Shepparton Irrigation Region Catchment Implementation Strategy

Surface Water Management Program

Five Year Review

2006/2007

Volume I - Final Report

GOULBURN BROKEN
CATCHMENT MANAGEMENT AUTHORITY

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Abbreviations

ARI	Average Recurrence Interval
CAOP	Catchment and Asset Operation Plan
CMA	Catchment Management Authority
CSDCC	Community Surface Drainage Co-ordinating Committee
CSWMP	Community Surface Water Management Program
CSWMS	Community Surface Water Management System
DCD	Drainage Course Declaration
DESM	Drainage Evaluation Spreadsheet Model
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
EPA	Environment Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
GBCMA	Goulburn Broken Catchment Management Authority
GBWQS	Goulburn Broken Water Quality Strategy
G-MW	Goulburn-Murray Water
HVEF	High Value Environmental Feature
IDMOU	Irrigation Drainage Memorandum of Understanding
MER	Monitoring, Evaluation and Reporting
MDBC	Murray Darling Basin Commission
NVR	Native Vegetation Retention
PSWMP	Primary Surface Water Management Program
PSWMS	Primary Surface Water Management System
RCS	Regional Catchment Strategy
SEPP	State Environment Protection Policy
SIR	Shepparton Irrigation Region
SIRCIS	Shepparton Irrigation Region Catchment Implementation Strategy
SIRIC	Shepparton Irrigation Region Implementation Committee

SIRLWMP	Shepparton Irrigation Region Land and Water Management Plan
SIRLWSMP	Shepparton Irrigation Region Land and Water Salinity Management Plan
SIRLWMS	Shepparton Irrigation Region Land and Water Management Strategy
SIRSWMS	Shepparton Irrigation Region Surface Water Management System
SIRTEC	Shepparton Irrigation Region Technical Support Committee
SMEC	Snowy Mountain Electricity Commission
SMP	Salinity Management Plan
SPPAC	Salinity Pilot Program Advisory Committee
SWMP	Surface Water Management Program
SWMS	Surface Water Management System
SWMWG	Surface Water Management Working Group

1. Executive Summary

1.1 Review context

A review of the Shepparton Irrigation Region (SIR) Surface Water Management Program (SWMP) has been carried out twice since the program began. The purpose of this review is to look at the achievements of the past 6 years (July 2000-June 2006) and to provide the necessary direction to ensure the current investment strategy is on track for completion over the next five year period (2006-2011). A more comprehensive review is scheduled to be completed in 2011.

This review focuses heavily on the nature and impacts of the changes in both water and natural resources management over the past decade. In addition, it provides an overview of the status of the whole program and where the impacts of various changes in management might influence future implementation.

1.2 Adaptation to a changing environment

The implementation of the SWMP has been influenced by a number of changes in water and natural resources management over the past six years. The changing nature of management within these sectors has required that program managers have had to work within and adapt to a significant number of new and revised initiatives. These were grouped into the following three general categories for further analysis:

- Policy and Strategy Influences – A total of 24 external policies and strategies were examined to identify the influence that they may have had on SWMP implementation. These were grouped to consider the impact of legislative changes at a State and Federal level, as well as local policy and strategies. The introduction of legislative change has generally been reflected in a more inclusive and comprehensive process for the design, approval and construction of Surface Water Management Systems (SWMS).
- External Influences – A list of 15 external influences, which have emerged over the past six years and have been recognised as having an indirect influence on the program, were identified through the Steering Committee. These issues may not necessarily be able to be fully controlled by SWMP managers, but their impacts have had to be considered and managed. This group includes issues such as deregulation, climate change, water trade and institutional change. These influences have manifested themselves in various ways, some positive and some negative.
- Proactive Management– This group of changes was developed to reflect the response by the SWMP managers as they adapt to the changes that they face. The key changes identified in this grouping include development of the Irrigation Drainage Memorandum of Understanding (IDMOU), participation in the Irrigation Futures program, the need to move towards national frameworks such as Monitoring, Evaluation and Reporting (MER), the move to develop management tools such as Catchment Asset and Operation Plans (CAOP) and revision of guidelines for design and construction to better reflect changes in policy.

Many of the initiatives within these groups of changes have had a significant influence on the direction of the SWMP over the past six years, and in turn will influence the future of the program. The recommendations from this review capture the necessary actions to address the effect of these changes.

1.3 Achievements 2000 – 2006

There have been considerable achievements over the past six years, with the majority of on-ground works being completed under the Primary Surface Water Management Program (PSWMP). The PSWMP has largely followed the program priorities developed in the original Surface Drainage Strategy. During the past six years, the PSWMP has constructed 63 km of SWMS. These SWMS provide direct drainage for 5,773 ha within the SIR. Further, this implementation work has provided the opportunity for approximately 14,381 ha

of Community Surface Water Management Systems (CSWMS) to proceed through provision of a suitable outfall.

The Community Surface Water Management Program (CSWMP) has seen 33.75 km of CSWMS constructed, directly serving 2,202 ha. A further 312km of CSWMS, servicing an area of around 27,795ha, were or are currently in the process of being surveyed and designed during the review period but have not yet been constructed. Construction has generally not commenced due to lack of community support which is required under the guidelines for developing these systems. The drought continues to render SWMS a low priority amongst landholder groups, so this situation is not expected to change until the drought breaks.

Program staff from Goulburn-Murray Water (G-MW), the Department of Primary Industries (DPI) and the Goulburn Borken Catchment Management Authority (GBCMA) have continued to work on a range of activities which are not always directly related to on-ground implementation works but are required to meet the changing management environment as discussed in Section 1.2. The key areas where achievements of the program are recognised include:

- Retrofitting and remodelling – Retrofitting of existing SWMS to current standards has focussed on Murray Valley Drain 13 through G-MW's Advanced Maintenance Program. This type of work is likely to gain greater importance in the future as the PSWMP implementation nears completion. Remodelling works were completed on the Deakin Main (9.7km) and Deakin 16 (7.4km) systems.
- Drainage diversion strategies – A policy for assessing and managing drainage diversion licensing was completed in 2000. Assessments of resource availability are now generally complete.
- Monitoring – Monitoring, review and reporting of data collected under this and other programs has been regularly undertaken during the review period.
- Metering – G-MW has employed a number of diversion inspectors to meter all low flow diversions.
- Government response to Nolan Review – The Government response to the Nolan review (Nolan ITU, Feb 2001) has led to a number of aspects of the program being modified or improved. The response confirms that the program is leading the way with respect to best practice in surface water management.
- Development and implementation of the IDMOU has been a lengthy process but represents an agreement between a number of partner organisations to address the potential negative impact of irrigation activities on downstream water bodies.
- Salinity audit – An audit of the downstream salinity impacts of both the surface water and the subsurface drainage programs was completed during the review period. This was a significant body of work undertaken in an attempt to improve the methodology for estimating the salinity impact of works.
- Murray Valley Drain 11 Planning Process – Significant time and effort was invested in preparation of a submission for the planning panel addressing concerns about downstream impacts of the proposed SWMS.
- Management interactions at program and cross-program levels have continued to be a strong focus in promoting partnerships and a cooperative approach within the region.

1.4 Performance 2000-2006

The performance of the SWMP from 2000–2006 has been assessed in line with the triple bottom line indicators - ***economic***, ***environmental*** and ***social***. This type of assessment has not been completed before and there will be aspects of the methodology that require additional work prior to the next review being undertaken. The nature of the assessments for this review is detailed as follows:

Economic performance indicators: A number of economic indicators have been used previously to assess the overall viability of the program, however the methodology for deriving these has not been consistent from one assessment to the next.

The preferred indicators include:

- present value of costs (including construction costs, operation and maintenance costs and downstream impacts);
- present value of benefits (including salinity, waterlogging, flooding, roads, reuse and land-use change); and
- benefit to cost ratio (Present Value benefits / Present Value costs).

Calculations indicate that the benefit to cost ratio for the overall program is currently 1.16:1, although further work is required in the coming year/s to develop a more appropriate methodology for assessing financial status of the program into the future.

Additional indicators that provide a more realistic view of actual progress relate to unit costs for implementation. As can be seen from the following indicators, the average cost of implementation has increased from the previous reviews:

- PSWMS - $200,000 per km (a 13% increase from $177,000 per km in 2000)
- CSWMS - $76,000 per km (a 12% increase from $ 68,000 per km in 2000)

Further increases in these costs are expected in line with inflation and as the more complex and therefore difficult to implement systems are tackled (ie most of the more cost effective components of the plan have already been implemented).

It is useful to note that inflation, as measured by the Consumer Price Index (CPI), has risen by around 21% between 1999/00 and 2005/06.

Environmental performance indicators: The Environmental Management Program (EMP) is being reviewed independently however the SWMP and the Environmental Management Program are closely linked. There has been considerable work undertaken by the EMP in direct support of the SWMP with respect to environmental performance. The focus has included works assessment for proposed construction activities, mapping of the areas of native vegetation (protection and enhancement), development of wetland health initiatives and working with the implementation team in integrating the environmental requirements into the design of new systems.

Specific wetlands addressed during the review period include Brays Swamp, Reedy Swamp, Mansfields Swamp and Kinnairds Wetland.

Mapping of native vegetation planting is now regularly undertaken as a part of the standard recording process, with the proportion attributed to the SWMP shown in Table 1.

- **Table 1 Vegetation Planted**

Year	Total Vegetation Planted (ha)	Area Planted adjacent to SWMS (ha)	Proportion attributed to SWMP (%)
2000/01	79.9	4.9	6%
2001/02	59.2	12.65	21%
2002/03	58.1	7.55	13%
2003/04	44.4	8.47	19%
2004/05	18.1	0.40	2%
2005/06	48.26	1.60	3%
TOTAL	307.96	35.57	10.6%

Source: DPI Tatura 2007 (A Sislov).

Social performance indicators: The social aspects of SWMP have not previously been considered, however a recent assessment framework developed by consultants HydroEnvironmental proposes a qualitative method that relies on feedback through case studies and workshops. This method was adopted to assess the status of social considerations. The results of the workshop, shown in Table 2, indicated that most social aspects of the strategy are viewed as having a very positive influence on society. It is noted that although the views of those included in this assessment are likely to be adversely influenced by the current drought conditions, the outlook for future benefits to be achieved through the plan was generally optimistic.

- **Table 2 Social assessment**

Indicator	Comment on appropriateness of Indicator to SWMS	Score (+5 / -5)
Community well-being	There was a feeling that with new SWMS, there was a generally positive feeling and improved economic performance, however, there was nothing significant noted for existing SWMS.	+3
Sense of community	There was a sense that although CSWMS have not progressed as much in the past 5 years, the overall level of achievement in this category was high.	+3
Natural resources knowledge base	Extension activities associated with the program are credited with the broader education of landholders around the region. The increased knowledge is not limited to drainage considerations but also brings together aspects relating to environmental values and best farm management practices	+4
Improved business confidence	It was felt that with SWMS, there was a greater level of confidence for development to occur.	+4
Access to water supply	Rules in place to control increase in water on undrained properties.	+3
Security of water supply	There were instances noted where existence of works had allowed additional water to be secured, although this was generally not widespread.	0 to +1
Changes in landscape	The landscape of the SIR is seen to be improved compared to previous times. Some debate whether people attributed the improvement to the SWMS or not. This was not material.	+3 to +4
Confidence in the program	The general feeling is that program confidence is positive; there are other external factors that many have had an impact on program implementation.	+3
Protection of significant cultural and historic sites	The process of assessing impacts of proposed works was seen to be positive as the sites would not have otherwise been identified.	+4

1.5 Future of the Program

The area of the SIR which is not serviced by a SWMS is currently 233,535ha which represents around 44% of the total SIR. Although the benefits that the SWMP was to provide (including reduced waterlogging, flooding and salinity, protection of roads, reuse and land-use change) may have been largely realised due to alternative influences (ie dryer climatic conditions and improved irrigation management than when the benefits of the program were first calculated), the projected benefits of the SWMP have not and will not be fully realised until the appropriate infrastructure is put in place.

The value of the already significant investment in the PSWMP to date is potentially at risk if the remaining works are not completed. It is crucial to the future improvement of irrigated farming in the SIR that the works program be implemented in a timely manner.

The future works required to achieve the desired outcomes of the SWMP fall into the following four general areas:

Primary Surface Water Management Works Program works

The PSWMP has followed the program priorities developed in the 1995 Surface Drainage Strategy and although there are still some significant works to be constructed, it is likely that the focus will move to operating and maintenance (of previously constructed SWMS) following the 2011 review. It is essential that the PSWMS continue in its current form if the projected economic benefits of the strategy are to be fully realised. Of the 130 km of SWMS remaining in the works program, most of this is either at the survey and design phase or well into construction. Funding of around $4 million per year is required to ensure that the short term program targets are met by 2011.

Community Surface Water Management Program works

The implementation of the CSWMP has and is likely to continue to slow considerably as a number of external factors such as climate cycles, terms of trade and funding arrangements influence the ability of the community to commit the required resources. The program is dependant on the construction of PSWMS to enable outfall to occur and this construction will largely be complete by 2011.

During the review period 22 CSWMS have been designed, yet most have not received enough community support to proceed with construction. Although this lack of support has allowed funding to be directed to additional works under the PSWMP, it is also likely to have impacted upon the realisation of benefits assumed for the total SWMP investment required in the region.

It appears that an alternative implementation model may be required to achieve the necessary uptake of the community program. This would need to be decided pending the outcome of the cost sharing review being undertaken by consultants URS as well as any return to more prosperous climatic conditions.

An appropriate prioritisation policy is in place to fund the implementation of CSWMS as community support arises.

Other plan works

The PSWMP works which are required to complement the capital works described above include:

- Retrofitting and remodelling – no works are specifically planned before 2011. Developments under the IDMOU may influence decisions to increase the amount of retrofitting to achieve its objectives.
- Metering – to be continued in line with current program.
- Monitoring – Monitoring is required to assess performance and will need to continue to in accordance with current arrangements. It is likely that increased monitoring will be required to achieve the IDMOU objectives.

Strategic focus

A number of specific aspects of the strategy have been identified as requiring additional work to provide a more targeted program in the interim and a more rigorous and strategic review of the SWMP status in 2011. These aspects include:

- Review of economic benefits – There is a need to address the deficiencies in the current economic performance indicators by undertaking a detailed review of the benefits and costs of surface water management.
- Future landscapes – Recognition that irrigation landscapes will change in the future and that a suitable action plan to address potential future scenarios will need to be developed.
- Integrated monitoring objectives – Current performance indicators are heavily *output* based. The MER process requires that targets for *outcomes* also be developed which will require data from this program to be integrated with other catchment information. Although the flow gauging of newly constructed SWMS has been implemented and existing sites linked to the program are maintained, there may be a requirement, with various new initiatives such as MER, IDMOU and CAOP, to undertake a review of monitoring requirements. This may also be beneficial at a Catchment Implementation Strategy level.
- Future management of the program – A refocus on overall program management will assist in progressing the strategic aspects of the program at the same time as the implementation programs for PSWMS and CSWMS continue. Improved coordination at this level, both across program and agency boundaries, could assist in short term staff reassignments between management and implementation levels to maintain and build capability.

1.6 Summary of Recommendations

This review has considered the past six years of the SWMP, the changes in policy and strategy, and the external influences as well as the implementation of both the 1995 and 2000 programs. As a result the following recommendations, aimed at providing some logical direction for improvements in the SWMP management over the next five years, have been developed.

1 Program continuation - It is recommended that:

1.1 Funding of $4M per year for the next five years be sought to continue implementation of the PSWMP in order to maximise the likelihood that the SWMP benefits are realised.

1.2 Funding of $500,000 per year for the next five years be sought to continue implementation of CSWMS. Until conditions return to a wetter climate, emerging priorities for CSWMS funding should be prioritised in accordance with existing policy and managed within this budget allowance.

1.3 Funding of $135,000 per year be sought to continue monitoring and metering activities and $200,000 for SWMS management and IDMOU activities.

2 Information management and coordination - It is recommended that the following tasks be completed to address the information management issues that currently exist:

2.1 Examine user requirements of SWMP information and agree on data collection requirements, data handling, ownership, and reporting formats.

2.2 Upgrade SWMP map bases to a more functional GIS platform.

2.3 Examine options for a compatible reporting system or database for implementation work projections of both the PSWMP and CSWMP.

3 Staff and knowledge management - It is recommended that:

3.1 Development and co-ordination of documented procedures for PSWMS and CSWMS be completed in the 2007/08 financial year.

3.2 Collation of available documents relating to the SWMP be completed and indexed for uploading to a common access point for program managers.

4 Economic viability review - It is recommended that:

4.1 An economic review be undertaken in the 2007/08 financial year including a review of all of the catchment and agronomic benefits that can be reasonably quantified.

5 Irrigation landscapes development and coordination - It is recommended that SWMP managers:

5.1 Revise the objectives of the SWMP to include 'facilitating increases in water use efficiency and irrigation management' and address any issues with the alignment with the needs of government investors.

5.2 Engage in a process of developing outcomes based MER targets which is coordinated with the requirements of government investors, IDMOU, CAOP and reconfiguration/modernisation objectives and targets.

5.3 Develop future landscape objectives for SIR sub-catchments in accordance with irrigation futures objectives.

5.4 Ensure SWMP has a stronger alignment with the reconfiguration and modernisation project.

6 Program / Project management - It is recommended that:

6.1 Program managers continue to exercise flexible practices to meet the challenge of continually changing circumstances.

6.2 A renewed focus on the role of the Project/Program Manager be made and if necessary appoint a new full-time project manager to facilitate the implementation of the review outcomes, and the co-ordination of the SWMP.

6.3 Adopt a standard reporting format, similar to the format used for this review, for tracking and reporting expenditure, for recording completion of works, for reporting environmental performance and for reporting social performance.

7 Review of program options - It is recommended that:

7.1 The current design principles are maintained as valid until 2011 or until such time as additional information is obtained which suggests that changes may improve performance.

7.2 Ensure that sufficient data is available by 2011 to assess the impacts of water trade, modernisation and reconfiguration on the design capacity methodology currently used.

7.3 Additional technical work should be undertaken before 2011 to determine the viability of Drainage Course Declarations as a component of the overall SWMP.

7.4 Managers ensure that the cost-share arrangements being reassessed under the RCS review will provide sufficient incentive for CSWMS to proceed when conditions allow.

7.5 An investigation be carried out into the use of Section 32 agreements to ensure existing or potential commitments to SWMS are made known to new owners as part of the land purchase process. If necessary, GBCMA commence state level negotiations to ensure this occurs.

Implementation of these recommendations prior to the next review will assist in setting the priorities for beyond 2011.

2. Introduction

The Shepparton Irrigation Region Land and Water Management Plan (SIRLWMP (now SIRCIS)) was introduced in 1989 and included a Surface Drainage Strategy to provide drainage services to a large portion of the SIR catchment. The strategy included a proposed works program, prioritised to allow progressive implementation of surface drainage works across the SIR up until the year 2020. A 5 year review process was included whereby the strategy could be reviewed and updated into the future.

A review of the Surface Drainage Strategy was undertaken in 1995 at which point the 'Shepparton Irrigation Region Surface Drainage Strategy' became a significant revision to the program for future implementation of surface water management works.

The next review of the Strategy was undertaken for implementation works completed up until the year 2000. The outcome of this 2000 review was a revision to the prioritised works program, intended to guide the implementation of a range of initiatives over a 10 year period and to direct resources to the highest priority areas.

This 2006 review is the next scheduled review of the program and is intended to provide a status check of the 10 year program proposed in the 2000 review. In particular, it is evident that a significant number of changes since the last review have influenced not only the Surface Water Management Program (SWMP) but many catchment and natural resource management programs across the Murray Darling Basin.

The structure of this report has been established to cover the following key areas of the review:

- Background and context of review
- Adaptation to changing circumstances
- Achievements and performance of the program from 2000 – 2006
- Future directions of the program from 2006 – 2011
- Summary of recommendations

3. Review background and context

3.1 Aims of the 2000-2006 review

A major review of the SWMP was completed by Snowy Mountain Engineering Corporation (SMEC) for strategy works completed prior to the year 2000. It proposed a program of works to be implemented during the ten-year period from 2000 to 2010.

The purpose of this report is to review the implementation of the SWMS over the past 6 years (July 2000-June 2006) and to provide the necessary direction to ensure that the current investment strategy is on track for completion over the remaining five year period from 2006-2011. The next review has been targeted for 2011 to align with other program timeframes.

Although this 2006 review focuses heavily on the nature and impacts of the changes in both water and natural resources management over the past decade, it also briefly describes the current status of the whole strategy and where the impacts of such changes might influence future implementation.

This review is not as detailed as the previous review, as a detailed review is scheduled to be completed in 2011. It is intended to provide direction for further work rather than deal comprehensively with many aspects of the strategy that may need specific additional work. This report has been structured to highlight any key conclusions or observations as they arise (noted in ***italics*** throughout the text) and to draw these together into key recommendations for program managers to address in subsequent years.

3.2 Goals of the Surface Water Management Program

One of the key goals of the Shepparton Irrigation Region Land and Water Management Plan (SIRLWMP) is to:

'By 2020, improve the health of natural resources and improve productivity in the Shepparton Irrigation Region by providing an appropriate Surface Water Management service in areas where the total benefits, including economic, social and environmental benefits, exceed the cost.'

The SWMS includes details covering each of the following areas;

- Strategy Relationship to the Regional Catchment Strategy (RCS)
- Linkages with other RCS irrigation programs
- Environmental considerations / values
- Philosophy
- Principles
- Responsibilities
- Regional Surface Water Management Components
- Strategy Cost

The relationship between the SWMP and the State, Federal and local programs and their interaction is shown in **Figure 1.**

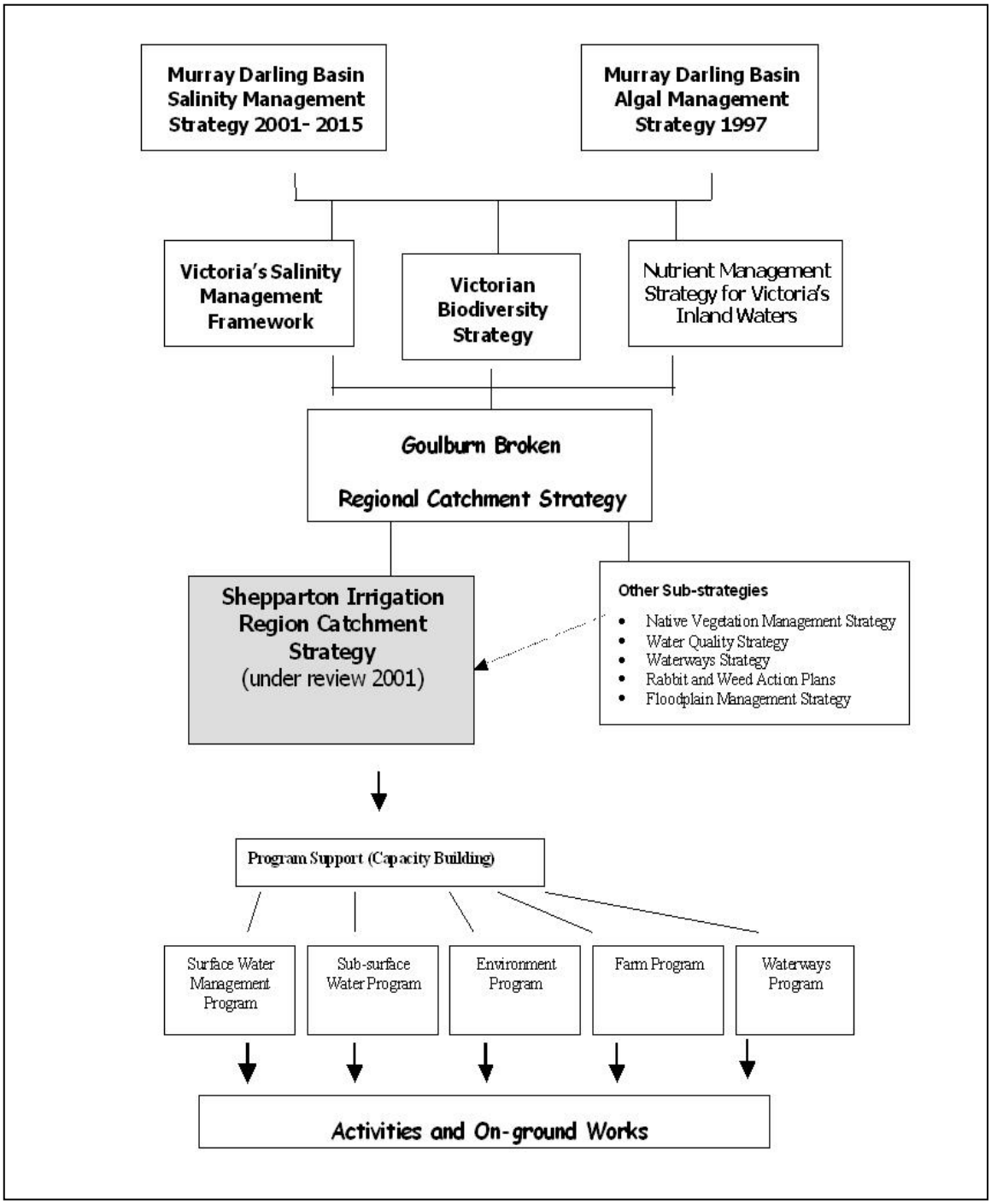
3.3 Strategy objectives

Implementation of the SWMP addresses risks to the SIR such as waterlogging, salinisation and downstream water quality impacts, which are most likely to threaten agricultural production and environmental conservation.

The overall objectives of the strategy originally, are as follows:

- Enable the removal of excess rainfall run-off from irrigated land
- Provide an outfall for groundwater pumps
- Facilitate management and reduction of nutrient inflows to receiving waterways or outflows from the irrigation catchment, and
- Create the opportunity to preserve and enhance wetlands and native vegetation.

Further discussion about the suitability of these objectives is included in Section 6.1.



- **Figure 1 Relationship between SWMP and other programs**

Figure copied from: Shepparton Irrigation Region Implementation Committee (2003) *Shepparton Irrigation Region Implementation Strategy 1990-2020 Update 2003 (including Implementation Plan)*, Shepparton: Goulburn Broken Catchment Management Authority.

3.3.1 Terminology

In the process of undertaking this review, terms such as performance indicators, goals, outcomes, outputs, objectives, sub-goals, targets, monitoring, and monitoring, evaluation and reporting (MER) were encountered in separate documents, but often meant the same thing. Ultimately these terms need to be captured in the one logical framework to simplify the language and hence develop greater clarity for shared decision making.

A notable change has been the shift in terminology to better reflect the changed emphasis of the program. Previously called drains, the program has adopted the term 'Surface Water Management System' to cover all assets within a catchment or sub-catchment. An individual drain is now termed a 'Surface Water Management System'. These terminology changes better reflect the integrated approach to water management within the catchment. Throughout the document, these changes have been adopted where possible to reflect the updated terminology.

4. Adaptation to a changing environment

A significant number of changes are broadly recognised as having had an impact on the rate of implementation of the SWMP over the past six years.

A list of the changes that are perceived or recognised as having an influence on program delivery was developed with assistance from the Steering Committee. These have been reviewed and the implications summarised for reference. The following broad categories, which are discussed in detail in the following sections, have been used to group the changes into comparable aspects:

- Policy and Strategy Influences – Essentially changes to external policies and strategies (management) which intentionally influence strategy implementation progress.
- External Influences – A number of external influences which indirectly influence the strategy have emerged over the past six years. These issues are not necessarily able to be controlled but the impacts need to be managed.
- Proactive Management – Response of the strategy implementation team to adapt to changing policies and strategies. This is a formal recognition that actions have been implemented.

4.1 Policy and strategy influences

A complete list of policy and strategies influencing the SWMP is contained in **Appendix B**. The list below provides some detail on the major policies and strategies. The key policies and strategies that have or are likely to influence the SWM Strategy can be grouped in the following manner:

Biodiversity and Environment

This includes the EPBC Act 2000, the Flora and Fauna Guarantee Act 1998, the Environmental Assessment Procedures for Primary and Community SWMS and the Native Vegetation Retention Controls 1989.
These policies and Acts address the identification and protection of environmental features. This requires a more rigorous assessment process, with specific requirements and as a result, the assessment procedure has a more integrated outcome, is more inclusive and comprehensive. There may be some delays in the approvals process as alternate alignments are investigated, or additional costs as protection measures are implemented, however these are outweighed by the benefits of an inclusive process.

River Health and Water Quality

This includes amendments to the Water Act 1989 and Revision of the SEPP (Waters of Victoria) 2003, Safe Drinking Water Act 2003, River Health Strategy 2005, Water Quality Strategy 2002, Our Water Our Future 2004 and the IDMOU 2005.

These policies, Acts and strategies all provide strategic direction and assist in the coordinated management of surface water. The requirements of these Acts and strategies may result in the need for additional monitoring to enable reporting requirements to be adequately met.

Archaeological

This includes the Aboriginal and Torres Straits Islander Heritage Protection Act 1984 and the Aboriginal Heritage Act (2006) which aim to identify and protect archaeological and heritage features. The Aboriginal Heritage Act will be enacted on 28th May 2007.

This legislation requires a more rigorous assessment process with specific requirements and as a result produces a more integrated outcome, is more inclusive and comprehensive. There may be some delays in the approvals process as alternate sites are investigated, or additional costs as protection measures are implemented, however, these are outweighed by the benefits of an inclusive process.

Asset Management and Planning

This includes the Road Management Act 2004, Water (Irrigation Farm Dams) Act 2002, and planning application requirements to satisfy Local Government Planning Scheme Amendments.

As a result of these changes, there may be a more lengthy planning approval process and possible realignment of SWMS.

Resource Management

This includes strategies such as the Basin Salinity Strategy 2001, the Living Murray, The Victorian Government White Paper "Our Water Our Future" 2004, the MDBC cap 1997, and the Basin Salinity Management Plan Operational Protocols 2005.

The salinity and drainage strategy has a major impact on the future of the SWMP. As the construction of SWMS is known to generate salinity impacts, work implemented under the SWMP is an accountable action and thus requires salinity (EC) credits. The Basin Salinity Management Strategy will impact on both Surface and Sub-Surface programs.

Other

As part of the reporting process to governments, the then Department of Natural Resources and Environment (NRE) together with the Murray Darling Basin Commission (MDBC) engaged the environmental consultancy firm, Nolan-ITU, to conduct an independent review of the environmental aspects of the surface water drainage programs in Northern Victoria. This review was carried out in 2001 and made recommendations for the SWMP to improve outcomes and targets as well as the identification of additional works. Further, a government response to this review specifically recommended the future works required to address shortcomings where identified.

4.2 External Influences

A number of external activities and events which indirectly influence the SWMP have emerged over the past six years. These influences are not necessarily able to be controlled by the Program Managers; however, the impacts do need to be managed. These issues and their likely impact on the SWMP are listed in **Table 3**.

Table 3 External Influences on the SWMP

Aspect relevant to SWMS	Description of aspect	Positive Impact	Negative Impact
Dairy deregulation	In July 2000, dairy deregulation came into effect. Essentially this has resulted in the removal of the Domestic Market Support Levy, a price support mechanism for the dairy industry previously funded by a levy from milk processors and manufacturers. As part of the deregulation package, assistance is offered over eight years to farmers to assist the transition.	Expanding enterprises may have the capital to install SWMS.	A lower milk price to the farmer, and as a result, a number of farmers have used the opportunity to exit the dairy industry. Over the past 6 years, this has resulted in money transferring to infrastructure other than SWMS.
Climatic influences (Adopted from Draft paper 'Salinity policy and practices regarding irrigation in north central Victoria')	Climate change is increasingly being recognised as a real threat to regional communities. Outlined below are two current scenarios* on what is happening with our climate: ■ (1) due to the influence of anthropogenic climate change, the current drought is typical of the conditions we can expect as the norm in the future ■ (2) the current drought is the "dry" phase of the multi-decadal cycle of wet and dry regimes that has been observed across Australia over the period that instrumental records exist – in this cycle 15-30 year dry phases (e.g. similar to what we have seen over the last 15-30 years) are followed by 15-30 years of "wet" conditions, before, at some time in the future, another dry sequence sets in, then the cycle repeats.	Lower groundwater levels = lower salinity impacts. Lower water allocations heighten landholder awareness of improved water use efficiency.	Continued dry conditions may mean that SWM is no longer a high priority for farmers, particularly since community support for SWMS is low.
Terms of trade	Commodity prices have a direct impact on farm businesses and their ability to operate.	Promoting a 'Clean Green' image for agriculture may require quality assurance plans for farms.	Financial issues are generally the reason landholders object to the installation of SWMS.
Water allocations	Water allocation is linked to irrigated crop or pasture production. Allocations exceeding 100% have not been seen in the past 6 years and it is likely that this will continue given record low storage levels in most Victorian dams.	Greater emphasis on water savings and improved practices and efficiencies.	Any reduction in water allocation correlates to a reduction in fodder, pasture, crops = less money to invest in SWMS.
Water trade	G-MW has placed annual limits on trade out of irrigation zones/areas. From January 2007, permanent trade will be permitted to occur between States.	Water trade opportunities may be enhanced in areas where SWMS exist – irrigation development and drainage are complementary activities and development is less costly where both already exist.	Uncertainty with respect to stranded asset maintenance and costs. Access to SWMS is not necessarily going to stop water trading out of a region.

Aspect relevant to SWMS	Description of aspect	Positive Impact	Negative Impact
			Water trade into an area is limited if SWM does not exist.
Reconfiguration	A change in the infrastructure that delivers water and removes drainage may occur as a result of or because of water trade and irrigation development.	Reconfiguration may provide increased security to areas where irrigation supply is guaranteed, therefore increasing the likelihood of SWM being supported.	Potential for stranded assets Reduction in service to isolated areas. Some areas are hesitant to invest in SWM infrastructure until they establish a guarantee on supply.
Our Water Our Future	The White Paper provides a series of actions to achieve improved water use and management.	As a result of implementation of the White Paper actions, there may be opportunities to improve on-farm water use.	Unbundling of land and water rights may reduce security for individuals. Reconfiguration of irrigation infrastructure and assets may threaten the viability of some SWMS.
Road Management Act	Change in legislation regarding the management of infrastructure located on road reserves now puts the responsibility back to the constructing authority.	Neutral.	Neutral.
IDMOU	The development of the IDMOU between relevant organisations has set agreed water quality targets for within catchment river health. The targets are in place to assist in measuring the effectiveness of the program.	An adaptive program with specific actions and measures at specific locations.	This may put additional pressure or limitations on the SWMP and potentially increase costs. Eg by putting additional requirements on SWMS to remove sediment and trap nutrients.
Planning Scheme Amendment	Local council planning schemes specify the conditions under which development can proceed. The interpretation of planning schemes is most evident in respect of whether surface water management infrastructure is classified as a 'minor utility'.	Transparency.	The duration of the approval process and any appeals significantly adds to the cost of SWMS construction. The possible need to review rural/urban boundaries where development has increased pressure on land-use requirements.
Lifestyle Farmlets	Increase in the number of people wanting to have access to services for non-profit activities	Subdivisions potentially increase number of holdings accessing drainage – a greater rate base to 'share the cost' of SWMS.	The development of smaller land parcels for lifestyle properties means that potentially more services are required. The standard level of service required by these properties is also uncertain. Whilst these landowners are likely to want a high level of service, the economic benefits are unlikely to be significant and there may also be reluctance by such people to invest in expensive infrastructure.
Council stormwater outfalls	The subdivision of farming land on the fringes of urban areas may occur at a rate greater than the expansion of the council storm-water network.	Opportunity may exist to rationalise the existing SWMS on urban fringes.	This may have an impact on the capacity of existing SWMS and the ability of these systems to operate as originally designed.

Aspect relevant to SWMS	Description of aspect	Positive Impact	Negative Impact
			Additional resources required to address such issues.
Land ownership	A change in land ownership over time plays a part in the support for and understanding of the need for SWMS.	DPI has developed a 'new landowner information package' relating to CSWMS. Links exist between DPI and solicitors to ensure issues relating to Section 32 are understood. G-MW Landowner Information statements provide appropriate information to purchasers using: -generic statements; -specific statements where a SWMS is at a certain stage of design.	Lack of understanding regarding SWM needs for an area may delay a SWMS while new landowners come to understand SWM needs for their area. Lack of disclosure by vendor, Lawyer and Real Estate Agents can create issues.
Institutional and staff change	Consistent with many other work places, there has been a dramatic reduction in the continuity of staff within government funding bodies. This translates to a need for greater emphasis on documenting knowledge with greater clarity. The style and language of this documentation needs to evolve towards standards being promoted nationally. This includes output and target setting, and reporting. The on-ground works undertaken need to clearly demonstrate links to these National Frameworks (refer to section 3.3.8.2)	A turn over of staff can bring a fresh perspective and new ideas into the SWMP.	Lack of continuity in staffing may pose problems where relationships with the community have been developed and in some cases where conflict has arisen within the catchment.
Program Management		Inter-agency relationships and cooperative efforts are an integral part of the strategy.	Lack of detailed program may result in unqualified deviations from the program. This makes budget tracking difficult and inefficient.

* Climatologists (A Kiem) offer evidence in support of Scenario (2). As well as the east-west Pacific cycle known as El Niño/Southern Oscillation (ENSO), there is the Interdecadal Pacific Oscillation (IPO), which is defined by low frequency (15 to 30 years) anomalous warming and cooling of Pacific-wide sea surface temperatures. When the IPO is in a positive phase dry conditions prevail in Australia, and vice versa. A plot of Australia's overall recorded climate is remarkably like a mirror image of an IPO plot. The El Nino-La Nina cycle imposes its effects on the low frequency IPO cycle – that is, El Nino-La Nina creates "scatter" on the IPO cycle.

Currently it seems that the IPO, which has been positive, is trending down and if this trend continues into a negative IPO phase, history suggests that wet conditions will ensue.

There is another relevant weather phenomenon known as the Antarctic Circumpolar Wave (ACW), which is a clockwise circulation of weather around the Antarctic. This brings the succession of rain-bearing "lows" across southern Australia. At the moment the ACW seems to have "tightened up" on itself, so that the lows are dropping much of their rain uselessly into the ocean south of Australia. It is a debateable point whether or not the current behaviour of the Antarctic Circumpolar Wave is due to some aspect of climate change and will continue. It seems, however, that the IPO and ENSO cycles are dominant and likely that the ACW is also cyclical, in which case is unlikely that drought conditions will continue indefinitely. (Extract from draft paper on 'Salinity policy and practices regarding irrigation in north central' - SKM 2006.

4.3 Proactive Management - Implementation of changes

A number of management actions and activities have been undertaken which may or may not complement some of the policies and strategies that have been discussed above. The key management actions and relevant policies and strategies for each are described further in the following sections. Key observations and conclusions have been noted in ***bold italics***.

4.3.1 Community Surface Water Management Systems - Guidelines for Design

These guidelines were developed in 1990 by the then Rural Water Commission under the direction of a reference panel that is now known as the Community Surface Drainage Co-ordinating Committee (CSDCC). These guidelines have been reviewed on a number occasions since then with the most recent update being completed in November 2006.

The guidelines cover all major aspects of CSWMS including basic principles, capacity determination, location, hydraulic design, structure design, survey requirements, construction details and environmental considerations. The optimum SWMS capacity is that which produces the maximum benefit/cost ratio greater than one. Designs based on a 24 hour summer rainfall with an Average Recurrence Interval (ARI) of about 1:2 years and a five day runoff removal period are considered to be appropriate for CSMWS (DPI CSWMS- Guidelines for Design). It is also stated in the guidelines that decisions on the viability of individual systems should be based on participant willingness and ability to pay rather than a rigorous benefit/cost analysis (DPI CSWMS- Guidelines for Design).

4.3.2 Primary Surface Water Management Systems – Guidelines for Design

Guidelines for the design of PSWMS are being developed along the same lines as the CSWMS Guidelines for Design developed by CSDCC and will be completed in 2007.

The guidelines cover all major aspects of PSWMS including basic principles, capacity determination, location, hydraulic design, structure design, survey requirements, construction details and environmental considerations. A key aspect of the guidelines in terms of improved management practice is the increased focus on and consideration of environmental and social issues. This includes integrating natural wetlands and nutrient control measures such as constructed wetlands, batter stabilisation and vegetated waterways into the overall PSWMS (PSWMS, Guidelines for Design).

4.3.3 Design basis (rainfall events)

As highlighted in the goals and objectives (**Section 3.2**), the current SWMP is aimed at removing the irrigation induced component of rainfall run-off. It is a necessary trade-off that the three factors which influence the design capacity of a SWMS, being intensity, frequency and duration of rainfall events, have to be selected based on a comparison of the economic costs and benefits of servicing those rainfall events. The design philosophy for selection of these factors which determine SWMS capacity has varied through time as the balance of costs and benefits has fluctuated.

Initial design standards were based on providing a level of service for a 75 mm rainfall event occurring in 24 hours which is approximately equivalent to a 1 in 10 year event. Current system design, revised in 1992, is based on a 50 mm summer rainfall event (with an ARI of about 1:2 years) falling on the catchment over a 24 hour period and being removed within five days. Although this could be further refined if implementation costs continue to escalate, adoption of a smaller capacity would need to be accompanied by significant evidence that it would provide an acceptable level of benefits. Previous studies have found that a reduction in

level of service does not correspond to an equivalent reduction in cost as most of the works are not particularly sensitive to the actual flow rate (Section 6.1.5 – Background papers SD1 Surface Drainage Strategy 1989).

The number of events within the review period where 50 mm of rainfall has been recorded either in a single day or over a two day period are summarised in Table 4. Where the rainfall that occurred during a 24 hour period was less than the design rainfall event but the cumulative rainfall in the 48 hour period was in excess of the design event, that rainfall is shown in brackets. Although the current climate is accepted as being a severe drought, data indicates that the occurrence of design rainfall events continues to be experienced.

- **Table 4 Design events during review period (Kyabram rainfall gauge 080091)**

Date	Rainfall event > 50mm in 24 hr period (mm)	Rainfall event > 50mm over 48 hr period (mm)
24 October 2000	52.8	59.8
5 and 6 November 2004	(7)	51.2
3 February 2005	52.4	95.2

Note: May 2005 – January 2006 data not available.

It is reasonable to assume that altering the level of service will not provide any significant improvement in the benefit : cost ratio of the SWM Program.

Further, the design basis requires an understanding of irrigation patterns within a catchment. SWMS are designed to manage runoff generated from a rainfall event on ground saturated due to recent irrigation. The current method of determining the likely irrigation patterns is dependent upon water entitlements which have traditionally been bundled with property ownership. The recent moves by Victoria to unbundle water rights and allow unrestricted trade of entitlements may mean that this design principle may need to be reviewed or altered in the future. Emerging practices have been observed where commercial operations readily rotate crops from one property to the next, based on business decisions such as potential for low rental rates, availability of water through temporary water trade and labour availability. Whilst there are rules in place that restrict the volume of water that can be transferred onto a property where a SWMS is not available, there is still the potential for the design basis to change rapidly if it is based on the original water entitlement for the property.

A review of the likely effects of unbundling of water entitlement on future design capacity calculations should be given high priority.

A further impact is the reconfiguration of irrigation areas and infrastructure that is occurring as recommended in the White Paper. This will potentially result in the irrigation footprint in the region changing, which could affect both existing and future SWMS.

A better understanding of land capability and investment (land-use) potential throughout the region is a critical input to a rigorous review of the design requirements for surface water management systems.

4.3.4 Water quality improvement projects

The Goulburn-Broken Water Quality Strategy (GBWQS) aims to reduce the risk of algal blooms in waterways by reducing nutrient loads entering waterways. SWMS were identified as a major contributor of nutrients to rivers and a number of actions were proposed to reduce the impact of SWMS. Those that have occurred since 2000 include:

- A detailed Drainage Diversion Strategy was developed by G-MW and began implementation in 2000, with the aim of optimising diversion of drainage water for irrigation, thereby reducing nutrient loads exiting SWMS.
- Increased implementation of Whole Farm Plans and reuse schemes (DNRIS) as the main preventative measures adopted for nutrient load reductions.
- The process to deal with dairy shed effluent discharges to SWMS has been reviewed and revised amongst relevant agencies (GMW, EPA, DPI, GBCMA).
- Industry point source discharges to SWMS have been identified and reduced (eg. dairy factories installing treatment and reuse schemes).
- Promotion of best management practices, such as fertiliser application.
- Two investigations to determine the potential of reducing nutrients in irrigation drainage systems using in-line wetland technology and batter stabilisation. The drainage audit carried out by GMW in 2000 and the D118 project (Nutrient Removal from Rural Drainage Systems Using Wetlands) confirmed the importance of vegetation as well as SWMS design and SWMS management in the removal of nutrients in irrigation drainage water. These two projects developed a series of specific recommendations for aspects such as revegetation, SWMS design and construction, and operation and maintenance.
- Clause 7.4.2 (3) of the IDMOU requires a table showing the relationships between the individual management actions and resource condition change to be included in the SIRCIS SWMP. Due to a lack of data these relationships are not accurately known and therefore this table has not been included as part of this the 2006 SIRCIS SWMP review. It is however proposed that this table will be included in the 2011 review document for the SIRCIS SWMP.

Water quality projects including diversions and wetlands (vegetation) should continue to be incorporated into the design philosophy of SWMS.

4.3.4.1 Drainage Nutrient Removal Incentive Scheme

The Drainage Nutrient Removal Incentive Scheme (DNRIS) was introduced in April 1998 to encourage landowners to construct storages (drain nutrient removal storages) to collect and use regional drainage water from high flow events. The water and nutrients collected can then be used productively rather than being exported to areas of the catchment where they may cause problems such as blue green algal blooms. In addition, the storages can increase the volume of water available to the irrigator. Further discussion of the achievements made under this scheme is included in Section 5.3.4.

4.3.5 Catchment and Asset Operation Plans

In the past 5 years SWMS management plans have been developed for the operation of individual SWMS to limit adverse impacts downstream. The development of the IDMOU has identified the need for more detail in these plans.

A Catchment and Asset Operation Plan (CAOP) will include information ranging from technical guidelines through to operation and maintenance requirements of the 9 catchments indentified in the IDMOU. The Catchment part of the plan is owned and developed by the CMA and will focus on the catchment and farm assets such as significant environmental, cultural and heritage features and their preservation as it relates to surface water management. The Asset part of the plan is owned and developed by the asset operator (generally G-MW) and captures any specific management requirements relating to significant features in the serviced area which could be impacted by the SWMS to which they relate. It will also document the operational actions that will be undertaken to maintain the SWMS asset. The CAOP will bring all the

information together to be available for new system operators and landowners. With the introduction of CAOP, drain management plans will become obsolete.

A periodic review of factors that influence key results for nutrient monitoring is planned as part of the Decision Support System for Resource Condition Targets (IDMOU). Although there has not been any completed CAOP produced to date, it is likely that the performance targets developed from this process will be limited to key nutrients such as total phosphorous and total nitrogen.

The linkage between the rapid decision support system and other catchment parameters and changes to these parameters is not clear. Although the process attempts to correlate outcomes with outputs, there is likely to be a need to establish a well coordinated information management system to track these links adequately. Such a system does not currently exist, which may be contributing to the current delays in completing the rapid assessment process.

Improved management of implementation data, both for the SWMP and other programs such as the Farm Program, will greatly assist future evaluation of SWMP outcomes and continued implementation of the IDMOU objectives.

4.3.6 Changing Management

The intent of the CSWMP was that local communities collaborate to implement surface water management systems. Over time, however, ownership of some of the bigger CSWMS has transferred to G-MW due to some Local Government Authorities no longer being prepared to collect rates on behalf of the CSWMS group. Of the CSWMS that were constructed during the review, seven were completed using processes outlined in the G-MW CSWMS Administration Guidelines and one was constructed under the Landholder Management Option. There has been a significant trend towards transfer of operation and maintenance of existing CSWMS to G-MW indicating that the current policy is effective.

It is likely that the trend of G-MW ownership will continue, with bigger CSWMS perhaps even beginning their construction through G-MW. It may be that the smaller CSWMS between 0 and 2km in length should continue to be landowner managed as there is an administrative component that is largely fixed and will result in a high cost/km if transferred to G-MW.

There is a need to ensure that adequate and up-to-date policy is in place to reflect the likely future management requirements for G-MW CSWMS

4.3.7 Water savings, asset modernisation and reconfiguration initiatives

A number of initiatives have actively sought to improve irrigation delivery system efficiencies through works such as reduction in irrigation channel outfalls, installation of improved channel control structures (ie flume gates) and reconfiguration of assets.

The Shepparton and Rochester Irrigation Areas were the first areas to be examined with respect to modernisation. Rationalisation or extension of the PSWMS network was not a high priority for these areas as the PSWMS networks are largely complete. It is likely that a reduction in channel outfalls is expected to result in a significant decline in the availability of water for SWMS diverters. It should be noted that although G-MW does not guarantee either the quantity or quality of water available to SWMS diverters, there are a significant number of developments that exist as a result of historic availability.

The impacts of G-MW asset re-configuration on existing SWMS diversions as a result of irrigation system modernisation and reconfiguration will need to be considered and the existing diversion policy revised.

Further work is planned to examine water savings in the Murray Valley and Central Goulburn Irrigation Areas of G-MW. It is not clear from existing planning processes whether SWMP has been included in any evaluation of rationalisations.

The most likely impact on the SWMP is that less water will be available for SWMS diversions as delivery system efficiencies are improved. However, the majority of potential impacts, with respect to the SWMP are less certain. These include key questions such as:

- Where will existing SWMS services become redundant?
- Where will new SWMS services be required?
- What mechanisms will be required to build, operate and maintain required SWMS?

There is a need to formalise the requirements of modernisation to include SWMP objectives into the reconfiguration planning process. Whilst this could potentially add a significant amount of work to the process it would appear to be the most effective means of addressing the need to integrate future planning for surface water management into a program that is heavily focussed on delivery system efficiency gains and rationalisation.

4.3.8 Monitoring, Evaluation and Reporting (MER)

The Monitoring, Evaluation and Reporting strategy for the GBCMA covers all activities that impact on natural resource management. The RCS lists principles, policies, targets and actions and provides a context for all MER actions. The integrated management of natural resources within the catchment involves decisions based on a range of information from disciplines such as salinity, biodiversity and sociology. The presentation of this information ensures that multiple benefits and trade-offs are easily and well understood, it assists decision making and builds greater trust between community, agencies and investors (Garrett, B & McLennan, J.R. 2004).

Monitoring is the systematic collection of data to enable evaluation and reporting. Evaluation involves assessing against a stated goal, objective or value and determines the efficiency, effectiveness and appropriateness of a program. The 'reporting' has been added in recent years to increase the emphasis on and usefulness of information for decision making.

MER plays a critical role in information management and a consistent, structured approach across all disciplines is required. National frameworks for monitoring and evaluating as well as for target setting are used as the basis for developing this consistency.

The quality of MER varies with the maturity and approach of different disciplines and improving the information and developing consistency will continue for many years.

The Goulburn Broken MER Strategy 2004 includes an appendix which is an example of the list of items that need to be monitored to inform evaluation at different stages of planning and implementation cycles. The Sub-Surface Drainage Program has put considerable effort into sorting information over the last couple of years so that the need for the data collected is self-evident.

4.3.8.1 Identifying outcomes of investment

It is likely that government funding bodies will continue to require the future benefits of investment to be identified. This is usually very difficult in natural resource management given the long lag time between cause and effect, and the complexity of interconnections.

This does, however, provide a strategic opportunity in communicating investment benefits for the SWMP because of the relatively good understanding of cause and effect relationships, helped by focused research over a long period of time as well as the relative simplicity afforded by engineering solutions in discrete parts of the landscape.

The GBCMA's MER Strategy of 2004, includes an equation for identifying the expected, or predicted outcomes:

Outcomes = Outputs x assumptions.

This equation is being used to help prepare trajectory graphs of progress toward long-term outcomes and to identify information gaps. This methodology is also gaining traction in several other CMA's.

The MER Strategy generally, including the application of the equation, does not present a distracting revolution for the GBCMA's natural resource management programs. It provides a means of gradually aligning the approaches between different NRM disciplines (Garrett & McLennan, 2004).

4.3.8.2 Alignment with State and National Frameworks

Department of Sustainability and Environment (DSE) has advocated the use of consistent methodologies, including software such as "Axapta" and "CAMS", for recording investment and outputs across all natural resource management projects over the last several years. This methodology has historically not resulted in information useful for regional decision making. However, it is now time that a formal assessment of the usefulness of this statewide methodology for the SWMP, and for the broader SIRCIS, is undertaken. Specific feedback to DSE should place the SWMP in a favourable light with this important government funding body.

The GBCMA has been actively involved in promoting outputs standardisation across Victoria. This gained significant traction in 2006 and has resulted in very good alignment between most SIRCIS program outputs and statewide outputs.

As discussed in Section 3.3, the SWMP must review and probably revise its objectives and targets so that they become consistent in style and language with National Frameworks. The National Frameworks, developed in 2002, have been endorsed by the Natural Resource Management Ministerial Council. There are two documents that have been endorsed at a national level to assist with setting targets, monitoring, evaluation and reporting on natural resource management. The Standards and Targets Framework set out the National Framework outcomes that investment in natural resources management should work to achieve. During 2007 a major thrust emerging from the Commonwealth and DSE is for regional bodies to develop a 'program logic'. This push will need to be watched closely so that the needs of government investors are satisfied.

To measure progress against the targets, a suite of related indicators have been developed under the second document (National NRM Monitoring and Evaluation Framework) and once a region has identified targets relevant to its activities, it will be able to draw on the list of indicators to see which to use and how to use them.

Government funding bodies increasingly want to see alignment with the National Frameworks for monitoring and evaluation and for standards and targets, and with whatever their thinking has evolved into. Communication and resourcing will be best achieved with these funding bodies if the SWMP uses similar language and logic.

A review of the objectives hierarchy of the SWMP is required to ensure that they align as much as possible with the needs of government investors.

4.3.9 Knowledge management

It is apparent that the size and complexity of the SWMP requires some stringent management including financial accountability, as well as some flexibility in the long-term and annual programming. The SWMP is complex, involving community, agency, state and federal organisations in the decision-making, funding and implementation of the SWMP.

In response to an identified need for better information management, DPI has developed a number of Program Management Tools (S Ward, pers. comm.) with a specific database being developed to record historic achievements and actions specific to the CSWMP. Within G-MW a document management system has been implemented to track and store important documents.

However, none of these systems are linked and discrepancies in information and reporting are occurring.

Management tools which include works requirements, programming and financial tracking could be improved to streamline management practices and to maximise the SWMP opportunities.

4.3.10 PSWMS discharge monitoring

PSWMS are monitored for water quantity and quality to determine progress in achieving nutrient reduction targets specified in the GBWQS, in meeting salinity targets, and to identify trends in a range of parameters that could trigger further investigation.

The overall monitoring for the SWMP has experienced only minor change during the past 6 years. The addition of monitoring sites occurs at the completion of SWMS construction as well as when the need for additional information is identified. During the past 6 years, 3 sites have been added to the monitoring network – Murray Valley Drain 13 (404711 – flow added), Muckatah outfall (404712 – flow and quality) and Muckatah upstream of Kinnairds Swamp (404713 - flow and quality).

The proportion of drained area in the SIR now monitored for flow is 93% and for water quality is 87%.

A biological monitoring trial in rivers near SWMS outfalls has been carried out during the past 5 years, with the objective to determine if biological impacts, rather than just chemical impacts, of drainage outfall can be detected in rivers over the longer term. This trial is due for review after 2007. Monitoring of biocides and metals in SWMS sediments has been undertaken on several occasions since 2000 and detected very little and nothing at levels of concern.

The need for and priority of additional monitoring is addressed as part of the RCDSS under the IDMOU.

Identify links between items monitored and decisions to assist in gap identification and to avoid duplication. Consider alignment with the methodology used by the SSDP (see section 3.3.8).

4.3.11 Local Government

Local government plays a significant role in the implementation of the SWMP, notably through its planning processes.

Over the past five years, a number of issues have emerged that illustrate gaps in policy or procedure such as ownership of CSWMS structures and development of rural land-use strategies by various shires. The review of the Regional Catchment Strategy also provides an opportunity to address any outstanding issues that may impede delivery of SWM projects.

The lengthy and time consuming process of gaining local government planning approval for SWMS is a major impediment and source of rapidly increasing costs to the SWM program. The issue needs to be addressed

through high level submissions to planning reviews and possibly directly to the Minister. The Victorian Planning Policies will be reviewed this year (2007) providing an opportunity for state-level input. Discussion on these processes should commence with the DSE Regional Planning Offices.

Negotiations be held with DSE, local government, GBCMA and VCAT to investigate options for reducing timeframes for planning amendments and other formal approvals associated with surface water management systems. In addition, based upon the outcomes of these negotiations, the GBCMA to encourage / organise submission/s to state level reviews of the Victorian Planning Policies and other state planning processes that impact on timelines affecting the SWM program.

There is currently no formal requirement or process for purchasers of properties to be informed about existing or potential involvement of properties in SWMS. This has led to delays and other problems. Requiring a notification through the Section 32 agreements requires a determination if current processes should provide for appropriate SWM information as well as informing responsible parties of their obligation to provide information. It may also require a policy change on the formal requirements of Section 32 statements.

An investigation be carried out into the use of Section 32 agreements to ensure existing or potential commitments to SWMS are made known to new owners as part of the land purchase process. If necessary, GBCMA commence state level negotiations to ensure this occurs.

4.3.12 Irrigation Futures

The Irrigation Futures project explored scenarios for future irrigation in the Goulburn Broken Catchment. Four plausible scenarios were developed as a tool to promote discussion amongst various organisations and groups to generate and develop new ideas.

The SWMP conducted a workshop which used the scenario planning to determine challenges and opportunities for the program, as well as identifying some of the implications for the program.

The group identified a number of challenges and strategies, some of which are listed below, to provide for potential future changes:

- Look at a more cost effective system; is there a less expensive first option? Look for opportunities to integrate with other programs to explore possible flexibility and possible cost savings.
- Monitor changing community attitudes and evaluation the implications (this applies to all programs).
- Have a high level of communication with new irrigation development, particularly horticulture.
- Assess whether level of service is still applicable, look at opportunities to provide variable service.
- Look at all priority setting for works in catchments.
- Develop stronger links with local government to ensure an understanding and inclusion of issues such as drainage requirements for sub-divisions.
- Maintenance of works for next flood.
- Become involved in policy change to ensure expectations are not unrealistic.
- Exchange information amongst stakeholders.

It is recognised that although development of a detailed action plan from this work would be valuable, the constantly changing nature of the natural resources sector has made such a plan difficult to visualise.

One of the ways that the irrigation futures work could be improved is the linking of these scenarios to tangible management actions which can be measured and compared with other MER objectives and targets.

A more detailed overview of the Irrigation Futures program is provided in **Appendix E.**

5. Achievements of 2000-2006

5.1 Targets - Recommendations from 2000 review

The previous strategy review in 2000 proposed a works program that was to be implemented post-2000 (see **Table 5**) as well as a program of works to be implemented up to the year 2010 (see **Table 6**). The actual implementation rates achieved are discussed separately for PSWMS and CSWMS in the following sections. Although there were no specific recommendations listed in the 2000 review, program managers have assembled a list of recommendations which have been the focus of much of the work. These are included in Appendix C for reference.

In terms of the MER equation discussed in the previous chapter, the current performance indicators tend to be mainly output driven. Although there do not appear to be any specified performance indicators for the SWMP, the following outputs have generally been accepted and regularly quoted as being important indicators:

- percentage length completed,
- capital expenditure,
- cost per kilometre for SWMS construction,
- area drained, and
- area indirectly drained.

The relevance and context of these output indicators is discussed further in **Section 6.4** which includes an assessment of the economic, social and environmental performance of the SWMP. It should be noted that although development is in its infancy, performance indicators for the SWMP are likely to become self-evident if the logic is more explicit, which would be achieved using the methodologies described in Section 4.3.8, including use of the equation:

Outcomes = Outputs x Assumptions.

5.2 Works implemented during 2000-2006

5.2.1 Primary Surface Water Management Program

The information in **Table 7** and **Table 9** below detail the PSWMS works completed, the corresponding areas deemed to be formally drained and the expenditure during the period 2000-2006. The Program implementation maps have also been updated according to the information contained in **Table 7**.

Table 8 shows the works that are in progress for other PSWMS which are included in the works remaining at July 2006, and are summarised in **Table 5**. The works remaining have been calculated by reducing the works required after the 2000 review by the works completed during the review period. One of the significant figures to note from these tables is that around 56% of the SIR catchment is currently classified as ‘drained’, with a significant amount of remaining works targeted for CSWMS implementation.

44% of the SIR is yet to have formal access to a SWMS.

Table 5 Status of SWM Strategy - Works Remaining after 2000 Review

Surface Water Management Area	Area of Catchment (ha)	Area requiring service (ha)	New PSWMS (km)	CSWMS (km)	Drainage Course declaration (km)	SWMS remodelling (km)
Lockington	20,440	3,620	0.0	46.8	120.0	0.0
Bamawn	11,570	1,550	0.0	13.2	0.0	0.0
Wharparilla	9,470	3,290	0.0	35.7	0.0	0.0
Campaspe	11,180	7,400	2.3	58.6	20.0	0.0
Strathallan	9,240	4,360	0.0	28.0	0.0	0.0
Rochester WSC Area	61,900	20,220	2.3	182.3	140.0	0.0
Deakin	46,230	19,320	23.0	157.6	15.0	7.0
Corop Lakes	48,620	34,450	15.0	121.8	143.0	0.0
Tongala	14,930	2,160	0.0	14.1	0.0	0.0
Mosquito	45,990	24,200	27.5	230.6	56.0	0.0
Coram	7,100	1,660	0.0	19.1	0.0	0.0
Wyuna	22,750	12,910	0.0	133.8	0.0	0.0
Rodney	17,230	4,200	0.0	61.3	0.0	0.0
Coomboona	15,360	6,870	0.0	53.9	0.0	0.0
Ardmona	9,420	3,330	0.0	25.7	0.0	0.0
Toolamba	8,740	1,470	0.0	25.6	0.0	0.0
Central Goulburn WSC Area	236,370	110,570	65.5	843.5	214.0	7.0
Kialla	17,110	4,930	0.0	48.1	14.0	0.0
#Shepparton South WSC Area	17,110	4,930	0.0	48.1	14.0	0.0
Shepparton	9,800	540	0.0	2.4	0.0	0.0
Tallygaroopna	37,110	27,300	13.5	224.0	53.0	5.0
Invergordon	19,180	5,480	0.0	24.4	0.0	0.0
Kaarimba	8,900	5,830	0.0	51.0	0.0	0.0
#Shepparton north WSC Area	74,990	39,150	13.5	301.8	53.0	5.0
Barmah/Nathalia	55,200	26,940	37.5	185.1	0.0	0.0
Strathmerton	33,630	6,510	0.0	76.5	0.0	0.0
Muckatah	40,040	33,190	70.3	147.4	141.0	0.0
Broken Creek						7 weirs*
Murray Valley WSC Area	128,870	66,640	107.8	409.0	141.0	7 weirs
Total remaining works (2000)	519,240	241,510	189	1,785	562	12
Total remaining works (1995)	519,240	286,040	362	2,102	614	282

*Note: Seven Broken Creek weirs are funded under this program-Rice's, Kennedy's, Schiers, Lucke's, Nathalia Town, Ball's and Harding's. Chinaman's weir has been funded by another source.

#Reflects catchments north and south of the Broken River

- **Table 6 PSWMS Work Program (2000 – 2010) (Note red shading= not done, green = completed, amber = partially completed)**

	Proposed Works										
Catchment	**2000 priority index**	**2000/01**	**2001/02**	**2002/03**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**
Lockington DCD	12										
Lockington remodel	12										
Campaspe PSWMS	3										
Campaspe DCD	3										
Deakin PSWMS	1										
Deakin DCD	1										
Deakin remodel	1										
Corop Lakes PSWMS	4										
Corop Lakes DCD	4										
Mosquito PSWMS	2										
Mosquito DCD	2										
Wyuna PSWMS	10										
Wyuna remodel	10										
Rodney remodel	9										
Ardmona PSWMS	8										
Kialla DCD	11										
Tallygaroopna PSWMS	7										
Tallygaroopna DCD	7										
Tallygaroopna remodel	7										
Barmah/Nathalia PSWMS	5										
Muckatah PSWMS	6										
Muckatah DCD	6										
Drain retrofitting											
Drain monitoring											
Drain diversion strategy											
Diversion Metering/Management)											
Expected expenditure ($'000)		4,857	4,957	6,027	6,027	6,027	6,071	6,071	6,071	4,373	3,653

- **Table 7 PSWMS construction completed during review period**

Catchment and System Name	Length of constructed PSWMS (km)	Area drained by PSWMS (ha)	Area indirectly served (ha)	Cost per Km	Comments
Campaspe Campaspe SWMS 3A	5.3	186	2,675	$109,000	Includes 1.1km of new cut drain and 4.2 km of modified natural waterway Note that the 2000 strategy anticipated 2.3 km of new drain
Deakin Old Deakin 5 (Stage 1)	8.02	907	522	$174,000	Stage 2 designed but not yet constructed. Additional 8 km to be constructed.
Mosquito Depression Mosquito Stage 9	4.2	373	100	$195,000	Completed in 2003
Mosquito Depression Mosquito 25 Stage 2	4.3	610	932.2	$166,000	Documented as requiring 2.6km in 2000 review
Muckatah Muckatah Main SWMS – Stage 1a	4.3	380	988	$406,000	Higher unit rate due to Kinnairds works Completed in August 1999 but not included in previous review
Muckatah Muckatah Main Drain – Stage 1b	7.3	592	208	$194,000	Completed in July 2002
Muckatah Muckatah Main Drain – Stage 2	12.7	1,020	3,041	$239,000	Completed in December 2003
Muckatah Muckatah Main Drain – Stage 3	13.3	1,290	3,155	$207,000	Completed in June 2005
Muckatah Muckatah Drain 3	3.57	415	2,760	$234,000	Completed in June 2005
TOTAL	**63.0**	**5,773**	**14,381**	**$213,778 (average all SWMS)**	**$190,000 (average part*)**

Note: Cost/km includes all G-MW expenditure (including expenses incurred outside of review period)

* average excludes Muckatah Stage 1a due to inclusion of wetland works

- **Table 8 Partially completed works during review period**

Catchment and System Name	Length of PSWMS at completion (km)	Area drained by PSWMS *(ha)	% complete	Cost per Km (to June 2006)	Comments
Barmah/ Nathalia Murray Valley Drain 11	37.5	14,400	5%	N/A	Design phase Pump station construction commenced 2006/07
Mosquito Depression Mosquito Stage 10	5.0	845	90%	$150,000 per km ($190,000 projected exp)	2,776 ha indirect $0.78M exp to date
Mosquito Depression Mosquito 36	8.0	2,200	0%	N/A	Design stage
Mosquito Depression Mosquito 1/36	4.7	2,300	0%	N/A	Design stage
Mosquito Depression Mosquito 40	5.12	350	0%	N/A	Design complete. Planning Scheme to be obtained. 2,600 ha indirectly served
Muckatah Muckatah Stage 4	8.75	1,303	90%	$171,000 ($200,000 projected exp)	2,378 ha indirect $1.78M exp to date
Muckatah Muckatah Drain 8	12.46	1,660	90%	$176,000 per km ($200,000 projected exp)	ha indirect $2.19M exp to date
Mosquito Mosquito 22	13	661	0%	-	Design stage 1,380 indirectly served
Corop Lakes Stanhope	13.6	1,250	35%	N/A	Construction commenced Oct 2006
Deakin Deakin 16 Extension	15	1,200	0%	-	Design stage 5,300ha indirectly served
Tallygaroopna Shepparton 2/11 Extension	8.6	9,470	0%	-	Design stage Includes dryland area outside irrigation area
Total	131.73	35,639	-	N/A	

* denotes estimated area serviced at 100% completion

- **Table 9 PSWMS expenditure (All figures $M)**

Year	Capital Expenditure ($M)	Survey	Design	Construction	Property & Legal	Project Management
2000 / 01	4.37	0.37	0.35	3.21	0.16	0.28
2001 / 02	3.87	0.13	0.67	2.52	0.26	0.29
2002 / 03	3.17	0.22	0.32	2.21	0.26	0.16
2003 / 04	3.20	0.35	0.38	2.15	0.13	0.19
2004 / 05	3.08	0.28	0.43	1.90	0.15	0.32
2005 / 06	3.73	0.25	0.60	2.19	0.46	0.23
Total	21.42	1.60	2.75	14.18	1.42	1.47
% Total	-	7.5 %	12.8%	66.2%	6.6%	6.9%

All figures exclusive of GST

In collating expenditure and works completion information for this review, there was some difficulty in obtaining consistent data.

It is considered important that program managers continue to track and report expenditure against individual SWMS sub-catchments as well as for the particular categories of expenditure (ie survey, design, construction, property and legal and project management).

In consideration of the cost of completed and partially completed PSWMS, ***the cost of constructing PSWMS has been revised to $200,000/km for current expenditure projections.***

5.2.2 Community Surface Water Management Program

Progress on the CSWMP has been slow and similar statistics for completions and expenditure are included in **Table 10** and **Table 12**. The key point to take from this is that whilst few CSWMS have been constructed, the PSWMS implementation has provided outfall for a significant number of CSWMS if there is sufficient support for them to proceed. Partially completed CSWMS works are included in Table 11.

A total of five existing CSWMS were transferred to G-MW management during the review period. These transfers, which have required varying degrees of upgrade, include Mosquito 5/24P, Mosquito 8/24P, Rodney 3/6P, Rodney 5/6P and Coomboona 3P.

Further, a total of eight CSWMS have been constructed in the review period, most under the G-MW option as shown in Table 10.

- **Table 10 CSWMS construction completed during review period**

System Name	Length of constructed (km)	Area serviced by (ha)	Unit rate * ($ per Km)	Comments
Deakin 7/3 P	0.55	45	$145,000	G-MW Management Option Completed August 2003
Mosquito 6/25 P	2.5	118	$41,000	G-MW Management Option Completed January 2003
Mosquito 10/25 P	1.9	91	$53,000	G-MW Management Option Completed August 2002
Mosquito 11/25 P	2.1	78	$61,000	G-MW Management Option Completed August 2001
Mosquito 14/25 P	11.1	820	$38,000	G-MW Management Option Completed July 2004
Wyuna 5/7 P	8.9	706	$62,000	G-MW Management option Completed June 2002
Shepparton 3B /11P	6.0	292	$57,000	G-MW Management Option Completed June 2006
Muckatah 2A P	0.7	52	$12,000	Landowner Management Option Completed June 2001
TOTAL	33.75	2,202	$58,500 (avg)	

*Note: Unit rate does not include DPI or G-MW program support costs which have been calculated to be in the order of $24,000/km based on typical annual costs.

The reporting of expenditure for specific aspects of the CSWMP has not been specifically tracked and so ***it is considered important that program managers continue to track and report expenditure against individual CSWMS sub-catchments as well as for the particular categories of expenditure such as survey/design grants, program support, transfers and construction.***

Table 11 Partially completed CSWMS during review period

Catchment	System length (km)	Area serviced (ha)	Grants ($)	Comments
Ardmona 3/12P	2	123	$1,165	Note 1
Ardmona 5/11P	18	814	6,000	Note 1
Coomboona 1P	35	3,600	$13,428	Note 1
Coram 3/5/4	0.9	41	$7,410	Note 1
Deakin 16P	60	6,664	$134,765	Note 2
Deakin 2AP	9.3	1,023	$5,156	Note 1
Mosquito 1/36P	14.5	1,226	$93,558	Note 2
Mosquito 1/8/19P	10	736	$6,546	Note 1
Mosquito 21P	25	2,001	-	Note 1
Mosquito 22P	30	1,938	$31,970	Note 1, Note 3
Mosquito 27P	3	213	-	Note 4
Mosquito 8/25P	1	51	-	
Muckatah 1P	4	333	$9,824	Note 1
Muckatah 1/8P	2.7	302		Note 5
Muckatah 2P	7.96	565	$3,382	Note 1
Muckatah 4P	3.3	186	$81	Note 6
Muckatah 2/8P	1.96	122	$26,330	Note 6
Old Deakin 5P	32	3,155	$67,128	Note 3
Rodney 1 & 2P	6	780	$5,674	
Shepparton 26P	23	1,742	$77,519	Note 1
Wyuna 2A / 7P	3	230	$7,501	Note 1
Wyuna 6 / 3P	20	1,950	$5,142	Note 1
TOTAL	312.62	27,795	$192,757	

Note 1: Survey and design complete – insufficient support to construct
Note 2: Survey and design scheduled to be completed in 06/07
Note 3: Case study underway to examine PSWMS extension
Note 4: Feasibility stage
Note 5: Survey and design complete – constructed privately
Note 6: Under construction

- **Table 12 CSWMS expenditure**

Year	Total Capital Expenditure	Expenditure through CMA				Regional Contributions		
		Survey / Design	Program Management and extension*	Transfers	Construction	G-MW contribution	Roads authorities	Community contribution
2000 / 01	$378,552	$96,967	$ 148,023	$49,797	$29,178	$6,682	$3,651	$44,255
2001 / 02	$1,163,143	$157,322	$ 183,930	$63,534	$352,467	$48,832	$46,487	$310,571
2002 / 03	$454,341	$ 48,627	$ 132,450	$32,705	$114,810	$9,073	$11,459	$105,217
2003 / 04	$741,042	$ 89,033	$ 182,175	$ 9,616	$224,637	$5,294	$28,478	$201,810
2004 / 05	$381,933	$ 91,704	$ 237,855	$ 3,381	$17,818	$447	$2,059	$28,669
2005 / 06	$630,996	$ 49,147	$ 200,155	$ 25,441	$171,385	$2,007	$14,216	$168,645
TOTAL	$3,750,008	$532,800	$ 1,084,588	$184,474	$910,295	$72,335	$106,350	$859,167
		14%	29%	5%	24%	2%	3%	23%

All figures exclusive of GST. Note *: Program management includes all extension activities directly related to program.

The cost of constructing a CSWMS has been revised to $76,000/km for current expenditure projections. (Reference M Paganini)

5.3 Other Plan activities

Although the implementation of the SWMP has focussed heavily on construction of SWMS, a number of other works have been completed as part of the strategy which are critical to achieving the objectives. Progress on these aspects in the past 6 years is described below.

5.3.1 Retrofitting and remodelling

No retrofitting works have been completed during the review period. Murray Valley SWMS 13 has been upgraded under G-MW's Advanced Maintenance Program (AMP) as it was identified in the Murray Valley Drain 10 Water Quality Improvement Works report (SKM, 2005). The works included reshaping tracks to prevent direct runoff to the PSWMS and fencing of laneways to prevent stock access. A portion of these upgrade works were funded by the PSWMP.

Remodelling work has been completed on Deakin Main (9.7km) and Deakin 16 (7.4km). The required works was reported in the 2000 review as Deakin Drain 16 / DMD requiring 7km of remodelling. The lengths to complete in this sub-catchment have been revised to zero.

5.3.2 Primary Extension Case Studies

The Old Deakin 5P and Mosquito 22P SWMS were originally intended to be CSWMS. These catchments are very large and have been identified for a trial of PSWMS. Criteria have been set for a maximum CSWMS length for the Mosquito 22 and Old Deakin 5P Stage 2. G-MW is still waiting on final costs to determine if this is the preferred method.

5.3.3 Drainage Course Declarations

No drainage course declarations (DCD) were completed during the review period. The Muckatah DCD was not noted in the 2000 review although this has been completed. The unit costs for such works have not been examined in this review.

5.3.4 Diversion strategies

5.3.4.1 Policy

The SWMS Diversion Strategy was finalised by G-MW in 2000, at which point implementation began. As part of this process, an assessment of the water resource available was completed for SWMS catchments using a standardised methodology. This identified where additional diversion agreements could be allocated for low and high flow situations. New and revised agreements have since been issued, mainly in the Murray Valley and Shepparton irrigation areas. The same process is now undertaken for all new PSWMS works to establish and allocate the available resources for diversion.

The key issue arising from new works is that many landowners have traditionally utilised water stored in depressions. Construction of SWMS has in some cases altered a landowner's ability to do this and so G-MW has worked through numerous decisions about low flow and high flow diversion which need to be considered when issuing diversion licences on new SWMS.

5.3.4.2 Low flow

Metering of low flow diversions is partly a retrospective activity as many diversions have historically not been monitored. Low flow diversions from new SWMS are being fitted with meters as part of the construction costs. G-MW has in the past 5 years employed drain inspectors in each irrigation district to provide, among other tasks, for diversion monitoring and resolution of equity issues amongst diverters where

they have arisen. Whilst low flow diversions are often self-regulating, diversion of high flows still requires communication to diverters that high flow conditions have been declared or activated.

The objective specified in the Drainage Diversion Strategy (G-MW, 2000) was for all low flow diversion sites to be metered but not high flow diversions, unless combined with a low flow site or reuse system. Shepparton and Rochester areas completed metering low flow sites in 2001. Central Goulburn and Murray Valley areas are still installing meters and replacing failed indirect meters with more reliable and accurate direct meters (about 80% complete).

5.3.4.3 High flow

Since the DNRIS commenced, the total number of high flow storages that have been constructed in the SIR (within the Goulburn Broken catchment) with assistance from the incentive scheme is 32. The combined storage capacity is 5,728 ML. These storages have made a combined reduction in the export of phosphorus and salt loads as shown in Table 13**.** Appendix F shows a map of the constructed high flow diversion schemes in each of the water service areas.

- **Table 13 High flow storage - salt and phosphorus load diversions 2000-2006**

Water Service Area	Storage Constructed (ML)	Volume Diverted (ML)	Phosphorus diverted (kg)	Salt diverted (kg)
Central Goulburn	1,968	13,160	15,806	4,962
Murray Valley	2,315	11,170	15,663	9,473
Shepparton	1,295	8,115	7,937	3,771
Rochester (GBCMA section)	150	500	630	103
Total	**5,728**	**32,945**	**40,036**	**18,309**

Data provided by DPI, K Ockerby,

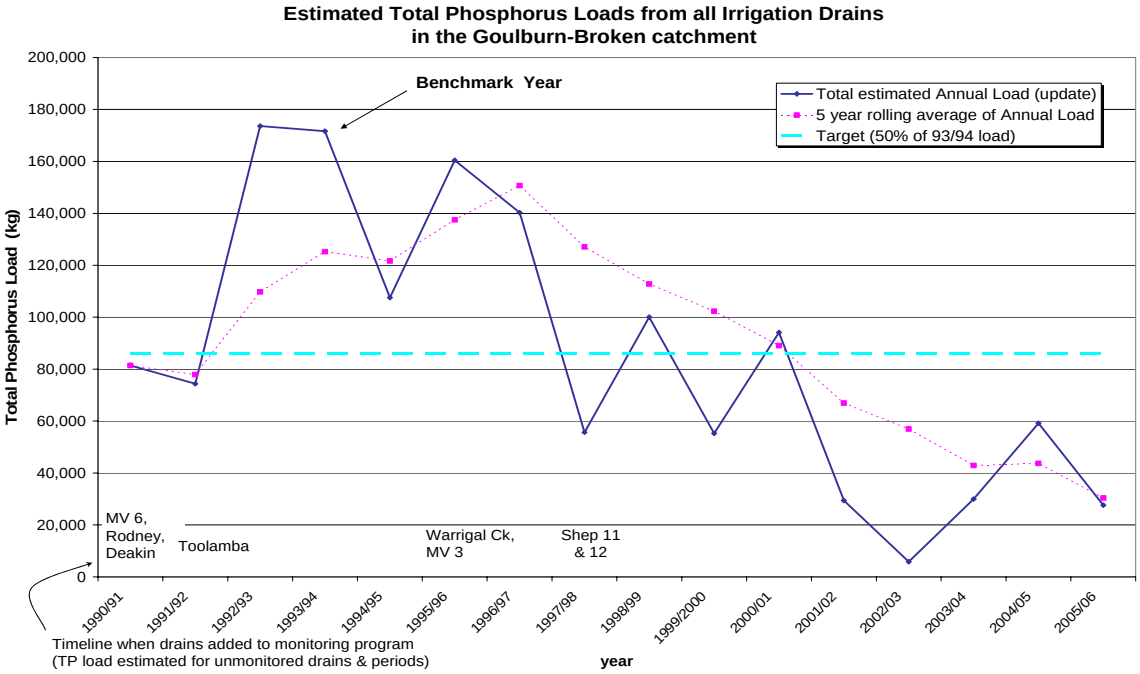
It is clear that the data collated for this program demonstrates a tangible impact of the program and provides a valuable tool for managing drainage water.

The collection and recording of data on storages constructed and the quantity and quality of water diverted should continue to be measured and reported. Coordination with Goulburn-Murray Water to examine ways to integrate all diversion data would be a valuable catchment data source.

5.3.5 Monitoring

The flow and water quality monitoring network has continued over the review period. Funding for this work is from the GBCMA and G-MW as the data serves many programs and purposes. No additional sites have been established during the review period other than those included in new PSWMS. The IDMOU is guiding decisions on new and upgraded monitoring sites. The proportion of area served by SWMS in the SIR now monitored for flow is 93% and for water quality is 87%. Analysis of the data obtained is undertaken quarterly and annually, and compared to the GBWQS target of 50% reduction in annual phosphorus export. **Figure 2** below shows that the target was reached in 2001/02. Checks are also made against salinity targets and relevant guidelines.

- **Figure 2 Phosphorus loads from Irrigation Drains in GB Catchment**



5.3.6 Nolan Review Response

The GBCMA prepared a response to the Independent Review of the Environmental Aspects of Northern Victoria's Surface Drainage Program in Irrigation Areas Feb 2001 (Nolan Review) during the review period. The response addressed each of the 14 key recommendations of the review as well as 12 'additional recommendations'. The general outcome of the response was that most recommendations either have been or are currently being addressed (GBCMA, 2005).

5.3.7 IDMOU

Following the Independent Review of the Environmental Aspects of Northern Victoria's Surface Drainage Program in Irrigation Areas Feb 2001 (Nolan Review) and the Government's response, work commenced on the development of a High Level Operating Agreement between DSE, EPA, G-MW, GBCMA and North Central CMA. This process culminated in the signing of the Memorandum of Understanding for Irrigation Drainage Management and Water Quality (IDMOU).

To implement the objectives of the IDMOU the CMAs engaged a project manager and the following outcomes have been achieved:

- Development of a risk based approach for setting water quality targets;
- Testing of target setting methodology;
- Development of format for CAOP's;
- Defining assumptions linking water quality outcomes to on-ground works; and
- Implementation of stage 1 of target setting process in the Broken Creek Catchment.

In the next five years the program will continue to support the implementation of the IDMOU and specifically will achieve:

- ***Risk based water quality targets for all catchments containing PSWMS;***

- ***An audit framework to report against water quality improvements linked to specific catchment activities;***
- ***An overarching CAOP for the SIR; and***
- ***Catchment specific CAOPs for each strategy sub-catchment.***
- ***Water quality improvement targets for the rivers at key locations.***

5.3.8 Salinity Audit

It is broadly recognised that the methods for accounting for 'average' salt disposal impacts are relatively crude. An attempt has been made to address this with a significant review of the SIR's salt disposal status. The review has highlighted a number of catchment-wide 'changes to drain impacts' which include:

- A change due to the decision to assume that the impact per km due to PSWMS is the same as the impact per km due to CSWMS. Previously, the salt disposal impact of SWMS was estimated using factors obtained from the original SIRLWSMP background papers and it was assumed that PSWMS would be deeper than CSWMS and have a higher salt disposal impact. The audit has determined that the 2 types of SWMS have a similar construction depth, and the audit is suggesting that the impact attributed to surface drainage is half the previous estimates.
- A significant addition as a result of the review is that the reduction in Tailwater Fraction has been quantified for the first time. This quantification adds a debit of 1.0 EC to the region, however, whether the reduction of this Tailwater Fraction is attributed to measures in the strategy or not, needs to be determined (SKM, 2006).

There is no immediate need to alter the implementation program to manage the availability of salt disposal credits, although planning for a future shortfall in such will need to be given priority.

Salt disposal credits are not a limitation for continued implementation of SWMP works over the next 5 years.

5.3.9 Murray Valley Drain 11 Panel Hearing

In February 2004 GMW submitted an application for a Planning Scheme Amendment and Planning Permit for the proposed Murray Valley Drain 11 PSWMS. At the close of the exhibition period on 23 April 2004, a number of objections were received. A Planning Panel was appointed to hear and consider submissions and after several delays, the hearing took place between 7 and 11 February 2005.

The Panel heard submissions from Council, the proponents (GMW), catchment partners GBCMA and DPI, local government, community groups and a number of individuals. Submissions involved:

- Water quality (salinity, turbidity, nutrients)
- Threatened species (Murray Cod, Small Scurf Pea)
- Native vegetation
- Integrated catchment management
- SWMS design

The proposal was considered against the Strategic Assessment Guidelines including the State and Local Planning Policy Frameworks as well as other strategic documents relating specifically to the Shepparton Irrigation Region.

Part of the response from the proponents was based on the achievements as shown by the outcomes of the Muckatah Mediation Agreement Audit which was carried out by an independent consultant HydroEnvironmental, to ensure that conditions set out in the Muckatah agreement had been completed. Of the 60 commitments made, only three had not been completed and only one of these was considered significant. This fact combined with the quality presentations of the proponents and stakeholders, provided the Panel with confidence in the SWMP. This resulted in a recommendation to Council that the merits of the amendment were proven and that a Planning Permit be granted. Based on the Panel report the project was gazetted in December 2005 and a Planning Permit issued on 3 January 2006.

As can be seen from the timeframe, the time taken to complete the above process has been excessive and recommendations are included in this review in an attempt to resolve the issue.

5.3.10 Management interaction

Management interaction currently occurs at a number of levels including:

- D800 meetings - PSWMS coordination meeting including interagency staff and design consultants.
- SIRTEC meetings – stakeholder representatives for the SIRCIS who provide technical input to the implementation of the SIRCIS.
- CSD CC – statewide committee.
- CSWMS Operational Group (COG) – DPI and G-MW on-ground staff.
- SWMWG – SIRCS representative group including landowners, DPI, G-MW, SIRIC, Shires responsible for implementing the SWMP.
- GMW's Drain Coordinating Committee (DCC).
- SIRIC – Responsible for implementation of the SIRCIS.

These various forums ensure that the management of the program is consistently integrated and linked to the larger SIRCIS.

5.4 Case studies

Many of the changes that have influenced the SWMP are not easily quantifiable and so three case studies were developed to better understand the potential impacts of the changes. The case studies were completed to answer questions such as:

- Has this investment been worthwhile?
- Has the provision of outfall, through construction of PSWMS, led to the construction of CSWMS?
- Factors impacting on demand for SWMS (eg water trading).
- Impacts of SWMS on the broader catchment (eg industry).

5.4.1 Case Study 1: Mosquito 24 SWMS

The Mosquito 24 catchment covers approximately 4,607 ha and is located near Merrigum. The catchment predominantly supports grazing and dairy enterprises. This catchment was selected for a case study as it includes both a PSWMS, a network of CSWMS, and a significant environmental feature. The catchment was considered too large to be served solely by CSWMS and so a PSWMS was necessary to divide the catchment into a number of smaller community groups.

Details of the study are included in Appendix H.

The key conclusions drawn from this study include:

- ***It would appear that limits on available funds, whilst a valid reason for slow implementation, may not be the main reason for lengthy delays in proceeding.***
- ***There is a view amongst some members of the community that SWMS is not required.***
- ***Implementation in some sub-catchments, such as the 9/24P, can be stalled by a small number of landholders who do not support the implementation of CSWMS.***
- ***The Mosquito 24 PSWMS construction costs were in-line with expectations, with unit rates of $178,000/km comparing well with the estimated rate of $177,000/km.***
- ***Environmental features can be incorporated into design of PSWMS and can be cost effective***
- ***The increased costs to implement CSWMS are having an impact on SWMP bottom line.***

5.4.2 Case Study 2: Muckatah Stage 1 – Kinnairds Wetland

The Muckatah Catchment covers approximately 600 sq km and is located south-east of Yarrawonga, extending westerly before outfalling into Kinnairds Wetland and the Broken Creek near Numurkah. The catchment is generally flat with the Muckatah depression being a shallow meandering ancestral watercourse. Approximately 4,500 hectares of wetlands exist in the catchment, ranging from several significant wetlands, typically redgum in origin, to open freshwater meadows.

This catchment was selected for a case study as the design was modified significantly to incorporate a wetland near the outfall.

The key conclusions drawn from this study include:

- ***Assessment procedures have progressed to a point where identification and mapping of environmental features, and hence the ability to manage these into the future has expanded significantly.***
- ***Planning conditions, including compliance with legislative controls and community acceptance, can add significantly to the implementation timelines.***
- ***The incorporation of environmental features is recognised as performing a valuable nutrient reduction function with respect to protecting water quality improvements in receiving waterways.***
- ***A significant environmental wetland feature added significantly to the capital cost of the Muckatah PSWMS.***
- ***Improvement of Kinnairds Wetlands as a public amenity has had a significantly positive impact on community and social wellbeing.***

5.4.3 Case Study 3: Shepparton 3B / 11P CSWMS

The Shepparton 3B 11P Catchment covers approximately 328 ha and is located near Tallygaroopna, approximately 20km north of Shepparton.

The Shepparton 3B/11P G-MW CSWMS services a catchment area of 291.9ha, serves 15 properties and has a total length of 6.05 km. The outfall for the CSWMS is to G-MW's Shepparton 11 SWMS to the south west of Tallygaroopna.

This catchment was selected as it is an example of a recently constructed CSWMS. In this case, construction was carried out under the direction of GMW.

The key conclusions drawn from this study include:

- ***Flexible management is able to contribute to timely implementation of SWMS.***
- ***CSWMS are more likely to proceed with the G-MW management option.***
- ***Current CSWMS design principles are valid and can be affected by catchment specific features.***

6. Performance Assessment

As part of the MER process, output performance is generally evaluated annually and outcome performance is evaluated about every 5 years. The latter should include a review of the assumptions underpinning the SWMP.

As discussed, the SWMP performance has really only been reported using output indicators until now. Further, the performance targets for the works to be undertaken following the 2000 review were implied and not formally specified. This is to be expected as budgeting of such programs is often fluid and there was very little emphasis on targets to be achieved other than construction lengths and areas (hectares) protected.

Despite the historic evaluation of benefits being completed using Drainage Evaluation Spreadsheet Model (DESM), there is now a much stronger emphasis on evaluating the SWMP benefits using triple bottom line reporting (TBL). The methodology to be used for such a reporting framework is outlined in a paper which was prepared by HydroEnvironmental in 2006.

It can sometimes be problematic to examine TBL aspects specific to the SWMP because social and environmental aspects are interrelated with the broader RCS. The degree to which the methodology can be followed is described for these aspects in the following sections.

6.1 Review of objectives and goals

It is useful to examine the goals and objectives to provide a context for this review.

The SWMP generally has been delivering and continues to deliver what it proposed, being to:

- enable removal of excess rainfall run-off from irrigated land,
- provide an outfall for groundwater pumps,
- facilitate management and reduction of nutrient inflows, and
- create the opportunity to preserve and enhance wetlands and native vegetation.

These objectives are still largely sound, however, the program would benefit from reviewing these objectives to align them with a number of new influences, including National Frameworks and the agreed principles of the IDMOU.

In addition to these objectives, the ***Steering Committee agreed that the following objective should be added to the mix, in recognition that the SWMP has been a catalyst for improved water use efficiency throughout the irrigation region:***

- ***facilitating increases in water use efficiency and irrigation management,***

The broad goal of the SWMS was discussed with the Steering Committee and revised to read:

'By 2020, improve the health of natural resources and improve the productivity in the Shepparton Irrigation Region by providing an appropriate Surface Water Management service in areas where the total economic, social and environmental benefits, exceed the cost.'

The goals and objective of the SWMP are probably still appropriate, however there would be benefit in reviewing these objectives to align them with the National Frameworks. A revision of the current objectives into perhaps 'targets' will need to include explicit reference to the threats being managed, for example, high and saline watertables.

The 'sub-goals' listed in the 2002 Review should also be considered in this review of objectives.

These 'objectives' and the logic associated with them need to be framed around the 'Resource Condition Targets' that are the primary focus for the SWMP, in this case river and land salinity. The contributions of the SWMP to the beneficial secondary outcomes such as wetlands and native vegetation also need to be better defined.

In addition, it is important to clearly demonstrate the economic, environmental and social consequences of the investment. Initially, it may be beneficial to document what is known to be useful to enable informed decisions on the required directions.

The current drought conditions combined with the growing complexity in being able to demonstrate the often intangible benefits of the SWM Strategy have led to growing concern that the Strategy may not continue in its current form. Some of the issues surrounding these concerns are discussed in the following sections.

6.2 Economic performance

6.2.1 Modelling context

The basis of the SWMP's economic viability is the Murray Darling Basin Commission's DESM model. This model has been used to assess the economic benefit : cost ratio of the SWMP works, which was originally determined (in 1989) to be 2.1:1. It should be noted that the DESM benefits are acknowledged as being an understatement of the true benefits of surface water management (SMEC 2001). This has perhaps not been a selling point for government investment in the past. Some of the less tangible environmental and social benefits are now being estimated as common practice. These aspects are discussed further in Sections 6.3 and 6.4.

A significant review of the business case for the SWMP was completed by SMEC for the 2000 review (Project 2). The conclusion from this review was that provision of surface water management initiatives within the SIR was not only beneficial but seen to be best practice. Despite this conclusion, the benefit:cost ratio for the SWMP continues to fall, quoted as being reduced from 1.7 to 1.23 between the 1995 and 2000 Strategy reviews.

One of the greatest concerns for the Strategy, conveyed through steering committee contacts is the perceived escalation in construction costs over the past 6 years. This is particularly concerning given the proportion of benefits attributed to particular works. It is noted that of the benefits of the SWMP documented in the 2000 review (SMEC 2001(a)), over 37% was quoted to be in roads. This would suggest that regional benefits of the strategy are perhaps more important than the individual landholder benefits. This is potentially a major

impediment to the progress of the CSWMP program as landholders are less likely to be in a position to make significant investments in either SWM infrastructure or on-farm improvements within the next 5 years.

6.2.2 Current Performance Indicators

As discussed in Section 4.3.8, the performance indicators for the SWMP are related mainly to outputs of the program. Although there has been no formal agreement regarding the methodology or specific indicators to be used for assessment of the economic performance of the strategy, the performance indicators which are currently being reported are summarised as follows:

- Benefit: Cost ratio. Previously reported as:
  - 2.1 in 1993 (RWC, Jacob and Hallows, 1993)
  - 1.7 in 1995 (GBSPAC, 1995)
  - 1.23 in 2000 (SMEC, 2000)
- Unit cost per km Primary SWMS
  - $120,000/km (GBSPAC, 1995)
  - $177,000/km in 2000 ($1999)
  - $200,000+/km in 2005/06
- Unit cost per km CSWMS
  - $20,000/km (RWC, 1989)
  - $30,000/km (GBSPAC, 1995)
  - $67,800/km (SMEC, 2000, $1999)
  - $76,000/km in 2005/06
- Operation and maintenance cost per km Primary SWMS
  - $410 /km/yr (RWC, 1989)
  - $554 /km/yr (SMEC, 2000)
  - $750 /km/yr (2005/06)
- Operation and maintenance per km of CSWMS
  - $200/km/yr (RWC, 1989)
  - $463 /km/yr (2005/06)

The DESM model was not re-run for this review as previous model was not able to be located. An alternative methodology was adopted. A brief review of the methodology adopted and the parameters used in the model was completed and the results for this are tabulated in Appendix D**.** This review was done mainly to provide an indication of the confidence limits of adopting an indexation as a means of updating the benefits. This review indicates that the basis for assessing the benefits may have changed in a non-linear fashion.

It was also discovered in reviewing the model parameters that there is a potential issue in comparing benefit-cost ratios from one review to the next. The 1995 strategy assumed a capital investment profile that saw works in each catchment begin in the first year. This was to enable comparison of catchments and subsequent prioritisation of works. In actual fact, the capitalised cost using this approach is not representative of the true cost as the program proceeds. It is also not clear how the capitalised costs was calculated for the 1995 and 2000 review so no further comment can be made about the figures published.

Full reporting of actual expenditure should be included in the 5 year review process and included in revisions to the economic evaluation of the SWMP.

A brief methodology for the current calculation is included in Appendix D.1. The capital costs were updated with actual expenditure information supplied by G-MW and DPI and are summarised in Table 14. The benefits were assumed similar to the 2000 review and have been updated as shown in Table 15. Operation and maintenance costs $22.84M ($1999) and downstream costs $0.32M ($1999) were indexed from the previous review to $27.7M and $0.39M respectively.

The benefit: cost ratio was evaluated as being 1.16:1.

A review of the benefits of the SWMP should be undertaken within the next 2 years to provide a better indicator of the economic and environmental status of implementation.

Costs will continue to escalate for features such as wetland protection and/or enhancement, which was never envisaged as being part of the SWMP, however the benefits do not appear to have been quantified. This should be a focus prior to the next review in 2011.

It is understood that there is work currently being undertaken by URS to review the existing cost share arrangements that Government has in place for the RCS.

The status of the remaining performance indicators is summarised below Table 14.

- **Table 14 Summary of capital investments**

Review Period	Indicator	PSWMS		CSWMS		Area directly served by implementation (ha)	Total Cost $M
		Length completed* km	Expenditure $M	Length completed km	Expenditure $M		
1990 – 1994	Completed in period	27.1	$5.68	85.71	$2.13		
	Cumulative completed to date ($ nominal)	37.98	$5.68	85.71	$2.13	183,100	$7.81
	Cumulative to date($)	-		-		-	
1994 – 1999	Completed in period	140.1	$21.43	269.13	$11.46	44,530	
	Cumulative completed to date ($ nominal)	167.2	$27.11	354.84	$13.59	227,630	$40.7
	Cumulative to date ($)	-		-		-	
2000 - 2006	Completed in period	80.7	$21.42	33.75	$3.75	7,928	
	Cumulative completed to date ($ nominal)	247.9	$48.55	-	$17.34	235,558	$65.89
	Cumulative to date ($ 2006)		$ 58.07		$21.56		$79.63
Projections post 2006	Nominal	-	$38.11	-	$133.07	-	$ 171.18
Projections post 2006	Present Value					-	$120.72
CAPITAL COST		$89.3 M	$139.0 M	$ 1.93M			$200.35M

* Includes new PSWMS and remodelling

- **Table 15 Summary of (DESM) benefits**

Period	Salinity	Waterlogging	Flooding	Reuse	Roads	10% Land-use change	Total Benefit
1995 (model) (from 1995)	$22,600,000	$18,700,000	$ 41,300,000	$32,500,000	$77,100,000	$ 0	**$ 195,400,000**
2000 ($1999) (from SMEC 2000)	$24,200,00	$ 20,000,000	$ 47,590,000	$ 34,750,000	$ 82,450,000	$9,180,000	**$ 218,130,000**
2006 ($2006)	$ 29,312,332	$ 24,265,176	$ 57,726,853	$ 42,160,743	$ 100,033,187	$ 11,137,716	**$ 264,636,006**

Note: Figures above indexed from 2000 review using CPI 1999/00 = 125.2, 2005/06 = 151.9

The benefit of the SWMP outweighs the costs by a ration of 1.16 to 1.

It should be noted that the real present value of the benefit and costs can vary greatly depending upon the finance profile adopted.

Limited availability of funds historically continues to erode the bottom line of the SWMP. Stalled completion rates for CSWMS are also starting to affect the true value of the investment made to date.

6.3 Environmental performance

The environmental aspects of SWM across the SIR are closely linked to the Environment Program (see **Figure 1**). The Environment Program is being reviewed separately however it is very clear that the SWMP and the Environment Program are closely linked.

Proposed performance indicators focus on areas of native vegetation (protection and enhancement) and wetland health. The areas where progress has been made are discussed below.

- **Native vegetation mapping** – A project carried out as part of the Sub-Surface Drainage Program (Assessment of High Value Environmental Features within the SIR, 2006) identified areas of native vegetation and wetlands under existing or potential threat from salinity. Mapping of native vegetation has been completed in the review period through this project which identifies all high value environmental features located on public land and some located on private land. A priority has been assigned to each feature for protection.

  The total area revegetated under the environment program and the proportion attributed to the SWMP is shown below in **Table 16**. The mapping of this protected vegetation does not occur directly under the SWMP.

  - **Table 16 Vegetation Planted**

Year	Total Vegetation Planted (ha)	Area Planted adjacent to SWMS (ha)	Proportion attributed to SWMP (%)
2000/01	79.9	4.9	6%
2001/02	59.2	12.65	21%
2002/03	58.1	7.55	13%
2003/04	44.4	8.47	19%
2004/05	18.1	0.40	2%
2005/06	48.26	1.60	3%
TOTAL	307.96	35.57	11.6%

Source of figures: DPI Tatura 2007 (A Sislov).

The mapping of native vegetation protected should be a routine task carried out at the completion of works on new SWMS.

- **Wetlands** – The SWMP has protected a number of wetlands by incorporating and enhancing them in a number of SWMS. The wetlands, including Brays Swamp (part of the Mosquito Drain 24), Reedy Swamp (part of Shepparton 11 SWMS), Mansfield Swamp (part of the Timmering SWMS), and Kinnairds Wetland (part of the Muckatah SWMS) have all been specifically designed to deliver environmental water allocation and improve water quality of the outfalling water. A brief commentary on the wetland incorporated into designs implemented in the past 6 years is included below;

  - **Bray's Swamp**

    Bray's Swamp is an 80 ha privately owned wetland complex southwest of Merrigum. It is a shallow ephemeral wetland, approximately 0.5 m deep. It is located in a prior stream depression (Byrneside Depression) and is fed from a 4,605 ha catchment that begins southwest of Tatura. It is a terminal wetland system at the bottom of the Byrneside Depression, Mosquito 24 Sub-catchment. The outfall

from the swamp historically flowed 3 km north to the main Mosquito Prior Stream Depression (*Bray's Swamp Environmental Management Program, March 2001*).

The wetland vegetation is dominated by Barren Cane Grass (*Eragrostis infecunda*) and River Red Gums (*Eucalyptus camaldulensis*). It is a popular breeding ground for a variety of birds, including the Brolga (*Grus rubicundus*).

The wetland is of state and regional significance, representing a habitat type that was once more common and was a Brolga breeding site (*DCE & OE 1992, Webster 1993 in Bray's Swamp Environmental Management Program, March 2001*). A more recent history of unseasonal or prolonged flooding at the site, arising from irrigation-induced runoff gravitating to the wetland, threatened these values.

The construction of the Mosquito 24 PSWMS to service the irrigation community has similarly provided an ability to now manage the flood regime in the wetland. The flooding flows are now able to enter the wetland via specifically designed overflow spillways in the SWMS and outfall from the wetland is regulated with a drop-bar structure prior to flow rejoining the Primary SWMS. An Environmental Water Allocation or 'make-up' supply has been used to enable a greater degree of flexibility in wetland management. This enables control over the flood regime in the wetland for the first time (*Bray's Swamp Environmental Management Program, DPI March 2001*).

Bray's Swamp Management Plan was endorsed in 2001 and since then, monitoring has occurred when water has been delivered via Environmental Water Allocations. This monitoring includes the observation of bird and invertebrate species, water quality and vegetation regeneration (*Bray's Swamp Environmental Monitoring 2005/06 report. 2007*.)

- **Kinnairds Wetland**

  Kinnairds Wetland is a freshwater marsh that covers 93 ha and is made up of both public and private land. The Muckatah depression drains into the northern end of Kinnairds, before outfalling into the Broken Creek. The wetland supports a number of waterbirds listed under the migratory agreements JAMBA and CAMBA (Japan and China Migratory Bird Agreements) as well as a number of wading birds. The wetland vegetation is dominated by common spike sedge (*Eleocharis acuta*) and water milfoil (*Myriophyllum spp*) with sparse mature River Red Gums (*Environmental Review of the Muckatah Catchment, Nov 2004*).

  In addition works carried out during the construction of the Muckatah SWMS were designed to enhance environmental values throughout the catchment. This was achieved by constructing some 156 overflow sills that have been set at levels to ensure the reinstatement of appropriate wetting and drying cycles. A silt trap and drainage diversion sump upstream of Kinnairds wetland collects sediment prior to water entering the retardation basin system (*Environmental Review of the Muckatah Catchment, Nov 2004*).

  Downstream flows enter Kinnairds via a series of low confining banks along the eastern boundary. The shallow wetland profile ensures the maximum removal of sediment, with the low sediment water delivered into the Broken Creek (*Environmental Review of the Muckatah Catchment, Nov 2004*).

A complimentary monitoring program is carried out on a fortnightly basis for a range of physical and chemical parameters upstream and downstream of Kinnairds wetlands and suggests that water quality is improved. This monitoring will continue and includes continuous turbidity monitoring for the first time in a SWMS *(Greg Smith, G-MW, in Environmental Review of the Muckatah Catchment, Nov 2004)*.

Kinnairds Wetland design was the recipient of a Banksia Environmental Award in 2000.

The improvements have been achieved through a number of initiatives including sills of varying levels to enable the appropriate wetting and drying cycles to occur, silt traps, water management, vegetation buffers and constructed wetlands.

- **Works assessment procedures** – A comprehensive assessment procedure has been developed by the DPI Environmental Management Program to assess natural features, determine potential impacts and make suitable recommendations for the implementation of new surface water management systems. The development of these procedures and the ongoing cooperative approach to implementation ensures that legislative requirements are considered and incorporated at the planning and design phase.

- **Design intention** – The design of new surface water management systems is vastly different to historic methods. SWMS are now planned and designed to be sympathetic to the environment and to enhance features where possible. This flows on to wetland management where, as much as possible, natural watering regimes are mimicked. A suitable performance indicator could be the number or area of high value remnant vegetation and wetlands that have been protected or enhanced, although the definition of these terms need to be carefully written to avoid ambiguous interpretation and hence unreliable data.
- **Water Quality & Quantity -** nutrient exports and summer flows have been in sharp decline since 2000 and are now well below the GBWQS target (refer graph in Section 5.3.5). An assessment of biological impacts in receiving water has not detected any trends to date. (G Smith)

6.4 Social performance

Social performance indicators have not been used previously for the SWM Program. However, HydroEnvironmental has developed an assessment framework to determine the social indicators which should be used to assess social performance for future works. The methodology proposed for a social assessment is primarily qualitative and relies upon feedback through workshops and case studies. In this instance, feedback has been sought through the three case studies (Section 5.4) as well as Steering Committee feedback at the February 2007 meeting. The outcomes of this feedback are detailed in **Table 17** Social Assessment**.**

The indicators to be assessed include:

- Community well-being – population stability and community health
- Sense of community – cohesion
- Natural resources knowledge base – understanding of issues and processes
- Improved business confidence – reduced business risk and greater preparedness to invest in the SIR.
- Access to water supply
- Security of water supply – program impact

- Changes in landscape – aesthetics / environment
- Confidence in the program – likelihood of objectives being achieved
- Protection of significant cultural and historic sites.

Each indicator should have been assessed for the 'do-nothing' scenario and for the 'with-works' scenario. Given that this assessment was not completed originally, a number of assumptions have been made regarding the initial plan perception, which also considers the program in light of 'normal' climate conditions.

- **Table 17 Social Assessment**

Indicator	Comment on appropriateness of Indicator to SWMS	Score (+5 / -5)
Community well-being	There was a feeling that with new SWMS, there was a generally positive feeling and improved economic performance, however there was nothing significant noted for existing SWMS.	+3
Sense of community	There was a sense that although CSWMS have not progressed as much in the past 5 years, the overall level of achievement in this indicator was high.	+3
Natural resources knowledge base	Extension activities associated with the program are credited with the broader education of landholders around the region. The increased knowledge is not limited to drainage considerations but brings together aspects relating to environmental values and best farm management practices	+4
Improved business confidence	It was felt that with SWMS, there was a greater level of confidence for development to occur.	+4
Access to water supply	Rules in place to control increase in water on undrained properties.	+3
Security of water supply	There were instances noted where existence of works had allowed additional water to be secured, although this was generally not widespread.	0 to +1
Changes in landscape	The landscape of the SIR is seen to be improved compared to previous times. Some debate whether people attributed the improvement to the SWMS or not. This was not material.	+3 to +4
Confidence in the program	The general feeling is that program confidence is positive; there are other external factors that may have had an impact on program implementation.	+3
Protection of significant cultural and historic sites	The process of assessing impacts of proposed works was seen to be positive as the sites would not have otherwise been identified.	+4

The SWMP has been assessed as generating significant social returns.

7. Future of the SWMP 2006-2011

The next review of the program is due in 2011, however given the changes that have occurred both external to the program and with the projected implementation rates of the actual program, it would be appropriate to review the priorities and revisit the targets.

7.1 Primary Surface Water Management System Works Program

The PSWMP has largely followed the program priorities developed in the 1995 SWM Strategy. Although there are still some significant works being designed and constructed (shown in **Table 18**), it is likely that the PSWMP will shift focus for the next review period. The focus beyond 2011 is likely to move to operating and maintenance of previously constructed SWMS.

Continuation of the PSWMS works program is essential if the projected benefits of the SWMP are to be realised. Despite current dry climate conditions, there is no evidence to suggest that the need for SWMS has diminished and it is unlikely that the landscape will change enough over the foreseeable future to negate the need for SWMS.

Of the 133 km remaining, approximately 127 km is either at construction or survey and design phase. Funding of around $4M per year is required to ensure that the short term program targets are met by 2011. A revised program has been included in **Table 19** and the costs for implementation are included in **Table 20**.

The following priorities are included in the PSWMP:

- ***Complete existing construction works including Stanhope, Muckatah Stage 4 and Murray Valley 11.***
- ***Continue to implement remaining works as shown in Table 19.***
- ***Continue to evaluate priorities and document reasons for deviations.***
- ***Ensure that designs of future works are available for rapid implementation as the need for services arises and in response to available government funding.***

Funding of around $4M per year until the year 2011 is required in order to complete works currently being planned.

Operation and maintenance activities are to be undertaken in the context of Catchment and Asset Operation Plans which will continue to be developed in accordance with the approved list of priorities (G-MW IDMOU catchment data).

Projected program expenditure for the next 5 years has been based on the best estimate of the likely level of government funding.

7.2 Community Surface Water Management System Works Program

The Community SWMP is dependant on the construction of PSWMS for outfall and these have largely been constructed. The community program has and is likely to continue to slow considerably as a number of external factors influence the ability of the community to financially commit to the works. It would appear that an alternative model may be required to ensure full implementation in a timely manner.

A review of the cost share arrangements for the CSWMP was undertaken by Mike Young and Associates in 2004. The purpose was to examine financial incentives for providing an accelerated implementation rate. It also hints at a "market failure" of existing arrangements. It does not appear that any real progress has been made in addressing this aspect of the Strategy, although a number of policy developments such as PSWMS extensions have been completed, which means future implementation of CSWMS may occur more quickly.

As part of this current review, a workshop was held between DPI staff to examine where some initiatives could be explored to reinvigorate the program. The two key areas identified through this workshop were:

- Improved communicated program reporting and promotion. The current reporting regime is heavily focussed on basic indicators such as length of CSWMS constructed and does not necessarily highlight the additional benefits achieved by the works. These benefits are generally acknowledged and include aspects such as nutrient removal, implementation of best farming practices, improvements in rural landscapes and increased awareness of native vegetation management.
- Management options for program implementation. These include:
  - G-MW Management Option
  - Landowner Management Option
  - Local Government Management Option
  - Landscape controls – eg. landuse could be managed according to regional catchment objectives.
  - Revised incentive arrangements – for example, funding could be increased if on-farm works such as landforming could be completed at the same time as CSWMS construction.
  - Improved coordination between programs including data and information management and access.

Mechanisms have been put in place by DPI to evaluate priorities for implementation as interest and need arises. Outfall is unlikely to be a limiting factor in many of the CSWMS proceeding and so future funding pressures may be experienced. ***Priority policy will need to be stringently applied and should be supported as conditions dictate future needs for CSWMS implementation.***

The best option for the CSWMP is that the G-MW takes ownership of some CSWMS where appropriate, such as if the CSWMS outfall is to a natural waterway.

G-MW and DPI should continue to work together in planning CSWMS and should continue to examine alternative management techniques for facilitating progress.

Current work being undertaken by URS is likely to influence the degree to which cost sharing could be used to promote the program. It is also likely that the reconfiguration teams may need to look at how cost share arrangements are considered in their work.

The cost to implement the remaining CSWMP is in the order of $132M as shown in Table 20. Funding of around $11M per year, shared between government and community, would be required to achieve full implementation by 2020. However, based on current levels of funding and the climate, it is planned to provide only nominal funding ($500,000 per year) to maintain some implementation rates. Staffing levels will also need to be considered as support activities will still be required.

7.3 Other works

There is no retrofitting / remodelling planned for the next 5 years. It is likely that the need for future works on this aspect will be targeted through the CAOP process. Based on current funding arrangements, program managers should continue to adapt solutions to fit issues as the need arises.

The need for retrofitting in the next 5 years would be evaluated if and when a requirement arises.

The diversions metering strategy has been reviewed and should continue to be implemented where new meters are required.

Funding will be required for the continuation of metering programs over the next 5 years.

This review has not examined in detail the proposed DCD remaining on the priority list. Therefore, no revision has been made to the length of DCD required. ***Given that no DCD have been completed recently and are not planned for the next 5 years, there is likely to be a need for the large areas targeted for DCD to be subject to a feasibility review with a view to deciding on the future need for DCD by 2011.***

7.4 Monitoring

The drain monitoring program has kept pace with the implementation of the SWMP. There has been little change over the past 5 years, apart from the addition of sites at the completion of SWMS construction. The implementation of the IDMOU and construction of SWMS will influence the monitoring requirements for the next period.

The monitoring includes a range of standard parameters such as:

- Level and Flow;
- Salt (electrical conductivity),
- Nutrients, and
- Suspended solids, turbidity and pH.

G-MW estimates that monitoring costs will be in the order of $110,000 per year for the next 5 years and that the metering program will require $25,000 per year. An additional $200,000 per year will be required to implement the IDMOU monitoring activities.

Continuation of the current level of monitoring will need to be funded and supported in order to support the objectives of the SWMP and to enable suitable evaluation of its performance.

Table 18 Status of SWM Strategy - Works Remaining as at July 2006

SWMS Area	Area of Catchment (ha)	Area serviced 2006 (ha)	Area remaining requiring SWMS or service (ha)	New Primary SWMS (km)	Community SWMS (km)	Drainage Course Declarations (km)	Primary SWMS Remodelling (km)
Lockington	20,440	1,780	3,620	0	46.8	120	0
Bamawn	11,570	190	1,550	0	13.2	0	0
Wharparilla	9,470	6,180	3,290	0	35.7	0	0
Campaspe	11,180	186	7,214	0	58.6	20	0
Strathallen	9,240	0	4,360	0	28	0	0
Rochester WSC Area	61,900	8,336	20,034	0	182.3	140	0
Deakin	46,230	2,842	18,368	15.0	157.05	15	0
Corop Lakes	48,620	4,400	34,450	15.0	121.8	143	0
Tongala	14,930	0	2,160	0	14.1	0	0
Mosquito	45,990	12,010	22,110	20.7	213.7	56	0
Coram	7,100	0	1,660	0	19.1	0	0
Wyuna	22,750	2,136	12,204	0	124.9	0	0
Rodney	17,230	6,480	4,200	0	61.3	0	0
Coomboona	15,360	2,030	6,870	0	53.9	0	0
Ardmona	9,420	2,400	3,330	0	25.7	0	0
Toolamba	8,740	2,940	1,470	0	25.6	0	0
Central Goulburn WSC Area	236,370	35,238	106,822	50.7	817.2	214	0
Kialla	17,110	1,040	4,930	0	48.1	14	0
Shepparton South WSC Area	17,110	1,040	4,930	0	48.1	14	0
Shepparton	9,800	292	540	0	2.4	0	0
Tallygaroopna	37,110	200	27,008	13.5	217.6	53	5
Invergordon	19,180	0	5,480	0	24.4	0	0
Kaarimba	8,900	0	5,830	0	51	0	0
Shepparton North WSC Area	74,990	492	38,858	13.5	295.4	53	5
Barmah/Nathalia	55,200	400	26,940	37.5	185.1	0	0
Strathmerton	33,630	1,800	6,510	0	76.5	0	0
Muckatah	40,040	5,199	29,441	29.13	146.7	0	0
Murray Valley WSC Area	128,870	7,399	62,891	66.6	408.3	0	0
Total Remaining Works (2006)	519,240	52,505	233,535	130.8	1,751	421	5

Table 19 Proposed PSWMS Work Program (2006-2011)

	Proposed Works						
	Year						
Catchment	**2000 rating index priority**	**Works comment**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**
Lockington DCD	12	The length of DCD remaining at July 2006 is 120km					
Campaspe DCD**	3	The length of DCD remaining at July 2006 is 20 km					
Deakin Primary SWMS	1	The length of drain remaining is 15km					
Deakin DCD**	1	The length of DCD remaining at July 2006 is 15km.					
Corop Lakes SWMS	4	The length of drain remaining is 13.6 km					
Corop Lakes DCD	4	The length of DCD remaining at July 2006 is 143 km					
Mosquito Main Drain		Completion of 27.2km of new drains required					
Mosquito DCD**	2	The area of DCD remaining at July 2000 is 56 km (SMEC2001)					
Kialla DCD**	11	The area of DCD remaining at July 2000 is 14 km (SMEC 2001)					
Tallygaroopna primary SWMS	7	The Shepparton Drain 2/11 catchment requires 13km					
Tallygaroopna DCD	7	The area of DCD remaining at July 2000 is 53 km (SMEC 2001)					
Tallygaroopna remodel	7	The length of remodelling required at July 2000 is 5km (SMEC 2001)					
Barmah/Nathalia Primary SWMS	5	Murray Valley Drain 11 construction commenced 2006/07- 28km					
Muckatah Primary SWMS		Completion of Muckatah Stage 4 required – 7.3km					
Muckatah DCD**	6	The area of reported by SMEC 2001 was 141km This is completed and has been corrected in tables.					
SUBTOTAL			4,250*	4,000	4,000	4,000	4,000
Drain retrofitting	8, 9 and 10	Nominal budget allocated for works as required	0	0	0	0	0
Drain monitoring		Nominal budget allocated	310	310	310	310	310
Drain diversion strategy		Nominal budget allocated	0	0	0	0	0
Diversion (Metering/Management)		Nominal budget allocated	25	25	25	25	25
Expected expenditure ($'000)			4,585	4,335	4,335	4,335	4,335

Note: program assumed Muckatah and Mosquito works will be completed under existing arrangements. Details of all works included in Appendix G.

* Based on 2006/07 forward budget estimates at time of estimate. **These works were identified in the previous review as part of the proposed work program. They remain in this table for that reason, even though they are not proposed in the next five year work plan.

Table 20 Status of Strategy - Costs Remaining as at July 2006

SWMS Area	Area of Catchment (ha)	Area serviced 2006 (ha)	Area remaining requiring SWMS or service (ha)	New Primary SWMS ($M)	Community SWMS ($M)	Drainage Course Declarations ($M)	Primary SWMS Remodelling ($M)
Lockington	20,440	1,780	3,620	0	3.56	3.0	0
Bamawn	11,570	190	1,550	0	1.00	0	0
Wharparilla	9,470	6,180	3,290	0	2.71	0	0
Campaspe	11,180	186	7,214	0	4.45	0.5	0
Strathallen	9,240	0	4,360	0	2.13	0	0
Rochester WSC Area	61,900	8,336	20,034	0	13.85	3.5	0
Deakin	46,230	2,842	18,368	3.0	11.94	0.38	0
Corop Lakes	48,620	4,400	34,450	3.0	9.26	3.58	0
Tongala	14,930	0	2,160	0	1.07	0	0
Mosquito	45,990	12,010	22,110	4.1	16.19	1.40	0
Coram	7,100	0	1,660	0	1.45	0	0
Wyuna	22,750	2,136	12,204	0	9.49	0	0
Rodney	17,230	6,480	4,200	0	4.66	0	0
Coomboona	15,360	2,030	6,870	0	4.10	0	0
Ardmona	9,420	2,400	3,330	0	1.95	0	0
Toolamba	8,740	2,940	1,470	0	1.95	0	0
Central Goulburn WSC Area	236,370	35,238	106,822	10.1	62.06	5.36	0
Kialla	17,110	1,040	4,930	0	3.66	0.35	0
Shepparton South WSC Area	17,110	1,040	4,930	0	3.66	0.35	0
Shepparton	9,800	292	540	0	0.18	0	0
Tallygaroopna	37,110	200	27,008	2.7	16.57	1.33	0.38
Invergordon	19,180	0	5,480	0	1.85	0	0
Kaarimba	8,900	0	5,830	0	3.88	0	0
Shepparton North WSC Area	74,990	492	38,858	2.7	22.48	1.33	0.38
Barmah/Nathalia	55,200	400	26,940	7.50	14.07	0	0
Strathmerton	33,630	1,800	6,510	0	5.81	0	0
Muckatah	40,040	5,199	29,441	5.83	11.15	0	0
Murray Valley WSC Area	128,870	7,399	62,891	13.33	31.03	0	0
Total Remaining Works (2006)	519,240	52,505	233,535	26.13	133.08	10.54	0.38

The estimated capital cost to complete the SWMP is $170.13M.

7.5 Strategic direction / Implementation

A number of aspects of the SWMP would benefit from an increased focus on strategic aspects of program implementation which may assist in promoting the program into the future. Many of these aspects relate directly to potential improvements in the collation of information on performance measures. The following conclusions are largely based on the challenges experienced through the process of preparing this review.

It is recognised that some of these aspects may be considered as high priorities and some may be considered as 'nice to have'. However, additional work on all of these areas has been included as it will contribute to a more targeted program in the interim and a more rigorous and strategic review of the Strategy in 2011.

7.5.1 Review of economic benefits

The economic benefits of the SWMP have not been satisfactorily updated as implementation has progressed. The economics are based on a catchment scale assessment which does not necessarily reflect the true economic viability of individual SWMS. Although this limitation of the adopted method is broadly acknowledged there is growing pressure to justify the cost of individual SWMS.

Improved understanding of the current benefits of individual SWMS is required in order to provide a better understanding of the economic benefits of the overall program.

Further, the economic analysis includes a number of assumptions that mean the currently quoted indicators are not a true reflection of the overall program benefits. An example of this is the assumption about timing of works. Existing benefit-cost calculations are based on an assumption that all works will be constructed at the same time. The assumption was adopted to allow comparison between sub-catchments for prioritisation purposes, however the results have been incorrectly indexed to provide a revised benefit-cost ratio of the SWMP even though the actual time taken to implement works has been nothing like the assumed time.

Improved understanding of the economic indicators is required to accurately reflect program status and ensure consistent reporting.

One of the significant assumptions behind the Strategy is that construction of SWMS is the most cost effective means of providing appropriate surface water management. This may have been true when the 1995 assessment was completed but the reasons for constructing SWMS (ie the benefits) have not necessarily been compared with the ever escalating construction costs. The lack of an up-to-date method for assessing the benefits and whether those benefits have in fact been realised through implementation of Program works makes economic viability extremely difficult to determine.

Improved understanding of the current benefits of SWMS is required in order to determine the economic viability of the program

The impacts of water reform may also need to be better understood by program managers. One of the assumed motivations for landholders wanting to have access to a drainage service is that it will allow them to make decisions to modify their water consumption and on-farm development. However, assessment of future landuse has not been a feature of current economic analysis and movements in water due to trading are not necessarily considered in assessing the economic viability of new works. The implication of this is that the decisions of investors will determine where services will be required regardless of the infrastructure being in place or not. A lack of economic data means that decisions to proceed with construction of new SWMS may be made without a full understanding of the economic context (ie construction in certain areas may be a poor investment).

Improved understanding of the financial variables relating to agronomic production and water trade is critical if opportunities to guide and take advantage of future landuse developments are to be taken.

7.5.2 Future landscapes vision

It is recognised that the irrigation and drainage landscape in the SIR is likely to change considerably in the future. A number of influences, including the need for water savings and the ability to trade water across the broader Murray Darling Basin are emerging as drivers for reconfiguration of the regional delivery systems, with any number of external influences providing the impetus for future planning in projects like the Goulburn Broken Irrigation Futures Project. The degree to which these changes are likely to influence the design basis into the future should be considered in detail.

Whilst the design basis for SWMS is currently determined by the water entitlement held by properties within the SWMS, this takes no account of potential future scenarios where water may be traded into and out of catchments readily and thus rapidly altering the design needs of particular SWMS services. Under this scenario, the economic viability of systems could fluctuate 'on paper'. An example of this may be where regular crop rotations from one property to the next, such as occurs with tomatoes, are constantly moving the location of irrigation water applications. A design methodology based on permanent water right may restrict the level of such developments.

The SWMP does not at present have adequate access to data to enable a full assessment of such variables. An opportunity exists to explore options to optimise SWMP infrastructure requirements based on better integration with the reconfiguration, irrigation futures and sub-surface drainage programs.

Coordination of data collection will be a significant input to any future decision making framework for landscape change assessments as part of SWMS planning and design.

It is also not clear from discussions with G-MW whether the objectives of the SWMP are adequately included into reconfiguration and asset modernisation planning processes. If the more significant catchment works are to be completed under such programs into the future, there is a need for SWMP managers to be involved or at the very least informed on the processes used to decide priorities for these other programs.

Links to be developed with reconfiguration and modernisation managers to ensure SWMS principles are considered in these programs and that funds are available for required SWMP works.

The Irrigation Futures Project has carried out some scenario planning that assigns priority to different influences and explores possible outcomes, both positive and negative. Projects like this enable planning scenarios to be evaluated and weighted against each other.

Improved understanding of the regional outlook and better integration of the irrigation futures planning into reconfiguration and modernisation processes has potential to reduce costs of the SWMP.

Development of action plans and strengthening of irrigation development policies for the SIR catchments may go some way to ensuring that the irrigation futures scenarios are adequately addressed in the SWMP and other programs.

7.5.3 Integrated monitoring objectives

As discussed in **Section 4.3.8**, the current performance indicators for the SWMP are heavily focussed on outputs rather than outcomes. This is not necessarily a problem although it needs to be recognised that this potentially reduces the likelihood that managers are linking their activities to important outcomes such as catchment health and water quality improvements. At present these are assumed outcomes of implementation works and are not necessarily actively managed.

A process of developing a more detailed understanding of the variables that could be monitored to demonstrate performance of SWMS would be of benefit in so far as it creates a focus on what's important.

The strengthening of monitoring, evaluation and reporting according to agreed and meaningful indicators for critical program outputs and outcomes would go some way to supporting triple bottom line reporting requirements of the program.

This should be a precursor to making all appropriate information available on the GBCMA's website. Initially, the documents only need to be placed on the website to enable easy navigation. The majority of the critical assumptions of the SWMP have been documented, and these need to be consolidated so that trajectory graphs can be prepared and information gaps identified.

There are many assumptions that underpin the SIRCIS, including assumptions for surface water management, which were documented for the Bayesian Network development in 2003. The targets of the GBRCS 2003 list many quantitative assumptions.

Some draft concept trajectory graphs with several assumptions from the 2003 RCS were prepared for the GBCMA's MER project during 2006.

It is part of any accountable program / project that annual reporting occur. This annual reporting should provide potential investors with the information required to decide where to invest.

Reporting tools that will assist in program transparency and accountability should be explored to improve the level of detail available from annual reporting.

The change in terminology from 'drains' to 'surface water management systems' has occurred in name although this has not translated to the logic of the change and the emphasis has not been reflected in the performance indicators**.**

7.5.4 Future management of the program

The SWMP not only consists of the primary and community surface water management components but retains significant links to other catchment programs such as monitoring, the farm program, environment and subsurface drainage programs. The complexity of the links between these programs and the interaction required between organisations increases the need for good coordination and timely dissemination of information.

An increased focus on information management is seen as a key area where improved efficiencies could be achieved, both in terms of reporting and for regular day to day work activities, in the next 5 years.

This review has provided some insight into the management processes currently being used for this program. Whilst there are some good processes in place, there is also room to improve.

An example of good practice is the recording of minutes and actions arising out of D800 meetings. This process provides a transparent record of how the management issues are being addressed. Another good example is the implementation of an Access database for the recording of information relevant to the CSWMP.

An example of where improvements could be made is the process of obtaining total program expenditure data for this review. Three separate contacts are required to obtain this data for PSWMS, CSWMS and G-MW CSWMS. Whilst there is no issue with having expenditure managed by separate organisations or people within organisations, this type of process introduces fundamental problems with respect to consistency of information, transparency and auditability.

The reporting on expenditure and progress of this program should be possible on at least a quarterly basis with minimal effort required. A tool as simple as a dedicated spreadsheet or database acting as a central repository for expenditure and progress data could be established quickly and easily to achieve such reporting capability.

An initial project to establish the available tools and an agreement on the standard format of data to be supplied would be an effective investment to improve efficiency.

Opportunities to improve the overall management structure should also be examined. It is not uncommon for organisations with large numbers of people and budgets to have a designated project manager who is responsible for managing resources. Although managers are in place to manage resources at an organisational level, there is currently no designated project manager to draw together the different components of the SWMS and the processes are at best inconsistent.

A wide range of tools are available to assist managers with such tasks. This type of arrangement may be more costly but is likely to introduce efficiencies that will outweigh the costs.

The general continuity of staff involved with the SWMP has enabled relatively good information on achievements, especially on-ground work outputs, to be recorded. There is a risk that this information will be lost if the recording system is not formalised. The relevant information is currently scattered across different organisations and individuals and relies upon good working relationships between these people to enable continuity.

It is recommended that all available information be documented and indexed as a matter of priority.

8. Summary of key conclusions

The key conclusions noted throughout this report are summarised below under the relevant section heading. A reference to the recommendation that addresses each of these conclusions is noted below the conclusion where relevant.

Section 4.3.3 Design Basis (Page 25)

A brief review of rainfall events during the review period indicated that the design basis is valid, with the frequency of design events occurring as expected.

- It is reasonable to assume that altering the level of service will not provide any significant improvement in the benefit : cost ratio of the SWMP. (***Refer Recommendation 7***)

The design of SWMS is currently based on an assessment of permanent water entitlements, which are in turn affected by land-use trends, water trade and reconfiguration works.

- A review of the likely effects of unbundling of water entitlement on future design capacity calculations should be given high priority. (***Refer Recommendation 7***)
- A better understanding of land capability and investment (land-use) potential throughout the region is a critical input to a rigorous review of the design requirements for surface water management systems. (***Refer Recommendation 5 and 7***)

Section 4.3.4 Water Quality Improvements (Page 26)

SWMS have been identified as a major contributor to nutrients in rivers and so a number of actions have been incorporated into the SWMP. A range of positive initiatives are being assessed and implemented to address water quality issues.

- Water quality projects including diversions and wetlands (vegetation) should continue to be incorporated into the design philosophy of SWMS. (***Refer Recommendation 7***)

Section 4.3.5 Catchment Asset Operation Plans (Page 27)

The development of CAOP's includes the development of a rapid decision support system which attempts to correlate actions with outcomes. Linkages between outcomes and outputs are not yet clear and further work is required.

- Improved management of implementation data, both for the SWMP and other programs such as the Farm Program, will greatly assist future evaluation of SWMP outcomes and continued implementation of the IDMOU objectives. (***Refer Recommendations 2 and 5***)

Section 4.3.6 Changing Management (Page 28)

Policy has been adapted to allow better management of larger CSWMS through a G-MW operation and maintenance option.

- There is a need to ensure that adequate and up-to-date policy is in place to reflect the likely future management requirements for G-MW CSWMS. (***Refer Recommendation 3***)

Section 4.3.7 Water savings, asset modernisation and reconfiguration initiatives (Page 28)

Various irrigation efficiency improvement projects will change the way water is delivered for irrigation which will reduce the quantity of water in some SWMS and has the potential to alter the way that SWMS are managed and implemented.

- The impacts of G-MW asset re-configuration on existing SWMS diversions as a result of irrigation system modification and reconfiguration will need to be considered and the existing diversion policy revised. (***Refer Recommendation 5***)
- There is a need to formalise the requirements of modernisation to include SWMP objectives into the reconfiguration planning process. Whilst this could potentially add a significant amount of work to the process it would appear to be the most effective means of addressing the need to integrate future planning for surface water management into a program that is heavily focussed on delivery system efficiency gains and rationalisation. (***Refer Recommendation 5***)

Section 4.3.8.2 Alignment with State and National Frameworks (Page 30)

Funding through State and National sources requires that particular reporting requirements are used to demonstrate that effective processes are in place to manage resources.

- A review of the objectives hierarchy of the SWMP is required to ensure that they align as much as possible with the needs of government investors. (***Refer Recommendation 7***)

Section 4.3.9 Knowledge management (Page 31)

Some management tools and processes have been adopted by managers of SWMP information but gaps are still evident.

- Management tools which include works requirements, programming and financial tracking could be improved to streamline management practices and to maximise the SWMP opportunities. (***Refer Recommendation 2 and 6***)

Section 4.3.10 PSWMS discharge monitoring (Page 31)

The proportion of drained area in the SIR now monitored for flow is 93% and for water quality is 87%.

- Identify links between monitoring and decisions to assist in gap identification and to avoid duplication. Consider alignment with the methodology used by the SSDP. (***Refer Recommendation 2***)

Section 4.3.11 Local Government (Page 31)

A review of local government issues indicated that:

- Negotiations be held with DSE, local government, GBCMA and VCAT to investigate options for reducing timeframes for planning amendments and other formal approvals associated with surface water management systems. In addition, based upon the outcomes of these negotiations, the GBCMA to encourage/organise submissions to state level reviews of the Victorian Planning Policies and other

state planning processes that impact on timelines affecting the SWM program. (***Refer Recommendation 7***)

- An investigation be carried out into the use of Section 32 agreements to ensure existing or potential commitments to SWMS are made known to new owners as part of the land purchase process. If necessary, GBCMA commence state level negotiations to ensure this occurs. (***Refer Recommendation 7***)

Section 4.3.12 Irrigation futures (Page 32)

Program managers participated in an irrigation futures process and developed some scenarios for future planning. A number of challenges and strategies were identified through this process although an action plan was not prepared.

- One of the ways that the irrigation futures work could be improved is the linking of these scenarios to tangible management actions which can be measured and compared with other MER objectives and targets. (***Refer Recommendation 5***)

Section 5.2.1 Primary Surface Water Management Program (Page 33)

A review of PSWMS implementation rates and expenditure was completed.

- 44% of the SIR is yet to have formal access to a SWMS. (***Refer Recommendation 1***)
- It is considered important that program managers continue to track and report expenditure against individual SWMS sub-catchments as well as for the particular categories of expenditure. (***Refer Recommendations 2 and 6***)
- The cost of constructing PSWMS has been revised to $200,000/km for current expenditure projections. (***Refer Recommendation 1***)

Section 5.2.2 Community Surface Water Management Program (Page 38)

A review of CSWMS implementation rates and expenditure was completed.

- It is considered important that program managers continue to track and report expenditure against individual CSWMS sub-catchments as well as for the particular categories of expenditure such as survey/design grants, program support, transfers and construction. (***Refer Recommendations 2 and 6***)
- The cost of constructing a CSWMS has been revised to $76,000/km for current expenditure projections. (***Refer Recommendation 1***)

Section 5.3.3 Diversion strategies (Page 42)

Low flow and high flow diversions are a key strategy for nutrient reductions and should continue to be implemented.

- The collection and recording of data on storages constructed and the quantity and quality of water diverted should continue to be measured and reported.
- Coordination with Goulburn-Murray Water to examine ways to integrate all diversion data would be a valuable catchment data source. (***Refer Recommendation 2***)

Section 5.3.7 IDMOU (Page 45)

In the next five years the program will continue to support the implementation of the IDMOU and specifically will achieve:

- Risk based water quality targets for all catchments containing PSWMS;
- An audit framework to report against water quality improvements linked to specific catchment activities;
- An overarching CAOP for the SIR;
- Catchment specific CAOPs for each strategy sub-catchment; and
- Water quality improvement targets for the rivers at key locations.

(***Refer Recommendation 5***)

Section 5.3.8 Salinity Audit (Page 45)

A salinity audit was undertaken to examine the extent to which salt disposal credits have been used.

- Salt disposal credits are not a limitation for continued implementation of SWMP works over the next 5 years. (***Refer Recommendation 1***)

Section 5.4.1 Case Study 1 (Page 46)

A case study was completed for the Mosquito 24 SWMS and concluded that:

- It would appear that limits on available funds, whilst a valid reason for slow implementation, may not be the main reason for lengthy delays in proceeding.

  (***Refer Recommendation 7***)
- There is a view amongst some members of the community that SWMS is not required.

  (***Refer Recommendation 7***)
- Implementation in some sub-catchments, such as the 9/24P, can be stalled by a small number of landholders who do not support the implementation of CSWMS.

  (***Refer Recommendation 7***)
- The Mosquito 24 PSWMS construction costs were in-line with expectations, with unit rates of $178,000/km comparing well with the estimated rate of $177,000/km.

  (***Refer Recommendation 1***)
- Environmental features can be incorporated into design of PSWMS and can be cost effective.

  (***Refer Recommendation 1***)
- The increased costs to implement CSWMS are having an impact on SWMP bottom line.

  (***Refer Recommendation 7***)

Section 5.4.2 Case Study 2 (Page 47)

A case study was completed for Stage 1 of the Muckatah SWMS and concluded that:

- Assessment procedures have progressed to a point where identification and mapping of environmental features, and hence the ability to manage these into the future has expanded significantly.

  (***Refer Recommendation 2***)
- Planning conditions, including compliance with legislative controls and community acceptance, can add significantly to the implementation timelines. (***Refer Recommendation 1***)
- The incorporation of environmental features is recognised as performing a valuable nutrient reduction function with respect to protecting water quality improvements in receiving waterways.

  (***Refer Recommendation 1, 5 & 6***)
- A significant environmental wetland feature added significantly to the capital cost of the Muckatah PSWMS. (***Refer Recommendation 5***)
- Improvement of Kinnairds wetlands as a public amenity has had significantly positive impact on community and social wellbeing. (***Refer Recommendation 6***)

Section 5.4.3 Case Study 3 (Page 47)

A case study was completed for the Shepparton 3B/11P CSWMS and concluded that:

- Flexible management is able to contribute to timely implementation of CSWMS.

  (***Refer Recommendation 6***)
- CSWMS are more likely to proceed with the G-MW management option.

  (***Refer Recommendation 6***)
- Current CSWMS design principles are valid and cost can be affected by catchment specific features.

  (***Refer Recommendation 1***)

Section 6.1 Review of objectives and goals (Page 48)

The goals and objectives were examined through the Steering Committee.

- These objectives are still largely sound, however, the program would benefit from reviewing these objectives to align them with a number of new influences, including National Frameworks and the agreed principles of the IDMOU.
- The Steering Committee agreed to add to the objectives 'facilitating increases in water use efficiency and irrigation management' in recognition that the SWMP has been a catalyst for improved water use and efficiency throughout the irrigation region. (***Refer Recommendation 7)***

Section 6.2 Economic Performance Indicators (Page 49)

The SWMP economic indicators were examined. Not all of the information required to complete the assessment was available.

- Full reporting of actual expenditure should be included in the 5 year review process and included in revisions to economic evaluation of the SWMP. (***Refer Recommendation 4***)
- A review of the benefits of the SWMP should be undertaken within the next 2 years to provide a better indicator of the economic and environmental status of implementation. (***Refer Recommendation 4***)

- It should be noted that the real present value of the benefit and costs can vary greatly depending upon the finance profile adopted. Limited availability of funds historically continues to erode the bottom line of the SWMP. Stalled completion rates of CSWMS are affecting the true value of the investment made to date. (***Refer Recommendation 1 and 4***)

- The present benefit of the SWMP outweigh the costs by a ration of 1.16 to 1. (***Refer Recommendation 1 and 4***)

Section 6.3 Environmental performance (Page 54)

A review of the environmental aspects specific to the SWMP was completed.

- The mapping of native vegetation protected through SWMS implementation should continue to be a routine task carried out at the completion of works on new SWMS. (***Refer Recommendation 1 and 2***)

Section 6.2 Social Performance (Page 56)

A new method for assessing social performance was used as part of the review.

- The SWMP has been assessed as generating significant social returns. (***Refer Recommendation 1***)

Section 7.1 Primary Surface Water Management Works Program (Page 58)

The estimated capital cost to complete the overall SWMP is $170.13M. The balance of works remaining under the 2000 – 2011 works schedule were assessed and concluded that:

- Funding of around $4M per year until the year 2011 should be sought to complete PSWMP works currently being planned.
  - Complete existing construction works including Stanhope, Muckatah Stage 4 and Murray Valley 11.
  - Continue to implement remaining works as shown in Table 19.
  - Continue to evaluate priorities and document reasons for deviations.
  - Ensure that designs of future works are available for rapid implementation as the need for services arises and in response to available government funding.

  (***Refer Recommendation 1***)

Section 7.2 Community Surface Water Management System Works Program (Page 58)

Implementation of CSWMS works have been slow and are difficult to budget and schedule.

- Mechanisms have been put in place by DPI to evaluate priorities for implementation as interest and need arises. Outfall is unlikely to be a limiting factor in many of the scheme proceeding and so future funding pressures may be experienced. Priority policy will need to be stringently applied should be supported as conditions dictate future needs for CSWMS implementation. (***Refer Recommendation 1***)
- G-MW and DPI should continue to work together in planning SWMS and should continue to examine alternative management techniques for facilitating progress. (***Refer Recommendation 1***)

Section 7.4 Other works (Page 60)

Complementary activities under the program which contribute to objectives were assessed.

- The need for retrofitting in the next 5 years would be evaluated if and when a requirement arises. (***Refer Recommendation 7***)
- Funding will be required for the continuation of metering programs over the next 5 years.

  (***Refer Recommendation 1***)

- No DCD are planned for the next 5 years. Areas targeted for DCD should be subject to a feasibility review with a view to deciding on the future need for DCD by 2011. (***Refer Recommendation 7***)

Section 7.4 Monitoring (Page 60)

Monitoring is undertaken to demonstrate the effectiveness of the SWMP.

- Continuation of the current level of monitoring will need to be funded and supported in order to support the objectives of the SWMP and to enable suitable evaluation of its performance.

  (***Refer Recommendation 1***)

Section 7.5 Strategic Direction / Implementation (Page 63)

Strategic development tasks are not included in the PSWMP and there is benefit to be gained from additional work to address some of the following areas:

Economic review

- Improved understanding of the current benefits of individual SWMS is required in order to provide a better understanding of the economic benefits of the overall program.
- Improved understanding of the economic indicators is required to accurately reflect program status and ensure consistent reporting.
- Improved understanding of the current benefits of SWMS is required in order to determine the economic viability of the program.
- Improved understanding of the financial variables relating to agronomic production and water trade is critical if opportunities to guide and take advantage of future land-use developments are to be taken.

  (***Refer Recommendation 4***)

Future Landscape

- Coordination of data collection will be a significant input to any future decision making framework for landscape change assessments as part of SWMS planning and design.
- Links to be developed with reconfiguration and modernisation managers to ensure SWMS principles are considered in these programs and that funds are available for required SWMP works.
- Development of action plans and strengthening of irrigation development policies for the SIR catchments may go some way to ensuring that the irrigation futures scenarios are adequately addressed in the SWMP and other programs. (***Refer Recommendation 5***)

Integrated Monitoring

- The strengthening of monitoring, evaluation and reporting according to agreed and meaningful indicators for critical program outputs and outcomes would go some way to supporting triple bottom line reporting requirements of the program. (***Refer Recommendation 5***)

Program Management

- An increased focus on information management is seen as a key area where improved efficiencies could be achieved, both in terms of reporting and for regular day to day work activities, in the next 5 years.
- An initial project to establish the available tools and an agreement on the standard format of data to be supplied would be an effective investment to improve efficiency.
- It is recommended that all available information be documented and indexed as a matter of priority. (***Refer Recommendation 6***)

9. Recommendations

A number of observations and conclusions have been made throughout this report and these have been consolidated and distilled into a number of specific recommendations. These have been formulated to ensure a more focussed future for the implementation of effective surface water management in the SIR.

1) Program continuation

There is a large proportion of the SIR (45%) that does not yet have access to a SWMS. Although the benefits that the SWMP was to provide (waterlogging, salinity, reuse, flooding and roads benefits) may have been largely realised due to other factors (ie dryer climatic conditions) in the short-term, the projected benefits of the SWMP have not and will not be fully realised until the appropriate infrastructure is put in place.

The value of the already significant investment in the SWMP to date is potentially at risk given the limited completion of the remaining works. The program has a benefit to cost ratio of 1.16 to 1 and is generating positive environmental and social outcomes.

It is crucial to the future of irrigated farming in the region that the works program be implemented in a timely manner.

It is recommended that:

1.1 Funding of $4M per year for the next five years be sought to continue implementation of the PSWMP in order to maximise the likelihood that SWMP benefits are realised.

1.2 Funding of $500,000 per year for the next five years be sought to continue implementation of CSWMS. Until conditions return to a wetter climate, emerging priorities for CSWMS funding should be prioritised in accordance with existing policy and managed within this budget allowance.

1.3 Funding of $135,000 per year be sought to continue monitoring and metering activities and $200,000 for SWMS management and IDMOU activities.

2) Information management and coordination

An increased focus on information management is seen as a key area where significant improvements in efficiency could be achieved in the next 5 years.

The Surface Water Management Program not only consists of the primary and community surface water management components but retains significant links to other catchment programs such as the monitoring, farm, waterways, environment and sub-surface drainage programs.

The complexity of the links between these programs, the shared data requirements and the staff interaction required between personnel from a range of organisations demonstrate that there is a need for good coordination and timely dissemination of information.

It is recommended that the following tasks be completed to address the information management issues that currently exist:

2.1 Examine user requirements of SWMP information and agree on data collection requirements, data handling, ownership, and reporting formats.

2.2 Upgrade SWMP map bases to a more functional GIS platform.

2.3 Examine options for a compatible reporting system or database for implementation work projections of both the PSWMP and CSWMP.

It is acknowledged that these tasks may also fall under, and need to be coordinated with, any broader RCS information management objectives and the SIR IC policy document.

3) Staff and knowledge management

An area that has been identified through Steering Committee consultation is that of staff continuity and succession planning. This issue is likely to be a high priority in the next couple of years given the status of the community program in the current climate.

There are a number of documents to assist new and existing staff, including CSWMS and PSWMS Guidelines for Design, CSWMS Operational Manual and the update of the G-MW Administration Guidelines. Ensuring these documents are maintained along with the development of additional documented procedures will assist in maintaining program continuity and information transfer between staff. This is particularly important where staff changes occur during the course of planning or construction.

It is recommended that:

3.1 Development and co-ordination of documented procedures for PSWMS and CSWMS be completed in the 2007/08 financial year.

3.2 Collation of available documents relating to the SWMP be completed and indexed for uploading to a common access point for program managers.

4) Economic viability review

The business case for development of a surface water management strategy is eroding as time progresses, as evidenced by declining benefit to cost ratio. This is partly attributed to the fact that the potential benefits of the SWM (salinity, waterlogging, flooding, roads, re-use and landuse change) have not been reviewed for some time. There does not appear to have been any work undertaken to demonstrate that these projected benefits have been realised.

Whilst the productivity of the region as a whole has been shown to be improving, there does not appear to have been due recognition that surface water management, amongst other things, has contributed to this bottom line improvement.

It is seen as a high priority to undertake a major review of the economic performance criteria for the program, specifically to understand the relative importance of all components on the benefits and costs currently used to evaluate economic viability. Ideally this work will be coordinated with any work undertaken to strengthen MER requirements, which in turn will go some way to supporting triple bottom line reporting.

It is recommended that:

4.1 An economic review be undertaken in the 2007/08 financial year including a review of all of the catchment and agronomic benefits that can be reasonably quantified.

5) Irrigation landscapes development and co-ordination

Many of the objectives of new initiatives such as irrigation futures, modernisation, reconfiguration and CAOP require an integrated approach to data collection and information analysis. The outcomes of much of the analysis are likely to provide significant improvements in assessing the future need for SWMS.

The integration of information under the agency programs including IDMOU, CAOP, reconfiguration and irrigation futures needs to be co-ordinated to provide the most efficient use of resources.

It is recommended that SWMP managers:

5.1 **Revise the objectives of the SWMP to include 'facilitating increases in water use efficiency and irrigation management' and to address any issues with the alignment with the needs of government investors.**

5.2 **Engage in a process of developing outcomes based MER targets which is coordinated with the requirements of government investors, IDMOU, CAOP and reconfiguration/modernisation objectives and targets.**

5.3 **Develop future landscape objectives for SIR sub-catchments in accordance with irrigation futures objectives.**

5.4 **Ensure the SWMP has a stronger alignment with the reconfiguration and modernisation project.**

6) Program / Project Management

The complexity of the SWMP highlights the importance of detailed project planning on a number of levels. The overall program and priorities need strategic planning, while each individual project requires a high level of planning and monitoring.

It has become apparent during the course of this review, that information is often difficult to obtain. Given that current climatic conditions may require some downsizing of resources, it is likely that similar issues will arise in the future without a concerted management input immediately.

A surface water coordinator was appointed to the program three years ago on a part-time basis, a role that may need to be reviewed and perhaps strengthened to ensure a robust and detailed project management program is followed.

It is recommended that:

6.1 **Program managers continue to exercise flexible practices to meet the challenge of continually changing circumstances.**

6.2 **A renewed focus on the role of the Project/Program Manager be made and if necessary appoint a new full-time project manager to facilitate the implementation of the review outcomes, and the co-ordination of the SWMP.**

6.3 **Adopt a standard reporting format, similar to the format used for this review, for tracking and reporting expenditure, for recording completion of works, for reporting environmental performance and for reporting social performance.**

7) General Program recommendations

The large number of policy and legislative changes during the past 5 years has and will continue to influence the type of SWMP works required.

It is recommended that:

7.1 **The current design principles are maintained as valid until 2011 or until such time as additional information is obtained which suggests that changes may improve performance.**

7.2 **Ensure that sufficient data is available by 2011 to assess the impacts of water trade, modernisation and reconfiguration on the design capacity methodology currently used.**

7.3 **Additional technical work should be undertaken before 2011 to determine the viability of Drainage Course Declarations as a component of the overall SWMP.**

7.4 **Managers ensure that the cost-share arrangements being reassessed under the RCS review will provide sufficient incentive for CSWMS to proceed when conditions allow.**

7.5 **An investigation be carried out into the use of Section 32 agreements to ensure existing or potential commitments to SWMS are made known to new owners as part of the land purchase process. If necessary, GBCMA commence state level negotiations to ensure this occurs.**

10. References and reviewed documents

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Acts and Legislation

Safe Drinking Water Act

Archaeological and Aboriginal Relics Preservation Act 1972 (State)

Road Management Act 2004

Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Commonwealth

Flora and Fauna Guarantee Act 1998

Environment Protection and Biodiversity Conservation (EPBC) Act

Appendix A Consultation activities

The following consultation activities were included in this review:

- Steering Committee 1 – Project inception, confirmation of review scope
  - Case study workshop – Tatura
  - Case study workshop - Numurkah
- Steering Committee 2 (15 Dec 2006) – Review of strategies and policies
  - CSWMS team – Review of future program directions
- Steering Committee 3 (February 2007) – Performance criteria and review of triple bottom line reporting requirements.
- Steering Committee 4 (March 2007) – Draft report presented for comments
- Presentation to SIRIC – M Paganini Friday 27 April 2007.

Appendix B External Strategy Influences

Policy/ Strategy	Year effective	Description of Policy / Strategy and Key Principles	Summary of Potential Impact on Strategy
Environment Protection and Biodiversity Conservation (EPBC) Act (Commonwealth)	1999/2000	The Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) has significant implications for natural resource and environmental management in Australia. This Act lists vulnerable, endangered and extinct species, threatening processes, threatened ecological communities and migratory species. It relates to actions likely to have a significant impact on matters of National Environmental Significance. These actions are subject to a rigorous assessment process. For example, if the proposed works may impact significantly on a species listed under the EPBC Act, it will be necessary to refer the action to the Department of Environment and Heritage for final determination on the proposed action. An example of the real impact of this is the assessment of impacts on Murray Cod which was listed as a vulnerable species in 2003. It is also listed as threatened in Victoria under the Flora Fauna Guarantee Act.	In the event that a species listed under this act is located, the impacts include re-working the SWMS alignment, additional time required to complete alignment and approval. Ministerial approvals frequently take considerable time. The inclusion of Murray Cod effectively means that all new outfall works require referral and assessment.
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Commonwealth)	1984	Whereas the State Act provides legal protection for all the physical evidence of past Aboriginal occupation, the Commonwealth Act deals with Aboriginal cultural property in a wider sense. Such cultural property includes any places, objects and folklore that 'are of particular significance to Aboriginals in accordance with Aboriginal tradition'. In most cases, Aboriginal archaeological sites registered under the State Act will also be Aboriginal places subject to the provisions of the Commonwealth Act. There is no cut-off date and the Act may apply to contemporary Aboriginal cultural property as well as ancient sites. The Commonwealth Act takes precedence over State cultural heritage legislation where there is conflict. The responsible Commonwealth Minister may make a declaration under Section 10 of the Act in situations where state or territory laws do not provide adequate protection of heritage places. In 1987, Part IIA of the *Aboriginal and Torres Strait Islander Heritage Protection Act* 1984 was introduced by the Commonwealth Government to provide protection for Aboriginal cultural property in Victoria. Immediately after enactment, the Commonwealth delegated the powers and responsibilities set out in Part IIA to the Victorian Minister responsible for Aboriginal Affairs. This legislation is administered on a daily basis by AAV.	Heritage issues continue to be better understood and considered as a design issue.
Aboriginal Heritage Act	To be proclaimed in 2006	The *Aboriginal Heritage Act 2006* retains key features of the *Archaeological and Aboriginal Relics Preservation Act 1972* such as: ■ Blanket protection of Aboriginal places, objects and human remains; ■ Community-based decision making; ■ Victorian Aboriginal Heritage Register; ■ Requirements to report Aboriginal places, objects and remains. The *Aboriginal Heritage Act 2006* will establish: ■ Broader and more flexible Aboriginal community representation; ■ Mandatory preparation of Cultural Heritage Management Plans, linked to certain planning permits and project approvals; ■ Improved procedures for Cultural Heritage Permits and Agreements; ■ Dispute resolution through VCAT; and ■ A process for Cultural Heritage Audits.	Impacts on the SWMP include the potential requirement for managing impacts of works on Aboriginal cultural heritage; the development of Cultural Heritage Management Plans; clarification and consultation with Aboriginal parties and resolution of disputes through VCAT.

Policy/ Strategy	Year effective	Description of Policy / Strategy and Key Principles	Summary of Potential Impact on Strategy
Farm Dams Legislation	2002	The introduction of the Farm Dam legislation means that all existing dams have the option of being registered or licenced. Any new dam that is to be used for irrigation and commercial purposes whether on a waterway or not, will need a licence. Stock and Domestic dams and reuse dams do not require registration, unless the reuse dam is in excess of 1ML/10ha of land.	
Flora and Fauna Guarantee Act 1998	1998	The *Flora and Fauna Guarantee Act 1988* – sets out guidelines to ensure the continued conservation and protection of Victoria's native flora and fauna through species listings (eg: Victorian Rare or Threatened Species – VROT) and species specific Action Statements. The purpose of the Act is to establish a legal and administrative structure to enable and promote the conservation of Victoria's native flora and fauna; and to provide for a choice of procedures which can be used for conservation, management or control of flora and fauna and the management of potentially threatening processes. The objectives of the Act are to guarantee that all taxa of Victoria's flora and fauna other than the taxa listed in the Excluded List can survive, flourish and retain their potential for evolutionary development in the wild; -to conserve Victoria's communities of flora and fauna; -to manage potentially threatening processes; -to ensure the use of flora and fauna by humans is sustainable; -to ensure that the genetic diversity of flora and fauna is maintained; -to provide programs of community education in the conservation of flora and fauna; -to encourage co-operative management of flora and fauna through, amongst other things, -the entering into of land management co-operative agreements under *the Conservation Forests and Lands Act 1987*; and -to encourage the conserving of flora and fauna through co-operative community endeavours.	Significant increase in the emphasis on completing environmental assessments prior to implementation and protection of environmental features during construction. Increased costs have resulted during both design and construction phases. Increase in protection of potentially sensitive environmental features.
Road Management Act 2004	2004	The Road Management Act is designed to document the responsibilities of various authorities who manage infrastructure within road reserves. The road Management Act of 1994 provided for VicRoads to manage drainage infrastructure when on the road reserve. The Road Management Act 2004 now makes provision for the constructing Authority, in this case, G-MW, to own and manage Primary Drainage infrastructure.	No foreseeable negative impacts. Ensures ownership and responsibilities for structures are better defined.
Safe Drinking Water Act	2003	The purpose of this Act is to make provision for the supply of safe drinking water. In outline this Act—requires water suppliers and water storage managers to prepare and implement plans to manage risks in relation to drinking water and some types of non-potable water; and requires water suppliers to ensure that the drinking water they supply meets quality standards specified by the regulations; and requires water suppliers to disclose to the public information concerning the quality of drinking water; and provides for the variation, after community consultation, of water quality standards that relate only to aesthetic factors; and requires the reporting of known or suspected contamination of drinking water to the Secretary to the Department of Human Services;	May have implication for water quality where drainage water enters channels or water courses. These issues are addressed under alternative policies and strategies. Similar objectives to IDMOU

Policy/ Strategy	Year effective	Description of Policy / Strategy and Key Principles	Summary of Potential Impact on Strategy
Water Act		The Water Act 1989 is the most significant state legislation for the SIR. The Water Act: ■ Provides for the integrated management of all elements of the water cycle ■ Ensures water resources are conserved and properly managed for sustainable use and for benefit of present and future Victorian's ■ Maximises community involvement in the making and implementation of arrangement relating to the use, conservation and management of water resources ■ Provides formal means for protecting and enhancing environmental qualities of waterways and their in-stream uses; and ■ Provides for protection of catchment conditions	Works which may disturb the bed or banks of a designated waterway require a Works on waterways permit from the CMA (Section 160, By-law 1) Regulations for permanent transfer of water rights are made under sections 228 and 324 of the *Water Act 1989*
Planning Scheme		A planning permit is required for most types of construction works. Each council has a planning scheme that is open to interpretation by planning officers. As such, drainage works may have once been classified as minor utilities; however, this is not necessarily the case. The classification of drainage infrastructure as major works requires more comprehensive consultation, more referrals and subsequently additional time to complete due process. It is the somewhat lengthened process as well as the additional conditions that may add considerable time and expense to the construction of any scheme. The planning scheme is reviewed every three years.	The time required to complete the planning process is somewhat lengthened if drainage works are classified as utilities rather than minor utilities. As well, additional referral agencies may mean additional conditions to comply with; this may significantly increase the cost or length of time for completion. Despite lengthening the process this also ensures that due process is followed for any proposed works. The standard 2 year limit on planning permits has also created difficulties as commencement and implementation can often stretch over a period in excess of 2 years.
Yorta Yorta Cooperative Management Agreement	2004	An agreement outside the native title process to formally involve indigenous people in the management of their traditional lands and waters. The Agreement establishes a committee (Yorta Yorta Joint Body) as a forum for exchanging ideas, discussing management issues and making recommendations. The function of the Joint Body is to provide advice to the Minister for Environment in relation to management of designated Crown land and waters, including public land and waters along the Murray and Goulburn Rivers.	Yorta Yorta Joint Body should be consulted regarding land and water management issues within designated public lands (Schedule 2 of the Co-operative Management Agreement)
Murray Darling Basin Cap	1997	Since the 1950's the quantity of water diverted from the rivers of the Murray-Darling Basin increased substantially. Amid growing concerns about the changes to the flow regimes in rivers within the Basin and their consequences, the Ministerial Council in June 1993 initiated an audit of water use in the Murray-Darling Basin. The Audit, completed in 1995, showed that if the volume of water diversions continued to increase, this would exacerbate river health problems, reduce the security of water supply for existing irrigators in the Basin, and reduce the reliability of water supply during long droughts. In response to the findings of the Audit, a limit was imposed on the volume of water which could be diverted from the rivers for consumptive uses. This limit is called the Cap. An interim Cap was imposed in June 1995. Following an independent review of equity issues a permanent Cap for New South Wales (NSW), Victoria and South Australia was implemented from 1 July 1997. For NSW and Victoria, the Cap is	The introduction of the farm dams legislation has implications for the retention of water above the Cap, which affects the degree to which storages can be constructed to retain drainage water within catchments (ie for reuse).

Policy/ Strategy	Year effective	Description of Policy / Strategy and Key Principles	Summary of Potential Impact on Strategy
		defined as "*The volume of water that would have been diverted under 1993/94 levels of development.*" For Queensland (a moratorium on further development in place since September 2000) and the Australian Capital Territory which together divert less than 7% of total water being diverted in the Basin, the Cap arrangements are still being worked out. While the Cap restrains further increase in water diversions, it does not constrain new developments provided the water for them is obtained by using water more efficiently or by purchasing water from existing developments.	
National Frameworks	2002	The Natural Resource Management Ministerial Council, which includes representatives of the Australian Government and all states and territory governments, was established to develop a coordinated approach to issues affecting natural resource management in Australia. The Council has endorsed two national level documents to assist with setting targets, monitoring, evaluation and reporting on natural resource management, they are ▪ National Framework for Natural Resource Management Standards and Targets, and the ▪ National Natural Resource Management Monitoring and Evaluation Framework The Standards and Targets Framework sets out national outcomes that investment in natural resource management (through	Government funding bodies increasingly want to see alignment with the National Frameworks, it will help communication with them if the surface water management strategy uses a similar logic and language.
The Living Murray	ongoing	The Living Murray Initiative is about what constitutes a healthy working river and what is needed to achieve it. It is about protecting the things the River Murray means to Australians: prosperity, clean water, industry, natural landscape, culture and tradition. In March 2001, the Ministerial Council agreed to a vision and objectives for the River Murray. The vision is: a healthy River Murray system, sustaining communities and preserving unique values. The Ministerial Council consists of Ministers responsible for land, water and environmental resources in each of the Australian, South Australian, Victorian, New South Wales, Queensland and Australian Capital Territory Governments. In April 2002, the Ministerial Council agreed to conduct a community engagement strategy to address the issue of environmental flows for the River Murray, and to conduct a comprehensive analysis of the economic, social and environmental impacts of providing environmental flows. The Ministerial Council also recognised a need to spend $150 million, over 7 years, on structural and operational measures to achieve the best environmental outcomes from the water currently available to the River Murray system. This suite of decisions was the beginning of what has become known as The Living Murray. The Living Murray is now a program comprising four key program areas: water recovery; statutory support; environmental delivery; and works and measures. The Murray-Darling Basin Commission, through The Living Murray Board, administers the program.	The major impacts of the Living Murray Initiative relate to where the additional water for environmental flows will be sourced. This is likely to mean reduced water availability in some catchments and may also exaggerate the impacts of water trade. The surface water management strategy may need to be curtailed in areas where water entitlement is being significantly reduced.
Basin Salinity Management Strategy 2001-2015	2001	The Basin Salinity Management Strategy sets out how Basin communities and Governments will work together to control salinity and protect important environmental values and assets. It contains accountability arrangements that are the 'first of a kind' for salinity strategies in Australia. This strategy specifies river salinity targets to be met in by the year 2015 and builds on the 1988 Salinity and Drainage Strategy. This Basin Salinity Management Strategy is the Ministerial Council's response to the threat of salinity to water quality, environmental values, regional infrastructure and productive agricultural land. The SIRLWSMP was initially (1990) allocated 3.4EC credits for implementation. This was increased to 4.9EC in 2000/01 and has recently been reviewed through a rolling 5 -year review completed by SKM,	The salinity impact of works completed under the strategy is regularly calculated and reported and is likely to be more of an issue in the next 5 year term rather than in the past 5 years. BSMS is currently under review. Implementation of future works, which is contingent upon the region having

Policy/ Strategy	Year effective	Description of Policy / Strategy and Key Principles	Summary of Potential Impact on Strategy
		2006. The impact of current works is reported as being 2.87EC.	sufficient salt disposal credits, appears secure.
Basin Salinity Management Strategy Operational Protocols	2005	This document has been prepared to provide operational detail and consistency and where necessary, give practical form to the principles and accountabilities set out in Schedule C (the schedule that authorises the Commission to make any protocols it considers necessary to give effect to the Schedule)	Negligible effect
White Paper – Securing our Water Future Together	2004	The Victorian Government's White Paper is an action plan aimed at improving water use and management across the state. It addresses the protection of environmental flows, urban water use, recycling and reuse of water, healthy rivers and sustainable irrigation. Key actions include: ▪ Increased and improved environmental flows; ▪ Making 'Sales' water into secure tradeable entitlements; ▪ Unbundling of land and water rights; and ▪ Projects to improve on-farm water efficiencies and reuse systems	Likely to reduce drainage flows in non-rainfall periods. This does not impact upon the design basis for SWMS but may place a higher emphasis on water reuse and water harvesting. Potential conflict with farm dams objectives.
State Environment Protection Policy (SEPP)		State Environment Protection Policies (SEPPS) are subordinate legislation under the Environment Protection Act 1970. SEPP Waters of Victoria (WoV) is the key policy reelvant to this review. The policy establishes a legal framework for government agencies, businesses and the community to work together in order to protect and rehabilitate Victoria's surface water environments and the social and economic values they support. The policy was reviewed in June 2003 and therefore reflects current scientific approaches and Victoria's catchment management arrangements. The SEPP sets a statutory framework for the protection of the uses and values of Victoria's fresh and marine water environments. As is required by the Environment Protection Act 1970, the SEPP includes: the uses and values of the water environment that the community and government want to protect (known as beneficial uses), the objectives and indicators which describe the environmental quality required to protect beneficial uses, guidance to CMA's, Coastal Boards, Water Authorities, Communities, businesses, local government and state government to protect and rehabilitate water environments to a level where environmental objectives are met and beneficial uses are protected (known as the attainment program). The implementation of the revised SEPP will help to ensure that our catchments, rivers and coasts are managed in an integrated manner so that actions in the catchment do not have a detrimental impact on the quality of our fresh and marine water environments. Specifically, SEPP (WoV) includes key clauses that are relevant to surface water management in irrigated areas: ▪ Cl.36 relates to saline discharges, stating that any discharge of saline water to surface water should not pose a risk to the receiving environment. ▪ Cl.37 (3) relates to chemical management and the need to ensure that the use and storage of biocides and fertilisers does not pose a risk to surface waters. ▪ Cl.39 addresses the issue of stock impacts on waterways and the need for government agencies to work with the community to minimise these impacts. ▪ Cl 43 relates to surface water management and works. It states that any works on or adjacent to a	An assessment of the effectiveness of the program against each of these clauses should be undertaken. A process should be included in the new program which provides a straight forward way of assessing the program against SEPP WoV requirements. Government agencies and the community are required to report back to state government on attainment levels.

Policy/ Strategy	Year effective	Description of Policy / Strategy and Key Principles	Summary of Potential Impact on Strategy
		waterway need to be managed to minimise environmental risks and to protect other beneficial uses. ▪ Cl 50 states that agricultural activities need to be implemented by landholders to minimise the impacts from the activities on waterways. ▪ Cl 51 relates to irrigation channels and drains, stating that the need to be managed for the purposes for which they were constructed, ie the removal of rainfall induced irrigation run-off.	
Environmental Assessment Guidelines	2006	The State and Federal Governments require proposed Primary and Community Integrated Surface Water Management Systems (SWMS) to take account of environmental issues during the planning phase. Key policy documents that ensure that environmental values are protected include the Environment Protection and Biodiversity Conservation Act 1999, Catchment and Land Protection Act 1994, Ramsar Convention, Victoria's Biodiversity Strategy, the Flora and Fauna Guarantee Act (1988), Goulburn Broken Native Vegetation Management Strategy 2000, JAMBA and CAMBA Treaties, LCC Recommendations and Waterway Protection Policy. The purpose of the environmental assessment is to highlight areas of environmental value and enable recommendations to be made on water regimes or management strategies required to maintain and enhance those environmental values.	Increased emphasis on environmental protection and provision of offsets. Positive outcome for environment
IDMOU (Irrigation Drainage Memorandum of Understanding)	2005	A memorandum of understanding has been developed between NCCMA, GBCMA, GMW, DSE and EPA to deliver sustainable surface water management in the irrigation districts of GBCMA and NCCMA. The MOU was initiated in response to the findings of an Independent Review of the Environmental Aspects of Northern Victoria's Surface Drainage Programs in Irrigated Areas (Nolan Report) 2001. The MOU highlights a commitment from signatories to work together to provide increased assurance to government and the community that surface water management in irrigation areas minimises associated risks to the environment, particularly surface water, while also enhancing the economic and social aspects of Northern Victoria's irrigated catchments.	The design of infrastructure and programs to reduce nutrient loads to receiving waters has been given significantly more emphasis and has added costs to the design and construction compared to what the strategy originally envisaged. IDMOU has provided common understanding between organisations of key provisions. The IDMOU needs to be recognised as a key document in future and existing surface water management programs. It is thought that the future implementation of the MOU would be the responsibility of the steering committee.
Goulburn Broken Regional Catchment Strategy	Reviewed in 2002	The Goulburn Broken Regional Catchment Strategy provides the framework for the community to work with state, federal and local agencies to implement actions and achieve the vision for the catchment. The RCS identifies threats to the region and prioritises actions and works that are required in order to address these threats. A number of sub-strategies exist under the framework of the RCS, including River Health, Water Quality, River Health, vegetation, Pest plants and animals and these have more detail with respect to the protection of the catchment assets.	
River Health Strategy	2005	The Regional River Health strategy provides a framework for the integration of actions to protect and enhance natural waterways for current and future generations. The Regional River Health Strategy prioritises river reaches, based on environmental, economic and social values with seven separate programs targeting the key threats as well as monitoring, research and community engagement.	
Goulburn-Broken Water Quality	1996	The Goulburn Broken CMA is responsible for the implementation of the Goulburn Broken Water Quality Strategy (WQS). The WQS is a community endorsed document that was developed in 1996 to serve as a	Drain diversions are a key feature of this strategy and have been developed since

Policy/ Strategy	Year effective	Description of Policy / Strategy and Key Principles	Summary of Potential Impact on Strategy
Strategy	(Revised 2002)	strategy for water quality management throughout the catchment for the subsequent 20 years. The goal of the Goulburn Broke WQS is to; "Improve and maintain water quality at optimum levels within and downstream of the catchment for native ecosystems, recreation, human and animal consumption, agriculture and industry." While this strategy concentrates on nutrient issues there are also a number of other existing or potential water quality issues in the catchment that need to be addressed. Other issues include turbidity, suspended sediments, biocides, acidity and temperature. All of these issues are briefly addressed in the Strategy. Additionally, it should be noted that this strategy is a surface water quality strategy only, as impacts on water quality from groundwater activities were not adequately understood.	the year 2000. An assessment of resources diversion is now regularly undertaken. Significant issues have arisen regarding compensation where new drains have effectively removed water harvesting form natural depressions.
NVR guidelines and framework	1989	The Native Vegetation Retention (NVR) Controls were first introduced by the Victorian State Government in 1989 to limit broad-scale clearing of native vegetation, protect habitat for flora and fauna and to reduce the impacts of land and water degradation. The NVR Controls are established under the provisions of the Planning and Environment Act 1987. Under clause 52.17, a permit is required to remove, destroy or lop native vegetation (subject to a range of exemptions designed to facilitate normal domestic and rural practices) on any landholding of 0.4 hectare or greater in size. It is strongly recommended that the proponent of works seek advice from the local municipal planning officer or appropriate DSE officer to obtain further information. Local municipalities process all permit applications and are the responsible authority for implementation and enforcement of planning scheme controls relating to the clearance of native vegetation.	
Nolan Review	2001	The Nolan review is a review of the Environmental aspects of the SWMP within the Goulburn-Murray Irrigation District (GMID). The Nolan review made a number of recommendations to improve the environmental outcomes of the SWMP within the GMID, these cover aspects such as planning, construction management, monitoring, and a range of other aspects. A response to the Nolan Review was prepared by the GBCMA in 2005. The GBCMA addresses the fourteen key recommendations made in the Nolan review as well as the twelve additional recommendations. The report outlines the proposed actions to be taken to address the recommendations. Some of the recommendations (for example the IDMOU) made have been addressed	Most recommendations are being addressed with minimal change to existing policy and practices.

Appendix C 2000 review recommendations

The Shepparton Irrigation Region Surface Water Management Strategy Review 2000, outlined a number of recommendations to be addressed. With the next review to be compiled and completed by the end of 2006, it was important to identify the recommendations outlined in the current strategy and identify what responses and action have been undertaken to address these recommendations. The document below contains the recommendations as listed in the Projects 1 – 3 of the review and the evidence of their completion.

Any documents that have been identified to show evidence have been attached at the end of the document for reference or a link to their location has been identified.

These responses should be read in consultation with the "Goulburn Broken Catchment Management Authorities response to the "Independent Review of the Environmental Aspects of northern Victoria's Surface Drainage Programs in Irrigation Areas' (Nolan)".

1. Increased environmental monitoring to quantify the benefits and dis-benefits of drainage works.

G-MW have a regular monitoring system in place and report their findings on a quarterly and annual basis. EMP have ongoing monitoring at sites affected by surface water management systems, with examples of these being Brays Swamp, Kinnairds Wetland, Reedy Swamp and Mansfield Swamp.

Environmental monitoring of drainage works is also covered in the Irrigation and Drainage Memorandum Of Understanding (IDMOU) that was signed off in June 2004.

2. Enforcement of planning controls over earthworks in and adjacent to natural drainage courses

Local government agencies are responsible for enforcement of planning controls over earthworks in natural drainage areas. G-MW will provide direction on these issues and have systems in place where they ensure that works identified in the whole farm planning process are not to occur in the natural drainage course. G-MW has a Whole Farm Plan referral checklist which ensures that these works are identified and prevented from occurring.

3. Application of new techniques and design features to old drains.

Each financial year the G-MW budget contains funds to undertake retrofitting of existing drains. Currently this amount is set at approximately $500,000 a year. Some works that have been identified to occur has been hydro-mulching of drain batters, with 7 sites having been identified to have works undertaken in the next 2 years.

Works are also being undertaken to assess the value of changing the batter slopes to assist in the aid batter stabilisation and control of nutrients.

G-MW also has operational plans for each CSWMS and a priority list for maintaining each CSWMS.

4. A greater emphasis on timely education of individual landowners and drainage issues and design standards before community meetings are held to initiate community drainage schemes.

Recent years, due to environmental conditions, have seen little initiation of new projects. However work has been undertaken to look at having processes in place to ensure that any new enquiries are dealt with in a

timely and effective manner. A step by step process of how landowners can take the first steps towards formation of a CSWMS group have been outlined in a "Microsoft Visio" flowchart, which includes documentation that informs landowners of their responsibility in establishing a CSWMS group and receiving government support.

Recently, communication strategies have been written outlining the steps involved in canvassing a new catchment and the steps required, as well as a strategy for targeting established catchments which have been inactive for sometime. These strategies will be used as a blueprint for initiating new or older projects.

5. A better transfer of knowledge on proposed works between vendors and purchasers of land.

Surface Water Management staff are regularly contacted about drainage proposals occurring on properties of land that are in the process of being sold. A system has been developed by the partnership portfolio officer to look at ensuring that all conveyancing officers with the region seek advice from the SWMP prior to properties being sold. This ensures that SWMO are able to keep up to date with landowner changes, which helps the SWMO be pro-active in contacting the new landowners and providing them with knowledge of the surface water management system. This helps to keep the momentum of the CSWMS progressing. (Process attached)

6. Improved construction management skills for those charged with supervising the construction of CSD"s

Staff within the Surface Water Management Program have undertaken contract management training, through the Environmental Engineers Australia, to enhance their knowledge of contract management. As part of the induction process new staff are encouraged to look at undertaking similar training throughout their time with the program. The development of checklist (for designer works and due diligence) to ensure all tasks are completed has ensured that staff have a process to follow before works are completed.

7. The community will be involved, organised, well informed and motivated to enhance productivity by actively managing surface water flows while preserving and enhancing environmental values and catchment health.

Extension packages developed by the Surface Water Management Officers, ensure that existing and new landowners to the area are well informed of the benefits that drainage can provide to their individual property and the catchment they live in.

Environmental Management Program staff undertake and environmental assessment of the catchment prior to construction and through extension at group meetings inform landowners of the benefits of vegetation in the catchment. EMP staff play important role developing management plans for the wetlands and high value environmental areas within the Shepparton region. Examples of this are Biodiversity Action Plans.

8. The mix of Primary and Community Drains will be optimised to minimise costs while streamlining the implementation and operation of a system that covers a very large area.

Work is underway to further align the progress of CSWMS with that of the Primary System, by the undertaking of a joined budget approach for the 2005-2006 financial year. This ensured that works were aligned with one process coming to completion as the other was initiated. A case study is currently in progress to look at the use of a new concept of "Primary extension", which looks at extending the primary drainage network further into the catchments of community drains which exceed the recommended length and number of landowners, bringing them back to a more manageable size of 15 landowners or 10 kilometres

long.

New policy was also introduced to look at reducing the costs of CSWMS, by creation of a new concept deemed as “design flexibility on spur ends”. This looks at reducing the design level on the last 2 properties of a spur drain, without reducing the level of service provided to the landowners. (see attached brochure).

9. The system will have the capacity to provide the agreed level of protection of irrigated land against inundation.

As part of the design of the CSWMS, the designer is aware that the CSWMS must be capable of removing the design level of service of 50mm of rainfall in a 24 hour period removed over 5 days. On completion of the construction of the CSWMS, through agreement with G-MW as the manager of the CSWMS, the landowner enters into an agreement that G-MW will ensure that the level of service provided when the CSWMS is first constructed is maintained at the appropriate level. G-MW have a customer service agreement, which ensures that they will maintain a guaranteed level of service to the landowner. (Contact G-MW for a copy of the customer service agreement)

10. The momentum of community groups formed to implement community surface drains will be maintained despite the fact that the individuals and the authorities involved may change in the course of the implementation process.

Continuity of momentum amongst landowners is an important step in ensuring the completion of a CSWMS. Steps have been undertaken in the Surface Water Management Program to ensure that the transfer of information and the steps involved in implementing a CSWMS are updated. Standardisation of the filing system, both hard copy and electronic, has ensured a smooth transfer of knowledge of current working on each CSWMS. On top of this all the information is now centrally stored on the “j” drive allowing access for all surface water management officers.

The CSWMP, with the introduction of new staff has ensured it has an induction program in place for orientating new staff to where information is stored and how it can be easily retrieved. The induction process also involves ensuring staff are aware of their role, and the development of an operational manual and transfer operation manual has ensured that each SWMO has a step by step procedure to follow. When inheriting an existing CSWMS, a new officer can continue where an existing officer has left the CSWMS, without a loss of momentum.

11. Drainage flows and the nutrients they contain will be recognised as valuable resources that should be held and reused within the Irrigation Region wherever possible. The system will include features that facilitate the reuse of drainage flows within the Region.

The Drainage Nutrient Removal Incentive Scheme (DNRIS) ensures that nutrients are seen as a valuable resource and can be reused as part of a landowners irrigation system. Throughout the time the incentive has been running 32 storages have been built throughout the Shepparton Irrigation Region. The number of storage’s built has the capacity to store 5,728 ML of water for reuse (as of March 31st 2006). (see attached data).

12. The community will value the environmental, flow retardation and nutrient and silt stripping qualities of wetlands, drainage depressions and other low lying areas above their agricultural potential. Whole farm plans will reflect these values and relevant aspects of the Regional Catchment Strategy.

The community is well aware of the effects that wetlands can play in nutrient and silt stripping. Articles have appeared in the "Bush and Land" column in the County News (weekly insert of several country papers). Articles have also appeared in the Shepparton Irrigation Region Implementation Committee column, a paid section within newspapers in the region, promoting the benefits that wetlands and depressions play in nutrient stripping and silt trapping.

Monitoring takes place of the water entering the wetlands (Kinnairds) and the water leaving the wetland, so comparisons can be made on the effect that the wetlands are having on water quality.

ACTION: Further work needs to be undertaken to promote the use of drainage depressions and low lying areas as valuable sources of nutrient stripping and silt entrapment, when they are encountered along the alignment of a community surface water management system.

13. The environmental assessment procedure will efficiently identify and facilitate the protection and enhancement of high value environmental features.

The environmental assessment procedure is 80% complete and will be available in the near future. The Environmental Management Program have undertaken a similar approach with identifying environmental features protected by the sub surface water management program, with this report having just been completed.

14. Drain design and vegetation will incorporate features that are analogues of natural wetland features that trap silt and nutrients.

Reedy and Brays Swamp and Kinnairds Wetland are examples where drain design has been incorporated to ensure that the wetland and swamps play an important role in trapping sediment and nutrients. The Guidelines for design also promote the use of on-line and off-line wetlands when drainage design is being undertaken. Monitoring of these wetlands and swamps is also currently underway which will be able to provide data on the effect that the drain is having on the management of the wetland and depressions.

15. Drain design incorporates features that protect and enhance existing wetlands. Support is cultivated amongst the owners of land containing the wetlands.

Management plans are developed for the wetlands in the Shepparton Irrigation Region, looking to ensure ongoing management of these wetlands into the future. Examples of some of these wetlands management plans are Kinnairds Wetland, Reedy Swamp, Brays Wetland. Landowners are consulted on the management of these areas and other low lying depression through the environmental assessment process undertaken by the EMP as part of the survey and design of the CSWMS.

Further work is required however on promoting the benefits that low lying areas and wetlands can play in the role of community surface water management systems.

16. The implementation program has the flexibility to respond to changes in demand resulting from shifts in irrigation intensity and enterprise profitability.

Reconfiguration work that is currently underway is giving an indication to the Surface Water Management Program of areas that are having shifts (or are estimated to) in their water use and farming enterprise. Surface Water Management program staff are involved in discussions around this topic and thus can alter works accordingly. Staff have also been involved in a GIS Atlas collation of farms are investigating further use of this technology and information. The SWMP has also been proactive in ensuring that works proceed with creation of new policies intended to accelerate the uptake of drainage. These policies (flexible spurs, deferring payment into construction) have been approved by SWMWG and CSDCC, showing the flexibility of the program to respond to a decrease in works, due to seasonal conditions.

17. Community drains are implemented within a reasonable time so that enthusiasm is sustained, while the interest of individual landowners and environment issues are given reasonable consideration.

With the current conditions facing the Community Surface Water Management Program, maintaining individual enthusiasm is out of the control of the Surface water Management Officers.

18. Agency staff have well developed facilitation and project management skills which result in community drains being built quickly and efficiently and in accordance with the needs of the community.

One of the key selection criteria for the employment of Surface Water Management Officers (SWMO) within the program, is that they meet the following key selection criteria:

1. "Knowledge of extension principles, practices and adult learning needs, including facilitation of groups to make appropriate shared decisions, conciliation and negotiation techniques" and

2. "Demonstrated ability to develop and implement community activities involving sound project management skills, including development and management of a budget". With all staff ensuring they meet these criteria prior to employment ensures that all staff have the skills to progress a CSWMS. Any skills gaps that are identified through a staff's employment are addressed through the regular supervisors meetings and staff are encouraged to attend training to develop these skills.

Staff within the program all attended a contract management training course in 2003, to ensure all staff were provided with information ion best how to manage contracts.

Having all the appropriate skills can ensure that staff progress the CSWMS efficiently and quickly, but the main driver of progress will be community involvement which can be outside the control of the SWMO. The program has ensured however that all SWMO are adequately trained to provide the appropriate level of support to the community.

19. Agreements between individual landowners and the drainage Authority are well documented and passed on, so that there is a continuity of knowledge through a turnover of agency staff and landowners. This includes landowner agreement plans and letters, which document the layout of drainage works, areas subject to flooding and responsibilities of the various parties.

The introduction of Work Specification Plans, or landowner agreements, has ensured that landowners are aware of the works that will take place on their property and changes that will occur to their outlay as a result.

(Example attached).

A new central store of final reports will allow for new staff to easily access information on completed drains, without having to search through a multiple of files to extract the information.

Work is also currently underway to finalise the contract documents for survey and design to ensure that the roles and expectations are clear between the Technical Liaison Group and the designer.

Investigation is also underway to look at the copyright of plans and the ownership of them between designers and the group, should further work need to be undertaken on them and at a date beyond the completion of the final survey and design.

20. Effective surveillance and sanctions ensure drains and farm development works are carried out in accordance with approved plans.

Local government is responsible for ensuring that works are being carried out in accordance with the approved plans. Goulburn Murray Water are a referral agency of the council and ensure that the works that are proposed are acceptable to their drainage plans and have no impact on their assets. G-MW have a process whereby they ensure that whole farm plans meet the criteria outlined in their checklist when plans are checked. (checklist attached)

21. Monitoring programs quantify the effect of drain design and operation on wetlands within the region and the rivers downstream.

Brays and Reedy Swamp and Kinnairds Wetland all have monitoring programs undertaken on them, which have the impact of assessing whether the drain design and its operations have an impact on the operation of the wetland.

The GBCMA have developed a “Lower Broken Creek Waterway Management Strategy”, which is looking at maintaining diversity with summer flows, drainage flows and winter drawdown. The Irrigation and Drainage Memorandum of Understanding (IDMOU) has developed a decision support system that is a framework to identify drainage issues and develop monitoring to assess them. (Lower Broken Creek Waterway Management Strategy included)

22. Mechanism exist for applying significant advances in drain design or operation to older drains, where those advances result in improvements to water quality outfalling from the system.

Each financial year the G-MW budget contains funds to undertake retrofitting of existing drains. Currently this amount is set at approximately $500,000 a year. Some works that have been identified to occur has been hydro-mulching of drain batters, with 7 sites having been identified to have works undertaken in the next 2 years.

Works are also being undertaken to assess the value of changing the batter slopes to assist in the aid batter stabilisation and control of nutrients.

G-MW also has operational plans for each CSWMS and a priority list for maintaining each CSWMS.

23. Reduction of irrigation induced nutrient loads in drains

The Irrigation and Drainage Memorandum of Understanding (IDMOU) will cover and focus on a reduction on nutrient loads in drains. It will pull together all the current work that is occurring on ensuring that targets are met.

24. Development of non – structural nutrient control instruments including Whole Farm Planning to ensure that impacts on nutrients and water quality are considered in the planning use developments.

Over the past five years there has been a greater emphasis on water quality in the whole farm planning process. Some of the procedures in place to address water quality and nutrients include:

- the requirement that properties over 10 hectares must have a re-use system designed for it,
- training and workshops with staff and designers incorporating information on effluent management, and
- the introduction of re-use and automatic irrigation incentives to reduce run –off from properties.

25. Development of Whole Farm Plans with a targeted 25% increase in annual preparation rate until all irrigation farms have approved Whole Farm Plans.

The rate of whole farm plans completed with the assistance of an incentive is currently 3.7% of the irrigated area of the SIR per year. While this is below the recommendation of 25%, it is above the original target set out in the Regional Catchment Strategy of 3.5% per year. The level of uptake of whole farm plans is based on the landholders ability to pay for a whole farm plan. Resources have been provided to service the level of demand from landholders.

26. Increase installation of farm re-use systems by 20% per year until 80% of farms have functioning systems.

Incentives for the construction of re-use systems were developed in July 2000. Since then, 309 re-use systems have been constructed under the incentive program, providing re-use facilities for 21,074 hectares of irrigated land

There are also many re-use systems constructed without the assistance of the incentive.

The level of demand for re-use systems is driven by the landholders ability to fund the works. Resources are provided to service the demand from landholders.

27. Increase in diversions from drains achieved by a mixture of reuse systems, drainage diversions and other BMP's.

Incentives are available for the construction of reuse systems on landholders properties as well as Drainage Nutrient Removal Incentive Scheme for diversion from Primary Surface Water Management Systems. These incentives have led to an increase in the numbers of reuse systems installed in catchments that are serviced by drainage.

Whilst online reuse systems are permitted within CSWMS design, off line systems are encouraged as an alternative to keeping nutrients on farm and thus recycled.

28. Development of off stream storage's for diverted drainage water and installation of appropriate pumping and switching gear.

The Department of Primary Industries, in collaboration with the Goulburn Broken Catchment Management Authority have developed a Drainage Nutrient Removal Incentive Scheme. The guidelines to be eligible for this incentive state that the pump and motor must be permanently fixed to receive the grant money. It also states that is essential that the property receiving the grant has an approved whole farm plan, which outlines the design for the pump and motor to ensure sufficient volumes of water can be pumped. There are also other criteria that the property must comply with before the incentive is paid.

29. Embargo on direct dairy shed effluent discharge to drains and development of BMP's for discharges from feed pads, calf sheds and other intensive dairy operations.

G-MW have in place a policy (attached) outlining an embargo on dairy effluent entering directly into G-MW channels or drains, including Community surface drains. Direct discharge is defined as discharge directly or via farm drainage lines, from a dairy, feedpad, feedlot or dairy effluent pond.

An industry agreed target of 100% compliance for dairy effluent management in accordance to SEPP waters of Victoria 1988-2003. Embargo of all point source dairy effluent discharges to waterways, drainage networks and groundwater. This includes dairy sheds, feed pads, effluent ponds, bridge crossings and other intensified activities causing concentration of effluent. The development and implementation of Effluent Management and Nutrient Management Plans (EFMP and NMP). The referral of all non compliant dairy effluent discharges to appropriate agencies (EPA, G-MW, Municipal councils) to ensure rectification of issues and progression towards industry targets.

30. Drain management institutional responsibilities resolved (Drain Management Option).

The Irrigation and Drainage Memorandum of Understanding (IDMOU) will cover and focus on a drain management and responsibilities associated with it. It will pull together all the current work that is occurring to ensure drains are managed appropriately.

31. Further development of monitoring of wetlands and remnant vegetation is required such that areas affected by the construction of surface drains can be assessed to measure change, in particular, the degree of enhancement being achieved through its implementation.

ACTION: This recommendation is yet to be completed, with a similar action item outstanding from the SIRTEC Forum (Action Item 03 - 1x3).

A Monitoring, Evaluation and Reporting Strategy has been completed by the Goulburn Broken Catchment Management Authority which outlines a strategy to ensure that monitoring of environmental features is undertaken.

This recommendation is seen as a joint process / project that will need to be undertaken by the EMP, CSWMP and TLG of the group.

32. Development of Management Plans for all drains. Drain Management Plans are being developed by G-MW to define BMP's for maintenance and operation of drains. The management plans will also be used as a basis for allocation of drainage diversion permits. Plans are currently being prepared for the Muckatah, Murray Valley Drain 6 and Deakin catchments, and will be developed for all G-MW Primary Drains. These plans will be used as a basis for management plans for all Primary Drain catchments within the SIR.

Goulburn Murray Water have developed Management Plans, naming them Asset Operational Plans. They develop these plans for long term monitoring and maintenance of drainage systems they are involved with. These asset operational plans are currently being implemented, and further support will be provided through outcomes of the Irrigation and Drainage Memorandum of Understanding.

33. Development of plans and cost sharing arrangements for retrofitting, biodiversity, wetlands and other environmental features into existing drains. Further investigation will be required to identify existing drains that would benefit from retrofitting. Prioritisation of works is expected to reflect the benefits achieved.

Each financial year the G-MW budget contains funds to undertake retrofitting of existing drains. Currently this amount is set at approximately $500,000 a year. Some works that have been identified to occur has been hydro-mulching of drain batters, with 7 sites having been identified to have works undertaken in the next 2 years.

Works are also being undertaken to assess the value of changing the batter slopes to assist in the aid batter stabilisation and control of nutrients.

G-MW also has operational plans for each CSWMS as a priority list for maintaining each CSWMS.

New policy has been passed enabling the retrofitting of CSWMS that are in the process of transferring the management of their CSWMS from local government to Goulburn Murray Water. This policy allows for upgrade works in these systems to be financed as per the cost share arrangement for construction. (50%). (see attached paper)

34. Development of wetland and remnant vegetation monitoring strategy and plan, including flora and fauna, to provide protection and preservation of wetlands and remnant vegetation after drains are built. A wetland and remnant vegetation management plan is being developed by NRE for Bray's Swamp. These plans will form the basis for the development of plans for all significant wetlands and remnant vegetation sites within the SIR.

Wetland Plans have been developed for Brays and Reedy Swamp as well as Kinnairds Wetland. Further wetland plans are currently being undertaken. Draft Plans have been developed for Mansfield Swamp and Kanyapella Basin. Processes have also been developed to incorporate wetlands into the design of surface water management systems. The implementation of these plans is currently underway through staff from the EMP.

Biodiversity Action Plans (BAP) will be prepared for 5 areas within the Shepparton Irrigation Region, with a draft plan for the Yarrawonga region currently having been completed. These BAP's identify and record areas of remnant vegetation with each area evaluated and scored for its condition and diversity. Each BAP

identifies a strategy for ongoing maintenance.

35. Resolution of water quality monitoring and reporting responsibilities and third party auditing and reporting. There is currently no single organisation that has responsibility for meeting water quality objectives of drain outfalls, which would simplify the potentially complex problem of interfacing and management of outfalls with separate organisations or individuals. Investigate alternative forms of monitoring such as biological monitoring.

The signing of the Irrigation and Drainage Memorandum of Understanding ensures that there is a long term investment for the resolution of water quality monitoring. The IDMOU is a joint agreement between the Department of Sustainability and Environment, Goulburn Broken Catchment Management Authority, North Central Catchment Management Authority, Environment Protection Authority Victoria and Goulburn Murray Rural Water Authority. (IDMOU is attached)

36. Regional Drainage Research and Development. Research and development need to continue to develop best management practices, both on-farm and off-farm. Controlling pollution at its source is a high priority, and has been targeted by the strategy through inclusion of the Goulburn – Broken Water Quality Strategy objectives and its focus on BMP's on farm to better manage water quality and contaminants.

The Irrigation Drainage Memorandum of Understanding will cover this aspect of the program. The development of Catchment Operational Plans, will help to define what is happening in the broader catchments, separately to that of occurrences in sub catchments.

37. Design Manual for G-MW Primary Drains, DCD's and water harvesting systems. Design Guidelines for CSD's have been developed to provide minimum standards and design philosophies, while still providing flexibility for designers. Design manuals incorporating Primary Drains, DCD's and water harvesting systems are required to document current best practice in surface water management system construction and design.

Goulburn Murray Water is currently in the progress of completing guidelines for design for Primary Drainage Systems. A final draft of this document has been completed and will be available for use from the next financial year (2006 / 07). The guidelines for design for the Community Surface Water Management Systems has been recently updated, with the new version to be placed on the Internet for easy access by all users throughout the state. (Currently there are 200 people who receive a copy of the guidelines). The guidelines were updated in November 2005.

38. Development of a process control system for the strategy requires further work to detail the procedures established over the last decade, define a process for review and improvement and provide traceability within the strategy.

Processes are in place to ensure that the SWMP reviews the recommendations identified in the strategy on a regular basis. The CSWMP has initiated a yearly planning day, which will focus on ensuring that the works program are in line with the strategy goals. Discussions are taking place between both community and primary staff on ensuring that the budgets of the two programs are in alignment to ensure that works are progressing together. A document in now is circulation outlining the steps undertaken to review the strategy each time it is undertaken and will form the blueprint for further reviews. The employment of both an

executive support officer and policy development and implementation officer has ensured that all new processes developed within the program are now recorded and appropriately rolled out. All policies have an implementation and communication strategy attached to them and will not be approved prior to these documents being completed.

ACTION: To ensure that future recommendations are traceable through the life of the review, all recommendations will be identified in a separate chapter of the review so easy retrieval, to allow for measurement of the performance to complete these to be undertaken on an annual basis.

39. Strategy recording and reporting system, including improvement to linkages between GIS and tabular reporting systems.

Developing strong linkages with the GIS department are starting to develop but further work is required to develop all the sub sets of information that is required.

40. Process control for the design, construction and transfer of management responsibilities for the Surface Water Management Systems.

Throughout the past 5 years, the program has ensured that many of its processes and guidelines have been documented to ensure that ongoing transfer of knowledge occurs throughout the change of staff in the program. The production of an operational and transfer of management manual, has been undertaken in he community program, providing a step by step process towards achieving the completion of these tasks. These documents have a quality control system in place to ensure that the most recent information is documented in them and available to staff, in regular updates.

The production of other documentation, such as maintenance manuals, checklists (for design plans, environmental etc) and administration guidelines ensures the control of the procedures in place for the program. G-MW is currently in the process and have completed a copy of draft guidelines for the processes behind the construction of primary Surface Water Management Systems.

Appendix D Economics (DESM) parameters

The economic benefits of the SWMP were evaluated in 1995 using DESM and these were then indexed (presumably using CPI index) to be shown as $1999 in the 2000 SMEC review. This is concluded by the comment 'The current analysis adopts the salinity, waterlogging, flooding, reuse and roads used in the 1995 analysis and converts them to 1999 dollars' SMEC 2001.

There are a number of potential concerns with the methodology adopted in the 2000 review, being:

- The benefit to cost ratio quoted using a methodology similar to those methods used in previous reviews is not a meaningful indictor for current financial progress. It is an indicator of what the strategy would theoretically achieve under a specified set of assumptions. It would appear that the assumptions are framed to provide a financial indictor for the express purpose of prioritising works between catchments.
- Actual expenditure has not been reported in any previous reviews. Tracking of expenditure vs budgeted expenditure would appear to be a critical item to report in any review of progress.
- Benefits of the SWMP do not necessarily vary in proportion to CPI changes. The status of the model parameters and the validity of these assumptions has been briefly examined to determine the potential sensitivity of the statement of economic benefits attributed to the strategy.

- **Table 21 Evaluation of DESM parameter sensitivities**

Model parameter required	Information required	Risks / Impact on Bottom line
Capital Costs		
	Estimate of total costs	Costs are distributed over a period of time. Original strategy was capitalised in order to prioritise catchments. Assumed all projects started in year 1.
Salinity (yield impacts)		
Area shallow watertable	Total area affected – mapping data available for August watertable study	Projections into the future are increasingly being questioned as potential overestimates. Assumed increase from 75% to 90% over 20 years. A review of projections is currently being undertaken as part of a sub-surface drainage strategic project. Preliminary results suggest significant climate influences and possibly a lower impact than predicted 90%, although the potential risk is still present.
Waterlogging		
Yield loss per crop type	Research available to base this estimate on	Likely to be a reliable estimate of loss if waterlogging present.

	24% dairy, 21% mixed farm	.
% each crop type affected	Area without drainage? 20% prone to waterlogging based on soil types Topography coef = 0.6	Understanding of this likely to improve at finer scales Extent of potential waterlogging has not been reviewed
Flooding		
Yield loss per crop type	Research available to base this estimate on	Likely to be a reliable estimate if flooding present
% each crop type affected	Area without drainage?	Understanding of this likely to improve at finer scales Extent of potential waterlogging has not been reviewed
Roads		
Length of roads (3 types)	Mapping data – length of roads measured directly	Has the actual cost been reviewed recently? Various studies have been undertaken although not clear whether SIR has been considered or reviewed. The conversion of 1995 benefits to $1999 may have been OK (CPI indexed) but this may have changed significantly in light of resources boom and escalation in oil prices.
Re-use		
% reuse		
$/ML	Cost of water	Diversion license costs set by G-MW (0.25 x water cost) Prediction of water cost into the future is potentially variable.
Land-use change		
Area of crop	Total area for each	Intermittent data collated - captured by Landsat

	crop- mapping data	1996. Forward projections based on predicted behaviour of landholders
Gross margin of crop	$/ha for particular crop type	Tracked well historically. Forward prediction is potentially unreliable over 50 year period
Irrigation intensity	ML/ha for particular crop type – plenty of research data available	Relatively well understood. Variation in this is less likely to impact on outcome than other parameters.
Drainage / Landforming		
Area Drained	Total length of drains in ground – well known	Reliable data updated regularly.
Area landformed	Total area of land improved 3% per year (with) and 1.5% per year (without) up to 70%	Current estimates tracked Future change is based on 10% improvement (SMEC 2000) This is probably a reasonable assumption, although recent uptakes may have
Drainage effectiveness		
% effectiveness	Figure according to tabulated data	Subject to judgement of economic modeller. Not easily reviewed without copy of original model.

D.1 2006 Evaluation

The benefit to cost ratio for current works program implementation was derived using the following method:

- Present value costs
  - The expenditure to date was calculated by applying actual CPI index to annual expenditure recorded by G-MW for PSWMS and DPI for CSWMS.
  - Projected capital expenditure was based on a G-MW works program and assuming a 5% discount rate until the year 2020.

- The G-MW works program has been tailored to suit current levels of budget coverage of $4M per year. It should be recognised that shortfalls in funding will increase the cost of the strategy in real terms.
- Projected operation and maintenance costs were indexed at current rates which were extended until 2030 in the previous review.

- Present value benefits

The original 1995 benefits were indexed using actual CPI index. Whilst it is recognised that this is not correct, there is a large body of work required to review the economic basis for benefits of the program.

Appendix E Irrigation Futures - Overview

The Goulburn Broken Irrigation Futures project was established to assist the regional community to plan for the future. It is a regional initiative, funded by the GBCMA, National Action Plan for Salinity and Water Quality, G-MW, DPI, DSE and Land and Water Australia.

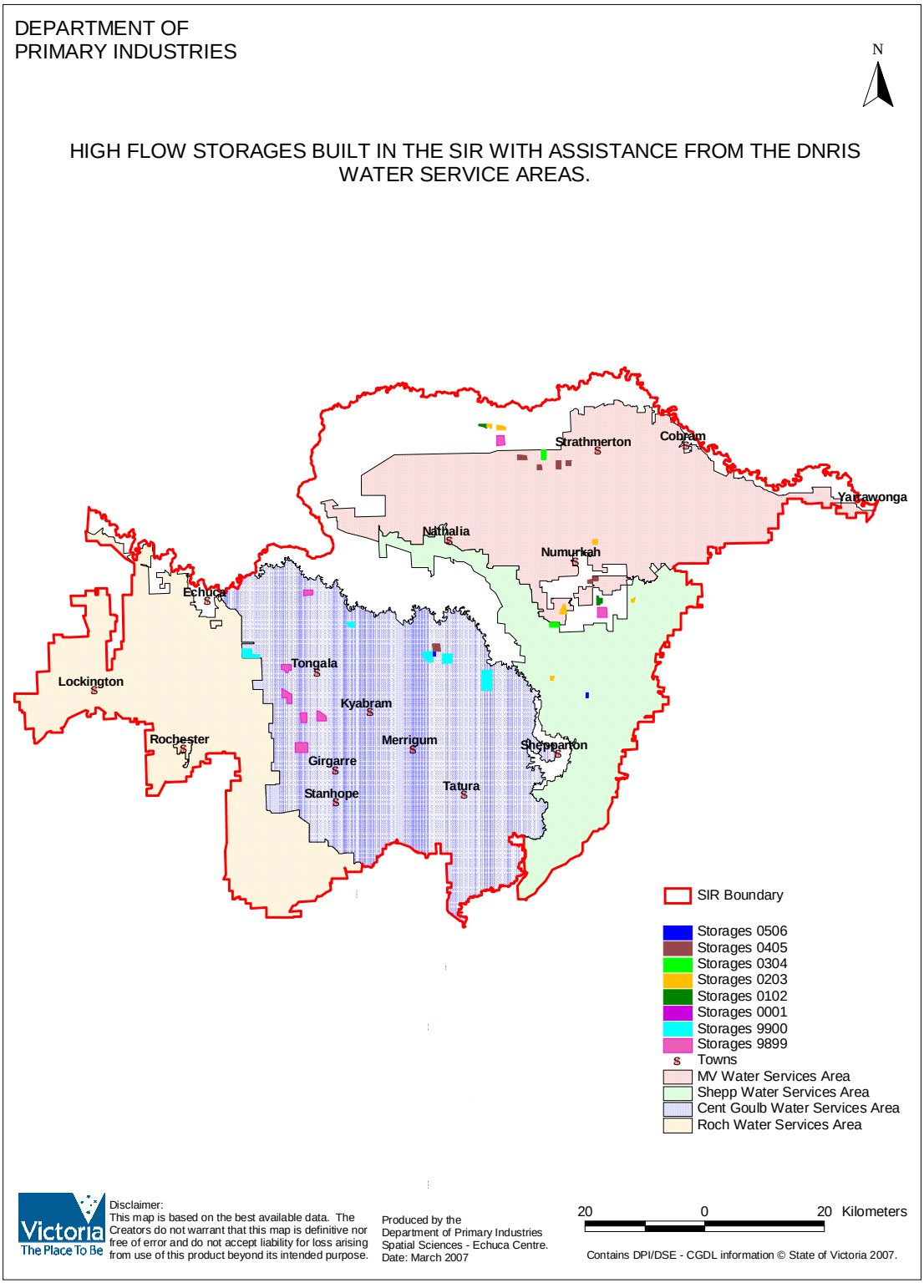
The project objectives were to:

- Facilitate key stakeholders to develop a shared vision for the future of irrigation in the Goulburn Broken catchment over the next 30 years, and to identify scenarios of major constraints and opportunities and of regional response options.
- Understand the social, economic and environmental consequences of various scenarios through impact assessment that integrates the best available knowledge.
- Facilitate key stakeholders to build consensus on preferred regional options for future irrigation, and recommend regional follow-up actions.
- Develop a methodology that can be applied elsewhere in Australia for sustainable irrigation planning at a catchment scale.

The Irrigation Futures Project engaged extensively with the community and other stakeholders in exploring vision and strategies for irrigated agriculture in the Goulburn Broken Catchment. Four plausible future scenarios were developed that described the evolution of external forces, regional responses and impacts on regional well-being. The competencies of the region were examined through the lenses of the scenarios, and strategies were developed. Scenario implications for the provision of services and infrastructure were worked through with agencies in the region, including G-MW, GBCMA and local government. The project highlights that the future is uncertain and a key to future prosperity is flexibility and adaptability.

Appendix F Drainage Nutrient Removal Incentive Scheme

High flow storages built in the SIR with assistance from the DNRIS (based on water services area)



Appendix G Details of works remaining

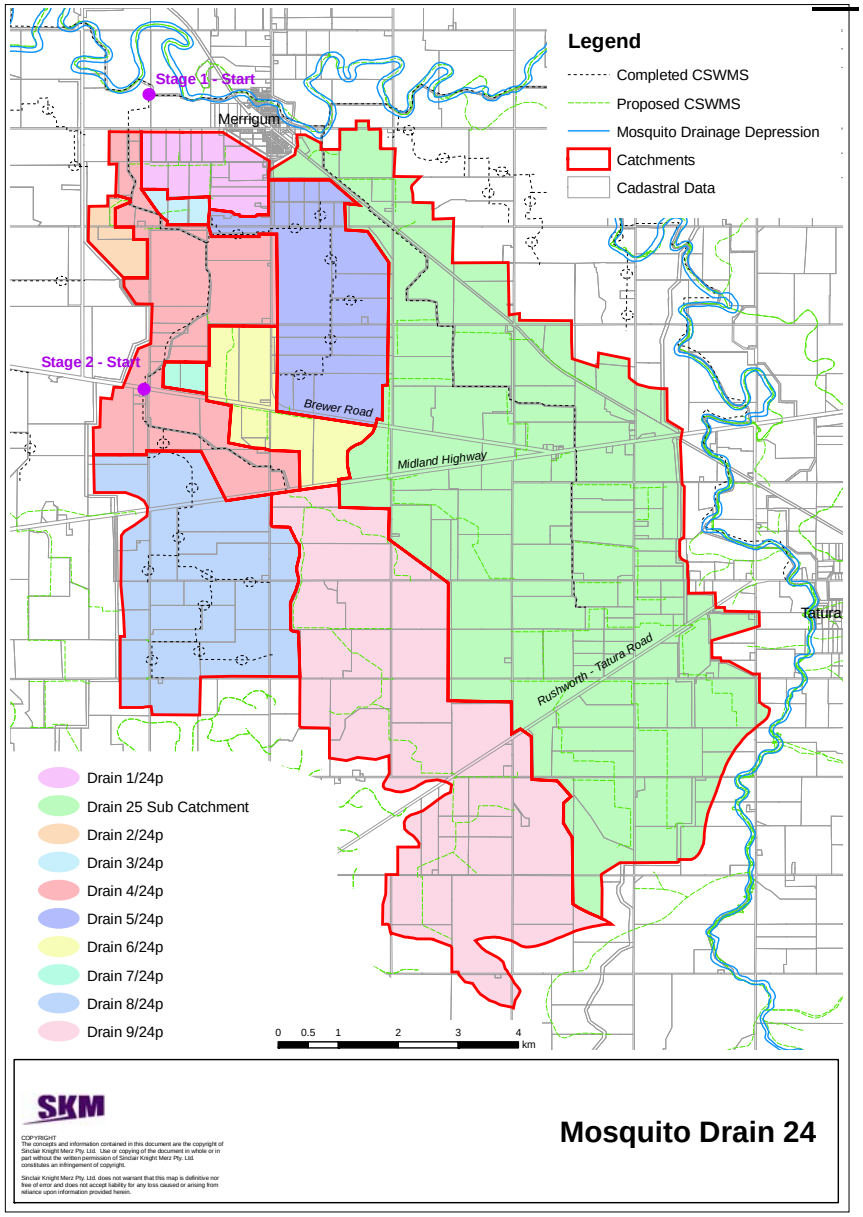
Lockington DCD	The length of DCD remaining at July 2000 is 120 km (SMEC 2001)
Campaspe DCD	The length of DCD remaining at July 2000 is 20 km (SMEC 2001)
Deakin Primary Drains	Proposed 23km in 2000 strategy. 8.02km completed 2001 - 2006 Deakin Drain 16 = 15.26km Old Deakin 5 – Stage 2 = 7.6km to be completed Drain 16 extension
Deakin DCD	The length of DCD remaining at July 2000 is 15 km (SMEC 2001).
Corop Lakes Primary drains	The area remaining to be drained at July 2000 is 34,450 ha (SMEC 2001) Stanhope Stage 1 = 6.8km (50%) Stanhope Stage 2 = 6.8km
Corop Lakes DCD	The area of DCD remaining at July 2000 is 143 km (SMEC 2001)
Mosquito Main Drain	Proposed 27.5 km in 2000 strategy. 4.2 km completed in period (Stage 9) Stage 10 = 5 km (90% complete @ June 2006) Drain 36 Stage 1 = 3.3 km (design complete) Drain 1/36 = 4.7 km Drain 36 Stage 2 = 9 km Drain 40 = 5.12 km (design complete) Drain 22 to be converted to PSWMS (approx. 13km) Total works remaining = 27.12 (ie additional compared to 2000 strategy)
Mosquito DCD	The area of DCD remaining at July 2000 is 56 km (SMEC2001)
Kialla DCD	The length of DCD remaining at July 2000 is 14 km (SMEC 2001)
Tallygaroopna primary drains	The area remaining to be drained as at July 2000 is 27 300ha (SMEC 2001) Shepparton Drain 2/11 extension = 8.6km Bunbartha = 10km
Tallygaroopna DCD	The length of DCD remaining at July 2000 is 53 km (SMEC 2001)
Tallygaroopna remodel	The length of remodelling required at July 2000 is 5km (SMEC 2001) Shepparton Drain 2/11 remodel = 5km
Barmah/Nathalia Primary Drains	Proposed 37.5 km in 2000 strategy Murray Valley Drain 11 = 37.5km
Muckatah Primary Drains	Proposed 70.3km drain in 2000 strategy. 28.53km completed in period Drain 8 = 12.46km Stage 4 = 8.75km (90% complete) No further PSWMS required – strategy adjusted
Muckatah DCD	Proposed 141km DCD Already done – strategy adjusted (error in 2000 SMEC review)

Appendix H Case Studies

Case Study 1

Combined PSWMS and CSWMS

Mosquito 24 catchment



Introduction:

The Shepparton Irrigation Region is located in the central northern area of Victoria and is one of regional Australia's most important food producing and food processing areas. The region is primarily contained in the Goulburn Broken Catchment with a smaller area west of the Campaspe River located in the North Central Catchment.

The removal of native open woodland and the development of irrigated agriculture in the SIR have altered the natural hydrologic balance. The removal of most of the trees and the frequent application of irrigation water has resulted in the soils of the region having a higher than average moisture content. This in turn results in higher volumes of runoff occurring after a rainfall event (Surface Water Management Strategy Review, 2002).

Ponded rainfall is a significant source of recharge to the watertable exacerbating soil salinisation. It can result in prolonged waterlogging on-farm which can impact adversely on productivity.

Approximately 60% of the region was without effective surface drainage at the commencement of implementation of the Surface Water Drainage Strategy in 1990. The Surface Water Management Strategy aims to facilitate the installation of Primary and Community Surface Water Management Systems and carry out upgrading works where required (Surface Water Management Strategy, 2002).

Catchment Background:

The Mosquito 24 catchment covers approximately 4,607 ha and its outfall is located near Merrigum. The catchment extends from Bitcon road at Byrneside to the outfall into the Mosquito Main SWMS (Stage 5) west of Merrigum.

The catchment predominantly supports grazing and dairy enterprises and investment in drainage was well supported during the planning and implementation phases.

An economic study by Farmanco in 1994 detailed the following mix of enterprises in the 4,607ha catchment:

- Dairy 2,446 ha (53%)
- Mixed faring 1,775 ha (39%)
- Horticulture 89 ha (2%)
- Hobby 294 ha (6%)
- House blocks 2.8 ha (<1%)

It is estimated that over 45% of the catchment is subject to waterlogging (due to soil types) and losses in the 1991/92 period were estimated around $0.5M. Lack of effective surface water management infrastructure was seen as a major impediment to farm development.

The surface water management strategy for this catchment consists of a G-MW PSWMS coupled with nine CSWMS (see Figure 1). The catchment was considered too large to be served solely by CSWMS and so a PSWMS was necessary to divide the catchment into a number of smaller community groups. This package of works also reduces the cost when compared to all properties being served by G-MW PSWMS.

Surface Water Management Context:

Catchment Features

The Mosquito 24 catchment had a relatively well defined natural depression although some obstructions in the upper catchment were problematic to water management. Within the catchment a significant environmental feature, Brays Swamp, was identified for a special management approach.

Brays Swamp is considered a high value wetland which is particularly significant because it is a known Brolga breeding site. The wetland was naturally a seasonal wetland with a relatively short wetting regime. However, since the introduction of irrigation, wetting has become more prolonged which is the main reason for Brolga visits.

The design of the works generally follows the natural depression and allows for water to spill to Brays Swamp in higher flow events. Although the natural depression was evident, the works allowed for obstructions to be removed and allow for improved surface water management.

Construction of the Mosquito Main PSWMS was completed to beyond the Drain 24 outfall, thus providing an outfall for Drain 24 works to proceed in early 1996.

Implementation of SWMS

The design of the Mosquito 24 SWMS was completed prior to 1996 and construction was undertaken in two stages over three irrigation seasons, mainly due to the need to distribute funding amongst a number of other concurrent surface water management projects within the region. Stage 1 (6.1km) was constructed over the 1995/96 and 1996/97 seasons and Stage 2 (3.4km) over the 1996/97 and 1997/98 period.

The implementation of CSWMS has been slow despite having had an outfall available for around ten years. The current status of CSWMS implementation is shown in Table 1.

Table 1 – CSWMP implementation status (completed works in BOLD)

CSWMS name	No. Landholders	Designed (Yes / No)	Constructed	Sub-catchment area (ha)	Length of SWMS (km)
1 / 24P	13	Yes	No	195	2.46
2 / 24P	2	Yes	No	62	0.70
3 / 24P	3	Yes	No	38	0.41
4 / 24P	1	Yes	No	21	0.16
5 / 24P	**15**	Yes	**Yes**	**583**	**6.4**
6 / 24P	6	Yes	No	241	3.7
7 / 24P	2	Yes	No	35	0.15
8 / 24P	**21**	Yes	**Yes**	**812**	**9.1**
9 / 24P	25	Yes	No	1860	20.1
All totals	88	-	-	3,847	43.6
Total completed	36	9	2	1,395	15.5
% complete	41 %	100%	22%	48%	36%

In examining the reasons for slow implementation rates of CSWMS, it is evident that:

- Lack of available funds is often put forward as a reason. By comparison around 1,097 ha of CSWMS have been constructed using the G-MW management option in Drain 25 catchment in past 5 years, representing an implementation rate of over 51% (by length). ***It would appear from this statistic that limits on available funds, whilst a valid reason for slow implementation, may not be main reason for lengthy delays in proceeding.***
- ***There is a view amongst some members of the community that SWMS is not required.*** Some of the specific issues include reasons such as particular farms having higher ground that does not require a SWMS, adequate reuse infrastructure and generally dry conditions.
- ***Implementation in some sub-catchments, such as the 9/24P, can be stalled by a small number of landholders who do not support the implementation of CSWMS***. Reasons for not agreeing include interruption to farm practices and layout, difficulty accepting government design and implementation processes, ownership arrangements and conditions such as protection of environmental features forcing restrictions on land-use.

Hydrology

The works are designed to remove a 50 mm summer rainfall event, falling over a 24 hour period, within 5 days. This is equivalent to a 1 in 2 year Average Recurrence Interval rainfall event. It can be seen from Table 2 below that the events greater than the design event have occurred on at least 3 occasions since the works have been in place. This suggests that events leading to agricultural losses through flooding and waterlogging should be all but non existent with SWMS implemented.

Table 2 – Design rainfall events or greater (Kyabram gauge 080091)

Date	Rainfall event > 50mm in 24 hr period (mm)	Rainfall event > 50mm over 48 hr period (mm)
Pre Implementation		
17 / 18 January 1993	(14)	74.8
3 / 4 October 1993	(8.8)	114.7
12 November 1998 (PSWMS complete only)	67.8	67.8
26 / 27 August 1999 (PSWMS complete only)	(11.8)	50
Post implementation		
24 October 2000	52.8	59.8
5 / 6 November 2004	(7)	51.2
3 February 2005	52.4	95.2

Note: May 2005 – January 2006 data not available. Where the rainfall that occurred during a 24 hour period was less than the design rainfall event but the cumulative rainfall in the 48 hour period was in excess of the design event, that rainfall is shown in brackets.

Design flow for the PSWMS varies from 115 ML/d at the lower end to 80 ML/d towards the top of the catchment. The design was developed in accordance with current practices which ensure higher flows are not routed through the system but are retained to some degree within the catchment to minimise downstream impacts.

Three drain diversion sites exist along the drain with a total of 150ML of low flow licenses.

It is clear that opportunities to test the SWMS have been limited and thus benefits have not been recognised by community in this area.

Key performance aspects:

The key elements used to evaluate the performance of a surface water management system relate to the environmental, economic and social aspects. The relevant aspects of these are discussed for this catchment below:

- **Environmental health indicators**

Brays Swamp has been incorporated into the PSWMS design essentially as an environmental feature which supports birdlife, specifically being recognised as a Brolga breeding area. In order to maintain an agreed watering regime, the works have been designed with spillways to allow water to spill into the wetland during higher flow events. The advantage of this design is that low flows, with potentially high salinity and nutrient concentrations, are prevented from entering the wetland at times when the wetland would otherwise have been dry.

A management plan was put into place in March 2001. It includes monitoring arrangements which will be used to evaluate environmental performance.

Drought conditions in the past 5 years have meant that the natural hydrologic regime may not have been realised in recent times. However, this may be indicative of a potential issue related to the proportion of CSWMS adopted in a catchment.

CSWMS do not require licensing of drain diversions and the water quality is often an unknown factor. Hence, it is possible that environmental features in a catchment with a high proportion of CSWMS may not be provided with sufficient flows, with respect to volume and quality, to sustain this environmental feature.

There is also room to debate whether environmental features that have resulted from the presence of irrigation should be maintained under a regime where irrigation runoff is reduced according to 'best management practice' of the time.

- **Economic performance indicators**

The costs for implementation of the G-MW works have been tracked and are well defined: The capital costs were $1.09M for Stage 1 and $0.52M for Stage 2. The length of PSWMS constructed is 9.5km which directly services an area of 589 ha.

The Mosquito 24 PSWMS construction costs were in-line with expectations, with unit rates of $178,000/km comparing well with the estimated rate of $177,000/km.

The construction cost to implement all CSWMS was estimated in 1994 to be $1.69m (Planright, 1997), or $39,000 per kilometre. Actual construction costs for the 5/24P and 8/24P sub-catchments were $332,427 ($52,000/km) and $373,185 ($41,000/km). Projected capital expenditure to fully service the catchment based on these unit rates is $1.98m.

Recently, transfer costs of $29,816 and $44,232 were incurred to transfer to G-MW management respectively taking the total cost of CSWMS works, including actual expenditure plus projected expenditure, to over $2.1m.

The benefit-cost ratio for the Mosquito catchment was quoted as being 1.3 in the 1995 Surface Drainage Strategy. Given an estimated total cost of $2.43m to complete the CSWMS, this suggests that benefits in the order of $3.2m would be gained through implementing this strategy.

Although actual expenditure of $2.3m has not exceeded the value of benefits, projected expenditure is likely to reduce the benefit-cost ratio below one.

Most of the benefits have not been fully realised within this catchment due to the dry climatic conditions, although positive feedback has been received by G-MW confirming that the drains in the area have been effective during one of the few heavy rainfall events experienced since construction. Realisation of benefits is reliant upon implementation through the whole of the catchment. Although outfall has been available for CSWMS for around 10 years, less than half of the catchment is currently serviced. The full economic value will not be realised until all the CSWMS are constructed.

Environmental features can be incorporated into design of PSWMS and can be cost effective.

The increased costs to implement CSWMS are having an impact on SWMP bottom line.

- **Social impact**

Social impacts of the SWMP cover aspects such as community wellbeing, sense of community, natural resources knowledge base, business confidence, security of water, changes in landscape and protection of cultural heritage.

Planning and construction was completed prior to many of the new policies and strategies being introduced. Negotiation with landholders and DCNR were the key approval mechanisms and the main issues were those of cost and loss of land.

General morale was reported as being low which is unlikely to be due to the Strategy. The progress towards construction of new CSWMS has been slow mainly due to climatic conditions and lack of available funds to invest in new works.

A number of CSWMS have been transferred to G-MW to own, operate and maintain, with an average of $30,000 per CSWMS to upgrade to G-MW standard. This is indicative of the issues associated with CSWMS and their operation and management or lack thereof.

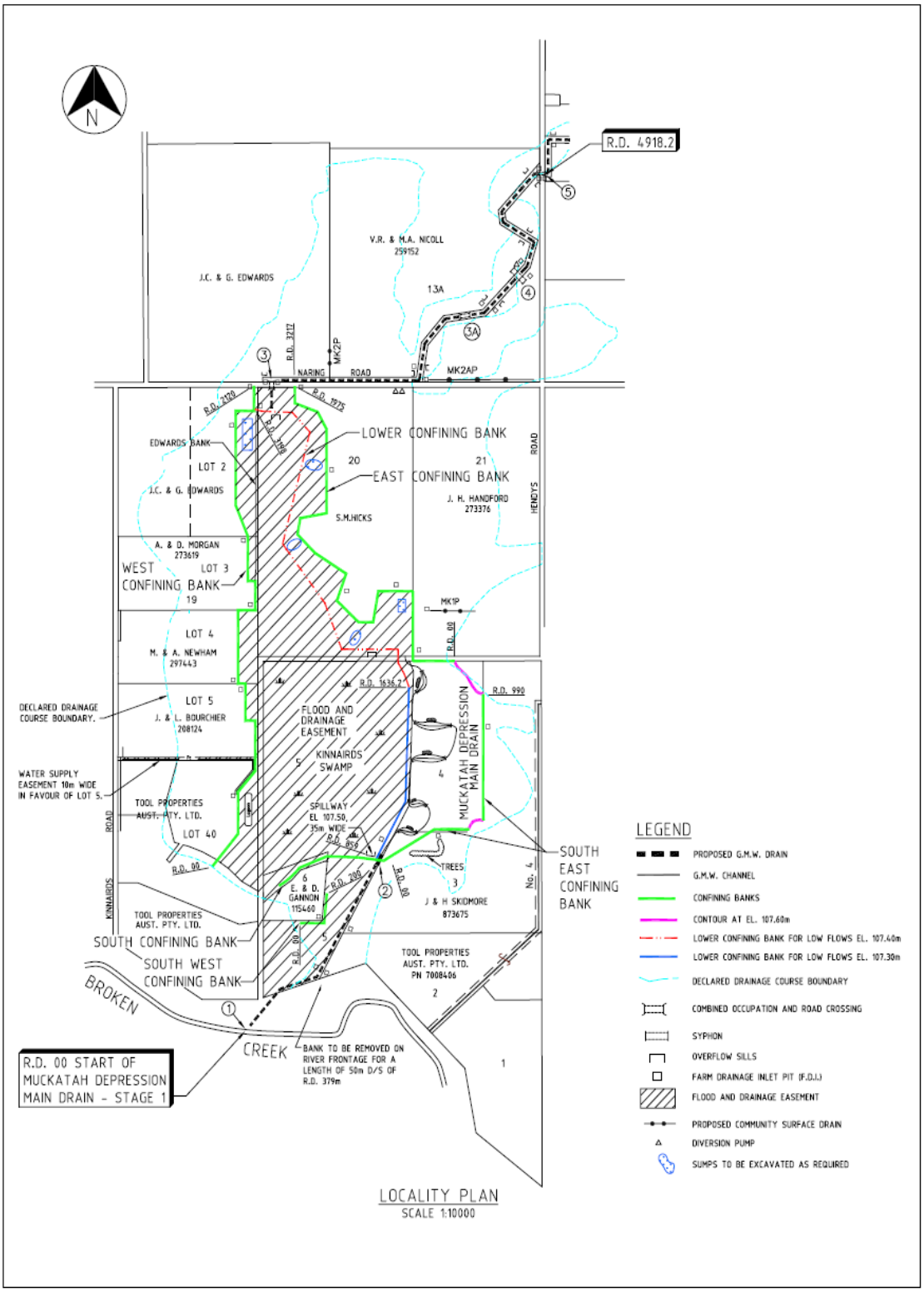
Conversely, implementation rates have been much higher in the Mosquito 25 catchment, where 51% has been drained during the same period as that seen for the Mosquito 24 catchment.

Although CSWMS were initially seen to have a social benefit by reducing flooding and preventing disputes between neighbours, factors including increased construction costs and decreased runoff and flooding caused by drought conditions and lower allocations have decreased the importance of drainage to landholders.

Case Study 2

Primary Surface Water Management System

Muckatah Stage 1A (Kinnairds Wetland)



Introduction:

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Ponded rainfall is a significant source of recharge to the watertable exacerbating soil salinisation. It can result in prolonged waterlogging on-farm which can impact adversely on productivity.

Approximately 60% of the region was without effective surface drainage at the commencement of implementation of the Surface Water Drainage Strategy in 1990. The Surface Water Drainage Strategy aims to facilitate the installation of Community Surface Water Management Systems, Primary Surface Water Management Systems and carry out upgrading works where required (Surface Water Management Strategy, 2002).

Background:

The Muckatah Catchment covers approximately 600 sq km and is located south-east of Yarrawonga, extending westerly before outfalling into Kinnairds Swamp and the Broken Creek near Numurkah.

The catchment is generally flat with the Muckatah depression being a shallow meandering ancestral watercourse. Approximately 4500 hectares of wetlands exist in the catchment, ranging from several significant swamps, typically redgum in origin, to open freshwater meadows.

There are approximately 400 landowners engaged in farming enterprises within the catchment, which supports a range of farming enterprises (dairying, horticulture, beef cattle, sheep, irrigated and dryland cropping).

The breakdown of landuse characteristics is as follows:

- Dry farming 52%
- Mixed farming 30%
- Dairy 17%
- Horticulture 1%

(figures taken from Environmental Review of the Muckatah Catchment, 2004).

When irrigation was introduced into the Muckatah catchment some 50 years ago, no provision was made for drainage, and coupled with clearing within the catchment, watertables have risen from 20 metres below the surface to within 1-2 metres recently.

Surface Water Management Context:

Catchment Features:

The Muckatah catchment is one of 23 sub-catchments, however, unlike previous designs, the challenge was to incorporate a SWMS to not only provide relief to the immediate catchment, but to also be sensitive to environmental features and potential impacts downstream, in particular, flow and water quality.

The Muckatah depression serves several wetlands within the catchment, including Dowdle Swamp, Kinnairds Wetland and Kels Swamp. The SWMS will assist in the protection of approximately 2,295 ha of remnant vegetation, 1,638ha of on-line depression wetlands and 727ha of off-depression wetlands (Environmental Review of the Muckatah Catchment, 2004).

Implementation

The construction of the Muckatah PSWMS was carried out over four stages and after many years of planning. Stage 1A was completed in 2001 and Stage 4 is currently under construction. The planning process, which included significant mediation with concerned community members, extended from 1995 to 1997.

Planning conditions, including compliance with legislative controls and community acceptance, can add significantly to the implementation timelines.

The project received an award in The Engineering Excellence Award from the Victorian Division of the Institution of Engineers, Australia (1999) in recognition of the engineering and project management work associated with implementation.

Hydrology

The Muckatah PSWMS is based on a small rainfall event with a 1 in 2 year Average Recurrence Interval (ARI). The system design enabled the natural depression to act naturally under larger flooding events. The main issues raised concerned potential downstream flooding impacts.

This was addressed by replacement of eight weirs on the lower Broken Creek at Nathalia, as well as the provision of automatic remote operation doors to enable additional creek capacity in higher flow conditions.

Key Performance Issues:

- Environmental

The incorporation and enhancement of Kinnairds Swamp into the Muckatah SWMS addressed a major concern of the community; water quality. The return of a more natural wetting cycle to the wetland also assisted in improving the water quality for the Broken Creek.

The environmental assessment procedures implemented best practice for the environment by enabling the protection of vegetation by drain realignment even after the construction phase had commenced. This was also made possible by the strong and close working arrangements between the then Department of Natural Resources and the Environment, the Goulburn Broken Catchment Management Authority and Goulburn-Murray Water.

A full review of the environmental aspects of the catchment was completed by the Department of Primary Industries. Identification and mapping of environmental features has ensured that the design and

implementation process is transparent and comprehensive and that future monitoring will have a comprehensive benchmark for detecting change.

Assessment procedures have progressed to a point where identification and mapping of environmental features, and hence the ability to manage these into the future, has expanded significantly.

Water quality upstream and downstream of the Kinnaird's wetland is now continuously monitored. An example of the total phosphorous loads, shown below in Figure 2, shows that the wetland is having a beneficial effect on water quality in Broken Creek compared to having no wetland.

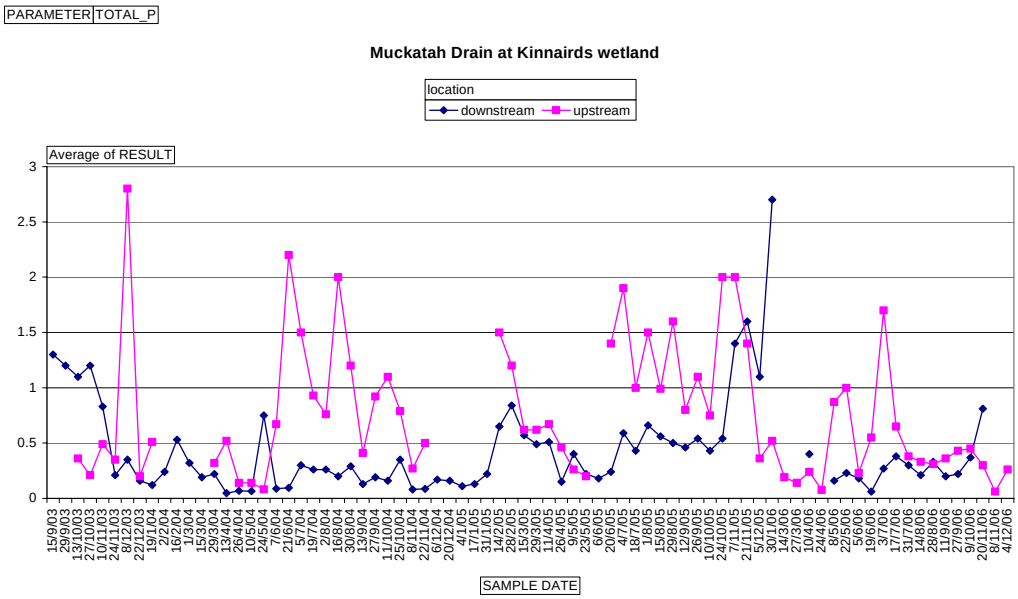


Figure 2 – Example of water quality outcomes (source: G-MW)

The incorporation of environmental features is recognised as performing a valuable nutrient reduction function with respect to protecting water quality improvements in receiving waterways.

The project also received a prestigious environment award in the Banksia Environmental Foundation Award (2000) in recognition that the environmental aspects of the design are considered highly valuable and an example of best practice.

- Economic indicators

The construction of the Muckatah PSWMS was carried out over four stages and as shown below was more costly than the unit cost of $177,000/km ($1999) as estimated in the 2000 SWMP review:

Scheme Stage	**Length of works**	**Cost**	**Unit rate**
Stage 1a	4.km	$1.988M	($406,000/km)
Stage 1b	7.3km	$1.414M	($193,000/km)
Stage 2	12.7km	$3.04M	($239,000/km)
Stage 3	13.3km	$2.75M	($207,000/km)

Stage 1a costs were heavily influenced by the Kinnaird's wetland work which explains the high unit rate. The costs for subsequent stages were higher than allowed mainly due to higher legal costs linked to landholder negotiations. Construction costs also increased with the number of structures being incorporated into the design.

While construction costs have risen due to improved design standards and offsets associated with landholder negotiations, the cost of incorporating significant environmental features into a SWMS design is significantly more costly than for a conventional design.

A significant environmental wetland feature added significantly to the capital cost of the Muckatah PSWMS.

- Social

Social impacts of the SWMP cover aspects such as community wellbeing, sense of community, natural resources knowledge base, business confidence, security of water, changes in landscape and protection of cultural heritage.

During the design phase, extensive community consultation occurred, including property inspections, catchment based meetings and the formation of the Muckatah Community Surface Drainage Group which met regularly. Despite extensive consultation, a large number of objections were received when the planning permit application was submitted.

As a result of receiving such a large number of objections, a mediation process was undertaken which resulted in an agreement being struck between all representative parties. The approval of the SWMS which addressed concerns over the water quality indicated that the community values the natural waterways of the receiving Broken Creek.

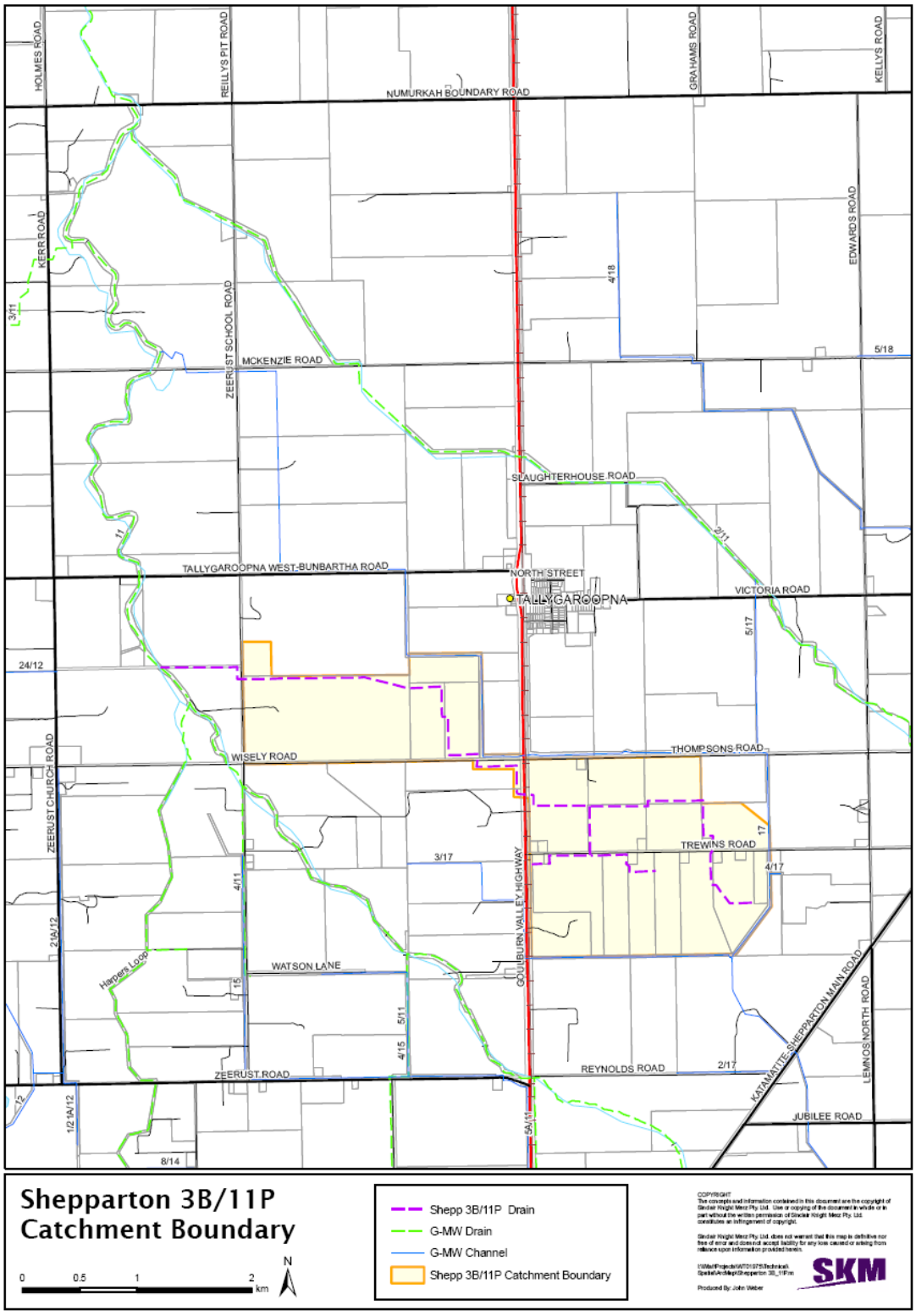
The construction of amenities such as walking tracks, viewing platforms and signage has also provided a focus for eco-tourism and general recreation that the community now values highly.

Improvement of Kinnairds wetlands as a public amenity has had significantly positive impact on community and social wellbeing.

Case Study 3

Community Surface Water Management System

Shepparton Drain 3B / 11P



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Approximately 60% of the region was without effective surface drainage at the commencement of implementation of the Surface Water Drainage Strategy in 1990. The Surface Water drainage Strategy aims to facilitate the installation of Community Surface Drains, Primary Drains and carry out upgrading works where required (Surface Water Management Strategy, 2002).

Surface Water Management Context:

Catchment Features

The Shepparton Drain 3B 11P Catchment covers approximately 328 ha and is located near Tallygaroopna, approximately 20km north of Shepparton.

The Shepparton 3B/11P G-MW Community Surface Water Management System services a catchment area of 291.9ha, serves 15 properties and has a total length of 6.05 km. The outfall for the CSWMS is to Goulburn-Murray Water's (G-MW's) Shepparton Drain 11 to the south west of Tallygaroopna.

Implementation

Implementation required flexible management to deal with a number of issues that arose with the system. Although design was completed in 1992, construction did not commence until January 2006 and was completed by May 2006. The implementation was managed by G-MW and involved negotiations with landholders. Some of the issues that arose during the process included land ownership changes, changing views of landholders of the need for the service, landholder disagreements and changes in staff and costs.

G-MW was able to adopt a more flexible arrangement to implement works than would have been the case if a landholder group had undertaken the negotiations itself. The ability to negotiate, particularly being a third party without a vested interest in the land, enabled the landholders who still wanted the SWMS to persevere and eventually achieve constructing of the system. One of the management changes used to achieve this was that the CSWMS was allowed to proceed despite not all of the landholders in the catchment being serviced.

Flexible management is able to contribute to timely implementation of CSWMS.

CSWMS are more likely to proceed in a timely manner with the G-MW management option.

Hydrology

The CSWMS is designed for a 1 in 2 year rainfall event which is 50 mm of rain in 24 hours occurring during summer with a removal period of 5 days.

There has not been an opportunity to evaluate the performance to date due to lack of rainfall.

Key performance aspects:

The key elements used to evaluate the performance of a surface water management system relate to the environmental, economic and social aspects. The relevant aspects of these are discussed for this catchment below:

- **Environmental health indicators**

The environmental assessment of the Shepparton 3B/11P CSWMS was carried out by the Department of Primary Industries (DPI). It was determined that no significant vegetation was identified along the proposed alignment and there were no matters of national importance that required higher level approvals.

The construction of the CSWMS was carried out in accordance with the Environmental Risk Management Plan and the Environmental Assessment requirements which are part of any new SWMS development.

- **Economic performance indicators**

The capital cost of drain construction was $358,694 or $58,288/km. This does not include DPI and G-MW program support costs which are estimated to average around $23,000/km. These costs are higher than the typical construction costs which were estimated to be $67,800 in the SWMP review in 2000. This is largely due to the requirement for more significant structures than would normally be required and the proximity of works to major services.

The economic benefit and costs have not been fully tested within this catchment due to the climatic conditions. However, the costs are relatively well defined due to the G-MW management option being adopted.

Current CSWMS design principles would appear to be valid and cost can be affected by catchment specific features.

- **Social impact**

Social impacts of the SWMP cover aspects such as community wellbeing, sense of community, natural resources knowledge base, business confidence, security of water, changes in landscape and protection of cultural heritage.

Planning and construction was completed at the time when many of the new policies and strategies relating to the SWMP were being introduced, although the landholders would have been separated from much of this by electing the G-MW option.

Negotiation with landholders was the main issue and cost was the main drawback.

Although progress towards construction of new CSWMS has been slow mainly due to climatic conditions and lack of available funds to invest in new works, implementation of this system suggests a positive outlook by local communities.

Despite trying conditions, the persistence of community members, G-MW and DPI has created a positive sense of achievement amongst those who supported the SWMS.

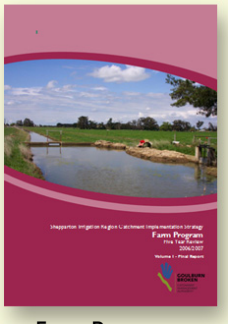
Success in delivery of the Shepparton Irrigation Region Catchment Implementation Strategy component of the Goulburn Broken Regional Catchment Strategy is due to strong:

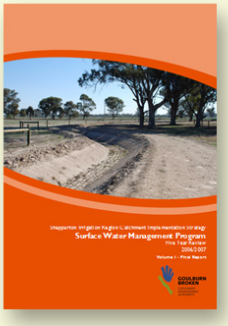
- Community involvement and empowerment through the Implementation Committee and working groups
- Partnerships between agencies and local, state and federal governments
- Partnerships with Landcare, Local Area Planning and the Goulburn Murray Landcare Network
- Integrated approach to tackling natural resource issues and protecting assets
- People skills, dedication and leadership in natural resource management

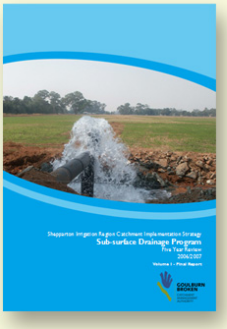
The five-year review of programs overseen by the Shepparton Irrigation Region Implementation Committee presents an opportunity to celebrate our achievements, describe our forward planning, demonstrate value of investment and describe our engagement of community and partner agencies.

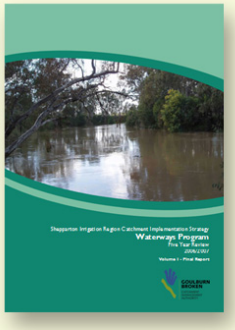
Look for these other five-year reviews:


Environment Program


Farm Program


Surface Water Management Program


Sub-surface Drainage Program


Waterways Program

For more information visit www.gbcma.vic.gov.au