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FORESHORE ASSESSMENT IN THE CANNING CATCHMENT

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Foreshore assessment in the Canning Catchment

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Foreword

Landcare groups in Western Australia have been concerned with the protection and rehabilitation of river systems for some time. However, with such large areas to cover, and many streams being in private ownership, there is a lack of information available to many groups to assist them in making management decisions.

In 1995 Pen and Scott developed a technique for '*Stream Foreshore Assessment in Farming Areas*'.
This provided a standardised assessment technique that can be performed by groups and individual landholders themselves. It has been widely accepted and used to successfully assess many streams throughout south-west WA. As use of the technique has expanded from farm to catchment scale surveys, some users began to express a need for a modification of the methodology that would enable them to assess streams in urban and semi-rural environments, where there are a different suite of issues to be considered. In 1997 the Water and Rivers Commission obtained Natural Heritage Trust funding to assist in the development of a foreshore condition assessment methodology suitable for use in urban areas and to undertake surveys on several major tributaries of the Swan-Canning Catchment.

Nicole Siemon and Kelly Shepherd of Ecosystem Management Services (EMS), in consultation with the Water and Rivers Commission, have developed a technique for '*Foreshore Condition Assessment in Urban and Semi-rural Areas*'. The assessment technique is comprehensive yet, like that of Pen and Scott, does not require specialised knowledge or expensive technical assistance and hence assessment can be performed by groups and individuals themselves.

The methodology considers overall stream condition to be comprised of four major parameters that are independently assessed and the results are then combined to determine the overall stream condition.

Bank stability includes assessment of bank slope, erosion, slumping, sedimentation and stabilising structures.

Foreshore vegetation structure and composition, includes the use of tables with native and weed species commonly found in the region. This allows for straightforward yet comprehensive vegetation surveys looking at abundance, health and regeneration of individual species.

Stream cover recognises the importance of overhanging native vegetation and in-stream cover, and notes the abundance of native and exotic vegetation and the presence of deciduous trees.

Habitat diversity includes stream form, water quality and identifies habitat requirements for a variety of terrestrial and aquatic fauna.

Along with recording information on stream condition at the time of the survey the methodology also ensures that information is collected that will aid groups in making management decisions. This information includes disturbance factors, surrounding land use, evidence of existing management and special cultural or spiritual significance.

The condition assessment technique that has been developed has several features that are particularly important in helping groups to make their own river management decisions. The techniques:

- do not require specialised knowledge or expensive technical assistance and surveys can therefore be undertaken by individual landholders or by community groups;
- immediately provide managers with data to aid them in their decision making, especially in prioritisation of works;
- provide standardised data suitable for compilation and comparative assessment, even when using data collected by a variety of groups and individuals; and
- provide standardised data suitable for ongoing monitoring and evaluation.

The methodology has been tested on several tributaries in the Swan-Canning catchment. These tributaries have active catchment groups working on, or planning, rehabilitation works. Reaches surveyed were those identified by the catchment groups as priority areas in which they plan to be undertaking works. It is hoped that this report will assist in the long-term management of these tributaries.

Contents

Appendices

List of tables

List of maps

1. Introduction

The riparian zone adjacent to natural watercourses acts as a buffer to the surrounds. Healthy foreshore vegetation stabilises the foreshore banks, slows and filters water thus reducing erosion of the banks and sedimentation of major channels. Foreshore vegetation also provides stream cover and suitable habitats for aquatic and terrestrial animals. Often these areas are a haven for native fauna, particularly during the dry summer months.

Riparian areas have always been a focus for development and as a consequence are often highly degraded. The major threats to foreshore health are the loss of native vegetation or a decline in health due to weed invasion. The loss of deep-rooted native plants often causes the destabilization of foreshore banks, leaving these areas prone to erosion particularly during peak flow events.

Gaining an understanding of the health of river foreshores is the first step towards developing appropriate management strategies to protect and enhance these areas.

1.1 Need for this study

Community groups are becoming increasingly interested in foreshore management and are taking an active role in this process. This interest in foreshores provides opportunities to collect substantial data about waterways.

The need for a standard methodology to assess foreshore condition was recognised to ensure consistency of information gathering, in the early 1990s. Procedures for recording information on foreshore condition have been available in rural areas for a number of years (Pen and Scott 1995) however this system had limited applications in urban and semi-rural environments. Recognition of the need to modify this methodology occurred in 1997, and resulted in a funding application being developed for the Natural Heritage Trust. This successful application required the development of a standard foreshore assessment method based on the rural system (Water and Rivers Commission 1999), testing of the new methodology and developing a reporting technique for this work. Ecosystem Management Services (EMS) undertook this project on behalf of Water and Rivers Commission (WRC) and the Natural Heritage Trust (NHT).

1.2 Community involvement process

The intended audience for the foreshore assessment method is state and local government officers and the community. In order to ensure that the information included on the assessment form was relevant to these groups, and captured most of the data required, EMS and the WRC implemented a community involvement process for development of the form.

A preliminary draft of the foreshore assessment method was developed and presented to representatives from many of the catchment groups in the metropolitan area. The comments from this meeting were assimilated into the method. This second draft was then presented at a subsequent series of meetings with each catchment group, to canvas further comments. Again, suggestions recorded were collated and incorporated into the document.

Discussion was also held at the second series of meetings to determine specific areas of interest for each catchment group. Each group identified priority foreshore areas to undergo assessment, to enable further refinement of the standard method. The locations selected included areas that were already a focus or are potential sites for future rehabilitation works.

The sites nominated by groups to be surveyed were as follows:

Bennett Brook Catchment
- Bennett Brook

Upper Canning Catchment
- Bannister Creek
- Canning River
- Roley Pool
- Southernwood Creek
- Wright Brook

Ellen Brook Catchment
- Breera Brook
- Ellen Brook

As a result of time constraints and access difficulties not all of the foreshore areas that were nominated by the community groups were surveyed.

1.3 This report

This report summarises the results of the preliminary surveys conducted on the selected tributaries within the Canning River Catchment using the revised (draft) foreshore assessment method (Water and Rivers Commission 1999). These surveys were conducted to verify and refine the method. Recommended strategies for appropriate management of future works on these focus foreshore areas are also detailed in the document. Information is provided on weed control techniques, recommended native species for rehabilitation work and methods to undertake soft engineering works.

The results from the surveys conducted within the Bennett Brook Catchment and Ellen Brook Catchment have been published as separate reports (Water and Rivers Commission 1999).

2. Methodology

2.1 Site selection within tributaries

Following the community involvement process the nominated sections on the Canning and Southern-Wungong Rivers and their tributaries were assessed to determine the most appropriate areas to undertake the foreshore survey. This was based on the need to assess a complete range of foreshore health to ensure that the methodology was sufficiently balanced to cover all situations ranging from rural to urban zones.

Following is a summary of the extent of the nominated waterways within the Canning Catchment that were surveyed to assess and refine the foreshore assessment method.

Bannister Creek Catchment Group

Waterway	Extent of Survey
Bannister Creek	South of Adenia Road to Iveston Road

Upper Canning/Southern-Wungong Integrated Catchment Group

Waterway	Extent of Survey
Roley Pool	Soldiers Road to a few hundred metres upstream of the stairway at Collins Road.
Southernwood Creek	Confluence of Southern River to the entry drain near Michel Crescent.
Canning River	South of Parkside Drive to a few hundred metres upstream of Albany Highway.
Wright Brook	Confluence of Canning River with Wright Brook to a few hundred metres upstream of Turner Road.

2.2 Implementing the assessment method

The foreshore assessment survey method has been developed to enable community groups to assess the condition of foreshores in urban and semi-rural areas. For detailed information on the methodology used to assess foreshore condition refer to Water and Rivers Commission (1999).

As outlined above, this process ensures a consistent method is used to gather information. This allows the data collected from multiple surveys, conducted by various people over time, to be collated together. This accumulated information can then be used to prepare management plans and focus on priority areas for rehabilitation. The results can also be used to monitor changes over time and to compare different foreshore areas, and be shared amongst state and local government authorities and the community.

2.2.1 Undertaking foreshore surveys

Each of the foreshore areas selected were traversed prior to the survey being conducted. The foreshore was then divided into relatively homogeneous sections of similar vegetation structure and land use. A survey was conducted for each of these sections, and the condition of the foreshore parameters was calculated and the overall Stream Condition Index was determined.

In areas where foreshore vegetation was very dense on both banks, both sides were surveyed separately and a form was completed for each side. On highly degraded rivers where the foreshore along both banks was easily observed from one side, and the vegetation and disturbance factors were similar, a single survey form was completed.

Scaled baseline maps were prepared by WRC showing cadastral boundaries and the waterway. The cadastral information assists in gaining bearings out in the field. As each homogeneous section was identified, information was sketched onto the baseline maps. Other information such as the extent of vegetative overstorey along the foreshore, the location and extent of

predominant middlestorey native species and weeds and the presence of disturbance factors such as discharge pipes and infrastructure such as fences present, were detailed on each map. This ensured that each form completed for a specific section also had all relevant information marked on the correct map.

Note that the left and right side of the main channel are defined by looking upstream.

2.2.2 Environmental Parameters of Foreshore Condition

Principal environmental parameters are used as indicators of foreshore condition and are assessed during the foreshore survey to determine the overall Stream Condition Index.

These parameters are;

- Bank stability
- Foreshore vegetation
- Stream cover
- Habitat diversity

A colour coded system has been developed to summarise the condition of each of the above environmental parameters. This system allows the information to be provided in an immediately recognizable form. The status of each of the parameters are assessed and graded from Blue (Excellent) to Black (Very Poor) (Table 1) using the criteria outlined in Table 2. For example, the Bank Stability of an area is determined by assessing the level of erosion, slumping and sedimentation along the foreshore. In a pristine area where there is no discernable decline in condition, and no obvious erosion the Bank Stability may be graded as Blue. In a highly modified system where the foreshore is highly degraded and subject to severe erosion and bank collapse, Bank Stability may be graded as Red or Black. A scoring system is linked to this process to provide a quantitative method of calculating stream health.

Table 1: Colour codes and points value for ranking stream conditions

Condition	Excellent	Good	Moderate	Poor	Very Poor
Colour rating	**Blue**	**Green**	**Yellow**	**Red**	**Black**
Score	8	6	4	2	0

From: Water and Rivers Commission (1999).

Table 2: Determining summary foreshore health

	Blue - Excellent 8 points	Green - Good 6 points	Yellow - Moderate 4 points	Red - Poor 2 points	Black - Very poor 0 points
Bank Stability	No erosion, slumping or sediment deposits; dense nativevegetation cover on banks and verge; no evidence of disturbance or areas of exposed soil.	No significant erosion, slumping or sediment deposits in floodway or on lower banks; good native vegetation cover; only isolated areas of exposed soil or thinning vegetation.	Some localised erosion, slumping and sediment deposits; native vegetation cover on verges may be patchy and interspersed with patches of exposed soil.	Extensive active erosion slumping and sediment desposition particularly during peak flows; bare banks and verges common.	Almost continuous erosion; over 50% of banks slumping; sediment heaps line or fill much of the floodway; little or no vegetation cover.
Foreshore vegetation	Healthy, undisturbed native vegetation with structure intact and verges more than 20 m wide; no weed or signs of disturbance evident.	Vegetation structure dominated by native plants that comprise 80 - 100% of the total number of species; only scattered weeds or rarely evident in small clusters; nil or minor signs of disturbance (i.e: tracks, rubbish dumping).	Some changes in vegetation structure, native plants comprising of 50 - 80% of the total species composition; little regeneration of trees and shrubs; weeds occurring occassionally; moderate levels of disturbance.	Modified vegetation structure with native plants comprising only 20 - 50% of the total species composition. Trees remain with only scattered shrubs and an understorey dominated by weeds; high prevalence of disturbance.	Insufficient vegetation to control erosion; natural vegetation structure absent with occasional native trees and shrubs comprising less than 20% of the total species composition; weeds abundant; very high prevalence of disturbance and extensive areas of exposed soil.

	Blue - Excellent 8 points	Green - Good 6 points	Yellow - Moderate 4 points	Red - Poor 2 points	Black - Very poor 0 points
Stream Cover	Abundant stream cover from dense overhanging vegetation providing almost continuous shade; frequent instream cover from aquatic vegetation and/or leaf litter, rocks or logs.	Abundant shade from overhanging vegetation; occasional instream cover from patches of aquatic vegetation and isolated heaps of leaf litter or rocks and logs.	Scattered fringing vegetation with occasional patches of shade; infrequent instream cover with little aquatic vegetation, very infrequent rocks and logs.	Stream channel mainly clear; fringing vegetation almost absent providing very little permanent shade; instream cover almost absent with generally no instream vegetation and very infrequent rocks and logs.	Zero or minimal stream cover with no permanently shaded areas and no instream cover.
Habitat Diversity	Excellent water quality with permanent water (i.e: pools and creeks); three or more aquatic and terrestrial habitats including diverse vegetation types, edge waters, instream cascades, riffles, pools and woody debris.	Good water quality and some permanent water; at least three aquatic habitat types; at least one habitat type for terrestrial invertebrates; at least one habitat type for each terrestrial vertebrate category (frogs, reptiles and birds).	No apparent problems with water quality (i.e: muddy or cloudy in winter); at least two aquatic habitat types; at least one habitat type for terrestrial invertebrates; at least one habitat type for any two of the terrestrial vertebrate categories.	Possible seasonal problems with water quality and no permanent water; at least one aquatic habitat type; at least one habitat type for terrestrial invertebrates; at least one habitat type for one of the terrestrial vertebrates.	Poor water quality; almost no healthy habitats available for aquatic and terrestrial organisms.

The Stream Condition Index is a summary of the foreshore environmental parameters (Table 3) and is an indication of the overall stream condition.

Table 3: Summary of Stream Condition Index

Colour Code	Parameter Rating	Description
Blue (32 points)	**Excellent**	All parameters blue.
Green (22-30 points)	**Good**	Three to four parameters rated green or better with only one parameter rated yellow; no red or black ratings.
Yellow (14-20 points)	**Moderate**	Three parameters rated yellow or better with no more than one red; no black
Red (6-12 points)	**Poor**	Two or three parameters rated red with no more than one black.
Black (0-4 points)	**Very Poor**	Two or more parameters rated black.

2.2.3 Collating the results

The results compiled from the foreshore surveys of the selected sites on the Canning and Southern-Wungong Rivers and their tributaries were collected and a series of maps produced. These maps were digitised to enable presentation of the foreshore information in a visual format with corresponding text.

The summary codes of the condition of each environmental parameters and the Stream Condition Index are included on the summary map for each site.

This report contains a detailed description of the key findings of the four environmental parameters assessed for each survey section within the nominated survey sites. The recommended strategies for appropriate remedial works are discussed for each section.

3. Key findings for the Upper Canning catchment

The Canning and Southern Wungong Rivers and their tributaries flow through areas with both urban and semi-rural landuse. Along many sites the overstorey is completely absent or present for a few metres only on either side of the main channel. This frequently occurs where residential housing extends almost to the edge of the watercourse, or alternatively where stock have access to the riparian zone. The lack of healthy foreshore vegetation often leads to a decrease in bank stability, stream cover and habitat diversity.

3.1 Bank stability

Bank stability is determined by the extent of erosion and slumping occurring along foreshore banks and the level of sedimentation within stream channels. Erosion is evident at almost all sites, generally at low to moderate levels.

Localised disturbance frequently occurs along steep banks near the entry points of drainage channels or near outflow points of discharge pipes. Erosion also increases where infrastructure works have been undertaken for example near crossovers and bridges.

The impact of a decrease in the extent of dense emergent species along most of the foreshores surveyed is evidenced by increased erosion, particularly near the base of trees that grow immediately along the banks. As the soil is scoured away, roots are exposed and trees are less supported. Subsequently, there is an increased likelihood of trees collapsing and exacerbating the erosion problem.

Bank stability ranges from Yellow (Moderate) to Black (Very Poor) along the selected foreshore areas within the Canning River Catchment. There are a number of areas that are prone to severe erosion due to a lack of foreshore vegetation and the consequent decline in bank stability. For example severe erosion is occurring along much of Wright Brook and is particularly evident at Section C/Map 2 where the surrounding vegetation is reduced to a few trees and an understorey of maintained grass (lawn).

There is little evidence of severe bank collapse along the surveyed foreshore areas. Artificial stabilization structures have been utilised in some areas for example along Bannister Creek (Section A/Map 1). Recommended strategies include the use of geotextile matting to support areas cleared of weeds prior to planting native species to minimise the effect of further destabilizing foreshore banks (Appendix 4).

Sedimentation levels vary along the main channels of the surveyed watercourses. Significant levels of sedimentation and increasing particle load in the water column are indicative of erosion occurring further upstream. This highlights the need to understand processes occurring upstream of any waterway and demonstrates that no site can be considered in isolation.

3.2 Vegetation

The species composition of foreshore vegetation and the level of weed invasion are major indicators of stream health.

The foreshore vegetation ranges from Black (Very Poor) to Red (Poor) along all of the survey sites. The overstorey is often reduced to a few metres either side of the main waterway channel. Where the overstorey persists Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) predominate. Other less common tree species include Modong (*Melaleuca preissiana*) and Marri (*Corymbia calophylla*) which often occur on drier soils.

Native shrubs are generally infrequent in the middlestorey and usually present in areas where there is an extensive and relatively healthy overstorey as seen at Roley Pool. The native shrubs often persist in low numbers away from the immediate foreshore as they are typically excluded by dense stands of weeds such as Watsonia (*Watsonia bulbillifera*) or Blackberry (*Rubus fruticosus*) which dominate these areas.

Species present at a number of the survey sites include Swamp peppermint (*Agonis linearifolia*), Coojong (*Acacia saligna*), Narrow leaved oxylobium (*Oxylobium lineare*), Prickly moses (*Acacia pulchella*), Swishbush (*Viminaria juncea*) and Blackboy (*Xanthorrhoea preissii*) (Appendix 1A).

There are very few native understorey species occurring along foreshore areas. Ground creepers such as Running postman (*Kennedia prostrata*) and Native wisteria (*Hardenbergia comptoniana*) are present infrequently. Native sedges and rushes such as the Pale rush (*Juncus pallidus*) occur in clumps along the foreshore channels and in low-lying damp areas. The small herb Centella (*Centella cordifolia*) persists often in highly weed-infested areas.

Exotic deciduous trees such as Fig (*Ficus* spp.), Willow (*Salix* spp.), Japanese pepper (*Schinus terebinthifolia*) and the Coral Tree (*Erythrina x sykesii*) are common along these degraded foreshore areas. Many introduced tree species have established along Canning River (Section E and F/Map 7 and 8) and the upper reaches of Wright Brook (Section I/Map 8). These trees were originally planted as ornamentals or have escaped from nearby gardens. Deciduous trees threaten foreshore health as sudden leaf fall during winter decreases available stream cover and often introduces large amounts of vegetative material into the water column. The breakdown of large amounts of soft leaves may cause a sudden decline in the amount of available oxygen in the water column affecting instream organisms.

The control and removal of exotic trees is often difficult as species such as Willow produce numerous suckers. These trees often grow in areas with limited foreshore cover and the removal of these large trees may threaten bank stability.

Weeds in the middlestorey often form dense stands in clumps or in narrow strips along the edge of the watercourse. The most common species frequently present in dense stands include Blackberry (*Rubus fruticosus*), Watsonia (*Watsonia bulbillifera*) and the Giant reed (*Arundo donax*). Arum lily (*Zantedeschia aethiopica*) is often present in high numbers along foreshore areas and in low lying winter wet depressions in the floodplain. Other weed species that are present at a number of the survey sites but generally in low numbers include Castor oil (*Ricinus communis*), Deadly nightshade (*Solanum nigrum*) and Cotton bush (*Gomphocarpus fruticosus*) (Appendix 1B).

The greatest threat to revegetation is the presence of dominant understorey weeds including grasses such as Kikuyu (*Pennisetum clandestinum*), Couch (*Cynodon dactylon*), Perennial veldt grass (*Ehrharta calycina*), African lovegrass (*Eragrostis curvula*) and Wild oats (*Avena fatua*). Frequent annual weeds include Soursob (*Oxalis pes-caprae*), Whiteflower fumitory (*Fumaria capreolata*) and Fleabane (*Conyza* spp.). The introduced rush *Juncus microcephalus* occurs along foreshore banks and within low lying flooded areas. Creepers such as Bridal creeper (*Myrsiphyllum asparagoides*) and less frequently Morning glory (*Ipomoea* spp.) are present in a number of weed dominated foreshore areas (Appendix 1B).

The aquatic weed Watercress (*Rorrippa nasturtium-aquaticum*) is present in the main channel at a number of the survey sites.

3.3 Stream cover

The level of overhanging vegetation and the abundance of native and exotic species along the foreshore determines the level of cover and permanent shade along a waterway. Instream submerged and emergent vegetation and the presence of rocks and logs also provide cover for aquatic organisms.

Stream Cover along sections of Bannister Creek (Section B/Map 1) and Canning River (Section C/Map 3) were graded as Yellow (Moderate) even though the Foreshore vegetation along these sites was scored as Red (Poor). These areas have a high score for Stream Cover due to the presence of dense stands of weeds such as Watsonia (*Watsonia bulbillifera*) or Blackberry (*Rubus fruticosus*) that overhang the waterway and provide patches of permanent shade.

Sections along Wright Brook (Section C/Map 2 and Section I/Map 8) and the Canning River (Section F/Maps 8 and 9 or Section G/Map 10), were graded as Red (Poor) or Black (Very Poor). These areas are highly modified and the absence of dense overstorey trees and the predominance of small weeds in the understorey minimise the amount of available stream cover at these sites.

The presence of large numbers of exotic trees in the overstorey also minimises available cover as a number of the most prevalent species e.g. Fig, Willows and Coral trees are deciduous, dropping their leaves in autumn.

3.4 Habitat diversity

Instream habitat diversity is affected by the quality and permanency of water and by the presence of instream rocks, submerged and emergent vegetation and logs. These features provide substrates for attachment for aquatic invertebrates, cover for fish and potential basking sites for turtles. Healthy, diverse streamside vegetation provides suitable habitats for terrestrial organisms and overstorey trees provide roosting and nesting sites for birds.

Many of the survey sites assessed were scored as having either Red (Poor) or Black (Very Poor) Habitat Diversity. Water flow in sites such as Wright Brook (Section C/Map 2) is seasonal and therefore unable to support aquatic organisms throughout the year. Frequently streams are narrow and shallow and are generally not suitable for fish and turtles.

The frequent lack of healthy, diverse native vegetation often limits the number of suitable habitats available for terrestrial animals.

3.5 Overall summary conditions for all surveyed sites

The overall summary conditions of the foreshore sections surveyed for each of the tributaries is provided below.

3.5.1 Summary results for Bannister Creek (Lower Canning River Catchment)

Bannister Creek (Section A)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Red	Red	**Red**
Moderate	Poor	Poor	Poor	**Poor**
4	2	2	2	**10**

Bannister Creek (Section B)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Yellow	Red	**Red**
Moderate	Poor	Moderate	Poor	**Poor**
4	2	4	2	**12**

Bannister Creek (Section C)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Red	Black	Black	Black	**Black**
Poor	Very Poor	Very Poor	Very Poor	**Very Poor**
2	0	0	0	**2**

Bannister Creek (Section D)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Red	Red	**Red**
Moderate	Poor	Poor	Poor	**Poor**
4	2	2	2	**10**

Bannister Creek (Section E)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Red	Red	**Red**
Moderate	Poor	Poor	Poor	**Poor**
4	2	2	2	**10**

3.5.2 Summary results for Canning River (Upper Canning River Catchment)

Canning River (Section A)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Red	Red	**Red**
Moderate	Poor	Poor	Poor	**Poor**
4	2	2	2	**10**

Canning River (Section B)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Yellow	Red	**Red**
Moderate	Poor	Moderate	Poor	**Poor**
4	2	4	2	**12**

Canning River (Section C)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Yellow	Red	**Red**
Moderate	Poor	Moderate	Poor	**Poor**
4	2	4	2	**12**

Canning River (Section D)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Red	Red	**Red**
Moderate	Poor	Poor	Poor	**Poor**
4	2	2	2	**10**

Canning River (Section E)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Red	Red	Red	Red	**Red**
Poor	Poor	Poor	Poor	**Poor**
2	2	2	2	**8**

Canning River (Section F)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Red	Black	Red	Red	**Red**
Poor	Very Poor	Poor	Poor	**Poor**
2	0	2	2	**6**

Canning River (Section G)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Black	Black	Black	**Black**
Moderate	Very Poor	Very Poor	Very Poor	**Very Poor**
4	0	0	0	**4**

3.5.3 Summary results for Roley Pool (Upper Canning River Catchment)

Roley Pool (Section A)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Yellow	Green	**Yellow**
Moderate	Poor	Moderate	Good	**Moderate**
4	2	4	6	**16**

Roley Pool (Section B)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Green
Moderate	Poor	Moderate	Good
4	2	4	6

Stream Condition
Yellow
Moderate
16

3.5.4 Summary results for Southernwood Creek (Southern River Catchment)

Southernwood Creek (Section A)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Black	Black	Black
Moderate	Very Poor	Very Poor	Very Poor
4	0	0	0

Stream Condition
Black
Very Poor
4

Southern River (Section B)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

3.5.5 Summary results for Wright Brook (Upper Canning River)

Canning River upstream of Wright Brook confluence (Section A)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Canning River downstream of Wright Brook confluence (Section B)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Red	Red	Red	Red	**Red**
Poor	Poor	Poor	Poor	**Poor**
2	2	2	2	**8**

Wright Brook (Section C)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Black	Black	Black	Black	**Black**
Very Poor	Very Poor	Very Poor	Very Poor	**Very Poor**
0	0	0	0	0

Wright Brook (Section D)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Red	Red	Yellow	Red	**Red**
Poor	Poor	Moderate	Poor	**Poor**
2	2	4	2	**10**

Wright Brook (Section E)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Red	Red	Yellow	Red	**Red**
Poor	Poor	Moderate	Poor	**Poor**
2	2	4	2	**10**

Wright Brook (Section F)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Red	Yellow	Red	**Red**
Moderate	Poor	Moderate	Poor	**Poor**
4	2	4	2	**12**

Wright Brook (Section G)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Red	Red	Yellow	Red	**Red**
Poor	Poor	Moderate	Poor	**Poor**
2	2	4	2	**10**

Wright Brook (Section H)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Red	Red	Yellow	Red	**Red**
Poor	Poor	Moderate	Poor	**Poor**
2	2	4	2	**10**

Wright Brook (Section I)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Black	Black	Black	**Black**
Moderate	Very Poor	Very Poor	Very Poor	**Very Poor**
4	0	0	0	**4**

4. Specific site reports

4.1 Bannister Creek

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Bannister Creek — Map 1 (Section A) Right Bank

Length of section (m): approximately 465 m

Recorder's name: Kelly Shepherd and Nicole Siemon

Date surveyed: 8/8/98

Nearest road access: South of Adenia Road, north of Hybanthus Road

Lot numbers: 767, 768, 769, 749, 748, 710, 296, 649, 648, 13, 14, 645, 644, 643, 642, 10

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Description

Bank stability: The main creek channel is 2 - 3 m wide with the foreshore bank rising to a height of 1 - 1.5 m. Low lying winter wet depressions occur within 10 - 15 m of the main channel. Dredging has occurred in the past and the soil has been dumped on the right bank increasing the height compared to the left bank. This area is currently undergoing rehabilitation. Isolated areas of erosion occur along 0 - 5% of the foreshore area near the base of trees growing immediately along the bank. Other points of erosion occur near the discharge pipe immediately preceding the Hybanthus Road crossover. There is little evidence of slumping along the foreshore. Some areas of sedimentation occur along 0 - 5% of the foreshore where the river meanders. Areas of artificial bank stabilization using erosion control fabrics are present.

Vegetation: The overstorey vegetation is narrow (< 20 m wide), continuous (> 80% cover) and is comprised of Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) with evidence of tree regeneration. The middlestorey layer is sparse (< 20% cover) with very occasional Grey stinkwood (*Jacksonia furcellata*) and Green stinkwood (*Jacksonia sternbergiana*) shrubs present.

Recommended Strategies

- Assess the effectiveness of artificial bank stabilization and continue weed control and revegetation works in these zones to further stabilise the foreshore area.
- Assess current peak water loads to Bannister Creek and maximum loads anticipated following establishment of new subdivisions within the Catchment.
- Select future revegetation sites based on the anticipated water levels to minimise the risk of planted seedlings being washed away during peak flows.
- Plant emergent species immediately upstream of trees suffering erosion to slow water movement. Use 600 mm "U" shaped steel pegs to stake the plants into the channel bed.

- Continue intensive weed control program, focusing on maintaining areas where previous work has been undertaken.
- Reinforce native component of middlestorey and understorey, particularly along the banks and within seasonally inundated swales using species recommended in Appendix 3.

The understorey is patchy (20 - 80% cover) with extensive areas undergoing revegetation. Native species that have been planted include *Astartea fascicularis*, Winged acacia (*Acacia alata*), *Regelia ciliata* and the ground creeper Running postman (*Kennedia prostrata*). Rushes and sedges that have been planted on the foreshore bank or immediately within the creek channel include Lake club rush (*Schoenoplectus validus*), Pale rush (*Juncus pallidus*) and Tufted sedge (*Isolepis setiformis*). Weed species present include Soursob (*Oxalis pes-caprae*) and other annual flatweed species.	• Focus on establishment of deeply rooted native species such as Pale rush, *Kunzea micrantha* and overstorey *Melaleuca* species on channel banks to increase the level of stability.
Stream Cover: There is little overhanging vegetation present along the foreshore bank providing no permanent shade. There is little evidence of instream cover present as branches and instream vegetation and detritus occur very infrequently.	• Increase the number and extent of trees along the foreshore bank including Swamp paperbark, Modong and Flooded gum. • Liaise with Water Corporation to obtain agreement to leave branches and vegetation within creek where it does not exacerbate erosion along the foreshore banks.
Habitat diversity: There is permanent water flowing in the creek. The water colour is brown due to the presence of tannins. Some suspended solids are also present in the water column. The river channel varies in depth from 0.2 - > 1m. There are very few scattered instream logs and pools providing very few potential habitat sites for aquatic invertebrates, fish and turtles. The limited amount of scattered streamside bark and leaf litter limits habitats for terrestrial invertebrates and reptiles. Trees provide nesting and roosting sites for birds.	• Liaise with Water Corporation and Water and Rivers Commission to monitor water quality. • Implement draft Bannister Creek Reserve Management Plan recommendations to improve water quality. • Increase establishment of native vegetation to improve cover along stream banks. • Liaise with Water Corporation to obtain agreement to leave branches and vegetation within creek where it does not represent a threat to bank stability.
Other issues: The presence of a woodchip pathway along the immediate foreshore may pose a threat to revegetation works as people use this path as a walk trail. Some hydrological disturbance is evident near the outflow points of the discharge pipe.	• Define access tracks including the dual use pathways throughout reserve in accordance with the suggestions outlined in the draft Bannister Creek Reserve Management Plan. • Protect any plants established adjacent to pathways and stake to reduce trampling. • Assess and develop stormwater drainage and develop treatments to reduce their impact. • Develop signage to increase community awareness of the value of revegetation works undertaken by the Bannister Creek Catchment Group.

Bannister Creek — Map 1 (Section B) Left Bank

Length of section (m): approximately 465 m

Recorder's name: Kelly Shepherd and Nicole Siemon

Date surveyed: 8/8/98

Nearest road access: South of Adenia Road, north of Hybanthus Road

Lot numbers: 287, 286, 285, 284, 283, 282, 281, 280, 279, 278, 277, 276, 275, 274, 273, 272, 271, 270, 269, 268

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Description

Bank stability: The main creek channel is 2 - 3 m wide. The left bank is lower than the right bank and rises to a height of < 1 m. Localised areas of erosion occur along 5 - 20% of the foreshore bank particularly near the base of trees growing immediately along the foreshore. Evidence of slumping and bank collapse was not observed along the foreshore area. Sedimentation is occurring along 0 - 5% of the river channel accumulating along the inside bends of the river meanders.

Vegetation: The overstorey vegetation is continuous (> 80% cover) and extends approximately 30 - 80 m from the main channel. Predominant tree species include abundant Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) and occasional Marri (*Corymbia calophylla*) and Modong (*Melaleuca preissiana*). Occasional exotic tree species include deciduous Fig trees (*Ficus* sp.) and the Japanese pepper (*Schinus terebinthifolia*). There is evidence of tree seedling regeneration. The middlestorey is patchy (20 - 80% cover) with occasional native species such as Grey stinkwood (*Jacksonia furcellata*) and Green stinkwood (*Jacksonia sternbergiana*) present. Other species occurring very infrequently include Swishbush

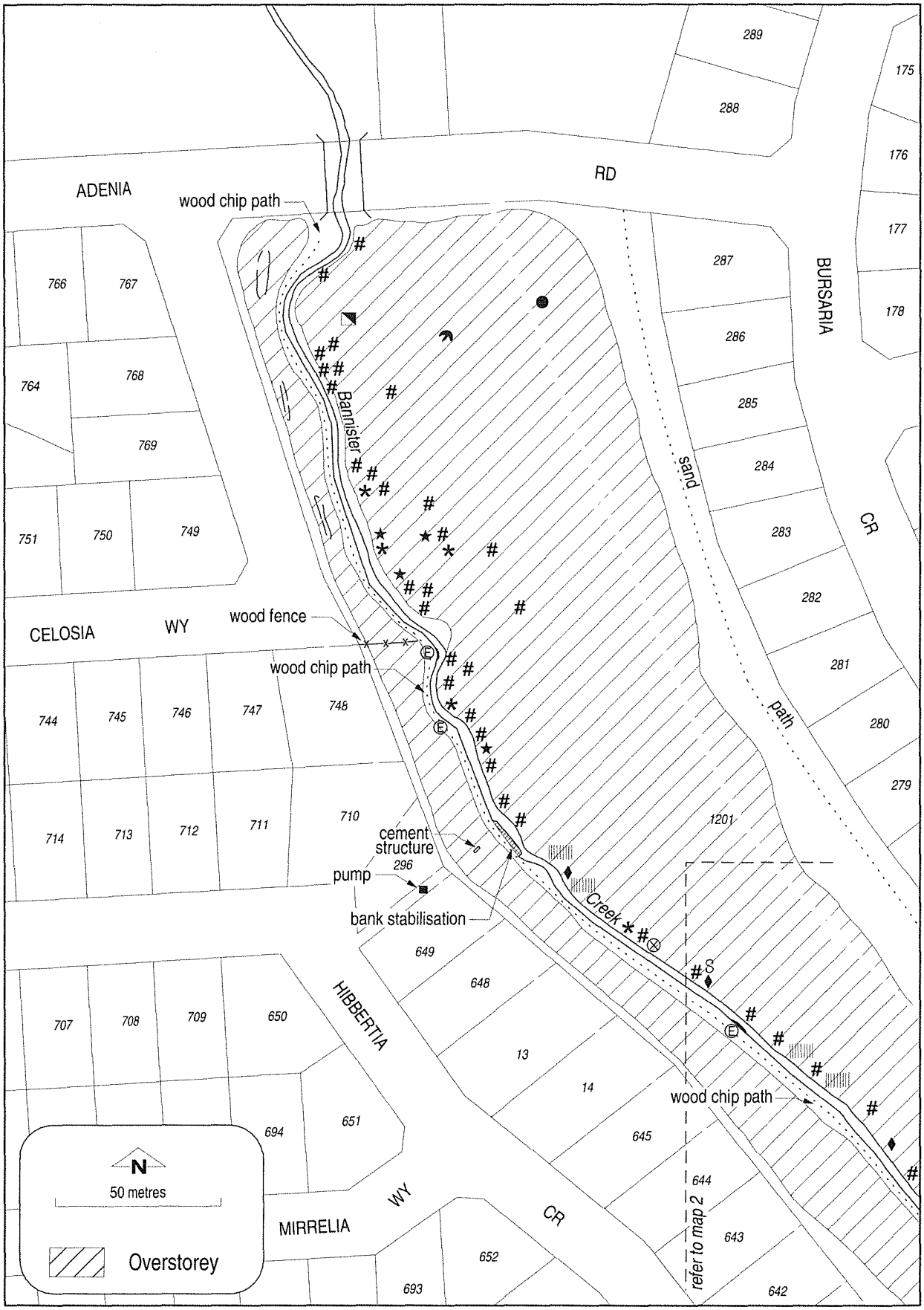
Recommended Strategies

- Monitor maximum water loads during peak flows to ensure that future sites selected for rehabilitation will not be washed away during storm events.
- Plant emergent native rushes and sedges within the creekline to slow water movement and minimise erosion around the base of trees growing along the foreshore banks. Use 600 mm "U" shaped steel pegs to stake the plants into the channel bed.
- Focus on establishment of deeply rooted species such as Pale rush, *Kunzea micrantha* and overstorey *Melaleuca* species on channel banks to increase bank stability.

- Continue intensive weed control and revegetation program, with a focus on sustaining level of weed control in areas where previous work has been undertaken. Ensure that weed control activities do not threaten bank stability.
- Monitor regeneration of both native and weed species following weed control activities and spot treat any weed infestation when the plants are small and readily managed.
- Reinforce native middlestorey and understorey component using species listed in Appendix 3. Plant in extremely high densities to minimise the level of re-invasion of weeds and germination of the weed seedbed.

(*Viminaria juncea*), Narrow-leafed oxylobium (*Oxylobium lineare*) and the Swamp peppermint (*Agonis linearifolia*). Common middlestorey weed species include Blackberry (*Rubus fruticosus*) and Arum lily (*Zantedeschia aethiopica*). Introduced species that occur occasionally include Deadly nightshade (*Solanum nigrum*), Castor oil (*Ricinus communis*), Pampas grass (*Cortaderia selloana*), Giant reed (*Arundo donax*) and Bulrush (*Typha orientalis*). The understorey is continuous (> 80% cover) and is dominated by weed species except for the occasional Running postman (*Kennedia prostrata*) ground creeper. Common understorey weed species include Fleabane (*Conyza* sp.), *Cyperus* sp., Fat hen (*Chenopodium album*), Perennial veldtgrass (*Ehrharta calycina*) and creepers such as Morning glory (*Ipomoea* sp.) and Bridal creeper (*Myrsiphyllum asparagoides*). Further from the main channel, annual and perennial grasses predominate. Isolated pockets of weed control have been undertaken.	• Inject herbicide into Japanese pepper and Poplars at 10 cm intervals around the truck in spring. Monitor and poison any re-growth from suckers. Remove when dead. • Control introduced grass species to minimise the fire hazard in the dryland areas of the reserve. • Maintain a buffer adjacent to the streamline until instant replacement of native plants following weed removal is possible. Alternatively clear in nodes along the foreshore and use stabilization methods to ensure bank stability while planted seedlings establish.
Stream Cover: There is frequent overhanging vegetation present along the foreshore bank from overstorey trees and dense stands of Blackberry (*Rubus fruticosus*) providing areas of permanent shade. There is little evidence of instream cover present as branches and instream vegetation and detritus occurs very infrequently.	• Maintain continuous tracts of vegetation through reserves to provide shelter and a corridor for fauna passage. • Remove Blackberry in sections and replace immediately with dense plantings of understorey rushes to reduce the level of re-invasion, provide instream cover and ensure bank stabilization.
Habitat diversity: There is permanent water flowing in the creek. The water colour is brown due to the presence of tannins leached from vegetation detritus. Some suspended solids are also present in the water column. The river channel varies in depth from 0.2 - > 1m. There are very few scattered instream logs and pools providing little adequate habitat for aquatic invertebrates, fish and turtles. The presence of bark and leaf litter on the stream bank and patches of dense vegetation may provide some habitats for terrestrial invertebrates and reptiles. The dense stands of vegetation may also provide suitable habitats for frogs. Trees and stands of reeds may provide nesting and roosting sites for birds.	• Liaise with Water Corporation and Water and Rivers Commission to monitor water quality. • Implement Draft Bannister Creek Reserve Management Plan recommendations to improve water quality. • Liaise with Water Corporation to obtain agreement to leave branches and vegetation within creek where it does not represent a threat to bank stability. • Increase vegetation establishment after weed control to improve cover on stream banks.

Other issues: A sandy track runs along the edge of the reserve adjacent to housing providing a service corridor for fire control and maintenance. Lawn clippings and rubbish are evident in the area.	• Stabilise the sand track adjacent to the housing area by mulching. • Increase awareness amongst local residents about the impacts of dumping lawn clippings, garden refuse and general waste on the reserve.



Bannister Creek Map 1

Bannister Brook — Map 2 (Section A) Right Bank

Length of section (m): approximately 465 m

Recorder's name: Kelly Shepherd and Nicole Siemon

Date surveyed: 8/8/98

Nearest road access: South of Adenia Road, north of Hybanthus Road

Lot numbers: 767, 768, 769, 749, 748, 710, 296, 649, 648, 13, 14, 645, 644, 643, 642, 10

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Refer to previous description and recommended strategies for Section A (Map 1)

Bannister Creek — Map 2 (Section B) Left Bank

Length of section (m): approximately 465 m

Recorder's name: Kelly Shepherd and Nicole Siemon

Date surveyed: 8/8/98

Nearest road access: South of Adenia Road, north of Hybanthus Road

Lot numbers: 287, 286, 285, 284, 283, 282, 281, 280, 279, 278, 277, 276, 275, 274, 273, 272, 271, 270, 269, 268

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Refer to previous description and recommended strategies for Section B (Map 1)

Bannister Creek — Map 2 (Section C) Right Bank

Length of section (m): approximately 810 m

Recorder's name: Kelly Shepherd

Date surveyed: 10/8/98

Nearest road access: South of Hybanthus Road, north of Iveston Road

Lot numbers: 4, 2, 2575, 2630

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Black	Black	Black
Poor	Very Poor	Very Poor	Very Poor
2	0	0	0

Stream Condition
Black
Very Poor
2

Description

Bank stability: The main creek channel is 2 - 3 m wide with the foreshore bank rising to a height of 1 - 2 m. Due to dredging of the channel in the past, sections immediately adjacent to the foreshore bank rise an additional 1 - 2 m in height. Areas of erosion occur along 5 - 20% of the foreshore bank, particularly on outer bends of river meanders. Small sections of the foreshore bank have been stabilised using wooden planks to prevent further erosion and slumping. Some areas of sedimentation occur within the creekline.

Vegetation: The vegetation along this section of Bannister Creek is completely modified, with maintained grass lawns running along the length of the foreshore area. The overstorey is reduced to small isolated stands a few metres wide with single Swamp paperbark (*Melaleuca rhaphiophylla*), Flooded gum (*Eucalyptus rudis*), Marri (*Corymbia calophylla*) or Modong (*Melaleuca preissiana*) trees present. The

Recommended Strategies

- Assess the effectiveness of artificial bank stabilization and continue revegetation works in these zones. Modify structures if required.
- Assess current peak water loads to Bannister Creek and maximum loads anticipated following establishment of new subdivisions within the Catchment. Determine if new flow regimes have an adverse affect on bed and bank stability
- Plant emergent native sedges and rushes immediately upstream of trees growing along foreshore banks to slow water movement and minimise erosion around tree bases. Use 600 mm "U" shaped steel pegs to stake the plants into the channel bed.
- Accept erosion on outer bends of river meanders as a natural process.

- Monitor the level of recreational use of this section of the park.
- Undertake, if possible, revegetation works along the creekline establishing a buffer at least 15 m wide along the edge of the foreshore banks. Define the edge of the rehabilitation works by linking with existing walkways.

middlestorey is completely absent with the exception of the occasional weed species associated with the small stands of trees. There weeds include species such as Arum lily (*Zantedeschia aethiopica*) and Cyperus (*Cyperus involucratum*). The understorey is comprised of maintained perennial grasses with very infrequent weeds such as Perennial veldtgrass (*Ehrharta calycina*) and Vetch (*Vicia sativa*) present on the edge of the lawn areas.	• Eradicate grass by scalping and revegetate using understorey, middlestorey and overstorey species (Appendix 3). • Plant trees within the parkland using well-developed trees greater than 1.5 m in height for an immediate effect. • Implement weed control activities, including maintenance of the newly created buffer zone (Appendix 2).
Stream Cover: There is no overhanging vegetation to provide stream cover along this side of the foreshore. There is little evidence of instream cover present as branches and instream vegetation and detritus occur very infrequently.	• Plant clumps of dense understorey to high water mark to provide stream cover and increase habitat diversity.
Habitat diversity: There is permanent water flowing in the creek. The water colour is brown due to the presence of tannins leached from vegetation detritus. Some suspended solids are also present in the water column. The river channel varies in depth from 0.2 - > 1 m. There are no deep pools providing little adequate habitat sites for aquatic invertebrates, fish and turtles due to increased sedimentation within the river. There are a few rocks within the creek channel providing small riffle zones that may be suitable for aquatic invertebrates. Streamside bark, leaf litter and vegetation is completely absent and there are only occasional trees available as nesting and roosting sites for birds.	• Liaise with Water Corporation and Water and Rivers Commission to monitor water quality. • Implement draft Bannister Creek Reserve Management Plan recommendations to improve water quality. • Liaise with Water Corporation to obtain agreement to leave branches and vegetation within creek where it does not represent a threat to bank stability. • Increase vegetation establishment to improve cover on stream banks.
Other issues: This is a high use recreational area with open lawns, established walkways and a Gazebo. Also discharge pipes increase potential for erosion damage and hydrological disturbance.	• Assess level of recreational use and main activities undertaken in park. • Determine practicality of establishing dense, low vegetation immediately adjacent to the Creek with a clearly defined barrier between lawn and revegetation zones. • Assess the need for information signs about the reserve, the Creek and the works being undertaken to improve the level of awareness within the community.

Bannister Creek — Map 2 (Section D) Left Bank

Length of section (m): approximately 400 m

Recorder's name: Kelly Shepherd

Date surveyed: 10/8/98

Nearest road access: South of Hybanthus Road, north of Metcalfe Road

Lot numbers: 32, 34, 1

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Description

Bank stability: The main creek channel is 2 - 3 m wide with medium grade foreshore bank rising to a height of 1 m. Isolated erosion points (< 5% of the foreshore bank) are evident along outer edge of creek meanders with no evidence of severe slumping or bank collapse. Sedimentation is evident along 5 - 20% of the main channel. Low lying winter wet depressions and small braided creeks adjacent to the main channel are evident in the floodplain. During peak flow periods erosion increases along these areas due to the increased water flow.

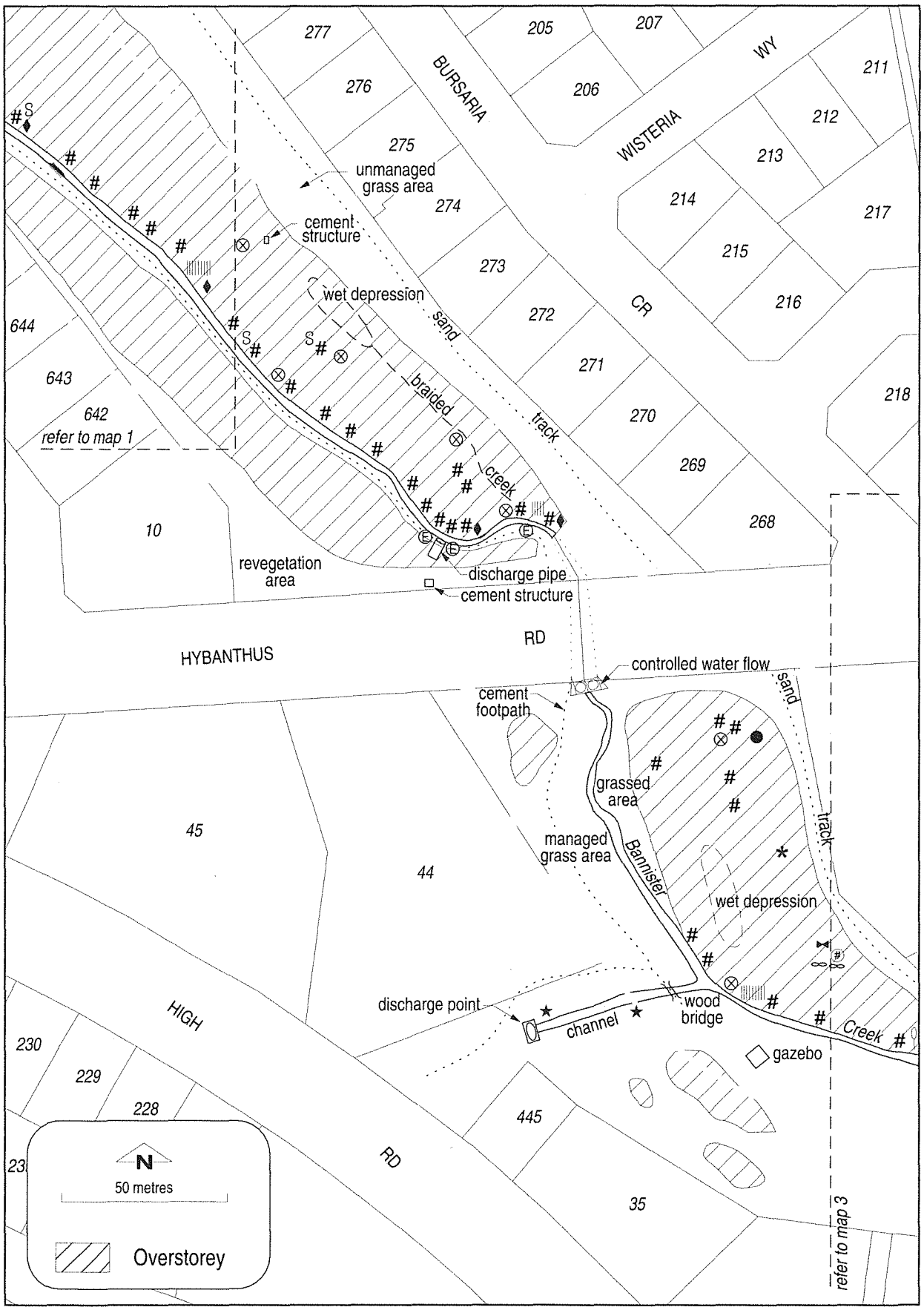
Vegetation: The overstorey vegetation is patchy (20 - 80% cover) with cleared areas interspersed between stands of trees of 20 - 30 m wide. Predominant tree species include abundant Swamp paperbark (*Melaleuca rhaphiophylla*) and frequent Flooded gum (*Eucalyptus rudis*). Marri (*Corymbia calophylla*) and Modong (*Melaleuca preissiana*) trees occur occasionally. There is evidence of tree seedling regeneration. Scattered exotic trees include the Japanese pepper (*Schinus terebinthifolia*), Poplars (*Populus* sp.) and introduced Wattles (*Acacia* sp.). The middlestorey is patchy (20 - 80% cover) with dense patches of Blackberry (*Rubus fruticosus*) interspersed with Arum lily (*Zantedeschia*

Recommended Strategies

- Plant emergent rushes and sedges along the foreshore banks and in the winter wet depressions to slow water movement and stabilise the foreshore area. Use 600 mm "U" shaped steel pegs to stake the plants into the channel bed.
- Re-establish deep rooted native understorey and middlestorey plants (Appendix 3) increase the stability of the foreshore.

- Implement weed control activities in nodes, which can be effectively managed (Appendix 2). Ensure that control activities do not impact foreshore stability.
- Prevent clearing vegetation within immediate vicinity of banks until native vegetation is well established in nodes.
- Inject herbicide into Japanese pepper and Poplars at 10 cm intervals around the truck in spring. Monitor and poison any re-growth from suckers. Remove when dead.
- Remove most biomass on middlestorey and creepers and treat regrowth with herbicide.

aethiopica). Other introduced species occurring less frequently include the Giant reed (*Arundo donax*). The understorey is continuous (> 80% cover) and is dominated by weed species. Common understorey weeds include Soursob (*Oxalis pes-caprae*), Kikuyu (*Pennisetum clandestinum*) and Pampas grass (*Cortaderia selloana*). A number of creepers such as Morning glory (*Ipomoea* sp.) and Lantana (*Lantana camara*) are present in the understorey. A dense patch of Nasturtium (*Tropeolum* sp.) has escaped from a nearby garden. Between the stands of tress there is an open area of maintained grass.	• Handweed Soursob and Nasturtium being careful to remove the entire root system. • Remove flowering seed heads from Pampas grass, Giant reed and Arum lily to minimise re-establishment from seed. • Replant native vegetation in any areas which have been treated to a stage of supporting minimal weed species. • Continue weed control program. • Determine recreational use of the area and consider replanting the open grass areas with native species.
Stream Cover: Overstorey trees and dense stands of Blackberry (*Rubus fruticosus*) provide patches of permanent shade along the foreshore bank. There is little evidence of instream cover present as branches and instream vegetation and detritus occurs very infrequently.	• Ensure the impact on bank stability is considered when undertaking weed control activities. • Remove dense Blackberry weeds in nodes and immediately replace with deep rooting middlestorey and understorey species recommended in Appendix 3. • Determine if erosion control devices are required while vegetation re-establishes.
Habitat diversity: Water flow within the creek is permanent. The water colour is light brown due to the presence of tannins leached from vegetation detritus. The river channel varies in depth from 0.2 - 1 m. Large cement blocks are present within the main channel near the flow through pipes that run under Hybanthus Road. Scattered logs and smaller logs near the pipe produce a riffle zone. Scattered streamside vegetation provides very few suitable habitats for terrestrial invertebrates and small vertebrates such as lizards and frogs. The overstorey is not continuous and does not provide a continuous corridor for fauna. The overstorey trees may provide nesting and roosting sites for birds.	• Implement alternative erosion control devices to the large cement blocks, if deemed necessary, to increase habitat viability for instream organisms and to enhance aesthetic appeal. • Enhance remnant vegetation overhanging stream by implementing reinforcement plantings of overstorey and understorey species (Appendix 3).
Other issues: A sandy track along the edge of the reserve adjacent to housing acts as a fire break and provides a service corridor along this section of foreshore.	• Stabilise access track by mulching. • Control any introduced grasses or annual species established along the track to minimise the fire hazard to the reserve.



Bannister Creek Map 2

Bannister Creek — Map 3 (Section C) Right Bank

Length of section (m): approximately 810 m

Recorder's name: Kelly Shepherd

Date surveyed: 10/8/98

Nearest road access: South of Hybanthus Road, north of Iveston Road

Lot numbers: 44, 2, 2575, 2630

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Black	Black	Black
Poor	Very Poor	Very Poor	Very Poor
2	0	0	0

Stream Condition
Black
Very Poor
2

Refer to previous description and recommended strategies for Section C (Map 2)

Bannister Creek — Map 3 (Section D) Left Bank

Length of section (m): approximately 400 m

Recorder's name: Kelly Shepherd

Date surveyed: 10/8/98

Nearest road access: South of Hybanthus Road, north of Metcalfe Road

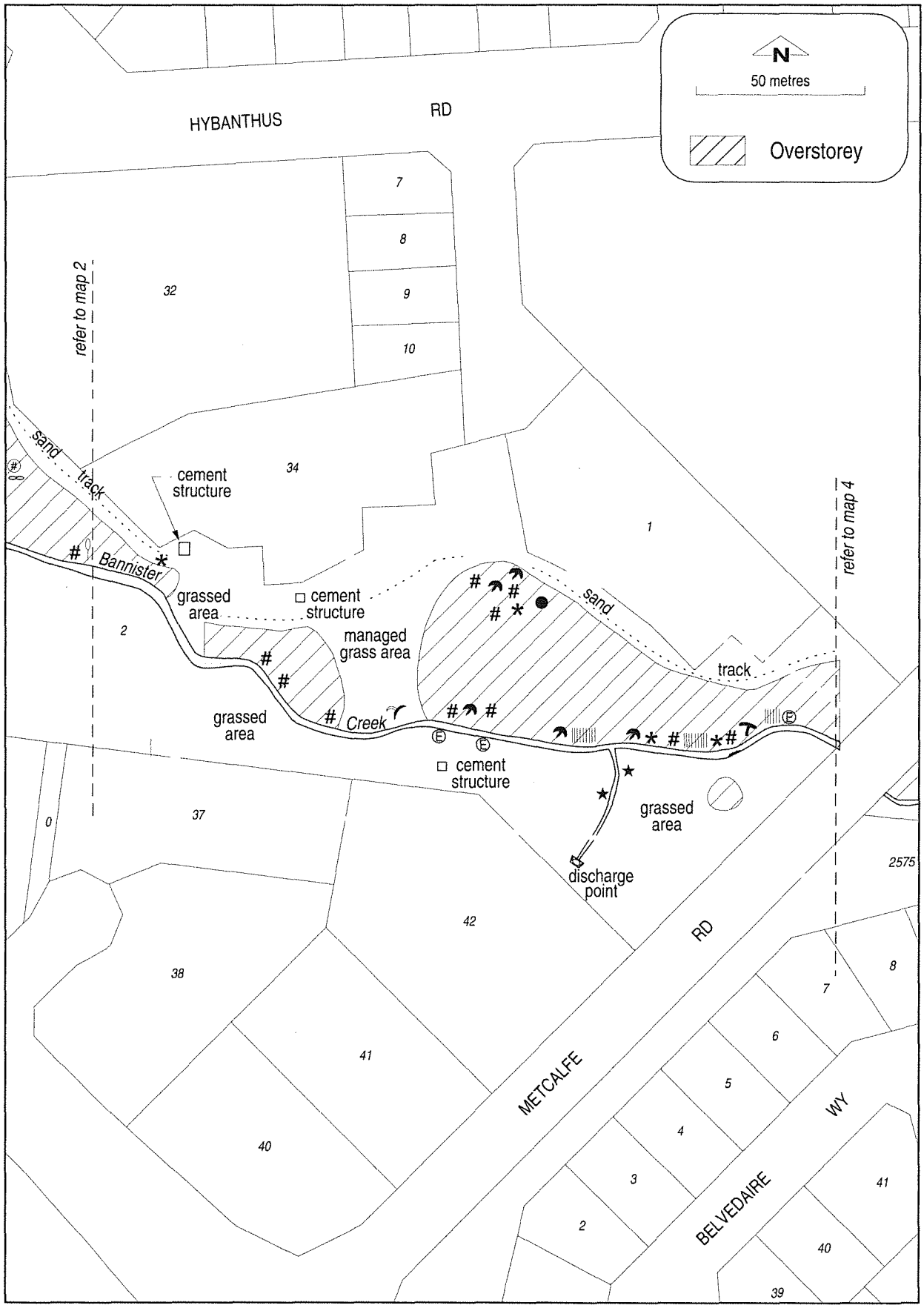
Lot numbers: 32, 34, 1

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Refer to previous description and recommended strategies for Section D (Map 2)



Bannister Creek Map 3

Bannister Creek — Map 4 (Section C) Right Bank

Length of section (m): approximately 810 m

Recorder's name: Kelly Shepherd

Date surveyed: 10/8/98

Nearest road access: South of Hybanthus Road, north of Iveston Road

Lot numbers: 44, 2, 2575, 2630

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Black	Black	Black
Poor	Very Poor	Very Poor	Very Poor
2	0	0	0

Stream Condition
Black
Very Poor
2

Refer to previous description and recommended strategies for Section C (Map 2)

Bannister Creek — Map 4 (Section E) Left Bank

Length of section (m): approximately 505 m

Recorder's name: Kelly Shepherd

Date surveyed: 10/8/98

Nearest road access: South of Metcalfe Road, north of Iveston Road

Lot numbers: 2575, 789, 788, 809, 808

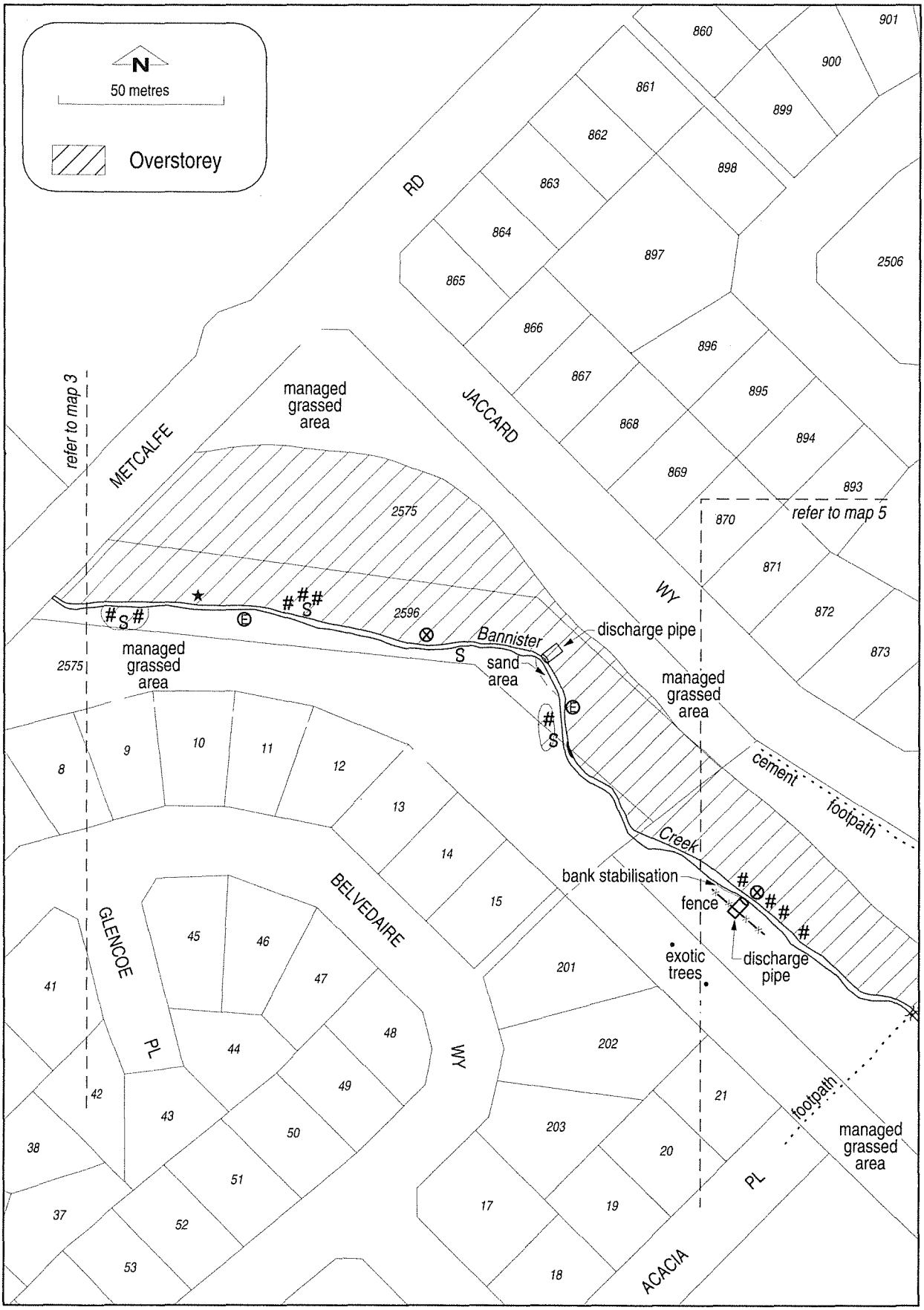
Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Description	Recommended Strategies
Bank stability: The main channel is 3 - 5 m wide with the foreshore banks rising on a gentle grade to a height of 0.8 - 1.5 m. Active erosion is occurring along 5 -20% of the foreshore, particularly near the out source point of a discharge pipe. Slumping occurs very infrequently and is evident on 0 - 5% of the total foreshore. There is some evidence of sediment deposition occurring along 0 - 5% of the main channel particularly downstream of the discharge pipe located on the right bank. There is a cluster of cement blocks, which have been placed within the river near the Iveston Road Bridge.	• Liaise with Water Corporation and Water and Rivers Commission to assess quality, volume and velocity of water leaving the drainage discharge point. • Implement soft engineering works to undertake erosion control in vicinity of drainage pipe (Appendix 4). • Plant emergent sedges and rushes using 600 mm "U" shaped steel pegs to stake the plants into the channel bed. • Assess viability of opening drainage line through reserve to create a living stream. • Assess value of cement blocks as riffle structure and determine potential alternatives with greater aesthetic and habitat value, and implement if feasible.
Vegetation: The overstorey is continuous with > 80% cover. Predominant native trees include abundant Swamp paperbark (*Melaleuca rhaphiophylla*) and frequent Flooded gum (*Eucalyptus rudis*) with infrequent Marri (*Corymbia calophylla*) and Modong (*Melaleuca preissiana*) trees present. Tree seedlings are evident, with Marri seedlings being the most common. Exotic, deciduous trees occur very occasionally within this section, including Fig trees (*Ficus* sp.) and the Coral tree (*Erythrina x sykesii*). The middlestorey is patchy (20 - 80% cover) with dense areas of Blackberry (*Rubus* spp). Other weed species occurring occasionally include Nightshade (*Solanum nigrum*), Bulrush (*Typha orientalis*), Arum lily (*Zantedeschia aethiopica*) and the Giant reed (*Arundo donax*). The native Swamp peppermint (*Agonis linearifolia*) occurs very infrequently. The understorey is continuous (> 80% cover) and is comprised of a mixture of annual and perennial grasses. Weed species present include Kikuyu (*Pennisetum setaceum*), Pampas grass (*Cortaderia selloana*) and Cyperus (*Cyperus involucratum*). Climbing weeds that occur very infrequently include Morning glory (*Ipomoea* sp.) and Vetch (*Vicia sativa*). Occasional native understorey species persist, including Native wisteria (*Hardenbergia comptoniana*), Pale rush (*Juncus pallidus*) and the small herb Centella (*Centella cordifolia*).	• Protect native plants persisting in the area and focus weed control activities around those species where resources are limited. • Ensure weed control activities are sustained in areas already undergoing rehabilitation prior to the addition of any new sites. • Poison exotic trees using injection method (Appendix 2). Monitor any growth from suckers and remove plants and poison stumps as required. • Undertake selective weed control, focussing on removal of most plant material (biomass) from site for weeds such as Bulrush, Blackberry, Pampas grass and Giant reed then follow up with hand weeding and herbicides application if neccessary. • Maintain a buffer adjacent to the streamline until instant replacement of native plants following weed removal is possible • Focus hand weeding on Nightshade, Morning Glory, Vetch and Cyperus and monitor and remove any regrowth. Spray with selective herbicides if necessary. • Replant Centella, Pale rush and Swamp peppermint and other recommended species listed in Appendix 3 in areas where weed control has been undertaken.

Stream Cover: Overhanging vegetation provides occasional infrequent shade. There is little instream vegetation however there is a cluster of cement blocks, which have been placed within the river near the Iveston Road Bridge to manage erosion.	• Undertake weed control and reinforce planting of understorey and middlestorey native vegetation within 15 m of Creek. • Focus revegetation works on native rush and sedge planting, within stream and first three metres of the banks.
Habitat diversity: There is permanent water running through Bannister Creek. The water levels vary, becoming very shallow near the Iveston Road bridge as water flows over exposed cement blocks. The water is light brown in colour due to the presence of tannins leached from the breakdown of vegetation detritus in the water column. The shallow depth of water and the infrequent amounts of instream cover or vegetation provide few suitable habitats for aquatic invertebrates, fish or turtles. Scattered streamside vegetation and patch middlestorey provide few habitats for larger terrestrial vertebrates. The continuous overstorey of trees provide suitable nesting and roosting sites for birds.	• Ensure nodes of native vegetation are established following weed control activities prior to undertaking broad scale control - to ensure maintenance of some habitat for fauna and minimise the threat to foreshore stability. • Assess effectiveness of concrete blocks and determine the viability of using alternative riffle structure which will increase habitat value and aesthetic appeal. • Focus revegetation works on restoring middlestorey and understorey species.
Other issues: Managed parkland, grassed areas and footpaths along the length of the reserve adjacent to the remnant vegetation increase access and problems in maintaining native vegetation.	• Define access points and plant species like Prickly moses to encourage pedestrians to walk on paths. • Establish signage indicating that reserve management will be focussing on weed control and revegetation



Bannister Creek Map 4

Bannister Creek — Map 5 (Section C) Right Bank

Length of section (m): approximately 810 m

Recorder's name: Kelly Shepherd

Date surveyed: 10/8/98

Nearest road access: South of Hybanthus Road, north of Iveston Road

Lot numbers: 44, 2, 2575, 2630

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Black	Black	Black
Poor	Very Poor	Very Poor	Very Poor
2	0	0	0

Stream Condition
Black
Very Poor
2

Refer to previous description and recommended strategies for Section C (Map 2)

Bannister Creek — Map 5 (Section E) Left Bank

Length of section (m): approximately 505 m

Recorder's name: Kelly Shepherd

Date surveyed: 11/8/98

Nearest road access: South of Metcalfe Road to Iveston Road

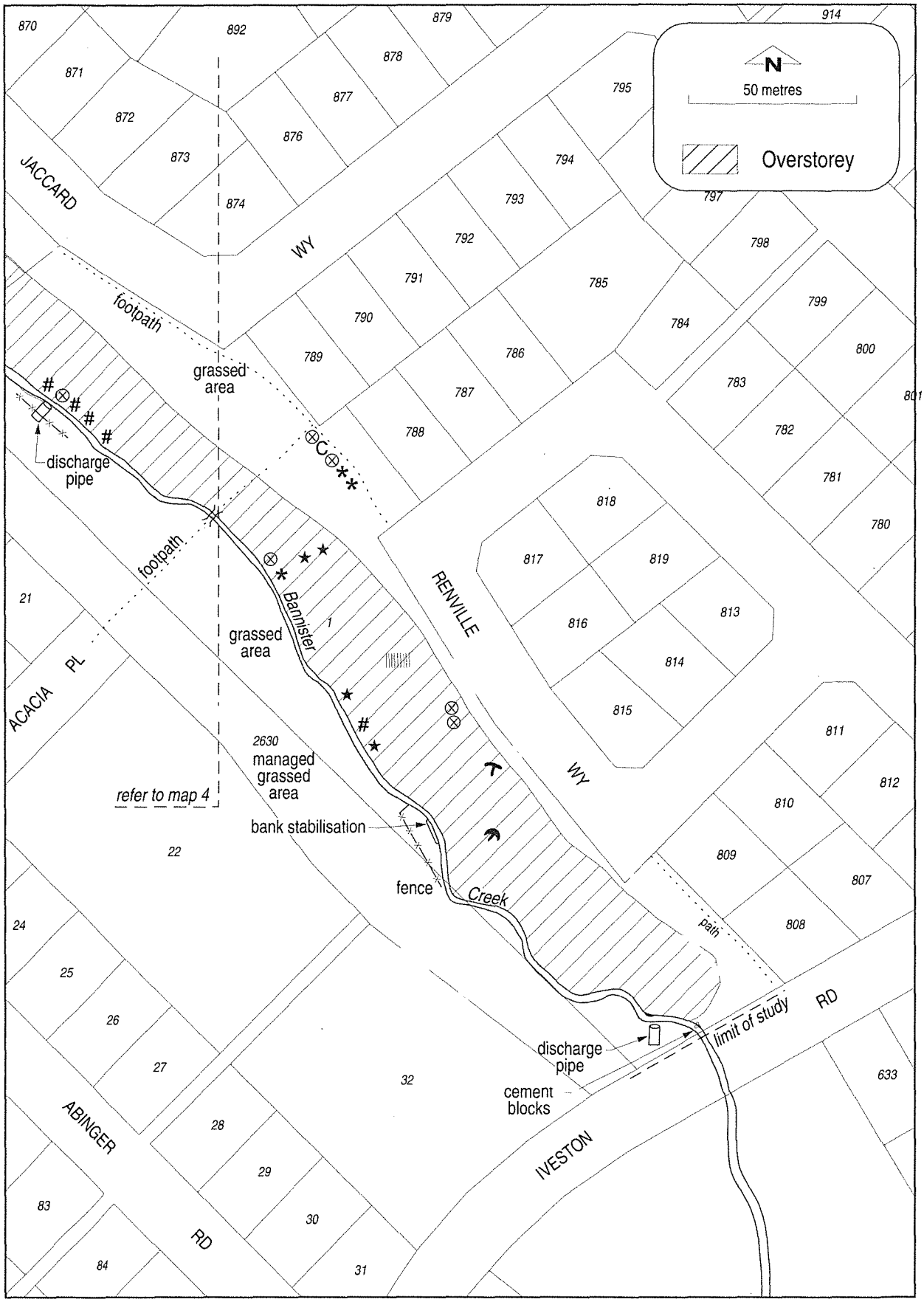
Lot numbers: 2575, 789, 788, 809, 808

Summary of river health:

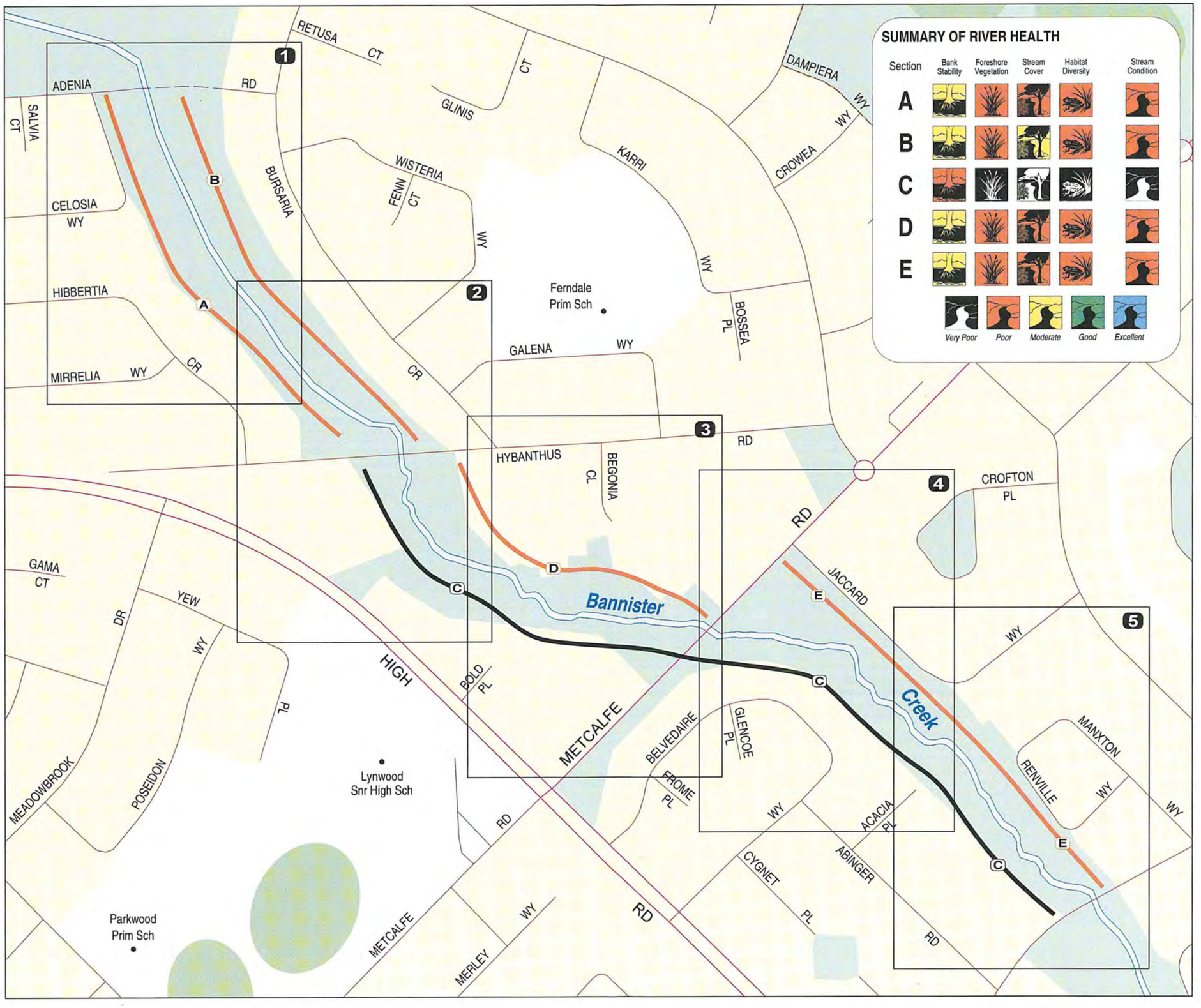
Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Refer to previous description and recommended strategies for Section E (Map 4)



Bannister Creek Map 5



Bannister Creek - Locality Map

4.2 Canning River

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Canning River — Map 1 (Section A) Right Bank

Length of section (m): approximately 910 m

Recorder's name: Kelly Shepherd

Date surveyed: 22/10/98

Nearest road access: South of Parkside Drive to Burslem Drive

Lot numbers: 2473, 203, 3267

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Red	Red
Moderate	Poor	Poor	Poor
4	2	2	2

Stream Condition
Red
Poor
10

Description

Bank stability: The main river channel is 2 - 3 m wide with the foreshore banks rising on a steep gradient to 3 - 4 m. Erosion is localised (5-20% of the foreshore length) particularly around the base of trees growing along the steep graded foreshore. There is little evidence of slumping or sedimentation.

Vegetation: The overstorey is continuous (> 80% cover) and extends from a width of only a few metres to a band of vegetation 10 - 15 m wide. The overstorey is comprised of Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) with very infrequent Marri trees (*Corymbia calophylla*). Introduced exotic tree species including the Japanese pepper (*Schinus terebinthifolia*) and Fig (*Ficus* sp.) occur occasionally. The middlestorey is continuous (> 80% cover) and is dominated by weeds. Dense stands of Watsonia (*Watsonia bulbillifera*) are present, often extending well past the edge of the overstorey vegetation.

Recommended Strategies

- Plant large clumps (400mm x 400 mm) of emergent vegetation immediately upstream of trees to slow water movement and minimise erosion. Secure the plants using 600 mm steel "U" pegs.
- Assess bank grade and opportunities for re-contouring to reduce gradient.
- Undertake weed control and plant deep rooted native understorey and middlestorey species to reinforce bank stability.
- Consider potential for use of erosion control matting as an option to reduce weed re-emergence, support plants installed and improve bank stability on steeper gradient banks.

- Undertake weed control activities in nodes, focusing on areas that can be effectively managed.
- Maintain a buffer adjacent to the streamline until weeds can be immediately replaced with dense plantings of native middlestorey and understorey species to inhibit weed re-establishment.
- Inject herbicide into Japanese pepper, introduced Wattles, Castor oil plants and Figs at 10 cm intervals around the trunk in Spring (Appendix 2). Selectively spray any suckers where they regenerate, and remove adult plants once dead.

Interspersed through out the middlestorey vegetation are frequent Arum lilies (*Zantedeschia aethiopica*). Other weed species present include Narrow leaf cotton bush (*Gomphocarpus fruticosus*), Castor oil (*Ricinus communis*), Weed wattles (*Acacia* sp.), Canna lily (*Canna* sp.) and the Giant reed (*Arundo donax*). The understorey layer is also continuous (> 80% cover) and is comprised predominantly of introduced weed species. Predominant weeds include Kikuyu (*Pennisetum clandestinum*), Couch (*Cynodon dactylon*), White flower fumitory (*Fumaria capreolata*), Dock (*Rumex* spp.), Ribwort plantain (*Plantago lanceolata*), Soursob (*Oxalis pes-caprae*), Cape weed (*Arctotheca calendula*), African lovegrass (*Eragrostis curvula*), Wild oats (*Avena fatua*), Great brome (*Bromus diandrus*) and an exotic creeper. Infrequent weeds include *Cyperus involucratum* and Vetch (*Vicia sativa*).	• Selectively paint herbicide on Watsonia and Arum lilies to minimise disturbance to the foreshore. • Cuts stems of Narrow leaf cotton bush and paint stump or alternatively, where the bank is stable, hand weed the entire plant prior to flowering and remove from site. • Cut and remove bulk of vegetative material from Giant reed and pour systemic poison down stump immediately. Do not disturb the rhizome mat as it will result in significant destabilization of the banks. • Brush cut Couch and Kikuyu and other grasses and treat with flauzifop-butyl in accordance with the recommendations in Appendix 2. • Hand weed White flower fumitory, Dock, Ribwort plantain, Soursob, Cape weed and Vetch prior to flowering and remove from site. • Replant native vegetation in areas that have undergone extensive weed control programs and consequently support minimal weeds. • Extend the overstorey by planting Swamp paperbark, Flooded gum close to the waterway grading into Marri with increasing distance from the foreshore. • Collect seed heads from *Cyperus* or remove whole plant where possible, before this species spreads and becomes a greater problem.
Stream Cover: The narrow overstorey and presence of deciduous exotic trees limits the amount of permanent cover along the right foreshore bank. The presence of large logs in the main river channel provides intermittent patches of instream cover.	• Increase the density and extent of overstorey trees along the foreshore using species recommended in Appendix 3. • Focus weed control in manageable sections, to minimise damage to the foreshore area and to maintain patches of stream cover. Plant dense middlestorey and understorey species once weeds have been eradicated. • Liaise with the Water Corporation to obtain an agreement to leave branches and vegetation within the river where it does not exacerbate erosion along the foreshore.

Habitat diversity: Water is permanent as a result of artificial maintenance and light brown in colour due to the presence of tannins leached from vegetation detritus. There is little suspended material in the water column. The river channel varies in depth from <10cm to < 1.5 m. There are instream logs providing suitable substrates for aquatic invertebrates and basking sites for turtles but these are infrequent. The foreshore vegetation is highly modified and the lack of native streamside vegetation limits the habitats available to terrestrial organisms. The overstorey is relatively narrow in areas along the foreshore restricting available nesting and roosting sites for birds.	• Liaise with the Water Corporation and Waters and Rivers Commission to monitor water quality and flow rates throughout the year. • Plant emergent sedges and rushes along the river bed and along the foreshore banks, including species such as Jointed twig rush, Pale rush and Spreading sword sedge to increase stream cover. • Undertake planting of overstorey and middlestorey species once weed control activities have eradicated weeds present along the foreshore. • Protect instream branches and other material providing instream cover, ensuring that large logs and branches do not exacerbate foreshore erosion.
Other issues: The right foreshore is a residential reserve. This recreation area is used by local residents and has maintained grass lawns and footpaths. Old fence line may be a safety hazard.	• Assess level of use of the grassed areas and potential for lawn removal adjacent the River, with the dual use path acting as a barrier between the native zone and the lawn. • Assess suitability of the location of the dual use path and determine potential to redesign the layout to extend the extent of remnant vegetation and increase the distance of lawn species from the native zone. • Establish native garden beds between the dual use path and Parkside Drive to screen traffic noise and improve visual amenity. • Plant shade trees within reserve using species such as Marri, Jarrah and Flooded gum, and protect with low bollards. • Provide two formal access points to the River, which connect with the dual use path.

Canning River — Map 1 (Section B) Left Bank

Length of section (m): approximately 910 m

Recorder's name: Kelly Shepherd

Date surveyed: 22/10/98

Nearest road access: South of Parkside Drive to Burslem Drive

Lot numbers: 0, 177

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Description

Bank stability: The main river channel is 2 - 3 m wide with occasional braided creeks forming on the left bank. The left foreshore rises on a medium gradient to 1.5 m. Erosion is localised (5 - 20% of the foreshore) particularly around the outer bends of the river meanders and where large logs have fallen into the river. Winter wet depressions are infrequent. There is little evidence of slumping or sedimentation.

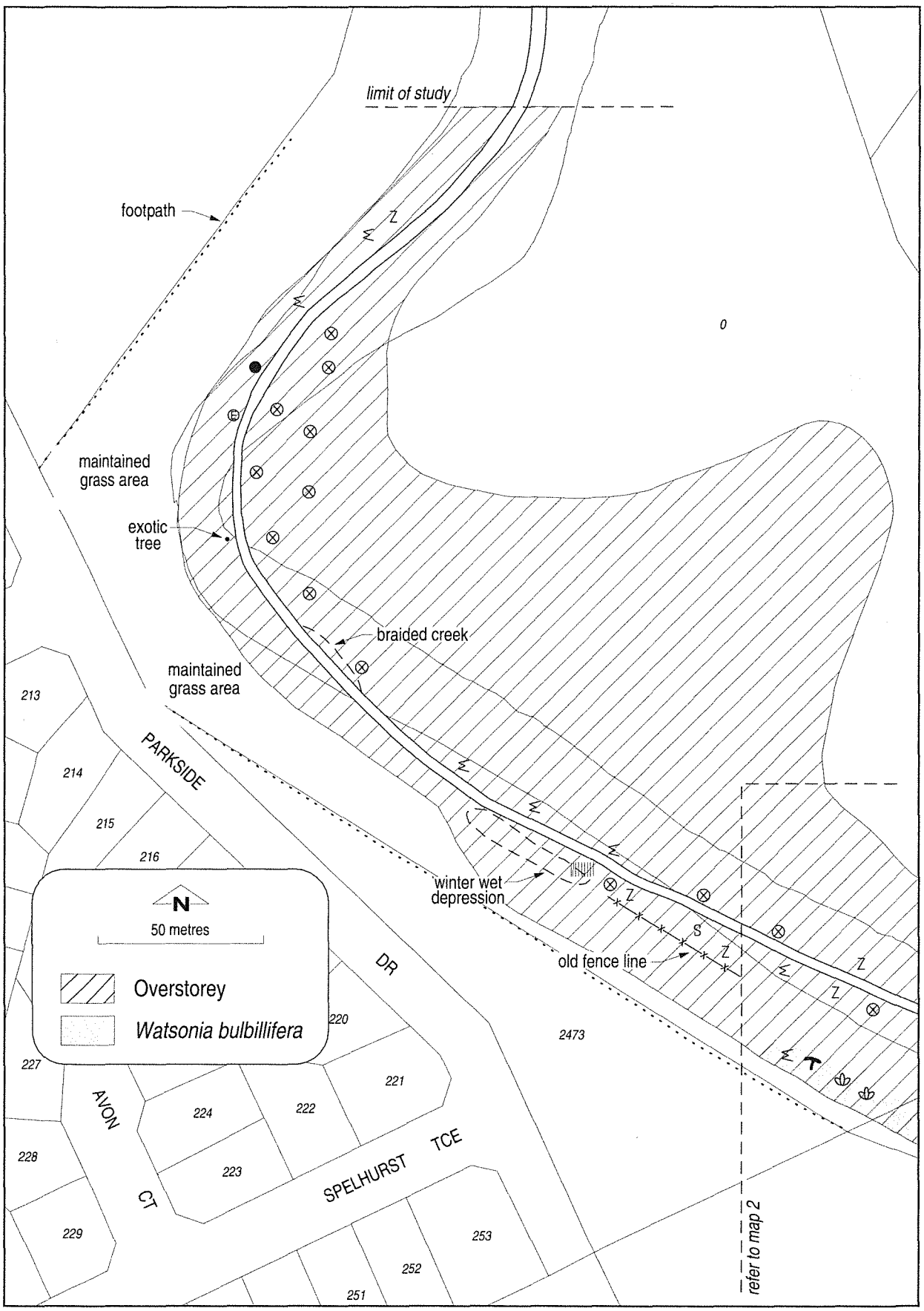
Vegetation: The overstorey is continuous (> 80% cover) and extends approximately 35 - 80 m from the main river channel. The overstorey is predominantly Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) with Marri (*Corymbia calophylla*) increasing in frequency with increasing distance from the main river channel. Introduced deciduous trees such as Fig (*Ficus* sp.) occur occasionally along the foreshore. The middlestorey is continuous (> 80% cover) and is dominated by weeds. Watsonia (*Watsonia bulbillifera*) and Arum lilies (*Zantedeschia aethiopica*) are abundant, forming dense stands. Other middlestorey weeds present include Narrow leaf cotton bush (*Gomphocarpus fruticosus*), Nightshade (*Solanum nigrum*) and the Giant reed (*Arundo donax*). The understorey is also

Recommended Strategies

- Plant emergent rushes and sedges within the main river channel, along braided creeks and in winter wet depressions. Use 600 mm "U" shaped steel pegs to stake the plants to the channel bed.
- Ensure weed control activities do not threaten bank stability.
- Reinforce native vegetation components on banks using species recommended in Appendix 3.

- Undertake weed control activities (Appendix 3) ensuring bank stability is not threatened with weed removal.
- Focus weed control activities around any natural regeneration or where native plants persist, and maintain a minimum buffer of one metre from any native plants.
- Inject deciduous Fig trees with herbicide at 10 cm intervals around the trunk in Spring. Remove plants and poison suckers as required.
- Selectively paint herbicide on Watsonia and Arum lilies to minimise disturbance to the foreshore.
- Cut and remove bulk of vegetative material (biomass) from Giant reed and pour systemic poison down stump immediately.

continuous (> 80% cover) and is comprised predominantly of introduced weed species. The small native herb Centella (*Centella cordifolia*) is present. Predominant weeds include Kikuyu (*Pennisetum clandestinum*), Couch (*Cynodon dactylon*), Soursob (*Oxalis pes-caprae*), White flower fumitory (*Fumaria capreolata*) and the creeper Morning glory (*Ipomoea* sp.).	• Cut stems of Narrow leaf cotton bush and paint stump or alternatively, where the bank is stable, hand weed entire plant and remove from site, prior to flowering. • Hand weed Nightshade, White flower fumitory, and Soursob prior to flowering and remove from site. • Brush cut Couch and Kikuyu and other grasses and treat with flauzifop-butyl in accordance with the recommendations in Appendix 2. • Replace plants removed from weeded areas with native plants using species recommended in Appendix 3.
Stream Cover: Native vegetation overhangs the main river channel providing intermittent patches of permanent shade. The presence of infrequent logs and branches and large rocks provides occasional instream cover.	• Focus weed control to manageable nodes and replace plants immediately with deep rooted native understorey and middlestorey species. • Liaise with the Water Corporation to obtain an agreement to leave branches and vegetation within the river where it does not exacerbate erosion along the foreshore. • Assess opportunities to create a riffle zone to slow water movement and provide greater instream cover.
Habitat diversity: Water is permanent as a result of artificial maintenance and light brown in colour due to the presence of tannins leached from vegetation detritus. There is little suspended material in the water column. The river channel varies in depth from < 0.1 to < 1.5 m. There are infrequent instream logs limiting potential substrates for aquatic invertebrates and basking sites for turtles. The stands of weeds and overhanging streamside vegetation and litter provide a few habitats for terrestrial invertebrates and reptiles. The continuous open overstorey provides nesting and roosting sites for birds.	• Ensure weed control activities are undertaken in nodes with understorey corridors maintained to allow fauna movement. • Replace weeds with indigenous species (Appendix 3) within nodes, and once established continue weed control. • Protect instream debris to maximise habitat provision.
Other issues:	



Canning River Map 1

Canning River — Map 2 (Section A) Right Bank

Length of section (m): approximately 910 m

Recorder's name: Kelly Shepherd

Date surveyed: 22/10/98

Nearest road access: South of Parkside Drive to Burslem Drive

Landowner details: 2473, 203, 3267

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Red	Red
Moderate	Poor	Poor	Poor
4	2	2	2

Stream Condition
Red
Poor
10

Refer to previous description and recommended strategies for Section A (Map 1)

Canning River — Map 2 (Section B) Left Bank

Length of section (m): approximately 910 m

Recorder's name: Kelly Shepherd

Date surveyed: 22/10/98

Nearest road access: South of Parkside Drive to Burslem Drive

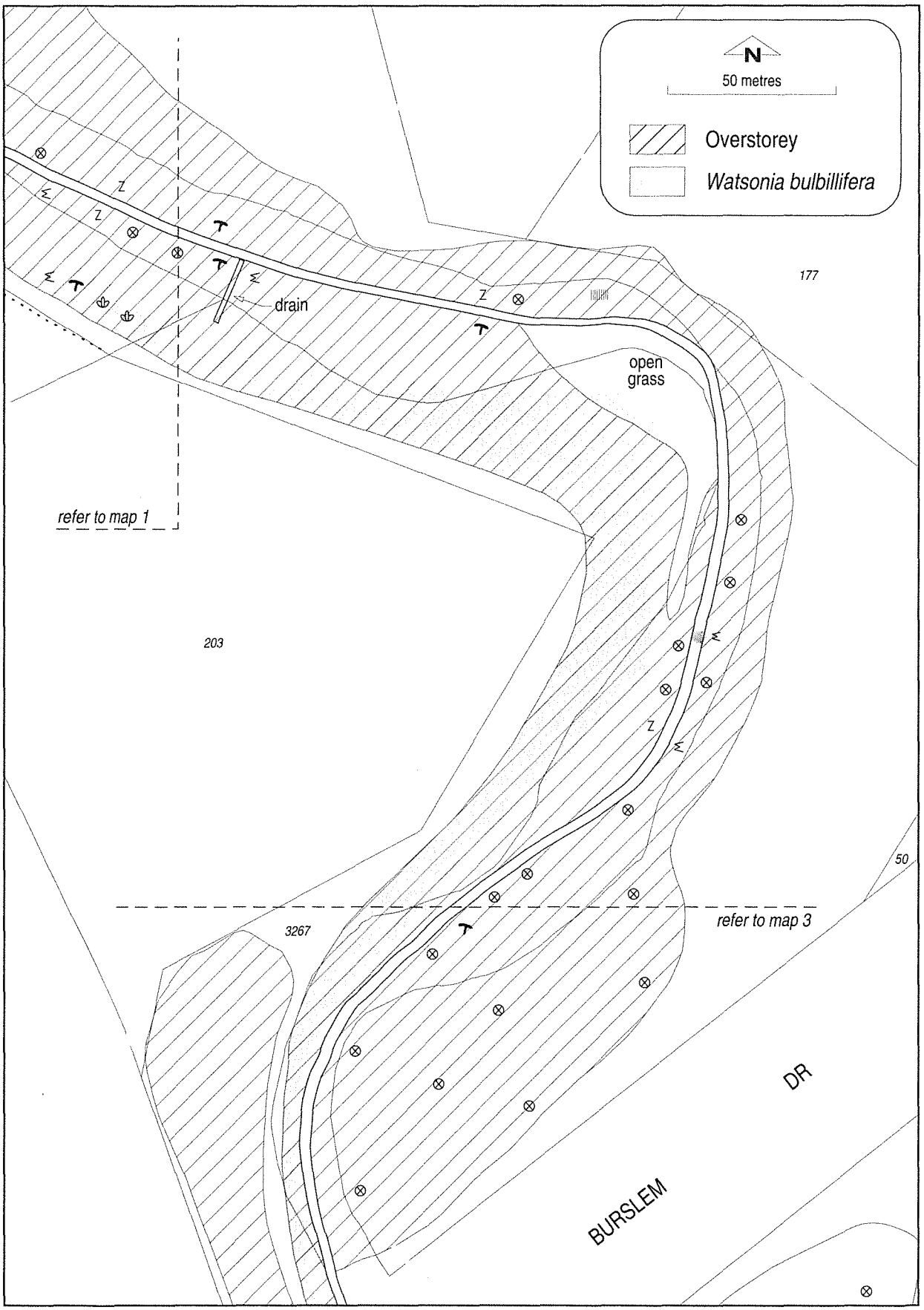
Lot numbers: 0, 177

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Refer to previous description and recommended strategies for Section B (Map 1)



Canning River Map 2

Canning River — Map 3 (Section C)

Length of section (m): approximately 465 m

Recorder's name: Kelly Shepherd

Date surveyed: 22/10/98

Nearest road access: Burslem Drive

Lot numbers: Right Bank - 201, 3267, 4145 Left Bank - 181, 33, 34

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Description

Bank stability: The main river channel is 2 - 4 m wide. The river foreshore banks rise on a medium gradient to 0.5 - 1 m high. The floodway extends a few metres either side of the main channel and flooding occurs during peak flows. Erosion is localised (5 - 20% of the foreshore area) near the outer river meanders. There is little evidence of slumping and sedimentation is localised (5 - 20% of the foreshore) with infrequent sandbanks in the main channel and along river meanders.

Vegetation: The overstorey vegetation is continuous (>80% cover) and comprised predominantly of Swamp paperbark (*Melaleuca rhaphiophylla*), Flooded gum (*Eucalyptus rudis*) and scattered Marri (*Corymbia calophylla*). The overstorey extends 20 - 50 m from the high water mark on the left foreshore. A large cleared oval of maintained lawn area extends almost to the main river channel on the right foreshore. A small strip of vegetation 10 - 25 m wide persists. The middlestorey is continuous (> 80% cover) and is dominated by stands of Watsonia

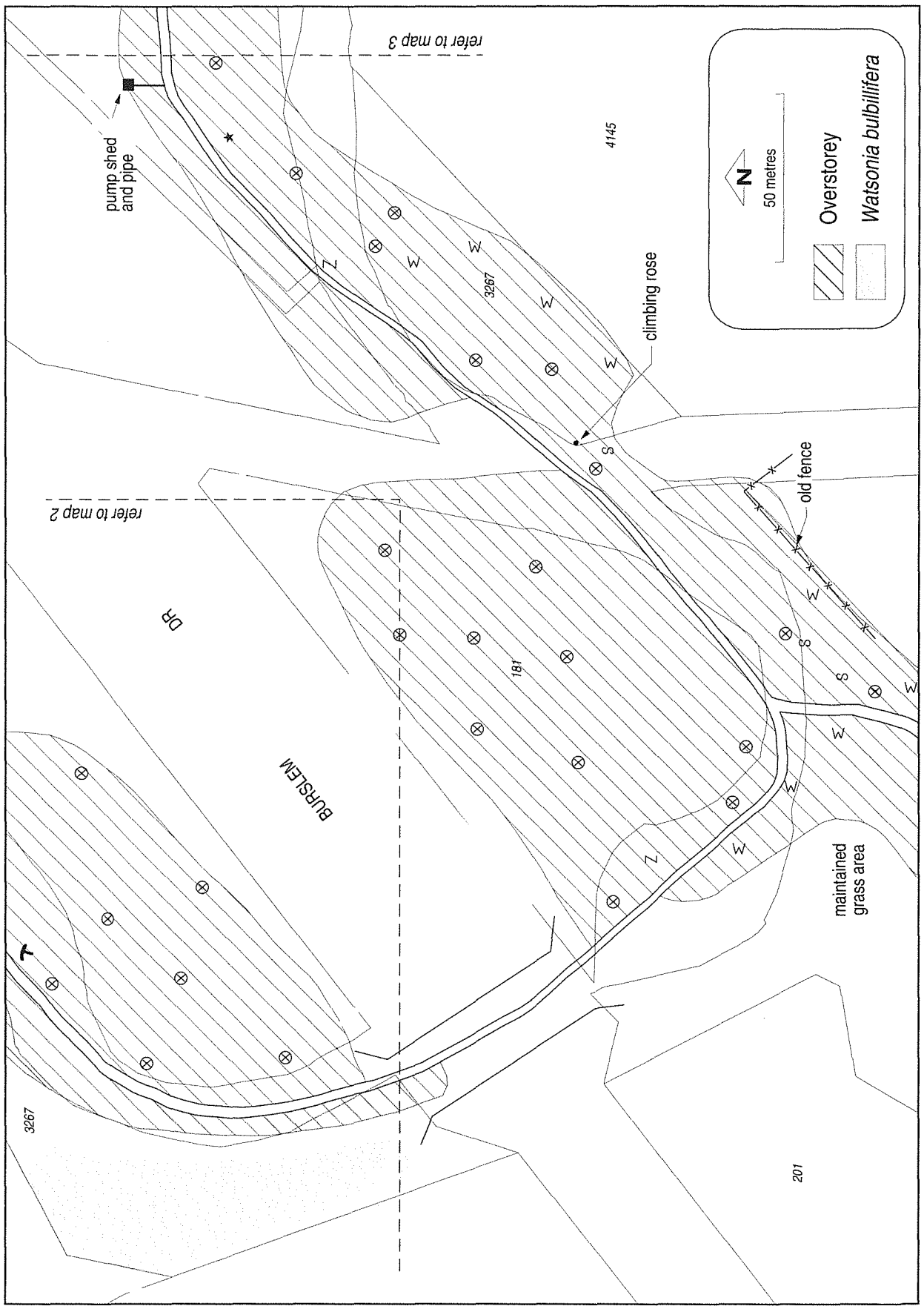
Recommended Strategies

- Liaise with the Water Corporation and the Water and Rivers Commission to monitor assess water quality, particularly sediment load and erosive power.
- Assess foreshore stability during peak flows and undertake remedial measures if required (Appendix 4).
- Increase the density of vegetation cover and improve vegetation structure on banks through weed control (Appendix 2) and planting deep rooted species (Appendix 3).
- Establish clumps of emergent sedges and rushes in the river channel and along the foreshore banks using 600 mm steel "U" pegs to secure plants.

- Undertake an intensive weed control program in nodes so areas can be effectively managed and ensure that foreshore bank stability is not threatened due to activities.
- Hand weed Narrow leaf cotton bush, Nightshade, Soursob, Cape weed and Dock, prior to flowering and remove from site.
- Selectively paint herbicide to poison Watsonia, and Arum to minimise disturbance to the substrate.

cover) and is dominated by stands of Watsonia (*Watsonia bulbillifera*) and Arum lily (*Zantedeschia aethiopica*). Frequent weeds include Narrow leaf cotton bush (*Gomphocarpus fruticosus*), Nightshade (Solanum nigrum) and Bulrush (*Typha orientalis*). The continuous understorey (> 80% cover) is comprised of dense weeds including abundant Kikuyu (*Pennisetum clandestinum*) and Couch (*Cynodon dactylon*). Frequent ground cover weeds include *Cyperus* sp., Soursob (*Oxalis pes-caprae*), Cape weed (*Arctotheca calendula*), *Paspalum* sp. and Dock (*Rumex* sp.). Bridal creeper (*Myrsiphyllum asparagoides*) is also present.	• Brush cut Paspalum, Couch and Kikuyu and treat regrowth with flauzifop-butyl in accordance with the recommendations in Appendix 2. • Brushcut Bulrush and remove bulk of vegetative material and paint regrowth with systemic herbicide (Appendix 2). Should Bulrush occur within the stream channel, brushcut in May/June and assess regrowth in September/October. • Extend if possible the width of overstorey on the right foreshore, planting Swamp paperbark and Flooded gum trees. • Plant dense clumps of middlestorey and understorey species in islands where weeds have been effectively eradicated, and maintain a one metre weed control buffer around each island. • Join densely planted islands together over time as weed management effort becomes reduced.
Stream Cover: Occasional overhanging native vegetation provides patches of permanent shade along the main channel, particularly along the left foreshore. Shade is more patchy on the right bank. Occasional logs, branches and large rocks provide instream cover.	• Plant dense clumps of middlestorey and understorey species in islands where weeds have been effectively eradicated. • Increase the extent of emergent rushes and sedges within the river channel and along the foreshore banks to increase instream cover. • Protect instream logs and branches when not exacerbating foreshore erosion.
Habitat diversity: Water is permanent and light brown in colour due to the presence of tannins leached from vegetation detritus. Water entering from Southern River is dark red-brown in colour. The river depth varies from 0.4 - 1.5 m. Occasional instream logs, branches and rocks provide suitable habitats for aquatic invertebrates. Logs at low angles provide basking sites for turtles. Streamside vegetation on the left foreshore may provide habitats for terrestrial invertebrates and reptiles but the right foreshore is too exposed to support a diverse array of organisms. The continuous open overstorey provides nesting and roosting sites for birds.	• Increase the density of vegetation cover and improve vegetation structure on banks through weed control (Appendix 2) and indigenous plantings (Appendix 3). • Assess water quality data obtained from the Water Corporation and the Water and Rivers Commission for water entering the Canning River from Southern River and implement catchment management strategies to improve water quality.

Other issues: The maintained grass lawns along the right foreshore increase access to the riparian area. Pumps and extractor pipes are present. Old fence may be a safety hazard.	• Remove lawn on the waterway side of the dual-use path and replace with native species recommended in Appendix 3. • Plant species such as Prickly moses along access points to encourage pedestrians to remain on defined pathways. • Review pumps and extractor pipes to ensure that riparian water rights prevail and the water is not being extracted in a manner that contravenes the Act. • Assess the level of use of the reserve and determine whether the old fenceline poses a hazard.



Canning River Map 3

Canning River — Map 4 (Section C)

Length of section (m): approximately 465 m

Recorder's name: Kelly Shepherd

Date surveyed: 22/10/98

Nearest road access: Burslem Drive

Lot numbers: Right Bank - 201, 3267, 4145 Left Bank - 181, 32, 33

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Refer to previous description and recommended strategies for Section C (Map 3)

Canning River — Map 4 (Section D)

Length of section (m): approximately 850 m

Recorder's name: Kelly Shepherd

Date surveyed: 23/10/98

Nearest road access: Burslem Drive

Lot numbers: Right Bank - 4145, 4146, 4147, 4148, 1129, 4, 553, 110, 50 Left Bank - 34, 35, 4078, 41, 40, 152, 202

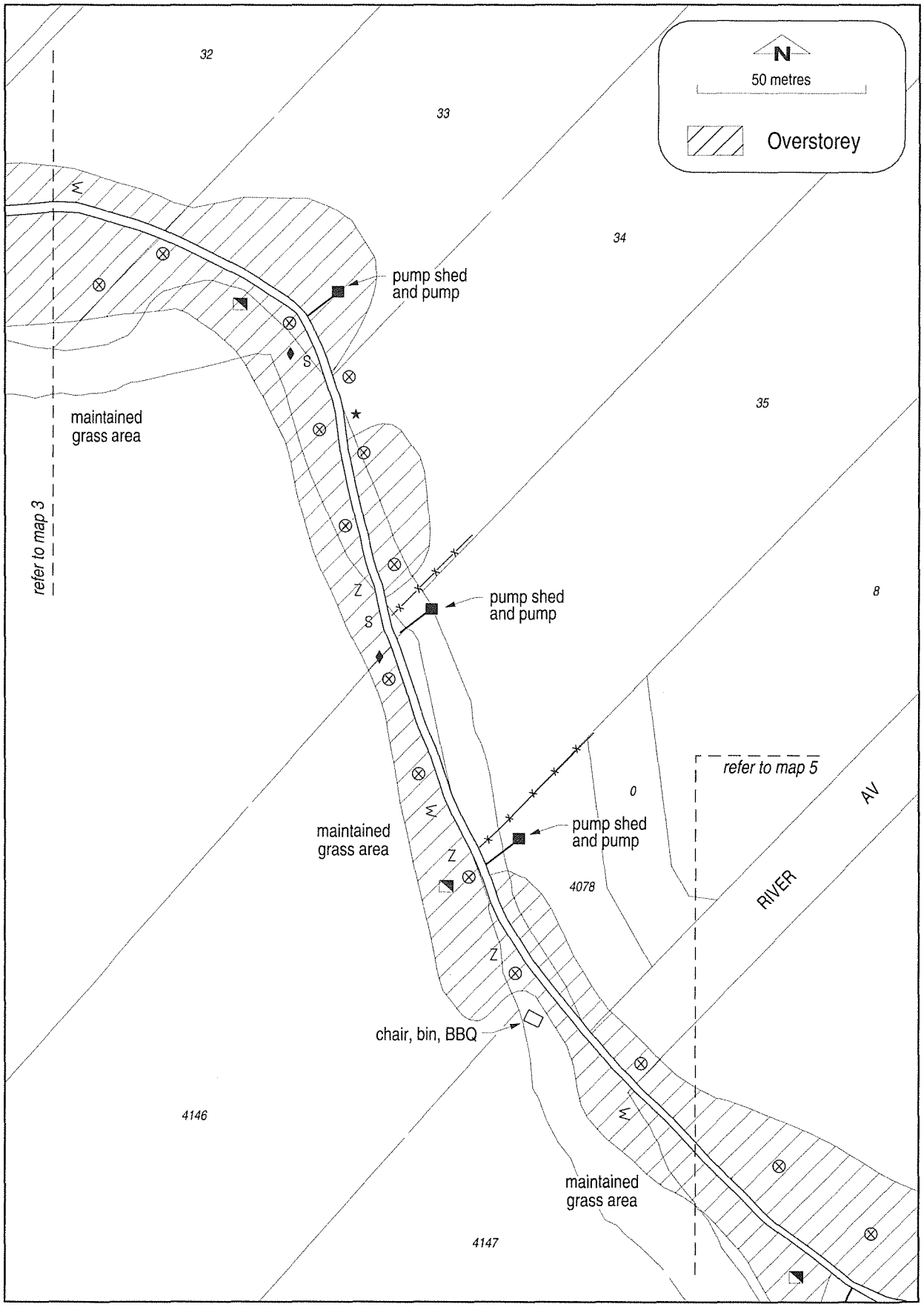
Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Red	Red
Moderate	Poor	Poor	Poor
4	2	2	2

Stream Condition
Red
Poor
10

Description	Recommended Strategies
Bank stability: The main river channel is 5 - 8 m wide extending to 10 m at the confluence with the small creek entering on the right foreshore near the end of this survey section (See Map 7). The foreshore banks rise on a medium grade to 0.8 - 1 m. Winter wet depressions in the floodway occur infrequently. Erosion is localised (5 - 20% of the foreshore) near areas with little foreshore vegetation to stabilise the foreshore bank. Focus points of erosion also occur near the base of trees growing immediately within the foreshore area. There is little evidence of slumping and sedimentation is localised (5 - 20% of the foreshore) as water flow slows and deposition occurs.	• Plant species tolerant of seasonal inundation such as Pale rush and Joint twig rush immediately upstream of trees suffering erosion at their bases to slow water movement, along braided creeks and in winter wet depressions. Secure clumps of emergent species to the channel bed using 600 mm "U" shaped steel pegs. • Implement weed control activities ensuring that the impact on foreshore stability is considered before undertaking any works. • Reinforce native vegetation by planting deep rooted middlestorey and understorey species on foreshore banks to improve cover and bank stability. • Identify sources of sediment from catchment and work to reduce the sediment load to the river, focussing on reduction of large particulate matter.
Vegetation: The overstorey vegetation is continuous (> 80% cover) but reduced to very narrow strip of trees extending only a few metres wide in some areas. Swamp paperbark (*Melaleuca rhaphiophylla*) predominates with occasional to frequent Flooded gum (*Eucalyptus rudis*) and Marri (*Corymbia calophylla*). Exotic trees such as Japanese pepper (*Schinus terebinthifolia*), Fig (*Ficus* sp.), Willows (*Salix* sp.) and Coral trees (*Erythrina x sykesii*) are infrequent. The middlestorey is patchy (20 - 80% cover) with intermittent stands of Watsonia (*Watsonia bulbillifera*) and scattered Arum lily (*Zantedeschia aethiopica*), Narrow leaf cotton bush (*Gomphocarpus fruticosus*), Nightshade (*Solanum nigrum*), Castor oil (*Ricinus communis*), Canna lily (*Canna* spp.). The understorey is continuous (> 80% cover) and dominated by weeds. Common introduced species include Kikuyu (*Pennisetum clandestinum*), Couch (*Cynodon dactylon*), Dock (*Rumex* sp.), Soursob (*Oxalis pes-caprae*), Cape weed (*Arctotheca calendula*), *Paspalum* sp., Wild radish (*Raphanus raphanistrum*), Fleabane (*Conyza* spp.) and Bridal creeper (*Myrsiphyllum asparagoides*). The submerged aquatic plant, Ribbon weed (*Vallisneria gigantea*), occurs in patches where there is minimal canopy and marginally greater water depth.	• Implement weed control activities in nodes to ensure eradication of weeds prior to revegetation. • Monitor the level of recreational use of the right foreshore area. • Undertake, if possible, revegetation along the right foreshore. Increase the density and extent of overstorey trees, creating a buffer from the open grassed area. Define the edge of the rehabilitation works by establishing walkways along the length of the foreshore area. • Reinforce the native middlestorey and understorey component by planing species recommended in Appendix 3 following weed control. • Focus the weed control program on Kikuyu and Couch in accordance with recommendations in Appendix 2. • Inject poison into the trunk of Japanese pepper, Fig, Willows and Coral trees at 10 cm intervals. Where appropriate, ensure any suckers are poisoned prior to removal of the parent plant. • Hand weed Narrow leaf cotton bush, Nightshade, Castor oil, Dock, Soursob, Cape weed, Wild radish, Fleabane prior to flowering and remove from site.

	• Develop and implement intensive weed management program using herbicides to control Bridal creeper, Watsonia and Arum lily. Harvest flowers prior to fruiting to limit the amount of seed entering the seed bed in the short term.
Stream Cover: The overhanging vegetation is very limited providing only scattered patches of permanent stream cover. The deciduous exotic trees along the foreshore will be bare for part of the year. The presence of Ribbon weed and occasional instream rocks, logs and branches provide some instream cover.	• Implement overstorey replacement program and commence localised weed control in the vicinity of native seedlings to maximise their growth rate. • Poison and remove exotic tree species once replacement plants are well developed. • Plant emergent riparian species (Appendix 3) to increase instream cover. • Protect instream debris and rocks from removal where it is not threatening bank stability. • Implement catchment management upstream to manage sediment load and reduce sedimentation within natural riffle zones.
Habitat diversity : Water is permanent, light brown in colour and clear. The depth of the rivers varies and is relatively shallow < 0.5 - 1.5 m. The instream logs, branches and rocks provide a few habitats for aquatic invertebrates and turtles. The narrow streamside vegetation provides very few habitats for terrestrial invertebrates, frogs and reptiles. The narrow overstorey provides very few nesting and roosting sites for birds.	• Implement overstorey replacement program and commence localised weed control in the vicinity of native seedlings to maximise their growth rate. • Plant dense clumps of middlestorey and understorey species in islands where weeds have been effectively eradicated, and maintain a one metre weed control buffer around each island. • Join densely planted islands together over time as weed management effort becomes reduced.
Other issues: Extractor pipes and pumps are frequent along the left foreshore. Surrounding landuse is Residential and semi-rural and orchards. There is some evidence of rubbish along the foreshore.	• Assess the need for riparian water rights and ensure that all extraction points are legitimate. • Develop and distribute an information brochure for landholders adjoining the River to encourage improved land management practices by residential, semi-rural and orchard owners to protect and enhance the River e.g. Swan River Trust Advice brochures. • Remove rubbish dumped from reserve and construct signage stating "Dumping is prohibited" to advise the community that rubbish dumping within the reserve is not an acceptable practice.



Canning River Map 4

Canning River — Map 5 (Section D)

Length of section (m): approximately 850 m

Recorder's name: Kelly Shepherd

Date surveyed: 23/10/98

Nearest road access: Burslem Drive

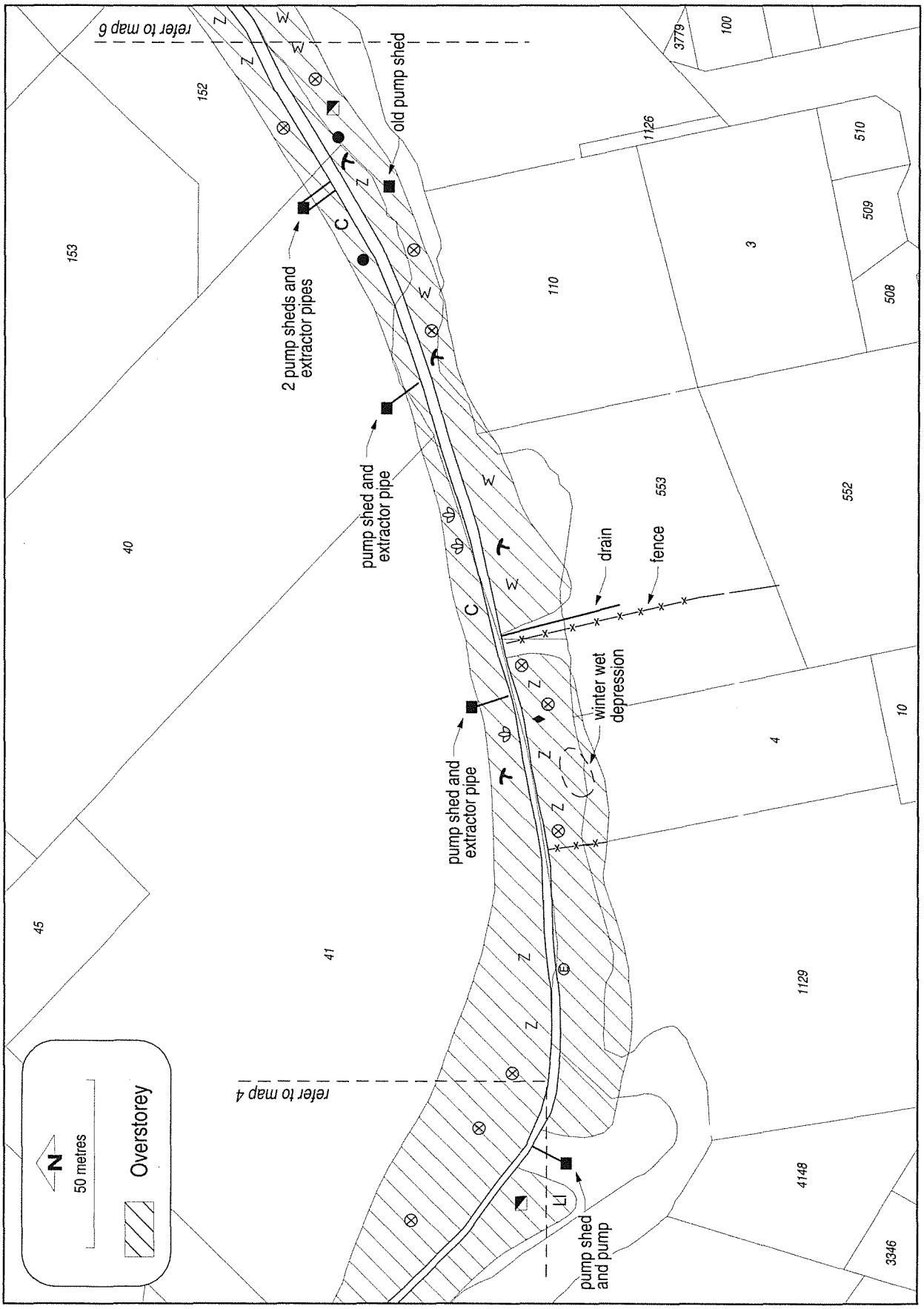
Lot numbers: Right Bank - 4145, 4146, 4147, 4148, 1129, 4, 553, 110, 50 Left Bank - 34, 35, 4078, 41, 40, 152, 202

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Red	Red
Moderate	Poor	Poor	Poor
4	2	2	2

Stream Condition
Red
Poor
10

Refer to previous description and recommended strategies for Section D (Map 4)



Canning River Map 5

Canning River — Map 6 (Section D)

Length of section (m): approximately 850 m

Recorder's name: Kelly Shepherd

Date surveyed: 23/10/98

Nearest road access: Burslem Drive

Lot numbers: Right Bank - 4145, 4146, 4147, 4148, 1129, 4, 553, 110, 50 Left Bank - 34, 35, 4078, 41, 40, 152, 202

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Red	Red
Moderate	Poor	Poor	Poor
4	2	2	2

Stream Condition
Red
Poor
10

Refer to previous description and recommended strategies for Section D (Map 4)

Canning River — Map 6 (Section E)

Length of section (m): approximately 460 m

Recorder's name: Kelly Shepherd

Date surveyed: 23/10/98

Nearest road access: Albany Highway

Lot numbers: Right Bank - 50, 1123, 1122 Left Bank - 0

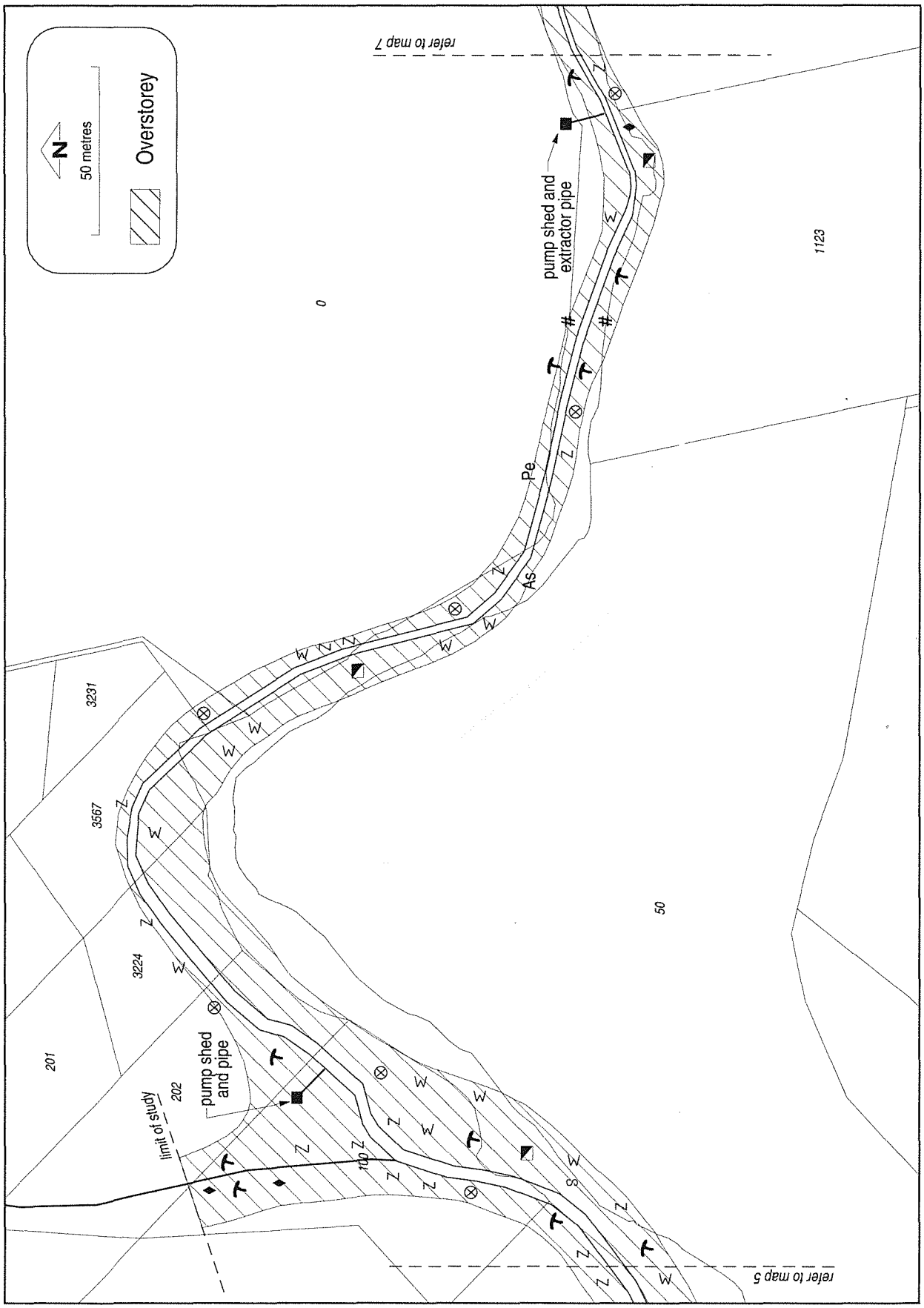
Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Red	Red
Poor	Poor	Poor	Poor
2	2	2	2

Stream Condition
Red
Poor
8

Description	Recommended Strategies
Bank stability: The river channel is 6 - 10 m wide with the foreshore banks rising on a medium to steep gradient to a height of 1 - 1.5 m. Significant levels of erosion are occurring along 20 - 50% of the foreshore area due to the steep banks and minimal foreshore vegetation. There is little evidence of broadscale bank collapse and slumping. Localised damage is present along 5 - 20% of the foreshore. Sedimentation is also localised along the river channel with deposition evident along 5 - 20% of the main channel.	• Focus attention on developing and implementing remedial strategies for significant areas of erosion utilizing erosion control matting and revegetation works, instream works such as re-creation of a riffle zone and widening the vegetation buffer in this zone. • Implement catchment management strategies to reduce the sediment load moving through the River system to reduce erosive capacity. • Plant clumps of emergent native rushes and sedges within the river channel and along the foreshore banks to slow water movement and stabilise the foreshore banks. Secure the plants to the channel bed using 600 mm "U" shaped steel pegs.
Vegetation: The overstorey is patchy (20 - 80% cover) and present in very narrow strips extending a few metres either side of the river channel. Along some sections the overstorey is reduced to almost single tree width. The most frequent overstorey species is Swamp paperbark (*Melaleuca rhaphiophylla*) with occasional Flooded gum (*Eucalyptus rudis*). Introduced Fig trees (*Ficus* sp.) are frequent along the foreshore. The middlestorey is patchy (20 - 80% cover) and dominated by weeds such as Watsonia (*Watsonia bulbillifera*), Arum lily (*Zantedeschia aethiopica*), Narrow leaf cotton bush (*Gomphocarpus fruticosus*) and Castor oil (*Ricinus communis*) Blackberry (*Rubus fruticosus*) and Giant reed (*Arundo donax*) are also present. The only native species present are Coojong (*Acacia saligna*) and Bracken fern (*Pteridium esculentum*) which occur very infrequently. The understorey is continuous (> 80% cover) and dominated by weeds. Frequent species include Kikuyu (*Pennisetum clandestinum*), Couch (*Cynodon dactylon*) and Bridal creeper (*Myrsiphyllum asparagoides*).	• Develop and implement intensive public awareness campaign providing information to landholders about preferred management techniques, protecting their foreshores and encouraging landholders to fence off the first 15 metres of land from the river. • Encourage private landholders to undertake intensive weed control and revegetation works planting deep rooted native understorey and middlestorey species to reinforce bank stability. • Provide financial support or material assistance to landholders willing to implement rehabilitation activities. • Ensure the impact on bank stability is considered before weed control works are undertaken. Consider potential for use of erosion control matting as an option to reduce weed re-emergence, support plants installed and improve bank stability on steeper gradient banks. • Ensure weed control activities are undertaken in nodes, replacing weeds immediately with native species recommended in Appendix 3. • Cut Fig trees and paint the stump with systemic herbicide immediately (Appendix 2). Paint the leaves of any suckers shooting to reduce their spread. Remove the stump from the site once dead. • Spray two metre diameter circles and plant native overstorey species including Flooded gum and Swamp paperbark and fence to protect from livestock, if large scale fencing can not be undertaken.

	• Hand weed Narrow leaf cotton bush and Castor oil plants - notify landholders that these plants can be toxic to livestock. • Remove bulk of Blackberry vegetative material and paint regrowth with systemic herbicide. • Remove bulk of Giant reed vegetative material and pour systemic herbicide down tube immediately following cutting.
Stream Cover: The patchy, narrow overstorey provides little permanent shade along the river channel. Instream cover is also intermittent as there are very few instream rocks and logs.	• Implement urgent vegetation reinforcement and weed control program to enhance amount of stream cover and bank stability. • Fence off streamlines where livestock have access and plant indigenous species (Appendix 3). • Plant emergent native sedges and rushes within the river channel to increase the level of instream cover.
Habitat diversity: Water is permanent, light brown in colour with little suspended sediment. The water depth varies from 0.5 - 1.5 m. The infrequent instream logs and rocks provide very few habitats for aquatic invertebrates. The lack of dense streamside vegetation also limits suitable habitats for terrestrial invertebrates, frogs and reptiles. The patchy overstorey provides few nesting and roosting sites for birds.	• Develop and implement intensive public awareness campaign providing information to landholders about preferred management techniques, protecting their foreshores and encouraging landholders to fence off the first 15 metres of land from the river. • Encourage private landholders to undertake intensive weed control and revegetation works to encourage natural regeneration within this area, if resources allow. • Advise residents of severity of the situation to encourage them to undertake works to manage weeds and replacement.
Other issues: Surrounding landuse is semi-rural with stock access to the brook along some sections.	• Provide information leaflets to landholders adjoining Canning river encouraging protection of the foreshores, native vegetation, nutrient management and techniques to minimise other potential impacts. • Encourage landholders to fence off the foreshores and create off-line watering points for stock.



Canning River Map 6

Canning River — Map 7 (Section E)

Length of section (m): approximately 460 m

Recorder's name: Kelly Shepherd

Date surveyed: 23/10/98

Nearest road access: Albany Highway

Lot numbers: Right Bank - 50, 1123, 1122 Left Bank - 0

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Red	Red
Poor	Poor	Poor	Poor
2	2	2	2

Stream Condition
Red
Poor
8

Refer to previous description and recommended strategies for Section E (Map 6)

Canning River — Map 7 (Section F)

Length of section (m): approximately 820 m

Recorder's name: Kelly Shepherd

Date surveyed: 26/10/98

Nearest road access: Albany Highway

Lot numbers: Right Bank - 1841, 1842, 1109, 0, 7, 1106, 32, 30, 1102, 31, 1100, 3919, 3616
Left Bank - 41, 1, 2, 13, 12, 18, 24, 23, 14, 2942, 25, 8, 2, 101

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Red	Red
Poor	Poor	Poor	Poor
2	2	2	2

Stream Condition
Red
Poor
8

Description	Recommended Strategies
Bank stability: The main river channel is 4 - 6 m wide with the foreshore banks rising on a steep gradient to a height of 2 - 4.5 m. Significant levels of erosion are occurring along 20 - 50% of the foreshore area near entry points of extractor pipes and the base of trees growing along foreshore banks. Evidence of livestock damage was also observed. There is little evidence of broadscale bank collapse and slumping although there is localised damage present along 5 - 20% of the foreshore. Sedimentation is also localised along the river channel with deposition evident along 5 - 20% of the main channel.	• Develop and implement major instream remedial works to assist the river to rebuild its bed and banks which are considerably incised. • Assess the feasibility of creating an artificial riffle zone to encourage sedimentation and slow water velocities in peak flow conditions. • Protect remnant vegetation from livestock damage by fencing. • Assess riparian water rights and encourage landholders retaining these rights to use floatation devices on extractor pipes to prevent dredging and the resulting scour. • Plant 400mm x 400 mm clumps of emergent species such as Lake Club Sedge and Joint Twig Rush immediately upstream of trees suffering erosion at their bases and stake the clumps using 600 mm "U" shaped steel pegs.
Vegetation: The overstorey is continuous (> 80% cover) extending 5 - 20 m from the river channel. Swamp paperbark (*Melaleuca rhaphiophylla*) is abundant with occasional Flooded gum (*Eucalyptus rudis*). Introduced Fig trees (*Ficus* sp.) are frequent along the foreshore and Willow (*Salix* sp.), Japanese pepper (*Schinus terebinthifolia*), Poplar (*Populus* sp.) and Coral trees (*Erythrina x sykesii*) are present but uncommon. The middlestorey is patchy (20 - 80% cover) and dominated by weeds. Frequent species include Watsonia (*Watsonia bulbillifera*), Arum lily (*Zantedeschia aethiopica*), Giant reed (*Arundo donax*), Narrow leaf cotton bush (*Gomphocarpus fruticosus*), Castor oil (*Ricinus communis*) and Blackberry (*Rubus fruticosus*). The understorey is continuous (> 80% cover) and is dominated by weeds. Frequent species include creepers such as Bridal creeper (*Myrsiphyllum asparagoides*), Climbing roses (*Rose* spp.) and Nasturtium (*Tropeolum* sp.). Other frequent ground cover species include Kikuyu (*Pennisetum clandestinum*) and other perennial grasses. The native Pale rush (*Juncus pallidus*) occurs very rarely.	• Develop and implement intensive public awareness campaign providing information to landholders about preferred management techniques, protecting their foreshores and encouraging landholders to fence off the first 15 metres of land from the river. • Encourage private landholders to undertake intensive weed control and revegetation works to encourage natural regeneration within this area, if resources allow. • Provide financial support or material assistance to landholders willing to implement the above activities. Encourage Catchment group to obtain funds to provide native plant species for all strata to landholders annually. • Ensure the impact on bank stability is considered before weed control works are undertaken. Consider potential for use of erosion control matting as an option to reduce weed re-emergence, support plants installed and improve bank stability on steeper gradient banks. • Inject systemic poison into Figs, Coral trees, Willow, Poplar and Castor oil plants at 10 cm intervals around the trunk in spring. Monitor and poison any re-growth from suckers. Remove when dead.

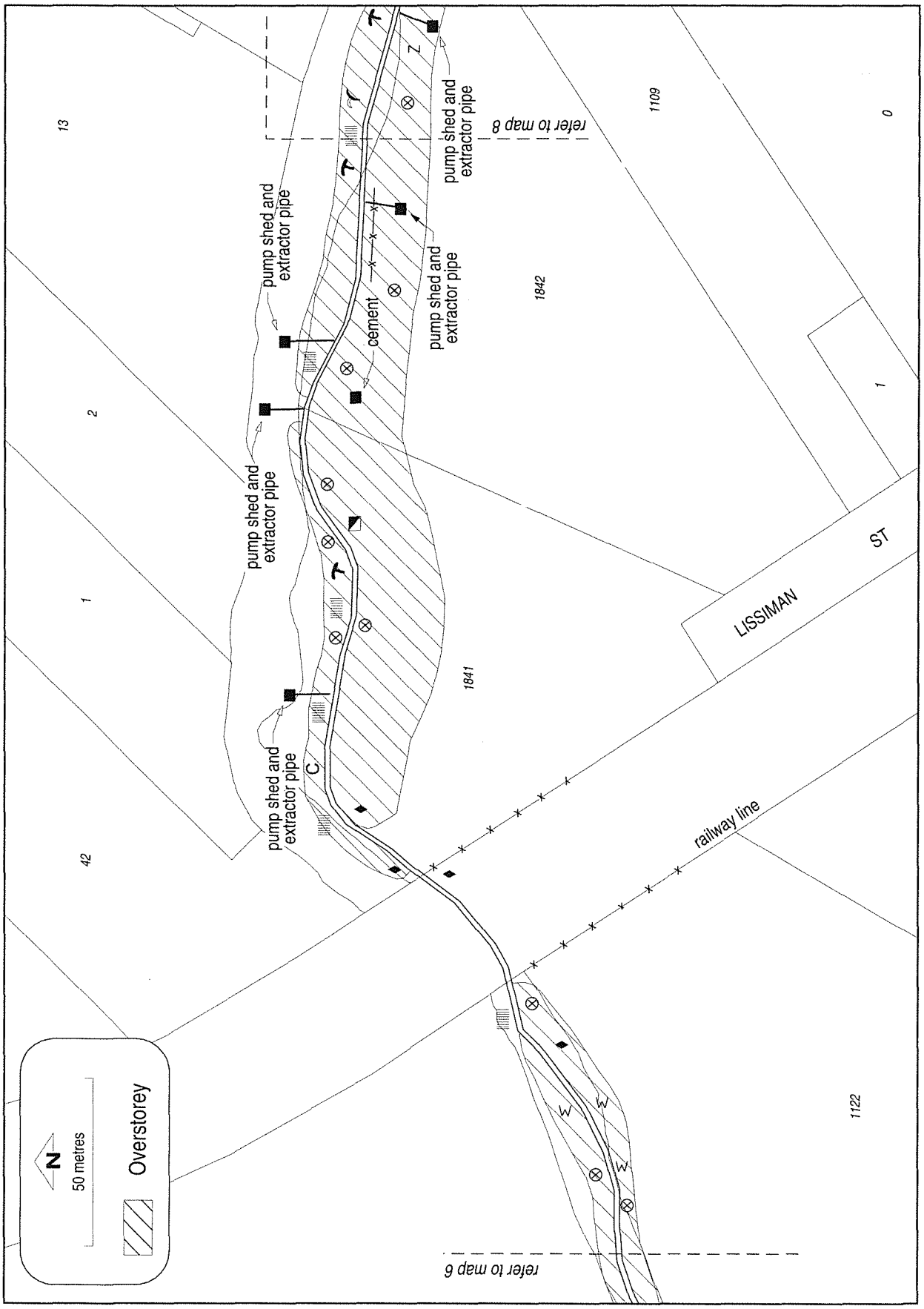
	• Spray two metre diameter circles and plant native overstorey species including Flooded gum and Swamp paperbark and fence to protect from livestock, if large scale fencing can not be undertaken. • Hand weed Nasturtium and Castor oil plants and notify landholders that these plants can be toxic to livestock. • Remove bulk of Blackberry vegetative material and paint regrowth with systemic herbicide. Selectively treat any regrowth. • Remove bulk of Giant reed vegetative material and pour systemic herbicide down tube immediately following cutting. Selectively treat any regrowth. • Implement selective grass control program (Appendix 2).
Stream Cover: The narrow overstorey comprised of native species and many deciduous exotic trees provides little permanent shade along the river channel. There is intermittent instream cover from scattered rocks and logs.	• Develop and implement intensive public awareness campaign providing information to landholders about preferred management techniques, protecting their foreshores and encouraging landholders to fence off the first 15 metres of land from the river. • Implement overstorey and middlestorey revegetation as a priority, protecting these plants from invasion by weeds by focussing weed control in these areas. • Plant emergent native sedges and rushes within the river channel to increase the level of instream cover.
Habitat diversity: Water is permanent, light brown in colour with little suspended sediment. The water depth varies from 0.5 - 1.5 m. The infrequent instream logs and rocks provide very few habitats for aquatic invertebrates. The presence of low lying logs may provide suitable basking sites for turtles but there is little protected nesting sites for this animal. The lack of dense native streamside vegetation also limits suitable habitats for terrestrial invertebrates, frogs and reptiles. The overstorey provides few nesting and roosting sites for birds.	• Implement catchment action plan and water sensitive urban design to manage sediment load moving down the river. • Assess viability of creating an artificial riffle zone to manage water velocities and sedimentation processes to rebuild the river. • Protect remnant vegetation and support a planting and weed control program to improve cover and habitat and protect residents in times of flood.

Other issues: The surrounding landuse is semi-rural. A number of small orchards are also present. A flock of sheep has access to a section of foreshore on the right bank. There is evidence of grazing and disturbance of the foreshore structure.

Many garden exotics such as Nasturtium and Climbing roses were observed near a number of residencies that are very close to the foreshore area on the left bank.

Sections of the foreshore have been fenced. The fence line runs along the edge of the steeply rising foreshore banks with minimal distance from the top of the rise.

- Inform residents of the problem of exotic species escaping from gardens in information brochures.
- Develop and implement intensive public awareness campaign providing information to landholders about preferred management techniques, protecting their foreshores and encouraging landholders to fence off the first 15 metres of land from the river.
- Focus attention on the development of a series of informative articles about all of the issues raised along this section of River, and endeavour to get these published with photographs in the local community news.
- Liaise with Agriculture WA to investigate fertiliser practices in small orchards to minimise their contribution of nutrients to the river system.



Canning River Map 7

Canning River — Map 8 (Section F)

Length of section (m): approximately 820 m

Recorder's name: Kelly Shepherd

Date surveyed: 26/10/98

Nearest road access: Albany Highway

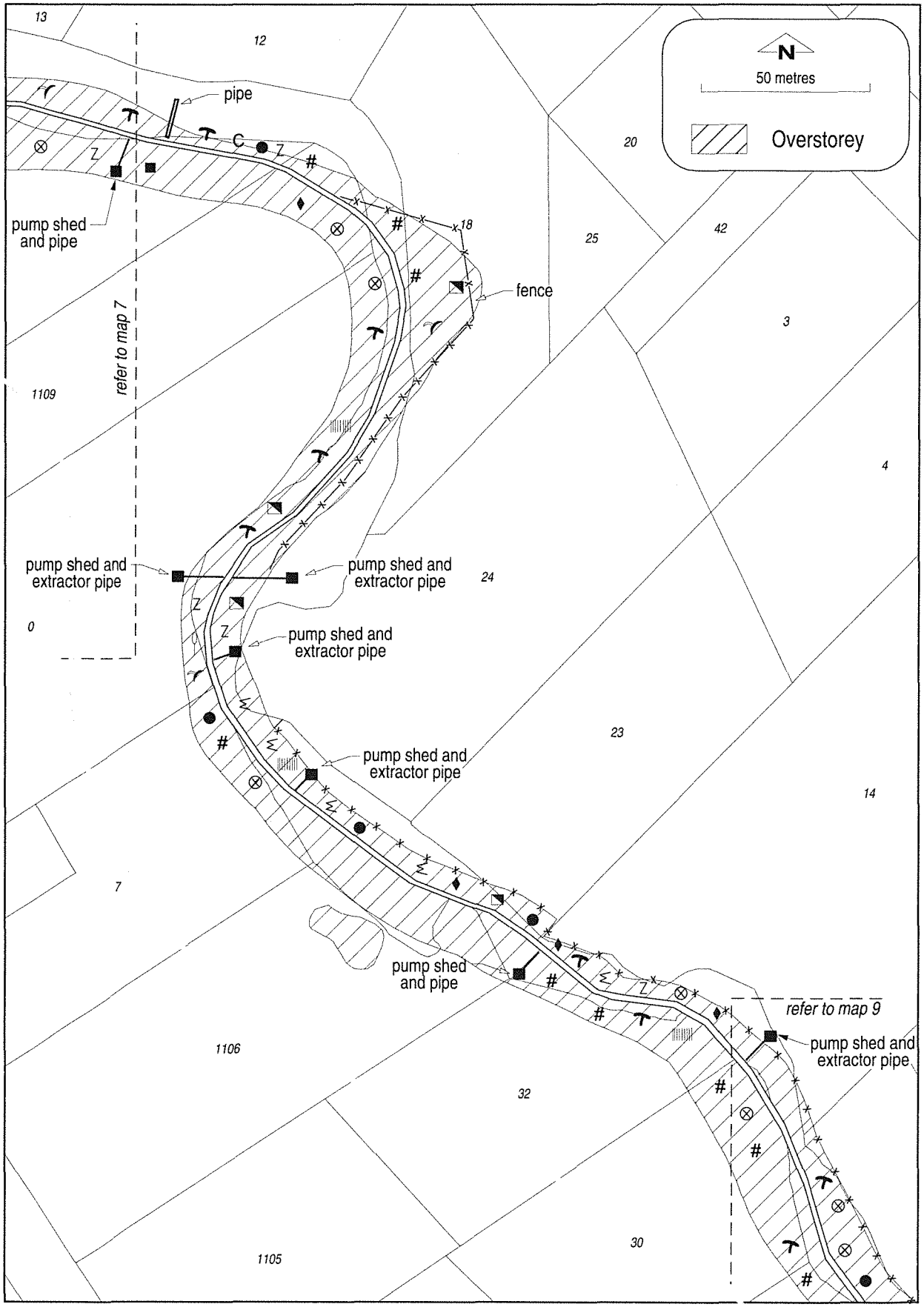
Lot numbers: Right Bank - 1841, 1842, 1109, 0, 7, 1106, 32, 30, 1102, 31, 1100, 3919, 3616
Left Bank - 41, 1, 2, 13, 12, 18, 24, 23, 14, 2942, 25, 8, 2, 101

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Black	Red	Red
Poor	Very Poor	Poor	Poor
2	0	2	2

Stream Condition
Red
Poor
6

Refer to previous description and recommended strategies for Section F (Map 7)



Canning River Map 8

Canning River — Map 9 (Section F)

Length of section (m): approximately 820 m

Recorder's name: Kelly Shepherd

Date surveyed: 26/10/98

Nearest road access: Albany Highway

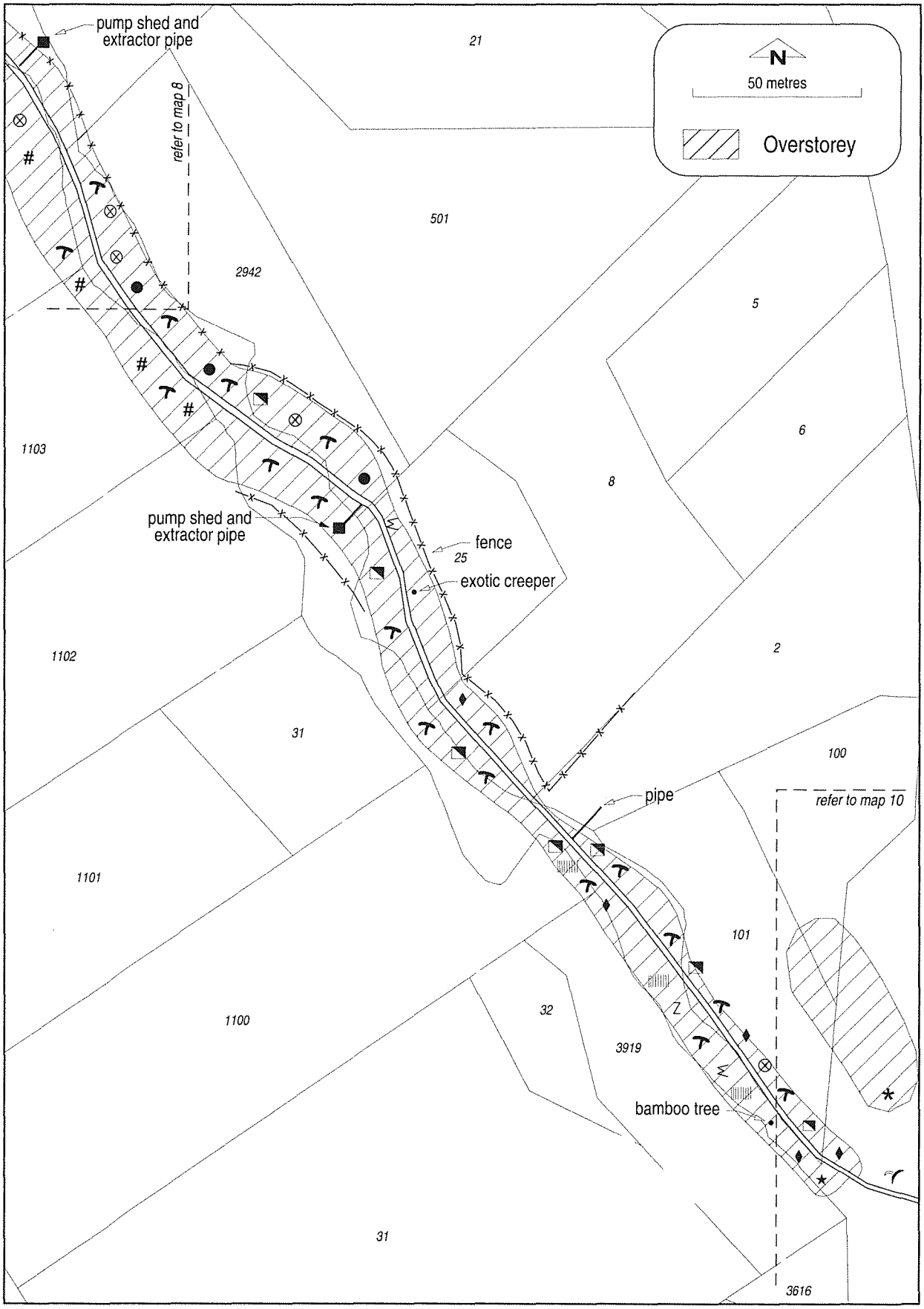
Lot numbers: Right Bank - 1841, 1842, 1109, 0, 7, 1106, 32, 30, 1102, 31, 1100, 3919, 3616
Left Bank - 41, 1, 2, 13, 12, 18, 24, 23, 14, 2942, 25, 8, 2, 101

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Black	Red	Red
Poor	Very Poor	Poor	Poor
2	0	2	2

Stream Condition
Red
Poor
6

Refer to previous description and recommended strategies for Section F (Map 7)



Canning River Map 9

Canning River — Map 10 (Section G)

Length of section (m): approximately 500 m

Recorder's name: Kelly Shepherd

Date surveyed: 26/10/98

Nearest road access: Albany Highway

Lot numbers: Right Bank - 4, 105, 51, 4, 7 Left Bank - 0, 16, 100, 14, 703

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Black	Black	Black
Moderate	Very Poor	Very Poor	Very Poor
4	0	0	0

Stream Condition
Black
Very Poor
4

Description

Bank stability: The main river channel is 2 - 4 m wide with the foreshore banks rising on a steep gradient to 2 - 5 m in height. Localised areas of erosion were observed on 5 - 20% of the foreshore area, particularly near the base of trees growing immediately along the foreshore bank. There is also evidence of erosion near the Albany Highway bridge. There is little evidence of slumping but localised sedimentation indicated by accumulation of sand within the main channel was observed along 5 - 20% of the channel.

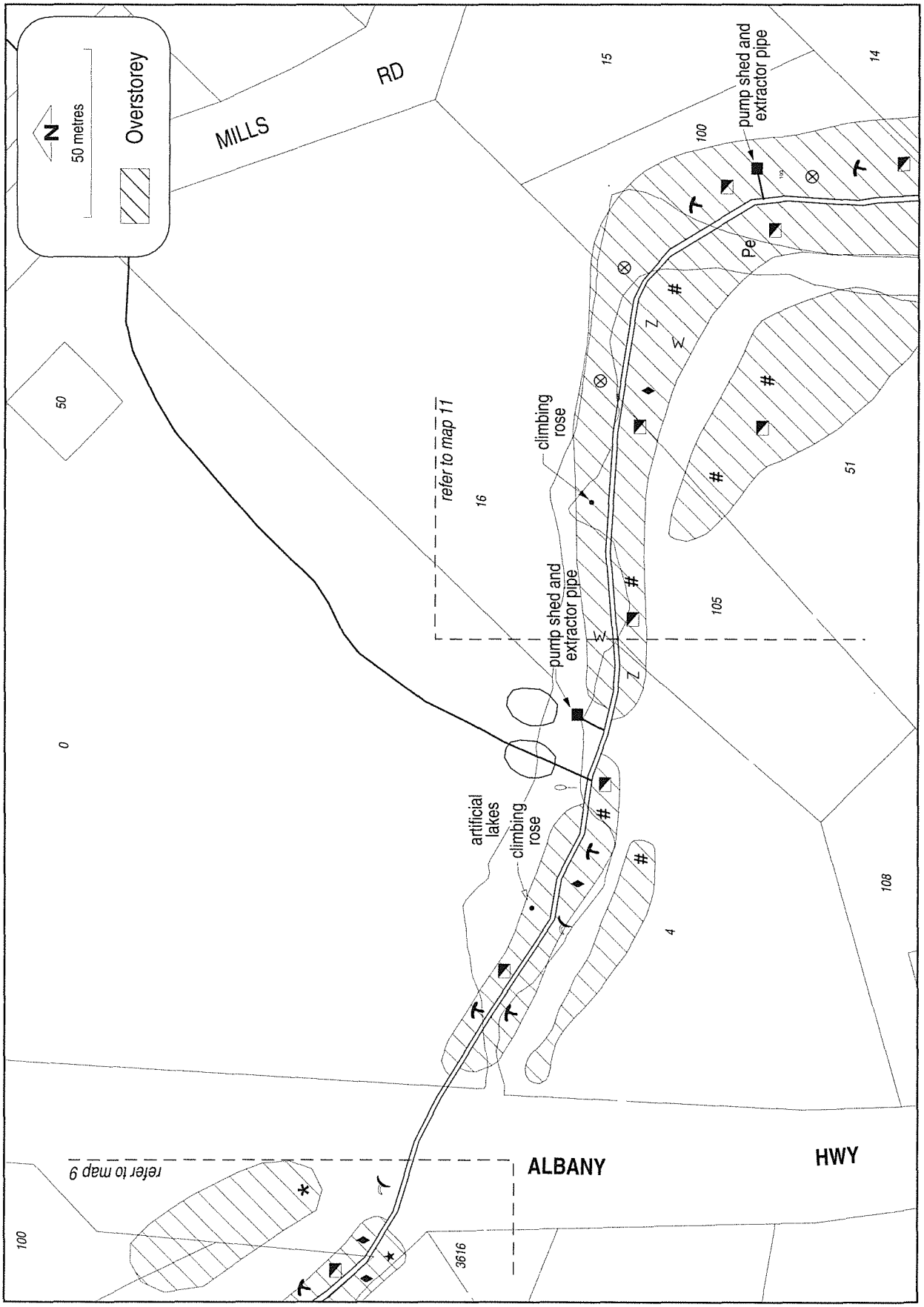
Vegetation This section of foreshore has been highly disturbed and is now maintained as a recreation area with extensive lawns surrounding the Gosnells City Council. The overstorey is patchy (20-80% cover) and extends only a few metres either side of Canning River. The overstorey is comprised of Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) with occasional Marri (*Corymbia calophylla*). There are a number of exotic, deciduous trees present including frequent Fig trees (*Ficus* sp.), and occasional Willow (*Salix* sp.) and Poplar (*Populus* sp.) trees. The middlestorey is patchy (20-80% cover) and is comprised of weeds with very few native species such as Coojong (*Acacia saligna*), Bracken fern (*Pteridium esculentum*)

Recommended Strategies

- Monitor water flows upstream, beneath and downstream of the Albany Highway Bridge and determine whether reinforcement is required around the bridge.
- Assess the effectiveness of the current concrete structures functioning as a riffle zone and replace if necessary.
- Reintroduce emergent vegetation species (Appendix 3) into the river upstream of any threatened tree species and peg using 600 mm "U" shaped pegs to stabilise the plants during peak flows.

- Liaise with City of Gosnells, if possible, to revegetate the foreshore area, increasing the density and extent of overstorey trees to a distance of at least 10 m.
- Define the edge of the rehabilitation works by establishing walkways along the length of the foreshore area.
- Reinforce the native middlestorey and understorey component by planting species recommended in Appendix 3 following weed control.
- Maintain grass control using flauzifop-butyl within rehabilitation zone.

and Swamp peppermint (*Agonis linearifolia*) shrubs present in the remaining portions of overstorey vegetation adjacent to the foreshore area. Common weed species include Castor oil (*Ricinus communis*), Blackberry (Rubus fruticosus), Narrow leaf cotton bush (*Gomphocarpus fruticosus*), Arum lily (*Zantedeschia aethiopica*) and Watsonia (*Watsonia bulbillifera*). The understorey is continuous (> 80% cover). Grass lawns are maintained almost to the very edge of the river foreshore. Common weeds associated with the narrow strip of overstorey vegetation include African lovegrass (*Eragrostis curvula*), Soursob (*Oxalis pes-caprae*), Couch (*Cynodon dactylon*), Ribwort plantain (*Plantago lanceolata*) and Whiteflower fumitory (*Fumaria capreolata*). Common creepers include Bridal creeper (*Myrsiphyllum asparagoides*), Climbing roses (*Rosa* spp.), and Morning glory (*Ipomoea* sp.).	• Implement weed management of priority weed species such as Narrow leaf cotton bush as a minimum but preferably remove and control all tree weeds (Figs, Willows and Poplars) present using methods recommended in Appendix 2. • Tag all native species persisting on the foreshore prior to any weed control activities. • Implement intensive weed control to reduce the biomass of Castor oil, Blackberry, Arum lilies and Watsonia. • Coordinate a community working bee to hand weed Narrow leaf cotton bush, African lovegrass, Soursob, Ribwort plantain and White flower fumitory. • Implement control of creepers and plants that spread rapidly, in accordance with Appendix 2. • Maintain weed control and revegetation program.
Stream Cover: The narrow overstorey and the number of deciduous exotic trees present along the foreshore indicate that very little permanent shade is available. There are intermittent rocks, logs and branches and some vegetative material present in the river channel providing some instream cover.	• Encourage Council to remove exotic trees and implement replacement using mature specimens of Flooded gum, Swamp paperbark and Marri as soon as possible. • Ensure any engineering works do not result in the removal of instream features.
Habitat diversity: The water within the main channel is permanent and clear to light brown in colour. The water depth varies and is shallow, particularly near the Albany Highway bridge. Cement blocks have been placed within the river to act as artificial riffle zone areas. The infrequent logs and vegetation within the channel provide limited habitats for aquatic invertebrates. The absence of healthy riparian vegetation limits suitable habitats for terrestrial animals.	• Assess and develop alternative erosion control devices to the large cement blocks, if deemed necessary, to increase habitat viability for instream organisms and to enhance aesthetic appeal. • Protect instream detritus, logs and branches where these features do not threaten bank stability. • Implement revegetation of the foreshore area, increasing the density and extent of overstorey trees. Undertake reinforcement planting of middlestorey and understorey species.
Other issues: The Gosnells City Council area surrounds Canning River along this survey section and is a high use recreation area. Water enters the lake through artificial lakes situated close by. A pump and extractor pipe are also situated on the river.	• Assess recreational use of the area and ensure that current access pathways meet pedestrian requirements. • Define boundary between lawn and riparian zone with pathways and manage separately. • Liaise with Gosnells City Council about lake management, discharge water quality and potential for ornamental plants such as lilies escaping into the river system. • Assess legality of riparian water rights and determine process for managing volumes extracted.



Canning River Map 10

Canning River — Map 11 (Section G)

Length of section (m): approximately 500 m

Recorder's name: Kelly Shepherd

Date surveyed: 26/10/98

Nearest road access: Albany Highway

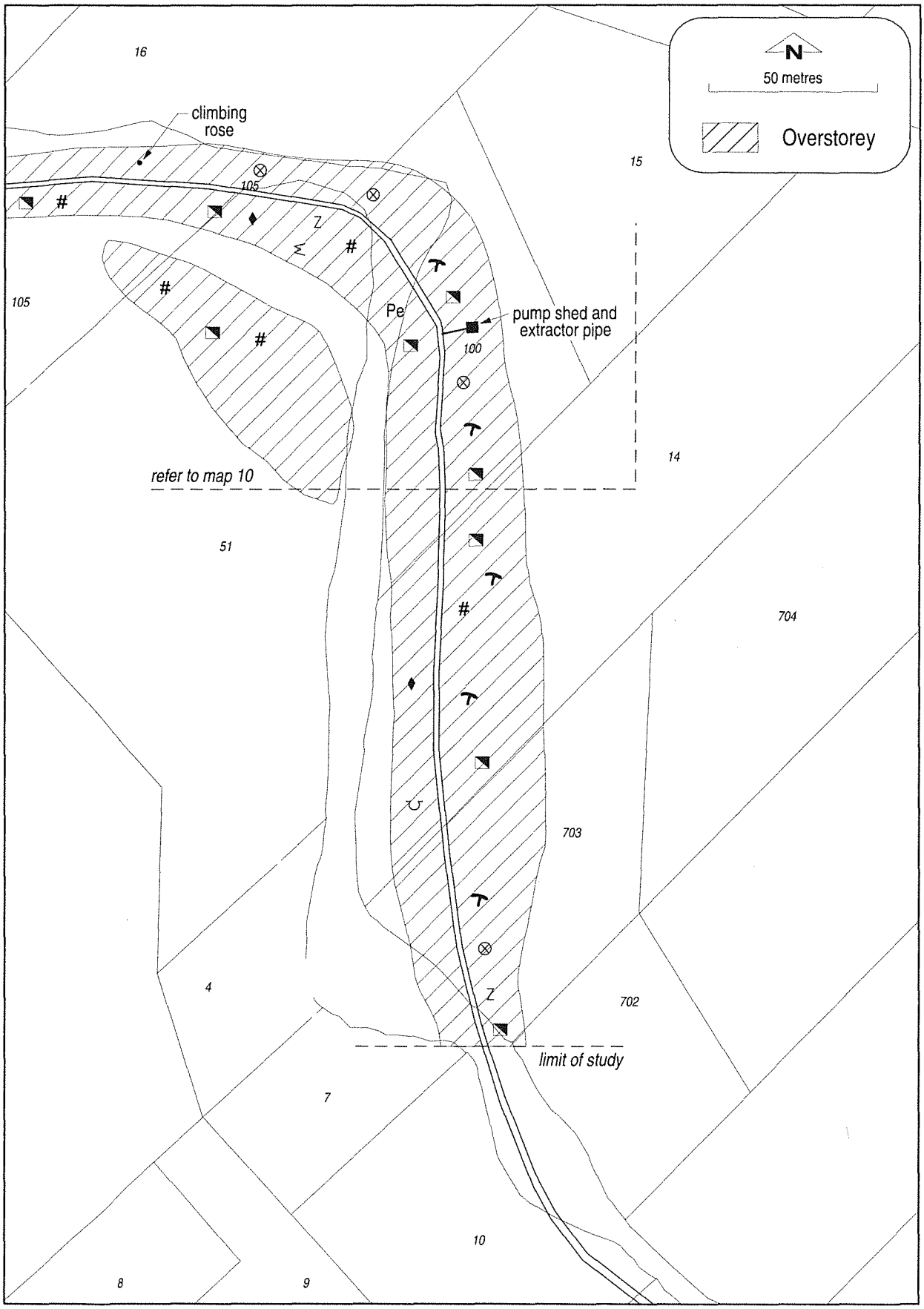
Lot numbers: Right Bank - 4, 105, 51, 4, 7 Left Bank - 0, 16, 100, 14, 703

Summary of river health:

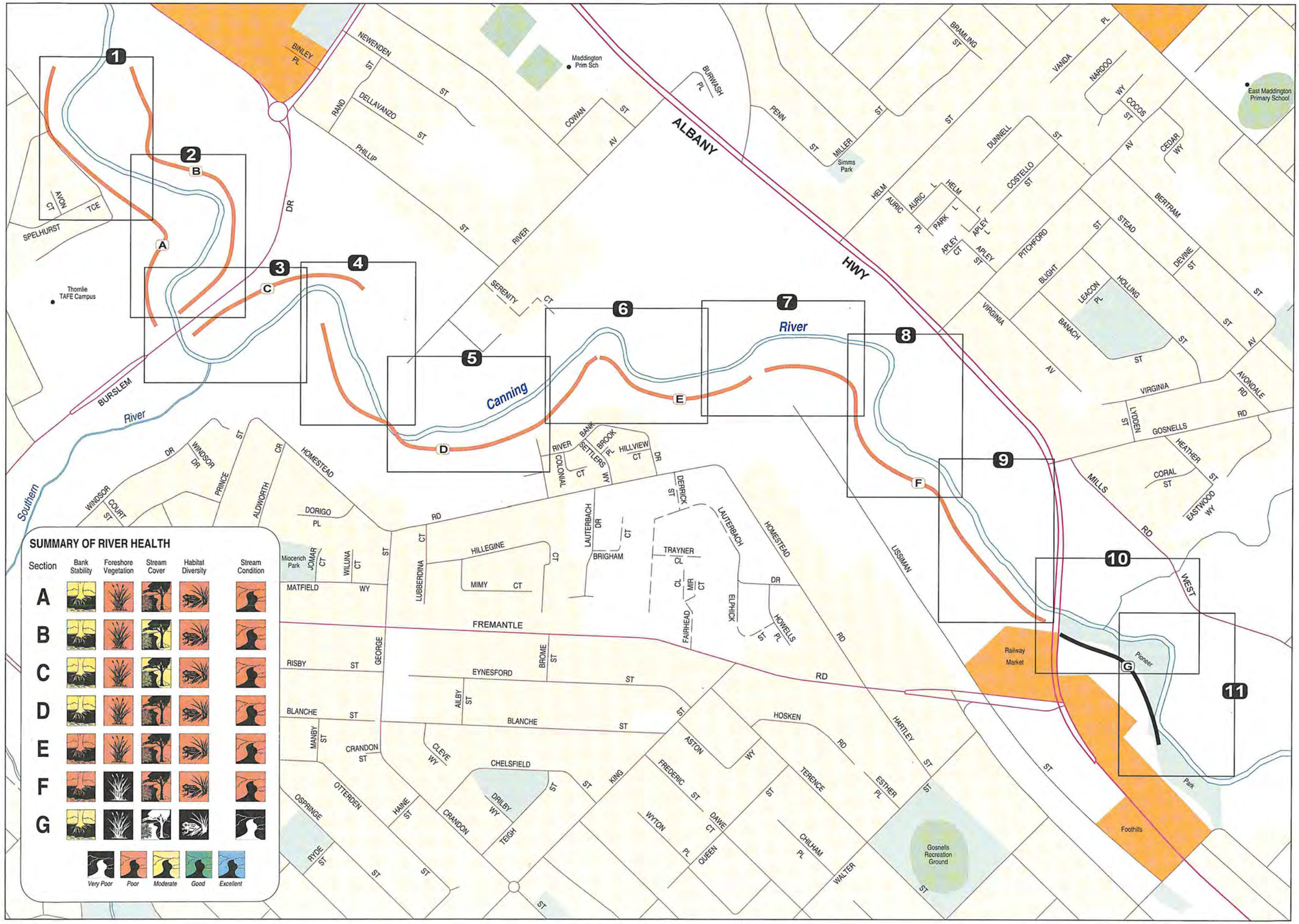
Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Black	Black	Black
Moderate	Very Poor	Very Poor	Very Poor
4	0	0	0

Stream Condition
Black
Very Poor
4

Refer to previous description and recommended strategies for Section G (Map 11)



Canning River Map 11



Canning River - Locality Map

4.3 Roley Pool

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Roley Pool — Map 1 (Section A) Left Bank

Length of section (m): approximately 885 m

Recorder's name: Kelly Shepherd

Date surveyed: 13/8/98

Nearest road access: Collins Road

Lot number: R 28353, Lot 11,2,3,4,5

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Green
Moderate	Poor	Moderate	Good
4	2	4	6

Stream Condition
Yellow
Moderate
16

Description

Bank stability: The main river channel is 2 - 7 m wide. Roley Pool is an open expanse of water 15 - 20 m wide. The right foreshore bank rises on a medium gradient 1 - 1.5 m in height. The floodway area is narrow with the surrounding landscape rising steeply on both sides of the river. Isolated areas of erosion occur along 0 - 5% of the foreshore, particularly around the base of trees growing immediately adjacent to the river channel. There is little evidence of slumping with considerable sedimentation present in the main pool.

Vegetation: The overstorey is continuous (> 80% cover) broken only by the presence of large granite outcrops upstream. The overstorey comprises Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) with occasional Marri trees (*Corymbia calophylla*) present on higher ground. On the steep slopes beyond the riparian zone, Wandoo (*Eucalyptus wandoo*) are common. Introduced Wattles (*Acacia* spp.) occur very rarely within the foreshore area. The middlestorey is patchy (20 - 80% cover) with vegetation present in dense clumps. Native shrub species are present particularly on the steeper slopes rising above the main

Recommended Strategies

- Liaise with Water Corporation and Water and Rivers Commission to assess sedimentation of the main pool through core analysis and determine options for maintaining water depth.
- Identify sources of sediment upstream and implement best management practice to control erosion.
- Work to control weeds and minimise fire risk in the valleys as fire is likely to result in significant topsoil losses.
- Plant emergent species such as native rushes and sedges along the banks of the Pool following grass control to improve bank stability. Leave defined access ways for swimmers and fishermen.

- Manage weeds to reduce the fire hazard and encourage indigenous plant species such as Couch honeypot to recover.
- Define weed control access tracks to minimise disturbance on the steep slopes, and minimise the number of people working on the slopes.
- Tag all native plants to ensure that unnecessary losses are minimised.
- Undertake assisted regeneration of native vegetation by focussing activity on selective weed control using herbicide for Watsonia and Bridal creeper in accordance with Appendix 2.

channel of Canning River. Occasional native species present include Blackboy (*Xanthorrhoea preissii*), Prickly moses (*Acacia pulchella*), Coojong (*Acacia saligna*), Hibbertia spp. Narrow-leafed oxylobium (*Oxylobium lineare*), Thomasia foliosa, Zamia (*Macrozamia riedlei*), Prickly poison (*Gastrolobium spinosum*), *Lasiopetalum bracteatum* and *Grevillea* spp. Weed species are common along the foreshore immediately above the river channel. Frequent species include Blackberry (*Rubus fruticosus*), Bridal creeper (*Myrsiphyllum asparagoides*) and Watsonia (*Watsonia bulbillifera*). A stand of the Giant reed (*Arundo donax*) occurs upstream. The understorey is continuous (> 80% cover) and is dominated by weeds. Scattered clumps of native sedges and rushes such as the Pale rush (*Juncus pallidus*) and Angular sword-sedge (*Lepidosperma tetraquetrum*) are present along the foreshore margin. Couch honeypot (*Dryandra nivea*) occurs infrequently on the higher ground above the river channel. Common weed species in the understorey include Perennial veldtgrass (*Ehrharta calycina*), Ribwort plantain (*Plantago lanceolata*), Soursob (*Oxalis pes-caprae*), Wild radish (*Raphanus raphanistrum*), Blowfly grass (*Briza maxima*), Kikuyu (*Pennisetum clandestinum*), Paspalum (*Paspalum* sp.) and African lovegrass (*Eragrostis curvula*). The introduced rush *Juncus microcephalus* is also present along the river foreshore.	• Remove the bulk of plant biomass of Blackberry, and poison regrowth in accordance with Appendix 2. • Undertake grass control using herbicides containing flauzifop-butyl as recommended in Appendix 2 and replace immediately with native rush and sedge species. • Maintain grass control amongst rushes, as outlined above. • Assess the amount of regeneration of native plants following weed control activities and focus control on weeds in the immediate vicinity of seedlings. • Hand-weed exotic plant seedlings and broadleaf weeds such as Soursob, Ribwort plantain and Wild radish to minimise need for herbicide use. • Remove seed heads from *Juncus microcephalus* prior to ripening, dig out plants and replace immediately with native rush species. Note that it is important not to remove plants which are assisting in bank stabilisation. Plants in high flow zones should be painted with herbicide and not dug out. • Minimise frequency of prescribed burns to enable remnant vegetation to regenerate naturally. • Provide information signs about the bushland and the need to minimise fire in the reserve, and place near the barbecues.
Stream Cover: The native overstorey vegetation overhanging the main channel provides patches of permanent shade along the river. The dense stands of Blackberry and Watsonia also provide patches of cover. The open pool at the base of the stairs descending from Collins Road has no overhanging cover as there is little vegetation around the margin of the pool. Scattered leaf litter and vegetation are present within the main channel. Infrequent rocks and occasional branches provide instream cover.	• Plant mature Flooded gum on both banks to increase shading of the main pool. • Protect remnant vegetation providing stream cover by directing public access to limited points along the foreshore. • Ensure weed control activities are immediately followed by revegetation works, or alternatively managed as maintenance weed control, should sufficient resources not be available for revegetation.

Habitat diversity: Water is permanent at Roley Pool. The depth of the river varies from < 0.1 - 1 m as water flows over exposed granite rocks. The water is light brown in colour due to the presence of tannins. The presence of instream cascades, riffles, pools, rocks and vegetation provide many suitable habitats for aquatic invertebrates, marron, gilgies and fish. The presence of logs at low-lying angles is indicative of suitable basking sites for turtles. There are scattered habitats for terrestrial invertebrates and lizards due to the dense patches of streamside vegetation. The continuous overstorey provides suitable nesting and roosting sites for birds.	• Ensure that assessment of the changes to water depth in Roley Pool take into consideration habitat for instream fauna such as marron. • Work to increase stream cover through instream plantings of species such as those listed in Appendix 3 and increasing the number of trees on the foreshore. • Ensure weed control activities occur in islands with areas of vegetation maintained for fauna habitat. • Replant areas where weed control has been successful as densely as possible to minimise weed re-invasion.
Other issues: This areas is a popular recreational site with two barbecue areas, rubbish bins and park benches. There is a great deal of rubbish scattered about particularly in the recreation area near the base of the stairs at Collins Road. There are undefined walk trails along the foreshore area and along the higher ground. Water discharged from the large pipeline in the downstream area is used to artificially maintain the flow in summer, affecting the hydrological regime. There is some evidence of exacerbated scour as this discharge enters the River from approximately 1.8 m above the main river channel. The density of weeds increases near the residential lots.	• Establish physical boundaries such as walk trails between the lawn area and native vegetation to define areas that require broader scale weed management work. • Ensure rubbish collection occurs on a regular basis; particularly during the marron season. • Designate walk trails and close those not required. It is best to link the trails with the fire access tracks (firebreaks) to minimise further disturbance. • Liaise with Water and Rivers Commission and Water Corporation engineers to determine alternative drop structures for the water used to recharge the Canning River, to reduce scouring. • Encourage landholders adjacent the reserve to manage domestic plants and dispose of garden waste appropriately, to minimise the risk of increasing the distribution of weeds.

Roley Pool — Map 1 (Section B) Right Bank

Length of section (m): approximately 885 m

Recorder's name: Kelly Shepherd

Date surveyed: 13/8/98

Nearest road access: Collins Road

Landowner details: R 28293

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Green
Moderate	Poor	Moderate	Good
4	2	4	6

Stream Condition
Yellow
Moderate
16

Description:

Bank stability: The main river channel is 2 - 5 m wide. Roley Pool is an open expanse of water approximately 15 - 20 m wide. The left foreshore bank rises on a medium gradient to a height of 1 - 1.5 m. There are limited areas of erosion occurring but little evidence of severe undercutting or slumping. Erosion is evident where water flow rates increase, near the outflow pipe and adjacent to rapidly flowing water near rapids. Only 0 - 5% of the foreshore is affected. Sedimentation is localised evident along 0 - 5% of the main channel.

Vegetation: The overstorey is continuous (> 80% cover) and consists of Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) with frequent Marri trees (*Corymbia calophylla*) further up the slope. The middlestorey is also continuous (> 80% cover). Occasional native shrubs are present including Blackboy (*Xanthorrhoea preissii*), Winged wattle (*Acacia alata*), Coojong (*Acacia saligna*), Narrow-leafed oxylobium (*Oxylobium lineare*), *Thomasia foliosa, Thomasia*

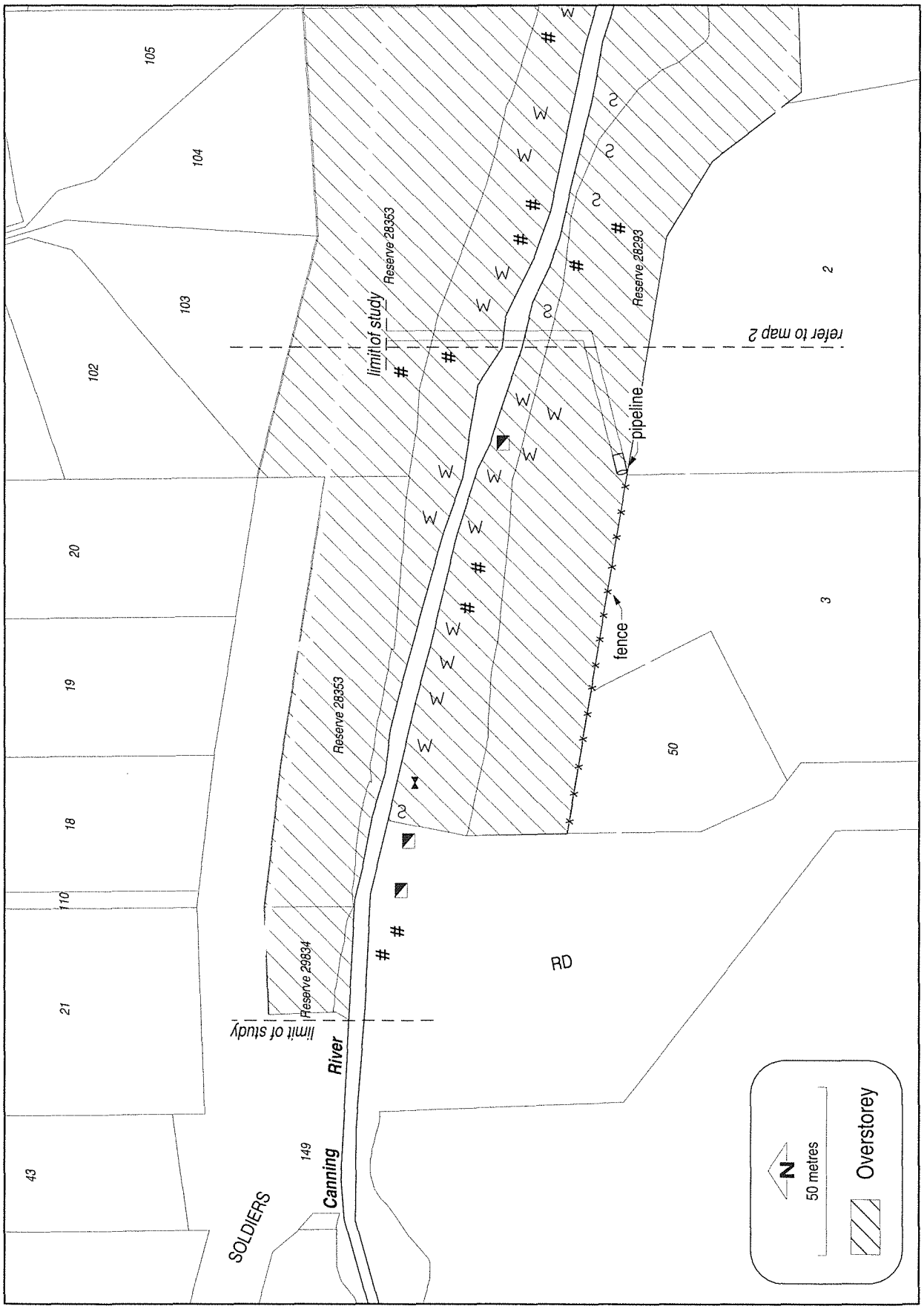
Recommended strategies

- Liaise with Water Corporation and Water and Rivers Commission to assess sedimentation of the main pool through core analysis and determine options for maintaining water depth.
- Monitor water quality particularly sediment load, and trace sources of excessive sediment should high loads occur.
- Identify sources of sediment upstream and implement best management practice to control erosion.
- Protect riparian zone and the valley slopes from fire, which is likely to increase loss of topsoil.
- Maintain existing native vegetation cover and ensure that weed control activities do not threaten bank stability.
- Establish a permanent water depth marker in Roley Pool to assess future changes to sediment load.

- Develop access tracks which minimise disturbance to native vegetation when undertaking weed control activities. Ensure that all involved in weed management work keep to these tracks.
- Focus weed control on Blackberry, Watsonia and Bridal creeper in accordance with Appendix 2.
- Hand weed, prior to flowering, Soursob, Ribwort plantain, localised patches of Blowfly grass and Red natal grass, bag and remove from site.

macrocarpa, Prickly poison (*Gastrolobium spinosum*), *Acanthocarpus preissii*, *Corynotheca micrantha*, Swamp peppermint (*Agonis linearifolia*) and very occasionally Lemon-scented Darwinia (*Darwinia citriodora*). Weed species predominate. Common species include Blackberry (*Rubus fruticosus*) and Watsonia (*Watsonia bulbillifera*). Bridal creeper (*Myrsiphyllum asparagoides*) also occurs frequently. The understorey is continuous (> 80% cover). Isolated clumps of the native Pale rush (*Juncus pallidus*) and Angular sword-sedge (*Lepidosperma tetraquetrum*) are infrequent. Ground weeds that are common include Ribwort plantain (*Plantago lanceolata*), Soursob (*Oxalis pes-caprae*), Blowfly grass (*Briza maxima*) and Red natal grass (*Rhynchelytrum repens*). The aquatic weed Watercress (*Rorrippa nasturtium-aquaticum*) also occurs infrequently within the main channel.	• Treat large stands of Blowfly grass and Red natal grass with Fusilade at 2 l/ha and 4 l/ha respectively. • Hand weed Watercress carefully, ensuring that all below ground stems are removed and segments of the plants do not break off. Replace Watercress immediately with emergent rushes (Appendix 3) such as *Lepidosperma tetraquetrum* or *Baumea rubiginosa.* • Beyond the riparian zone, tag all native species prior to treating weeds with herbicide to minimise unnecessary loss of native plants. • Develop a mobile herbarium of native plants and weed species to enable rapid identification of plants while working, particularly the rushes and sedges. • Monitor natural regeneration following weed control activities and implement intensive planting program (Appendix 3) if required.
Stream Cover: Frequent patches of permanent shade are present along the main channel due to the density of overhanging native vegetation. The presence of the aquatic weed also provides instream cover. There is leaf litter and frequent rocks and branches also providing instream cover.	• Protect native plants occurring on riverbank to maintain stream cover. • Monitor natural regrowth in areas subject to weed control, and if regeneration of native species is limited implement a selective replacement program using species recommended in Appendix 3. • Ensure that instream features such as branches and leaf litter are protected where they are not exacerbating erosion. • Assess the feasibility of controlling the aquatic weed and reintroducing emergent vegetation whilst maintaining stream cover.
Habitat diversity: Water flow is permanent at Roley Pool. Small riffle zones and cascades aerate the water as it flows over exposed instream rocks. Immediately downstream of the elevated pipeline that crosses above the river, large boulders slow water movement. Upstream of the boulders, a small pool 7 - 8m wide has formed. There is little suspended solid material in the water column. The water is light brown in colour due to the presence of tannins. The presence of instream pools, rocks and vegetation provide many suitable habitats for aquatic invertebrates, marron, gilgies, fish and turtles.	• Ensure that weed control activities occurs in nodes and that continuous corridors of vegetation are left to provide habitat until replacement species have established. • Ensure that weed control occurring on the banks and the floodway take into consideration the impact of increasing water velocity in peak flows resulting from vegetation removal; by taking bank vegetation out in sections. • Plant large clumps of emergent native rushes and sedges instream, and stabilise using 600mm "U" shaped pegs.

There are scattered habitats for terrestrial invertebrates and lizards due to the dense patches of streamside vegetation. Note that this vegetation is weed dominated which will affect habitat diversity as weed control is undertaken. The continuous overstorey provides suitable nesting and roosting sites for birds.	• Protect the riparian zone from prescribed burns until more effective weed management programs are developed and implemented.
Other issues: Access to the river is limited and therefore there is currently less recreational impact along this side of the river. Weed control is difficult due to the steep river valley and the presence of native species.	• Define access tracks to correspond with the fire access tracks (fire breaks). • Use existing fire breaks to gain access for weed control activities. • Discourage unnecessary access to this bank by limiting walk trails leading to it. • Minimise removal of weed root structure further up the valley due to high risk of increasing topsoil loss.



Roley Pool Map 1

Roley Pool — Map 2 (Section A) Left Bank

Length of section (m): approximately 885 m

Recorder's name: Kelly Shepherd

Date surveyed: 13/8/98

Nearest road access: Collins Road

Lot number: R 28353, Lot 11,2,3,4,5

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Green
Moderate	Poor	Moderate	Good
4	2	4	6

Stream Condition
Yellow
Moderate
16

Refer to previous description and recommended strategies for Section A (Map 1)

Roley Pool — Map 2 (Section B) Right Bank

Length of section (m): approximately 885 m

Recorder's name: Kelly Shepherd

Date surveyed: 13/8/98

Nearest road access: Collins Road

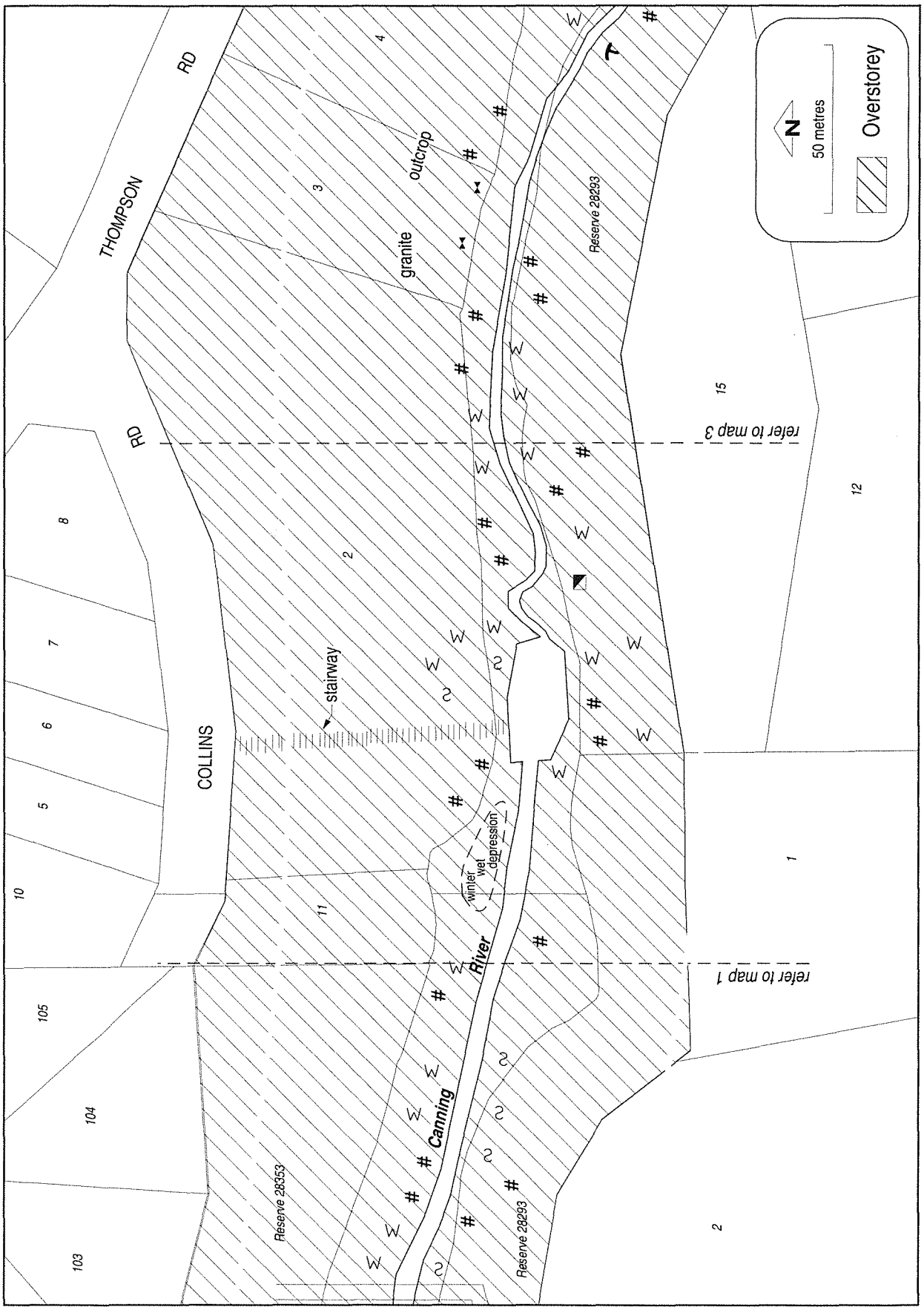
Landowner details: R 28293

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Green
Moderate	Poor	Moderate	Good
4	2	4	6

Stream Condition
Yellow
Moderate
16

Refer to previous description and recommended strategies for Section B (Map 1)



Roley Pool Map 2

Roley Pool — Map 3 (Section A) Left Bank

Length of section (m): approximately 885 m

Recorder's name: Kelly Shepherd

Date surveyed: 13/8/98

Nearest road access: Collins Road

Lot number: R 28353, Lot 11,2,3,4,5

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Green
Moderate	Poor	Moderate	Good
4	2	4	6

Stream Condition
Yellow
Moderate
16

Refer to previous description and recommended strategies for Section A (Map 1)

Roley Pool — Map 3 (Section B) Right Bank

Length of section (m): approximately 885 m

Recorder's name: Kelly Shepherd

Date surveyed: 13/8/98

Nearest road access: Collins Road

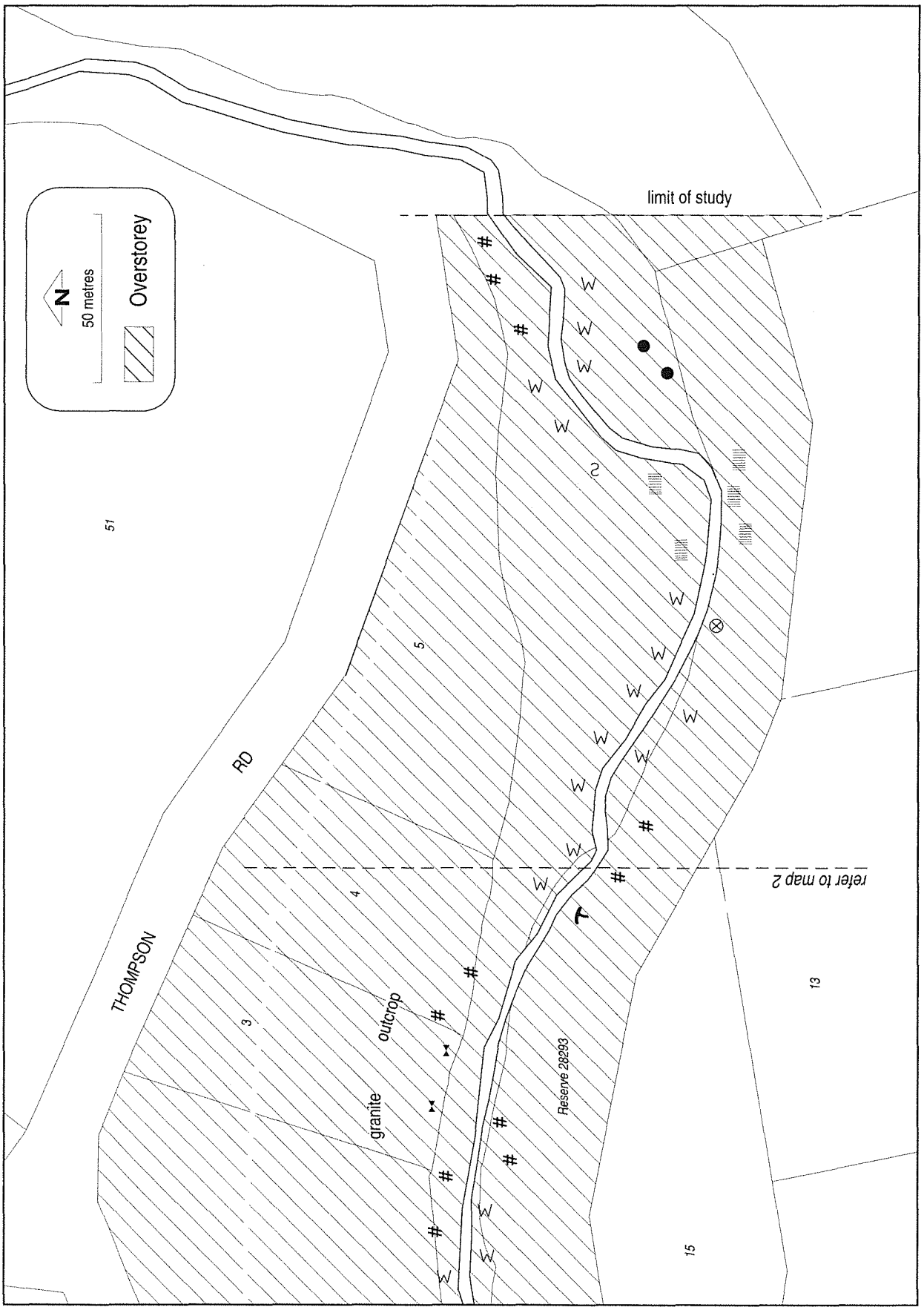
Landowner details: R 28293

Summary of river health:

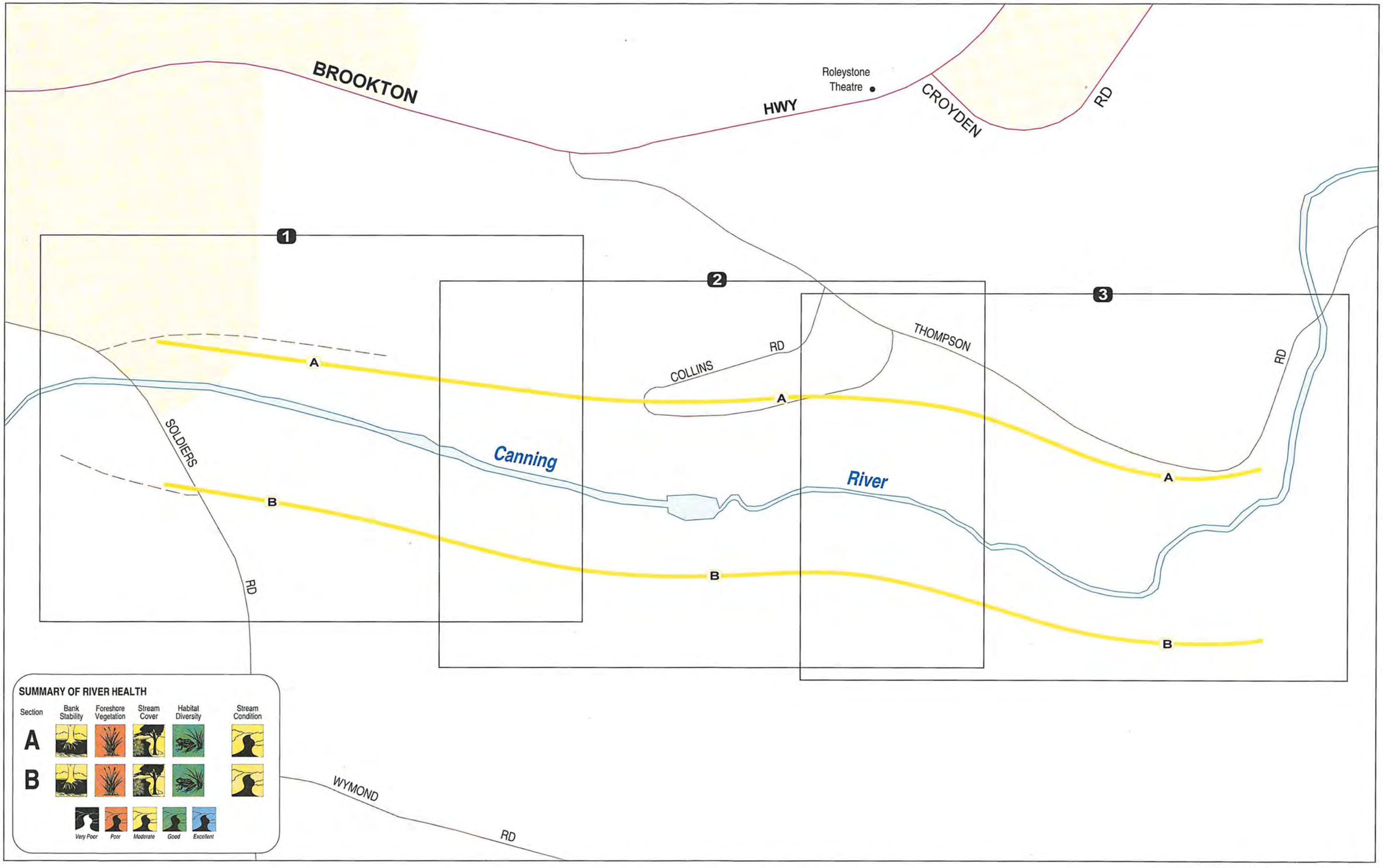
Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Green
Moderate	Poor	Moderate	Good
4	2	4	6

Stream Condition
Yellow
Moderate
16

Refer to previous description and recommended strategies for Section B (Map 1)



Roley Pool Map 3



Roley Pool - Locality Map

4.4 Southernwood Creek

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Southernwood Creek — Map 1 (Section A)

Length from river mouth (m): approximately 305 m

Recorder's name: Kelly Shepherd

Date surveyed: 2/10/98

Nearest road access: Euro Place

Lot Number: 681, 3287, 2970, 3307

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Black	Black	Black
Moderate	Very Poor	Very Poor	Very Poor
4	0	0	0

Stream Condition
Black
Very Poor
4

Description:

Bank stability: Southernwood Creek is 1 - 2 m wide. The foreshore banks are steep, rising to 1 - 4.5 m in height. These banks are prone to erosion due to the lack of foreshore vegetation. Isolated areas of erosion occur near the base of Flooded gum (*Eucalyptus rudis*) trees and discharge pipe outlets resulting in 5 - 20% of the total area being affected. Localised sedimentation is present along 0 - 5% of the creekline. No obvious signs of slumping have occurred recently.

Vegetation: The overstorey vegetation is sparse (< 20% cover) with a few isolated trees remaining along both banks of Southernwood Creek. The tree cover is predominantly Flooded gum (*Eucalyptus rudis*), with a small stand of Marri (*Corymbia calophylla*) and introduced Victorian coastal tea tree (*Leptospermum laevigatum*) on the left bank. Scattered Coojong (*Acacia saligna*) bushes and an occasional Swishbush (*Viminea juncea*), account for the small amount of shrub cover (< 20% cover) present in the middlestorey. The understorey is continuous (> 80% cover) and is dominated by introduced weeds. Perennial grasses such as Kikuyu (*Pennisetum setaceum*) are frequent while Couch (*Cynodon dactylon*), Wild oats (*Avena fatua*), Great brome

Recommended strategies

- Continue implementation and maintenance of extensive revegetation works on both banks of the Southernwood creek.
- Monitor the effectiveness of bank stabilization structures including geotextile matting and caged gabions of limestone rock.

- Continue rehabilitation of the foreshore banks using a mixture of overstorey *Acacia* spp., *Eucalyptus* spp. and *Melaleuca* spp. as recommended in Appendix 3.
- Continue revegetation of the creek bed and banks through planting rushes and sedges.
- Cut Victorian coastal teatree trunks at ground level annually and/or paint immediately with systemic herbicide the first time the plant is cut.
- Hand weed any juvenile Victorian coastal teatree, and any small annuals such as Fleabane, Capeweed, Whiteflower fumitory, Soursob, Flatweed, Musky crowfoot, Pimpernel and Wild radish and remove from site.

(*Bromus diandrus*), Barley grass (*Hordeum leporinum*), African lovegrass (*Eragrostis curvula*) and Guildford grass (*Romulea rosea*) occur occasionally. Small annual weeds such as Soursob (*Oxalis pes-caprae*) are common, while Capeweed (*Arctotheca calendula*), Fleabane (*Conyza* sp.), Vetch (*Vicia sativa*), Wild radish (*Raphanus raphanistrum*), Whiteflower fumitory (*Fumaria capreolata*), Flatweed (*Hypochoeris radicata*), Pimpernel (*Anagallis arvensis*) and Musky crowfoot (*Erodium moschatum*) are present less frequently. The aquatic weed Watercress (*Rorrippa nasturtium-aquaticum*) is present in the upper reaches of the creek.	• Create a mobile herbarium of native and weed species to enable all participants involved in the project to distinguish between weeds and native species. • Investigate opportunities for funding to run plant identification courses involving all participants interested in weed identification and management techniques. • Selectively spray the annual and perennial grasses with Fusilade at 2-4 l/ha to encourage natural regeneration and reduce fire hazard (Appendix 2). • Continue removal of Watercress from the creek ensuring all plant material is placed in bags and removed from site. • Ensure that any weeds removed are not dumped within high water mark to minimise potential for re-infestation.
Stream Cover: Stream cover is rare or completely absent along both banks of Southernwood creek. There is little instream leaf litter or detritus. The aquatic weed Watercress is being systematically removed.	• Investigate the possibility of planting mature tree stock (10 to 50 litre bags) with assistance of the Gosnells City Council to increase the rate of stream cover creation. • Increase the level of planting instream vegetation and bankside species (Appendix 3) to increase instream cover. • Install branches and other features of healthy waterways to increase cover whilst maintaining bank stability.
Habitat diversity: The water flowing in the creek is very light brown in colour and relatively clear with little suspended solids in the water column. The water depth is shallow < 0.5 m. Large rocks and cement blocks present along the main channel are creating riffle zones and aerating the water.	• Investigate the potential for replacing the cement blocks with more natural features to function as riffle zones. • Plant areas with mature stock to provide diversity of age structure and increase rate of shade creation. • Plant instream vegetation in accordance with Appendix 3.

Other issues: This area is a high use recreational site with maintained lawns and walkways surrounding the creek.	• Investigate the opportunity to remove the lawn from the creek side of the dual use path to minimise potential invasion by these species into the rehabilitation zone. • Extend plantings to the dual use path, using ornamental species such as Prickly moses and attractive groundcovers such as Snake bush (*Hemiandra pungens*) to encourage pedestrians to keep to the paths. • Plant shade trees for recreational users.

Southernwood Creek — Map 1 (Section B)

Length from river mouth (m): approximately 160 m

Recorder's name: Kelly Shepherd

Date surveyed: 5/10/98

Nearest road access: Euro Place, Todd Place

Lot Number: 3426, 681, 310000

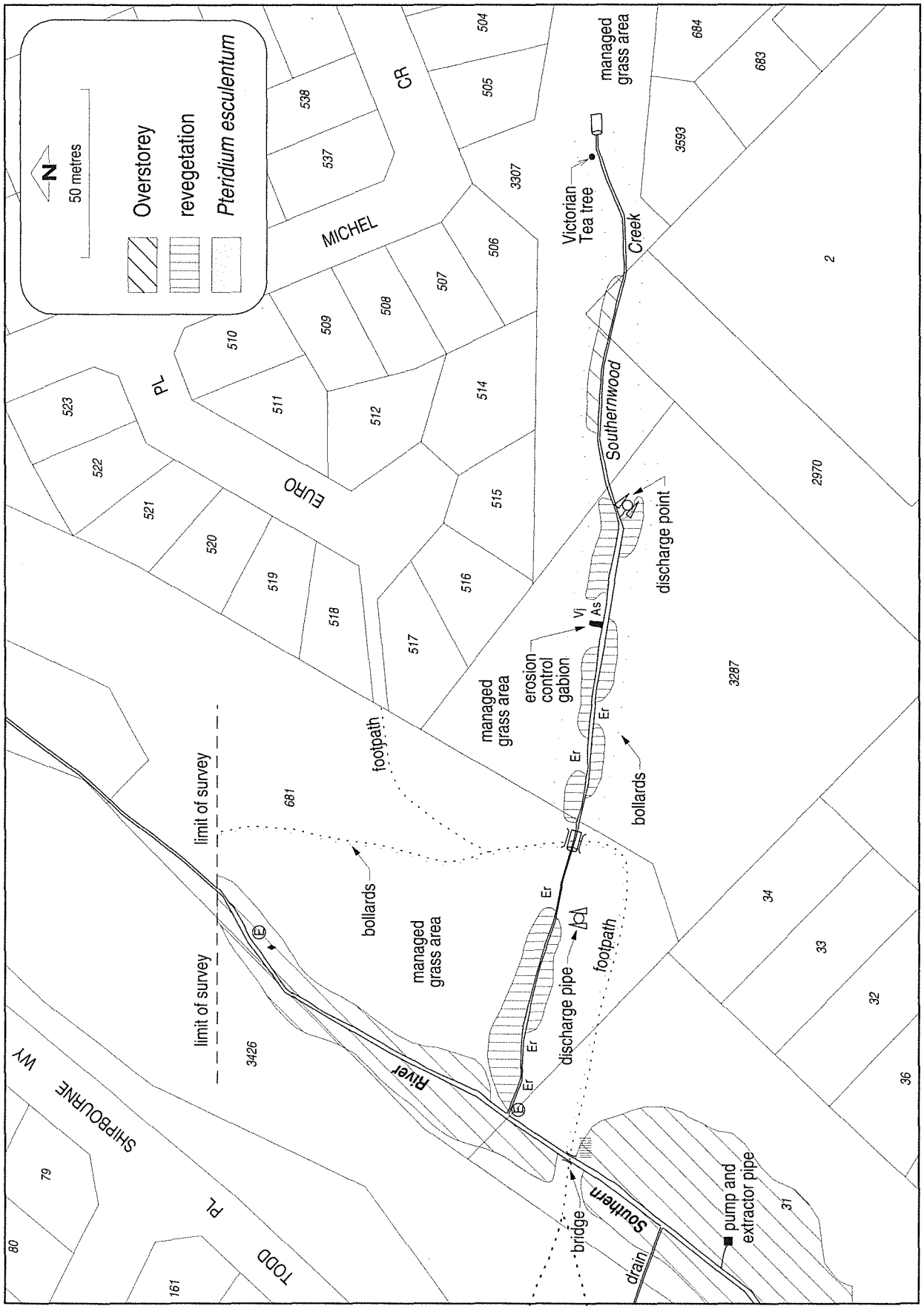
Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

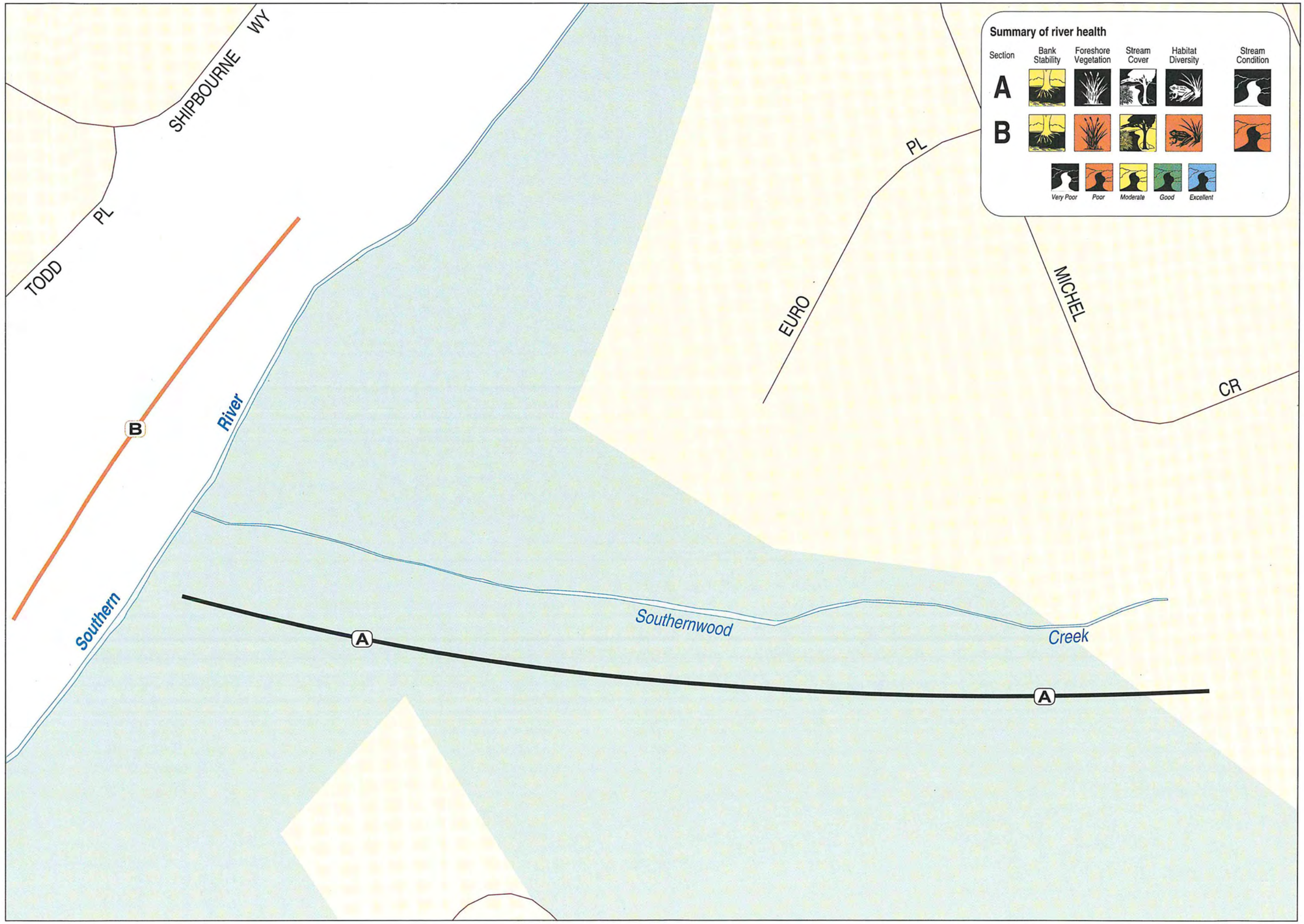
Stream Condition
Red
Poor
12

Description:	Recommended strategies
Bank stability : The main channel of Southern River is 1 - 2 m wide. The foreshore banks rise on a medium to steep gradient to 1 - 1.5 m in height. Localised erosion is evident along 0 - 5% of the foreshore around the base of trees growing along the margins of the foreshore banks and where large logs have fallen across the river. There is little evidence of slumping and bank collapse occurring. Sedimentation is localised, evident along 0 - 5% of the main river channel.	• Plant emergent rush species upstream of the trees subject to erosion to slow water movement and stabilise the foreshore bank. Secure clumps using 600 mm "U" shaped pegs. • Maintain the logs within the main channel if they are currently not impacting on bank stability. • Implement a weed control and revegetation program, planting deep rooted native middlestorey and understorey species to improve bank structure as weeds are eradicated.
Vegetation: The overstorey vegetation is continuous (> 80% cover) and consists of Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) with infrequent Marri trees (*Corymbia calophylla*). Isolated exotic trees such as Weeping willows (*Salix* sp.) are present along the foreshore area. The middlestorey is sparse (< 20% cover) with a small stand of Bracken fern (*Pteridium esculentum*) and occasional Coojong (*Acacia saligna*) present on the left bank near the confluence with Southernwood Creek. Scattered weeds such as Castor oil (*Ricinus communis*) and the Giant reed (*Arundo donax*) are present in low numbers. The understorey is continuous and dominated by weeds. Common grass species include Kikuyu (*Pennisetum setaceum*) and Paspalum (*Paspalum* sp.) with species such as African lovegrass (*Eragrostis curvula*) and Annual Veldt grass (*Ehrharta longiflora*) occurring less frequently. Annual weeds are also present including as Soursob (*Oxalis pes-caprae*), Vetch (*Vicia sativa*) and Whiteflower fumitory (*Fumaria capreolata*). There are scattered Watsonia (*Watsonia bulbillifera*), Jonquils (*Narcissus tazetta*) and Bridal creeper (*Myrsiphyllum asparagoides*) present along the right bank, downstream of the confluence with Southernwood Creek.	• Ensure that weed control activities and replacement programs do not impact on bank stability. Implement in nodes if labour is limited and the potential for erosion is high. • Inject systemic herbicide into Willow and other introduced trees at 10 cm intervals around the trunk. Treat any suckers that appear by painting both leaf surfaces with systemic herbicide at full strength. Remove adult plants once dead • Selectively control Castor oil and Giant reed as suggested in Appendix 2. • Focus hand weeding and herbicide work on Watsonia, Jonquils and Bridal creeper to prevent these becoming a broadscale problem (Appendix 2). • Spray introduced annual and perennial grasses with Fusilade at 2 - 4 l/ha, and monitor any natural regeneration (Appendix 2). • Mark any naturally regenerating seedlings in the area and implement weed control in their vicinity. • Hand weed Whiteflower fumitory, Vetch and Soursob. • Plant high-density nodes of native vegetation in areas where weed control has been successful and maintain weed management status.

Stream Cover: Overhanging native vegetation is frequent along the foreshore banks of the Southern River. The deciduous Willow trees provide only seasonal cover. There is leaf detritus (from the deciduous exotic trees) and branches and logs instream. There is little instream cover.	• Protect remaining native trees and implement weed control to encourage natural regeneration. • Work on re-establishing dense nodes of Swamp paperbark and understorey rushes to increase instream cover. • Plant emergent rushes and sedges and stabilise using 600 mm pegs (Appendix 3).
Habitat diversity: The water in Southern River is brown in colour due to the presence of tannins leached from instream vegetation detritus. There are instream logs and branches, which provide suitable attachment points for aquatic invertebrates. The river is shallow as a result of sedimentation and rocks, and may not support turtles and fish. The lack of native species in the middlestorey and understorey along the foreshore banks limits the number of suitable habitats for terrestrial animals, particularly frogs and reptiles. The continuous overstorey provides suitable nesting and roosting sites for birds.	• Focus revegetation works on re-establishing middle and understorey species. • Ensure weed control close to the banks does not affect bank stability. • Work on reestablishing dense nodes of Swamp paperbark and understorey rushes to increase stream cover.
Other issues: There are undefined walk trails evident along the foreshore area that lead from the walkway bridge. There is a rope attached to a tree on the left foreshore bank indicating children may play in the area. Scattered rubbish was also evident. There is a pump shed and extractor pipe present on the right foreshore downstream from the confluence with Southernwood Creek.	• Select the highest use walk trails and formalise the trails leading from the bridge. • Close any walk trails that are surplus to requirements and revegetate. • Encourage the local government authority to collect rubbish from the riparian zone. • Investigate legality of extraction pipe and pump by clearly defining the cadastral boundary.



Southernwood Creek Map 1



Southernwood Creek - Locality Map

4.5 Wright Brook

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Wright Brook — Map 1 (Section A)

Canning River upstream of Wright Brook confluence

Length of section (m): approximately 390 m

Recorder's name: Kelly Shepherd

Date surveyed: 13/8/98

Nearest road access: Brookside Avenue

Lot Number: Right bank - 2159/C 29398, 66, 93, C 40982, PT 25
Left Bank - PT 11, 246/C 29398, 248 C 29398

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Description

Bank stability: The main river channel is 2 - 4.5 m wide with the foreshore banks ranging from gentle graded slopes < 1 m to more steeply graded banks rising to 1.5 - 2 m in height. Erosion is significant occurring along 20 - 50% of the foreshore section. Focus points of erosion are evident along the shallow graded areas that are prone to flooding. Winter wet depressions are present near excavated banks within the floodway area which were modified several decades ago. Slumping and undercutting are localised and apparent along 5 - 20% of both foreshore banks. Deposition of sediment occurs along 5 - 20% of the main river channel.

Vegetation: The overstorey is continuous (> 80% cover) and extends 35 - 40 m from the river channel on the left bank. Immediately north of the Brookside Avenue walkway the vegetation narrows to 20 - 30 m. The vegetation extends < 20 m on the right foreshore. The overstorey is predominantly Swamp paperbark (*Melaleuca rhaphiophylla*) and Marri (*Corymbia calophylla*) with scattered Flooded gum (*Eucalyptus rudis*) trees immediately along the foreshore banks. Introduced exotic trees such as the Fig (*Ficus* sp.) and Japanese Pepper (*Schinus terebinthifolia*) are present.

Recommended strategies

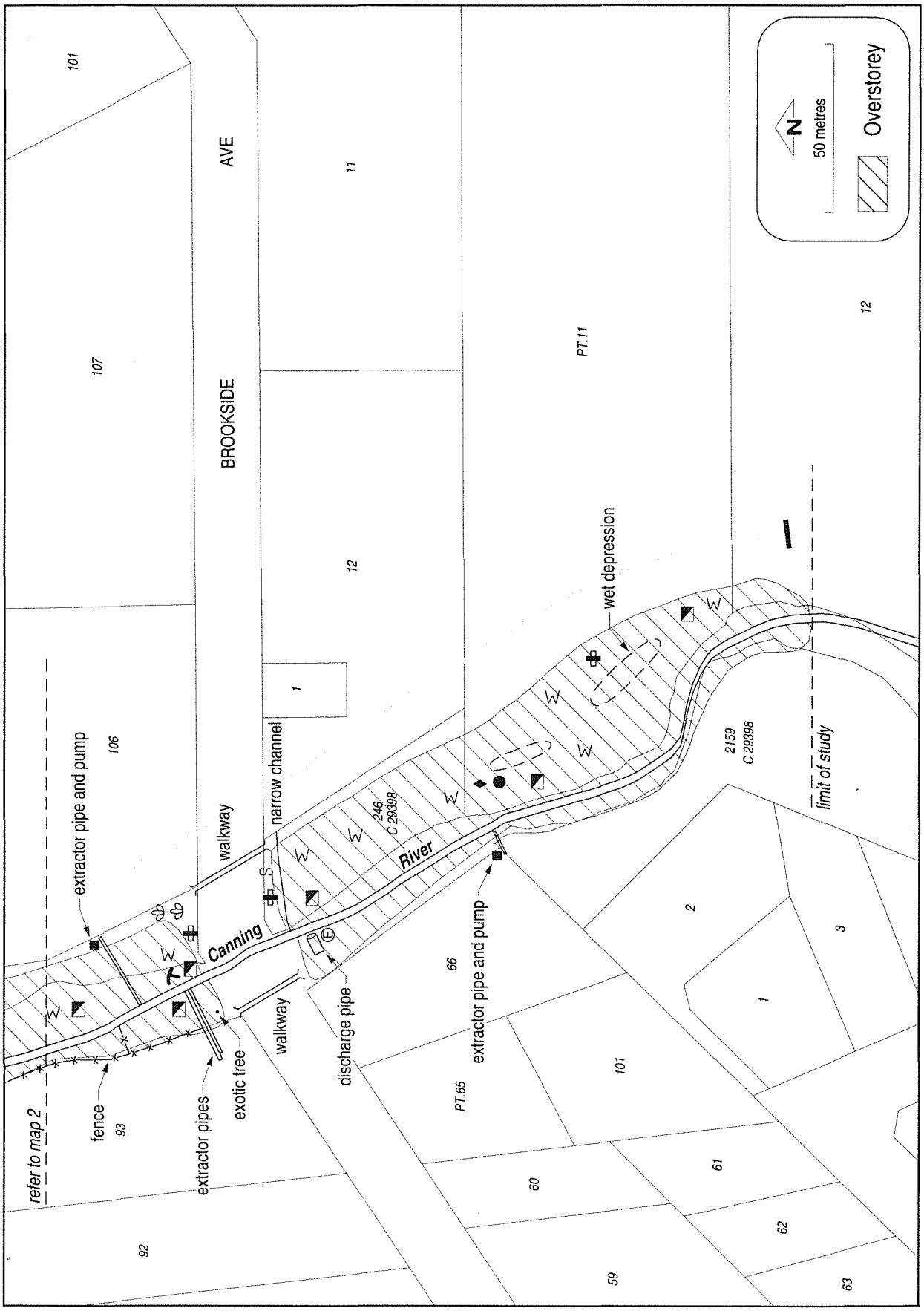
- Establish reserve boundaries and peg boundary to ensure recognition by local residents.
- Increase awareness of catchment management to reduce sediment load to the river and landholder responsibilities relating to riparian rights and foreshore management.
- Increase awareness of impact of excavation on bank stability.
- Where critical erosion is occurring, undertake soft engineering works (Appendix 4) and revegetation to protect trees and minimise foreshore undercutting.

- Undertake weed control in manageable nodes and focus on reinforcing overstorey species and restoring the middlestorey and understorey species once weeds have been eradicated.
- Monitor germination and support native seedling establishment by focussing weed control around natural and assisted regeneration sites. Undertake assisted regeneration if required, by planting overstorey and middlestorey species as listed in Appendix 3.

The middlestorey is patchy (20 - 80% cover). Native species such as Coojong (*Acacia saligna*) areuncommon. Weeds such as Watsonia (*Watsonia bulbillifera*) predominate, present in large, dense stands. A few small Blackberry (*Rubus fruticosus*) plants are present near the confluence of Canning River with Wright Brook. Scattered weeds such as Castor oil (*Ricinus communis*), Canna lily (*Canna* sp.) and Cotton bush (*Gomphocarpus fruticosus*) are also growing along the left foreshore. The understorey is continuous (> 80% cover) and comprises predominantly of introduced weed species. Frequent weeds include Bridal creeper (*Myrsiphyllum asparagoides*), African lovegrass (*Eragrostis curvula*), Kikuyu (*Pennisetum clandestinum*), Couch (*Cynodon dactylon*) and Tambookie grass (*Hyparrhenia hirta*). Soursob (*Oxalis pes-caprae*) and White flower fumitory (*Fumaria capreolata*) are also present.	• Treat Bridal creeper, Watsonia, African lovegrass, Kikuyu and Couch with selective herbicides as recommended in Appendix 2. • Selectively hand weed Castor oil plants, Soursob and Fumitory prior to fruiting. Place weeds in a black plastic garbage bag, secure and remove from site. Leave the plastic bag in the sun for a week to kill any mature seeds. • Monitor and continue treatment of weed species as outlined in Appendix 2. • Reestablish instream vegetation by reintroducing native rushes to the banks of the River; suitable species are outlined in Appendix 3. Use 600 mm "U" shaped steel pegs to secure clumps of species to the stream bed.
Stream Cover: Native vegetation frequently overhangs the narrow river channel providing patches of permanent shade. Exotic deciduous trees such as Fig (*Ficus* sp.) occur infrequently and provide only seasonal shade. Occasional large branches and vegetation debris within the main channel provide instream cover.	• Protect existing remnant vegetation by controlling weeds and reinforcing native vegetation through conducting a planting program. • Increase the extent and density of native emergent rushes and sedges to increase instream cover. • Protect instream branches from removal where they do not obstruct water flow or exacerbate erosion.
Habitat diversity: Water is permanent and light brown in colour due to the presence of tannins leached from instream vegetation. The river channel varies in depth from < 0.1 - 0.8 m. There are logs and rocks within the river providing suitable substrates for aquatic invertebrates. The streamside vegetation is dense but weed dominated and the lack of healthy native vegetation limits the number of suitable habitats for terrestrial organisms.	• Retain debris within the river to maintain habitats for instream organisms. • Assess the need for riparian water rights and ensure that all extraction points are legitimate. • Improve the condition of native vegetation providing instream cover by undertaking weed control activities outlined above.

Other issues: Point source discharge pipes cause increased erosion particularly during high rainfall periods. There are many pumps, bores and off-take pipes used for water extraction from the river. Rubbish washed down from upstream is present within the river channel. Old fence lines occur along sections of the river.

- Modify discharge pipes to reduce scouring by creating a riffled spillway.
- Assess the need for riparian water rights and ensure that all extraction points are legitimate.
- Advise river residents of issues associated with river management including Swan River Trust Act and WRC Act.
- Advise river residents to use floating extraction devices to remove the need to dredge extraction points.
- Encourage residents to remove litter from riparian zone and discourage dumping.



Wright Brook Map 1

Wright Brook — Map 2 (Section A)

Canning River south of Wright Brook confluence

Length of section (m): approximately 390 m

Recorder's name: Kelly Shepherd

Date surveyed: 13/8/98

Nearest road access: Brookside Avenue

Lot Number: Right bank - 2159/C 29398, 66, 93, C 40982, PT 25
Left Bank - PT 11, 246/C 29398, 248 C 29398

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Refer to previous description and recommended strategies for Section A (Map 1)

Wright Brook — Map 2 (Section B)

Canning River downstream of Wright Brook confluence

Length of section (m): approximately 135 m

Recorder's name: Kelly Shepherd

Date surveyed: 14/8/98

Nearest road access: Cockram Road

Lot Number: Right bank - 1, 2, 3 Left bank - PT 25, 98, 3432/C 37779

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Red	Red
Poor	Poor	Poor	Poor
2	2	2	2

Stream Condition
Red
Poor
8

Description	Recommended strategies
Bank stability: The main river channel is 2 - 4.5 m wide with relatively steep foreshore banks rising 1.5 - 2 m in height. Significant levels of erosion occur along 20 - 50% of the steeper sections of the foreshore and around the base of trees growing near the main channel. There is little evidence of slumping or bank collapse. Sediment deposition is localised along 0 - 5% of the river channel including deposits of gravel downstream of the confluence with Wright Brook.	• Liaise with the Water Corporation and the Water and Rivers Commission to assess water volume, velocity and sediment load in peak conditions from Wright Brook and develop strategies to slow the discharge as required. • Identify sources of gravel and implement remedial works to prevent further erosion and sediment load from these sources. • Protect riparian vegetation by implementing soft engineering solutions where necessary (Appendix 4). • Plant large clumps (400 mm x 400 mm) of emergent vegetation immediately upstream of trees to slow water movement and minimise erosion. Secure the plants using 600 mm steel "U" pegs.
Vegetation: The overstorey vegetation is continuous (> 80% cover) along both banks downstream of the Wright Brook confluence. The foreshore vegetation extends only a few metres on the left bank and < 20 m on the right. This vegetation consists of Swamp paperbark (*Melaleuca rhaphiophylla*) and Marri (*Corymbia calophylla*) with scattered Flooded gum (*Eucalyptus rudis*). A Japanese pepper (*Schinus terebinthifolia*) is growing on the right foreshore. The shrub layer is patchy (20 - 80% cover) and contains no native species while the ground layer is a continuous layer (> 80% cover) of exotic weeds. The most common weeds include clumps of Watsonia (*Watsonia bulbillifera*) and a stand of the Giant reed (*Arundo donax*).	• Increase the extent of vegetation by designing and implementing revegetation works, particularly on the left bank using the species listed in Appendix 3. • Undertake extensive weed control however, note these activities should not involve physical disturbance of the ground due to high erosion risk. • Focus weed control activities to reduce fire hazard. • Define access tracks along Brook to undertake weed control activities to reduce disturbance. • Immediately plant native species in high densities where weeds have been eradicated to minimise reinvasion.
Stream Cover: Due to the narrow width of overstorey and the lack of dense middlestorey species, stream cover is patchy along the foreshore banks. Instream cover such as leaf detritus, branches and vegetation occur infrequently.	• Implement overstorey and middlestorey plantings to increase canopy cover and reduce incising of the Brook. • Slow the water velocity moving along the Brook and at confluence using soft engineering works as recommended in Appendix 4. Do not remove instream branches where erosion is not exacerbated.

Habitat diversity: As stream side vegetation narrows habitat diversity decreases along the foreshore area.	• Improve vegetation by implementing weed management and revegetation program. • Undertake weed control in manageable sized nodes to minimise soil disturbance and ensure some habitat continuity between revegetation sites for terrestrial animals.
Other issues: Point source discharge pipes are present and may cause increased erosion particularly during high rainfall periods.	• Assess drainage outlets and retrofit/modify any inappropriately designed outlets to reduce the velocity of water entering the river.

Wright Brook — Map 2 (Section C)

Length of section (m): approximately 280 m

Recorder's name: Kelly Shepherd

Date surveyed: 14/8/98

Nearest road access: Cockram Road

Lot Number: Right bank - 104 Left bank - 1, VCL, C 36382

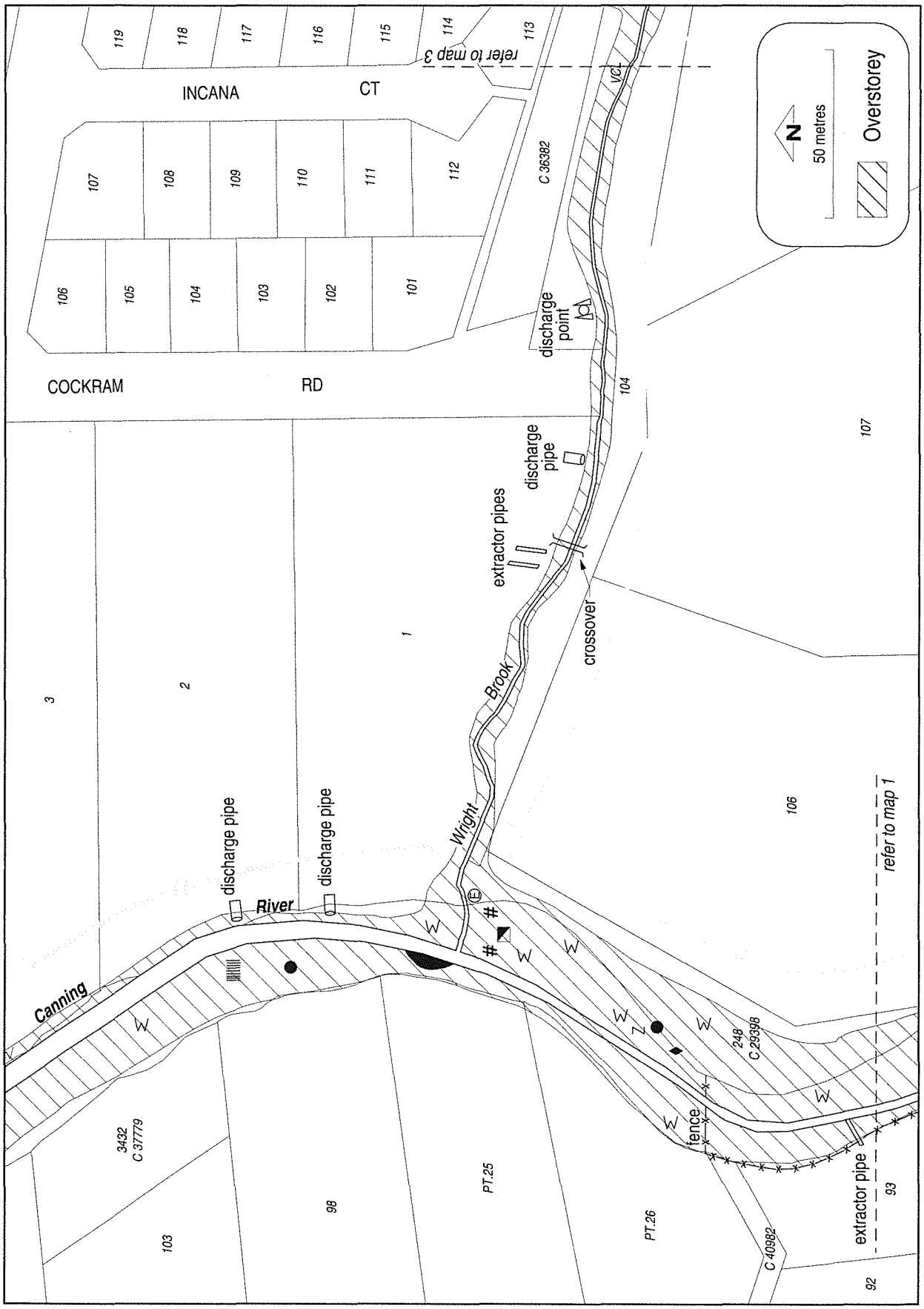
Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Black	Black	Black	Black
Very Poor	Very Poor	Very Poor	Very Poor
0	0	0	0

Stream Condition
Black
Very Poor
0

Description	Recommended strategies
Bank stability: The main channel is very narrow (< 1 m wide) with very steep foreshore banks rising to a height of 1.5 m. Subdivisions further upstream has resulted in an increase in flow rates and load. Erosion is severe evident on > 50% of both foreshore banks. Localised slumping has occurred along 5 - 20 % of the foreshore. Sedimentation is also localised and present along 5 - 20% of the main channel. The Brook may have been artificially modified in the past, reducing the natural meanders along the length of the channel.	• Assess cadastral information to determine extent of drainage reserve. • Survey and peg boundary, and determine vested agency. • Encourage landholder to implement a revegetation program including weed control and restoration of trees as a minimum, ensuring that all plants are protected from grazing. • Replace middlestorey and understorey species as the trees establish and weed control is managed, to improve stability of banks and reduce sediment load. • Undertake a subcatchment assessment to determine a mechanism to manage higher water yield to reduce impact on lower reaches of the Brook. • Assess feasibility of creating a sedimentation pond upstream within drainage reserve to manage water flows. This needs to be determined through a process of liaison between City of Armadale, Water and Rivers Commission and the Water Corporation.
Vegetation: This section of Wright Brook runs through private property and is completely degraded and the overstorey is almost absent (< 20% cover). The overstorey has been reduced to a single row of trees on the left bank, with no trees present on the right. The tree species present include Marri (*Corymbia calophylla*) and Flooded gum (*Eucalyptus rudis*). The middlestorey is almost completely absent with the exception of introduced *Acacia* shrubs and an Oleander bush (*Nerium oleander*). The understorey is continuous (> 80% cover) and comprises of maintained perennial grasses.	• Liaise with private landholder to increase the extent of trees and encourage introduction of native understorey and middlestorey. Peg boundary to prevent mower access, which may assist natural regeneration. • Undertake intensive revegetation and weed management to improve stability and value of Brook using recommendations outlined in Appendices 2 and 3. • Remove exotic species such as Oleander from within drainage line.
Stream Cover: There is minimal overhanging vegetation along the foreshore and almost no available permanent shade. Infrequent instream cover is present as small amounts of vegetative debris collects around rocks and occasional branches.	• Implement revegetation works and weed control activities as soon as practicable.

Habitat diversity: Water flow is seasonal. During winter the water depth is shallow (< 0.3 m) and clear with little vegetative material. No quality habitats for aquatic or terrestrial organisms are present.	• Implement recommendations focussing on water management and riparian zone improvements which will assist in improving habitat diversity.
Other issues: The foreshore vegetation is completely cleared and surrounded by managed perennial grasses.	• Determine the opportunity to fence off both banks of the Brook at a minimum distance of 15 m on either side to undertake intensive re-vegetation while maintaining the lawn outside the rehabilitation zone. • Encourage landholder to maintain current maintenance of perennial grasses, should re-vegetation works not be recognised as a priority.



Wright Brook Map 2

Wright Brook — Map 3 (Section D)

Length of section (m): approximately 340 m

Recorder's name: Kelly Shepherd

Date surveyed: 14/8/98

Nearest road access: Greener Avenue and Wright Place

Lot Number: Right bank - 208, 243/C33954 Left bank - 3152/C36382, 243/C33954

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Description

Bank stability: The main channel is narrow (< 1m wide), meandering, with steep foreshore banks rising 1.5 - 2.5 m in height. The channel is deeply incised as a result of increased water yield from the catchment following development further upstream. A number of small runoff channels are present. Erosion is significant along 20 - 50% of the foreshore, particularly near the base of trees growing along the edge of the foreshore banks and near drainage points where water runoff increases after storm events. Slumping occurs very occasionally. Sedimentation is localised (5 - 20% of the channel) accumulating near the inside curve of channel meanders.

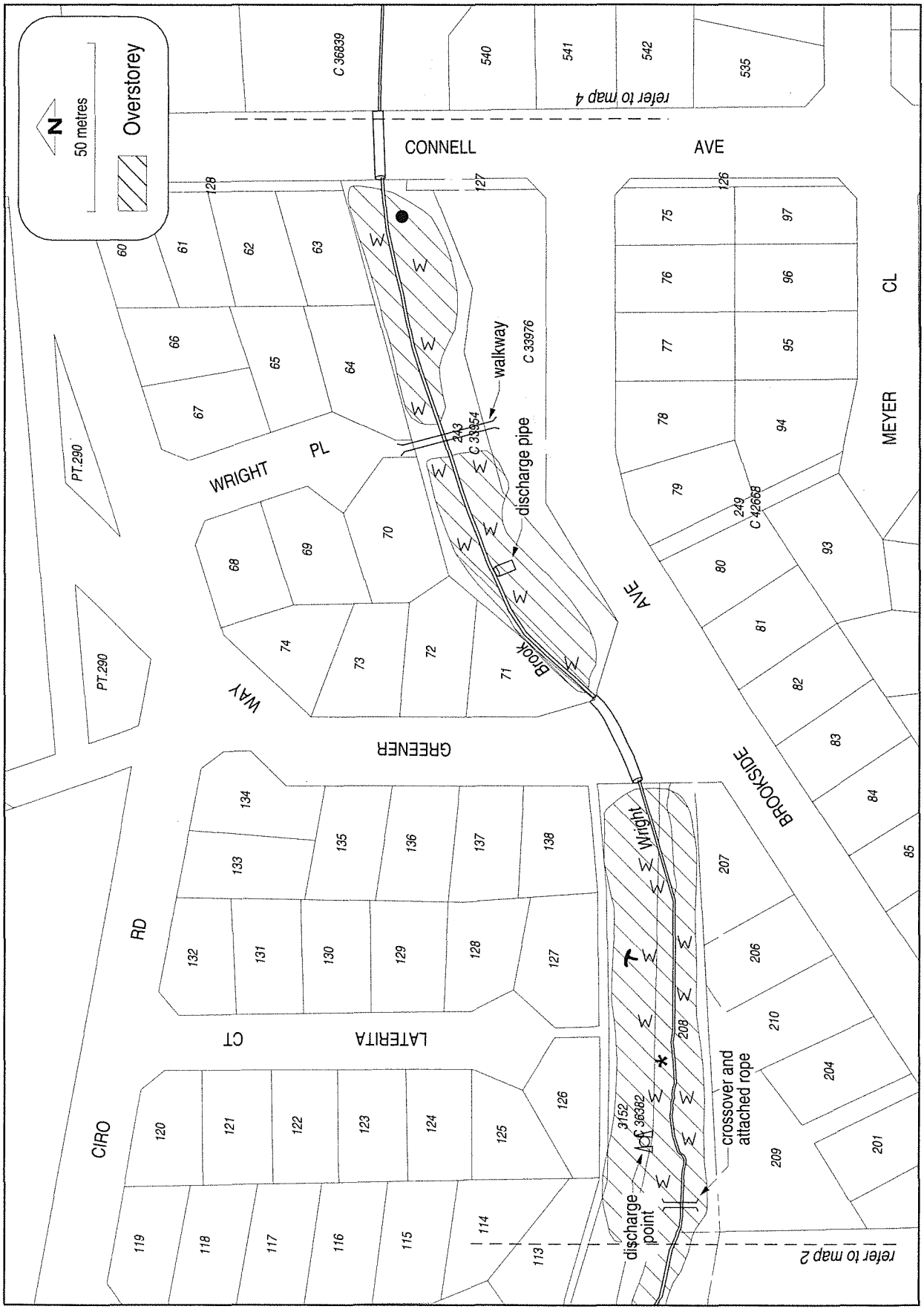
Vegetation: The overstorey is continuous (> 80% cover). Common tree species include Swamp paperbark (*Melaleuca rhaphiophylla*), Flooded gum (*Eucalyptus rudis*) and Marri (*Corymbia calophylla*) on the higher areas of the reserve away from the main channel. The middlestorey is continuous (> 80% cover) with scattered native species present such as Blackboy (*Xanthorrhoea preissii*), Prickly moses (*Acacia pulchella*), Winged

Recommended strategies

- Assess catchment drainage system and determine the need for retrofitting with a sedimentation basin to reduce water velocity and volume. This needs to be determined through a process of liaison between City of Armadale and Water and Rivers Commission.
- Assess the need for, and implement if appropriate, instream works, such as riffles, to slow water speed.
- Ensure that the impact on bank stability is considered prior to any weed control activities are undertaken along the foreshore.
- Plant emergent species immediately upstream of trees suffering erosion to slow water movement. Use 600 mm "U" shaped steel pegs to stake the plants into the channel bed.

- Maintain current ornamental planting of species such as Silver Princess (*Eucalyptus caesia*) and Robin Gordon grevillea (*Grevillea* sp.) close to residences on the east side of Greener Avenue.
- Provide information booklets on benefits of planting locally indigenous species.
- Undertake weed control using qualified weed control operators.

wattle (*Acacia alata*), Semaphore sedge (*Mesomeleana tetragona*), *Hibbertia* sp. and *Grevillea* sp. Dense stands of Watsonia (*Watsonia bulbillifera*) predominate. Pampas grass (*Cortaderia selloana*) is scattered throughout the area. The understorey is continuous (> 80% cover) and comprises introduced weed species. Common weeds include African lovegrass (*Eragrostis curvula*) and Kikuyu grass (*Pennisetum clandestinum*). Paspalum sp. while the Dolichos pea creeper (*Dipogon lignosus*) and Lantana (*Lantana camara*) occur less frequently.	• Protect native species by using a person familiar with native plants to tag these species prior to implementing weed control activities, to reduce unnecessary loss. • Undertake grass control using process recommended in Appendix 2. • Hand weed Dolichos pea (*Dipogon lignosus*) and treat suckers and regrowth with herbicide (Appendix 2). • Reintroduce understorey and reinforce overstorey with species recommended in Appendix 3 once weeds are eradicated.
Stream Cover: Overhanging vegetation provides patches of stream cover along the brook. Leaf detritus, rocks and the occasional branch provide instream cover.	• Protect and enhance remnant vegetation occurring near the streamline during weed control activities.
Habitat diversity: Water flow is seasonal. During winter the water depth is shallow (< 0.3 m) particularly near areas of increased sediment deposition. The water is clear and fast flowing. Instream rocks and shallow water provide occasional riffles appropriate for aquatic invertebrates but most likely too shallow for fish and turtles. The lack of native vegetation in the middlestorey and understorey along the fringes of the foreshore limits the number of suitable habitats for terrestrial invertebrates and vertebrates such as small reptiles and frogs. The continuous overstorey provides nesting and roosting sites for birds.	• Implement recommendations above to enhance native vegetation and reduce the level of weed invasion. • Assess water yield and opportunities to reduce the impact of increased water volumes, and then implement program.
Other issues: Discharge pipes are present within the foreshore area, with some of the outflow points occurring away from the foreshore bank causing erosion as water flows toward the brook. There is evidence that the main channel is dredged. The clearing of debris and sediment from the brook increases the speed of water and may exacerbate erosive damage to foreshore banks. Scattered rubbish has accumulated within the Brook.	• Encourage continued weed control near the Wright Place walkway. • Liaise with City of Armadale and WRC to assess drainage management and advise of negative impacts of dredging and clearing within the foreshore area. • Budget for, or apply for external funding, to retrofit drainage system to improve water management through the Wright Brook subcatchment.



Wright Brook Map 3

Wright Brook — Map 4 (Section E)

Length of section (m): approximately 210 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

Nearest road access: Megisti Street

Lot Number: 3222, C36839

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Description

Bank stability: The main channel is narrow 1 - 1.5 m wide. The steep gradient foreshore banks rise to a height of 1 - 2.5 m. The channel is deeply incised as a result of an increased water yield from the catchment following development. Numerous dredged channels occur within the area in conjunction with sheet runoff spreading across the reserve, is causing increased erosion. The dumped dredged material is piled close to the banks of the graded channels. Erosion is significant and evident near the base of trees and at drainage points. A total of 20 - 50% of the channel within this section is experiencing some form of erosion. Slumping occurs very occasionally. As water movement is rapid sediment only accumulates within the main channel in small deposits.

Vegetation: The overstorey is patchy (20 - 80% cover) as some areas have been cleared. Swamp paperbark (*Melaleuca rhaphiophylla*), Flooded gum (*Eucalyptus rudis*) and Marri (*Corymbia calophylla*) predominate. Occasional introduced Fig (*Ficus* sp.) and Acacia (*Acacia* sp.) trees are present in the overstorey. The middlestorey is continuous (> 80% cover). Scattered native species such as Coojong (*Acacia saligna*), Prickly moses (*Acacia pulchella*), Winged wattle (*Acacia alata*), *Thomasia foliosa,*

Recommended strategies

- Assess catchment drainage system and determine the need for retrofitting with a sedimentation basin to reduce water velocity and volume. Liaise with City of Armadale and Water and Rivers Commission to determine possible options.
- Assess the need for, and implement if appropriate, instream works, such as riffles to slow water speed and divert some flow to floodplain.
- Protect tree roots where necessary by establishing geotextiles or similar products in the short term.
- Establish clumps of native emergent sedges and rushes to increase bank stability. Secure plants using 600 mm "U" shaped steel pegs.

- Develop a reserve management plan to assess community needs, define access points, determine catchment hydrology issues and develop recommendations to improve and enhance native vegetation and control exotic species is required - note this applies to all of Wright Brook.
- Undertake weed control activities in accordance with methods outlined in Appendix 2. Undertake activities in nodes, focusing on areas that can be effectively managed.

Hibbertia sp. and Green stinkwood (*Jacksonia sternbergiana*) are very infrequent. These species occur on higher ground away from the main channel. Common weeds present include dense stands of Watsonia (*Watsonia bulbillifera*) with isolated stands of the Giant reed (*Arundo donax*). Scattered Nightshade (*Solanum nigrum*) and Cotton bush (*Gomphocarpus fruticosus*) plants are also present near the foreshore. The understorey is continuous (> 80% cover) and is dominated by introduced weeds. The native ground creeper Running postman (*Kennedia prostrata*) occurs infrequently. Weed species include Plantago (*Plantago lanceolata*), Lupins (*Lupinus* sp.), African lovegrass (*Eragrostis curvula*), Cyperus (*Cyperus involucratum*), Red natal grass (*Rhynchelytrum repens*), Paterson's Curse (*Echium plantagineum*), Annual veldtgrass (*Ehrharta longiflora*) and the two creepers Dolichos pea (*Dipogon lignosus*) and Morning glory (*Ipomoea* sp.).	• Tag native plants prior to any herbicide application to ensure there are no unnecessary losses. • Maintain a buffer adjacent to the streamline until weeds can be immediately replaced with dense plantings of native species to inhibit weed re-establishment. • Re-establish middle and upperstorey species in a planned revegetation program using species recommended in Appendix 3. • Plant understorey species in high density groups, following several weed treatments to minimise re-invasion. • Inject herbicide into introduced Wattles and Figs at 10 cm intervals around the trunk in spring (Appendix 2). Selectively spray any suckers where they regenerate, and remove adult plants once dead. • Cut and remove bulk of vegetative material (biomass) from Giant reed and pour systemic poison down stump immediately. Monitor any regrowth. • Cut stems of Narrow leaf cotton bush and paint stump or alternatively, where the bank is stable, hand weed entire plant and remove from site, prior to flowering. • Hand weed Nightshade, Plantago and Lupins prior to flowering and remove from site. • Remove the bulk of vegetative material of the creepers Dolichos pea and Morning glory and selectively treat the re-growth. Juvenile plants can be easily hand weeded. • Hand weed small populations of African lovegrass, Red natal grass and Annual veldtgrass. Alternatively spray with Fusilade at a rate of 4 l/ha. • Repeatedly brushcut Cyperus and Paterson's Curse prior to flowering. Treat with herbicide in accordance with the recommendations outlined in Appendix 2.
Stream Cover: Overstorey trees provide frequent overhanging stream cover and patches of shade along the foreshore. Instream leaf litter, rocks and branches provide instream cover. Some Watsonia (*Watsonia bulbillifera*) plants are growing within the river channel.	• Remove Watsonia from within channel and replace with emergent native rush species such as Pale rush (*Juncus pallidus*).

Habitat diversity: The fast flowing water is clear to very light brown in colour. The river channel is narrow and shallow and may not support larger aquatic fish and turtles but may provide adequate habitats for aquatic invertebrates. A lack of healthy native vegetation types along the foreshore may limit available habitats for terrestrial invertebrates, reptiles and frogs. The presence of a continuous overstorey provides roosting and nesting sites for birds.	• Undertake revegetation works and weed control to improve cover and habitat diversity as outlined above. • Manage weed control in nodes and ensure faunal corridors are maintained to facilitate movement of any animals present within the reserve. • Establish buffer zones around any revegetation works to minimise re-invasion of weeds to improve habitat diversity.
Other issues : The proximity to residential areas and the presence of undefined walk tracks throughout the surveyed area indicates some recreational use. There is evidence of dredging and some planting but little weed control. There is also evidence of recent burning and tree regeneration within patches of the bushland.	• Develop a reserve management plan which assesses community needs, defines access points, determines catchment hydrology issues and develops recommendations to improve and enhance native vegetation and control exotic species, note this applies to all of Wright Brook. • Encourage local residents to participate in management of the local park. • Increase rubbish bin availability to reduce the quantity of litter entering the Brook.

Wright Brook — Map 4 (Section F)

Length of section (m): approximately 175 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

Nearest road access: Anembo Place

Lot Number: 1055

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Red	Yellow	Red
Moderate	Poor	Moderate	Poor
4	2	4	2

Stream Condition
Red
Poor
12

Description

Bank stability: The main channel is narrow (< 1 m) and the foreshore bank grade is very steep, rising to a height of 5 m. Erosion is localised along 5 - 20% of the foreshore. There is little evidence of slumping or bank collapse. Sedimentation is localised along 5 - 20% of the main channel.

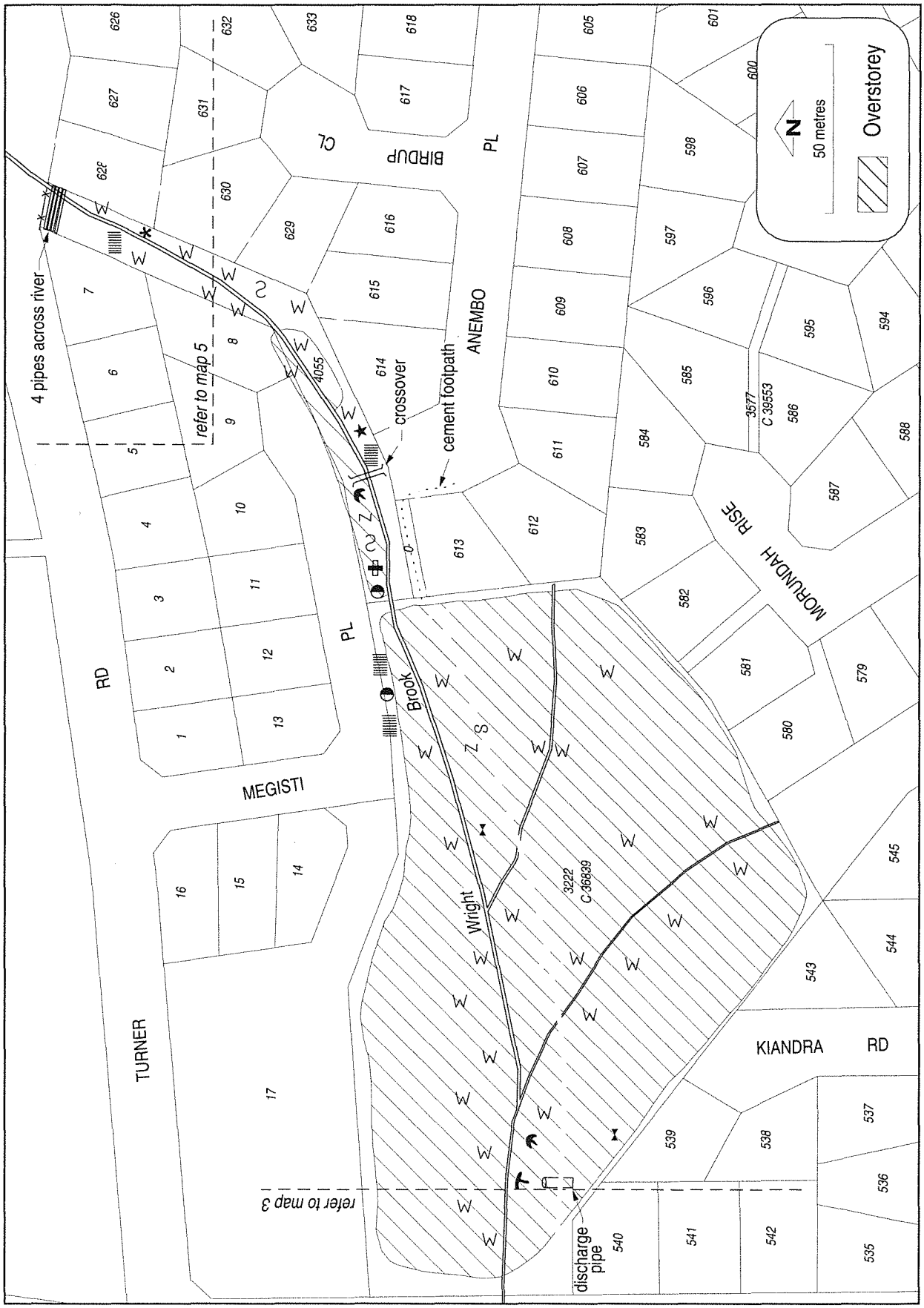
Vegetation: The foreshore is bounded by residential subdivisions reducing the foreshore vegetation to a narrow strip a few metres wide each side of the brook. The overstorey is patchy (20 - 80% cover) and Flooded gum (*Eucalyptus rudis*) and occasional Marri (*Corymbia calophylla*) trees are present. Areas along the foreshore have been cleared and tree seedlings are regenerating. The middlestorey is patchy (20 - 80% cover) and includes native species such as Coojong (*Acacia saligna*), Swishbush (*Viminaria juncea*), Prickly moses (*Acacia pulchella*) and *Thomasia macrocarpa*. Common weed species include dense stands of Watsonia (*Watsonia bulbillifera*) and isolated patches of the Giant reed (*Arundo donax*). Infrequent introduced shrubs include Cotton bush (*Gomphocarpus fruticosus*), Nightshade (*Solanum nigrum*), Pampas grass (*Cortaderia selloana*) and Bulrush (*Typha orientalis*). The understorey is continuous (> 80% cover) and is dominated by

Recommended strategies

- Identify the agency holding vesting and the responsibility for managing the reserve.
- Encourage increased management of reserve, particularly as it relates to weed control and replanting with native species.
- Protect bank stability during weed control procedures and clearly define access points.

- Undertake weed control but limit activities to areas which can be replanted immediately as the steep banks are susceptible to erosion.
- Consider potential for use of erosion control matting as an option to reduce weed re-emergence, support plants installed and improve bank stability on the steep gradient banks.
- Treat Bridal creeper, Watsonia, African lovegrass, Kikuyu and Couch with selective herbicides without disturbing the banks using methods suggested in Appendix 2. This is particularly important as currently these species represent a significant fire hazard due to the proximity to private properties.
- Cut and remove bulk of vegetative material from Giant reed and pour systemic poison down stump immediately. Do not disturb the rhizome mat as it will result in significant destabilization of the banks.

introduced weed species. Many weed species are growing within the main channel. Some occasional species include *Paspalum* sp., White flower fumitory (*Fumaria capreolata*), Soursob (*Oxalis pes-caprae*), Fleabane (*Conyza* sp.), Cape weed (*Arctotheca calendula*), Ribwort plantain (*Plantago lanceolata*), Wild oats (*Avena fatua*), Paterson's Curse (*Echium plantagineum*) and the introduced sedge *Juncus microcephalus*. Exotic creepers are growing along the residential fences and escaping into the reserve.	• Selectively hand weed Castor oil plants, Soursob, Fumitory prior to fruiting and remove from site. • Undertake assisted regeneration if required, by planting overstorey and middlestorey species outlined in Appendix 3 once weeds have been eradicated. • Support seedling establishment by focussing weed control around natural and assisted regeneration sites. • Re-establish instream vegetation by reintroducing native rushes and sedges to the banks of the River. Suitable species are outlined in Appendix 3. Secure clumps of plants using 600 mm "U" shaped steel pegs.
Stream Cover: The overhanging vegetation provides patchy stream cover along the brook. Dense understorey weed species are growing within the main channel and almost cover the stream completely.	• Focus on increasing canopy cover by planting middle and overstorey native plants, and once established undertake weed control close to the stream. Maintenance weed control will be required around seedlings to enable the plants to establish.
Habitat diversity: Due to the highly degraded surroundings and narrow strip of modified vegetation, it is unlikely that the area can support a great variety of habitats for aquatic or terrestrial animals.	• Undertake revegetation and weed control activities as outlined above to improve habitat diversity.
Other issues: This area is adjacent to a new subdivision and is highly disturbed. Building rubble has been dumped along the left foreshore.	• Identify vesting of the reserve and contact reserve manager to request better management of the drainage reserve. • Assess opportunities for community involvement in stream management and try to develop commitment to drainage management by land manager. • Define access tracks adjacent to streamline to encourage use of the area and thereby generate support for improvements. • Encourage landholders and land managers to remove rubbish dumped into the area.



Wright Brook Map 4

Wright Brook — Map 5 (Section G)

Length of section (m): approximately 550 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

Nearest road access: Turner Road

Lot Number: PT 290, PT 138, 138

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Description

Bank stability: The Brook channel is narrow (< 1m) with steep banks rising to 2 m. Further upstream sections of the Brook flow over expanses of granite rock. The main channel is undefined along these areas and braided creeks form. During peak flows the Brook is prone to flooding. Erosion along the foreshore banks is significant occurring along 20 - 50% of the area. Focus points of erosion occur where small drainage channels lead into the Brook and around the base of trees growing along the foreshore bank. Scouring has also occurred where large branches have fallen across the stream. Slumping is localised along 5 - 20% of the foreshore. There is little evidence of sedimentation within the main channel.

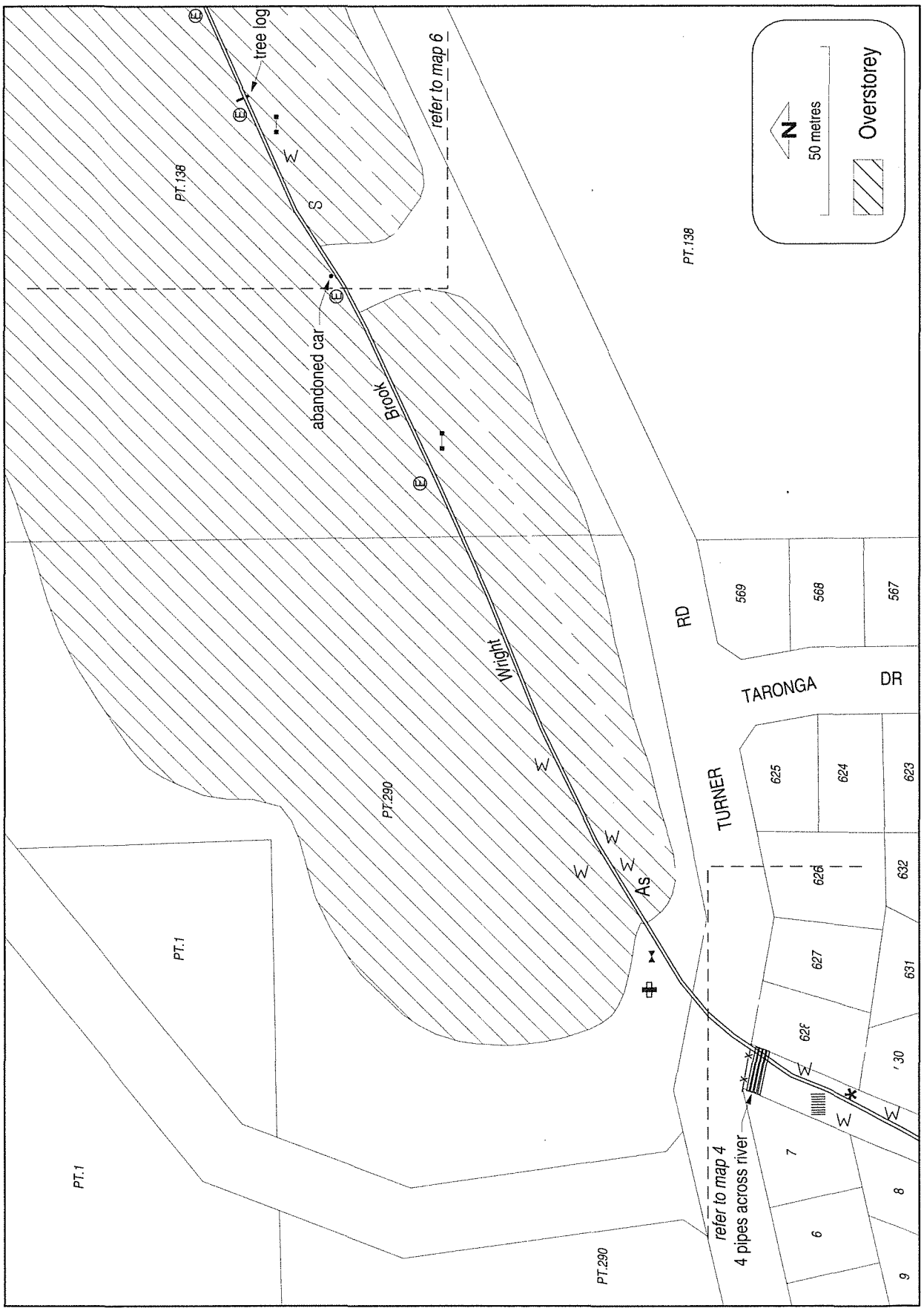
Vegetation: The overstorey is predominantly Marri (*Corymbia calophylla*) and Swamp paperbark (*Melaleuca rhaphiophylla*) with occasional Flooded gum (*Eucalyptus rudis*). The overstorey is continuous (> 80% cover). An isolated area was recently burnt and tree seedlings are regenerating. The middlestorey is sparse (< 20% cover). Occasional native species present include Coojong (*Acacia saligna*), Prickly moses (*Acacia pulchella*), Winged wattle (*Acacia alata*), *Thomasia foliosa*,

Recommended strategies

- Enhance native vegetation by planting deep rooted native understorey and middlestorey species along the foreshore banks to minimise the impact of erosion. Use species recommended in Appendix 3.
- Create small contour banks parallel with the landform to slow water movement, increase infiltration and reduce erosion.
- Plant dense clumps of native sedges and rushes along the brook channel and drainage lines to further slow water movement
- Assess the impact of branches on stream dynamics and remove where causing excessive scouring.
- Liaise with the Water Corporation and Water and Rivers Commission to monitor and assess water quality and load.

- Ensure the impact on bank stability is considered before weed control works are undertaken.
- Eradicate weeds and focus initial planting on reestablishing the middlestorey and understorey in accordance with species listed in Appendix 3.
- Consider potential for use of erosion control matting as an option to reduce weed re-emergence, support plants installed and improve bank stability on the steep gradient banks.

Blackboy (*Xanthorrhoea preissii*), Zamia (*Macrozamia reidlei*) and Swamp peppermint (*Agonis linearifolia*). Isolated patches of Watsonia (*Watsonia bulbillifera*) are present along the foreshore. Other infrequent weed species include Cotton bush (*Gomphocarpus fruticosus*) and Nightshade (*Solanum nigrum*). The understorey is continuous (> 80% cover) and is dominated by introduced pasture grasses. Other weeds include White flower fumitory (*Fumaria capreolata*), Soursob (*Oxalis pes-caprae*), Ribwort plantain (*Plantago lanceolata*), Vetch (*Vicia sativa*) and various grass species. Two creepers are present in low numbers; Bridal creeper (*Myrsiphyllum asparagoides*) and Morning glory (*Ipomoea* sp.).	• Selectively paint herbicide on Watsonia to minimise disturbance to the foreshore. • Cuts stems of Narrow leaf cotton bush and Nightshade, and paint stump or alternatively, where the bank is stable, hand weed the entire plant prior to flowering and remove from site. • Hand weed Fumitory, Vetch, Soursob and the creepers to prevent reinfestation and minimise future weed control works. Remove material from site in black plastic bags. • Undertake grass control in accordance with the recommendations outlined in Appendix 2. • Control weed species that are currently present in limited quantities using techniques outlined in Appendix 2, to reduce future work.
Stream Cover: The overstorey is narrow along many sections of the foreshore and the middlestorey is almost absent. There is little stream cover or permanent shade along the main channel. Scattered instream leaf material, rocks and branches provide limited instream cover.	• Improve vegetation structure and density on foreshore banks by undertaking weed control (Appendix 2) and planting of indigenous species recommended in Appendix 3. • Focus revegetation works in the immediate vicinity of the streamline. Reintroduce native rush species within the main channel and along associated drainage lines to increase stream cover. Secure clumps using 600 mm steel "U" shaped pegs.
Habitat diversity: The water depth is shallow ranging from 0.15 - 0.3 m. The water is very clear and light brown in colour with little suspended material evident in the water column. Small cascades and riffle zones within the main channel aerate the water. Due to the shallow nature and the narrow width of the Brook it is unlikely it will support turtles or fish. The absence of healthy native understorey and middlestorey species limits the number of suitable habitats available for terrestrial organisms. The overstorey trees may provide some habitats for birds.	• Assess modified areas of the stream such as constructed riffle zones to ensure that they are improving water movement across the landscape. • Implement revegetation works to increase instream cover and habitat provision.
Other issues: Rubbish including old tyres and a car are present within the reserve.	• Continue weed control efforts that are likely to explain the patchy distribution of Watsonia and the presence of some native plant regeneration. • Sustain follow up weed control and replanting to minimise re-invasion. • Remove rubbish present within the area.



Wright Brook Map 5

Wright Brook — Map 6 (Section G)

Length of section (m): approximately 550 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

Nearest road access: Turner Road

Lot Number: PT 290, PT 138, 138

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Refer to previous description and recommended strategies for Section G (Map 5)

Wright Brook — Map 6 (Section H)

Length of section (m): approximately 640 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

Nearest road access: Turner Road

Lot Number: Right bank - 138 Left bank - 138, 139

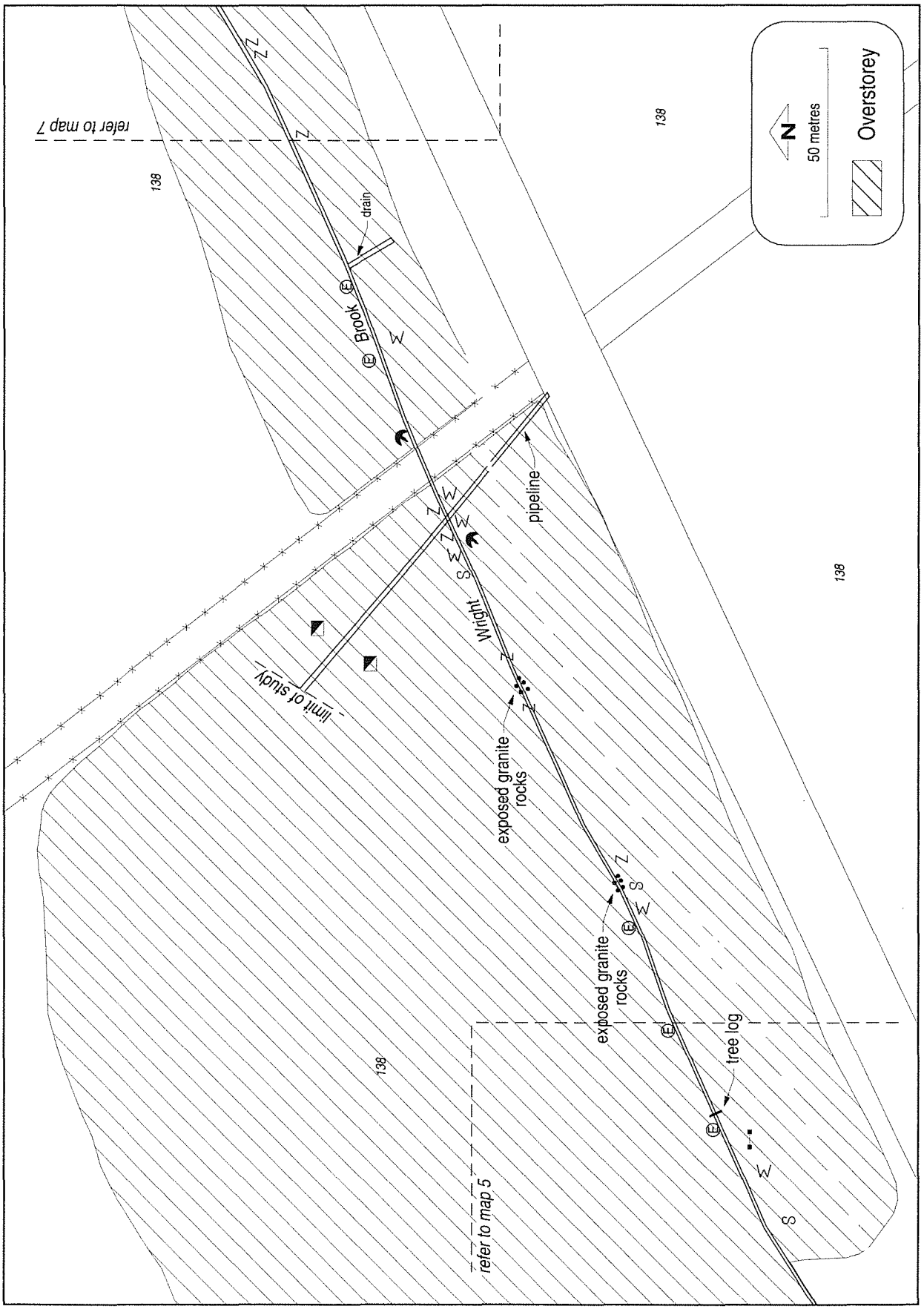
Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Description	Recommended strategies
Bank stability: The main channel is 1 - 1.5 m wide. In areas where logs have fallen across the brook, water has pooled and the channel widens to 2 - 2.5 m. The bank grade is steep and rises to a height of 1 m. Erosion is significant along 20 - 50% of the foreshore particularly along points where small side drains enter the main channel. Localised slumping occurs along 5 - 20% of the foreshore and there is little evidence of sedimentation.	• Identify the agency holding vesting and the responsibility for managing the area. • Encourage increased management of the site, particularly as it relates to weed control and replanting with native species. • Liaise with the Water Corporation and the Water and Rivers commission to monitor and assess water quality, particularly load and erosive power. • Minimise impact of erosion by planting deep rooted native understorey and middlestorey species along the foreshore. • Create small contour banks across the neighbouring paddock, parallel with the landform, to slow water movement, increase infiltration and reduce erosion. • Plant sedges recommended in Appendix 3 along exposed drain lines to decrease the velocity of fast flowing water.
Vegetation: The overstorey is open and continuous (> 80% cover). Predominant trees include Marri (*Corymbia calophylla*) and Swamp paperbark (*Melaleuca rhaphiophylla*). Scattered exotic Figs (*Ficus* sp.) are present on both sides of the brook. The middlestorey is patchy (20 - 80% cover). Occasional native species such as Prickly moses (*Acacia pulchella*), Winged wattle (*Acacia alata*), *Thomasia macrocarpa*, Prickly poison (*Gastrolobium spinosum*), Blackboy (*Xanthorrhoea preissii*), Bracken fern (*Pteridium esculentum*) and Swamp peppermint (*Agonis linearifolia*) are scattered along the foreshore. Weeds present in the middlestorey include Watsonia (*Watsonia bulbillifera*), Cotton bush (*Gomphocarpus fruticosus*), Nightshade (*Solanum nigrum*), Giant reed (*Arundo donax*) and Arum lily (*Zantedeschia aethiopica*). The understorey is continuous (> 80% cover) and is predominantly introduced pasture grasses. The native sedge Pale rush (*Juncus pallidus*) occurs in dense clumps particularly along drainage lines entering the main brook. Common weeds include *Juncus microcephalus*, Soursob (*Oxalis pes-caprae*), Ribwort plantain (*Plantago lanceolata*), Bridal creeper (*Myrsiphyllum asparagoides*) and Morning glory (*Ipomoea* sp.).	• Focus initial planting on re-establishing the middlestorey in accordance with species listed in Appendix 3 after intensive weed control has been undertaken. • Inject herbicide into Figs at 10 cm intervals around the trunk in Spring (Appendix 2). Selectively spray any suckers where they regenerate, and remove adult plants once dead. • Selectively paint herbicide on Watsonia and Arum lily to minimise disturbance to the foreshore • Cut and remove bulk of vegetative material from Giant reed and pour systemic poison down stump immediately. Do not disturb the rhizome mat as it will result in significant destabilization of the banks • Undertake grass control in accordance with the recommendations contained in Appendix 2. • Hand weed Cotton bush, Fumitory, Soursob and creepers and remove from site • Remove flowering heads prior to seeds ripening of plants such as Arum lily, Bridal creeper and *Juncus microcephalus* and spot spray with flauzifop-butyl in accordance with the recommendations in Appendix 2.

	• Focus revegetation works in the immediate vicinity of the streamline - reintroducing rush species such as *Juncus pallidus, Juncus planifolius* and *Juncus pauciflorus.*
Stream Cover: The overstorey along the foreshore banks is open and the middlestorey is almost absent, providing little shade and stream cover. In stream leaf material, rocks and branches provide intermittent instream cover.	• Focus revegetation works in the immediate vicinity of the streamline planting deep rooted native species to stabilise the foreshore and provide stream cover.
Habitat diversity: Water depth of the main channel varies from 0.1 - 0.15 m. The water deepens to 1.5 - 2 m in areas where large branches partially block the main channel slowing water movement. The water is relatively clear with no obvious leaf detritus present. Small riffle zones occur occasionally as water flows over exposed granite rocks. Instream logs cause small pools of water to form. Dense stands of Pale rush (*Juncus pallidus*) may provide suitable habitats for frogs and other terrestrial organisms such as reptiles. The overstorey trees may provide roosting and nesting sites for birds.	• Protect streamline and existing remnant vegetation from stock access by fencing the creekline off at a preferred distance of 30 m either side of the Brook. • Enhance the continuity of remnant vegetation through supported revegetation of the riparian zone to improve habitat diversity. • Undertake weed control within riparian zone as outlined in Appendix 2.
Other issues: Rural pastures surround the foreshore area with no established fences along the riparian zone. Stock may have access to the site, however, no stock were observed during the survey.	• Fence Wright Brook at a preferred minimum distance of 30 m on both sides of the Brook to exclude stock access. • If necessary designate one stock access/crossing point in fencing design.



Wright Brook Map 6

Wright Brook — Map 7 (Section H)

Length of section (m): approximately 640 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

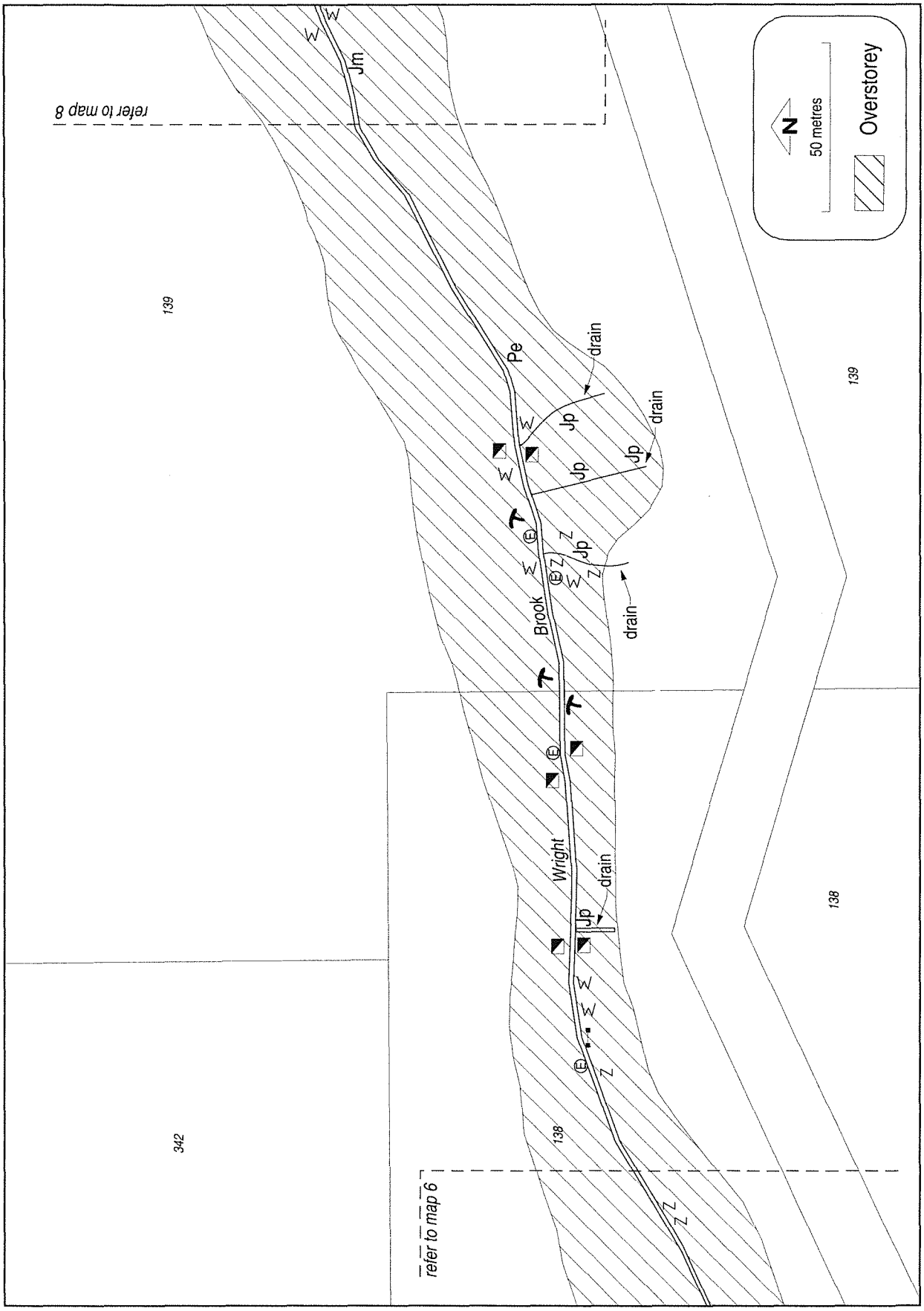
Nearest road access: Turner Road

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Refer to previous description and recommended strategies for Section H (Map 6)



Wright Brook Map 7

Wright Brook — Map 8 (Section H)

Length of section (m): approximately 640 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

Nearest road access: Turner Road

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Red	Red	Yellow	Red
Poor	Poor	Moderate	Poor
2	2	4	2

Stream Condition
Red
Poor
10

Refer to previous description and recommended strategies for Section H (Map 6)

Wright Brook — Map 8 (Section I)

Length of section (m): approximately 650 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

Nearest road access: Turner Road

Lot number: 139, 262, 671

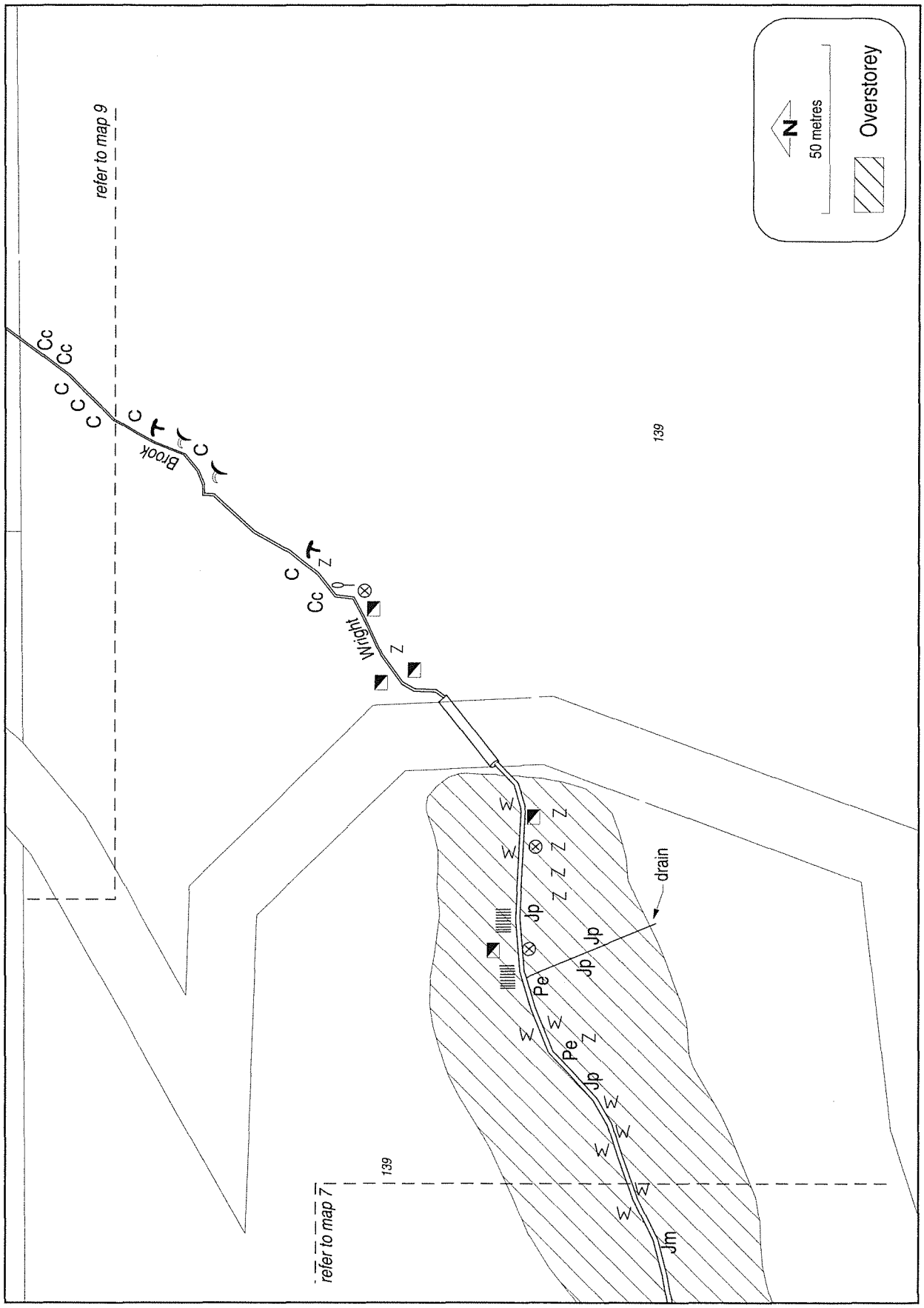
Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Black	Black	Black
Moderate	Very Poor	Very Poor	Very Poor
4	0	0	0

Stream Condition
Black
Very Poor
4

Description	Recommended strategies
Bank stability: The brook channel is very narrow (< 1 m) and not well defined in a number of areas as the foreshore banks are shallow and often choked with pasture weeds. Erosion is localised and resent along 5 - 20% of the foreshore section. Particular points of severe erosion are evident around the base of trees growing along the edge of the main channel. There is little evidence of slumping or sedimentation.	• Provide information to the landholder about preferred management techniques; encouraging protection of the foreshores, native vegetation, nutrient management and techniques to minimise other potential impacts of poor management. • Encourage the landholder to fence off at least the first 15 m of land either side of the main channel and create off-line watering points for stock. • Provide financial support or material assistance to landholders willing to implement rehabilitation activities. • Encourage the landholder to undertake intensive weed control to encourage natural regeneration within this area and revegetation works if required.
Vegetation: The area is highly degraded with little overstorey present (< 20% cover). A few remaining native Marri (*Corymbia calophylla*) trees are present. Other tree species include deciduous Fig (*Ficus* sp.), Coral trees (*Erythrina x sykesii*) and Weeping willows (*Salix* sp.). The middlestorey has a patchy distribution (20 - 80% cover) with a dense stand of the native shrub Swamp peppermint (*Agonis linearifolia*) and scattered Bracken fern (*Pteridium esculentum*). The understorey is continuous (> 80% cover) and is predominantly introduced weeds. Common weeds include a dense stand of Canna lilies (*Canna* sp.) and patches of Arum lilies (*Zantedeschia aethiopica*). Weeds that occur less frequently include the Bridal creeper (*Myrsiphyllum asparagoides*). Dense pasture weeds are present including Paterson's Curse (*Echium plantagineum*).	• Undertake weed control in manageable sized nodes to reduce the potential for erosion due to loss of vegetation cover, and plant overstorey and dense understorey species within these nodes. • Establish a buffer around revegetation works to minimise weed re-invasion. • Inject herbicide into Fig, Coral trees and Weeping willows at 10 cm intervals around the trunk in Spring (Appendix 2). Selectively spray any suckers where they regenerate, and remove adult plants once dead. • Selectively paint herbicide on Canna and Arum lilies to minimise disturbance to the foreshore area. • Undertake grass control in accordance with the recommendations contained in Appendix 2. • Control weed species that are currently present in limited quantities using techniques outlined in Appendix 2 to reduce future work. • Replace any removed vegetation with indigenous overstorey species such as *Eucalyptus rudis* and *Melaleuca rhaphiophylla* immediately. Plant understorey and middlestorey species recommended in Appendix 3.

Stream Cover: The highly degraded overstorey and presence of deciduous trees provides little consistent stream cover. The dense stand of *Agonis linearifolia* may provide a small area of cover along the upper reaches of the brook. There is very little instream cover present.	• Undertake replanting in the streamline with a focus on re-establishing native rushes and sedges and overstorey species as outlined in Appendix 3 to increase the level of instream cover.
Habitat diversity: The main channel is shallow in most parts and the water is clear and very light brown in colour and lacking any vegetative material. The shallow water depth and narrow channel provides very limited suitable habitats for aquatic animals. The lack of streamside vegetation along the banks of Wright Brook also provides few habitats for terrestrial animals.	• Implement overstorey and middlestorey revegetation as a priority, protecting these plants from invasion by weeds by focussing weed control in these areas. • Install small pockets of twigs and branches to increase the amount of instream cover and monitor the effectiveness of this technique in encouraging invertebrate life to the area. This monitoring will also enable effective management of any potential erosion risk.
Other issues: Rural pastures surround the foreshore area with no established fences along the riparian zone. There is evidence of stock access to the site as there are plants which have been grazed.	• Fence Wright Brook at a preferred minimum distance of at least 15 m on both sides of the Brook to exclude stock access. • If necessary designate one stock access/crossing point in the fencing design. • Liaise with landholder to encourage improved management practices along Brook.



Wright Brook Map 8

Wright Brook — Map 9 (Section I)

Length of section (m): approximately 650 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

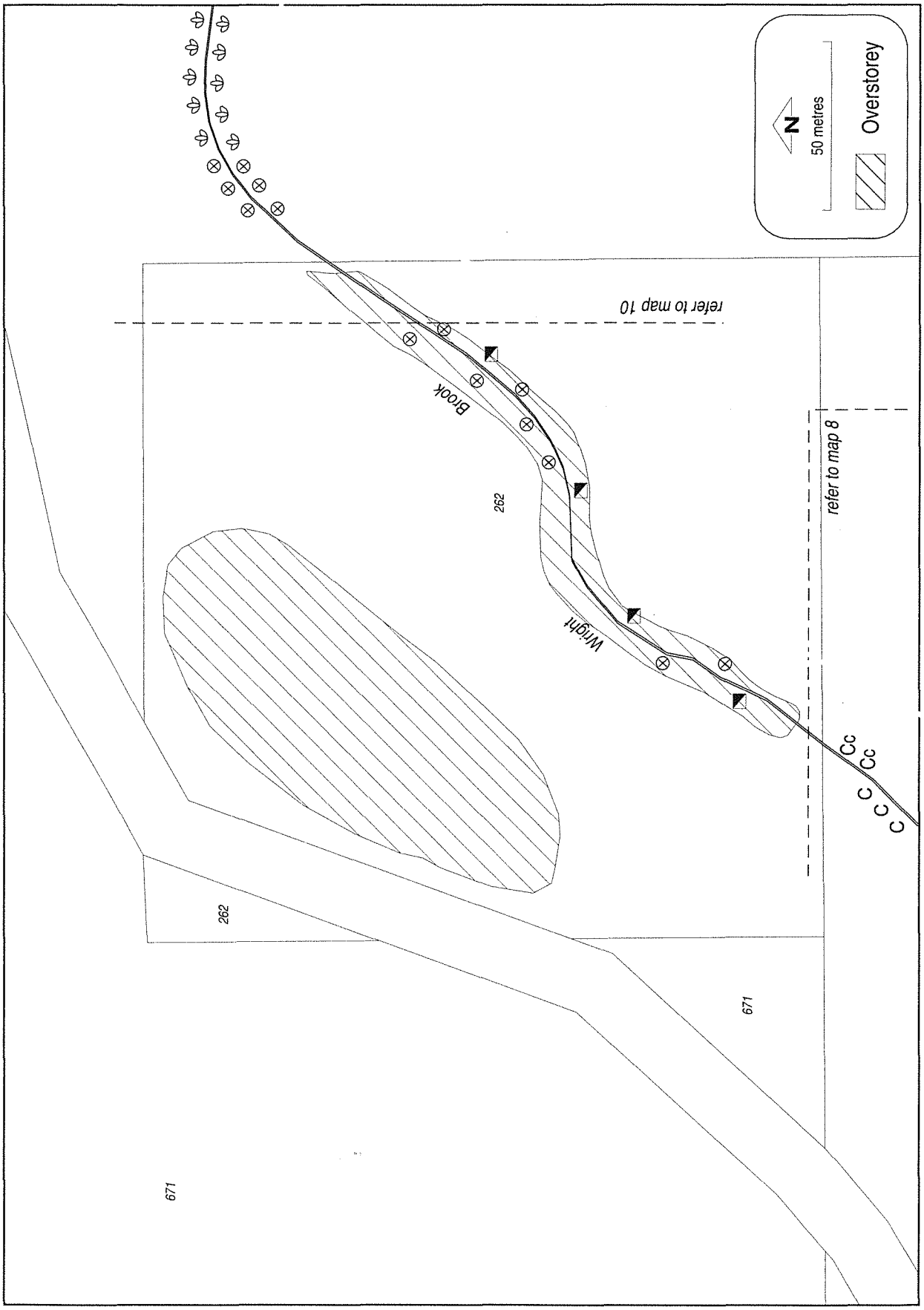
Nearest road access: Turner Road

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Black	Black	Black
Moderate	Very Poor	Very Poor	Very Poor
4	0	0	0

Stream Condition
Black
Very Poor
4

Refer to previous description and recommended strategies for Section I (Map 8)



Wright Brook Map 9

Wright Brook — Map 10 (Section I)

Length of section (m): approximately 650 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/8/98

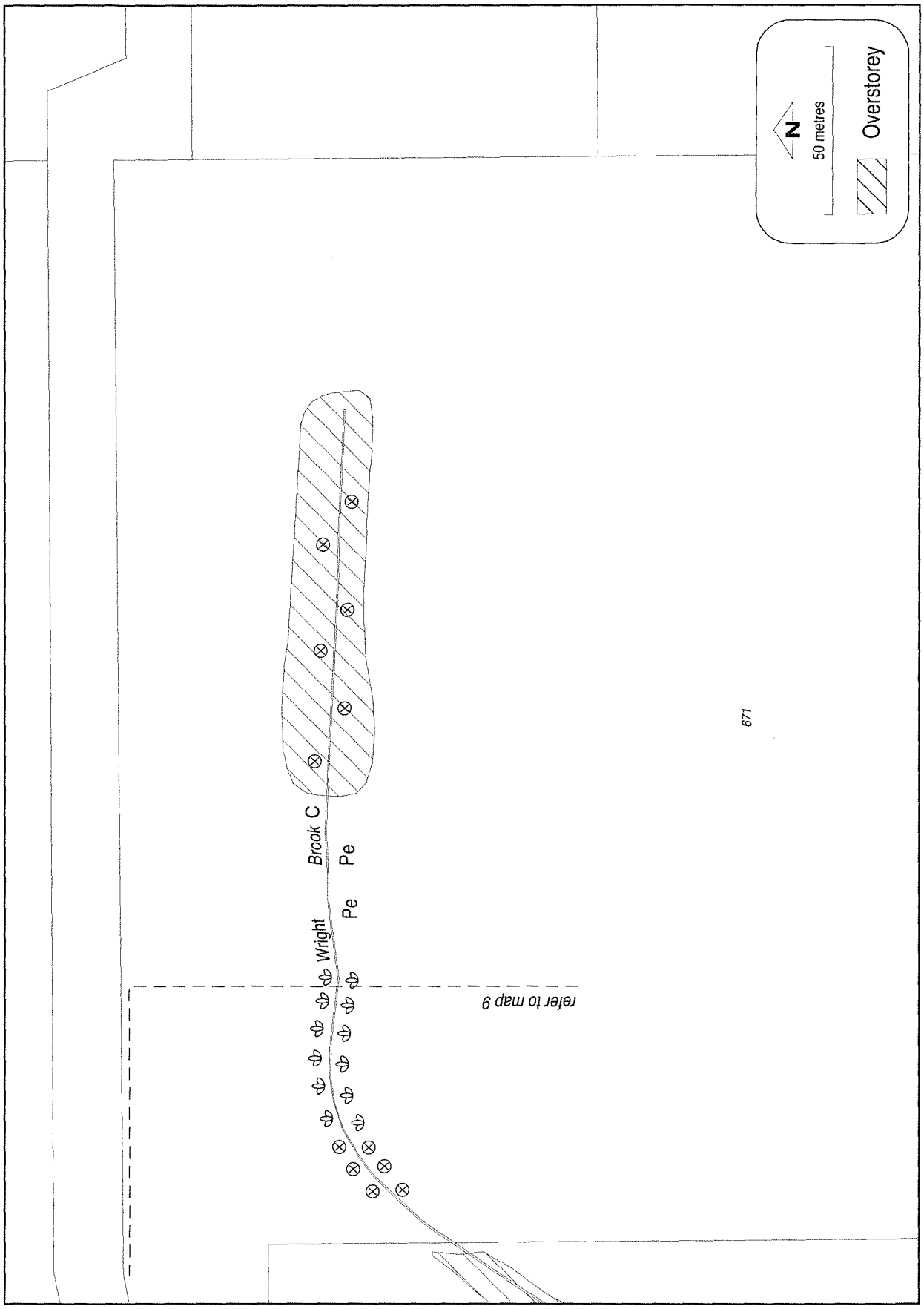
Nearest road access: Turner Road

Summary of river health:

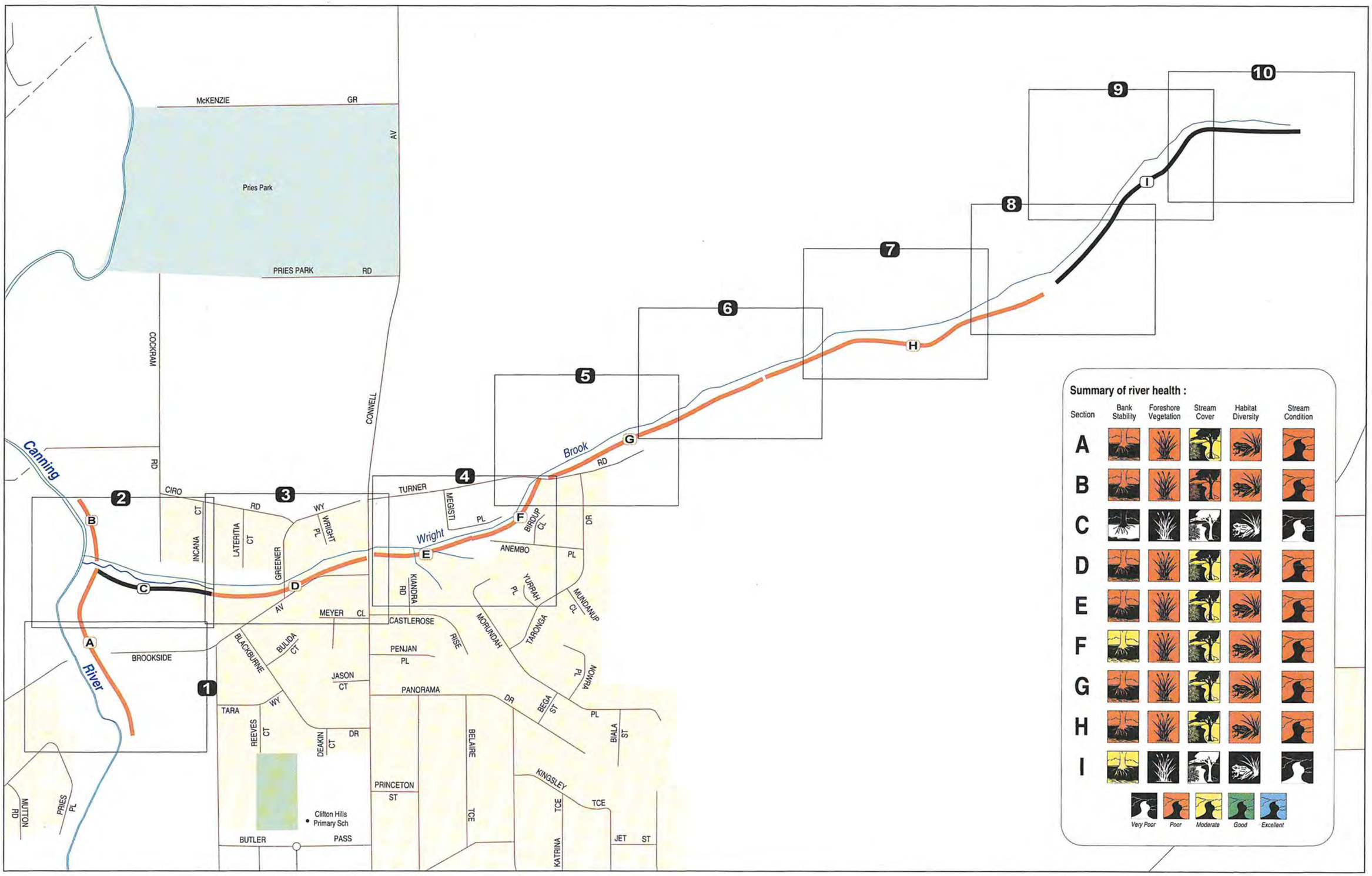
Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Black	Black	Black
Moderate	Very Poor	Very Poor	Very Poor
4	0	0	0

Stream Condition
Black
Very Poor
4

Refer to previous description and recommended strategies for Section I (Map 8)



Wright Brook Map 10



Summary of river health :

Section	Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	Stream Condition
A					
B					
C					
D					
E					
F					
G					
H					
I					

Very Poor · Poor · Moderate · Good · Excellent

Wright Brook - Locality Map

5. General recommendations

A number of general recommendations can be identified which apply to all of the sites. These are divided into the core activities, which will be required for groups to successfully develop and implement rehabilitation strategies.

5.1 Planning

- Determine cadastral boundaries and landowner/manager and ensure that they support the foreshore assessment process, and are involved in the development and implementation of any remedial strategies.
- Collate as much existing information about the focus waterway and catchment as possible.
- Focus initial foreshore assessment survey work in areas where future rehabilitation projects may be undertaken.
- Extend future foreshore assessment work from previously surveyed areas along the foreshore, eventually mapping all sites. Future surveys may also include re-assessment of earlier surveys to assess changes to the environment.
- Create herbariums of native and weed species to teach group members and other interested parties to distinguish between native and introduced plants present in the rehabilitation zone.
- Ensure that all works are planned well in advance and that a long-term strategy has been developed and is amended as new information becomes available.
- Ensure that all agencies with statutory responsibilities such as the relevant local government authority, Water Corporation and Swan River Trust is advised of any works within their management areas, to ensure that the works meet all of the legislative requirements.
- Develop information brochures to increase community awareness of the importance of foreshore areas and to encourage community involvement in managing their own foreshores and surrounding reserves.
- Develop an information brochure for the landholder to suggest methods of improved land management practices and encourage rehabilitation of the foreshore area.
- Endeavour to source funds from outside sources to assist both the group and any private landholders that are willing to implement rehabilitation activities.

5.2 Site preparation

5.2.1 Weed control

- Ensure weed control activities are undertaken in manageable sized nodes, reinforcing overstorey species and restoring the middlestorey and understorey species (using species recommended in Appendix 3 of this report) once weeds have been eradicated.
- Tag any native plants present to protect them from weed control activities.
- Hand weed where possible, especially annual weeds and instream weeds.
- Use a qualified herbicide operator if chemical control is undertaken near waterways.
- Always consider the impacts that weed control will have on habitat, particularly for reptiles and small mammals such as bandicoots. Maintain vegetated corridors for animals to move within until sufficient native plants have re-established.
- Ensure that all weeds are removed from the site to limit re-infestation.
- Create buffers around existing clumps of native vegetation to encourage natural regeneration of existing plants e.g. spray Fusillade around native rushes to control introduced grasses and enable the clumps of rushes to spread naturally.
- Ensure the impact on bank stability is considered before weed control works are undertaken. Consider potential for use of erosion control matting as an option to reduce weed re-emergence, support plants installed and improve bank stability on steeper gradient banks.

5.2.2 General site preparation

- Encourage landholders throughout the rural and semi-rural catchments to fence off waterways and tributaries and implement broadscale revegetation program.
- Provide financial support or material assistance to landholders willing to implement rehabilitation activities.
- Define access tracks to weed management areas or where there are planting programs, to minimise disturbance and limit damage to existing vegetation and the substrate.
- Implement intensive weed control activities in manageable sized nodes where planting will be undertaken.
- Remove flower heads prior to seeding to limit reinforcement of the weed seed bank.
- In broadscale areas proposed for future works or in high-risk areas of dense weeds with few native plants where complete removal is inappropriate, ensure either flower removal or repeated brushcutting occurs prior to seeding.

5.3 Planting out

- Ensure planted areas within streamlines are artificially stabilised and planted in low-flow conditions to enable sufficient time for establishment, to reduce the chance for plants to be washed out during peak flows.
- Plant native species only in areas where weeds have been effectively controlled and managed for a preferred minimum of two seasons.
- Encourage landholders to ensure all strata of vegetation including understorey, middlestorey and upperstorey species are included in revegetation works to reinforce bank stability.
- Plant overstorey species initially in highly exposed regions lacking vegetation, to create a level of cover and protection for future plantings.
- Plant emergent and wetland plants in permanent water between September and March, securing those planted in flowing water with 600mm steel "U" shaped pegs.
- Plant dryland plants and seasonally inundated areas in May to July.
- Plant in higher densities than ultimately required to create instant habitat and improve weed exclusion; particularly in the inner urban environments.
- Obtain professional advice about planting densities for each recommended species, to optimise chances of success and re-creating a more natural ecosystem.

5.4 Maintenance

- Ensure the works program includes ongoing intensive maintenance of areas where weed control and planting works have previously been undertaken.
- Implement ongoing weed management, prior to commencing site preparation and planting works in new areas.
- Monitor for any natural regeneration on a regular basis, and undertake weed control around any emerging native plant seedlings.
- Assess the effectiveness of any river restoration works or installation of any products such as hemp matting and modify as required.
- Determine the impact of vandalism if any, and develop and implement strategies to manage this problem.

5.5 Monitoring

- Continue to use the method to assess changes and improvement to foreshore health over time.
- Assess the effectiveness and relative benefits of different management techniques utilised and update the works program accordingly.
- Document the results and learn from experience.
- Monitor the effectiveness of sustaining interest within the project at both the management and implementation level. Develop techniques to support community groups and individuals in undertaking this work.
- Minimise the potential for burnout by not over-extending limited resources, particularly labour.

6. Common issues

6.1 Ownership and access

It is essential that cadastral boundaries are determined at each site and that the people implementing the foreshore assessment are aware of who owns the land. Permission is required from the landowners, who may be State or local government agencies or private landholders, prior to undertaking any survey work. Gaining access to private property may prove to be difficult, whilst permission to enter most government managed lands is generally readily available.

Often property boundaries are fenced and landowners may be suspicious that any information collected during surveys along their foreshore will eventually be used against them. It is important that people implementing the survey are clear about the process and the reasons for the survey and approach all landholders. Where landholder agreement cannot be readily obtained, it is important not to waste time and resources in excessive negotiations. Locate landholders that are interested in improving the health of their foreshore and assist these properties to enhance their land. Healthy foreshores can increase property values and through discussion within communities can ultimately result in peer pressure on others to work on protecting their waterways.

There are often conflicting perceptions about the requirements for managing riparian zones and determining what is a healthy foreshore. Many landholders consider lawn to the high water mark with occasional trees to be healthy and providing sufficient habitat for example, as large numbers of birds e.g. black ducks, may frequently use the foreshore. It is very difficult to articulate foreshore management issues until a common perception of a stable, intact waterway is developed between the group doing the work and the wider community.

A further conflict can arise when landholders consider that their current foreshore management program is adequate. For example, as well maintained lawns reduce the fire hazard, limits uncontrolled weed growth and keep the streambed free of debris, it is argued by these private landholders to be an appropriate management technique to protect the waterway. Frequently this management regime is in contrast to management practices in neighbouring foreshore reserves that are managed by State and Local government authorities. Extensive weeds, limited access and considerable fire risk are often features of these reserves. As a result it is perceived that there is little management effort. In situations where State and Local government authorities are not demonstrating best management practice, it is difficult to discourage landholders from maintaining their own inappropriate management program.

Both State and Local government and the wider community need to implement improved foreshore management.

6.2 Developing management and rehabilitation plans

Management plans are an important tool used to strike a balance between the multiple use demands of foreshore areas and the protection of flora, fauna and water quality. These documents should have clearly defined aims, objectives and visions as ultimately, the final use of the land will affect how, where and if, rehabilitation plans need development and implementation.

If, for example, a grassed area occurs adjacent to a waterway which is a high use recreation zone, then extensive revegetation works are likely to impinge on the purpose of the land and therefore may be inappropriate. A compromise position may need to be negotiated such as establishing a narrow buffer zone immediately along the stream banks, with well defined access points for viewing the waterway. The buffer zone needs to have a clearly defined boundary between any lawn areas and native vegetation to avoid trampling of native seedlings.

All issues associated with development, conservation and management of the waterway and associated land need to be addressed prior to the development of any plans. Community needs and visions for particular areas need to be canvassed to ensure the document reflects community attitude, which affects whether or not plans get implemented.

At the next level, following management planning there is a need to develop a complete rehabilitation plan for the waterway. It is essential to extend the assessment of foreshore condition to the length of the waterway, prior to any works to gain a complete understanding of current health. This may be limited by access issues, however the broader the understanding of the waterway and their tributaries, the better.

An ecosystem approach to management will ensure that appropriate rehabilitation plans are developed minimizing the impact of any activities. For example complete eradication of dense weeds along the immediate foreshore results in acute loss of habitat and may destabilise foreshore banks increasing the danger of severe erosion and bank collapse. It is necessary to undertake weed control in small, manageable sized nodes to ensure that eradicated weeds are immediately replaced with deep-rooted native species, to minimise the impact on bank stability, and protect native fauna.

Developing detailed management and rehabilitation plans and having a clear understanding of the works required over the long term, enables the development of detailed budgets, allocation of funding or opportunities to raise funds to ensure the completion of any project.

6.3 Long term management

The rehabilitation planning process should include a maintenance schedule for any existing works as well as directing future projects. The importance of continued maintenance within current project sites prior to beginning any new works, can not be emphasised enough. Ongoing management in the long term must be scheduled to ensure the success of any rehabilitation works. Weed control needs to be continued indefinitely as there will always be the threat of reinfestation.

Undertaking works on crown land and reserves requires ongoing community commitment and an interest from state and local government agencies to provide assistance such as fire break maintenance and provision of qualified herbicide operators to undertake weed control.

Private landowners must be strongly committed to any project undertaken on their property to ensure ongoing maintenance. Any change in ownership may require a negotiation with the new owners to determine if management will continue.

Once a rehabilitation project has commenced on a property it will require a significant amount of time to implement weed control, planting and maintenance. Setting manageable areas for work and achievable targets is the most effective way to ensure success. Over-extension of limited resources frequently causes the areas to degrade further, resulting in a situation that is worse than prior to any rehabilitation effort.

There is nothing more disillusioning than having put considerable effort into developing and implementing works for little or no benefit in the medium to long term.

6.4 Surrounding landuse

Adjacent landuse can have a considerable impact on the riparian zone and waterway health. Different landuses have different implications for stream health and therefore the appropriate management regimes required will vary.

Riparian zones are often highly degraded. Foreshore vegetation is frequently reduced to a few metres either side of the watercourse. It is important to provide information to landholders and land managers about the benefits of undertaking remedial works along foreshores, emphasizing the importance of fencing off riparian areas and excluding stock. Sourcing funds and providing support may encourage interested landholders to undertake intensive weed control and revegetation works.

Foreshores in urban areas are frequently high use recreation sites. Traditionally large open areas of maintained lawn were favoured over dense stands of native vegetation. Advertising campaigns and creating signage around project sites are useful tools to increase community awareness. Providing detailed information on the benefits of replanting native species such as stabilizing foreshore banks and increasing stream cover and habitat diversity will increase awareness and may encourage local residents to become involved in the projects.

Sedimentation of watercourses is generally an indication of erosion occurring further upstream. No system can be considered in total isolation, as there will always be impacts from activities further upstream. When undertaking any projects it is essential that groups have a clear understanding of the surrounding landuse and the condition of any tributaries feeding into the main waterway.

The impact of new subdivisions or earthworks upstream should be carefully monitored. Weeds may invade from nearby residential housing. Subdivisions can also have a huge impact on water regimes and sediment loads entering streams and tributaries. Early detection of potential threats minimises the impact on foreshore health in the long term if remedial action is undertaken immediately.

6.5 Gaining support from state and local government

State and local government have a significant role to play in supporting foreshore rehabilitation. Many agencies are also directly involved in managing waterways and foreshore areas. Water Corporation, Water and Rivers Commission, Swan River Trust, Agriculture WA and local government authorities all actively manage some waterways within the State.

Many of these agencies also have statutory requirements to meet, that relate to management of these areas. The Swan River Trust Management Area, for example, relates to the bed and banks of the Swan and Canning Rivers extending across the riparian zone to the limit of the Parks and Recreation Reservation. It is illegal to undertake any works within the SRT Management Area without notifying the Swan River Trust.

Some agencies also have community support functions to assist groups to undertake hands on work, prepare management and rehabilitation plans and can also provide some support for administrative and information requirements.

Key contacts include:

Contact	AgencyContact	Number
Ecoplan	Department of Environmental Protection	9222 7000
	Swan Catchment Centre	9221 3840
	Water and Rivers Commission	9278 0300
	Swan River Trust	9278 0400
	Agriculture WA	9368 3333
	Relevant local government authority	White pages

There may be contacts within each agency for on-ground support. The Swan Catchment Centre has a Landcare trailer that is fully rigged for landcare activities and provides the relevant equipment for site preparation, weed control and planting.

Where reserves are managed by a state or local government authority it is essential that the community liaises with the land manager to develop and implement any assessment and rehabilitation projects.

Support from agencies also improves the opportunities for gaining funding from external sources such as Greening WA, Lotteries WA and the Natural Heritage Trust.

6.7 Fire management

Fire is not recommended as a management technique for riparian zones, particularly in the Scarp region and areas with peaty soils. Should fire occur as a result of vandalism or an accidental burn, then advantage should be taken of the increased access to the area for weed control activities.

Prescribed burns are likely to do significant damage to fringing vegetation, the seed bank and potentially may result in reduced bank stability and higher levels of erosion. Fire also often encourages further weed invasion and spread of existing weed species. Autumn burns are particularly risky.

6.8 Access to information

State and local government authorities have considerable information resources about waterways and should be contacted. Many agencies also have libraries that the community can access, however borrowing books is generally not permitted.

Existing information about any particular waterway should be collated prior to development of management plans.

General information about weed control techniques, site preparation and stream and foreshore restoration needs to be obtained prior to the development of rehabilitation plans.

7. Summary

The foreshore assessment process has been developed to aid interested community groups, officers of State and local government authorities and private landholders in urban and semi-rural areas to gain an understanding of the condition of foreshore areas within their own community. By using a standard methodology to gather information it is possible to compare and contrast foreshore condition of the same area over time, or between different sites in the same survey season to prioritise works.

This document provides the results of the first series of foreshore assessments undertaken along sections of Bannister Creek and the Canning and Southern Rivers in accordance with the Water and Rivers Commission (1999) foreshore condition assessment method. Testing and refining the assessment protocol in this work was intended to identify any shortcomings or limitations of the method.

Implementing the technique has resulted in a limited number of modifications to the methodology and provided considerable documentation for the surveyed sections of the waterways listed above.

The foreshore sites selected for this baseline study ranged in condition and current management practices. The detailed recommended strategies outlined for each of these sites aim to give suggestions for hands-on works for rehabilitation of degraded foreshore systems. General recommendations have been provided for broadscale long term planning which emphasise the need to consider the implications of any works, and the commitment required to sustain these activities in the long term.

This report of foreshore condition will be the first of many, as the process continues to evolve and be implemented across urban and semi-rural areas statewide.

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Appendix 1

Native and weed species identified during the foreshore assessment process (1998)

Appendix 1a: Native Species identified during the foreshore assessment process (1998)

Scientific name	Common Name	Bennett Brook	Bannister Creek	Canning River	Roley Pool	Southernwood Creek	Wright Brook	Ellen Brook	Breera Brook
Acacia alata	Winged wattle		Y		Y		Y		
Acacia pulchella	Prickly moses	Y			Y		Y		
Acacia saligna	Coojong	Y		Y	Y	Y	Y	Y	Y
Acanthocarpus preissii					Y				
Agonis linearifolia	Swamp peppermint	Y	Y	Y	Y		Y	Y	Y
Astartea fascicularis	Common astartea				Y			Y	
Banksia menziesii	Firewood banksia	Y							
Baumea juncea	Bare twigrush		Y					Y	Y
Bolboschoenus caldwellii	Marsh club rush		Y						
Baumea rubiginosa	River twigrush		Y						
Burchardia umbellata	Milkmaid								Y
Caladenia spp.	Orchids	Y							
Carex appressa	Tall sedge		Y					Y	Y
Carex divisa	Divided sedge		Y						
Carex fascicularis	Tassel sedge		Y					Y	Y
Centella cordifolia	Centella	Y	Y	Y				Y	Y
Centrolepis spp.	Centrolepis		Y						
Chenopodium glaucum	Glaucous goosefoot		Y						
Corynotheca micrantha	Sand lily		Y						Y
Conostylis spp.		Y							
Corynotheca micrantha					Y				
Corymbia calophylla	Marri	Y	Y	Y	Y	Y	Y	Y	Y
Cotula coronopifolia	Button weed	Y	Y						
Darwinia citriodora	Lemon-scented darwinia								
Drosera erythrorhiza	Red ink sundew								Y
Drosera glanduligera	Pimpernel sundew								Y
Dryandra nivea	Couch honeypots				Y				Y

Dryandra sessilis	Parrot bush								Y
Eucalyptus rudis	Flooded gum	Y	Y	Y	Y	Y	Y	Y	Y
Eucalyptus wandoo	Wandoo				Y				
Gahnia decomposita								Y	Y
Gastrolobium spinosum	Prickly poison				Y		Y		
Gompholobium tomentosum	Hairy yellow pea	Y							
Grevillea spp.					Y		Y		Y
Hakea prostrata	Harsh hakea								Y
Hakea varia	Variable leaf hakea		Y						
Hardenbergia comptoniana	Native wisteria	Y	Y						
Hemiandra pungens	Snake bush								
Hibbertia spp.	Native buttercups	Y			Y		Y		Y
Hypocalymma angustifolium	White myrtle	Y	Y					Y	Y
Isolepis setiformis	Tufted sedge		Y						
Jacksonia furcellata	Grey stinkwood	Y	Y					Y	Y
Jacksonia sternbergiana	Green stinkwood	Y	Y				Y		Y
Juncus amabilis	Blue rush		Y						
Juncus kraussii	Sea Rush		Y						
Juncus pallidus	Pale rush	Y	Y	Y	Y		Y	Y	Y
Kennedia prostrata	Running postman	Y	Y				Y		
Kunzea spp.								Y	Y
Lasiopetalum bracteatum	Helena velvet bush				Y				
Lepidosperma effusum	Spreading sword sedge	Y	Y					Y	Y
Lepidosperma longitudinale	Pithy sword-sedge	Y						Y	Y
Lepidosperma tetraquetrum	Angle sword-sedge	Y			Y				Y
Lomandra spp.								Y	Y
Lyginia barbata								Y	Y
Macrozamia riedlei	Zamia	Y			Y		Y		Y
Melaleuca lateritia	Robin redbreast bush		Y						
Melaleuca preissiana	Modong	Y	Y					Y	Y
Melaleuca rhaphiophylla	Swamp paperbark	Y	Y	Y	Y	Y	Y	Y	Y

Mesomeleana tetragona	Semaphore sedge		Y				Y		
Oxylobium lineare	Narrow-leaved oxylobium	Y	Y		Y			Y	Y
Paraserianthes lophantha	Albizia	Y						Y	Y
Patersonia occidentalis	Purple flag							Y	Y
Persicaria decipiens	Slender knotweed		Y						
Phyllanthus calycinus	False boronia								Y
Potamogeton crispus	Curly pondweed		Y						
Pteridium esculentum	Bracken fern	Y		Y			Y	Y	Y
Regelia ciliata			Y						
Schoenoplectus validus	Lake club rush		Y						
Schoenus spp.								Y	Y
Schoenus subfascicularis	Bog rush							Y	Y
Thomasia foliosa					Y		Y		
Thomasia macrocarpa					Y		Y		
Verticordia spp.	Feather flowers								Y
Viminaria juncea	Swishbush		Y			Y	Y	Y	Y
Xanthorrhoea preissii	Blackboy	Y			Y		Y	Y	Y

Appendix 1b: Weed Species identified during the foreshore assessment process (1998)

Scientific name	Common Name	Bennett Brook	Bannister Creek	Canning River	Roley Pool	Southernwood Creek	Wright Brook	Ellen Brook	Breera Brook
Acacia spp.	Weed wattles		Y	Y	Y		Y		
Allium triquetrum	Three-cornered garlic								
Alopecurus myosuroides	Slender foxtail		Y						
Alternanthera nodiflora	Joyweed	Y	Y						
Anagallis arvensis	Pimpernel					Y		Y	
Aponogeton elongatus		Y						Y	
Arctotheca calendula	Capeweed	Y		Y		Y	Y	Y	
Arundo donax	Giant reed	Y	Y	Y	Y	Y	Y	Y	
Aster subulatus	Bushy starwort		Y						
Avena fatua	Wild oats		Y	Y		Y	Y	Y	
Briza spp.	Blowfly grass, shivery grass		Y		Y			Y	
Bromus diandrus	Great brome					Y		Y	
Canna spp.	Canna lily			Y			Y		
Centaurea spp.	Thistles								
Chenopodium album	Fathen		Y						
Conyza spp.	Fleabane	Y	Y	Y		Y	Y	Y	
Cortaderia selloana	Pampas grass		Y	Y			Y		
Cynodon dactylon	Couch grass			Y		Y	Y	Y	
Cyperus difformis	Dirty dora							Y	
Cyperus involucratum	Cyperus	Y	Y				Y		
Cytisus proliferus	Tree lucerne						Y		
Cyperus spp.			Y	Y					
Dipogon lignosus	Dolichos pea						Y		
Echinochloa telmatophila	Swamp barnyard grass		Y						
Echium plantagineum	Paterson's curse						Y	Y	
Ehrharta calycina	Perennial veldt grass	Y	Y		Y			Y	
Ehrharta longiflora	Annual veldt grass					Y	Y	Y	

Eragrostis curvula	African lovegrass			Y	Y	Y	Y	Y	
Erodium moschatum	Musky crowfoot					Y			
Erythrina x sykesii	Coral tree		Y	Y			Y		
Ferraria crispa	Black flag iris	Y							
Foeniculum vulgare	Fennel		Y						
Ficus spp.	Edible Fig Tree	Y	Y	Y			Y		
Freesia aff. leichtlinii	Freesia	Y							
Fumaria capreolata	Whiteflower fumitory	Y		Y		Y	Y	Y	
Gladiolus spp.	Gladiolus								
Gomphocarpus fruticosus	Cotton bush			Y			Y		
Hesperantha falcata		Y						Y	
Homeria flaccida	One leaf cape tulip	Y						Y	
Hordeum leporinum	Barley grass					Y			
Hyparrhenia hirta	Tambookie grass						Y	Y	
Hypochaeris radicata	Flatweed								
Ipomoea spp	Morning glory		Y	Y			Y		
Isolepis prolifera			Y						
Juncus articulatus									
Juncus capitatus				Y					
Juncus microcephalus		Y	Y		Y		Y	Y	Y
Lantana camara	Lantana		Y				Y		
Leptospermum laevigatum	Victorian tea-tree								
Lolium spp.	Ryegrass							Y	
Lupinus spp.	Lupins	Y					Y	Y	
Medicago spp.	Medics							Y	
Monopsis debilis			Y						
Myrsiphyllum asparagoides	Bridal creeper		Y	Y	Y	Y	Y		
Narcissus tazetta	Jonquils					Y			
Nerium oleander	Oleander						Y		
Olea europaea	Olive Tree								
Oxalis pes-caprae	Soursob	Y	Y	Y	Y	Y	Y	Y	

Panicum capillare	Witchgrass		Y						
Paspalum spp.	Paspalum	Y		Y	Y	Y	Y		
Pelargonium capitatum	Geranium	Y							
Pennisetum clandestinum	Kikuyu	Y	Y	Y	Y	Y	Y	Y	
Plantago lanceolata	Ribwort plantain	Y		Y	Y		Y	Y	
Populus spp.	Poplars		Y	Y					
Raphanus raphanistrum	Wild radish			Y	Y	Y			
Rhynchelytrum repens	Red natal grass				Y		Y	Y	
Ricinus communis	Castor oil	Y	Y	Y		Y	Y		
Romulea rosea	Guildford grass					Y		Y	
Rorrippa nasturtium-aquaticum	Watercress	Y	Y		Y	Y			
Rubus fruticosus	Blackberry	Y	Y	Y	Y				
Rumex spp.	Dock	Y	Y	Y				Y	
Salix spp.	Willows	Y	Y	Y		Y			
Schinus terebinthifolia	Japanese pepper	Y	Y	Y					
Solanum nigrum	Deadly nightshade	Y	Y	Y			Y	Y	Y
Stachys arvensis	Staggerweed							Y	
Stenotaphrum secundatum	Buffalo grass								Y
Taraxacum officinale	Dandelion	Y	Y	Y		Y	Y	Y	
Thunbergia alata	Black-eyed Susan			Y					
Trifolium spp.	Clover	Y						Y	
Tropeolum spp.	Nasturtium		Y	Y					
Typha orientalis	Bulrush	Y	Y	Y			Y		Y
Ursinia anthemoides	Ursinia							Y	
Vicia sativa	Vetch	Y	Y	Y		Y		Y	
Vinca major	Periwinkle								
Watsonia bulbillifera	Watsonia	Y		Y	Y	Y	Y	Y	
Zantedeschia aethiopica	Arum lily	Y	Y	Y					

Appendix 2

Suggested weed control methods

Appendix 2: Suggested weed control methods

Some of the information contained in this report has been taken from Dixon and Keighery (1995) in Managing Perth's Bushlands or referenced to Kings Park Board.

		Control Priority	Location	Habit	Form
Species Name:	**Acacia spp**	2	Dryland ☑ Riparian ☑ Aquatic ☐	Bulb/Corm ☐ Perennial ☑ Annual ☐	Tree ☑ Shrub ☑ Herb ☐ Rush/Sedge ☐ Grass ☐ Climber ☐
Common Name:	Weed wattles				
Seed Form:	Light seed				
Seeding Time:					
Method of Spread:	Spreads mostly from seed				
Best Time of Control:	Species dependent - prior to flowering				
Method of Control:	Hand weed juvenile plants. Small plants means they are relatively easy to remove. Once plants are mature or woody stemmed, cut the main trunk/stem below the widest part of the stem beneath the ground. This will effectively kill all wattles.				

		Control Priority	Location	Habit	Form
Species Name:	**Allium triquetrum**	3	Dryland ☑ Riparian ☑ Aquatic ☐	Bulb/Corm ☑ Perennial ☐ Annual ☐	Tree ☐ Shrub ☐ Herb ☑ Rush/Sedge ☐ Grass ☐ Climber ☐
Common Name:	Three cornered garlic				
Seed Form:					
Seeding Time:					
Method of Spread:	Spreads by bulb or corm growth				
Best Time of Control:					
Method of Control:	Apply Glyphosate 1 in 50 or Glean whilst plants are in flower. Repeat applications will be necessary.				

		Control Priority	Location	Habit	Form
Species Name:	**Alopecurus myosuroides**	3	Dryland ☐ Riparian ☑ Aquatic ☐	Bulb/Corm ☐ Perennial ☐ Annual ☑	Tree ☐ Shrub ☐ Herb ☐ Rush/Sedge ☐ Grass ☑ Climber ☐
Common Name:	Slender foxtail				
Seed Form:					
Seeding Time:					
Method of Spread:					
Best Time of Control:					
Method of Control:	Hand weeding prior to seeding is effective. Herbicides are not recommended as this plant occurs in wetlands and there is a threat of contamination. Repeated brushcutting prior to seeding is effective and reduces the rate of spread of this plant.				

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	**Alternanthera nodiflora**	1	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Joyweed		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:	March-April						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☐
Best Time of Control:	Oct-Nov							
Method of Control:	Hand weed plants in strips up to 2 m perpendicular to water flow and replace immediately with native emergent species. Carefully bag and remove weed material from the site. Any segment which is broken from this plant is likely to regenerate into a new plant, so using a floating bund with netting or similar device downstream to trap any segments missed.							

		Control Priority	Location		Habit		Form	
Species Name:	**Anagallis arvensis**	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Pimpernel		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:							*Climber*	☐
Best Time of Control:								
Method of Control:	Hand weeding small populations is effective. Alternatively treat with Glyphosate or Glean at 15g per ha.							

		Control Priority	Location		Habit		Form	
Species Name:	**Aponogeton elongatus**	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:			*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☑	*Annual*	☐	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☐
Best Time of Control:	Nov - Mar (access dependent)							
Method of Control:	This aquatic weed is difficult to control because it slows water movement, increases sedimentation and reduces erosion which affects bed and bank stability following removal. The recommended removal technique involves manual clearing of a channel and also clearing 5 to 10 m wide bands, 20 metres apart which are perpendicular to the stream flow. This will minimise the potential for de-stabilising the stream bed. Seek expert advice and approvals from the relevant government agencies prior to implementing broad scale works. Herbicides should not be used for this weed. Shading out and planting dense clumps of indigenous plants are the most effective management techniques.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location	Habit	Form
Species Name:	***Arctotheca calendula***	3	*Dryland* ☑ *Riparian* ☐ *Aquatic* ☐	*Bulb/Corm* ☐ *Perennial* ☐ *Annual* ☑	*Tree* ☐ *Shrub* ☐ *Herb* ☑ *Rush/Sedge* ☐ *Grass* ☐ *Climber* ☐
Common Name:	Capeweed				
Seed Form:	Coarse seed				
Seeding Time:					
Method of Spread:	Spreads mostly from seed				
Best Time of Control:	Oct - Feb				
Method of Control:	Hand weeding small populations of this plant is effective. Rotary hoeing broadscale infestations repeatedly can also work. Kings Park Board recommends glyphosate at 100ml in 15l water. Lontrel 1 in 100 has been successful on larger plants in areas without any native vegetation.				

		Control Priority	Location	Habit	Form
Species Name:	***Arundo donax***	2	*Dryland* ☐ *Riparian* ☑ *Aquatic* ☐	*Bulb/Corm* ☐ *Perennial* ☑ *Annual* ☐	*Tree* ☐ *Shrub* ☐ *Herb* ☐ *Rush/Sedge* ☐ *Grass* ☑ *Climber* ☐
Common Name:	Giant reed				
Seed Form:	Light seed				
Seeding Time:	Sept - Dec				
Method of Spread:	Spreads readily from rhizome growth				
Best Time of Control:	All year				
Method of Control:	Cut down and spray regrowth when 0.5 - 1.0m high with Glyphosate 360 100ml in 10l of water. An alternative technique is to remove bulk of plant material and pour herbicide down each tube. Ensure removal of seed heads prior to ripening if plant control is not possible. Generally this plant occurs on the banks of streams and rivers. It is important not to dig this plant out if there is a risk of increasing erosion. Onsite poisoning is the preferred option leaving the dense rhizome mat intact.				

		Control Priority	Location	Habit	Form
Species Name:	***Aster subulatus***	3	*Dryland* ☐ *Riparian* ☑ *Aquatic* ☐	*Bulb/Corm* ☐ *Perennial* ☑ *Annual* ☑	*Tree* ☐ *Shrub* ☐ *Herb* ☑ *Rush/Sedge* ☐ *Grass* ☐ *Climber* ☐
Common Name:	Bushy starwort				
Seed Form:	Light and easily spread by wind				
Seeding Time:					
Method of Spread:	Spreads mostly from seed				
Best Time of Control:	Aug - Mar				
Method of Control:	Hand weeding these plants is easy and effective. It is essential to weed them prior to flowering and fruiting to reduce their spread.				

		Control Priority	Location	Habit	Form
Species Name:	***Avena spp.***	2	*Dryland* ☑ *Riparian* ☐ *Aquatic* ☐	*Bulb/Corm* ☐ *Perennial* ☑ *Annual* ☑	*Tree* ☐ *Shrub* ☐ *Herb* ☐ *Rush/Sedge* ☐ *Grass* ☑ *Climber* ☐
Common Name:	Wild Oats				
Seed Form:	Light, easily spread by wind				
Seeding Time:	March - June				
Method of Spread:	Spreads mostly from seed				
Best Time of Control:	Aug - Oct				
Method of Control:	Hand weeding small plants in winter is effective for small populations. Blanket/Spot spraying at 2l Fusillade per ha is effective. Brushcutting plants with immature seed heads will aid control in the longer term by minimizing seed spread. Dense populations represent a significant fire hazard and threat to remnant vegetation, so repeated brushcutting also assists in reduction of fire hazard.				

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location	Habit	Form
Species Name:	***Briza maxima***				
Common Name:	Blowfly grass	2	Dryland ☑	Bulb/Corm ☐	Tree ☐
Seed Form:	Light, easily spread by wind		Riparian ☐	Perennial ☐	Shrub ☐
Seeding Time:	Sept - Nov		Aquatic ☐	Annual ☑	Herb ☐
Method of Spread:	Spreads mostly from seed				Rush/Sedge ☐
Best Time of Control:	June - Aug				Grass ☑
Method of Control:	Hand weeding is effective.				Climber ☐
	Control may be achieved by spot/blanket spraying Sertin or similar at 2l per ha.				

		Control Priority	Location	Habit	Form
Species Name:	***Briza minor***				
Common Name:	Shivery grass	2	Dryland ☑	Bulb/Corm ☐	Tree ☐
Seed Form:	Light, easily spread by wind		Riparian ☐	Perennial ☐	Shrub ☐
Seeding Time:	Sept - Oct		Aquatic ☐	Annual ☑	Herb ☐
Method of Spread:	Spreads mostly from seed				Rush/Sedge ☐
Best Time of Control:	June - Aug				Grass ☑
Method of Control:	Hand weeding is effective.				Climber ☐
	Control may be achieved by spot/blanket spraying Sertin or similar at 2l per ha.				

		Control Priority	Location	Habit	Form
Species Name:	***Bromus diandrus***				
Common Name:	Great brome	2	Dryland ☑	Bulb/Corm ☐	Tree ☐
Seed Form:	Coarse seed		Riparian ☐	Perennial ☐	Shrub ☐
Seeding Time:	Sept - Nov		Aquatic ☐	Annual ☑	Herb ☐
Method of Spread:	Spreads mostly from seed				Rush/Sedge ☐
Best Time of Control:	June - Aug				Grass ☑
Method of Control:	Hand weeding is easy and effective for small populations. The most frequently recommended treatment is Fusillade at between 2-4l per ha, when the plants are actively growing in winter. Repeated brushcutting can also be effective.				Climber ☐
	Note: Correct identification of grasses is important to protect native grasses from removal. The presence of native grasses should be investigated prior to spraying herbicides.				

		Control Priority	Location	Habit	Form
Species Name:	***Canna spp.***				
Common Name:	Canna	3	Dryland ☐	Bulb/Corm ☐	Tree ☐
Seed Form:	Heavy seed		Riparian ☑	Perennial ☑	Shrub ☐
Seeding Time:			Aquatic ☐	Annual ☐	Herb ☑
Method of Spread:	Spreads readily from rhizome growth				Rush/Sedge ☐
Best Time of Control:	Sept - Apr				Grass ☐
Method of Control:	Dig out small infestations. Selectively spraying the leaves with a systemic herbicide can be effective.				Climber ☐
	Encourage residents to harvest the flowers to reduce seed production.				
	Broadscale removal of dense stands may threaten bank stability. Remove in nodes perpendicular to the water course or remove the bulk of biomass then treat with herbicide. Ensure the dense rhizome mat intact.				

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	**Centaurea spp**	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Thistles		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light, easily spread by wind		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:	April - July						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	Srping / summer						*Climber*	☐

Method of Control: Hand weeding is effective for this group of plants. Vigilance is required to ensure removal prior to seeding.

Some people have adverse reactions to the sap and prickles of these plants. Care should be taken to minimise contact with bare skin and eyes.

		Control Priority	Location		Habit		Form	
Species Name:	**Chenopodium album**	3	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Goosefoot		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:	April - June and Sept - Oct						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	All year.						*Climber*	☐

Method of Control: Hand weeding is easy and effective prior to seeding.

Make sure that this species is correctly identified as Chenopodium glaucum is a similar native species.

		Control Priority	Location		Habit		Form	
Species Name:	**Conyza spp**	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Fleabane		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light, easily spread by wind		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:	April - Dec and July - Feb						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	Oct - Mar						*Climber*	☐

Method of Control: Hand weeding is effective prior to seeding. Needs to be ongoing. Ensure any seed heads present are bagged prior to removal if hand weeding has not occurred prior to this time.

Common on roadsides and disturbed areas as a primary coloniser. This species is tolerant of salt, wind and is adaptable to variable soil types and therefore represents a long term problem. It is easy to control and a difference can easily be seen when controlled in bushland communities.

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	**Cortaderia selloana**	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Pampas Grass		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light and easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	Dec - Feb						*Rush/Sedge*	☐
							Grass	☑
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	Sept - Nov							
Method of Control:	Cut plumes before seed ripens to limit spread. Remove most leaf material with a heavy duty brushcutter and paint regrowth with Glyphosate 1 in 2. Thoroughly wet both sides of the leaf. In riparian situations do not attempt to dig out these plants, due to the potential to affect bank stability. Should fire occur in a riparian zone, then treat the plants as soon as they reshoot to take advantage of easy access.							

		Control Priority	Location		Habit		Form	
Species Name:	**Cynodon dactylon**	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Couch		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	May, April						*Rush/Sedge*	☐
							Grass	☑
Method of Spread:	Spreads readily from rhizome growth						*Climber*	☐
Best Time of Control:	Oct - Feb and April - May							
Method of Control:	Hand weeding is very difficult, labour intensive and rarely effective. The most effective method is to spot/blanket spray in late spring - autumn using Fusillade or Targa at 4l per ha. Brushcutting and raking off bulk of plant material prior to treatment often improves ease of removal and spraying. Do not spray over winter as this plant does not actively grow at this time. Flauzifop-butyl can be used on couch occurring amongst native rushes and sedges as they are tolerant of this chemical. Ensure that the population requiring treatment is not Sporobolus virginicus, the native salt water couch.							

		Control Priority	Location		Habit		Form	
Species Name:	**Cyperus spp**	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:			*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	May - July Oct - Jan						*Rush/Sedge*	☑
							Grass	☐
Method of Spread:	Spreads readily from rhizome growth and seed						*Climber*	☐
Best Time of Control:	Nov - Jan							
Method of Control:	Spot spraying in summer using 150ml of Roundup in 15l of water + Pulse. Note, Biactive is more acceptable than other forms of Glyphosate for use over waterlogged areas. Repeated brushcutting to prevent flowering is also effective in the long term. Identification is frequently difficult with these species so it is important to ensure that the plant to be controlled is a weed and not native to the area. Remove seed heads as a minimum control technique until such time as identification has been achieved.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Cytisus proliferus***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Tree lucerne		*Riparian*	☑	*Perennial*	☑	*Shrub*	☑
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	All year							
Method of Control:	The most effective method is to cut the plant off at ground level. Treating the stump with chemical is not usually necessary, unless the stump is cut more than 20mm above ground level. Remove all plant material from the site. Kings Park recommends using Glyphosate at 1:15 on the cut stump.							

		Control Priority	Location		Habit		Form	
Species Name:	***Dipogon lignosus***	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Dolichos pea		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☑
Best Time of Control:								
Method of Control:	Hand removal of small populations. Spot spraying with Glyphosate 1 in 50 or 1:100, can be effective. At the moment, this plant is not extensively distributed around the waterways in the Perth Metropolitan area. It does have the potential however, to become a serious weed in this region - so works should focus where this species is present.							

		Control Priority	Location		Habit		Form	
Species Name:	***Echinolochloa telmatophila***	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Barnyard grass		*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☐
Seeding Time:	Oct - Dec						*Rush/Sedge*	☐
							Grass	☑
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	July - Sept							
Method of Control:	Remove small populations by hand. Hand weeding is preferred provided it will not increase erosion potential of any areas. As this plant occurs in wetlands, herbicide use is not preferred. Alternatively treat with Fusillade or equivalent prior to flowering. Herbicide rates of 750ml to 2l dependent on plant size - prior to flowering.							

		Control Priority	Location		Habit		Form	
Species Name:	***Echium plantagineum***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Paterson's curse		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:	Nov - Jan						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	July - Oct							
Method of Control:	Hand weed small populations. Broader scale populations can be sprayed with Glyphosate. A rate of 75-100 ml per 15l of water is recommended by Kings Park Board staff.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

		Control Priority	Location		Habit		Form	
Species Name:	***Ehrharta calycina***		*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Veldtgrass	1	*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light, easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	March, April and Sept, Oct						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☑
Best Time of Control:	Aug - Dec						*Climber*	☐

Method of Control: Hand weed localised infestations. Repeated brushcutting of larger stands of the weed, close to root base has been effective, followed by spot/blanket spraying using Fusillade at 4l per ha or Sertin/Targa. It is important to tag any native plants persisting amongst stands of Veldtgrass to protect them from brushcutting activities. Hand weed grasses close to any native plants.

This plant represents a significant fire hazard in dense, extensive populations which generally occurs along disturbed road verges and fire access tracks.

		Control Priority	Location		Habit		Form	
Species Name:	***Eragrostis curvula***		*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	African love grass	1	*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light, easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	June - Nov						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☑
Best Time of Control:	Nov - March						*Climber*	☐

Method of Control: Hand weed small infestations prior to mulching. Kings Park have found complete foliar spraying after fire or in summer months using Glyphosate 1l in 100l water and wetter e.g. Agral 60, X77 to be effective. Repeated brushcutting can be effective combined with herbicide treatment of regrowth. This minimises herbicide required by a reducing the amount of leaf material.

This plant represents a significant fire hazard and therefore a major threat to native vegetation. Do not set fire to on purpose but take advantage of easier access should any wildfire occur over summer.

		Control Priority	Location		Habit		Form	
Species Name:	***Erodium moschatum***		*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Musky crowfoot	2	*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	June - Sept						*Climber*	☐

Method of Control: Hand weeding is effective in predominantly native vegetation zones. This species is difficult to control due to the widespread nature of the populations.

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Erythrina x sykesii***	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Common Name:	Coral Tree		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads from suckers						*Climber*	☐
Best Time of Control:	Sept - Mar							
Method of Control:	Inject tree with systemic herbicide at 10 - 15 cm intervals around the trunk. Treatment may be required several times. Cut and paint any suckers with Glyphosate. Remove any branches which fall from the tree, as these can take root. Ensure bank stability is not threatened when removing the dead trunk.							

		Control Priority	Location		Habit		Form	
Species Name:	***Ferraria crispa***	2	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
Common Name:	Black flag		*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:	Nov - Dec						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads by bulb or corm growth						*Climber*	☐
Best Time of Control:	Aug - Oct							
Method of Control:	Hand weed using gloves as this species is highly toxic. Kings Park suggests spot spraying Glyphosate 1 in 100 for control or using Ally/Brushoff and Glean at flowering time.							

		Control Priority	Location		Habit		Form	
Species Name:	***Ficus spp.***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Common Name:	Edible fig tree		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	Dec - Mar						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	Sept - Nov							
Method of Control:	Small plants can be removed by hand. Mature plants can be injected with full strength Glyphosate at 15 cm intervals around the trunk. Fruit removal effectively reduces the rate of spread of this weed. These plants are common in riparian zones. It is important not to disturb their root structure as generally these plants provide considerable bank stability in the absence of native plants. Removing the bulk of the branches and stems in dense areas may be appropriate.							

		Control Priority	Location		Habit		Form	
Species Name:	***Foeniculum vulgare***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Fennel		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:	Dec - Feb						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	Aug - Sept							
Method of Control:	Hand weeding is effective for small plants. For large plants, cut the stems below ground and remove plant material prior to fruiting to reduce future spread. Alternatively, this weed can be controlled by applying Glyphosate 1 in 100 before or at flowering or repeated brushcutting.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Freesia aff leichtlinii***							
Common Name:	Freesia	2	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
Seed Form:	Light seed		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seeding Time:	Oct - Nov		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Method of Spread:	Spreads by bulb or corm growth						*Rush/Sedge*	☐
Best Time of Control:	Aug - Sept						*Grass*	☐
Method of Control:	Small infestations can be dug out, bagged and removed from site. The sieving method outlined for Watsonia can be effective. Care needs to be taken to ensure that no corms are dropped when removing the plants from site - otherwise it will create more work in the future. For large infestations Kings Park Board Staff recommend applying Glyphosate 1 in 100 or Brushoff 5g per ha just prior to flowering (August).						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Fumaria capreolata***							
Common Name:	Whiteflower fumitory	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light seed		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seeding Time:	Dec - Mar		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	May - Sept						*Grass*	☐
Method of Control:	Hand weed prior to seeding.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Gladiolus spp***							
Common Name:	Gladiolus	2	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
Seed Form:	Light, easily spread by wind		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seeding Time:	Feb-June		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Method of Spread:	Spreads by bulb/corm growth and seed						*Rush/Sedge*	☐
Best Time of Control:	Aug - Dec						*Grass*	☐
Method of Control:	Remove flower heads to prevent seed production. In heavy soils, handweed by digging around clump, sieving and shaking back sand. Can hand weed easily in dryland areas (Aug-Sept). Bag all the corms and dispose of carefully. It is possible to use herbicide for severe infestations including Glean, Brushoff and Glyphosate - using hand wiping technique.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Gomphocarpus fruticosus***							
Common Name:	Cotton bush	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light and easily spread by wind		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:	Nov - Dec		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	Sept - Dec						*Grass*	☐
Method of Control:	Hand weed small plants prior to fruiting. Alternatively cut at or slightly below ground level and remove plant material. Selectively spraying the leaves with Glyphosate 1 in 100 is the suggested herbicide treatment. Some people have adverse reactions to the sap of this plant. Wear gloves and take care when handling plant material.						*Climber*	☐

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Hesperantha falcata***	1	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
Common Name:			*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads by bulb or corm growth						*Climber*	☐
Best Time of Control:								
Method of Control:	Kings Park Board staff have been unable to find little information about controlling this weed. This agency recommends using Glyphosate at a rate of 1 to 100 at flowering time, but because this plant has small leaves it is difficult to target. Trialling Glean/Brushoff is also recommended.							

		Control Priority	Location		Habit		Form	
Species Name:	***Homeria flaccida***	1	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
Common Name:	One leaf cape tulip		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:			*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads by bulb or corm growth						*Climber*	☐
Best Time of Control:								
Method of Control:	Removing these plants by hand can be effective if care is taken to remove all corms. For extensive populations, it is recommended that the plants are wiped with Glyphosate 1 in 10. It is important to note that not all corms re-shoot in a given year so it is essential to monitor and treat re-growth annually. This plant is toxic to stock.							

		Control Priority	Location		Habit		Form	
Species Name:	***Hordeum leporinum***	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Barley grass		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☐
Seeding Time:	Sept - Oct						*Rush/Sedge*	☐
							Grass	☑
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	July - August							
Method of Control:	Hand weeding is effective for small populations. Herbicide treatment using Fusillade at 2l per ha can work in bushland environments. Kings Park recommends spraying in July-Aug. It is important that hand weeding or spraying occurs before seed set.							

		Control Priority	Location		Habit		Form	
Species Name:	***Hyparrhenia hirta***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Tambookie grass		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	Nov - Mar							
Method of Control:	Hand weeding small plants prior to flowering is relatively easy. Brushcutting to remove most leaf material prior to herbicide treatment improves the effectiveness of the appplication. Fusillade at 4l per ha works best on new growth. Repeat treatments are likely to be required. This is a WA native grass which is extending its distribution as a result of disturbance and vehicle movement.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	**Hypochaeris radicata**							
Common Name:	Flatweed	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light and easily spread by wind		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:	Oct - Mar		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	All year						*Grass*	☐
Method of Control:	Hand weeding is fast and effective prior to, or during flowering.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	**Ipomoea spp**							
Common Name:	Morning glory	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:			*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seeding Time:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Rush/Sedge*	☐
Best Time of Control:							*Grass*	☐
Method of Control:	Cut and remove existing growth, and then treat regrowth as it develops with Glyphosate at 300ml per 15l water with Pulse. This technique is preferred by the Kings Park Board staff. Continued effort to remove the bulk of the vegetative material, taking care not to drop segments, can also be helpful in minimising the need for herbicide use. This plant is becoming increasingly dominant in highly urbanised streams and should be controlled.						*Climber*	☑

		Control Priority	Location		Habit		Form	
Species Name:	**Isolepis prolifera**							
Common Name:	Budding club rush	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light seed		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seeding Time:	Dec - Feb		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Rush/Sedge*	☑
Best Time of Control:	Winter						*Grass*	☐
Method of Control:	This plant occurs in homogeneous clumps in seasonally waterlogged area. It may be worth trying to cover this weed with black plastic held down with rocks to drown the plant over winter. Rotary hoeing and spraying the regrowth with Glyphosate with surfactant can be effective. Kings Park Board suggests Glyphosate 1 to 20 plus Pulse. It is important to do this in summer following the frog breeding season and prior to the bird breeding season. Repeat treatments will be required.						*Climber*	☐

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Juncus articulatus***	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Articulated rush		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☐
Seeding Time:	Nov - Mar						*Rush/Sedge*	☑
Method of Spread:	Spreads mostly from seed						*Grass*	☐
							Climber	☐
Best Time of Control:	Sept - Mar							
Method of Control:	Manually weeding all plants is the preferred method for removing this species.							
	Ensure that the plants to be controlled have been correctly identified as the weed species. If unsure of weed status then removing the flowering heads to minimise spread is helpful and will not seriously interfere with the plants until they have been correctly identified.							

		Control Priority	Location		Habit		Form	
Species Name:	***Juncus capitatus***	3	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:			*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☐
Seeding Time:	Dec - mar						*Rush/Sedge*	☑
Method of Spread:	Spreads mostly from seed						*Grass*	☐
							Climber	☐
Best Time of Control:	Sept - Nov							
Method of Control:	Manually weed small plants. The preferred method for removing larger clumps involves brushcutting to remove the bulk of material and then digging the plants out and removing the base and leaves from the site. Any regrowth from sections missed can then be slashed and treated with Glyphosate applied at half strength. Several applications may be required.							
	Ensure that the plants to be controlled have been correctly identified as weed species. If unsure of weed status then removing the flowering heads to minimise spread is helpful and will not seriously interfere with the plants until they have been correctly identified.							

		Control Priority	Location		Habit		Form	
Species Name:	***Juncus microcephalus***	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:			*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	Dec - Mar						*Rush/Sedge*	☑
Method of Spread:	Spreads mostly from seed						*Grass*	☐
							Climber	☐
Best Time of Control:	Sept - Dec							
Method of Control:	Manually weed small plants. The preferred method for removing larger clumps involves brushcutting to remove the bulk of material and then digging the plants out and removing the base and leaves from the site. Any regrowth from sections missed can then be slashed and treated with Glyphosate applied at half strength. Several applications may be required.							
	This plant is a serious weed. Ensure correct identification prior to implementing weed control as this plant is similar to native rush and sedge species. Plants occurring on river banks should not be dug out as removal may create a new erosion problem. Use extra care when using herbicides close to the water.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Lantana camara***							
Common Name:	Lantana	3	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:			*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seeding Time:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Rush/Sedge*	☐
Best Time of Control:							*Grass*	☐
Method of Control:	Hand weed (grub out) small communities. Spray localised populations with Glyphosate 1 in 10 covering all foliage. Monitoring re-occurrence of this plant in areas where previous control work has been undertaken is essential.						*Climber*	☑

		Control Priority	Location		Habit		Form	
Species Name:	***Leptospermum laevigatum***							
Common Name:	Victorian coastal teatree	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Seed Form:	Light, easily spread by wind		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seeding Time:	April - October		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	All year						*Grass*	☐
Method of Control:	Hand weed seedlings. For mature plants, cut stems to ground level annually until control is achieved. Remove flowering branches when possible. Note, in some cases where this weed provides shelter this should be done only after native plants have grown sufficiently to take their place.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Lolium spp.***							
Common Name:	Rye grass	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light, easily spread by wind		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:	March - June		*Aquatic*	☐	*Annual*	☑	*Herb*	☐
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	Dec - Mar						*Grass*	☑
Method of Control:	Handweeding is preferred, except for extensive populations. Spot spraying of Sertin, Targa or similar at 4l per ha prior to flowering can be effective. In areas where steep banks are present and this species is dominant removing the seed heads to limit spread is preferred to complete removal, in order to ensure that bank stability is protected.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Lupinus angustifolia***							
Common Name:	Lupin	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Heavy seed		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seeding Time:	Oct - Dec		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	Aug - Oct						*Grass*	☐
Method of Control:	Handweed small populations. Alternatively, spray the plants selectively with Glyphosate 2% solution.						*Climber*	☐

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	**Medicago spp**	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Medics		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	June - Sept						*Climber*	☐
Method of Control:	This plant may be controlled effectively with Glyphosate. Kings Park Board recommends a rate of 75-100ml in 15l of water.							

		Control Priority	Location		Habit		Form	
Species Name:	**Monopsis debilis**	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:			*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:			*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:							*Grass*	☐
Best Time of Control:							*Climber*	☐
Method of Control:	Pull out small populations to prevent them from spreading. Repeated rotary hoeing/mowing to prevent flowering can be helpful. Kings Park Board staff suggest Glyphosate at 75-100ml in 15l of water prior to flowering.							

		Control Priority	Location		Habit		Form	
Species Name:	**Myrsiphyllum asparagoides**	1	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
Common Name:	Bridal Creeper		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	Oct - Dec						*Rush/Sedge*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Grass*	☐
Best Time of Control:	Jul - Sept						*Climber*	☑
Method of Control:	Remove young plants by hand as they appear. If spraying, remove the bulk of the plant material prior to spraying then treat the smaller biomass of plants approximately a fortnight later. Kings Park currently recommends using either Glyphosate 360 at a rate of 1 in 100, or 2.5 to 5g per ha in 250l of water. Repeat applications will be required for either chemical. Kings Park may have more up to date control measures. It is essential to take extreme care when treating this plant as it generally occurs within close proximity of native plants, and casuing the unintentional death of non-target plants is possible.							

		Control Priority	Location		Habit		Form	
Species Name:	**Narcissus tazetta**	2	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
Common Name:	Jonquil		*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:	Spreads by bulb or corm growth						*Grass*	☐
Best Time of Control:	Winter - Spring						*Climber*	☐
Method of Control:	Removing these plants by hand can be effective if care is taken to remove all corms. For extensive populations, it is recommended that the plants are wiped with Glyphosate 1 in 10. It is important to note that not all corms re-shoot in a given year so it is essential to monitor and treat re-growth annually. This plant is toxic to stock.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Nerium oleander***							
Common Name:	Oleander	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Coarse seed		*Riparian*	☐	*Perennial*	☑	*Shrub*	☑
Seeding Time:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Rush/Sedge*	☐
Best Time of Control:	All year						*Grass*	☐
Method of Control:	Dig out the individual plants. Otherwise cut the stumps and paint with full strength systemic herbicide.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Olea europaea***							
Common Name:	Olive tree	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Seed Form:	Heavy seed		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:	Nov - Jan		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:							*Grass*	☐
Method of Control:	Hand weed juvenile plants. For small plants, selectively spray foliage with full strength Glyphosate. Larger trees can be managed by either cutting the stump and painting with Glyphosate or Garlon (recommended by Kings Park Board staff), or alternatively injecting into the stem at 15 cm intervals. Follow up treatments may be required. Encouraging fruit harvesting by residents will reduce the rate of spread of this weed.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Oxalis pes-caprae***							
Common Name:	Soursob	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light seed		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seeding Time:	Sept		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads by runners						*Rush/Sedge*	☐
Best Time of Control:	July - Sept						*Grass*	☐
Method of Control:	Hand weeding can be effective provided that care is taken to trace all runners from the parent plant and that no stem and root is left behind. Apply Glyphosate 75ml in 10l in winter or before foliage starts to yellow.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Panicum capillare***							
Common Name:	Witchgrass	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:			*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seeding Time:			*Aquatic*	☐	*Annual*	☑	*Herb*	☐
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:							*Grass*	☑
Method of Control:	As with most introduced grasses, Fusillade at 2l per ha can be effective. The herbicide should be applied prior to flowering. This species has the potential to spread rapidly through wetland environments.						*Climber*	☐

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Paspalum spp***	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Paspalum		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	Dec - Jan						*Rush/Sedge*	☐
							Grass	☑
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☐
Best Time of Control:	Aug - Mar							
Method of Control:	Repeated brushcutting/slashing can be effective in controlling this plant - provided it occurs prior to seed development. The accepted herbicide treatment is the application of Fusillade at 4l per ha. It is possible to reduce the volume of herbicide required by slashing/rotary hoeing and then treating the regrowth.							

		Control Priority	Location		Habit		Form	
Species Name:	***Pelargonium capitatum***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Rose pelargonium		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light, easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:	Jan - April						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☐
Best Time of Control:	Spring							
Method of Control:	Hand weed in autumn / winter, trying very hard not leave any stem or root behind as the plants will reshoot. Kings Park suggests the two herbicide treatments listed. Spot Spray with Ally/Brush 5g per ha or spray with Glyphosate 1 in 100 with wetting agent in early September. This plant is an effective coloniser and it may smother any small native plants present.							

		Control Priority	Location		Habit		Form	
Species Name:	***Pennisetum clandestinum***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Kikuyu		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Sterile or non seed producing		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
							Grass	☑
Method of Spread:	Spreads readily from rhizome growth						*Climber*	☐
Best Time of Control:	Sept - Dec							
Method of Control:	The most effective technique recognised is the application of Fusillade at a rate of 4l per ha while the plant is actively growing. Fusillade should not be applied over open water. Native rushes and sedges are not at risk when using this chemical.							

		Control Priority	Location		Habit		Form	
Species Name:	***Plantago lanceolata***	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Ribwort plantain		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	Nov - Dec							
Method of Control:	Pull Ribwort by hand ensuring that tap root is properly removed. Generally populations of this weed are limited and can be be managed effectively using manual weed control methods. Kings Park Board recommends wiping with Glyphosate 100ml in 15l water.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	**Populus spp**							
Common Name:	Poplar	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Seed Form:			*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads from suckers						*Rush/Sedge*	☐
Best Time of Control:	Oct - Feb						*Grass*	☐
Method of Control:	Experience indicates that injecting concentrated systemic herbicide at 10 - 15 cm intervals around the trunk can be effective, and reduces the number of suckers which can occur following the cut stump technique. Kings Park considers this plant difficult to control and recommends the cut stump method with Garlon 600.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	**Raphanus raphanistrum**							
Common Name:	Wild radish	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light seed		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seeding Time:	Dec		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	Sept - Nov						*Grass*	☐
Method of Control:	Removing these species by hand is easy and can be done very quickly. Removal should occur prior to the plants flowering and seeding to reduce the rate of spread. Bagging and cutting the seeding stems, from any plants, should be undertaken prior to removal. The alternative is to paint with Glyphosate 1 in 10.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	**Rhynchelytrum repens**							
Common Name:	Red natal grass	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light and easily spread by wind		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:	Sept - Nov		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	June to Aug						*Grass*	☑
Method of Control:	This plant is effectively controlled using Fusillade at a rate of 4l per ha (as for most other introduced grasses).						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	**Ricinus communis**							
Common Name:	Castor Oil	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Seed Form:	Heavy seed		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:	Nov - Jan		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	Any time but best prior to fruiting						*Grass*	☐
Method of Control:	Small populations can be removed by hand. Individual plants can be cut and painted with Glyphosate. Populations of seedlings can be sprayed with Glyphosate 1 in 80, while injecting large plants with a systemic herbicide is effective. The seed from this plant has been shown to be viable more than 1 000 years later, so vigilance is required to remove plants prior to seeding.						*Climber*	☐

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Romulea rosea***							
Common Name:	Guildford grass	1	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
Seed Form:	Light seed		*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seeding Time:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads by bulb or corm growth						*Rush/Sedge*	☐
Best Time of Control:							*Grass*	☑
Method of Control:	In areas with homogeneous populations, Kings Park Board suggests Brushoff / Ally can give good control and can be used over some turf species. Repeated rotary hoeing and slashing prior to flowering can assist in managing populations.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Rorippa nasturtium-aquaticum***							
Common Name:	Watercress	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light seed		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:			*Aquatic*	☑	*Annual*	☐	*Herb*	☑
Method of Spread:	Spreads from both seed and vegetative growth						*Rush/Sedge*	☐
Best Time of Control:	Access dependent						*Grass*	☐
Method of Control:	This aquatic weed is difficult to control because it slows water movement, increases sedimentation and reduces erosion which means implementing control can affect bed and bank stability. The recommended removal technique involves manual clearing of a channel and also clearing 5 to 10 m wide bands, 20 metres apart which are perpendicular to the stream flow. This will minimise the potential for de-stabilising the stream bed. Seek expert advice and approvals from the relevant government agencies prior to implementing broad scale works.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Rubus spp***							
Common Name:	Blackberry	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Heavy seed		*Riparian*	☑	*Perennial*	☑	*Shrub*	☑
Seeding Time:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Rush/Sedge*	☐
Best Time of Control:	Dec - April						*Grass*	☐
Method of Control:	Brush cut and remove brambles. Hand weed removing knotty stumps and as much root as possible. Paint regrowth with Glyphosate 12ml to 1l of water. Better control is often achieved with a combination of Brushoff, Garlon or blackberry and tree killer. Biological controls using a rust fungus have been successful. Agriculture WA may be able to assist with this. Brushcutting these plants can provde very difficult and using a team of goats as the first method of attack can prove very useful in terms of increasing access and removing the bulk of the vegetative material. It is important that any blackberry control takes into consideration fauna corridors in coninuous strips of sufficient width to discourage predators, particularly to protect brids and bandicoots.						*Climber*	☐

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	**Rumex spp**							
Common Name:	Dock	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light and easily spread by wind		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:	March - June		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	Nov - Mar						*Grass*	☐
Method of Control:	These plants are readily eradicated through hand weeding. Remove flowering heads prior to seed ripening if complete plant removal is not possible. Always bag plants with seeds and dispose of carefully.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	**Salix spp**							
Common Name:	Willow	1	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☑
Seed Form:	Heavy seed		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seeding Time:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads from suckers						*Rush/Sedge*	☐
Best Time of Control:	Dec - Mar						*Grass*	☐
Method of Control:	Small plants can be removed by hand. Mature plants can be injected with full strength Glyphosate at 10 - 15 cm intervals around the trunk. Any suckers which appear can be painted with systemic herbicide. It is important not to remove the parent plant until it is dead and no more suckers are being produced. Removal of willows along watercourses can have a detrimental effect through loss of habitat, streamside erosion and exposure of understorey. Consideration should be given to replacing the plants to be removed two years prior to undertaking removal.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	**Schinus terebinthifolia**							
Common Name:	Japanese pepper	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Seed Form:	Coarse seed		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:	Sept		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads from suckers and seed						*Rush/Sedge*	☐
Best Time of Control:	All year, but in wetlands treat in summer						*Grass*	☐
Method of Control:	Hand weed small seedlings. It is important to monitor for any new germinants to enable rapid removal from the site. Treating the large plants can be undertaken either by cutting the trunk and immediately painting the stump, or alternatively injecting systemic herbicide at 10 - 15 cm intervals around the trunk. Kings Park recommends either Glyphosate, Velpar or Garlon. The seed is spread predominantly by introduced birds and there is some anecdotal evidence that many native birds are poisoned by the seeds.						*Climber*	☐

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	**Solanum nigrum**							
Common Name:	Deadly nightshade	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Coarse seed		*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seeding Time:	Oct - Dec		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	Sept - Oct						*Grass*	☐
Method of Control:	Hand weed small infestations. Kings Park Board recommends using Glyphosate 1 in 100. Dessicant herbicides applied to all parts of the plant can be effective on warm to hot days.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	**Stachys arvensis**							
Common Name:	Staggerweed	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Heavy seed		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seeding Time:			*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:							*Grass*	☐
Method of Control:	Pull out small populations to prevent them from spreading. Repeated rotary hoeing/mowing to prevent flowering can be helpful where there are no remnant native species. Kings Park Board staff suggest Glyphosate at 75-100ml in 15l of water prior to flowering.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	**Stenotaphrum secundatum**							
Common Name:	Buffalo grass	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Sterile or non seed producing		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seeding Time:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads readily from rhizome growth						*Rush/Sedge*	☐
Best Time of Control:	Aug - Sept						*Grass*	☑
Method of Control:	Hand weeding is very difficult, labour intensive and rarely successful. The most effective method is to implement a minimum of two spot/blanket treatments in Aug-Oct and April-May using Fusillade or Targa at 4l per ha. Brushcutting often improves ease of removal and spraying. This process typically requires more than two treatments. Can implement spraying amongst native rushes and sedges which have been demonstrated to tolerate flauzifop-butyl.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	**Taraxacum officinale**							
Common Name:	Dandelion	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:	Light, easily spread by wind		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seeding Time:	All year round		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	Sept - Nov						*Grass*	☐
Method of Control:	Hand weeding is the most effective means of control ensuring that if seed heads are present , they are carefully bagged prior to removal of the plant. Wiping with Glyphosate is also effective.						*Climber*	☐

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Thunbergia alata***	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Black-eyed Susan		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☑
Best Time of Control:								
Method of Control:	Remove small plants manually. Spot spraying with Glyphosate at a rate of 1 in 50 can be effective.							
	This plant poses a serious threat to the State's waterways and any small populations should be worked on quickly to reduce the potential spread.							

		Control Priority	Location		Habit		Form	
Species Name:	***Trifolium spp.***	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Clovers		*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:								
Method of Control:	Hand weed small populations. Spraying populations with Glyphosate at 75 - 100 ml in 15l of water is recommended by Kings Park Board. Repeated rotary hoeing with follow up spraying can be effective in pasture situations.							

		Control Priority	Location		Habit		Form	
Species Name:	***Tropaeolum majus***	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Nasturtium		*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☐
Seeding Time:	Nov - Jan						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☑
Best Time of Control:	Aug / Sept							
Method of Control:	Removing this species by hand is effective. Selectively applying Glyphosate 1 in 100 can be effective.							
	Awareness campaigns about the implications of dumping garden waste in reserves need to be upgraded and implemented intensively to discourage such activities.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Typha orientalis***	1	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Bulrush		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light, easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☑
Method of Spread:	Spreads readily from rhizome growth and seed						*Grass*	☐
Best Time of Control:	Winter						*Climber*	☐

Method of Control: Remove seed heads prior to ripening in September - December. Cut stems below water level in May, if sufficient water is present, monitor regrowth and continue to cut until September to drown the plants.

For populations occurring in waterlogged areas only use Glyphosate BioActive 1 to 10 in spring, after slashing plants first and wipe new growth when plants are 1m tall. Take care when using herbicide over water.

The native cumbungi, Typha domingensis, looks similar to Bulrush and it is important to ensure that the population being controlled is in fact the weed species.

		Control Priority	Location		Habit		Form	
Species Name:	***Ursinia anthemoides***	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Ursinia		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:							*Grass*	☐
Best Time of Control:							*Climber*	☐

Method of Control: Pull out small populations to prevent them from spreading. Repeated rotary hoeing/mowing to prevent flowering can be helpful.

Kings Park Board staff suggest Glyphosate at 75-100ml in 15l of water prior to flowering.

		Control Priority	Location		Habit		Form	
Species Name:	***Vicia sativa***	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Vetch		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Grass*	☐
Best Time of Control:							*Climber*	☐

Method of Control: Kings Park recommends trying Glyphosate 75ml in 15 l when the plants are actively growing. Hand weeding small populations is possible and effective.

		Control Priority	Location		Habit		Form	
Species Name:	***Vinca major***	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Periwinkle		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:	Spreads by runners						*Grass*	☐
Best Time of Control:	June - Aug						*Climber*	☑

Method of Control: It is generally recommended that this weed is managed by applying Glyphosate at 1 in 10 with surfactant.

Applications will need to be repeated several times at intervals of one month.

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Watsonia bulbillifera***							
Common Name:	Watsonia	1	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
			Riparian	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light and easily spread by wind and wat		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
							Rush/Sedge	☐
Seeding Time:	March - May						*Grass*	☐
Method of Spread:	Spreads by bulb/corm growth						*Climber*	☐
Best Time of Control:								
Method of Control:	Remove corms by carefully digging a large area around each plant, putting the sand onto flywire, sieving and collecting all the corms. Flowers should also be harvested to prevent the production of seed and subsequent spread. The collected corms should be disposed of carefully. Broadscale removal of dense stands may threaten bank stability. Remove in nodes along the waterway. Selectively spray a combination of herbicides between July to August using Glean and Ally/Brushoff and subsequently painting leaf with Glyphosate in September to November can be effective. Remove the bulk of dead biomass leaving the rhizome mats in tact.							

		Control Priority	Location		Habit		Form	
Species Name:	***Zantedeschia aethiopica***							
Common Name:	Arum lily	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
			Riparian	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
							Rush/Sedge	☐
Seeding Time:	Dec						*Grass*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☐
Best Time of Control:	April - Nov							
Method of Control:	Entire plants can be removed by digging - make sure to remove all of the rhizome. Spot spray from April to Novemer using Glyphosate 1in 100 or Gleen Ally/Brushoff 1in 50 (20g per ha). Respraying is likely to be required 8 weeks later. In wetland environments Roundup Biactive should be used to minimise fauna losses.							

Control priority 1 - Major environmental weed, urgent control required
Control priority 2 - Nuisance weed, control as soon as possible
Control priority 3 - Minor weed, control as resources become available

Ecosystem Management Services 1999

Appendix 3

Suggested species for revegetation works

Appendix 3: Suggested species for revegetation works

Species	CommonName	Location								Habitat		
		Roley Pool	*Wright Brook*	*Breera Brook*	*Bannister Creek*	*Bennett Brook*	*Ellen Brook*	*Southern Wood Creek*	*Upper Canning*	*Dryland*	*Bank*	*Emergent*
1.Spreading tree												
Banksia attenuata	Slender banksia	☐	☐	☐	☐	☑	☑	☑	☐	◉	○	○
Banksia littoralis	Swamp banksia	☐	☐	☐	☐	☑	☑	☐	☐	○	◉	○
Banksia menziesii	Firewood banksia	☐	☐	☐	☐	☑	☑	☑	☐	◉	○	○
Casuarina obesa	Saltwater sheoak	☐	☐	☐	☐	☑	☑	☑	☐	◉	◉	○
Corymbia calophylla	Marri	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Eucalyptus marginata	Jarrah	☑	☑	☐	☐	☐	☑	☑	☑	◉	○	○
Eucalyptus rudis	Flooded gum	☑	☑	☑	☑	☑	☑	☑	☑	○	◉	◉
Eucalyptus wandoo	Wandoo	☑	☐	☐	☐	☐	☐	☐	☐	◉	○	○
Paraserianthes lophantha	Native albizia	☑	☑	☑	☐	☑	☑	☐	☑	◉	○	○
2.Compact tree												
Eucalyptus todtiana	Coastal blackbutt	☐	☐	☑	☐	☐	☑	☐	☐	◉	○	○
Melaleuca cuticularis	Saltwater paperbark	☐	☐	☐	☐	☑	☑	☐	☐	○	◉	○
Melaleuca preissiana	Modong	☐	☐	☑	☑	☑	☑	☑	☑	○	◉	○
Melaleuca rhaphiophylla	Swamp paperbark	☑	☑	☑	☑	☑	☑	☑	☑	○	◉	◉
Nuytsia floribunda	Christmas tree	☐	☐	☐	☐	☐	☑	☐	☐	◉	○	○
3.Large shrub												
Acacia saligna	Coojong	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Agonis linearifolia	Swamp peppermint	☑	☑	☑	☑	☑	☑	☑	☑	○	◉	◉
Dryandra sessilis	Parrot bush	☑	☑	☐	☐	☐	☑	☐	☑	◉	○	○
Grevillea diversifolia	Variable leaved grevillea	☐	☐	☐	☑	☐	☑	☑	☑	◉	○	○
Melaleuca incana	Grey honeymyrtle	☐	☐	☐	☑	☑	☑	☑	☐	○	◉	○
Melaleuca teretifolia		☐	☐	☐	☑	☑	☑	☑	☑	○	◉	○

This information is site specific to the sections of assessed foreshore. Please seek expert advice if placing these species outside of the surveyed sections.

Species	CommonName	Location								Habitat		
		Roley Pool	*Wright Brook*	*Breera Brook*	*Bannister Creek*	*Bennett Brook*	*Ellen Brook*	*Southern Wood Creek*	*Upper Canning*	*Dryland*	*Bank*	*Emergent*
Melaleuca viminea	Mohan	☐	☐	☐	☐	☐	☑	☑	☑	○	◉	○
Oxylobium lineare	River pea	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Viminaria juncea	Swishbush	☑	☑	☑	☑	☑	☑	☑	☑	○	◉	○
4.Medium shrub												
Acacia pulchella	Prickly moses	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Astartea fascicularis	Common Astartea	☑	☑	☑	☑	☑	☑	☑	☑	○	◉	○
Darwinia citriodora	Lemon scented darwinia	☑	☐	☐	☐	☐	☐	☐	☑	◉	○	○
Hakea varia	Harsh hakea	☑	☐	☐	☑	☐	☑	☑	☑	◉	○	○
Hibbertia spp	Native buttercups	☑	☑	☐	☐	☑	☑	☑	☑	◉	○	○
Jacksonia furcellata	Grey stinkwood	☐	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Jacksonia sternbergiana	Green stinkwood	☐	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Kunzea ericifolia	Spearwood	☐	☐	☑	☐	☐	☑	☑	☐	◉	○	○
Lasiopetalum bracteatum	Helena Velvet Bush	☑	☑	☐	☐	☐	☐	☐	☑	◉	○	○
Melaleuca lateritia	Robin Red-breast bush	☑	☑	☐	☑	☑	☑	☑	☑	○	◉	◉
Melaleuca viminea	Mohan	☐	☐	☐	☑	☑	☑	☑	☐	○	◉	○
Pericalymma ellipticum	Swamp teatree	☑	☑	☐	☐	☐	☐	☐	☑	○	◉	○
Pteridium esculentum	Bracken fern	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Regelia ciliata	Regelia	☐	☐	☐	☑	☐	☑	☑	☐	○	◉	○
Thomasia macrocarpa		☑	☑	☐	☐	☐	☐	☐	☑	◉	○	○
5.Low shrub												
Acacia alata	Winged wattle	☑	☑	☐	☑	☐	☐	☐	☑	○	◉	○
Acanthocarpus preissii		☐	☐	☐	☑	☑	☑	☑	☐	◉	○	○
Bossiaea spp		☑	☑	☐	☐	☐	☑	☑	☑	◉	○	○
Corynotheca micrantha	Sand lily	☑	☐	☐	☐	☐	☑	☐	☑	◉	○	○
Gompholobium tomentosum	Hairy yellow pea	☐	☐	☐	☐	☑	☐	☐	☐	◉	○	○

This information is site specific to the sections of assessed foreshore. Please seek expert advice if placing these species outside of the surveyed sections.

Species	CommonName	Location								Habitat		
		Roley Pool	*Wright Brook*	*Breera Brook*	*Bannister Creek*	*Bennett Brook*	*Ellen Brook*	*Southern Wood Creek*	*Upper Canning*	*Dryland*	*Bank*	*Emergent*
Hakea prostrata	Harsh Hakea	☐	☐	☐	☑	☑	☑	☐	☐	◉	○	○
Hypocalymma angustifolium	White myrtle	☐	☐	☑	☑	☑	☑	☐	☐	◉	○	○
Hypocalymma robustum	Swan River myrtle	☐	☐	☐	☐	☑	☑	☑	☐	◉	◉	○
Leucopogon spp		☑	☑	☐	☑	☐	☑	☑	☐	◉	○	○
Macrozamia riedlei	Zamia	☐	☐	☐	☑	☑	☑	☑	☐	◉	○	○
Verticordia spp	Featherflowers	☐	☐	☑	☑	☑	☑	☑	☐	◉	◉	○
6.Ground cover												
Centella cordifolia	Centella	☑	☑	☑	☑	☑	☑	☑	☑	○	◉	◉
Conostylis candicans	Grey cottonhead	☐	☐	☐	☑	☑	☑	☑	☐	◉	○	○
Cotula coronopifolia	Waterbuttons	☐	☐	☐	☑	☑	☑	☑	☐	○	◉	○
Dryandra nivea	Couch honeypots	☑	☐	☐	☐	☐	☑	☐	☑	◉	○	○
Hemarthria uncinata	Mat grass	☑	☑	☐	☑	☑	☑	☑	☑	○	◉	○
Hemiandra pungens	Snake bush	☐	☐	☐	☑	☑	☑	☑	☐	◉	○	○
Patersonia occidentalis	Western iris	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Sporobolus virginicus	Saltwater couch	☐	☐	☐	☐	☐	☑	☐	☐	○	◉	◉
7.Climber												
Clematis pubescens	Common clematis	☐	☐	☐	☐	☐	☑	☐	☑	◉	○	○
Hardenbergia comptoniana	Native wisteria	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Kennedia coccinea	Coral creeper	☑	☑	☐	☐	☐	☐	☐	☑	◉	○	○
Kennedia prostrata	Running postman	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
8.Rush or Sedge												
Juncus subsecundus	Finger rush	☐	☐	☐	☑	☑	☑	☑	☑	○	◉	◉
Baumea articulata	Jointed twig sedge	☑	☐	☐	☑	☑	☑	☑	☑	○	○	◉
Baumea juncea	Bare twig rush	☐	☐	☑	☑	☑	☑	☑	☑	○	◉	◉
Baumea preissii	Broad twig sedge	☑	☐	☑	☑	☑	☐	☑	☑	○	○	◉

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Species	CommonName	Location								Habitat		
		Roley Pool	*Wright Brook*	*Breera Brook*	*Bannister Creek*	*ennett Brook*	*Ellen Brook*	*Southern Wood Creek*	*Upper Canning*	*Dryland*	*Bank*	*Emergent*
Baumea rubiginosa	River twig	☑	☐	☑	☑	☑	☑	☑	☑	○	◉	◉
Bolboschoenus caldwellii	Marsh club rush	☐	☐	☐	☑	☐	☑	☑	☐	○	○	◉
Carex appressa	Tall sedge	☐	☐	☑	☑	☐	☑	☐	☑	○	◉	◉
Carex divisa	Divided sedge	☐	☐	☐	☑	☑	☑	☑	☐	○	◉	◉
Carex fascicularis	Tassel sedge	☑	☐	☑	☑	☑	☑	☐	☑	○	◉	◉
Carex tereticaulis	Tube sedge	☐	☐	☐	☐	☐	☑	☑	☑	○	◉	○
Centrolepis spp		☐	☐	☐	☐	☐	☑	☑	☑	○	◉	○
Eleocharis acuta	Spike sedge	☐	☐	☐	☐	☑	☐	☑	☐	○	○	◉
Isolepis nodosa	Knotted Club sedge	☐	☐	☐	☐	☐	☑	☐	☐	◉	◉	○
Isolepis setiformis	Tufted sedge	☑	☐	☐	☑	☐	☑	☑	☑	○	◉	◉
Juncus holoschoenus	Joint-leaf rush	☐	☐	☐	☐	☐	☑	☑	☑	○	◉	○
Juncus kraussii	Shore rush	☐	☐	☐	☑	☐	☑	☑	☐	○	◉	◉
Juncus pallidus	Pale rush	☑	☑	☐	☑	☑	☑	☑	☑	○	◉	◉
Juncus pauciflorus	Slender rush	☐	☐	☐	☑	☐	☑	☑	☐	○	◉	◉
Lepidosperma effusum	Spreading sword sedge	☐	☐	☑	☑	☑	☑	☐	☐	○	◉	◉
Lepidosperma longitudinale	Pithy sword sedge	☐	☐	☑	☐	☑	☑	☐	☐	○	◉	○
Lepidosperma tetraquetrum	Angle sword sedge	☑	☐	☐	☐	☑	☑	☐	☑	○	◉	◉
Restio spp		☐	☐	☐	☐	☐	☑	☑	☑	○	◉	○
Schoenoplectus validus	Lake Club Sedge	☐	☐	☐	☑	☑	☑	☑	☐	○	○	◉

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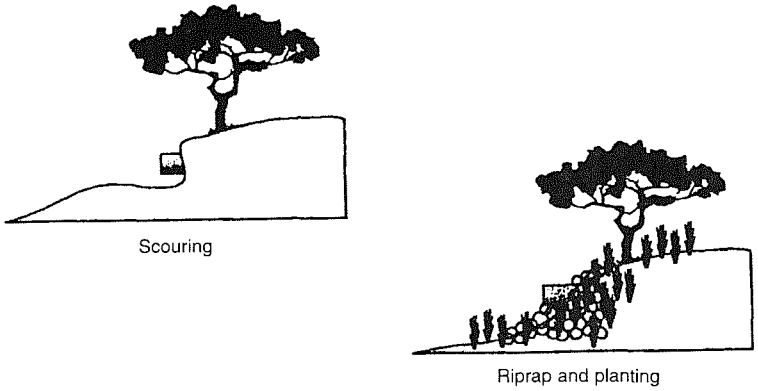
Appendix 4

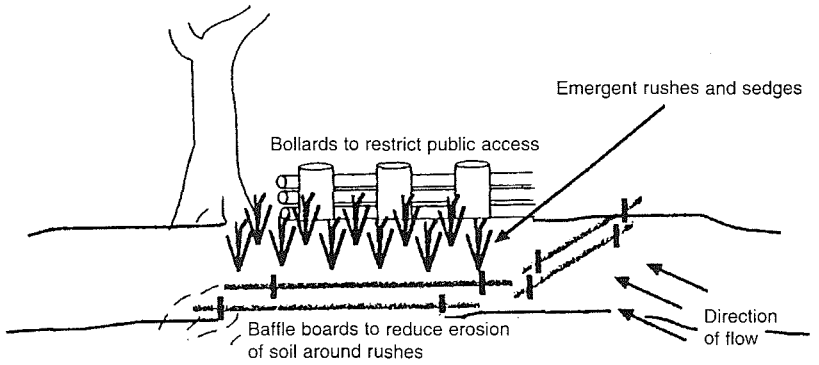
Suggested soft engineering works

Appendix 4: Suggested soft engineering works

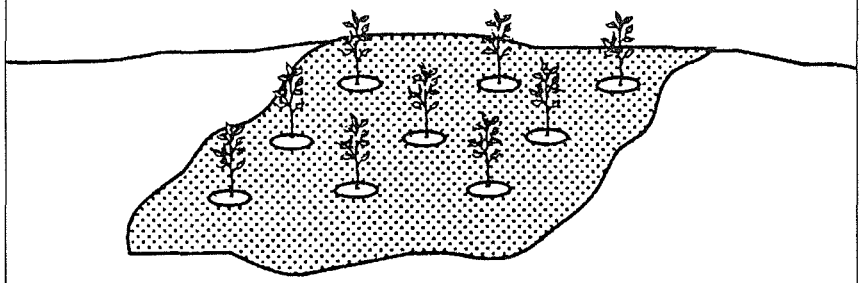
DRAINAGE OUTFALL TREATMENT



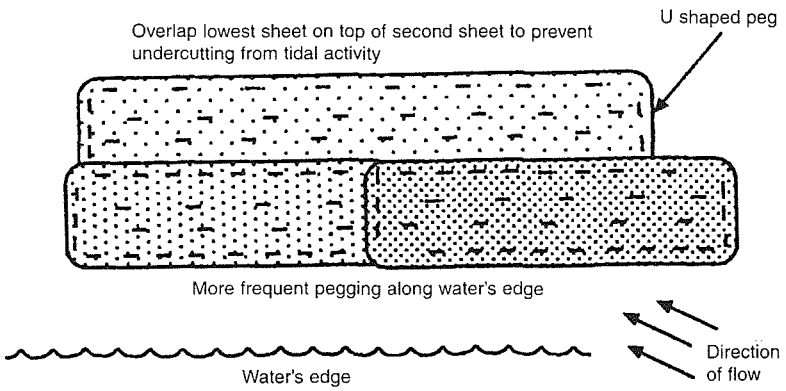
USING BAFFLES FOR PLANT PROTECTION AND SOIL STABILISATION



PLANT ARRANGEMNET THROUGH HEMP MATTING



HEMP MATTING INSTALLATION



Appendix 5

Condition mapping symbols

Weeds

Symbol	Common name	Scientific name
⋈	Weed wattles	*Acacia spp.*
|||	Giant reed	*Arundo donax*
♧	Canna lily	*Canna spp.*
*	Pampas grass	*Cortaderia selloana*
◑	Perennial veldtgrass	*Ehrharta calycina*
⊣⊢	African lovegrass	*Eragrostis curvula*
C	Coral tree	*Erythrina x sykesii*
⊤	Edible fig tree	*Ficus spp.*
Z	Cotton bush	*Gomphocarpus fruticosus*
△	One leaf cape tulip	*Homeria flaccida*
⊼	Morning glory	*Ipomoea spp.*
⊞		*Juncus microcephalus*
ⓗ	Lantana	*Lantana camara*
◹	Bridal creeper	*Myrsiphyllum asparagoides*
∿	Paspalum	*Paspalum spp.*
♦	Castor oil bush	*Ricinus communis*
#	Blackberry	*Rubus fruticosus*
⊤	Willow	*Salix spp.*
●	Japanese pepper	*Schinus terebinthifolia*
S	Deadly nightshade	*Solanum nigrum*
⚯	Nasturtium	*Tropeolum spp.*
★	Bulrush	*Typha orientalis*
⊷	Vetch	*Vicia sativa*
≤	Watsonia	*Watsonia bulbillifera*
⊗	Arum lily	*Zantedeschia aethiopica*

Native Species

Symbol	Common name	Scientific name
Al	Swamp peppermint	*Agonis linearifolia*
As	Coojong	*Acacia saligna*
Ba	Slender banksia	*Banksia attenuata*
Bj	Bare twigrush	*Baumea juncea*
Ca	Tall sedge	*Carex appressa*
Cc	Marri	*Corymbia calophylla*
Er	Flooded gum	*Eucalyptus rudis*
Hc	Native wisteria	*Hardenbergia comptoniana*
Jp	Pale rush	*Juncus pallidus*
Js	Green stinkwood	*Jacksonia sternbergiana*
Kp	Running postman	*Kennedia prostrata*
Ll	Pithy sword-sedge	*Lepidosperma longitudinale*
Lt	Angle sword-sedge	*Lepidosperma tetraquetrum*
Mr	Swamp paperbark	*Melaleuca rhaphiophylla*
Ol	Narrow-leaved Oxylobium	*Oxylobium lineare*
Pe	Bracken fern	*Pteridium esculentum*
Vj	Swishbush	*Viminaria juncea*

Cadastral and Streetsmart data supplied by the Dept. of Land Administration (1998)

Map Legend