GOVERNMENT OF WESTERN AUSTRALIA

FORESHORE ASSESSMENT IN THE WOOROLOO BROOK CATCHMENT

WATER RESOURCE MANAGEMENT SERIES

WATER AND RIVERS COMMISSION REPORT NO. WRM 19
2001

WATER AND RIVERS COMMISSION

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Cover Photograph: Wooroloo Brook off Great Eastern Highway - Virginia Shotter

Foreshore assessment in the Wooroloo Brook Catchment

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WATER AND RIVERS COMMISSION

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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 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 and 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 destabilisation 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 in both rural and urban environments was recognised to ensure consistency of information gathering. This led to the development of the Foreshore Assessment Proforma (Shepherd and Siemon 1999; WRC Report RR2) during Stage 1 of the foreshore assessment surveys undertaken by Ecosystem Management Services (EMS) on behalf of the Water and Rivers Commission (WRC) and the Natural Heritage Trust (NHT) (WRC Report No. WRM 13, 1999). The Stage 1 surveys were conducted along the waterways of the Bennett Brook, Canning and Ellen Brook catchments.

This report comprises of work undertaken by EMS for the Foreshore Assessment Stage 2 Project. Stage 2 involved testing the suitability of the proforma within a broader range of environments, including the Perth Hills and eastern side of the Swan Coastal Plain.

1.2 Community involvement process

The intended audience for the Foreshore Assessment Stage 2 is State and local government officers and the community. In order to ensure that the information included in the report 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 original proforma.

Discussion was then held with community groups to determine specific areas of interest for each catchment group. Each group identified priority foreshore areas to undergo assessment during Stage 2 (Table 1). The locations selected included areas that were already a focus or are potential sites for future rehabilitation works.

The sites to be surveyed, as nominated by the Wooroloo Brook Catchment Group for this second stage of surveys, were as follows:

Wooroloo Brook site selection

Table 1: Wooroloo Brook catchment selected sites

Site No	Location	Situated
1	Berri Reserve	Reen Road
3	Gidgegannup Brook	Joseph & Cameron Roads
2	Equitus Gully	Farringtons – end of East Road
4	Tilden Park	Tilden Drive
5	Cookes Brook	Toodyay Road North of Lilydale Road
6	Noble Falls	Toodyay Road
7	Wooroloo Brook	Government Road - Prison Farm
8	Wooroloo Brook	Linley Valley Road
9	Coates Gully – 3 Mile Flats	Great Eastern Highway

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

1.3 This report

This report summarises the results of the Stage 2 Foreshore Assessment Surveys using the foreshore condition assessment proforma (Shepherd and Siemon 1999; WRC Report RR2). It provides a description of the current status of the foreshore environment, and identifies major threats to the health of the area. Recommended strategies for appropriate management of future works on the focus foreshore areas are also detailed in the document. Information is provided on weed control techniques, recommended native species for foreshore rehabilitation and how to undertake soft engineering works.

2. Methodology

2.1 Site selection within tributaries

Following the community involvement process the nominated sections of the selected waterways were assessed to determine the most appropriate areas for the foreshore survey. This was based on the need to assess a complete range of foreshore health in a variety of areas, to ensure that the proforma continued to be sufficiently balanced to cover all situations ranging from rural to urban.

2.2 Implementing the survey

The foreshore assessment survey proforma 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 Shepherd and Siemon 1999; WRC Report RR2.

As outlined above, this process ensures consistency of information gathering over time, allowing the information collected from multiple surveys by various people to be collated. The accumulated information can then be used to prepare management plans and identify 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 was traversed before the survey. 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 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 both sides.

Scaled baseline maps were prepared by the Water and Rivers Commission showing cadastral boundaries and the waterway. The cadastral information assists in identifying location out in the field. As each homogeneous section was identified, information was sketched onto baseline maps. Other information such as the composition and location of native vegetation along the foreshore, the location and extent of predominant weeds and the presence of disturbance factors such as discharge pipes and other infrastructure was detailed on each map. Fences and remedial works were also noted.

Note that the left and right sides of the main channel are defined with respect to the view upstream.

2.2.2 Environmental parameters of foreshore condition

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

These parameters are:

- bank stability
- foreshore vegetation
- stream cover
- habitat diversity

A colour-coded system has been developed to summarise the condition of each of the above environmental parameters. This system allows the information to be provided in an immediately recognisable form. The status of each of the parameters is assessed and graded from Blue (Excellent) to Black (Very Poor) (Table 2) using the criteria outlined in

Table 3. 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 discernible 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 2: 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: Shepherd and Siemon 1999; WRC Report RR2.

Table 3: The determination of 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 native vegetation 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 occasionally; 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 4) and is an indication of the overall stream condition.

Table 4: 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 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 the four environmental parameters assessed at each site and the overall Stream Condition Index is included on each summary map.

This report also contains a detailed description of each site surveyed outlining the key findings of the four environmental parameters assessed and recommended strategies for appropriate remedial works.

3. Key findings for the Wooroloo Brook Catchment

The waterways comprising the Wooroloo catchment originate in the Darling Range. Broad acre farming, special rural properties and nature reserves were the dominant landuses in areas surveyed. There are some subdivisions occurring on land adjoining the Brook.

The catchment and waterway health reflects changes associated with rising groundwater tables and associated increases in surface water salinity. The riparian vegetation in some sections surveyed is stressed as a result of changing environmental conditions.

With the increasing population in the area associated with the subdivisions, there is an increased risk of new non-native plants becoming established in the middle and upper catchment.

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 of the surveyed sites within the Wooroloo Brook catchment to varying degrees.

The foreshore areas most prone to erosion often lack healthy fringing vegetation that act to stabilise foreshore banks. The bank stability ratings of the sites surveyed ranged from Good (Green) at Berri Reserve (Site 1) to Very Poor (Black) at Gidgegannup Brook (Site 3, Section A), Coates Gully (Site 9) and Wooroloo Brook (Site 7, Section B). Wooroloo Brook runs through the grounds of the Wooroloo Prison Farm and the banks are significantly affected by erosion and slumping with localised areas of sedimentation in the main channel. Many banks rated as Very Poor are often associated with the presence of saline waters that create bare salt scalds. These scalds kill off the fringing vegetation, leaving the banks of the waterway prone to the formation of erosion rills and gullies. Where river channels run through open pasture paddocks there was little evidence of the presence of livestock, however it is possible that grazing may be contributing to the impact on foreshore vegetation and bank destabilisation.

The foreshore banks of Wooroloo Brook in Berri Reserve (Site 1) show only isolated occurrences of bank destabilisation, slumping or sedimentation. This area contains good levels of fringing vegetation, which helps to stabilise banks, and there are no significant areas of disturbance within the riparian zone.

3.2 Vegetation

The foreshore vegetation condition along the surveyed tributaries within the Wooroloo Brook catchment ranges from Good (Green) at Berri Reserve (Sites 1 and 2) and Wooroloo Brook (Site 7, Section A; Site 8, Section A) and Equitus Gully (Site 2), to a Very Poor (Black) condition at Gidgegannup Brook (Site 3, Section A) and Coates Gully (Site 9). A decline in foreshore health often reflects the degree of disturbance to the area. Disturbance factors observed throughout the Wooroloo Catchment include significant levels of weed invasion, physical disturbance through stock trampling and grazing vegetation and excessive indiscriminate access by people both on foot and in vehicles. Even in areas with clearly defined walk trails, there is evidence of vegetation trampling caused by walkers. Other disturbance factors include clearing of vegetation for residential, rural and semi-rural developments and surface expression of saline waters resulting in the death of vegetation.

3.2.1 Native species

Native riparian vegetation provides a range of functions that aid bank stability, provide habitat for native fauna and contribute to managing water flow and velocities.

Within the sites surveyed, the characteristic overstorey species include *Corymbia calophylla* (Marri), *Melaleuca cuticularis* (Saltwater Paperbark), *Eucalyptus marginata* (Jarrah), *E. rudis* (Flooded Gum), *E. wandoo* (Wandoo), *E. laeliae* (Darling Range Ghost Gum), *Banksia littoralis* (Swamp Banksia) and *Melaleuca rhaphiophylla* (Swamp Paperbark).

The dominant middlestorey native species observed include *Acacia pulchella* (Prickly Moses), *Hakea amplexicaulis* (Prickly Hakea), *Xanthorrhoea preissii* (Grass Tree), *Acacia saligna* (Coojong), *Hakea lissocarpha* (Honeybush), *H. undulata* (Wavy Leaved Hakea), *Dryandra sessilis* (Parrot Bush), *Calothamnus quadrifidus* (One Sided Bottlebrush), *Hypocalymma robustum* (Swan River Myrtle) and *Grevillea endlicheriana* (Spindly Grevillea). These species were dominant at the margins of the riparian zone. *Trymalium ledifolium*, *Agonis linearifolia* (Swamp Peppermint), and *Astartea fascicularis* (Common Astartea) often occurred in dense homogeneous stands, with an understorey of *Baumea articulata* (Jointed Twig Sedge) and occasional *Hypocalymma angustifolium* (White Myrtle) within these closed communities. A number of other species were identified during the survey. These are listed in Appendix 1A.

The dominant native components of the understorey of the surveyed sites included *Baeckea camphorosmae* (Camphor Myrtle), *Lepidosperma scabrum*, *Sarcocornia* spp., *Baumea juncea*, *Alexgeorgea arenicola*, *Grevillea bipinnatifida* (Native Fuchsia) and *Dryandra nivea* (Couch Honeypot). Other species present included *Leucopogon* sp., *Haemodorum* sp., *Hibbertia subvaginata* (Yellow Buttercups), *Macrozamia reidlei* (Zamia), *Lechenaultia biloba*, *L. floribundum*, *Drosera microphylla* and *Clematis pubescens*.

3.2.2 Weeds

Commonly encountered weeds of the Wooroloo Catchment overstorey included Edible Figs, (*Ficus carica*), Olive Trees (*Olea europaea*), Giant Reed (*Arundo donax*) and Radiata Pine (*Pinus radiata*). All of these species are able to spread very rapidly along waterways and in nearby bushland, if no control measures are utilised.

Weeds encountered within the middlestorey and understorey included a range of annual grasses and pasture grasses, Shivery Grass (*Briza minor*), Guildford Grass (*Romulea rosea*), Dock (*Rumex* spp.), introduced Bulrush (*Typha orientalis*), Kikuyu (*Pennisetum clandestinum*), Perennial Ryegrass (*Lolium* sp.), *Juncus acutus*, Soursob (*Oxalis pes-caprae*), Fleabane (*Conyza* spp.), Bridal Creeper (*Asparagus asparagoides*) and Watsonia (*Watsonia bulbillifera*).

3.3 Stream cover

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

Within the Wooroloo catchment, the quality of cover along streams and within channels varied a great deal. Equitus Gully (Site 3, Section A) was the only site that was rated as Excellent (Blue) due to an abundance of stream cover offered by dense fringing vegetation and the presence of instream features, such as branches, logs and leaf litter. A number of sites were rated as Poor (Red), including Wooroloo Brook (Site 8, Section B), Cookes Brook (Site 5), Gidgegannup Brook (Site 3, Section A) and Coates Gully-3 Mile Flats (Site 9). At Gidgegannup Brook, the surface expression of saline waters and clearing of vegetation for pasture establishment have resulted in a complete loss of fringing vegetation.

3.4 Habitat diversity

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

Within the Wooroloo Catchment, the habitat diversity ratings for the surveyed sites ranged from Good (Green) to Very Poor (Black). An example of a site with a Very Poor rating for habitat diversity was Gidgegannup Brook (Site 3, Section A) due to the lack of fringing vegetation, instream habitat features and absence of permanent water. Berri Reserve (Site 1, Section A) is an example of a site exhibiting a Good (Green) rating for habitat diversity. This site is relatively undisturbed, with a wide fringe of vegetation extending into extensive bushland reserves on either side of the gully. There are also diverse instream features present.

3.5 Overall summary conditions for

The presence or absence of permanent water is a defining feature of an Excellent (Blue) habitat rating. However, this may be misleading for the sites surveyed in the Scarp region. Many of the upper reaches of the waterway are expected to be seasonal, with permanent water only occurring where there are permanent seeps. As a consequence this often results in the downgrading of many sites where the permanence of water is uncharacteristic. Therefore, in some circumstances, it maybe useful to reduce the weighting of this character when the headwaters of a catchment are surveyed.

all surveyed sites

The overall condition of the foreshore sections surveyed for each of the sites is summarised below.

3.5.1 Summary results for Berri Reserve

Summary of river health: Site 1 – Section A – Berri Reserve

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Green	Green	Green	Green	**Green**
Good	Good	Good	Good	Good
6	6	6	6	**24**

Summary of river health: Site 1 – Section B – Reen Road

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**

3.5.2 Summary results for Equitus Gully

Summary of river health: Site 2 – Section A – Equitus Gully

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

Summary of river health: Site 2 – Section B – Equitus Gully

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Green	blue	Yellow	**Green**
Moderate	Good	Excellent	Moderate	**Good**
4	6	8	4	**22**

3.5.3 Summary results for Gidgegannup Brook

Summary of river health: Site 3 – Section A – Gidgegannup Brook

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

Summary of river health: Site 3 – Section B – Gidgegannup Brook

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Yellow	Green	Yellow	**Yellow**
Moderate	Moderate	Good	Moderate	**Moderate**
4	4	6	4	**18**

3.5.4 Summary results for Tilden Park

Summary of river health: Site 4 Tilden Drive

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Yellow	Green	Yellow	**Yellow**
Moderate	Moderate	Good	Moderate	**Moderate**
4	4	6	4	**18**

3.5.5 Summary results for Cookes Brook

Summary of river health: Site 5 Cookes Brook

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

3.5.6 Summary results for Noble Falls

Summary of river health: Site 6 Toodyay Road

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Yellow	Yellow	Yellow	Green	**Yellow**
Moderate	Moderate	Moderate	Good	**Moderate**
4	4	4	6	**18**

3.5.7 Summary results for Wooroloo Brook

Summary of river health: Site 7 – Section A – Government Road

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

Summary of river health: Site 7 – Section B – Government Road

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity	**Stream Condition**
Black	Red	Yellow	Red	**Red**
Very Poor	Poor	Moderate	Poor	**Poor**
0	2	4	2	**8**

3.5.8 Summary results for Wooroloo Brook

Summary of river health: Site 8 (Section A) Linley Valley Road

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

Summary of river health: Site 8 (Section B) Linley Valley Road

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

3.5.9 Summary results for Coates Gully – 3 Mile Flats

Summary of river health: Site 9 Coates Gully – 3 Mile Flats

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

4. Specific site reports

4.1 Berri Reserve

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Wooroloo Brook – Site 1: Maps 1-4 (Section A) Berri Reserve

Length of section (m): 1440 m

Recorder's name: B Waining and N Siemon

Date surveyed: 16/6/99

Nearest road access: Reen Road

Lot number(s): 7720

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Green	Green	Green	Green
Good	Good	Good	Good
6	6	6	6

Stream Condition
Green
Good
24

Description

Bank stability: This section of Wooroloo Brook in the Berri Reserve (Site 1, Section A) comprises the western end of this surveyed site. It is characterised by steep rocky slopes bounding the river channel, which is at least 10 m wide. The foreshore banks are steep (45-60˚) and exhibit only localised areas of erosion, with minimal sedimentation or slumping. There are no artificial stabilisation structures. There is a crossing point at the western end of the site, where vehicles are able to cross the river. This crossing is a potential site for further bank destabilisation and is a point of entry for sediment to the river. Water depth is approximately 0.5 m along the length of the surveyed channel.

Vegetation: The vegetation in this site comprises a moderately healthy representation of all three strata of vegetation. The overstorey is patchy, consistent with the expected characteristics of open woodland communities. It comprises entirely native species, including frequent *Melaleuca rhaphiophylla* (Swamp Paperbark), and infrequent to occasional *Eucalyptus rudis* (Flooded Gum), *E. marginata* (Jarrah), *E. wandoo* (Wandoo) and *Corymbia calophylla* (Marri). The middlestorey also consists entirely of native species including frequent *Acacia pulchella* (Prickly Moses), *Calothamnus quadrifidus* (One Sided Bottlebrush), *C. sanguineus* (Pindak), *Grevillea*

Recommended Strategies

- Liaise with the local government authority to redesign and formalise the tracks that lead to the river, to trap sediment and therefore reduce the sediment load within the river.
- Address the localised areas of erosion, with the use of appropriate soft engineering techniques (Appendix 4).

- Implement a selective Watsonia management program, work in manageable sized nodes ensuring that works do not threaten foreshore stability or the viability of the native plants present (Appendix 2).
- Monitor the level of natural regeneration of native species within the areas where intensive Watsonia control has occurred and, if necessary, encourage natural regeneration through the spreading of seed collected locally (Appendix 3).

endlicheriana (Spindly Grevillea), *Hakea trifurcata* (Two-Leaf Hakea), *H. undulata* (Wavy Leaved Hakea) and *Trymalium ledifolium*. There are also occasional *Acacia saligna* (Coojong), *Agonis linearifolia* (Swamp Peppermint), *Grevillea glabrata* (Smooth Grevillea), *G. wilsonii* (Wilson's Grevillea), *Hakea petiolaris* (Sea Urchin Hakea), *Viminaria juncea* (Swishbush) and *Xanthorrhoea preissii* (Grass Tree). The understorey, however, has a reduced dominance of native representing approximately 60% of all the species present. Common species include *Dryandra nivea* (Couch Honeypot), *Baeckea camphorosmae* (Camphor Myrtle), *Hakea prostrata* (Harsh Hakea), *Hypocalymma angustifolium* (White Myrtle), *Leucopogon* spp. (Bearded Heath), *Pimelea spectabilis*, *Drosera* spp. (Sundews), *Baumea juncea* (Bare Twig Rush), *Lepidosperma effusum* (Spreading Sword Sedge) and *Borya* sp. The highly invasive weed Watsonia (*Watsonia bulbillifera*) is abundant along the foreshore. Annual grasses are less common.	• Encourage recreational users to keep to the paths and use the toilet facilities provided near the entrance. This may be achieved by installing signs, wood chip guideways and low fences (bollards) in areas where there is evidence of indiscriminate trampling.
Stream Cover: There is abundant stream cover offered by the fringing native vegetation. There was no evidence that weed species provide any shading to the instream environment. Within the river there is leaf litter, rocks, branches and occasional instream vegetation providing cover. There are also periodic mid-stream islands, which have been colonised by vegetation including species like *Melaleuca rhaphiophylla* (Swamp Paperbark), which offer permanently shaded areas.	• Maintain the integrity of the overstorey and middlestorey vegetation complexes. • Support natural regeneration by implementing a Watsonia control program.
Habitat diversity: It is highly possible that there are areas of permanent water within this section of river in some of the deeper pools (possibly >1 m in depth). The depth of water varies with the width of the main channel. The water is milky brown in colour, indicating upstream channel or catchment erosion. The vegetation diversity and low level of weed invasion give rise to an extensive range of habitats for terrestrial invertebrates, mammals and reptiles. A number of protected basking sites are available for the invertebrates and reptiles of the area. The dense streamside vegetation and emergent plants provide good habitat for frogs. Trees and shrubs provide good nesting and roosting sites for birds. The river environment contains sufficient variation in water depth and flows to provide habitat to a variety of aquatic organisms.	• Investigate the sediment source within the catchment and develop strategies to address erosion problems upstream to reduce the current sediment load. • Develop a fire management plan for the area in conjunction with the Department of Conservation and Land Management, the Shire, Fire and Rescue and the State Emergency Service to ensure a strategy is in place to protect the area from wildfires.

Other issues: There is evidence of a number of camping sites scattered along the riverbank, signified by the presence of ashes, broken glass and rubbish. Tracks in the area are likely to be maintained for fire management access, however it is apparent that recreational users, both on foot and in vehicles, are also using these tracks. The *Hakea undulata* (Wavy Leaved Hakea) population appears to be affected by some disease.

- Liaise with the local government authority to install boom gates with padlocks to limit the areas available to non-emergency vehicles and close off and rehabilitate unnecessary vehicle tracks.
- Monitor old access tracks for increased weed invasion and control immediately to reduce further invasion or increased fire risks.
- Ensure that the Department of Conservation and Land Management, the Shire and the local fire brigade are aware of any changes to access to the area.
- Investigate the disease that is affecting the health of the Hakea where resources permit, and work to assist the survival of this species. Contact AGWEST for advice.

Wooroloo Brook – Site 1: Maps 4-5 (Section B) Berri Reserve

Length of section (m): 860 m

Recorder's name: B Waining and N Siemon

Date surveyed: 16/6/99

Nearest road access: Reen Road

Lot number(s): 7702

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

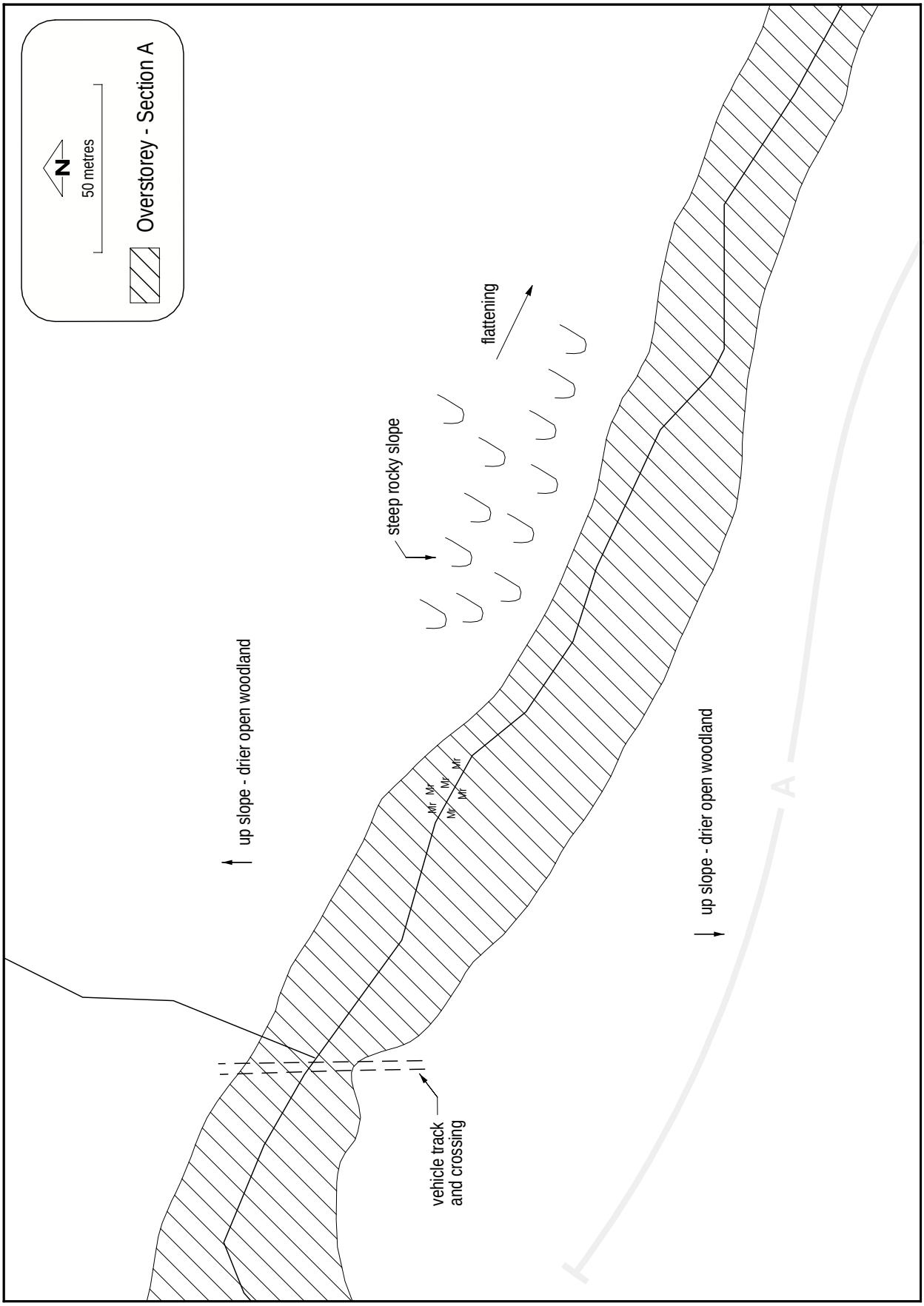
Bank stability: This portion of Wooroloo Brook in the Berri Reserve (Site 1, Section B) comprises the western end of the surveyed area. The floodplain in this section is wider and flatter, with a denser vegetation structure than the downstream section (Section A). The banks of the river channel, however, are very steep,(>60˚), and the main channel is up to 10 m wide and >1 m deep. The banks display significant levels of erosion, with up to 50% of the section affected. There are also localised occurrences of slumping, with minimal evidence of sedimentation.

Recommended Strategies

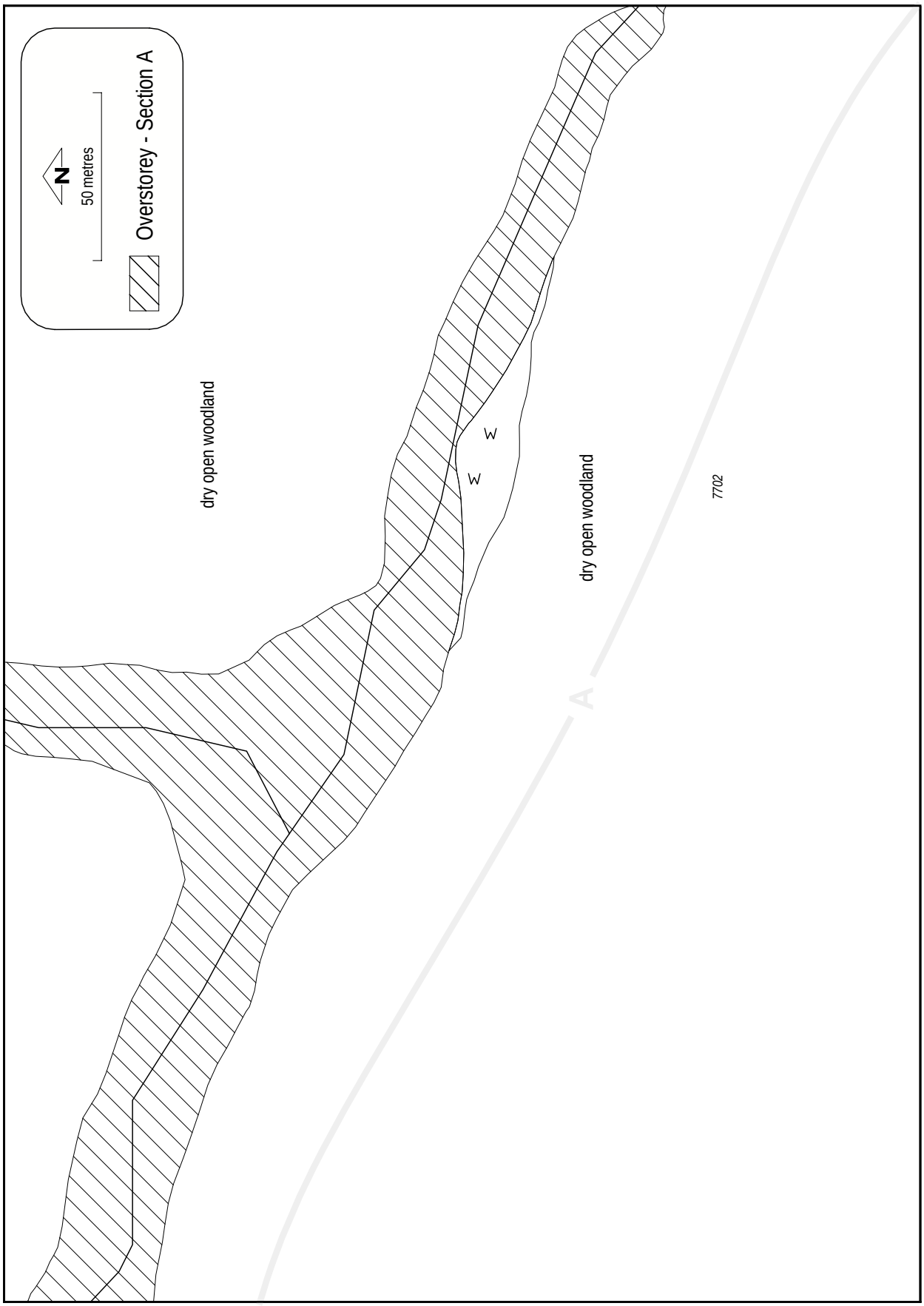
- Install soft engineering works to ameliorate bank destabilisation in the areas most severely affected (Appendix 4).
- Encourage the local government authority to re-design or relocate access tracks to minimise erosion impact.
- Liaise with the local government authority to re-assess open accessibility to all vehicles, closing off access through the installation of locked boom gates, and rationalise the number of tracks.

Vehicle access tracks wind their way to the riverbank in a number of places, and appear to be acting as preferential drainage paths, creating some bank destabilisation and contributing sediment to the waterway.	• Inform the local Fire and Rescue, Emergency Services Volunteers and the Department of Conservation and Land Management of any changes to access.
Vegetation: The vegetation of this section comprises a patchy overstorey, a dense continuous middlestorey and continuous understorey. The overstorey vegetation comprises exclusively native tree species, which include frequent *Eucalyptus rudis* (Flooded Gum) and occasional *Corymbia calophylla* (Marri) and *Melaleuca rhaphiophylla* (Swamp Paperbark). Dense thickets of native species in the middlestorey include frequent occurrences of *Grevillea glabrata* (Smooth Grevillea), *Hakea undulata* (Wavy Leaved Hakea), *H. trifurcata* (Two-Leaf Hakea), *Dryandra sessilis* (Parrot Bush), *Calothamnus sanguineus* (Pindak) and *C. quadrifidus* (One Sided Bottlebrush). There are also occasional *Acacia saligna* (Coojong), *A. pulchella* (Prickly Moses) and *Trymalium ledifolium*. The understorey consists of approximately 75% native species including *Leucopogon* sp. (Bearded Heath), *Lepidosperma effusum* (Spreading Sword Sedge), *L. longitudinale* (Pithy Sword Sedge) and *Baumea juncea* (Bare Twig Rush). The remaining 25% of cover is dominated by abundant stands of Watsonia (*Watsonia bulbillifera*) with only occasional annual grasses present.	• Remove Watsonia (see Appendix 2), working in manageable sized nodes to reduce the possibility of this species becoming widespread through the area. • Monitor for natural revegetation of the area. Revegetate the understorey with appropriate locally derived native species (Appendix 3) if required. • Ensure an adequate fire management plan is in place, and that all State Emergency Services Volunteers and Fire and Rescue have copies of maps which show access to the reserve.
Stream Cover: There is abundant fringing native vegetation providing permanent shade within the brook. The overhanging paperbarks and eucalypts provide shade, as well as instream cover in the form of leaf litter and branches. There are also rocks and other vegetative material providing instream cover.	• Retain instream features providing cover, ensuring stream flow is not interrupted or bank stability threatened. • Control Watsonia, limiting access to defined weed control pathways to protect native vegetation from trampling and other disturbance factors, to encourage natural regeneration processes.

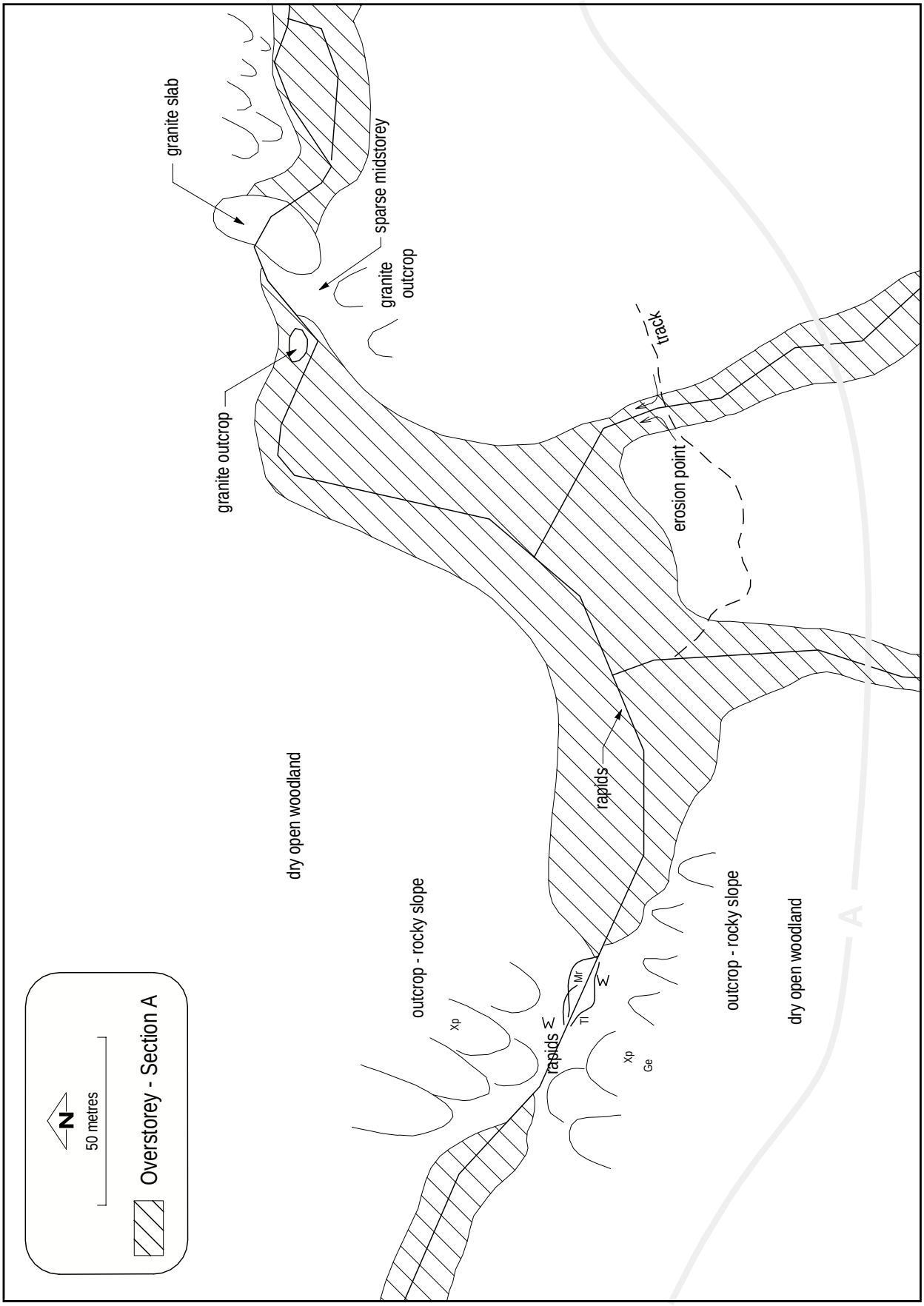
Habitat diversity: It is probable that there is permanent water within the brook providing perennial habitat for aquatic organisms. The water is relatively deep, up to 1.5 m in depth. It is discoloured, a milky brown turbid colour, indicating the presence of suspended clays and fine clays/silt. Wildlife observed within this section included an echidna, with signs of wombats, kangaroos and bandicoots. The density and variety of vegetation types provides suitable continuous protected habitat for terrestrial animals, reptiles and frogs. The trees and shrubs present provide good nesting/roosting sites for birds. Aquatic organisms are supported through a diversity of habitat including cascades/riffles, meanders, pools, instream logs and cobbles.	• Investigate the source (s) of sediment entering the brook and address as required. • Retain instream habitat features that do not exacerbate erosion. • Manage foreshore vegetation, to ensure the protection of the habitats available for a range of animals by monitoring and controlling weed invasion. • Install signage about the diverse fauna in the reserve for the interest of recreational users of the reserve to increase public awareness of the importance of maintaining healthy riparian areas.
Other issues: There are a number of informal campsites along the river foreshore, at the end of access tracks. Fires have been lit in these areas, and they contain rubbish including broken glass. The fires may present a problem if they burn out of control and jump to the dense foreshore vegetation. The tracks and campsites appear to be a source of sediment to the river, with erosion evident along their length. The *Hakea undulata* (Wavy Leaved Hakea) populations display signs of disease throughout the area.	• Close off unnecessary tracks and restrict general access through the installation of boom gates to prevent access by unauthorised vehicles. • Ensure that an adequate fire management plan is in place. • Assess the condition of the *Hakea undulata* (Wavy Leaved Hakea) where resources permit and address as required. Contact AGWEST to obtain advice. • Contact appropriate government agencies to enforce a no camping policy.



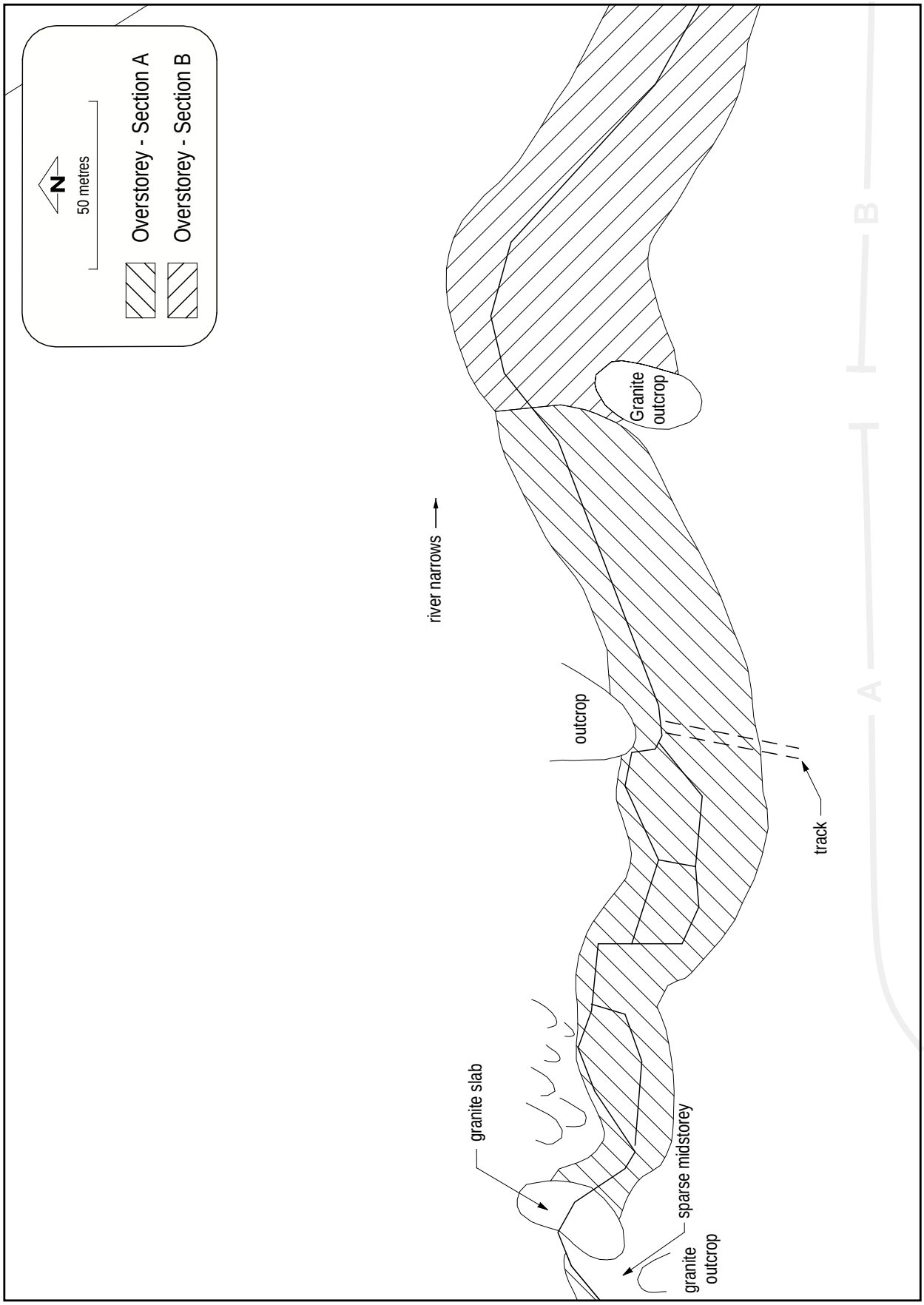
Berri Reserve Site 1: Map 1



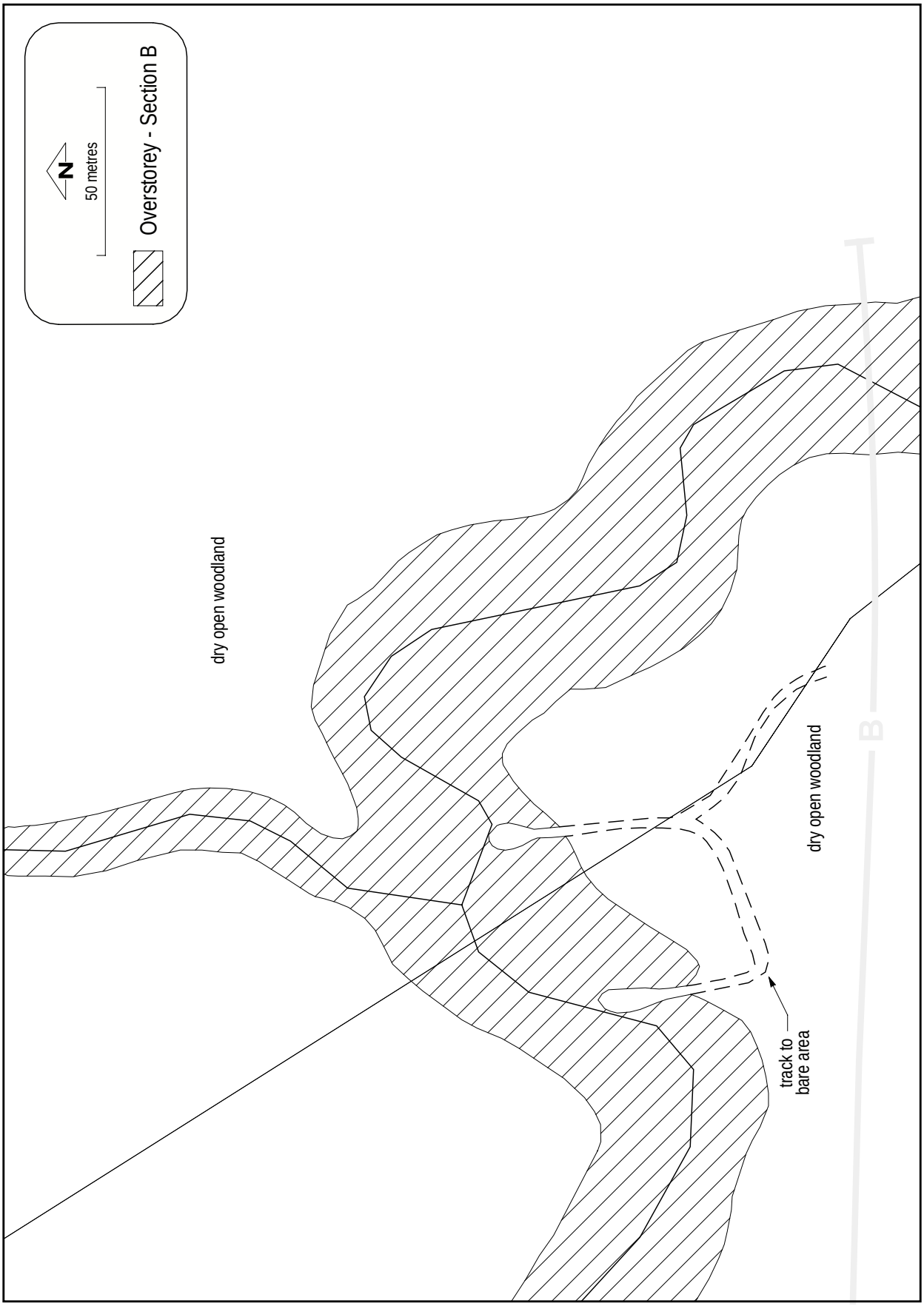
Berri Reserve Site 1: Map 2



Berri Reserve Site 1: Map 3



Berri Reserve Site 1: Map 4



Berri Reserve Site 1: Map 5

4.2 Equitus Gully

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Equitus Gully – Site 2: Maps 2-3 (Section A) East Road

Length of section (m): 600 m

Recorder's name: B Waining and N Siemon

Date surveyed: 15/6/99

Nearest road access: East Road

Lot number(s):

Summary of river health:

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

Stream Condition
Green
Good
22

Description

Bank stability: This site along Equitus Gully (Site 3, Section A) comprises the northern end of the section. The foreshore banks are steep (45-60˚), and open out to slopes vegetated by dry open woodland. The banks exhibit significant levels of erosion, localised areas of sedimentation and minimal slumping. There are no artificial stabilisation structures within the section. There is a crossing point within this section, which directly crosses the banks of the brook with no stabilisation structures. The main channel becomes braided along this section.

Vegetation: This section is a continuous, open overstorey of exclusively native plant species including frequent occurrences of *Corymbia calophylla* (Marri), *Eucalyptus laeliae* (Darling Range Ghost Gum), and occasional *E. wandoo* (Wandoo), *E. rudis* (Flooded Gum) and *Banksia littoralis* (Swamp Banksia). The middlestorey is patchy and comprises exclusively native plant species including abundant *Astartea fascicularis* (Common Astartea) and occasional *Acacia saligna* (Coojong), *Dryandra sessilis* (Parrot Bush), *Hakea trifurcata* (Two-Leaf Hakea), *H. undulata* (Wavy Leaved Hakea), *Trymalium ledifolium* and *Xanthorrhoea preissii*

Recommended Strategies

- Encourage the local government authority to establish a formalised crossing point that it is the width of the main channel and does not constrict water flow or exacerbate bank erosion.
- Install artificial stabilisation structures using soft engineering techniques (Appendix 4) to stabilise badly affected areas of bank.

- Ensure a fire management plan is developed and available to Fire and Rescue, the Shire and the State Emergency Services.
- Liaise with the landholder about the current land management practices, stocking levels and opportunities to protect the riparian zone.
- Encourage the landholder to hold working bees during spring to hand weed Fleabane and selectively treat other weeds prior to seed set, to reduce the rate of weed spread.

(Grass Tree). The understorey is also patchy and comprises approximately 75% native plant species including frequent *Dryandra nivea* (Couch Honeypot) and *Leucopogon* sp. (Bearded Heath), with occasional to infrequent *Haemodorum* sp., *Hibbertia subvaginata* (Yellow Buttercups), *Hypocalymma robustum* (Swan River Myrtle), *Macrozamia reidlei* (Zamia), *Lechenaultia floribundum*, *L. biloba*, *Drosera microphylla* and *Clematis pubescens.* Included within the understorey are also occurrences of native rushes and sedges including *Lepidosperma angustatum*, *Juncus pallidus* and *Typha domingensis* (Native Bulrush). The weeds within the understorey include occasional Soursob (*Oxalis pes-caprae*), Fleabane (*Conyza* sp.) and annual grasses and pastures including Medics (*Medicago* sp.).	
Stream Cover: The continuous overstorey provides areas of permanent shade along the brook. Aquatic vegetation provides temporary instream cover. Large logs occur very infrequently along the brook.	• Retain instream cover features such as logs and branches, ensuring that bank stability is not threatened. • Revegetate the fringing vegetation zones, with appropriate native species (Appendix 3).
Habitat diversity: It is uncertain if there is any permanent water within the brook. During the time of the survey the depth of water within the main channel varied from a few centimetres, up to 0.4 m. The water quality is good, with no signs of turbidity or other evidence of degradation. There was evidence of kangaroos, emus, bandicoots and numerous bird species present at the site. The variety of vegetation types and its structure provides habitat for terrestrial invertebrates and reptiles. The trees, shrubs and rushes provide nesting and roosting places for birds. The instream environment provides a variety of aquatic habitats in the form of riffles, cascades, meanders, and instream cobbles and rocks.	• Retain instream habitat features. • Maintain vegetation diversity and structure. • Control weed species within the section and frequently monitor for new weed invasions.
Other issues: There is evidence of the area being used for camping, with old residue from campfires visible. The firebreaks/access tracks are starting to become overgrown. There is a constructed “humpy” located on the banks of the brook.	• Maintain firebreaks in accordance with Council policy controlling weeds to reduce the fire hazard. • Liaise with the local government authority to prevent unauthorised access and fire lighting by ensuring that fences and access points are locked. • Develop a fire management plan for the area in conjunction with the Department of Conservation and Land Management, the Shire, Fire and Rescue and the State Emergency Service ensuring all parties are informed of any change to access to the area.

Equitus Gully – Site 2: Maps 1-2 (Section B) East Road

Length of section (m): 680 m

Recorder's name: B Waining and N Siemon

Date surveyed: 15/6/99

Nearest road access: East Road

Lot number(s):

Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Yellow	Green	Blue	Yellow
Moderate	Good	Excellent	Moderate
4	6	8	4

Stream Condition
Green
Good
22

Description

Bank stability: The channel along this section of Equitus Gully (Site 3, Section B) is approximately 2 m wide and up to 1m deep. The banks are very steep, with a gradient >60˚, and exhibit localised areas of erosion and sedimentation. There is minimal slumping along the section. Much of the erosion is confined to the bends in the brook, where peak flow events have destabilised the banks. These occurrences of erosion may be the primary source of sediment within the brook.

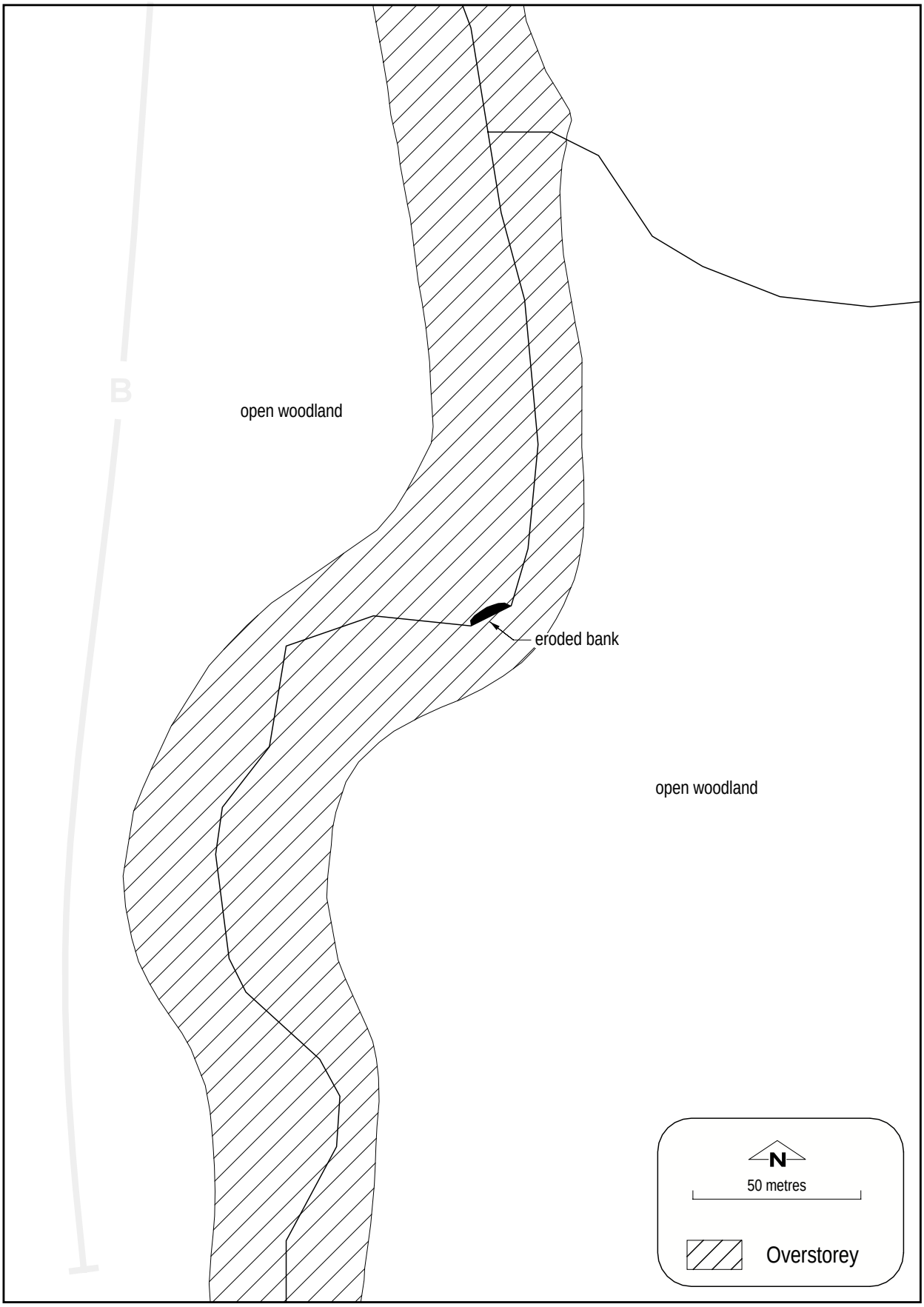
Vegetation: The vegetation of this section is characterised by a patchy overstorey, continuous middlestorey and patchy native understorey. Weeds are only present within the understorey, comprising approximately 10% of the cover. The overstorey comprises occasional to rare *Eucalyptus wandoo* (Wandoo), *E. marginata* (Jarrah), *E. rudis* (Flooded Gum), *E. laeliae* (Darling Range Ghost Gum), *Banksia littoralis* (Swamp Banksia) and *Corymbia calophylla* (Marri). The middlestorey is dominated by dense stands of *Trymalium ledifolium*. Also present within the middlestorey are occasional *Acacia saligna* (Coojong), *Xanthorrhoea preissii* (Grass Tree) and *Dryandra sessilis* (Parrot Bush). A range of native grasses, rushes and sedges including *Haemodorum* sp., *Juncus pallidus* (Pale Rush), *Anigozanthos*

Recommended Strategies

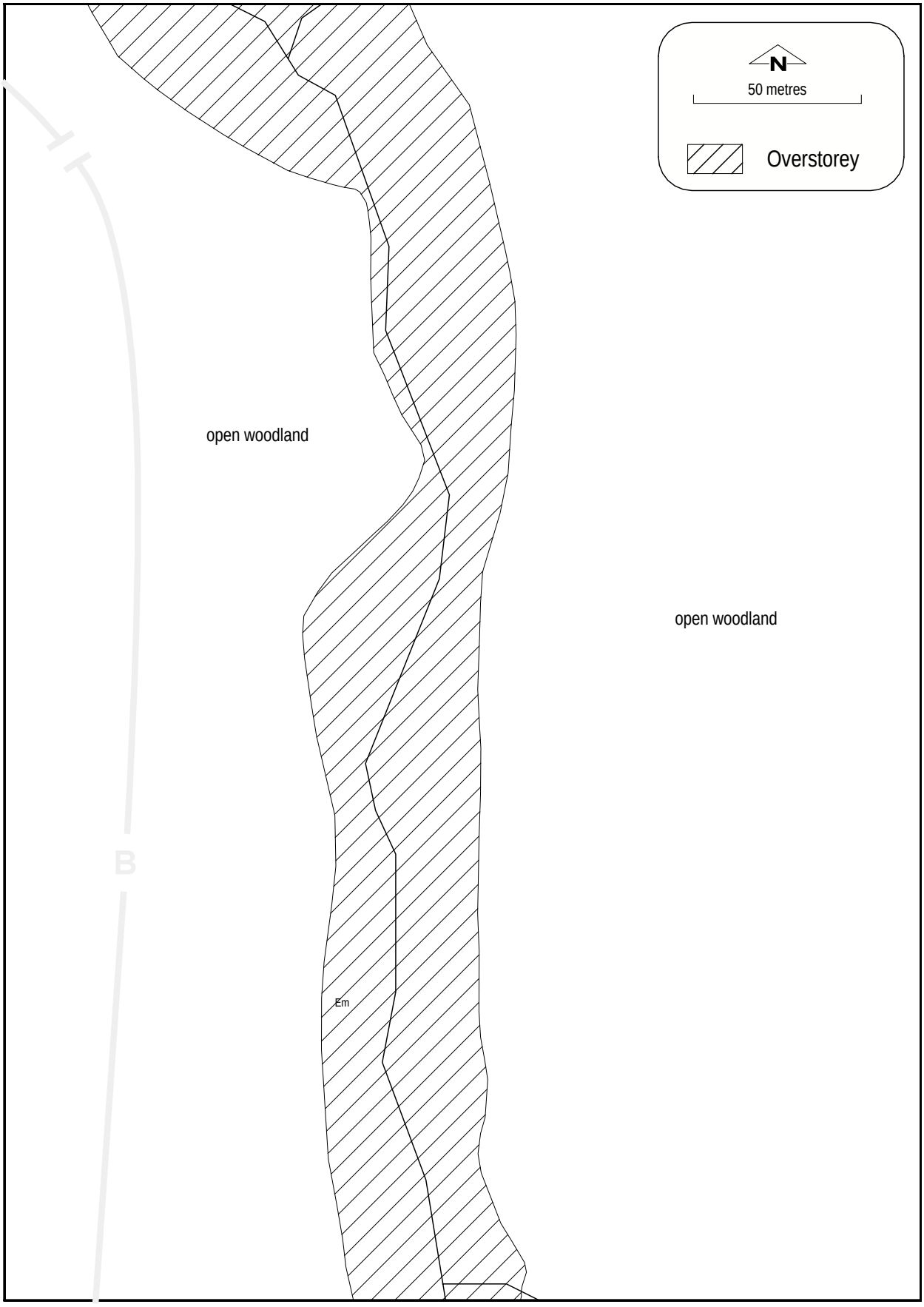
- Approach the Water and Rivers Commission to determine if the water quantity entering the waterway from the catchment can be monitored and determine whether or not there are any river restoration techniques that may be appropriate to slow water flow across the catchment.
- Monitor natural regeneration of the riparian zone, and reinforce where necessary by planting appropriate tubestock of native species (Appendix 3).

- Control annual weed species like Fleabane by removing manually them prior to flowering, to reduce the rate of spread.
- Monitor natural regeneration of the riparian zone, and reinforce where necessary by planting appropriate tubestock of native species (Appendix 3).
- Develop a fire management plan for the area in conjunction with the Shire, Fire and Rescue and the State Emergency Service.
- Utilise a qualified operator to undertake localised control of annual grasses using Fusilade®, taking care not to impact on native grasses (Appendix 2).

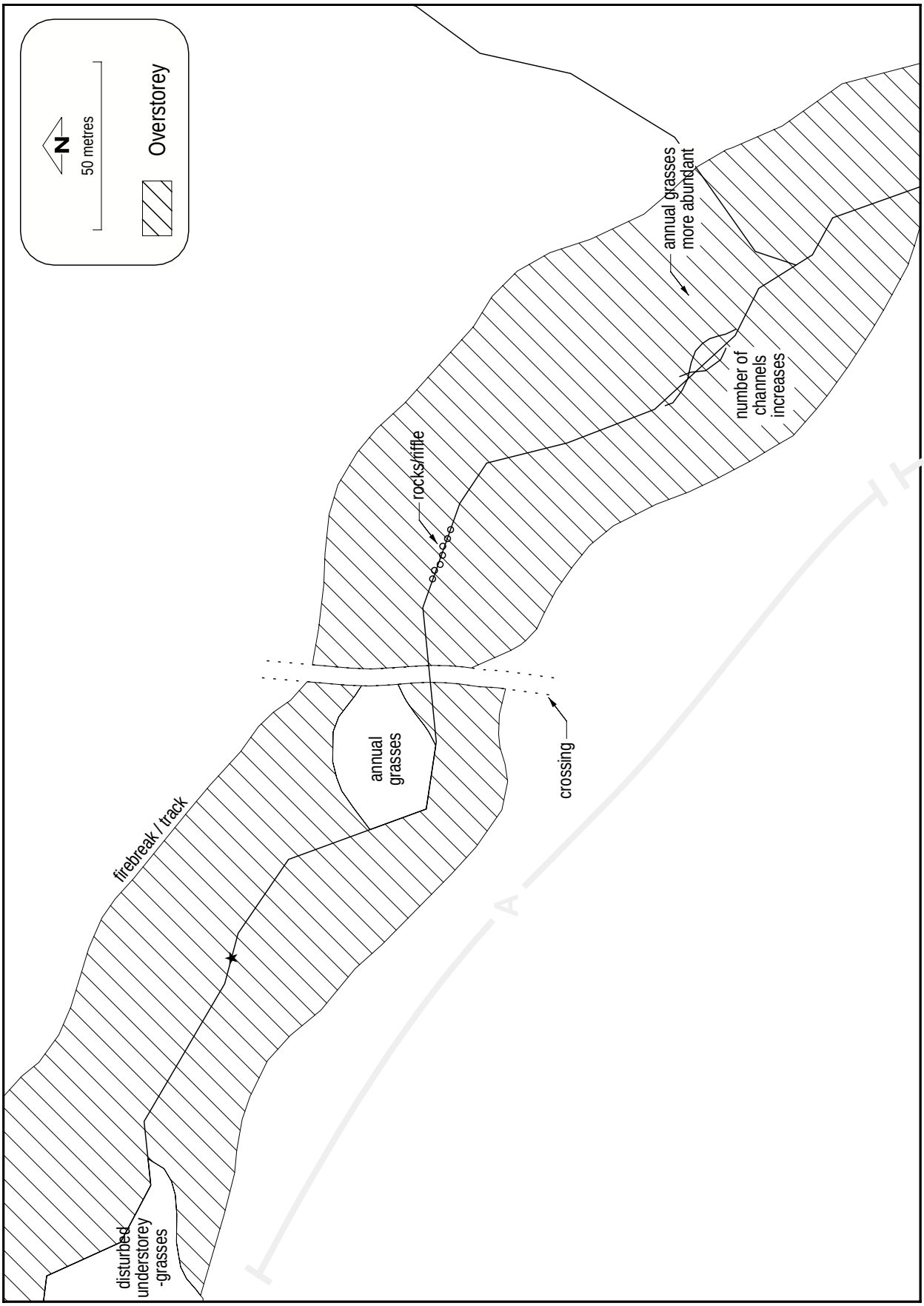
humilis (Catspaw), *Alexgeorgea arenicola* and *Dianella revoluta* (Flax Lily) are present but provide only sparse understorey. Weeds present include Fleabane (*Conyza* sp.) and annual grasses.	
Stream Cover: There is abundant stream cover due to the dense fringing *Trymalium ledifolium*. The overstorey species also provide some areas of permanent shade within the brook. Leaf litter, branches and vegetation provide instream cover.	• Retain instream features that do not impact on bank stability. • Monitor natural regeneration of the riparian zone, and reinforce where necessary by planting appropriate tubestock of native species (Appendix 3).
Habitat diversity: It is uncertain if this section of the brook maintains permanent water. During the time of the survey the water depth was generally <0.2 m, however there are isolated deeper pools. The water is slightly discoloured, from tannins and possibly some sediment. The dense fringing vegetation provides protected habitat for terrestrial invertebrates and reptiles. The dense streamside vegetation also provides suitable habitat for frogs. The trees and shrubs provide ample areas for nesting and roosting sites for birds. Instream meanders and pools maintain some variety of habitats for the aquatic organisms. At the time of survey, kangaroos, emus and various woodland bird species were observed.	• Protect the vegetative diversity of the area by assessing the stocking and land management regime. • Liaise with the landholder to minimise trampling of the native vegetation, vehicle movement and stock access. • Monitor for the presence of feral animals such as rabbits and foxes. If detected, liaise with the Department of Conservation and Land Management to control.
Other issues: There appear to be minimal stocking rates in this part of the property. This management practice is helping to protect the vegetation and waterway from widespread destruction by livestock. Managing these stocking levels, possibly excluding stock, would continue to benefit this area. It is important that the firebreaks are maintained effectively to enable ready access in case of wildfire.	• Maintain fences to exclude stock. • Undertake annual maintenance of firebreaks to reduce weed invasion into the healthy foreshore vegetation and to reduce the fire hazard.



Equitus Gully Site 2: Map 1



Equitus Gully Site 2: Map 2



Equitus Gully Site 2: Map 3

4.3 Gidgegannup Brook

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Gidgegannup Brook – Site 3: Maps 1 and 3 (Section A)

Length of section (m): 830 m

Recorder's name: B Waining

Date surveyed: 24/6/99

Nearest road access: Cameron Road and Joseph Road

Lot number(s): 119

Summary of river health:

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

Stream Condition
Black
Very Poor
2

Description

Bank stability: This description is relevant for Site 2, Section A of Gidgegannup Brook, which occurs at the northern and southern ends of the surveyed area outlined on Map 1 and Map 3 respectively. The banks are severely eroded, with more than 50% of the section affected by bank destabilisation. There are also significant proportions of the bank and channel affected by slumping and sedimentation. There are some stabilisation devices in isolated areas, in the form of rock piles, strategically placed instream and along the banks in an attempt to reduce the levels of scouring. The banks of the main brook channel are approximately 5 m wide and up to 1 m deep. The banks are very steep (>60˚) and show areas of undercutting. Much of the erosion and destabilisation of the banks is associated with saline seepage from the surrounding paddocks. This seepage has created bare ground patches with no vegetation, which have lead to the development of erosion gullies and rills leading into the brook. Grazing sheep have uncontrolled access to the brook.

Vegetation: The vegetation health within this site is very poor. The overstorey and the middlestorey cover is sparse. The understorey provides near to continuous cover. The overstorey comprises occasional stands of trees, predominantly *Eucalyptus*

Recommended Strategies

- Encourage the landowner to fence the waterway and establish off-line watering points to prevent stock access and minimise further impact on bank stability.
- Revegetate the foreshore zones of the brook, with appropriate salt tolerant native species (Table 5 Section 6.8).
- Install soft engineering devices at the worst affected areas of bank destabilisation (Appendix 4).
- Revegetate upslope to contribute to a reduction in the flow from saline seeps to the brook.
- Liaise with AGWEST to investigate the potential to establish salt tolerant perennial pastures within the surrounding paddock. Ensure that the management of such a cropping system prevents the plants from seeding, and that plant fragments are trapped to prevent these species from invading the riparian foreshore.

- Inform the landowner of the benefits of improving foreshore health and encourage the exclusion of stock from the waterway.
- Revegetate the foreshore fringe with appropriate salt tolerant native species (Appendix 3 and Table 5).

rudis (Flooded Gum) and *Corymbia calophylla* (Marri). Many of the trees are dead, or are dying, which is most likely attributable to increasing salinity. The middlestorey is absent from much of the section, with species present in only 160 m of the total length of the section. These species include the native *Hakea amplexicaulis* (Prickly Hakea) and the introduced Bulrush (*Typha orientalis*). These occur in conjunction with a section of patchy overstorey, which is showing signs of regeneration following exclusion of stock from the area. The understorey consists of approximately 90% pasture grass species and weeds, with occasional to infrequent occurrences of *Juncus* spp. rushes. The annual pasture cover also contains some occurrences of Dock (*Rumex* spp.) and Guildford Grass (*Romulea rosea*).	• Address saline seepage problems, through revegetation techniques. • Investigate the use of perennial pastures and significant levels of tree planting upslope and adjacent to the brook. • Undertake to control introduced Bulrush by brush cutting in May, taking care to minimise damage to foreshore banks. • Establish adjacent plantings of instream native rushes and sedges prior to control to ensure adequate habitats for organisms are maintained and foreshore stability is not further threatened.
Stream Cover: The fringing native vegetation provides only occasional cover along the waterway. There are also rare occurrences of stream cover maintained by exotic vegetation. Within the channel, leaf litter and branches provide permanent cover. There are isolated rocks within the main channel, which may also provide some areas of instream cover.	• Retain instream features where they do not disrupt water flow or exacerbate erosion. • Revegetate the foreshore fringe using appropriate native species (Appendix 3).
Habitat diversity: It is unlikely that there is any permanent water within this section. The water is clear, salty and shallow, less than 0.2 m deep. There is a lack of vegetation and vegetative diversity within this section and little habitat value to the organisms existing in this area. During the survey, wildlife observed included Black Cockatoos, Ducks and Finches.	• Restore salt tolerant native vegetation in dense nodes along the foreshore fringe using appropriate native species (Appendix 3). • Erect fences to exclude stock from the area. • Retain instream habitat features.
Other issues: The major issue facing this section of brook is the presence of severe salt scalds and hypersaline water seeping from the surrounding cleared pasture paddocks. The associated vegetation loss and erosion has decreased the overall health of the waterway.	• Liaise with the local government agencies, the Water and Rivers Commission and AGWEST to address the salinity issue on a whole of catchment scale and try to develop a media campaign to encourage local landholders to become involved in catchment management. • Install fencing to exclude stock from the waterway and try to establish nodes of salt tolerant species.

Gidgegannup Brook – Site 3: Map 2 (Section B)

Length of section (m): 370 m

Recorder's name: B Waining

Date surveyed: 24/6/99

Nearest road access: Cameron Road and Joseph Road

Lot number(s): 119

Summary of river health:

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

Stream Condition
Yellow
Moderate
18

Description

Bank stability: This section of Gidgegannup Brook (Site 2, Section B) is outlined on Map 2. This foreshore displays significant levels of erosion, with localised areas of sedimentation and slumping. There is a dam within the main waterway. The banks of the brook are steep (up to 60˚) and up to 3 m apart. The main channel contained within, is approximately 1 m wide and 0.7 m deep. However, the main channel begins to braid just to the south of the dam, which appears to have been created from excessive sedimentation. This section of Gidgegannup Brook is not as badly affected by the impacts of salinity as Section A. Fencing has been erected to exclude stock from the foreshore.

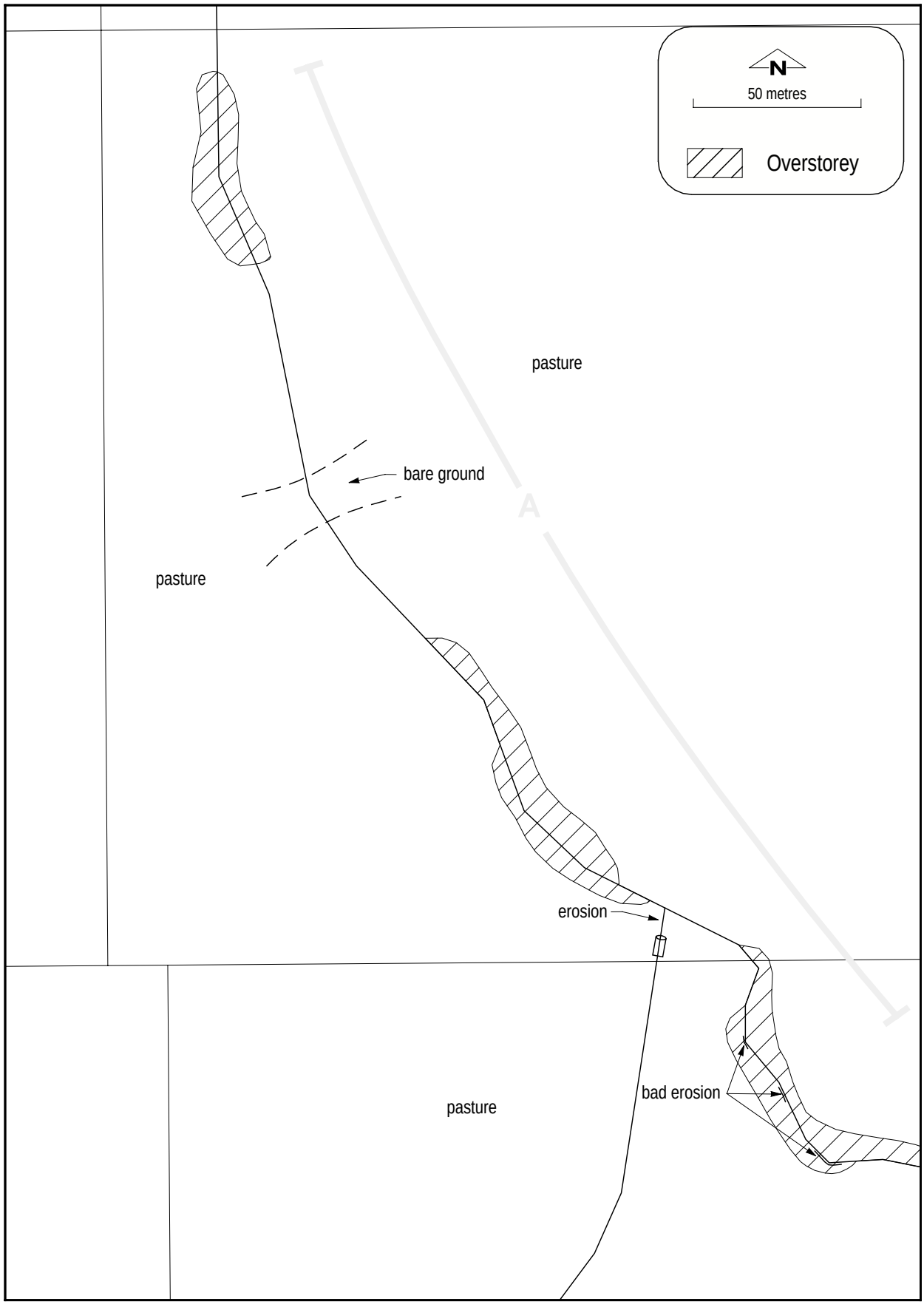
Vegetation: The overstorey cover of this section is limited to isolated patches of native trees. Species present include frequent *Corymbia calophylla* (Marri) with occasional to infrequent *Melaleuca cuticularis* (Saltwater Paperbark), *Eucalyptus marginata* (Jarrah) and *Nuytsia floribunda* (Christmas Tree). The middlestorey is sparse and includes occasional to infrequent occurrences of *Acacia pulchella* (Prickly Moses), *Astartea fascicularis* (Common Astartea), *Hakea amplexicaulis* (Prickly Hakea) and *Xanthorrhoea preissii* (Grass Tree). The understorey of this section is patchy. The only remnant native

Recommended Strategies

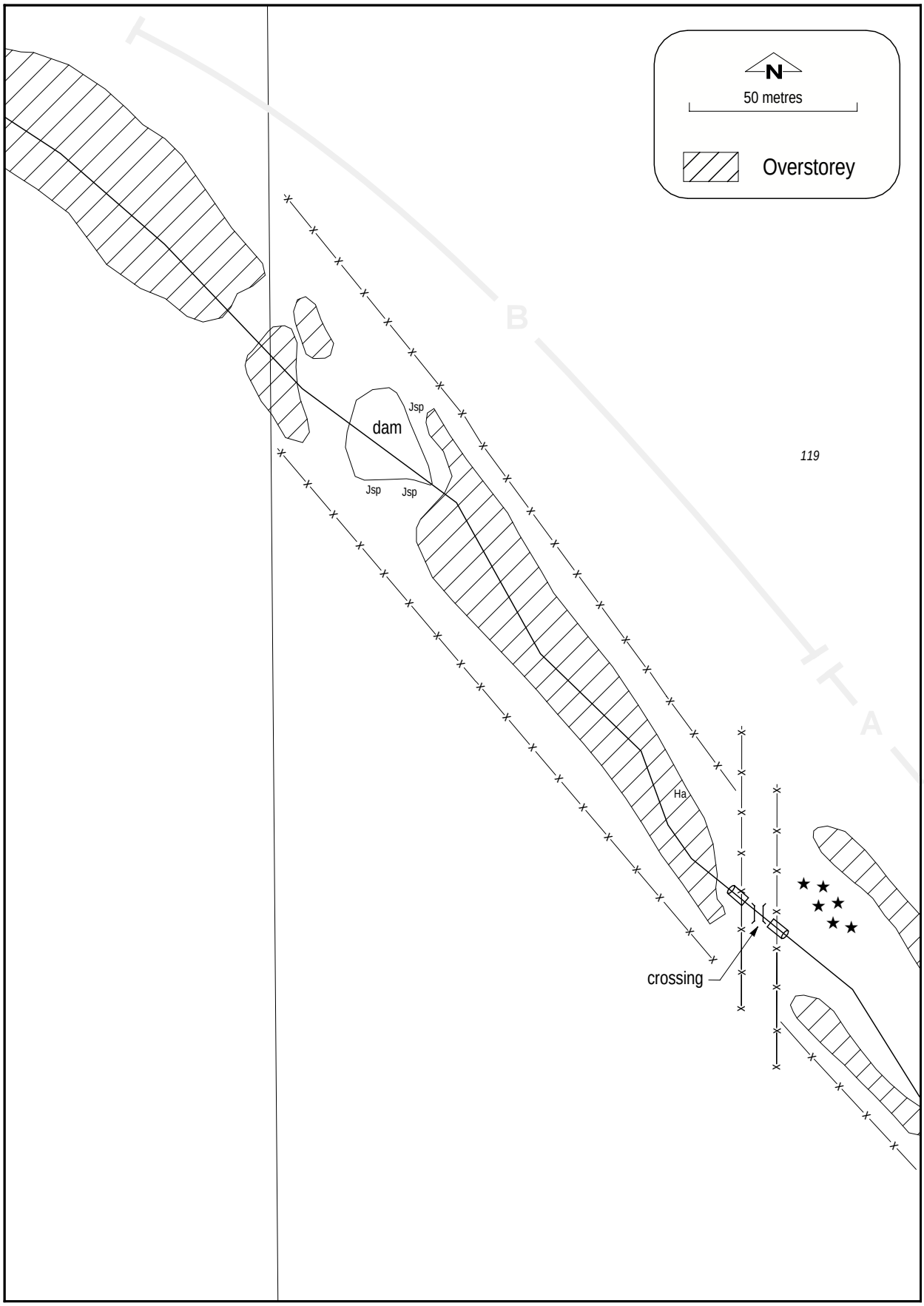
- Address areas of bank destabilisation with the use of soft engineering techniques (Appendix 4).
- Revegetate the area of the dam with appropriate native species (Appendix 3).
- Liaise with the local government authority, AGWEST and the Water ad Rivers Commission to investigate opportunities to retain water upslope by increasing groundwater use through planting trees. In the event that such works are insufficient, investigate the feasibility of diverting part of the saline flow into a holding pond.

- Revegetate around the dam and foreshore areas using salt tolerant species of plants, using native species endemic to the Swan Coastal Plain (Appendix 3, Table 5 Section 6.8).
- Combine direct seeding and tubestock planting revegetation techniques
- Implement a direct seeding program in April and again in September, mixing all strata of vegetation.
- Continue revegetation efforts, seeking help from the catchment groups and monitor and control for weed invasion.

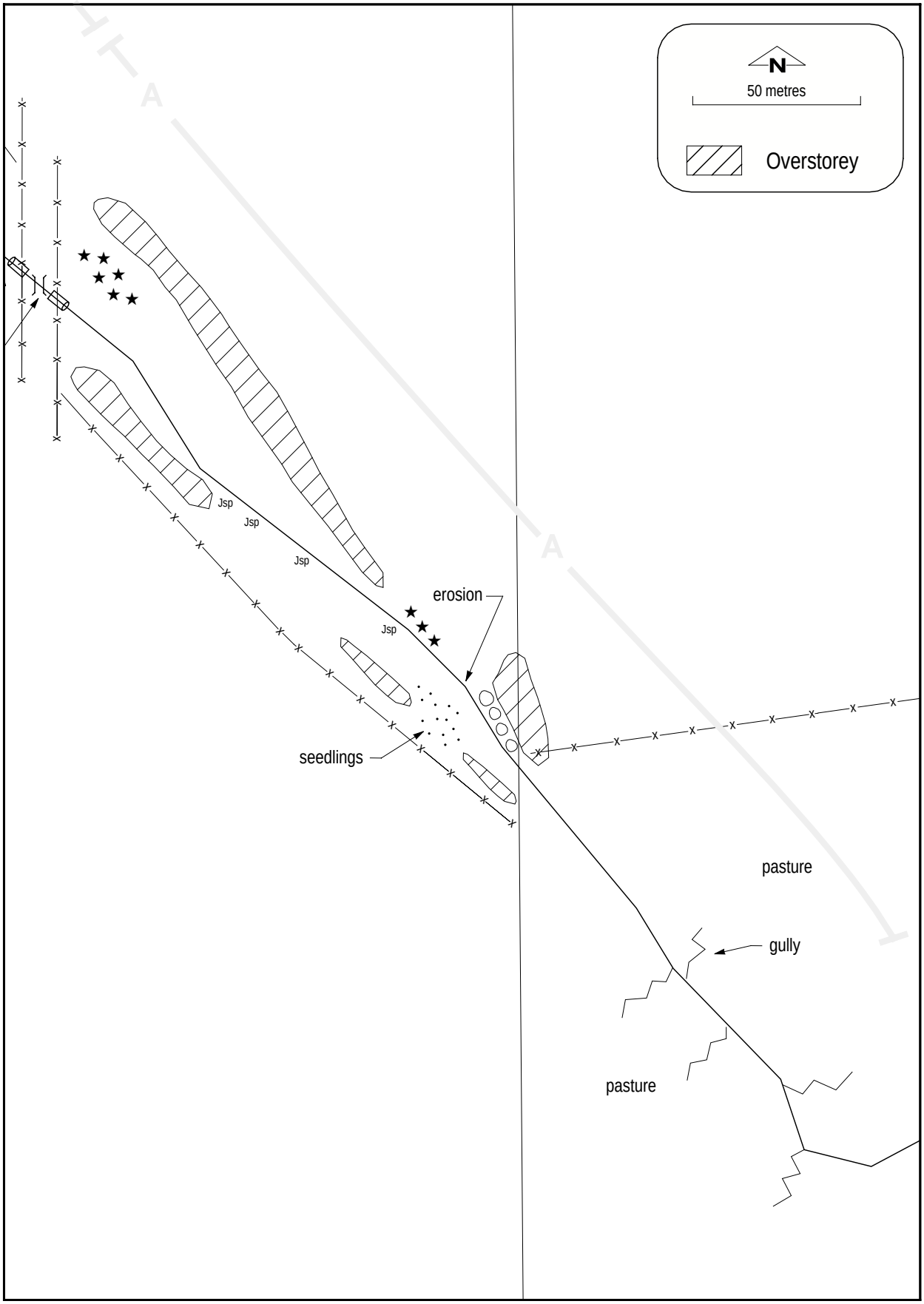
species are frequent *Baeckea camphorosmae* (Camphor Myrtle) and occasional *Juncus pauciflorus* (Slender Rush) and *Juncus pallidus* (Pale Rush). The understorey is dominated by weed species, including annual grasses and pasture, Shivery Grass (*Briza minor*), Guildford Grass (*Romulea rosea*) and Dock (*Rumex* sp.). There is an area on the left bank where there has been an effort made to revegetate the area, with mounding and planting evident. The survival rates of the eucalypt seedlings are poor, and they exist with an understorey of pasture grasses.	• Provide the landholder with the Salinity Action Plan and additional relevant information from government agencies that provide advice specifically about management of hypersaline seeps and saline land (Agriculture WA). • Monitor for the exotic rush *Juncus acutus*, and control as quickly as possible by repeated brush cutting prior to seeding to manage the spread. • Hand weed broadleaf weeds such as Dock prior to flowering and seed set to minimise the spread along the foreshore area.
Stream Cover: There is some stream cover provided by the fringing native vegetation, which provides areas of permanent shade within the brook. The exotic species do not contribute any cover. There is instream cover provided by leaf litter and branches.	• Revegetate the dam fringes with salt tolerant species such as *Melaleuca rhaphiophylla* (Freshwater Paperbark), *M. cuticularis* (Saltwater Paperbark) and *Baumea juncea* (Bare Twig Rush) on the banks with *Juncus pallidus* (Pale Rush) planted between the high and low water mark. • Retain instream cover features where they do not impact on the brook hydrology or bank stability.
Habitat diversity: The dam is the only area that maintains permanent water within this survey section. The water within the brook is shallow, less than 0.2 m in depth flowing along a relatively flat-based channel, creating a braided section. The vegetation complex of the section provides good diversity of vegetation types and a protected habitat for a variety of terrestrial animals and reptiles. Dense streamside vegetation provides habitat for frogs. There are nesting and roosting sites for birds within the trees and shrubs of the area. The meandering nature of the brook, with occasional instream cobbles, provides habitat for the aquatic organisms of the brook.	• Continue the revegetation program, using combined direct seeding and tubestock planting of salt tolerant plants. • Retain instream habitat features. • Investigate the possibility of monitoring the sediment load and identify sources of sediment to ensure that the carrying capacity of the brook is not exceeded.
Other issues: This section has been fenced off from stock access. The level of streamside vegetation has helped to reduce the impact of salinity on the waterway within this section.	• Maintain fences to exclude stock. • Maintain healthy and diverse plant communities.



Gidgegannup Brook Site 3: Map 1



Gidgegannup Brook Site 3: Map 2



Gidgegannup Brook Site 3: Map 3

4.4 Tilden Park

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Wooroloo Brook – Site 4: Maps 1-3 (Section A) Tilden Park

Length of section (m): 1020 m

Recorder's name: B Waining

Date surveyed: /6/99

Nearest road access: Tilden Drive

Lot number(s): 12743, 12621 and 30

Summary of river health:

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

Stream Condition
Yellow
Moderate
18

Description

Bank stability: This section of the brook along Tilden Park (Site 4) exhibits only minimal bank destabilisation, with only 5% of the section affected by erosion, slumping or sedimentation. The predominant areas displaying bank disturbance surround the culverts installed within the brook. The foreshore banks are steep, 45-60˚, and the water depth is predominantly shallow to a maximum of approximately 0.2 m. At the southern end of the surveyed section the banks are higher, creating a channel with a maximum depth of approximately 1m. The channel is narrow to a maximum of 1 m in width, but becomes increasingly wider and shallower where it becomes braided. Stormwater drain outfalls entering the section from along roadsides are the worst affected areas in terms of erosion and bank destabilisation.

Recommended Strategies

- Encourage the local government authority to install stabilisation structures at the outfall of stormwater drains.
- Approach the local government authority to address scouring around culverts, with the use of appropriate engineering techniques (Appendix 4).

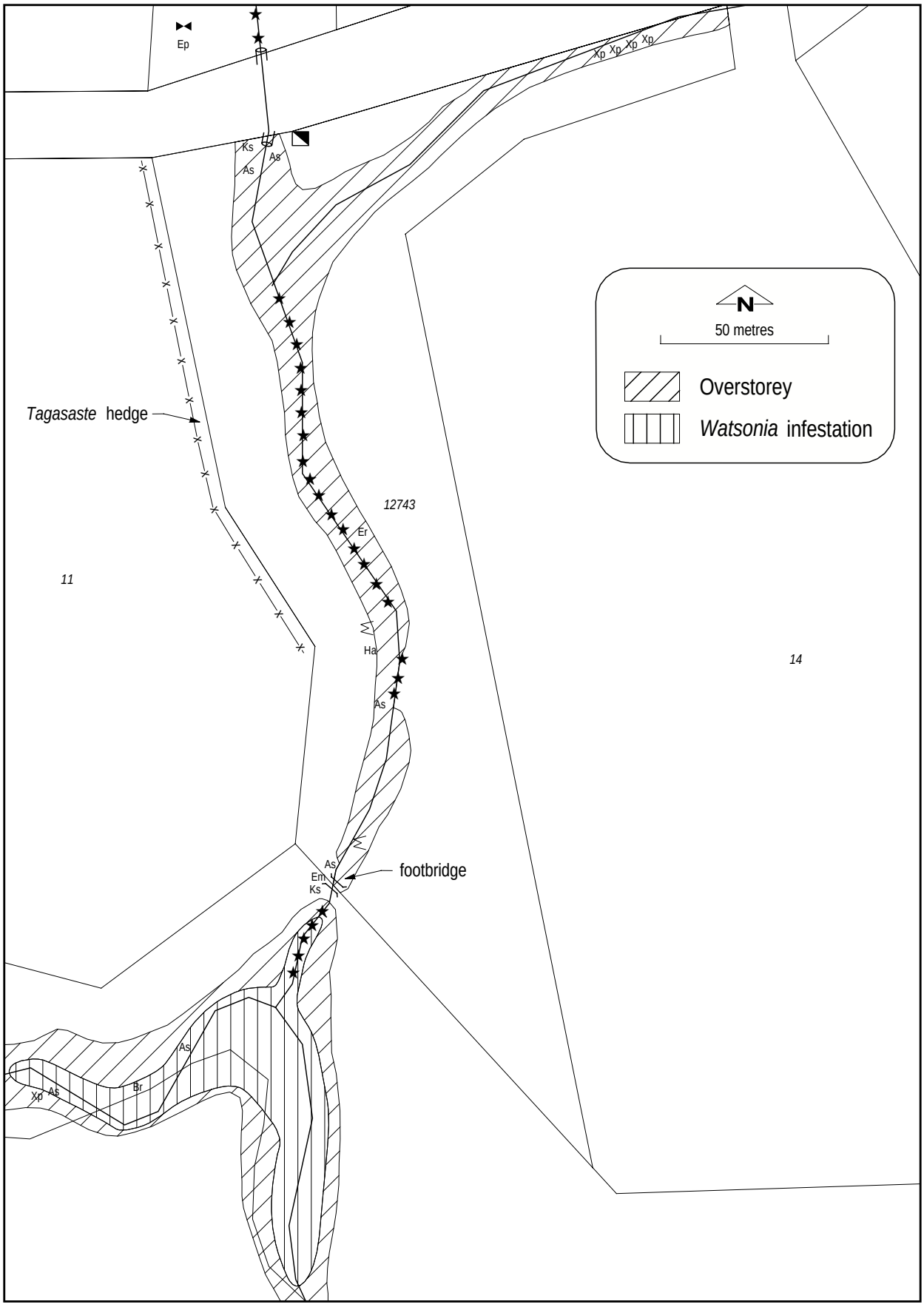
Vegetation: The vegetation cover of this section is continuous in the overstorey and understorey, and sparse in the middlestorey. The overstorey appears to be largely derived from revegetation activities, with a mixture of overstorey species, not all of which are native to the region. Present within the overstorey are occasional to frequent *Eucalyptus laeliae* (Darling Range Ghost Gum), *E. marginata* (Jarrah), *E. patens* (Blackbutt), *E. wandoo* (Wandoo), *Melaleuca rhaphiophylla* (Swamp Paperbark) and a species of

- Encourage the landholders to become actively involved in managing Watsonia and Bridal Creeper occurrences, to prevent these species becoming widespread. See Appendix 2 for suggested weed control methods.
- Work to manage the extent of understorey weeds, such as annual grasses, by increasing the native middlestorey and overstorey extent and density using appropriate species (Appendix 3).

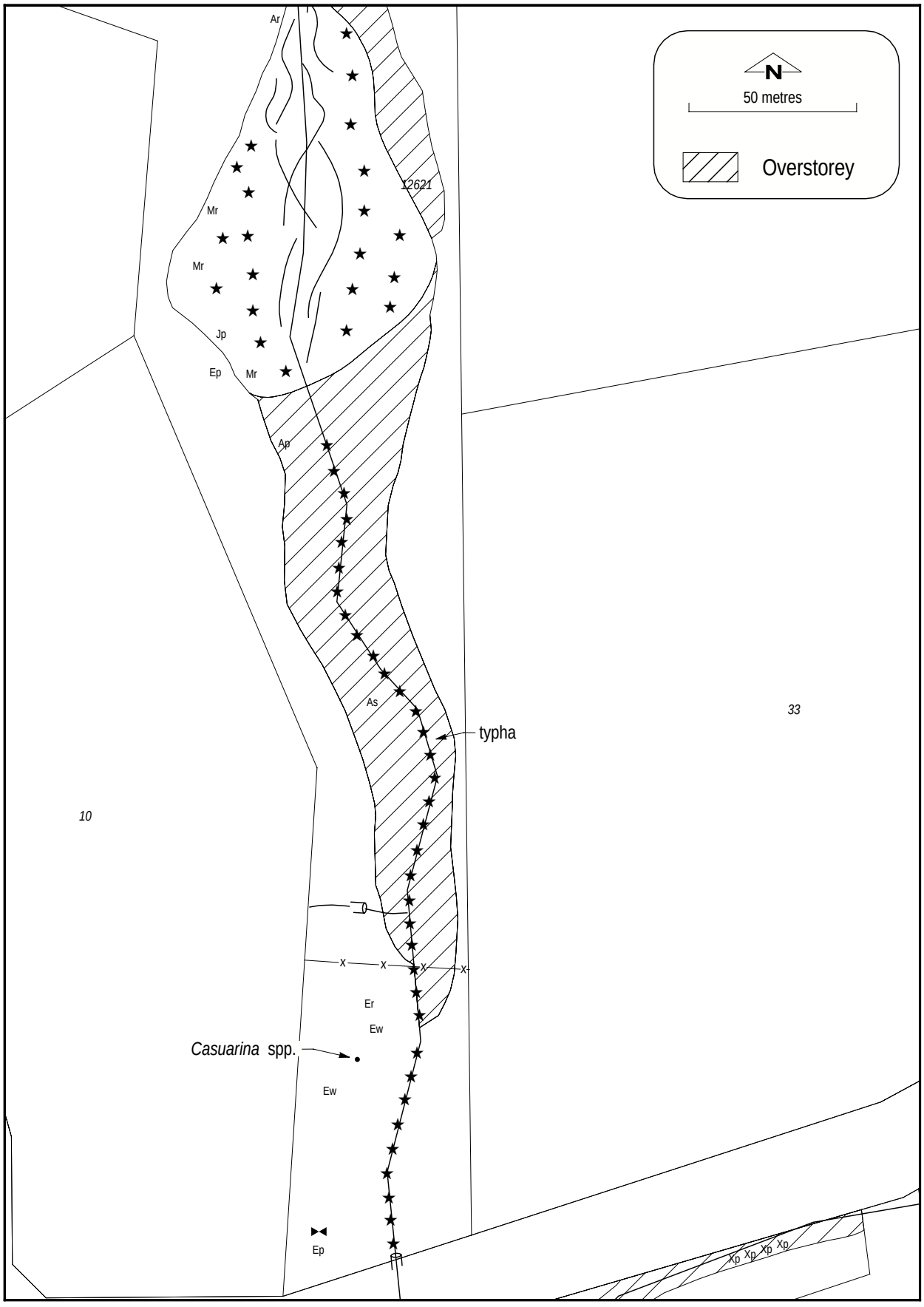
Casuarina that is possibly exotic. The sparse middlestorey retains infrequent to occasional native species including *Acacia pulchella* (Prickly Moses), *A. saligna* (Coojong), *Hakea amplexicaulis* (Prickly Hakea), *Xanthorrhoea preissii* (Grass Tree) and *Callistemon glaucus.* The introduced Bulrush (*Typha orientalis*) is the dominant weed species of the middlestorey, and is abundant in its occurrence. There is also a stand of Giant Reed (*Arundo donax*). The understorey is continuous, and is dominated by weed species. There are occasional occurrences of native species such as *Kennedia stirlingii* (Rusty Kennedia), *Juncus pallidus* (Pale Rush) and a species of *Lepidosperma*. The dominant weeds within the understorey are annual grasses, Soursob (*Oxalis pes-caprae*), Guildford Grass (*Romulea rosea*), *Phalaris* spp. and Watsonia (*Watsonia bulbillifera*). There are also a few occurrences of Bridal Creeper (*Asparagus asparagoides*).	• Commence control of the introduced Bulrush in April/May, by cutting it as close to ground level as possible in 10 m wide sections using a brush cutter. • Implement a gradual replacement program using native rushes and sedges in areas where the introduced Bulrush has been successfully controlled.
Stream Cover: Abundant levels of exotic and native vegetation offer permanent cover to the brook. The stands of introduced Bulrush within the channel and the braided sections of the channel provide extensive areas of very dense shading. The overstorey species provide permanent shade in areas where their branches overhang the banks of the brook, in some instances providing cover within the channel. There is some leaf litter, rocks, branches and vegetation offering instream protection.	• Retain instream features for added cover where they do not exacerbate bank erosion. • Incorporate a larger proportion of native rushes and sedges in the braided sections and channel banks of the brook, and in the shelter of the introduced Bulrush (that is subject to management works), to stabilise these areas and maintain instream cover.
Habitat diversity: There are no areas of extensive permanent water within the main channel, although there may be some permanent pools in the southern section of the site. The water is relatively clear, but some filamentous algae is present. There is evidence that feral and domestic animals such as foxes, rabbits and horses are present within the area. Frogs were also noted during the survey. The lack of vegetative diversity reduces the overall habitat value of the area. There are some protected basking sites for terrestrial invertebrates and reptiles. The dense streamside vegetation offers suitable frog habitat. The trees and rushes offer nesting and roosting sites for birds.	• Increase the amount and diversity of native middlestorey vegetation using appropriate native species (Appendix 3). • Retain instream habitat features, such as logs and branches, that do not impact on stream hydrology cause erosion of foreshore banks. • Work with the users of the Bridle Trail to manage access and encourage them to use sterile feed for their horses to limit the spread of weed species. • Liaise with the Department of Conservation and Land Management and Agriculture WA to determine the feasibility of implementing feral animal control.

Other issues: This area is a recreational reserve and horse riders frequently use the Northern Valley Bridle Trail, which comes to within 15 m of the waterway. There is a dam at the northern end of the section. The surrounding land use is semi-rural, with houses and horse paddocks surrounding the riparian reserve.

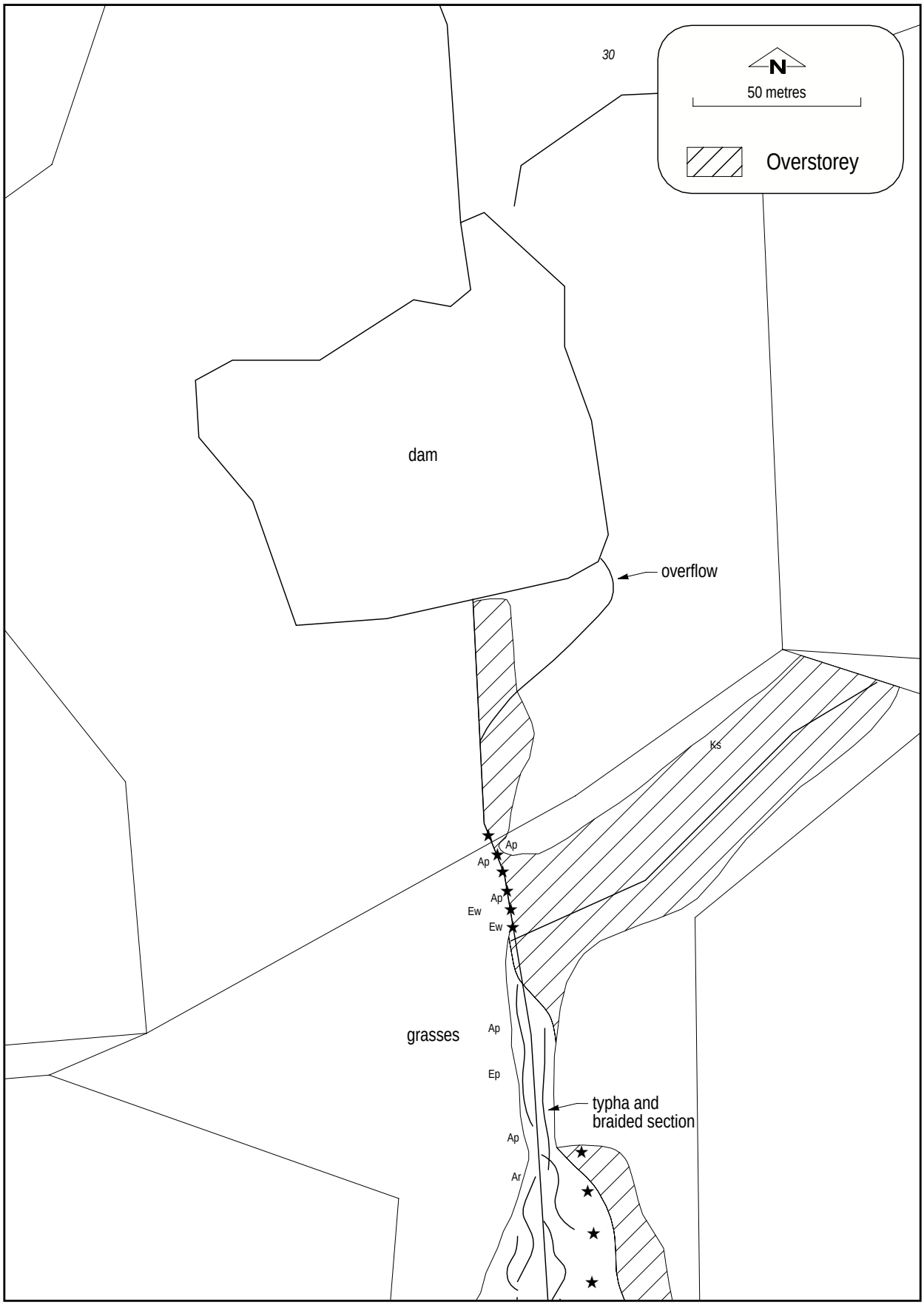
- Liaise with landholders to ensure horses do not directly access the waterway, where bank destabilisation may become a problem.
- Supply information to local residents about the importance of maintaining foreshore health.
- Install signage to inform users of the uniqueness of the area and of any rehabilitation works underway to encourage local support.
- Approach the Water and Rivers Commission to determine the possibility of investigating the degree of hydrological disturbance caused by the dam.



Tilden Park Site 4: Map 1



Tilden Park Site 4: Map 2



Tilden Park Site 4: Map 3

4.5 Cookes Brook

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Cookes Brook – Site 5: Maps 1-2

Length of section (m): 1040 m

Recorder's name: B Waining

Date surveyed: 29/6/99

Nearest road access: Toodyay Road and Lilydale Road

Lot number(s): 72

Summary of river health:

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

Stream Condition
Red
Poor
10

Description

Bank stability: Cookes Brook (Site 5) extends north from Lilydale Road. The banks of the brook are steep on a gradient of 45-600. The main channel is approximately 2 m wide and <1 m deep. The banks exhibit localised areas of erosion, slumping and sedimentation. There are artificial stabilisation structures to direct the flow beneath Lilydale and Toodyay Roads in the form of culverts with headwalls. There is an instream crossing point approximately half way along the section where stock movement is affecting bank stability.

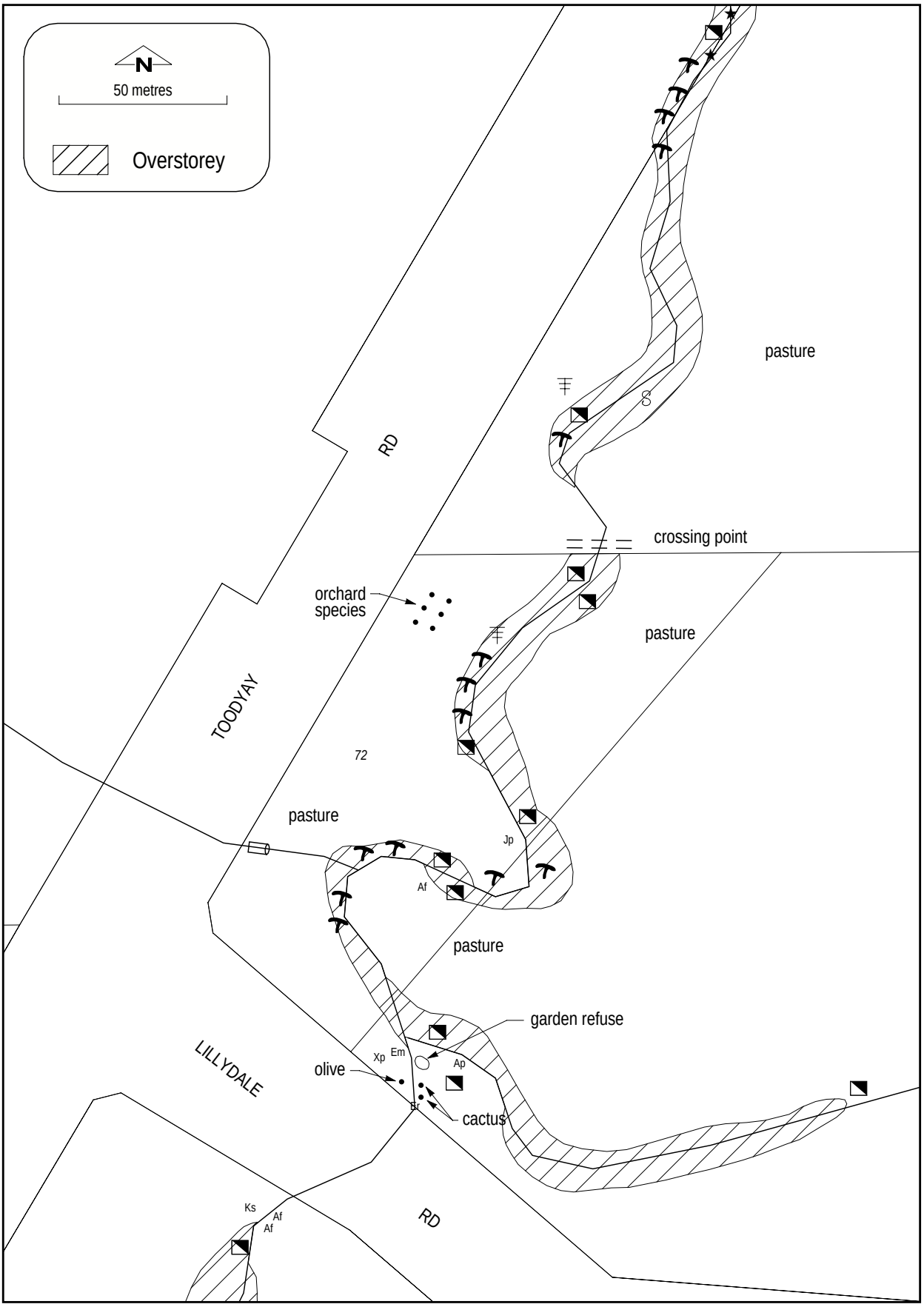
Vegetation: The dense vegetation surrounding the brook comprises a continuous overstorey and understorey, with a sparse middlestorey. The overstorey retains approximately 80% native species, including frequent *Eucalyptus rudis* (Flooded Gum), occasional *Corymbia calophylla* (Marri) and infrequent *E. marginata* (Jarrah). Weed species within the overstorey include frequent Edible Fig Trees (*Ficus carica*), occasional Olive Trees (*Olea europaea*) and some Radiata Pine (*Pinus radiata*). The sparse middlestorey comprise 75% native species. Frequent *Agonis linearifolia* (Swamp Peppermint) occur in a mosaic with occasional to infrequent *Acacia pulchella* (Prickly Moses), *A. saligna* (Coojong), *Astartea fascicularis* (Common

Recommended strategies

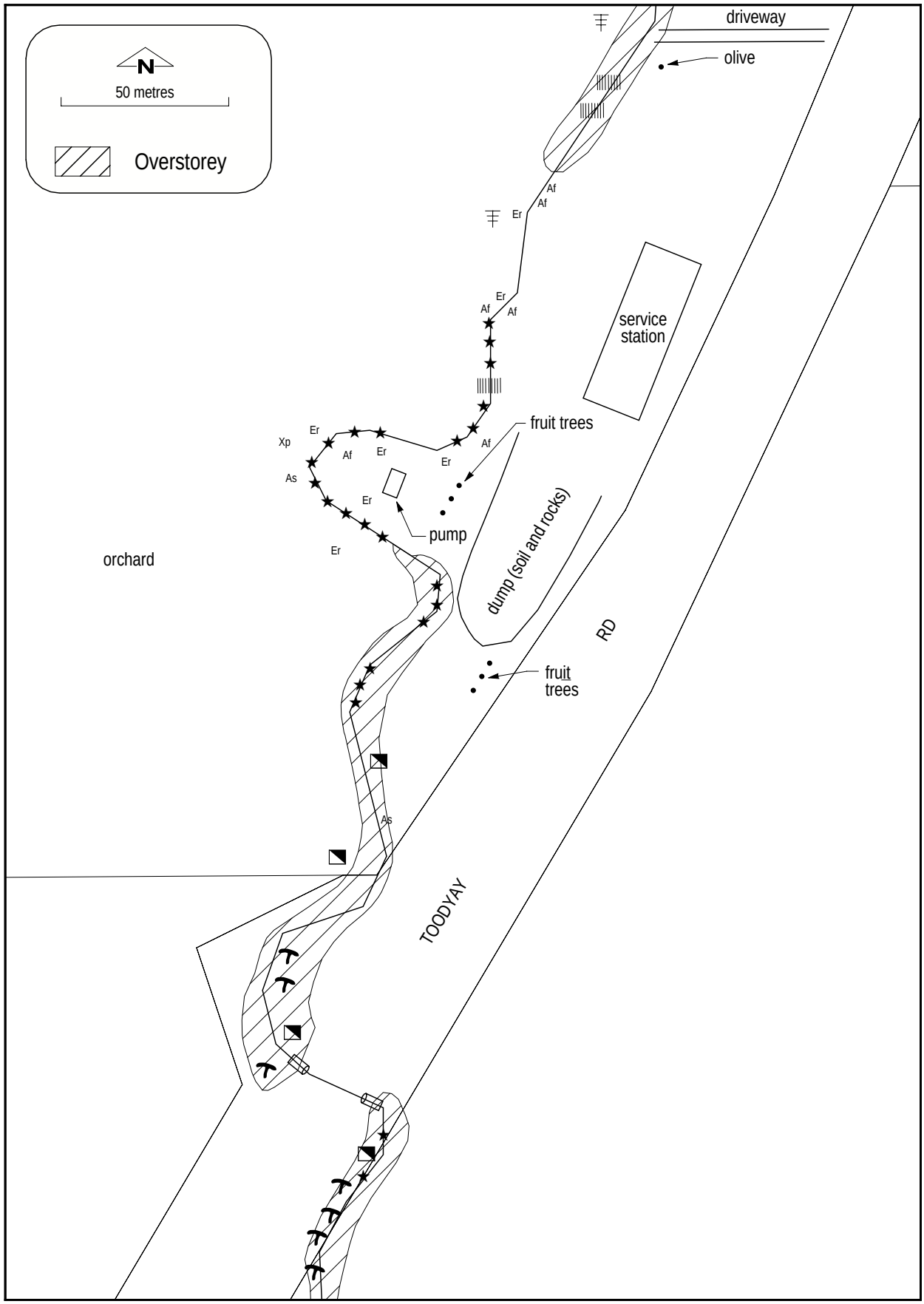
- Address areas of bank instability, with the use of soft engineering techniques (Appendix 4) and revegetation (Appendix 3).
- Liaise with the landowner to encourage the installation of fencing along the length of the brook to prevent uncontrolled stock access, and to direct livestock to the crossing point.
- Liaise with the local government authority and the Water and Rivers Commission to formalise the crossing point in accordance with appropriate river restoration techniques, to improve bank stability.

- Liaise with the landholders to encourage them to actively manage the highly invasive and poisonous species of weed including Bridal Creeper and Deadly Nightshade respectively (Appendix 2). Ensure that protective clothing is worn while removing the Deadly Nightshade to avoid contact with the sap.
- Inject the Edible Fig and Olive trees every 15 cm around the truck with a non-selective systemic herbicide at full strength. Remove the dead upper parts of the plants without disturbing the root structure to ensure bank stability is not threatened.

Astartea) and *Grevillea glabrata* (Smooth Grevillea). The weeds within the middlestorey include the introduced Bulrush (*Typha orientalis*), Giant Reed (*Arundo donax*) and an occurrence of a species of Cactus. Weed species including abundant annual grasses, Bridal Creeper (*Asparagus asparagoides*) and Soursob (*Oxalis pes-caprae*) dominate the understorey. There are also occurrences of *Phalaris* sp., Kikuyu (*Pennisetum clandestinum*), Shivery Grass (*Briza minor*), Deadly Nightshade (*Solanum nigrum*), Dock (*Rumex* sp.) and Fleabane (*Conyza* sp.). The only native species within the understorey are occasional to infrequent stands of native rushes and sedges including *Lepidosperma effusum* (Spreading Sword Sedge), *Juncus pauciflorus* (Slender Rush) and *Juncus pallidus* (Pale Rush).	• Monitor for suckers or new tree seedlings and control as necessary. • Commence works to manage the dense understorey of weeds, by either crash grazing or implementing nodes of weed control followed by high density planting of native tubestock. • Encourage landholders to work on hand weeding Fleabane and selectively painting Dock and other weeds with systemic herbicides, before the seed, focusing on creating a buffer around any native plants. • Implement a revegetation program along sections of the brook lacking native fringing vegetation using native species (Appendix 3). This should be undertaken in nodes to ensure the best results.
Stream cover: There is frequent stream cover due to the healthy fringing native vegetation along this section. These permanent areas of shade are interspersed between open areas and occasional sections of exotic vegetation cover. The Edible Fig trees are deciduous and provide only seasonal shading to the brook. Within the instream environment there is cover provided by leaf litter, rocks and vegetation.	• Retain instream cover features. • Remove exotic and deciduous vegetation fringing the brook using minimal disturbance techniques. • Revegetate the foreshore areas with appropriate locally derived native plant species (Appendix 3) to maintain fauna habitat.
Habitat diversity: The water within this section of the brook is not permanent. The water is slightly turbid and shallow (<0.2 m deep). Frogs are the only signs of wildlife within the section. A sufficient variety of vegetation types creates protected basking sites for terrestrial invertebrates and reptiles. Trees provide some nesting and roosting sites for birds. The brook contains suitable habitat for aquatic organisms, with riffles, meanders and instream logs available.	• Revegetate the foreshore areas with native species (Appendix 3). • Retain instream, and foreshore zone habitat features, such as logs and branches, ensuring that they are not exacerbating erosion.
Other issues: The proximity of Toodyay Road to the brook has resulted in a quantity of rubbish entering the waterway. There is an area where garden refuse has been dumped, which may have been the source of the cactus present. There is at least one pump extracting water from the brook from an area below the service station. The dominant surrounding land use is orchards, which may be a source of pollutants to the waterway. There is evidence of stock activity along this section.	• Undertake regular rubbish removal to minimise the amount of litter reaching the waterway. • Remove garden refuse. • Provide an information leaflet to landholders about the benefits of protecting their waterway, managing disposal of garden material, and what they can do to help retain natural features. • Investigate through the Water and Rivers Commission the legality of all pumps located along the section and monitor the level of water extraction. Relate this information to riparian water rights and functional stream flows.



Cookes Brook Site 5: Map 1



Cookes Brook Site 5: Map 2

4.6 Noble Falls

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Wooroloo Brook – Site 6: Maps 1-2 (Section A) Noble Falls

Length of section (m): 800 m

Recorder's name: B Waining

Date surveyed: 29/6/99

Nearest road access: Toodyay Road

Lot number(s): 151, 20

Summary of river health:

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

Stream Condition
Yellow
Moderate
18

Description

Bank stability: This section of the brook is situated within the Noble Falls Reserve (Site 6). The banks of the brook are up to 1 m in height and are generally very steep (>60˚), becoming flatter where rock outcrops occur. The main channel is up to 4 m in width. There is localised erosion and slumping along the section, with minimal evidence of sedimentation. Erosion is most evident at the outer reaches of meanders, where it is often associated with slumping of the steep banks. Some of the erosion that is occurring on the right hand bank is a result of runoff arising from the adjacent gravel parking area. A crossing point for vehicles exists at the eastern end of the section.

Vegetation: The overstorey and understorey provide continuous cover in this section. The middlestorey is patchy. The right bank has retained only a narrow fringe of vegetation as a result of the provision of recreation infrastructure, such as car parks and roads, while the left bank supports a far wider fringe of vegetation. The overstorey comprises exclusively native species including frequent *Eucalyptus rudis*

Recommended Strategies

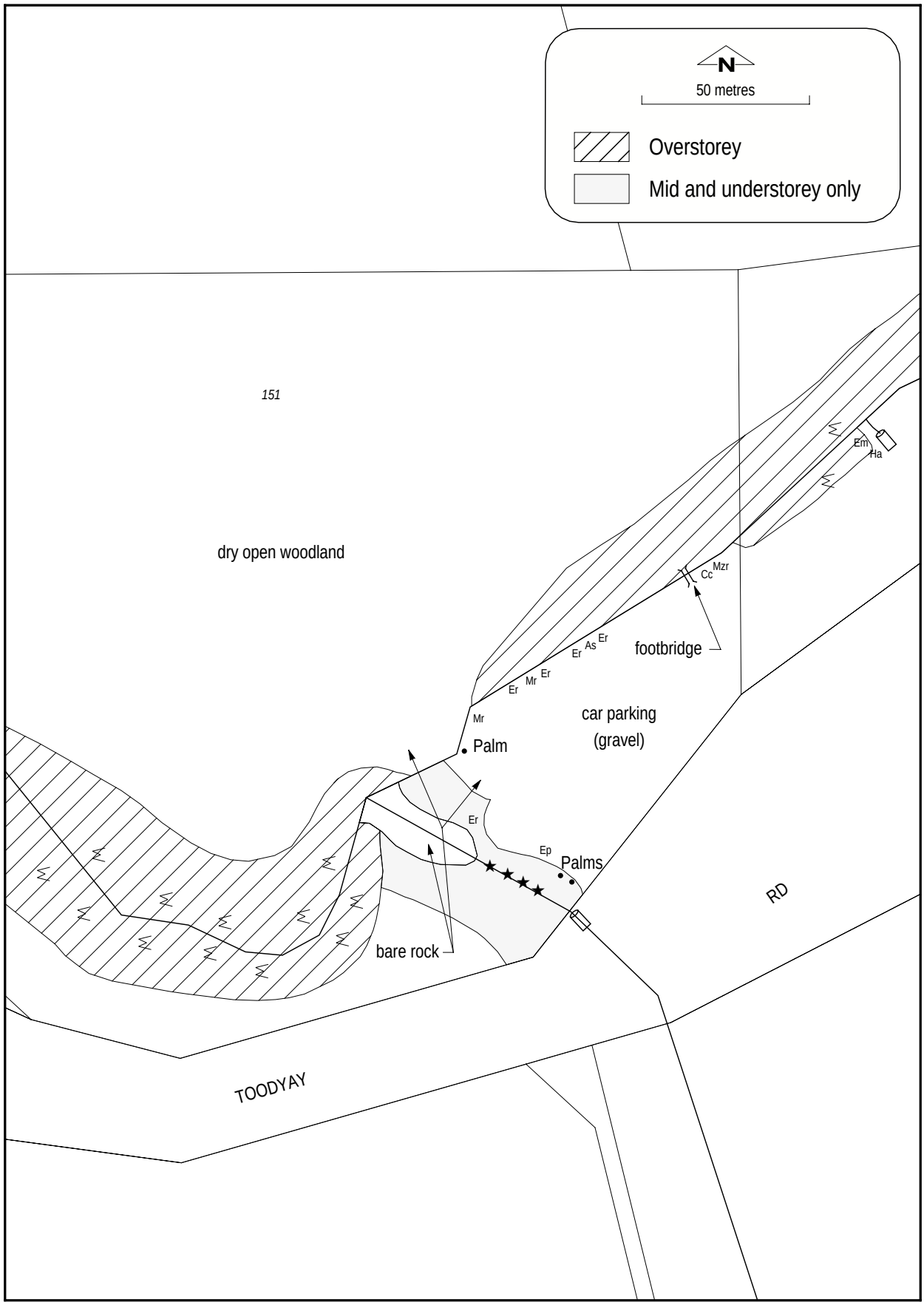
- Investigate the feasibility of moving the car parking areas back from the river bank.
- Liaise with the local government authority, Main Roads WA and the Water and Rivers Commission to construct appropriate drainage mechanisms along the front of the car parking area, to prevent direct runoff to the river. Any strategy employed should work to retain stormwater on site.
- Install soft engineering works to control erosion and slumping of affected bank areas (Appendix 4).
- Liaise with the local government authority to upgrade the crossing point, using culverts, which meet the width of the waterway, at the existing crossing at the eastern end of the site.
- Increase the width of fringing vegetation along the right-hand bank, in front of the car park using appropriate native species (Appendix 3).

- Focus weed control efforts on the highly invasive Watsonia, ensuring those efforts to manage this species do not impact on native remnant vegetation (Appendix 2).
- Extend the width of fringing vegetation along the right-hand bank, where the recreational pressures are higher.

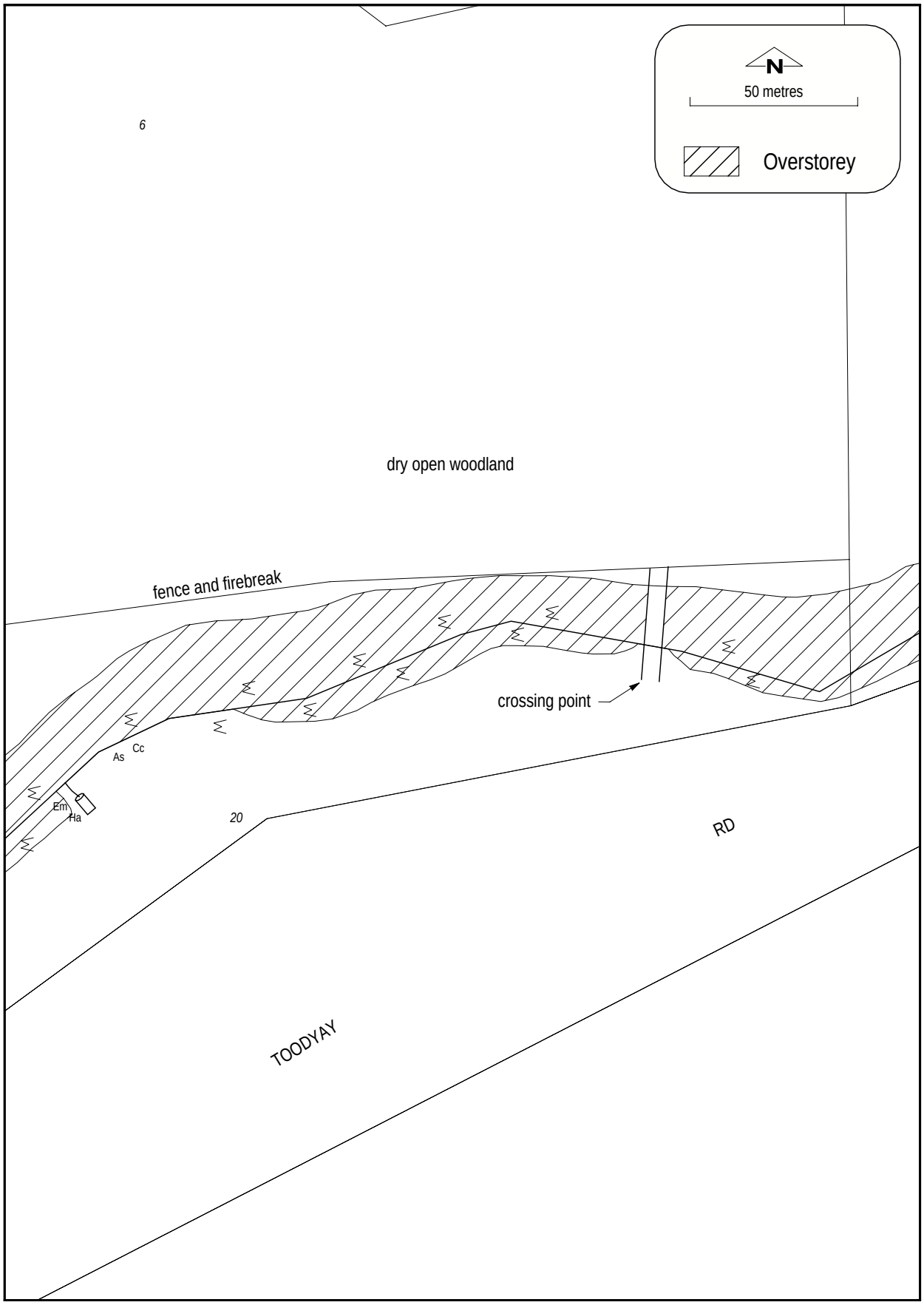
(Flooded Gum) and occasional *E. marginata* (Jarrah), *Corymbia calophylla* (Marri) and *Melaleuca rhaphiophylla* (Swamp Paperbark). The middlestorey has a mosaic of occasional to infrequent occurrences of *Acacia pulchella* (Prickly Moses), *A. saligna* (Coojong), *Astartea fascicularis* (Common Astartea), *Calothamnus quadrifidus* (One Sided Bottlebrush), *Hakea amplexicaulis* (Prickly Hakea), *Trymalium ledifolium*, *Viminaria juncea* (Swishbush) and *Xanthorrhoea preissii* (Grass Tree). No weed species were observed within the over- or middle- storeys. The understorey is dominated by weed species, which comprise approximately 60% of the total understorey species. Native species within the understorey include occasional *Carex appressa*, *Cyperus* spp., *Lepidosperma longitudinale*, *Baumea rubiginosa* (River Twig), *B. juncea* (Bare Twig Rush), *Daviesia decurrens* (Prickly Bitter-Pea), *Dryandra nivea* (Couch Honeypot), *Alexgeorgea arenicola* and *Macrozamia reidlei* (Zamia). The dominant weeds include abundant Watsonia (*Watsonia bulbillifera*), Soursob (*Oxalis pes-caprae*) and annual grasses. There are occasional occurrences of Guildford Grass (*Romulea rosea*) and Shivery Grass (*Briza minor*).	• Regularly brushcut annual grasses, Soursob and other species making up the chaotic weed assemblage areas, to reduce the fire risk and the spread of these species. This should occur prior to them seeding. • Monitor natural regeneration within the area and determine the feasibility of undertaking active regeneration if necessary. • Revegetate weeded areas with appropriate native species of the understorey and middlestoreys (Appendix 3). • Focus revegetation activities on smaller areas to improve the effectiveness of the works. • Liaise with the local government authority to delineate specific paths through the bush using bollards and wood chip pathways, to prevent uncontrolled trampling of large areas of vegetation. • Install signage outlining key features of the bushland and waterway, showing where the designated tracks are, and outlining the impacts that people may have on the area if they do not keep to the paths.
Stream Cover: There is frequent permanent stream cover along the foreshore provided by the fringing native vegetation. None of the exotic vegetation present is contributing any cover. Instream cover is provided by leaf litter, rocks, branches and vegetation.	• Establish a denser fringe of vegetation between the brook and car park by excluding vehicle access from the zones immediately adjacent to the riverbanks. • Retain instream features, such as branches and logs, to provide instream protection for aquatic organisms.
Habitat diversity: There is permanent water within this section of the river. There are pools retaining deeper water, with shallow zones where the water flows over rocks and outcrops within the stream channel. The water is very slightly turbid and tannin stained. The diverse vegetation in this area provides habitat and protected basking sites for terrestrial invertebrates and reptiles. The dense vegetation fringing sections of the riverbanks provides good habitat for frogs. The trees and shrubs of the area provide habitat value for roosting and nesting birds. Within the river, the variation in depth and form of the river channel provides a variety of habitats for aquatic organisms.	• Retain instream habitat features where they do not exacerbate bank erosion. • Improve the extent of fringing vegetation between the car park and waterway, to provide a continuous fauna corridor. • Implement intensive Watsonia control, and replace with native understorey and middlestorey species, undertaking works in selected nodes so as to retain some cover during the establishment of the native revegetation.

Other issues: The area is a popular recreation reserve and picnic spot. There are facilities for picnics and children's entertainment (i.e. playground equipment). The presence of a fit-pack (hypodermic syringes) in the bush suggests some level of antisocial behaviour is occurring within the area. The proximity of the gravel parking area to the river may be of some concern, with high levels of watershed from this area carrying sediment into the river and destabilising the banks.

- Provide signs explaining the ecology of the foreshore vegetation, and the need for one path to be used within the bushland to prevent trampling.
- Liaise with the appropriate authorities to redesign the car parking area, to reduce erosion of the gravel base and subsequent sediment load within the river.



Noble Falls Site 6: Map 1



Noble Falls Site 6: Map 2

4.7 Wooroloo Brook

Government Road

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Wooroloo Brook – Site 7: Maps 1-2 (Section A) Government Road

Length of section (m): 640 m

Recorder's name: B Waining and N Siemon

Date surveyed: 22/6/99

Nearest road access: Government Road

Lot number(s): Wooroloo Prison Farm

Summary of river health:

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

Stream Condition
Green
Good
22

Description

Bank stability: This section of Wooroloo Brook (Site 7) occurs within the southern portion of the survey site. The stream channel is poorly defined and is 3-4 m wide. The brook is highly braided across a wide floodplain, with the outer banks having a variable slope between 10-60˚. The banks exhibit localised areas of erosion and slumping with minimal sedimentation evident. A culvert maintains water flow beneath a pipeline and access track. The surrounding paddock is sown with pasture and is directly upslope from the brook. Sheet runoff from this hillside would be high during rainfall events.

Vegetation: The overstorey cover is patchy, while the middlestorey and understorey vegetation is continuous along the survey site. The overstorey is characterised by abundant *Eucalyptus rudis* (Flooded Gum), with occasional to infrequent occurrences of *E. laeliae* (Darling Range Ghost Gum) and *Corymbia calophylla* (Marri) upslope. There are dense *Melaleuca* and *Leptospermum ellipticum* thickets, including *Melaleuca rhaphiophylla*. The middlestorey is dominated by dense homogeneous

Recommended Strategies

- Liaise with the appropriate authorities to install a fence along the entire foreshore length beyond the extent of remnant vegetation to protect from stock access.
- Install soft engineering works (Appendix 4), where appropriate, to remedy destabilised areas of bank.
- Encourage landholder to install mini-interceptor banks upslope on the left bank to trap weed seed and sheet runoff.
- Liaise with AGWEST to determine if the establishment of a perennial pasture is appropriate. Ensure that the management of such a cropping system prevents the plants from seeding, and traps plant fragments (see recommendation above) so as not to invade the riparian foreshore.

- Monitor the level of natural regeneration. If necessary, propagate plants at the Wooroloo Prison Farm from seed collected in the area, and undertake reinforcement plantings and direct seeding.
- Assess the feasibility to monitor water quality, focusing on nutrient and salinity levels as part of a catchment wide monitoring program.

stands of *Baumea articulata* (Jointed Twig Sedge), which occurs mostly within the braided channel of the brook. Other middlestorey species present in the floodway include *Acacia saligna* (Coojong), *Astartea fascicularis* (Common Astartea), *Hakea amplexicaulis* (Prickly Hakea), *H. lissocarpha* (Honeybush) and *Xanthorrhoea preissii* (Grass Tree). The understorey is excluded from the main channel, being limited to the upslope regions. It comprises low shrubs and groundcovers such as *Dryandra nivea* (Couch Honeypot), *Grevillea bipinnatifida* (Native Fuchsia), *Conostylis setigera, Conostylis* sp., *Drosera microphylla* and *Alexgeorgea arenicola*. Other understorey species include a range of rushes and sedges such as *Baumea juncea* (Bare Twig Sedge), *Juncus pallidus* (Pale Rush), *Lepidosperma scabrum*, *Lepidosperma effusum*, *Isolepis setiformis* (Tufted Sedge), *Hypolaena exsulca* and other members of the Restionaceae family. The extent of this community is limited by the intrusion of saline waters (refer Section B). Weed species comprise approximately 30% of the cover in the understorey, dominated by annual and perennial pasture grasses and supporting annuals, however these are generally limited to the edges of the riparian zone.	• Establish a vegetation free buffer between the fence and the paddock to act as fire access track, and reduce contact between weed species and native vegetation. • Liaise with the Water and Rivers Commission to monitor salt levels from seeps by becoming involved in the Ribbons of Blue program. Use data to encourage involvement with State and local government authorities to develop techniques to ensure saline runoff does not enter this wetland area.
Stream Cover: There is abundant stream cover maintained by the fringing and emergent native vegetation, particularly by instream *Baumea articulata* (Jointed Twig Sedge) and the extensive overstorey and middlestorey vegetation. There is no exotic vegetation fringing the stream. There is considerable instream cover also, provided by leaf litter, branches and other vegetative debris.	• Retain instream cover features that do not impact on foreshore stability. • Monitor the success of revegetation and weed control works, and the extent of salt intrusion, and continue implementation in accordance with the most successful techniques.
Habitat diversity: There is no permanent water within this section of the brook. The density of vegetation and diversity of vegetation types ensures an adequate level of habitat for terrestrial invertebrates, amphibians, reptiles and mammals. The presence of dense streamside vegetation and emergent plants results in good continuous habitat. The trees and rushes of the section provide nesting and roosting sites for birds including Swamp Hens and woodland bird species. The sheltered nature of the stream section provides protection for the aquatic organisms.	• Maintain vegetative diversity and health by monitoring and removing any weed infestations prior to seed set to minimise further spread. • Retain instream habitat features.

Other issues: There is some garden refuse dumped where the track crosses the waterway, which may be a source of weeds entering the area. There is evidence of rabbits within the section and their burrows may disrupt bank stability. There are areas of annual grasses close to the roads, which increases the fire threat posed for this high conservation value area. There is no controlled access to this area from Government Road.	• Remove garden refuse and provide an information leaflet to residents of Wooroloo, advising them of the impact of dumping garden waste on the natural environment. • Liaise with the appropriate agencies to undertake rabbit control by installing poisoned grain (1080) at night. The grain needs to be covered during the day to prevent lizards, birds and other native fauna from consuming the poison. • Use revegetation techniques, and/or mini-interceptor banks to improve infiltration of water and reduce runoff from the surrounding paddocks. • Ensure adequate control of annual grasses and regular roadside maintenance to minimise the fire hazard. • Liaise with the local government authority to investigate the feasibility of closing off general access, by installing padlocked boom gates or equivalent to discourage indiscriminate trampling of foreshore vegetation. • Develop a fire management plan in conjunction with the Department of Conservation and Land Management, the Shire and the local fire brigade and inform them of any changes to access to ensure adequate routes are maintained to protect the area in the event of fire.

Wooroloo Brook – Site 7: Maps 2-3 (Section B) Government Road

Length of section (m): 640 m

Recorder's name: B Waining and N Siemon

Date surveyed: 22/6/99

Nearest road access: Government Road

Lot number(s): Wooroloo Prison Farm

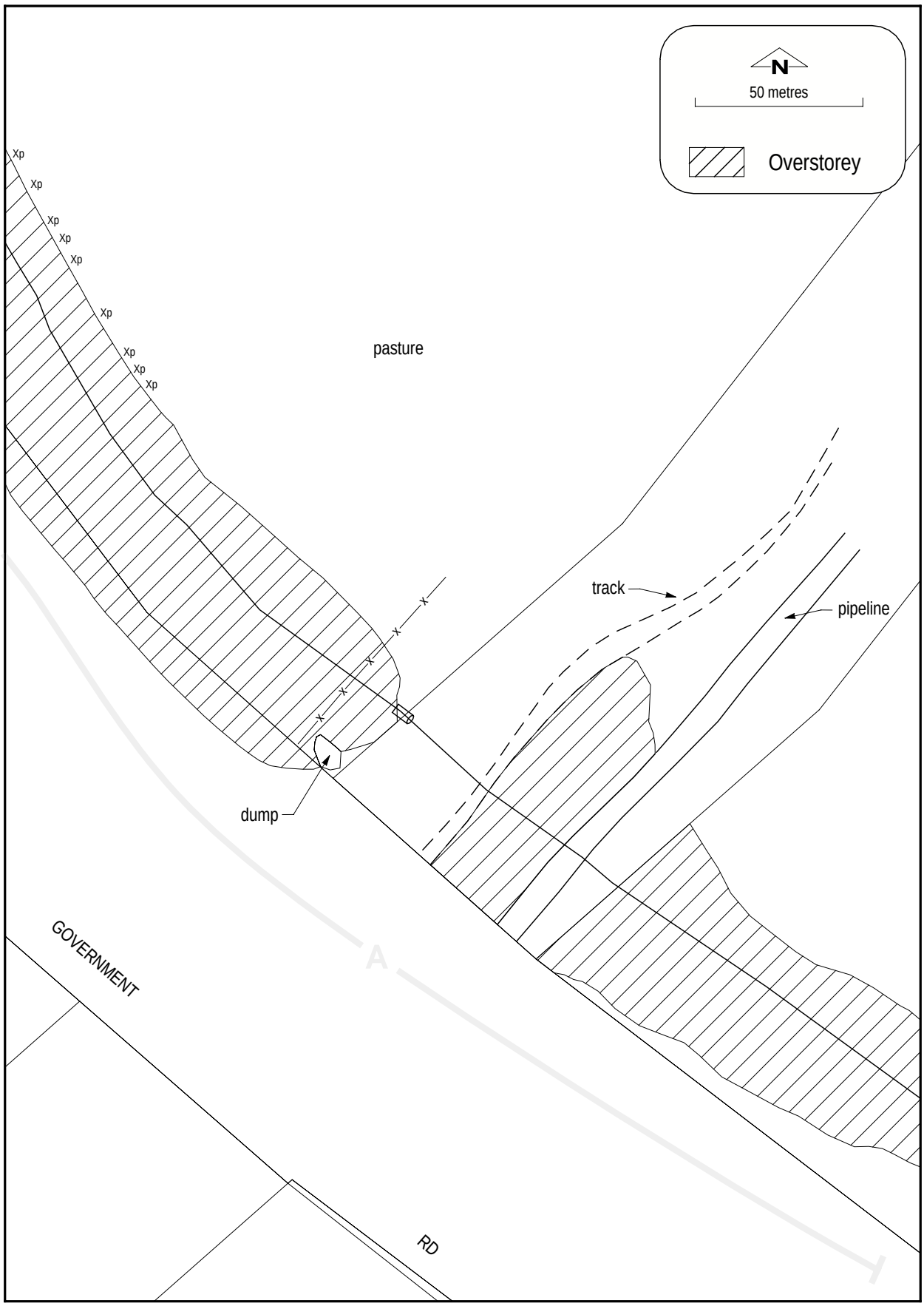
Summary of river health:

Bank Stability	Foreshore Vegetation	Stream Cover	Habitat Diversity
Black	Red	Yellow	Red
Very Poor	Poor	Moderate	Poor
0	2	4	2

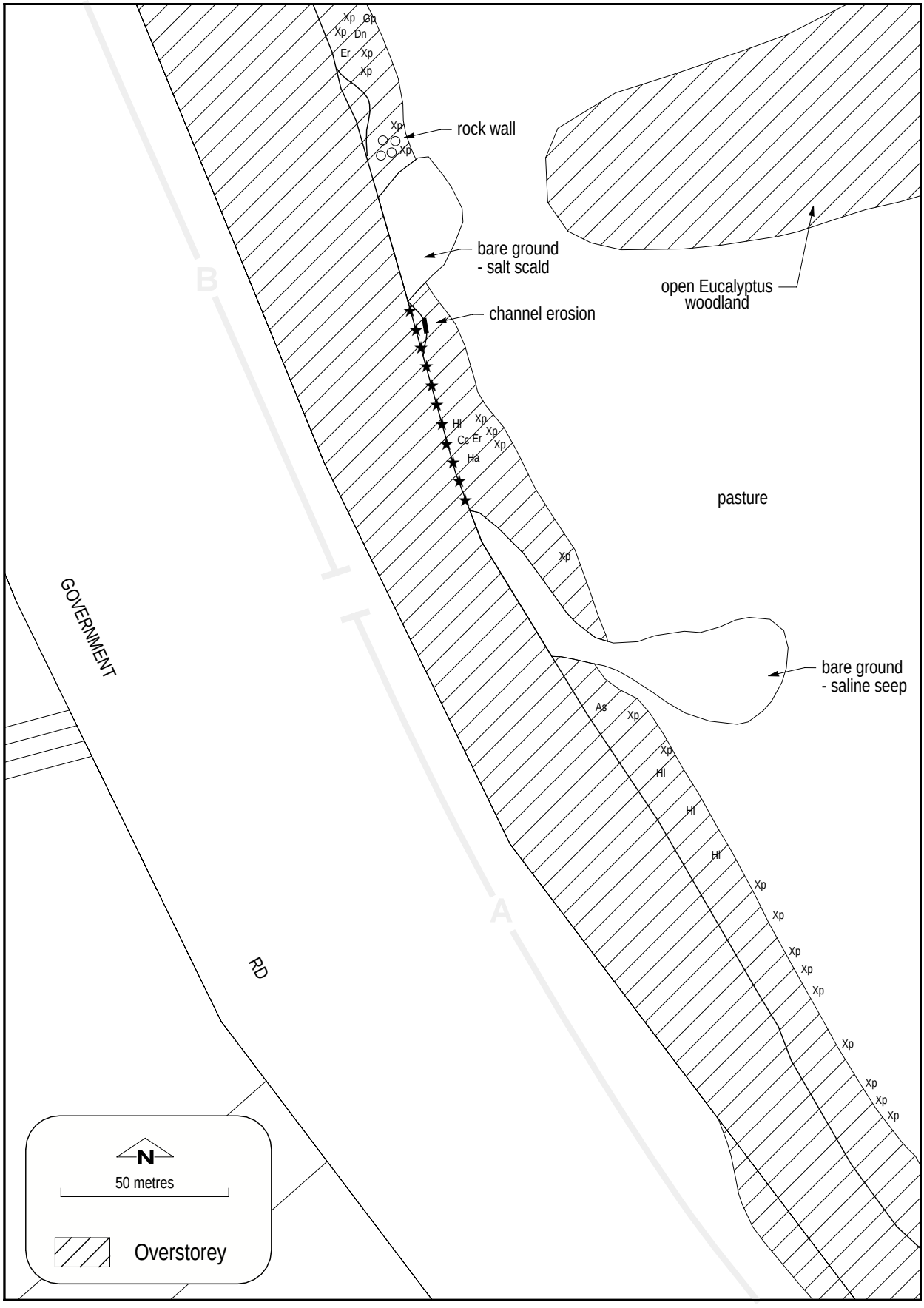
Stream Condition
Red
Poor
8

Description	Recommended Strategies
Bank stability: This section of Wooroloo Brook (Site 7, Section B) is at the northern end of the survey area. Significant sections of the banks are affected by erosion and slumping, with localised areas of sedimentation. The foreshore bank gradient is variable, ranging between 10-60˚. The banks of the brook are up to 2 m apart and the main channel is well-defined and approximately 0.75 m in depth. In some localised sections the channel braids or bifurcates. Much of the erosion and slumping of the banks is associated with meanders, and areas of saline scalding. There are some areas where rock-fill has been used to stabilise previously unstable lengths of bank. Sheet runoff from the paddocks upslope may also be contributing to the erosion of the banks of this area.	• Address areas of bank destabilisation using soft engineering techniques (Appendix 4), and revegetate using salt tolerant species. • Revegetate saline scald areas with salt tolerant species using a combined direct seeding and tubestock planting program listed in Table 5 (Section 6.8). • Liaise with the Water and Rivers Commission and AGWEST to investigate mechanisms to contain saline runoff upslope away from the brook, to protect the remnant vegetation from the hypersaline waters. • Encourage the local government authority to install riffle structures and granite spoils instream, upstream of areas losing vegetation, to prevent scouring of sections where the vegetation has been lost. • Encourage the landholder to revegetate recharge areas.
Vegetation: The vegetation of this section is characterised by a sparse overstorey and patchy middlestorey and understorey. The sparse overstorey retains occasional to infrequent *Corymbia calophylla* (Marri), *Eucalyptus laeliae* (Darling Range Ghost Gum) and *E. rudis* (Flooded Gum). The cover provided by these remnant trees is open, with many of the trees appearing unhealthy or dying, most likely due to excessive salt levels in the soil and water. The middlestorey retains frequent *Acacia saligna* (Coojong), *Xanthorrhoea preissii* (Grass Tree) and *Hakea lissocarpha* (Honeybush). Other middlestorey species include occasional to infrequent *Hakea amplexicaulis* (Prickly Hakea) and *Astartea fascicularis* (Common Astartea). The introduced Bulrush (*Typha orientalis*) dominates the emergent vegetation component. The understorey is fragmented and is limited to occasional to frequent occurrences of *Dryandra nivea* (Couch Honeypot) and *Grevillea bipinnatifida* (Native Fuchsia). The dominant rushes and sedges within this section include *Lepidosperma scabrum*, *Baumea juncea* (Bare Twig Sedge) and *Lepidosperma* sp. The dominant weeds on the margins of the area surveyed include annual grasses and pasture species.	• Liaise with the Water and Rivers Commission and AGWEST to determine if the dying overstorey can be attributed to the salinity problem. If another cause is determined, address as required. • Revegetate using salt tolerant species to stabilise exposed areas Table 5, (Section 6.8). • Undertake removal of introduced Bulrush and replace with salt tolerant native rushes and sedges, (Table 5, Section 6.8) in nodes to ensure that the weed control works do not impact on the stability of the soil. • Exclude stock from the riparian zone by installing fencing. • Monitor the vegetation loss over time, and take steps to plant salt tolerant native species to protect the banks from erosion as a result of widespread vegetation loss.

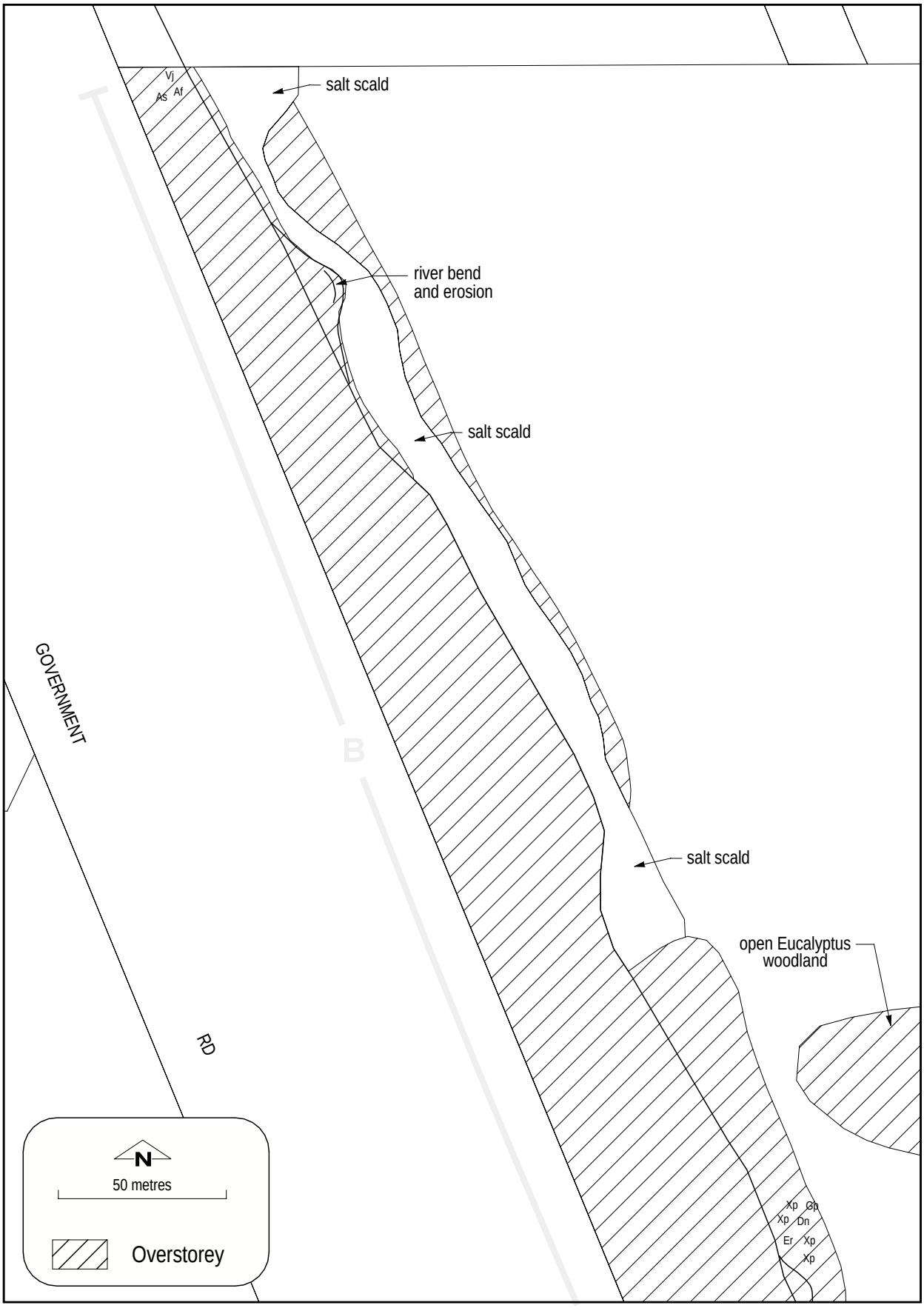
Stream Cover: There is frequent stream cover provided by fringing and emergent vegetation along the foreshore zone. The introduced Bulrush is the only exotic species providing stream cover within this section. Leaf litter, branches and other vegetative material provide instream protection.	• Retain instream cover features that do not impact on brook hydrology and bank stability. • Progressively replace exotic vegetation with native species (Appendix 3), ensuring that continuous habitat is provided for native fauna.
Habitat diversity: The water depth varies from 1 - 2 m, often forming small pools as large logs partially block the main channel. The water is dark brown and muddy due to tannins and the presence of suspended material in the water column. The presence of dense streamside vegetation provides suitable habitats for terrestrial invertebrates, reptiles and frogs. The overstorey provides nesting and roosting sites for birds.	• Address the salinity problem, using revegetation and water containment techniques upslope. • Liaise with the appropriate agencies or the Department of Conservation and Land Management to become part of the Western Shield Program to control feral animals. Under direction, use poisoned grain (1080) at night. The grain needs to be covered during the day to prevent lizards, birds and other native fauna from consuming the poison. • Retain habitat features, such as logs and branches. • Exclude stock from the riparian zone by installing fencing at the top of the verge. • Install parallel bunds upslope to trap sheet runoff and seep water, to help improve water quality and reduce sediment load.
Other issues: There is evidence of a recent fire, with blackened bark and trunks remaining. The remnant trees are showing signs of salt stress. Uncontrolled stock access may be reducing the levels of successful natural regeneration within this area.	• Develop and maintain a strategic fire management strategy by installing fire access tracks between the pasture and riparian vegetation, and provide information to the local government agencies and Volunteer Fire Fighters to ensure that all staff are aware of the designated access. • Exclude stock from the riparian zone by installing fencing and establishing off-line watering points if required. • Liaise with the Water and Rivers Commission to determine the extent of salt expression for the catchment and waterway and liaise with State and local government authorities to determine appropriate remedial actions.



Wooroloo Brook (Government Road) Site 7: Map 1



Wooroloo Brook (Government Road) Site 7: Map 2



Wooroloo Brook (Governemnt Road) Site 7: Map 3

4.8 Wooroloo Brook

Linley Valley Road

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Wooroloo Brook – Site 8: Maps 1,2 & part 3 (Section A) Linley Valley Road

Length of section (m): 420 m

Recorder's name: N Siemon

Date surveyed: 13/6/99

Nearest road access: Linley Valley Road

Lot number(s): 73, 43

Summary of river health:

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

Stream Condition
Yellow
Moderate
20

Description

Bank stability: This brook (Site 8, Section A) meanders down the valley in a reasonably stable drainage line. The channel width ranges from 6 m to less than 2 m. These variations in channel width reflect the variability in bank steepness, which is classified as moderate. Active erosion is occurring along power bends, which is in line with natural stream processes. There are localised areas of significant sedimentation near the crossover point and adjoining Great Eastern Highway. The sedimentation, characterised by large particulates including gravel, forms large plumes in the middle of the brook. The lower reaches of Section A have been subject to a recent fire, which has impacted on the surrounding vegetation and consequently destabilised the steeper banks.

Vegetation: The vegetation within the site is subject to grazing pressure from stock that freely access the area. A fire has also impacted on the downstream boundary. The overstorey is patchy and dominated by *Eucalyptus marginata* (Jarrah) and *E. wandoo* (Wandoo) with occasional *Corymbia calophylla* (Marri). The prevalence of *Eucalyptus wandoo* (Wandoo) and *Eucalyptus laeliae* (Darling Range Ghost Gum) increases upstream. The middlestorey cover is sparse and the understorey is patchy. Species

Recommended Strategies

- Encourage the landowner(s) to fence remnant vegetation to exclude stock.
- Liaise with the Water and Rivers Commission and the local government authority to establish a monitoring program to assess changes to land use upstream to gauge any subsequent impact on streamflow.
- Assess riparian zone health annually to monitor its stability.
- Liaise with Main Roads WA to determine techniques to retain sediment insitu and prevent the gravel and other materials from being transported downstream.

- Focus selective weed control on species which are currently not dominant in the area, but are highly invasive and can spread rapidly such as Watsonia, Bridal Creeper and Deadly Nightshade. See Appendix 2 for control methods.
- Fence off the remnant vegetation from Great Eastern Highway to the crossover point, and then fence remnant vegetation at its junction with the pasture zones.

diversity is moderate in the middlestorey and is dominated by *Acacia pulchella* (Prickly Moses), *Dryandra nivea* (Honeypot) and *Trymalium* sp. (Basket Bush). Other native species are represented occasionally. Rushes and sedges, including representatives of *Baumea*, *Mesomelaena*, *Loxocarya* and *Lepidobolus* are present in the understorey in less disturbed areas. There are occasional weeds including Watsonia (*Watsonia bulbillifera*), Deadly Nightshade (*Solanum nigrum*) and Bridal Creeper (*Asparagus asparagoides*). There is a localised area where groundwater is expressed and a wetland is present. The introduced Bulrush (*Typha orientalis*) dominates in this area with the native *Juncus pallidus* (Pale Rush) and *Baumea rubiginosa* (River Twig) persisting along the margins of the wetland. There is one patch of extensive instream sedgeland (*Baumea juncea*). Due to the impact of stock and the recent fire there is minimal leaf litter.	• Control annual grasses in accordance with suggested methods (Appendix 2), to reduce fire hazard. • Brushcut as low as possible the introduced Bulrush that dominates the wetland during May, and treat regrowth. • Plant native rushes and sedges (Appendix 3) adjacent to controlled Bulrush to maintain suitable habitat for fauna.
Stream Cover: The stream cover decreases between the areas with intact vegetation and the regenerating bushland site. Native plants provide frequent cover in the upstream area, and the cover maintained by exotic vegetation is minimal. Instream cover occurs where leaf litter has accumulated against logs or rocks. The greatest level of instream cover is localised in the area of sedgeland (*Baumea juncea*).	• Fence off riparian zone to prevent stock access, and encourage natural regeneration. Monitor for invasion of weed species and control. • Retain any instream features that do not threaten bank stability. • Plant appropriate species instream following control of the introduced Bulrush.
Habitat diversity: The water depth varies from 0.15 m to 0.6 m, and it is not known if the stream is permanent. During the survey the water was clear, with foam forming in riffle zones. There were three species of frog heard in the area, and evidence of fantails, magpies, crows and kangaroos. Fox footprints were identified. The habitat diversity is quite high in the healthy bushland, but is reduced where the grazing level is greater due to uncontrolled stock access.	• Encourage landowners to exclude stock from the riparian zone and adjoining bushland. • Liaise with Main Roads WA to ensure that annual grasses along Great Eastern Highway are brushcut or sprayed regularly to minimise the fire risk. • Approach the Department of Conservation and Land Management to assess the feasibility of using the Western Shield poisoning program in this area to control feral animals.

Other issues: There are considerable amounts of rubbish moving into the riparian zone from the discharge pipes servicing Great Eastern Highway. There are some areas of scour resulting from the point source discharge entering the property from the road reserve. Sheep also have uncontrolled access to the stream, and are contributing to degradation of the riparian zone.	• Remove rubbish from the property prior to the litter entering the main stream channel. • Liaise with Main Roads WA to determine the feasibility of establishing a gross pollutant trap to increase the rate of litter retrieval adjoining the property. • Liaise with Main Roads WA to address stormwater discharge issues, which are exacerbating erosion. • Develop an improved fencing system, which directs sheep movement across the waterway to the crossing point, and excludes them from general access to the waterway.

Wooroloo Brook – Site 8: Maps part 3, 4 & 5 (Section B) Linley Valley Road

Length of section (m): 420 m

Recorder's name: N Siemon

Date surveyed: 3/6/99

Nearest road access: Linley Valley Road

Lot number(s): 73, 43

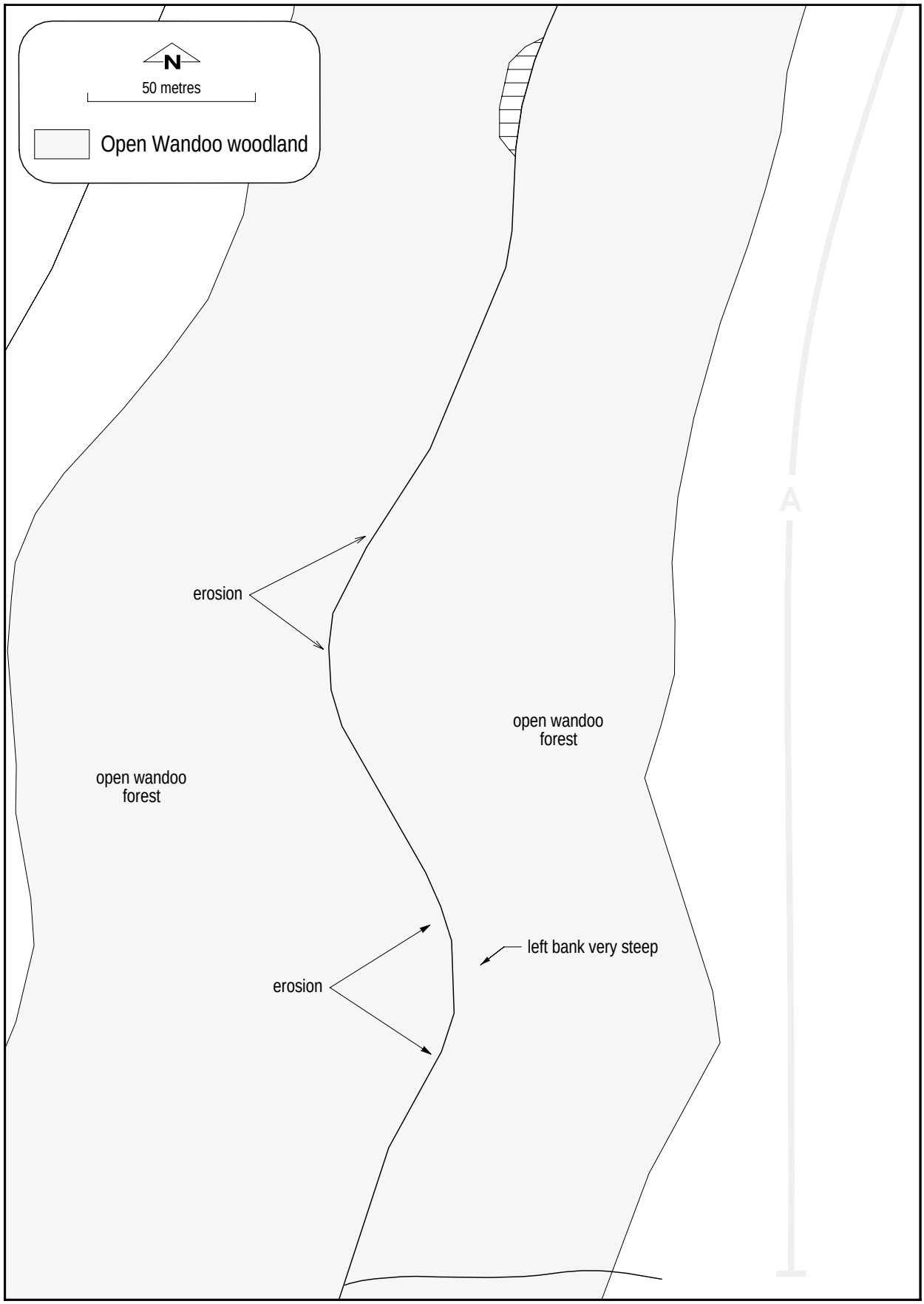
Summary of river health:

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

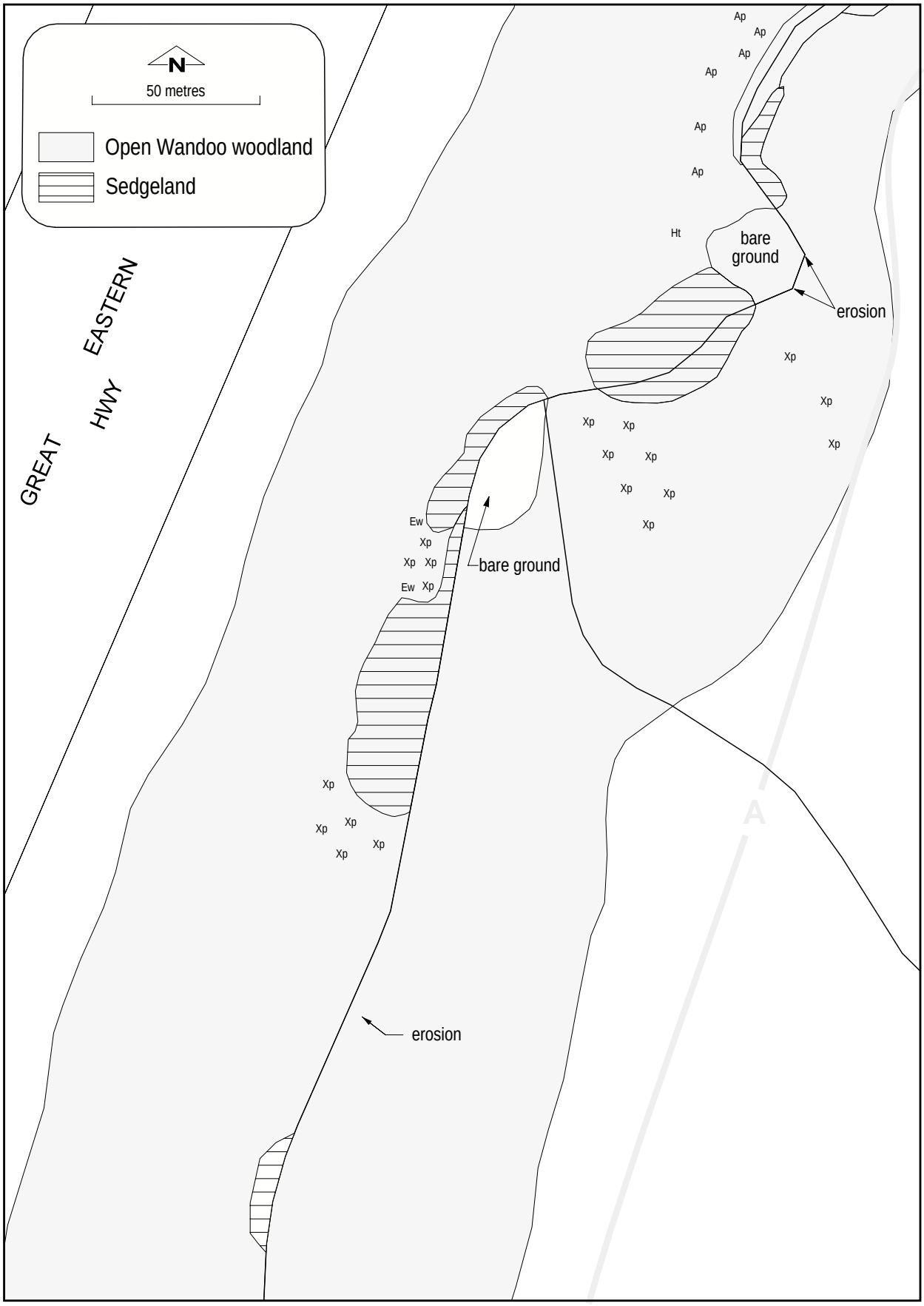
Stream Condition
Red
Poor
10

Description	Recommended Strategies
Bank stability: There is minimal evidence of erosion and slumping along the upper reaches of Wooroloo Brook (Site 8, Section B). The bank heights range from 0.5 m up to 2.5 m on the powerbends. The channel width varies from less than 3 m to approximately 8 m. The bank gradients are moderate along 70% of the section, and steep along the remainder. There are localised patches of sedimentation. The crossover point has resulted in some disruption to stream flow.	• Encourage landowners to fence off the riparian zone and establish off-line watering points to limit stock access. • Liaise with the local government authority and the Water and Rivers Commission to monitor the cross-over point and ensure that sediment accumulation is managed.
Vegetation: The vegetation along this surveyed site is reduced to an open pasture with a patchy overstorey of *Eucalyptus rudis* (Flooded Gum) with the slopes supporting *Eucalyptus wandoo* (Wandoo). The middlestorey is absent and understorey sparse. Fewer than 10% of the understorey species are native. There are considerable numbers of weeds present including annual and perennial grasses, herbs such as Bushy Starwort (*Aster subulatus*), Fleabane (*Conyza* sp.) and agricultural weeds such as thistles, Medics (*Medicago* spp.) and Flat Weed (*Hypochaeris glabra*). There are localised patches of Deadly Nightshade (*Solanum nigrum*), Watsonia (*Watsonia bulbillifera*) and Bridal Creeper (*Asparagus asparagoides*). Leaf litter is absent.	• Fence off the riparian zone to reduce the impact of uncontrolled stock movement and grazing on bank stability and plant regeneration. • Selectively manage potentially difficult weed species such as Watsonia and Bridal Creeper before the populations spread (Appendix 2). • Ensure that care is taken, such as wearing gloves when removing Deadly Nightshade to avoid contact with the sap. • Spray perennial and annual grass species in the buffer zone to reduce fire hazard. Ensure that the operator is qualified to handle herbicides. • Assess the level of natural regeneration frequently, and determine if there is a need to implement an assisted revegetation program using appropriate native species (Appendix 3). • Liaise with AGWEST to investigate the potential to improve the pastures by modifying the management practices and considering the use of perennial pasture species.
Stream Cover: Stream cover by native plants is minimal, with exotic vegetation providing occasional cover. There is limited instream cover provided by leaf litter and vegetation.	• Fence off the riparian zone to encourage natural regeneration processes. • Undertake to plant appropriate native species once weeds have been controlled using species listed in Appendix 3. • Establish plantings of instream rushes and sedges to increase habitat diversity. Peg plants if required, to prevent removal during peak flows. • Maintain any instream features that appear within the main channel that do not threaten bank stability.

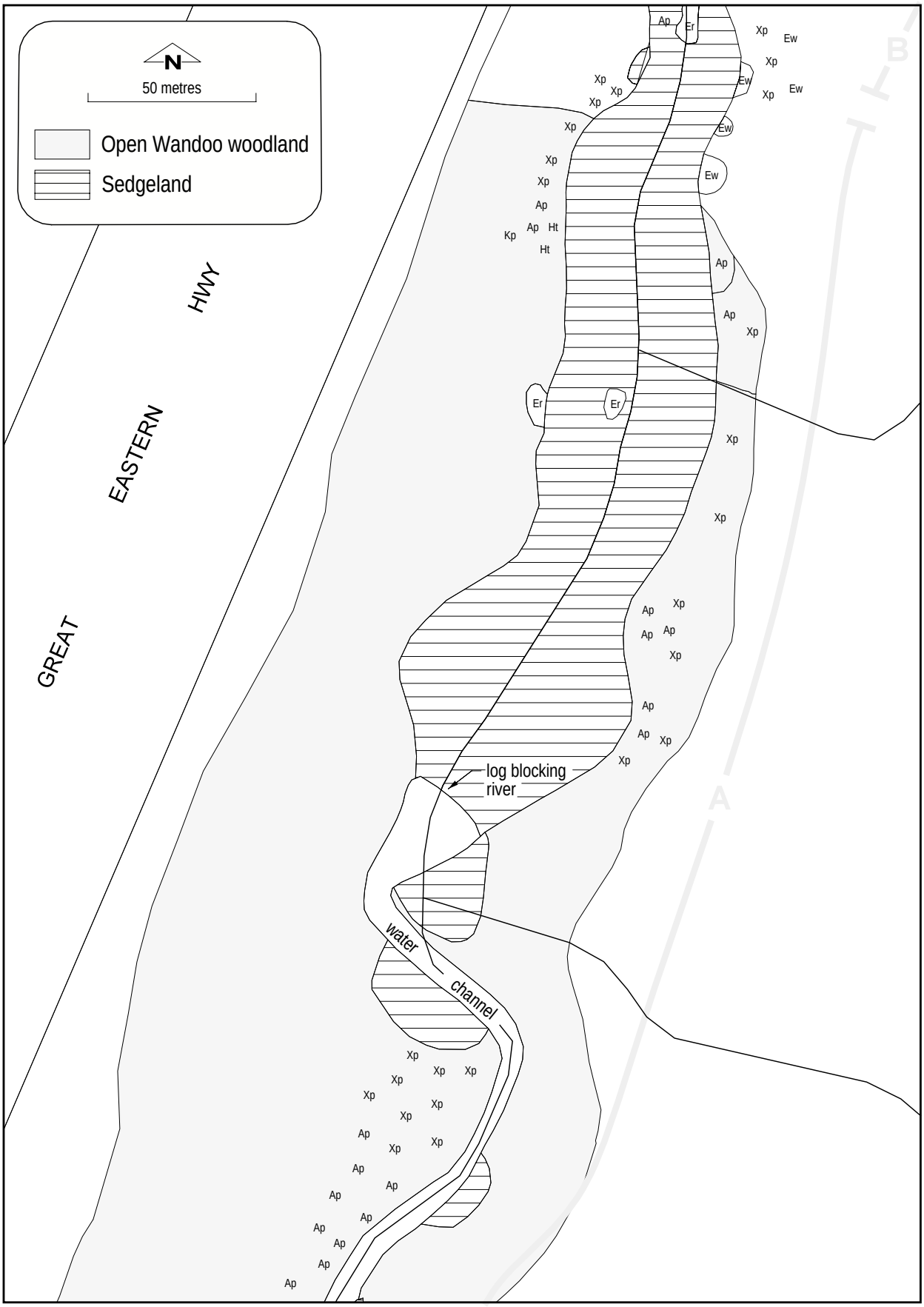
Habitat diversity: The water depth is shallow through this section. During the time of survey there were some suspended fine clays evident in the water column. The limited presence of trees and other vegetation results in habitat diversity being very low.	• Fence off the riparian zone. • Implement a weed control program and assess the level of natural regeneration. Use tubestock planting and direct seeding methods to revegetate the area if natural regeneration is limited.
Other issues: The sheep have uncontrolled access to the stream, and are contributing to degradation of the riparian zone. Stock watering points are generally denuded, although in some areas annuals persist. The crossover point has resulted in some disruption to stream flow. A 100 mm off take pipe is present.	• Fence off the riparian zone and provide offsite stock watering points. • Determine the use of/ need for the off take pipe. • Encourage the local government authority to investigate the impact of the existing cross over point on stream flow and bank stability and modify if required.



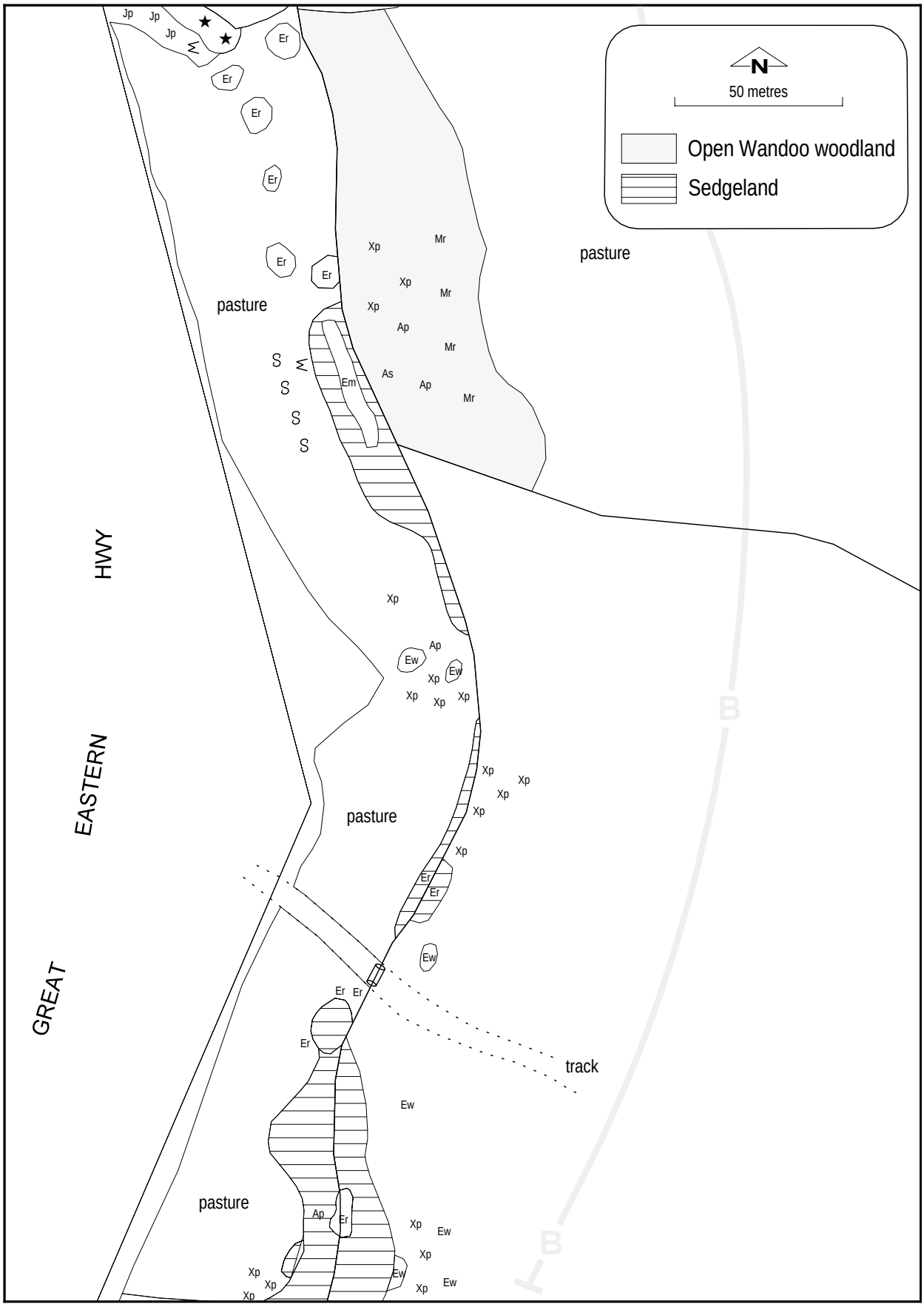
Wooroloo Brook (Linley Valley Road) Site 8: Map 1



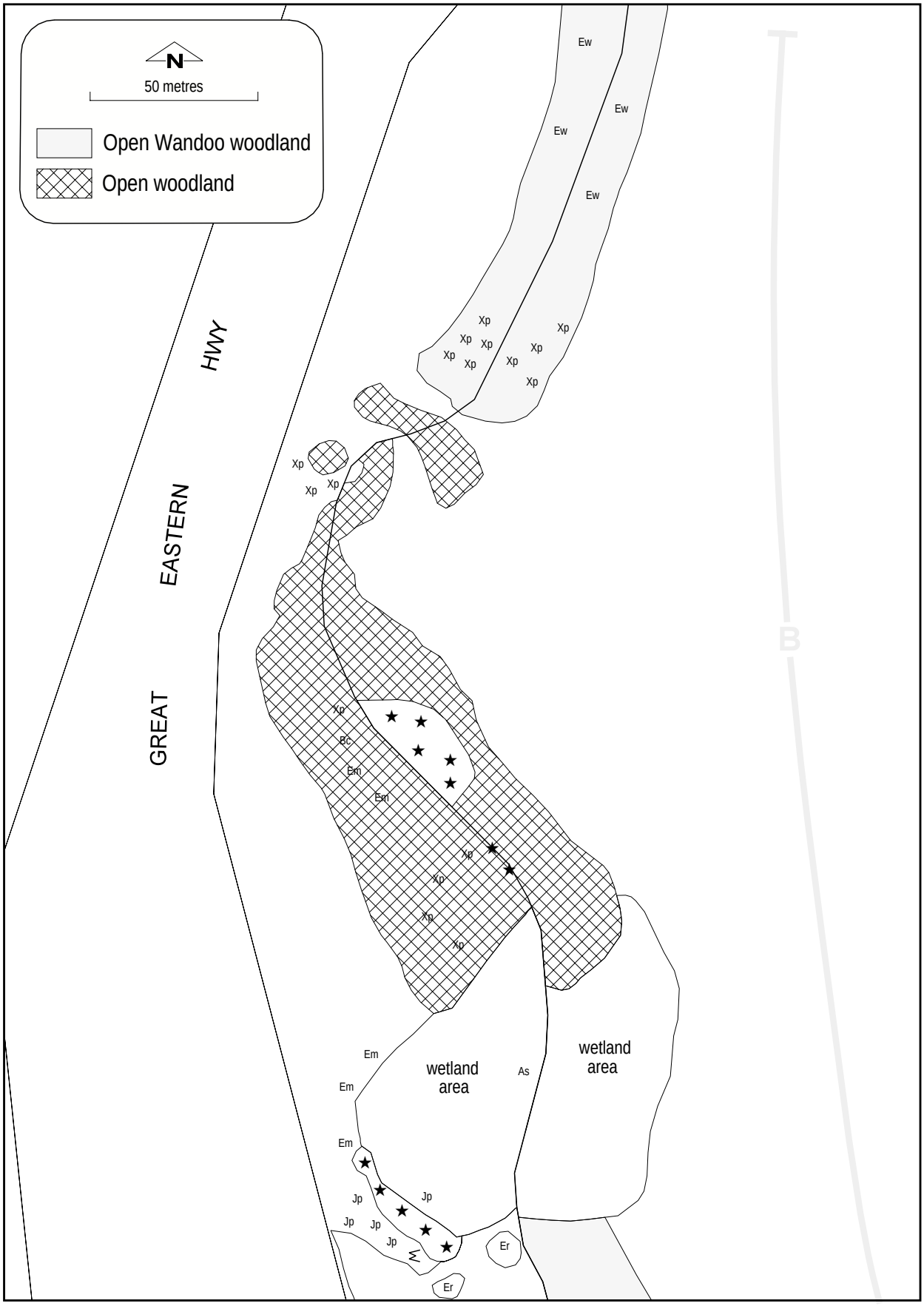
Wooroloo Brook (Linley Valley Road) Site 8: Map 2



Wooroloo Brook (Linley Valley Road) Site 8: Map 3



Wooroloo Brook (Linley Valley Road) Site 8: Map 4



Wooroloo Brook (Linley Valley Road) Site 8: Map 5

4.9 Coates Gully - 3 Mile Flats

Results
Foreshore Condition Survey

A Study undertaken on behalf of

Water and Rivers Commission and the Natural Heritage Trust

Coates Gully - 3 Mile Flats – Site 9: Maps 1-5

Length of section (m): 2050 m

Recorder's name: Ben Waining

Date surveyed: 9/7/99

Nearest road access: Great Eastern Highway – Coates Gully Crossing

Lot number(s):

Summary of river health:

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

Stream Condition
Black
Very Poor
4

Description

Bank stability: The Coates Gully-3 Mile Flats (Site 9) survey area is extensively affected by salinity and is a Landcare revegetation site. The main channel is up to 4 m wide and 1 m deep. The banks are steep with a gradient up to 60˚ and display significant levels of erosion. There are also some localised areas of slumping, with significant sedimentation levels throughout the section. Much of the erosion is associated with the bare saline scalds where gullies and rills have been created. The high saline levels have significantly contributed to the loss of vegetation and subsequent bank destabilisation. There are also some remnant sheep tracks within the area, which are acting as preferred water drainage paths. Revegetation has commenced along the foreshore of the brook in an attempt to stabilise the banks. Some ripping and mounding of the revegetated areas has been implemented down contours or oblique to the contours, and has resulted in some problems with the creation of preferential water paths along these mounds.

Vegetation: Exotic plant species, especially within the middlestorey and understorey of the section, dominate the vegetation of this section. The overstorey of the site is sparse, with many of the original old trees displaying signs of sickness, most probably due to the levels of salinity.

Recommended strategies

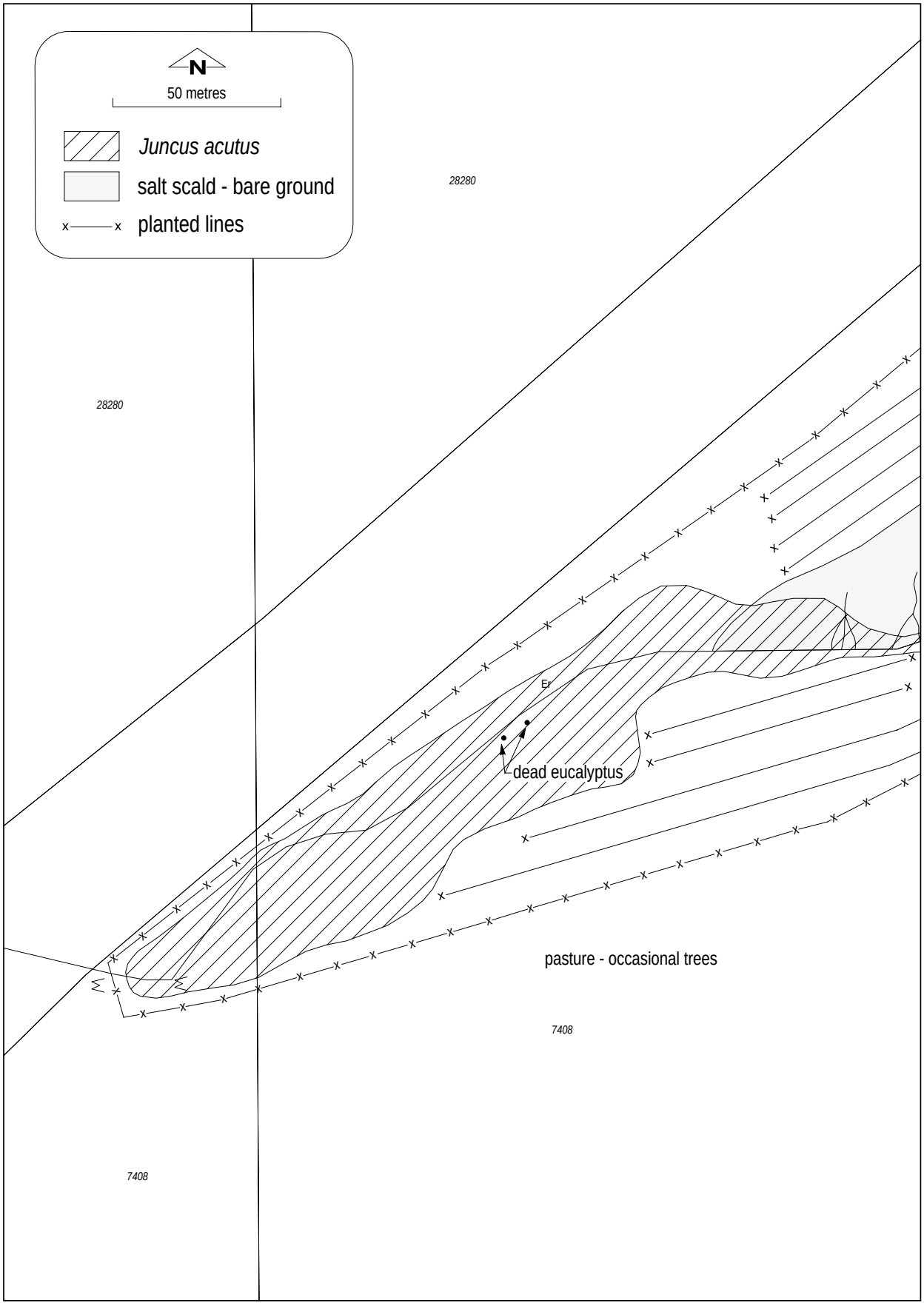
- Continue revegetation using appropriate salt tolerant native species (Table 5, Section 6.8). Consider using *Sporobolus virginicus* (Saltwater Couch) as a perennial pasture.
- Employ soft engineering techniques to aid in bank stabilisation (Appendix 4).
- Liaise with the local government authority, the Water and Rivers Commission and AGWEST to address the salinity issue on a catchment wide scale and try to develop a media campaign to encourage local landholders to become involved in catchment management.
- Liaise with the Water and Rivers Commission and AGWEST to investigate opportunities to retain water upslope by increasing groundwater use through planting trees.
- Ensure any new ripping/mounding is done across contours.

- Brush cut grasses and control weeds using methods outlined in Appendix 2.
- Continue revegetation efforts using appropriate salt tolerant native species such as *Melaleuca rhaphiophylla* (Freshwater Paperbark),

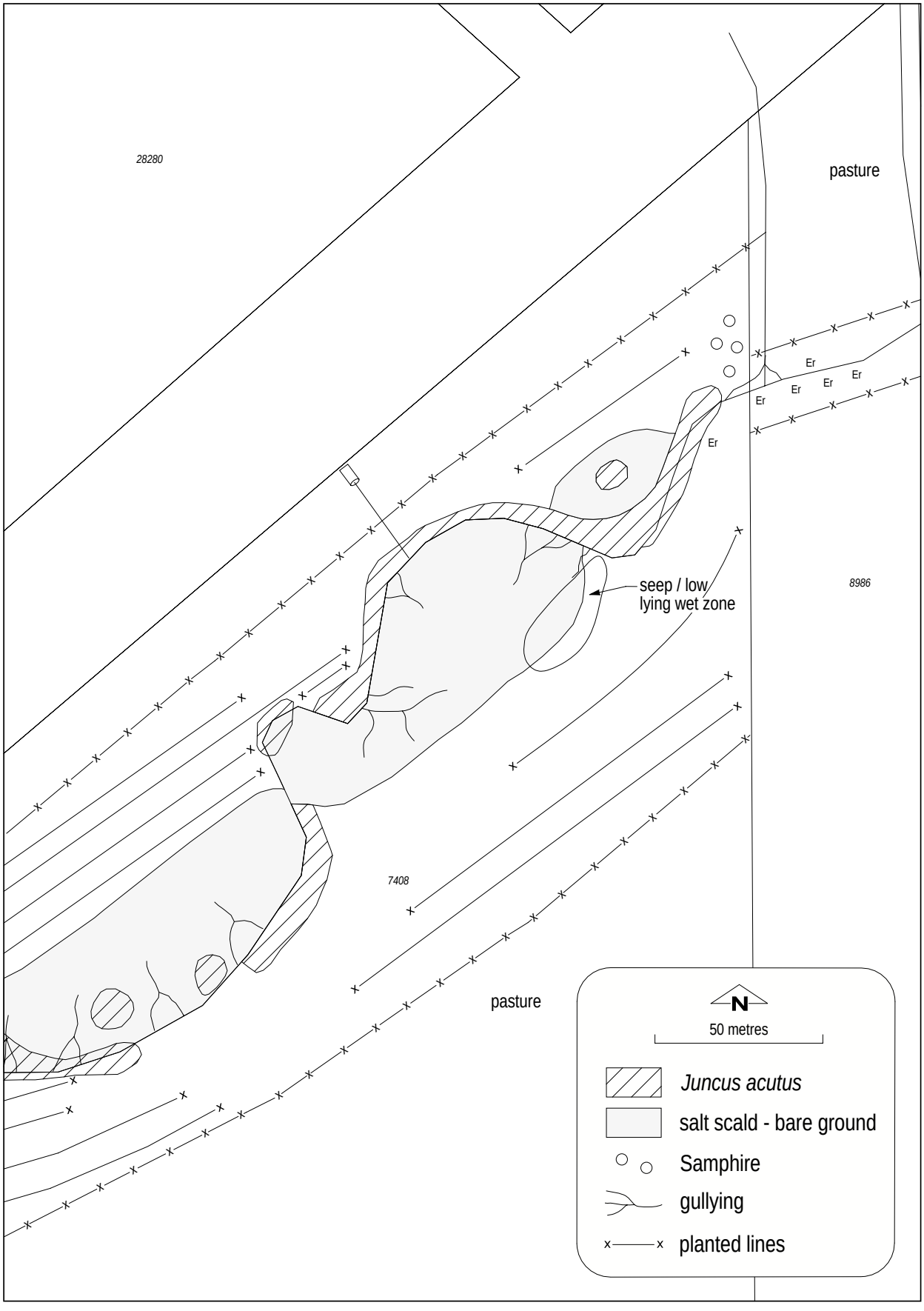
Many overstorey plants have been planted with the use of mounding techniques in an attempt to revegetate the area, and include various species of Eucalypt, Melaleuca, and Casuarina. Many of the planted areas are showing signs of sickness. Of the remnant overstorey vegetation, there exist some occasional to infrequent occurrences of *Eucalyptus rudis* (Flooded Gum) and *E. wandoo* (Wandoo). The middlestorey of this section is dominated by the exotic rush *Juncus acutus*. This rush is thriving within the main channel and along the wetter areas of the banks. The only native species within the middlestorey of this site, are two isolated occurrences of *Baumea articulata*. The understorey is patchy in nature, reflecting the amount of ground affected by saline scalding. The dominant species of the understorey are exotic weed species. These species include annual pasture grasses, Kikuyu (*Pennisetum clandestinum*), Perennial Ryegrass (*Lolium* sp.) and Guildford Grass (*Romulea rosea*). Kikuyu is well established, especially in the eastern portions of the section, and may prevent re-establishment of some of the native species of the area. Native species within the understorey include rare to occasional occurrences of *Lepidosperma scabrum* and frequent occurrences of the halophyte *Sarcocornia* spp.	*M. cuticularis* (Saltwater Paperbark) and *Baumea juncea* (Bare Twig Rush) on the banks, with *Juncus pallidus* (Pale Rush) planted in the instream environment between the high and low water mark (Appendix 3). • Liaise with the local government authority and the Water and Rivers Commission to investigate the feasibility of installing upslope interception banks, or other appropriate methods to reduce the amount of saline waters entering the waterway (Appendix 4).
Stream cover: There is only occasional stream cover maintained by native vegetation due to the patchy distribution along the foreshore, whereas abundant exotic grasses and rushes provide frequent cover. Within the instream environment, leaf litter and vegetation provide cover.	• Retain instream cover features where water flow is not interrupted or bank stability threatened. • Continue revegetation efforts, attempting to establish more fringing vegetation.
Habitat diversity: It is uncertain if this site contains any permanent water. At the time of survey the water was clear, but very salty. There are some frogs within the brook, and some bird species do exist within the area. Evidence of feral cats was also seen during the survey. The lack of vegetation variety and density provides little in the way of habitat value to the area. There is a section with dense streamside Kikuyu, which provides some level of habitat for the frogs of the area. The trees, old stags and rushes provide habitat for nesting and roosting birds. Some meanders exist at the northeastern end of the section, which may provide some habitat value for any aquatic organisms present.	• Continue revegetation efforts, to obtain a denser, more diverse vegetation complex. • Liaise with the Department of Conservation and Land Management to become part of the Western Shield Program to control feral animals. • Retain old dead trees for nesting sites.

Other issues: There is rubbish present within the surveyed area, which has most probably come from the highway which parallels this site. Stormwater drains from the highway are sites of erosion and origins of rubbish. The service station, and associated landfill, may be a source for contaminants to the waterway. This site is a Landcare demonstration site for the rehabilitation of saline affected lands. It is important that it is seen to be successful, to encourage further involvement by the surrounding landowners to ameliorate salt affected land.

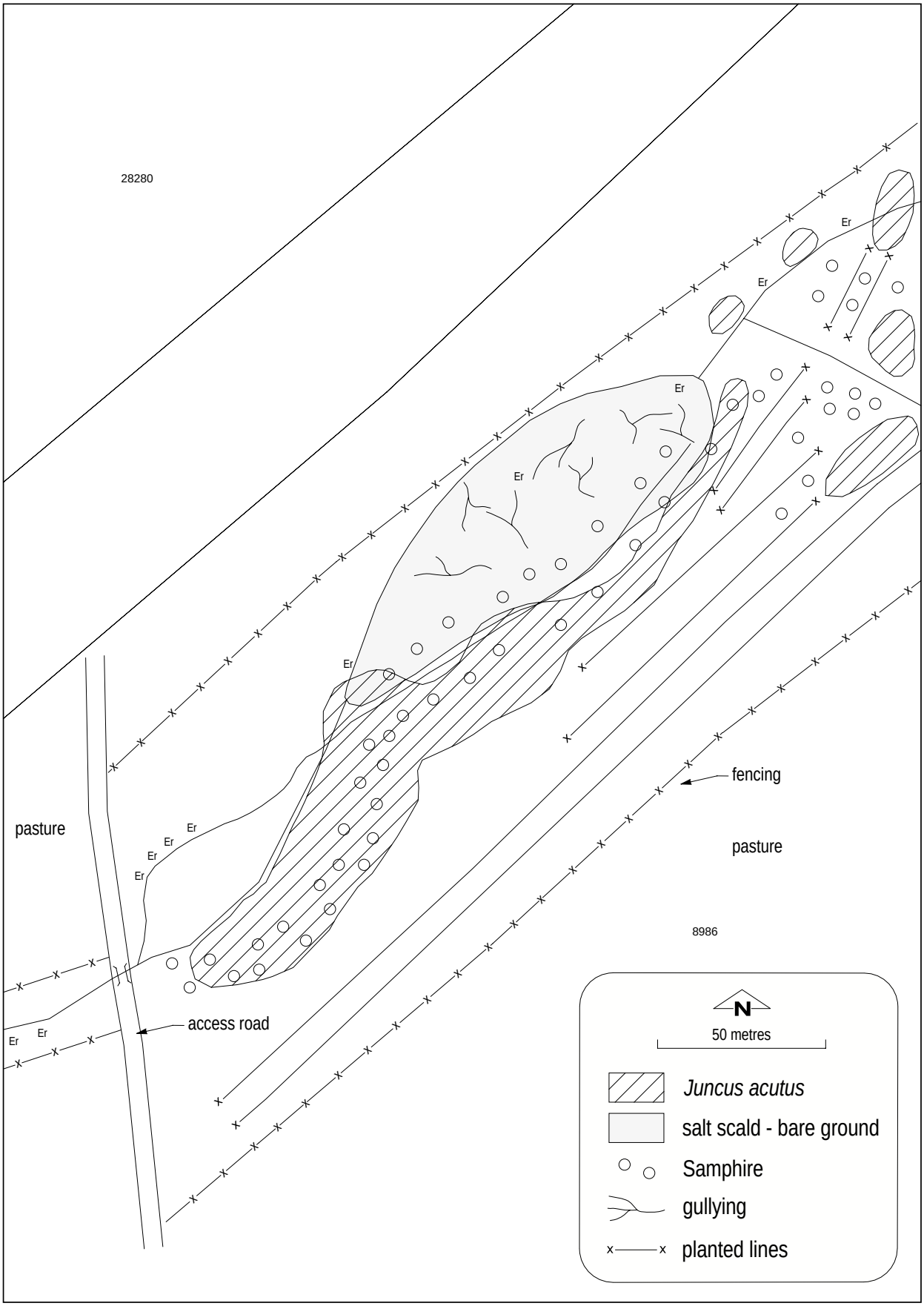
- Encourage Main Roads WA and the local government authority to assess stormwater outflow points to address the sites of erosion and to install rubbish screens (gross pollutant traps).
- Approach the Department of Environmental Protection to instigate a water quality monitoring program to check for contamination from the service station, and road.
- Continue the rehabilitation efforts.



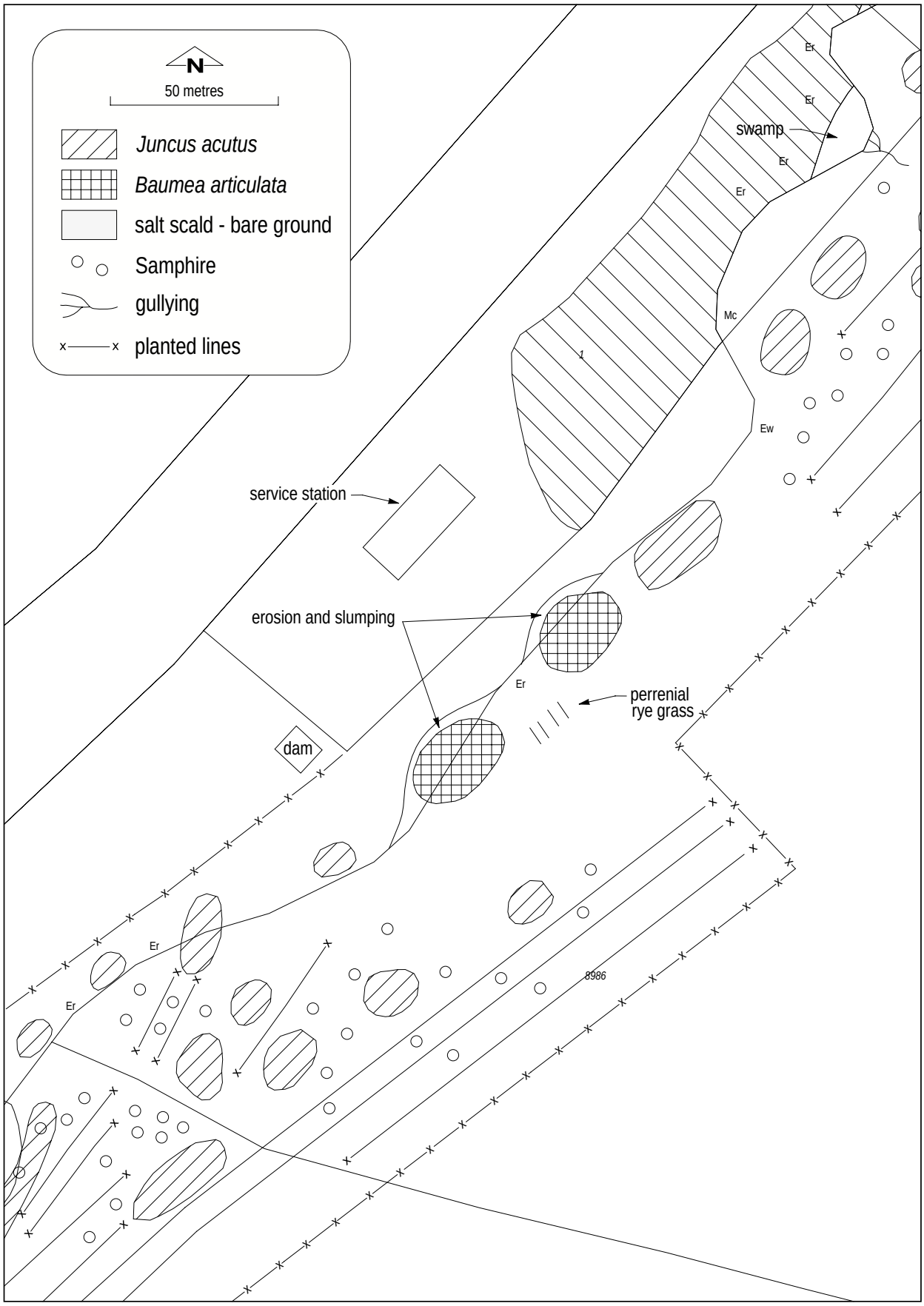
Coates Gully - 3 Mile Flats Site 9: Map 1



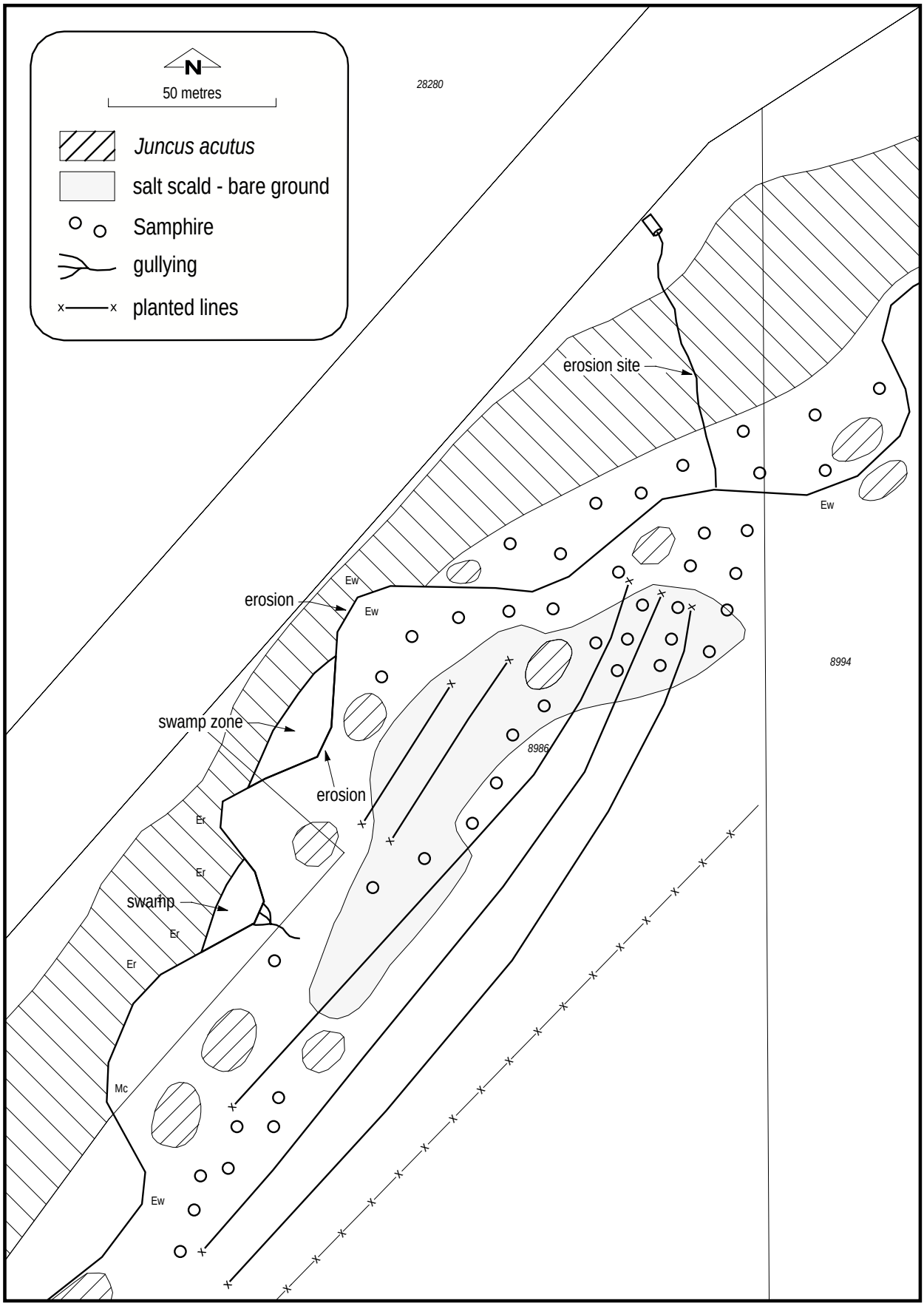
Coates Gully - 3 Mile Flats Site 9: Map 2



Coates Gully - 3 Mile Flats Site 9: Map 3



Coates Gully - 3 Mile Flats Site 9: Map 4



Coates Gully - 3 Mile Flats Site 9: Map 5

5. General recommendations

A number of general recommendations apply to all of the sites. They are listed under the core activities which will be required for groups to successfully develop and implement rehabilitation strategies.

5.1 Planning

- Determine cadastral boundaries and landowner/ management to ensure that they support the foreshore assessment process, and are involved in the development and implementation of any remedial strategies.
- Collate as much existing information about the focus waterway and catchment as possible.
- Focus initial foreshore assessment survey work in areas where future rehabilitation projects may be undertaken.
- Extend future foreshore assessment work from previously surveyed areas along the foreshore, eventually mapping all sites. Future surveys may also include re-assessment of earlier surveys to assess changes to the environment.
- Create herbariums of native and weed species to assist group members and other interested parties to distinguish between native and introduced plants present in the riparian zone. This could include seedlings.
- 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, the Water Corporation, the Water and Rivers Commission and the Swan River Trust are advised of any works within their management areas, to ensure that the works meet legislative requirements.
- Develop information brochures to increase community awareness of the importance of foreshore areas 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 and encourage rehabilitation of the foreshore area.
- Endeavour to obtain funds from outside sources to assist both the group and any private landholders who are willing to implement rehabilitation activities.

5.2 Site preparation

5.2.1 Weed control

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

5.2.2 General site preparation

- Encourage landholders throughout the rural and semi-rural catchments to fence off or delineate waterways and tributaries and implement a broadscale revegetation program.
- Endeavour to source external funding to 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 soil.
- Implement intensive weed control activities in manageable-sized nodes where planting will be undertaken.
- Remove flower heads prior to seeding to limit reinforcement of the weed seed bank.
- In broadscale areas proposed for future works, or in high-risk areas of dense weeds with few native plants where complete removal is inappropriate, ensure either flower removal or repeated brushcutting occurs prior to seeding.

5.3 Planting out

- Ensure planted areas within streamlines are artificially stabilised and planted in low-flow conditions to enable sufficient time for establishment, to reduce the chance of plants being washed out during peak flows.
- Plant native species only in areas where weeds have been effectively controlled and managed for a preferred minimum of two seasons.
- Encourage landholders to ensure all strata of vegetation, including understorey, middlestorey and overstorey species are, over time, included in revegetation works to reinforce bank stability.
- Plant overstorey species initially in highly exposed regions lacking vegetation, to create a level of cover and protection for future plantings.
- Plant emergent and wetland plants in permanent water between September and March, securing those planted in flowing water with 600 mm steel "U" shaped pegs.
- Plant dryland plants in May to July and seasonally inundated areas in August to September.
- 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-create 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 proforma 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 undertake 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, which may be State or local government authorities or private landholders, prior to undertaking any survey work. Gaining access to private property may prove to be difficult, while 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 the relevant 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 them to enhance their land. Healthy foreshores can increase property values and, through discussion within communities, can ultimately result in peer pressure on others to protect 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 value. For example, large numbers of birds, e.g. black ducks, frequently using the foreshore, may be construed as evidence of adequate habitat. 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, limit uncontrolled weed growth and keep the stream bed free of debris, it is claimed 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 plans should have clearly defined aims, objectives and visions as, ultimately, the use of the land will determine how, where and if, rehabilitation plans should be developed and implemented.

For example, if 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 that the plan reflects community attitudes, which will affect whether or not plans are implemented.

Following management planning, the next stage is to develop a rehabilitation plan for the whole waterway. It is essential to extend the assessment of foreshore condition to the full 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 more complete the understanding of the waterway and their tributaries, the better.

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

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

6.3 Long term management

The rehabilitation planning process should include a maintenance schedule for existing works as well as future projects. The importance of continued maintenance on current project sites prior to beginning any new works is emphasised. Long term ongoing management 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 assistance from State and local government agencies, firebreak 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 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 land use can have a considerable impact on the riparian zone and waterway health. Different land uses have different implications for stream health and therefore the appropriate management regimes will vary.

Riparian zones are often highly degraded. Foreshore vegetation is frequently reduced to a few metres either side of the watercourse. It is important to provide information to landholders and land managers about the benefits of undertaking remedial works along foreshores, emphasising the importance of fencing off riparian areas and excluding stock. Obtaining 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 signage around project sites can increase community awareness. Providing detailed information on the benefits of replanting native species (such as stabilising foreshore banks and increasing stream cover and habitat diversity) will increase awareness and may encourage local residents to become involved in the projects.

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

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

6.5 Gaining support from state and local government

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

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

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

Key contacts include:

Contact	Agency	Contact Number
Ecoplan	Department of Environmental Protection	9222 7000
	Swan Catchment Centre	9221 5300
	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 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 liaise with the land manager to develop and implement any assessment proforma and rehabilitation projects.

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

6.7 Fire management

Fire is not recommended as a general management technique for riparian zones, particularly in the Scarp region and areas with heavy soils. Should fire occur as a result of arson or accident, then advantage should be taken of the increased access to the area for weed control.

Over burning is likely to significantly damage fringing vegetation, depleting the seed bank of some species, and may result in reduced bank stability and higher levels of erosion. Excess fire may encourage further weed invasion and the spread of existing weed species. Autumn burns are particularly risky. Liaise with the Water and Rivers Commission and the Department of Conservation and Land Management for advice on over burning and acceptable fire levels.

Areas deemed to be at risk of fire should have a detailed fire management plan in place. This plan should detail actions required in the event of a fire, locations of water available for fire fighting and access routes for fire fighters to enter the area. This is especially important if foreshore areas have been fenced off to prevent stock access, or unauthorised access, thus hindering fire services from entering the area. The fire management plan should be prepared in conjunction with representatives from the Fire and Emergency Services Association.

6.8 Notes on reclamation of salt affected land

Surface expressions of salinity can be due to a number of causes. In Western Australia much of the salinity can be attributed to the rising watertable bringing salt, stored in the soil profile, to the surface. One of the main reasons for the rise in watertable levels is the large scale removal of the native, deep-rooted perennial plants.

Areas affected by salinity are capable of being a productive resource. To facilitate the return of salt affected land to a productive state a number of factors need to be considered. These include desired land use (grazing, agroforestry, recreational etc.), current salinity levels, availability of financial and logistical resources and the identification of recharge/discharge areas.

Revegetation using appropriate salt tolerant native species is recommended for the amelioration of salt affected lands. Attention should also be paid to addressing the cause of the rising watertable. This may involve using revegetation techniques at the point of recharge, which is often in areas of permeable soils higher in the topography of the area. This is a priority in areas where clearing of the native vegetation has previously occurred. High water use plants can be used lower in the topography, where over time they may aid in reducing the watertable levels.

Amelioration of salt affected lands within riparian zones is especially important, as the scalding associated with the surface expression of salinity leaves areas devoid of vegetative cover. The removal of the fringing vegetation exacerbates the problems of erosion and bank destabilisation, reduces the levels of stream cover and results in a loss of the habitat values of waterways.

Agriculture WA and scientists from the University of Western Australia suggest a number of salt tolerant species. The following table contains some of these:

Table 5: Some suggested salt tolerant species.

BOTANICAL NAME	COMMON NAME	COMMENTS
Understorey species		
**Paspalum vaginatum*	Saltwater couch tolerance.	Very high waterlogging tolerance, no drought. Needs summer moisture.
**Thinopyrum elongatum*	Tall wheat grass	Moderate waterlogging tolerance, weed potential.
**Trifolium michelianum*	Balansa clover	Weed potential.
**Trifolium fragiferum*	Strawberry clover	High waterlogging tolerance. Best on summer moisture, weed potential.
Halosarcia spp.		Many species are very tolerant of waterlogging and salinity.
Sarcocornia blackiana		Combined salt and waterlogging tolerance is particularly high. Can tolerate periodic inundation.
Sarcocornia quinqueflora sub sp. quinqueflora	Glasswort, Samphire	Combined salt and waterlogging tolerance is particularly high. Can tolerate periodic inundation.
Sporobolus virginicus	Marine couch	Reports tolerance to 25-50 dS/m on alkaline duplex soils and wet sites.
Middlestorey species		
Baumea juncea *Isolepis nodosa*	Bare Twigrush Nodding Club Rush	Limited salt tolerance and prefers seasonally moist soils. Very drought tolerant but not indigenous to the hills area.
Schoenoplectus validus	Lake Club Rush	Requires permanent waterlogging or shallow water.
Atriplex spp.	Saltbush spp.	Generally require well-drained sites, some salinity tolerance.
Acacia cyclops	Coastal wattle	Severe to extreme tolerance. Sensitive to waterlogging.
Acacia saligna	Golden wreath wattle	Variation in provenances. Very good tolerance for salt and some waterlogging.
Melaleuca lateriflora		
Overstorey species		
Casuarina obesa	Salt sheoak	
**Eucalyptus halophila*	Salt lake mallee	
**Eucalyptus platypus var. heterophylla*	Coastal moort	Could have very high salt tolerance.
Eucalyptus rudis	Flooded gum	
Melaleuca cuticularis	Saltwater paperbark	

NB: Asterix (*) denotes non-local Western Australian species

Before selecting species for revegetation programs, especially within the riparian zone, salinity levels should be determined and appropriate species, which are unlikely to become a weed species, should be selected. Selection of species should be made in conjunction with a Landcare, Agriculture WA or other authority on appropriate local species. Plants or seed should be sourced from within the local provenance, where possible.

6.9 Access to information

State and local government authorities have considerable information resources about waterways and should be contacted for assistance.

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.

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 the foreshore condition of the same area over time, or of different sites in the same survey season to prioritise works.

7. Matters for Consideration

7.1 Liaison with government agencies

A number of recommendations cited throughout this report require substantial technical assistance or additional funds to implement. Consequently, it may be beyond the scope of many community groups to undertake these projects due to a lack of available resources. Further, in many instances approval from the appropriate authority is required before any works can progress. Liaison with government agencies at the local and State level is an important step in determining if these remedial strategies can be implemented. Therefore, even though these recommendations can often not be addressed immediately, they can become a focus for future works when funds and assistance become available.

7.1.2 Water and Rivers Commission and the Swan River Trust

The Water and Rivers Commission and the Swan River Trust play an integral role in the management and protection of our waterways. Many of the recommendations suggest that community groups liaise with these agencies to determine opportunities to investigate the following:

- Monitor stream health at a catchment level to assess erosion events, sediment loads, peak flow rates and pollution levels.
- Determine opportunities to retain water upslope when flow rates are high by increasing groundwater use through planting trees or to investigate the feasibility of diverting water flow into holding ponds.
- Assess the potential to minimise the amount of saline water entering waterways by installing upslope interception banks.
- Determine the legality of all off-take pipes, pumps and water containment structures (ponds and dams) located along waterways to investigate the level of water extraction.
- Assess the impact of dams and ponds on stream flow and sedimentation, ensuring that these structures meet with stipulated conditions of construction and design and do not impact on stream hydrology or foreshore stability.

7.1.3 Local Government Authority

Community groups need to establish close links with their local government authorities when aiming to undertake any rehabilitation works on foreshore areas, as approval and support is required. It is important to understand the current policies and requirements of these authorities and to undertake works within a framework that complements their own aims for the management of these riparian areas.

Work with the local government authorities to:

- Review current structures that may be exacerbating erosion and address these problems using appropriate water sensitive urban design principles.
- Determine the possibility to construct where required, crossover points, drainage outfalls, rock spillways and riffle zones that promote the stabilisation of foreshore areas.
- Assess the provision of recreational facilities such as bins to limit rubbish entering the waterway.
- Provide guideways using bollards and woodchip pathways to minimise the trampling of vegetation, particularly near revegetation works or valuable remnant vegetation.
- Promote careful management of recreational parks, ensuring mowing and other maintenance work does not threaten native plants.
- Encourage the use of appropriate native species in any planting works associated with foreshore areas.
- Assess and limit access to areas if required.
- Install signage to inform the local community and promote care of the foreshore environment.
- Ensure that any prescribed burns are undertaken in a mosaic pattern to provide sufficient cover and habitat for fauna while the vegetation is regenerating.

7.1.4 Department of Environmental Protection

The primary responsibility of the Department of Environmental Protection is to monitor and protect the environment. This department will provide information to the community about numerous issues including stating appropriate guidelines for development proposals, environmental protection and management rules, policy directions and will undertake assessment of reports of pollution or environmental damage.

Contact the Department of Environmental Protection to assess:

- Potential source points of nutrient or chemical pollutants entering the waterway from surrounding residential, business (such as petrol stations) or rural developments.

7.1.5 Ministry for Planning

The Ministry for Planning is the government agency responsible for landuse planning and therefore the community should liaise with this department (and the Department of Environmental Protection) to ensure:

- Any future subdivisions and residential developments close to foreshore areas have suitable management systems and infrastructure in place, to prevent degradation of the foreshore and stream environments.
- The use of water sensitive urban design principles, to aid in decreasing potential water and sediment loads to waterways when developing drainage infrastructure close to waterways.

7.1.6 Main Roads Western Australia

Main Roads Western Australia manages the road and transport network and associated road reserves. Encourage Main Roads WA to:

- Install gross pollutant or sand/silt traps on stormwater system outfalls into waterways to collect rubbish and sediment.
- Maintain weed management in road reserves adjacent to riparian areas.

7.1.7 Department of Conservation and Land Management

The Department of Conservation and Land Management (CALM) is the State government agency that manages our national parks and reserves. Foreshore areas on reserve land are protected by legislation and managed by the department and therefore approval is required if community groups wish to undertake any works in these areas. CALM also provides a wide range of information and support to community groups. Contact the department to find out information about the:

- Western Shield Program to control feral animals.
- Detection and management of Jarrah dieback or other plant diseases.

7.1.8 Agriculture Western Australia (AGWEST)

Agriculture Western Australia has a great deal of information that is available to the community including pamphlets and publications on a range of landcare subjects. They also provide a number of services. Liaise with AGWEST to:

- Gain advice on the identification and control of pest insects.
- Assess salinity levels in salt affected areas and investigate mechanisms to contain saline runoff upslope, away from waterways to protect vegetation from the hypersaline waters.
- Determine if it is appropriate to establish perennial pastures associated with foreshore areas to provide an alternative to landholders that currently allow stock to freely graze these areas. Ensure that the management of such a cropping system prevents the plants from seeding, and that plant fragments are trapped to prevent these species from invading the riparian zone.

7.1.9 Fire & Emergency Services Authority of WA

It is essential that community groups ensure that appropriate fire management plans are developed for foreshore areas as these sites are often in close proximity to high-density residential areas and may pose a threat to public safety. Community groups should liaise with the Fire & Emergency Services Authority of WA to ensure a comprehensive plan is maintained. It is important that all associated agencies such as the Department of Conservation and Land Management, the local volunteer fire brigade and the State Emergency Service are informed of any changes to access to sites. It is also important to ensure that firebreaks are maintained.

7.2 Further information

The world wide web can provide a wealth of information and useful contacts. Following are some URL addresses that may be of use:

The Government of Western Australia:
http://www.wa.gov.au/

Water and Rivers Commission:
http://www.wrc.wa.gov.au/

Swan River Trust:
http://www.wrc.wa.gov.au/srt/index.htsml

Water Corporation:
http://www.watercorporation.com.au/

Department of Environmental Protection:
http://www.environ.wa.gov.au/

Main Roads WA:
http://website.mrwa.wa.gov.au/

Ministry for Planning:
http://www.planning.wa.gov.au//index.html

Department of Conservation and Land Management:
http://www.calm.wa.gov.au/

Agriculture Western Australia:
http://www.agric.wa.gov.au/agency/index.htm

Fire and Emergency Services Western Australia:
http://www.fire.wa.gov.au/

WA online: http://www.onlinewa.com.au/enhanced/

8. Summary

This document provides the results of the second series of foreshore assessments undertaken along selected sections within the Wooroloo Brook catchment in accordance with the Shepherd and Siemon 1999; WRC Report RR2 foreshore condition assessment proforma. Testing and refining the assessment protocol in this work was intended to identify any shortcomings or limitations of the proforma.

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 the foreshore condition of the same area over time, or of different sites in the same survey season to prioritise works.

The key finding of the study showed that the health of the Wooroloo waterways, rated in accordance with the Stream Condition Index, ranged from Very Poor to Good. Of interest is that the very poor ratings occurred in the middle to upper sections of the catchment. This is of particular concern in the Sections surveyed that are subject to salt intrusion. The salt poses a threat to:

- Bank stability – because of increased water volumes and loss of vegetation,
- Vegetation – due to the loss of freshwater plant species that are unable to cope with high salt loads,
- Stream cover – due to the loss of fringing vegetation,
- Habitat diversity – due to potential for increased sediment loads, lack of salt tolerance and reduced extent and diversity of vegetation,
- Land values, ability to farm or utilise the land to earn a living, and
- Fauna – freshwater faunas that are intolerant of increased salinity are being lost from the system.

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

9. References and recommended reading

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Appendix 1

Native species identified during the foreshore assessment – Stage 2

Appendix 1a: Native species identified during the foreshore assessment process (1999)

Scientific name	Common Name	Jane Brook	Blackadder-Woodbridge Creeks	Helena River	Wooroloo Brook
Acacia alata	Winged Wattle				
Acacia pulchella	Prickly Moses				
Acacia saligna	Coojong				
Acacia sp.					
Acacia teretifolia					
Agonis flexuosa	WA Peppermint				
Agonis linearifolia	Swamp Peppermint				
Alexgeorgea arenicola					
Allocasuarina fraseriana	Sheoak				
Allocasuarina humilis	Dwarf Sheoak				
Andersonia aristata	Rice Flower				
Andersonia lehmanniana					
Anigozanthos sp.	Kangaroo Paw				
Astartea fascicularis	Common Astartea				
Astroloma ciliatum	Moss-Leaved Heath				
Astroloma foliosum	Candle Cranberry				
Astroloma pallidum	Kick Bush				
Azolla sp.					
Baeckea camphorosmae	Camphor Myrtle				
Banksia littoralis	Swamp Banksia				
Baumea articulata	Jointed Twig Rush				
Baumea juncea	Bare Twigrush				
Baumea rubiginosa	River Twigrush				
Baumea sp.					
Borya sphaerocephala	Pincushions				
Borya sp.					
Bossiaea aquifolium	Water Bush				
Bossiaea sp					
Caladenia spp.	Orchids				
Callistemon sp.					
Calothamnus quadrifidus	One Sided Bottlebrush				
Calothamnus sanguineus	Pindak				
Calytrix variabilis	Star Flowers				
Carex appressa	Tall Sedge				
Carex fascicularis	Tassel Sedge				
Carex sp.					
Cassytha flava	Dodder Laurel				

Scientific name	Common Name	Jane Brook	Blackadder-Woodbridge Creeks	Helena River	Wooroloo Brook
Cassytha sp.					
Casuarina obesa	Swamp Sheoak				
Centella cordifolia	Centella				
Centrolepis sp.	Centrolepis				
Cheilanthes austrotenuifolia	Rock Fern				
Cheilanthes distans	Bristly Cloak Fern				
Chenopodium glaucum	Glaucous Goosefoot				
Clematis microphylla	Old Mans Beard				
Clematis pubescens	Common Clematis				
Conostylis setigera	Bristly Conostylis				
Conostylis setosa	White Cottonhead				
Conostylis sp.					
Convolvulus erubescens	Pink Bindweed				
Corymbia calophylla	Marri				
Corynotheca micrantha	Sand Lily				
Cryptandra arbutiflora	Waxy Cryptandra				
Dampiera alata	Winged stem Dampiera				
Darwinia citriodora	Lemon Scented Darwinia				
Darwinia thymoides					
Daviesia decurrens	Prickly Bitter Pea				
Daviesia horrida					
Daviesia preissii					
Dianella revoluta	Spreading Flax Lily				
Dianella sp.					
Dillwynia sp.					
Drosera glanduligera	Pimpernel Sundew				
Drosera macrantha	Climbing Drosera				
Drosera microphylla	Purple Rainbow				
Drosera pallida	Pale Rainbow				
Dryandra armata	Prickly Dryandra				
Dryandra bipinnatifida					
Dryandra nivea	Couch Honeypots				
Dryandra sessilis	Parrot Bush				
Eucalyptus laeliae	Darling Range Ghost Gum				
Eucalyptus marginata	Jarrah				
Eucalyptus patens	Black Butt				
Eucalyptus rudis	Flooded Gum				
Eucalyptus wandoo	Wandoo				

Scientific name	Common Name	Jane Brook	Blackadder-Woodbridge Creeks	Helena River	Wooroloo Brook
Gompholobium tomentosum	Hairy Yellow Pea				
Goodenia fasciculata					
Grevillea bipinnatifida	Native Fuchsia				
Grevillea diversifolia	Variable Leaf Grevillea				
Grevillea endlicheriana	Spindly Grevillea				
Grevillea glabrata	Smooth Grevillea				
Grevillea pilulifera	Woolly Grevillea				
Grevillea quercifolia	Oak-leaved Grevillea				
Grevillea sp.					
Grevillea synapheae	Catkin Grevillea				
Grevillea wilsonii	Wilsons Grevillea				
Haemodorum sp.	Mene				
Hakea amplexicaulis	Prickly Hakea				
Hakea cristata	Snail Hakea				
Hakea erinacea	Hedge-hog Hakea				
Hakea lissocarpha	Honeybush				
Hakea petiolaris	Sea-Urchin Hakea				
Hakea prostrata	Harsh Hakea				
Hakea ruscifolia	Candle Hakea				
Hakea trifurcata	Two-Leaved Hakea				
Hakea undulata	Wavy-Leafed Hakea				
Hakea varia	Variable Leaf Hakea				
Hardenbergia comptoniana	Native Wisteria				
Hemiandra pungens	Snake Bush				
Hemiandra sericea					
Hibbertia spicata					
Hibbertia hypericoides	Yellow Buttercup				
Hibbertia sp.	Native Buttercups				
Hibbertia subvaginata					
Hovea chorizemifolia	Holly-leaved Hovea				
Hovea pungens	Devils Pins				
Hovea trisperma	Common Hovea				
Hybanthus floribundus					
Hypocalymma angustifolium	White Myrtle				
Hypocalymma robustum	Swan River Myrtle				
Hypolaena sp.					
Isolepis nodosa	Knotted Club Rush				
Isolepis setiformis	Tufted Sedge				
Isolepis sp.	Club Rushes				
Isopogon sphaerocephalus	Drum Stick Isopogon				

Scientific name	Common Name	Jane Brook	Blackadder-Woodbridge Creeks	Helena River	Wooroloo Brook
Jacksonia furcellata	Grey Stinkwood				
Jacksonia sternbergiana	Green Stinkwood				
Juncus holoschoenus	Jointed Rush				
Juncus kraussii	Shore Rush				
Juncus pallidus	Pale Rush				
Juncus sp.					
Kennedia prostrata	Running Postman				
Kennedia stirlingii	Bushy Kennedia				
Kunzea sp.					
Labichea lanceolata	Tall Labichea				
Labichea punctata	Lance Leaved Cassia				
Lasiopetalum bracteatum	Helena Velvet Bush				
Lasiopetalum sp.					
Laxmannia squarrosa					
Lechenaultia biloba	Blue Lechenaultia				
Lepidosperma angustatum					
Lepidosperma effusum	Spreading Sword Sedge				
Lepidosperma longitudinale	Pithy Sword Sedge				
Lepidosperma scabrum					
Lepidosperma sp.					
Lepidosperma tetraquetrum	Angle Sword Sedge				
Leptospermum ellipticum	Tea Tree				
Leucopogon sp.	Bearded Heath				
Leucopogon verticillatus	Tassel Flower				
Lomandra odora	Tiered Mat Rush				
Lomandra preissii					
Macrozamia riedlei	Zamia				
Melaleuca cuticularis	Salt Water Paperbark				
Melaleuca lateritia	Robin Redbreast Bush				
Melaleuca preissiana	Modong				
Melaleuca rhaphiophylla	Swamp Paperbark				
Melaleuca scabra	Rough Honeymyrtle				
Melaleuca viminea	Mohan				
Mesomelaena preissii					
Mesomelaena pseudostygia					
Mesomelaena stygia					
Mesomelaena tetragona	Semaphore Sedge				
Notodanthonia sp.					
Nuytsia floribunda	WA Christmas Tree				

Scientific name	Common Name	Jane Brook	Blackadder-Woodbridge Creeks	Helena River	Wooroloo Brook
Oxylobium lineare	Narrow-leaved Oxylobium				
Paraserianthes lophantha	Albizia				
Patersonia occidentalis	Purple Flag				
Patersonia umbrosa	Shade Patersonia				
Pentapeltis peltigera					
Pericalymma ellipticum	Swamp Teatree				
Petrophile stricta					
Pimelea ciliata	White Banjine				
Pimelea spectabilis	Banjine				
Pimelea suaveolens	Scented Banjine				
Pronaya fraseri	Elegant Pronaya				
Pteridium esculentum	Bracken Fern				
Ptilotus esquamatus					
Ptilotus manglesii	Mulla Mulla				
Regelia ciliata					
Restio sp.					
Rulingia cygnorum					
Schoenoplectus validus	Lake Club Rush				
Schoenus grandiflorus	Large Flowered Rush				
Schoenus sp.					
Stirlingia latifolia	Blueboy				
Stylidium sp.					
Styphelia tenuiflora	Common Pinheath				
Synaphea petiolaris	Granite Synaphea				
Templetonia biloba					
Themeda australis	Kangaroo Grass				
Thomasia foliosa					
Thomasia macrocarpa	Large Fruited Macrocarpa				
Tricoryne elatior	Yellow Autumn Lily				
Triglochin procera	Arrowgrass				
Trymalium ledifolium					
Typha domingensis	Bulrush				
Verticordia huegelii	Variegated Feather Flower				
Verticordia sp.	Feather Flowers				
Viminaria juncea	Swishbush				
Xanthorrhoea gracilis	Slender Grass Tree				
Xanthorrhoea preissii	Grass Tree				

Appendix 1b: Weed species identified during the foreshore assessment process (1999)

Scientific name	Common Name	Jane Brook	Helena River	Wooroloo Brook	Blackadder-Woodbridge Creeks
Acacia spp	Introduced Wattles	■	■	■	
Alocasia brisbanensis	Elephant Ear				■
Alternanthera sp.	Joyweed	■			
Aponogeton elongatus					
Arundo donax	Giant Reed	■	■	■	■
Asparagus asparagoides	Bridal Creeper	■	■	■	
Aster subulatus	Bushy Starwort	■		■	■
Avena fatua	Wild Oats		■	■	■
Briza maxima	Blowfly Grass	■	■	■	■
Briza minor	Shivery Grass	■	■	■	■
Carex divisa	Divided Sedge		■	■	
Centaurea spp.	Thistles	■	■		■
Chenopodium album	Fat Hen		■		
Conyza spp	Fleabane	■	■	■	■
Cortaderia selloana	Pampas Grass		■		
Cynodon dactylon	Couch Grass	■	■		■
Cyperus spp.		■	■		■
Cytisus proliferus	Tagasaste	■	■		
Echium plantagineum	Patersons Curse				■
Eragrostis curvula	African Lovegrass				■
Ficus carica	Edible Fig Tree	■	■	■	■
Foeniculum vulgare	Fennel			■	
Freesia aff. leichtlinii	Freesia	■		■	■
Fumaria capreolata	Whiteflower Fumitory	■	■	■	■
Gladiolus sp.	Gladiolus	■	■	■	
Gomphocarpus fruticosus	Cotton Bush	■	■		■
Hedra helix	Ivy		■		
Hypochaeris radicata	Flatweed				■
Ipomoea sp.	Morning Glory				■
Juncus acutus	Spiny Rush			■	
Juncus microcephalus					■
Lolium sp.	Ryegrass			■	■
Lupinus angustifolia	Lupins	■			■
Mentha pulegium	Pennyroyal	■			
Olea europaea	Olive Tree	■	■	■	
Opuntia sp.	Prickly Pear		■		■
Oxalis pes-caprae	Soursob	■	■	■	■
Oxalis glabra			■		

Scientific name	Common Name	Jane Brook	Helena River	Wooroloo Brook	Blackadder-Woodbridge Creeks
Oxalis purpurea	Purple Wood Sorrel				
Paspalum spp.	Paspalum				
Pennisetum clandestinum	Kikuyu				
Pennisetum setaceum	Fountain Grass				
Phalaris spp.	Phalaris				
Phytolacca octandra	Inkweed				
Pinus radiata	Radiata Pine				
Plantago lanceolata	Ribwort Plantain				
Populus sp	Poplars				
Quercus sp.	Oak Tree				
Raphanus raphanistrum	Wild Radish				
Rhynchelytrum repens	Red Natal Grass				
Ricinus communis	Castor Oil				
Romulea rosea	Guildford Grass				
Rosa sp.	Rose				
Rubus fruticosus	Blackberry				
Rumex spp.	Dock				
Salix sp	Willows				
Schinus terebinthifolia	Japanese Pepper				
Solanum nigrum	Deadly Nightshade				
Stenotaphrum secundatum	Buffalo Grass				
Trifolium sp.	Clover				
Typha orientalis	Bulrush				
Vicia sativa	Vetch				
Watsonia bulbillifera	Watsonia				
Zantedeschia aethiopica	Arum Lily				

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**							
Common Name:	Weed wattles	2	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Seed Form:	Light seed		*Riparian*	☑	*Perennial*	☑	*Shrub*	☑
Seeding Time:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Method of Spread:	Spreads mostly from seed						*Rush/Sedge*	☐
Best Time of Control:	Species dependent - prior to flowering						*Grass*	☐
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.						*Climber*	☐

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

		Control Priority	Location		Habit		Form	
Species Name:	**Alopecurus myosuroides**							
Common Name:	Slender foxtail	3	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Seed Form:			*Riparian*	☑	*Perennial*	☐	*Shrub*	☐
Seeding Time:			*Aquatic*	☐	*Annual*	☑	*Herb*	☐
Method of Spread:							*Rush/Sedge*	☐
Best Time of Control:							*Grass*	☑
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.						*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:	***Alternanthera nodiflora***	1	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Joyweed		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:	March-April						*Rush/Sedge*	☐
							Grass	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☐
Best Time of Control:	Oct-Nov							
Method of Control:	Hand weed plants in strips up to 2 m perpendicular to water flow and replace immediately with native emergent species. Carefully bag and remove weed material from the site. Any segment which is broken from this plant is likely to regenerate into a new plant, so using a floating bund with netting or similar device downstream to trap any segments missed.							

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

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

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

Ecosystem Management Services 1999

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

Method of Control: Cut plumes before seed ripens to limit spread. Remove most leaf material with a heavy duty brushcutter and paint regrowth with Glyphosate 1 in 2. Thoroughly wet both sides of the leaf.

In riparian situations do not attempt to dig out these plants, due to the potential to affect bank stability. Should fire occur in a riparian zone, then treat the plants as soon as they reshoot to take advantage of easy access.

		Control Priority	Location		Habit		Form	
Species Name:	**Cynodon dactylon**	1	Dryland	☑	Bulb/Corm	☐	Tree	☐
Common Name:	Couch		Riparian	☑	Perennial	☑	Shrub	☐
Seed Form:	Light seed		Aquatic	☐	Annual	☐	Herb	☐
Seeding Time:	May, April						Rush/Sedge	☐
Method of Spread:	Spreads readily from rhizome growth						Grass	☑
Best Time of Control:	Oct - Feb and April - May						Climber	☐

Method of Control: Hand weeding is very difficult, labour intensive and rarely effective. The most effective method is to spot/blanket spray in late spring - autumn using Fusillade or Targa at 4l per ha. Brushcutting and raking off bulk of plant material prior to treatment often improves ease of removal and spraying.

Do not spray over winter as this plant does not actively grow at this time. Flauzifop-butyl can be used on couch occurring amongst native rushes and sedges as they are tolerant of this chemical. Ensure that the population requiring treatment is not Sporobolus virginicus, the native salt water couch.

		Control Priority	Location		Habit		Form	
Species Name:	**Cyperus spp**	2	Dryland	☐	Bulb/Corm	☐	Tree	☐
Common Name:			Riparian	☑	Perennial	☑	Shrub	☐
Seed Form:	Light seed		Aquatic	☐	Annual	☐	Herb	☐
Seeding Time:	May - July Oct - Jan						Rush/Sedge	☑
Method of Spread:	Spreads readily from rhizome growth and seed						Grass	☐
Best Time of Control:	Nov - Jan						Climber	☐

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*	☑
Best Time of Control:	Aug - Dec						*Climber*	☐

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

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

		Control Priority	Location		Habit		Form	
Species Name:	***Eragrostis curvula***	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*	☑
Best Time of Control:	Nov - March						*Climber*	☐

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

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

		Control Priority	Location		Habit		Form	
Species Name:	***Erodium moschatum***	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*	☐
Best Time of Control:	June - Sept						*Climber*	☐

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

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

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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	☐
Seeding Time:							Rush/Sedge	☐
							Grass	☐
Method of Spread:	Spreads from suckers						Climber	☐
Best Time of Control:	Sept - Mar							
Method of Control:	Inject tree with systemic herbicide at 10 - 15 cm intervals around the trunk. Treatment may be required several times. Cut and paint any suckers with Glyphosate. Remove any branches which fall from the tree, as these can take root. Ensure bank stability is not threatened when removing the dead trunk.							

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

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

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

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

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

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

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

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

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

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

		Control Priority	Location		Habit		Form	
Species Name:	***Ipomoea spp***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Morning glory		*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:	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.							

		Control Priority	Location		Habit		Form	
Species Name:	***Isolepis prolifera***	2	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Budding club rush		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	Dec - Feb						*Rush/Sedge*	☑
							Grass	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☐
Best Time of Control:	Winter							
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.							

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

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	**Juncus articulatus**	2	Dryland	☐	Bulb/Corm	☐	Tree	☐
Common Name:	Articulated rush		Riparian	☑	Perennial	☑	Shrub	☐
Seed Form:	Light seed		Aquatic	☐	Annual	☑	Herb	☐
Seeding Time:	Nov - Mar						Rush/Sedge	☑
Method of Spread:	Spreads mostly from seed						Grass	☐
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***	3	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Lantana		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Grass*	☐
Best Time of Control:							*Climber*	☑
Method of Control:	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.							

		Control Priority	Location		Habit		Form	
Species Name:	***Leptospermum laevigatum***	1	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☑
Common Name:	Victorian coastal teatree		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light, easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	April - October						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	All year						*Climber*	☐
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.							

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

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

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*	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						*Climber*	☐
Best Time of Control:	June - Sept							
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*	☐
							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:	**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*	☐
							Grass	☐
Method of Spread:	Spreads from both seed and vegetative growth						*Climber*	☑
Best Time of Control:	Jul - Sept							
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*	☐
							Grass	☐
Method of Spread:	Spreads by bulb or corm growth						*Climber*	☐
Best Time of Control:	Winter - Spring							
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**	3	Dryland	☑	Bulb/Corm	☐	Tree	☐
Common Name:	Oleander		Riparian	☐	Perennial	☑	Shrub	☑
Seed Form:	Coarse seed		Aquatic	☐	Annual	☐	Herb	☐
Seeding Time:							Rush/Sedge	☐
							Grass	☐
Method of Spread:	Spreads from both seed and vegetative growth						Climber	☐
Best Time of Control:	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**	2	Dryland	☑	Bulb/Corm	☐	Tree	☑
Common Name:	Olive tree		Riparian	☐	Perennial	☑	Shrub	☐
Seed Form:	Heavy seed		Aquatic	☐	Annual	☐	Herb	☐
Seeding Time:	Nov - Jan						Rush/Sedge	☐
							Grass	☐
Method of Spread:	Spreads mostly from seed						Climber	☐
Best Time of Control:								
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**	2	Dryland	☐	Bulb/Corm	☐	Tree	☐
Common Name:	Soursob		Riparian	☐	Perennial	☐	Shrub	☐
Seed Form:	Light seed		Aquatic	☐	Annual	☐	Herb	☐
Seeding Time:	Sept						Rush/Sedge	☐
							Grass	☐
Method of Spread:	Spreads by runners						Climber	☐
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**	3	Dryland	☑	Bulb/Corm	☐	Tree	☐
Common Name:	Witchgrass		Riparian	☐	Perennial	☐	Shrub	☐
Seed Form:			Aquatic	☐	Annual	☑	Herb	☐
Seeding Time:							Rush/Sedge	☐
							Grass	☑
Method of Spread:	Spreads mostly from seed						Climber	☐
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*	☑	*Bulb/Corm*	☐	*Tree*	☑
Common Name:	Poplar		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:			*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:							*Rush/Sedge*	☐
Method of Spread:	Spreads from suckers						*Grass*	☐
Best Time of Control:	Oct - Feb						*Climber*	☐
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*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Wild radish		*Riparian*	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☑
Seeding Time:	Dec						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	Sept - Nov						*Climber*	☐
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*	☑	*Bulb/Corm*	☐	*Tree*	☐
Common Name:	Red natal grass		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light and 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 to Aug						*Climber*	☐
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*	☑	*Bulb/Corm*	☐	*Tree*	☑
Common Name:	Castor Oil		*Riparian*	☐	*Perennial*	☑	*Shrub*	☐
Seed Form:	Heavy seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
Seeding Time:	Nov - Jan						*Rush/Sedge*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	Any time but best prior to fruiting						*Climber*	☐
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**	1	Dryland	☑	Bulb/Corm	☑	Tree	☐
Common Name:	Guildford grass		Riparian	☑	Perennial	☐	Shrub	☐
Seed Form:	Light seed		Aquatic	☐	Annual	☐	Herb	☐
Seeding Time:							Rush/Sedge	☐
							Grass	☑
Method of Spread:	Spreads by bulb or corm growth						Climber	☐
Best Time of Control:								
Method of Control:	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**	2	Dryland	☐	Bulb/Corm	☐	Tree	☐
Common Name:	Watercress		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:	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**	1	Dryland	☑	Bulb/Corm	☐	Tree	☐
Common Name:	Blackberry		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:	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

Ecosystem Management Services 1999

		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*	☐
Method of Spread:	Spreads mostly from seed						*Grass*	☐
Best Time of Control:	Nov - Mar						*Climber*	☐

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*	☐
Method of Spread:	Spreads from suckers						*Grass*	☐
Best Time of Control:	Dec - Mar						*Climber*	☐

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*	☐
Method of Spread:	Spreads from suckers and seed						*Grass*	☐
Best Time of Control:	All year, but in wetlands treat in summer						*Climber*	☐

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

Ecosystem Management Services 1999

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

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

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

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

Ecosystem Management Services 1999

		Control Priority	Location		Habit		Form	
Species Name:	***Typha orientalis***							
Common Name:	Bulrush	1	*Dryland*	☐	*Bulb/Corm*	☐	*Tree*	☐
			Riparian	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Light, easily spread by wind		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
							Rush/Sedge	☑
Seeding Time:							*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***							
Common Name:	Ursinia	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
			Riparian	☐	*Perennial*	☐	*Shrub*	☐
Seed Form:	Light seed		*Aquatic*	☐	*Annual*	☑	*Herb*	☑
							Rush/Sedge	☐
Seeding Time:							*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***							
Common Name:	Vetch	3	*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:								
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***							
Common Name:	Periwinkle	3	*Dryland*	☑	*Bulb/Corm*	☐	*Tree*	☐
			Riparian	☑	*Perennial*	☑	*Shrub*	☐
Seed Form:	Coarse seed		*Aquatic*	☐	*Annual*	☐	*Herb*	☐
							Rush/Sedge	☐
Seeding Time:							*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

Ecosystem Management Services 1999

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

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

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

Ecosystem Management Services 1999

Appendix 3

Suggested species for revegetation works

Appendix 3: Suggested species for revegetation works

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

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

Species	CommonName	Location								Habitat		
		Roley Pool	*Wright Brook*	*Breera Brook*	*Bannister Creek*	*Bennett Brook*	*Ellen Brook*	*Southern Wood Creek*	*Upper Canning*	*Dryland*	*Bank*	*Emergent*
Melaleuca viminea	Mohan	☐	☐	☐	☐	☐	☑	☑	☑	○	◉	○
Oxylobium lineare	River pea	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Viminaria juncea	Swishbush	☑	☑	☑	☑	☑	☑	☑	☑	○	◉	○
4.Medium shrub												
Acacia pulchella	Prickly moses	☑	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Astartea fascicularis	Common Astartea	☑	☑	☑	☑	☑	☑	☑	☑	○	◉	○
Darwinia citriodora	Lemon scented darwinia	☑	☐	☐	☐	☐	☐	☐	☑	◉	○	○
Hakea varia	Harsh hakea	☑	☐	☐	☑	☐	☑	☑	☑	◉	○	○
Hibbertia spp	Native buttercups	☑	☑	☐	☐	☑	☑	☑	☑	◉	○	○
Jacksonia furcellata	Grey stinkwood	☐	☑	☑	☑	☑	☑	☑	☑	◉	○	○
Jacksonia 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	☑	☐	☑	☑	☑	☐	☑	☑	○	○	◉

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

Species	CommonName	Location								Habitat		
		Roley Pool	*Wright Brook*	*Breera Brook*	*Bannister Creek*	*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	☐	☐	☐	☑	☑	☑	☑	☐	○	○	◉

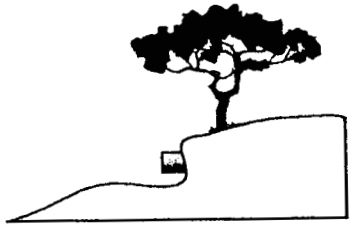
This information is site specific to the sections of assessed foreshore. Please seek expert advice if placing these species outside of the surveyed sections.

Appendix 4

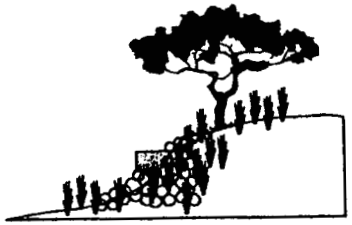
Suggested soft engineering works

Appendix 4: Suggested soft engineering works

DRAINAGE OUTFALL TREATMENT

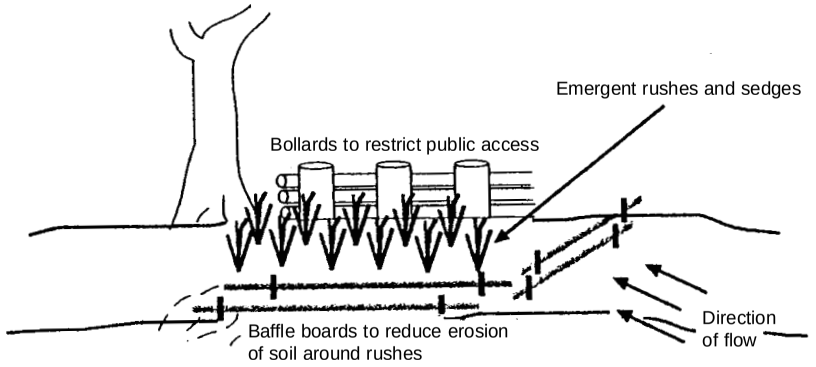


Scouring

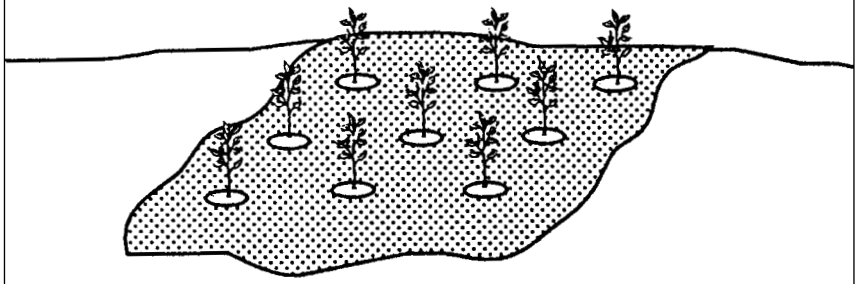


Riprap and planting

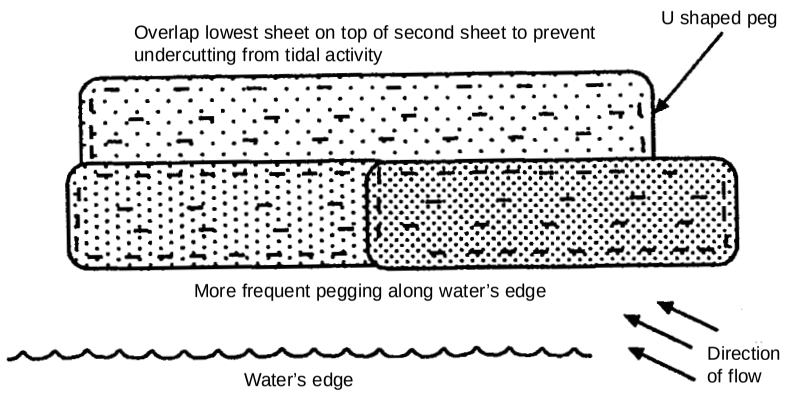
USING BAFFLES FOR PLANT PROTECTION AND SOIL STABILISATION



PLANT ARRANGEMENT 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.*
	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*
	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