natural fish and wildlife movements at other times.

The retention, mitigation and habitat values of this creek could be improved by the construction of a retention pond at a suitable low-lying point, possibly near Old Common Road. The Australian Centre for Tropical Freshwater Research is currently investigating the feasibility of an artificial wetland system for an area between the Townsville Airport and Melrose Creek.

(b) Pedestrian and bicycle transport

Melrose Creek is already well used by adults and children to travel between Rowes Bay and Melrose Park. Having only one road crossing at Old Common Road, this thoroughfare is a much safer route for children than the Bundock Street bike lane. The growing range of sporting facilities in the area will also increase the need for a safe bike route.

The construction of a sealed bike and pedestrian pathway will greatly improve the present value of Melrose Creek as a local thoroughfare, and provide a safe link to the Pallarenda bike path.

(c) Natural and scenic values

As discussed previously, Melrose Creek contains a range of natural habitats, similar to those found on the Town Common Environmental Park. A range of waterbirds, including broilgas and magpie geese, may be seen at certain times of year. Fishing is a common activity in the lower reaches of the creek.

However, previous clearing of vegetation, subsequent invasion by numerous weeds (particularly grasses, vines and woody weeds) and occasional wild fires has degraded these natural habitats.

Suitable environmental management and works will enhance the natural values of Melrose Creek. A staged weed control and revegetation program will concentrate on restoration of the creek-side vegetation, surrounding woodland and fresh water and saline wetlands. These works should reduce the future maintenance costs to council, by minimising unwanted grass and weed growth in and adjacent to the creek, reducing erosion and eliminating small stagnant pools of water which breed mosquitoes.

(d) Promoting awareness of Townsville's cultural and environmental heritage

Interpretive signs describing the cultural and environmental values of the Melrose Creek area will enhance the appeal of the pathway and associated works, and also provide favourable publicity for the council. The Department of Community and Cultural Services is already documenting cultural and historical information about the area, so suitable interpretive material will soon be available.

3 Action Plan

3.1 Aims and Strategies

The aim of this project is to revegetate, beautify and improve community access along Melrose Creek from Melrose Park to Rowes Bay.

These aims will be achieved by a staged process, and will include the following steps:

- Construction of a pedestrian and bicycle pathway beside the creek, and a bridge near Lockheed Street for improved access to the Police Youth Club in Harold Phillips Park.
- Interpretive signs along the pathway describing social, historical and biological points of interest.
- Revegetation of the creek banks and nearby land with locally occurring plant species, to recreate some of the original vegetation types and reduce erosion.
- Control and management of the introduced weeds and feral animals in the site.
- Construction of a retention pond to improve the flood mitigation abilities of the creek and provide extra wetland habitat for wildlife.

This process will be conducted with full and regular consultation with the local community, and any other interested people and organisations.

It is suggested that consultation strategies may include:

- continued encouragement of involvement by local community organisations and residents in the planning group.
- specific discussions with land holders and users along the proposed pathway.
- doorknocking residents closest to the proposed pathway to obtain feedback on the broad proposal and to identify any issues

of concern.

- a local community meeting to discuss plans and to encourage involvement in early stages of project.

3.2 Bicycle and pedestrian pathway

The proposed pathway (map 2, total length 2.2 km) begins at Douglas Street, crosses Melrose Creek near Harold Phillips Park, and then follows the eastern creek bank until Hooper Street. The path runs along the side of Hooper Street for a short distance (to pass around a saline wetland area), and then returns to follow the eastern creek bank to Cape Pallarenda Road. The bridge crossing will allow a safe access route from the Police Youth Club to residential areas west of the creek. The final pathway will be determined after consultation with all concerned local residents and organisations. Local response has been very favourable up to this date.

A range of surfaces have been considered for this path, including gravel, bitumen (coloured or uncoloured), asphalt, concrete and pavers. Due to cost, maintenance and structural considerations, bitumen and asphalt are the preferred choices. Current costing for a 2.5 metre wide asphalt path by Townsville City Council Engineering Department is approximately \$70/m (including standard bikeway signs). Bushmates Pty Ltd will be asked to provide a similar quote for a coloured bitumen path, which would blend more aesthetically with the natural scenery. Bollards to restrict vehicle access will be required at both ends of the path and on either side of Old Common Road. Construction will be staged over 3 years to spread out costs. The section linking The PCYC to Lockheed St (including bridge) will be completed in the first year, from the PCYC to Hooper St in year 2, and Hooper St to Rowes Bay in year 3.

Overhead lights have also been discussed; further consultation is needed to assess the desirability and economic viability of lighting. The benefits of convenience and safety for night time users need to be weighed against the high installation and running costs, and adverse impacts on local residents and the natural values of the creek. The cost of lighting the 300 metre section from Lockheed St to the PCYC (the section most likely to be used at night) is given in the costing table.

3.3 Retention pond

As mentioned previously, the Australian Centre for Tropical Freshwater Research is currently examining the feasibility of an artificial wetland between Melrose Creek and the Townsville airport, near Old Common Road. Dependent on the outcome of their investigations, this system could be linked to Melrose Creek, providing flood mitigation, habitat and scenic enhancement in the area. Although these studies are still only preliminary, the works outlined in this proposal will be designed to integrate with any future wetland development. Regular liaison with the relevant government and private organisations will continue to ensure this important link is maintained.

3.4 Vegetation management and revegetation

The proposed revegetation works (map 3) include the restoration of a 5 metre wide strip of riparian vegetation along both banks of the creek (approximately 22,000 m²) and 100 clumps of woodland vegetation (2000 m²). This will be achieved in stages, and will endeavour to attract community participation in tree planting and follow-up maintenance work.

Initial weed control on the site will concentrate on the invasive grasses (primarily guinea grass and para grass) and woody weeds (chinee apple, parkinsonia and leucaena). Depending on location, grass will be controlled by varying combinations of mowing, spraying with glyphosate (Biactive® or a similar formulation with low toxicity surfactants for use near waterways), and manual removal. Woody weeds will be removed by cutting down near the base, followed by application of a picloram/triclopyr herbicide (eg Starane®, Grazon®) on the cut stump. Larger plants can be chipped to produce mulch on site. Several follow-up applications may be necessary to achieve effective control.

Preparation of planting sites is essential for successful revegetation. Following weed control, some sites may require ripping, depending on the level of soil compaction. Application of gypsum at the rate of 1 kg/m² will improve soil structure in areas of heavy duplex soils. A thick layer of mulch (at least 150 mm thick) will improve the physical and chemical structure of the soil and reduce weed growth and watering requirements.

Native plants sourced from locally collected seed should be used, as these locally adapted plants will need less maintenance, give higher success and provide natural habitat for wildlife. A list of suitable species for each habitat type is given in Appendix 4.3.

Riparian (creekside) plants will be closely spaced (2 m spacing) to provide bank stabilisation, and so they will begin to shade out weeds as quickly as possible (to reduce ongoing weed control costs). Woodland plantings will be made in small mulched clumps, ranging from 10 to 50 m² in size, with plant spacings of 3 to 4 metres. These more open patches will not produce enough shade to control weeds, so ongoing control will be necessary, either by slashing, regular mulching or herbicide.

Both riparian and woodland plantings will require intensive maintenance (watering, weed control) for the first year and less regular maintenance (annual mulching, watering, weed control if needed) for a further 2 years, by which time the plants should be well established.

Planting work will be carried out in 4 to 6 stages, over 3 years, to spread costs, labour and plant stock requirements. Smaller plantings will also allow greater community participation and so enhance local support and "ownership" of revegetated areas.

3.5 Interpretative signs and brochure

Suitable interpretive information on aspects of Melrose Creek and the surrounding area is being collected by the study of the social history of the Garbutt area by Townsville City Council. This material will be used to produce a small number of interpretive signs, to be placed at appropriate sites along the track. If sufficient material is collected, a small brochure will also be produced. The consent and active participation of any interested residents or groups (eg local Aboriginal and Torres Strait Islander community) will be an important priority in this process.

4.1 Plant species list [sorted alphabetically by scientific name]

Scientific name	Common name	Family	Habitat					
			PI	WI	GI	Of	Mf	Sf
<i>Acacia crassicaarpa</i>	beach wattle	Mimosaceae				p	p	
<i>Acacia holosericea</i>	silver leaf wattle	Mimosaceae				p	p	
<i>Acacia mangium</i>	brown salwood	Mimosaceae	p					
<i>Albizia lebbek</i> *	Indian sirus	Mimosaceae	p	p				
<i>Alphitonia excelsa</i>	red ash	Rhamnaceae				p		
<i>Alternanthera pungens</i> *	khaki weed	Amaranthaceae		p	p		p	
<i>Amaranthus viridis</i> *	green amaranth	Amaranthaceae		p	p			
<i>Avicennia marina</i>	grey mangrove	Verbenaceae					p	
<i>Bothriochloa decipiens</i>	pitted bluegrass	Poaceae			p			
<i>Bougainvillea sp.</i> *	bougainvillea	Nyctaginaceae	p					
<i>Brachiara mutica</i> *	para grass	Poaceae		p	p			
<i>Bruguiera axaristata</i>	orange mangrove	Rhizophoraceae					p	
<i>Canarium australianum</i>	mango bark	Burseraceae				p		
<i>Cassytha pubescens</i>	dodder laurel	Lauraceae				p		
<i>Casuarina cunninghamiana</i>	river she oak	Casuarinaceae	p					
<i>Catharanthus roseus</i> *	periwinkle	Apocynaceae	p					
<i>Cenchrus ciliata</i> *	buffel grass	Poaceae			p			
<i>Cenchrus echinatus</i>	Mossman River grass	Poaceae			p	p		
<i>Ceriops tagal</i>	yellow mangrove	Rhizophoraceae					p	
<i>Chaemacrista mimosoides</i>		Caesalpinaceae		p	p			
<i>Chloris barbata</i> *	purple top chloris	Poaceae			p			
<i>Cleome viscosa</i>	tick weed	Capparaceae		p				
<i>Clerodendrum floribundum</i>	lolly bush	Verbenaceae		p			p	
<i>Clitoria ternatea</i> *	butterfly pea	Fabaceae		p	p			
<i>Corymbia ptychocarpa</i> *	swamp bloodwood	Myrtaceae	p					
<i>Corymbia tessellaris</i>	Moreton Bay ash	Myrtaceae		p		p		
<i>Crotalaria goreensis</i> *	gambia pea	Fabaceae		p	p	p		
<i>Cryptostegia grandiflora</i> *	rubber vine	Asclepidaceae				p		
<i>Cupaniopsis anacardioides</i>	tuckeroo	Sapindaceae				p		
<i>Delonix regia</i> *	poinciana	Caesalpinaceae	p					
<i>Eucalyptus miniata</i> *	woolybutt	Myrtaceae	p					
<i>Eucalyptus platyphylla</i>	poplar gum	Myrtaceae		p				
<i>Euphorbia hirta</i> *	asthma plant	Euphorbiaceae			p			
<i>Ficus benjamina</i> *	weeping fig	Moraceae	p					
<i>Ficus opposita</i>	sandpaper fig	Moraceae		p		p		
<i>Flueggia virosa</i>	white currant bush	Euphorbiaceae				p		
<i>Geijera salicifolia</i>	scrub wilga	Rutaceae				p		
<i>Gomphrena celosiioides</i> *	gomphrena weed	Amaranthaceae		p	p			
<i>Grewia retusifolia</i>	dog balls	Tiliaceae				p		
<i>Halosarcia halocnemoides</i>		Chenopodiaceae						p

Mundy Creek Catchment and Riparian Management Strategy

<i>Halosarcia indica</i>		Chenopodiaceae					p	p
<i>Heteropogon contortus</i>	black spear grass	Poaceae			p			
<i>Hyptis suaveolens*</i>	hyptis	Lamiaceae		p		p		
<i>Indigofera hirsuta</i>	hairy indigo	Fabaceae				p		
<i>Ipomea pes-caprae</i>	beach morning glory	Convolvulaceae					p	
<i>Jasminium didymum</i>	native jasmine	Oleaceae				p	p	
<i>Lantana camara*</i>	lantana	Verbenaceae				p		
<i>Leucaena leucocephala*</i>	leucaena	Mimosaceae		p	p			
<i>Lophostemon grandiflorus</i>	northern swamp box	Myrtaceae		p				
<i>Lumnitzera racemosa</i>	black mangrove	Combretaceae					p	
<i>Macroptilium atropurpureum*</i>	siratro	Fabaceae		p	p	p	p	
<i>Macroptilium lathyroides*</i>		Fabaceae				p		
<i>Mallotus philippensis</i>	red kamala	Euphorbiaceae				p		
<i>Mangifera indica*</i>	mango	Anacardiaceae	p					
<i>Melaleuca dealbata</i>		Myrtaceae		p			p	
<i>Melaleuca leucadendra</i>	weeping paperbark	Myrtaceae	p					
<i>Melia azedarach</i>	white cedar	Meliaceae	p					
<i>Melinis repens*</i>	red Natal grass	Poaceae			p	p		
<i>Merremia sp.</i>		Convolvulaceae				p		
<i>Murraya paniculata</i>	mock orange	Rutaceae	p					
<i>Nauclea orientalis</i>	Leichardt tree	Rubiaceae	p					
<i>Neptunia gracilis</i>		Mimosaceae		p	p			
<i>Pandanus whitei</i>	pandanus	Pandanaceae		p				
<i>Panicum maximum*</i>	guinea grass	Poaceae		p	p	p		
<i>Parkinsonia aculeata*</i>	Jerusalum thorn	Caesalpinaceae		p	p			
<i>Passiflora foetida*</i>	stinking passionfruit	Passifloraceae		p	p	p		
<i>Peltophorum pterocarpum*</i>	yellow flame tree	Caesalpinaceae	p					
<i>Phyllanthus virgatus</i>		Euphorbiaceae			p			
<i>Pleiogynium timorense</i>	Burdekin plum	Anacardiaceae				p		
<i>Portulaca oleracea</i>	pigweed	Portulacaceae			p			p
<i>Pterocaulon serrulatum</i>	rag weed	Asteraceae		p	p	p		
<i>Rhizophora stylosa</i>	spider mangrove	Rhizophoraceae					p	
<i>Samanea saman*</i>	rain tree	Mimosaceae	p					
<i>Schefflera actinophylla</i>	umbrella tree	Araliaceae	p					
<i>Schinus terebinthifolia*</i>	Brazilian pepper tree	Anacardiaceae	p					
<i>Sesbania cannabina</i>		Fabaceae		p	p	p		
<i>Sesuvium portulacastrum</i>	sea purslane	Aizoaceae						p
<i>Sida acuta*</i>	flannel weed	Malvaceae			p			
<i>Sida cordifolia</i>	flannel weed	Malvaceae			p			
<i>Sporobolus virginicus</i>	salt water couch	Poaceae			p		p	p
<i>Sporobolus australasicus</i>		Poaceae			p			
<i>Stachytarpheta jamaicensis*</i>	snakeweed	Verbenaceae			p	p		
<i>Sterculia quadrifida</i>	peanut tree	Sterculiaceae	p					
<i>Stylosanthes humilis*</i>	Townsville stylo	Fabaceae		p	p			
<i>Suaeda arbusculoides</i>	seablite	Chenopodiaceae						p
<i>Tabebuia sp.*</i>	trumpet tree	Bignoniaceae	p					
<i>Tamarindus indica*</i>	tamarind	Caesalpinaceae	p					
<i>Tecoma stans*</i>	tecoma	Bignoniaceae	p					
<i>Terminalia catappa</i>	beach almond	Combretaceae	p					
<i>Thevetia peruviana*</i>	yellow oleander	Apocynaceae	p					
<i>Tribulus cistoides</i>	caltrop	Zygophyllaceae			p			
<i>Trichodesma zeylanicum</i>	camel bush	Boraginaceae		p				

<i>Tridax procumbens</i> *	tridax daisy	Asteraceae		p	p	p		
<i>Zizyphus mauritiana</i> *	chinee apple	Rhamnaceae		p	p	p		

Notes: Pl = Planted, Of = Open forest, Wl = Woodland, Mf = Mangrove forest, Gl = Grassland, Sf = Salt flat shrubland and * indicates species are introduced (non-native). p indicates the species is present in the habitat/area.

4.2 Faunal species list

(a) Reptiles

Scientific name	Common name	Family
<i>Diporiphora australis</i>	tommy roundhead	Agamidae
<i>Carlia pectoralis</i>	garden skink	Scincidae
<i>Ctenotus robustus</i>	striped skink	Scincidae
<i>Morelia spilota</i>	carpet python	Boidae
<i>Dendrelaphis punctulata</i>	tree snake	Colubridae
<i>Varanus gouldii</i>	sand goanna	Varanidae

(b) Birds

Scientific name	Common name	Family
<i>Dacelo novaeguineae</i>	laughing kookaburra	Alcedinidae
<i>Haliastur indus</i>	brahminy kite	Accipitridae
<i>Haliastur sphenurus</i>	whistling kite	Accipitridae
<i>Milvus migrans</i>	black kite	Accipitridae
<i>Anseranas semipalmata</i>	magpie goose	Anatidae
<i>Geopelia striata</i>	peaceful dove	Columbidae
<i>Eudynamys scolopacea</i>	common koel	Cuculidae
<i>Dicaeum hirundinaceum</i>	mistletoe bird	Dicaeidae
<i>Dicrurus bracteatus</i>	spangled drongo	Dicruridae
<i>Grallina cyanoleuca</i>	magpie lark	Grallinidae
<i>Grus rubicundus</i>	brilga	Gruidae
<i>Entomyzon cyanotis</i>	blue-faced honeyeater	Meliphagidae
<i>Philemon buceroides</i>	helmeted friarbird	Meliphagidae
<i>Merops ornatus</i>	rainbow bee-eater	Meropidae
<i>Nectarinia jugularis</i>	yellow sunbird	Nectariniidae
<i>Specotheres viridis</i>	figbird	Oriolidae
<i>Passer domesticus</i> *	house sparrow	Passeridae
<i>Phalacrocorax sulcirostris</i>	little black cormorant	Phalacrocoracidae
<i>Threskiornis molucca</i>	sacred ibis	Plateleidae
<i>Threskiornis spinicollis</i>	straw-necked ibis	Plateleidae
<i>Trichoglossus haematodus</i>	rainbow lorikeet	Psittacidae
<i>Acridotheres tristis</i> *	common myna	Sturnidae

(c) Mammals

Scientific name	Common name	Family
<i>Canis familiaris</i> *	dog	Canidae
<i>Felis catus</i> *	cat	Felidae
<i>Equus caballus</i> *	horse	Equidae
<i>Hydromys chrysogaster</i>	water rat	Muridae
<i>Mus musculus</i> *	house mouse	Muridae
<i>Isodon macrourus</i>	brown bandicoot	Peramelidae
<i>Trichosurus vulpecula</i>	brushtail possum	Phalangeridae
<i>Pteropus alecto</i>	black flying fox	Pteropodidae

4.3 Plant species for revegetation work [sorted alphabetically by scientific name. Mangroves separated]

Scientific name	Common name	Family	Planting area
<i>Acacia crassicarpa</i>	Beach wattle	Mimosaceae	F,S,W
<i>Acacia holosericea</i>	Silver leaf wattle	Mimosaceae	F,S,W
<i>Acacia leptostachya</i>	Townsville wattle	Mimosaceae	F,W
<i>Aidia racemosa</i>	Native cherry	Rubiaceae	F,S
* <i>Alphitonia excelsa</i>	Red ash	Rhamnaceae	F,W
<i>Calophyllum inophyllum</i>	Beach laurel	Clusiaceae	S
<i>Canarium australianum</i>	Mango bark	Burseraceae	F,S
<i>Casuarina cunninghamiana</i>	River she oak	Casuarinaceae	F
<i>Clerodendrum floribundum</i>	Lolly bush	Verbenaceae	F,S,W
<i>Corymbia maritima</i>	Bloodwood	Myrtaceae	W
<i>Corymbia tessellaris</i>	Moreton Bay ash	Myrtaceae	F,S,W
<i>Cupaniopsis anacardioides</i>	Tuckeroo	Sapindaceae	F,S
<i>Dodonea lanceolata</i>	Hop bush	Sapindaceae	F,S,W
<i>Eucalyptus platyphylla</i>	Poplar gum	Myrtaceae	W
<i>Eucalyptus tereticornis</i>	Blue gum	Myrtaceae	F
<i>Ficus opposita</i>	Sandpaper fig	Moraceae	F,S,W
<i>Ficus racemosa</i>	Cluster fig	Moraceae	F
<i>Geijera salicifolia</i>	Scrub wilga	Rutaceae	F,S
<i>Halosarcia halocnemoides</i>		Chenopodiaceae	S
<i>Halosarcia indica</i>		Chenopodiaceae	S
* <i>Hibiscus tiliaceus</i>	Beach hibiscus	Malvaceae	F,S
<i>Ipomea pes-caprae</i>	Beach morning glory	Convolvulaceae	S
<i>Jasminium didymum</i>	Native jasmine	Oleaceae	F,S
<i>Larsenaikia ochreatea</i>	Native gardenia	Rubiaceae	F,W
<i>Livistona decipiens</i>	Cabbage palm	Arecaceae	F,S
<i>Lophostemon grandiflorus</i>	Northern swamp box	Myrtaceae	F
* <i>Macaranga tanarius</i>	Cottonwood	Euphorbiaceae	F
<i>Mallotus philippensis</i>	Red kamala	Euphorbiaceae	F
* <i>Melaleuca dealbata</i>		Myrtaceae	F,S,W
* <i>Melaleuca leucadendra</i>	Weeping paperbark	Myrtaceae	F
<i>Melaleuca viridiflora</i>	Broad-leafed paperbark	Myrtaceae	S,W
<i>Melia azedarach</i>	White cedar	Meliaceae	F
<i>Mimusops elengi</i>	Red coodoo	Sapotaceae	F,S
<i>Nauclea orientalis</i>	Leichardt tree	Rubiaceae	F
<i>Pandanus whitei</i>	Pandanus	Pandanaceae	F,S
<i>Pleiogynium timorense</i>	Burdekin plum	Anacardiaceae	F,W
<i>Polyalthia nitidissima</i>	Canary beech	Annonaceae	F
<i>Pongamia pinnata</i>		Fabaceae	F
<i>Sterculia quadrifida</i>	Peanut tree	Sterculiaceae	F,S
* <i>Terminalia catappa</i>	Beach almond	Combretaceae	S
* <i>Terminalia muelleri</i>	Beach damson	Combretaceae	F,S
<i>Thespesia populnea</i>		Malvaceae	S
<i>Timonius timon</i>	Tim tam tree, Swizel bush	Rubiaceae	F,W
Mangroves			
<i>Avicennia marina</i>	Grey mangrove	Verbenaceae	S
<i>Bruguiera axaristata</i>	Orange mangrove	Rhizophoraceae	S
<i>Ceriops tagal</i>	Yellow mangrove	Rhizophoraceae	S
<i>Lumnitzera racemosa</i>	Black mangrove	Combretaceae	S
<i>Rhizophora stylosa</i>	Spider mangrove	Rhizophoraceae	S
<i>Sporobolus virginicus</i>	Salt water couch	Poaceae	S

<i>Suaeda arbusculoides</i>	Seablite	Chenopodiaceae	S
-----------------------------	----------	----------------	---

Notes: Planting areas are F = banks of freshwater stretch of creek, S = banks of saltwater stretch of creek and W = woodland. * was included in Russell Butler plant list. Pink shading indicates selected for draft planting list for future plantings on the west bank upstream of the footbridge.

4.4 List of individuals and organisations involved in project:

Tropical Urban Production and Landcare Group
Australian Centre for Tropical Freshwater Research, James Cook University
Belgian Gardens Scout Group
Castle Hill Police and Citizens Youth Club
Cleveland Youth Training Centre
Garbutt State School
Garbutt Neighbourhood House Group
Garbutt Public Tenants Group
Interested local residents

Community and Cultural Services, Townsville City Council
Engineering Services, Townsville City Council
Environmental Planning Services, Townsville City Council
Parks Services, Townsville City Council

4.5 Bibliography:

Birtles, R.A., and T.H.B., Sofield 1992, Brolga Dreaming: A vision for the future of the Townsville Town Common.

Murtha, G.G., and R. Reid 1992, Soils of the Townsville area in relation to urban development.

Queensland National Parks and Wildlife Service 1987, Townsville town common environmental park management plan.

Townsville City Council 1993, Bikeway study of Cranbrook.


Townsville City Council 1988, Ross River recreation master plan.

Townsville City Council 1997, Special place, special people: A social history of Garbutt.


Appendix D

Chronology and Site Visit Notes

Appendix D Chronology and Site Visit Notes/Waypoints

Date	Action/event	Comments
10 Feb 2012	Site visit	With Bernadette Boscacci. Initial look at the project and start to plan the environmental management component
2 Mar 2012	Meeting	Look at maps and take photos. Take two large aerial photos to ISS Rowes Bay that Bernadette Boscacci was provided by TCC previously
March to December 2012	Mundy Creek catchment carers working on the west bank upstream of the footbridge	
11 May 2012	Site visit	With Bernadette, CDTLI and NQDT
17 May 2012	Site visit	Look at weed extent for site management plan
1 Jun 2012	Site visit	Finalise west bank planting site locations and other actions with Bernadette Boscacci for environmental management planning
July 2012	Submission	Bernadette's Concept Plan lodged with Townsville City Council
26 Jul 2012	Meeting and site visit	Bernadette Boscacci and Brodie Akacich to discuss Everyone's Environment application and Townsville Airport involvement with the Mundy Creek project and issues associated with birdstrike and vegetation. Mundy Creek with Brodie and tributary where Typha was cleaned out with Swampy machine
July 2012		Draft Mundy Creek Riparian Management Plan completed
29 Aug 2012	Site visit	With Andrew Hannay (TCC) and Bernadette
10 Sep 2012	Site visit	With Bernadette and Kim Sellars (CDTLI) about CVA team work and Everyone's Environment application
14 Sep 2012	Site works	CVA team - morning (shortened due to team leader illness)
12 Oct 2012	Site visit and meeting	Check on previous works and requirements for following week for CVA team. Bernadette Boscacci about CVA teams at Mundy Creek (not in town for 19th but back for 26 th)
19 Oct 2012	Site works	With CVA team in stream weed removal (Para grass). Erica doing documentary. Michael Johnston and Stagpole St crew visited and will arrange workshop/s with Bernadette
23 Oct 2012	Meeting	Bernadette Boscacci to arrange workshops
2 Nov 2012	Site works and meeting	Prepare management line for future works and meet with local volunteers (Bernadette Boscacci and Jeannie) and Qld Health (Stagpole St workshop cancelled out due to lack of numbers)
2 Nov 2012	Meeting	About Mundy Creek revegetation and soil samples with Andrew Hannay (ISS/TCC)
7 Nov 2012	Site visit	Remove Para grass from Mundy Creek confluence with PCYC drain
9 Nov 2012	Site visit	Peg management line and remove Para grass and Cumbungi from near footbridge. Tidy up previous works
13 Nov 2012	Fire	Hot grassland fire adjacent to west bank and through the revegetation area


Mundy Creek Catchment and Riparian Management Strategy

19 Nov 2012	Site visit	Assess the fire damage and review work activities for CVA team
20 Nov 2012	Meeting	About Mundy Creek project and moving forward after the fire Bernadette Boscacci and Russel Butler
20 Nov 2012	Meeting	Bernadette Boscacci and Michael Johnston about Mundy Creek project workshops
21 Nov 2012	Workshop	Stagpole St Drug and Alcohol Rehabilitation Unit (DARU) about CfoC project and habitat management especially Mundy Creek
23 Nov 2012	Damage	20 tonne excavator with slasher attachment in Mundy Creek upstream of the footbridge (Construction and Maintenance contractor)
23 Nov 2012	Site works	Including some clean-up of the slashed salt couch and cumbungi pulling downstream of the footbridge – morning with CVA, Earth Environmental and Bernadette B
26 Nov 2012	Damage	20 tonne excavator with slasher attachment in Mundy Creek downstream of the footbridge (Construction and Maintenance contractor)
26 Nov 2012	Site visit and meeting	To survey damage caused by the excavator downstream of the footbridge with Bernadette Boscacci
27 Nov 2012	Site visit	Check on extent of excavator damage and fish photos
12 Dec 2012	Meeting	Community meeting at PCYC
12 Jan 2013	Landcare Day	First CDTLI Landcare day and then on the first Saturday of the month after that <ul style="list-style-type: none"> • Grubbed out the mother-in-law-tongue / cast iron plant in Harold Phillips Park and, • Spread some more mulch around the adjacent clump of trees behind the PCYC.
12 Jan 2013	Landcare Day	
17 Jan 2013	Meeting	Discuss way forward with Bernadette Boscacci for west bank plantings and preparation
17 Jan 2013	Site works	Peg areas for preparation on the west bank. Management line definition removing Para Grass
18 Jan 2013	Site works	Measure site preparation areas using 100m tape
19 Jan 2013	Site works	Mark (paint) site preparation areas. Para grass removal for management line
20 Jan 2013	Site works	Check measurements as mapped. Rake in stream mulch and place on the edge of reveg areas upstream of the footbridge
20 Jan 2013	Meeting	Plan west bank plantings and species list review and additions with Bernadette Boscacci and Peter Buosi
21 Jan 2013	Site visit and works	Photographs of mulch cleared areas and management lines. Remove woody regrowth, some minor mulch removal and Para grass
2 Feb 2013	Landcare	Bernadette leading


Mundy Creek Catchment and Riparian Management Strategy

	afternoon	
8 Feb 2013	Site works	CVA (morning) and EE management lines and some grassland edge cleaning
8 Feb 2013	Meeting	About meeting and way forward with Bernadette Boscacci
9 Feb 2013	Site visit	Photos
20 Feb 2013	Meeting	With Belinda Binckley (GA) and Bernadette about Greening Australia involvement and funding possibilities
March to December 2013	Maintenance	Earth Environmental team (EE) including removal of Para Grass from grassland edges and maintenance of management lines, mulching, weeding planting area (total 128 hours)
2 Mar 2013	Landcare afternoon	John Gunn leading with CDTLI and Mundy Creek Catchment Care (MCCC). Indigenous kids joined volunteers. NQDT Coastal plants books (12) to volunteers including; Denise Weightman (Art workshops), Mary dolindi? and son Matthew. Indigenous kids – Malona, Timana, Eccles and Tilo
2 Mar 2013	Meeting	About planting plans and potential CfoC funding application and/or Biodiversity Fund with Bernadette Boscacci and Peter Buosi
3 Mar 2013	Site works	Mundy Creek continue with Para Grass cleaning from the grassland edge - EE
13 Mar 2013	Site visit	Site induction and work plan layout with Luis - EE team
15 Mar 2013	Site visit	Reconnaissance and meet Bernadette. Lunch and walk
18 to 21 Mar 2013	Site works	Para Grass cleaning from the grassland edge and establishment of management lines along the creek - EE
22 Mar 2013	Site works	Induction and site introduction for Jadore - EE
25 Mar 2013	Site works	Remove para grass from grassland edge – EE
26 Mar 2013	Meeting	Planning for planting and Mundy management with Bernadette Boscacci
26 to 28 Mar 2013	Site works	Para grass from grassland edge and start management line for brushcutting the revegetation area west bank - EE
27 Mar 2013	Site visit	With Simon Igloi (ISS/TCC) to check site for planting
29 Mar 2013	Site works	Photos and minor weeding downstream of the footbridge. Lessor joy weed - EE
4 Apr 2013	Site works	Para edges - EE
6 Apr 2013	Landcare afternoon	Jadore and Bernadette led - EE
7 and 8 Apr 2013	Site works	Para grass from grassland edge - EE
9 Apr 2013	Meeting	To finalise arrangements for Mundy Creek planting with Bernadette Boscacci
10 Apr 2013	Site works	Para grass SE corner of grassland – rain - EE
11 Apr 2013	Meeting	Bernadette Boscacci (BB) NEATO and TCC Parks about Mundy works and TCC requirements
13 Apr 2013	Community planting	Rotary hoe planting area and spread gypsum. Water in. Mulch spread in places
14 Apr 2013	Site works	Photos and mulch spreading with BB
16 Apr 2013	Meeting	About finalising CfoC application and log in with BB
17 Apr 2013	Site visit	Inspection and advise of ongoing works – EE
29 and 30 Apr 2013	Site works	Nut grass removal and mulch spreading southern end – EE
4 May 2013	Landcare afternoon	EE (Jadore) (4pm start)
24 May 2013	Site visit	With BB west bank weed separation and look at finishing strategy
30 May 2013	Site works	Weeding around plantings. Fire and firs arrived – EE
May 2013	Strategy update	Fire management planning added to catchment strategy
1 Jun 2013	Landcare afternoon	Mulch and nut grass – EE (Luis)
6 Jun 2013	Site works	Mulch raking and nut grass - EE

Mundy Creek Catchment and Riparian Management Strategy

7 Jun 2013	Site works	Para grass on the edge of the grassland SE corner, some lessor joy and para grass etc towards Lockheed past revegetation area- EE
7 Jun 2013	Meeting	About Mundy Creek actions and plans and group incorporation BB
20 Jun 2013	Meeting	Fire management planning with Russell Butler and then photographs of burnt area
20 Jun 2013	Site works	Grassland SE corner. Guinea grass grubbing and liberate regrowth - EE
21 Jun 2013	Site visit and meeting	GPS and site notes/photos for management strategy. About finalising management strategy and group incorporation BB
1 Jul 2013	Site works	Para grass and management lines
6 Jul 2013	Landcare afternoon	John Gunn led - Para grass recleaning and some late cumbungi tossing (need gumboots/waders) – EE plus 2 volunteers
11 Jul 2013	Site works	Para grass and rubbish on PCYC side with BB - EE
24 Jul 2013	Site works	Nut grass and then downstream of footbridge management line up from salt couch. Slash non-native grasses liberate tree and gull exposed. Cumbungi into erosion gully - EE
July 2013	Strategy update	Draft catchment and riparian management strategy amended
3 Aug 2013	Landcare afternoon	BB led
26 Aug 2013	Site works	Downstream management line - EE
7 Sep 2013	Landcare afternoon	John Gunn and BB led
7 Sep 2013	Landcare afternoon	
5 Oct 2013	Landcare afternoon	John and Bernadette leading

Mundy Creek Catchment and Riparian Management Strategy

5 Oct 2013	Landcare afternoon	
2 Nov 2013	Landcare afternoon	John leading
3 Nov 2013	Meeting	Mundy Creek catchment group formation with BB and Peter Buosi
3 Nov 2013	Site works	Para grass edges/management line and mulch from creek flow removed
4 Nov 2013	Site works	Para grass edges management line and mulch from creek flow removed and rubbish collected 2 bags
7 Dec 2013	Landcare afternoon	John and Bernadette leading. Creek side management line and weed plantings
9 Dec 2013	Site works	Management line and weed plantings. Rake mulch washed back on high tide
10 Dec 2013	Site works	Management line and weed plantings. Rake and remove mulch washed back on high tide
Dec 2013	Strategy finalised	Final additions to Mundy Creek catchment strategy



Site Visit Notes and Waypoints

17 May 2012

WP	Latitude S	Longitude E	UTM Eastings	UTM Northings
001	-19.25678677	146.78543857	7870745.33957396	477452.257605568
002	-19.25690269	146.78518494	7870732.47991512	477425.620003625
003	-19.25672290	146.78369170	7870752.17923772	477268.673773061
004	-19.25623734	146.78300137	7870805.81670969	477196.061248303
005	-19.25565546	146.78303548	7870870.20707788	477199.565404261
006	-19.25763150	146.78254656	7870651.49104143	477148.459118053

17 May 2012

WP	Description
1	Drain near carpark photos
2	Edge/corner of veg patch up from the drain Tamarind, guinea grass, chinee apple, leucaena, mintweed, snwd, alternathera, rattlepod, vine ipomea white flower digital leaves, albizia, sandpaper fig, mel dealbata, macaranga, photo C tess, pandanus
3	End line of trees tamarind photos Sesbania, para grass, centro expanse towards the creek. Could be the site for a constructed wetland overflow i.e. not at the same level as the main channel and only starts to fill on a high flow. Engineering / levels need to be calculated and design modelling before any work
4	Channels joining point photos
5	Footbridge Also appears to be the end of salt influence. Salt couch and mangroves ds with para us near junction/confluence
6	End of lockhead para, sesbania, some couch and Rhodes, alternanthera

Mundy Creek Catchment and Riparian Management Strategy

21 June 2013

WP	Latitude S	Longitude E	UTM Eastings	UTM Northings
001	-19.25766938	146.78251547	7870647.29547197	477145.197196699
002	-19.25753804	146.78256224	7870661.83459467	477150.093945244
003	-19.25727904	146.78261991	7870690.5009213	477156.118480741
004	-19.25715390	146.78259694	7870704.34483083	477153.687288349
005	-19.25698299	146.78264061	7870723.26202282	477158.252808995
006	-19.25667563	146.78273214	7870757.28390187	477167.828967129
007	-19.25638343	146.78271529	7870789.61405637	477166.017794916
008	-19.25629492	146.78271269	7870799.40747895	477165.732316285
009	-19.25606593	146.78274647	7870824.75000509	477169.250513517
010	-19.25585856	146.78267632	7870847.68658571	477161.849856172
011	-19.25576745	146.78276827	7870857.78012801	477171.500145402
012	-19.25561607	146.78275662	7870874.52902009	477170.254917724
013	-19.25491836	146.78282610	7870951.74079755	477177.459979917
014	-19.25441184	146.78295041	7871007.80430915	477190.453598848
015	-19.25421663	146.78305317	7871029.4180706	477201.225624884
016	-19.25394589	146.78326665	7871059.40384806	477223.62278825
017	-19.25380692	146.78389538	7871074.86338048	477289.67676699
018	-19.25361405	146.78413552	7871096.23609785	477314.886536406
019	-19.25343518	146.78421507	7871116.03870818	477323.221866022
020	-19.25316076	146.78479216	7871146.47889486	477383.830709519
021	-19.25261484	146.78566078	7871206.99856088	477475.039716466
022	-19.25450974	146.78200099	7870996.84661616	477090.693117382
023	-19.25374229	146.78078050	7871081.60471973	476962.325359492
024	-19.25349494	146.78031681	7871108.91281845	476913.561602153
025	-19.25328464	146.77982999	7871132.11807053	476862.372155048
026	-19.25319395	146.77951936	7871142.11166033	476829.715242434
027	-19.25314249	146.77937460	7871147.78647569	476814.495141701
028	-19.25440589	146.77918165	7871007.96362543	476794.39562805
029	-19.25534131	146.77894117	7870904.42585886	476769.255392926
030	-19.25581623	146.77872978	7870851.84696293	476747.107572389
031	-19.25621219	146.77848025	7870807.99997026	476720.940672001
032	-19.25608655	146.77945389	7870822.03240292	476823.241267096
033	-19.25681334	146.78034087	7870741.73007768	476916.55429998
034	-19.25686246	146.78042762	7870736.30639947	476925.67755198
035	-19.25692013	146.78155012	7870730.07383678	477043.646797195

21 June 2013

WP	Description
001	Path at the end of Lockheed Street
002	Pathway and entrance to the west bank/grassland management unit
003	Lpole 1
004	Causeway under pathway
005	Lpole 2 and path bend
006	Lpole 3 First Euc is 3m to the se
007	Lpole 4 – curve end and start of straight section
008	Path – end of the most recent revegetation work
009	Lpole 5 6m to Euc and Thespesia
010	small para grass incursion - grassland/mown edge
011	Lpole 6
012	Path end and bend to footbridge Head downstream along the track/firebreak Creek side of track (CSoT)

	<p>Fire may have been extinguished here as the section downstream of the footbridge for 40m is unburnt Some spear grass plus lesser joy, that grass and some regrowth Ggrass and joy also in marine couch</p> <p>[Action: clear around regrowth and burn]</p>
013	<p>Track through grassland joins creek track Tvl stylo, sickle plant photos Mel regrowth also visible through the landscape photos Further on stylo and grass on the edge Small patch of para leaf type grass without runners</p>
014	<p>Track curve start and burn start Stylo and siratro photos</p>
015	<p>Burn crosses the break/track from the creek side to the grassland Dirt mounds and drainage channels could be reshaped for Water Quality Responsive Design</p>
016	<p>End curve track 10m ds is an erosion gully associated with disturbance to the riparian zone including small levee banks or berms and redirection and channelling associated with the disturbance photos Ggrass, para and leucaena paddock on creek side of track</p> <p>[Action: define the edge at salt couch and then spray all the regrowth i.e. para and ggrass, also rubbish]</p> <p>Cumbungi on edges if removed could be used as an erosion matt on the banks which are fairly barren after the fire (cumbungi removal 2 days x 6 crew) Mangroves are a form of litter collection point Samphire burnt in places Concrete rubble in levee [all needs to be removed and then reshaped 1 day with a truck and loader/excavator] Objective is the restoration of overland flow to the creek filtered through vegetation which is also preventing soil erosion Some joy and leucaena</p>
017	<p>Rubble and fill levee photos Grassland edge has para plus some in amongst the grassland [5 hrs x 2 crew] Tall stalky grass and spear grass</p>
018	<p>End erosion gully photo More rubble Mixture of grasses including: Rhodes, stalky, couch, native sensitive Joy and ggrass near mangrove bank edge</p>
019	<p>Marker post and first small burn path Grassland edge has stalky grass, other natives plus Rhodes grass</p>
020	<p>Rubble/fill piles [2-3 truck loads] Leucaena and para reshooting after the fire photos Rubble near the creek edge. This material redirects runoff causing channelling and erosion Native sens photos and other (weed), siratro</p>
021	<p>Ds photos Joy, para, guinea, leucaena [management line first then spray. Need some mulch to stabilise the banks Major weed spreading from TCC corner Guinea patches marching from the TCC end [needs control 2 days x 6 crew] Jabiru resting in the burnt grass patch Head along the central track/break</p>
022	<p>Burn patch stops at the track photos Burns following the wind direction at present so easy to contain with current moisture levels Mel regrowth stunted by fire Termite nests</p>
023	<p>Lolly bush patch photos and other plant Photos e s w n Plus sida, tridex, stylo, red natal, ggrass</p>
024	<p>End of weedy patch near the track. More ggrass to the north</p>

	Concrete slab 10m on
025	Start of chinee apple and ggrass, sida and a poplar gum
026	Track end intersection
027	Sand pile on next block, weedy photos n e s w Some ggrass patches in grassland also sida, leucaena, stylo [use the track as the management line/break]
028	Rubbish dumped photos w n e s
029	Some stylo, red natal, siratro and sida
030	Fence weedy corner with regrowth [project site] vines, ggrass, herbs [compost area needed] photos
031	Peel and Sunderland vehicle access
032	Turnaround circle photos n e s w Weed start/edge with more intact upwind. Some hard rubbish [harvest spear grass seed before burning]
033	Fence at the end of Ramsay Street Palm fronds and other discards in the grassland [education required] Ggrass patch
034	Gate centre 4m wide ggrass in places on the edge of the grassland plus sickle
035	Break photos n e w Concrete pipe in grassland and grader edge berm
036	Peter/Bern guinea grass trial photos n e s w



Appendix E

Fire Management

Appendix E Mundy Creek Grassland Fire Management

Background

The amount of grass growth is largely dependent on the preceding wet season conditions (November to April). Generally the grasses go to seed and then brown off through the drier winter and spring months (May to November). This leaves a dry, standing fuel load, which is easily ignited and provides an irresistible temptation for pyromaniacs.

A fire swept through the site on 13 November 2012 (see Figure 4-4) fanned by a strong north easterly wind. The grasslands were totally burnt out and there was damage to residential properties on the southern end of the grasslands i.e. fences, sheds, vegetation and livestock (chickens) (see Figure 4-5).

Uncontrolled fires in bushland or grassland in the vicinity of residential properties needs to be replaced with a system of planned burning to both reduce the risk of damage to properties and maintain the ecological integrity of the grasslands using fire as a management tool.

Any fire management plan will need to involve surrounding areas and neighbours. Residents of Lockheed Street are obviously keen to have a fire management plan in place and implemented to ensure another episode such as occurred in November 2012 isn't repeated.

Figure A Grassland Overview



Note: Red is the state land grassland being managed as part of the Mundy Creek catchment strategy. Council land is shown in yellow with road reserves shown by broken lines.

Tenure

Council tenure investigations to start efforts to coordinate fire management of the grasslands revealed that the state land covered by the grassland has a lease over it. Management of the leased lot, including fire management, is the legal responsibility of the lessee (see text box below).

Council is responsible for land bounding the state grassland block (road reserve) on the east and also on part of the southern end (yellow broken lines on Figure A). Council's other neighbours on the southern end

include 10 Lockheed Street residences. The state land also borders 7 Lockheed Street residential lots to the west of Council's neighbours. This is illustrated in Figure A.

"All term leases are subject to various conditions that landholders must comply with."
"Statutory requirements—all term leases are subject to various statutory requirements" including a "Duty of care—requires the landholder to maintain the land in good condition, e.g. implementation of good land management practices or preventing land degradation and/or contamination."
(Source: Term leases – landholder's responsibilities (L135) 2012, Dept. of Natural Resources and Mines)

Current fire management

At present (2012) there is no fire management plan for the state block.

Townsville City Council (TCC) maintains the area between residence fences and the grassland along the southern boundary by slashing a 6 metre wide buffer. This southern buffer is partly on Council land and partly on state land (western side of the southern edge of the grassland block) (see Figure A). On the eastern side of the block the area on both sides of the pathway is regularly mown by TCC.

Ecological condition

The site is in relatively good condition ecologically with the majority of the grassland consisting of native grasses and herbs with the occasional shrub or tree seedling. The regular (hot) burning maintains the area as a grassland by killing woody growth (shrubs and trees) before it has the chance to become established and develop resilience by growing above the height of the grasses.

Changing the fire regime (season and/or hot to cold burns) of the grasslands has the potential, over time, to alter the structure of the grasslands and promote the growth of trees. If this is not seen as desirable ecologically and socially e.g. by Townsville Airport neighbour, then further habitat management will be required to maintain the area as a grassland e.g. selective tree regrowth removal.

There are small outbreaks of non-native grasses and woody weeds in isolated patches on the edge of the grassland. These need to be removed and contained so that the integrity of the grassland is maintained and fuel loads are reduced, especially on the southern edge of the grassland. Guinea Grass is the main issue in terms of fuel load while Para Grass and Guinea Grass create an ecological issue in terms of their invasiveness and competition with native species. Para Grass is established in moist depressions mostly in the vicinity of the creek line and pathway through vegetative growth while Guinea Grass expands in clumps and is also spread by seed.

Weed control should be included as a complementary component of the fire management plan for both; fuel load reduction purposes and to improve the ecological condition of this unique urban grassland habitat setting.

In the natural context a grassland of this size and relatively uniform composition would most likely be totally burnt out whenever fire was introduced, assuming the moisture content of the grass is low enough to carry a fire. Mosaic burns are therefore difficult to manage without either establishing a system of fire management lines within the grassland or carefully monitoring the fuel moisture content and burning selectively when the majority of the site is still too moist to sustain a fire.

Given its good condition and with the appropriate machinery or manual techniques it may be possible to use the grassland as a seed source for native habitat regeneration projects across the Mundy Creek and Rowes Bay catchments. If a grass seed harvesting machine was used it could also be used to establish management lines for controlled and mosaic burns. Further investigation is required to determine the feasibility of this option.

Key management strategy topics

The key management strategies in terms of fire management for property protection and habitat management of Mundy Creek native grassland include:

- Integrated hazard reduction and ecological burns including;
 - Maintaining a buffer (to residences);
 - Installation of management lines;
 - Removal of Guinea Grass, Para Grass and other invasive species;
 - Native habitat 'farming' including seasonal seed harvesting;
 - Understanding of system ecological processes through traditional ecological knowledge and science;
 - Monitoring for hazard reduction and ecological management;
- Post burn monitoring, evaluation and reporting.

The strategies are discussed below and the main zones to implement the fire management strategy are shown in Figure B.

Buffer (to residences)

A slashed buffer of five to six metres should be maintained during the wet season (current year round measures) and extended to ten metres as the grassland dries out and fire risk increases during the dry season. Native seed harvesting may be possible in the extended buffer area if carefully managed. This would involve the exclusion of any weed species from the harvest by progressive removal of weed plants from the harvest area and subsequently keeping the area weed free.

Slashing of weed species in the extended buffer zone should not be carried out if exotic grasses adjoining intact native areas have seeded. Slashing at the interface between native areas and exotic species needs to be replaced by manual treatment e.g. cane knives, shovels/forks and selective herbicide application. Weed material can be placed back into weedy areas if there are no central weed recycling/composting facilities on site.

Management lines and invasive species control

The management lines are already defined or partly defined and it is now more a matter of maintaining the lines at the appropriate times based on knowledge of the site, experience and ongoing monitoring. As determined from site work in 2012 and 2013 the control of invasive species is mostly focussed around the edges.

The seed production cycle of weed plants needs to be interrupted so that the expansion of weedy patches by close range seed dispersal is halted. The only weed expansion options are then restricted to vegetative growth and seed being transported from surrounding weedy areas by high winds, animals, people and vehicles.

Monitoring will be required within the grassland to opportunistically control isolated plants and prevent seeding and potential outbreaks.

Native habitat 'farming'

Aboriginal people harvested and farmed the Australian bush creating opportunities for native habitat to regenerate and opportunities to hunt and gather. The modern version of native habitat farming in the urban context is more about habitat regeneration than food production.

Seasonal seed harvesting could be a productive native habitat farming activity for other regeneration areas without detracting from the ability of the grasslands to maintain their ecological values.

Factors to consider:

- Seed fate in the natural context i.e. no human influences – birds, ants and other insects food source;
- Seed production and losses including time on the ground and loss rates due to grazers and browsers;
- Germination rate and quantity of seed required for viable/sustainable grasslands (see above);
- Harvesting scenarios e.g. total harvest and return, harvest management lines, mosaic harvesting and harvesting near weed species.

Figure B Integrated fire management zones



Note: Light blue (1) denotes the joint weed control management lines and fire hazard reduction management zone. The remainder (2) is the native habitat management zone (ecological burning practiced)

Understanding of systems

Gaining a greater understanding of the ecological processes of the grassland system and surrounding areas from traditional ecological knowledge, earth sciences and local observations will assist with an integrated fire management strategy. This will need to be weighed against the social needs associated with the site including personal safety, property protection and the desirability of maintaining the area as a grassland rather than allowing a 'natural' succession to woodland or forest.

Fire has been used by Australian Traditional Owners for thousands of years to manipulate the landscape to create and maintain areas as grassland, woodland or forest. The first matter is to determine the type of natural system desired for the current grassland and then to use the understanding of the system to fashion the area to meet the outcome.

Monitoring

Monitoring is undertaken for two main purposes:

- For hazard reduction and ecological management;
- Post burn monitoring and reporting.

Monitoring for fire hazard reduction is required after the wet season when the drying cycle is in progress. The intent of the monitoring is to determine the need for and timing of controlled burning prior to an unacceptable escalation of fire risk, which could adversely impact properties neighbouring the grassland. The monitoring would also be used to maximise ecological management outcomes associated with controlled burns as part of an integrated fire management approach.

Post burn monitoring is less important from a fire risk perspective and is used more to assess the ecological condition of the grasslands and potential transformations associated with the fire regime. Observations can be used to assess the need and timing of future burns to enhance ecological condition of the grasslands and support any desirable succession of the area.

Integrated fire management

Integrated fire management for the Mundy Creek grasslands is about combining the factors above to achieve:

- Fire hazard reduction along the southern and western edges of the grassland,
- Maintaining dual fire and weed management lines around the edges and where existing tracks/firebreaks are located,
- Maintaining the overall ecological integrity of the grasslands.



Slow burn 30 May 2013 (5.30pm)

Addendum

Controlled Burn

TCC sought and obtained permission from the lessee of the State land (Lot 151 on SP 232890) where the grassland is located to manage the area in terms of controlled burning.

A fire permit was obtained in early July 2013 with the intent of conducting a controlled burn shortly after when weather conditions were appropriate i.e. wind speed below 15 kilometres per hour. Local residents were informed of this intent however an unauthorised fire was lit in the area on Friday 12 July. The fire resulted in a relatively cool and patchy burn and served to reduce the fuel load in the native grassland.

Unauthorised fires were also lit along the track earlier in the year and these were also low intensity burns with the fire brigade called to the site on 30 May 2013 during the late afternoon to extinguish a slow moving fire, which would most likely have self-extinguished. All of the unauthorised fires served to 'clean' out the dry material and create patches of burnt and unburnt areas. When the July spread through the grassland conditions were such that the fire did not present as a risk to neighbours and did not adversely impact the grassland. Photographs of the grassland following the 2013 cool fires are provided below (compare to Figure 4-5).

Figure C View to Lockheed Street Residences



20130713 post fire

Figure D View to Many Peaks Range



20130713 post fire

Figure E 90 degree panorama southern and eastern edges of the grassland



20130713 post fire