GOVERNMENT OF WESTERN AUSTRALIA

FORESHORE ASSESSMENT IN THE ELLEN BROOK CATCHMENT

WATER RESOURCE MANAGEMENT SERIES

WATER AND RIVERS COMMISSION REPORT NO. WRM 16
1999

WATER AND RIVERS
COMMISSION

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Cover Photograph: Ellen Brook (Map 9), Upper Swan. [Taken by Adrian Parker]

Foreshore assessment in the Ellen Brook Catchment

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Surveys and mapping were undertaken by Kelly Shepherd, EMS.

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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.

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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 assessment method 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 assessment 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 assessment method. The locations selected included areas that were already a focus or were 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 within the Ellen Brook Catchment using the revised (draft) foreshore assessment method (Water and Rivers Commission 1999). These surveys were conducted to verify and refine the assessment method. Recommended strategies for appropriate management of future works on the focus foreshore areas along Ellen Brook and Breera Brook 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 Canning Catchment are included in separate reports (Water and Rivers Commission 1999).

2. Methodology

2.1 Site selection within tributaries

Following the community involvement process the nominated sections of Ellen Brook and its 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 assessment method 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 Ellen Brook Catchment that were surveyed to assess and refine the foreshore assessment method.

Ellen Brook Integrated Catchment Group

Waterway	Extent of Survey
Breera Brook	~ 80 m upstream of railway line to eastern boundary of Lot M13.
Ellen Brook	Railway line at Almeria Parade upstream to the end of Lot 501.

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 for each section.

Scaled baseline maps were prepared by WRC showing cadastral boundaries and the waterway. The cadastral information also 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 summarised into 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 within the Ellen Brook Catchment were collated 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 Ellen Brook catchment

The Ellen Brook catchment is a predominantly semi-rural/rural area and a great proportion of Ellen Brook runs through private property where stock often have access to the waterway. Stock access causes damage to the riparian zone, frequently augmenting the loss of foreshore vegetation. 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 increases near disturbance sites where works have been undertaken for example near crossovers and bridges.

A decrease in the extent of dense emergent species along foreshores has caused erosion to increase, particularly near the base of trees that grow immediately along the banks. As the soil is scoured away, roots are exposed and trees become less supported. Subsequently, there is an increased likelihood of trees collapsing and exacerbating the erosion problem.

There are a number of foreshore areas along Ellen Brook that show levels of severe erosion. For example damage to bank stability is particularly evident along the lower sections of Ellen Brook (Sections A - B/Maps 1 - 3) where the surrounding vegetation is reduced to a few trees and stock have free access to the foreshore area.

There is little evidence of severe bank collapse along these surveyed sites, however large amounts of sedimentation are evident and in some areas sandbars have become stabilised and vegetated. Significant levels of sedimentation indicate that erosion is 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.

In contrast, bank stability along Breera Brook is graded as Yellow (Moderate) to Green (Good), with minimal evidence of localised erosion, slumping or sedimentation. The dense vegetation along Breera Brook foreshore minimises the impact of water flow on bank stability.

3.2 Vegetation

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

Breera Brook is a good example of a relatively healthy system with a foreshore vegetation condition of Yellow (Moderate) to Green (Good). The overstorey is continuous and consists of Swamp paperbark (*Melaleuca rhaphiophylla*), Flooded gum (*Eucalyptus rudis*) and scattered Marri (*Corymbia calophylla*). Native species common in the middlestorey include Coojong (*Acacia saligna*), Swishbush (*Viminea juncea*), Narrow-leafed oxylobium (*Oxylobium lineare*), *Kunzea* spp. and Blackboy (*Xanthorrhoea preissii*).

Native rushes and sedges, the Pithy sword sedge (*Lepidosperma longitudinale*) in particular, dominate the understorey. These species are present in dense stands along the margins of the main channel and in wet depressions along the floodway. Bracken fern (*Pteridium esculentum*) is also present in dense stands, more commonly found further away from the damp foreshore banks adjacent to the Brook.

There are a few scattered weeds such as Bulrush (T*ypha orientalis*) found within Breera Brook (Section A/Map 1).

Within Ellen Brook the foreshore vegetation condition ranges from Black (Very Poor) along the lower sections where stock have access to the foreshore (Section A - B/Map 1 - 3) to Red (Poor) further upstream. In the highly degraded areas the overstorey is completely absent or present for a few metres only on either side of the main channel.

The overstorey is predominantly Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*). Marri (*Corymbia calophylla*) trees are present some distance from the foreshore area in low numbers. Where stock have access to Ellen Brook the remaining overstorey trees are unhealthy and many are dying. There is little evidence of seedling regeneration. The natural middlestorey is absent and pasture weeds dominate the understorey. Perennial grasses such as Kikuyu (*Pennisetum clandestinum*) and Couch (*Cynodon dactylon*) are abundant and species such as One leaf cape tulip (*Homeria flaccida*) occur frequently.

Further upstream there are scattered native shrubs present in the middlestorey. For example Section C (Maps 4 - 6) species include Coojong (*Acacia saligna*), White myrtle (*Hypocalymma angustifolium*), Parrot bush (*Dryandra sessilis*), Blackboy (*Xanthorrhoea preissii*), Green stinkwood (*Jacksonia sternbergiana*), *Hibbertia* spp., *Verticordia* sp., Harsh hakea (*Hakea prostrata*), *Grevillea* sp. and *Kunzea* sp. These native shrubs occur in low numbers and are present some metres from the immediate foreshore area. Dense stands of Watsonia (*Watsonia bulbillifera*) dominate along the margins of the foreshore.

Scattered native species such as Honey pots (*Dryandra nivea*), False boronia (*Phyllanthus calycinus*), Milkmaids (*Burchardia umbellata*) and Red ink sundew (*Drosera erythrorhiza*) persist in the understorey. A large number of perennial and annual weeds predominate in these areas (Appendix 1B).

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 vegetation and the presence of rocks and logs also provide cover for aquatic organisms.

In relatively healthy, undisturbed areas along sections of Breera Brook the Stream Cover is graded as Yellow (Moderate) to Green (Good) due to the presence of a healthy overstorey and dense stream side vegetation including stands of emergent sedges and rushes.

Stream Cover along sections of Ellen Brook (Section C/Map 4 and 5) were also graded as Yellow (Moderate), however in this instance the rating is due to the presence of dense stands of weeds such as Watsonia (*Watsonia bulbillifera*) that overhang the waterway and provide patches of permanent shade. In the highly disturbed sites such as the lower sections of Ellen Brook where the overstorey is reduced and the understorey is dominated by low lying weeds the stream cover is graded as Red (Poor) or Black (Very Poor).

3.4 Habitat Diversity

Instream habitat diversity is affected by the quality and permanency of water and by the presence of instream rocks, 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.

The Habitat Diversity was graded as Yellow (Moderate) along Breera Brook which indicates that there are no apparent problems with water quality and there are suitable sites for aquatic organisms such as logs and rocks instream. Further, diverse habitats for terrestrial organisms such as a variety of vegetation types, deep leaf litter and dense streamside vegetation are also present.

Many of the survey sites assessed along Ellen Brook were scored as having either Red (Poor) or Black (Very Poor) Habitat Diversity. The lack of healthy, diverse native vegetation in the middlestorey and understorey limits the number of suitable habitats available for terrestrial animals. Frequently streams are narrow and shallow and are generally not suitable for fish and turtles.

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 Breera Brook (Ellen Brook Catchment)

Breera Brook (Section A)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	Stream Condition
Yellow	Yellow	Yellow	Yellow	**Yellow**
Moderate	Moderate	Moderate	Moderate	**Moderate**
4	4	4	4	**16**

Breera Brook (Section B)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	Stream Condition
Yellow	Green	Green	Yellow	**Yellow**
Moderate	Good	Good	Moderate	**Moderate**
4	6	6	4	**20**

Breera Brook (Section C)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	Stream Condition
Green	Green	Green	Yellow	**Green**
Good	Good	Good	Moderate	**Good**
6	6	6	4	**22**

Breera Brook (Section D)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	Stream Condition
Green	Green	Green	Yellow	**Green**
Good	Good	Good	Moderate	**Good**
6	6	6	4	**22**

Breera Brook (Section E)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	Stream Condition
Green	Yellow	Green	Yellow	**Yellow**
Good	Moderate	Good	Moderate	**Moderate**
6	4	6	4	**20**

3.5.2 Summary Results for Ellen Brook (Ellen Brook Catchment)

Ellen Brook (Section A)

Bank Vegetation	Foreshore Stability	Stream Cover	Habitat Diversity	Stream Condition
Black	Red	Red	Black	**Black**
Very Poor	Poor	Poor	Very Poor	**Very Poor**
0	2	2	0	**4**

Ellen Brook (Section B)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	Stream Condition
Black	Red	Red	Black	**Black**
Very Poor	Poor	Poor	Very Poor	**Very Poor**
0	2	2	0	**4**

Ellen Brook (Section C)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	Stream Condition
Yellow	Red	Yellow	Yellow	**Yellow**
Moderate	Poor	Moderate	Moderate	**Moderate**
4	2	4	4	**14**

Ellen Brook (Section D)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	Stream Condition
Yellow	Red	Yellow	Yellow	**Yellow**
Moderate	Poor	Moderate	Moderate	**Moderate**
4	2	4	4	**14**

Ellen Brook (Section E)

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**

Ellen Brook (Section F)

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Black	Red	Red	Black	**Black**
Very Poor	Very Poor	Poor	Very Poor	**Very Poor**
0	2	2	0	**4**

4. Specific site reports

4.1 Breera Brook

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Ellen Brook — Map 1 (Section A) Breera Brook

Length of section (m): approximately 288 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/10/98

Nearest road access: Breera Road

Lot number: Land owner - Tony Wilkie

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Yellow	Yellow	Yellow
Moderate	Moderate	Moderate	Moderate
4	4	4	4

Stream Condition
Yellow
Moderate
16

Description

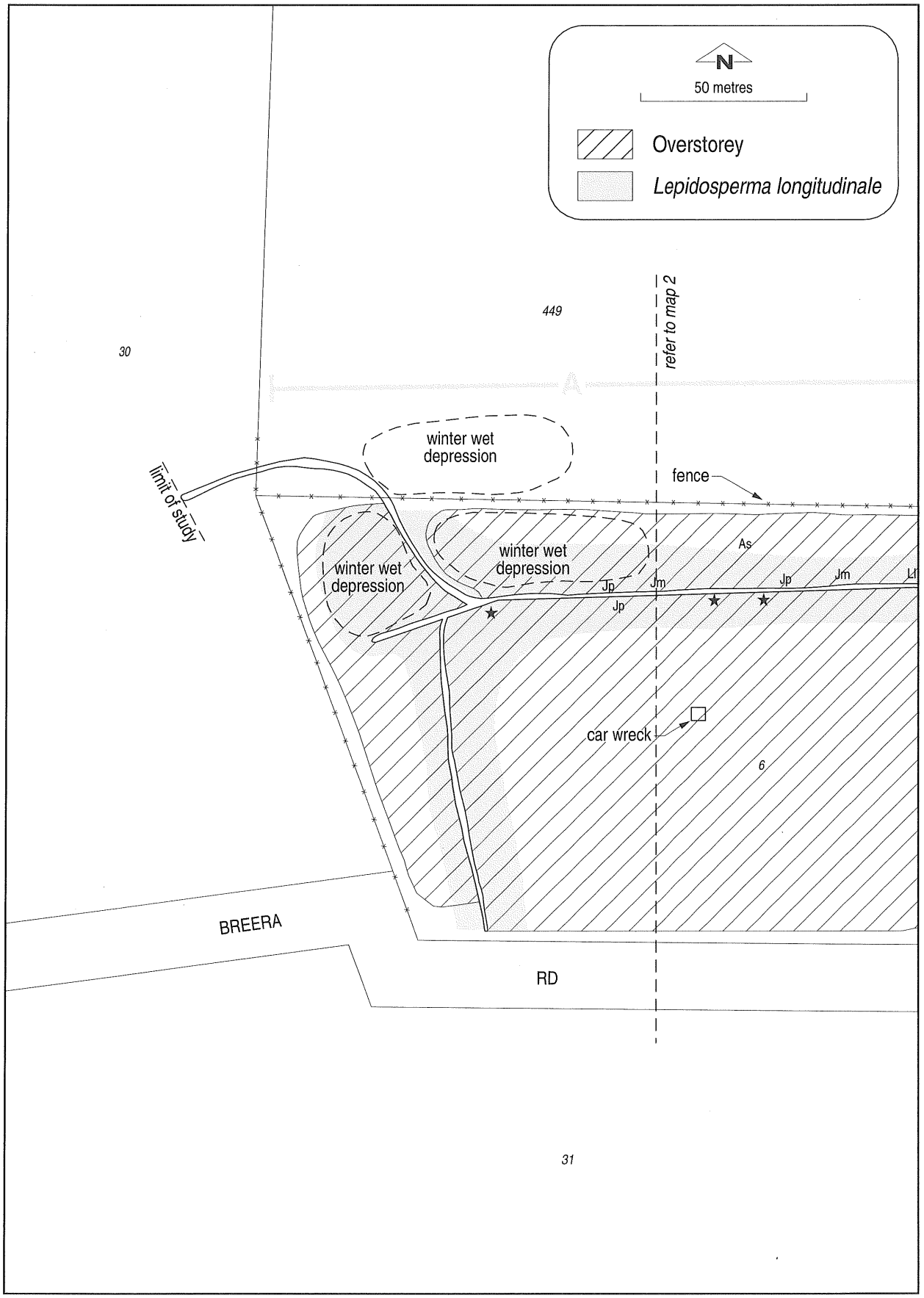
Bank stability: The main channel of Breera Brook is 2 - 3 m wide with the foreshore banks rising on a medium gradient to a height 0.5 - 1.5 m. The main channel is narrow, shallow and may have been artificially straightened in the past. The channel floods in winter over a floodplain area of approximately 5 - 15 m either side of the Brook. An artificial drain has been constructed along the edge of the property to direct flow to the south across Breera Road. Large winter wet depressions are present near the confluence of the artificial drain and the main channel of Breera Brook. Erosion is localised along 5 - 20% of the foreshore and there is little evidence of slumping. Sedimentation is also localised along 5 - 20% of the main channel.

Recommended strategies

- Assess the surface water hydrology and hydraulics of the Brook along its entire length and within the catchment, and develop a management plan for the subcatchment.
- Liaise with Westrail, Water and Rivers Commission, Shire of Gingin and the landholders to assess the current drainage problems near the railway embankment.
- Assess the feasibility of re-establishing the culvert locations to correspond with the actual streamline to restore the natural hydrological function.
- Assess the levels of sediment load to the Brook and liaise with landholders further upstream to identify the major erosion points and sources of sediment. Encourage landholders to undertake remedial activities to reduce particulate load.
- Assess legality of riparian water rights, ensure that all extraction points are legitimate and determine process for managing volumes extracted.
- Recommend options to reduce conflict between users of the Brook.

Vegetation: The vegetation along this section of Breera Brook has been disturbed in the past as the overstorey vegetation is patchy (20 - 80% cover) with stands of young trees of similar age growing along the foreshore. The overstorey consits of native trees including Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*). Adjacent to the foreshore vegetation along the right bank (looking upstream) the overstorey vegetation extends over 50 m from the main brook channel. The native Swamp paperbark and Flooded gum trees are older and abundant throughout this area. Occasional Marri trees (*Corymbia calophylla*) are also present. The middlestorey along the banks of Breera Brook is continuous (> 80% cover) and common native plants are present including Coojong (*Acacia saligna*) and Swishbush (*Viminea juncea*). Adjacent to the main channel and floodplain other species such as *Kunzea* spp. predominate. Native species that occur infrequently include Blackboy (*Xanthorrhoea preissii*), Narrow-leafed oxylobium (*Oxylobium lineare*) and Purple flag (*Patersonia occidentalis*). The introduced weed Bulrush (*Typha orientalis*) is found growing in stands along the main channel. The understorey vegetation is continuous (> 80% cover) and dominated by native sedges that grow along the floodway area in dense stands approximately 5 - 15 m wide. The Pithy sword sedge (*Lepidosperma longitudinale*) is abundant while the Pale rush (*Juncus pallidus*) occurs intermittently along the foreshore area. The small herb Centella (*Centella cordifolia*) also occurs infrequently. Weed species present include *Juncus microcephalus* and Dirty dora (*Cyperus difformis*). The submerged aquatic weed *Aponogeton elongatus* is found infrequently within the main channel.	• Undertake weed control ensuring that foreshore bank stability is not threatened due to activities. • Define access tracks for any personnel entering the site to minimise trampling of native plants. • Brushcut introduced Bulrush below the waterline in May, monitor and re-cut any regrowth in September (Appendix 2). • Protect native species by using a person familiar with native plants to tag weed species prior to implementing weed control activities, to reduce unnecessary loss. • Brushcut Dirty dora and the introduced rush *Juncus microcephalus* prior to seeding in November-December if plants occur in dense stands. Alternatively, hand pull any weeds present in low numbers. • Remove any seed heads from the above mentioned species to reduce any spread, if species can not be immediately eradicated. Place seed heads and other waste material in a black plastic bag, secure and remove from site. Place the plastic bag in the sun for a week to kill the seeds. • Control access to the site by people and livestock to reduce disturbance and the associated weed invasion. • Ensure fire access tracks are suitably managed to facilitate ready access which hopefully will result in minimal damage to the wetland, should a fire occur.
Stream Cover: The overstorey along the foreshore is patchy, although the presence of stream side vegetation ensures that there are areas of permanent instream cover along the brook providing shade. Vegetative material, scattered branches and logs within the brook channel provide intermittent instream cover.	• Implement control of the introduced Bulrush in winter to minimise disturbance to invertebrate fauna.

Habitat diversity: The water in Breera Brook is brown in colour due to the presence of tannins leached from vegetation detritus. Water depth in winter ranges from < 0.5 - 1.0 m in depth. The scattered instream vegetation, logs and branches provide limited habitats for aquatic invertebrates. The main channel of the Brook is narrow and it is unknown whether the Brook can support fish or turtles. The dense streamside vegetation and leaf litter provides suitable habitats for terrestrial invertebrates and for larger organisms such as lizards and frogs. The continuous overstorey provides nesting and roosting sites for birds.	• Protect instream features such as vegetation, logs and branches where these features do not exacerbate foreshore bank erosion.
Other issues: This area frequently floods during winter particularly near the confluence of the artificial drain and Breera Brook due to the disruption of the natural flow pattern of the Brook further downstream. The Brook flows westward from the survey site through private property to exit near a railway line that runs parallel to Brand Highway. The lack of sufficient flow through drains beneath the railway bund disrupts water flow causing the flooding. The artificial drain flowing southwards redirects water flow decreasing water levels downstream in the summer months. Old car wrecks have been dumped within the area. Landholders appear to be quite skeptical about the role and intentions of government agencies, and are likely to be unreceptive to some of the recommendations for this Brook.	• Encourage local government agencies, Main Roads WA, Westrail, CALM, Water and Rivers Commission, Agriculture WA and the private landholders to meet on site during the winter months to assess the water management issues and facilitate the reaching of an agreement about water management. • Liaise with local government authority to remove car wrecks from the area ensuring that the removal does not increase disturbance to the site. • Protect remnant wetland from access by livestock to maintain the weed free status of the area. • Investigate the feasibility of land acquisition by CALM and subsequent potential opportunities for the creation of a reserve. • Assist current landholder to develop land management options for both properties, which encourage the protection of the wetland. • Manage conflict between property owners within the area by facilitating opportunities for all to develop the land and/or gain benefit from the land.



Breera Brook Map 1

Ellen Brook — Map 2 (Section A) Breera Brook

Length of section (m): approximately 288 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/10/98

Nearest road access: Breera Road

Lot number: Land owner - Tony Wilkie

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Yellow	Yellow	Yellow
Moderate	Moderate	Moderate	Moderate
4	4	4	4

Stream Condition
Yellow
Moderate
16

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

Ellen Brook — Map 2 (Section B) Breera Brook

Length of section (m): approximately 390 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/10/98

Nearest road access: Breera Road

Lot number: Land owner - Tony Wilkie

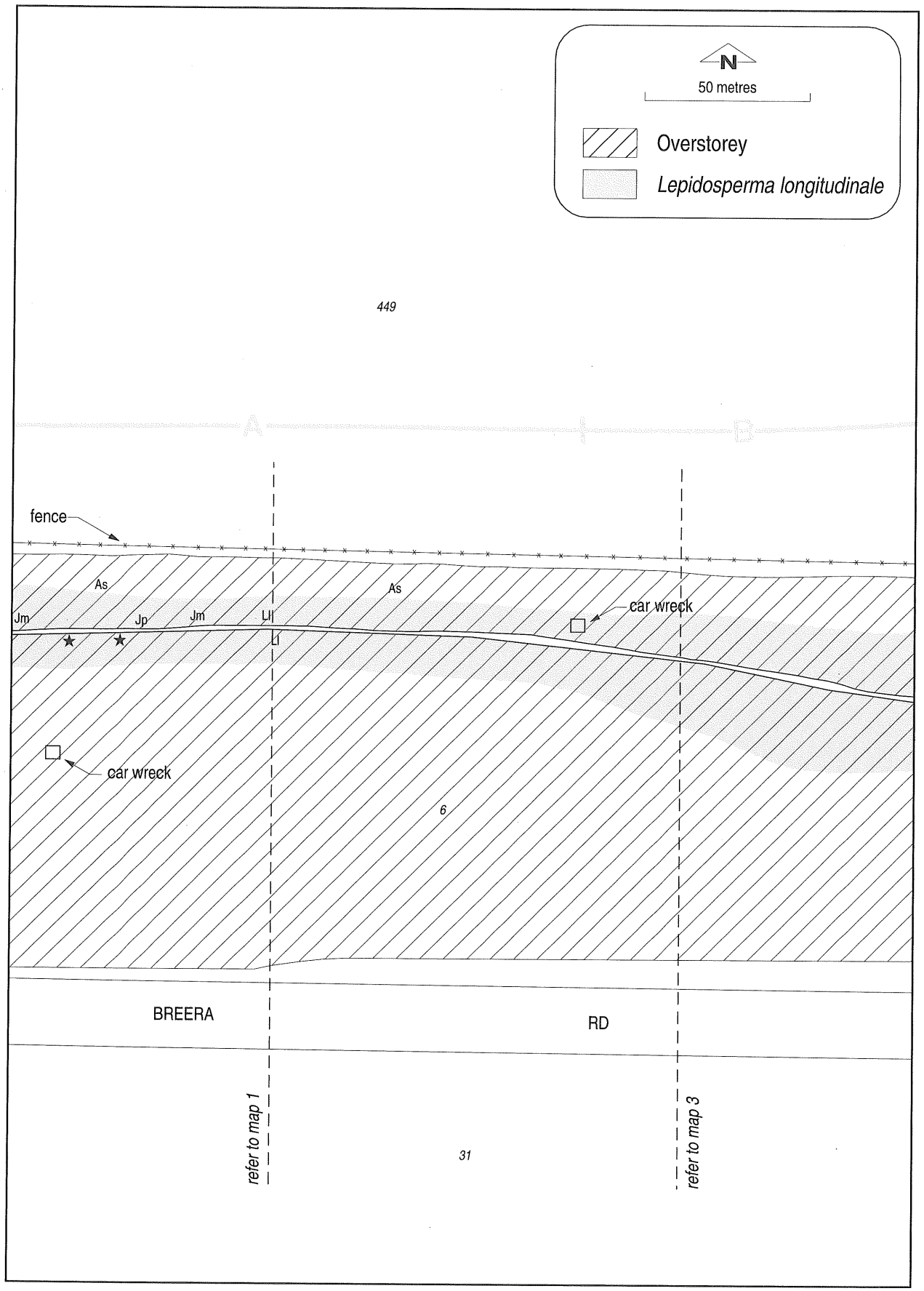
Summary of river health:

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

Stream Condition
Yellow
Moderate
20

Description	Recommended strategies
Bank stability: The main channel along this section of Breera Brook is 1 - 2 m wide. The foreshore banks rise on a medium gradient to a height of 0.5 - 1.5 m. The floodway extends 10 - 30 m either side of the Brook. There is minimal erosion (0 - 5%) along the foreshore banks with no evidence of slumping. Further there are localised areas of sedimentation along 5 - 20% of the channel.	• Assess the surface water hydrology and hydraulics of the Brook along its entire length and within the catchment, and develop a management plan for the subcatchment. • Assess sediment load to the Brook, sources of sediment and identify mechanisms to reduce particulate load if required.
Vegetation: The overstorey vegetation is continuous (> 80% cover) and comprises native trees including Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*). Marri (*Corymbia calophylla*) does not occur near the floodway area but is present on the right foreshore area on drier ground. The middlestorey is patchy 20 - 80% cover with frequent Coojong (*Acacia saligna*) and Narrow-leaved oxylobium (*Oxylobium lineare*) and occasional Blackboy (*Xanthorrhoea preissii*). The continuous understorey (> 80% cover) is dominated along the floodway area by dense stands of the Pithy sword sedge (*Lepidosperma longitudinale*). The Pale rush (*Juncus pallidus*) is also scattered along the brook. The emergent aquatic weed *Aponogeton elongatus* is growing in the main channel of the brook.	• Protect remnant wetland from access by livestock to maintain the weed free status of the area. • Monitor the area to ensure any weed invasion is appropriately managed. • Assist current landholder to develop land management options, which encourage the protection of the wetland. • Investigate the feasibility of future land acquisition by CALM and subsequent potential opportunities for the creation of a reserve. • Manage conflict between property owners within the area by facilitating opportunities for all to develop the land and/or gain benefit from the land. • Ensure protection of the area from fire by implementing weed control along boundary fences to reduce the risk of wildfire through the wetland.
Stream Cover: The continuous overstorey along the foreshore provides instream cover and shade along both foreshores of the brook. The presence of instream weeds, leaf litter and detritus, scattered branches and logs all provide intermittent instream cover.	• Protect the remnant vegetation in the area from clearing and/or other activities to minimise degradation.

Habitat diversity: Water is brown in colour and the water depth ranges from < 0.5 - 1.0 m. The instream cover such as aquatic weeds, logs and branches provide habitats for aquatic invertebrates. It is possible that fish and turtles are present in the area. The dense streamside vegetation and leaf litter provide suitable habitats for terrestrial invertebrates and lizards and frogs. The continuous overstorey provides nesting and roosting sites for birds.	• Protect the remnant vegetation in the area from clearing and/or other activities that will increase degradation.
Other issues: Landholders appear to be quite skeptical about the role and intentions of government agencies, and are likely to be unreceptive to some of the recommendations for this Brook.	• Provide non-threatening support and information to landholders about ways in which they can contribute to protecting the Brook and its associated vegetation on a one to one basis not a bulk mail out. • Develop alternative acceptable opportunities for landholders to maximise profitability of land ownership with minimal damage to the environment.



Breera Brook Map 2

Ellen Brook — Map 3 (Section B) Breera Brook

Length of section (m): approximately 390 m

Recorder's name: Kelly Shepherd

Date surveyed: 19/10/98

Nearest road access: Breera Road

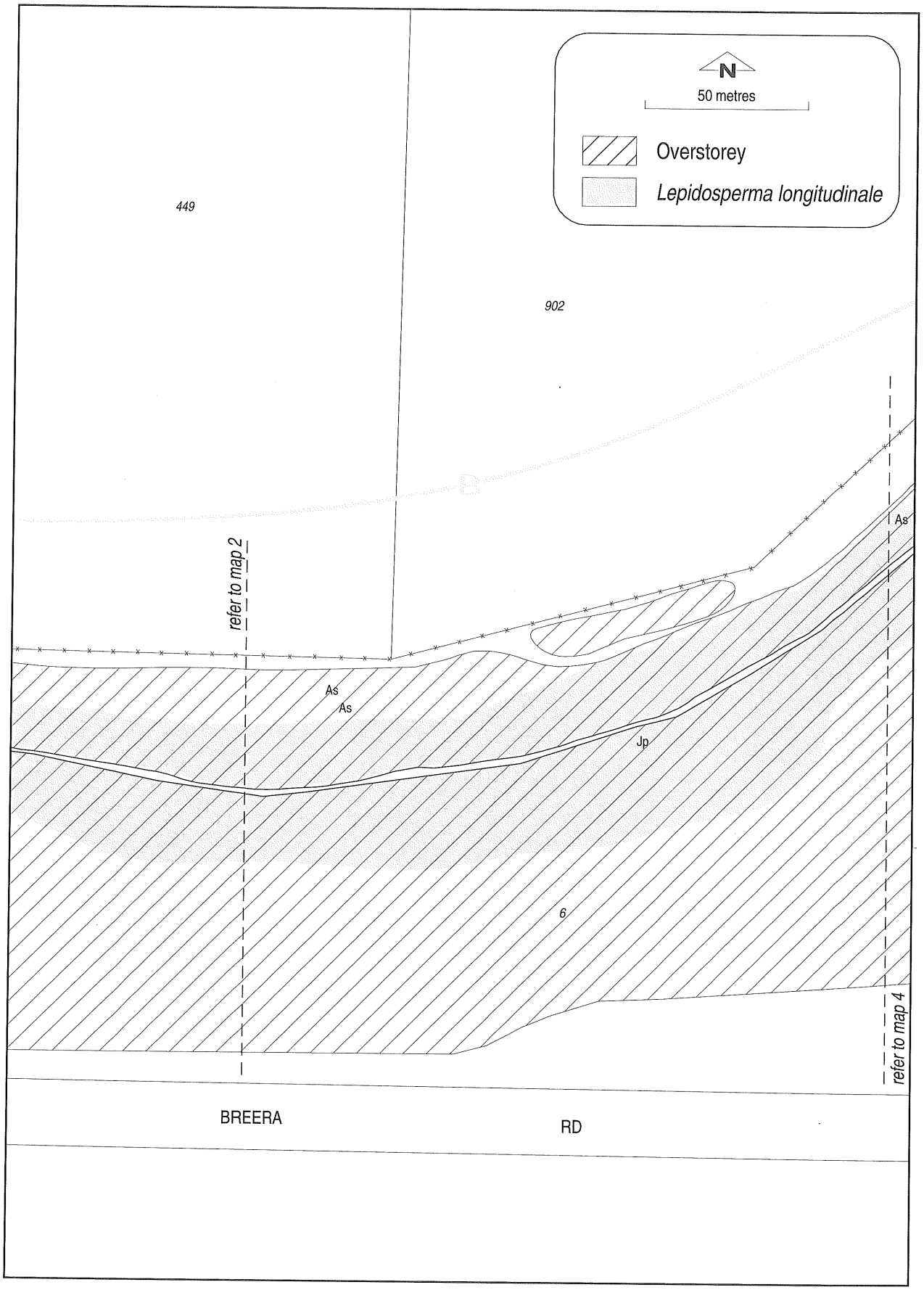
Lot number: Land owner - Tony Wilkie

Summary of river health:

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

Stream Condition
Yellow
Moderate
20

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



Breera Brook Map 3

Ellen Brook — Map 4 (Section C) Breera Brook

Length of section (m): approximately 295 m

Recorder's name: Kelly Shepherd

Date surveyed: 20/10/98

Nearest road access: Breera Road

Lot number: Land owner - Tony Wilkie

Summary of river health:

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

Stream Condition
Green
Good
22

Description

Bank stability: The main channel is 1.5 m wide with the foreshore banks rising on a medium gradient to a height of 1 - 1.5 m. The floodway immediately adjacent to the brook extends 8 - 20 m from the main channel. There is minimal erosion evident along the foreshore (0 - 5% of the area) generally evident around the base of trees growing immediately along the foreshore banks. There is little evidence of slumping along the foreshore and localised sedimentation occurring. Deposits of sand occur along 5 - 20% of them main channel.

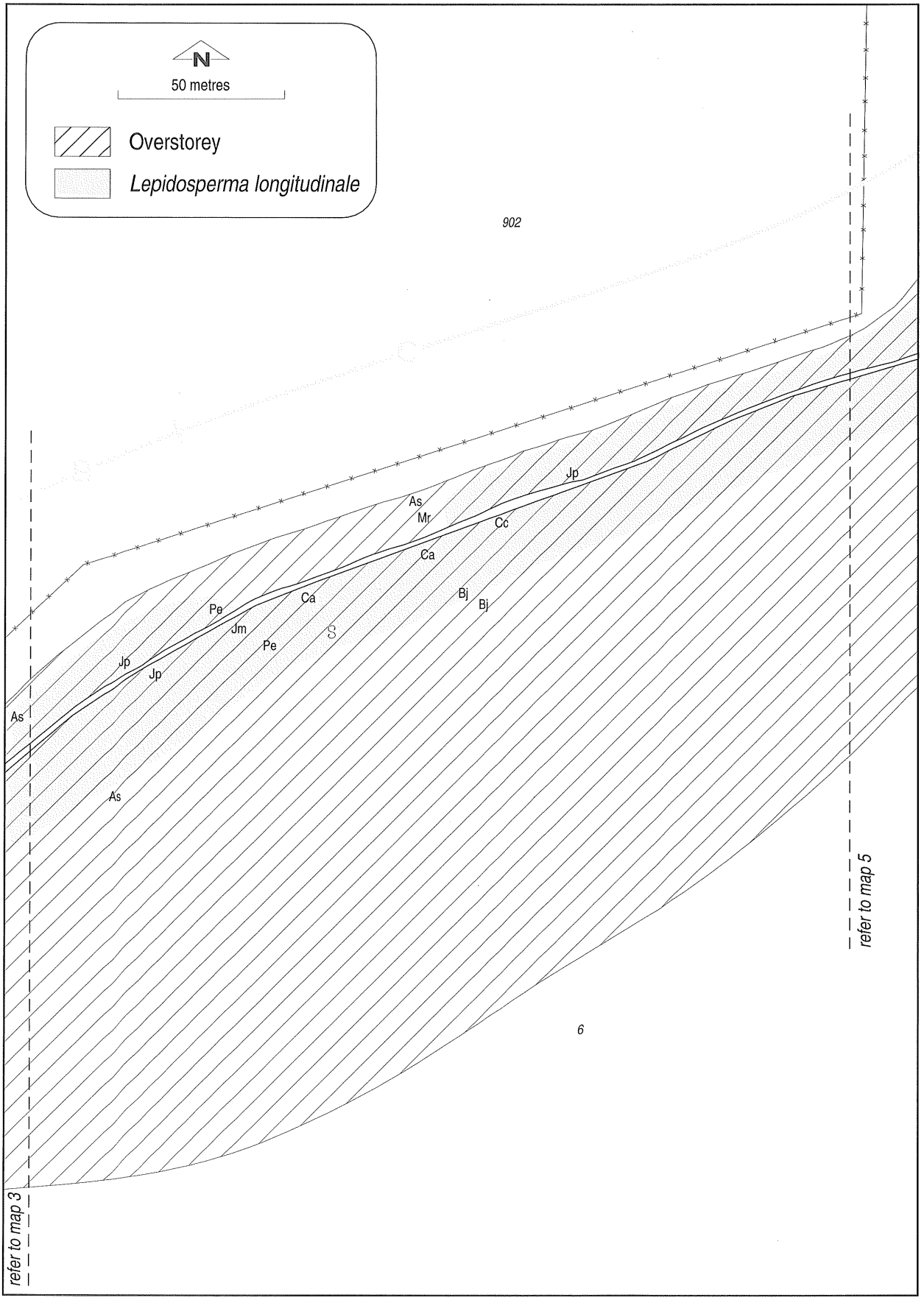
Vegetation: The overstorey is continuous (> 80% cover) and extends approximately 15 m on the left foreshore and over 100 m along the right foreshore. Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) are abundant with frequent tree seedlings regenerating in the area. Occasional Marri (*Corymbia calophylla*) and Modong (*Melaleuca preissiana*) trees are present along the right foreshore area. The middlestorey is continuous > 80% cover with frequent stands Coojong (*Acacia saligna*) and *Kunzea* spp. Scattered Narrow-leaved oxylobium (*Oxylobium lineare*), Swishbush (*Viminea juncea*), occasional Blackboy (*Xanthorrhoea preissii*) and Purple flag (*Patersonia occidentalis*) species are present. An isolated Nightshade (*Solanum nigrum*) weed was observed on

Recommended strategies

- Assess the surface water hydrology and hydraulics of the Brook along its entire length and within the catchment, and develop a management plan for the subcatchment.
- Determine the effectiveness of the current water management regime and recommend options to reduce conflict between users of the Brook.
- Assess sediment load to the Brook, sources of sediment and identify mechanisms to reduce particulate load if required.

- Undertake weed control activities ensuring that the potential impact on foreshore stability is considered prior to any works.
- Protect native species by using a person familiar with native plants to tag weed species prior to implementing weed control activities.
- Define access tracks for any personnel entering the site to minimise trampling of native plants.
- Remove Nightshade plant prior to fruiting to prevent further seed entering the seed bank.
- Repeatedly (biannually) brushcut *Juncus microcephalus* and Dirty dora prior to seeding, if plants occur in dense stands. Alternatively hand pull

the right foreshore. The understorey is continuous and the floodway is dominated by dense stands of the Pithy sword sedge (*Lepidosperma longitudinale*). Other native species include small clumps of Bare twigrush (*Baumea juncea*), Bracken fern (*Pteridium esculentum*) and Tall sedge (*Carex appressa*). The small native herb Centella (*Centella cordifolia*) is common. Weed species present include *Juncus microcephalus* and Dirty dora (*Cyperus difformis*).	infrequent weed species. Remove all waste material from the site by placing in a large black plastic bag. Leave the bag in the sun for a week to kill any seed. • Monitor the site and eradicate any new weeds before numbers increase. • Prevent stock access to the wetland area to protect the vegetation from degradation. • Encourage all property owners within the subcatchment to manage surrounding land to minimise fire risk, nutrient and sediment movement across the landscape and prevent stock access to the Brook.
Stream Cover: The overstorey is continuous along the foreshore and provides areas of permanent shade along the Brook. The presence of instream vegetative detritus, scattered branches and logs provide instream cover.	• Protect vegetation from disturbance factors such as fire, livestock and development to maintain cover. • Maintain instream vegetative material and do not remove debris unless it is causing significant damage to the stream banks and bed.
Habitat diversity: Breera Brook water depth ranges from < 0.5 - 1.0 m. The instream cover provides habitats for aquatic invertebrates. It is possible that fish and turtles are present in the area. Streamside vegetation is suitable for terrestrial invertebrates, lizards and frogs. The continuous overstorey provides nesting and roosting sites for birds.	• Protect the entire wetland system from stock access and other degradation factors to maintain the extremely high conservation values of this Brook.
Other issues:	



Breera Brook Map 4

Ellen Brook — Map 5 (Section D) Breera Brook

Length of section (m): approximately 360 m

Recorder's name: Kelly Shepherd, Nicole Siemon, Jodie Oates

Date surveyed: 26/8/98

Nearest road access: Breera Road

Lot number: Land owner - Tony Wilkie

Summary of river health:

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

Stream Condition
Green
Good
22

Description

Bank stability: The main flow channel of Breera Brook is 1.0 - 1.5 m wide. The foreshore banks rise on a medium gradient to a height of 0.5 - 1.5 m. The brook floods during peak flows and the surrounding floodway extends 15 - 25 m either side of the main channel. The dense streamside vegetation and slow moving water minimises erosion along the foreshore banks, reducing the level of erosion to 0 - 5% of the foreshore area. There is little evidence of slumping of the foreshore banks. Sedimentation is localised with deposition occurring along 5 - 20% of the main channel.

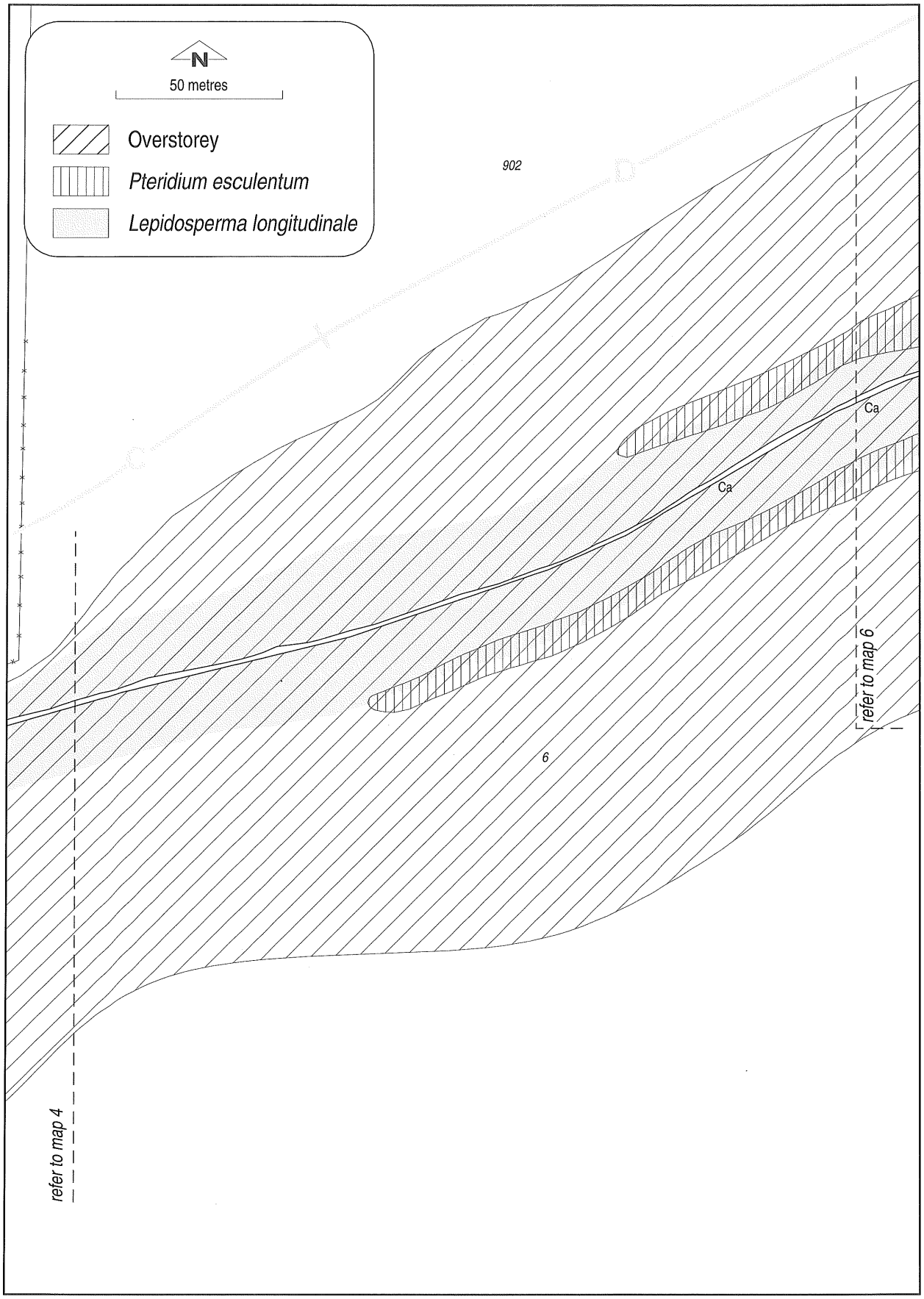
Vegetation: The overstorey is continuous (> 80% cover) extending 75 - 100 m from the brook on the left foreshore and approximately 100 m on the right foreshore. The overstorey consists of abundant Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) trees. Marri (*Corymbia calophylla*) occurs infrequently. The middlestorey is continuous (> 80% cover) dominated by a dense stand of Bracken fern (*Pteridium esculentum*) that has established 10 - 15 m from the main channel along the edge of the frequently inundated floodway. Other native species that occur infrequently include Grey stinkwood (*Jacksonia furcellata*) and White myrtle (*Hypocalymma angustifolia*). The understorey is continuous (> 80%

Recommended strategies

- Assess the surface water hydrology and hydraulics of the Brook along its entire length and within the catchment, and develop a management plan for the subcatchment.
- Determine the effectiveness of the current water management regime and recommend options to reduce conflict between users of the Brook.

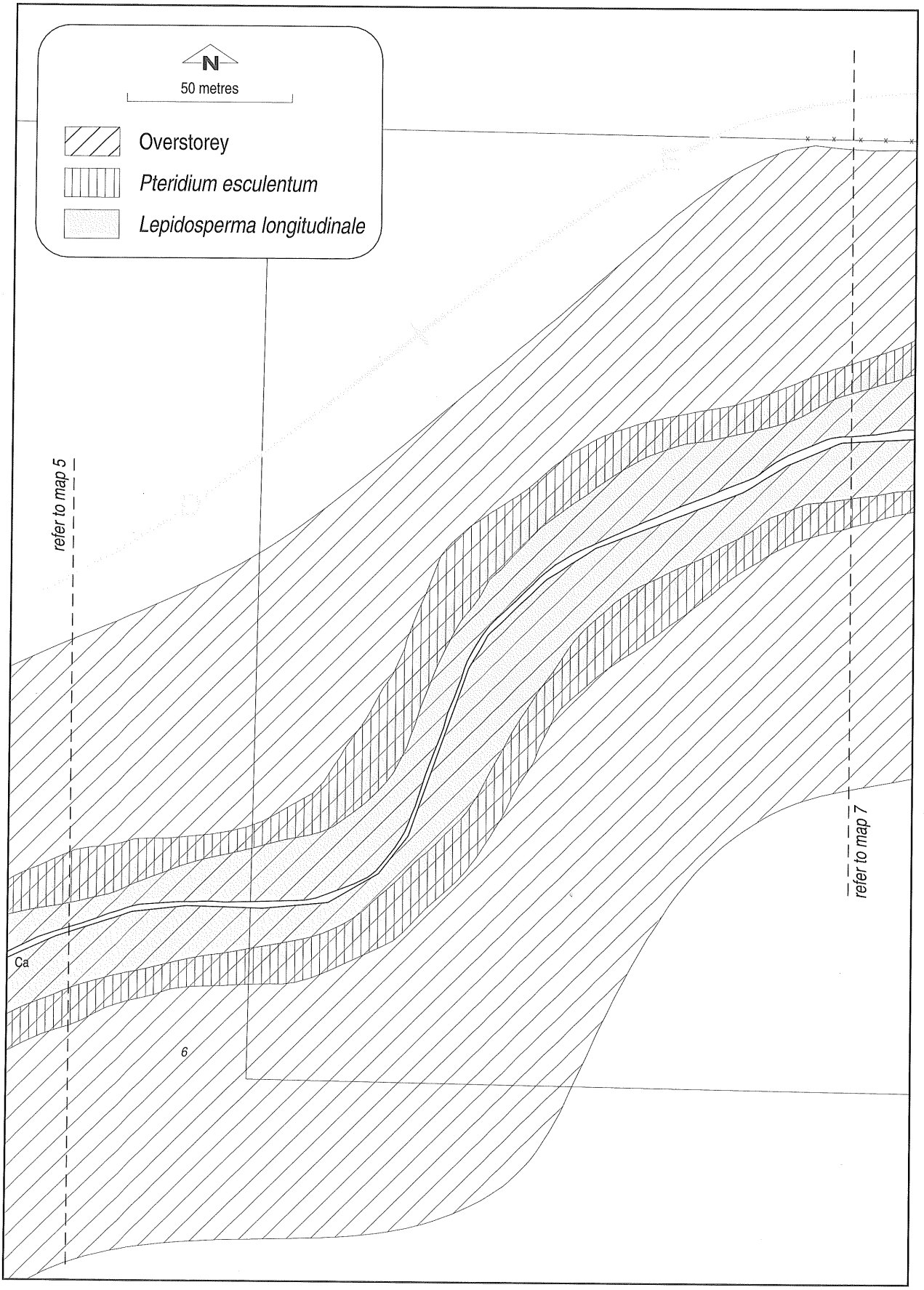
- Protect remnant wetland from access by livestock to maintain the weed free status of the area.
- Investigate the feasibility of land acquisition by CALM and subsequent potential opportunities for the creation of a reserve.
- Assist current landholder to develop land management options, which encourage the protection of the wetland.
- Ensure protection of the area from fire by implementing weed control along boundary fences to reduce the risk of wildfire through the wetland.
- Monitor germination of any new weed species and hand weed while plants remain juvenile to minimise spread.

cover) with dense stands of Pithy sword-sedge (*Lepidosperma longitudinale*) present in the floodway adjacent to the Brook. Other native species present include infrequent patches of the Bare twigrush (*Baumea juncea*) and Tassel sedge (*Carex fascicularis*). The restio species *Lyginia barbata* is also present in the understorey.	
Stream Cover: The continuous overstorey and dense streamside vegetation provides areas of permanent stream cover and shade along the Brook. The presence of leaf litter and detritus, logs and branches and occasional rocks within the Brook provides instream cover.	• Protect the remnant vegetation in the area from clearing and/or other activities, which will increase degradation.
Habitat diversity: The water in the Brook is brown in colour and the channel is < 0.5 - 1.0 m in depth. The leaf litter and material, instream logs and rocks all provide suitable habitats for aquatic invertebrates. Water is slow moving and there are no fast moving riffle zones or cascades along the channel facilitating the aeration of water within the brook. The Brook may support fish or turtles. The dense streamside vegetation is suitable for terrestrial invertebrates, lizards and frogs. The continuous overstorey provides nesting and roosting sites for birds.	• Protect the remnant vegetation in the area from clearing and/or other activities that will increase degradation. • Undertake a faunal survey to determine the presence of native species within the area.
Other issues:	



Breera Brook Map 5

Stream Cover: The healthy overstorey and dense streamside vegetation provides patches of permanent stream cover along the brook. Large branches that have fallen into the brook have partially blocked the stream flow. Leaf litter and detritus is also present within the channel providing intermittent instream cover.	• Protect the remnant vegetation in the area from clearing and/or other activities, which will increase degradation.
Habitat diversity: The water within Breera Brook is dark brown in colour with little suspended solids within the water column. The dark coloured water is due to the presence of tannins resulting from the breakdown of vegetative material in the water. The channel is shallow and only 0.5 - 1.0 m deep. There are small pools and meanders in the channel with instream logs and vegetation. This instream material may provide attachment sites for aquatic invertebrates but water movement is slow with few riffle zones facilitating the aeration of the water. The Brook may support fish or turtles. The dense streamside vegetation and presence of leaf litter provide suitable habitats for terrestrial invertebrates and reptiles and frogs. The continuous overstorey vegetation provides suitable habitats for birds.	• Protect the remnant vegetation in the area from clearing and/or other activities, which will increase degradation. • Undertake a faunal survey to assess if there are turtles and fish within the Brook and to determine the presence of terrestrial vertebrates.
Other issues: The surrounding landuse is rural and the access track across the brook is not stabilise	• Develop and provide information relating to farm planning, protection of remnant vegetation, opportunities to gain funding from catchment groups and other agencies and preferred land management techniques to landholders in the subcatchment. • Encourage landholder to install a box culvert or rubble of the same width as the Brook to formalise access and protect the crossing from erosion.



Breera Brook Map 6

Ellen Brook — Map 7 (Section E) Breera Brook

Length of section (m): approximately 370 m

Recorder's name: Kelly Shepherd, Nicole Siemon, Jodie Oates

Date surveyed: 26/8/98

Nearest road access: Breera Road

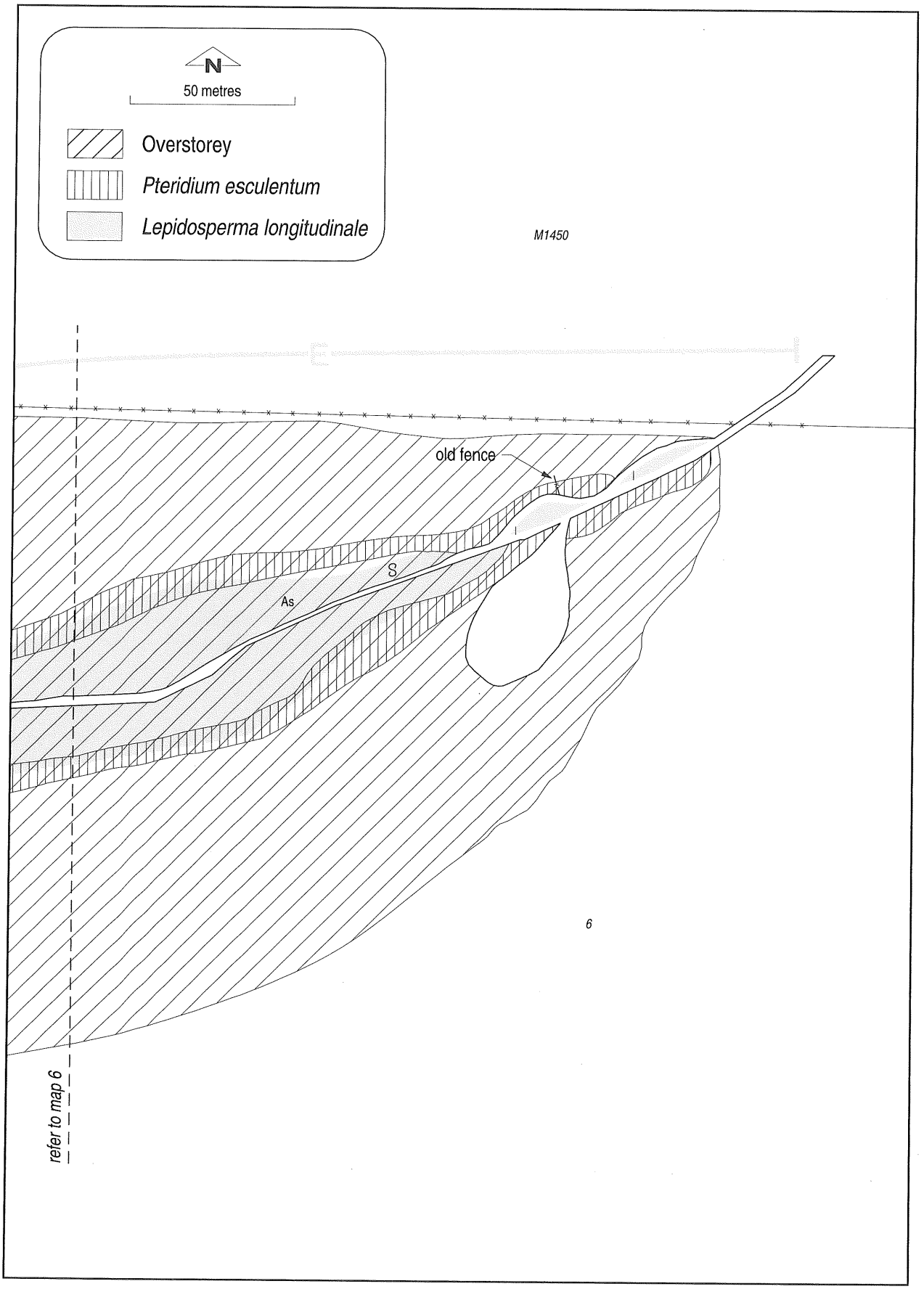
Lot number: Land owner - Tony Wilkie

Summary of river health:

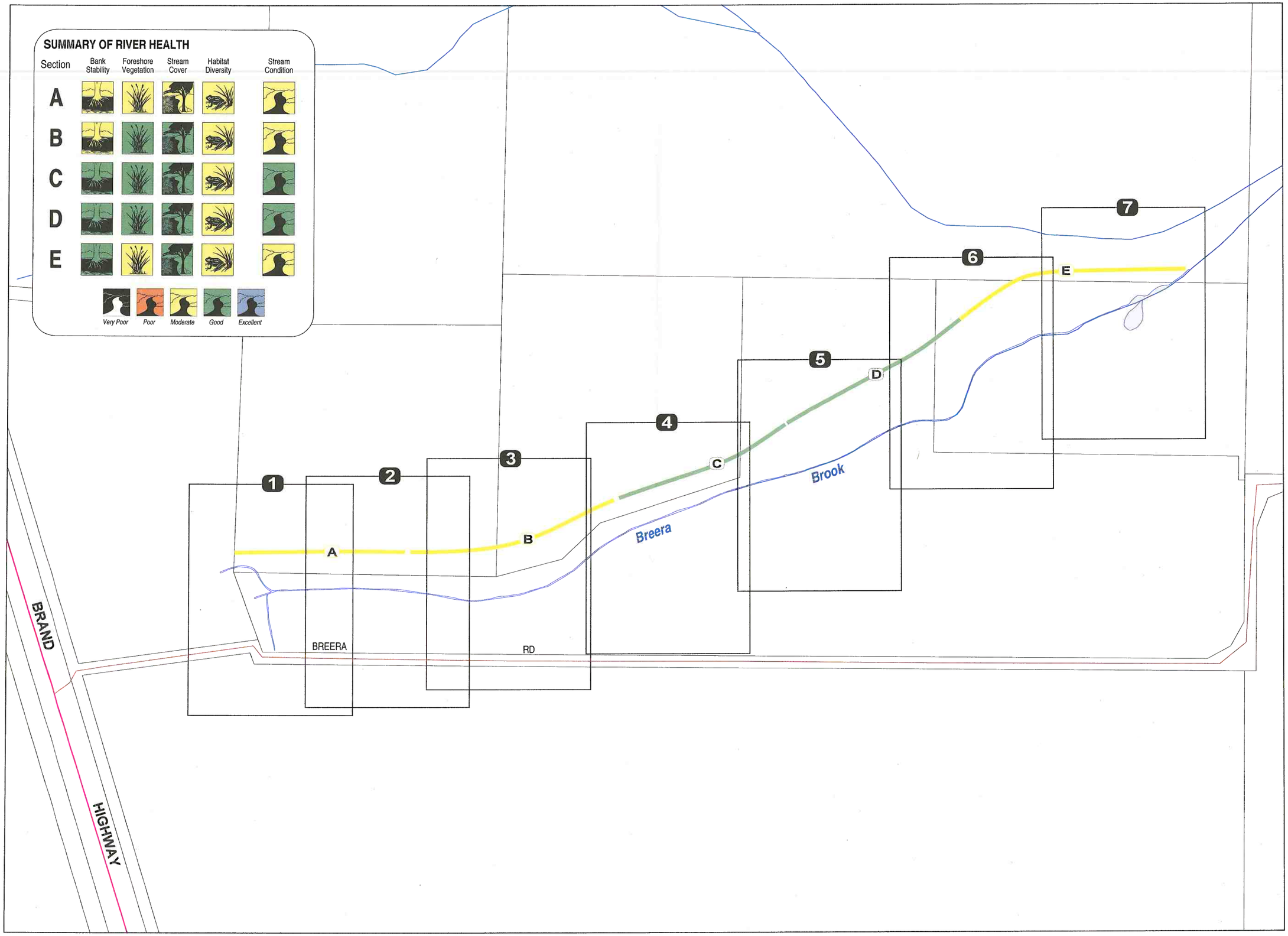
Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Green	Yellow	Green	Yellow
Good	Moderate	Good	Moderate
6	4	6	4

Stream Condition
Yellow
Moderate
20

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



Breera Brook Map 7



Breera Brook - Locality Map

4.2 Ellen Brook

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Ellen Brook — Map 1 (Section A)

Length of section (m): approximately 375 m

Recorder's name: Kelly Shepherd

Date surveyed: 1/10/98

Nearest road access: Almeria Parade

Lot number: 6 (right bank) Land Owner - Ron Redwood

Summary of river health:

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

Stream Condition
Black
Very Poor
4

Description

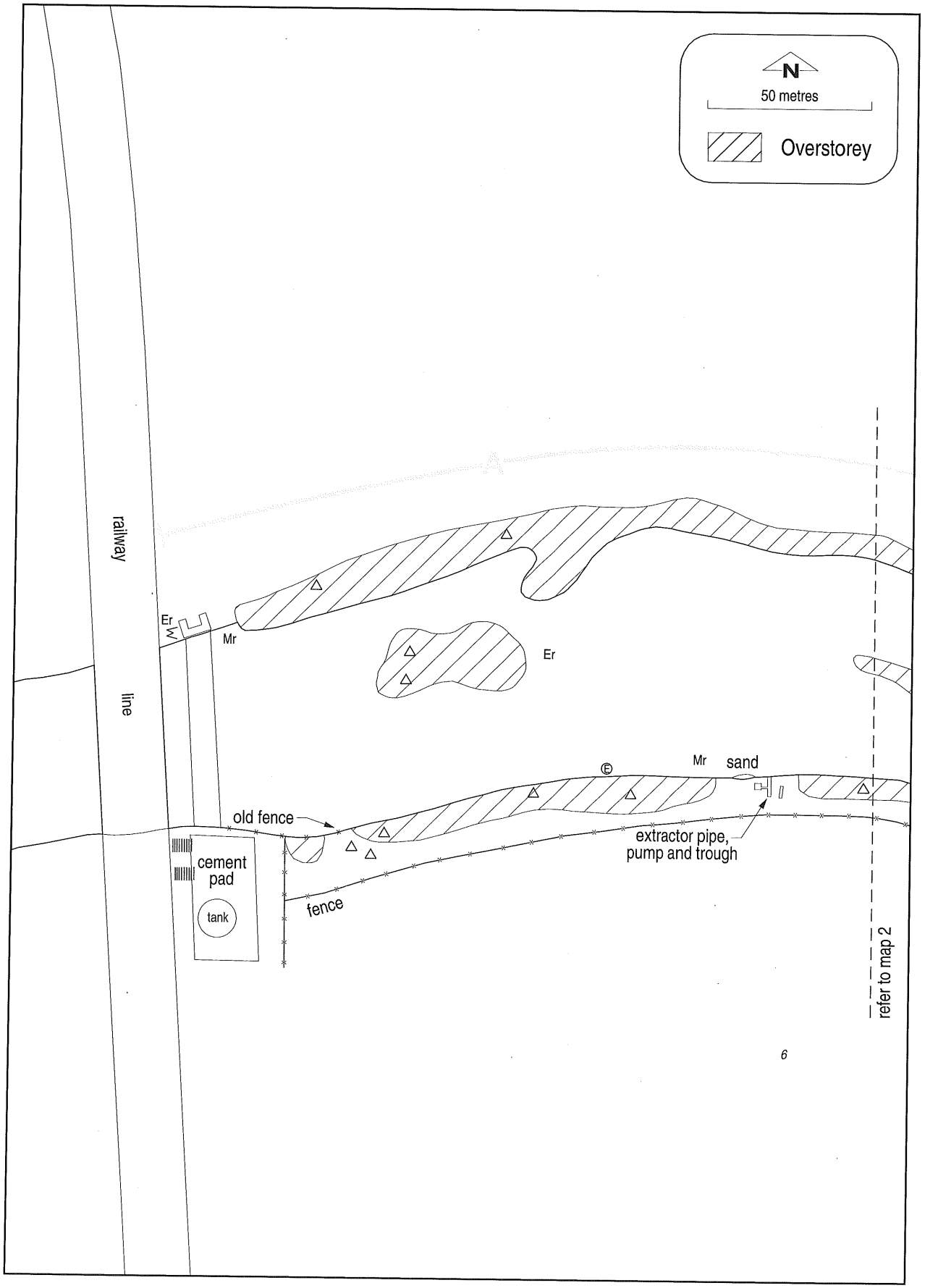
Bank stability: The natural flow of Ellen Brook has been restricted as a result of the construction of a railway line and elevated bridge. This has created a large, open expanse of water 40 - 60 m wide upstream. Immediately prior to passing beneath the bridge, the main channel narrows to 10 - 15 m and flows 1.5 m down an artificial drop structure (spillway). Upstream of the open expanse of water the foreshore banks rise on a medium to steep gradient to 0.5 - 2.5 m in height. Water accumulates along the foreshore in low lying winter wet depressions. Erosion is severe occurring along > 50% of the foreshore. There is evidence of high stock use with walk tracks leading to the waters' edge and patches of bare ground that are either compacted or subject to disturbance. Erosion damage is particularly evident along the steep right bank as water flows over exposed granite outcrops down drainage channels into the brook. There is localized undercutting and slumping along 5 - 20% of the foreshore and significant sedimentation along 20 - 50% of the brook.

Recommended strategies

- Liaise with Westrail, Water and Rivers Commission, Shire of Swan and the landholder to meet onsite and assess the feasibility of modifying the existing railway embankment to restore the natural hydrological function of the Brook.
- Encourage landholder to fence off both banks of the Brook to prevent stock access at a minimum distance of 35 m on either side of the Brook; either in sections or along the entire length.
- Provide financial support to landholder to enable fencing to be constructed and establishment of off site watering points.
- 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.
- Liaise with landholders upstream to identify sources of excessive sediment due to erosion along the tributaries or the main channel of the Brook. Encourage landholders throughout the catchment to undertake remedial actions to stabilize banks by

	fencing off the Brook and implementing broadscale revegetation program. Undertake remedial actions and soft engineering works (Appendix 4) where required.
Vegetation: The overstorey vegetation is patchy (20 - 80 % cover) and comprises Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*). The overstorey along both banks is completely absent or extends for a few metres only. Some stands of overstorey vegetation have established on large sandbars in the middle of the open water. Upstream, as the main channel begins to narrow, stands of Swamp paperbark and Flooded gum have established right across the floodway. Many trees are unhealthy and a number are dead or dying. There is no evidence of seedling regeneration. The middlestorey is absent and the understorey is patchy (20 - 80% cover) and dominated by weeds. Frequent weeds include Perennial veldtgrass (*Ehrharta calycina*), Kikuyu (*Pennisetum clandestinum*), Soursob (*Oxalis pes-caprae*), Whiteflower fumitory (*Fumaria capreolata*), Dock (*Rumex* sp.), Ribwort plantain (*Plantago lanceolata*), Cape weed (*Arctotheca calendula*), Wild oats (*Avena fatua*), Cape tulip (*Homeria flaccida*), Paterson's curse (*Echium plantagineum*), Clovers and Medics (*Trifolium* and *Medicago* spp.). Small stands of the Giant reed (*Arundo donax*) were observed near the foreshore around the railway bridge.	• Fence off the riparian zone as a priority. • 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 of any native trees within riparian zone following fencing and selectively herbicide around any germinants to encourage growth. • Remove small stands of Giant reed by cutting stems and immediately pouring systemic herbicide down each stem, before the stands become unmanageable. Monitor and poison any regrowth. Ensure the rhizome mat remains undisturbed to prevent further bank erosion. • Manage weeds by selectively spraying grasses with flauzifop-butyl and broad leaf weeds, particularly Paterson's curse and Cape weed with glyphosate in accordance with the recommendations outlined in Appendix 2. • Treat Wild oats to reduce fire hazard over summer (Appendix 2). • Teach the landholder how to distinguish native plants from introduced species within the riparian zone to ensure weed control is focussed on the correct species.
Stream Cover: There is little native vegetation overhanging the main channel and very few areas of permanent shade across the open water of Ellen Brook immediately upstream of the railway line. Further upstream the presence of overstorey vegetation across the channel provides areas of permanent shade. The presence of scattered logs, branches and rocks provide some instream cover.	• Fence off foreshore zone as a priority and undertake selective weed control of the grasses to encourage natural regeneration. • Monitor whether or not any natural regeneration is occurring and if not, plant trees within fenced areas. • Establish clumps of native sedges and rushes within the streamline channel and along the foreshore to increase stream cover and bank stability. Use 600 mm "U" shaped steel pegs to secure plants to the stream bed.

Habitat diversity: Water is permanent and light brown in colour due to the presence of tannins leached from vegetation detritus. The river channel is very shallow in places due to sediment deposition. Water depth varies from < 0.3 - < 1.5 m. The lack of instream logs, branches and rocks limits the number of suitable substrates for aquatic invertebrates to establish. There are a few suitable basking sites for turtles. As the streamside vegetation is highly degraded and there is very little leaf litter evident there are no suitable habitats for terrestrial frogs and reptiles. The patchy overstorey provides some nesting and roosting sites for birds.	• Reduce sediment load to the Brook by fencing the foreshore banks to limit the impact of stock. • Plant trees, shrubs and understorey plants such as rushes and sedges within the stream zone to increase the amount of cover and habitat diversity. • Support landholder in achieving these objectives. • Protect any instream debris present that is not exacerbating erosion.
Other issues: The surrounding landuse is rural with stock utilising the Brook for water. Both cattle and sheep were observed. A new fence line has been established along the right foreshore but livestock access to the foreshore area is not prevented. Old fence lines near the railway bridge on the right foreshore are a potential safety hazard.	• Provide information to the landholder about the benefits of undertaking the above listed activities. • Support landholder in achieving the outlined objectives, possibly through provision of materials. • Provide off line watering points for livestock and move the existing pump and trough beyond the fenceline.



Ellen Brook Map 1

Ellen Brook — Map 2 (Section A)

Length of section (m): approximately 375 m

Recorder's name: Kelly Shepherd

Date surveyed: 1/10/98

Nearest road access: Almeria Parade

Lot number: Right bank - Lot 6 (Ron Redwood)

Summary of river health:

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

Stream Condition
Black
Very Poor
4

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

Ellen Brook — Map 2 (Section B)

Length of section (m): approximately 390 m

Recorder's name: Kelly Shepherd

Date surveyed: 1/10/98

Nearest road access: Almeria Parade

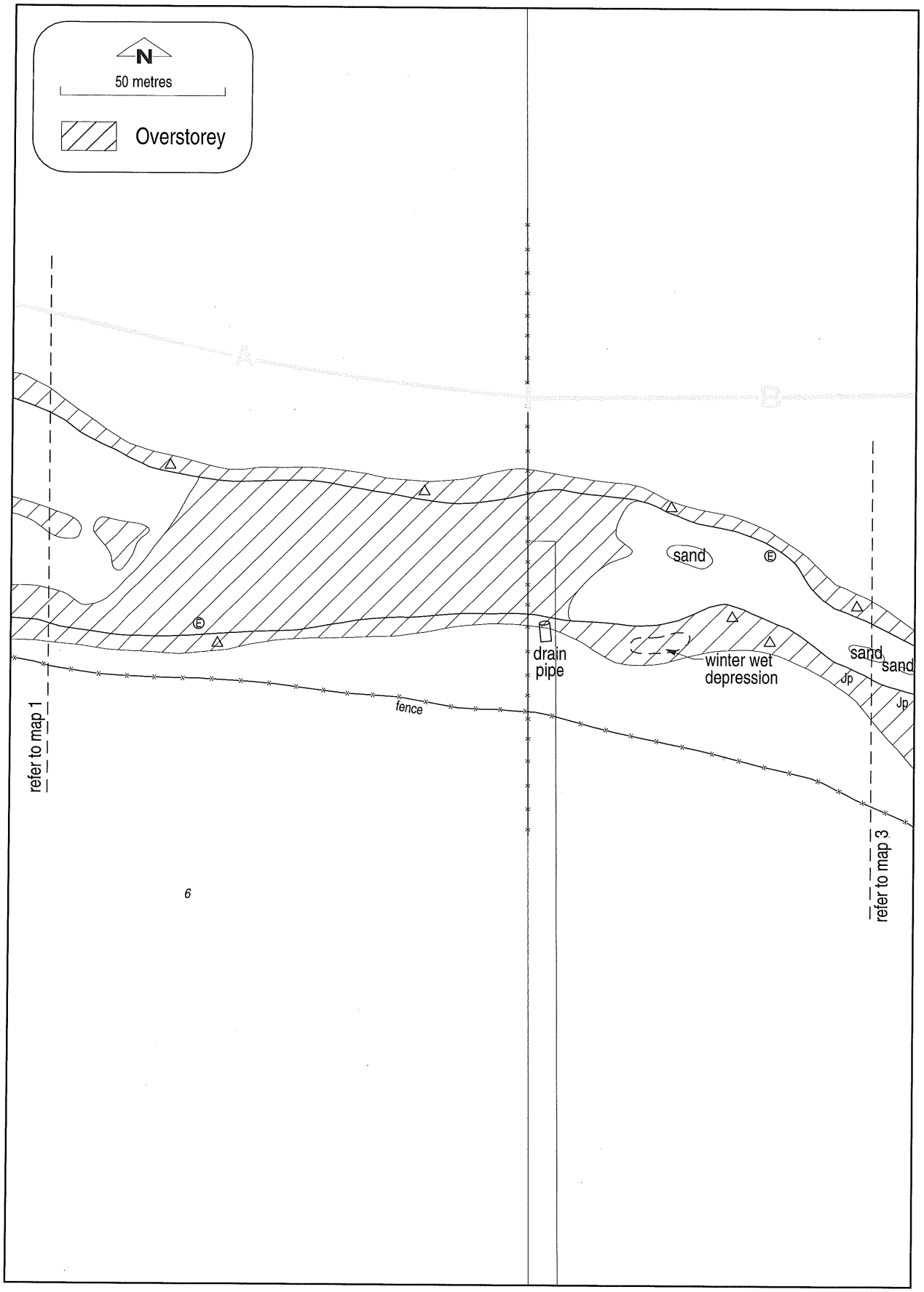
Summary of river health:

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

Stream Condition
Black
Very Poor
4

Description	Recommended strategies
Bank stability: Upstream of the railway line and the open expanse of water, Ellen Brook returns to the historical flow pattern with a main channel approximately 10 - 20 m wide. Due to large amounts of sedimentation, sandbars are common within the channel. Significant amounts of erosion are occurring and 20 - 50% of the foreshore area is affected. Slumping is localised along 5 - 20% of the foreshore. Sedimentation is severe with deposition occurring along > 50% of the channel.	• Encourage landholder to fence off both banks of the Brook to prevent stock access at a minimum distance of 35 m on either side of the main channel; either in sections or along the entire length. • Provide financial support to landholder to enable fencing to be constructed and off site watering points provided. • Encourage landholder to implement a revegetation program including weed control and restoration of the overstorey as a minimum, ensuring that all plants are protected from grazing. • Encourage landholder to provide shade trees for livestock away from the riparian zone and fence these by constructing a 3 m diameter fence around each tree. • Replace middlestorey and understorey species as the trees establish and weed control is managed, to improve stability of banks. • Encourage landholders throughout the catchment to fence off the Brook and its tributaries and implement broadscale revegetation program. • Establish clumps of native sedges and rushes within the streamline channel and along the foreshore to increase stream cover and bank stability. Use 600 mm 'U' shaped steel pegs to secure plants to the stream bed.
Vegetation: The overstorey vegetation is continuous (> 80% cover) and consists of Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*). The narrow overstorey extends only 5 - 20 m either side of Ellen Brook with scattered trees growing within the channel and on stable sandbars. The middlestorey is absent with the exception of very occasional Coojong (*Acacia saligna*) shrubs. The understorey is patchy (20 - 80% cover) interspersed with small areas of exposed sand. The understorey is dominated by introduced weeds such as One leaf cape tulip (*Homeria flaccida*), *Juncus microcephalus*, Ribwort plantain (*Plantago lanceolata*), Cape weed (*Arctotheca calendula*), Whiteflower fumitory (*Fumaria capreolata*), Fleabane (*Conyza* spp.), African lovegrass (*Eragrostis curvula*) and Couch (*Cynodon dactylon*). The native Pale rush (*Juncus pallidus*) occurs periodically along the foreshore.	• Fence off the riparian zone as a priority. • Teach the landholder to distinguish difference between the introduced rush Juncus microcephalus and the native Pale rush and encourage removal of seed heads from the weed species. • Undertake weed management (Appendix 2) around persisting clumps of Pale rush to encourage natural spread. • Manage weeds by selectively spraying grasses with flauzifop-butyl and broad leaf weeds, particularly Paterson's curse and Cape weed with glyphosate in accordance with Appendix 2. • Treat Wild oats to reduce fire hazard over summer (Appendix 2).

	• Replace eradicated weeds with native middlestorey and understorey species to promote bank stability and minimize weed reinvasion. • Monitor germination of any native trees within riparian zone following fencing and selectively herbicide around any germinants to encourage growth.
Stream Cover: The narrow strip of native vegetation along the foreshore of Ellen Brook provides very little permanent shade. The established overstorey growing on the sandbars within the channel may shade sections within the centre of the channel. Scattered instream vegetation, logs and rocks within the brook may provide intermittent instream shade.	• Fence off foreshore zone as a priority and undertake selective weed control of the grasses to encourage natural regeneration. Ensure that the potential impact on bank stability is considered prior to undertaking any weed control works. • Monitor whether or not any natural regeneration is occurring, if not undertake supportive plantings of overstorey trees within fenced areas. • Protect any established native plants from weed invasion by managing the planted areas. • Plant emergent native rushes and sedges along the foreshore to increase stream cover.
Habitat diversity: Water is permanent and light brown in colour due to the presence of tannins leached from vegetation detritus. The high levels of sediment deposition results in variable water depth within the channel from < 0.2 - < 1.5m. Instream rocks form shallow riffle zones and the presence of scattered logs and branches provide a few suitable substrates for aquatic invertebrates. The lack of healthy native vegetation along the foreshore significantly reduces the number of available habitats for terrestrial invertebrates and vertebrates such as frogs and reptiles. The patchy overstorey provides very few nesting and roosting sites for birds.	• Protect areas with instream riffles by ensuring that any fencing off of the foreshore extends 50 m either side of the riffle zone. • Monitor the germination of any native trees within riparian zone following fencing and selectively herbicide around any germinants to encourage growth. • Implement replanting program ensuring that trees planted are managed and weed control is maintained around each tree to optimize plant establishment. • Assess sediment load to stream and develop strategies to reduce excessive sediment contributions from the catchment.
Other issues: A drain pipe is located near the channel bank on the right foreshore.	• Assist landholder to develop a farm plan that enables foreshore fencing, weed control and replanting works to fit in with the existing workload. • Assess water quality and load from the discharge pipe. Consider alternative options for management of outflow.



Ellen Brook Map 2

Ellen Brook — Map 3 (Section B)

Length of section (m): approximately 390 m

Recorder's name: Kelly Shepherd

Date surveyed: 1/10/98

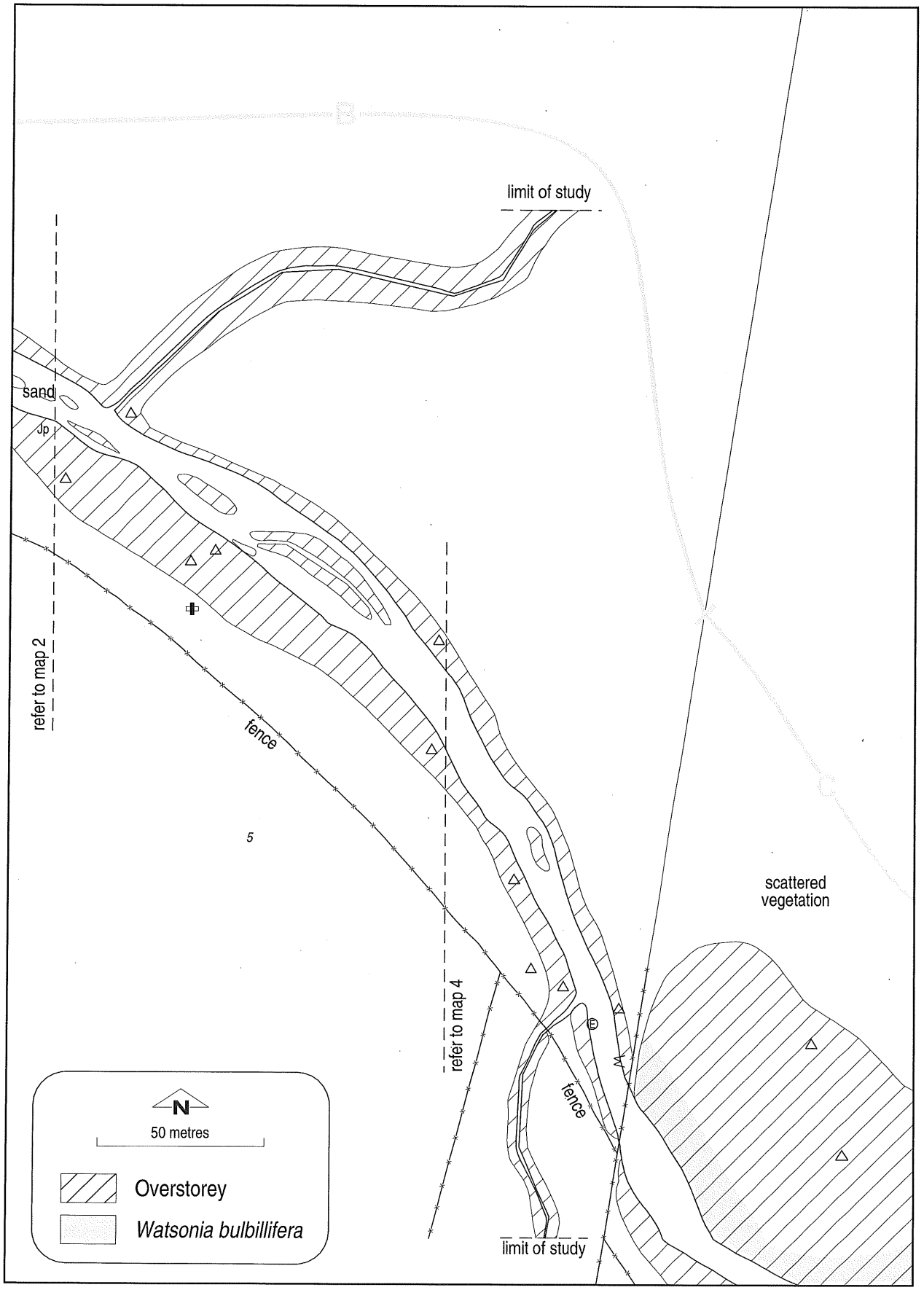
Nearest road access: Almeria Parade

Summary of river health:

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

Stream Condition
Black
Very Poor
4

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



Ellen Brook Map 3

Ellen Brook — Map 4 (Section C)

Length of section (m): approximately 625 m

Recorder's name: Kelly Shepherd

Date surveyed: 2/10/98

Nearest road access: Almeria Parade

Summary of river health:

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

Stream Condition
Yellow
Moderate
14

Description

Bank stability: The main channel is 5 - 10 m wide with the foreshore banks rising on a medium to steep gradient to 0.5 - 1 m in height. Localised points of erosion are present along 5 - 20% of the survey section. The most common location of erosion is along steep banks and around the base of trees growing along the foreshore. Slumping is localised (5 - 20% of the foreshore) where undercutting has occurred. Sedimentation is significant with large depositions observed along 20 - 50% of the main channel.

Vegetation The overstorey vegetation is continuous (> 80% cover) and consists of Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*) with scattered Marri (*Corymbia calophylla*) present some distance from the main channel on drier soil. The vegetation on the left foreshore extends approximately 20 - 40 m from Ellen Brook. The overstorey vegetation associated with the right bank extends 10 - 30 m from the main channel. The middlestorey is continuous (> 80% cover) with dense stands of the weed Watsonia (*Watsonia bulbillifera*) present in linear strips extending approximately 5 - 10 m either side of the foreshore. Adjacent to the dense Watsonia on the right foreshore is a stand of Coojong (*Acaciasaligna*).

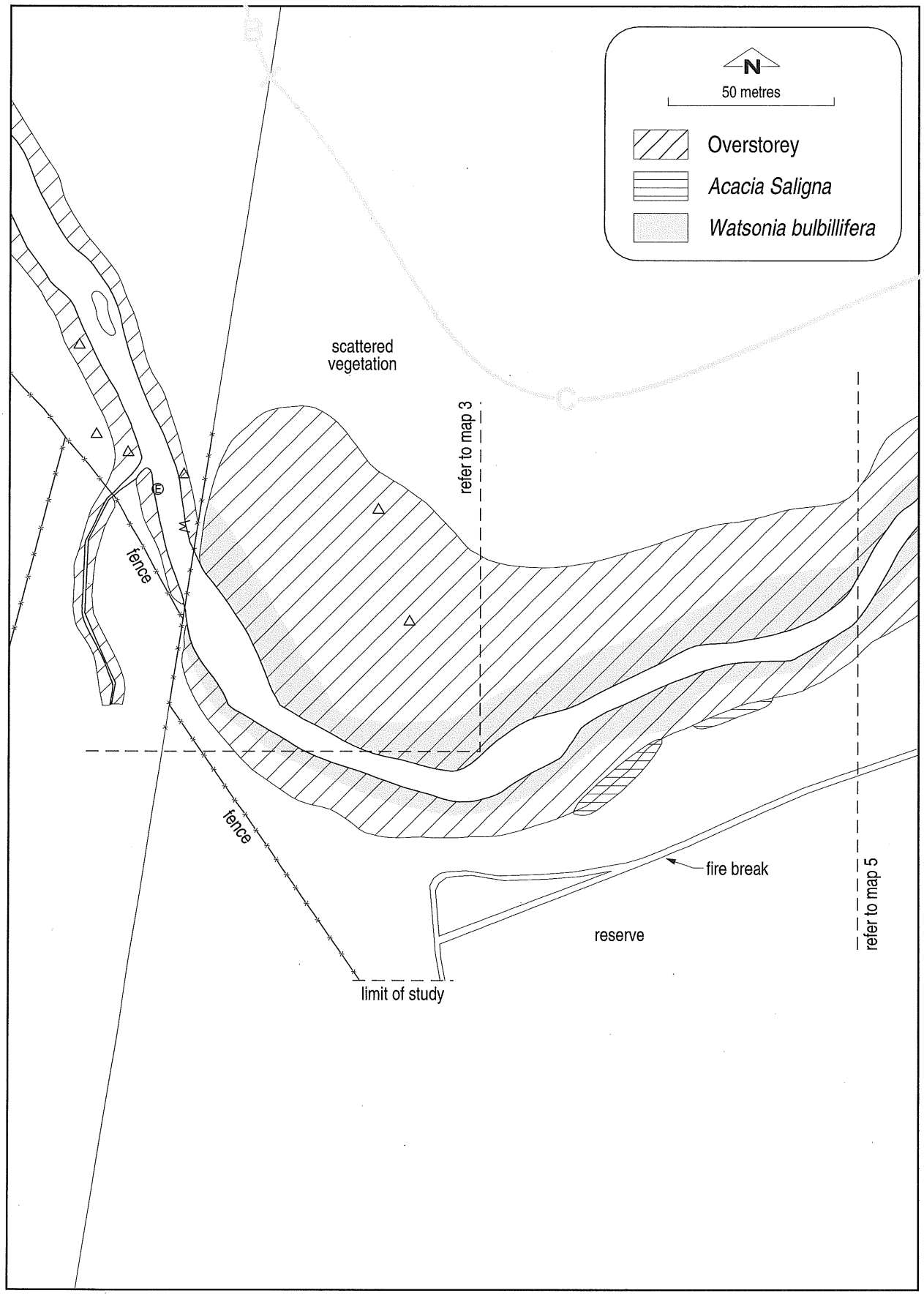
Recommended strategies

- Undertake weed control in zones and ensure that the impact on bank stability is taken into consideration prior to any works. Reintroduce native plants immediately following weed control treatments.
- Plant emergent rushes such as Pale rush and stake into the ground using 600 mm "U" shaped steel pegs immediately upstream of trees suffering erosion at their bases.
- Install erosion control matting in steep zones and plant densely with rushes.

- Undertake weed control in areas where native species persist. 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.
- Define access tracks for any personnel entering the site to minimise trampling of native plants.
- Focus weed control on Watsonia and the introduced grasses as these species pose the greatest fire hazard and threat to the integrity of the remnant. Use methods outlined in Appendix 2.
- Implement weed control in nodes, focusing on areas that can be effectively managed. Brushcut and remove flower heads from all of the Watsonia along

Scattered native species present along the right foreshore adjacent to the stand of Coojong include White myrtle (*Hypocalymma angustifolium*), Parrot bush (*Dryandra sessilis*), Blackboy (*Xanthorrhoea preissii*), *Grevillea* sp., False boronia (*Phyllanthus calycinus*), *Lepidosperma* spp. and *Kunzea* sp. The understorey is continuous (> 80% cover) with stands of the weed Hesperantha falcata. Other occasional weed species include Whiteflower fumitory (*Fumaria capreolata*), Fleabane (*Conyza* sp.), One leaf cape tulip (*Homeria flaccida*), Soursob (*Oxalis pes-caprae*), Guildford grass (*Romulea rosea*), Ursinia (*Ursinia anthemoides*), Stagger weed (*Stachys arvensis*) and Pimpernel (*Anagallis arvensis*). Introduced grasses frequently present are Great brome (*Bromus diandrus*), Tambookie grass (*Hyparrhenia hirta*), African lovegrass (*Eragrostis curvula*), Perennial veldtgrass (*Ehrharta calycina*), Kikuyu (*Pennisetum clandestinum*) and Blowfly grass (*Briza maxima*).	the foreshore to minimize the levels of seed entering the soil seed bank. Place the plants with seed heads in large plastic garbage bags, secure and remove from site. Leave the black bags in the sun for 1 week to kill the seeds. • Establish dense plantings of middlestorey and understorey species in areas once weeds are eradicated to ensure bank stability and suppress re-invasion of weeds. • Maintain a 2 m wide buffer around remnant vegetation and around revegetation sites. Hand weed Whiteflower fumitory, Fleabane, Ursinia and other small annuals. • Selectively spray *Hesperantha falcata* and One leaf cape tulip using methods recommended in Appendix 2. • Monitor natural regeneration at this site following selective herbicide application and maintain vigilant weed control in areas already treated.
Stream Cover: Overhanging vegetation along the foreshore provides patches of permanent shade along this section of Ellen Brook. The presence of leaf litter, occasional branches and fallen trees, and rocks provides intermittent instream shade.	• Protect stream cover by protecting the remnant vegetation and encouraging natural replacement of aging and sick trees. Undertake reinforcement plantings of native species following weed control to maintain bank stability and stream cover. • Protect instream features from removal by land managers (where there is no threat to bank stability) through an awareness campaign of the importance of such features.
Habitat diversity : Water is permanent and light to dark brown in colour due to the presence of tannins leached from vegetation detritus in the water column. The channel is shallow in areas where sediment has accumulated. Water depth varies from < 0.2 - < 2 m. Scattered instream rocks, logs and branches provide limited habitats for aquatic invertebrates and basking sites for turtles. The dense stands of Watsonia along the foreshore currently provide cover for terrestrial organisms, but decreases habitat diversity. The continuous overstorey provides nesting and roosting sites for birds.	• Undertake weed control to reduce fire risk and protect habitat diversity. • Implement Watsonia control in the immediate vicinity of the banks in nodes to minimise the risk of reducing bank stability. • Plant rushes and sedges along the bank in areas where Watsonia successfully controlled in dense clumps to exclude weed species. Maintain a 2 m weed controlled buffer around each revegetated site. • Maintain instream features where they do not exacerbate foreshore erosion. • Preserve leaf litter and logs within the area to protect potential Western swamp turtle habitats.

Other issues: There are service roads in the reserve along the fence line of the Twin Swamps Nature Reserve which was created to protect the Western swamp turtle (*Pseudemydura umbrina*).	• Ensure that weed control is undertaken along service roads, focusing on introduced grass species that pose an increased fire hazard.



Ellen Brook Map 4

Ellen Brook — Map 5 (Section C)

Length of section (m): approximately 625 m

Recorder's name: Kelly Shepherd

Date surveyed: 2/10/98

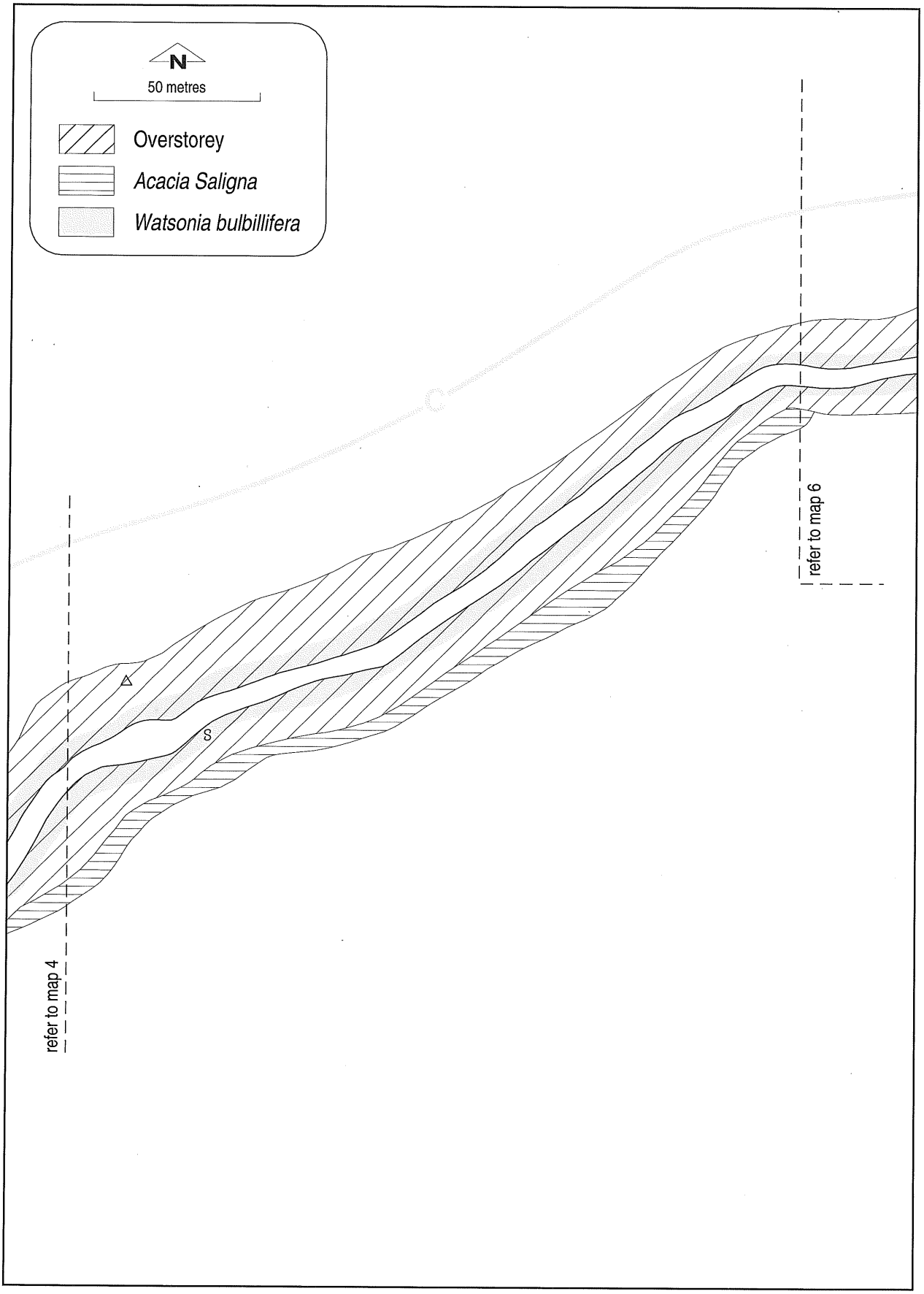
Nearest road access: Almeria Parade

Summary of river health:

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

Stream Condition
Yellow
Moderate
14

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



Ellen Brook Map 5

Ellen Brook — Map 6 (Section C)

Length of section (m): approximately 625 m

Recorder's name: Kelly Shepherd

Date surveyed: 2/10/98

Nearest road access: Almeria Parade

Summary of river health:

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

Stream Condition
Yellow
Moderate
14

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

Ellen Brook — Map 6 (Section D)

Length of section (m): approximately 380 m

Recorder's name: Kelly Shepherd

Date surveyed: 2/10/98

Nearest road access: Great Northern Highway

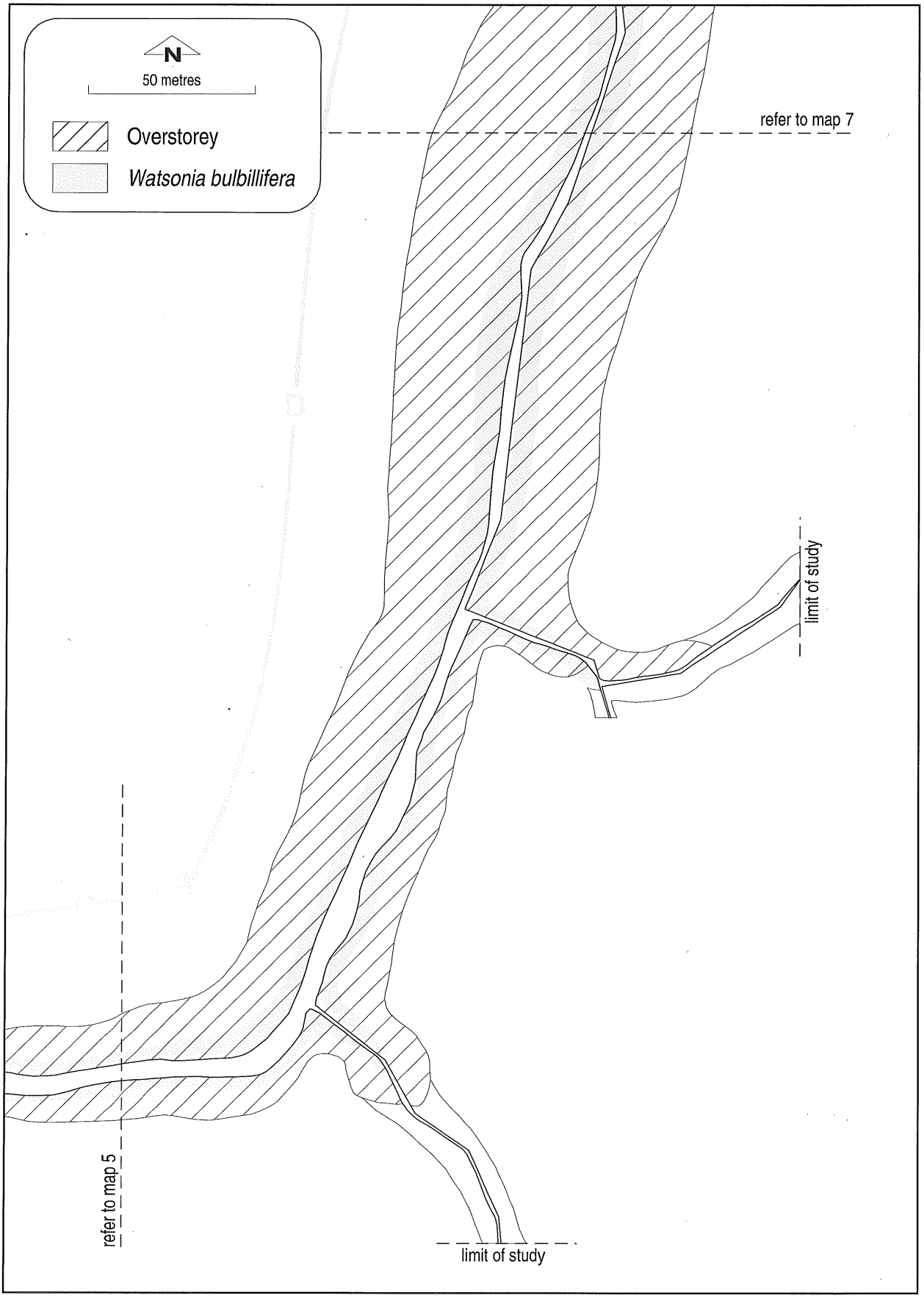
Summary of river health:

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

Stream Condition
Yellow
Moderate
14

Description	Recommended strategies
Bank stability: The main channel of Ellen Brook is 10 - 15 m wide and braided due to large amounts of sediment deposition along the main channel. Erosion is localised along 5 - 20% of the foreshore, near the base of trees growing along the foreshore banks and as drains enter the brook. The drains entering the brook are 0.5 - 1 m wide with steep foreshore banks rising to a height of 1 m. Slumping is minimal (0 - 5%) while sedimentation is significant (20 - 50%) in the main channel.	• Assess current drainage line management and develop alternative management techniques if required. • Identify sources of sediment from the catchment and develop and implement remedial strategies to reduce the load. • Plant clumps of emergent species including Pale rush, Finger rush and Pithy sword-sedge upstream of exposed tree roots to improve soil stability. Secure the clumps using 600 mm "U" shaped steel pegs to secure the plants to the channel bed.
Vegetation: The overstorey vegetation is continuous (> 80% cover) and consists of Swamp paperbark (*Melaleuca rhaphiophylla*), Flooded gum (*Eucalyptus rudis*) and occasional Marri (*Corymbia calophylla*) on higher ground. The overstorey extends 10 - 30 m either side of the brook. The middlestorey is continuous (> 80% cover) with dense stands of Watsonia (*Watsonia bulbillifera*) around 5 - 15 m wide along the length of the foreshore. Native species present on the higher ground adjacent to the Watsonia include frequent Coojong (*Acacia saligna*) and occasional White myrtle (*Hypocalymma angustifolium*), Green stinkwood (*Jacksonia sternbergiana*), *Hibbertia* spp., *Verticordia* spp. and Harsh hakea (*Hakea prostrata*). The understorey is continuous (> 80% cover) and is dominated by weeds. Native understorey species include frequent Pithy sword-sedge (*Lepidosperma longitudinale*) and occasional Pale rush (*Juncus pallidus*) near the foreshore and the banks of a drain entering the brook. Other scattered native species include Honey pots (*Dryandra nivea*), False boronia (*Phyllanthus calycinus*), Milkmaids (*Burchardia umbellata*), Red ink sundew (*Drosera erythrorhiza*) and Pimpernel sundew (*Drosera glanduligera*). A wide range of introduced grasses such as Couch (*Cynodon dactylon*), *Paspalum* spp., African lovegrass (*Eragrostis curvula*), Blowfly grass (*Briza maxima*), Perennial veldtgrass (*Ehrharta calycina*), Annual veldtgrass (*Ehrharta longiflora*), Great brome	• Protect remnant native species by tagging these species prior to implementing weed control activities, to reduce unnecessary loss. Define access tracks for any personnel entering the site to minimize trampling of native plants. • Undertake weed management using methods recommended in Appendix 2 around persisting clumps of Pale rush and Pithy sword-sedge. Establish a buffer zone around remnants to prevent further weed invasion and encourage natural regeneration. • Localize weed control around persistent native plants if a minimalist approach to weed control is more realistic. Remove weeds occurring in low numbers by hand weeding or spot spraying or remove flowering heads to reduce levels of seed entering the seed bank. Removal of infrequent weeds prevents numbers increasing in the future. • Focus weed control on Watsonia and the introduced grasses as these species pose the greatest fire hazard and threat to the integrity of the remnant (Appendix 2). Implement weed control in nodes, focusing on areas that can be effectively managed. Remove the flower heads from plants that cannot be immediately eradicated in the short term. Place collected material in large plastic garbage bags, secure and remove from site. Leave the black bags in the sun for 1 week to kill any seeds.

(*Bromus diandrus*) and Red natal grass (*Rhynchelytrum repens*) is common. Common flowering weeds include One leaf cape tulip (*Homeria flaccida*), Dock (*Rumex* spp.), Cape weed (*Arctotheca calendula*), Whiteflower fumitory (*Fumaria capreolata*), Vetch (*Vicia sativa*) and Lupin (*Lupinus* spp.). The introduced rush Juncus microcephalus occurs sporadically along the foreshore banks along the main channel and the drain leading to the brook.	• Ensure that the management of Watsonia and the introduced grasses is seen as a long-term management issue. The commitment to an organised weed control program is essential. • Monitor natural regeneration at this site following selective herbicide application and continue follow up weed control.
Stream Cover: The open continuous overstorey along the length of Ellen Brook provides some permanent shade stream cover. The presence of leaf litter, branches and very infrequent logs provide occasional instream cover.	• Reinforce plant community by planting overstorey trees where no natural regeneration is occurring. • Following weed eradication undertake intensive planting of understorey and middlestorey species to stabilize the foreshore area and suppress weed invasion in accordance with recommendations outlined in Appendices 2 and 3 respectively. • Establish clumps of native sedges and rushes along the foreshore to promote stream cover.
Habitat diversity: Water is permanent and light to dark brown in colour. The water flow through the drains leading toward the Brook is slow. Due to high levels of sedimentation the water depth in the main Brook channel varies and is shallow in many areas ranging from < 0.2 - < 2 m in depth. Scattered instream rocks, logs and branches provide limited habitats for aquatic invertebrates and basking sites for turtles. The dense stands of Watsonia along the foreshore currently provide cover for terrestrial organisms, but decreases habitat diversity. The continuous overstorey provides nesting and roosting sites for birds.	• Protect instream features such as rocks, logs and branches from removal where these features are not exacerbating erosion along foreshore banks. • Ensure Watsonia control does not disturb the ground and threaten bank stability. • Ensure weed control activities do not remove all areas for native fauna in a short period of time - always provide immediate replacement of vegetation or localize weed control in manageable sized nodes. • Plant nodes of native rushes and sedges and deep rooted species recommended in Appendix 3 where Watsonia has been effectively eradicated. • Reinforce the overstorey if required by planting tubestock where weeds are effectively controlled.
Other issues: Frequent rabbit droppings and burrows present along the foreshore area indicate that feral rabbits are in the reserve.	• Request CALM and Agriculture WA to determine the presence of Calici Virus and encourage introduction of the virus if the agencies agree that it does not pose a threat native animals.



Ellen Brook Map 6

Ellen Brook — Map 7 (Section D)

Length of section (m): approximately 380 m

Recorder's name: Kelly Shepherd

Date surveyed: 2/10/98

Nearest road access: Great Northern Highway

Summary of river health:

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

Stream Condition
Yellow
Moderate
14

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

Ellen Brook — Map 7 (Section E)

Length of section (m): approximately 335 m

Recorder's name: Kelly Shepherd

Date surveyed: 5/10/98

Nearest road access: Great Northern Highway

Lot number: 500

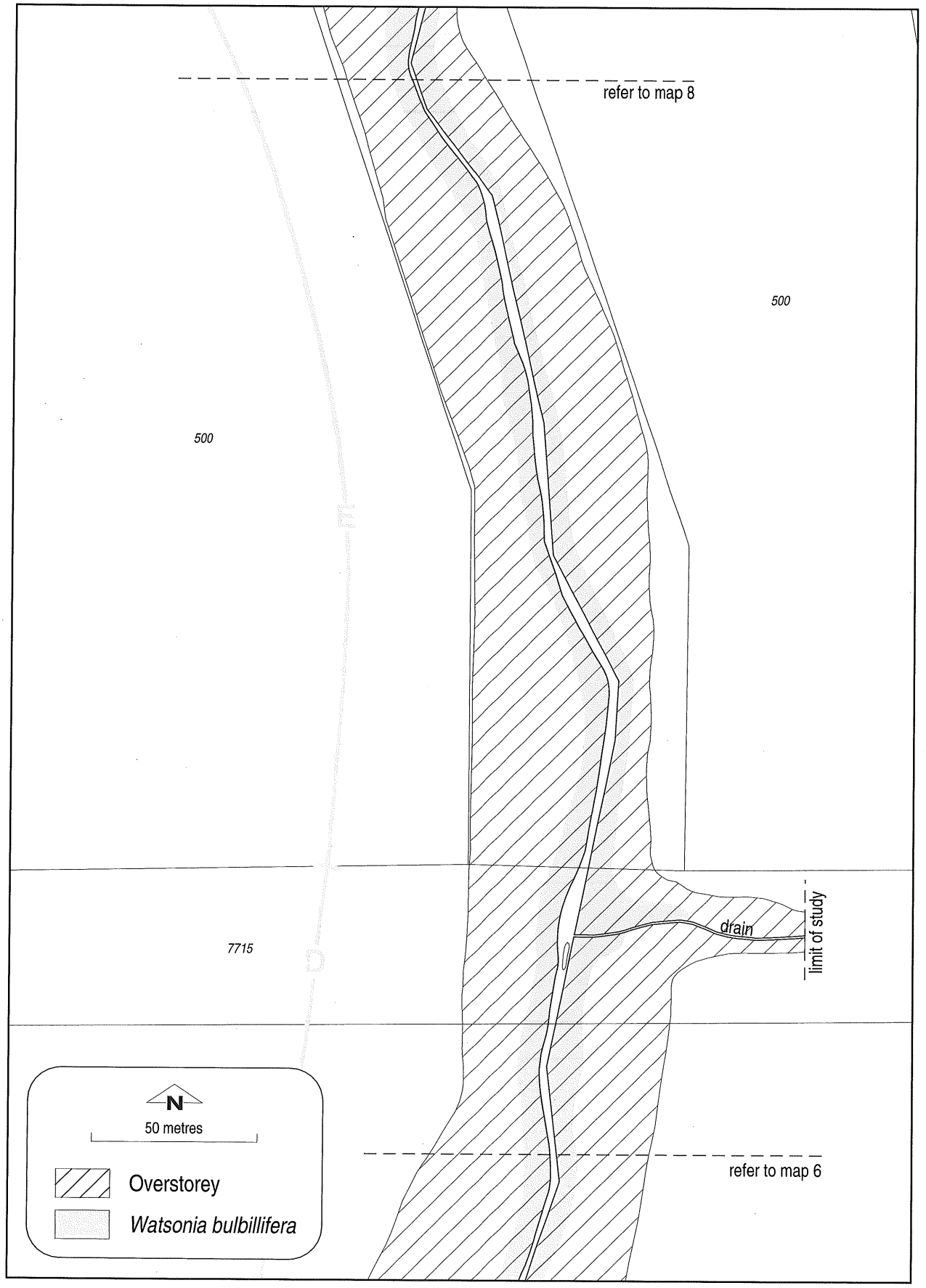
Summary of river health:

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 5 - 10 m wide with the foreshore banks rising on a medium gradient to 1.0 - 1.5 m in height. Sections of the foreshore area are subject to erosion damage. Localised erosion is present along 5 - 20% of the foreshore. There is little evidence of slumping while sedimentation is significant with obvious deposits of sand present along 20 - 50% of the main channel.	• Liaise with landholders further upstream to determine the major sources of sediment to the Brook and develop strategies to reduce the overall sediment load. • Monitor maximum loads during peak flows and assess techniques to slow water movement and minimize erosion. • Undertake intensive weed control however consider implications for foreshore stability prior to any works. • Focus on establishing deeply rooted native species on channel banks to increase the level of stability as recommended in Appendix 3. • Undertake reinforcement planting of the overstorey.
Vegetation: The overstorey vegetation is continuous (> 80% cover) and consists of Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (Eucalyptus rudis). Marri (*Corymbia calophylla*) is infrequent and occurs on higher ground. The overstorey extends only 5 - 20 m from the main channel on either side of the Brook. The middlestorey is continuous (> 80%). Watsonia (*Watsonia bulbillifera*) is present in dense stands 5 - 8 m wide immediately adjacent to the brook on both foreshores. Green stinkwood (*Jacksonia sternbergiana*) a native shrub occurs rarely in the survey area. Other infrequent native shrubs include Coojong (*Acacia saligna*) and Zamia (*Macrozamia riedlei*). The understorey is continuous (> 80% cover) and weeds predominate. Common species include Perennial veldtgrass (*Ehrharta calycina*), Annual veldtgrass (*Ehrharta longiflora*), Whiteflower fumitory (*Fumaria capreolata*), Capeweed (*Arctotheca calendula*), Lupin (*Lupinus* sp.) and Couch (*Cynodon dactylon*). Occasional native Pale rush (*Juncus pallidus*) occurs near the main channel.	• Focus weed control on Watsonia using broad scale treatment techniques away from the banks and controlling this weed in sections adjoining the Brook to minimize disturbance to bank stability and stream cover as recommended in Appendix 2. • Control introduced grasses using flauzifop-butyl or hand weeding/brushcutting to reduce the fire risk associated with these species. • Control weeds around persistent clumps of Pale rush and other native remnants to encourage the natural regeneration of these plants. • Reinforce the native component of the middlestorey and understorey, particularly along the banks and extend the overstorey planting species recommended in Appendix 3. • Protect native plants from spray drift when undertaking any weed control activities and tag any native plants to ensure accidental poisoning does not occur.

Stream Cover: The open continuous overstorey along the length of Ellen Brook provides some permanent shade stream cover. The presence of leaf litter, branches and very infrequent logs provide occasional instream cover.	• Implement Watsonia control in nodes along the foreshore to protect the banks from erosion, and immediately plant dense clumps of native rush species to improve bank stability. Use 600 mm "U" shaped steel pegs to secure the plants to the foreshore banks. • Maintain a buffer zone of 2 m around any revegetation works and near the establishing sedges and rushes to minimize weed reinvasion. • Undertake intensive planting of deep rooted middlestorey and understorey species to increase bank stability and stream cover. • Maintain instream branches and logs where these features do not exacerbate foreshore erosion.
Habitat diversity: Water is permanent and light brown in colour. Due to high levels of sedimentation the water depth varies and is shallow in many areas ranging from < 0.2 - < 2 m in depth. Scattered instream rocks, logs and branches provide limited habitats for aquatic invertebrates. The dense stands of Watsonia along the foreshore currently provide cover for terrestrial organisms, but has reduced habitat diversity. The continuous overstorey provides nesting and roosting sites for birds.	• Determine sediment load and instream dynamics using river restoration principles to protect the main channel from filling up with sand. • Ensure weed control activities do not remove all areas for native fauna in a short period of time - always provide immediate replacement of vegetation or localize weed control manageable sized nodes. • Reinforce and extend the width of the overstorey if possible, by planting trees where weeds have been effectively controlled.
Other issues: The reserve is restricted to a narrow corridor decreasing habitat diversity. A maintained service corridor/firebreak runs immediately adjacent to the remnant vegetation along the foreshore area. Adjacent to the firebreak is an unmanaged open area where perennial grasses predominate.	• Assess the effectiveness of the reserve, determine the responsible agency and encourage the creation of a reserve management plan which includes weed control, fire management, wildlife corridors and alternative management possibilities. • Ensure weed control of perennial grasses adjacent to the foreshore area as these species pose an increased fire hazard.



Ellen Brook Map 7

Ellen Brook — Map 8 (Section E)

Length of section (m): approximately 335 m

Recorder's name: Kelly Shepherd

Date surveyed: 5/10/98

Nearest road access: Great Northern Highway

Lot number: 500

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 7)

Ellen Brook — Map 8 (Section F)

Length of section (m): approximately 388 m

Recorder's name: Kelly Shepherd

Date surveyed: 5/10/98

Nearest road access: Great Northern Highway

Lot number: 501

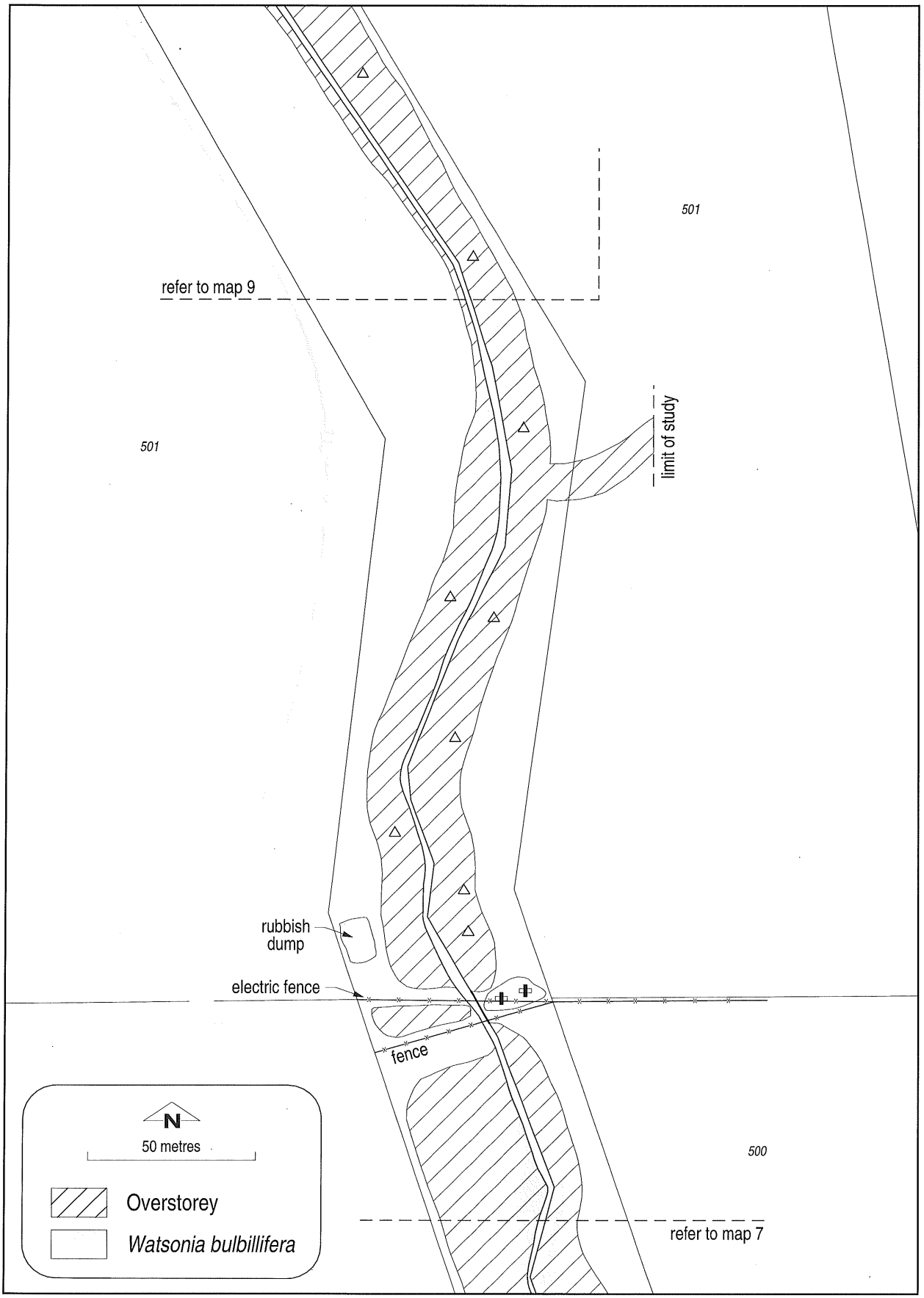
Summary of river health:

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

Stream Condition
Black
Very Poor
4

Description	Recommended strategies
Bank stability: The main channel of Ellen Brook is 5 - 10 m wide with the foreshore banks rising on a medium gradient to 1.0 - 1.5 m in height. Erosion is severe as > 50% of the foreshore is affected. The significant levels of erosion are due to the presence of stock within the foreshore area. Slumping is localized along 5 - 20% of the foreshore. Sedimentation is significant. The main channel is braided as large deposits of sediment have accumulated along 20 - 50% of the channel.	• Develop an information brochure for the landholder to suggest methods of improved land management practices and encourage rehabilitation of the foreshore area. • Encourage landholder to fence off both banks of the Brook to prevent stock access at a minimum distance of 35 m on either side of the Brook; either in sections or along the entire length. • Provide financial support to landholder to enable fencing to be constructed along with off site watering points. • Encourage landholder to implement a revegetation program and undertake weed control in manageable nodes. • Focus on reinforcing the overstorey as a minimum ensuring that all plants are protected from grazing. • Monitor and control any weeds invading revegetation sites. • Replace middlestorey and understorey species as the trees establish and weed control is managed, to improve stability of banks and reduce sediment load. • Encourage landholder to provide shade trees for livestock away from the riparian zone and construct a 3 m diameter fence around each tree.
Vegetation: The overstorey vegetation is continuous (> 80% cover), extending only a few metres on the left foreshore and up to 20 m along the right. The overstorey vegetation comprises Swamp paperbark (*Melaleuca rhaphiophylla*) and Flooded gum (*Eucalyptus rudis*). The overstorey trees are sick or dying with little evidence of seedling regeneration. The middlestorey is absent with the exception of a single Nightshade (*Solanum nigrum*) plant. The understorey is patchy (20 - 80% cover) and dominated by weeds interspersed with areas of bare sand due to stock accessing the brook. Abundant weeds include One leaf cape tulip (*Homeria flaccida*), Lupin (*Lupinus* sp.), and Capeweed (*Arctotheca calendula*). Less frequent species include Wild oats (*Avena fatua*) and Guildford grass (*Romulea rosea*). Surrounding the narrow strip of remnant vegetation along Ellen Brook are pasture paddocks.	• Encourage the landholder to fence off the foreshore zone and try to provide incentives to achieve this. • 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 where soil is exposed. • Hand weed the Nightshade plant prior to fruiting to reduce spread. Monitor any further germination from seed and hand weed new seedlings and remove from site. • Control weeds such as One leaf cape, Lupin, Capeweed and Wild oats using flauzifop-butyl within rehabilitation zone as recommended in Appendix 2.

	• Monitor and treat any weeds emerging or increasing in abundance due to the removal of stock from the riparian area. • Focus revegetation on overstorey species increasing, if possible, the extent of the riparian vegetation by replanting indigenous species including Swamp paperbark, Flooded gum and Marri. • Undertake intensive planting of deep rooted understorey and middlestorey species as recommended in Appendix 3, as weeds are eradicated.
Stream Cover: The narrow overstorey along this length of Ellen Brook provides limited stream cover. Old branches and logs have occasionally fallen into the brook providing intermittent instream cover. The absence of middlestorey or healthy native streamside vegetation provides little stream cover.	• Encourage landholder to protect instream debris where these features do not increase erosion along foreshore banks. • Encourage fencing of the entire riparian zone and revegetation works to increase stream cover. • Establish clumps of native sedges and rushes to increase stream cover.
Habitat diversity: Water is permanent and dark brown in colour. Due to the high level of sedimentation along the Brook the water depth is shallow in many areas. Water depth ranges from < 0.2 - 1.5 m in depth and is unlikely to be suitable for fish or turtles. The scattered instream logs and branches provide limited habitats for aquatic invertebrates. The absence of any middlestorey and the presence of many annual weed species in the understorey suggest there are no habitats suitable for terrestrial invertebrates and vertebrates. The overstorey is narrow and the trees are not healthy limiting potential nesting and roosting sites for birds.	• Replace middlestorey and understorey species as the trees establish and weed control is managed, to improve stability of banks and reduce sediment load. • Plant clumps of emergent rushes such as Pale rush and stake into the ground using 600 mm "U" shaped steel pegs immediately upstream of trees suffering erosion at their bases.
Other issues: Stock have access to both sides of the Brook from the surrounding pasture paddocks. The movement of stock threatens the health of the riparian vegetation and foreshore stability.	• Develop and implement information leaflet about the benefits of protecting the riparian zone on farming land and provide lists of contacts who can provide support for farmers in the Ellen Brook Catchment to achieve these objectives. • Fence off the riparian zone and establish off line watering points for stock.



Ellen Brook Map 8

Ellen Brook — Map 9 (Section F)

Length of section (m): approximately 388 m

Recorder's name: Kelly Shepherd

Date surveyed: 5/10/98

Nearest road access: Great Northern Highway

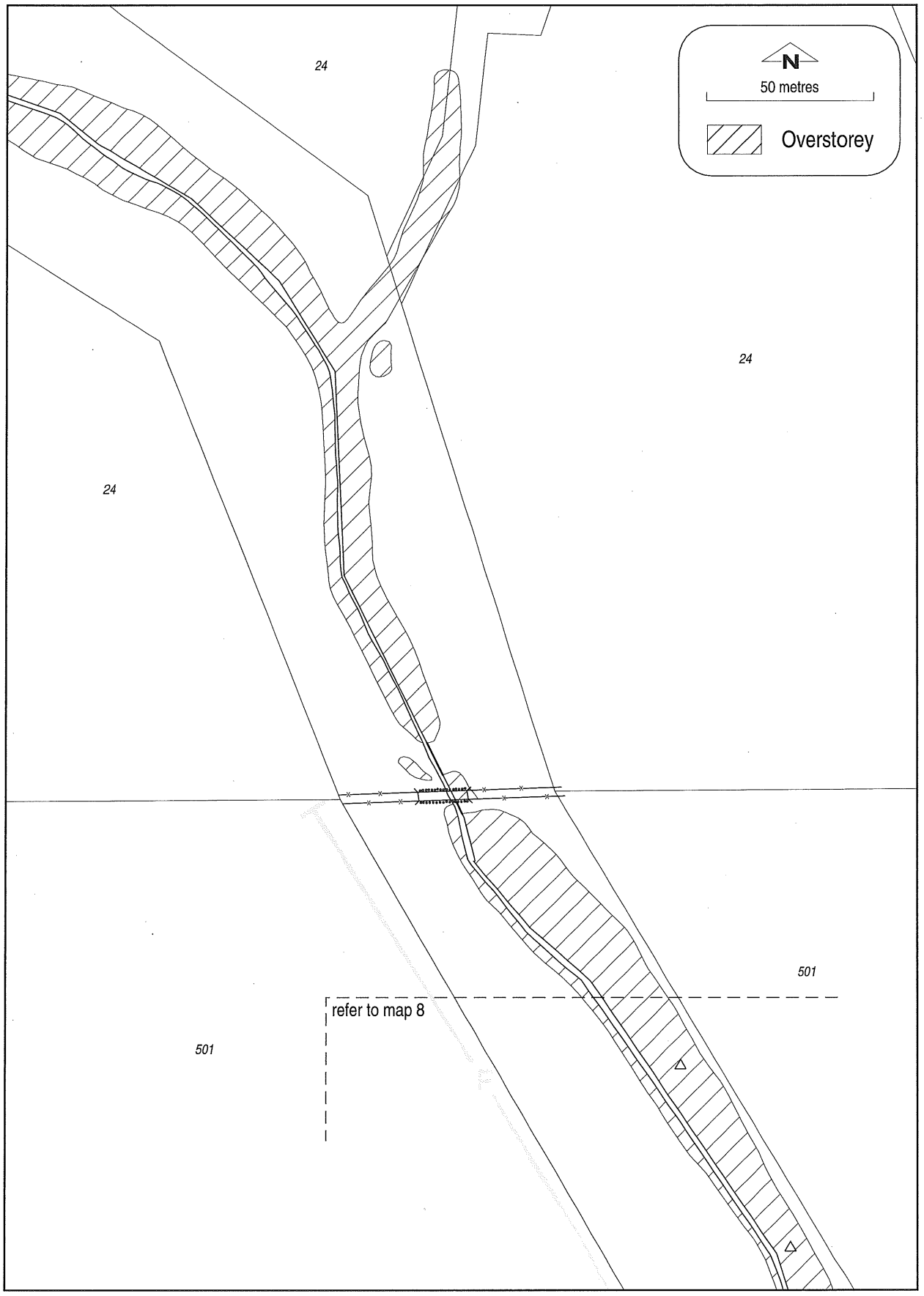
Lot number: 501

Summary of river health:

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

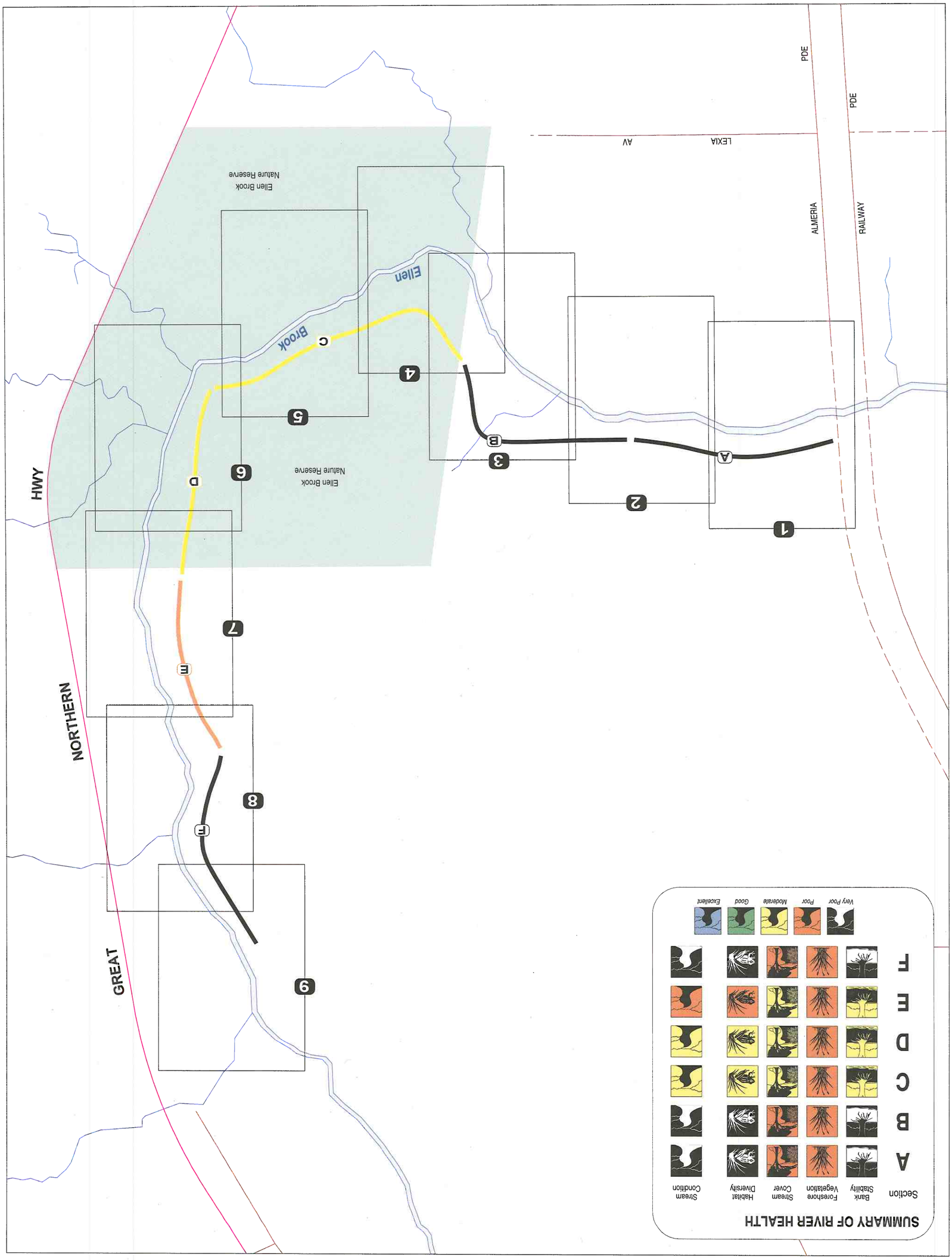
Stream Condition
Black
Very Poor
4

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



Ellen Brook Map 9

Ellen 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 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 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 adequate 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 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 preferably minimum of two seasons.
- Encourage landholders to ensure all strata of vegetation including understorey, middlestorey and upperstorey species to reinforce bank stability.
- Plant overstorey species is highly exposed regions lacking vegetation first to create a level of cover and protection for future plantings.
- Plant emergent and wetlands 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 assessment 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 will 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.

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 water course. It is important to provide information to landholders and land managers about the benefits of undertaking remedial works along foreshores, emphasising 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 increases community awareness. Providing detailed information of 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 a potential impact from activities further upstream. When undertaking any projects it is essential that groups have a clear understanding of the surrounding landuse and the conditions of tributaries feeding into the main watercourse.

The impact of new subdivisions or earthworks upstream should be carefully monitored. Weeds may invade from nearby residential housing. Subdivisions may 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 Parks and Recreation Reservation. It is illegal to undertake any works within the SRT Management Area without notifying the Swan River Trust.

Some also have community support functions to assist in groups undertaking hands on work, preparing management and rehabilitation plans and providing 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 method 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 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 selected sections of Ellen Brook and Breera Breera Brook in accordance with the Water and Rivers Commission (1999) foreshore condition assessment method. The process of implementing this work to test and refine the assessment protocol was intended to identify any shortcomings or limitations of the assessment method.

Implementing the technique has resulted in a limited number of modifications to the assessment 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*	☑	*Bulb/Corm*	☐	*Tree*	☑
Common Name:	Weed wattles		*Riparian*	☑	*Perennial*	☑	*Shrub*	☑
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
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*	☑	*Bulb/Corm*	☑	*Tree*	☐
Common Name:	Three cornered garlic		*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:	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*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Slender foxtail		*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:			*Aquatic*	☐	*Annual*	☑	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
							Grass	☑
Method of Spread:							*Climber*	☐
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

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		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

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		Control Priority	Location	Habit	Form
Species Name:	***Arctotheca calendula***				
Common Name:	Capeweed	3	Dryland ☑	Bulb/Corm ☐	Tree ☐
Seed Form:	Coarse seed		Riparian ☐	Perennial ☐	Shrub ☐
Seeding Time:			Aquatic ☐	Annual ☑	Herb ☑
Method of Spread:	Spreads mostly from seed				Rush/Sedge ☐
Best Time of Control:	Oct - Feb				Grass ☐
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.				Climber ☐

		Control Priority	Location	Habit	Form
Species Name:	***Arundo donax***				
Common Name:	Giant reed	2	Dryland ☐	Bulb/Corm ☐	Tree ☐
Seed Form:	Light seed		Riparian ☑	Perennial ☑	Shrub ☐
Seeding Time:	Sept - Dec		Aquatic ☐	Annual ☐	Herb ☐
Method of Spread:	Spreads readily from rhizome growth				Rush/Sedge ☐
Best Time of Control:	All year				Grass ☑
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.				Climber ☐

		Control Priority	Location	Habit	Form
Species Name:	***Aster subulatus***				
Common Name:	Bushy starwort	3	Dryland ☐	Bulb/Corm ☐	Tree ☐
Seed Form:	Light and easily spread by wind		Riparian ☑	Perennial ☑	Shrub ☐
Seeding Time:			Aquatic ☐	Annual ☑	Herb ☑
Method of Spread:	Spreads mostly from seed				Rush/Sedge ☐
Best Time of Control:	Aug - Mar				Grass ☐
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.				Climber ☐

		Control Priority	Location	Habit	Form
Species Name:	***Avena spp.***				
Common Name:	Wild Oats	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:	Aug - Oct				Grass ☑
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.				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

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

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

		Control Priority	Location	Habit	Form
Species Name:	***Bromus diandrus***	2	*Dryland* ☑	*Bulb/Corm* ☐	*Tree* ☐
Common Name:	Great brome		*Riparian* ☐	*Perennial* ☐	*Shrub* ☐
Seed Form:	Coarse seed		*Aquatic* ☐	*Annual* ☑	*Herb* ☐
Seeding Time:	Sept - Nov				*Rush/Sedge* ☐
Method of Spread:	Spreads mostly from seed				*Grass* ☑
Best Time of Control:	June - Aug				*Climber* ☐
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.				
	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.***	3	*Dryland* ☐	*Bulb/Corm* ☐	*Tree* ☐
Common Name:	Canna		*Riparian* ☑	*Perennial* ☑	*Shrub* ☐
Seed Form:	Heavy seed		*Aquatic* ☐	*Annual* ☐	*Herb* ☑
Seeding Time:					*Rush/Sedge* ☐
Method of Spread:	Spreads readily from rhizome growth				*Grass* ☐
Best Time of Control:	Sept - Apr				*Climber* ☐
Method of Control:	Dig out small infestations. Selectively spraying the leaves with a systemic herbicide can be effective.				
	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

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		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

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		Control Priority	Location		Habit		Form	
Species Name:	**Cortaderia selloana**							
Common Name:	Pampas Grass	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
			Riparian	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light and easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
							Rush/Sedge	☐
Seeding Time:	Dec - Feb						*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**							
Common Name:	Couch	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
			Riparian	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
							Rush/Sedge	☐
Seeding Time:	May, April						*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**							
Common Name:		2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
			Riparian	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
							Rush/Sedge	☑
Seeding Time:	May - July Oct - Jan						*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

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		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***	1	Dryland	☑	Bulb/Corm	☐	Tree	☐
Common Name:	Veldtgrass		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	☑
							Climber	☐

Best Time of Control: Aug - Dec

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***	1	Dryland	☑	Bulb/Corm	☐	Tree	☐
Common Name:	African love grass		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	☑
							Climber	☐

Best Time of Control: Nov - March

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***	2	Dryland	☑	Bulb/Corm	☐	Tree	☐
Common Name:	Musky crowfoot		Riparian	☐	Perennial	☐	Shrub	☐
Seed Form:	Coarse seed		Aquatic	☐	Annual	☑	Herb	☑
Seeding Time:							Rush/Sedge	☐
Method of Spread:	Spreads mostly from seed						Grass	☐
							Climber	☐

Best Time of Control: June - Sept

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

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		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	☐
							Rush/Sedge	☐
Seeding Time:							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	☑
							Rush/Sedge	☐
Seeding Time:	Nov - Dec						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	☐
							Rush/Sedge	☐
Seeding Time:	Dec - Mar						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	☑
							Rush/Sedge	☐
Seeding Time:	Dec - Feb						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

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		Control Priority	Location	Habit	Form
Species Name:	***Freesia aff leichtlinii***				
Common Name:	Freesia	2	Dryland ☑ Riparian ☐ Aquatic ☐	Bulb/Corm ☑ Perennial ☐ Annual ☐	Tree ☐ Shrub ☐ Herb ☑ Rush/Sedge ☐ Grass ☐ Climber ☐
Seed Form:	Light seed				
Seeding Time:	Oct - Nov				
Method of Spread:	Spreads by bulb or corm growth				
Best Time of Control:	Aug - Sept				
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).				

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

		Control Priority	Location	Habit	Form
Species Name:	***Gladiolus spp***				
Common Name:	Gladiolus	2	Dryland ☑ Riparian ☐ Aquatic ☐	Bulb/Corm ☑ Perennial ☐ Annual ☑	Tree ☐ Shrub ☐ Herb ☑ Rush/Sedge ☐ Grass ☐ Climber ☐
Seed Form:	Light, easily spread by wind				
Seeding Time:	Feb-June				
Method of Spread:	Spreads by bulb/corm growth and seed				
Best Time of Control:	Aug - Dec				
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.				

		Control Priority	Location	Habit	Form
Species Name:	***Gomphocarpus fruticosus***				
Common Name:	Cotton bush	1	Dryland ☑ Riparian ☐ Aquatic ☐	Bulb/Corm ☐ Perennial ☑ Annual ☐	Tree ☐ Shrub ☐ Herb ☑ Rush/Sedge ☐ Grass ☐ Climber ☐
Seed Form:	Light and easily spread by wind				
Seeding Time:	Nov - Dec				
Method of Spread:	Spreads mostly from seed				
Best Time of Control:	Sept - Dec				
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.				

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

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		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	☐
Method of Spread:	Spreads by bulb or corm growth						Grass	☐
Best Time of Control:							Climber	☐
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	☐
Method of Spread:	Spreads by bulb or corm growth						Grass	☐
Best Time of Control:							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	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	☐
Method of Spread:	Spreads mostly from seed						Grass	☑
Best Time of Control:	July - August						Climber	☐
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	☐
Method of Spread:	Spreads mostly from seed						Grass	☐
Best Time of Control:	Nov - Mar						Climber	☐
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

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		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

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		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*	☐
Best Time of Control:	Sept - Mar						*Climber*	☐

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*	☐
Best Time of Control:	Sept - Nov						*Climber*	☐

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*	☐
Best Time of Control:	Sept - Dec						*Climber*	☐

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

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		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

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		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

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

		Control Priority	Location	Habit	Form
Species Name:	***Olea europaea***				
Common Name:	Olive tree	2	Dryland ☑ Riparian ☐ Aquatic ☐	Bulb/Corm ☐ Perennial ☑ Annual ☐	Tree ☑ Shrub ☐ Herb ☐ Rush/Sedge ☐ Grass ☐ Climber ☐
Seed Form:	Heavy seed				
Seeding Time:	Nov - Jan				
Method of Spread:	Spreads mostly from seed				
Best Time of Control:					
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.				

		Control Priority	Location	Habit	Form
Species Name:	***Oxalis pes-caprae***				
Common Name:	Soursob	2	Dryland ☐ Riparian ☐ Aquatic ☐	Bulb/Corm ☐ Perennial ☐ Annual ☐	Tree ☐ Shrub ☐ Herb ☐ Rush/Sedge ☐ Grass ☐ Climber ☐
Seed Form:	Light seed				
Seeding Time:	Sept				
Method of Spread:	Spreads by runners				
Best Time of Control:	July - Sept				
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.				

		Control Priority	Location	Habit	Form
Species Name:	***Panicum capillare***				
Common Name:	Witchgrass	3	Dryland ☑ Riparian ☐ Aquatic ☐	Bulb/Corm ☐ Perennial ☐ Annual ☑	Tree ☐ Shrub ☐ Herb ☐ Rush/Sedge ☐ Grass ☑ Climber ☐
Seed Form:					
Seeding Time:					
Method of Spread:	Spreads mostly from seed				
Best Time of Control:					
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.				

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

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		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*	☐
							Rush/Sedge	☐
Seeding Time:	Dec - Jan						*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*	☑
							Rush/Sedge	☐
Seeding Time:	Jan - April						*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*	☐
							Rush/Sedge	☐
Seeding Time:							*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*	☑
							Rush/Sedge	☐
Seeding Time:							*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

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		Control Priority	Location	Habit	Form
Species Name:	**Populus spp**	2	Dryland ☑ Riparian ☐ Aquatic ☐	Bulb/Corm ☐ Perennial ☑ Annual ☐	Tree ☑ Shrub ☐ Herb ☐ Rush/Sedge ☐ Grass ☐ Climber ☐
Common Name:	Poplar				
Seed Form:					
Seeding Time:					
Method of Spread:	Spreads from suckers				
Best Time of Control:	Oct - Feb				
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.				

		Control Priority	Location	Habit	Form
Species Name:	**Raphanus raphanistrum**	3	Dryland ☑ Riparian ☑ Aquatic ☐	Bulb/Corm ☐ Perennial ☑ Annual ☐	Tree ☐ Shrub ☐ Herb ☑ Rush/Sedge ☐ Grass ☐ Climber ☐
Common Name:	Wild radish				
Seed Form:	Light seed				
Seeding Time:	Dec				
Method of Spread:	Spreads mostly from seed				
Best Time of Control:	Sept - Nov				
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.				

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

		Control Priority	Location	Habit	Form
Species Name:	**Ricinus communis**	1	Dryland ☑ Riparian ☐ Aquatic ☐	Bulb/Corm ☐ Perennial ☑ Annual ☐	Tree ☑ Shrub ☐ Herb ☐ Rush/Sedge ☐ Grass ☐ Climber ☐
Common Name:	Castor Oil				
Seed Form:	Heavy seed				
Seeding Time:	Nov - Jan				
Method of Spread:	Spreads mostly from seed				
Best Time of Control:	Any time but best prior to fruiting				
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.				

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

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		Control Priority	Location		Habit		Form	
Species Name:	**Romulea rosea**							
Common Name:	Guildford grass	1	*Dryland*	☑	*Bulb/Corm*	☑	*Tree*	☐
			Riparian	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
							Rush/Sedge	☐
Seeding Time:							*Grass*	☑
Method of Spread:	Spreads by bulb or corm growth						*Climber*	☐
Best Time of Control:								
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.							

		Control Priority	Location		Habit		Form	
Species Name:	**Rorippa nasturtium-aquaticum**							
Common Name:	Watercress	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
			Riparian	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☑	*Annual*	☐	*Herb*	☑
							Rush/Sedge	☐
Seeding Time:							*Grass*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☐
Best Time of Control:	Access dependent							
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.							

		Control Priority	Location		Habit		Form	
Species Name:	**Rubus spp**							
Common Name:	Blackberry	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
			Riparian	☑	*Perennial*	☑	*Shrub*	☑
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
							Rush/Sedge	☐
Seeding Time:							*Grass*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☐
Best Time of Control:	Dec - April							
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.							

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

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		Control Priority	Location		Habit		Form	
Species Name:	***Rumex spp***	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Dock		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light and easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:	March - June						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	Nov - Mar							
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.							

		Control Priority	Location		Habit		Form	
Species Name:	***Salix spp***	1	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☑
Common Name:	Willow		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads from suckers						*Climber*	☐
Best Time of Control:	Dec - Mar							
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.							

		Control Priority	Location		Habit		Form	
Species Name:	***Schinus terebinthifolia***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Common Name:	Japanese pepper		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	Sept						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads from suckers and seed						*Climber*	☐
Best Time of Control:	All year, but in wetlands treat in summer							
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.							

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

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		Control Priority	Location		Habit		Form	
Species Name:	**Solanum nigrum**	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Deadly nightshade		*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:	Oct - Dec						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	Sept - Oct						*Climber*	☐
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.							

		Control Priority	Location		Habit		Form	
Species Name:	**Stachys arvensis**	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Staggerweed		*Riparian*	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*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 where there are no remnant native species. Kings Park Board staff suggest Glyphosate at 75-100ml in 15l of water prior to flowering.							

		Control Priority	Location		Habit		Form	
Species Name:	**Stenotaphrum secundatum**	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Buffalo grass		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Sterile or non seed producing		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:	Spreads readily from rhizome growth						*Grass*	☑
Best Time of Control:	Aug - Sept						*Climber*	☐
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.							

		Control Priority	Location		Habit		Form	
Species Name:	**Taraxacum officinale**	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Dandelion		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light, easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:	All year round						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	Sept - Nov						*Climber*	☐
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.							

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

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		Control Priority	Location		Habit		Form	
Species Name:	***Thunbergia alata***							
Common Name:	Black-eyed Susan	2	*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:							*Grass*	☐
Method of Control:	Remove small plants manually. Spot spraying with Glyphosate at a rate of 1 in 50 can be effective.						*Climber*	☑
	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:	***Trifollum spp.***							
Common Name:	Clovers	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:	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.						*Climber*	☐

		Control Priority	Location		Habit		Form	
Species Name:	***Tropaeolum majus***							
Common Name:	Nasturtium	3	*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:	Aug / Sept						*Grass*	☐
Method of Control:	Removing this species by hand is effective. Selectively applying Glyphosate 1 in 100 can be effective.						*Climber*	☑
	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

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		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 ☑
					Grass ☐
Method of Spread:	Spreads readily from rhizome growth and seed				Climber ☐
Best Time of Control:	Winter				
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 ☐
					Grass ☐
Method of Spread:					Climber ☐
Best Time of Control:					
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 ☐
					Grass ☐
Method of Spread:	Spreads from both seed and vegetative growth				Climber ☐
Best Time of Control:					
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 ☐
					Grass ☐
Method of Spread:	Spreads by runners				Climber ☑
Best Time of Control:	June - Aug				
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

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		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

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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		☐	☐	☐	☑	☑	☑	☑	☑	○	◉	○

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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 stembergiana	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	☐	☐	☐	☐	☑	☐	☐	☐	◉	○	○

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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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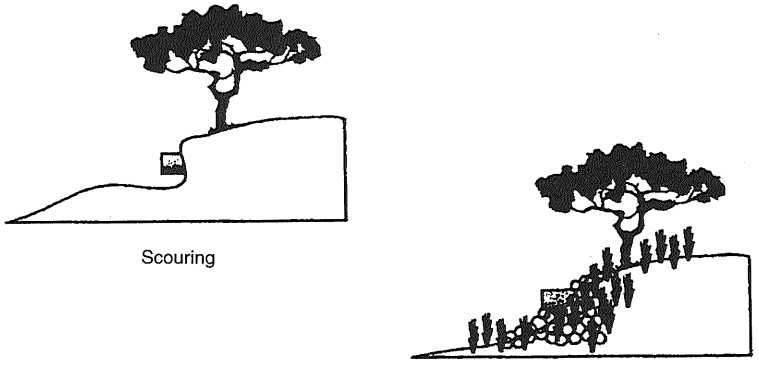
Appendix 4

Suggested soft engineering works

Appendix 4: Suggested soft engineering works

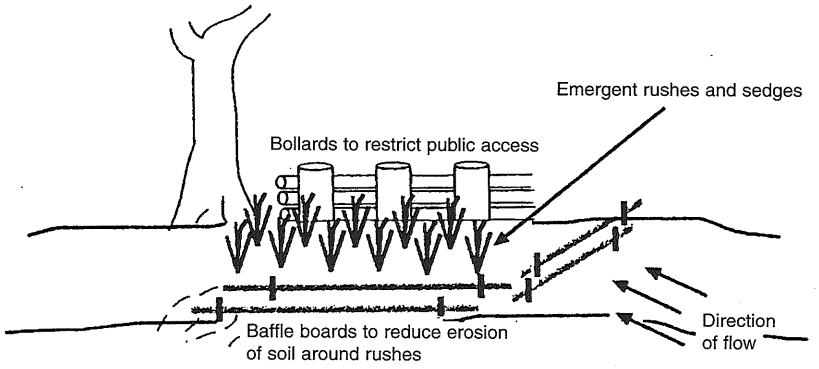
DRAINAGE OUTFALL TREATMENT



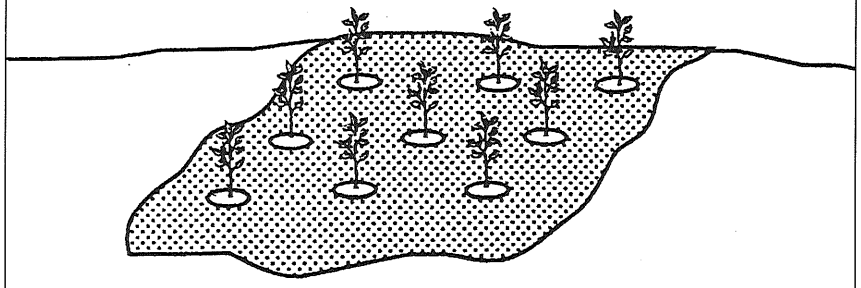
Scouring

Riprap and planting

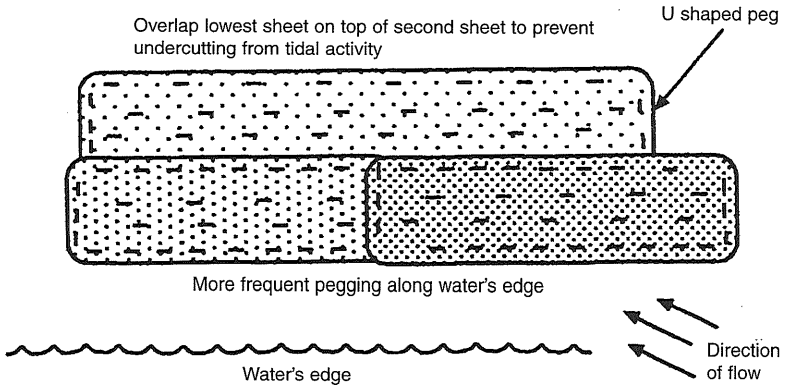
USING BAFFLES FOR PLANT PROTECTION AND SOIL STABILISATION



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*
8	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