

JUNEE SHIRE COUNCIL



URBAN STORMWATER

MANAGEMENT PLAN

2001

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SECTION 1 - INTRODUCTION

1.1 PURPOSE OF THE PLAN

This document is the Urban Stormwater Management Plan for the Junee Shire. Within the Shire there is one major township which is affected by the plan and that is the township of Junee (Plate 1).

The purpose of this plan is to provide the Shire Council, business, residents, community and environmental groups with guidance as to the management of Stormwater in the Junee Shire. In addition it aims to identify areas of concerns and priorities of the residents of the Shire with regard to urban Stormwater, and to incorporate those concerns and priorities in a single, accessible, planning document.

The implementation of the Plan will improve the management of Stormwater in the urban areas of Junee and will, over time, lead to the following outcomes:-

- Recognition of the Junee Wetlands as an environmental asset.
- Improved water quality in the Junee Wetlands.
- Improved aquatic habitat.
- Re-vegetation of the catchment and Wetlands.
- Creation of an environmental recreation and education space for Junee residents.
- Improvement in water quality in Houlaghan's Creek (Downstream of Junee Wetlands) and eventually the Murrumbidgee River.

1.2 FRAMEWORK FOR PREPARING THIS PLAN

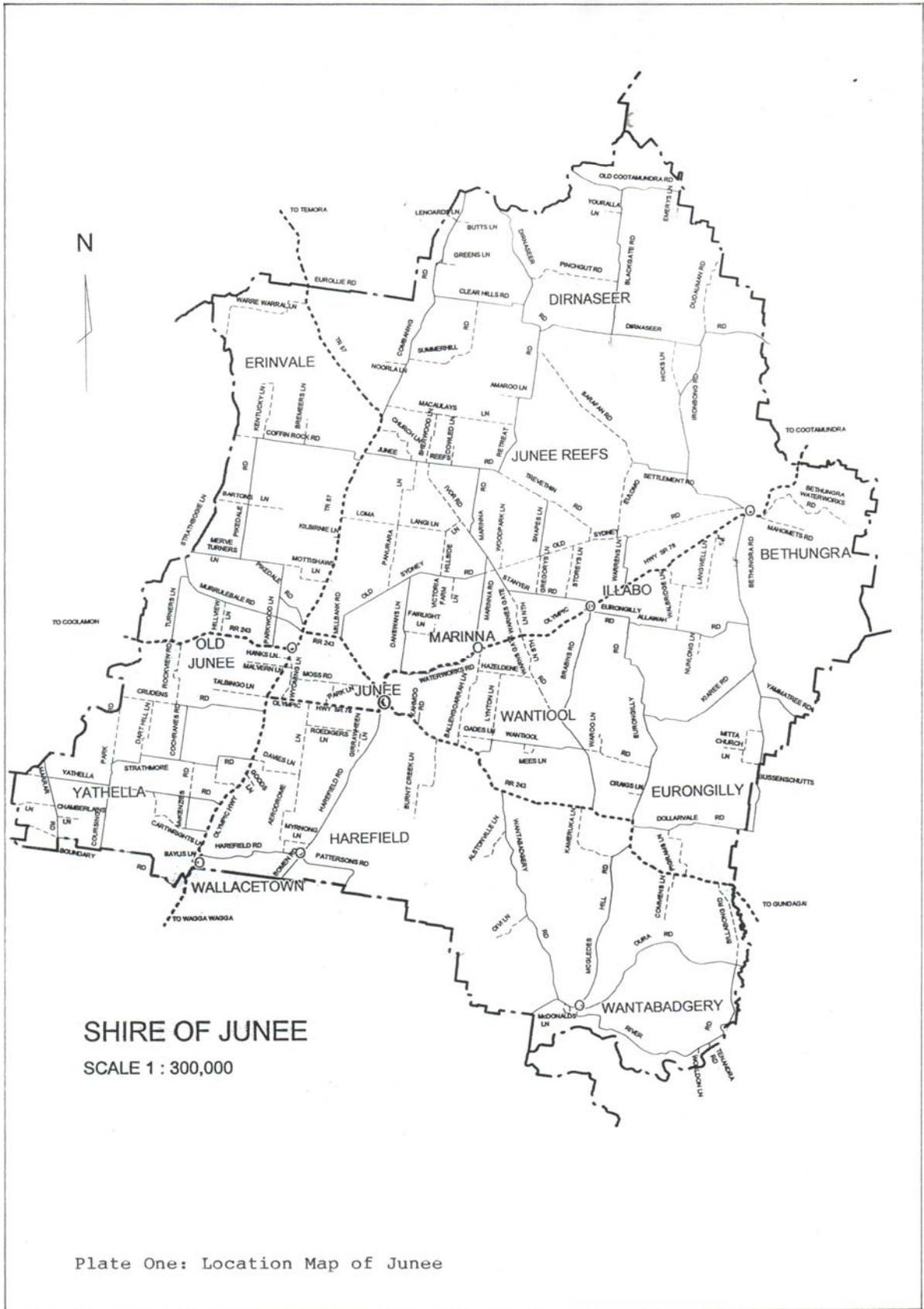
This Plan has been prepared to comply with the requirements of a Notice issued to Junee Shire Council by the Environment Protection Authority (EPA) under Section 12 of the *Protection of the Environment Administration Act, 1993*.

This Plan builds on the work previously undertaken by the Shire, particularly the "*Junee Wetlands Enhancement Plan*" prepared by Sainty and Associates in July 1997.

1.3 STORMWATER MANAGEMENT RESPONSIBILITIES

The responsibility for the implementation of the Junee Shire Urban Stormwater Management Plan rests with the council itself and specific council officers. Within Council, there are a number of departments that form part of the management team which will monitor Stormwater.

Figure 1 identifies those departments and Council officers responsible for Stormwater.



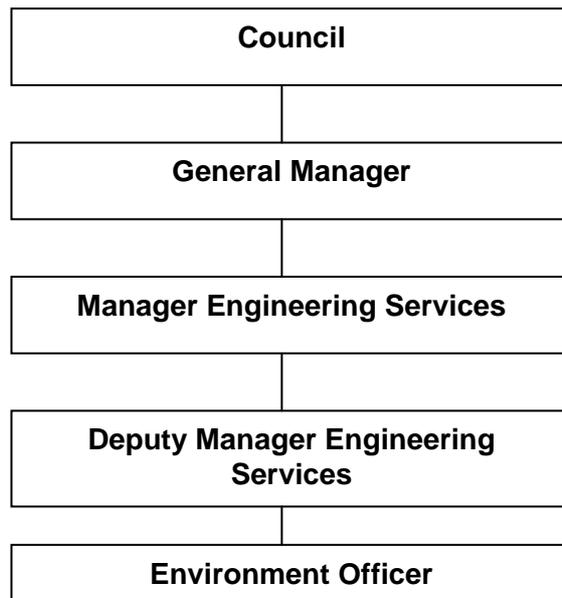


Figure 1 - Stormwater Management Responsibilities

1.3.1 Council

Council has the overriding responsibility for the implementation of this plan. Council will be required to formally adopt this plan and commit to its implementation. Council will balance the benefits the plan is to deliver against other projects and commitments competing for Council funds each year. Planned actions to be implemented by Council will be integrated into Councils management plan.

1.3.2 General Manager

The General Manager has the responsibility to ensure that Councils approved plans are implemented. The General Manager will work with Councils management team to deliver solutions for the implementation of this plan. All staff are ultimately responsible to the General Manager.

1.3.3 Manager Engineering Services

The Manager of Engineering Services is responsible to the General Manger for the management of engineering and field staff responsible for the implementation of this plan and the ongoing maintenance of the Stormwater system.

1.3.4 Deputy Manager Engineering Services

The Deputy Manger Engineering Services (DMES) is responsible to the Manager Engineering Services for the implementation of this plan. The DMES is responsible for providing reports to Council on the implementation of this plan and for providing estimates of costs for planned activities and making recommendations on budgets to be provided for the implementation of this plan. The DMES has responsibility to ensure that actions identified to implement this plan are carried out as per Council's Management Plan for each financial year. The DMES also has responsibility for making recommendations to Council on policy affecting Stormwater.

1.3.5 Environment Officer

Councils Environment Officer (EO) reports to the DMES and will provide support in the form of technical advice and assistance in all aspects of the implementation of this plan. The EO will also assist with the community consultation and education aspects of this plan along with helping to ensure compliance with environmental legislation requirements of both Council's workforce and private individuals.

The Stormwater Management Plan will be recognised through the Junee Shire Council Management Plan and the implementation of the strategies within it will be budgeted for in Council's annual budget.

1.4 STAKEHOLDER CONSULTATION

This Plan has been prepared in consultation with a number of stakeholder groups, namely:-

- the Murrumbidgee Catchment Management Committee.
- the Department of Land and Water Conservation.
- Landcare.
- the residents and businesses of Junee Shire.

In addition council officers and representatives from the Department of Land and Water Conservation participated in a walking tour of the catchment which identified specific issues and problem areas that were considered in the formulation of the Plan.

Council consulted some of the larger organisations, including the NSW Ambulance Service and some local garages, in order to obtain additional feedback on the planning process. This was useful in obtaining a more thorough assessment of the overall needs of the community.

The RTA is not considered to have any responsibilities in relation to stormwater management in the Junee Urban Catchment Area. As such, they have not provided input into the production of this Plan.

1.5 RELEVANT EXISTING PLANS AND REPORTS

This Plan has made reference to the "*Junee Wetlands – Enhancement*" Study prepared by Sainty and Associates in July 1997.

The Study, particularly considered vegetation issues in relation to the maintenance of the Wetlands and provided an action plan for the Wetlands and the surrounding catchment.

SECTION 2 - CATCHMENT DESCRIPTION

2.1 OVERVIEW

The major catchments in the eastern Riverina are the Murrumbidgee and Murray River basins. There are many major tributaries of these river systems that supply water to the area. Along many of these tributaries are varying amounts of flow regulation. The Tumut River and Murrumbidgee Rivers are highly regulated, forming part of the Snowy Mountains Scheme. Blowering and Burrinjuck Dams are used for storage and release water through the catchments regularly. Most of the tributaries are in their natural condition with some modifications for damming or erosion control. Water quality varies across the region. Reflecting the diverse nature of the region, extraction of water for irrigation ranges from being an activity of no consequence in most of the region, to a major activity in Tumut and Urana Shires.

2.2 WATERWAYS

The major watercourse through the area is Houlaghan's Creek (Plate 2), which drains to the Murrumbidgee River. No significant irrigation, nor any flow regulation occurs in the area, apart from farm storage. Tributaries of the Creek are Rocky Creek and Butlers Gully. There are also several unnamed creeks in the Junee urban area. The catchment area of Houlaghan's Creek is approximately 350 square kilometres and its length is around 50 kilometres.

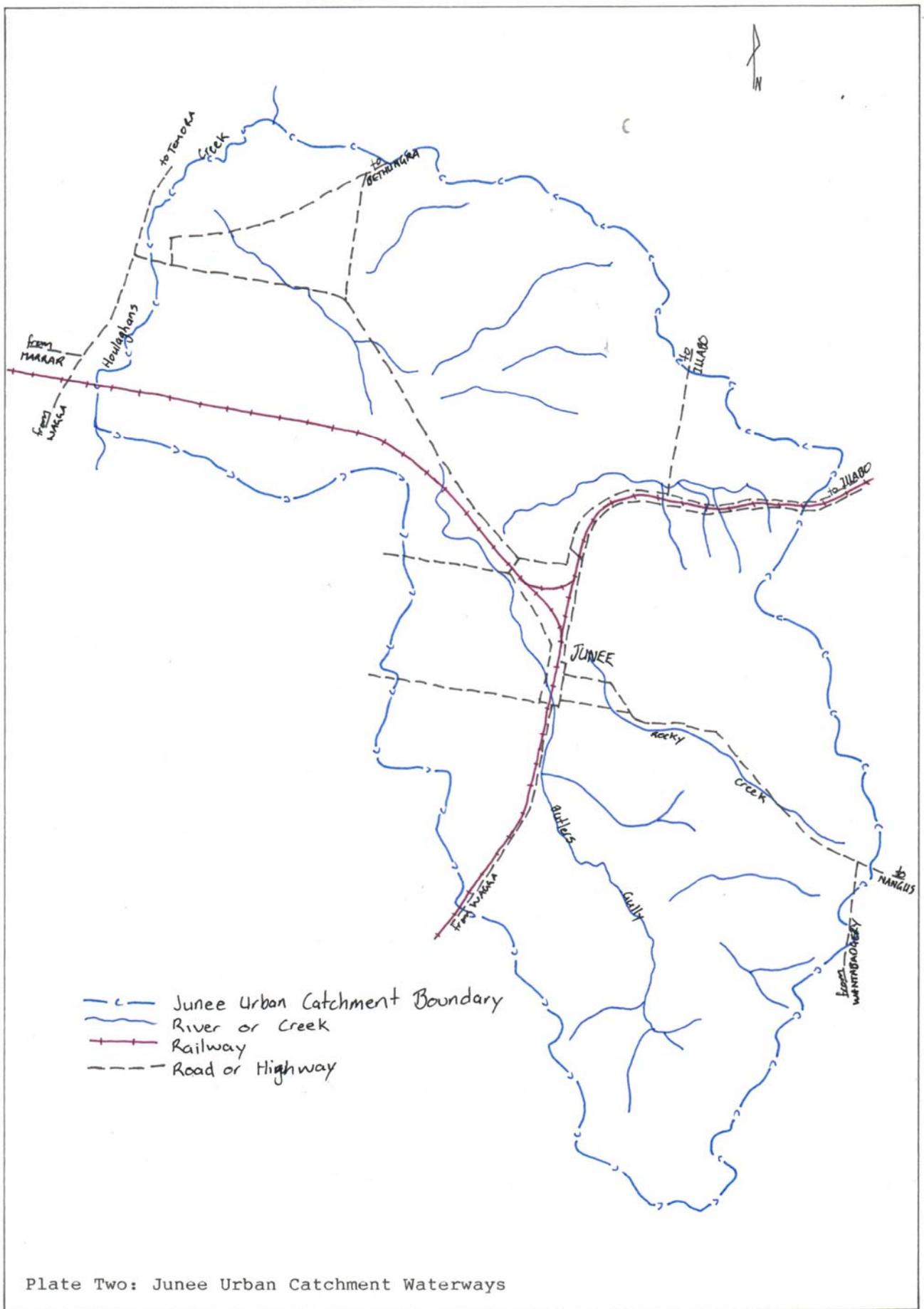
2.2.1 Upper Catchment - Junee Wetland



The Junee Wetland is fed primarily by an ephemeral stream that rises at Butler's Gully. The Wetland collects water from a rural area upstream of the urban catchment (Plate 3). The channels through the town of Junee are grassed and concrete lined, opening to the Wetland area. There is no formal regulation of watercourses through the area with attenuation of flow affected only by farm dams and the Wetland area.

The catchment for the Wetland is about 3,000 hectares and during heavy rain events can deliver 600 megalitres of water to the Wetland area. The flow at times is large and the whole Wetland area becomes temporarily flooded.

Groundwater is shallow in parts and there is evidence of surface salinity. A recent survey and report by Coffey Geosciences "Salinity Survey, Junee, NSW" produced 21 December 2000 details the groundwater levels and salinity in the lower catchment area.



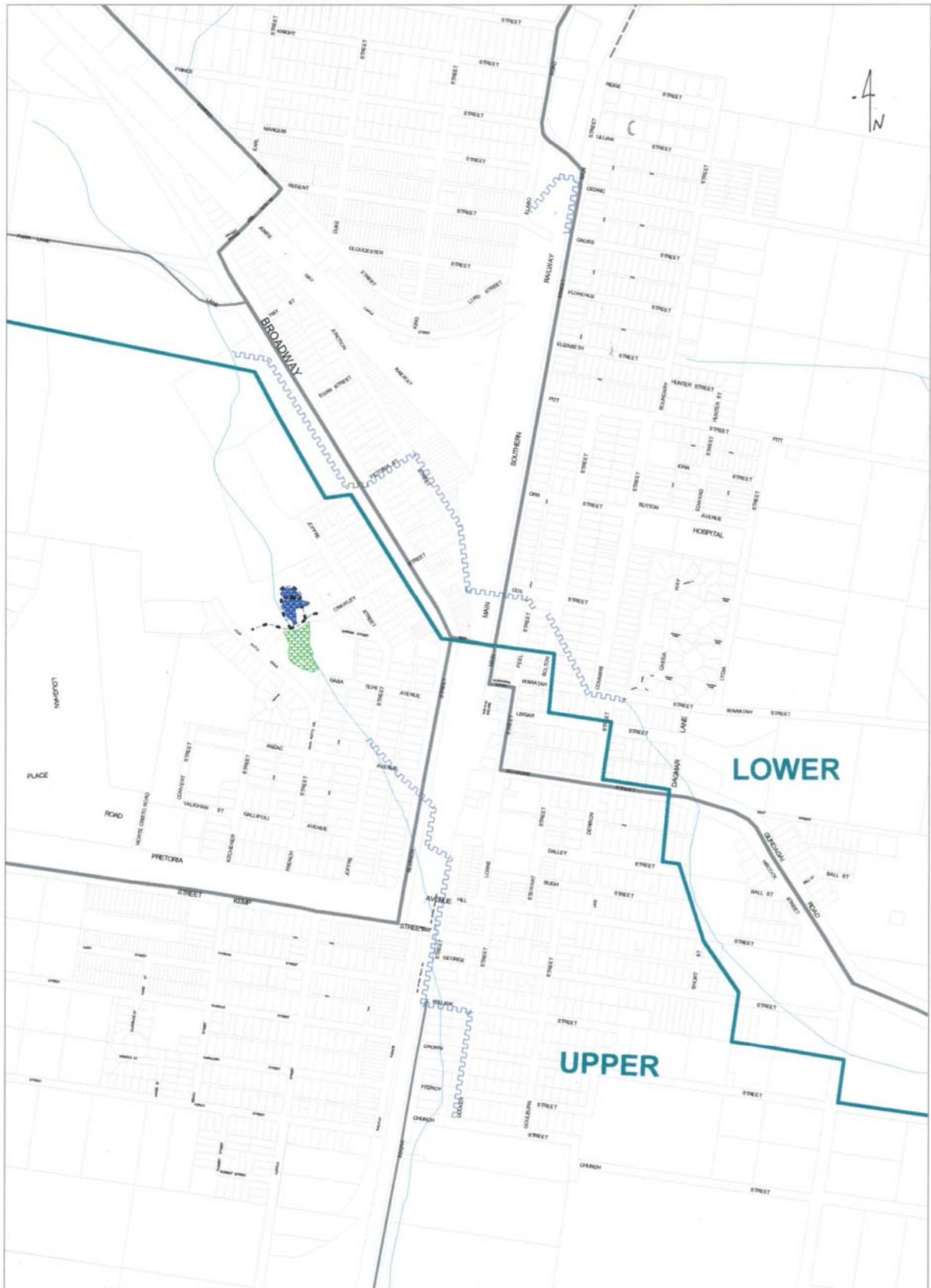


Plate Three: Junee Urban Catchment Area - Upper & Lower

2.2.2 Lower Catchment

Stormwater generated in the northern areas of town drain through concrete lined drains to the bottom area of the Wetlands (Plate 3). This water does not actually enter the Wetlands, nor does it affect the Wetlands area in any way. This water joins with that flowing from the Wetlands, to make its way through the bottom area of town and eventually to Houlaghan's Creek.

2.3 LAND USE

There are land degradation problems in the region, which can largely be attributed to land clearing. The Murrumbidgee Catchment Management Committee (MCMC) has identified the issues of priority to be:-

- Surface water;
- Quality management;
- Dry land salinity and water-logging;
- Native remnant vegetation management;
- Native vegetation decline;
- Soil erosion and acidity; and
- Seed management.

These concerns have ramifications for every area of local government concern, including planning, engineering services, community services and financial management.

2.4 TOPOGRAPHY

Junee Shire is located in an area of undulating hills on the western extremity of the south western slopes (Plate 4). The town of Junee has developed around a rail corridor oriented north-south along the river valley. Urban development has extended up the slopes, reaching elevations of 290 metres ASL in the north west to 343 metres ASL on hill crests in the south west. The town has slopes draining generally to the north west and a surrounding ridge-line which is undeveloped.

2.5 GEOLOGY AND SOILS

The soils of the region vary according to the topography and geomorphology. The soils vary quite dramatically even across local government boundaries. Tumbarumba has soils of decomposed granite and basalt whilst Gundagai, on the slopes of a flood plain, has shale, slate and clay. Red loams and black soils are common in the Lockhart area and Urana has alluvial loams and heavy clays. Junee and Cootamundra have podzolic soils.

Soils in the Junee area are generally red podzolic with a granite base (Plate 5). These soils are generally well drained, although the finer grain soils in the mid and lower slopes are less well drained. Much of the Shire is cleared farming land. The urban area is small, with rural small holdings around its perimeter. Urban land use accounts for around 5 square kilometres of the Shire, with rural residential land covering approximately 4 square kilometres (Plate 6).

2.6 CLIMATE

The average annual rainfall is 532mm but can vary across the Shire with the north-western portion significantly drier than the southern areas. The median summer maximum is 31.3°C and the winter minimum is 2.6°C.

2.7 BUSHLAND VEGETATION

Within the Junee Urban Catchment area there is no urban bushland. Therefore Stormwater issues discussed in this plan do not impact on bushland.



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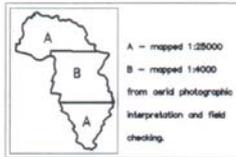
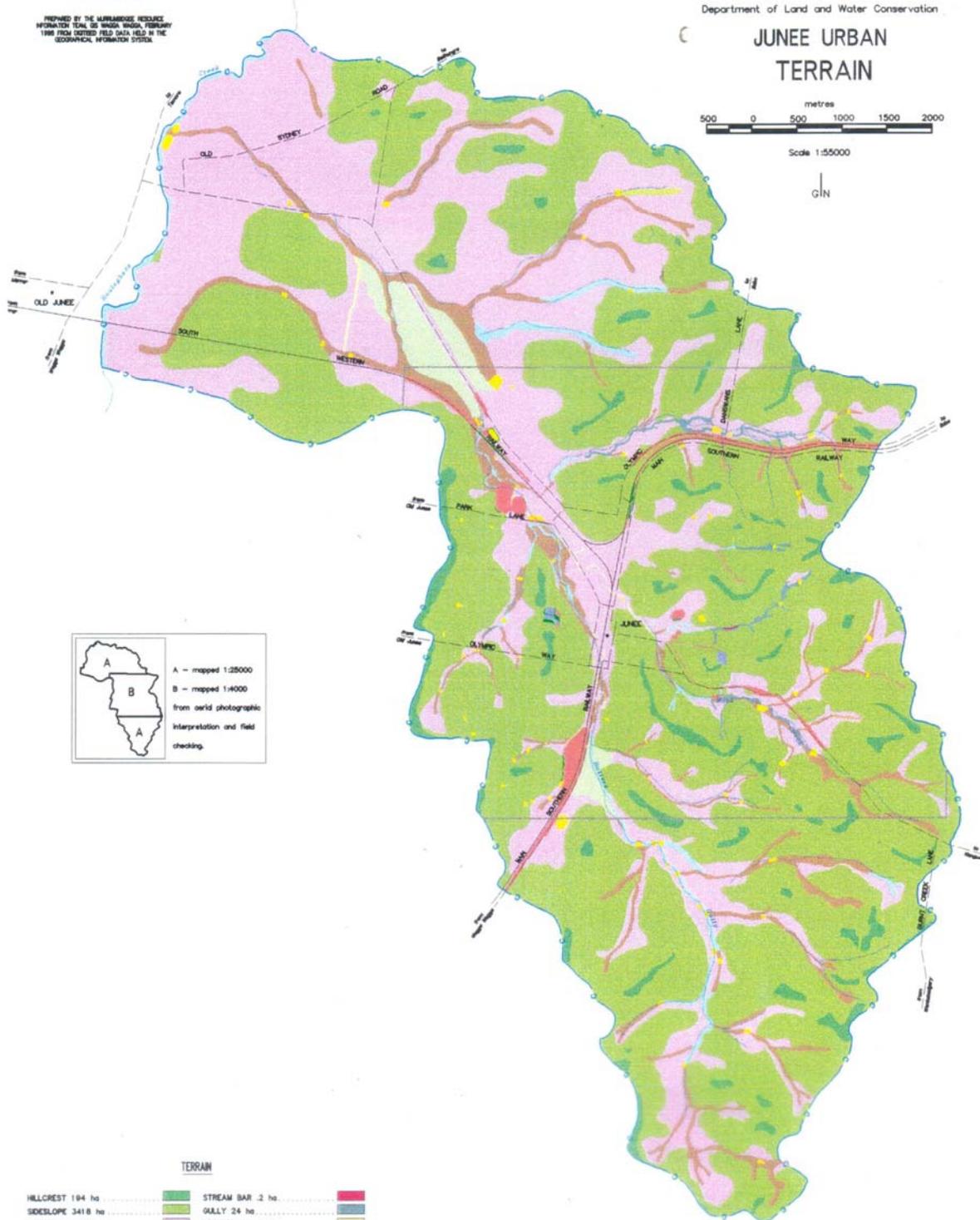
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JUNEE URBAN TERRAIN



Scale 1:55000

GIN



A - mapped 1:25000
 B - mapped 1:4000
 from aerial photographic interpretation and field checking.

TERRAIN		
HILLCREST 194 ha	STREAM BAR 2 ha	
SIDESLOPE 3418 ha	GULLY 24 ha	
FOOTSLOPE 1826 ha	DRAIN/CANAL 7 ha	
FLOOD PLAIN 82 ha	DAM/RESERVOIR 23 ha	
DRAINAGE PLAIN or DEPRESSION 333 ha	CONSTRUCTED WATERWAY 4 ha	
FAN 5 ha	EMBANKMENT 3 ha	
INCISED DRAINAGE	LAND FILL 3 ha	
CHANNEL 79 ha	DISTURBED TERRAIN 70 ha	
	CULVERT 5 ha	

INFRASTRUCTURE	
STUDY AREA BOUNDARY	—
RIVER or CREEK	—
ROAD or HIGHWAY	—
RAILWAY	—

Plate Four

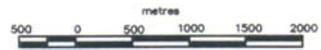


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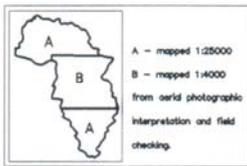
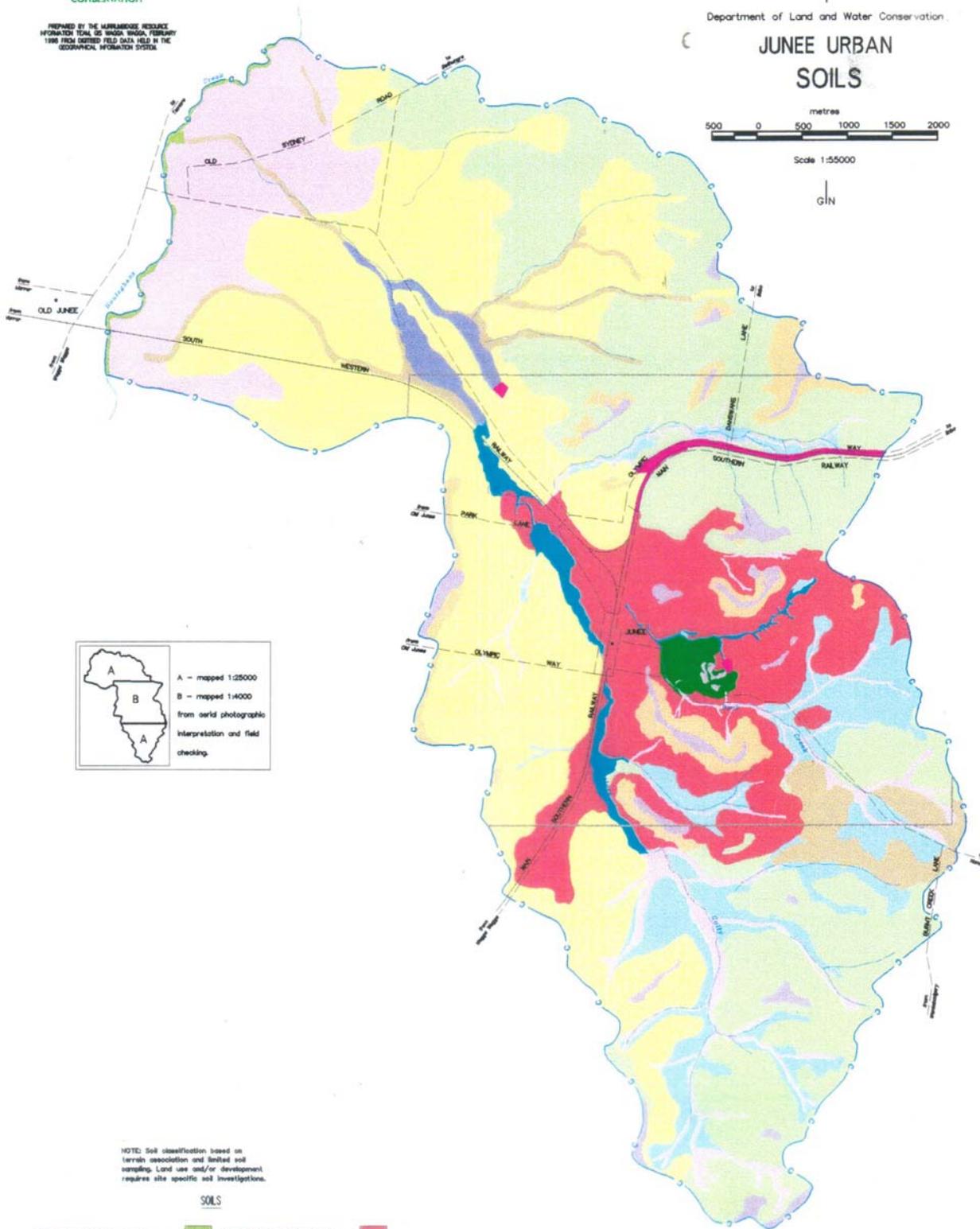
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JUNEE URBAN SOILS



Scale 1:55000



A - mapped 1:25000
 B - mapped 1:4000
 from aerial photographic
 interpretation and field
 checking.

NOTE: Soil classification based on
 terrain association and limited soil
 sampling. Land use and/or development
 requires site specific soil investigations.

SOILS

SOLONCHETS 21 ha	RED BROWN EARTHS 730 ha	
ALLUVIAL 74 ha	RED EARTHS 1847 ha	
BROWN PODZOLIC 38 ha	RED PODZOLIC 1635 ha	
GLEYPED PODZOLIC 1 ha	SOLOCHIC 64 ha	
LITHOSOLS 110 ha	YELLOW EARTHS 231 ha	
HO SUITABLE GROUP 29 ha	YELLOW PODZOLIC 417 ha	
MINIMAL RED PODZOLIC 193 ha	YELLOW SOLOCHIC 887 ha	

INFRASTRUCTURE

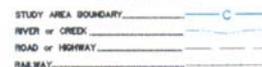


Plate Five

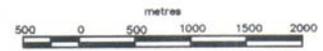


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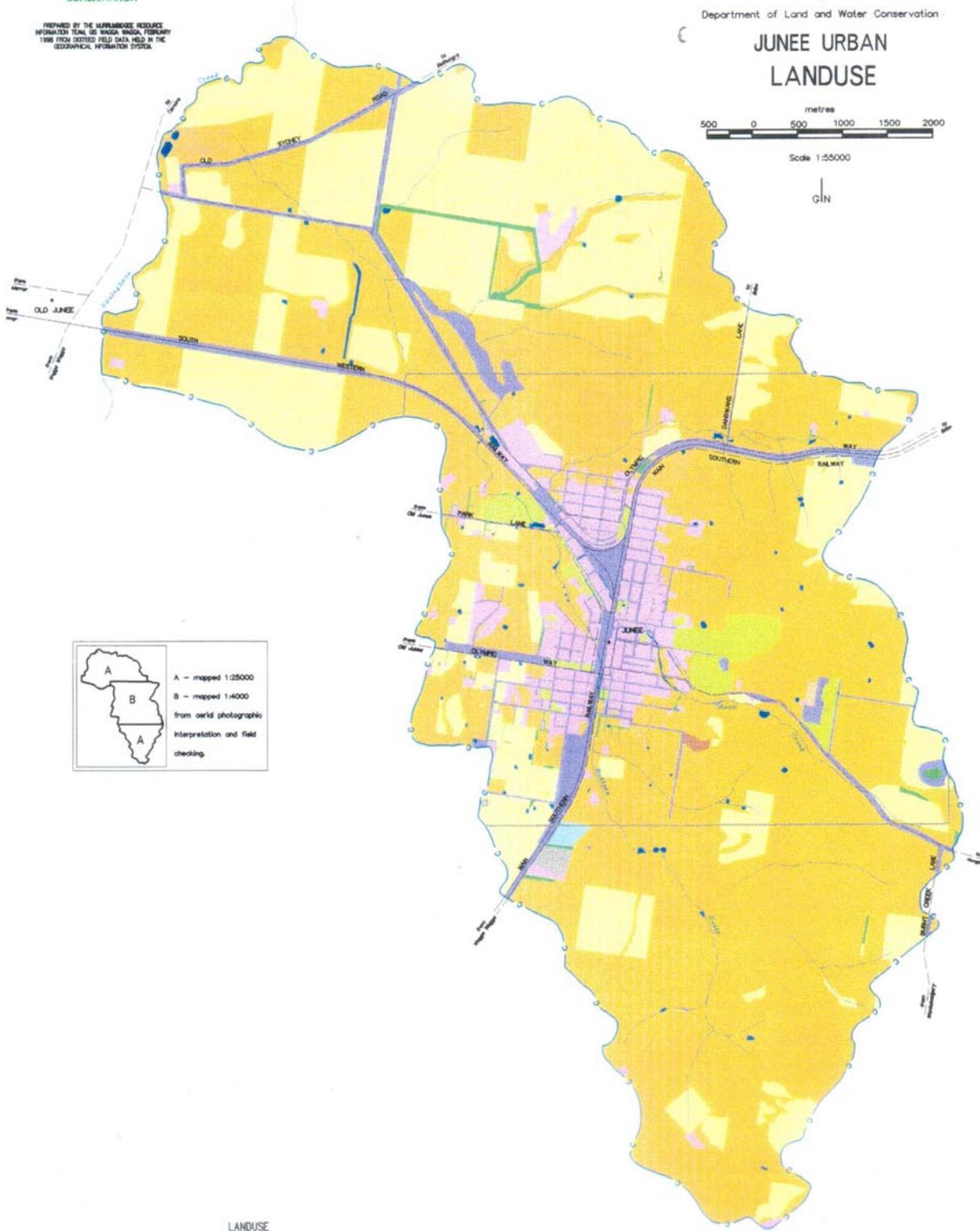
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JUNEE URBAN LANDUSE



Scale 1:55000



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LANDUSE	
CROPPING 1589 ha	RECREATION 112 ha
GRAZING 3598 ha	AQUACULTURE 8 ha
TIMBER 39 ha	GRAVEL EXTRACTION 4 ha
HORTICULTURE 3 ha	WATERBODIES 22 ha
UTILITIES 377 ha	URBAN 315 ha
INTENSIVE ANIMAL PRODUCTION 10 ha	

INFRASTRUCTURE	
STUDY AREA BOUNDARY	(dashed line)
RIVER or CREEK	(blue line)
ROAD or HIGHWAY	(double line)
RAILWAY	(line with cross-ticks)

Plate Six

SECTION 3 - EXISTING URBAN AREA CONDITIONS

3.1 STORMWATER INFRASTRUCTURE

The Junee Stormwater system consists of existing concrete lined drains and earthen drains vegetated with native vegetation.



The trap collects large pollutants from the town area that enters the main system. The trap is maintained regularly and has achieved good levels of success.

3.1.1 Upper Urban Catchment Area

In the upper catchment, the combination of alternating earthen and concrete lined drains discharge into a constructed Wetland in a low-lying area close to town.



The Wetland collects water from a rural area upstream of the Wetland area.

3.1.2 Lower Urban Catchment Area

In the lower catchment area, concrete lined drains through the streets of Junee, discharge at the bottom of the Wetland area. The Stormwater discharged here, joins with that flowing from the Wetlands to eventually make its way to Houlaghan's Creek.



3.2 HYDROLOGY

3.2.1 Flow Levels

The Council has not undertaken any monitoring of flow levels. Houlaghan's Creek is not sufficiently close to town to warrant monitoring and the Butler's Gully stream is ephemeral, feeding straight into the constructed Wetland, therefore monitoring has not been required.



A native planting regime carried out in the Wetland area has shown a possible attributable lowering of groundwater levels in the Wetland area, but will not affect the quantity of water flowing into the Wetlands. The velocity of floodwater entering into the Wetland is reduced by the narrow town drainage system, opening into a broad grassed area with little slope immediately upstream of the Wetland.

3.2.2 Flooding

Minor flooding occurs in the lower areas of town in the vicinity of Illabo Road, Regent Street and Kanaley Square. This is the result of development having proceeded in the upper areas of the catchment, without adequate planning for Stormwater in the lower areas. In periods of high rainfall, the road becomes the Stormwater drainage system with minor flooding of houses on occasion.

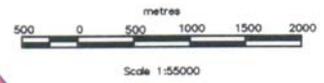


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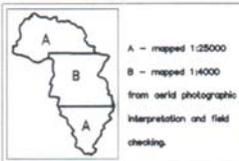
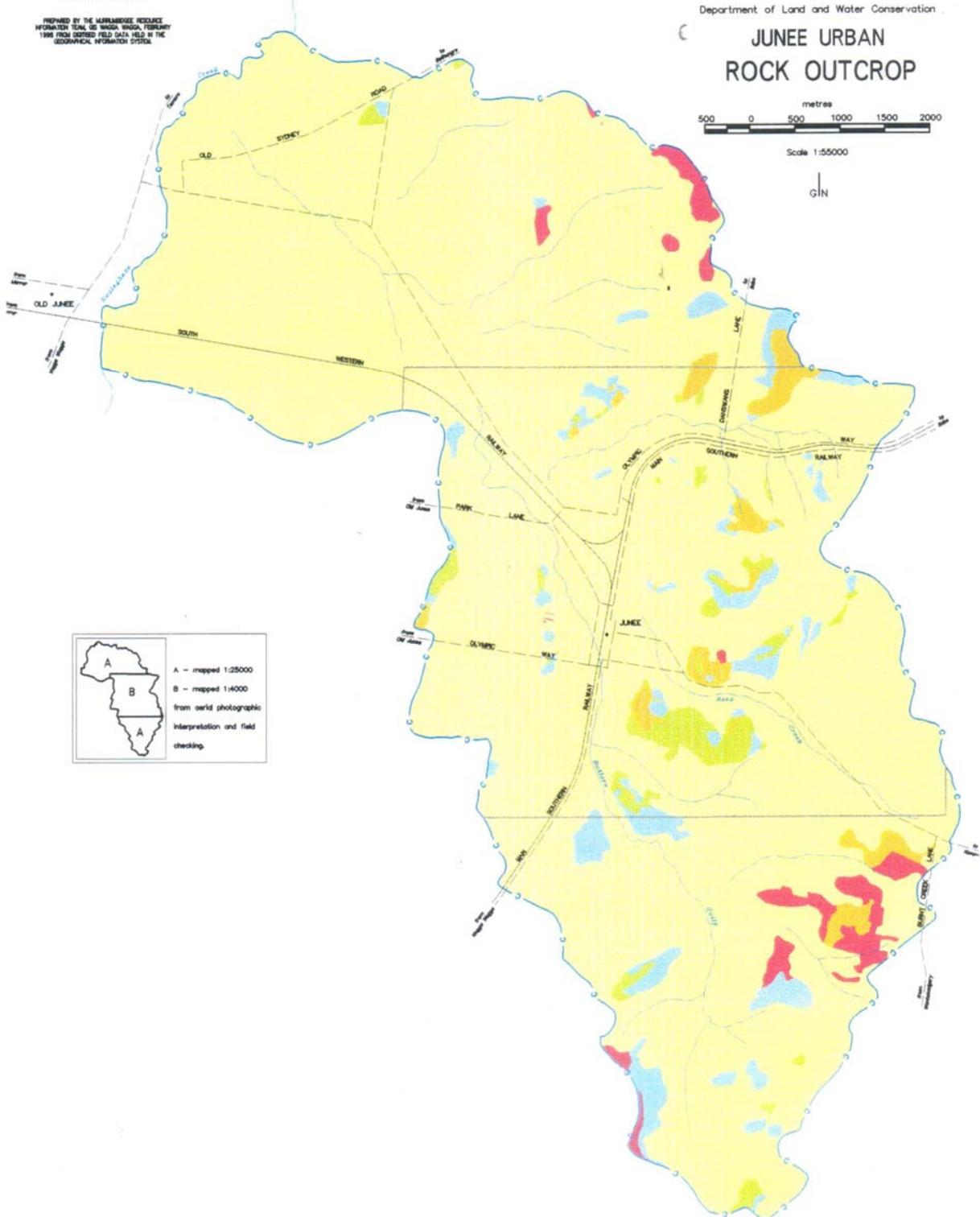
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JUNEE URBAN ROCK OUTCROP



Scale 1:55000



A - mapped 1:25000
 B - mapped 1:4000
 from aerial photographic
 interpretation and field
 checking.

ROCK OUTCROP	
NO ROCKS or STONES 5488 ha	[Yellow box]
LOOSE STONES or BOULDERS 118 ha	[Red box]
ROCK OUTCROP <20% 228 ha	[Orange box]
ROCK OUTCROP 20-50% 118 ha	[Light Green box]
ROCK OUTCROP 50-70% 123 ha	[Dark Green box]

INFRASTRUCTURE	
STUDY AREA BOUNDARY	[Blue dashed line]
RIVER or CREEK	[Blue solid line]
ROAD or HIGHWAY	[Black solid line]
RAILWAY	[Black dashed line]

Plate Seven

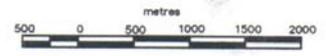


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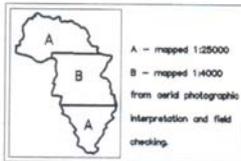
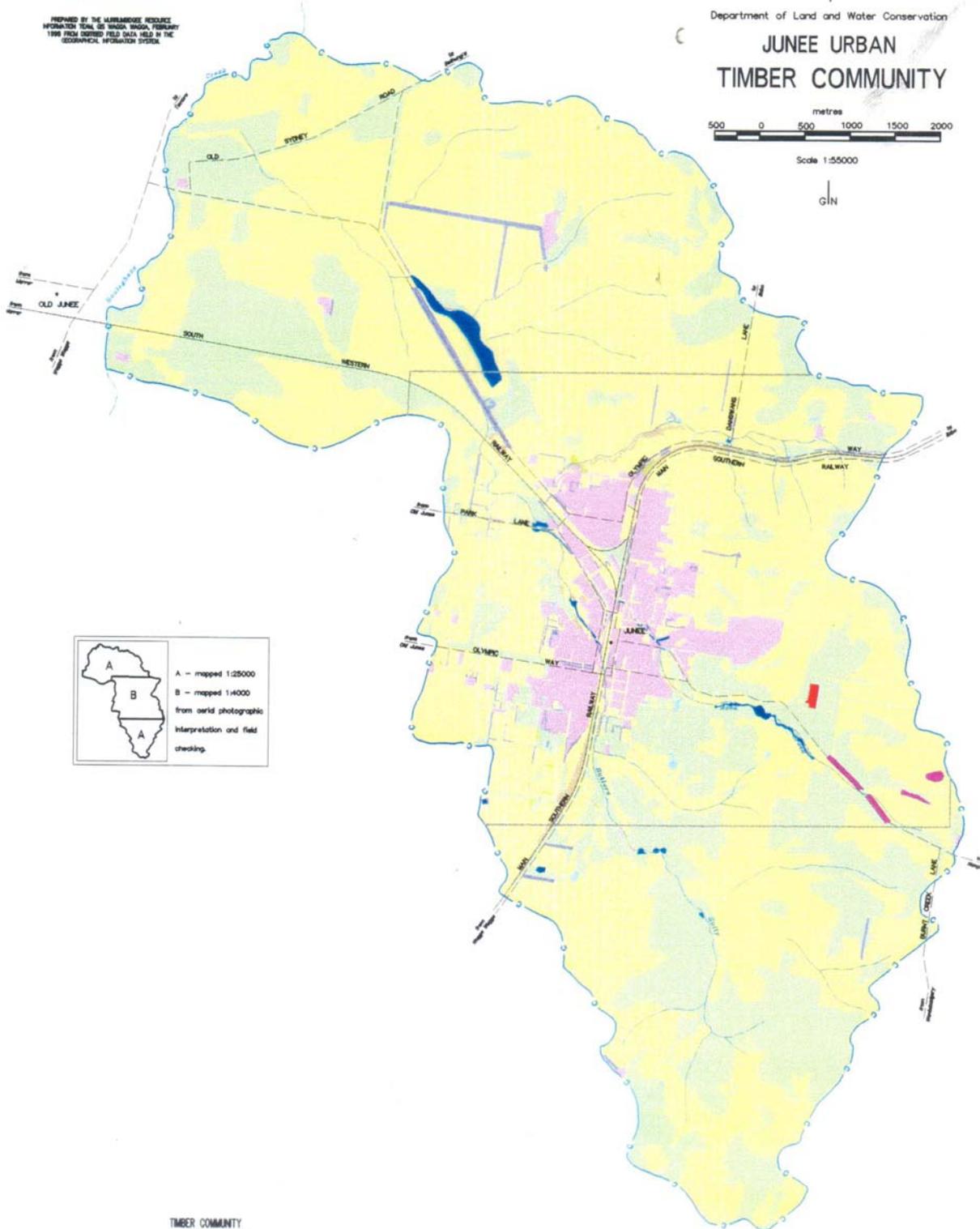
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JUNEE URBAN TIMBER COMMUNITY



Scale 1:55000



A - mapped 1:25000
B - mapped 1:4000
from aerial photographs
interpretation and field
checking.

TIMBER COMMUNITY

WOODLAND 9 ha	NO MATURE TREES 3812 ha	
PLANTATION - OTHER EXOTIC 3 ha	TREELOT 4 ha	
SHRUB - OTHER 32 ha	WINDBREAK or TREE ROW 57 ha	
SWAMP COMPLEX 30 ha	SCATTERED TREES 1781 ha	
LANDSCAPED 341 ha	TREES IN CLUMPS 7 ha	

INFRASTRUCTURE

STUDY AREA BOUNDARY	
RIVER or CREEK	
ROAD or HIGHWAY	
RAILWAY	

Plate Eight

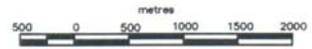


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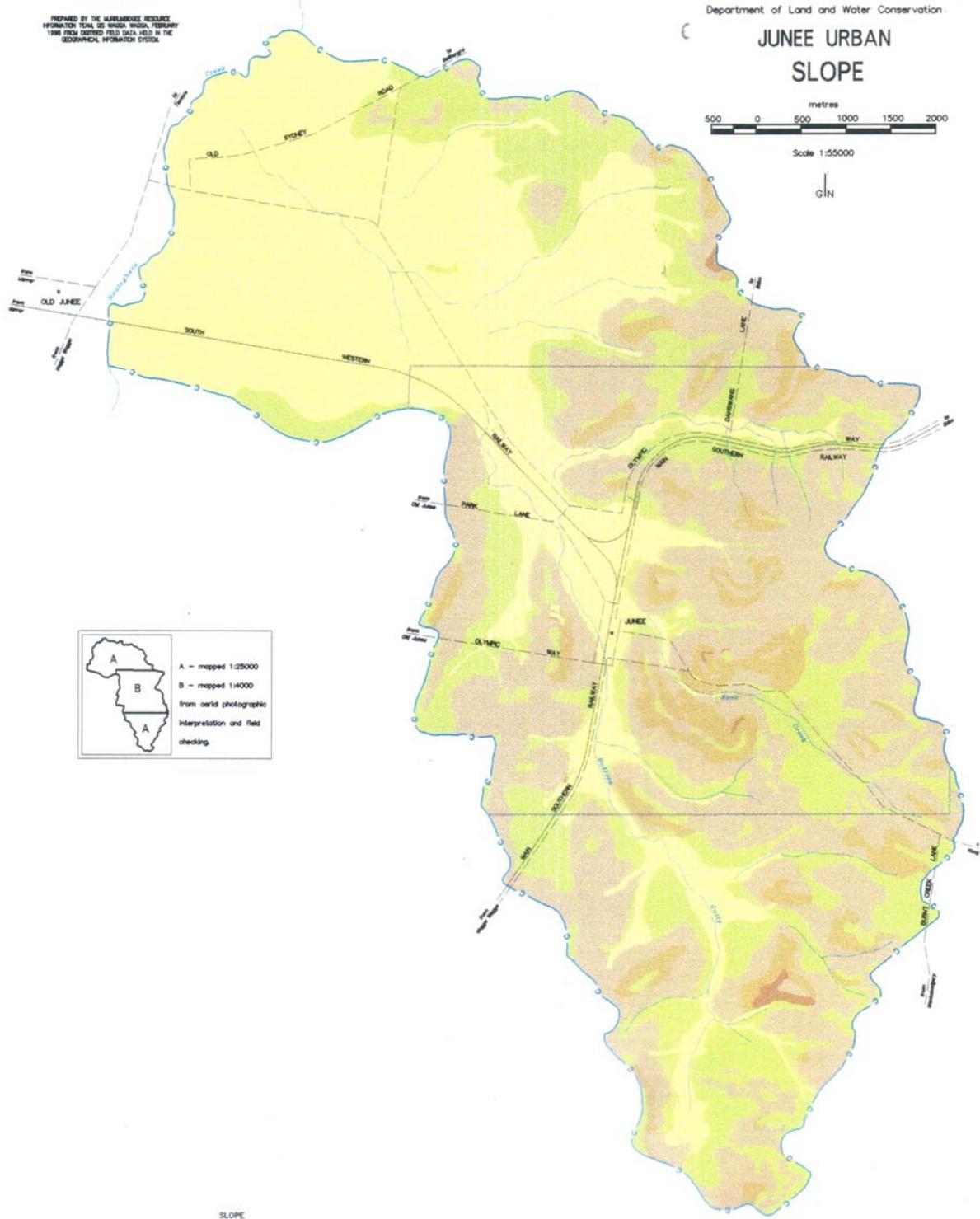
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JUNEE URBAN SLOPE



Scale 1:55000



A - mapped 1:25000
 B - mapped 1:4000
 from aerial photographic interpretation and field checking.

SLOPE	
LEVEL TO VERY GENTLY INCLINED (0 - 2%)	2218 ha
GENTLY UNDULATING (2 - 5%)	1473 ha
UNDULATING (5 - 10%)	1977 ha
ROLLING (10 - 20%)	391 ha
HILLY (20 - 33%)	17 ha
MOUNTAINOUS (33 - 50%)	0.3 ha

INFRASTRUCTURE

- STUDY AREA BOUNDARY
- RIVER or CREEK
- ROAD or HIGHWAY
- RAILWAY

Plate Nine



Plate Ten: Unsealed Rear Lanes in Junee

3.3 EROSION AND SEDIMENTATION

3.3.1 Fluvial Geomorphology

The top of the catchment is made up of rocky outcrops with medium to steep slopes and undulating hills (Plate 7). The vegetation consists mainly of grasses with sparse tree growth (Plate 8). It is a re-charge zone categorised by the DLWC as Zone 6-7 for agricultural use. Natural water courses in the upper catchment area are grass-lined, however, they change to concrete lined drains in the lower areas of town.

Both the upper and lower catchment areas consist of flat to low sloping land with high urban development (Plate 9).



Concrete drains have been constructed for a length of approximately 900 metres, after which they once again become earthen drains, lined with Combungie. The water from these drains discharge into a constructed Wetland.

Vegetation consists mostly of grasses and pasture. There is sparse tree growth as many trees have been extensively cleared to make way for urban development and agricultural uses.

3.3.2 Sedimentation

The large number of unsealed rear lanes (Plate 10) that service properties within the township area exacerbates sedimentation in the catchment. In times of high rainfall the lanes contribute significantly to the transfer of material from the upper catchment areas to the streets and eventually the Wetland area.

In addition, significant residential development in the town contributes sediment from the disturbance of soil during construction activity. This sediment is contributing to a build up of material in gutters and the Stormwater system and eventually the Wetland area.



3.3.3 Erosion

There is no significant erosion affecting the watercourses within the Junee catchment.

3.4 WATER QUALITY

3.4.1 Water Quality Guidelines

Council does not currently have any water quality guidelines in place. Council has reviewed the EPA's Interim Water Quality and River Flow Environmental Objectives but has found that because of the nature of the water courses in the Shire, a creek which is not located near town and an ephemeral stream, it is impractical to apply them to the Junee Catchment.

3.4.2 Ambient Water Quality

Council does not currently undertake any water quality testing. As part of the Junee Wetlands Project, Electrical Conductivity (EC) testing of the Wetlands was undertaken. Measurement of Electrical Conductivity is a convenient assessment of the salinity of a water sample. Surface water at the Wetland was measured on 10 June 1997 at dS/m 2.20 or 2000EC and at 6.40 dS/m at the Oval on the Butlers' Gully drainage system or 6400EC. Concerns were raised about the latter reading, as over time, it is sufficient to kill many freshwater species.

Council has not undertaken any further regular testing of surface water in these areas, however as part of this plan, it is intended to undertake water quality testing of samples from two locations, one at the top and one at the bottom of the Wetland.

3.4.3 Point Sources of Pollution

In late 1999, Council in conjunction with the NSW EPA undertook an assessment of the possible sources of pollution in the Shire. This assessment audited possible polluters for either current practices which were polluting or activities which had potential to pollute. No major areas of concern were identified, however, some businesses were provided with advice on how to conduct their business in a more environmentally sound manner.

Unsealed rear lanes within the town area contribute greatly to sediment being transported within the Stormwater system. There are more than 6km of unsealed rear lanes servicing the town area.



3.4.4 Sewer Overflows

The sewage system in the Shire is functioning well, there are very few overflows. Those overflows that do occur are dealt with where possible by containment and then pumped to the nearest sewer manhole.

3.5 SEDIMENT DATA

No sediment sampling has been undertaken for the Junee Catchment.

3.6 AQUATIC HABITAT

There is an extensive bird population living in the Wetlands. Many community members and visitors who utilise the viewing platform to engage in bird watching activities at the Wetlands enjoy the vast variety of species found there.



Individual species of birds identified are listed in Table 1 below, using common names. In addition the Wetland is home to frogs and turtles. *Gambusia affinis* have been introduced to the Wetlands as a biological control for the mosquito population. There are no rare or threatened species resident within the deep pools in the Wetland area.

Table 1 -Species of Birds Identified at the Junee Wetlands

Great Egret	Australian Wood Duck
White-faced Heron	Coot
Pied Stilt	Masked Plover
White Ibis	Pied Stilt
Straw-necked Ibis	Clamorous Reedwarbler
Yellow Billed Spoonbill	Purple Swamphen
Black Duck	Black-tailed Native Hen
Grey Teal	Dusky Moorehen
Australian Hobby	Rofus Songlark
Nankeen Falcon	Australian Raven
House Sparrow	Common Blackbird
Spotted Crake	Magpie
Magpie Lark	Willie wagtail
Black-shouldered Kite	Spotted Harrier
Swamp Harrier	Little Eagle

3.7 RIPARIAN AND FORESHORE VEGETATION

Within the Wetland area there are a number of moderate to high salt tolerant plant species.

Plant species recorded in the Wetlands include:-

- *Typha domingensis*
- *Atriplex prostrata*
- *Cotula coronopifolia*
- *Hordeum districhum*
- *Schoenoplectus pungens*
- *Spergularia sp.*
- *Rumex conglomeratus*
- *Aster subulatus*
- *Cyperus eragostis*
- *Trifolium fragiferum*
- *Ranunculus sceleratus*
- *Lolium rigidum*
- *Paspalum dilatatum*
- *Polypogon monspeliensis*



Sainty and Associates (1997) advised that “*this assemblage of plants was a certain indicator that the area is salinised – although the degree of salinisation is not severe as some moderately salt tolerant species are surviving. However, there is a warning here. The plants are indicating that salinity may be increasing.*”

3.8 CURRENT STORMWATER MANAGEMENT PRACTICES

Council planning, operation and management activities can have a direct or indirect influence on the environmental impacts of Stormwater discharges. Council’s current procedures and practices should be continually reviewed to ensure best practice guidelines are adopted.

3.8.1 Development Controls

Council recognises that it can influence Stormwater quality and quantity through the use of development controls. Existing development controls include:-

- Requirement for erosion and sediment control on large developments through Development Control Plans.
- Preparation of Review of Environmental Factors for council construction activities.
- All Council staff have been trained in Environmental Awareness which has a strong emphasis on erosion and sediment control techniques.

3.9 STORMWATER DRAINAGE SYSTEM

3.9.1 Maintenance

Council's Stormwater maintenance includes the following:-

- Regular inspections of the Stormwater system and where necessary cleaning out Stormwater pipes and the making of appropriate repairs.
- Regular cleaning of the Stormwater pollutant trap in Edgar Street.
- Responsive cleaning of the Stormwater system depending on the accumulation of litter, silt, debris etc.
- Regular Street cleaning.
- Engaging the services of a commercial street sweeping vehicle up to 4 times per year.



Open space management plans need to be produced for the major parks and reserves within the urban areas. Existing maintenance practices on these open space areas include:-

- Mowing and where required slashing of grass in open space and recreation areas on a regular basis. This includes slashing along the drains that feed the Wetland. Cut grass is not collected and a catcher is not used.
- Use of herbicides as required to remove weeds from open space and recreation areas.
- Application of fertiliser on an 'as needed' basis to sporting ovals.

Litter bins are located within the commercial areas of Junee and at public parks and ovals:-

- bins in the commercial area are emptied weekly.
- bins at the public parks and ovals are emptied weekly during spring and summer and fortnightly during autumn and winter.
- Cigarette disposal units are available in the CBD.

Council works depot is located near the Junee Wetland:-

- The vehicle washing and re-fuelling areas are not bunded, allowing wastewater and pollutants to enter the Stormwater system and the Wetlands directly.
- A project is currently underway to provide a washdown facility for machinery which will include covered wash area, oil separator and a discharge to Councils sewerage system.

3.10 COMMUNITY PROGRAMS

At present there are no community programs targeting Stormwater awareness and water quality. Council has previously supported the following programs in Junee Shire:-

- Providing information to local garages with EPA information on appropriate work methods.
- Streamwatch – this was undertaken in 1997

A number of community groups are active in the area including:-

- Landcare
- Birdwatchers Club

These groups can play an active role in identifying Stormwater issues and implementing Stormwater management options

SECTION 4 - CATCHMENT VALUES

4.1 DEVELOPMENT OF CATCHMENT VALUES

Junee Shire recognises that it is important to determine what elements of the catchment are deemed to be of value to the users of the catchment. Users of the catchment were defined as being residents of the Shire, those representing specific environmental, social, recreational and business organisations as well as Council itself.

It was agreed that in identifying catchment values the following actions would be undertaken:-

- A tour of the catchment with the local DLWC representative in order to identify specific catchment issues and to take photographs of areas of concern for discussion during the community consultation and inclusion in the Plan itself.
- A community consultation meeting would be held to discuss the outcomes of the tour and to determine catchment values and assign priorities.

4.1.1 Catchment Values

In determining catchment values Junee Shire agreed to use the categories of values identified by the EPA, the categories being:-

- a) Ecological
- b) Social
- c) Economic

The issues to be specifically considered through the consultations in each of the catchment value categories were as follows:

a) Ecological Values

- Aquatic Ecosystems – Including both aquatic flora and fauna. Aquatic fauna are those species that depend on the waterways for food and other habitat requirements eg. fish and frogs. Aquatic flora is the vegetation within the waterways which provide habitat, feeding and breeding grounds for various aquatic species.
- Riparian Vegetation – Vegetation along the embankments of the waterways which provide habitat, feeding and breeding grounds for various bird and animal species.
- Water Associated Wildlife – Wildlife that depends on the waterways for drinking water, food or other habitat requirements eg. wading birds.

b) Social Values

- Visual Amenity – What the Wetland looks like.
- Recreational Purposes – possible passive recreational activities e.g. walking and photography.

- Science and Education – learning opportunities presented by the Wetland.
- Access – ability for people to view and be near the Wetland.

c) Economic Values

- Water use – possibility of using water from the Wetlands.
- Property Values – the potential impact the Wetlands and its catchment area has on property values.
- Stormwater Reuse – potential to reuse Stormwater.

The catchment tour and community consultation was held on Monday, 31 July 2000 and was attended by a variety of stakeholders. The aim of the workshop was to identify and prioritise the desired values that stakeholders placed on the waterways of the Junee Shire catchment area. These values are summarised in the Table 2 below.

Table 2 - Community Values

Location	Value	Priority
Junee Wetlands	Aquatic Ecosystem	High
	Water Associated Wildlife	High
	Visual Amenity	High
	Passive Recreation	Medium
	Vegetation	Medium
	Access	Medium
	Property Values	Medium
	Science and Education	Low
	Water Use	Low
Stormwater Reuse	Low	

Stormwater management objectives have been developed to protect the desired catchment values as described in Section 4. These objectives incorporate both long and short term actions.

Stormwater objectives define what Council sees as a vision for the future of Stormwater in the Shire through identifiable and quantifiable actions.

SECTION 5 - STORMWATER MANAGEMENT OBJECTIVES FOR NEW DEVELOPMENT

5.1 ECOLOGICALLY SUSTAINABLE DEVELOPMENT (ESD)

In developing its objectives Council has considered the key principles of ESD and incorporated these in its planning processes. The Key Principles of ESD, as outlined in the draft Managing Urban Stormwater Council Handbook (NSW EPA 1997) and the manner in which they have been addressed is listed below:-

- **Precautionary principle** – this SMP advocates the development of guidelines and management practices which will prevent and mitigate environmental damage.
- **Inter-generational equity** – the Stormwater management objectives in this SMP aim to mitigate the impacts of Stormwater discharges on the environment to ensure that it is maintained or enhanced for future generations.
- **Conservation of biological diversity and ecological integrity** – this SMP aims to put into place appropriate actions to mitigate the impacts of Stormwater discharges on biological diversity and ecological integrity in the Junee catchment.
- **Improved valuation and pricing of environmental resources** – the prioritisation methodology used to rank the Stormwater management options in this Plan aim to integrate both financial and environmental costs into the evaluation framework.

5.2 MANAGEMENT OBJECTIVES

Long and short term objectives for each of the high priority values are described in Table 3 below. Objectives have only been developed for high priority values to ensure that resources are initially allocated to these values.

Table 3 - Stormwater Management Objectives

Ecological Values	Long Term	Short Term
Aquatic Ecosystems	<ul style="list-style-type: none"> • Conservation and maintenance of the existing flow path to ensure the Wetlands survival. • Improve the water quality in Junee Wetlands. • Reduce the level of pollutants in Junee Wetlands. • Raise community awareness of their role in ensuring water quality. 	<ol style="list-style-type: none"> 1. Introduce planning instruments that ensure the existing flow path of the Wetlands will not be endangered. 2. Identify the pollutants in the Junee Wetlands. 3. Determine the source of pollutants. 4. Reduce the level of pollutants entering the Wetlands. 5. Reduce the level of gross pollutants entering the Wetlands. 6. Plant Water Couch to remove nutrients and improve water quality. 7. Educate the local community on water quality.

Ecological Values (Cont.)	Long Term	Short Term
Native Vegetation	<ul style="list-style-type: none"> • Improve the variety of native vegetation in the Junee Wetlands. • Enhance the dry land area surrounding the Wetlands to improve Wetlands survival. 	8. Develop a vegetation plan for the Wetlands utilising recommendations in the Sainty Report on the Junee Wetlands. 9. Increase native vegetation planting for the dry land area surrounding the Wetlands. 10. Educate landowners on the benefits of native vegetation.
Water Associated Wildlife	<ul style="list-style-type: none"> • Create an environment that will support a diverse ecosystem. 	11. Plant vegetation to encourage and create habitats for birds, fish and water animals.
Social Values	Long Term	Short Term
Recreation	<ul style="list-style-type: none"> • Retain and improve the visual recreational opportunities at the Junee Wetlands. 	12. Improve recreational access to the Wetlands. 13. Provide information boards on wildlife and vegetation in the Wetlands. 14. As per Objective 4. 15. As per Objective 6.
Education	<ul style="list-style-type: none"> • Raise community awareness of their role in ensuring water quality. 	16. Raise awareness of waterways issues in schools.
Economic Values	Long Term	Short Term
Property	<ul style="list-style-type: none"> • Ensure that the Wetlands do not negatively impact the visual amenity of residences located nearby, or property values. 	17. Improve the visual amenity of the Wetlands. 18. Ensure that no airborne vectors originate in the Wetlands which will negatively impact on the living conditions in nearby residences. 19. As per Objective 1. 20. As per Objective 4. 21. As per Objective 6.

5.3 STORMWATER MANAGEMENT OBJECTIVES FOR NEW DEVELOPMENT

Stormwater Management Objectives for new Developments aim to recognise the potential negative impact developments can have on catchments and also to set acceptable and easily identifiable and manageable parameters by which developers can operate.

Council's commitment to the continued growth of new residential areas make it imperative that these parameters be included in the Stormwater Management Plan. The Plan already includes provision to ensure that the visual amenity of those new residential sub-divisions is not adversely affected by what occurs in the Wetlands, conversely it is important to ensure that what occurs in the development does not negatively affect the Wetland.

In forming these objectives Council recognises that there is not sufficient development occurring to warrant the setting and monitoring of specific levels of treatment or improvement in water quality nor can the cost of effectively monitoring specific levels be justified. For these reasons Council has chosen not to set quantitative objectives for new constructions.

Council is, however, committed to the setting of qualitative objectives that will be monitored throughout the construction and post-construction phases. The objectives set also reflect the fact that approximately 90% of construction that is likely to occur over the next three to five years will be in low density housing (occurring on large land blocks). Plate 11 is a plan which shows proposed and current residential sub-divisions and their proximity to the Junee Wetlands.

5.3.1 Construction Phase

Table 4 - Qualitative Objectives for New Development

Issue	Objective
Suspended Solids	<p>Minimise soil erosion and the discharge of sediment by the appropriate design, construction and maintenance of erosion and sediment control measures.</p> <p>Employ all practical measures to minimise soil erosion and the discharge of sediment in storm events.</p> <p>The measures to be employed are to be identified in Development and Building Applications to Council.</p> <p>Council Officer to visit new construction sites at the commencement of construction to ensure that measures are in place.</p>
Motor fuels, oils and other chemicals	All construction plans to include appropriate on-site storage facilities that ensure there is no possibility of contamination of Stormwater.
Litter	All construction plans to include appropriate on-site disposal of litter. No litter to be placed in a position where it may be blown or washed off-site.

5.3.2 Post-Construction Phase

Council recognises that different land uses have the potential to generate different outcomes for Stormwater run-off. Accordingly, the following measures will be put into place to accommodate changes in land use brought about by new construction, which will minimise the impact on Stormwater.

In determining the likely impacts of new land uses on Stormwater and the Junee Wetlands, Council will utilise the following table to assist in its risk assessment and management.

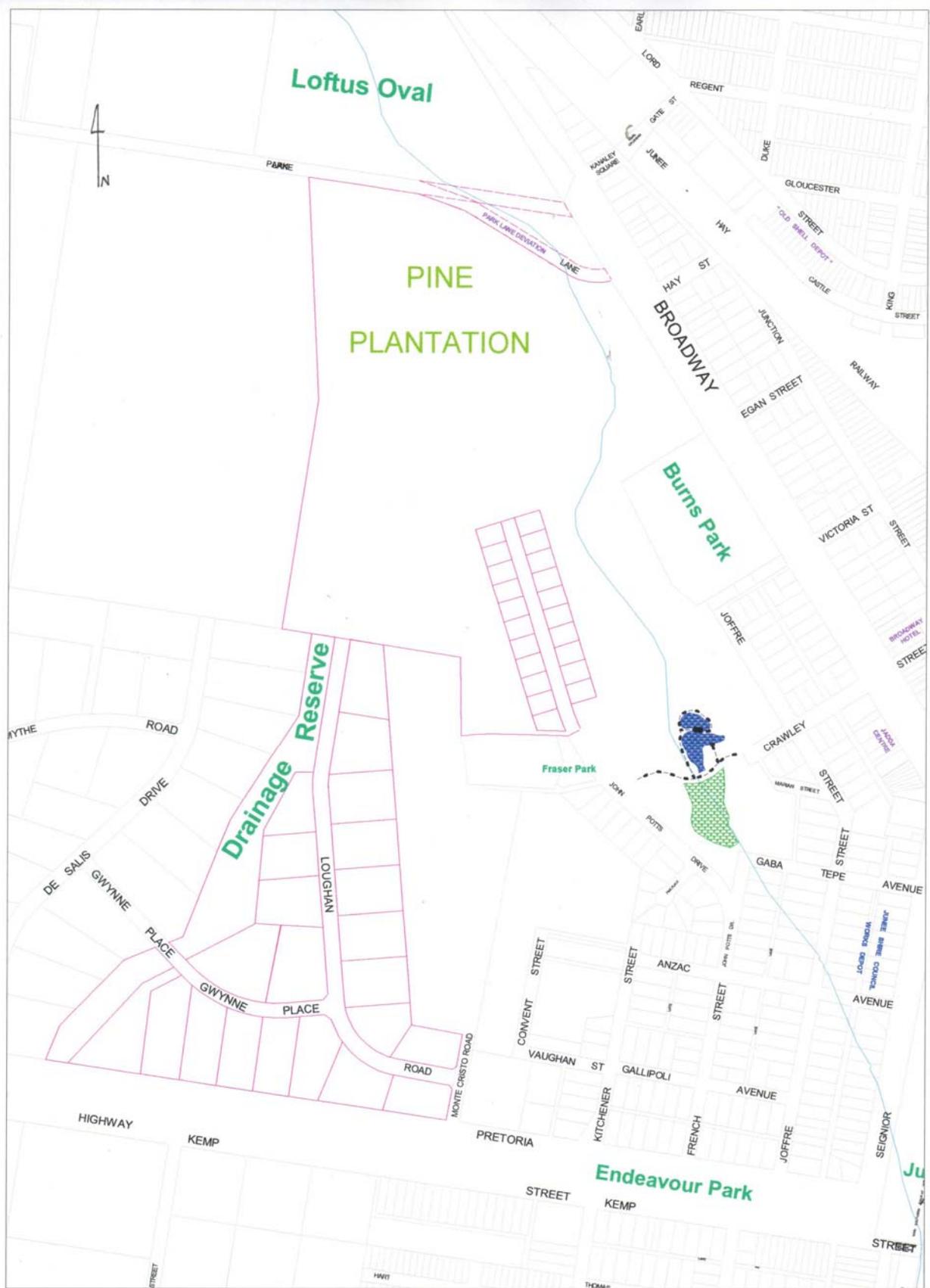


Plate Eleven: Sub-divisions - Proposed & Current

Table 5 - Risk Assessment Table for New Development

Development Type	Litter	Course Sediment	Fine Particles	Phosphorous	Nitrogen	Hydrocarbons, motor fuels, oils and greases
Low Density Residential	H	M	L	M	M	L
High Density Residential	H	H	M	H	H	M
Commercial, Shopping and Retail Outlets	H	L	L	M	L	M
Fast Food Outlets and Restaurants	H	L	L	H	M	L
Carparks, Service Stations and Wash Bays	H	M	M	H	H	H

(Adapted from EPA's Example Stormwater Management Plan)
H=High Risk, M=Medium Risk, L=Low Risk

Council will determine the level of action to be taken in order to meet stated management objectives which are based on the risk assessment for each site. The following management objectives have been agreed to for the post-construction phase.

Table 6 - Management Objectives for Post Construction Phase

Post-Construction Phase	Stormwater Management Objectives for New Development
Issue	Objective
Stormwater quality	Use of vegetated flow paths maximised
Flow	Alternations to natural flow paths, discharge points and runoff volumes from the site are to be minimised.
Amenity	Multiple use of Stormwater facilities (June Wetland) to the degree compatible with other management objectives.

Stormwater management issues are those factors that currently prevent, or may prevent, Stormwater management objectives being satisfied. Stormwater issues associated with the June catchment were identified from discussions with Council officers, stakeholders such as DLWC and from existing documentation. In addition, specific "hot spots" have been identified through the catchment tour.

"Hot spots" are known locations within the catchment which affect Stormwater discharges or are affected by Stormwater. It is important to target these specific issues in the Plan because their remediation or prevention will have a direct and noticeable effect on the catchment and the Stormwater environment. Stormwater issues and "hot spots" for each waterway are given in the following table. Possible causes associated with each are also presented.

SECTION 6 - STORMWATER MANAGEMENT ISSUES

Table 7 - Stormwater Management Issues and Causes

Short Term Stormwater Management Objectives	General Issues	“Hot Spots” and Possible Causes	Map Ref No.
1. Introduce planning instruments that ensure the existing flow path of the Wetlands will not be endangered	<ul style="list-style-type: none"> • New residential subdivisions changing the water flows • New agri-forestry planting impacting on natural water flows (see map ref.) • High water flow events forcing the water to by-pass the Wetland 	<ul style="list-style-type: none"> • New construction on sub-divisions (see map ref.) may not meet Stormwater management requirements • No clear parameters and standards set by Council for new construction sites 	Plate 12 E1 D1
2. Identify the pollutants in the Junee Wetlands	<ul style="list-style-type: none"> • Petro-chemical pollutants apparent • Discharge from industrial areas • No vegetation buffer zone for Stormwater to transverse before entering Wetland • Sewer overflows • Suspended solids entering Stormwater system from construction activity 	<ul style="list-style-type: none"> • Industry located too close to the Wetland • Council Depot located too close to the Wetland • No Development control on release of sediment from construction activity • Water quality unknown 	Plate 12 F3 F3
3. Determine source of pollutants	<ul style="list-style-type: none"> • Industry inefficiently disposing of waste and by-products • Council Depot inefficiently disposing of waste and by-products • Sewer overflows 	<ul style="list-style-type: none"> • Industry waste disposal and management system • Council cleaning processes at Depot • Unsealed Lanes 	Plate 12 F3
4. Reduce level of pollutants entering the Wetlands	<ul style="list-style-type: none"> • As above, and • Community unaware of impact of disposal into Stormwater has • Excessive weed growth and algal blooms in Wetlands. 	<ul style="list-style-type: none"> • As above, and • Washing of cars in the street • Excessive use of fertilizers on gardens and in parks 	

Short Term Stormwater Management Objectives	General Issues	“Hot Spots” and Possible Causes	Map Ref No.
5. Reduce the level of gross pollutants entering the Wetlands	<ul style="list-style-type: none"> • Lack of awareness by residents of impact of littering on the environment • General littering, commercial areas, roads etc. • Inadequate use of gross pollutant traps • Gross pollutant trap is not cleaned often enough • Garbage bins need emptying more frequently • Inappropriate use or placement of garbage bins 	<ul style="list-style-type: none"> • Litter from industrial area • Litter from Council Depot • Litter generated at shopping centre is not being captured • No water quality controls for new developments 	Plate 12 F4
6. Plant water Couch to remove nutrients and improve water quality	<ul style="list-style-type: none"> • Increase in nutrients affect the visual amenity of the Wetlands • Nitrification decreases biodiversity 	<ul style="list-style-type: none"> • Human Activity • Lack of awareness of how actions affect water quality 	
7. Educate the local community on water quality	<ul style="list-style-type: none"> • Lack of awareness by the community of the impact of urbanisation on the environment • Lack of awareness of where Stormwater finishes its journey – in the Junee Wetlands • Lack of awareness by residents of Stormwater issues and how their actions affect water quality • Lack of awareness of builders impact on Stormwater quality 	<ul style="list-style-type: none"> • Use environmental studies in schools to raise awareness levels • No Development Consent condition requiring erosion and sediment control on construction sites 	
8. Develop a Vegetation Plan for the Wetlands utilising recommendations in the Sainty report on the Junee Wetlands	<ul style="list-style-type: none"> • Sainty Report produced for council on the Wetland area has not been developed into actions to improve area 	<ul style="list-style-type: none"> • No Causes 	
9. Increase native vegetation planting for the dry land area surrounding the Wetlands	<ul style="list-style-type: none"> • Need to increase dry land vegetation in order to maintain a healthy ecosystem and lower ground water levels 	<ul style="list-style-type: none"> • No Causes 	Plate 13 F2

Short Term Stormwater Management Objectives	General Issues	“Hot Spots” and Possible Causes	Map Ref No.
10. Educate landowners on the benefits of native vegetation	<ul style="list-style-type: none"> • Self Explanatory 	<ul style="list-style-type: none"> • No Causes 	
11. Plant vegetation to encourage and create habitats for birds, fish and water animals	<ul style="list-style-type: none"> • Increase recreational value 	<ul style="list-style-type: none"> • No Causes 	
12. Improve recreational access to the Wetlands	<ul style="list-style-type: none"> • Expand boardwalk 	<ul style="list-style-type: none"> • No Causes 	Plate 13 F3
13. Provide information boards on wildlife and native vegetation on the Wetlands	<ul style="list-style-type: none"> • Increase Recreational Value 	<ul style="list-style-type: none"> • No Causes 	
14. Raise awareness of waterways issues in schools	<ul style="list-style-type: none"> • Stormwater issues are not included in the school curriculum 	<ul style="list-style-type: none"> • No Causes 	
15. Improve the visual amenity of the Wetlands	<ul style="list-style-type: none"> • Vegetation requires continual maintenance to ensure visual amenity is sustained 	<ul style="list-style-type: none"> • No Causes 	
16. Ensure that no airborne vectors originate in the Wetlands which will negatively impact on the living conditions in nearby residences	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • No Causes 	



Plate Twelve



Plate Thirteen: Native Vegetation Planting

SECTION 7 - IDENTIFICATION OF POTENTIAL MANAGEMENT OPTIONS

7.1 STORMWATER MANAGEMENT OPTIONS HIERARCHY

The options selected for addressing the Stormwater management issues and “hot spots” were based on the Stormwater Management Hierarchy shown in the Figure below. This Hierarchy is compatible with ESD. It aims to preserve the valuable features of the aquatic environment, then promote cost-effective Stormwater management by controlling Stormwater at the source and only propose “end of pipe” techniques for those impacts that cannot be cost-effectively mitigated at the source control.

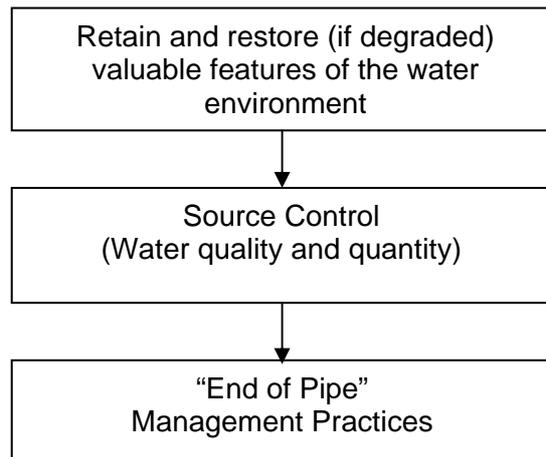


Figure 2 - Stormwater Management Hierarchy (NSW EPA 1997)

7.2 OPTIONS SELECTION

A variety of options are available for addressing the Stormwater management issues identified in Sections 6. These options fall into two general categories:-

- Non-structural; and
- Structural.

7.2.1 Non-structural Options

Potential non-structural options include:-

- Educational measures (schools' programs, community awareness).
- Planning controls (council policies, procedures and strategies).
- Site auditing.
- Review of management practices (the conduct of council maintenance activities).
- Studies and assessments.
- Other activities which lead to behavioural changes.

7.2.2 Structural Options

Structural options for Stormwater management can be beneficial for targeting known “hot spots” locations. These solutions typically address the immediate and often visible issue as opposed to addressing the source of the problem.

Many structural options are available for addressing the various stormwater issues some of these include:-

- Litter traps (litter baskets, letter booms, nets, gross pollutant traps).
- Sediment traps.
- Constructed Stormwater Wetlands.
- Bank stabilisation (vegetation planting, grass lining, rock walls, concrete).
- Vegetation plantings.
- Sand filters.
- Other interventions designed to capture pollutants.

The following table lists the potential options for addressing each of the management issues and “hot spots” identified in Section 6. This options list was developed by council officers in consultation with key stakeholders and focuses on source control wherever possible.

Table 8 - Stormwater Management Options Table

“Hot Spots” and Possible Causes	Options
<ul style="list-style-type: none"> • New construction on sub-divisions may not meet Stormwater management requirements. 	OP. 1 Incorporate sediment control plans into existing DCP for new sub-divisions
<ul style="list-style-type: none"> • No clear parameters and standards set by Council for new construction sites 	See Op. 1
<ul style="list-style-type: none"> • Industry located too close to Wetlands 	OP. 2 Undertake industrial auditing programs in conjunction with industry awareness programs, focusing on <ul style="list-style-type: none"> • Joffre street industrial estate • Council Depot
<ul style="list-style-type: none"> • Council depot located too close to the Wetland 	See Op. 2
<ul style="list-style-type: none"> • Water quality unknown 	OP. 3 Undertake a water quality testing program to:- <ul style="list-style-type: none"> • Determine water quality • Monitor water quality

“Hot Spots” and Possible Causes	Options
<ul style="list-style-type: none"> • Large proportion of unsealed lanes 	OP. 4 Implement program to increase sealing of rear lanes
<ul style="list-style-type: none"> • No development control on the release of sediment from construction activity 	See Op. 1
<ul style="list-style-type: none"> • Industry waste disposal and management system 	See Op. 2
<ul style="list-style-type: none"> • Council cleaning processes at Depot 	OP. 5 Review Council's cleaning processes at the Depot
<ul style="list-style-type: none"> • Washing of cars in street 	OP. 6 Undertake a Community Educational program to target <ul style="list-style-type: none"> • Appropriate fertiliser and pesticide/herbicide use (campaign to target residents and other non-Council users such as Golf Course staff) • Washing of cars in street • Collection of domestic animal faeces • Littering (including washing litter down drain)
<ul style="list-style-type: none"> • Excessive use of fertilisers on gardens and in parks 	See Op. 6
<ul style="list-style-type: none"> • Litter from industrial area 	See Op. 2
<ul style="list-style-type: none"> • Litter from Council Depot 	See Op. 2
<ul style="list-style-type: none"> • Litter generated at shopping centre is not being captured 	See Op. 6 OP. 7 Review location of rubbish bins in the shopping centre and increase frequency of cleaning
<ul style="list-style-type: none"> • No water quality controls for new developments 	OP. 8 Incorporate water quality controls into existing DCP for new sub-divisions
<ul style="list-style-type: none"> • Human activity 	See Op. 6
<ul style="list-style-type: none"> • Lack of awareness of how actions affect water quality 	See Op. 6
<ul style="list-style-type: none"> • Use environmental studies in schools to raise awareness levels 	OP. 9 Co-ordinate with the local schools to include environmental awareness of issues associated with Stormwater, in the curriculum
<ul style="list-style-type: none"> • No development consent condition requiring erosion and sediment control on construction sites 	See Op. 1 OP. 10 Increased inspection and enforcement of soil and water management control works on construction sites.

"Hot Spots" & Possible Causes	Options
<ul style="list-style-type: none"> Lack of awareness by community of Stormwater issues and how their actions affect water quality 	See Op. 6
<ul style="list-style-type: none"> Develop a Vegetation Plan for the Wetlands 	OP. 11 Review Sainty Report priorities and create an Action Plan
<ul style="list-style-type: none"> Increase native vegetation planting for the dry land area surrounding the Wetlands 	OP. 12 Utilise the Whitaker Report to plant out extensive areas of the Wetlands
<ul style="list-style-type: none"> Educate Landowners on the benefits of native vegetation 	OP. 13 Undertake a community campaign aimed at increasing the awareness of all community members and rural landholders, on the benefits associated with native vegetation
<ul style="list-style-type: none"> Plant vegetation to encourage and create habitats for birds, fish and water animals 	See Op. 12
<ul style="list-style-type: none"> Improve recreational access to the Wetlands 	OP. 14 Integrate all existing information into an overall plan for the development of the Wetland area
<ul style="list-style-type: none"> Provide information boards on wildlife and native vegetation on the Wetlands 	See Op. 14
<p>Raise awareness of waterways issues in schools</p>	See Op. 9
<p>Improve the visual amenity of the Wetlands</p>	OP. 15 Commit to an annual maintenance program for the upkeep of the Wetlands area to ensure it remains a community asset
<p>Ensure that no airborne vectors originate in the Wetlands which will negatively impact on the living conditions of nearby residences</p>	OP. 16 Maintain biological balance (predator fish) to prevent the spread of airborne vectors

SECTION 8 - EVALUATION OF POTENTIAL MANAGEMENT OPTIONS

8.1 METHODOLOGY OVERVIEW

Each of the Stormwater management options has been ranked by taking into consideration the costs and benefits associated with each option. In addition, a weighting relating to the community value for the outcome of the option was also included to ensure that the final choices reflected not only economic considerations but also community priorities.

8.2 EVALUATION AND RANKING OF POTENTIAL MANAGEMENT OPTIONS

In order to undertake the evaluation scores were derived for costs, benefits and community perceptions and based on the scoring process options were given a ranking.

8.2.1 Costs

The estimated cost for each option has been divided into two components:-

- Capital cost – the estimated initial cost involved to implement the option, including the cost associated with feasibility studies and construction.
- Annual operation and maintenance cost – the estimated annual cost to review, update or maintain the option.

The costs for each option were assigned to a cost range and a score was then assigned to each range (the higher the score, the higher the cost). This score was used to calculate a cost index for each option. The cost ranges and scores are listed in Table 9.

Table 9 - Cost Ranges and Scores

Capital Cost		Annual Operation and Maintenance	
<i>Estimated Cost (\$)</i>	<i>Score</i>	<i>Estimated Cost (\$)</i>	<i>Score</i>
<5,000	1	<5,000	1
5,000-20,000	2	5,000-10,000	2
20,001-50,000	3	10,001-15,000	3
50,001-100,000	4	15,001-20,000	4
100,001-250,000	5	20,001-30,000	5
250,001-350,000	6	30,001-40,000	6
350,001-500,000	7	40,001-50,000	7
500,001-750,000	8	50,001-70,000	8
750,001-1,000,000	9	70,000-100,000	9
>1,000,001	10	>100,001	10

8.2.2 Benefits

The scores assigned to each benefit category used in the evaluation process are defined below and summarized in Table 10:-

- Target Pollution.
- Relative Pollutant Harm.
- Number of Pollutants.
- Relative Effectiveness of Option.
- % Urban Area.

8.2.3 Community Priorities

The priorities indicated by the community during consultations were also weighted into the cost benefit analysis. Council recognises that unless these factors are weighted then those that participated in the consultation process could assume that their contributions were not given appropriate consideration when the final determinations were made with regard to what options would be implemented in the Plan.

Table 10 - Cost-Benefit Details for Stormwater Management Options

Option Ref No	Option Description	Costs		Benefits				
		Capital	Annual Operation	Target Pollutant	No. Pollutants	Effectiveness of Option	% Urban Area	Community Perception
OP.1	Incorporate sediment control plans into existing DCP for new sub-divisions.	\$1,000	\$1,000	Sediment	3	H	5%	7
OP.2	Undertake industrial auditing programs in conjunction with industry awareness programs.	\$1,500	\$2,500	Toxicants	6	H	30%	4
OP. 3	Undertake a water quality testing program.		\$2,500	All	8	H	10%	7
OP. 3	Implement program to increase sealing of rear lanes.	\$325,000	\$20,000	Sediment	2	H	15%	10
OP.4	Review Council's cleaning processes at the Depot.	\$20,000	\$3,000	Oil & Grease	6	M	2%	8
OP.5	Community educational program.	\$1,000	\$1,000	All	8	H	100%	5
OP.6	Review location of rubbish bins in the shopping centre and increase frequency of cleaning.	\$2,000	\$2,000	Litter	2	M	10%	10
OP.7	Incorporate water quality controls into existing DCP for new sub-divisions.	\$1,000	\$4,000	Sediment	5	H	5%	6
OP.8	Co-ordinate with the local schools to include environmental awareness of issues associated with Stormwater, in the curriculum.		\$1,000	All	8	H	30%	8
OP. 9	Increased inspection and enforcement of soil and water management control works on construction sites.	\$2,000	\$4,000	Sediment	8	H	20%	7
OP. 10	Review Sainty Report priorities and create an Action Plan.	\$500		Nutrients	1	M	15%	7
OP.11	Utilise the Whitaker Report to plant out extensive areas of the Wetlands.	\$1,500		Nutrients	1	M	15%	7

Option Ref No	Option Description	Costs		Benefits				
		Capital	Annual Operation	Target Pollutant	No. Pollutants	Effectiveness of Option	% Urban Area	Community Perception
OP.12	Undertake a community campaign aimed at increasing awareness of all community members and rural landholders, on the benefits associated with native vegetation.	\$2,500		Nutrients	1	M	30%	6
OP. 13	Integrate all existing information into an overall plan for the development of the Wetland area.	\$2,500		All	8	H	25%	7
OP.14	Commit to an annual maintenance program for the upkeep of the Wetland to ensure it remains a community asset.		\$10,000	All	8	H	35%	10
OP.15	Maintain biological balance (predator fish) to prevent the spread of airborne vectors.		\$1,000	Vectors	1	H	35%	6

8.3 RANKING OF OPTIONS

The Stormwater management options were ranked using a cost-benefit analysis based on the recommendations provided in the EPA document "Example Stormwater Management Plan" 1999. Council included a weighting for community priorities in its cost-benefit calculations.

8.3.1 Cost-Benefit Ratio

To compare the options and prioritise them, a cost-benefit ratio was calculated using methodology outlined below:

a) Calculation of Cost Index (CI)

The average of the capital and maintenance cost score gives the CI value. The higher the CI the greater the cost, with a CI of 10 being the highest cost option.

b) Calculation of Benefit Index (BI)

The average of the six benefit scores gives the BI value, the community priority has been included in to the calculation as the sixth benefit. The higher the BI the greater the benefit.

c) Calculation of Cost-Benefit Ratio (BC)

This is calculated by dividing BI by CI.

Table 11 lists the Stormwater Management options, ranked in order from highest priority to lowest priority based on the BC value.

Table 11 - Stormwater Management Options Ranked Highest to Lowest Priority

Option Rank	Option Ref. No.	Option Description	Benefit-Cost Ratio
1	OP.6	Community educational program	8.50
2	OP.9	Co-ordinate with the local schools to include environmental awareness of issues associated with Stormwater, in the curriculum	7.83
3	OP.14	Integrate all existing information into an overall plan for the development of the Wetland area	7.66
4	OP. 3	Undertake a water quality testing program	7.33
5	OP.10	Increased inspection and enforcement of soil and water management control works on construction sites.	6.50
6	OP.8	Incorporate water quality controls into existing DCP for new sub-divisions	5.66
7	OP.2	Undertake industrial auditing programs in conjunction with industry awareness programs	5.66
8	OP.15	Commit to an annual maintenance program for the upkeep of the Wetland to ensure it remains a community asset	5.55
9	OP.1	Incorporate sediment control plans into existing DCP for new sub-divisions	5.50
10	OP.16	Maintain biological balance (predator fish) to prevent the spread of airborne vectors	5.33
11	OP.7	Review location of rubbish bins in the shopping centre and increase frequency of cleaning	5.00
12	OP.13	Undertake a community campaign aimed at increasing awareness of all community members and rural landholders, on the benefits associated with native vegetation	4.33
13	OP.11	Review Saintry Report priorities and create an Action Plan	4.33
14	OP.12	Utilise the Whitaker Report to plant out extensive areas of the Wetlands	4.33
15	OP.5	Review Council's cleaning processes at the Depot	2.58
16	OP.4	Implement program to increase sealing of rear lanes	1.20

SECTION 9 - IMPLEMENTATION STRATEGIES

9.1 IMPLEMENTATION STRATEGIES

To ensure that the high priority Stormwater management options identified in Section 8 are implemented, an implementation strategy has been developed for Council. The Implementation Strategy will be used over the next 3-4 years to determine which projects and activities are included in Council's Management Plan and budget.

It is recognised that there is insufficient funding and resources to be able to implement all options in the short term. Options implementation has therefore been divided as follows:-

- 2001-2002 Options - These are the options that Council anticipates that it will commence in the next financial year. Some of these options are currently being undertaken or have been budgeted for as part of Council's works program
- 2002 – 2003 Options - These are the options that may commence within the 2002-2003 financial year. These options will be reviewed as part of the SMP review and will be included as part of Council's Work Program if funding is allocated for their implementation
- Future Options - These are the options that may potentially commence within the 2001-2004 financial year. These options can be implemented should appropriate levels of funding become available through either internal or external sources. These options will be reviewed as part of the SMP review process.

Council's implementation strategy is given in Table 12 below. Revision of each Implementation Strategy should occur annually as part of the monitoring and review process.

Each implementation strategy contains the following information:-

- Timeframe - The year within which implementation of the option is to commence
- Option Rank - This is the priority assigned to the option as part of the ranking process, as per Section 8. Options are listed in order of priority from highest priority to lowest
- Option Number - This is the standard reference number for each option to allow easy cross-referencing of options between tables
- Options Description - This is the description, in summary form, of the Stormwater management option to be implemented
- Responsibility - This column lists the responsible agency/ agencies for implementing the option
- Cost - This is the cost to Council to implement the option

According to Table 12, Options 2 and 13 were ranked to appear in the 2001-2002 implementation year. Due to the extensive program assigned to this period, it was deemed

necessary to move these two options to the following implementation year. This will ease time constraints and allow all other projects in this period to be completed.

Similarly, option 5 was moved up from the 2002-2003 implementation period to the 2001-2002 period. This was due to the fact that the EPA has indicated that Junee Shire Council is required to install a truck wash. Funding has already been secured to implement this project and therefore time constraints do not allow this option to begin so late in the implementation program.

Table 12 - Implementation Strategy

Option Rank	Option Ref No.	Option Description	Responsibility	% Contribution by Council	Capital Cost (\$)	Annual Operation & Maintenance Cost (\$)
2001-2002 Options						
1	OP.6	Community educational program	Council	100%	\$1,000	\$1,000
2	OP.9	Co-ordinate with the local schools to include environmental awareness of issues associated with Stormwater, in the curriculum	Council	100%		\$1,000
3	OP.3	Undertake a water testing program	Council	100%		\$2,500
4	OP.14	Integrate all existing information into an overall plan for the development of the Wetland area	Council	100%	\$2,500	
5	OP.10	Increased inspection and enforcement of soil and water management control works on construction sites.	Council	100%	\$2,000	\$4,000
6	OP.8	Incorporate water quality controls into existing DCP for new sub-divisions	Council	100%	\$1,000	\$4,000
7	OP.15	Commit to an annual maintenance program for the upkeep of the Wetland to ensure it remains a community asset	Council	100%		\$10,000
9	OP.1	Incorporate sediment control plans into existing DCP for new sub-divisions	Council	100%	\$1,000	\$1,000
10	OP.16	Maintain biological balance (predator fish) to prevent the spread of airborne vectors	Council	100%		\$1,000
11	OP.7	Review location of rubbish bins in the shopping centre and increase frequency of cleaning	Council	100%	\$2,000	\$2,000
15	OP.5	Review Council's cleaning processes at the Depot	Council	100%	\$20,000	\$3,000
			Total Cost (\$)		\$29,500	\$29,500

2002-2003 Options						
7	OP.2	Undertake industrial auditing programs in conjunction with industry awareness programs	Council	100%	\$1,500	\$2,500
12	OP.13	Undertake a community campaign aimed at increasing awareness of all community members and rural landholders, on the benefits associated with native vegetation	Council	100%	\$2,500	
13	OP.11	Review Sainty Report priorities and create an Action Plan	Council	100%	\$500	
14	OP.12	Utilise the Whitaker Report to plant out extensive areas of the Wetlands	Council	100%	\$1,500	
			Total Cost (\$)		\$6,000	\$2,500
Future Options						
16	OP.4	Implement program to increase sealing of rear lanes	Council	100%	\$325,000	\$20,000
			Total Costs (\$)		\$325,000	\$20,000

9.2 LINKING THE SMP TO COUNCIL’S PLANNING PROCESS

The link between the Stormwater Management Plan and other Council plans and policies is shown below.

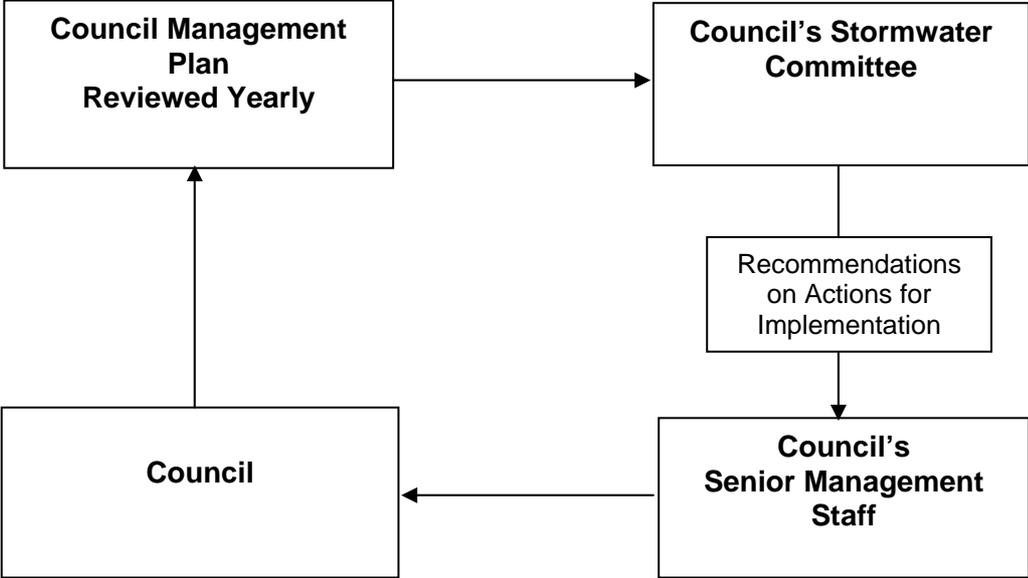


Figure 3 - Linking the SMP to Council’s Planning Process

SECTION 10 - MONITORING AND REPORTING

10.1 MANAGEMENT FRAMEWORK FOR PLAN IMPLEMENTATION

The responsibility for the implementation of the Urban Stormwater Management Plan will fall to a special Stormwater Management Committee the following council officers will be on the Committee:-

- Manager, Engineering Services.
- Deputy Manager, Engineering Services.
- Environmental Officer.

These officers will meet regularly to review the implementation of the Plan and will report to the Senior Management Team and then to Council. The Committee will advise Council whether works are proceeding in accordance with the Implementation Strategy and whether they are on schedule and to budget.

10.2 MONITORING

Monitoring is considered to be an essential component of the effective implementation of the SMP and is aimed at:-

- Assessing the degree of implementation.
- Assessing the effectiveness of the Plan in meeting its objectives.
- Allowing progressive improvement and refinement of the Plan.

Council will undertake the following forms of monitoring throughout the implementation of the SMP:

- Observation based monitoring.
- Water quality monitoring.
- Biological monitoring.
- Recording the progress of the Plan.

10.2.1 Observation Based Monitoring

Observation based monitoring will be used to provide indications of:-

- Existing conditions within the Stormwater system.
- The effect of implementation of SMP options on conditions within the Stormwater system.
- Areas requiring more scientific monitoring.

- The needed to employ water quality control measures/practices.

Observations will be undertaken by council staff and where appropriate community and school groups will be encouraged to participate in the process. The DLWC will also be requested to provide council with reports on any issues they observe arising in the system that needs to be addressed through the SMP process.

Observation monitoring will be undertaken on a monthly basis at both an upstream location and a downstream location and at all points where Council has installed gross pollutant traps.

In addition, Council has proposed the re-establishment of the Streamwatch program as part of this Plan. Council's Environmental Officer will be responsible for approaching both Primary and High Schools to encourage involvement and adoption of the program.

10.2.2 Water Quality Testing

As part of its implementation of the Stormwater Management Plan, Council will introduce regular water quality testing procedures for the Wetlands. This will be in addition to the Piezometer monitoring that is already undertaken.

a) *Wetland Monitoring*

This will be undertaken twice a year at two locations, one upstream and one downstream. The samples that are taken at these locations are analysed for the following:-

- | | |
|---|--|
| <input type="checkbox"/> Suspended Solids | <input type="checkbox"/> PH |
| <input type="checkbox"/> Total Nitrogen | <input type="checkbox"/> Conductivity |
| <input type="checkbox"/> Total Phosphorus | <input type="checkbox"/> Biochemical Oxygen Demand |
| <input type="checkbox"/> Grease & Oils | |

b) *Piezometer Monitoring*

Council currently has a number of piezometers located within the Junee Catchment which are checked on a quarterly basis. Council will continue to undertake this testing.

Quarterly Sampling - The samples taken on a quarterly basis from the piezometers are analysed for the following:

- | | |
|---------------------------------------|---|
| <input type="checkbox"/> Conductivity | <input type="checkbox"/> Depth to Water Table |
|---------------------------------------|---|

10.2.3 Biological Monitoring

Limited biological monitoring is currently undertaken by the DLWC. Council will continue to liaise with the local DLWC representative to obtain regular reports on the ecosystem health and diversity of the catchment.

10.2.4 Reporting Progress

Progress with regards to the implementation of the SMP recommendations is to be reported in Council's State of the Environment Report. In particular, results of monitoring programs, outcomes of environmental studies and effectiveness of pollution control devices as well as the outcomes of awareness programs will be highlighted in these reports.

SECTION 11 - UPDATING THE STORMWATER MANAGEMENT PLANT (SMP)

Council recognises that Stormwater management is a long term program that requires a process of continuous improvement. Preparation of this Plan is the first step in an on-going process of urban Stormwater management for Junee Shire Council.

Council has committed to the following process of review and revision of the SMP:-

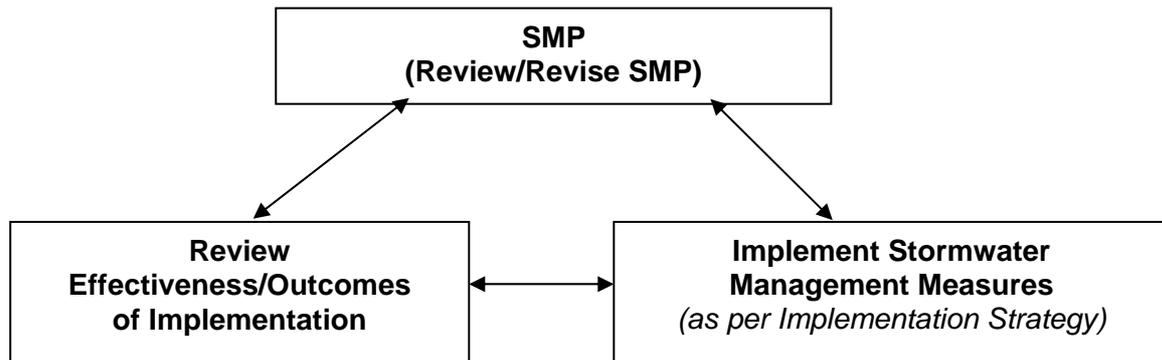


Figure 4 - Review and Revision of the SMP

11.1 REVISION OF THE SMP

Revision of the Stormwater Management Plan will be undertaken in two ways:-

- Revise/re-issue the Implementation Strategies.
- Review/revise the SMP document.

11.1.1 Revise/Reissue the Implementation Strategies

The Implementation Strategy is a dynamic document which must be changed as works are completed and new issues arise. Implementation strategies will be reviewed in totality on a yearly basis, the Stormwater Management Committee will review individual strategies on an on-going basis.

11.1.2 Review/Revise the SMP

A complete review and revision of the SMP will occur annually, in sufficient time to allow new strategies to be funded through Council's Management Planning process.

Priorities will be reviewed, strategies updated and revised and consultations held with stakeholders to ensure the Plan continues to reflect the needs the community and responds to the demands of the environment.

SECTION 12 - CONCLUSION

Much time and effort has been spent on ensuring that this SMP meets the environmental requirements - social and natural - and is realistic in its ability to deliver beneficial outcomes. The SMP is supported by Council as well as its management team and is a key plan in the improvement of the environment of Junee. The plan has been developed in consultation with the community and will address many of its concerns.

The implementation of the plan has been linked to Council's management planning process to achieve a staged implementation in line with community and budgetary requirements. The successful implementation of this plan will see immeasurable gain in the quality of urban stormwater and improve recreational value of the Junee stormwater system.

SECTION 13 - INCLUSIONS

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1. Location Map of Junee Shire (map).
2. Junee Urban Catchment waterways (map).
3. Junee Urban Catchment Area (map).
4. Junee Urban Terrain (DLWC map).
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2. Stormwater Management Hierarchy.
3. Linking the SMP to Council's Planning Process.
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2. Community Values.
3. Stormwater Management Objectives.
4. Qualitative Objectives for New Development.
5. Risk Assessment for New Development.
6. Management Objectives for Post Construction Phase.

7. Stormwater Management Issues and Causes.
8. Stormwater Management Options.
9. Cost Ranges and Scores.
10. Cost Benefit Details for SMP Options.
11. SMP Options Ranked Highest to Lowest Priority.
12. Implementation Strategy.

SECTION 14 - REFERENCES

- Coffey Geosciences (2000) *Salinity Survey, Junee, NSW*.
- DLWC (1998) *GIS Maps*.
- NSW EPA (1999) *Example Stormwater Management Plan*.
- Sainty and Associates (1997) *Junee Wetlands Enhancement Plan*.
- Whitaker, O. (1997) Planting Guide “*Junee Wetlands Dry Area*”.