

Six Mile Creek Waterway Action Plan

Job 6003046



September 2003

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Wimmera Catchment Management Authority

Six Mile Creek Waterway Action Plan

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Introduction

The Wimmera Catchment Management Authority plans to undertake a stream management works program along Six Mile Creek, which has been identified as a high priority for management. The Waterway Action Plan (WAP), being prepared by Earth Tech Engineering, is to help guide the most appropriate management and facilitate the implementation of waterway management works where required. The development of local community support, the investigation of reach wide issues and the subsequent provision of a technical and financial basis for works to government, are important aspects of Waterway Action Plans.

This report includes consideration of a number of plans and works developed and undertaken by various organisations including Department of Natural Resources and Environment and Project Platypus (Upper Wimmera Landcare network).

Review of State and Regional Strategies

The regional strategies that are relevant to the Wimmera River Catchment are:

- Victorian River Health Strategy (2002)
- Draft Wimmera Waterway Management Strategy (2002)
- Wimmera Water Quality Strategy (2002)
- Wimmera River Geomorphic Investigation (2002)
- Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment (2003)

The Victorian River Health Strategy

“The objective of the Victorian River Health Strategy (VRHS) is to achieve healthy rivers, streams and floodplains which meet the environmental, economic, recreational and cultural needs of current and future generations” (DNRE, 2002).

To achieve the objective, a management approach based on four key elements will be used :

- Protecting rivers that are of the highest community value from any decline in condition;
- Maintaining the condition of ecologically healthy rivers;
- Achieving an ‘overall improvement’ in the environmental condition of the remainder of the State’s rivers, and;
- Preventing damage from future management activities.

Implementation of this management approach will be by:

- Providing special protection for rivers of very high value;
- Establishing regional five and ten year targets for river protection and restoration through community-driven regional planning processes; and
- Establishing policies for specific management activities aimed at preventing damage to river health from future management activities.

The Wimmera Waterway Management Strategy

The Wimmera Waterway Management Strategy (WWMS) aims to, “*protect and enhance the region’s waterways through fair and sustainable management, taking account of environmental, economic, cultural and social objectives*”.

In 1997 the Wimmera Regional Catchment Strategy recognised the need to develop and implement an integrated waterway management program for the two river basins within the Wimmera CMA region. A series of programs, which are consistent with the Wimmera Regional Catchment Strategy, are detailed in the WWMS. Of particular relevance to this Waterway Action Plan are detailed in Table One.

Table One: Wimmera Waterway Management Strategy Programs

Program 1	Asset Management
Aim: To manage structural waterway assets so as to improve the health of the waterways	
Program 2	Waterway Repair and Maintenance
Aim: To preserve, maintain and/or rehabilitate the environmental, economic and social values of waterways	
Program 3	Riparian Management
Aim: To improve waterway health through the sustainable management of riparian zones	
Program 4	Catchment Management
Aim: To assist in addressing land management issues that have negative impacts on waterway values	
Program 5	Flow regimes
Aim: To improve the health of aquatic and riparian ecosystems through provision of appropriate flow regimes	
Program 8	Water Quality and Urban Stormwater Management
Aim: To improve the quality of water in the region’s waterways and wetlands	

The WWMS divided the Wimmera CMA region into 12 Waterway Management Units (WMU). The WMUs are shown in Figure 1. The Waterway Action Plan aims to confirm and elaborate on the findings of the WWMS in relation to Six Mile Creek, which is wholly contained within Waterway Management Unit 4.

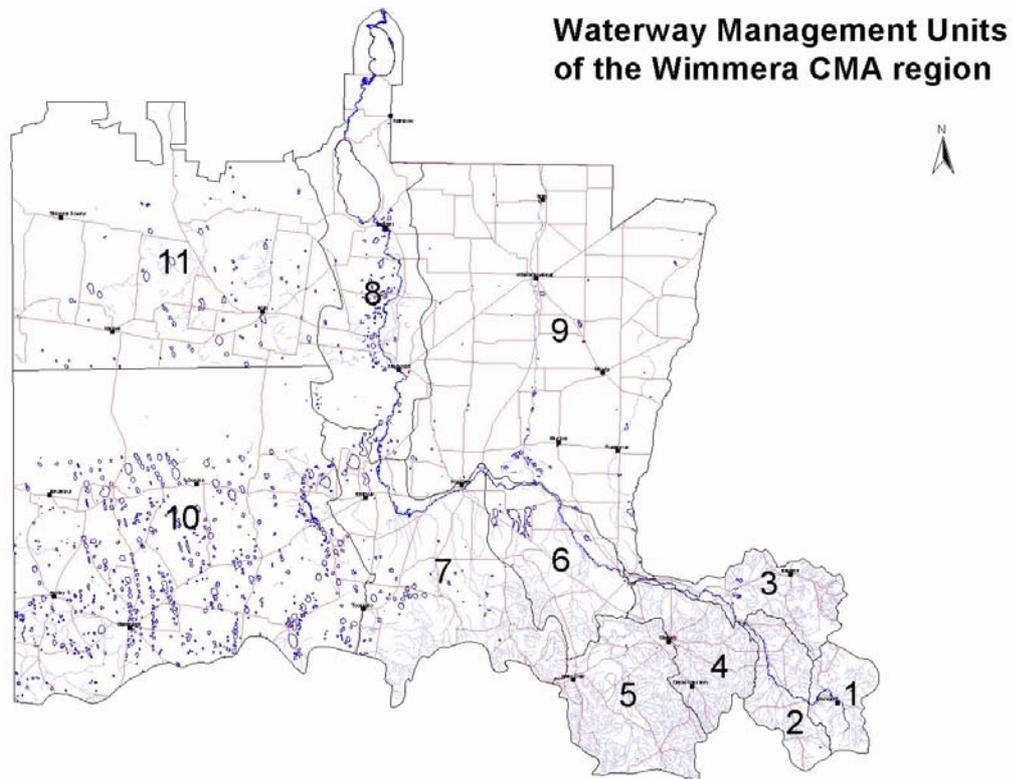


Figure 1: Waterway Management Units of the Wimmera CMA region

The Wimmera Water Quality Strategy

“The aim of the Wimmera Water Quality Strategy is to improve the quality of the Region’s water that will result in environmental, social and economic benefits to the Region”.

Implementing the strategy could reduce total phosphorous levels in the Wimmera River by up to 42 tonnes per year (WCMA 2001).

The strategy is to be applied through a number of Programs. Of these, Program 7; Catchment and River Health Management, is most relevant to this report. Its objective is to, *“ensure that catchment and river health management in the region will result in improved water quality”*. This is to be achieved through:

- Waterway repair and maintenance;
- Flow regimes;
- Riparian management; and
- Catchment management.

The Wimmera River Geomorphic Investigation

The Wimmera River Geomorphic Investigation (WRGI) comprised a review and analysis of sediment processes within the Wimmera catchment, with a focus primarily on the Wimmera River. This report recommends that the following priorities, based on the principles of best practice catchment management, be applied:

- Preserve areas with near pristine values;

- Restore areas of high value;
- Rehabilitate areas that place other values at risk or provide good opportunity for restoring values; and
- Maintain degraded areas to prevent values declining to unacceptable levels.

Broadly examining the upper catchment areas, the Geomorphic Investigation found that some streams and tributaries are delivering high sediment loads to the Wimmera River. This excess sediment is threatening reaches harbouring rare geomorphic and ecological features. In particular, the report found that Reaches 2, 4 and 6 are high priorities for management intervention. Reach 6 is a high priority for intervention as it is immediately upstream of Reach 7.

With regard to Reach 7 the WRGI (ID&A 2002) noted the following processes and Management Implications for Reach 7 and its tributaries.

“Upstream of the Stawell – Landsborough Road, Six Mile Creek has a natural floodout zone where sediment accumulation occurs. This reach has had a drain excavated through it several times in the last century in attempts to address repeated infilling and local waterlogging associated with the low gradient and excess sediment inputs from upstream.”

Wimmera River – Reach 7

“This reach of the Wimmera River has high environmental values. It is one of the least disturbed and has undergone little adjustment post European settlement. In terms of physical form, vegetation, hydrology and habitat structure it is probably in the best condition of all of the Wimmera River”.

“The main management objective for this reach should be to preserve and improve its current high environmental values through management actions within upstream reaches and tributaries.”

Tributaries

“The extensive erosion occurring in the Six Mile Creek catchment requires management action. The reasons for this are not purely derived from direct geomorphic impacts on the Wimmera River. This creek is not delivering large volumes of sediment to the Wimmera River. The reason for management is to encourage improved management and improved land use conditions in the floodout reaches of the creek that will reduce the threat of future direct impacts on the Wimmera River.

These reaches are naturally floodout zones, however the increased sediment loads being delivered to it from upstream will exacerbate the incompatibility of this reach with agricultural pursuits. The increased sediment loads being deposited in these reaches are likely to increase the waterlogging effects that occur in such zones, hence the likelihood of drainage excavation by landholders to relieve this is higher. To encourage participation in improved management of floodout zones, WCMA should undertake erosion control works to reduce the sediment inputs from upstream”.

Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment

The Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment (Earth Tech 2003) identified stream types and stream condition

throughout the Wimmera River catchment. The investigation highlighted the significant loss of discontinuous stream types due to channelisation. Those discontinuous stream types that remain are also under threat due to poor vegetation cover.

Vegetation cover along Six Mile Creek is less than 20% for much of its length and there are numerous examples of incised discontinuous stream types.

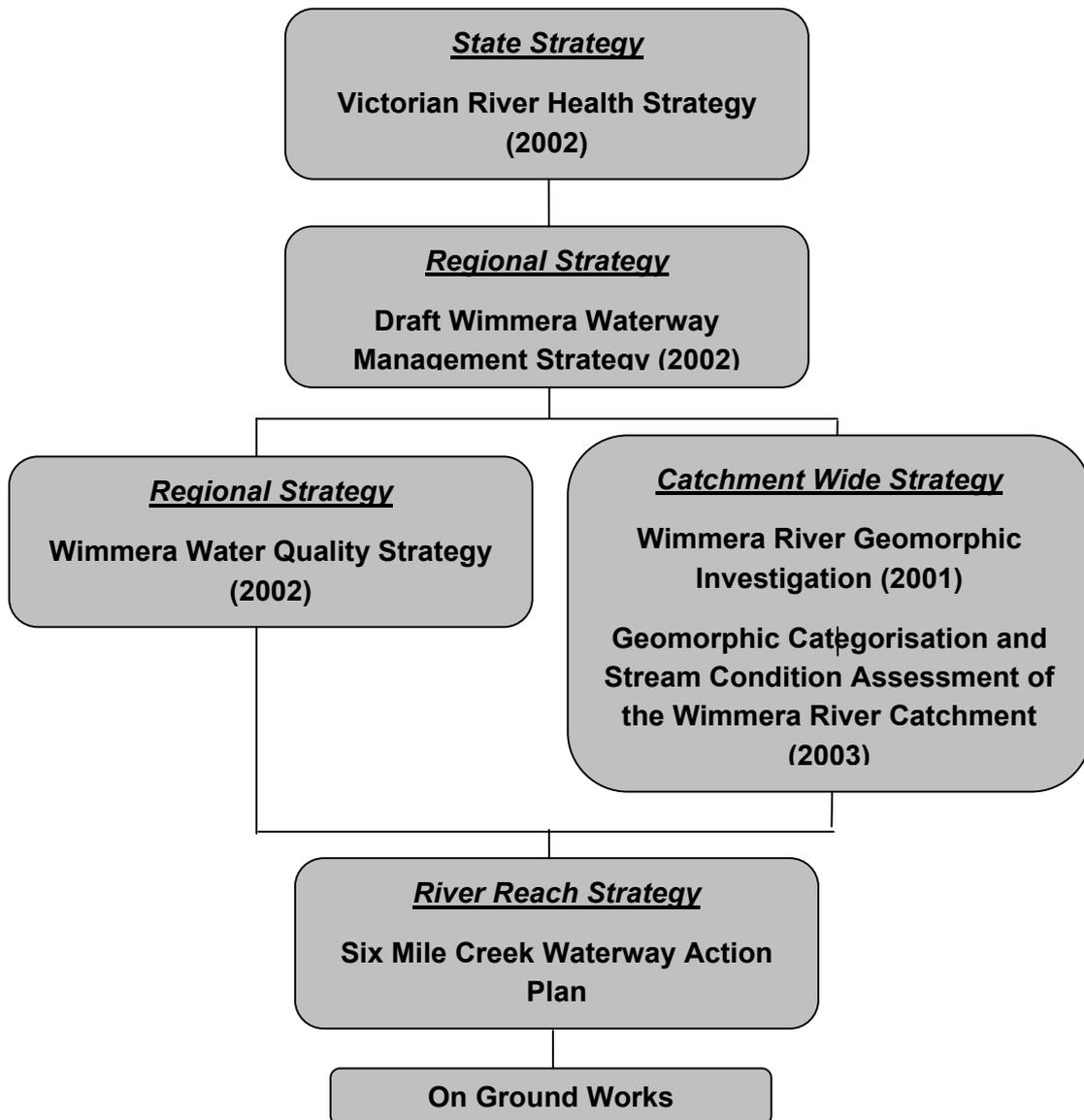


Figure 2: Relationships between strategies and action plans to be used to compile the Six Mile Creek Waterway Action Plan.

Management Objectives

The objectives of the Six Mile Creek Waterway Action Plan are;

1. To protect the health of Reach 7 of the Wimmera River.

This will involve

- Investigating sediment sources upstream from floodout zones within the catchment
 - Assessing the potential impact of water quality from the Six Mile Creek catchment on the Wimmera River
2. To identify any significant values within the Six Mile Creek catchment.
 3. To encourage landholder participation in improved management of floodout zones in order to reduce the likelihood of drainage excavation.

Six Mile Creek Catchment

Six Mile Creek is a left bank tributary of the Wimmera River that originates from the Great Dividing Range on the northern edge of Dunneworthy State Forest (See Figure 3, Localition Map).

With a catchment area of approximately 95 km², the predominant landuse is grazing. The geology in the catchment varies throughout the length of Six Mile Creek. The upper sections of the catchment are comprised of Cambrian sandstone and siltstones and limited graniodiorite outcrops. The lower sections are comprised Quaternary siltstone and sandstone, with fluvial gravels, sands and silts.

Six Mile Creek and its tributaries flow in a northerly direction to the Wimmera River. The creek enters the river north west from Joel Joel. Much of the tributary system has undergone gully erosion and incision.

Stream health varies throughout the catchment. In-stream values in the lower reaches of Six Mile Creek are higher than upstream. The creek regularly experiences a 'cease to flow' period in the summer months. Riparian vegetation, pools and LWD are therefore important refuges for aquatic species during this period. Fish species including Mountain galaxias, Flat-headed gudgeon and River blackfish could be expected to occur in lower reaches of Six Mile Creek, having been recorded in the Wimmera River in this area.

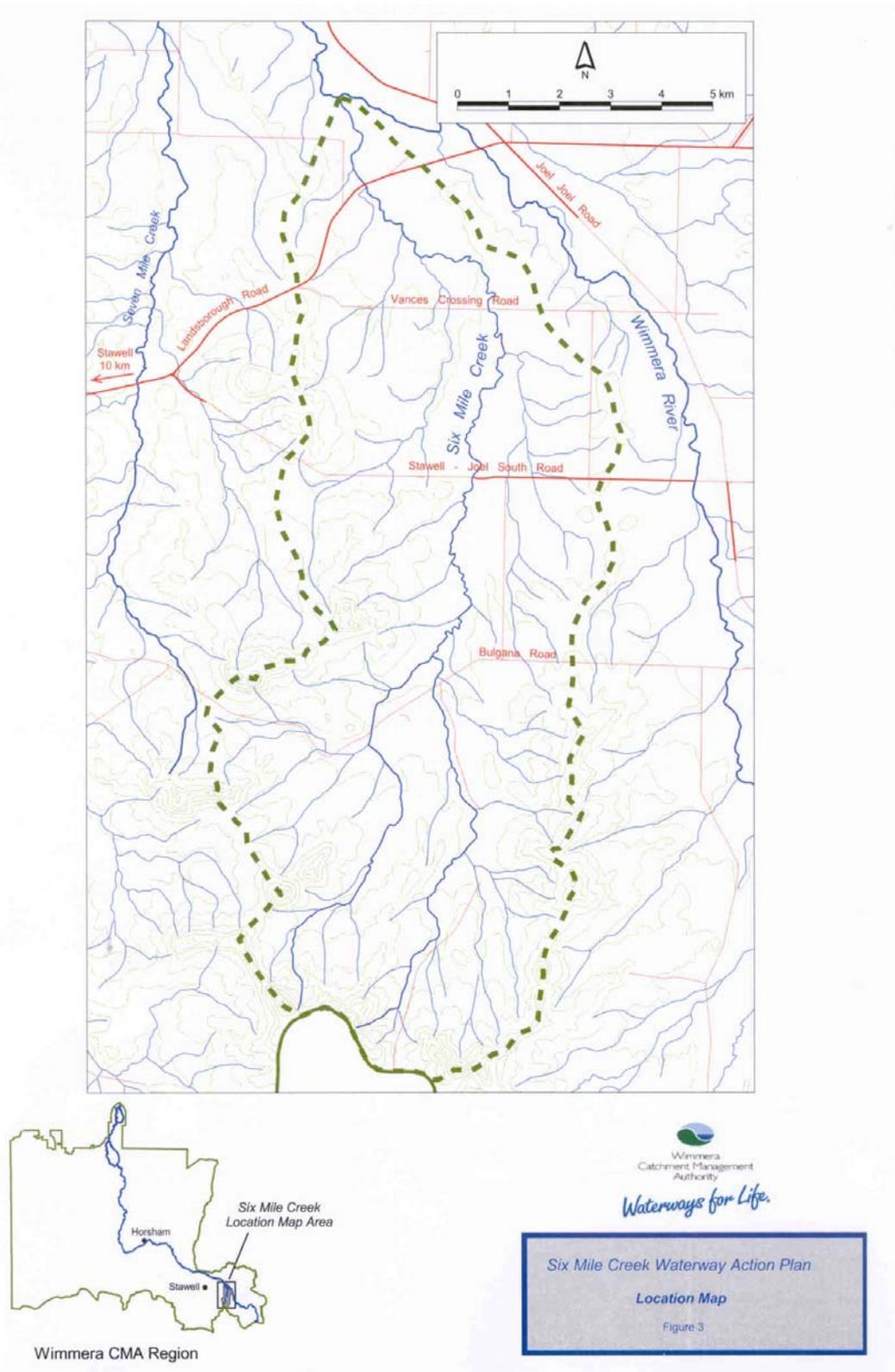
The Concongella Landcare Group has prepared a strategic management plan for the Six Mile Creek catchment (Bignell 1998). The plan identified salinity and active erosion sites and based management actions on land capability. It was noted in the plan that *"salt stain was observed on the creek bed for nearly the full length of the Six Mile Creek and the entire length of Mick's Creek"*.

The landowners in the Six Mile Creek catchment continue to undertake works based on the management plan. It is recommended that implementation of the Six Mile Creek Waterway Action Plan be undertaken in conjunction with the Concongella Creek Landcare Group strategic management plan.

It is recognised that works within the management plan are based predominantly on soil conservation techniques such as battering and gully plug dams. These techniques may not be common to those employed by the Wimmera CMA. The CMA has taken a softer engineering approach focussing on establishment of riparian zones to aid in achievement of bank stability. Cost effective, efficient and long term viable works are the outcome of any proposed actions.

Discussions with landholders indicated that further investigation in to soil characteristics is warranted. The outcomes of such investigations could result in modifications to erosion treatment techniques.

Figure 3: Six Mile Creek Catchment Location Map



Management Reaches

The main channel of Six Mile Creek has been divided into four reaches for the purpose of this investigation. Three main tributaries have also been identified to assist in describing the stream condition, identifying areas of concern and highlighting management actions. These reaches are detailed in Table Two.

Table Two: Reach delineation of Six Mile Creek

Reaches	Location
Reach 1	Upstream from Bulgana Road
Reach 2	Bulgana Road to Joel South Road
Reach 3	Joel South Road to Vance's Crossing Road
Reach 4	Downstream from Vance's Crossing Road
Reach 5	Left Bank Tributary of Reach Two
Reach 6	Right Bank Tributary of Reach Three
Reach 7	Left Bank Tributary of Reach Four (Mick's Creek)

Reach Assessments

(Stream categories have been determined from Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment. Earth Tech 2003)

Reach 1: Upstream from Bulgana Road

Reach 1: Condition and values

Physical Form

Common to the Six Mile Creek catchment, the reach has undergone incision in the past. Lower sections have recovered to a stable form while the upper sections are still recovering. The mid and upper sections of the reach are categorised as Alluvial continuous 5 and Intact Valley Fill respectively. Most of the reach is within farmland. There is evidence of previous stabilisation of headward erosion. Unfortunately, diversion banks have created problems in other areas.

The channel gradient increases as the slope of the land increases towards the upper catchment. As a result, a number of small active erosion heads occur in the upper sections of the reach. These erosion heads should be treated as a priority.

In the lower sections of the reach (Alluvial Continuous 1), there is a depositional zone. The physical form improves where there is improved riparian vegetation.

Riparian Ecology

The quality of riparian vegetation varies throughout the length of the reach. Better quality vegetation and habitat exists in the lower sections. It progressively decreases moving upstream. At the very top of the reach, which is adjacent to the Dunneworthy State Forest and the road reserve, Six Mile Creek is well vegetated. The right bank of the creek is fenced due to forming the boundary with the road. In many areas stock have direct access to the creek. Although the left bank is fenced in some sections, there is evidence of heavy grazing. An absence of regeneration and recruitment of vegetation is evident.

Instream Habitat

The stream is ephemeral, so instream opportunities are very limited. As noted with riparian ecology and geomorphology improved conditions occur within the lower section of the reach. Good riparian vegetation has resulted in increased amounts of large woody debris in the lower sections of the reach.

Water Quality

There is limited water flowing in the lower sections of the reach. The quality of the water is unknown. However, it would be significantly affected by stock access.



Figure 4: Reach 1

Upstream from Bulgana Road (Alluvial continuous 1). The physical form improves with improved riparian vegetation.



Figure 5: Reach 1

Most of the reach is within farmland and the upper sections are still recovering. (Alluvial continuous 5 in the photo)

Reach 1: Risks and Opportunities

Physical Form

Risk - There is a minor risk to the geomorphic form of the lower section of the reach by sediment from erosion in the upper sections.

Risk - Sediment currently stored in the floodout zone could be remobilized through damage to the riparian vegetation due to stock access.

Risk - Stock access poses a minor threat to bank stability.

Opportunity – Prompt action now to address the small erosion heads would mitigate the risks posed.

Opportunity - Restrict stock access to all flood out zones and allow the establishment of vegetation to hold deposited sediment.

Riparian Ecology

Risk – Grazing is affecting vegetation quality and regeneration.

Opportunity - The opportunity exists to fence and allow the re-establishment of native vegetation to enhance the streamside zone in the lower sections of the reach and improve vegetation in the upper section of the reach

Instream Habitat

Risk – Stock access presents a small risk to instream habitat particularly in lower sections of reach

Opportunity – Enhanced riparian vegetation would improve instream habitat for macroinvertebrates and terrestrial species which include the riparian zone in their habitat range. Pools are very limited and fish species are unknown, hence opportunities for fish are unlikely.

Water Quality

Risk – Stock access provides the major risk to water quality. Where the stream is close to the edge and ground cover is poor, runoff from the adjacent unsealed road would present a risk.

Opportunity – Water quality could be improved by controlling stock access.



Figure 6: Reach 1

Stock access poses a minor threat to bank stability and the major risk to water quality.



Figure 7: Reach 1

Prompt action now to address the small erosion heads would mitigate the risks posed.

Reach 1: Summary

	Condition	Score	Risk-Opportunity	Score	Final Score*
Physical Form	Moderate	3	Moderate	2	6
Riparian Ecology	Moderate	3	Moderate	2	6
In-Stream Habitat	Poor	2	Low	1	2
Water Quality	Poor	2	Low	1	2
					Total = 16

*Final Score = (Condition x Risk - Opportunity)

Reach 1: Management Actions

Management Actions	Priority for Works
Treat active erosion heads in the upper section of reach.	Medium
Fence and revegetate the channel to control stock access, improve soil stability, habitat and water quality values.	Medium



Figure 8: Reach 1

Treat active erosion heads in the upper section of reach.



Figure 9: Reach 1

Fence and revegetate the channel to control stock access, improve soil stability, habitat and water quality values.

Reach 2: Bulgana Road to Joel South Road

Reach 2: Condition and Values

Physical Form

The channel is generally in good condition with a variety of geomorphic forms such as bars, and pools. The stream is categorised as Alluvial Continuous 4 for most of its length with a small section (approximately 500 m) categorised as Discontinuous Channelised at the upper end. Scour features are common around Large Woody Debris (LWD) and overstorey trees that occur in the channel. The section of the reach immediately downstream from the Bulgana Road bridge is well grassed.

Riparian Ecology

The riparian zone ranges from good in the lower section of the reach to moderate in the upper section. Large mature trees occur throughout the reach, although these are restricted to a narrow corridor either side of the creek. These trees contribute large amounts of LWD to the channel. The surrounding land use is predominantly grazing and there is uncontrolled stock access to the creek in many areas of the reach. Consequently, there is a lack of regeneration.

Instream Habitat

Instream habitat is improved through the occurrence of pools. Such pools would be significant, given the ephemeral nature of the creek

Water Quality

The water quality is unknown although water was flowing at the time of inspection. Locally collected water quality data indicates EC levels as high as 13, 000EC during summer, although typically 7, 000 EC – 8, 000 EC.



Figure 10: Reach 2

Instream habitat is improved through the occurrence of pools.



Figure 11: Reach 2

The surrounding land use is predominantly grazing. Consequently, there is a lack of regeneration.

Reach 2: Risks and Opportunities

Physical Form

Risk - Stock access poses a minor risk to bank stability. There is no evidence of sediment entering the reach from upstream.

Opportunity – Fencing to control stock access would improve bank stability.

Riparian Ecology

Risk – Grazing is affecting vegetation quality and regeneration.

Opportunity - The opportunity exists to fence and allow the re-establishment of native vegetation. There is opportunity to improve the quality of vegetation in the reach particularly near Bulgana Road. This would create a continuous corridor from Reach 1.

Instream Habitat

Risk – Stock access presents a small risk to instream habitat.

Opportunity – Enhanced riparian vegetation would improve instream habitat. Pools and LWD are significant habitat within the Reach. The pools are important refuges for this ephemeral stream. The sighting of a foraging water rat is evidence of the value of habitat in the reach.

Water Quality

Risk – Stock access will continue to decrease water quality. Saline groundwater may pose a threat in this reach and in others downstream.

Opportunity – Control of stock would improve water quality.



Figure 12: Reach 2

Stock access will continue to decrease water quality.



Figure 13: Reach 2

Grazing is affecting vegetation quality and regeneration.

Reach 2: Summary

	Condition	Score	Risk-Opportunity	Score	Final Score*
Physical Form	Good	4	Low	1	4
Riparian Ecology	Moderate	3	Medium	2	6
In-Stream Habitat	Good	4	Medium	2	8
Water Quality	Moderate	3	Low	1	3

Total = 21

*Final Score = (Condition x Risk - Opportunity)

Reach 2: Management Actions

Management Actions	Priority for Works
Fence to control stock access. Revegetate to improve soil stability, habitat and water quality values	Low
Investigate the risk posed by saline groundwater in this reach, Reach 3 and Reach 4.	Medium

Reach 3: Joel South Road to Vance's Crossing Road

Reach 3: Condition and values

Physical Form

The channel has undergone historic incision and has recovered to a stable form. The stream is categorised as Alluvial Continuous 4 for its total length, except for an approximately 100 metre section of Intact Valley Fill. There is significant LWD and large vegetation in the channel creating scours, pools and point bars. The channel does not contain large amounts of sediment as seen in adjacent streams such as Seven Mile Creek and Concongella Creek.

Riparian Ecology

Riparian vegetation is good to very good throughout the reach. As with other reaches, regeneration is limited although improved in the lower section of the reach. Large overstorey trees contribute significant amounts of debris and contain many hollows.

Instream Habitat

Significant LWD and the occurrence of pools provide important refuge for instream habitat in this reach. The ephemeral nature of the creek and some poor sections downstream from Vance's Crossing Road raises questions of whether fish species would exist this far upstream in Six Mile Creek. The pools would provide refuge for galaxiads. The pools are also important habitat for those terrestrial species, which include the creek within their habitat range.

Water Quality

The water within the reach was generally clear. The occurrence of spiny rush indicates that salinity may be an issue.



Figure 14: Reach 3

Large overstorey trees contribute significant amounts of debris and contain many hollows.



Figure 15: Reach 3

The channel has undergone historic incision and has recovered to a stable form.

Reach 3: Risks and Opportunities

Physical Form

Risk - Stock access poses a minor risk to bank stability. There is no evidence of sediment entering the reach from upstream.

Opportunity – Fencing to control stock access would improve bank stability.

Riparian Ecology

Risk – Grazing is affecting vegetation quality and regeneration.

Opportunity - The opportunity exists to fence and allow the re-establishment of native vegetation. Revegetation is generally not required, as the trees would provide the seed source.

Instream Habitat

Risk – Stock access presents a small risk to instream habitat.

Opportunity – Enhanced riparian vegetation would improve instream habitat.

Water Quality

Risk – Stock access will continue to decrease water quality.

Opportunity – Control of stock would improve water quality.



Figure 16: Reach 3

Fencing to control stock access would improve bank stability.



Figure 17: Reach 3

Fence and allow the re-establishment of native vegetation.

Reach 3: Summary

	Condition	Score	Risk-Opportunity	Score	Final Score*
Physical Form	Good	4	Low	1	4
Riparian Ecology	Good	4	Medium	2	8
In-Stream Habitat	Good	4	Medium	2	8
Water Quality	Moderate	3	Low	1	3
Total = 23					

*Final Score = (Condition x Risk - Opportunity)

Reach 3: Management Actions

Management Actions	Priority for Works
Fence to control stock access. Revegetate to improve soil stability, habitat and water quality values	Medium
Investigate risk posed by saline groundwater inflow.	Medium

Reach 4: Downstream from Vance's Crossing Road

Reach 4 has been covered in the Waterway Action Plan for Wimmera River Reach 6.2. The reach is similar in condition to Reach 3, except where works are planned in a degraded section upstream of Landsborough Road.

Stream category varies throughout the reach. At its upper end, the reach is a continuation of the Alluvial Continuous 4 category which dominates Reach 3. Upstream of the Stawell Landsborough Road, for approximately 2 kilometres the stream is categorised as Discontinuous channelised. Downstream of the Stawell Landsborough Road to the confluence with the Wimmera River, the stream category is Alluvial Continuous 1.

Overview of Six Mile Creek (excerpts from Wimmera River Reach 6.2 Waterway Action Plan)

Astons Scour and Six Mile Creek are ephemeral tributaries of the Wimmera River which have the potential to contribute significant quantities of sediment to Reach 6.2. This Waterway Action Plan therefore includes a works program to maintain and improve the sediment trapping and holding abilities of Astons Scour and Six Mile Creek.

Six Mile Creek is a left bank tributary which joins the Wimmera River approximately 1.8km north of the Six Mile Creek bridge on the Landsborough Road. With a catchment area of approximately 88km², Six Mile Creek is a low capacity channel incorporating a long, low gradient reach toward its downstream end (ID&A, 2002). The Wimmera River Geomorphic Investigation (ID&A, 2002) notes that the Six Mile Creek also has a, “natural floodout zone where sediment accumulation occurs. This reach has had a drain excavated through it several times in an attempt to address repeated infilling and local waterlogging associated with the low gradient and excess sediment inputs from upstream”.



Figure 18: Reach 4



Figure 19: Reach 4

Six Mile Creek has the potential to contribute large volumes of sediment to the Wimmera River. The works program therefore aims to trap and hold sediment within the lower reaches of Six Mile Creek. As the creek is heavily incised through its original floodplain, reed growth should be encouraged within the stream bed. Riparian vegetation should be maintained where it exists and encouraged on reaches where clearing has occurred.



Figure 20: Reach 4



Figure 21: Reach 4

Summary of Works

Refer to Wimmera River Reach 6.2 waterway Action Plan for further details.

Six Mile Creek		
Priority	Location	Works Required
<i>High</i>	<i>55m upstream of the Six Mile Ck bridge on the Landsborough Rd.</i>	<i>Construct rock chute to stabilize stream bed grade. Batter, fence & revegetate banks. Provide off-stream watering points for stock.</i>
<i>Medium</i>	<i>Gully starting 55m upstream of the Six Mile Ck bridge on the Landsborough Rd.</i>	<i>Batter gully head to create grass chute. Batter & fence left and right banks of gully.</i>
<i>Medium</i>	<i>1 220m upstream of the Six Mile Ck bridge on the Landsborough Rd to the Joel Forest-Vances Crossing Rd.</i>	<i>Fence left and right banks of Six Mile Ck. Provide off-stream watering points for stock as necessary.</i>
<i>Medium</i>	<i>From confluence of Six Mile Ck & the Wimmera River to the Landsborough Rd</i>	<i>Fence left and right banks of Six Mile Ck. Provide off-stream watering points for stock as necessary.</i>
<i>Low</i>	<i>Joel Forest-Vances Crossing Rd, third crossing of Six Mile Ck from causeway on Wimmera River.</i>	<i>Monitor small but inactive headcut on this stable reach.</i>

Reach 5: Left Bank Tributary of Reach 2

This major left bank tributary of Reach 2 commences approximately 500 metres downstream from Bulgana Road. Moving upstream, the tributary divides into a number of arms which have been and continue to be the focus of soil conservation works by the former Soil Conservation Authority and Project Platypus. The stream category is predominantly Alluvial Continuous 5, interspersed with sections of Intact valley fill and Discontinuous channelised where contemporary channel erosion has occurred.

Reach 5: Condition and values

Physical Form

Overall, the reach is generally in moderate condition although some erosion heads are still active. A southern arm displays some physical diversity associated with moderate to good riparian vegetation. A northern arm, which parallels Bulgana Road, is still active, having bypassed a trickle pipe and associated works in the past. The erosion appears to be associated with a salt scald.

Riparian Ecology

Overall, riparian vegetation in the reach is in poor condition, although some minor tributaries contain moderate vegetation. Commonly, such sections are associated with stock control through fencing and revegetation. In one section, clearing of native understorey species has been carried out to assist in rabbit control, thus decreasing the value of the riparian vegetation. Proactive landholders have commenced revegetation in conjunction with gully erosion works.

Instream Habitat

Overall, instream habitat is very poor. There is little to no large woody debris and pools are few.

Water Quality

With large areas of uncontrolled stock access, poor riparian vegetation and some active erosion heads, water quality is expected to be poor.



Figure 22: Reach 5

With large areas of uncontrolled stock access, poor riparian vegetation and some active erosion heads, water quality is expected to be poor.



Figure 23: Reach 5

Overall, riparian vegetation in the reach is in poor condition.

Reach 5: Risks and Opportunities

Physical Form

Risk – There is a minor risk to higher value sections downstream from the erosion heads.

Opportunity – Treatment of erosion heads would mitigate the threat posed by continued erosion.

Riparian Ecology

Risk – Uncontrolled stock access continues to threaten the limited riparian vegetation in the reach.

Risk – Clearing of understorey vegetation threatens the good quality riparian zones, which are very limited in this reach.

Opportunity – Fencing and revegetation would significantly improve riparian values.

Opportunity – Education on the value of native vegetation, particularly understorey vegetation, is required.

Instream Habitat

Risk – Stock access presents a small risk to instream habitat.

Opportunity – Enhanced riparian vegetation would improve instream habitat.

Water Quality

Risk – Stock access will continue to decrease water quality.

Opportunity – Control of stock would improve water quality.



Figure 24: Reach 5

Enhanced riparian vegetation would improve instream habitat.



Figure 25: Reach 5

Treatment of erosion heads would mitigate the threat posed by continued erosion.

Reach 5: Summary

	Condition	Score	Risk-Opportunity	Score	Final Score*
Physical Form	Poor	2	Low	1	2
Riparian Ecology	Poor	2	Medium	2	4
In-Stream Habitat	Poor	2	Low	1	2
Water Quality	Poor	2	Low	1	2
					Total = 10

*Final Score = (Condition x Risk - Opportunity)

Reach 5: Management Actions

Management Actions	Priority for Works
Fence to control stock access in higher value sections. Revegetate to improve soil stability, habitat and water quality values.	Medium
Conduct education program on value of understorey vegetation.	Medium
Fence to control stock access. Revegetate to improve soil stability, habitat and water quality values.	Low
Treat active erosion heads.	Low

Reach 6: Right Bank Tributary of Reach Three

This right bank tributary of Reach 3 commences approximately 1500 metres south from Vance's Crossing Road. 1:25,000 scale mapping indicates an extensive stream system. However there are few drainage lines. There is a vegetated creek line 1500 metres upstream from the confluence with Six Mile Creek. Further upstream, there are no definable drainage lines. This subcatchment appears to have been treated successfully in the past. The reach requires no further work at this stage as it is stable and presents no risk to the values of Six Mile Creek.

Reach 7: Left Bank Tributary of Reach Four (Mick’s Creek)

This major left bank tributary of Reach 4 commences approximately 1000 metres north (downstream) from Vance’s Crossing Road. The tributary is known locally as Mick’s Creek and has been a major focus of the Concongella Landcare group in the past. The upper section of the reach is dominated by a visually unattractive series of erosion heads and a salt scald south from the Stawell - Joel South Road leading onto a deeply incised channel to the north of the road. The stream is categorised as Discontinuous channelised throughout its length.

Reach 7: Condition and values

Physical Form

The extensive erosion and salt scald south from Stawell Joel South Road is generally stable although there are a number of small active erosion heads. The site has been planted by the landholder. South from the road the channel has been fenced and battered and sown to grass seed. The landholder indicated the area is to be planted with native vegetation. Approximately 500 metres upstream from Thomas Road, where the property is owned by a different landholder, the channel has not been battered but the bed is stable. Sediment contribution is only minor from the banks. The creek bed is stabilised by a structure on Thomas Road. The lack of large amounts of sediment indicates little sediment is being generated upstream from Thomas Road. Immediately downstream from Thomas Road the channel form is good, in association with good riparian vegetation. Further downstream, the channel condition is poor as there is a lack of riparian vegetation and stock have direct access to the creek. As the tributary approaches Vance’s Crossing Road, its condition improves significantly, in association with riparian vegetation.

Riparian Ecology

Riparian vegetation within the reach is generally poor. There are isolated pockets of good vegetation. However, as stock have access, there is little to no regeneration.

Instream Habitat

Instream habitat is generally very poor.

Water Quality

As stock have access and banks are actively eroding, water quality is expected to be poor.



Figure 26: Reach 7

There are a number of small active erosion heads.



Figure 27: Reach 7

As stock have access and banks are actively eroding, water quality is expected to be poor.

Reach 7: Risks and Opportunities

Physical Form

Risk - Stock access poses a large risk to bank stability. There is little evidence of sediment entering the reach from upstream.

Opportunity – Fencing to control stock access would improve bank stability.

Riparian Ecology

Risk – Grazing is adversely affecting vegetation quality and regeneration

Opportunity – Fence and revegetate to link up isolated patches of good vegetation. Stock exclusion would also result in regeneration. A number of large trees are present and are likely to provide a readily available seed source.

Instream Habitat

Risk – Stock access presents a small risk to instream habitat, as little exists.

Opportunity – Improvement of instream habitat would be over the longer term as a result of fencing and revegetation.

Water Quality

Risk – Stock access will continue to decrease water quality.

Opportunity – Control of stock would improve water quality.

Opportunity - Control of salt discharge within the scald and the associated improvements in water quality will allow improvements in riparian vegetation downstream which will have associated improvements in stream habitat and stream ecological diversity.



Figure 28: Reach 7

Fencing to control stock access would improve bank stability.



Figure 29: Reach 7

Fence and revegetate to link up isolated patches of good vegetation.

Reach 7: Summary

	Condition	Score	Risk-Opportunity	Score	Final Score*
Physical Form	Poor	2	Low	1	2
Riparian Ecology	Poor	2	Medium	2	4
In-Stream Habitat	Very Poor	1	Medium	2	2
Water Quality	Poor	2	Low	1	2
Total = 10					

*Final Score = (Condition x Risk - Opportunity)

Reach 7: Management Actions

Management Actions	Priority for Works
Fence to control stock access. Revegetate to improve soil stability, habitat and water quality values.	Low

Management Priorities

Priorities for the allocation of resources are listed in the following table. These priorities are based on condition assessments and an assessment of the risks and opportunities associated with the recovery and maintenance of stream health. The higher relative score indicates a higher priority for action.

Reach	Score	Management Priority
Reach 1	16	3
Reach 2	21	2
Reach 3	23	1
Reach 4	Refer Wimmera River Reach 6.2 Waterway Action Plan	
Reach 5	10	4
Reach 6	N/A	N/A
Reach 7	10	5

Summary of Priorities for Management Action

Reach	Activity				
	Fence and revegetate to control stock access in Six Mile Creek	Treat active erosion heads	Fence and revegetate to control stock access in tributaries	Conduct community education on values of understory vegetation	Investigate risk posed by saline groundwater discharge
Reach 1	M	M			
Reach 2	L				M
Reach 3	M				M
Reach 4					M
Reach 5		L	M	M	M
Reach 6					M
Reach 7			L		M

For cost estimates of implementation of proposed works program, refer to Appendix B.

References

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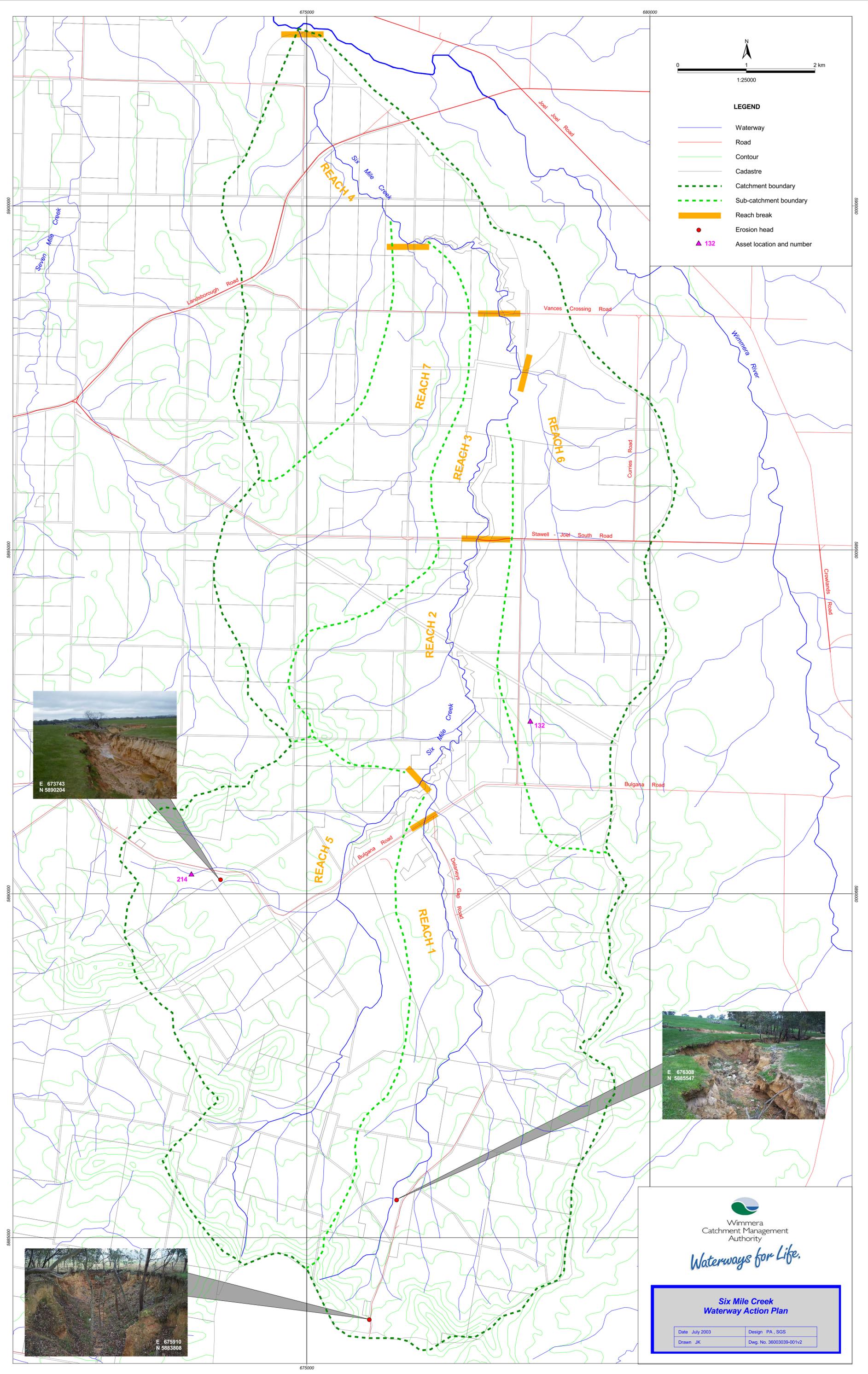
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Appendix A: Six Mile Creek Catchment Map




 Wimmera
 Catchment Management
 Authority
Waterways for Life.

**Six Mile Creek
Waterway Action Plan**

Date July 2003	Design PA, SGS
Drawn JK	Dwg. No. 36003039-001v2

Appendix B:

Cost Estimate for implementation of recommendations

Table B1: Cost Estimate for implementation of recommendations

Item	Description	Number	Unit	Rate (\$)	Total*	Notes
Reach 1						
1.1	Treat active erosion heads	3	each	5 000.00	15 000	
1.2	Fencing & revegetation	5 000	metres	6.00	30 000	
Reach 2						
2.1	Fencing & revegetation	6 000	metres	6.00	36 000	
2.2	Investigate the risk posed by saline groundwater in Reaches 2, 3 and 4	4 per annum	each	500.00	2 000	Costs are indicative only
Reach 3						
3.1	Fencing & revegetation	5 000	metres	6.00	30 000	
Reach 5						
5.1	Fencing & revegetation in high value sections	1 500	metres	6.00	9 000	
5.2	Conduct an education program on value of understorey vegetation				5 000	
5.3	Fencing & revegetation	4 000	metres	6.00	24 000	
5.4	Treat active erosion heads	1	each	10 000.00	10 000	
Reach 7						
7.1	Fencing & revegetation	6 000	metres	6.00	36 000	
TOTAL					\$197, 000	

*Total cost has not considered cost sharing