



Bushland Rehabilitation Plans

Introduction

Middle Harbour Catchment

2001

SECTION 1

INTRODUCTION

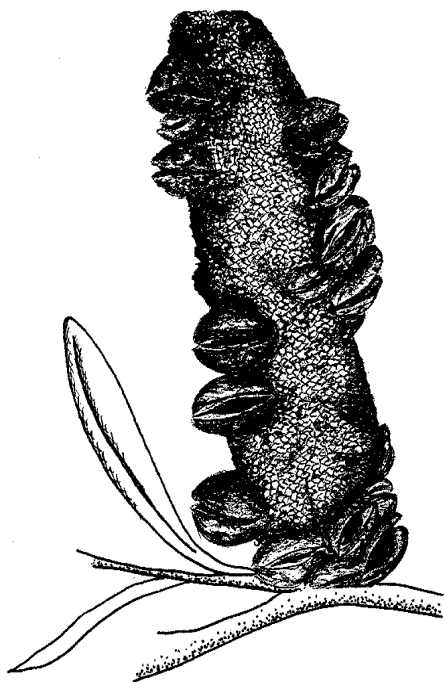
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VISION STATEMENT

The remnant bushland in North Sydney is a living system supporting the life of humans, locally indigenous flora, fauna and migratory species. Biodiversity plays a very important role in maintaining the integrity and variety of plants and animals which are essential for the health of our ecosystems. The biodiversity of an area also keeps our water drinkable, our air breathable, our soils fertile and our oceans clean.

The bushland provides the local community with a place to escape the developed areas, a resource for environmental education and a place to explore and discover our natural heritage. They are the places where local Aboriginal sites are naturally protected and where evolution has continued for thousands of years in complete isolation from the influence of other continents. Most of the plants and animals found in Australia are found nowhere else in the world.

These specific values and attributes of uniqueness of the local remnant bushland are what North Sydney Council aim to encourage, protect and conserve.



1.0 OVERVIEW

In 1995 North Sydney Council adopted a generic Plan of Management for all Bushland Reserves. It considers the broader issues seen to threaten the state of our existing bushland and unveils a process to overcome and manage these threats. The Bushland Rehabilitation Plans set out to achieve more specific goals for each reserve by looking at individual issues within each of these areas and devising ways to limit the threats, conserve existing biodiversity and rehabilitate degraded areas in relation to use and misuse.

The creation of the Bushland Rehabilitation Plans for Middle Harbour Catchment have been made possible through funding from Council's Environmental Levy.

1.1 Background

Bushland reserves in North Sydney provide fresh air and act as natural green buffer zones breaking up the vast continuum of urban sprawl. They are pleasant areas to walk, paint or take photographs and provide important refuges for our native flora and fauna. Each year many people visit our bushland areas to escape the pressures of the urban environment and to experience Sydney's natural heritage. Bushland reserves are also great places to live by!

Many international travellers visit the forests of the city. On a world scale, the extensive diversity of plants and animals contained within the remnant bushland of the Sydney Region is distinctly unique. Many species of wildlife can be found even in our own backyards. During the last few years of the twentieth century it is important that we make an effort to enhance these qualities of our unique city. Not only for our own benefit, but for the benefit of the next generation. We must begin to view our remnant bushland areas as nurseries for our natural heritage and give greater respect to the flora and fauna of our region. Bushland areas do not exist for recreation purposes alone.

North Sydney has only 4.5% of its original 1050 hectares of bushland remaining. Our bushland reserves are a precious resource and we need to protect the 47 hectares that remain.

The small pockets of bushland in North Sydney are minimal remnants compared to the overall remnant bushland areas of the North Shore, however, they are no less important. It may be assumed that the species present in North Sydney are protected in other conservation areas throughout the Sydney region. The Rehabilitation Plans set out to explore this assumption; taking into consideration aspects of isolation and attempts to balance conservation with existing local recreational uses.

How was the Bushland Saved from Development?

The geology of the Sydney region has made parts of the landscape difficult to develop during settlement. Certain areas were left undeveloped because the land was:

- too steep to build on;
- certain sites were inaccessible; and
- shady gullies were not the most favourable location for building a new home - (natural drainage lines invariably occur along these gullies).

Other bushland was saved from development by past generations dedicating land for open space. These areas we still enjoy today eg. Balls Head Reserve, Berry Island, Cremorne Point. It is from these two processes of the past that the remnant bushland parcels of North Sydney are made up today.

Size and Shape of Bushland Areas

The remaining bushland parcels are variable in size and shape. This has management implications. Long thin strips of bushland (eg. Gore Cove, Cremorne Point) bordered by waterways, sporting fields, open space (lawn) and residential areas are the most affected by present-day threats due to larger 'edge' (perimeter) areas which are more susceptible to weed invasion and subsequent degradation. Larger reserves that are circular in shape (eg, Balls Head, Berry Island) have much less edge to area ratio. These two reserves in particular are also protected from threats connected with residential areas and urban stormwater due to their isolation from these factors, however, they are more frequently impacted upon by human use and misuse.

1.2 The Need for the Rehabilitation Plans

In recent years (1993- present) Council has adopted a pro-active approach to the management of bushland areas. The combined efforts of the Bushland Management Team, the Bushland Education Program, Volunteer Bushcare Groups, individual volunteers and contractors have contributed to better management practices. The Bushland Rehabilitation Plans will assist in strategically applying these resources.

Present Programs, Activities and Facilities -

1 Preservation and Protection:

North Sydney has an area of 47 hectares of remnant bushland. Bushland is managed, regenerated and maintained by:

Council's Bushland Regeneration Team – 13.5%
Bushcare Groups – 17.1%
Bushland Regeneration Contractors – 66%
Bushland in Private Ownership – 3.4%

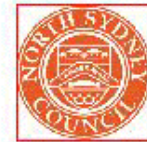
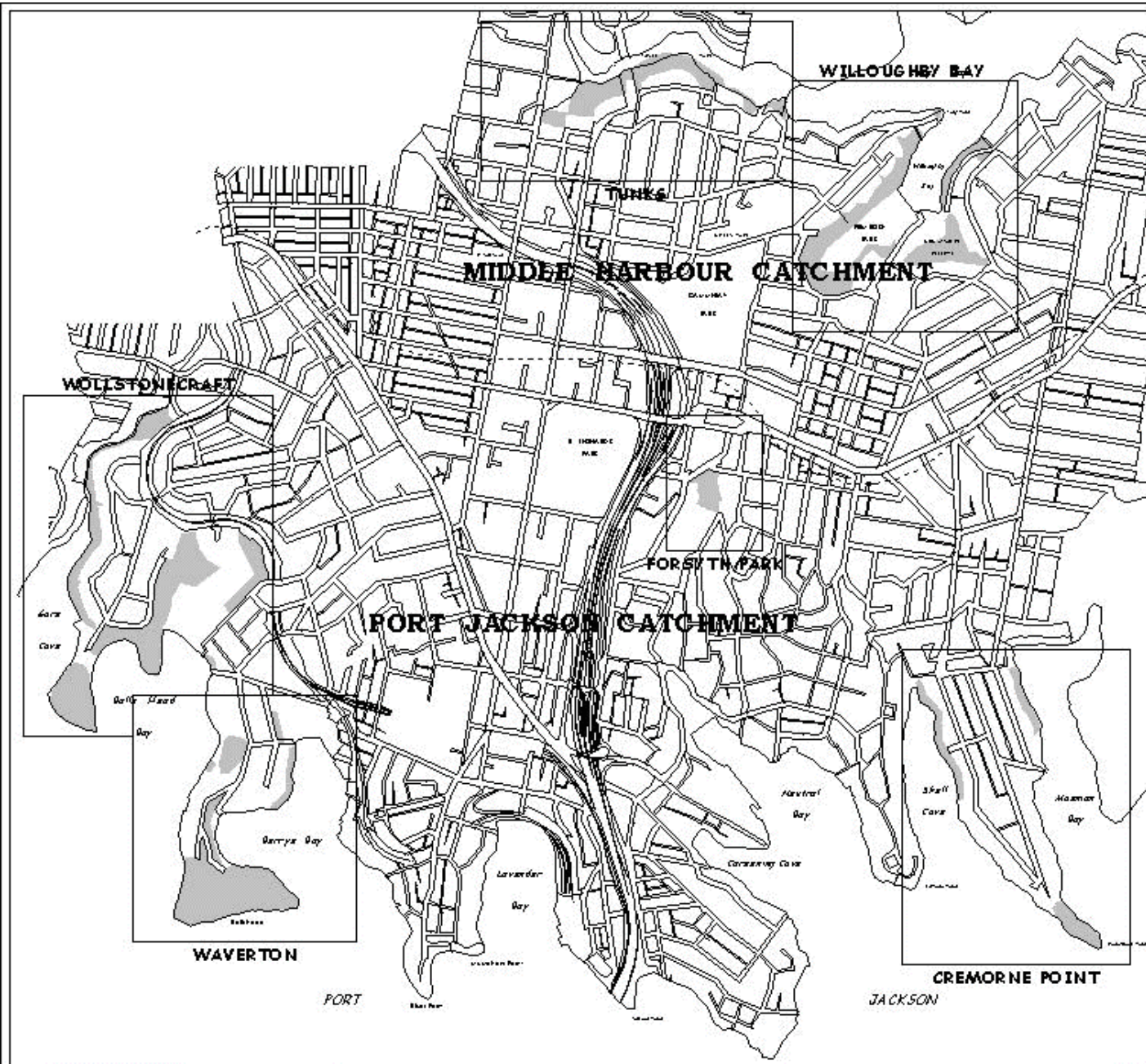
(see Map - 'Who's Looking After Our Bushland?')

2 Community Education and Information:

- Bushcare Adventures Program – Interpretive 'walks and talks' education program for all ages.
- Bushcare Introductory Training Course and Annual Workshop series.
- Interpretive Signage - Cremorne Point, Berry Island.
- Bushcare Newsletter - a quarterly publication.


3 Community Involvement:

- Wildlife Watch Program - community volunteers collecting information and data concerning the wildlife they commonly see in their own backyards, bushland reserves or elsewhere in the Council area.



REMNANT BUSHLAND
AREAS IN EACH
SUB-CATCHMENT

LEGEND

-  BUSHLAND
-  MAJOR CATCHMENT BOUNDARY



SCALE 1:15000

- Plant Propagation Program - community volunteers and local schools growing local native plant species from seed for use in bush regeneration projects throughout the Council area.

- Bushcare Volunteers - over 75 active bush regeneration volunteers working in 8 Reserves throughout North Sydney.

- Backyard Bushcare - For residents whose properties back onto bushland reserves. This is a pilot program initiated at Tunks Park where 10 active bush regeneration volunteers are working to compliment the adjacent bushland.

4 Provision of Facilities:

Key

A - Public Transport and/or Short Walk

B - Car Park

C - Toilets

D - Gas BBQ's

E - Tables and /or Seating

F - Foreshore Area

G - Adjacent Playground

Reserve	A	B	C	D	E	F	G
Smoothey Park/Gore Cove	X				X	X	
Berry Island Reserve	X		X		X	X	X
Tryon Avenue Bushland	X					X	
Balls Head Reserve	X	X	X	X	X	X	X
Cremorne Point	X		X		X	X	X
Forsyth Park	X						
Brightmore Reserve	X	X				X	X
Primrose Park	X	X	X		X	X	X
Tunks Park	X	X	X			X	X
Mortlock Reserve	X					X	X
Wonga Rd Reserve	X	X				X	X

To direct 'on the ground' works in the bushland of North Sydney, the Bushland Rehabilitation Plans prioritise the areas and issues needing attention and offer practical solutions for existing problems threatening our remaining natural areas. Integral to this process are the production of other management plans and strategies required for the rehabilitation process to be successfully and holistically achieved in the bushland reserves of North Sydney.

2.0 HISTORICAL HUMAN IMPACTS

Early planning laws for the city of Sydney included the preservation of a bushland buffer zone encompassing the whole of the city. These plans were however quickly abandoned because of increasing pressures of further residential, commercial and industrial expansion. Settlement expanded to the North Sydney area in the early 1800's. Initial habitat loss occurred from the removal of bushland for housing, farmland, roads, rail, industrial and commercial developments. With the laying down of impervious surfaces and the population influx, water runoff, stormwater and sewerage became issues for increasing concern. New residents to the area also brought with them exotic plants, weed species and feral animals. Changes also occurred to the 'natural' fire regimes which then began to effect the composition of plant communities. Further problems have been created in bushland areas due to past attitudes that the bushland is a dumping ground for road base, gravel, by-products of industry, household rubbish and other green waste.

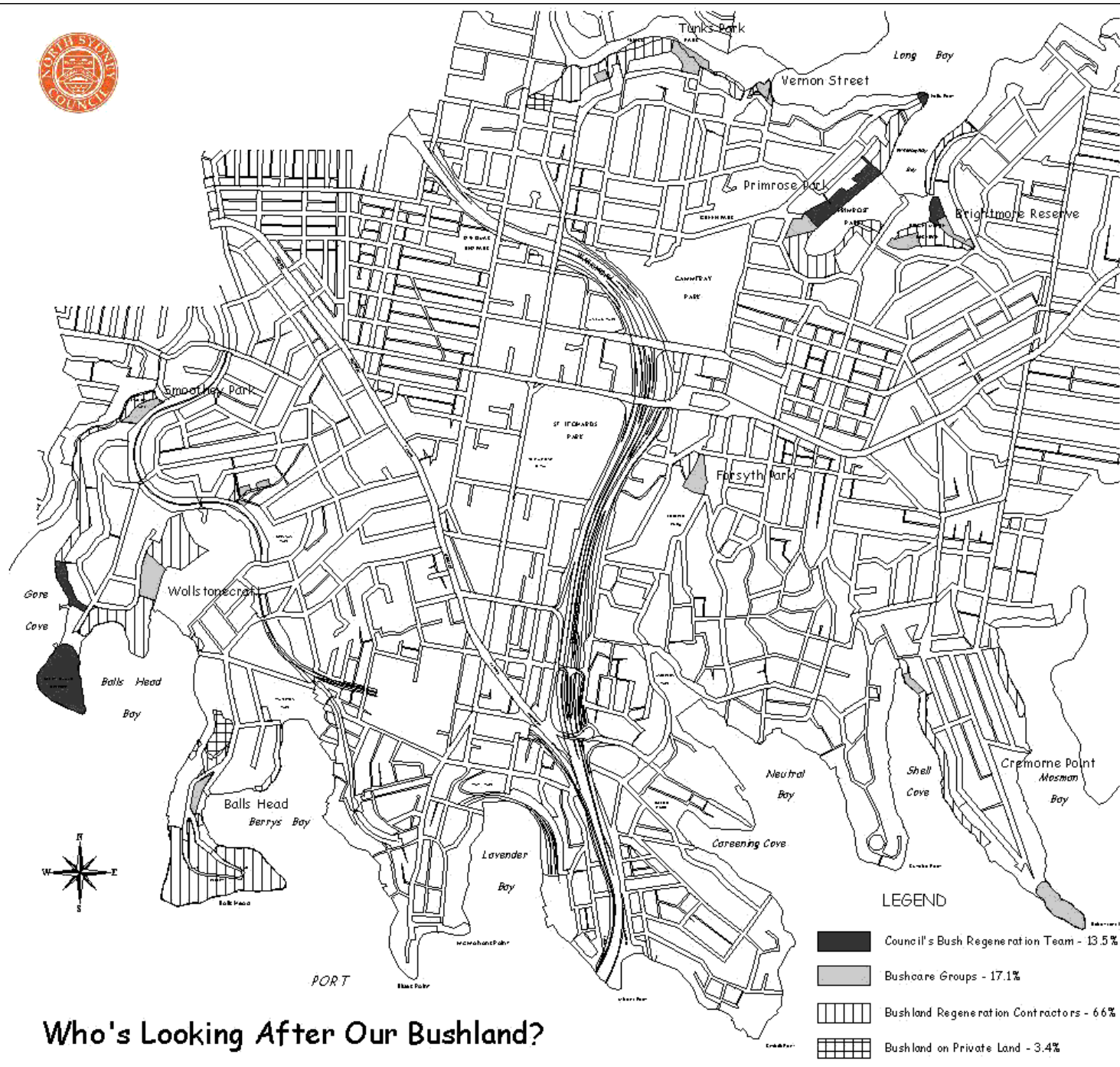
As most local government boundaries were established to satisfy the social, political or economic needs of the population, the management of our waterways has, in the past, been ineffective. In 1989 the NSW Government introduced the Total Catchment Management (TCM) framework to allow for more effective 'big picture' management based on the topography of the greater catchment. These areas are managed, co-ordinated and improved by the efforts of Catchment Management Committees.

The North Sydney Council area lies within the Middle Harbour and Port Jackson (Sydney Harbour) Catchment zones. The quality of a waterway is influenced by local activities as well as activities carried out further up in the catchment. High density urbanisation upon land surrounding areas of natural drainage and the diversion, piping and tunnelling of these waters within the catchment has lead to degradation of our waterways. Pollution enters the system through runoff from impervious surfaces (eg. roads, concrete), stormwater outlets and sewerage overflows. Without the built up urban environment 90% of rainfall would be soaked up by bushland areas (NSW Environmental Protection Authority 1995). Today, only 10% of rainfall is soaked up in residential gardens, parkland and bushland. The remaining 90% is diverted into our local waterways.

A Stormwater Management Strategy for each bushland reserve needs to be devised for bushland degraded by water runoff from the upper catchment. This Strategy will include the current condition of each creekline (eg. weed survey, level of bank erosion, native flora list) and strategies to address the cause and minimise the negative effect of stormwater on the adjacent bushland area.

Total Catchment Management (TCM) requires us to think about the decisions we make which affect our land, water, soil, vegetation and fauna, and to take account of their effect on others and on the whole catchment. The role of both the Middle Harbour and Port Jackson Catchment Management Committees for North Sydney is to facilitate better management of local natural resources from a broad catchment perspective (see Map 'Remnant Bushland Areas in Each Sub-Catchment' for detail). This includes:

- Promotion of better communication, cooperation and coordination of all natural resource management activities,
- Promotion of TCM strategies, policies and programs, and
- Promotion and coordination of funding programs.



3.0 ABORIGINAL HERITAGE

There are many Aboriginal sites around the North Sydney Council area which remain as evidence to the thousands of years of occupation by the local Cammeraygal Clan of the Guringai Tribe. An Aboriginal site is any place which has the remains of prehistoric and historic occupation, or is of contemporary significance to the Aboriginal community (NPWS, 1988). Occupation sites (shell middens), rock paintings and engravings, axe grinding grooves and burial sites are all evident in the North Sydney area.

All Aboriginal Sites are protected by law under the *National Parks and Wildlife Act, 1974*. Awareness of these sites is essential to the effective management of our bushland areas and they should not be disturbed throughout the rehabilitation process. For example: if you wish to dig into or plant into a shell midden for the purposes of regeneration and rehabilitation, permission must first be granted by the National Parks and Wildlife Service and the Metropolitan Local Aboriginal Land Council through North Sydney Council. If you discover an artefact whilst working in your local bushland please contact Council for verification and strategies for protection.

3.1 Aboriginal Sites

Occupation Sites

Shell Middens

‘midden’; ‘shell midden’ - a place where debris from eating shellfish has accumulated.

Shell middens usually occur close to a shellfish source: around the headlands, estuaries, along the tidal stretches of creeks and sandy foreshores of North Sydney. Middens range from thin scatters of shell to layered deposits (many metres in depth) which have built up over time.

Middens can also contain the bones of fish, birds and mammals, tools made from stone, shell or bone (including fish hooks). The deceased were sometimes buried in the middens because the ground was easier to dig compared to an undisturbed patch of earth.

Rock Shelter with Archaeological Deposit

In sandstone outcrops, overhangs may form a cave-like shelter. Ashes from fires and sediments accumulate in the protection of the shelter.

Open Camp Sites

These sites are surface scatters of stone, sometimes associated with fireplaces. Recent studies have shown them to have significant cultural and scientific value.

Rock Paintings

The ‘paints’ were made from red and yellow ochre, white pipeclay, gypsum (copi), and charcoal mixed with water to make a paste. The paste was applied to the rock surface with the end of chewed twigs (‘brushes’) or with the fingers (NPWS, 1988). Stencils were more common in the Sydney area and these were made by blowing wet paint from the mouth and over and around the object (hands, feet, boomerangs, woomeras, kangaroo tails...) held against the rock. Hands were commonly used in North Sydney. These images are of significance to the Cammeraygal people. Many sites are still regarded as sacred or of ceremonial significance.

Rock paintings are located on walls and ceiling of rock shelters, eaves and overhangs.

Rock Engravings

The most extensive Rock Engravings found in the Sydney basin are on prominent sandstone outcrops. The engravings in North Sydney were carried out by the men of the Cammeraygal tribe. Firstly, tiny dots were formed in the rock to outline the figure. Secondly, scraping between the dots formed a line completing the engraving. All engravings were created using rock to grind the surface of the sandstone. Like paintings, rock engravings are regarded as being of sacred and ceremonial significance to the Cammeraygal people.

Rock Engravings are usually found where a suitable rock outcrop of fairly flat, soft rock occurs.

Axe Grinding Grooves

These grooves were formed as a result of the shaping and sharpening of stone implements such as edge-ground axes or hatches. These were made of hard volcanic stone and fastened to a wooden handle for use (NPWS, 1988). Approximately 6 hours of rubbing is required to form each groove which are usually found close to a rock hole or waterway and can vary in size and shape. Water was necessary to clean the stone and to keep it cool due to the friction created in the process.

Burials

Aboriginal philosophy sees the inter-relatedness of all Aboriginal people with each other as well as with the land, therefore, Aboriginal people feel as strongly about a 20,000 year old burial as they do about the grave of a relative who passed away recently (NPWS, 1988). Burial sites in North Sydney may have been identifiable in the past but because most of the Cammeraygal tribe have disappeared from the land many years ago, these places have not been maintained and have hence evolved into a state of obscurity. Burial areas were usually marked by gypsum markers and women's clay mourning caps or by carving trees, or heaping logs or stones on the grave. Burials were sometimes in scattered groups or singular. Most were buried in soft soil, caves and midden deposits with their bodies either fully stretched out, sometimes in a crouched position, head upright or the body on its side (NPWS, 1988).

Ceremonial Grounds

Initiation ceremonies, marriage alliance ceremonies, tribal meetings and other important social functions were held on the ceremonial grounds. These places are of great significance to Aboriginal people.

Natural Sacred Sites

Features of the landscape such as mountains, waterholes, rivers and rocks are regarded as sacred to the Aboriginal people. They are places created by Dreamtime ancestors or are in some way associated with them. These sites can only be identified by Aborigines and they are highly significant.

3.2 Use of Fire

For many thousands of years the indigenous peoples of the Sydney area used fire as a multipurpose tool. Fire was used to regenerate native plants and as the native wildlife came to feed on the new growth after the fire, they would be hunted. The Aboriginals would lure the animals closer to their camps in this way so that they did not have to travel large distances in search of food (Watts, 1997).

Rainforest communities were once predominant in Australia. It has been proposed that the use of fire has contributed to the successful evolution of fire tolerant plant species which are

found in woodland and open forest communities that now tend to dominate the landscape (Flannery, 1996). Fire adaptations in plants include:

Adaptations to safeguard against fire:

- lignotubers
- fire resistant smooth bark
- hard seed coats that need fire to germinate

Adaptations to stimulate fire:

- rough bark
- oils in leaves

Grasslands were formed where fire was used too frequently for trees and shrubs to mature enough to produce seed. This left no seed store in the soil to be stimulated by successive fires. Native grasses therefore dominated these areas.

With the absence of fire in our current ecosystems some bushland areas may be slowly losing species that require fire for regeneration. This, together with the increase in moisture content in bushland nestled around stormwater drains and hard surface runoff areas, native species which are more adaptable to high moisture conditions and do not require fire for regeneration purposes are flourishing.

4.0 NATURE OF THE LAND

4.1 Topography

More than six thousand years ago the Australian continent was 20% larger than it is now due to large amounts of sea water being locked up in the ice caps around both poles of the earth during the last ice age. The sea level would have been approximately 50-70 metres lower than it is at present. Where we are situated today in North Sydney was about 12 km from the coastline at the time. Scientists claim that the Australian sea level reached its approximate current height about 6000 years ago after the ice caps began to melt. The remnant bushland areas on the edge of the drowned river valley in North Sydney are confined to steep gullies, rocky headlands and foreshore areas along the numerous bays and coves of both Port Jackson and Middle Harbour Catchments.

4.2 Geology and soils

The geology of North Sydney is predominantly Hawkesbury Sandstone producing poor sandy loams particularly deficient in nitrogen and phosphorus. Shale is found in the Wollstonecraft/Waverton area but is more prominent further north.

4.3 Native Flora

A limited range of original local plant communities exist throughout the North Sydney Council area. The dominant vegetation structure found on Hawkesbury Sandstone as identified by Benson and Howell (1994) in 'The Natural Vegetation of the Sydney 1:100 000 Map Sheet= - *Cunninghamia* Vol 3(4) is the Sydney Sandstone Complex constituting two (2) main vegetation communities:

- Sydney Sandstone Gully Forest (10ag)
- Sydney Sandstone Ridgetop Woodland (10ar)

Other vegetation structures found in the North Sydney area include:

- Estuarine Complex (4a) - creek/river confluences and along harbour foreshores.
- Blue Gum High Forest (6b) - found on shale north of Waverton and Wollstonecraft.

The seed from native species of the above plant communities is being collected to enhance the Native Seed Bank for North Sydney. The plants grown from these native seeds will be used in rehabilitation projects by Council, the Bushland Management Team, Contractors and Bushcare Groups. It is important to maintain existing genetic integrity of the local native plant species by only planting species which grow in the local catchment area. Eventually, these native plants will be made available to the general public to encourage the planting of local native indigenous stock in local gardens. Gardens form important corridors for wildlife from residential areas to parks and bushland.

It will be requested that other catchment stakeholders use this plant stock for rehabilitation and regeneration on their own land (eg. Rail Services Australia) within the North Sydney Council area.

4.3.1 Plant Communities and their Conservation Status

Community Structure	Dominant Canopy Species	Code	Status
Sydney Sandstone Gully Forest			
Open Forest/Woodland	<i>Eucalyptus piperita</i> (Sydney Peppermint), <i>Angophora costata</i> (Smooth-barked Apple), <i>Corymbia gummifera</i> (Red Bloodwood).	NS1	W
Tall Open Forest	<i>Eucalyptus pilularis</i> (Blackbutt), <i>Syncarpia glomulifera</i> (Turpentine).	NS2	S
Closed Forest	<i>Ceratopetalum apetalum</i> (Coachwood), <i>Tristaniopsis laurina</i> (Water Gum).	NS3	S
Sydney Sandstone Ridgetop Woodland			
Woodland/Low Woodland	<i>Corymbia gummifera</i> (Red Bloodwood), <i>Eucalyptus haemastoma</i> (Scribbly Gum).	NS4	S
Estuarine Complex			
Open Scrub	<i>Avicennia marina</i> (Grey Mangrove).	NS6	O
Herbland	<i>Suaeda australis</i> (Austral Seablite), <i>Tetragonia tetraganoides</i> (New Zealand Spinach).	NS7	O
Blue Gum High Forest			
Tall Open Forest/Open Forest	<i>Eucalyptus pilularis</i> (Blackbutt), <i>Eucalyptus saligna</i> (Blue Gum)	NS8	O

Key W = Widespread; S = Present at several locations; O = One small area only.

From: Benson and Howell (1994), *Cunninghamia Vol 3(4)*, Royal Botanic Gardens, Sydney.

The marine environment interfaces with many of the plant communities in North Sydney. Riparian (creekline) vegetation is mostly degraded and heavily infested with weed species such as Large Leaf Privet (*Ligustrum lucidum*), Lantana (*Lantana camara*) and choking vines (eg. Balloon Vine (*Cardiospermum grandiflorum*) and Morning Glory (*Ipomoea indica*)). Mudflat ecosystems are developing where the creeks and streams affected by stormwater

drain to the harbour. Fine silt carried by the water is deposited at the mouth of the stream creating an inter-tidal area supporting mudflat vegetation (eg. Grey Mangroves).

There are numerous species of mosses, lichen and fungi found throughout the area. These species are largely unexplored and limited data has been collected concerning their species, location and numbers. These three plant groups assist in the decomposition of dead plant material and their distribution and abundance may be an indicator of a healthy ecosystem and nutrient cycle.

4.3.2 Summary of Significant Flora

There are no known threatened or vulnerable flora species present in the area as classified in the *Threatened Species Conservation Act, 1995*. There are, however, several significant plant species that are uncommon in the area. These plants are titled Locally Rare and are described in **Section 7**.

4.4 Native Fauna

North Sydney bushland supports a variety of vertebrate species (eg. birds, mammals, reptiles) and invertebrates species (eg. insects, worms). Creeks and streams support a lesser variety of aquatic amphibians, fish and invertebrates. Mudflats and inter-tidal rock platforms support a variety of crustaceans, molluscs, fish and bird life.

There are 160 vertebrate species known to exist within the bushland remaining after European settlement. The loss of fauna species in the past has occurred due to the initial loss of habitat and the fragmentation of bushland pockets unable to support large populations. Species have also disappeared due to predation and competition by feral and domestic animals.

A Feral Animal Control Program needs to be devised and implemented for the bushland areas of North Sydney. For this Program to be effective it will have to be done simultaneously with adjoining Council areas.

A list of species which are known to have disappeared from the North Sydney area in the last 50 years is shown in **Section 7**.

4.4.1 Fauna Overview

Many species have adapted to urbanisation in North Sydney. Some species have actually benefited from the presence of lawn meeting the bushland edge (eg. Willie Wagtails) where insects can be gathered from the lawn and the bushland is a nearby place of shelter. Some species have increased population size due to the greater availability of ornamental flowering trees and shrubs in garden beds and residential areas (eg. Noisy Miners, Rainbow Lorikeets). Other species which have adapted are the birds which respond well to scavenging (eg. Magpies, Currawongs, Silver Gulls, Australian Ravens) and berry eating birds which feed on Privet (*Ligustrum sp.*), *Glochidion ferdinandi* (Cheese Tree) and *Elaeocarpus reticulatus* (Blueberry Ash) (eg. native Pigeons, Currawongs). Introduced species have also flourished (eg. feral pigeon, Indian mynah) in the urban areas.

4.4.2 Fauna Habitats

A range of habitats are represented in North Sydney's reserve system. Open Forest, Woodland and Open Scrub are dominated by typical Hawkesbury Sandstone vegetation. Important habitat components in these areas are:

- mature, native hollow-bearing trees,
- fallen timber (logs and branches),
- rock crevices,
- caves,
- leaf litter (mulch) on the forest floor containing native seed - the primary source of nutrient recycling,
- an understorey of native shrubs, grasses and other herbs, and
- the presence and permanence of fresh water.

Smaller reserves may provide important shelter and breeding niches for fauna which may utilise local gardens as foraging sites.

Diversity in and within habitats is the most important feature of nature conservation (Johnston & Don, 1990). Terrestrial and aquatic ecosystems provide important diversity components to the area. Riparian vegetation provides:

- bank and creek bed stabilisation
- shelter, food and nesting sites for a range of terrestrial animals and insects.
- food source and habitat for native fish. Fish feed on both the insects which drop from the trees and from the organisms which live on the plant material which falls from the bank vegetation.

These Riparian features are generally degraded in the area due to the effects of stormwater discharge (erosion, weed seed transportation, total suspended solids and pollutants). The intense stream flow during wet weather periods has the potential to flush aquatic creatures into the surrounding bays of the foreshore.

Mudflat ecosystems provide food, shelter and breeding grounds for waterbirds, mud crabs, fish species and invertebrates.

Although weed species have a distinctly negative impact on native bushland, they also provide important habitat for native animals forced to use these areas in the absence of a healthy ecosystem. The re-creation of native habitat by using bush regeneration techniques is a long-term and effective process. In each instance the welfare of the native animals using an area will be taken into consideration.

4.4.3 Summary of Significant Fauna

All native fauna found in North Sydney are protected and each species plays an important role in the ecology of the area. Some of the more significant species found in North Sydney's bushland are mentioned below.

The Large Bent-wing Bat (*Miniopterus schreibersii*) are known to roost in two separate locations throughout the North Sydney area. This species is listed as 'Vulnerable' on Schedule 2 of the *Threatened Species Conservation Act, 1995*.

The Powerful Owl (*Ninox strenua*) are known to feed throughout the Cremorne Point and Neutral Bay area. This species is also listed as 'Vulnerable' on Schedule 2 of the *Threatened Species Conservation Act, 1995*.

The Grey-headed Flying-fox (*Pteropus poliocephalus*) are known to feed throughout the North Sydney area. This species is also listed as 'Vulnerable' on Schedule 2 of the *Threatened Species Conservation Act, 1995*.

The nocturnal birds eg. Owls, Frogmouths, Nightjars are rarely seen but daytime sightings have been recorded. The circumstances surrounding these sightings are those of attack by other birds (eg. Currawongs) or death.

Birds of prey eg. Hawks, Kestrels, Falcons are high order carnivores on the food chain. Their presence in North Sydney indicates that there is abundant food sources and habitat for these birds to occupy the existing bushland. Their presence also indicates a healthy food chain.

Australian King Parrots, Rosellas and Cockatoos require nesting hollows in trees or stumps. The availability of nesting hollows is low in the area due to the lack of old trees (some hollows take up to 200 years to form). Native tree species are more likely to form hollows than exotic species which have little habitat value for our native wildlife, apart from perching and roosting sites.

Sacred Kingfishes, Laughing Kookaburras and Dollarbirds also require nesting hollows but may alternatively utilise termite nests for their nesting site. A hole is created in the termite nest, the eggs are laid and the termites repair the nest around the eggs. A constant temperature for the eggs is also achieved in this way.

Migratory species (eg. Channel-billed Cuckoo, Koel) are of significance due to their dependence on the habitats of North Sydney for seasonal visitation. If one habitat site on the regular pathway of a migratory species is lost or degraded the birds become susceptible to predator attack. They may also perish due to lack of nourishment and the inability to complete the next part of their journey.

The Bush Rat and the recent sightings of the Long-nosed Bandicoot (yet to be confirmed) are also of great significance due to the severely reduced size of original habitat, their ground dwelling habits and the possible threats from the introduced Red Fox and domestic cats.

Due to their intolerance to polluted conditions all frog species in the area are significant due to the degradation and pollution existing along some of the creeks in Middle Harbour Catchment making these species highly vulnerable.

4.5 Habitat - The Flora/Fauna Connection

The native fauna are essential to the health and viability of the bushland. Native plants and animals need each other for survival. Birds, mammals and insects assist in pollination of plant species. Native bees and wasps are huge contributors to this process. Native birds may also feast on insects which would otherwise defoliate trees. The lizards, decomposers, soil fauna and the aquatic life also contribute to a balanced healthy ecosystem which is entirely self-supporting.

The linkage of habitat to other areas of natural vegetation is of major importance in conserving the diversity and the genetic strength of both flora and fauna in North Sydney. Many species require continuous habitat for dispersal and survival. This is critical for smaller species such as frogs, lizards, some birds and small mammals. Many of these animals find it difficult to cross long distances of unsuitable habitat and are highly vulnerable to predators in exposed spaces (Johnston & Don, 1990). Isolated populations existing within small remnants are highly susceptible to natural and human disturbances. Many bushland parcels in North Sydney are isolated from other areas of native vegetation. The creation of habitat (vegetation) corridors are therefore a necessity for the long-term survival of the existing biodiversity.

Corridors and links of vegetation are beneficial because they:

- allow vulnerable fauna species to spread and breed in a safer environment,
- allow the genetic diversity of flora and fauna populations to be maintained, increasing the potential for survival of that species,
- increase the size of each remnant habitat, improving potential for nature conservation, and
- allow young animals to move out and seek new territories (reducing overcrowding and stress on the existing population).

Encouraging corridors within the North Sydney Council area will also be important to the success of vegetation corridors to link up with bushland in adjoining Council areas eg. Mosman, Lane Cove and Willoughby, so that a regional purpose may also be fulfilled.

It is necessary to develop a Wildlife Corridor Strategy for North Sydney's Bushland areas as outlined in the Bushland Plan of Management. The Rehabilitation Plans will identify present gaps in our corridor system and propose initial steps to join areas of bushland with other reserves, parks and 'patches of green'. The Wildlife Corridor Strategy would highlight and prioritise areas of special consideration, protection and enhancement. A planting schedule will be devised to compliment the Strategy by providing a list of appropriate plant species for certain areas depending on the wildlife present. For example, if a reserve has a decreasing population of small birds, plantings for these species could be concentrated in effort to encourage these animals in the area (see also Pittwater Council (1995) 'Conservation Strategy No.1 - Habitat and Wildlife Corridors').

4.6 Biodiversity

Biodiversity encompasses three major areas of concern; genetic, species and ecosystem diversity.

Genetic Diversity- refers to the genetic material contained within a population of species.

Species Diversity- refers to the variety of living things, whether they are plants, animals, invertebrates, lichen, moss, fungi, molluscs etc. Species are groups of actually or potentially interbreeding natural populations. Many species in the urban environment are reproductively isolated.

For North Sydney:

Group	Estimated Number of Native Species	Estimated Number of Introduced Species	Estimated Number of Extinct Species	Estimated Number of Threatened/ Vulnerable Species
Amphibians	4	-	-	1
Birds	122	7	-	2
Mammals	13	3	10 (known)	2
Reptiles	20	-	1 (known)	-
F/water Fish	N/A	-	-	-
Marine Fish	N/A	-	-	-
Invertebrates	N/A	-	-	-
Vascular Plants	366	140	-	-
Algae	N/A	-	-	-
Fungi (excluding lichens)	N/A	-	-	-
Mosses	N/A	-	-	-
Liverworts	N/A	-	-	-
Lichens	N/A	-	-	-
Micro-organisms (excluding fungi)	N/A	-	-	-

N/A = No data collected. These plants or animals do exist in the area however no data has been collected concerning species type, location and population numbers.

Ecosystem Diversity- A group of interacting organisms (community) and the physical environment they inhabit at a given time. This includes plant communities (eg. open forest) and the plants contained within them. Different plants provide certain habitats, food products, shelter and nesting sites for different species. If there are many ecosystem types in one large

area, it may be assumed that a large variety of animals can be supported due to the differing habitat components.

Direct Threats to Biodiversity

- Weed species
- Pollutants
- Feral Animals
- Lack of Fire
- A sterile urban environment
- Fragmented and isolated pockets of bushland
- Feeding native and introduced animals
- Misuse, damage, vandalism of bushland areas
- Stormwater: Increased nutrients and moisture in bushland

5.0 CURRENT MANAGEMENT STRATEGIES

5.1 Objectives and Implementation

The objectives of current management strategies include:

- To manage bushland areas in accordance with sound ecological principles and practices which are consistent with relevant legislation and identified community needs;
- To ensure the preservation of existing areas of remnant bushland and;
- To involve the community in the management of bushland through promotion and awareness.

These strategies are currently implemented 'on the ground' in programs involving bush regeneration practices, the use of fire as a management tool, alleviating the effects of excessive runoff and stormwater, the protection of Aboriginal and European Heritage sites, facilitation of volunteer community groups and undertaking bushland surveys and monitoring. These programs have been made possible with full support by Council funding as well as outside funding by various other organizations eg. Greenspace, Port Jackson and Middle Harbour Catchment Management Committees and Coastcare.

6.0 PREPARATION OF THE REHABILITATION PLANS

6.1 Approach

The Bushland Rehabilitation Plans are intended to be used as a tool that will promote an integrative vision for the rehabilitation and management of bushland areas in North Sydney. The Rehabilitation Plans bring together all relevant available information to provide a basis for future decisions made by local government authorities, contractors and residents. Co-operation with other catchment stakeholders is imperative to the success of the project.

The Bushland Rehabilitation Plans are not a final end point to the process. Hopefully they will provide a precedent for future bushland practices and procedures in rehabilitation and management. New rehabilitation and management issues are likely to emerge in the future. These issues should be addressed as they begin to pose threats to our natural areas.

6.2 Objectives of the Rehabilitation Plans

1. Provide baseline data on natural resources in Middle Harbour Catchment.
2. Identify the threats to bushland in Middle Harbour Catchment.
3. Identify the level of degradation of bushland areas in relation to these threats.
4. Set area-based vegetation management objectives.
5. Provide a strategy which prioritises the allocation of resources to individual areas.

On-going monitoring will be carried out throughout the life of the Bushland Rehabilitation Plans to ensure that objectives are being achieved. The Plans will be a working document to assist and direct the rehabilitation of the bushland with regular monitoring, feedback and re-assessment of the proposed actions. An adaptive management approach can be achieved in this way.

6.3 Development of the Plans

Information gathered from several sources provided the basic information needed to prepare and compile the Rehabilitation Plans, including:

- Bushland Management Team - Site Assessment
- Bushcare Groups (community volunteers)
- Information from the Wildlife Watch Program (community volunteers)
- Observations and other inputs from other staff of Council and contractors
- Technical experts
- Residents and local historians
- Other stakeholders within the catchment

6.4 Connecting Sub-catchments

A sub-catchment is an area of land drained by a creek, river or lake. The boundary of the sub-catchment is along a watershed, which is a line separating water flowing to different waterways. Because a sub-catchment is relatively self contained they become ideal management units. However, sub-catchments can be affected by other sub-catchments by the spread of noxious weeds and feral animals. It is often necessary to look beyond the sub-catchment for the solution to issues concerning our native flora and fauna. In ecological terms, in nature, everything is connected. Each sub-catchment is complex and comprises of diverse landuse and development elements.

7.0 OTHER CATCHMENT STAKEHOLDERS

A catchment stakeholder is a government or non-government organization that owns and controls parcels of land within the North Sydney Council area. Each organization has defined areas of responsibility. It is important to recognise the current activities of these organizations and their statutory obligations in relation to remnant bushland and biodiversity throughout the entire catchment.

Sydney Water Corporation (SWC)

Activities of Sydney Water

Any areas of bushland reserve disturbed by normal construction or maintenance activities are revegetated/rehabilitated in accordance with SWC policies (as below). This work only occurs in areas disturbed by SWC activities, and does not expand the area of bushland that was in existence before the work commenced.

Policies/Guidelines

The following policies are relevant to bushland areas:

- Urban Bushland Policy
- Bushland Management Guidelines
- Noxious and Environmental Weeds Policy
- Weed Management Guidelines
- Pesticide and Herbicide Policy
- Feral Animal Policy

SWC also provides guidelines for developers who are contracted to SWC called the Standard Urban Design System (SUDS). Within this document is a description of the existing environment, including flora and fauna, archaeology and public amenity.