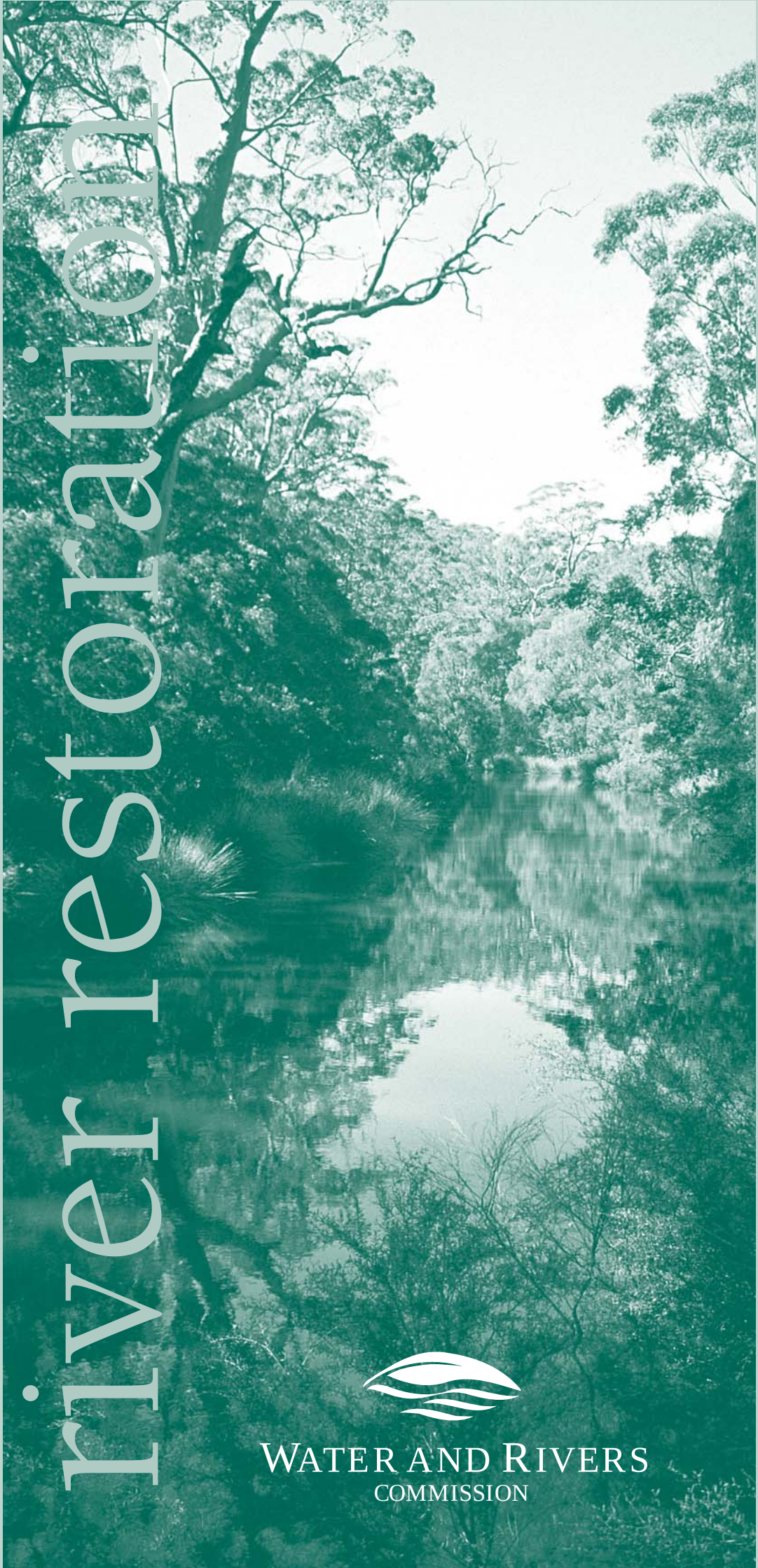
river restoration



WATER AND RIVERS COMMISSION

Revegetation

Case studies from south-west Western Australia

August 1999
Report No. RR 5

WATER & RIVERS COMMISSION
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REVEGETATION

Case Studies from south-west Western Australia

Prepared by
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jointly funded by

Natural Heritage Trust

WATER AND RIVERS COMMISSION

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Foreword

Many Western Australian rivers are becoming degraded as a result of human activity within and along waterways and through the off-site effects of catchment land uses. The erosion of foreshores and invasion of weeds and feral animals are some of the more pressing problems. Water quality in our rivers is declining with many carrying excessive loads of nutrients and sediment and in some cases contaminated with synthetic chemicals and other pollutants. Many rivers in the south-west region are also becoming increasingly saline.

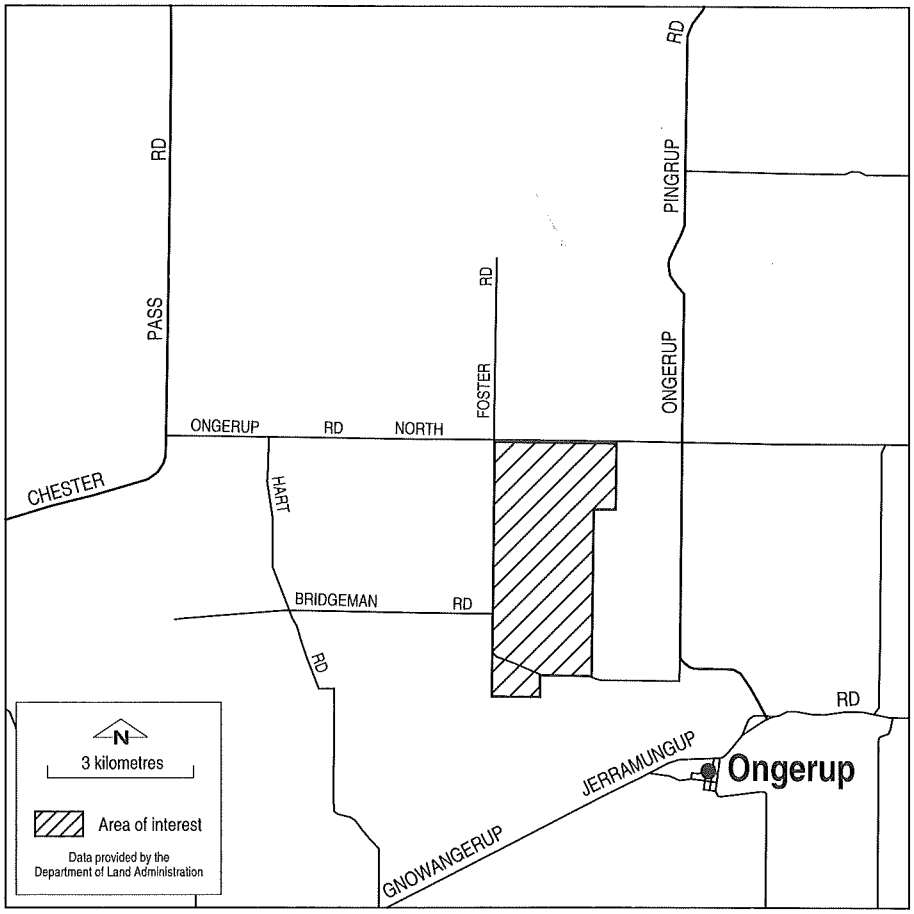
The Water and Rivers Commission is responsible for coordinating the management of the state's waterways. Given that Western Australia has some 208 major rivers with a combined length of over 25 000 km, management can only be achieved through the development of partnerships between business, landowners, community groups, local governments and the Western Australian and Commonwealth Governments.

The Water and Rivers Commission is the lead agency for the Waterways WA Program which is aimed at the protection and enhancement of Western Australia's waterways through support for on-ground action. One of these support functions is the development of river restoration literature that will assist Local Government, community groups and landholders to restore, protect and manage waterways.

This document is part of an ongoing series of river restoration literature aimed at providing a guide to the nature, rehabilitation and long-term management of waterways in Western Australia. It is intended that the series will undergo continuous development and review. As part of this process any feedback on the series is welcomed and may be directed to the Catchment and Waterways Management Branch of the Water and Rivers Commission.

Contents

1. Cleveland Creek 'Yebwen' Ongerup - Steve Newbey



CLEVELAND CREEK, ONGERUP LOCATION MAP

1.1 Original site description

1.1.1 Ownership and location

'Yebwen' is a 1000 ha farm owned by Steve Newbey, situated west of the Ongerup-Pingrup Rd. Steve runs sheep on the property, and leases out the rest of the land for cropping. Cleveland Creek runs along the edge of the property, joining into Warperup Creek and then into the Palinup River.

The creekline has been fenced for 50m either side of the creek since the 1970's. Steve has now increased the riparian zone significantly by fencing a further 25m of his property adjacent to the creek.

1.1.2 Remnant vegetation

There is some existing overstorey in the original fenced area of the riparian zone, however the newly fenced area had previously been pasture, and is denuded of vegetation. The vegetation community would have been composed of the species listed in section 1.3.2 revegetation.

1.1.3 Weed species

Weed species in the riparian zone consist mainly of Wireweed (*Polygonam aviculare*), Wild Radish (*Raphanus raphanistrum*), Capeweed (*Arctotheca calendula*), Barley Grass (*Hordeum leporinum*) and Wild Oats (*Avena barbarta*). Steve has found the summer weeds such as the Wireweed to be the worst competitor for the revegetation, as it rapidly colonises disturbed areas, and competes for nutrients and available water over the hotter months.

1.2 Rehabilitation Managers

Steve Newbey is one of the Gnowangerup Landcare Coordinators, and has taken a deep interest in the management of his own farm. He has completed a plan for the farm, and is now in the process of implementing it. Many thousands of trees have been planted across the property, and Steve has improved on the methods he uses each year through careful observation of what succeeded and what didn't. Apart from replanting, Steve has used many innovative ideas to improve the value of his farm to the local wildlife.

His whole farm is registered with the Land For Wildlife scheme, which is managed by CALM. Under this scheme, Steve receives free advice from the Land For Wildlife officer and a newsletter on work being done on other properties. An ephemeral wetland located on the property has been improved as a waterbird nesting site by the creation of 'islands' built with old wooden fence posts. Last year Steve had Pacific Black Duck chicks hatch in the wetland, and was delighted that they were able to shelter within the nooks and crannies of the island, safe from marauding foxes.

Steve has also created many wildlife corridors across the farm, and has come up with an innovative scheme to increase the use of the dams by wildlife while decreasing his own costs. Most dams on the farm are part of the wildlife corridors, and are fenced across the front. This means that stock can only access the dam by climbing over the back walls. As a result, there is no funnelling effect from stock tracks at the front of the dam, resulting in less clean-outs of the dams (Steve estimates that he will only need to clean the dams on average once every 50 years, as opposed to every 10-20 years for an unfenced dam). An added bonus is that wildlife can access the water supply in safety from the vegetated corridor.

1.3 Rehabilitation Works

1.3.1 Weed Control

Steve uses a Chatfield Tree Planter to revegetate areas on his farm, as he has found it gives good results. The machine scalps the area to be planted, removing weeds and the stored seedbank. This controls some weeds, however Steve has found a problem with summer weeds such as Wireweed colonising the area around the plantings. So far he has resorted to a shovel to remove the weeds prior to the summer, feeling that the use of herbicide was too dangerous to the new plantings.

Limited control of the grassy weeds is done, as Steve has found that the summer weeds which colonise in their place are more of a problem.

1.3.2 Revegetation

The soil at Cleveland Creek consists of sandy loam, with heavier clay layers beneath. The area was shallow ripped to prevent large clay clods being brought to the surface. Steve planted four rows of seedlings using the Chatfield Tree Planter, spacing the plants 5m apart, and separating rows by 6m. At the same time, the area is direct seeded from the seedbox on the back of the planter. The following year the area between each row is direct seeded, resulting in eight rows. The seedlings are grown by local nurseries, often using the seed grown on Steve's property. Only shrubs and understorey species are used in the revegetation, as Steve has found that the larger trees tend to grow too quickly, shading out the understorey and competing for water and nutrients. The understorey is unable to successfully establish, and remains sparse and stunted. Steve has found that the overstorey will come back naturally in time, after the shrub layer is well established. If shade is required in a certain area, Steve will hand plant a small number of trees.

The seeds which Steve uses for his direct seeding are mainly collected by him on the property, to ensure local provenance. The seed mix consists of as many shrub and understorey species as he can collect, mixed with the sievings from the seed cleaning, which Steve prefers to the bentonite clay often used to bulk up direct seeding. The clay has a tendency to 'tunnel', sticking to the sides of the seeding machine.

If the plantings and direct seeding are reasonably successful, Steve will do nothing but control summer weeds over the next twelve months. Sometimes plantings fail, affected by the amount and spread of rainfall for the year, viability of seed, insect predation and areas of different soil type. If areas have remained bare, they are direct seeded again the following year.

At Cleveland Creek, twenty-five species were planted or seeded the first year, and as Steve became more familiar with the vegetation on his property, fifty species were used in the second year.

The following species are used in revegetation:

SEEDLINGS	
Eucalyptus loxophleba	York Gum (hand planted only)
Melaleuca hamulosa	
Melaleuca thyoides	
Melaleuca cuticularis	Saltwater Paperbark
Casuarina obesa	Swamp Sheoak
DIRECT SEEDING	
Acacia acuminata	Jam Wattle
Acacia cyclops	Coastal Wattle
Acacia declinata	Pallinup Gold
Acacia glaucoptera	Clay Wattle
Acacia harveyi	
Acacia lasiocalyx	Granite Wattle
Acacia microbotrya	Manna Wattle
Acacia pulchella var glaberimma	Prickly Moses
Acacia redolens	Ongerup Wattle
Acacia saligna	Golden Wreath Wattle
Acacia uncinata	Weeping Wattle
Allocasuarina campestris	Tamma
Allocasuarina huegliana	Rock Oak
Callistemon phoeniceus	Lesser Bottlebrush
Calothamnus quadrifidus	One-sided Bottlebrush
Eucalyptus densa	
Eucalyptus eremophila	Tall Sand Mallee
Eucalyptus flocktoniae (Mallee Form)	Merrit
Eucalyptus pluricaulis	Purple-leafed Mallee
Leptospermum erubescens	Tea Tree
Leptospermum oligandrum	
Melaleuca acuminata	Scented Honey Myrtle
Melaleuca adnata	
Melaleuca cucculata	
Melaleuca cuticularis	Saltwater Paperbark
Melaleuca densa	Lemon Honey Myrtle
Melaleuca eleuterostachya	
Melaleuca elliptica	Granite Bottlebrush
Melaleuca glaberrima	Mallee Honey Myrtle
Melaleuca halmaturorum ssp cymbifolia	
Melaleuca hamulosa	Creekline Honey Myrtle
Melaleuca lateriflora	
Melaleuca nesophila	Mindiyed
Melaleuca pauperiflora	Boree
Melaleuca pentagonia	
Melaleuca sapientes	

Melaleuca spathulata	Purple Myrtle
Melaleuca spicigora	
Melaleuca strobiphylla	
Melaleuca thyoides	Salt Lake Honey Myrtle
Melaleuca uncinata	Broombush
Melaleuca undulata	Hidden Honey Myrtle
Melaleuca violacea	Purple Honey Myrtle

In addition to the above species Steve collected seed from many species which he has not yet been able to identify. There appears to be a large diversity in the seedlings which have germinated from seed, however it has not yet been possible to identify which species have been the most successful. Steve is hopeful that with time more of the seed will germinate, adding to the diversity. The planted seedlings at Cleveland creek also appear to have survived well, with about a 75% survival rate.

1.4 Costings

To revegtate 0.25ha Cleveland Creek over two years

Labour seed collecting 1 hrs @ $15/hr (200gm seed)	$15
Labour planting and seeding 4 hrs @ $15/hr	$60
Labour removing weeds 0.5hrs @ $15/hr	$7.50
100 seedlings @ 38c	$38
Use of Chatfield Tree Planter 4 hrs	$30
TOTAL	$150.50

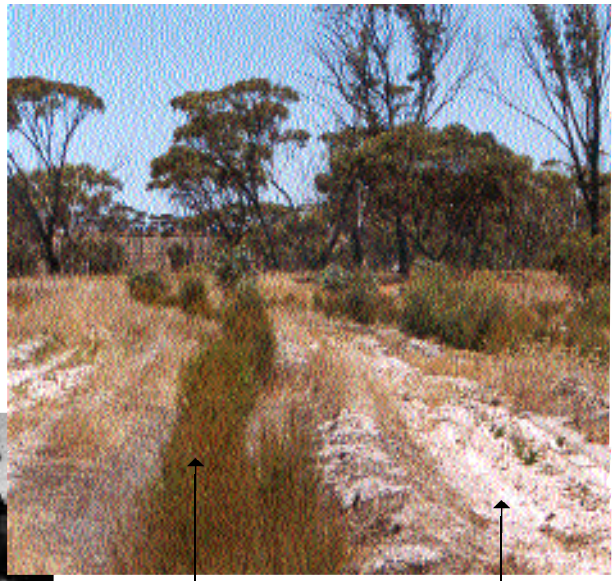
Chatfield treeplanter — used to plant seedlings, scalp and direct seed.

1.5 Outcomes

Steve Newbey is managing his farm according to a farm plan, which aims to halt degradation of soils and waterways, and restore habitat for fauna. This case study is only one small component of the restoration work that he has done over the last two years.

Steve is constantly learning from the work that he does, and experimenting with new ideas. The revegetation work at Cleveland Creek has been very successful, and within a few years should provide an excellent vegetated buffer for the waterway.

In addition, Steve has been a shining example of what can be achieved, and has motivated many other farmers to begin their own restoration projects.

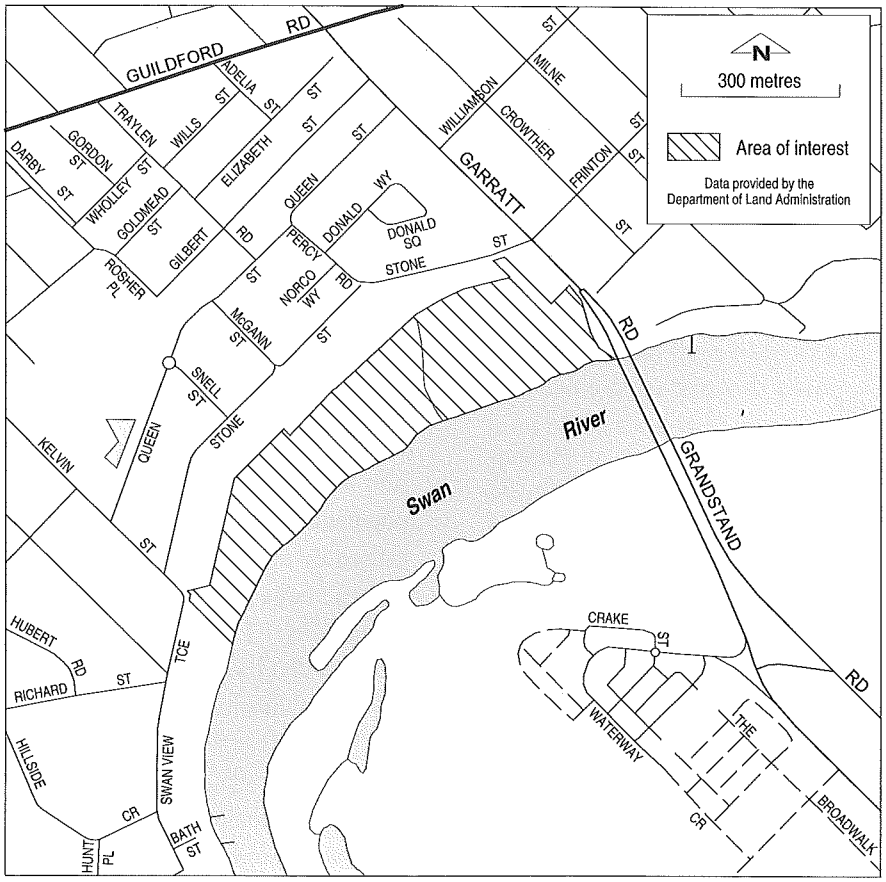


Seedling and direct seeding of shrub and understorey species.

Areas between rows direct seeded the following year.

(Photos supplied by Steve Newbey)

2. Baigup Reserve, Bayswater - Bayswater Greenwork, Regeneration Technology, City of Bayswater and Ministry for Planning



BAIGUP RESERVE, BAYSWATER LOCATION MAP

2.1 Original site description

2.1.1 Ownership and location

Baigup Reserve is located on the northern foreshore of the Swan River, extending for about a kilometre from Garrett Rd Bridge in Bayswater to Kelvin Rd in Maylands. The Reserve extends for 200m back from the river, and is bisected by a cycle path, which has had a dramatic effect on the hydrology of the area. The river side of the cycle path is strongly affected by tidal influences, while the area to the landward side has become a shallow freshwater swamp, flushed by groundwater seepage and stormwater outlets.

The Reserve was originally shared by two local authorities, however recent boundary changes have placed the whole of Baigup Reserve within the City of Bayswater. A portion of the area is Crown reserve, with the remaining two thirds owned by the Ministry for Planning.

The area was originally listed as a System 6 Reserve, and is currently zoned as Parks and Recreation. A Management and Rehabilitation Plan was prepared for the area by Regeneration Technology, and a three year implementation plan began in 1997. At the completion of the work, which is being funded by the Ministry of Planning, it is envisaged that the area will be handed over to the City of Bayswater to manage.

2.1.2 Remnant Vegetation

The vegetation of the Reserve consists of a mixture of estuarine and freshwater swamp communities, many of which are becoming rare along the Swan River. The tidal component of the wetland consists largely of shore rush (*Juncus kraussii*) sedgelands, with a fringe of swamp sheoak (*Casuarina obesa*) along the river's edge. In places there are belts of lake club rush (*Schoenoplectus validus*) and stands of freshwater paperbark (*Melaleuca rhaphiophylla*).

The landward side of the cyclepath consists mostly of freshwater species, with large stands of lake club rush, and dense stands of freshwater paperbark. There are also significant smaller occurrences of a wide variety of rushes and sedges.

2.1.3 Weed Species

There are many weed species present at Baigup, however the most prevalent by far is the bulrush (*Typha orientalis*). Also present in large quantities are Pampas Grass (*Cortaderia selloana*), Paspalum (*Paspalum dilatatum*), Eau de Cologne mint (*Mentha piperiata*) and giant reed (*Arundo donax*). In addition there are small infestations of almost every common wetland weed.

2.2 Rehabilitation Managers

Baigup was left largely unmanaged until the community group Bayswater Greenwork took an interest in rehabilitating the area in 1990. The group was very active, with a membership base of thirty-five, and began bulrush and pampas grass removal on Saturday mornings. The group soon realised however, that the scale of the weed problem was beyond their resources. Greenwork then became involved in one of the first LEAP (Landcare and Environmental Action Program) schemes, with a group of fifteen young people working for six months on the reserve.

At the same time, the group initiated a round table discussion with the key stakeholders to discuss the future of the area. Greenwork applied for a grant to commission a management plan, and with contributions from the Department of Environmental Protection, the Ministry of Planning, the City of Bayswater and the City of Stirling, Regeneration Technology were appointed as consultants to prepare the plan.

Once the plan was complete and adopted by the key bodies involved with Baigup, a funding source was required to begin the implementation. The Ministry of Planning were able to provide $500,000 over five years to allow the plan to proceed. Other sources have been accessed for the labour component, such as Greencorps and in the future a Work for the Dole scheme

A decision was made to request Regeneration Technology to oversee the three-year implementation, which began in 1997.

2.3 Rehabilitation Works

2.3.1 Weed Control

In assessing the weed control, priority has been given to control of bulrush, as the massive extent of the infestation is preventing the return of the indigenous populations of rushes and sedges. The fire hazard caused by this plant has resulted in almost annual fires, and a large reduction in the swamp paperbark community. The following summary outlines the methods and timing of weed control at the reserve, and gives an indication of the success of the treatments:

Bulrush

The initial attempts at control of bulrush by Bayswater Greenwork were largely unsuccessful. They consisted of repeated slashing of the plants as they regrew, in an attempt to weaken the rhizomes. Burnout of the group occurred long before the bulrush showed signs of diminishing. The LEAP group slashed larger areas of Bulrush, and then sprayed the regrowth with Roundup Biactive. This method showed a definite reduction in the amount of bulrush, however after the project finished the area was again invaded, and within eighteen months it was back to its original condition.

Control of the plants by Regeneration Technology has been the most successful, with the plants cut below the water surface (10-15cm). Most of the plants drowned, and the small amount of regrowth was wiped with Roundup Biactive (1%) two weeks later. However there is still the danger of re-invasion from the surrounding

Bulrush beds. The areas cleared are now being planted with Lake Club Rush (*Schoenoplectus validus*), a competitive plant that should quickly cover the site and exclude Bulrush re-invasion.

It is planned to excavate a lake at the western end of the reserve, which is almost totally a bulrush community. The plants here are growing in damp soil, and it is impossible to drown them. The lake will be excavated to the depth of 1.5m, which should prevent the bulrush from establishing.

Pampas Grass
Much of the pampas has been successfully removed from the reserve. The plants have been brushcut down to a small tussock, and any green shoots reappearing wiped with Roundup Biactive at 1% concentration.

Paspalum
This plant has been easy to control by slashing and spraying with 1% Roundup Biactive. There has been very little regrowth.

Other Weeds
A small patch of blackberry has been sprayed with Roundup Biactive, however this has had little effect. Consideration is being given to using a stronger chemical to control this plant. The giant reed has been successfully controlled by slashing and painting the regrowth with Roundup Biactive.

2.3.2 Revegetation

As described above, the areas cleared of bulrush are being planted with lake club rush. The plant grows rapidly in summer, and where it has established is forming thick beds. Many of the plants used were bare-root stock, and a large proportion of them were pulled out by waterbirds, who like to eat the rhizomes. More recent attempts at introducing the species using large clumps have been very successful. The same area has also been planted with swamp paperbark, as when mature, these trees will provide shade, which will assist with preventing re-invasion of bulrush. Erosion is a problem on the foreshore, both from wave action and bait digging. A boardwalk has been built to allow controlled access to the area, and it has been sandbagged and planted with shore rush and lake club rush. The club rush can tolerate brackish water, and can be planted in front of the shore rush, creating a natural wave baffle.

The edges of the cycleway have been planted with swamp sheoak (*Casuarina obesa*), swish bush (*Viminaria juncea*), robin redbreast bush (*Melaleuca lateritia*) and swamp paperbark to provide shade and a pleasant environment for users of the path.

At the time of writing, rehabilitation works still have three years to go, and Bulrush control will remain one of the major aims. The lake is due to be excavated in summer 1999, and will be planted densely with swamp paperbarks and a wide variety of rushes and sedges in the shallower margins.

The following species have been used in revegetation:

Casuarina obesa	Swamp Sheoak
Isolepis nodosa	Knotted Club Rush
Juncus kraussii	Shore Rush
Melaleuca lateritia	Robin Redbreast Bush
Melaleuca rhaphiophylla	Swamp Paperbark
Viminaria juncea	Swishbush
Schoenoplectus validus	Lake Club Rush

2.4 Costings

The restoration of Baigup Reserve is a five-year project with a budget of $500,000. The project is now at the end of the second year, and a total of $150,000 has been spent. Apart from weed control and revegetation, the costs have included signage, project management and the construction of a boardwalk. As well as the direct costs, there have been in-kind contributions from the City of Bayswater, large numbers of hours spent in committee meetings and an enormous amount of time contributed by volunteer labour. This has been obtained from training programs for the unemployed, such as Greencorps. Figures for these contributions were not available, however the following costs for revegetation materials have been supplied:

11,500 rushes and sedges @ $1	$11,500
1,000 trees @ 70c	$700
TOTAL	$12,200

2.5 Outcomes

The rehabilitation of Baigup Reserve is an example of what can be achieved by a joint effort of State Government, Local Government and community. The initial interest in the area came from the community, and by calling all stakeholders together, a significant amount has been achieved. A management plan has been prepared, which included timelines and budgets for implementation. Often progress stops at this point, however, in this case funding for full implementation was provided by the Ministry of Planning, and the restoration works handed over to project managers.

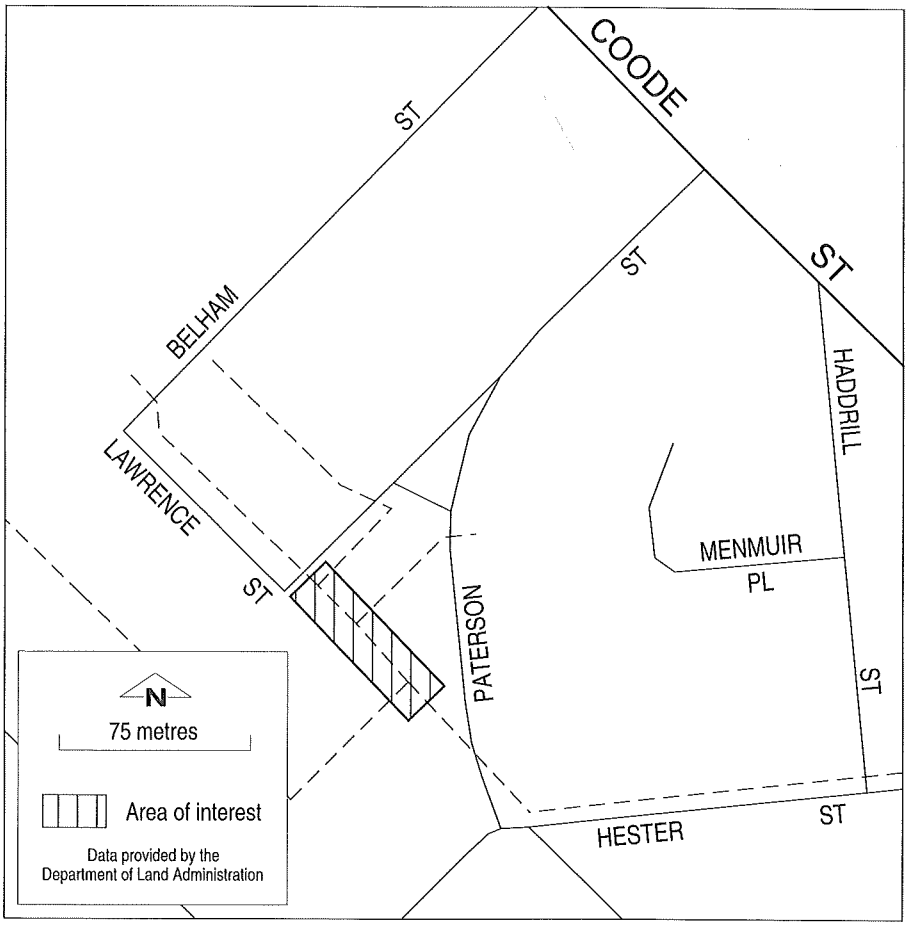
Considerable weed control has been achieved, and the end of the five-year plan should see the reserve in fairly good condition. The community has had little involvement in the implementation of the plan, however Bayswater Greenwork are still involved in the steering committee. There are plans to form a Friend's group in the next few years to carry on the maintenance of the Reserve, and to educate the public about the natural values of the area. The long-term maintenance of the area will need to be carried out by the City of Bayswater when they take over vesting at the completion of the project, in conjunction with the Friends group.

Baigup Reserve — bulrush prior to weeding.

Two years after weeding.

(Photos supplied by Jodie Oates, WRC)

3. Paterson St Drain,Paterson St Bayswater — The Bayswater Intergrated Catchment Management Group



PATERSON ST DRAIN, BAYSWATER LOCATION MAP

3.1 Original site description

3.1.1 Ownership and location

The Paterson St Drain is a 100m section of open drain owned by the Water Corporation. It feeds into the Bayswater Main Drain, which empties into the Swan River at the end of King William St, Bayswater. The drainage reserve is located adjacent to a park which is vested in the City of Bayswater and Chisholm College, a Catholic high school, is located close by. Local residents approached the council with a request to beautify the drain, and the project was handed over to the Bayswater Catchment Group.

3.1.2 Remnant vegetation

The drainage reserve and the parkland have no remnant vegetation save for a single 70 year old Zamia (*Macrozamia redlei*) that was transplanted to the park to preserve it. The area is highly urbanised and modified and has been so for a long time. The existing drain was probably never a creekline, but a low point in the extensive swamps, which were once found in the area.

3.1.3 Weed species

The drain itself contained various weed species, such as veldt Grass (*Ehrharta calycina*), wild oats (*Avena barbarta*), dandelions (*Taraxacum officinale*) and couch

(Cynadon dactylon). These plants are usually sprayed every year by the Water Corporation, resulting in bare surfaces on the drain banks. The parkland consists of a large expanse of grass, bounded by fig trees (*Ficus hillii*).

3.2 Rehabilitation Managers

The Bayswater Catchment Group has been in existence for eight years, and its members are attempting to turn the extensive drainage network of the Bayswater Main Drain into living streams in the areas where it is not piped. The group currently consists of an implementation committee of 12 people, as well as an extensive network of schools and community groups who have volunteered to help with the project. Represented on the committee are the three councils included in the catchment boundaries, City of Bayswater, City of Stirling and Town of Bassendean. Also on the committee are representatives from the community, the Swan River Trust, the Water Corporation, the business community (CSBP-Wesfarmers) and a local MLA.

Funding for the group has come mainly from NHT, with a Coordinator funded for the last six years, and grants available for specific projects.

Installation of the living stream at Paterson St was conducted by the Bayswater Catchment Group, with assistance from the Water Corporation, the City of Bayswater and the local community. The City of Bayswater will do ongoing maintenance of the project and maintenance of the drain channel will remain with the Water Corporation.

3.3 Rehabilitation Works

The Paterson St site is public open space, but not a natural area. The aim of the Bayswater Catchment Group for this project was to raise public awareness of the drainage system, create a living stream habitat to encourage fauna into the area and restore indigenous vegetation to the catchment. Once the community think of the drain as a 'living stream', they are more likely to care about its water quality and their effect upon it.

The rehabilitation of an urban drain has many problems, which are not common to other more natural sites. The function of an urban drainage system is to remove stormwater from residential and industrial areas as quickly as possible after a storm event, to prevent flooding of streets and buildings. This function cannot be compromised in any way, and the use of plants, rocks or woody debris in the bed of the drain needs to be considered in this light.

The drain at Paterson St also abuts a park, and will be used by the public as a recreation site. The slopes of the banks therefore need to be safe for public access. The back fences of many houses back on to one side of the drain, and the residents are often fearful of a fire hazard or of hidden access for intruders if plants are placed near back fences. For this reason, widespread public consultation was carried out before the project commenced.

3.3.1 Weed Control/Earthworks

It was necessary to carry out extensive grading of the drain banks before the project began. One side of the drain backed onto fences with a narrow 3m strip along the top of the bank. It was not possible to alter the slope on this side, and it remains at 40˚ - 50˚. To ensure public safety on the slope facing the park, the slope was contoured to 20˚. A meander was also created in the drain to give it a more natural appearance and to mimic the water's natural course of flow. No weed control was necessary to prepare the site for planting, as the banks were bare following the earthworks.

After planting, couch grass became a problem, as well as annual grasses. The couch will be sprayed with Fusillade or Glyphosate, and Greencorp trainees will remove the annual weeds. Greencorps is an environmental training program for young unemployed people.

Paterson St Drain after earthworks to create meanders and lessen the slope of the bank. (Photo supplied by Rosemary Glass, BICM).

3.2.2 Revegetation

The species used to plant the banks had to meet many criteria. They had to be colourful, and have visual appeal, so the local community would be attracted to the area. As well, to allay fears of intruders, the plants chosen were either very low, or were medium size, clear stemmed trees. Trees were planted so that there would be no overhang of branches over residents'properties. Wetland plants for the base of the drain were chosen because they would not spread rapidly, blocking the drainage channel, and were designed to block children's'access to the water - a request made by local residents. Finally, they had to be native to the area and available from nurseries. It was decided that plants native to the metropolitan area were acceptable in such a changed environment, to allow a greater range of plants for selection. 7055 individual plants were used to revegetate the site.

Eight months after planting (June/July 98). Couch is still a problem but the rushes are taking well and the meanders are clearly evident. (Photo supplied by Jodie Oates, WRC).

The following species were planted:

TREES	
Allocasuarina fraseriana	Common Sheoak
Banksia littoralis	Swamp Banksia
Eucalyptus rudis	Flooded Gum
LOW PLANTS < 1M	
Acacia stenoptera	
Anigozanthus manglesii	Kangaroo Paw
Beaufortia elegans	
Chorizema dicksonii	Yellow Eyed Flame Pea
Conostylis candicans	Grey Cottonhead
Dampiera linearis	Common Dampiera
Grevillea crithmifolia	
Hardenbergia comptoniana	Native Wisteria
Hemiandra pungens	Snakebush
Hovea pungens	Devil's Pins
Hypocalymma angustifolium	White Myrtle
Hypocalymma robustum	Swan River Myrtle
Kennedia prostrata	Running Postman
Orthrosanthus laxus	Morning Iris
Pimelea ferruginea	Coast Banjine
Sollya heterophylla	Australian Bluebell
Verticordia drummondii	Drummonds Featherflower

WETLAND PLANTS	
Baumea vaginalis	River Twig Sedge
Carex fascicularis	Tassel Sedge
Cotula coronopifolia	Water Buttons
Eleocharis acuta	Common Spike-rush
Juncus pallidus	Pale Rush
Restio stenostachyus	
Villarsia albiflora	

3.4 Costings

Earthworks and planting for 100m section of open drain

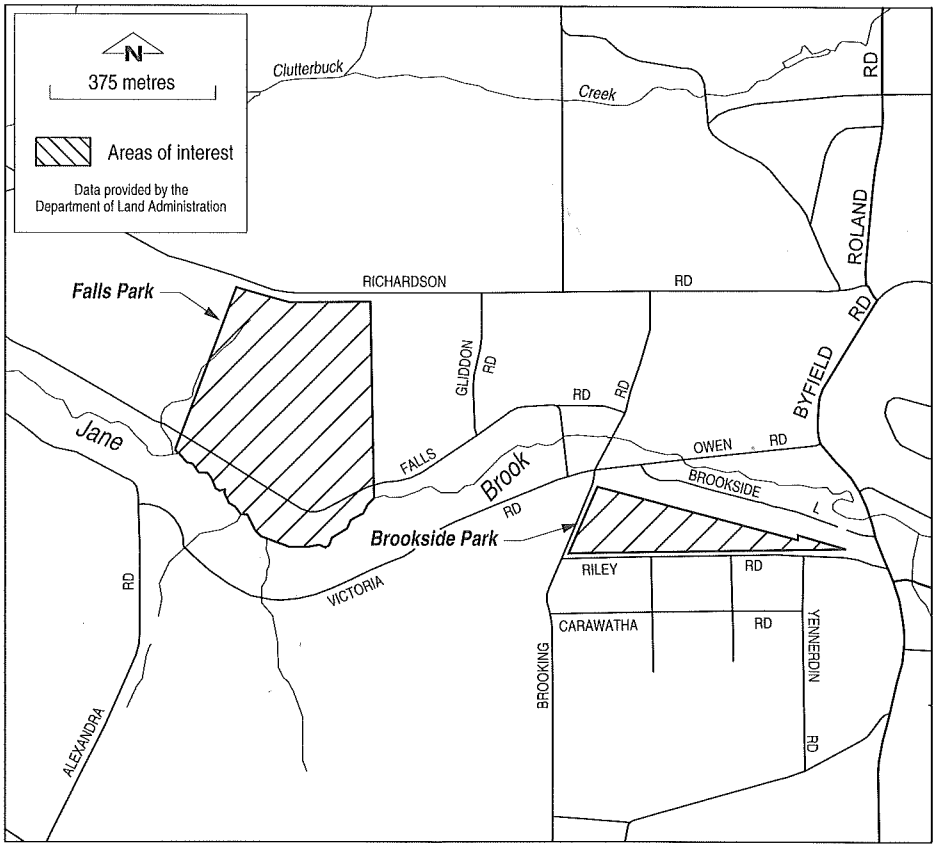
Earthworks	$2400
Surveying	$920
Removal soil by contractor	$1000
Earthworks for path	$1325
Installation of crushed gravel path	$2000
Landscape design	$2000
7055 plants @ $1	$7055
120 volunteer hrs planting @ $15/hrs	$1800
40 volunteer hrs weeding @ $15/hr	$ 600
40 hrs planning @ $25/hr	$1000
50 hrs supervision @ $25/hr	$1250
4 volunteer hrs doorknocking @ $15/hr	$60
20 volunteer hrs consultants @ $40/hr	$800
TOTAL	$25535

3.5 Outcomes:

The Bayswater Catchment Group is pioneering attempts at revegetating open drains, and has come up against many problems. A low level of vandalism has occurred with trampling from children playing on the banks. Uprooting of plants did not occur at this site as it did at others and this is probably because of the high degree of involvement from the community, resulting in ownership of the project. Couch, annual grasses and broadleaf weeds will continue to be a problem particularly until plants grow sufficiently to cover the ground. However this was expected, and ongoing maintenance of the site by the community and the City of Bayswater has been accepted. The site certainly provides far better fauna habitat, and is a much more attractive site after the project completion, so much so that Chisholm College has requested a further length of drain adjacent to their school to be rehabilitated.

Survival and growth rates of the different plant species are being determined over summer and will guide future selection of species for other sites. One lesson learned is that groundcovering species are needed early in rehabilitation to shade the ground, minimise weeds and maximise plant survival, and that non ground covering species may need to be planted in subsequent years. Plants which have been particularly successful in quick coverage include Coastal Grevillea, Coast Banjine and *Acacia Stenoptera*. Almost all of the wetland plants are doing well, however children playing on the banks have caved in a section of bank over the top of the wetland section. The Bayswater Catchment group plan to continue with the revegetation of the drain, and will look critically at this trial to ensure the success of future plantings.

4. Jane Brook — Hovea Ratepayers Association



JANE BROOK, PARKERVILLE LOCATION MAP

4.1 Original site description

4.1.1 Ownership and location

Jane Brook runs from Mundaring down to meet the Swan River in West Swan. East of John Forrest National Park, much of the linear reserve surrounding the Brook is vested in the Shire of Mundaring. The Hovea Ratepayers group has concentrated their rehabilitation efforts on two main areas, Falls Park and Brookside Park in Parkerville. Jane Brook is characteristic of many of the streams running down from the Darling Range. The streambed is fairly narrow (in most places 1-2 m wide), but is being continually eroded by the increased stormwater flow entering it from urban developments. The soils of the area are composed of clays and laterites, which bake to create a very hard surface layer when the streambed dries up in summer.

4.1.2 Remnant vegetation

The areas selected by the Hovea Ratepayers had lost most of the understorey vegetation, however there are remnant patches of bush nearby from which a species list has been compiled. The overstorey consists of Flooded Gum(*Eucalyptus rudis*), Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*). Along the brook there are stands of Swamp Peppermint (*Agonis linearifolia*)

4.1.3 Weed species

The predominant weed in Jane Brook was Watsonia (*Watsonia bulbillifera*). Also present in smaller quantities were Wild Fig (*Ficus carica*), Blackberry (*Rubus sp*), Arum Lily (*Zantedeschia aethiopica*) and Paspalum *(Paspalum dilatatum*)

4.2 Rehabilitation Managers

The Hovea Ratepayers group has been working on the rehabilitation of Jane Brook for seven years. The group consists of six to eight dedicated people who work in each area once a month on a Saturday. Public workdays are held twice a year, and attendance at these is usually around thirty or forty people. These days are advertised in the local newspaper, and a leaflet drop is carried out in the immediate area.

In addition, the group is planning to access Greencorps, which consists of a team of unemployed people on an environmental training program. They have also held Alinta Gas Bushland Care Days in conjunction with Ecoplan (Department of Environmental Protection). On these days, Alinta Gas pays for a team from the Australian Trust for Conservation Volunteers to work with the group for a day, and supply a sausage sizzle at lunchtime.

The Hovea ratepayers also work closely with the Shire of Mundaring, who provide the chemicals for the group to use. The Shire also funded an additional day with ATCV volunteers working at selected sites. Funds for seedlings have been obtained through Greening WA's Chain of Diamonds program, the Gordon Reid Foundation and the WA Conservation Grants.

Prior to Watsonia weeding.

4.3 Rehabilitation Works

4.3.1 Weed Control

Watsonia was the prime target of the weed control program over the last seven years.

At both Falls Park and Brookside Park, Watsonia formed a continuous carpet, and formed a monoculture in the understorey. The members of the group sprayed the infestations with a 1% solution of Roundup Biactive between August and November each year, starting with the drier areas, and following the receding water down towards the streambed. Initial spraying was done with a boom spray, and generally killed 80-85% of the Watsonia in the first year. The next year touch-up spraying was carried out with a 5L handsprayer, and the following year a final spray was done to eradicate any new seedlings. At this point, the area was burnt in autumn to stimulate growth of native seed within the soil bank, and planting of native seedlings was commenced the following winter. Any Watsonia plants reappearing were then easily dealt with by wiping them with herbicide.

After weeding.
(Photos supplied by Jenny Johnson, Hovea Bush Regenerators).

Other groups had tried burning initially before spraying, however this method caused massive germination of Watsonia, as well as stimulating the germination of native seedlings. The following spray with Roundup Biactive killed all new native plant germination as well as the Watsonia. Another problem encountered by the group was the occurrence of a large rainfall event in September after a very hot wildfire had burnt the area the summer before. The lack of vegetation resulted in large erosion problems along the stream banks.

The other weed species were present in much smaller numbers, and were all sprayed with Roundup as part of the weed removal program. The Arum Lily and Blackberry have proved difficult to eradicate with

Roundup, however this is the only spray which the group are permitted to use in the area. After initial removal of the Watsonia, the bare areas were colonised by other species, including annual grasses and Paspalum. The group also treated these weeds with Roundup in follow-up years.

Although the weed control began in an ad-hoc manner, the group has learnt from their mistakes, and has gained confidence to attempt larger projects. The group now prepares their projects for each year well in advance, applying for grant funds if necessary, and planning areas to be tackled and resources needed.

Natural regeneration.

4.3.2 Revegetation

Over the last four years, the group has planted 20,305 seedlings, with an average of one plant to 2sqm. The plantings have been very successful, and many of the original plantings are now seeding, which will continue the regeneration process.

The following species were grown by the group or by nurseries for planting.

SHRUBS	
Acacia alata	Winged Wattle
Astartea fascicularis	Astartea
Calothamnus quadrifidus	One-sided Bottlebrush
Calothamnus rupestris	Mouse Ears
Calothamnus sanguineus	Silky-leaved Blood Flower
Hakea lissocarpha	Honey Bush
Hakea petiolaris	Sea-Urchin Hakea
Kunzea recurva	
LOW PLANTS < 1M	
Beaufortia purpurea	Purple Beaufortia
Clematis pubescens	
Dampiera linearis	Common Dampiera
Dampiera alata	Winged Stem Dampiera
Dryandra lindleyana	Couch Honeypot
Daviesia cordata	Bookleaf
Diplopeltis huegelii	Pepperflower
Darwinia citriodora	Lemon-Scented Darwinia
Hypocalymma angustifolium	White Myrtle
Hovea pungens	Devil's Pins
Kennedia coccinea	Coral Vine
Kennedia prostrata	Running Postman
Leschenaultia biloba	Blue Leschenaultia

Melaleuca scabra	Rough Honeymyrtle
Sphaerolobium medium	
Trymalium floribundum	
Verticordia plumosa	
Thomasia glutinosa	Sticky Thomasia
Centella asiatica	Gota Kola
RUSHES AND SEDGES	
Carex appressa	Tall Sedge
Juncus pallidus	Pale Rush
Juncus subsecundus	Finger Rush

Direct seeding was tried one year by the group, but has been largely unsuccessful. In the group's opinion, this is due to the bare nature of the slopes, causing seed to wash away, and to insect and bird feeding.

Attempts have been made to plant rush and sedge species along the bank edges, however it has been difficult to prevent these from washing out in winter. The Shire of Mundaring is now leaving all debris in the stream as it falls instead of clearing it each year, and the group are hopeful that this will eventually slow the energy of the flood waters and allow plant establishment. The group is also considering adding woody debris to protect plantings along the banks.

4.4 Costings

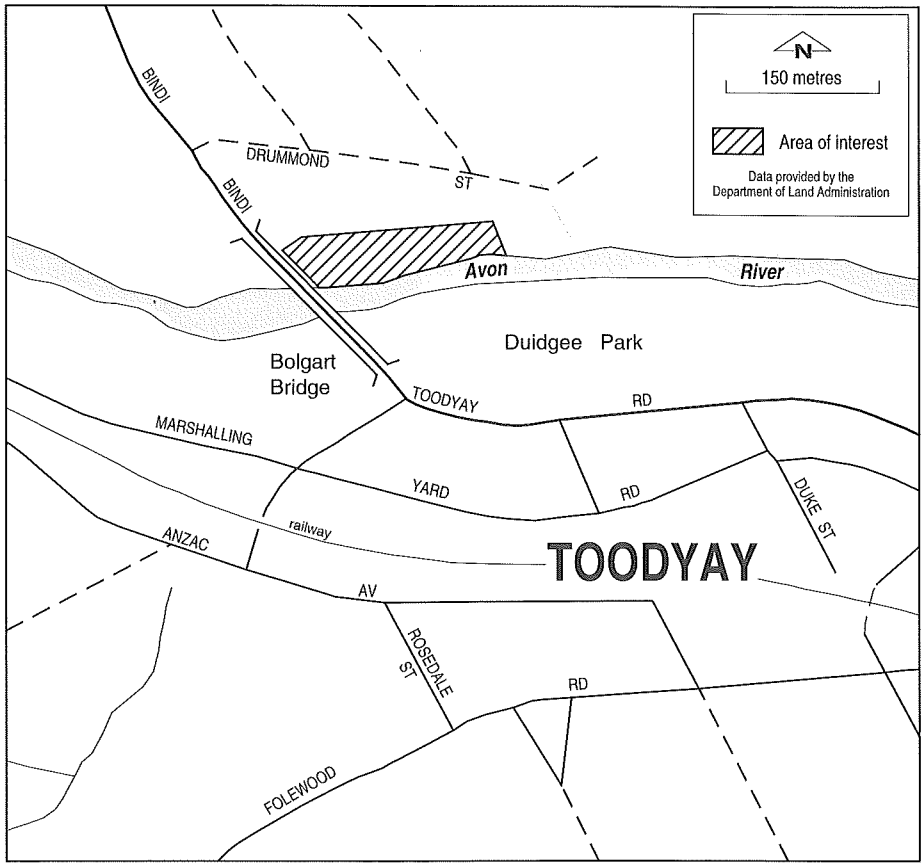
A rough estimate of costings over the seven-year period is given below, although much of this was community contribution on a volunteer basis.

6,100 hours volunteer labour @ $15/hr	$91,500.00
215 litres of Roundup Biactive @ $150/20 litres	$1,612.50
20,305 seedlings @ 65c	$13,198.25
TOTAL	$106,310.75

4.5 Outcomes

The outcomes from the work of this group have been spectacular. Nearly 6 ha of Watsonia have been removed from the banks of Jane Brook, and the dedication of the group over seven years has meant that regrowth has been controlled to the point where most areas are completely Watsonia free. Almost all other weeds have also disappeared, and the initial seedlings planted by the group are now seeding, and should become self-regenerating. Very few outside resources have been required to achieve this result, as the group have carried out all the labour of spraying, and have grown many of the plants themselves from locally collected seed, or had them provided by the Mundaring Shire. One of the important aspects for the success of the project has been the scrupulous attention to follow-up weed control by the group. They intend to keep expanding the sites they work on in the future.

5. The Avon River, Toodyay — The Friends of the River



AVON RIVER, TOODYAY LOCATION MAP

5.1 Original site description:

5.1.1 Ownership and location

The site chosen for this case study was the banks of the Avon River opposite Duidgee Park in Toodyay. The park is vested in the Shire of Toodyay, and the river itself is Crown land. The area is popular with both local people and tourists for picnics, and the riverbed is also often used by trailbikes and four wheel drive vehicles. The Friends of the River have worked on an area of the river about 500 m long by 80 m wide.

5.1.2 Remnant vegetation

Most of the Avon system has been grazed for many years, and the majority of the understorey has disappeared. The River Training Scheme of the 1950's through to the 1970's further degraded the remnant vegetation, particularly in the braided river sections, where the vegetation was almost entirely removed. The tree layer consists of Swamp Sheoak (*Casuarina obesa)*, Flooded Gum (*Eucalyptus rudis*) and Swamp Paperbark (*Melaleuca rhaphiophylla*). The herb layer comprises Seaheath (*Frankenia pauciflora*), Spiny Flat-sedge (*Cyperus gymnocaulos*) and Marine Couch (*Sporobolus virginicus*).

5.1.3 Weed species

This area of the river has an abundance of weeds, including Arum Lily (*Zantedeschia aethiopica*), Bridal Creeper (*Myrsiphyllum asparagoides*), Tamarisk (*Tamarix aphylla*), Giant Reed (*Arundo donax*) and Castor Oil Bush (*Ricinus communis*).

5.2 Rehabilitation Managers

The Friends of the River have been active in Toodyay for twelve months, supported by the Water and Rivers Commission in Northam, and the Avon River Management Authority(ARMA). The group has 34 members, and holds monthly workdays, with an average attendance of 10 people. The group's numbers have been built up by writing a monthly article for the local newspaper, and they have just started a newsletter. A sign has also been erected by ARMA at Duidgee Park, explaining what the group are doing and giving contact numbers for volunteers.

The group gave valuable input into the Avon River Recovery Plan (Section 3), which was produced in consultation with the community. The Shire of Toodyay actively support the Friends Group, carting away all the weeds removed, and ARMA have donated Roundup Biactive for their use. The members of the group have also sought private sponsorship for their projects, and Vernice Earthmoving has made a substantial donation. A local nursery has donated some of the trees for planting.

To generate interest in the river and its surrounds, the group has created a walk trail along the banks, and is planning to create a birdhide further downstream, where there is a natural pool. The aim is to promote enjoyment of the area so that people will wish to carry out further rehabilitation works, as well as maintain the restored vegetation.

5.3 Rehabilitation Works

5.3.1 Weed Control

Weed control has been the initial focus of the group, as they do not wish to revegetate until they have the bulk of the weeds under control. The Bridal Creeper has been cut and removed, and the regrowth sprayed with Roundup. The Arum Lily has also been slashed, and sprayed with Roundup, however the group have not found this to be very successful, and will be seeking other methods to control this species.

Tamarisk has been relatively easy to control, by cutting the trees with a chainsaw, and immediately painting the stump with neat Roundup. The herbicide must be applied straight after cutting, as the surface seals quickly, preventing absorption. Castor Oil Bush has been treated in a similar fashion with great success. The group has then been vigilant in pulling out the masses of Castor Oil Bush seedlings, which reappear.

Bridal creeper behind Toodyay town site (April 98)

5.3.2 Revegetation

The group planted 200 trees in 1998, collected and grown from local seed. Species used were Flooded Gum (*Eucalyptus rudis*) and Swamp Sheoak (*Casuarina obesa*). These have been well looked after, and have been watered by group members during recent dry spells. There appears to be about a 70% survival rate.

5.4 Costings

Rehabilitation of 1000sqm riverbank	
200 seedlings @ 65c	$130
Roundup Biactive 1L	$8
300 hrs labour @ $15	$4500
TOTAL	$4638

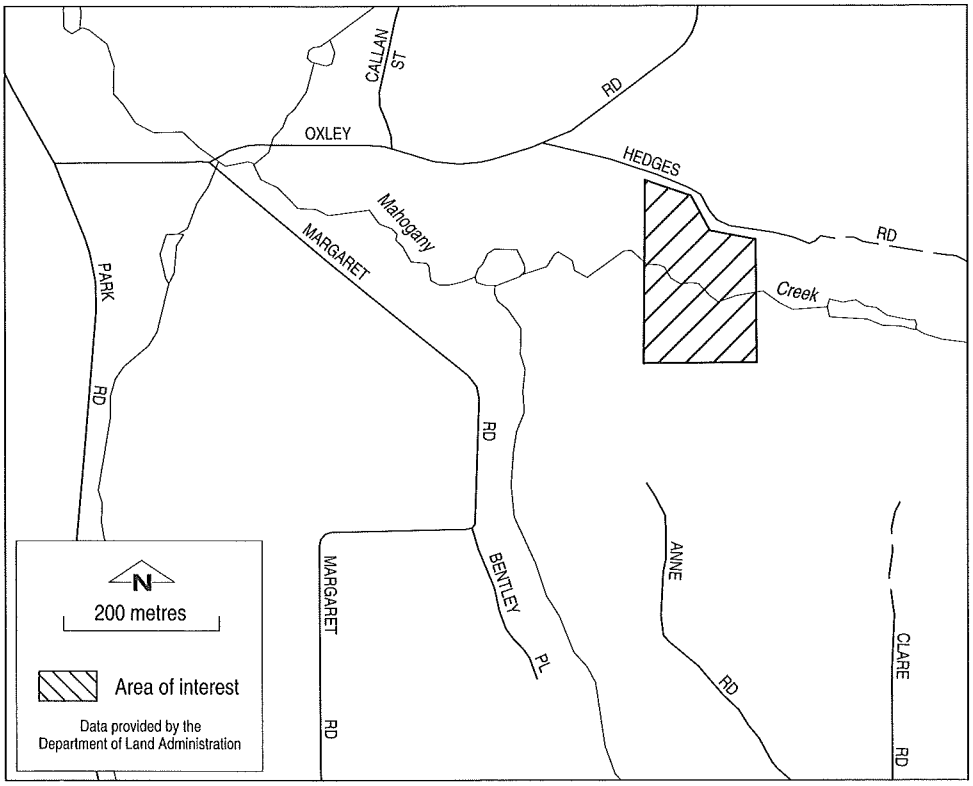
5.5 Outcomes

The Friends of the River have removed an enormous amount of weed material from the Avon. They have also generated significant interest within the town in rehabilitating the river. The group intends to continue working with the Shire of Toodyay and the Avon River Management Authority to follow-up their initial weed control, mainly by spraying regrowth with Roundup Biactive. They also intend to apply for funds to prepare a weed management plan for the area. This will prioritise areas for weed control, and give the group a three-year plan to work with.

Replanting has been successful, and further tree planting will occur as weed control is completed. It was felt that it would be ineffective to replant while there is still rapid regrowth of weed species. The group is also researching the understorey component that would have occurred at the site, and intends to try to restore that layer in future years.

Friends of the River removing giant reed (Jan 98). Diudgee Park, Toodyay.
(Photos supplied by Wayne Clarke, Friends of the river).

6. Mahogany Creek — Herbert Titelius



MAHOGANY CREEK, HOVEA LOCATION MAP

6.1 Original site description

6.1.1 Ownership and location

Mahogany Creek is one of the many small streams, which run down the Darling escarpment. It has its origins in Parkerville, and joins Jane Brook in John Forrest National Park. Much of the creek is in private ownership. The site described in this case study is part of a property owned by Darryl and Judith Williams, and is about 30m long by 20m wide.

6.1.2 Remnant vegetation

There is a considerable amount of the riparian vegetation left along the creek, and the site which was chosen for rehabilitation was surrounded by good quality bushland. The riparian vegetation consists of swamp peppermint (*Agonis linearifolia*), Astartea (*Astartea fascicularis) swishbush (Viminaria juncea*) and two species of twigrush (*Baumea juncea and Baumea vaginalis*)

6.1.3 Weed species

In the rehabilitation site the creek had divided around a small island. The island had become completely overgrown with Giant Reed (*Arundo donax*). The giant reed was leaning over the adjacent banks, and the shading had resulted in most of the native vegetation disappearing from these areas. Consequently, each winter there was further undercutting and eroding of the banks, assisted by the foraging of the large duck population. In addition, there were large infestations of bridal creeper *(Myrsiphyllum asparagoides*) which were infesting the banks.

6.2 Rehabilitation Managers

The Williams'had made a decision to remove the weeds from their section of the creek, and contracted Herbert Titelius, a bush regenerator who lives on an adjacent property. Herbert had considerable experience in restoring native bush, having worked with the Australian Trust for Volunteers and Ecojobs on many sites around Perth.

6.3 Rehabilitation Works

6.3.1 Weed Control

Herbert began by cutting the Giant Reed with a handsaw, however soon switched to a chainsaw. The cut stems were stockpiled higher up the bank near the rehabilitation site. Three to four weeks later the regrowth had reached 0.5 m, and this was sprayed with a 10% solution of Roundup Biactive in a handsprayer. The spraying was most effective when it was sprayed into the leaf nodes and on the new topgrowth. This treatment was effective in killing about 90% of the population of Giant Reed. Wiping of regrowth was carried out over the next two years, however there is still a small amount of reshooting occurring.

The Bridal Creeper was initially removed manually, and the cut material totally removed from the site. The resultant regrowth was left for one year, and then sprayed with a 1% solution of Roundup Biactive. This was effective in removing almost 80% of the weed infestation, and followup spot spraying has resulted in almost total control.

6.3.2 Revegetation

As the surrounding areas contained riparian vegetation in good condition, the area was left to regenerate naturally after the weed removal. Within twelve months the cleared area had been colonised by Swamp Peppermint, Astartea, Swishbush and Lobelia (*Lobelia alata*). The sedges did not recolonise, as the Twig Rushes do not readily reproduce from seed. The banks were also continually eroding, and the high water flows made it difficult for plants to re-establish on the edges of the stream bed.

Giant reed, dried for a minimum of 2 years, used as brush fencing to prevent erosion.
(Photo supplied by Herbert Titelius)

To counteract this, Herbert used the cut stems of the Giant Reed. He took stems which had been dried for two years (if the stems are not left for this length of time they may reshoot) and cut some into 1m lengths. In places where erosion was occurring, he forced the stems into the edges of the stream bed, until only about 50-60cm remained above the soil level. A long length of stem was then bound with twine to the top of the uprights.

The resultant 'fence' slowed the velocity of the water in areas of erosion, and silt began to deposit behind the stakes.

Initially Pale Rush (*Juncus pallidus*) was dug from nearby areas of the creek and planted behind the fence. Although they are growing well, Herbert now feels this was the wrong species to use, as this plant usually grows further back from the stream flow. Herbert then transplanted sections of River Twig Rush and Bare Twig Rush from nearby areas in late spring/summer to areas behind the fence. Care was taken when removing sections for transplant not to damage the vegetation

upstream, with small sections dug from a large number of plants. These transplants need to be done once the danger of major water flows is minimal, but before the stream bed dries too much. All transplants which were done in summer 1998 appear to be flourishing.

The natural regeneration and transplants are stabilising the island and the streambanks. Natural regeneration will continue, and Herbert intends to continue with the transplanting of sedges this summer. The fences of Giant Reed will eventually rot and disappear, but by this time it is hoped the banks will be stabilised with sedges.

6.4 Costings

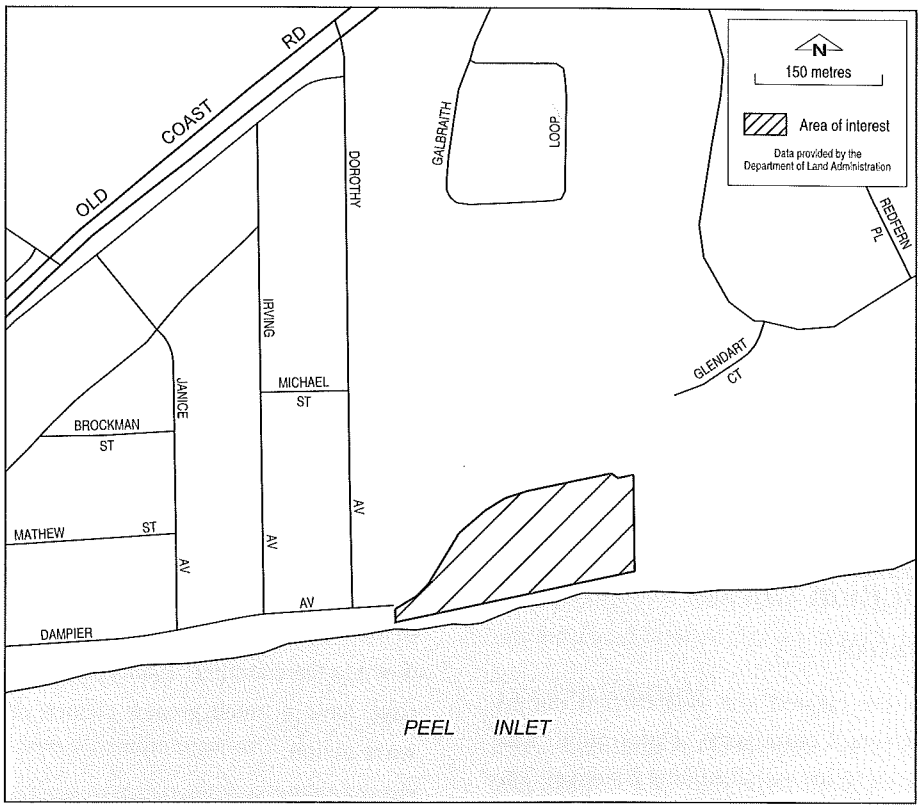
Weed control and restoration of a 600sqm area of streambank over 2 years.

Herbicide 250ml	$1.90
160 hrs labour @ $15	$2400
TOTAL	$2401.90

6.5 Outcomes

The innovative use of an on site weed to control erosion has been an outstanding success in this project. Natural regeneration has been rapid, as there is a large native seed source within the vicinity. There was also a source of sedges for transplanting, and this method is proving to be low cost and effective. The project has been running for two years, and Herbert estimates that within two more years the area will have returned to excellent condition, requiring little maintenance.

7. Dampier Ave, Peel Inlet, Mandurah — Water and Rivers Commission and the local community



DAMPIER AVENUE, MANDURAH LOCATION MAP

7.1 Original site description

7.1.1 Ownership and location

The foreshore reserve along the Peel Inlet on Dampier Avenue is vested in the City of Mandurah, and consists of a narrow 150 m foreshore reserve, backing onto a grassed parkland. The rushbeds, which would have been found along the foreshore, have virtually disappeared, and need to be replaced. The area has been recently developed, and the developers have cleared an area of 2600 m^2 adjacent to Erskine Nature Reserve at the northeastern end of Dampier Ave, which needs to be revegetated. Both areas are heavily used for recreation.

7.1.2 Remnant vegetation

The foreshore reserve has been virtually denuded of vegetation, with only isolated clumps of shore rush (*Juncus kraussii*) and knotted club rush (*Isolepis nodosa*) left along the tidal zone. The area affected by development was almost totally cleared, however it is adjacent to some remnants of estuarine vegetation in good condition.

7.1.3 Weed species

Dampier Road foreshore supports only salt tolerant couch grass (*Paspalum vaginatum*), which has covered the area above high tide mark. The cleared area is back from the foreshore strip, and contains veldt grass (*Ehrharta calycina*) and African lovegrass (*Eragrostis curvula*), as well as some Watsonia (*Watsonia bulbillifera)*

7.2 Rehabilitation Managers:

Rehabilitation works in this area have been initiated by the Water and Rivers Commission in Mandurah. They have involved local schools enrolled in the Ribbons of Blue program, local community members and have worked closely with the City of Mandurah.

Funding for project works has come from a variety of sources. The Water and Rivers Commission provided funding for the rushes and sedges, while the developer (Melpoll Pty Ltd) met the costs of revegetating the cleared area. In addition, money was obtained for trees from the Down to Earth Foundation, which provides money for environmental projects through the ANZ Charitable Trust funds. Fifty-six children from Falcon Primary School were involved in planting the two areas, supervised by the works crew from the Water and Rivers Commission over two days.

As a consequence of involving the local community, there has been very little vandalism or trampling of the plantings.

7.3 Rehabilitation Works

7.3.1 Weed Control

Weed control on the cleared site was carried out by the Water and Rivers Commission works crew, who sprayed the Watsonia twice with Roundup Biactive. The area was previously mowed, which kept the weeds down, however Veldt grass is now invading the site. A weed control program for this species will be commenced in 1999.

The Couch grass has been left untreated, as it is helping to prevent washout of the recently planted rushes and sedges. As these species reach maturity, a spray program for the grass may be initiated.

7.3.2 Revegetation

The foreshore strip was replanted with the shore rush (*Juncus kraussii*) and knotted club rush (*Isolepis nodosa*), as these species would have constituted the original shoreline community. The rushes and sedges were planted in three rows with a spacing of 30 cm, to allow for rapid coverage of the area, and the creation of a weed resistant rushbed.

The cleared area was planted with 1000 tree and shrub species found in the adjacent estuarine community.

There is a large rabbit population in the area, and the tree and shrub plantings were protected with tree guards to prevent predation. Part of the area had been filled with beach sand, and had very little organic matter to provide sustenance for the seedlings. The dead algal matter, which had accumulated along the foreshore, was buried within this sandy area, providing moisture retention and additional organic matter. The plants in this area have thrived.

Seed was collected locally, and grown by local schools or by selected nurseries. The trees were grown in tree tubes, and the rushes were provided in maxipots (100ml), with three rushes per pot. The larger size for the rushes was chosen to prevent washout of the rushes by storm events and high tides. The Water and Rivers Commission has found the best time for planting the rush and sedge species to be August/September, as these species do much of their growing over the warmer months. They have also found it better to begin planting at the high water mark, and to allow the rushes to grow down to the waterline. Plants placed closer to the water's edge have a much greater chance of being eroded by wave action.

A section of foreshore prior to revegetation.

The following species have been used in revegetation:

Acacia saligna	Golden Wreath Wattle
Allocasuarina fraseriana	Common Sheoak
Casuarina obesa	Swamp Sheoak
Jacksonia furcellata	Grey Stinkwood
Jacksonia sternbergiana	Green Stinkwood
Kunzea ericifolia	Spearwood
Melaleuca cuticularis	Saltwater Paperbark
Melaleuca rhaphiophylla	Swamp Paperbark
Melaleuca viminea	Mohan

Tree and shrub plantings in cleared area. Tree guards were used to help prevent loss to rabbits.

Rush planting on the foreshore — couch grass is being left untreated until rushes are established.

7.4 Costings

Planting of 1m x 150m foreshore reserve

1000 rushes maxipots @ $1.50	$1500
Site inspection 5hrs x $20	$100
Supervision 14hrs x $20	$280
Volunteer labour 140 hrs x $15	$2100
Follow-up site inspection 2 hrs x $20	$40
Lunch	$75
TOTAL	$4095

Planting of 2600sqm cleared foreshore area.

800 plants @ 70c	$600
Site inspection 5 hrs x $20	$100
Supervision 14 hrs x $20	$280
Volunteer labour 140 hrs x $15	$2100
Follow-up site inspection 2 hrs x $20	$40
Tree guards and stakes	$768
Lunch	$75
TOTAL	$3963

7.5 Outcomes

Both plantings at Dampier Ave have been very successful. The rush and sedge plantings have been almost 100% successful, and there has been very little vandalism or accidental trampling by the community. This is probably due to the high level of involvement of the local school children.

The Couch grass is invading the rush beds, however due to the harshness of the environment, it is not particularly vigorous, and the rushes are thriving. The intention of the Water and Rivers Commission is to strengthen the planting at Dampier Avenue by widening the rushbed to nearly 2 m wide over the area of the original planting, and to extend the plantings further down the foreshore in 1999.

The trees and shrubs planted in the cleared area have had a success rate of about 80%, with some plants crushed by four wheel drive vehicles. The remaining plants have grown well, with some nearly 1m high. The bare spaces between the plantings are beginning to accumulate weeds, with Veldt grass the main problem. Enrichment plantings are planned for future years, and weed control will need to be maintained to ensure the success of current and future plantings.