Irrigation Futures

of the Goulburn Broken Catchment

Final Report 5 – Scenario implications for catchment management

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1. Introduction

Irrigation Futures of the Goulburn Broken Catchment

The Goulburn Broken Catchment is known as the food bowl of Australia. It covers 2.4 million hectares and has a population of around 200,000 people (Department of Sustainability and Environment, 2005). Irrigated agriculture is a major business engine in the Goulburn Broken region, producing more than $1.2 billion at the farm gate in 2001-2002 from about 280,000 hectares of irrigated agricultural land. Investment in on-farm and processing infrastructure is about A$100 million per annum (Michael Young & Associates, 2001). The region is therefore a major contributor to the state and national economies and the quality of life of consumers.

The region faces significant challenges and opportunities. Issues such as free trade agreements, climate change, water reform, and technological developments will have a significant influence on the future. As one of the oldest gravity irrigation systems in Australia, Goulburn-Murray Water's irrigation system needs substantial renewal of its ageing infrastructure in the next 20 years. The consequences of these pressures for the region are highly uncertain and will include impacts on the region's economy, environmental assets and social fabric. Therefore, it is critical that the region develops a sound plan to strategically position itself for irrigation in the future.

Regional planning is highly challenging. In addition to the complexity of issues and high level of uncertainty, a diverse range of stakeholders have interests in the planning process and its outcomes. Enabling all stakeholders access to the planning process is important to managing their expectations and developing plans that are robust and likely to be adopted.

The Goulburn Broken Irrigation Futures project was established to assist the regional community to plan for the future. It was a regional initiative, funded by the Goulburn Broken Catchment Management Authority, Goulburn-Murray Water, Victorian Department of Primary Industries, Victorian Department of Sustainability and Environment, and National Program for Sustainable Irrigation. The project adopted a scenario planning approach in collaboration with the region's stakeholders to:

- develop a shared vision for the future of irrigation in the Goulburn Broken catchment over the next 30 years;
- identify scenarios of major constraints and opportunities and of regional response options;
- understand the social, economic and environmental consequences of various scenarios; and
- facilitate key stakeholders to build consensus on preferred regional strategies for future irrigation.

Scenario planning is a relatively new approach to strategic planning developed and applied famously by the Royal Dutch Shell Company to anticipate and plan profitably for the oil shocks of the 1970s (O'Brien, 2000; van der Heijden, 1996). Scenario planning explicitly acknowledges ambiguity and uncertainty in the strategic question by creating a set of scenarios that describe plausible, coherent pictures of alternative futures. These scenarios become a powerful tool for testing the robustness of strategies, as well as for generating new strategic options. Scenario planning also provides a useful means for organisational learning. While scenario

planning has become widely used by private corporations and public organisations (O'Brien, 2000), there are few examples of its application for regional planning.

The Goulburn Broken Irrigation Futures project used scenario planning in conjunction with the regional community to explore and plan for the future of irrigation in the region. The project was undertaken in four stages. Following an initial stage that developed the project, community perspectives on the future for irrigation were captured by an extensive stakeholder-engagement program. The third stage involved developing detailed scenarios and examining their regional implications. The final stage involved examining the implications of the scenarios for specific issues, in collaboration with the region's agencies and organisations.

Scenario implications for managing the Goulburn Broken catchment

Catchment management in the Goulburn Broken region is the responsibility of the Goulburn Broken Catchment Management Authority (GBCMA). The blueprint for natural resource management of the Goulburn Broken catchment is described in the Regional Catchment Strategy. The GBCMA administers the implementation of the Regional Catchment Strategy in three regions: the Shepparton Irrigation Region (SIR); the Mid Goulburn Region; and the Upper Goulburn Region, each of which has its own catchment strategy and implementation plan. The vast majority of irrigation occurs in the SIR and therefore, the SIR Catchment Strategy has an irrigation focus.

Implementation of the SIR Catchment Strategy is undertaken by five main complementary programs of activity: the farm; environment; waterways; surface water management; and sub-surface drainage programs. These programs seek to provide regional infrastructure and change farm management practices to improve the environmental condition of the Shepparton Irrigation Region.

The Regional Catchment Strategies in the Goulburn Broken catchment are reviewed every five years. These reviews document the achievements of previous five years of activity, examine the broad directions for the next five years and establish targets for the implementation of management activities. In the Shepparton Irrigation Region, each of the implementation programs reviews its activities separately and these separate reviews are then drawn together to provide an updated Catchment Strategy for the Shepparton Irrigation Region.

To support the implementation programs examine the broad directions for the next five years in a consistent manner, the Irrigation Futures project team ran a program of workshops and support activities.

The objectives for the workshop program were to:

- introduce the concept of scenario planning to the implementation program teams and build their capacity to undertake scenario planning.
- explore the opportunities and challenges for program implementation described by the Irrigation Futures scenarios,
- identify strategies and actions to manage the challenges and opportunities presented by the scenarios.

2. Method

To investigate the scenario implications for catchment management, we worked collaboratively with the Regional Catchment Strategy implementation program teams in their five-year review of the strategy. We ran a process involving two formal workshops and numerous support activities. As the investigation of the scenario implications progressed, the ownership of the process and output was progressively transferred from the project team to the implementation program teams.

Workshop 1

In the first workshop we provided the program teams with an introduction to scenario planning and how we planned to use this approach to contribute to the review of the Catchment Strategy. We commenced by asking program teams to articulate the catchment outcomes they were seeking to achieve through the implementation of their programs. This served to encourage participants to take a longer-term view and to remind the programs of the purpose and focus of their activities. We asked each team to share its most important outcome with the rest of the workshop, to build up a picture of the desired outcomes for the whole of the catchment strategy.

We then introduced a process to examine the implications of a scenario for their program. We provided a short verbal description of a single scenario highlighting the major drivers, the region's responses and some of the important consequences for catchment management in the region. We also provided the participants with a written version of the scenario. We asked the program teams to identify and list the challenges and opportunities that the scenario presented to the achievement of their catchment outcomes.

We asked the program teams to consider what the challenges and opportunities meant to the way the catchment was managed and specifically what they may mean for their programs. After allowing groups some time to consider these implications, we asked the program teams to share their two most important implications for catchment management and their program. We concluded the first workshop by setting a date for the second workshop and outlining the tasks we expected each program team to undertake before the next workshop, with the support of the project team.

Between workshops

Between the two workshops, we asked program teams to examine the challenges and opportunities of the three remaining scenarios and the implications of these for their program. We then asked them to look across all scenarios and consider the strategies their program could take to manage any of the scenarios. Once the program teams had completed their tasks, we compiled and synthesised the output.

Each program team took a different approach to the between workshop tasks, with some program teams going to considerable effort to examine the scenario implications. For example, the Sub-Surface Drainage Program of the GBCMA commissioned a consultant to estimate the sub-surface drainage requirement under each of the four scenarios. The consultant assessed the area of agricultural land requiring sub-surface drainage and the number of groundwater pumps required to provide drainage at the midpoint and end of each scenario.

Workshop 2

At the second workshop, we asked one person from each program to describe the process they used to examine the implications of the remaining scenarios. We then shared the output of each program with the workshop.

For each program, we presented a synthesis of the major challenges and opportunities followed by program implications of the scenarios. We then invited workshop participants to pose questions to challenge and clarify each program's thinking. We asked table-groups, centred on the programs, to consider these questions and identify strategies to deal with the identified challenges. We then requested each table-group share a brief summary of its discussion with all workshop participants.

We asked workshop participants to consider the material discussed earlier in the workshop and brainstorm the cross-program issues or opportunities that they could identify. We clustered these cross-program ideas into themes and asked groups to discuss a theme. We requested that the groups discuss the scope of the cross-program issue and identify possible strategies to assist the Catchment Management Authority address these issues. At the conclusion of the group discussion, we facilitated a brief plenary session where the groups summarised their discussion for other workshop participants.

Post workshop activities

Following this workshop series, the program teams completed their reviews, further developing the strategies they had identified and building them into their work plans for the next five years.

To support the implementation of the cross-program issues, the project team worked with the Executive Officer of the Shepparton Irrigation Region Implementation Committee to develop a framework for research and development to support adaptive management.

3. Results

This section provides a synthesis of the output generated by the implementation program teams through the workshop process. This interim output has been further developed by each of the implementation program teams for inclusion in their program reviews. The output includes:

- a summary of the target catchment outcomes,
- a summary of the output from each of the implementation programs describing the challenge and opportunities of the scenarios and the implications for program activities, and
- a summary of the cross program issues.

Target Catchment Outcomes

The Regional Catchment Strategy seeks to achieve the following catchment outcomes:

- Protection and enhancement of native biodiversity
- Protection of agricultural and natural assets from salinity and water logging
- Reduced impact of irrigation on waterways
- Maintaining and restoring functions and resilience of the river
- Healthy, vibrant and empowered communities

Farm Program

Opportunities and challenges

Changing agricultural business structures

- Increasing numbers of large, corporate-style farms with money to undertake works
- Program no longer dealing with land owners, but land managers

Changing communities and values

- Decreasing numbers of volunteers
- Decreasing willingness of people to become involved
- Increases in number of retirees willing to contribute time to community
- Increasing numbers of lifestyle residents

Land use change

- Increases in areas of extensive irrigation eg cropping
- New irrigation developments
- Increasing number of lifestyle properties
- Retirement of land from irrigation
- Retirement of land from agriculture
- Land use conflicts
- Providing direction for land use change to achieve the “best” outcomes
- Subdivision and rationalisation

Government policy changes

- Preference for market based instruments and solutions

Water availability

- Increasing importance of water in farmer decisions

Viability of agribusinesses

- Ability of producers to undertake works
- Communities driven by survival

Implications for Program

- Improve understanding of clients and the community, and their needs from the farm program
- Strengthen relationships with local government, industry providers to influence land use planning and change and government regulation.
- Increase capability of program staff particularly with respect to extensive agriculture and irrigation technology and planning.
- Ensure longevity of farm program through improved succession planning including documenting activities and their rationale, and publishing papers.
- Review the scale of farm plans and develop regional or multiple farm scale planning to maximise the benefits of system level change such as channel and reconfiguration and form a link between supply and drainage.
- Increase the strategic content of individual whole farm plans to consider issues such as combinations of low and high reliability water entitlement and crop areas.

Environment Program

Opportunities and challenges

Changing farm business structures

- Larger farm businesses with more money and ability to invest in environment, assist corporate image
- Program deals with farm manager rather than farm owner
- Need to get more out of land, will meet legal obligations.

Changing community values and attitudes

- Decreasing volunteerism creates more work for less people and decreases social cohesion.
- Community resentment/resistance to green ideas and biodiversity

Changing community

- Increase in number of lifestyle residents, who are harder to engage in programs and less aware of their legal responsibilities
- Increasing number of retired people providing a pool of volunteers
- New entrants into agriculture who place lower value on native vegetation.

Land use change

- Increasing number of dryland properties, due to irrigation infrastructure reconfiguration, makes establishing native vegetation easier
- Increasing number of lifestyle/residential subdivisions driving native vegetation removal
- Land use planning to influence/direct land use change
- Redevelopment of irrigation infrastructure, planned or unplanned.
- New industries including energy production, bush foods, environmental services
- Understanding the productivity benefits of biodiversity

Government policy change

- Decreasing investment in natural resource management.
- Large government investment into natural resource management.
- Lobbying government to influence policy and investment.

Climate change and variability

- Isolation of remnant vegetation
- Reluctance of farmers to plant vegetation
- Changes in vegetation classes
- Managing environmental water reserve and prioritising actions
- Understanding environmental and community response to drought

Farm viability/profitability

- Little interest in environment due to marginal farm viability, difficult to engage.

Free trade

- pests and diseases introduced due to freer trade

Lower salinity

- decreased marketing potential for native vegetation
- improved health of remnant vegetation

Implications for Program

- Maintain and strengthen relationships with partners, including other RCS programs, to:
  - Influence management of public land,
  - Influence management of private land
  - Develop partner understanding of government policies and options
  - Improve awareness of available tools

- Monitor and evaluate the benefits of native vegetation for productivity and biodiversity to:
  - Assist marketing of program
  - Demonstrate value of program to investors
  - Learn from history.

- Understand community/client base and their attitudes toward native vegetation.

- Raise community awareness and understanding of native vegetation and its benefits.

- Plan for program succession to maintain the skills within the group.

- Identify opportunities for capitalising on carbon sequestration.

- Develop proactive actions to target program implementation at regional and local level, including purchase of land and landholder involvement in native vegetation management.

Mechanisms to achieve

- Conduct training days for:
  - Local government planners
  - Extension programs and service providers
  - Broader community

- Better use of column in newspaper

- Update tools and brochures.

Waterways Program

Opportunities and challenges

Changing community composition, attitudes and values

- Increased recreation and urban pressures from lifestyle residents
- Community preferences for wetland management eg ephemeral vs permanent
- Continuity and maintenance of existing works
- Conflict in the community
- Urban developments

Land use change

- Landscape planning – directing changes in land use to preferred areas
- Land purchases by government or private investors for conservation and biodiversity purposes.
- Alternative industries eg ecotourism, plantations
- Increased connectivity of waterways and riparian vegetation
- Abandoned agricultural land

Climate variability and change

Dry conditions

- Decrease in floodplain and wetland inundation and connectivity
- Reduce area of irrigated agriculture – opportunity to buy water for environment
- (Increasing) community understanding of drought
- Promote weed emergence due to low crop cover and low management
- Increase value of water right – improving farm management and encouraging water recycling

Wet conditions

- Floods decrease motivation for good farm water management causing increase in salt and nutrient loads.

River condition

- Stress on water resources
- Decline in water quality as water becomes limited
- Transfer flows create unseasonal flow conditions
- Irrigation water storage on farm, piping of irrigation water
- Loss of ecological communities

Government priorities

- Investment in natural resource management increases or decreases

Implications for Program

- Influence land use planning and development to
    - ensure alignment between RCS and municipal strategic statements
    - land development meets flood plain management, cultural and biodiversity requirements.
- Develop and improve relationships with investors, through good reporting and communication practices.
- Improve internal relationships (within CMA), particularly with the Environment Program and look for complementary activities.

- Monitor and evaluate the short and long term benefits of management of the environmental water reserve.
- Increase understanding of the impact of environmental and transfer flows on riverine health.
- Increase understanding of land use change on runoff quantity and quality
- Improve understanding of community attitudes and values toward program activities.
- Continue to re-evaluate priorities for management

Surface Water Management Program

Challenges and Opportunities

Changing farm business structures

- Less farms – less objections to drains, fewer farmers to share costs
- Not necessarily dealing with farm owner.

Climate variability and change

Dry Conditions

- Maintaining interest of farmers and government in surface drainage
- Modify drainage service level
- Servicing wetlands using drainage infrastructure
- Maintaining program capability during periods of low demand for drainage

Wet conditions

- Waterlogging creates increased demand for drainage
- Managing increased demand for drainage

Land use change

- Modification of drainage service levels
- Increasing numbers of lifestyle farms, increases number of clients to deal with, but have wealth/income to undertake works.
- Change in viability of program due to changes in benefits and benefit:cost ratio
- Engagement of lifestyle residents
- Opportunities for multiple use of drains, eg floodway, irrigation supply, environmental reserves

Program management

- Managing changing demand for drainage, eg loss of staff and rebuilding program
- Completion of working group action items

Implications for Program

- Succession planning – develop systems to manage fluctuating demand for drainage, including times when no surface drainage staff are required.
- Build and strengthen relationships with investors and across programs.
- Understand surface drainage needs under changed land use and climate, and review drainage design standards.
- Influence/ respond to irrigation development and reconfiguration processes
- Develop methods to identify and understand change that may influence the program.
- Influence government policy changes.
- Improve understanding of clients, their attitudes and aspirations, and information requirements, with a view to increasing awareness of the need for surface drainage.
- Identify opportunities to achieve synergies with other programs.

Subsurface Drainage Program

Challenges and Opportunities

Agricultural viability

- Reduced ability of agriculture to pay for works due to lower prices received and increasing agricultural costs
- Increased profitability of agricultural businesses to pay for works
- Management of soil sodicity as agricultural intensity and groundwater use increases.
- Understanding salt tolerance of crops and adjusting program assets and operation.
- Reduced salinisation risk creating increased confidence of investment in the region

Land use change

- Influence reconfiguration of irrigation infrastructure
- Establish preferred development zones that have surface and sub-surface drainage and high standard of water supply
- Confine the establishment of assets to areas where water entitlement volumes are increasing
- Influence location of new irrigation development
- Influence land use planning and change.

Demand for works

- Drier climate reducing need for works and funding
- Increased farm efficiency reducing need for subsurface drainage works
- Water trade reduces irrigated area and need for works.
- Water trade and wetter climate increasing need and demand for works
- Decommissioning, mothballing and recommissioning of assets as demand changes

Changing environment

- Adapting regulatory framework for groundwater
- Understanding the changing environment and its implications on the program, including monitoring appropriate drivers to support decision and modelling.
- Maintaining program knowledge and capacity of the program
- Reduced need for and impact of salt disposal

Changing government priorities

- Alignment of program needs with available funding
- Aligning program with regulatory, statutory and planning frameworks.

Changing community

- Use of ageing population to interface with community
- Lifestyle residents require different level of service.
- Managing community expectations and program changes
- Convincing community to fund works to protect environmental assets

Impact of works

- Maintaining low downstream salt impact of region
- Minimising risk of salt conveyance
- Monitoring level of service provided.

Implications for Program

- Ensure monitoring, analysis and strategic planning is adequate to enable the plan implementation and asset operation to respond to change.
- Delay construction of high value assets and evaporation basins as long as possible
- Influence G-MW reconfiguration processes to ensure subsurface drainage aspects are considered
- Accept and develop processes to decommission and mothball works
- Ensure processes, procedures and decisions are related to the program are well documented to facilitate knowledge transfer
- Ensure succession planning at agency and community levels is a high priority.
- Maintain input from an astute and knowledgeable community to ensure program is effectively and efficiently community driven.
- Improve linkages between programs to increase understanding of their requirements for subsurface drainage.
- Strategically locate significant assets for drainage and salt management.
- Encourage integrated strategic planning across all programs and with local governments.
- Develop subsurface drainage policies for new horticultural developments.

Summary of Cross Program Issues and Recommendations

RCS program teams examined the implications of future scenarios for the catchment strategy in a series of workshops run by the Irrigation Futures project team. Discussions of the implications for each of the program have been summarised and circulated. This document summarises the discussion of the cross program issues and recommends ways of progressing each of these issues.

Succession Planning and Staff Development

Succession planning is concerned with maintaining the knowledge and capacity of existing programs. It involves transferring knowledge between staff and building the competencies of staff. Many methods are available to build competencies and transfer knowledge. One of the more effective methods to transfer knowledge and build staff capacity is through face to face contact. Strategic conversations within and between programs need to be encouraged to build the capacity of and transfer knowledge between programs staff. This will require investment of time and money to enable all staff to participate in strategic planning. Impromptu conversations, eg lunchtime discussions, also need to be actively encouraged.

Recommendation: The RCS review process identifies mechanisms to involve staff in strategic conversations.

G-MW Reconfiguration

Reconfiguration processes will involve the rationalisation and enhancement of irrigation delivery infrastructure throughout the region. There is a perception that water savings are driving reconfiguration processes, that expected water savings might be unrealistic or will transfer losses from infrastructure to farms. Catchment programs continue to invest in the provision of salinity management infrastructure without any reference to reconfiguration processes. Therefore, implementation of reconfiguration plans may potentially result in salinity management infrastructure becoming stranded.

The underlying issue with reconfiguration processes is the breakdown in communication, perceived or real, between two agencies who have complementary activities. Partnerships between the region's agencies need to be maintained and frequently renewed. This is particularly important when major programs are initiated that may influence the outcomes of other agencies. In this instance, it is necessary for the CMA to renew the partnership with G-MW to ensure reconfiguration processes consider CMA investments and objectives.

Recommendation: The CMA renews its partnership with G-MW as a part of the review process.

Integration of Catchment Programs

Integration of catchment programs is important to present landholders with consistent messages and ensure complementarity between program activities. Integrated program messages are well communicated by on ground staff, but could be improved by use on an internal referral framework, checklists, shared training and secondments. Local area plans (LAPs) provide a level of integration at subcatchment level, however these LAPs need to be refocussed to deliver catchment outcomes. At the strategic level, linkages between programs need to be improved. Such improvements could be assisted by developing a high level strategic research and investigation plan.

Recommendation: The RCS review process improves the strategic integration of catchment programs.

Research supporting adaptive catchment management

The catchment management programs deliver a variety of management strategies (outputs) that are designed to achieve the desired catchment outcomes. The complexity and uncertainty of natural systems means that many assumptions are made in designing the management strategies. To ensure the program remains current and adaptive to the prevailing conditions, a program of research is required. The research program needs to evaluate how efficiently the management strategies are implemented and how effective the management strategies are in achieving the desired outcomes, testing the validity of critical assumptions. In addition, changes in the operating environment need to be detected and understood to ensure management strategies and assumptions are still appropriate.

The research and evaluation program could be coordinated across CMA boundaries, by a small program group who establishes the processes and boundaries for the work, and makes connections with other groups.

Recommendation: The Irrigation Futures project team further develops the concept.

Included in Appendix.

Options for the evolution of farm planning

The Irrigation Futures RCS Review workshops identified that farm planning will need to evolve to consider more strategic issues, such as use of new water products and environmental management systems, or collective planning for multiple farms, to interface with irrigation infrastructure planning. Preliminary thinking and scoping of the possibilities for evolution of farm planning could form the basis of an additional investigation.

Recommendation: The farm program investigates options for the evolution of farm planning, involving staff from all programs.

Integrated Landuse Planning

Land use planning has been a recurrent challenge raised by participants in Irrigation Futures Workshops. The project team is commencing a process to engage local government and other partners in land use planning in a series of workshops to identify the issues and possible approaches to improving land use planning within the Shepparton Irrigation Region.

Recommendation: The Irrigation Futures project team involves RCS staff in work looking at land use planning

Implications of scenarios for water quality and soil health

The program team identified that the implications of the scenarios for water quality and soil health issues other than salinity were not considered in depth by the programs. These issues are the responsibility of the catchment management authority and the scenario implications may modify the management strategies promoted.

Recommendation: The Irrigation Futures project team undertakes further work to look at the implications of the scenarios for water quality and soil health.

nb. This work was not progressed further due to insufficient interest.

4. Conclusions

The Irrigation Futures project team ran a series of workshops and supporting activities with implementation programs of SIRIC to investigate the scenario implications for catchment management. The series of workshops was run in parallel to the implementation programs undertaking a review of the previous five years of implementation and planning their activities for the next 5 years. During the workshop process, each program team assessed the challenges and opportunities that the scenarios presented and identified the implications of these challenges and opportunities for their program activities. The program teams collectively identified issues raised by the scenarios that cut across program boundaries and proposed methods to manage these issues. This document summarises the output from these workshop processes.

Evaluation of the series of workshops suggested that the implementation program teams found the process used to investigate the scenario implications for catchment management to be insightful and useful in preparing plans for future implementation. At the conclusion of the series of workshops, all program teams further developed the ideas they had generated and included many in their action plans for the next five years. This suggests that the program teams had developed ownership over the scenario planning process and the project outputs.

Appendix: Framework for research and development to support adaptive management.

A framework for research and development to support adaptive management in the Goulburn Broken Catchment has been developed

Introduction

Context

- Catchment management deals with highly complex biophysical and socioeconomic systems. Management decisions have to be made in the face of uncertainties. It is important that a deliberate formal process of inquiry is integrated with management actions, to facilitate learning that will lead to better decision-making in the future. R&D should be designed to play a central role in supporting such an adaptive management approach to catchment management.
- GBCMA and others make significant investments in catchment management R&D. Priority R&D areas tend to change quickly with funding opportunities. There is a lack of continuity in R&D that tackles fundamental issues.
- GBCMA has developed an Monitoring, Evaluation and Review (MER) Strategy. One of the key result areas of the strategy is "Data knowledge and quality". There is an opportunity to systematically integrate R&D with MER objectives and actions.
- There is an opportunity to further integrate R&D with implementation programs to achieve better learning and more efficient use of resources.
- There is an opportunity to integrate various pieces of past, current and future R&D.
- A number of CMAs have similar R&D issues. There is an opportunity to achieve better resource use by a joint inquiry process.

Objectives

- To design R&D so that it is part of a deliberate formal process of inquiry that will lead to adaptive management learning.
- To provide continuity in R&D that addresses core research questions and a road map for taking advantage of funding opportunities. Knowledge, tools and capacity are built up over time.
- To integrate R&D with implementation programs.
- To integrate various R&D activities and outputs.
- To integrate R&D with MER.

Approach

Adaptive management incorporates R&D into management actions. At its core, adaptive management involves the integration of design, management, and monitoring to systematically test assumptions in order to adapt and learn.

It is acknowledged that some of the adaptive management principles are being practised in the management of the Goulburn Broken catchment. This framework emphasises **a deliberate formal process of inquiry** for adaptive management learning.

The following seven steps are adapted from Salafsky et al. (2001):

Step 1. Establish a clear and common purpose
- Set clear benchmark for measuring success (social, economic and environmental)
- Promote informed collaboration

Step 2. Construct an explicit model to conceptualise the systems (biophysical and socioeconomic)
- Collect relevant information including scientific and experiential
- Synthesise information to develop cause and effect models – qualitative and where necessary quantitative

Step 3. Use the model to examine management plans
- How do management actions cause the system to affect success?
- What are the most critical assumptions? – System structure (variables and links), values of functional responses, external forcing variables
- How to treat actions as experiments to test the critical assumptions? – Passive experiments, exploratory experiments, move-testing experiments, and hypothesis testing experiments.

Step 4. Review and develop monitoring plans
- What data are needed to test the critical assumptions?
- What data are already available?
- What data are being collected, and what data do not need to be collected in the future?
- What new data need to be collected, and how to collect them?
- Prioritise data collection (and assumption testing) given available resources
- Link with other reporting requirements
- *Also develop a plan for learning from sources external of the catchment*

Step 5. Implement the management and monitoring plans
- Do it!
- Set up a data management system

Step 6. Analyse data and communicate results
- Analyse data using the cause and effect models
- *Also synthesise learning from external sources*
- Document and communicate key lessons

Step 7. Use results to adapt and learn
- Incorporate adaptation into decision-making structures
- Use results to reinforce or change management strategies

Implementation - Recommendations

Structural set-up

- Establish an R&D program and form a working group. The working group would include researchers, implementation staff and stakeholders. SIRTEC may initially be used as the working group.
- Review current decision-making process and incorporate adaptive management learning into the process.
- Set up a project team to further develop this framework and pilot its implementation in the next 12 months. (This can be resourced through the funding allocated by the GBCMA for the extension of the GB Irrigation Futures project in 2008).
- Discuss with other CMAs and DSE to develop a joint approach where synergies can be achieved across regions.

Program plan

Further developmental work is required to turn the concepts in this framework into a detailed work plan. The following is only a broad outline.

The R&D approach is to be implemented through modules. Modules 1-5 may correspond to the five programs for the SIR. The Linking Module is to bring Modules 1-5 together. (See diagram below).

The pilot project is in its first year to work on Steps 1-4 for one of the modules. Steps 5-7 may be partially implemented using only existing data. Upon its successful completion, the work can be repeated for other modules. The R&D Program Working Group should guide the selection of the module for the first year pilot project.

The Linking Module will then integrate the results of individual modules and develop a coordinated monitoring plan for all the programs, taking into account of all CMA reporting requirements. This is to ensure that monitoring is cost-effective overall. Steps 5-6 are then to be taken through the Linking Module to achieve integration.

Over time, the modules and steps will be repeated to reflect a progressive improvement to available knowledge and developed tools and to meet the need to deal with new issues. For example, the models may gradually become more quantitative and higher in resolution.

It is noted that there is already experience and tools developed in the past that fit in with some of the steps for some of the modules. This work should build on the work already done in the past and be integrated with other R&D activities over a period of time. Specifically, it is recommended that

- The pilot project team will discuss with the Landscape Logic project team the possibility that they work within this R&D framework and will provide the necessary support if they decide to go in this direction.
- The pilot project team will work closely with the teams currently involved in sub-surface drainage R&D projects. The pilot project team will make use of the results from these sub-surface drainage R&D projects and will provide inputs to their project directions. Similarly the sub-surface drainage R&D teams will also provide inputs to the pilot project directions. It is envisaged that over a number of years (say three), the pilot project and other sub-surface drainage R&D projects will merge and come under this R&D framework.
- A similar arrangement can be made with other existing projects.

	Module 1	Module 2	Module 3	Module 4	Module 5	Linking
Step 1						
Step 2						
Step 3						
Step 4						
Step 5						
Step 6						
Step 7						

Reference

Salafsky N, Margolouis R and Redford K (2001). Adaptive management: a tool for conservation practitioners. Washing, DC: Biodiversity Support Program, World Wildlife Fund, Inc. 136p. http://fosonline.org/resources/Publications/AdapManHTML/adman_1.html. (February 6, 2004)