River Rehabilitation Works 2013
Ovens River; Germantown Reach

Upper Ovens Valley Landcare Group

UPPER OVENS
VALLEY LANDCARE

Riparian Management Services

Prepared by Riparian Management Services

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FINAL VERSION

EXECUTIVE SUMMARY

This river works plan focuses on a 4km reach of the Ovens River upstream of Bright in north east Victoria. Commencing at Germantown Bridge on the Tawonga Gap Road, the 'project reach' extends downstream to the footbridge on the Cherry Walk.

This section of the Ovens River has a history of significant disturbance since European settlement. Gold mining, including the use of dredges in the river, commenced in the 1850s and continued into the 20th century. The native riparian vegetation was removed, the course of the river was altered and much of the alluvial material that made up the floodplain was processed and re-deposited on site. After the mining had ceased, the left floodplain, terrace and footslope country was planted with pines and this land use continues to this day. The right side of the valley has been largely neglected and the riparian vegetation has followed a successionary sequence that has resulted in a largely exotic flora in many areas. This is particularly true of the low lying floodplains and channels where various willow species now dominate. Blackberry is also widespread.

The project reach is geomorphically complex. The reach commences and finishes as a bedrock gorge within which the channel is stable. In between, however, the valley is wider and the channel is free to move laterally across the floodplain. Using the River Styles™ Framework classification method, the condition of the project reach has been assessed. Geomorphic behaviour that is inconsistent with the identified River Style highlights degradation and the multiple channels that have developed to the left of the main channel 570m downstream of the Germantown Bridge are an example of this. A possible major channel avulsion (sudden shift in channel position) is developing in this area.

Over recent years the willows growing to the left of the main channel have been removed. A similar program is proposed for the willows on the right of the channel. The pros and cons of this work are discussed. Recent studies by the North East Catchment Management Authority show that there is a strong perception within the community that willows are important for erosion control[1]. This perception is backed up by detailed analysis of channel erosion following the 2010 and 2011 floods[2]. Recommendations are made to suggest how future willow works can be undertaken while minimising the risk of causing post-removal erosion problems.

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When building the GIS data library for the project Cameron Alexander from Alpine Shire was very helpful. Alpine Shire provided the aerial photograph base layer for the project maps.

DISCLAIMER

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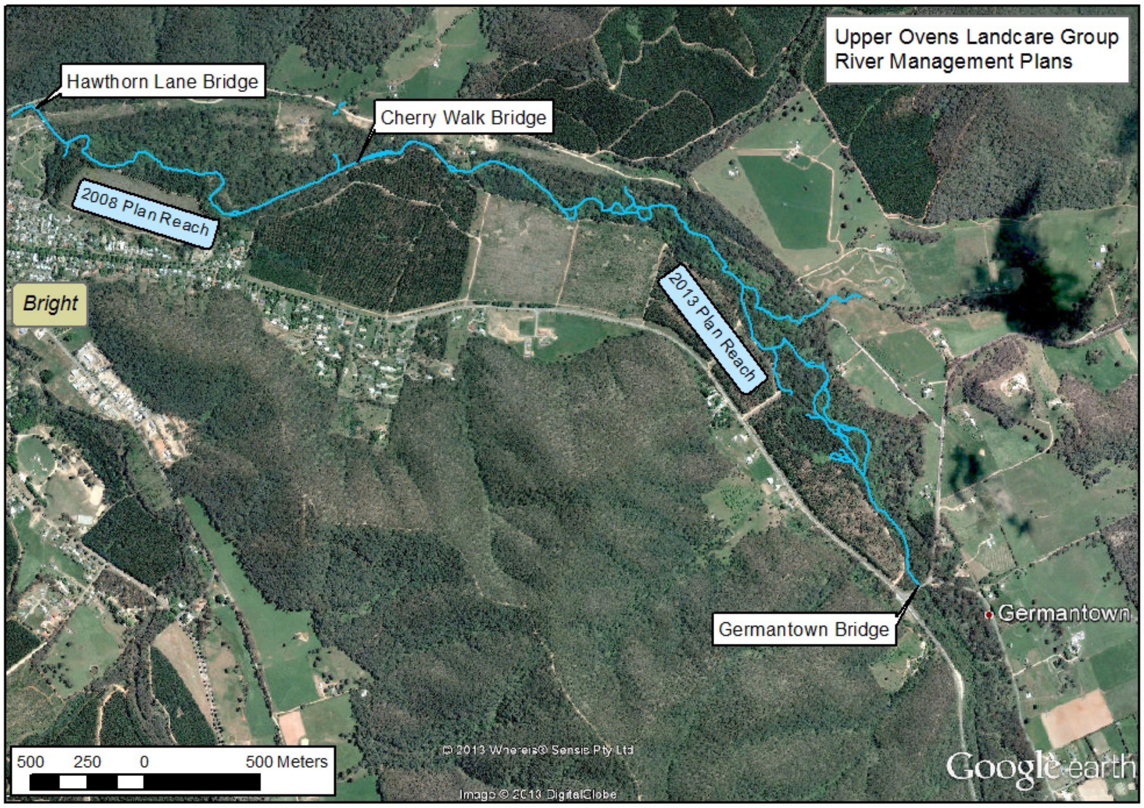
1. INTRODUCTION

In October 2012 Riparian Management Services (RMS) was commissioned by the Upper Ovens Valley Landcare Group (UOVLG) to prepare a River Rehabilitation Works Plan covering a section of the Ovens River upstream of Bright in north east Victoria. In 2008 RMS produced a similar plan for the UOVLG for the section of river from the Hawthorn Lane Bridge in Bright upstream to the Cherry Bridge. This 2013 plan builds on the previous work by extending the Group's formal river planning from where the 2008 plan finished at the Cherry Bridge upstream to Germantown Bridge – an additional channel distance of approximately 4 km (hereafter referred to as the 'project reach' - see map1).



Map 1. Upper Ovens Valley Landcare Group river plan reaches 2008 & 2013.

The Works Plan is in two parts; this Companion Report and two associated A1 map sheets (annotated aerial photographs). The maps provide a visual overview of the project area and list the recommendations, while this report provides further background detail.

Willows are an exotic taxa in Australia and their negative impacts have become widely understood in recent years and most species are now declared 'Weeds of National Significance'. The upper reaches of the Ovens River are badly infested with willows at various locations. The UOVLG has an ongoing program of willow control and this Works Plan consequently has a strong focus on this issue. Many willow control projects have been carried out across the country over recent years and the body of knowledge regarding how to plan and implement such programs has grown accordingly. In 2008, just after the completion of the first UOVLG Works Plan, a national willows management guide was published. It is recommended that this publication be referred to when planning the details of future on-ground willow control works. The guide can be accessed as follows:

Publication reference:

Holland Clift, S. & Davies, J. (2007). Willows National Management Guide: current management and control options for willows *(Salix sp.)* in Australia. Victorian Department of Primary Industries, Geelong.

Download from the Web at:

http://www.weeds.org.au/WoNS/willows/

This Works Plan has the specific aims of:

- Assessing the condition of the river within the project reach with respect to its geomorphic behaviour.
- Assessing the condition of the riparian vegetation across the entire floodplain.
- Reviewing the extent of the willow infestation and identifying management options for any future control works.
- Identify what are the key environmental assets within the project reach and how these assets can be maintained or enhanced in the future.
- Identify any threats to the environmental assets and how these can be ameliorated.
- Developing specific, prioritised management recommendations which, when implemented, will improve the condition of the project reach over time.

Common names are used throughout the body of this report, with full botanical names recorded in the tables at appendix 1. References to the left or right bank of the river (or river valley) are, as per the usual protocol, made with respect to someone looking downstream.

2. PROJECT REACH GEOMORPHOLOGY

2.1. The River Styles™ Framework

Non-living components of an ecosystem are referred to as “abiotic” elements (of the system). Within a river system, the bedrock and derived river sediments e.g. sands, gravels, boulders etc are abiotic elements. The science of fluvial geomorphology studies how these abotic components are arranged and how they change over time. The physical structure of a river system – its channels, floodplains, wetlands etc to a large extent dictate the flora and fauna that can reside therein. A fundamental first step in river management is, therefore, to gain an understanding of what the river system looks like in terms of is physical layout.

The River Styles™ Framework developed by Macquarie University provides a valuable river classification methodology based upon fluvial geomorphology[3]. Under this system, rivers can be classified according to the fundamental physical processes that drive their appearance and behaviour. Clearly, a mountain stream that is tumbling though a landscape comprised of solid bedrock is different to a low gradient sinuous river that meanders through a wide floodplain composed of alluvial sediments. By analysing river types (or 'styles') that have similar boundary conditions such as slope, flow volume, geology etc. distinct patterns can be ascertained. That is, across the World 'families' of river styles can be identified that display the same, or very similar, physical appearance and behaviour when operating under the same boundary conditions. Furthermore, when a river of a particular river style is subjected to some form of disturbance e.g. the removal of riparian vegetation, the geomorphic response observed is often the same as it was for another river of that style that suffered the same disturbance. From these observations it is possible to not only classify river styles but to predict their response to particular disturbances i.e. it is possible to build up a dynamic picture of change over time and, to some extent, predict likely changes in the future.

A single river system, e.g. the Ovens River, is usually composed of distinct reaches of different river styles. A fundamental criterion that determines river styles is the degree to which a river is 'confined'. That is, its ability over the short term in a geomorphic sense, to move horizontally (or laterally) and / or vertically (or incision). Three broad groups of river confinement are typically recognised and all three can be found on the Ovens River:

- Confined rivers or river reaches that flow mainly within a bedrock environment and therefore have little scope for lateral migration or incision e.g. the Ovens River upstream of Harrietville.
- Partially confined rivers or river reaches that have occasional floodplain 'pockets' where the valley within which they flow is wide enough. Some lateral movement and incision is possible e.g. the Ovens River between Harrietville and Wangaratta.
- Unconfined rivers or river reaches that flow mainly though alluvial sediments and are therefore free to move both laterally and to incise e.g. the Ovens River downstream of Wangaratta.

One of the strengths of the river styles methodology is that it can be applied at varying scales. Although a full river styles assessment is beyond the scope of this Works Plan, a brief assessment was carried out and is summarised in table 1 on page 4.

In areas of the project reach where the valley is wide with low floodplains on either side of the channel the *Wandering Gravel* river style can be identified e.g. the section commencing 570m downstream of Germantown Bridge. While multiple channels are a feature of this river style anastomosing channels, such as the ones that have formed within the recently cleared pine plantation, definitely are not and their presence is a strong indication of inappropriate geomorphic change for this river style. Hence geomorphic condition has been assessed as being moderate to poor.

The *Planform Controlled Low Sinuosity Gravel* river style occurs where the valley is narrower. The observed assemblage of channel and floodplain geomorphic features more closely matches the descriptions for this river style and consequently these reaches have been assessed as being in moderate condition.

The *Gorge* river style areas are far more resilient in terms of post disturbance geomorphic change and are in good condition.

Basic River Style label	Channel pattern	Geomorphic units	Geomorphic behaviour	Fragility	Geomorphic condition
Wandering Gravel (<10% of the channel abuts the valley margin, e.g. multi-channel section map sheet 1)	Multiple channels (2-5) separated by gravel deposits & islands. Low sinuosity. Continuous floodplain.	Channel zone: Chutes, mid-channel & bank-attached bars, islands, pools, riffles, secondary channels. Floodplain zone: Many palaeochannels & scour/stripping features.	Gravel or cobble/boulder bed dominated. Jumps or avulses frequently from one channel to another. Flow occurs in numerous channels at flood stage.	Medium	Moderate - Poor Justification: 1. Poor riparian vegetation (left bank more or less cleared, right bank heavily weed infested). 2. Localised accelerated erosion issues. 3. Inappropriate channel character – anastomosing channels ('floodout' channels to valley margin in pine plantation)
Planform Controlled Low Sinuosity Gravel (10% or more of the channel abuts the valley margin, e.g. middle section, map sheet 2 where valley width is restricted by footslope spur)	Single, planform controlled. Low sinuosity or straight. Occasional short reaches with 2 channels separated by islands (recent avulsion).	Channel zone: Lateral bars, islands in wider sections of channel, irregular riffles, may have elongate pools, benches. Floodplain zone: flood channels, paleochannels, terraces, wetlands.	Channel: Armoured gravel/sand. Floodplain: Gravel or sand based, with vertically accreted fines above. Composite banks. In wider reaches, bends migrate downstream. Adjusts through aggradation or degradation of the bed.	Medium	Moderate Justification: 1. Poor riparian vegetation (left bank cleared, right bank weed infested). 2. Localised accelerated erosion issues.
Gorge (Downstream end of map sheet 2)	Single, confined with no floodplain. Bedrock imposed configuration; may contain straight or highly sinuous reaches.	Channel zone: Often alternating sequences of steep stepped sections (with boulder bars, falls' cascades) & lower-slope sections with pools & rapids. Slackwater deposits.	Boulder, cobble & bedrock dominated, laterally stable; no change where bedrock banks & bed; slow change if weathered rock or colluvium.	Low	Good

Table 1. Rive Styles within the project reach. Labels & geomorphic descriptions from D.Outhet (2007)[4]. Condition assessments RMS.

2.2. Disturbance within the project reach

The following quote, taken from the Australian Mining History Association web site[5], briefly describes the gold mining history of the Bright area:

During the early 1850s, after the gold rushes in the Beechworth area had subsided, a new, rich gold field was discovered in the Bright area around 1853. Alluvial gold [was] *washed out of the river gravel and was taken first from the Buckland Valley with many other finds along the Ovens River to Harrietville and its tributaries such as Morse's Creek to Wandiligong. This was followed by reef mining and the turn of the century saw the coming of huge dredges.*

The gold mining, and particularly the use of dredges, caused massive disturbance to the river environment. Several dredges operated in the Bright – Germantown – Freeburgh area into the early part of the 20th century. The legacy of this period was a river that had been re-directed as required to gain access to floodplain sediments and a floodplain environment composed of unconsolidated mine spoil. When a floodplain develops naturally, sequential layers of material are deposited with each successive flood and, given time, these layers become 'cemented' i.e. with pressure and time the older layers of gravel and sand become quite hard and consequently have a certain degree of resistance erosion. In extreme cases, cemented alluvial deposits in terrace formations can become so hard that they act as the valley margin, that is, a non-erodible barrier to lateral channel migration. A floodplain composed of unconsolidated mine spoil on the other hand is easily eroded. During the period 2007 – 2010 RMS carried out a riparian zone monitoring and evaluation project for the North East Catchment Management Authority (NECMA)[6]. Ten sites along the Ovens River were assessed at yearly intervals including one near the Cherry Bridge and a site near Eurobin. Although this work was primarily aimed at assessing vegetation changes over time, the Eurobin site inadvertently detailed some major bank erosion when 17.2m of the river bank transect was washed away in one flood event in 2010. The bank and floodplain material at this site was loose, unconsolidated mine spoil.

In more recent times, the country to the south of the river within the project reach (left bank) has been managed as a pine plantation, including areas of floodplain. As with any crop grown on a floodplain, management activities that expose sediments e.g. harvesting, may lead to erosion problems if floods occur before suitable cover can be re-established. It is also worth noting that while the established pines will, no doubt, help bind the floodplain sediments to some degree, they will perform less well in this regard than vegetation that has evolved in a riparian setting e.g. the native River Bottlebrush. At the upstream end of the project reach the pines have been recently harvested off the floodplain (the 2010 aerial photograph used for the map sheets of this plan shows these pines had not been harvested at that time).

On the right side of the project reach, it appears that the mine-spoil floodplain has been left to re-grow naturally. The current vegetation is a mix of exotics and native riparian vegetation (this is discussed in more detail in the next section of this report). Although there is no evidence that the willows on the right bank were deliberately planted, it is worth noting that the planting of willows for erosion control purposes was common practice for many years both in Victoria and New South Wales.

In recent years some large patches of mature willow have been cleared from both the left bank and some small floodplain pockets that were not used for pines. The removal of these trees, like the harvesting of the pines off the floodplain, cannot be achieved without altering the dynamics of the site. Within the riparian landscape there is a close inter-relationship between the abiotic system components e.g. flow volumes, gradient, sediment type, the configuration of bedrock within the valley etc, and the prevailing riparian vegetation community. The balance of this relationship can determine not only the physical makeup of the riparian environment e.g. the pattern of channels, and floodplains, but also the habitat types that are created within the system e.g. deep, cool pools as opposed to shallow, warm water runs. Alterations in the composition of the riparian vegetation usually results in changes in terms of fluvial geomorphology.

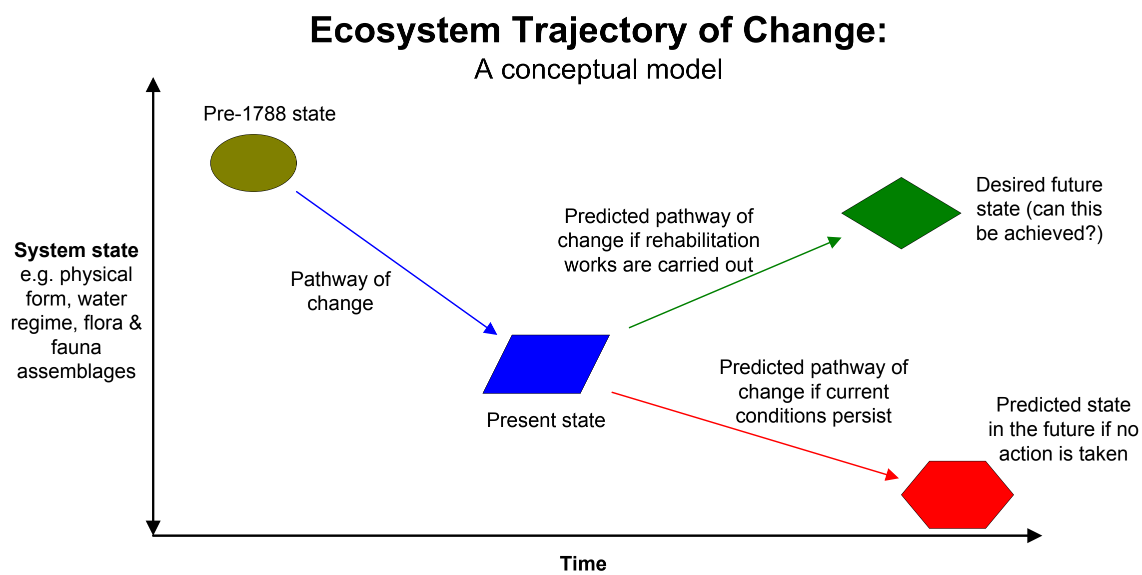


Figure 1. Conceptual model of ecosystem change over time. The project reach has undergone significant disturbance over time, which continues to this day. Predicting what the system might look like in the future, under varying management scenarios, can be very difficult because the consequences of past disturbances often take considerable time to play out.

2.3. Threats

In this section a 'threat' is something that has been identified that may impact on the current geomorphic condition of the project reach or geomorphic behaviour that is inconsistent with the river style.

As outlined in section 2.1, the multiple channels that have developed 570m downstream of Germantown Bridge represent behaviour that is inconsistent with this river style. From examination of the 2010 aerial photograph it appears that many of these channels have developed since that time – probably as a consequence of the sequence of floods from late 2010, 2011 and March 2012 (see flow hydrograph at appendix 2). A new secondary channel has developed along a former bank-side vehicular track and multiple channels now convey even relatively low flows out across the left hand floodplain (see photos 1 – 3 on the following pages). The almost complete absence of riparian vegetation, either on the bank or across the floodplain, has facilitated the development of these channels

Photo 1. Taken 550m downstream of the Germantown Bridge, the main channel divides. Currently the main flow is to the right, but if the flood wrack across the entrance to the left channel should move, this situation could soon be reversed.

Photo 2. Taken 60m downstream of photo 1, the channel divides again. The channel to the right follows an old vehicular track that used to run parallel with the main channel. The left hand channel soon splits into multiple channels that fan out across the floodplain. A possible major channel avulsion could take place in this area that would see the main channel move from the right of the floodplain to the left through the pine plantation.

Photo 3. Taken just downstream from photo 2, the channel in the foreground is a branch off the left hand channel shown in photo 2 (i.e. the 3rd division since the main channel split shown in photo 1). An avulsion of the main channel across this cleared floodplain should be avoided if at all possible.

and there is a real risk that an avulsion could occur during future floods that will see the main channel move out across this unprotected, low floodplain. This would have economic consequences in terms of damage to the recently re-planted pine plantation as well as creating a significant erosion issue as flows would be directed out across loose, unconsolidated floodplain deposits. It is likely that such a channel, should it develop, would be quite unstable and prone to significant lateral movement with the potential to re-work much of the floodplain.

Over the last couple of years, during which there have been a number of La Nina event floods in north east Victoria, there has been considerable debate about the role that willows play during periods of high flow. In particular, there is a strong perception within the community that the practice of removing willows from river banks leads to increased erosion. In a recent NECMA sponsored survey of community attitudes 62% of people '… stated that they consider willows to be good at holding or binding the banks'[1]. The same report provides a series of quotes from community members specifically regarding areas where willows have been removed, including the following:

"Everywhere that willows have been removed in the King Valley between Cheshunt and the last farm in the King Valley suffered erosion".

In addition to the community perceptions study quoted above, the NECMA commissioned a parallel investigation into the erosion caused by the floods and the role that willows, or the removal thereof, may have had[2]. The following paragraph from page 71 of this report is worth quoting verbatim:

"Of particular relevance to the objectives of this study we found a correlation between the presence of willow and an absence of erosion and a correlation between erosion and

the recent removal of willow. These correlations are not surprising. Willow was planted throughout much of north-east Victoria to address erosion at sites that were subject to regular erosion, i.e. at sites that we predisposed to erosion. The combination of the removal of willow at sites with a predisposition to channel change, and an absence of complementary works and suitable alternative vegetation at the time of a major flood event creates the circumstances for channel change".

Both of the recently published NECMA reports referred to above do highlight that the issue of willows and river bank erosion is a complex one. It is acknowledged that willows can cause problems, and even be a catalyst for bank erosion in certain situations e.g. where willows have colonised bars and mid-channel islands resulting in flood flows being directed against the bank. Many community members that supported the use of willows for erosion control also conceded that they do require management to control their less desirable qualities e.g. growing mid-channel or overly restricting channels.

There are extensive stands of mature willow at places within the project reach e.g. the Crack, Pussy and Weeping Willow around the area where German Creek crosses the Ovens floodplain. These exotic trees do provide an erosion control function in these areas e.g. a bed erosion control function along German Creek, and if they were to be removed all at once there is a risk of initiating bed erosion (or 'bed incision') within this creek system. In a similar manner, there are individual willows, or small groups of willows, at certain locations that do currently provide an erosion control function e.g. on the outside bend of the main channel.

Photo 4. The motorcycle trail bike track on the Ovens floodplain. A 'jump' has been created across German Creek. Extensive stands of mature Crack Willow provide both bed & bank erosion protection in this area.

The term 'chute cutoff' refers to a channel that is usually straight, or almost so, that develops across the base of a bend thereby short-circuiting the flow. Such channels typically form during high flow events when floodwater tends to pass straight down the valley rather than following a meander in the river. Although they can form 'naturally' i.e. in relatively undisturbed river reaches, they are often associated with disturbance events such as the over clearing of riparian vegetation on a bend that allows a break-out point to develop (the start of chute channel development). Chute cutoff development can be particularly problematic if several occur together within a short reach of channel as their development is associated with an erosion positive feedback loop, as follows:

- A chute cutoff shortens the distance water has to flow because it cuts across a bend. This means the gradient of the primary channel is now increased.
- An increase in gradient means that water can flow faster and consequently has greater erosive power.
- The increase in erosive power helps facilitate the development of another chute cutoff at the next bend downstream. The channel length within the reach is further shortened, the gradient increased and the erosive power raised again.
- Further cutoffs increase the erosion potential within the reach causing secondary problems such as bed incision and bank erosion.

A number of chute cutoff channels can be identified within the project reach (see the upstream end of map sheet 2), and there is the potential for more to develop.

Photo 5. This bend has been eroding and now has a very unstable alignment. The floodplain on the left has been cleared of willows, including those on the bank that were providing some erosion protection (NB the stump indicated by the arrow). This bend now forms a classic 'break out point' where flood flows are free to leave the main channel and short circuit the bend. Floodplain stripping or chute cutoff development are risks at this site.

2.4. Management recommendations

The plan map sheets contain recommendations aimed at alleviating the risks outlined in the previous section. The possible major channel avulsion at the top of the project area should be discussed with the current land managers (Hancock Victorian Plantations) with a view to developing a detailed program of works aimed at reducing the likelihood of this channel shift occurring. Some basic steps would include:

- Where the main channel first divides (see photo 1 on page 7) there is currently a build up of flood wrack across a fallen log. This partially blocks the left (secondary) channel. Formalising this arrangement by both pinning the existing log in place and maybe adding a few more will encourage flows down the right hand channel. Structures built of wood (tree trunks, branches, root balls etc) that are placed within stream channels to provide erosion control and other beneficial functions are often referred to as "engineered log jams" (ELJs). A detailed design manual for such structures was published by Land & Water Australia in 2006[7] and this should be referred to before undertaking the work recommended above.
- Although it is clear at the moment, making sure that the primary channel remains unblocked is important to help maintain flows in this direction.

- Conversely, dense planting of the banks of the secondary channel with suitable native species e.g. River Bottlebrush, will discourage further expansion, and hence flow capacity, along the secondary channel.

For future willow removal works it is recommended that trees be assessed for their erosion control function prior to the commencement of felling operations. Trees that are currently providing significant erosion control should be clearly marked and only removed if parallel works can be undertaken to mitigate their loss e.g. the installation of bed control structures where this function is currently being carried out by willow roots.

Poorly aligned eroding bends that are potential breakout points where chute cutoff channels may develop have been marked on the map sheets. A range of 'off-the-shelf' erosion control designs exist [8&9] to rehabilitate sites like this and these should be addressed as a matter of priority. Photo 6 shows an example of the sort of bend re-alignment works that can be used. This project was designed and installed by the author of this report in the late 1990s. In addition, appendix 3 contains RMS "standard designs" for typical bank and bed erosion control structures that would be suitable for use within the project reach.

Photo 6. Bend re-alignment structure, Myall River, Mid-North coast of NSW, late 1990s. The development of a break-out point has been prevented by re-aligning the main channel using a hardwood log front wall, backfilled with point bar gravel & chainmesh laterals. The chainmesh catches flood debris & encourages deposition on the created bench, which in turn leads to the natural regeneration of native riparian plants.

3. PROJECT REACH RIPARIAN VEGETATION

3.1. Past disturbances and current status

Section 2.2 on page 5 of this report outlines the disturbance history of the project reach, including comments on the native vegetation. In summary these are:

- Heavy clearing during the gold mining years (1850s to early 20th century).
- Natural re-growth of both native and exotic flora.
- The left side of the valley, from the river to the Great Alpine Road, has been managed as a pine plantation for many years. At the upstream end of the project reach (map sheet 1) the pines have been recently harvested and a further crop of pines has been planted. At the downstream end (map sheet 2) the left bank consists of mature pines.
- There are some small floodplain pockets to the left of the main channel that are not planted to pines. In these areas re-growth native vegetation can be found. The willows that formerly infested many of these areas have been recently cleared.
- The floodplain to the right of the channel has not been used for pines and is a mix of regrowth native vegetation and exotics. There are extensive stands of mature willows. In many areas the understorey is dominated by dense patches of Blackberry. The Blackberry was the target of a comprehensive spray program carried out in January 2013.

3.2. Riparian vegetation community types

3.2.1. Native riparian vegetation

In Victoria, the Department of Sustainability and Environment (DSE) has undertaken detailed vegetation mapping and classification. The fundamental mapping unit used in this work is the Ecological Vegetation Class (EVC). Simply put, EVCs are vegetation communities that share similar floristics and ecological characteristics. The mapping, EVC description sheets and much more is available from the DSE web site at:

http://www.dse.vic.gov.au/conservation-and-environment/native-vegetation-groups-for-victoria/ecological-vegetation-class-evc-benchmarks-by-bioregion

Appendix 4 contains the EVC map for the project reach, and the description sheets for the EVC types that are mapped within the floodplain and adjacent footslope country. In summary these are:

- Main Ovens valley – EVC #237 Riparian Forest / Swampy Riparian Woodland Mosaic.
- German Creek – EVC #83 Swampy Riparian Woodland
- Footslope country – EVC #23 Herb-rich Foothill Forest

(A ‘mosaic’ EVC recognises that there is unlikely to be a clear boundary at a particular location and mixes – or mosaics – of more than one EVC may be found. In the case of the project reach these are EVC # 83 Swampy Riparian Woodland and EVC #18 Riparian Forest, and these are the EVC sheets reproduced at appendix 4).

The EVC description sheets are not meant to be prescriptive. They provide a guide only to the type of vegetation community that it is thought should occur at a site with given features e.g. the bioregion, soil type, aspect, elevation etc.

Appendix 1.3 contains a map and a list of plant species. This is taken from the RMS copy of the flora database for Victoria produced by Viridans. This database allows a grid-based search to be carried out – in this case from Porepunkah to Harrietville. The database is populated with information gathered from formal on-the-ground assessments. A red grid on the map means no formal plant surveys have been recorded in that grid in the database. A black grid, on the other hand, means that results have been found. Because the database only allows a grid-by-grid search, many of the species listed are terrestrial plants. However, many are riparian zone specific and these have been recorded from formal surveys within the Ovens River valley between Porepunkah and Harrietville. (Note that on this list species marked with an asterisk* are exotic).

Appendix 1.1 contains a list of native plants found within the project reach by RMS either during the field work for the current plan, during the field work for the 2008 plan or from the Cherry Walk transect assessed as part of the NECMA monitoring and evaluation project (2007 – 2010).

3.2.2. Wetlands

Two wetland types were identified within the project reach: 'dredge hole' wetlands and Common Reed wetlands. The first of these, as the name suggests, are wetlands formed in depressions left over from mining activities (these may, or may not, actually be dredge holes, but this term has been used for these wetlands as that is what local residents call them). The so-called dredge hole wetlands may hold water for considerable periods of time as many are fed from groundwater. As with all wetlands, the vegetation community found is strongly influenced by the wetland's flow regime. Flow regime components include:

- Source – where does the water come from?
- Frequency – How often does the wetland receive water?
- Timing – At what time of year does the wetland receive water?
- Depth – To what depth does the wetland fill?
- Wet / dry cycle – How long does the wetland hold water once it fills? How long does it typically stay dry?

Wetland vegetation communities are very dynamic as, under Australian conditions, they usually have to be able to survive dry periods as well as wet times. Thus, a wetland vegetation assessment carried out during a dry phase would most likely record an entirely different collection of plants to those found during a wet phase.

Within the wider Upper Ovens River landscape that are many dredge hole wetlands, although only one was recorded within the project reach. Plants adapted to longer inundation phases are common at these wetland types e.g. Tall Spike-rush.

In recent years DSE have refined wetland classifications in Victoria and produced a separate suite of wetland specific EVC benchmark sheets. The Common Reed dominated wetlands found within the project reach most closely align to 'EVC #821 Tall Marsh' (a copy of this EVC sheet can be found at appendix 4). As outlined in the EVC sheet this wetland type is typically 'species-poor' i.e. dominated by one or two species of wetland plant, in this case Common Reed, and is often treeless. The flow regime found at this wetland type can, unfortunately, make it prone to willow infestation. This is the case within the project reach where most of the Common Reed wetlands are, as a minimum, fringed by Pussy Willow but in many cases also have individual plants scattered throughout the wetland as weedy 'emergents'.

Photo 7. A small 'dredge hole' wetland at the valley margin. This artificial wetland type, a left over from the gold mining era, typically hold water for many months of the year with some of them being near permanent and fed by groundwater. This one holds water most winters but tends to dry out over summer, which suits the Tall Spike-rush which was just starting to die back when this photograph was taken in January.

Photo 8. Common Reed dominated 'Tall Marsh' wetland at the valley margin. Limited species diversity (more or less Common Reed only in this case) and no tree component is typical of this wetland type. Note the Pussy Willow encroaching on the margins of the wetland (background).

3.2.3. Weedy riparian vegetation

A list of the weed species recorded within the project reach can be found at appendix 1.2. Overall, the project reach is moderately – heavily weed infested. This assessment is made on the basis of the following observations:

- The right hand side of the valley has extensive areas of willow infestation. The channel banks and low-lying floodplains are particularly affected. Until the recent clearing work was carried out, this picture was repeated on the left hand side of the valley too.
- Both within the areas affected by willow, and elsewhere, Blackberry is widespread. In places the degree of infestation is extreme with dense thickets two or more meters in height extending over wide areas.
- In those areas not affected by Blackberry, or only lightly infested, much of the groundcover is comprised of weedy grasses and forbs.

Where native vegetation is found on the floodplain, it typically consists of eucalypt 'emergents' through a Blackberry dominated understorey. In areas where the Blackberry infestation is light, a sub-canopy layer including Silver Wattle, Ovens Wattle, Blackwood, Tree Violet and Bursaria is common.

The least weedy areas are outside the riparian zone i.e. terrestrial vegetation along the margins of the active floodplain such as the footslope country to the right of the main channel (see map 2). Although these areas are outside of the project reach (which is focused on the river and its' floodplain only) the terrestrial areas between the Back

Photo 9. Much of the low lying floodplain country on the right side of the valley is willow infested with a Blackberry understorey, as here along the motorcycle track. Occasional eucalypt ‘emergents’ can be found through these areas.

Photo 10. Willow seedlings on damp alluvial soil within the project reach. Wind blown willow seeds are believed to be able to disperse as far as 50 – 100km so ongoing follow-up will be required as long as there are ‘parent’ plants in the district[10].

Germantown Road and the valley margin were assessed during the field work. Most of this valley margin country is characterised by a light infestation of Blackberry with occasional, scattered woody weeds of which Hawthorn is the most common.

3.3. Threats

Until recently, the vegetation within the project reach had received little direct management. As is common under these situations, competition between the native and weedy vegetation had resulted in a highly modified vegetation community forming. Without any weed control work it is likely that the Blackberry infestation would have continued to intensify as there is nowhere where there is not at least some Blackberry present. What typically forms in these situations, based on observations at similarly neglected sites within the Ovens valley, is a vegetation community with a sparse overstorey of eucalypts and a shrub / groundcover layer dominated by Blackberry and woody weed shrubs such as Hawthorn.

Once weed control works have commenced, as is the case within the project reach, the greatest threat in the mid to long term is an inability to keep up with the site maintenance. Broadscale clearing, be it the felling, stockpiling and burning of willows or the spraying of Blackberry, results in a re-setting of the vegetation succession process. Without ongoing management, it is highly likely that the vegetation community present before works commenced will reform.

3.4. Management recommendations

The proposed future management regime for the project reach is based on the following fundamental elements:

- Only treat areas for which there are sufficient resources for the long term maintenance.
- No access = no maintenance. It is important that a suitable network of access tracks be established in treated areas so that ongoing maintenance work can be undertaken. As a minimum, this involves establishing a track suitable for a 4WD spray vehicle. As most such vehicles have 100 – 200m hose reels, all areas that will require maintenance need to be within this distance of the track.
- Prioritise the weed species to be controlled. In most cases it is unrealistic to try and control all weeds at a site e.g. all the weedy grass and forb species. Typically, the long term aim is to achieve a native vegetation community where the overstorey and shrub layer are close to the original EVC i.e. species composition and density, but the groundcover is a mix of native plants and weeds. This will require the control of woody weeds, and the most aggressive colonisers in particular e.g. Blackberry.
- Following the initial round of weed control work, it is often more efficient to concentrate on controlling weed regrowth rather than trying to replant native vegetation. Sometimes, the natural regeneration of native plants can result in good regrowth without the need for costly revegetation efforts.
- Where very dense and extensive Blackberry infestations have been sprayed, mechanically removing the dead canes is desirable e.g. with an excavator. This will then permit access to the inevitable regrowth which otherwise would be very

difficult to control. (Refer to the recently published *Weeds of National Significance - Blackberry Control Manual*[11] for further information on Blackberry management).

- In the medium term (after 4 or 5 years), revegetation work can be carried out to 'fill in' any areas where natural regeneration has been poor, or to re-establish particular desirable species that have not returned through natural regeneration alone.
- The only exception to the foregoing is where native vegetation needs to be established quickly for erosion control purposes.

4. RECREATIONAL USE

4.1. Current use

Although assessing current community use of the project area was not part of the formal brief for this plan, nonetheless the following usage was recorded during the course of the field work:

- Trail bike riding (motorcycles)
- Bushwalking
- Cycling (along Back Germantown Road and to gain access to the right bank of the river)
- Fishing
- Swimming
- Bush camping

4.2. Tracks

The current track system within the project reach is fragmented. On the left side of the valley the once continuous track along the northern edge of the pine plantation has been cut downstream of the Germantown Bridge because a secondary channel has formed along part of the track system (see section 2.3 for further details regarding the channel changes in this area). There are a number of short spur tracks providing access to some of the floodplain pockets to the left of the main channel. On the right side of the valley, there are only three access tracks off Back Germantown Road down to the river.

Developing a loop track that connects both sides of the river via the Germantown Bridge would be difficult for the following reasons:

- Although a Crown Land corridor exists, in a number of places along the right bank houses have been built close to the main channel and the river bank has been more or less incorporated into back gardens. It is unlikely these residents would be supportive of having a track established in these areas.
- On the right side of the valley the available space between Back Germantown Road and the low lying floodplain country is very limited at a number of locations. This would necessitate building a track through the low lying country, much of which is regularly inundated.
- Areas of mine spoil would also have to be negotiated in order to establish a loop track.

4.3. Management recommendations

Upgrading and extending the current tracks would be the simplest way of achieving access for ongoing maintenance. Under this approach, Back Germantown Road and the pine plantation tacks that run parallel with the river would be used as the starting point for various spur tracks, or small loop tracks, aimed at getting access to floodplain pockets. Unfortunately, the issue of inappropriate use of bush access tracks has to be taken into consideration e.g. littering or the dumping of rubbish. For this reason, it is advisable that as access tracks are developed only some are left open for public access while the others are lockable.

A limited track network and dense Blackberry infestations made access to many areas very difficult during the preparation of this plan. For this reason, it is recommended that the selection of appropriate track routes is left until each new area is cleared of weeds and a proper survey of the site can be made.

The issue of what is appropriate public use for sections of the project area requires clarification e.g. the current motorcycle circuit is incompatible with more passive pursuits such as fishing and bushwalking.

5. FLORA & FAUNA RECORDS

As part of this River Rehabilitation Works Plan, the UOVLG requested that an estimate be made of what species may have been present within the project reach in the past but are either not present now, or are very sparse. Various flora and fauna datasets were examined to help answer this question.

5.1. Fauna

A data request was submitted to DSE for information from the recently developed Victorian Biodiversity Atlas. The Department provided the dataset "VBA_FAUNA25" which is a GIS file containing fauna records from both formal surveys and information provided by the public. In addition to this, DSE's on-line resource the "Biodiversity Interactive Map" was used to search for records within the project reach. The following native species have been recorded within the project area, and may still be present:

Two-spined Blackfish *(Gadopsis bispinosus)*
Murray Crayfish *(Euastacus armatus)*

Lintermans[12] records the Two-spined Blackfish as being "threatened", and Gilligan et al[13] note that the Murray Crayfish *"… is also listed as a threatened species across much of its range"* (intro. page vi).

5.2. Flora

The Viridans database printout at appendix 1.3 lists all plants identified in formal surveys within the Ovens River reach from Porepunkah to Harrietville. This database has a search resolution of one minute i.e. 1/60th of a degree, so inevitably includes species recorded immediately adjacent to the river channel. Of the 39 one minute resolution grids searched, 29 produced results. It is reasonable to assume that all the species listed in this search could occur within the reject reach.

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Appendix 1

Vegetation information

1.1 Native species list
1.2 Exotic species list
1.3 Viridans database printout
(Porepunkah – Harrietville)

Appendix 1.1 NATIVE VEGETATION LIST

Common Name	Botanical Name	Comments
Trees >5m		
Silver Wattle	*Acacia dealbata*	
Blackwood	*A. melanoxylon*	
Mountain Swamp Gum	*Eucalyptus camphora*	
Candlebark	*E. rubida*	
Manna Gum	*E. viminalis*	
Shrubs <5m		
Ovens Wattle	*Acacia pravissima*	
Hairy Bursaria	*Bursaria spinosa sbs. lasiophylla*	
River Bottlebrush	*Callistemon sieberi*	
Dogwood	*Cassinia sp.*	
Prickly Currant Bush	*Coprosma quadrifida*	
Tree Violet	*Hymenanthera dentata*	
Slender Tea-tree	*Leptospermum brevipes*	
Round-leaved Mint-bush	*Prostanthera rotundifolia*	
Vines		
Swamp Bindweed	*Calystegia sepium*	
Native Raspberry	*Rubus parvifolius*	
Grasses		
Wallaby Grass	*Danthonia spp.*	
Sword Tussock-grass	*Poa ensiformis*	
Kangaroo Grass	*Themeda triandra*	
Forbs		
Bidgee-widgee	*Acaena novae-zelandiae*	
Austral Horehound	*Lycepus australis*	
Crane's-bill	*Geranium sp.*	
Fireweed Groundsel	*Senecio linearifolius*	
Cotton Fireweed	*S. quadridentatus*	

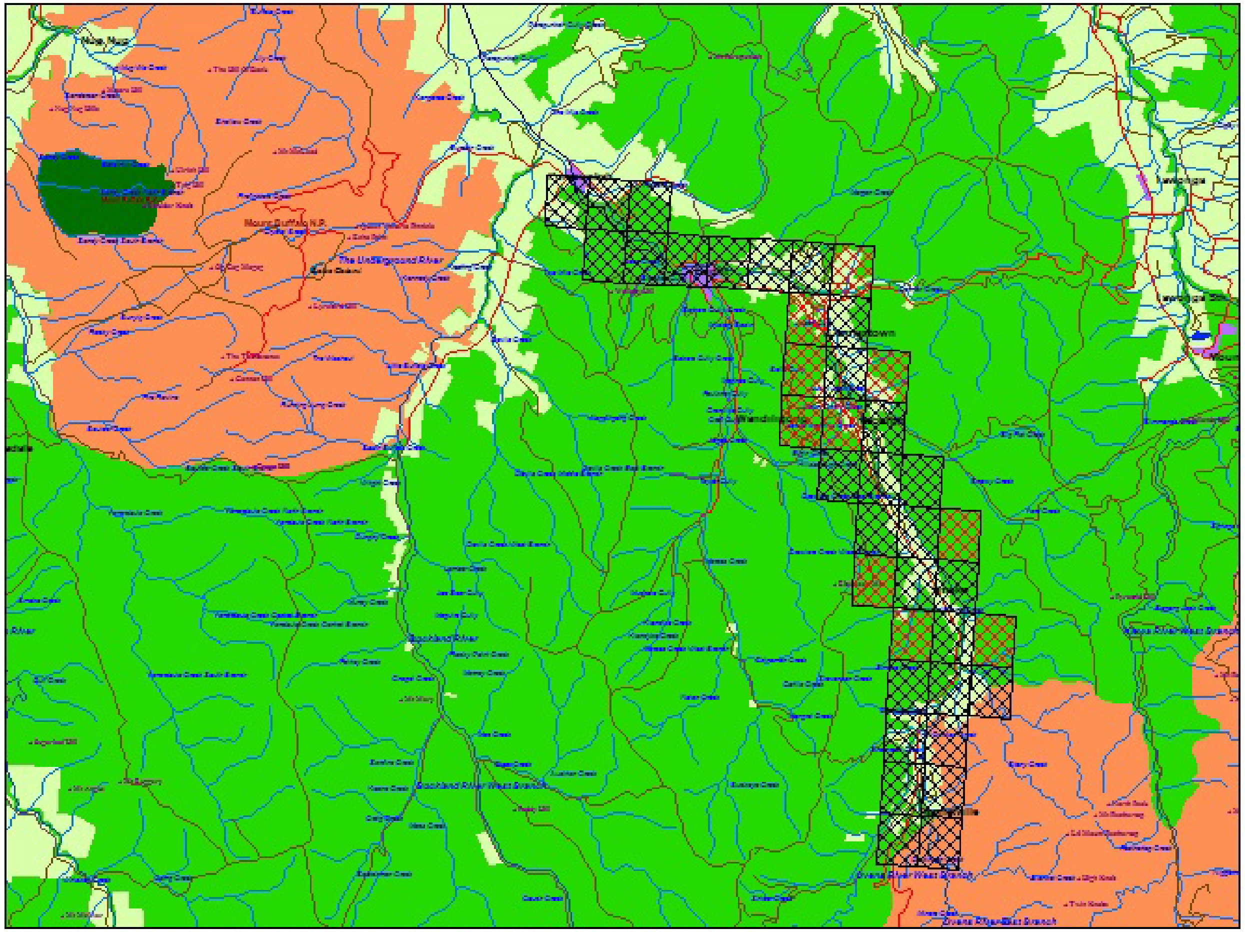
Ferns		
Bracken	*Pteridium esculentum*	
Soft Water-fern	*Blechnum minus*	
Fishbone Waterfern	*B. nudum*	
Wetland plants		
Grasses		
Common Reed	*Phragmites australis*	
Rushes		
Juncus	*Juncus sp.*	
Spike-rushes		
Common Spike-rush	*Eleocharis acuta*	
Tall Spike-rush	*E. sphacelata*	
Sedges		
Tall Sedge	*Carex appressa*	
Tassel Sedge	*C. fascicularis*	
Flatsedges		
Leafy Flatsedge	*Cyperus lucidus*	
Wetland Forbs		
Lesser Joyweed	*Alternanthera denticulata*	
Sneezeweed	*Centipedia minima*	
Slender Knotweed	*Persicaria decipiens*	
Water Pepper	*Persicaria hydropiper*	
Slender Dock	*Rumex brownii*	

Appendix 1.2 WEED LIST

Common Name	Botanical Name	Comments
Trees >5m		
Box Elder	*Acer negundo*	
Fig	*Ficus carica*	
Broad-leaf Privet	*Ligustrum lucidum*	
Pine	*Pinus sp.*	
False Acacia	*Robinia pseudoacacia*	
Pussy Willow or Grey Sallow	*Salix caprae*	
Crack Willow	*S. fragilis*	
Black Willow	*S. nigra*	
Weeping Willow	*S. babylonica*	
Shrubs <5m		
Hawthorn	*Crataegus monogyna*	
Small-leaf Privet	*Ligustrum vulgare*	
Vines		
Cleavers	*Galium aparine*	
Hop Vine	*Humulus lupulus*	
Honeysuckle	*Lonicera japonica*	
Blackberry; European Blackberry	*Rubus fruticosus* (aggregated)	
Vetch	*Vicia sp.*	
Grasses		
Wild Oats	*Avena fatua*	
Brome Grass	*Bromus sp.*	
Couch Grass	*Cynodon dactylon*	
Yorkshire Fog	*Holcus lanatus*	
Wimmera Ryegrass	*Lolium rigidum*	
Phalaris	*Phalaris sp.*	
Fescue	*Vulpia sp.*	
Forbs		
Sheep Sorrel	*Acetosella vulgaris*	

Common Bittercress	*Cardamine hirsuta*	
Chickweed	*Cerastium sp.*	
Spear Thistle	*Circium vulgare*	
Hemlock	*Conium maculatum*	
Wild Teasel	*Dipsacus fullonum* subsp. *fullonum*	
Stork’s-bills	*Erodium sp.*	
Caper Spurge	*Euphorbia lathyris*	
Fumitory	*Fumaria sp.*	
Tutsan	*Hypericum androsaemum*	
St. John’s Wort	*Hypericum perfoatum*	
Cat’s Ear	*Hypochoeris radicata*	
Nipple-wort	*Lapsana communis* subsp. *communis*	
Lemon Balm	*Melissa officinalis*	
Mint	*Mentha longifolia*	
Ribwort	*Plantago lanceolata*	
Broad-leaf Dock	*Rumex obtusifolia*	
Wild Sage	*Salvia verbenaca*	
Black-berry Nightshade	*Solanum nigrum*	
Sowthistle	*Sonchus sp.*	
Mulleins	*Verbascum sp.*	
Purple Top	*Verbena bonariensis*	
Watsonia	*Watsonis sp.*	
Wetland plants		
Flatsedges		
Drain Flatsedge	*Cyperus eragrostis*	

Appendix 1.3 Viridans Biological Databases – Search Map



Data: Flora Information System, Viridans - 2009 - © Viridans Biological Databases

Ppunkah to Hville ***29 grids***

Just a Minute - Victorian Plants

		Species Names	Family	Last Date
	r	***Acacia alpina*** - Alpine Wattle	Mimosaceae	Undated
		Acacia dealbata - Silver Wattle	Mimosaceae	1990-1999
		Acacia melanoxylon - Blackwood	Mimosaceae	1990-1999
		# ***Acacia pravissima*** - Ovens Wattle	Mimosaceae	Undated
		Acaena novae-zelandiae - Bidgee-widgee	Rosaceae	1990-1999
		* ***Acetosella vulgaris*** - Sheep Sorrel	Polygonaceae	1990-1999
		Adiantum aethiopicum - Common Maidenhair	Adiantaceae	1990-1999
		* ***Agrostis capillaris*** - Brown-top Bent	Poaceae	1990-1999
	V	***Amphibromus fluitans*** - River Swamp Wallaby-grass	Poaceae	Undated
		Amphibromus nervosus - Common Swamp Wallaby-grass	Poaceae	Undated
		* ***Anthoxanthum odoratum*** - Sweet Vernal-grass	Poaceae	1990-1999
		Asperula scoparia - Prickly Woodruff	Rubiaceae	1990-1999
		Australina pusilla - Shade Nettle	Urticaceae	1990-1999
		Australina pusilla subsp. muelleri - Shade Nettle	Urticaceae	1990-1999
		Austrodanthonia penicillata - Weeping Wallaby-grass	Poaceae	Undated
f	V v	***Babingtonia crenulata*** - Fern-leaf Baeckea	Myrtaceae	Undated
		Blechnum minus - Soft Water-fern	Blechnaceae	1990-1999
		Blechnum nudum - Fishbone Water-fern	Blechnaceae	1990-1999
		Brachyloma daphnoides - Daphne Heath	Epacridaceae	Undated
		* ***Buddleja davidii*** - Butterfly Bush	Scrophulariaceae	Undated
		Bursaria spinosa - Sweet Bursaria	Pittosporaceae	2000-2010
		Bursaria spinosa subsp. lasiophylla - Hairy Bursaria	Pittosporaceae	2000-2010
		# ***Callistemon citrinus*** - Crimson Bottlebrush	Myrtaceae	Undated
		Callistemon pityoides - Alpine Bottlebrush	Myrtaceae	Undated
	v	***Cardamine lilacina*** - Lilac Bitter-cress	Brassicaceae	Undated
		Carex appressa - Tall Sedge	Cyperaceae	1990-1999
		Carex fascicularis - Tassel Sedge	Cyperaceae	1990-1999
		Carex polyantha - River Sedge	Cyperaceae	1990-1999
		Cassinia aculeata - Common Cassinia	Asteraceae	1990-1999
		Cassinia arcuata - Drooping Cassinia	Asteraceae	1990-1999
		* ***Centaurea nigra*** - Black Knapweed	Asteraceae	2000-2010
		Chrysocephalum semipapposum - Clustered Everlasting	Asteraceae	Undated
		* ***Cichorium intybus*** - Chicory	Asteraceae	1990-1999
		* ***Cirsium vulgare*** - Spear Thistle	Asteraceae	2000-2010
		Comesperma ericinum - Heath Milkwort	Polygalaceae	1990-1999
		* ***Conium maculatum*** - Hemlock	Apiaceae	1990-1999
		* ***Conyza bonariensis*** - Flaxleaf Fleabane	Asteraceae	1990-1999
		Coprosma quadrifida - Prickly Currant-bush	Rubiaceae	1990-1999
		Correa lawrenceana - Mountain Correa	Rutaceae	1990-1999
		Correa lawrenceana var. latrobeana - Mountain Correa	Rutaceae	Undated
		* ***Crepis setosa*** - Bristly Hawksbeard	Asteraceae	Undated
		Cynodon dactylon - Couch	Poaceae	1990-1999
		Cyperus lucidus - Leafy Flat-sedge	Cyperaceae	1990-1999
		* ***Cytisus scoparius*** - English Broom	Fabaceae	2000-2010
		* ***Dactylis glomerata*** - Cocksfoot	Poaceae	1990-1999
		Dichondra repens - Kidney-weed	Convolvulaceae	1990-1999
		Dicksonia antarctica - Soft Tree-fern	Dicksoniaceae	1990-1999
		Dillwynia phylicoides - Small-leaf Parrot-pea	Fabaceae	Undated
		Dipodium roseum - Rosy Hyacinth-orchid	Orchidaceae	Undated
		* ***Echium plantagineum*** - Paterson's Curse	Boraginaceae	2000-2010
		* ***Echium vulgare*** - Viper's Bugloss	Boraginaceae	2000-2010
		Epilobium billardierianum - Variable Willow-herb	Onagraceae	1990-1999
		Eucalyptus bridgesiana - But But	Myrtaceae	Undated
		Eucalyptus camphora subsp. humeana - Mountain Swamp-gum	Myrtaceae	1990-1999
		Eucalyptus dives - Broad-leaf Peppermint	Myrtaceae	Undated
		# ***Eucalyptus globulus*** - Southern Blue-gum	Myrtaceae	1990-1999
		Eucalyptus globulus subsp. bicostata - Eurabbie	Myrtaceae	1990-1999
		Eucalyptus radiata - Narrow-leaf Peppermint	Myrtaceae	1990-1999
		Eucalyptus radiata subsp. radiata - Narrow-leaf Peppermint	Myrtaceae	Undated
		Eucalyptus viminalis - Manna Gum	Myrtaceae	1990-1999
		* ***Euphorbia lathyris*** - Caper Spurge	Euphorbiaceae	1990-1999
		Exocarpos cupressiformis - Cherry Ballart	Santalaceae	1990-1999
		Exocarpos strictus - Pale-fruit Ballart	Santalaceae	1990-1999

***Data Source:** Flora Information System, Viridans - 2009 - © Viridans Biological Databases*

	Species Names	Family	Last Date
*	***Galium aparine*** - Cleavers	Rubiaceae	Undated
	Galium binifolium - Reflexed Bedstraw	Rubiaceae	Undated
*	***Genista monspessulana*** - Montpellier Broom	Fabaceae	1990-1999
	Geranium potentilloides - Soft Crane's-bill	Geraniaceae	1990-1999
	Grevillea alpina - Cat's Claw Grevillea	Proteaceae	Undated
	Gynatrix pulchella - Hemp Bush	Malvaceae	1990-1999
	Hardenbergia violacea - Purple Coral-pea	Fabaceae	Undated
	Histiopteris incisa - Bat's Wing Fern	Dennstaedtiaceae	1990-1999
*	***Holcus lanatus*** - Yorkshire Fog	Poaceae	1990-1999
	Hydrocotyle hirta - Hairy Pennywort	Apiaceae	1990-1999
	Hypericum japonicum - Matted St John's Wort	Clusiaceae	1990-1999
*	***Hypericum perforatum subsp. veronense*** - St John's Wort	Clusiaceae	2000-2010
	Hypolepis rugosula - Ruddy Ground-fern	Dennstaedtiaceae	1990-1999
	Imperata cylindrica - Blady Grass	Poaceae	1990-1999
	Isolepis crassiuscula - Alpine Club-sedge	Cyperaceae	Undated
	Isolepis inundata - Swamp Club-sedge	Cyperaceae	1990-1999
	Joycea pallida - Silvertop Wallaby-grass	Poaceae	1990-1999
	Juncus australis - Austral Rush	Juncaceae	Undated
	Juncus bufonius - Toad Rush	Juncaceae	Undated
	Juncus gregiflorus - Green Rush	Juncaceae	1990-1999
	Juncus pauciflorus - Loose-flower Rush	Juncaceae	1990-1999
	Juncus sarophorus - Broom Rush	Juncaceae	Undated
*	***Juncus tenuis*** - Slender Rush	Juncaceae	Undated
	Kunzea ericoides spp. agg. - Burgan	Myrtaceae	1990-1999
	Lachnagrostis filiformis - Common Blown-grass	Poaceae	1990-1999
	Leptospermum brevipes - Slender Tea-tree	Myrtaceae	Undated
	Leptospermum continentale - Prickly Tea-tree	Myrtaceae	Undated
	Leptospermum grandifolium - Mountain Tea-tree	Myrtaceae	1990-1999
*	***Leycesteria formosa*** - Himalayan Honeysuckle	Caprifoliaceae	1980-1989
	Lomandra longifolia - Spiny-headed Mat-rush	Xanthorrhoeaceae	Undated
	Lomatia fraseri - Tree Lomatia	Proteaceae	1980-1989
	Lomatia myricoides - River Lomatia	Proteaceae	1990-1999
*	***Lonicera japonica*** - Japanese Honeysuckle	Caprifoliaceae	1990-1999
*	***Lotus corniculatus*** - Bird's-foot Trefoil	Fabaceae	1990-1999
	Lythrum salicaria - Purple Loosestrife	Lythraceae	Undated
	Melicytus dentatus - Tree Violet	Violaceae	1990-1999
	Microlaena stipoides var. stipoides - Weeping Grass	Poaceae	1990-1999
*	***Mimulus moschatus*** - Musk Monkey-flower	Phrymaceae	1990-1999
	Oxalis exilis - Shady Wood-sorrel	Oxalidaceae	1990-1999
	Ozothamnus rosmarinifolius - Rosemary Everlasting	Asteraceae	Undated
	Persicaria decipiens - Slender Knotweed	Polygonaceae	1990-1999
	Persicaria lapathifolia - Pale Knotweed	Polygonaceae	Undated
	Phragmites australis - Common Reed	Poaceae	1990-1999
	Pimelea alpina - Alpine Rice-flower	Thymelaeaceae	Undated
*	***Pinus radiata*** - Radiata Pine	Pinaceae	1990-1999
	Platylobium formosum - Handsome Flat-pea	Fabaceae	1990-1999
	Poa ensiformis - Sword Tussock-grass	Poaceae	1990-1999
	Polyscias sambucifolia - Elderberry Panax	Araliaceae	1990-1999
	Polystichum proliferum - Mother Shield-fern	Dryopteridaceae	1990-1999
	Pomaderris aspera - Hazel Pomaderris	Rhamnaceae	1990-1999
	Prostanthera lasianthos - Victorian Christmas-bush	Lamiaceae	1990-1999
*	***Prunella vulgaris*** - Self-heal	Lamiaceae	1990-1999
	Pteridium esculentum - Austral Bracken	Dennstaedtiaceae	1990-1999
	Pterostylis curta - Blunt Greenhood	Orchidaceae	Undated
r	***Pultenaea polifolia*** - Dusky Bush-pea	Fabaceae	Undated
r	***Ranunculus millanii*** - Dwarf Buttercup	Ranunculaceae	Undated
*	***Ranunculus muricatus*** - Sharp Buttercup	Ranunculaceae	1990-1999
*	***Ranunculus repens*** - Creeping Buttercup	Ranunculaceae	Undated
*	***Rubus fruticosus spp. agg.*** - Blackberry	Rosaceae	2000-2010
	Rubus parvifolius - Small-leaf Bramble	Rosaceae	1990-1999
*	***Sagina procumbens*** - Spreading Pearlwort	Caryophyllaceae	1990-1999
*	***Salix cinerea*** - Grey Sallow	Salicaceae	Undated
*	***Salix fragilis*** - Crack Willow	Salicaceae	1990-1999
	Senecio quadridentatus - Cotton Fireweed	Asteraceae	1990-1999

Species Names	Family	Last Date
* ***Silene latifolia*** **-** White Campion	Caryophyllaceae	1980-1989
Stellaria flaccida **-** Forest Starwort	Caryophyllaceae	1990-1999
Stellaria pungens **-** Prickly Starwort	Caryophyllaceae	1990-1999
Tetratheca ciliata **-** Pink-bells	Elaeocarpaceae	Undated
Themeda triandra **-** Kangaroo Grass	Poaceae	1990-1999
* ***Trifolium repens var. repens*** **-** White Clover	Fabaceae	1990-1999
Typha orientalis **-** Broad-leaf Cumbungi	Typhaceae	Undated
Urtica incisa **-** Scrub Nettle	Urticaceae	1990-1999
* ***Verbascum blattaria*** **-** Moth Mullein	Scrophulariaceae	1990-1999
* ***Verbena bonariensis*** **-** Purple-top Verbena	Verbenaceae	Undated
Veronica serpyllifolia **-** Thyme Speedwell	Veronicaceae	Undated
* ***Vicia sativa*** **-** Common Vetch	Fabaceae	Undated
* ***Vicia sativa subsp. nigra*** **-** Narrow-leaf Vetch	Fabaceae	Undated
Viola hederacea sensu Willis (1972) **-** Ivy-leaf Violet	Violaceae	1990-1999

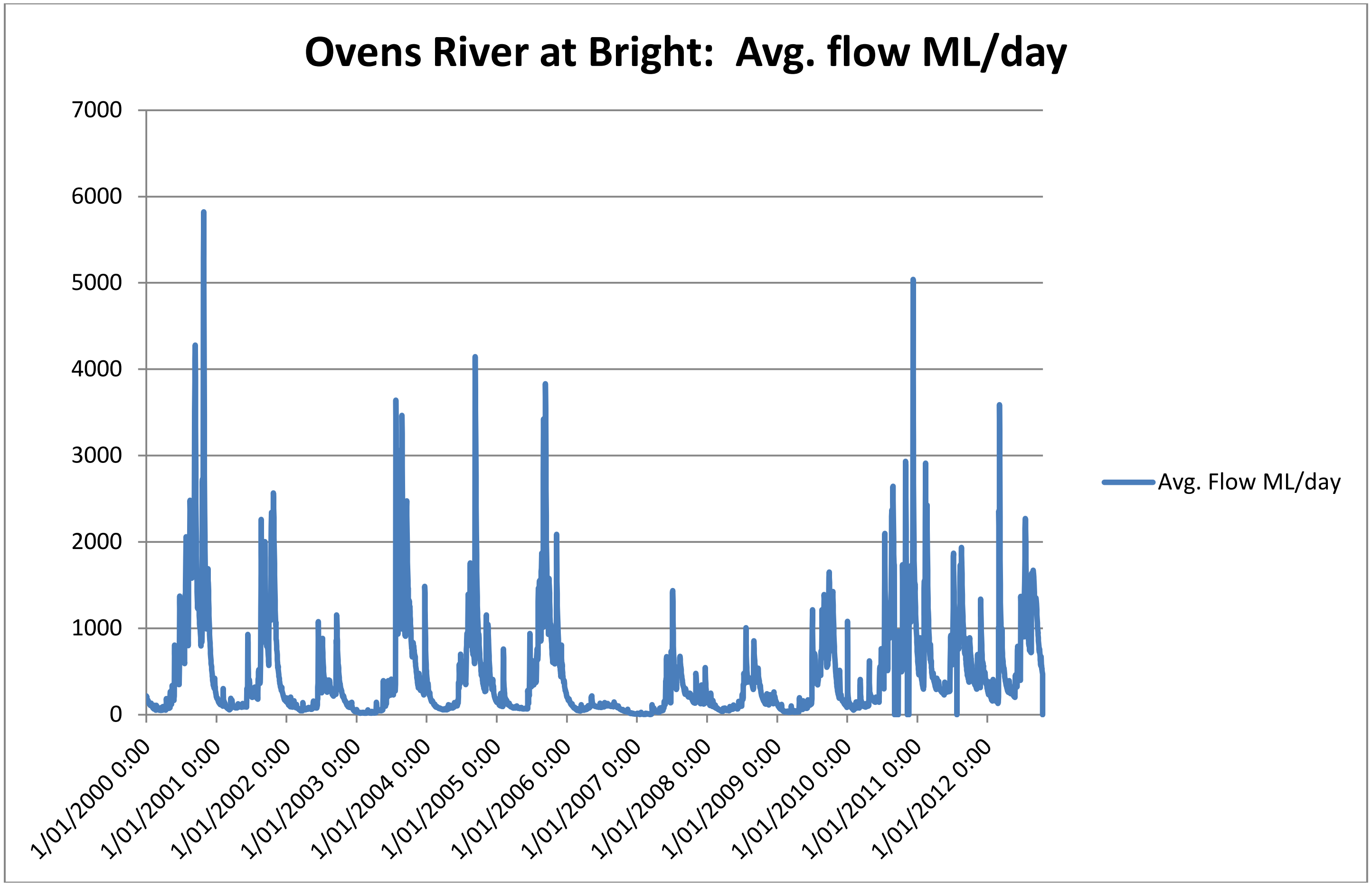
Data Source: *Flora Information System, Viridans - 2009 -*

Key:

*	*Exotic species*
f	*Listed in the Victorian Flora & Fauna Guarantee Act*
V	*Vulnerable (national listing)*
v	*Vulnerable (Victorian listing)*
r	*Included in Victorian Rare or Threatened Species list*
#	*Native, but occurs outside of its natural range*

Appendix 2

Ovens River @ Bright Flow Hydrograph
2000 - 2012



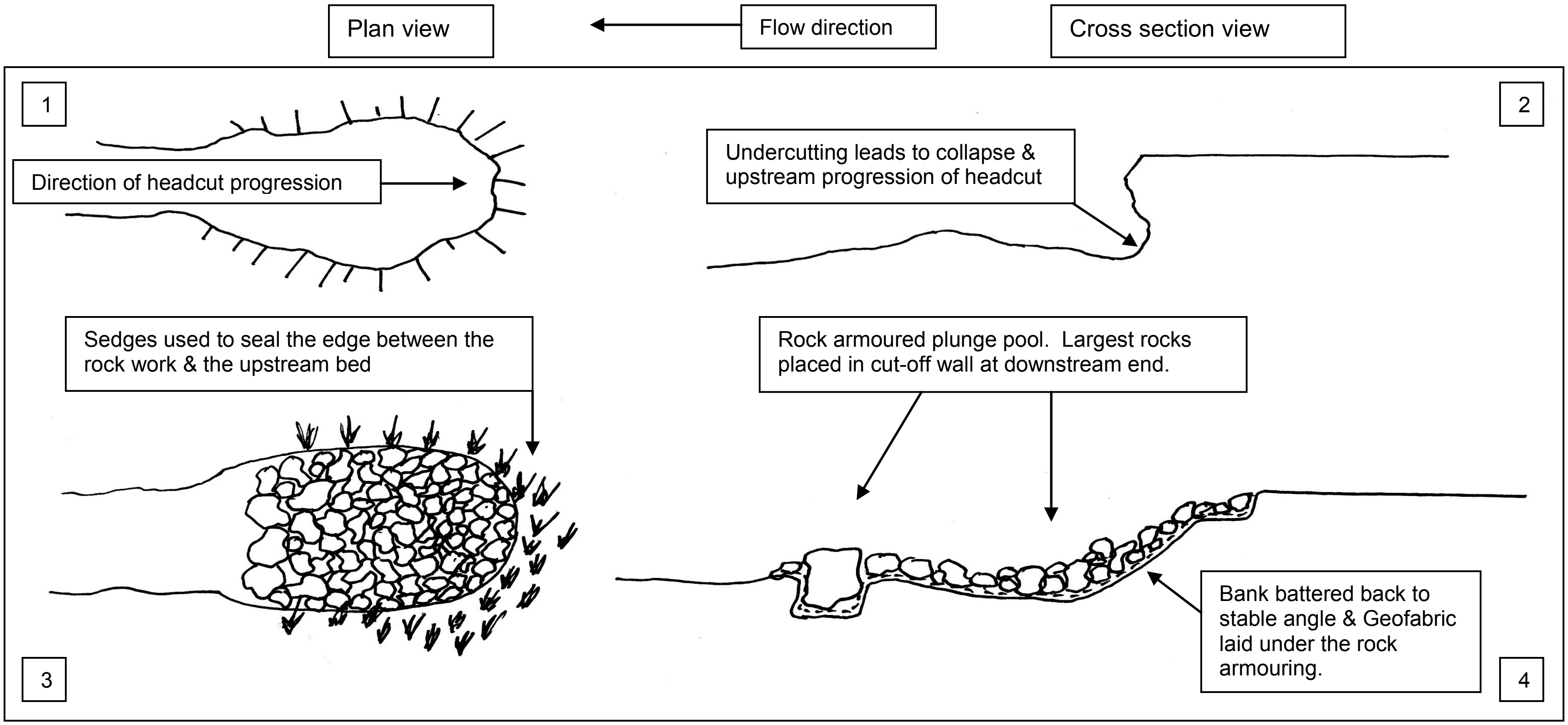
Flow data downloaded from Victorian Water Resources Data Warehouse, 24/1/13.
http://www.vicwaterdata.net/vicwaterdata/data_warehouse_content.aspx?option=4
Graph by RMS

Appendix 3

RMS Standard Designs

3.1 Headcut control – rock armoured drop-structure
3.2 Bed erosion control – rock ramp
3.3 Log V-Weir Bed Control
3.4 Erosion scour re-alignment using log front-wall & low mesh laterals
3.5 Rock revetment

HEADCUT CONTROL – ROCK ARMOURED DROP-STRUCTURE



Notes:

A. Sketches 1 & 2. Prior to protection, the headcut progresses upstream. The rate of progression depends on several factors including: Depth, velocity & frequency of flows; cohesiveness of the bed & bank materials; the presence / absence of binding vegetation.

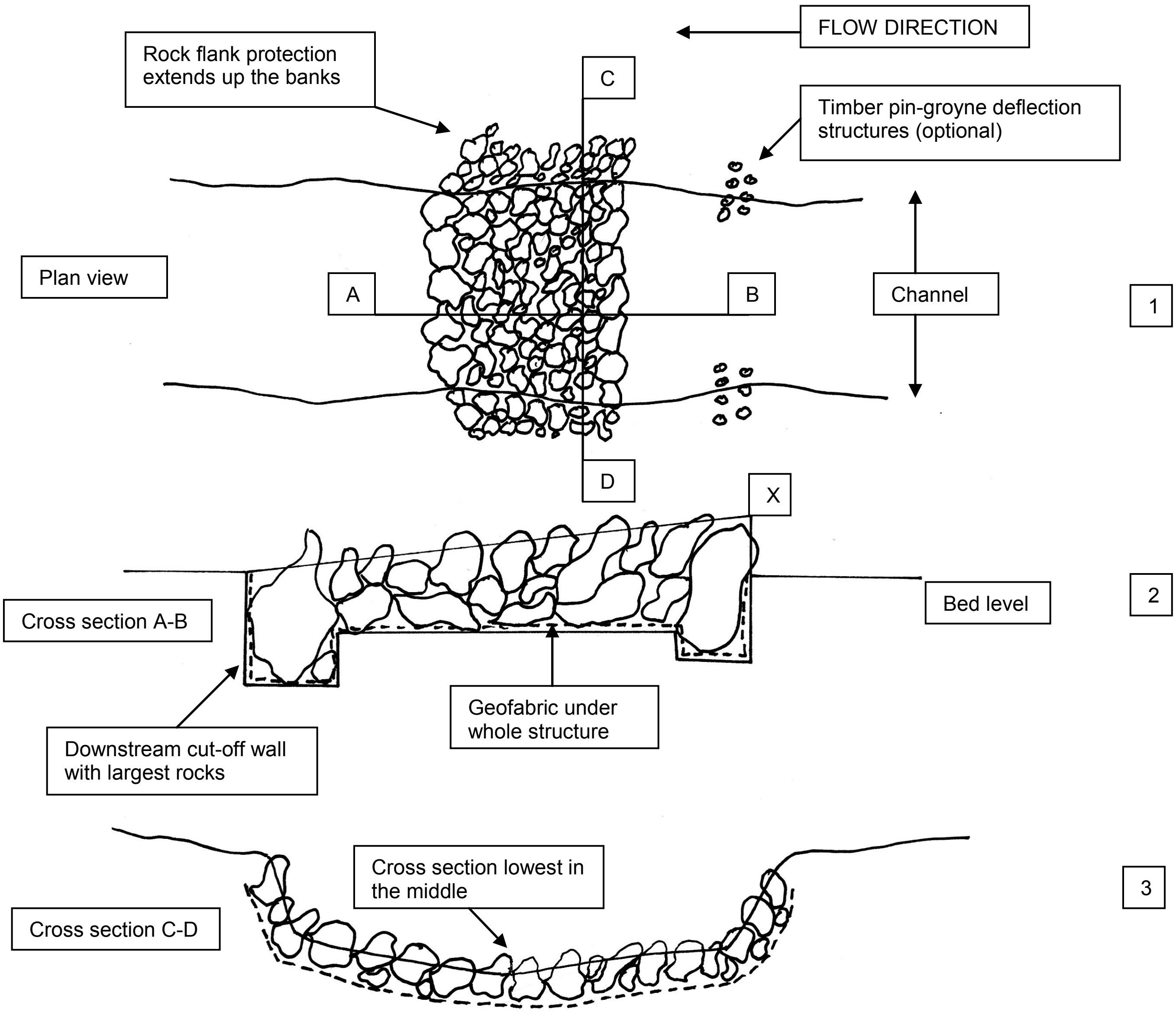
B. Sketches 3 & 4. After rock armouring. The unstable sides of the headcut have been battered back & a trench excavated for the cut-off wall at the downstream end. Geofabric is laid over the whole area & rocks placed with the largest in the cut-off trench. Care must be taken to get as smooth a join as possible between the edge of the rock & the upstream bed (to prevent flows under the geofabric). Planting native sedges etc. around the edge of the rock work can help 'seal' this join. The flanks of the structure should also be planted with native trees & shrubs to encourage flow down the centre-line of the structure. This will help prevent out-flanking from flows entering the gully over the side-walls.

C. Bed controls / further drop-structures may be required downstream if bed incision is still taking place (to prevent undercutting of the structure)

D. Rock sizes & other design details need to be developed for each specific situation – the above is a general guide only.

RMS Standard Detail
General information only.
Design details must be adapted to each site.
Permits may be required prior to installation.

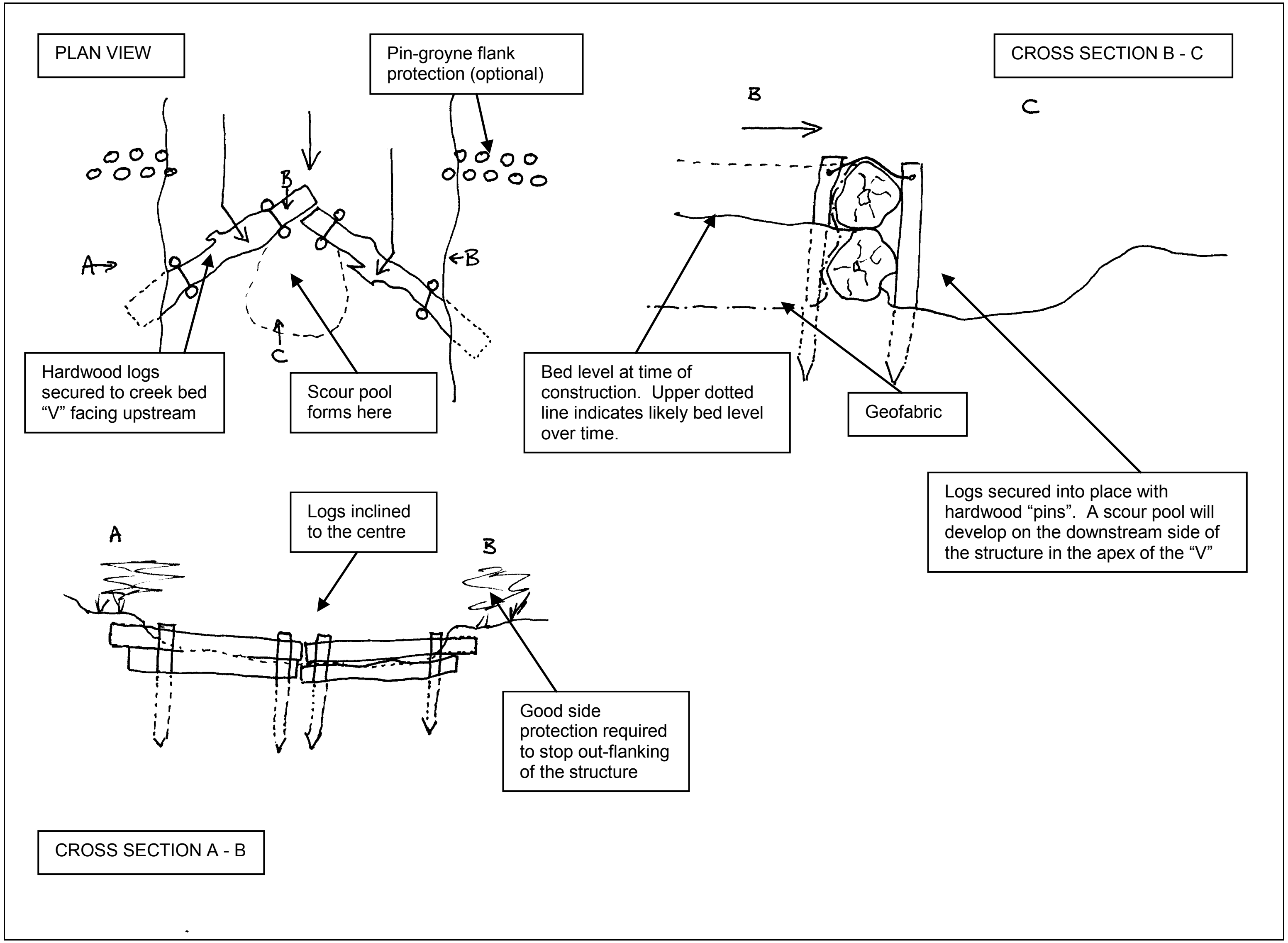
BED EROSION CONTROL – ROCK RAMP



Notes:
A. Sketch 1. Rock placed across the full width of the channel, with armouring extending up the banks (for flank protection). Bed control structures should always be placed on channel inflection points (i.e. straight sections of channel) to minimize the chances of them being out-flanked (bypassed). The upstream pin-groynes are designed to encourage flow down the centre-line of the rock ramp.
B. Sketch 2. The largest rocks are placed in the trenches at the top & bottom of the ramp. The downstream cut-off wall minimizes the chances of the structure being undercut by downstream bed lowering & must cater for the inevitable scour pool that forms below these structures. The crest height ‘X’ can vary from existing bed level (when the structure is usually called a ‘girdle’) to some height above existing bed level. When the crest is above existing bed level, sediments will usually be caught upstream of the structure thus raising the bed level in this area.
C. Sketch 3. Rock ramps are best constructed with a slight dip in the middle to encourage flows down the centre.
D. Rock sizes, crest height, ramp slope etc. are all critical design details & must be worked out for each specific location. The above is a general guide only.

RMS Standard Detail
General information only. Design details must be adapted to each site. Permits may be required prior to installation.

LOG V-WEIR BED CONTROL

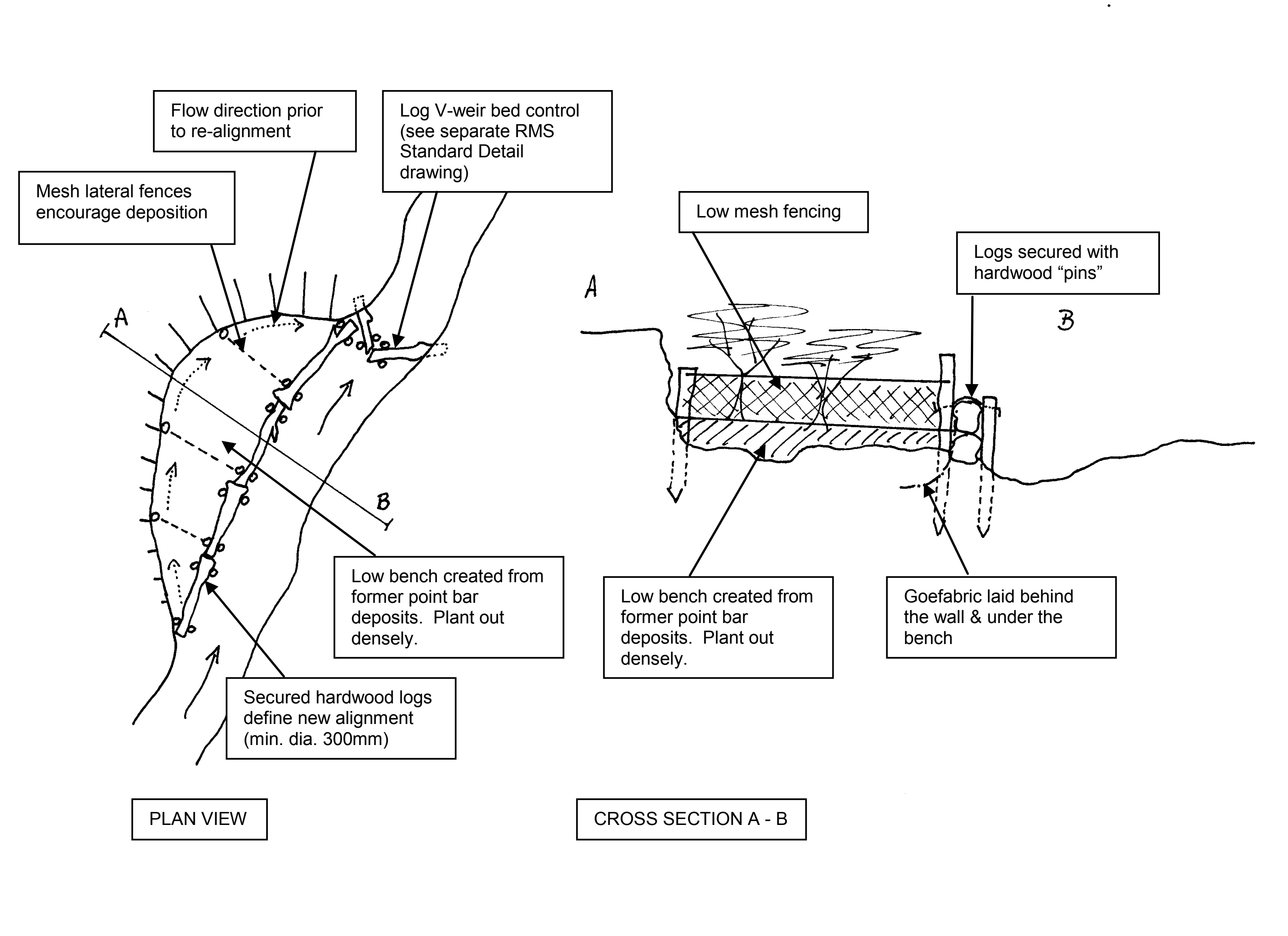


CONSTRUCTION NOTES

1. Log V-weirs should be installed on inflection points (i.e. straight sections of channel) to minimize the chances of out-flanking.
2. The structure should ideally be placed between two stable banks e.g. well-vegetated. If required, timber pin-groynes can be installed upstream to protect from out-flanking.
3. Logs are secured in place with hardwood posts driven into the bed of the creek. (An excavator-mounted hydraulic rock breaker fitted with a suitable adaptor is ideal). 12mm galvanised rod is threaded through holes bored onto the top of the posts.
4. Geofabric material (or "Tensar" plastic mesh for streams with large gravel bed loads) is attached to the back of the logs and laid out upstream prior to backfilling.
5. Logs should be overlapped as indicated in the plan view so they lock together through flow pressure (forming an arch).

RMS Standard Detail
General information only.
Design details must be adapted to each site.
Permits may be required prior to installation.

EROSION SCOUR RE-ALIGNMENT USING LOG FRONT-WALL & LOW MESH LATERALS

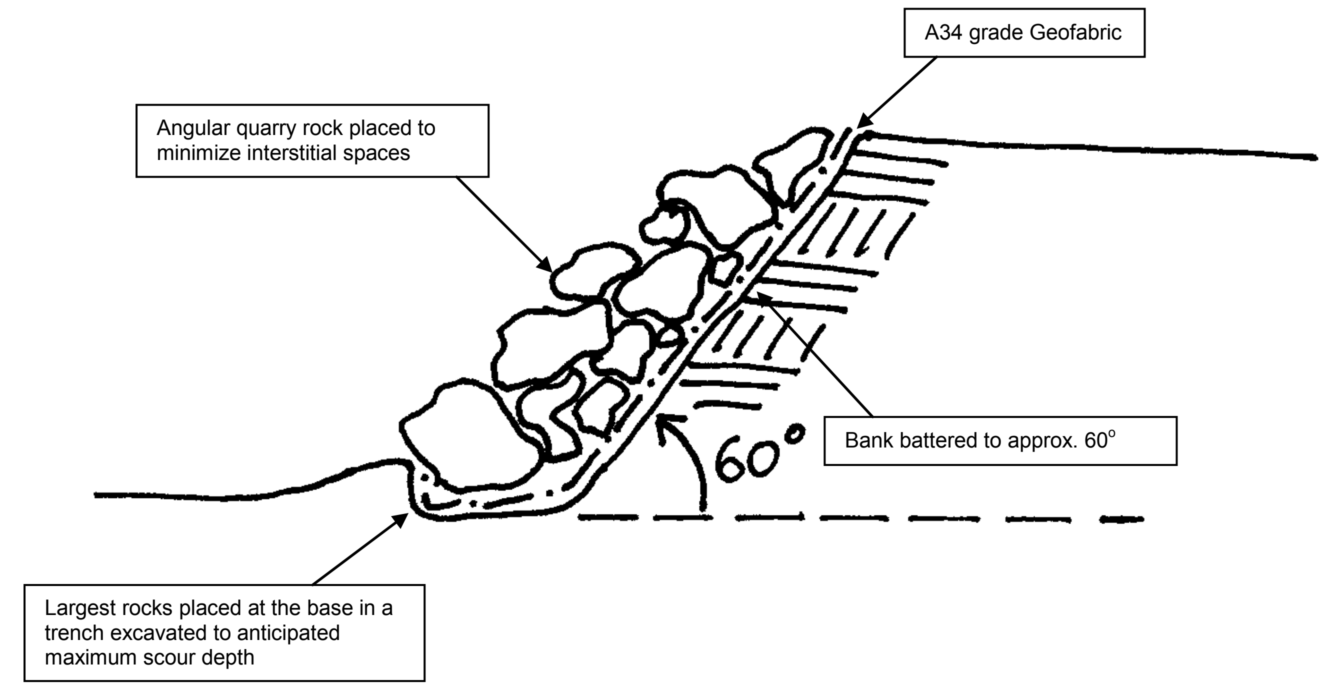


CONSTRUCTION NOTES

1. Suitable for sites where bank erosion has resulted in poor channel alignment. (Provides an alternative to rock armouring).
2. Logs are placed along the new alignment & secured in place with hardwood posts driven into the bed of the creek. (An excavator-mounted hydraulic rock breaker fitted with a suitable adaptor is ideal). 12mm galvanised rod is threaded through holes bored into the top of the posts.
3. Geofabric material is attached to the back of the logs & spread out behind.
4. Low mesh fences (chainlink) are installed.
5. Material is excavated from the old point bar & deposited behind the wall to form a low bench. This covers the geofabric & partially buries the low mesh fence.
6. The low bench is planted out with riparian plants with good erosion control properties (i.e. plants that can withstand high tractive stress levels).
7. A V-weir bed control structure is constructed at the downstream end of the wall to "lock in" the current bed level. This prevents the wall being undercut by bed lowering.

RMS Standard Detail
General information only.
Design details must be adapted to each site.
Permits may be required prior to installation.

ROCK REVETMENT



CONSTRUCTION NOTES

1. Batter bank to approx. 60°.
2. Rock revetment is usually only required to armour the first 2m of the bank toe. However, where bank sediments are highly erosion prone the full face may require treatment.
3. Rock sizes must reflect local stream energy conditions & be of a graded size range so that they lock together once placed.
4. Angular “shot rock” is required as this locks together properly.
5. The geofabric material prevents erosion of the bank face from flows working through the rock lattice.
6. Upper bank revegetation will further enhance bank stability & should be considered an integral part of river bank revetment projects.

Riparian Management Services

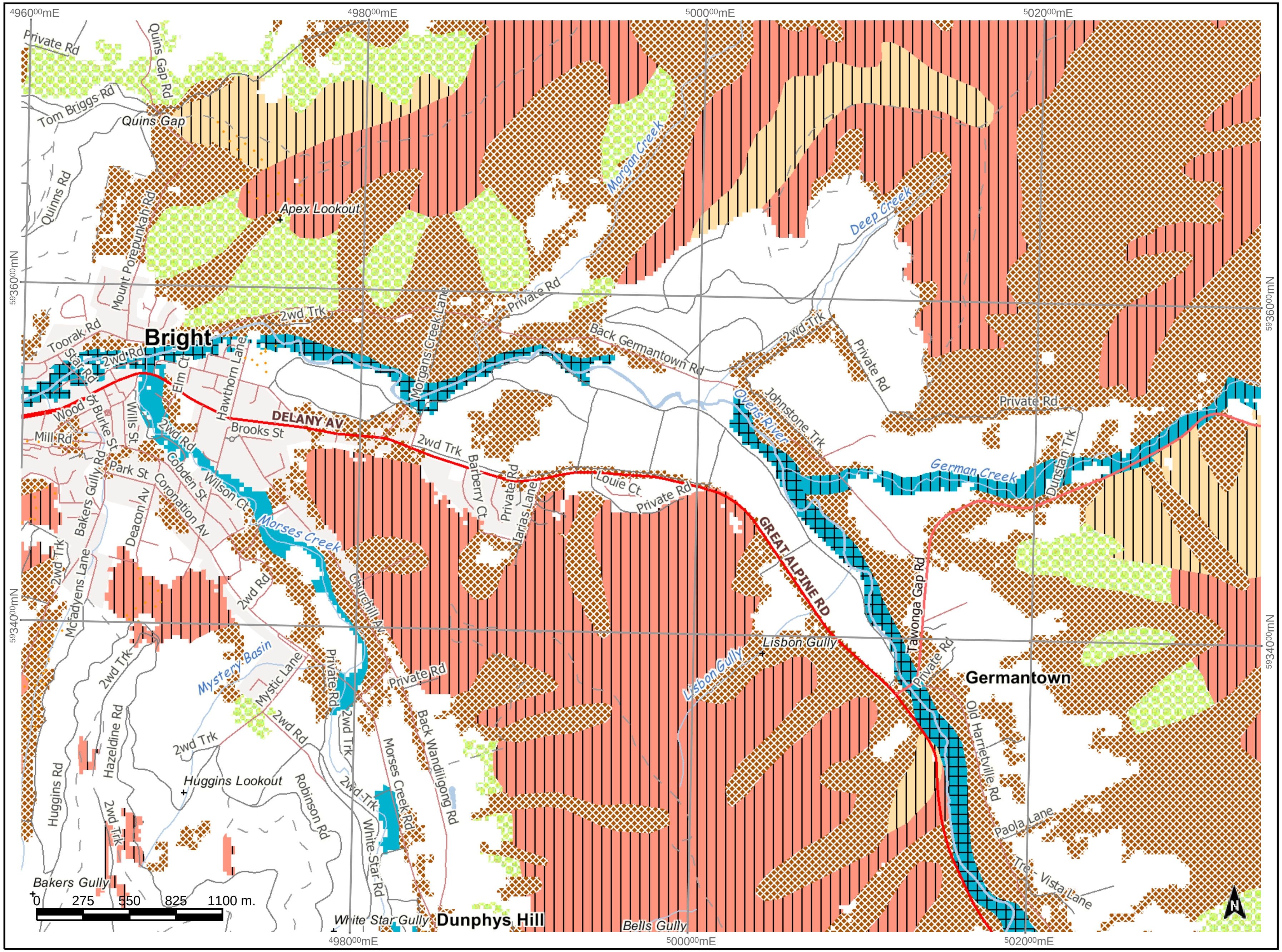
RMS Standard Detail
General information only.
Design details must be adapted to each site.
Permits may be required prior to installation.

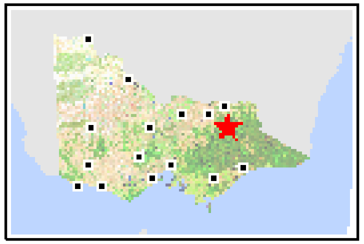
Appendix 4

DSE EVC Benchmark Sheets

Map created Thu Jan 24 15:37:12 EST 2013

Department of Sustainability and Environment





ROADS
- Freeway
- Highway
- Main Road
- Secondary Road
- Local Road
- 2WD (Unsealed)
- 4WD Only
- Walking or Cycle Track

WATERCOURSES
- Major Watercourse
- Minor Watercourse

ECOLOGICAL VEGETATION CLASSES
- 22 Grassy Dry Forest
- 18 Riparian Forest
- 83 Swampy Riparian Woodland
- 237 Riparian Forest/Swampy Riparian Woodland Mosaic
- 21 Shrubby Dry Forest
- 20 Heathy Dry Forest
- 23 Herb-rich Foothill Forest

WATERBODIES
- Watercourse Area
- Permanent Waterbody
- Wetland Area

BUILT UP AREAS

Map Scale 1:32,004

GDA Vicgrid94

State Government Victoria

Biodiversity Interactive Map A4 Landscape

Produced on Thu Jan 24 15:37:34 EST 2013

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Highlands – Northern Fall bioregion

EVC 18: Riparian Forest

Description:
A forest to 30 m tall of river banks and associated alluvial terraces with occasional occurrences in the heads of gullies leading into creeks and rivers. The soil is fertile alluvium, regularly inundated and permanently moist. Dominated by tall eucalypts, but also has an open to sparse secondary tree layer of wattles and scattered dense patches of shrubs, ferns, grasses and herbs.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	80 cm	20 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
40%	*Eucalyptus viminalis*	Manna Gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	4	20%	T
Medium Shrub	7	15%	MS
Small Shrub	1	1%	SS
Large Herb	2	1%	LH
Medium Herb	10	15%	MH
Small or Prostrate Herb	3	1%	SH
Large Tufted Graminoid	4	5%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	3	5%	MTG
Medium to Tiny Non-tufted Graminoid	2	1%	MNG
Ground Fern	5	25%	GF
Tree Fern	2	10%	TRF
Scrambler or Climber	2	5%	SC
Bryophytes/Lichens	na	20%	BL

EVC 18: Riparian Forest
Highlands - Northern Fall Bioregion

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia melanoxylon*	Blackwood
T	*Pomaderris aspera*	Hazel Pomaderris
T	*Acacia dealbata*	Silver Wattle
MS	*Coprosma quadrifida*	Prickly Currant-bush
MS	*Cassinia aculeata*	Common Cassinia
MS	*Prostanthera lasianthos*	Victorian Christmas-bush
MS	*Olearia phlogopappa*	Dusty Daisy-bush
LH	*Mentha laxiflora*	Forest Mint
MH	*Viola hederacea sensu Willis (1972)*	Ivy-leaf Violet
MH	*Acaena novae-zelandiae*	Bidgee-widgee
MH	*Geranium potentilloides*	Cinquefoil Cranesbill
SH	*Hydrocotyle hirta*	Hairy Pennywort
SH	*Dichondra repens*	Kidney-weed
SH	*Galium propinquum*	Maori Bedstraw
LTG	*Carex appressa*	Tall Sedge
LTG	*Poa labillardierei*	Common Tussock-grass
LNG	*Tetrarrhena juncea*	Forest Wire-grass
MTG	*Dianella tasmanica*	Tasman Flax-lily
MNG	*Microlaena stipoides var. stipoides*	Weeping Grass
MNG	*Poa tenera*	Slender Tussock-grass
GF	*Blechnum nudum*	Fishbone Water-fern
GF	*Pteridium esculentum*	Austral Bracken
GF	*Polystichum proliferum*	Mother Shield-fern
GF	*Adiantum aethiopicum*	Common Maidenhair
TRF	*Dicksonia antarctica*	Soft Tree-fern
TRF	*Cyathea australis*	Rough Tree-fern
SC	*Clematis aristata*	Mountain Clematis

Recruitment:
Continuous

Organic Litter:
40 % cover

Logs:
30 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	*Rubus fruticosus spp. agg.*	Blackberry	high	high
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Prunella vulgaris*	Self-heal	high	high

Published by the Victorian Government Department of Sustainability and Environment April 2004

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Highlands – Northern Fall bioregion

EVC 83: Swampy Riparian Woodland

Description:
Woodland to 15 m tall generally occupying low energy streams of the foothills and plains. The lower strata are variously locally dominated by a range of large and medium shrub species on the stream levees in combination with large tussock grasses and sedges in the ground layer.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	70 cm	10 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	*Eucalyptus camphora ssp. humeana*	Mountain Swamp-gum
	Eucalyptus radiata s.l.	Narrow-leaf Peppermint

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	2	15%	T
Medium Shrub	5	10%	MS
Small Shrub	1	1%	SS
Large Herb	3	5%	LH
Medium Herb	8	15%	MH
Small or Prostrate Herb	4	5%	SH
Large Tufted Graminoid	5	30%	LTG
Large Non-tufted Graminoid	2	5%	LNG
Medium to Small Tufted Graminoid	3	5%	MTG
Medium to Tiny Non-tufted Graminoid	3	5%	MNG
Ground Fern	4	10%	GF
Scrambler or Climber	1	1%	SC
Bryophytes/Lichens	na	20%	BL

EVC 83: Swampy Riparian Woodland
Highlands – Northern Fall bioregion

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia melanoxylon*	Blackwood
T	*Acacia dealbata*	Silver Wattle
MS	*Coprosma quadrifida*	Prickly Currant-bush
MS	*Leptospermum continentale*	Prickly Tea-tree
MS	*Epacris breviflora*	Drumstick Heath
SS	*Rubus parvifolius*	Small-leaf Bramble
LH	*Mentha laxiflora*	Forest Mint
LH	*Epilobium gunnianum*	Gunn's Willow-herb
LH	*Urtica incisa*	Scrub Nettle
LH	*Senecio minimus*	Shrubby Fireweed
MH	*Acaena novae-zelandiae*	Bidgee-widgee
MH	*Geranium potentilloides*	Cinquefoil Cranesbill
MH	*Asperula scoparia*	Prickly Woodruff
SH	*Hydrocotyle hirta*	Hairy Pennywort
SH	*Dichondra repens*	Kidney-weed
SH	*Hypericum japonicum*	Matted St John's Wort
SH	*Gonocarpus micranthus ssp. micranthus*	Creeping Raspwort
SH	*Hydrocotyle tripartita*	Slender Pennywort
LTG	*Cyperus lucidus*	Leafy Flat-sedge
LTG	*Carex appressa*	Tall Sedge
LTG	*Gahnia sieberiana*	Red-fruit Saw-sedge
LTG	*Poa labillardierei*	Common Tussock-grass
LNG	*Phragmites australis*	Common Reed
MTG	*Poa ensiformis*	Sword Tussock-grass
MNG	*Microlaena stipoides var. stipoides*	Weeping Grass
MNG	*Eleocharis gracilis*	Slender Spike-sedge
MNG	*Echinopogon ovatus*	Common Hedgehog-grass
GF	*Pteridium esculentum*	Austral Bracken
GF	*Blechnum nudum*	Fishbone Water-fern
GF	*Polystichum proliferum*	Mother Shield-fern
GF	*Blechnum minus*	Soft Water-fern
TRF	*Dicksonia antarctica*	Soft Tree-fern

Recruitment:
Continuous

Organic Litter:
20 % cover

Logs:
20 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	*Rubus fruticosus spp. agg.*	Blackberry	high	high
LH	*Cirsium vulgare*	Spear Thistle	high	high
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Prunella vulgaris*	Self-heal	high	low
MH	*Mimulus moschatus*	Musk Monkey-flower	high	low
MH	*Lotus corniculatus*	Bird's-foot Trefoil	high	high
SH	*Trifolium repens var. repens*	White Clover	high	low
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Anthoxanthum odoratum*	Sweet Vernal-grass	high	high

Published by the Victorian Government Department of Sustainability and Environment April 2004

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Highlands – Northern Fall bioregion

EVC 23: Herb-rich Foothill Forest

Description:
Occurs on relatively fertile, moderately well-drained soils on an extremely wide range of geological types and in areas of moderate to high rainfall. Occupies easterly and southerly aspects mainly on lower slopes and in gullies. A medium to tall open forest or woodland to 25 m tall with a small tree layer over a sparse to dense shrub layer. A high cover and diversity of herbs and grasses in the ground layer characterise this EVC.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	70 cm	20 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
40%	*Eucalyptus radiata s.l.*	Narrow-leaf Peppermint
	Eucalyptus dives	Broad-leaved Peppermint
	Eucalyptus obliqua	Messmate Stringybark

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	2	10%	T
Medium Shrub	7	15%	MS
Small Shrub	3	5%	SS
Prostrate Shrub	2	5%	PS
Large Herb	3	5%	LH
Medium Herb	11	20%	MH
Small or Prostrate Herb	3	5%	SH
Large Tufted Graminoid	2	5%	LTG
Large Non-tufted Graminoid	1	1%	LNG
Medium to Small Tufted Graminoid	6	10%	MTG
Medium to Tiny Non-tufted Graminoid	2	5%	MNG
Ground Fern	2	10%	GF
Scrambler or Climber	2	5%	SC
Bryophytes/Lichens	na	20%	BL

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EVC 23: Herb-rich Foothill Forest
Highlands – Northern Fall bioregion

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia dealbata*	Silver Wattle
MS	*Cassinia aculeata*	Common Cassinia
MS	*Coprosma quadrifida*	Prickly Currant-bush
MS	*Coprosma hirtella*	Rough Coprosma
MS	*Epacris impressa*	Common Heath
SS	*Tetratheca ciliata*	Pink-bells
SS	*Olearia erubescens*	Moth Daisy-bush
SS	*Hibbertia obtusifolia*	Grey Guinea-flower
SS	*Hovea heterophylla*	Common Hovea
PS	*Platylobium formosum*	Handsome Flat-pea
PS	*Acrotriche serrulata*	Honey-pots
PS	*Acrotriche prostrata*	Trailing Ground-berry
LH	*Senecio tenuiflorus*	Slender Fireweed
MH	*Viola hederacea sensu Willis (1972)*	Ivy-leaf Violet
MH	*Gonocarpus tetragynus*	Common Raspwort
MH	*Lagenophora stipitata*	Common Bottle-daisy
SH	*Hydrocotyle laxiflora*	Stinking Pennywort
SH	*Dichondra repens*	Kidney-weed
LTG	*Lomandra longifolia*	Spiny-headed Mat-rush
LNG	*Tetrarrhena juncea*	Forest Wire-grass
MTG	*Stylidium graminifolium s.l.*	Grass Trigger-plant
MTG	*Poa sieberiana*	Grey Tussock-grass
MTG	*Dianella tasmanica*	Tasman Flax-lily
MTG	*Luzula meridionalis var. flaccida*	Common Woodrush
MNG	*Microlaena stipoides var. stipoides*	Weeping Grass
GF	*Pteridium esculentum*	Austral Bracken
GF	*Polystichum proliferum*	Mother Shield-fern
SC	*Clematis aristata*	Mountain Clematis
SC	*Glycine clandestina*	Twining Glycine
SC	*Hardenbergia violacea*	Purple Coral-pea

Recruitment:
Continuous

Organic Litter:
40 % cover

Logs:
20 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Cirsium vulgare*	Spear Thistle	high	high
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Centaurium erythraea*	Common Centaury	high	low

Published by the Victorian Government Department of Sustainability and Environment April 2004

Department of Sustainability and Environment

EVC Benchmark for the Index of Wetland Condition

EVC 821: Tall Marsh

Description:

Wetland dominated by tall emergent graminoids, typically in thick species-poor swards. Rushland, sedgeland or reedbed - locally closed or in association or fine-scale mosaic with Aquatic Herbland (e.g. along floodway lagoons). At optimum development, the vegetation is treeless, but sparse *Eucalyptus camaldulensis* (or in higher rainfall areas, *E. ovata*) are dispersed through some sites where sufficient dry periods occur to allow their survival. Scattered across lowland Victoria.

Indicator species (some or all of these species should be present)

Scientific name	Common name
Bolboschoenus spp.	Club Sedge
Cladium procerum	Leafy Twig-sedge
Cyperus spp.	Flat Sedge
Juncus ingens	Giant Rush
Phragmites australis	Common Reed
Schoenoplectus tabernaemontani	River Club-sedge
Typha spp.	Bulrush
Associated Species	
Amphibromus fluitans	River Swamp Wallaby- grass
Azolla spp.	Azolla
Landoltia punctata	Thin Duckweed
Lemna spp.	Duckweed
Myriophyllum spp.	Water-milfoil
Potamogeton spp.	Pondweed
Pseudoraphis spinescens	Spiny Mud-grass
Rumex bidens	Mud Dock
Stellaria caespitosa	Matted Starwort
Calystegia sepium subsp. *roseata*	Large Bindweed
In cooler or more reliably inundated areas	
Urtica incisa	Scrub Nettle
Wolffia spp.	Duckweed

Notes on indicator species

Variously with *P. australis, Typha* spp., *J. ingens, S. tabernaemontanii* and in more marginal sites sometimes also *Bolboschoenus* spp., *Cyperus* spp. or (locally) *C. procerum*. Associated species are quite variable.

Conditions when the EVC should not be assessed

None recognised subject to water quality (if beyond the ability to view submerged vegetation). Winter sampling may understate scoring.

1. CRITICAL LIFEFORMS

Conditions when specific critical lifeform groupings should not be assessed

None recognised.

General comments on assessing critical lifeform groupings

None.

Victoria The Place To Be

EVC 821: Tall Marsh

Critical lifeform groupings and threshold values for determining if lifeform is substantially modified

Critical lifeform	No. spp.	% Cover	Comments
Herbs	2	+	Scrambling plants and broad-leaved plants which are inundation tolerant (but not aquatics). Substantially modified if absent
Small to medium aquatic herbs	1	+	substantially modified if absent
Small to medium aquatic to semi-aquatic graminoids	1	+	sedges and grasses, substantially modified if absent
Tall monocots	1	20	Leafy species, e.g. Cumbungi, reeds, sedges. Substantially modified if clearly dying.

+ denotes presence

2. WEEDS

High threat weed species

Scientific name	Common name
Aster subulatus	Aster-weed
Cotula coronopifolia	Water Buttons
Delairea odorata	Cape Ivy
Galium aparine	Cleavers
Juncus articulatus	Jointed Rush
Paspalum distichum	Water Couch
Rorippa palustris	Marsh Yellow-cress
Typha latifolia	Lesser Reed-mace
Salix spp.	Willow
Rubus anglocandicans	Blackberry

Conditions where weeds are considered to have a negligible impact

None recognised.

3. INDICATORS OF ALTERED PROCESSES

None recognised.

4. VEGETATION STRUCTURE AND HEALTH

Where Tall Marsh is a sparse component in mosaic or complex with other EVCs, assess for scoring category of >50% of benchmark cover.

Structural dominant	Benchmark cover
Tall graminoids, variously Bulrush *Typha* spp., Common Reed *Phragmites australis*, River Club-sedge *Schoenoplectus tabernaemontani*, Giant Rush *Juncus ingens*	40%

Published by the Victorian Government Department of Sustainability and Environment September 2009

For more information contact: Customer Service Centre, 136 186