TEMORA SHIRE COUNCIL URBAN STORMWATER MANAGEMENT PLAN - 2015

TEMORA
NSW
Riverina

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1 EXECUTIVE SUMMARY

The Temora Shire Stormwater Management Plan was originally prepared in 2002 as part of the State-wide program to develop Stormwater Management Plans throughout New South Wales (NSW) to meet the requirements of the NSW Environment Protection Authority (EPA) Section 12 Direction.

This Plan builds on Council's 2002 Plan and focuses on providing an effective framework for stormwater management and providing a clear implementation path to address priority issues.

The Plan seeks to review and improve Council's management and planning processes to ensure that stormwater systems are designed, constructed and maintained to best practice standards and in locations that will maximise their environmental, social and economic benefits to the community. The Plan therefore focuses on the management of stormwater quality, stormwater quantity and stormwater reuse issues.

The Plan focuses on land that is drained by the reticulated stormwater system but does not address specific drainage or flooding issues which may be managed by Flood Management Plans. This Stormwater Management Plan should be seen as one of the tools used as part of an integrated catchment management approach to achieving improved environmental practices.

The Plan documents values to be protected and restored in the Council's Urban waterways, and outlines clear, prioritised strategies to improve the quality of stormwater from existing urban areas, and to proactively implement best practice management for newly developing areas.

Since the 2002 Stormwater Management Plan (SWMP) a number of actions have been implemented, whilst some have not. Ongoing actions and actions from the 1st edition of the SWMP that have not yet been implemented, as well as new actions identified in this review, are contained in Appendix A. The SWMP, particularly the Actions/Options Tables, should be reviewed and updated on a regular basis.

During the Plan's development and review there has been close consultation with partnership agencies to generate commitment and awareness of stormwater issues. This involvement in the Plan's development has established the basis for ongoing co-operation and implementation by the Council and various agencies.

The Plan is largely non-technical and consists of actions that impact on the planning scheme, education and environmental services, operations and maintenance programs and design and infrastructure works.

2 INTRODUCTION

Rainwater is generally quite pure and safe. The only possible contamination it suffers as it develops and falls from the sky is through contact with dust particles in the air. Once rainwater reaches the ground however, the potential for contamination increases dramatically. Water running across agricultural and urban land can be contaminated in a number of ways.

Pesticides, fertilizers, manure from domestic animals, soil particles, grease & oil, rubber particles, fuel, bacteria, general street litter and any number of other contaminants can come in contact with water running across the ground (storm water) making it less than pure.

This plan is all about improving the quality of stormwater leaving the urban areas of Temora Shire Council.

2.1 BACKGROUND

The NSW Environment Protection Authority (EPA) has issued a legal direction to all Councils, under Section 12 of the Protection of the Environment Administration Act, to prepare Stormwater Management Plans (SWMPs) specific to urban areas with a population over 1,000.

This direction is aimed at improving water quality and river health by identifying solutions to mitigate the environmental impacts of urban stormwater discharges.

2.2 PURPOSE OF THE STORMWATER MANAGEMENT PLAN

This SWMP focuses on stormwater management for urban areas of Temora Shire Council and their associated catchments. While this plan has been prepared to comply with the EPA's Section 12 direction, it is also the intention of Temora Shire to effect an improvement in the quality of stormwater discharging from its urban catchments into its associated receiving waters. This document and the goal below have been produced to communicate to the community and staff, Council's intentions with respect to stormwater and its management.

The primary goal of this Stormwater Management Plan is:

"To facilitate the better management of stormwater within the urban areas of Council thereby having a positive effect on the quality of water entering the receiving waters of each of the respective catchments."

In order to achieve this goal the main objectives of the Stormwater Management Plan are to:

- identify through consultation, stormwater management values for the catchment;
- document objectives to focus on these values;
- identify barriers to achieving these objectives; and
- detail actions, their cost and their timing to achieve the objectives.

2.3 RESPONSIBILITIES FOR STORMWATER MANAGEMENT

Within Council area and its catchment, a number of organisations and individuals share responsibility for stormwater management. In general terms however, Temora Shire has prime responsibility for managing stormwater and this plan.

It should be stressed however that to achieve worthwhile results, the entire community needs to take responsibility for stormwater quality. This may be as simple as being a watch dog and reporting incidents likely to negatively impact on stormwater quality or it may be as positive as taking steps to use less fertiliser in farming and/or gardening.

The Roads and Maritime Services (RMS – formerly RTA) is responsible for the contracting of road construction works along State Road MR57 (Goldfields Way) and State Road MR84 (Burley Griffin Way). RMS have stringent environmental controls and standardised procedures for ensuring that sediments and other pollutants do not find their way to any watercourse. Each construction project must include an environmental management plan that meets these stringent guidelines. Except for road construction works along these State roads, Temora Shire is responsible for managing stormwater throughout its Council area. This includes stormwater runoff from State roads.

At Temora Shire, the position of Director Engineering Services has overall responsibility for the implementation of the SWMP with input from the Director of Environmental Services.

2.4 PROCESS USED TO PRODUCE THE SWMP

The process used to develop this plan has been that generally recommended by the EPA in their publication "Managing Urban Stormwater - Council Handbook". The steps are listed below:

2.5 STAKEHOLDER CONSULTATION

To achieve the objectives of the original SWMP, it was critical that the plan be prepared by Council in consultation with relevant government authorities, community groups and other stake holders as listed below.

- Environmental Liaison Committee,
- Grogan Landcare,
- Trungley Hall Landcare,
- Mirrool Creek Landcare group,
- EPA
- General public through local newspaper advertisements and community newsletters, Narraburra News plus exhibition of the draft plan.

2.6 RELEVANT EXISTING PLANS AND REPORTS

The SWMP developed in 2002 lists the following existing plans and reports that were used in the compilation of the plan.

2000/2001 State of the Environment (SoE) Report – This document provides some background information about the existing environment of the Temora Shire including rainfall information. The report states "Rainfall within the area is commonly recognised as being 584mm per year, predominantly from the west and generally distributed during the winter and spring. Rainfall in the summer months is usually storms producing short heavy downpours resulting in minor local short term flooding too many areas of the Shire."

The report notes the population of Temora Township to be 4,560.

Under section 8 headed Environmental Assessment, the report states

"A programme of environmental auditing will need to be implemented to assist in analysis of the status of the environment within the Temora Shire."

Section 10 contains reference to Water Recycling or the effluent re-use activities of Council and the awards received for these activities.

Earlier state of environment reports (SoE) contain references to a number of relevant issues.

The 1995/96 SoE refers to the establishment of a wetland to the north of the town. The report states "Council is now working with Government Departments of CALM; Water Resources; Agriculture; and Education in an effort to establish a wetlands for the township of Temora. This will have a very positive effect on the runoff water from Council's major area of population, the town of Temora. It is planned to construct the wetlands to the north of Temora Township upon the Department of Agriculture lands. The construction will include water traps, grit chambers, and wetlands infrastructure that will deal with all stormwater drainage water from the Temora Township.

The planned activity will have the effect of cleaning the Temora town runoff stormwater of all garbage (tins, bottles, bags, papers etc), nutrient (dry droppings and other animal excreta), heavy metals, pesticides, oils etc prior to the said water entering the major

stream, Trigalong Creek, that passes near the Temora township. This creek feeds into the Bland Creek, then into Lake Cowal and finally the Lachlan River.

When this work is completed a major step will have been taken to reduce water pollution caused by human activity." The same report also refers to the effluent re-use scheme stating "Council will, in the very near future, have achieved full waste recycling of all sewage effluent from its Temora Sewage Treatment Works. No waste water from the works will find its way to the Trigalong Creek escape, all such waters will be contained within Council control for its own use and benefit."

The 1996/97 SoE also refers to the proposed wetlands and effluent re- use scheme.

The report states "Moves have been taken in conjunction with the Department of Lands and Water Resources and with the co-operation of the New South Wales Department of Agriculture to bring to fruition the establishment of a wetlands area to the north of Temora.

A sum of $12,000 has now been granted for early planning work.

Such plan has now been drafted, and costing will be carried out to enable the project to proceed to completion when funds are forthcoming."

Reference to effluent re-use states "In relation to Council's own recycling efforts in respect to effluent disposal steps are now being taken to establish a more up to date and regular monitoring system of this procedure.

While Council has kept to the main requirement of storage in excess of 30 days the time has now come for more regular and more scientific monitoring of the scheme."

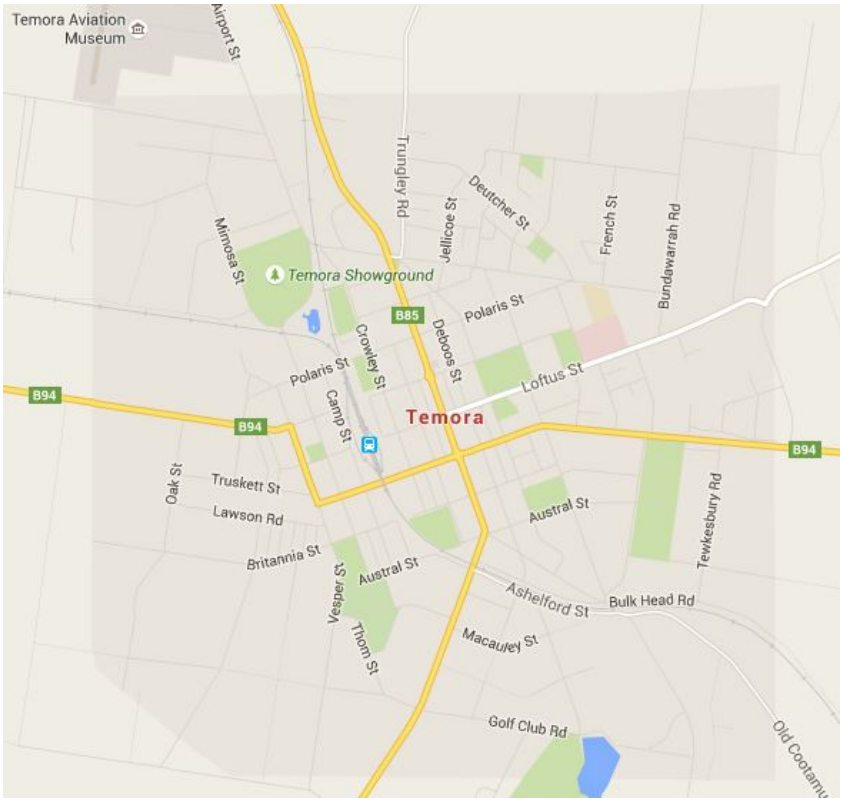
The 1997/98 SoE again refers to the wetland establishment stating "The work on establishing a wetlands to deal with urban run-off from Temora continues.
Council is setting aside funds to have this work carried out.
Further discussions have been held with the NSW Department of Agriculture and Department of Water Conservation and Lands. Council is making every effort to have this wetlands established to deal with Temora urban run-off water."

Review of Hydrologic Aspects for Proposed Recreational Lake on Trigalong Creek near Temora – This report contains detailed modelling information used in the lead up to construction of Lake Centenary. It also contains an aerial photograph of Temora in relation to the lake site and a map of the Trigalong Creek Catchment.
The report states that the Trigalong Creek catchment area is relatively small being 188 square kilometres.

3 CATCHMENT DESCRIPTION

3.1 WATERWAYS AND SUB-CATCHMENTS

Temora Township (Population 3874 (2011 Census)) catchment occupies an area of approximately 1,165 hectares.



Within the township there are two main drainage channels, with the channel on the east side of town known as “eastern drain” and that on the west side of town as the ‘western drain”. These drainage channels run approximately in a north/south direction, converging at the northern end of town.
From this convergence point, a single drainage depression meanders across private land to Lake Centenary approximately 4 kilometres to the north of the township.
At the northern end of the lake, a spill way discharges into Trigalong Creek.

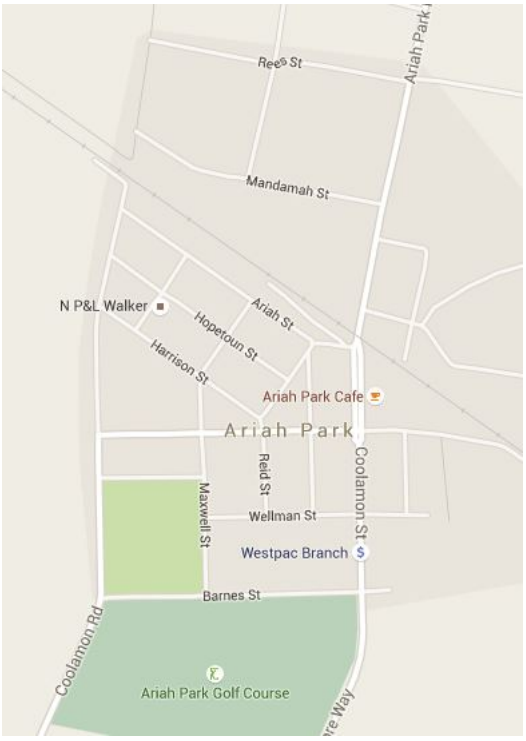
Areas to the south of Temora that eventually drain through the town and have the potential to affect stormwater quality include agricultural farming and grazing areas.

Council operates a successful effluent re-use system where treated sewage effluent is pumped from the Sewage Treatment Plant (STP) to storage dams around town. Effluent from these dams is then irrigated on public parks and sports fields.
This effluent has the potential to cause problems with nutrient increases and salinity.
Specific information relating to stream flows is not available.
Urban bushland does not exist within the township and therefore no reference has been made to the effect of stormwater on urban bushland.

Open farmland between Temora Township and Lake Centenary

Wetlands area at the Southern end of Lake Centenary (Trigalong Creek entrance)

Ariah Park village (Population 268 (2011 Census)) catchment occupies an area of approximately 1368 hectares.

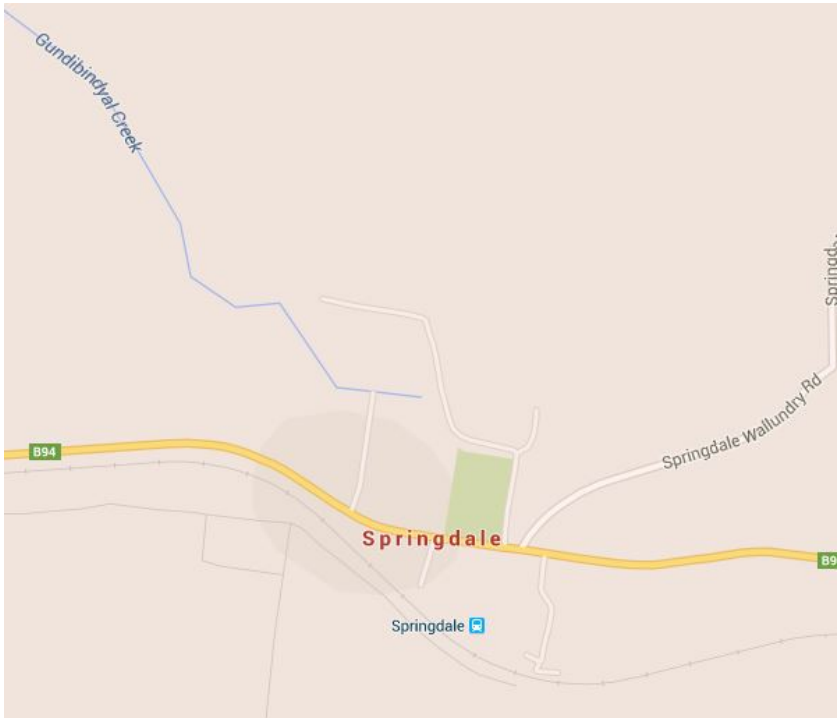


There is no clearly defined watercourse in and around the immediate surrounds of the village.
During heavy rain events overland flow infiltrates the village from the south and the east. This flow can alter from one event to the next depending on the agricultural use of the adjoining farmland at the time of the rainfall event
The majority of stormwater either falling within the village or infiltrating from the surrounding areas makes its way in a northerly direction to a railway dam located on the Northern edge of the village. If the dam overflows the resultant flow heads north for approximately 5.00Km and eventually flows into the Mirrool Creek.
Water is recycled from the Railway dam and is used within the village to help with the watering of the bowling club and is also used in road construction works in and around the village.
Drainage flows in and around the village are influenced by the Temora – Roto Railway line which dissects the village and the surrounding network of roads.

Railway Dam – Ariah Park

Cropping land to the East of Ariah Park

Springdale village (Population 70 (est) catchment occupies an area of approximately 1200 hectares.



Springdale has a clearly defined watercourse running generally from South to North through the middle of the village. It is located right at the headwater of Gundibindyal Creek which flows North West to join with the Narraburra Creek which in turn flows into the Bland Creek at the Northern end of the Council area.
Drainage flows in and around the village are influenced by the Lake Cargelligo Railway line which dissects the village and the surrounding network of roads.

Gundibindyal Creek passing under Lake Cargelligo Railway line at Springdale

Typical grazing country surrounding Springdale

3.2 LAND USE

Temora

Temora is typical of small rural towns in that it has small pockets of industrial and commercial activity with the majority of land use being residential. The town is surrounded by agricultural activity and a sewage treatment works is located to the north east of the township.

Ariah Park and Springdale

Both areas are zoned “village” and as such have little or no industrial activity and neither is sewered.

3.3 TOPOGRAPHY

Temora

The town of Temora is located in a small valley which gently falls to the north. There are two ridges that skirt the edges of the town and generally run in a north south direction. These ridges form the top part of the town catchment.
Fall occurs from the east and west ridges down towards the centre of the town. Run off is intercepted from the east by the eastern drain and from the west by the western drain.
It is then carried north by these drains to a point at the northern end of the town where the drains converge.
From here, fall is quite gentle with a low flat drainage depression carrying run off approximately 4 kilometres north to Lake Centenary (a manmade lake constructed in the early 1980’s).

Ariah Park

The village of Ariah Park is located at the bottom of small ridge which falls to the North. Runoff in the village is generally intercepted by street drainage within the village and is conveyed by this system to a railway dam located on the North Western each of the village.
Overflow from the Railway dam eventually finds its way to the Mirrool Creek some 5.00Km to the North of the village.

Springdale

The village of Springdale is located in a valley at the bottom of a range of small ridges. These small ridges which surround the village form the upper part of the village catchment. Stormwater drains down into the village from these surrounding ridges and is carried through the village in a northerly direction within a well-defined watercourse which becomes the headwaters for the Gundibindyal Creek.

3.4 SOIL LANDSCAPES

Temora

The eastern side of the Temora Township is located on rich red residual volcanic soils that are well drained and therefore are a recharge area for ground water.
The western side of Temora Township is located on metamorphosediments that are less permeable and that have the potential to deposit sediments and be subject to greater erosion potential.

It is these soils on the western side of town that are more likely to contribute to turbidity in run off.

Ariah Park

The village is surrounded by rich red residual volcanic soils that are well drained and therefore are a recharge area for ground water.

Springdale

The ridges which surround the village support some of the remaining iron bark bushland remaining within the Shire.
The soil types are generally of a poorer quality and are easily erodible. These soils are more likely to contribute to turbidity in run off.

3.5 CLIMATIC CONDITIONS

The Council area experiences an annual average rainfall of approximately 584mm per year. This rainfall mainly occurs in winter and spring. Summer storms however also produce heavy downpours over short periods resulting in minor flooding.

Average daily temperatures range from 15 degrees Celsius in winter to 30 degrees Celsius in summer.

4 EXISTING URBAN AREA CONDITIONS

4.1 STORMWATER INFRASTRUCTURE

Temora

In general terms the infrastructure consists of two drains that fall from south to north. These drains converge at the northern end of Temora Township and discharge to open, private lands.
Stormwater is conveyed to the two drains via a system of kerb and gutter along with underground drainage and lined or unlined surface channels.

Ariah Park and Springdale

Stormwater is conveyed through the village via a system of kerb and gutter along with underground drainage and lined or unlined surface channels.

4.2 HYDROLOGY AND HYDRAULICS

Temora

The only information relating to flows is that in a report on the hydrological aspects for the then proposed Lake Centenary and in more recent times modelling carried out for the new runway at the Temora Aerodrome. Both these reports contain information on flows in the Trigalong Creek but no specific information about Temora Township is available.

Ariah Park and Springdale

No specific information is available in relation to flows in the Gundibindyal Creek at Springdale or from within the village.
No specific information is available in relation to flows in or around Ariah Park.

4.3 EROSION AND SEDIMENTATION

Temora

The western side of Temora Township is located on metamorphosediments that are less permeable and that have the potential to deposit sediments and be subject to greater erosion potential.
It is these soils on the western side of town that are more likely to contribute to turbidity in run off.

Currently much of the sediments from urban run-off are intercepted at the confluence of the two town drains and immediately north on private lands where flows move from channelized to wider over land flows.
It is these overland flows of low velocity that allow sediments to deposit. Because of the distance (approximately 4 kilometres) stormwater travels overland before it meets Lake Centenary, much of the sediment drops out prior to discharge into the lake.

4.4 WATER QUALITY

Temora

Little or no data exists regarding the existing water quality of the Trigalong Creek. It should be noted that Trigalong Creek only has very intermittent flows and in some years it will not flow for its full length, therefore obtaining meaningful data on this particular stream is difficult.

Some data has been obtained from the Department of Land & Water Conservation for surface water quality in the two stormwater drains and at the proposed wetland site immediately north of the township.
Sampling was carried out in May 1995. A summary of this data as it appeared in the original SWMP is given below.

Ariah Park and Springdale

No data available.

Table 1: Temora Township Stormwater Quality May 1995 (DLWC sampling)

Parameter	Eastern Drain	Western Drain	Proposed Wetland Site
Faecal Coliforms (cfu/100mL)	7700	20000	1400
Biological Oxygen Demand (mg/L)	<5	<5	
Electrical Conductivity (uS/cm)	180	46	
Ammonia (mg/L as N)	.05	.11	
Nitrite + Nitrate (mg/L as N)	.20	.38	
Total Kjeldahl Nitrogen (mg/L as N)	1.1	.9	
Total Nitrogen (mg/L as N)	1.3	1.3	
pH	6.6	6.1	
Total Reactive Phosphorous (mg/L as P)	.380	.165	
Total Phosphorous (mg/L as P)	.545	.330	
Total suspended solids (mg/L)	80	220	

Discussions were held with Jim Salmon, Catchment Manager Temora, Department of Land & Water Conservation at the time the original SWMP was produced indicated that these readings are quite reasonable however the phosphorous levels may be a little high.
Two possible explanations for the elevated phosphorous levels are;

1) increased concentrations of horse manure due to horse keeping activities and
2) effluent re-use on sports fields and parks.

It is unusual however that associated nitrogen levels are low since if the above two possibilities were responsible, nitrogen levels would also be expected to be high.
Unfortunately, no comparative data is available in this collection of figures to show changes downstream except faecal coliforms.
Faecal coliforms are reduced by the time run off reaches the proposed wetland. This is to be expected given the exposure to sunlight and the widening of the drainage channel to give greater contact with the air, plants and sun.
It would also be expected that reductions should occur in other parameters.

A further set of comparative figures were produced by Temora Primary School and the Trungley Hall Landcare Group. While these figures may not be as accurate as those above, they compare quite well with the above figures and can be used as a guide.

Table 2: Water Quality Proposed Wetland & Lake Centenary March 1995 (Temora Primary School and Trungley Hall Landcare)

Parameter	Proposed Wetland Site	Lake Centenary
Phosphorous (mg/L)	5	2.5
Nitrogen (mg/L)	.24	.4
PH	8	7.5
Electroconductivity	100	100
Hardness	40	40

It is interesting to note from the above table the increase in nitrogen levels from proposed wetland site to Lake Centenary. This may be attributed to farming activity and fertiliser application however there is insufficient evidence to be certain.

With reference to potential point sources of pollution, Council will undertake a program of audit to minimise opportunity for contamination or pollution events. In general terms these are commercial and industrial premises. There are for example a number of commercial premises with wash down areas that discharge via triple interceptors to the stormwater system. It may be that improved interception devices need to be installed at some premises because of the nature of wash down.

The incidence of discharge from the sewerage system through overloading from stormwater infiltration is extremely low. In the past twenty years there has never been an incidence of surcharge due to overloading.

The latest stormwater quality readings for Temora Township are contained in the table below

Table 3: Water Quality Results August 2015

Parameter	East & West Drain	Wetland	Lake Centenary	Trigalong Upstream	Trigalong Downstream
Dissolved Oxygen (mg/L)	9.5	9.3	9.1	9.3	10.1
Conductivity (uS/cm)	134	71	164	97	162
Total Nitrogen (mg/L as N)	8	6	5	8	6
Nitrite + Nitrate (mg/L as N)	2.1	0.8	0.9	0.9	0.7
Total Phosphorous (mg/L as P)	0.76	0.23	0.13	0.29	0.16
Total Kjeldahl Nitrogen (mg/L as N)	6	5	4	7	5
Turbidity (NTU)	250	136	98	224	111

4.5 AQUATIC HABITAT

There is no information specifically referring to vegetation communities along the Trigalong Creek or waterways associated with the villages of Ariah Park and Springdale.

Michelle Perry, Conservation Manager, NSW Fisheries, Narrandera, advises that in the past Lake Centenary has been stocked with the following species of fish:

» Golden Perch *Macquaria ambigua*.

» Silver Perch *Bidyanus bidyanus*

» Murray Cod *Maccullochella peelii*

4.6 RIPARIAN, REMNANT AND FORESHORE VEGETATION

There is no information specifically referring to vegetation communities along the Trigalong Creek or waterways associated with the villages of Ariah Park and Springdale.

The following species are known to exist along waterways within Council's area.

» River Red Gum *E. camaldulensis*
» River Bottlebrush *Callistemon seeberi*
» Weeping Grass *Microlaena stipoides*
» Tussock Grass *Poa. Spp*.

In the drainage depression between Temora Township and the proposed wetland site, juncus is evident.

4.7 CURRENT STORMWATER MANAGEMENT PRACTICES

Council planning, operation and management activities can have a direct or indirect influence on the environmental impacts of stormwater discharges.
Additionally, Council must be “seen to be doing the right thing”.
As a major construction business, a developer, a regulator and a leader in the community, Council plays an integral role in showing the community how to best manage stormwater.

Some activities of Council that impact on storm water include:

- waste removal
- pollution & waste regulation & monitoring
- parks and gardens maintenance
- mowing of verges
- road construction & drainage
- road design & traffic facilities
- building approval & inspection
- strategic planning
- subdivision approval
- street tree maintenance
- effluent re-use

5 CATCHMENT VALUES

5.1 DEVELOPMENT OF CATCHMENT VALUES

Catchment values, for the purpose of this SWMP, have been defined to mean:

"Aspects or components of the stormwater drainage system, or the environment which interacts with that system, which are valued by the community or other stake holders"

Catchment values were developed through consultation with Council, Government agencies and the community. These values were established by the consultation process with questionnaires being completed by the Environment Liaison Committee and members of the general public. Questionnaires were designed to enable priorities to be assigned to values thereby enabling Council to determine high, medium and low priority values.
A copy of the questionnaire appears at Attachment 2.

Catchment values can be:

- Ecological
- Social
- Economic

Values that were identified for the SWMP are explained below:

Ecological Values

Habitat for Birds, Fish & Animals – The plants and water that native species rely upon to provide food and shelter.

Water Quality – Characteristics of water that indicate its suitability to support life. Such things as the amount of soil particles, types of chemicals and greases as well as bacterial levels all have an effect on the water's ability to support life in a natural system such as Trigalong Creek.

Social Values

Fishing – The use of Waterways for the purpose of recreational fishing.

Aesthetics – What the waterway looks like, ie is it natural looking and visually pleasing? Is there litter?

Tourism – The attraction provided by Waterways to tourists and passer-by.
This may include attractive natural environment and fishing as mentioned elsewhere.

Downstream Users – Property owners and members of the public who use the water for such purposes as irrigation, stock watering, recreational fishing and swimming

Swimming – Recreational activity where the body is immersed or in direct contact with the water.

Economic Values

Water Use – Extraction of water from waterway for the purpose of irrigation, watering livestock, domestic or other purposes.

Property Values – The additional sale value of a property because of its proximity to a watercourse.

Stormwater Re-Use – The collection and storage of stormwater for use in irrigation or Industrial applications.

5.2 PRIORITISATION OF CATCHMENT VALUES

The priorities for catchment values were developed from the Community Questionnaire and are as set out in the following table;

Table 4: Prioritisation of Catchment Values

VALUE TYPE	VALUE	PRIORITY
Ecological	Habitat for birds, fish and animals	**High**
	Water quality of receiving waters	**High**
Social	Fishing	**High**
	Aesthetics	**Medium**
	Tourism	**Medium/Low**
	Downstream users	**Medium**
	Swimming	**Low**
	Water use	**Very Low**
Economic	Property values	**Medium/Low**
	Aquaculture	**Medium/Low**
	Stormwater re-use	**Low**

6 STORMWATER MANAGEMENT OBJECTIVES

6.1 STORMWATER MANAGEMENT OBJECTIVES

The stormwater management objectives have been developed to protect the desired catchment values, as described in Section 5. These objectives need to incorporate both long term and short term (within 3-5 years) actions. The long term objectives are commitments in principle to a "vision" for the catchment.

Stormwater management objectives, for the purpose of the SWMP, have been defined to mean:

"*Temora Shire's aim in the management of stormwater is to protect the identified waterway and catchment values and where possible or necessary, achieve these values*"

6.2 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

It is important the stormwater management objectives be based on the principles of ecologically sustainable development (ESD). This requires the integration of environmental and economic considerations in decision making. Key principles of ESD, as outlined in the Draft Managing Urban Stormwater Council Handbook (NSW EPA 1997), and in the manner in which this SWMP addresses these objectives are listed below:

The precautionary principle – if there are threats of serious irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

This SWMP advocates the development of guidelines promoting the use of appropriate and strict water quality controls prior to any development or maintenance activities being undertaken. These guidelines will be updated regularly as more information becomes available. The use of best management practice measures will prevent and mitigate further environmental degradation.

Inter-generational equity – the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The stormwater management objectives in this SWMP aim to mitigate the impacts of stormwater discharges on the environment to ensure that the environment is maintained or enhanced for future generations.

Conservation of biological diversity and ecological integrity - This SWMP aims to put in place appropriate actions to mitigate the impacts of stormwater discharges on biological diversity and ecological integrity within both bushland, riparian and aquatic environments.

Table 5: Stormwater Management Objectives

Waterway Values	Stormwater Management Objectives	
	Long Term	Short Term
Ecological Values		
Habitat for birds, fish and animals	• Establish wetland or other nutrient reducing system immediately north of Temora Township and before flows reach lake Centenary	1. Educate land owners on benefits of native vegetation 2. Educate local community on water quality 3. Seek grant funds for establishment of wetland or other nutrient reducing system
Water quality of Trigalong Creek and other receiving waters	• Raise community awareness of their role in improving water quality • Improve quality of water leaving Temora township and the villages of Ariah park and Springdale • Improve quality of water leaving Lake Centenary	4. Audit all commercial premises to identify potential pollution problems 5. Introduce site controls for new development work 6. Educate council staff in use of site controls for construction work 7. Carry out baseline monitoring of water quality
Social Values		
Fishing	• Improve recreational access to Trigalong Creek for fishing activities	
Aesthetics	• Improve visual amenity of low lying land north of Temora • Reduce gross pollutants reaching and leaving towns and villages	8. Install gross pollutant traps in Temora Township (GPT)
Downstream users	• Ensure no reduction in water quality as a result of township and village discharges	9. As per objective 2 10. As per objective 4 11. As per objective 5 12. As per objective 8
Economic Values		
Nil		

6.3 PRIORITISATION OF STORMWATER MANAGEMENT OBJECTIVES

Objectives for each of the high and medium priority values are described in the table above. Objectives have only been developed for high and medium priority values to ensure that resources are initially allocated to these values. The objectives listed are given as outcomes. Specifics on how the objectives will be achieved are outlined in Section 8 entitled Potential Stormwater Management Options.

6.4 STORMWATER MANAGEMENT OBJECTIVES FOR NEW DEVELOPMENT

Stormwater management objectives for new development aim to define those stormwater outcomes which Council and/or developers will seek to achieve in the development or redevelopment of land. The purpose of prescribing such objectives is to minimise the impact of new development (including redevelopment) upon receiving waterways.

These objectives aim to capture the greater stormwater management opportunities that can be incorporated into new development, compared to those able to be cost- effectively retrofitted to existing urban areas. These objectives will provide guidance to both Council officers and development proponents in the management of stormwater from new developments.

Historically, stormwater runoff within Temora Township, Ariah Park and Springdale has been managed solely to minimise the impact of flooding on developed areas. This emphasis has led to the construction of engineered drainage systems designed to drain stormwater from urban areas as quickly and efficiently as possible.

As a result of the development of this SWMP, it is Council's intention to find a balance between efficient drainage and improvement in water quality.

Council recognises the potential for stormwater pollution during the construction phase of development. Stormwater management objectives are therefore to be adopted for both the construction-phase and post-construction phase of new development.

For each of these phases of development, stormwater management objectives will include qualitative management principles or objectives that will be adopted to mitigate potential impacts to the environment. . Quantitative objectives are costly and time consuming to measure and so the focus in this plan is on qualitative objectives.
In addition, it is useful to consider stormwater management objectives for new development at the scale of individual lots, subdivisions and sub-catchments.

A simple checklist will be provided to developers with approvals to assist them with ensuring these measures are implemented. This checklist will also be useful to Council staff in enforcing such measures.

7 STORMWATER MANAGEMENT ISSUES

7.1 IDENTIFIED STORMWATER MANAGEMENT ISSUES

The NSW EPA have defined stormwater management issues to be:

"those factors that currently prevent, or may prevent, stormwater management objectives from being satisfied"

These issues may be:

- Environmental
- Social
- Managerial

Stormwater issues associated with the Temora catchment were identified through discussions with Council officers, Councillors, DLWC staff and stakeholders.

The issues identified are listed below and linked with the high and medium priority values from section 5.2 – table 3 and short term objectives from section 6.2 – table 4.

Table 6: Identified Stormwater Management Issues

Short Term Stormwater Management Objectives	General Issues	"Hot Spots" and Possible Causes
Educate land owners on benefits of diverse species of native vegetation	Large areas of cleared land and therefore lack of biodiversity in watercourses Watercourses traverses private land outside of council control	Temora - Low lying land from convergence point of eastern and western drains to proposed wetland site lacking in biodiversity Low lying land from proposed wetland site to Lake Centenary lacking in biodiversity
Educate local community on water quality	Lack of knowledge through general community Need to empower community to take individual action for the common good	Farming land to north of Temora Township may be over fertilised contributing to increased nutrient levels Urban gardeners may be over applying fertilisers contributing to increased nutrients levels Horse and dog owners unaware of compounding effects of faeces on water quality Commercial and industrial premises owners may be unaware of poor housekeeping practices that compromise water quality

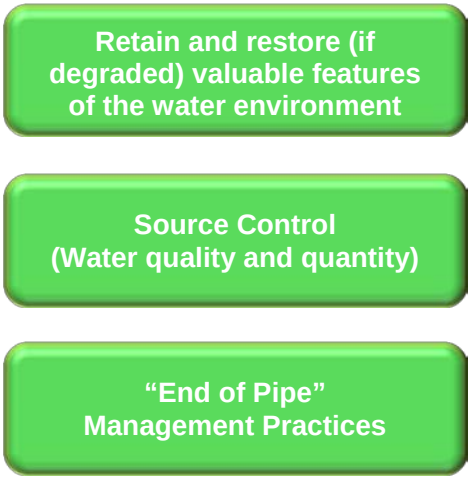
Short Term Stormwater Management Objectives	General Issues	"Hot Spots" and Possible Causes
Seek grant funds for establishment of wetland or other nutrient reducing system	Urban areas typically discharge high nutrient storm water Limited council resources	Horse, dog and other pet faeces contribute to nutrient increases Urban gardeners top dressing lawns increase nutrient levels in run off Effluent run off from public recreation areas has the potential to increase nutrient levels in storm water
Audit all commercial premises to identify potential pollution problems	Many commercial and industrial premises are known to have wash-down areas that discharge direct to the stormwater system Petrol stations wash down driveways direct to kerb and gutter Potential for undesirable waste disposal practises and accidents on premises likely to store chemicals, oils and/or greases	Commercial and industrial areas Council depot and storage areas
Introduce site controls for new development work	Suspended solids entering stormwater system from construction activity Opportunity for long term improvement can be achieved through the development approval process	New subdivisions Council roadwork – new roadside vegetation plans being developed
Educate council staff in use of site controls for construction work	Lack of knowledge through Councils organisation in the area of environmental controls Council need to be seen to be carrying out good practise in the environmental area to gain public support	Road construction gangs
Carry out baseline monitoring of water quality	Little or no water quality information Little comparisons of actual water quality between township, proposed nutrient reduction area, Lake Centenary and Trigalong Creek	Litter and gross pollutants need to be collected prior to or at potential nutrient reduction area

Short Term Stormwater Management Objectives	General Issues	"Hot Spots" and Possible Causes
Ensure no airborne vectors originate in nutrient reduction area that will negatively impact on human health	Ponding water provides a potential breeding site for vectors of disease Problem balancing need for retention times for water quality improvement and associated breeding problems in slow moving water	Potential nutrient reduction area could breed mosquitoes
Install gross pollutant traps within the eastern & western drains	Gross pollutants destroy visual amenity Gross pollutants have the potential to reduce water quality	Potential nutrient reduction area littered with gross pollutants
Existing stormwater system is deficient in a number of areas and non-existent in others	Limited council resources Gross pollutants destroy visual amenity	Progressively install new or upgrade existing stormwater infrastructure

8 STORMWATER MANAGEMENT ISSUES

8.1 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.



Stormwater Management Hierarchy (NSW EPA)

8.2 OPTIONS SELECTION

A variety of options are available for addressing the stormwater management issues identified in Section 7.

These options fall into to two general categories:

- non-structural: and
- structural.

8.2.1 NON-STRUCTUAL OPTIONS

Potential non-structural options include:

- Educational measures (school 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

8.2.2 STRUCTUAL 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 issues some of these include:

- litter traps (litter baskets, litter booms, nets, gross pollutant traps)
- sediment traps
- constructed stormwater wetlands or nutrient reduction areas
- bank stabilization (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 7.

This options list was developed by council officers in consultation with key stakeholders and focuses on source control wherever possible.

Table 7: Stormwater Management Options

“Hot Spots” and Possible Causes	Options
Low lying land from convergence point of eastern and western drains to proposed nutrient reduction area lacking in biodiversity	**1.** Undertake a community campaign aimed at increasing the awareness of rural landholders on the benefits associated with diverse native vegetation
Low lying land from proposed nutrient reduction area to Lake Centenary lacking in biodiversity	See option 1
Farming land to north of Temora Township may be over fertilised contributing to increased nutrient levels	**2.** Undertake a community campaign aimed at increasing urban and rural residents awareness of the effects of increased nutrient levels through over application of fertilisers compound effects of animal faeces and gross pollutant problems **3.** Install nutrient reduction area to intercept nutrients
Urban gardeners may be over applying fertilisers contributing to increased nutrients levels	See option 2 See option 3
Horse and dog owners unaware of compounding effects of faeces on water quality	See option 2

"Hot Spots" and Possible Causes	Options
Commercial and industrial premises owners may be unaware of poor housekeeping practices that compromise water quality	**4.** Undertake industrial auditing programs in conjunction with industry awareness programs
Horse, dog and other pet faeces contribute to nutrient increases	See option 2
Urban gardeners top dressing lawns increase nutrient levels in run off	See option 2
Effluent run off from public recreation areas has the potential to increase nutrient levels in storm water	**5.** Educate council staff responsible for irrigating effluent to ensure over irrigation does not occur **6.** Introduce training into induction program for all employees **7.** Install electronic devices to automatically irrigate **8.** Remove nutrients at Temora Sewerage Treatment Plant
Horse keeping areas	See option 2
Commercial and industrial areas	See option 4
Council depot and storage areas	**9.** Educate council staff about potential activities that may compromise water quality See option 6
New subdivisions	**10.** Incorporate sediment control plans into development control plans for new subdivisions and existing subdivisions **11.** Introduce standard conditions of approval for new development requiring site controls
Council roadwork	See option 6 and 9
Road construction gangs	See option 6 and 9
Litter and gross pollutants collect at potential nutrient reduction area	**12.** Install gross pollutant trap within the Western Drain See option 2

"Hot Spots" and Possible Causes	Options
Potential nutrient reduction area could breed mosquitoes	**13.** Chemically treat nutrient reduction area on a regular basis **14.** Stock nutrient reduction area with appropriate fish species **15.** Educate general public about measures to minimise mosquito exposure
Potential nutrient reduction area littered with gross pollutants	See option 2 and 12
Lack of baseline information about water quality exiting town and ultimately entering Trigalong Creek	**16.** Carry out monitoring of water quality at nominated points on a regular annual basis.
Progressively install new or upgrade existing stormwater infrastructure	**17.** Install new or upgrade existing stormwater infrastructure at identified locations within the Township and villages.

9 EVALUATION OF POTETIAL MANAGEMENT OPTIONS

9.1 METHODOLOGY OVERVIEW

Each of the stormwater management options has been ranked by taking into consideration the costs and benefits associated with each option.

9.2 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.

9.2.1 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 below.

Table 8: Cost Index

Capital Cost		Annual Operation and Maintenance	
Estimated Cost ($)	Score	Estimated Cost ($)	Score
<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**

9.2.2 BENEFITS

The scores assigned to each benefit category used in the evaluation process are defined below and summarized in the following table (Table 8):

Target Pollutant: This is the pollutant most likely to be targeted/reduced by implementation of the option.

The following target pollutants were selected:

- Toxicants
- Heavy metals
- Oil & grease
- Bacteria
- Nutrients
- Organic Matter
- Sediments
- Litter

Each target pollutant was assigned a score between 1 and 9, reflecting the extent to which the pollutant is perceived to be a problem within the catchment.

Relative Pollutant Harm: This is the potential harm of the target pollutant in urban stormwater on water quality and ecosystem health. The target pollutants listed above were given a score between 1 and 9 to reflect the relative potential harm in urban stormwater on water quality and ecosystem health.

Number of Pollutants: This category reflects the number of pollutants that are reduced/targeted by implementation of the option.

Relative Effectiveness of Option: This is the effectiveness of the option in addressing the target pollutant in that particular location or area. Options have been given a qualitative rating of low, medium or high depending on their effectiveness.

% Urban Area: A score from 1 to 10 is assigned to the percentage of the total area treated by the option.
The greater the percentage urban area, the higher the score.

Table 9: Target Pollutant – Score Distribution

Target Pollutant	Score	Relative Harm	Score	No. Pollutants	Score	Effectiveness of Option	Score	Urban Area %	Score
Toxicants	3	Litter	4	1	1	Low	1	<10	1
Heavy Metals	4	Organic Matter	4	2	2		2	11-20	2
Oil & Grease	5	Nutrients	4	3	3		3	21-30	3
Bacteria	6	Sediments	4	4	4		4	31-40	4
Nutrients	7	Bacteria	5	5	5	Medium	5	41-50	5
Organic Matter	7	Oil & Grease	6	6	6		6	51-60	6
Sediments	8	Heavy Metals	7	7	7		7	61-70	7
Litter	8	Toxicants	8	8	8		8	71-80	8
All	9	All	9				9	81-90	9
						High	10	91-100	10

Table 10: Cost-Benefit for Stormwater Management Options

Option No.	Option Description	Capital Cost	Ongoing Cost	Target Pollutant	No. Pollutants	Effectiveness of Option	% Urban Area
1	Undertake a community campaign aimed at increasing the awareness of rural landholders on the benefits associated with diverse native vegetation	$1,500	$1,000	Nutrients	3	Medium	Nil
2	Undertake a community campaign aimed at increasing urban and rural residents awareness of the effects of increased nutrient levels through over application of fertilisers compound effects of animal faeces and gross pollutant problems	$1,500	$1,000	All	8	High	100
3	Install nutrient reduction area to intercept nutrients	$200,000	$1,000	All	8	High	100
4	Undertake industrial auditing program in conjunction with industry awareness program	$5,000	$500	Toxicants	5	High	20

Option No.	Option Description	Capital Cost	Ongoing Cost	Target Pollutant	No. Pollutants	Effectiveness of Option	% Urban Area
5	Educate council staff responsible for irrigating effluent to ensure over irrigation does not occur	$500	$200	Nutrients	2	Medium	10
6	Introduce training into induction program for all employees	$500	$200	All	8	High	100
7	Install electronic devices to automatically irrigate	$50,000	$1,000	Nutrients	1	High	10
8	Remove nutrients at Temora Sewage Treatment Plant	$1,500,000	$15,000	Nutrients	1	High	10
9	Educate council staff about potential activities that may compromise water quality	$500	$200	All	8	High	100
10	Incorporate sediment control plans into development control plans for new subdivisions and existing subdivisions	$1,500	$500	Sediment	3	High	5
11	Introduce standard conditions of approval for new development requiring site controls	$1,500	$500	Sediment	3	High	5
12	Install gross pollutant trap within the western drain	$70,000	$1,500	Litter	1	High	100
13	Chemically treat nutrient reduction area on a regular basis	$300	$300	Vectors	1	Low	5
14	Stock nutrient reduction area with appropriate fish species	$400	$150	Vectors	1	Medium	5
15	Educate general public about measures to minimise mosquito exposure	$1,500	$500	Vectors	1	High	100
16	Carry out monitoring of water quality at nominated points on a regular annual basis	$1,500	$1,500	All	8	High	100
17	Install new or upgrade existing stormwater infrastructure at identified locations within the Township and villages.	$75,000	$1,000	Sediment	4	High	10

Table 11: Ranking of Stormwater Management Options

Option Rank	Option No.	Option Description	Cost Benefit Ratio
1.	2	Undertake a community campaign aimed at increasing urban and rural residents awareness of the effects of increased nutrient levels through over application of fertilisers compound effects of animal faeces and gross pollutant problems	**9.2**
2.	16	Carry out monitoring of water quality at nominated points on a regular annual basis	**9.2**
3.	6	Introduce training into induction program for all employees	**8.8**
4.	9	Educate council staff about potential activities that may compromise water quality	**8.8**
5.	10	Incorporate sediment control plans into development control plans for new subdivisions and existing subdivisions	**5.2**
6.	11	Introduce standard conditions of approval for new development requiring site controls	**5.2**
7.	15	Educate general public about measures to minimise mosquito exposure	**5.2**
8.	12	Install gross pollutant trap within the western drain	**4.4**
9.	1	Undertake a community campaign aimed at increasing the awareness of rural landholders on the benefits associated with diverse native vegetation	**4**
10.	5	Educate council staff responsible for irrigating effluent to ensure over irrigation does not occur	**3.8**
11.	4	Undertake industrial auditing program in conjunction with industry awareness program	**3.6**
12.	3	Install nutrient reduction area to intercept nutrients	**2.93**
13.	14	Stock nutrient reduction area with appropriate fish species	**2.6**
14.	17	Install new or upgrade existing stormwater infrastructure at identified locations within the Township and villages.	**2.38**
15.	13	Chemically treat nutrient reduction area on a regular basis	**2.2**
16.	7	Install electronic devices to automatically irrigate	**1.76**
17.	8	Remove nutrients at Temora Sewage Treatment Plant	**.73**

10 IMPLEMENTATION STRATEGIES

10.1 CURRENT/SHORT TERM OPTIONS

To ensure that the high priority stormwater management options identified in Section 9 are implemented, an implementation strategy has been developed for Council.
The Implementation Strategy will be used over the next 2 - 3 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:

2015 - 2016 Options:
These are the options that Council anticipates that it will commence in this financial year. Some of these options are currently being undertaken or have been budgeted for as part of Council's works program

2016 - 2017 Options:
These are the options that may commence within the 2016-2017 financial year. These options will be reviewed as part of the SWMP review and will be included as part of Council's Work Program if funding is allocated for their implementation

10.2 PERIODIC/ONGOING OPTIONS

These are the options that may be implemented on either an ongoing basis or on a needs basis. These options can be implemented should the need arise or it is considered that a previously run awareness campaign may need to be reactivated or revised.

10.3 FUTURE OPTIONS

These are the options that may potentially commence within the 2017 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 SWMP review process.

Council's implementation strategy is given in the Table 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 expected to commence

Option Rank: This is the priority assigned to the option as part of the ranking process, as per Section 9. 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

10.4 NUTRIENT REDUCTION AREA PRIOR TO LAKE CENTENARY

During the formulation of this review of the SWMP a number of discussions were held concerning the provision of a nutrient reduction area or series of devices between the Temora Township and Lake Centenary.
From the limited water quality data that is available it appears that the natural vegetation existing in the water course from the township to the lake is acting as a natural nutrient reduction device which in turn has raised the question as to the necessity to install additional devices.

As a short term strategy it is proposed that a rigorous water quality program be implemented over the next three year period to establish a data base of results which will enable Council to establish the necessity of installing nutrient reduction devices within the water course. Testing should be undertaken during this period every time there is a significant rainfall event which results in overland flow reaching Lake Centenary.

Once sufficient data has been obtained to allow a more accurate assessment of the quality of the current overland flows which are reaching the lake a decision can then be made as to the need for additional filtration works within the water course. These measures may include.

- Do nothing – leave the existing watercourse as it is and maintain it in a workable condition
- Upgrade the side banks of the existing watercourse to prevent water spilling onto productive agricultural land – this option would see the base of the watercourse remain as it is thus acting as a water filtering device
- Install a wetland area at some location between the northern edge of the township and the lake
- Upgrade the area around the existing sedimentation pond adjacent to the lake to a nutrient reduction area via either converting it to a wetland or by the provision of some form of “floating wetlands” to reduce nutrients.

10.5 LINKING THE SWMP TO COUNCIL'S PLANNING PROCESS

The link between the SWMP and other Council plans and policies is shown in the figure below. The SWMP will form one of the strategies that are part of Council's overall Management Plan. The actions in the SWMP will be incorporated into the Works Program with the Director Engineering Services being responsible for this.
Actions in relation to regulatory services will be incorporated into the budget for the Director of Environmental Services.
The various responsible officers are clearly indicated in the Implementation

Budgets are reviewed annually, as is the works Program. The SWMP will be reviewed every 3 years and be used to supply input into Councils Integrated Planning & Reporting Framework.

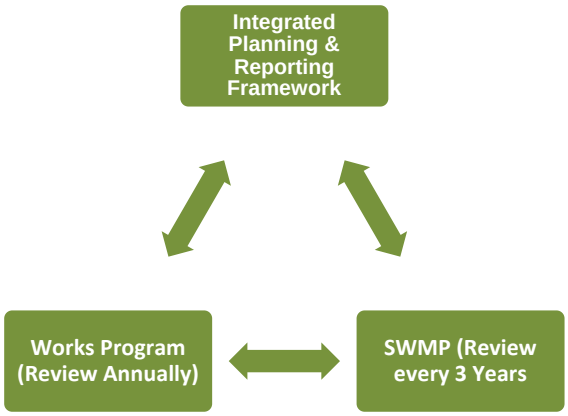


Table 12: Implementation Strategy – Current/Short-term Options

Option Rank	Option No.	Option Description	Responsible Officer	% Contribution by Council	Capital Cost $	Ongoing Cost $	Budget Year
2.	16	Carry out monitoring of water quality at nominated points on a regular basis (at least annually)	ENV SERVICES	100	$1,500	$1,500	Annually
14.	17	Install new or upgrade existing stormwater infrastructure at identified locations within the Temora Township and villages. *Identified Options* **Tenefts Street** **Temora Stormwater Infrastructure Rehabilitation**	DES	100	$140,000	$2,000	2015/2016
14.	17	Install new or upgrade existing stormwater infrastructure at identified locations within the Township and villages. *Identified Options* **Delavan Street** **Golden Gate Reserve – Detention Basin**	DES	100	$75,000	$2,000	2016/2017

Table 13: Implementation Strategy – Periodic/Ongoing Options

Option Rank	Option No.	Option Description	Responsible Officer	% Contribution by Council	Capital Cost $	Ongoing Cost $	Budget Year
1.	2	Undertake a community campaign aimed at increasing urban and rural residents awareness of the effects of increased nutrient levels through over application of fertilisers compound effects of animal faeces and gross pollutant problems	ENV SERVICES	100	$1,500	$1,000	As required
3.	6	Introduce training into induction program for all employees	DES	100	$500	$200	As required
4.	9	Educate council staff about potential activities that may compromise water quality	DES	100	$500	$200	As required
5.	10	Incorporate sediment control plans into development control plans for new subdivisions and existing subdivisions	ENV SERVICES	100	$1,500	$500	As required
6.	11	Introduce standard conditions of approval for new development requiring site controls	ENV SERVICES	100	$1,500	$500	As required
8.	1	Undertake a community campaign aimed at increasing the awareness of rural landholders on the benefits associated with diverse native vegetation	ENV SERVICES	100	$1,500	$1,000	As required
9.	5	Educate council staff responsible for irrigating effluent to ensure over irrigation does not occur	DES	100	$500	$200	As required
10.	4	Undertake industrial auditing program in conjunction with industry awareness program	ENV SERVICES	100	$5,000	$500	As required
12.	15	Educate general public about measures to minimise mosquito exposure	ENV SERVICES	100	$1,500	$500	As required

Table 14: Implementation Strategy – Future Options

Option Rank	Option No.	Option Description	Responsible Officer	% Contribution by Council	Capital Cost $	Ongoing Cost $	Budget Year
2.	16	Carry out monitoring of water quality at nominated points on a regular annual basis	ENV SERVICES	100	$1,500	$1,500	Annually
14.	17	Install new or upgrade existing stormwater infrastructure at identified locations within the Township and villages. *Identified Options* **Austral Street underground drainage –DeBoos to Aurora – 135m** **Western Drain Upgrade – Crowley to intersection of Polaris and Baker Streets** **Sharpe Street**	DES	100	$75,000	$2,000	Annually
7.	12	Install gross pollutant trap within the western drain	DES	100	$70,000	$3,500	
11.	3	Install nutrient reduction area to intercept nutrients prior to flows entering Lake Centenary (refer to section 10.4 for a possible strategy for this option)	DES	50	$250,000	$1,000	

11 MONITORING AND REPORTING PLAN IMPLEMENTATION AND EFFECTIVENESS

11.1 MANAGEMENT FRAMEWORK FOR PLAN IMPLEMENTATION

Overall responsibility for implementation of the SWMP rests with the Director Engineering Services with input and some actions being carried out by the Director of Environmental Services.
These officers, with the General Manager, will meet annually basis to review progress on the implementation of the plan.
Following these meetings, a brief report will be presented to Council outlining progress in relation to time frames and budget – such report to coincide with the annual budgeting time cycle.

11.2 MONITORING

Monitoring is an essential part of the SWMP and is aimed at:

- assessing the degree of Plan implementation;
- assessing the effectiveness of the Plan in meeting the objectives; and
- providing for improvement of the Plan.

Monitoring can be achieved through:

- observation
- water quality monitoring
- biological monitoring; and
- recording progress of plan implementation against documented objectives and actions.

As previously stated, water quality monitoring will occur annually (providing flows occur at designated sampling points) and SWMP progress review will occur annually. Observations will be ongoing since staff are in the field almost daily. All council staff and members of the general public will be encouraged to report immediately, any activities that compromise the objectives of the SWMP.

Observation Monitoring

Specific observation monitoring will include records of type and volume of litter collected in gross pollutant traps. These records will indicate any changes in trends with respect to pollution.

Water Quality Monitoring

Baseline data on the quality of water downstream of Temora Township will be obtained. Similar data will be obtained for the quality of water exiting the Temora stormwater system (prior to discharge to the Trigalong Creek).
Regular annual measurements will then be taken to compare original baseline data with ongoing water quality. In this way changes can be monitored and SWMP effectiveness assessed. The sampling will occur at least annually following a suitable rain event.

If sampling indicates a shift in strategy is needed and a subsequent shift or increase in resources, this can be effected during the budget deliberations.

The water quality data to be collected will include:

- Total Nitrogen;
- Total Phosphorous
- Turbidity
- Electroconductivity
- Dissolved Oxygen
- Faecal Coliforms.

This data will be collected annually, following a suitable rain event, at the following locations:

- Convergence of east and west drains
- Proposed nutrient reduction area at inlet to Lake Centenary
- Lake Centenary adjoining outlet
- Trigalong Creek upstream of Lake Centenary
- Trigalong Creek downstream of Lake Centenary.
- Aerodrome discharge to Trigalong Creek

Sampling will necessarily occur during or immediately after rainfall events.
Specific staff will be given the responsibility of carrying out this work.
Depending on the results obtained, resources and priorities can be reallocated to achieve the best outcomes

Biological Monitoring

Biological monitoring is useful for the direct assessment of ecosystem health and diversity and involves the collection and testing of marine and freshwater biota from the waterways. This type of monitoring can be expensive and often changes are only apparent over a longer time frame.
Biological monitoring should therefore be used as a longer term approach to monitoring changes in ecosystem diversity, health & resilience.

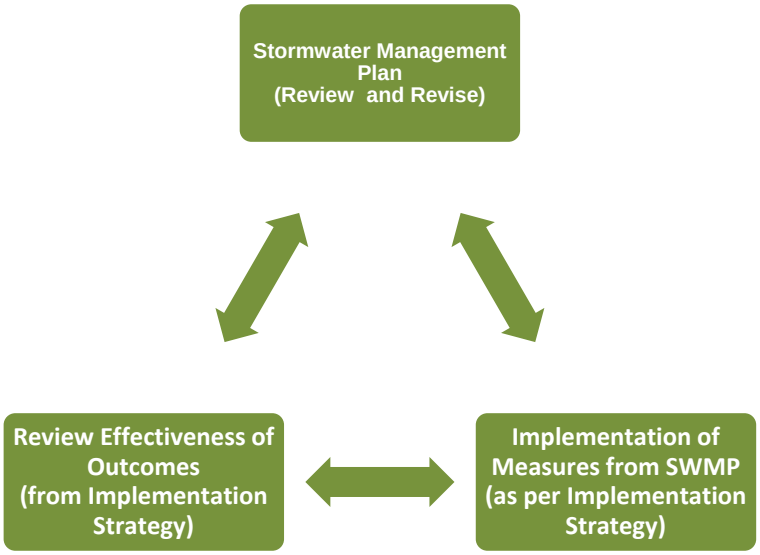
11.3 REPORTING

Progress with regard to the implementation of the SWMP actions is to be reported in Council's State of the Environment Report.
In particular, results of monitoring programs, installations as a result of Councils Works Program, outcomes of environmental studies, changes in council work practises and the effectiveness of pollution control devices will be highlighted.

As previously mentioned, Councils General Manager, Director Engineering Services and Director of Environmental Services, will meet on a regular basis (at least annually) to review SWMP implementation.
As a result of this meeting, a report will be provided to Council summarising the effectiveness thus far of the SWMP.

12 UPDATING THE PLAN

Stormwater management is a long term program that requires a process of continuous improvement. Preparation of this plan is only the first stage in the process. The diagram below illustrates the stormwater management cycle



The cycle shows how, after preparation of the SWMP, the measures are implemented as per the Implementation Strategy. The outcomes of the actions are then monitored and reviewed. This review process is used to update and revise the SWMP. The process continues as a cycle.

12.1 REVISION OF THE SWMP

Revision of the SWMP is to be undertaken in two ways:

1. Revision of Actions forming the basis of the Implementation Strategy
2. Revision of the SWMP document itself

Revision of Actions

The actions listed in the Implementation Strategy form the basis of the Council's stormwater works programme and ensures that stormwater related issues are carried out in a logical and prioritised sequence.
The Implementation Strategy also provides Council and staff with a convenient, consolidated list enabling the order of events and their costs to be viewed at a glance.

The order and type of actions may change as time goes on. This will occur because of changing information and knowledge or because of issues arising that were not previously obvious or present.

The actions will be reviewed as part of Council's budgetary process. This will occur annually. The review process will include a summary of works carried out to date, re assessment of priority, a discussion of the effectiveness of each action carried out or proposed and a review of any actions that may be deleted from the existing list or included for future implementation.

This review will include a summary of data collected including observations and water quality information.

Revision of Document

It is important that the SWMP document be reviewed and revised regularly. This is to ensure that it remains consistent with the community and Council's objectives and values.

The plan will be reviewed on a three yearly cycle in March when it will coincide with the annual budgetary review. This review will include consideration of the following:

- Results from any water quality monitoring programmes and environmental studies
- the effectiveness of each action implemented thus far
- whether objectives have been satisfied
- any additional objectives that are required or existing objectives that are no longer relevant
- any additional issues that need to be addressed or existing issues that are no longer relevant
- any other internal management issues or reassignment of responsibilities that need to occur.

13 CONCLUSION

Temora Shire Council has committed a significant amount of time and resources to producing this management plan. Consultation with the community and other agencies has been carried out to ensure, as much as possible, a document that reflects the needs of the community and the ability of Council to achieve its implementation. Additionally, it is hoped that this process of consultation results in the support of those people involved and their commitment to the objectives contained within it.

The essence of this document is the Implementation Strategy. It is this table that sets out Councils commitment in terms of resources, proposed time frames and who, on Council's staff, is responsible for each action.

While Council has produced this document and takes responsibility for its implementation, it is the community who benefit in the long term. With the assistance and support of the people of Temora, a true improvement in the quality of our environment can be effected.

14 BIBLIOGRAPHY

This bibliography is reproduced from the original SWMP

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Discussions with Jim Salmon, Catchment Manager, Temora, Department Land & Water Conservation, July 2001

Discussions with Michelle Perry, Conservation Manager, NSW Fisheries, August 2001.

Discussions with Dave Schlunke, local naturalist, August 2001.

Appendices

APPENDIX A STATUS OF IDENTIFIED OPTIONS

Option Rank	Option No.	Option Description	Cost Benefit Ratio	When Identified	Current Status
1.	2	Undertake a community campaign aimed at increasing urban and rural residents awareness of the effects of increased nutrient levels through over application of fertilisers compound effects of animal faeces and gross pollutant problems	9.2	Original SWMP	**Completed - Now Ongoing as required**
2.	16	Carry out monitoring of water quality at nominated points on a regular annual basis	9.2	Original SWMP	**Ongoing - To be undertaken annually**
3.	6	Introduce training into induction program for all employees	8.8	Original SWMP	**Completed - Now Ongoing as required**
4.	9	Educate council staff about potential activities that may compromise water quality	8.8	Original SWMP	**Completed - Now Ongoing as required**
5.	10	Incorporate sediment control plans into development control plans for new subdivisions and existing subdivisions	5.2	Original SWMP	**Completed - Now Ongoing as required**
6.	11	Introduce standard conditions of approval for new development requiring site controls	5.2	Original SWMP	**Completed - Now Ongoing as required**
7.	15	Educate general public about measures to minimise mosquito exposure	5.2	Original SWMP	**Completed - Now Ongoing as required**
8.	12	Install gross pollutant traps within the eastern and western drains	4.4	Original SWMP	**Pollutant trap installed in Eastern drain – Western trap still to be installed**
9.	1	Undertake a community campaign aimed at increasing the awareness of rural landholders on the benefits associated with diverse native vegetation	4	Original SWMP	**Completed - Now Ongoing as required**

Option Rank	Option No.	Option Description	Cost Benefit Ratio	When Identified	Current Status
10.	5	Educate council staff responsible for irrigating effluent to ensure over irrigation does not occur	3.8	Original SWMP	**Completed - Now Ongoing as required**
11.	4	Undertake industrial auditing program in conjunction with industry awareness program	3.6	Original SWMP	**Completed - Now Ongoing as required**
12.	3	Install nutrient reduction area to intercept nutrients	2.93	Original SWMP	**Included in future options**
13.	14	Stock nutrient reduction area with appropriate fish species	2.6	Original SWMP	**May no longer be required**
14.	17	Install new or upgrade existing stormwater infrastructure at identified locations within the Township and villages.	2.38	Current Revision	**Ongoing as budget permits**
15.	13	Chemically treat nutrient reduction area on a regular basis	2.2	Original SWMP	**May no longer be required**
16.	7	Install electronic devices to automatically irrigate	1.76	Original SWMP	**Completed**
17.	8	Remove nutrients at Temora Sewage Treatment Plant	.73	Original SWMP	**Completed**