Land and Water Management Plan

Loddon Campaspe Irrigation Region

Draft discussion paper (version 1, Dec 2019)

North Central CMA

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Acknowledgment of Country

The North Central Catchment Management Authority acknowledges Aboriginal Traditional Owners within the region, their rich culture and spiritual connection to Country. We also recognise and acknowledge the contribution and interest of Aboriginal people and organisations in land and natural resource management.

Document name: “Loddon Campaspe Irrigation Region, Land and Water Management Plan Draft discussion paper (version 1, Dec 2019).”

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Acronyms

Acronym	Full Words
AULs	Annual Use Limits
BSM2030	Basin Salinity Management 2030
CALP	Catchment and Land Protection
CMA	Catchment Management Authority
CRC	Cooperative Research Centre
D&S	Domestic and Stock
DCDs	Drainage Course Declarations
DELWP	Department of Environment, Land, Water and Planning
GL	Gigalitre (one billion litres)
GMID	Goulburn-Murray Irrigation District
GMW	Goulburn-Murray Water
GRDC	Grains Research and Development Corporation
ha	hectare
HRWS	High Reliability Water Share
ICC	Irrigated Cropping Council
LCIR LWMP	Loddon Campaspe Irrigation Region Land and Water Management Plan
L-MIRSWMS	Loddon Murray Irrigation Region Surface Water Management Strategy
LMLWMS	Loddon Murray Land and Water Management Strategy
MATs	Management Action Targets
MERL	Monitoring Evaluation Reporting and Learning
M	Million
ML	Megalitre (one million litres)
MLA	Meat and Livestock Australia
m	Metres
MDBA	Murray-Darling Basin Authority
MERI	Monitoring, Evaluation, Reporting and Improvement
MOU	Memorandum of Understanding
NPV	Net Present Value
NRM	Natural Resource Management

RCS	Regional Catchment Strategy
RCTs	Resource Condition Targets
SDL	Sustainable Diversion Limit
SMDB	Southern connected Murray-Darling Basin
SIP	Sustainable Irrigation Program
SMP	Salinity Management Plan
WFP	Whole Farm Planning/ Whole Farm Plan
WUE	Water Use Efficiency

Executive Summary

The Loddon Campaspe Irrigation Region Land and Water Management Plan Draft discussion paper will result in a final plan (LCIR LWMP) that comprises a sub-strategy of the North Central Regional Catchment Strategy (RCS). Together these provide an integrated planning framework for the management of land, water and biodiversity resources in the region.

The scope of the LWMP is private land that holds an irrigation water use licence where the cumulative impacts of irrigation has the potential to affect public or offsite values. This applies to all irrigation in the North Central Catchment Management Authority (CMA) region and to dryland that retains an irrigation water use licence.[1] The LWMP does not cover the management of public land or public waterways and wetlands. These are covered by other sub-strategies in the RCS. Feedback from consultation on issues related to other sub-strategies is recorded in the Appendices so the North Central CMA can refer to community feedback when these sub-strategies are reviewed and updated.

The LWMP determines priorities for investing in works and measures in the irrigation region for a range of investors and sets the accountability framework that ensures public funds are targeted to actions that align with Victorian government and local priorities. It demonstrates how actions are delivering on agreed objectives and irrigation management priorities and establishes how actions and outcomes will be monitored and reported to demonstrate the benefits of the program to the community and government.

The LCIR LWMP's vision over the next ten years is ***Using water for healthy, productive, sustainable, irrigated food and fibre***. Practically this means protecting and increasing the $800 million of Gross Value of Irrigated Agricultural Production at the farm gate produced by 1,386 irrigated farm businesses, the health of 24,892 km of waterways and 120 significant wetlands and the high value birds, fish, plants and animals that are influenced by farm practice.

To achieve the LWMP's vision, the Plan addresses a range of Victorian and Australian government's legislative and regulatory requirements and the requirements identified in *Water for Victoria* – Victoria's blue print for sustainable water management – during implementation of the current LWMP and recent consultation with irrigators, Traditional Owners, industry groups, local government representatives and staff from natural resource management, agricultural and water agencies:

- Declining water availability associated with climate change, water recovery for the environment and water trade which is creating land use change and farm adjustment.
- The potential re-emergence of salinity due to high watertables which cause salinisation of land, waterways and wetlands.
- Poor water quality from farm runoff, especially nutrients and sediments, and effluent management that may impact on downstream values and beneficial uses.
- Inappropriate floodplain management that does not balance biodiversity with upstream and downstream drainage needs or account for instream barriers for native fish.

[1] Also including Take and Use Licences covering irrigation from unregulated streams and from groundwater.

- Insufficient recognition of cultural heritage values and access to natural resources for Aboriginal people.
- Potential loss of terrestrial biodiversity from habitat loss and fragmentation on farms, fire, pest plants and animals.

These contemporary needs require the LWMP to take a significantly different approach to the current plan. The new LWMP will:

- Be narrower in scope than its predecessor and focus on the needs of the irrigation community. Broader issues will be addressed by improving integration with other RCS sub-strategies and industry and government programs instead of duplicating effort.
- Increase investment in agency staff delivering services directly to landholders and support advice with incentives to encourage on-ground works.
- Better target education and training at matters critical to assisting existing and new irrigation businesses to adapt to rapid change.
- Develop a better understanding of cultural heritage, Aboriginal water values, uses and objectives and the needs of recreational water users and build responses into programs.
- Implement a more cost-effective drainage program to service areas where the benefits of drainage are greatest.

Delivering change on private irrigated land is critical to achieving the Plan's vision. To give the LWMP the best chance of delivering this change, implementation of its seven programs will be overseen by a community steering committee.

The **Adoption program** is at the heart of the new LWMP and is where the majority of funding is required. It will deliver practice change on-farm to drive efficient water use and align farm actions with broader environmental objectives. Irrigators will have access to a combination of farm business and whole farm planning advice, incentives and information transfer through extension. The process will provide the strategic basis for farmer driven decisions about irrigation modernisation and rationalisation that best suits the long-term needs of their irrigation businesses.

The **Promotion and Partnerships program** will coordinate, collaborate and work with industry programs and other CMA and government programs to avoid duplication of effort and attract co-investment. It will promote stewardship of the region and undertake engagement with stakeholders such as field days, farm walks and expos. It will provide opportunities for two-way engagement with the broader community so the social change occurring in the community is understood and the Plan's programs are responsive to changing circumstances.

The LCIR is going through enormous change and the dynamic nature of these changes means the LWMP programs need to be flexible and adaptive to changing circumstances. The **Planning program** will ensure the programs remain relevant to the operating environment of the LCIR, including changing economic, social and environmental circumstances. It will fund the LWMP community steering committee to meet four times per year to review progress reported on by each agency involved in the Plan's programs. Governance arrangements for the Plan and the monitoring evaluation, reporting and improvement framework to track progress and adapt implementation will also be provided through the Planning program.

Compliance with Victorian and Australian government's legislative and regulatory requirements and best practice for new irrigation developments and significant redevelopments will be attained through the **Regulation / Standard program**.

By working closely with local landholders, the **Education and Training program** will improve knowledge of crops and sustainable farming systems that improve returns per ML and returns per hectare and enhance environmental outcomes. This will include identifying and trialling new crops and pastures and new technologies to reduce the cost of production of existing enterprises. Specific activities could include field days on alternative crops, regional seminars, information sessions, development of new initiatives to employ young people in agriculture and provision of fact sheets on water use efficiency case studies. Paddock-based activities will demonstrate to landholders various options and generate confidence to adapt and change farming practices.

The **Research and Monitoring program** will enable measurement and improved understanding of environmental change so the effectiveness of activities undertaken by the Plan can be continuously improved. Proposed projects include research into new water use efficient technologies, continuing to improve how to map and report on land and water use change and enhancing understanding of soil health on irrigation farms. Strong links to irrigators and industry will enable the program to identify new opportunities for research to inform practical change on farms.

Farm and regional drainage are essential for sustainable irrigation, but rapidly changing water availability and land use means that approaches to drainage must change if services are to be affordable and fit for purpose. The **Drainage, Infrastructure and Development program** will encourage farm reuse in undrained areas as a priority and work with community to increase the area and length of drains protected with drainage course declarations. This may include funding for obstruction removal as part of implementing drainage course declarations. Implementation will reduce waterlogging and drainage losses and salinity risks on both agricultural and environmental assets.

Full implementation of the seven LWMP programs will contribute greatly to the achievement of medium and long-term outcomes for irrigators, the regional community, the environment and Traditional Owners and Aboriginal landholders (see Figure 4-1).

Full implementation of the LWMP is estimated to cost $30.9 million (M) as a present value discounted at 4 per cent over 20 years. It will require investment from the Victorian and Australian governments of $5.5 M per year over five years with a present value of $25.4 M. It will also require investment of an additional $1.2 M per year with a present value of $5.5 M from farmers. This is on top of irrigators ongoing investment of an estimated $10 M to $30 M in irrigation systems that occurs without a LWMP.

Full implementation is estimated to provide an additional $57.3 M in total benefits. Of which, $25.5 M is costed public benefits and $31.8 M is costed private benefits. There are also additional uncosted public benefits, such as improved water quality, which are estimated to be worth a similar order of magnitude. There are also regional recreation and tourism benefits arising from the investment in the Plan.

The tailored nature of the programs are interdependent. The synergy created through the combination of programs will help address declining water availability through improved water use efficiency, restructuring and achieving enhanced environmental outcomes. This in turn will increase regional pride and sustainability.

This demonstrates that the draft LWMP is value for money for landholders, governments and industry, and will enhance our precious land and water resources – land, waterways, wetlands and birds, fish, plants and other animals.

The community steering committee is seeking feedback on this draft Plan to inform finalisation of the new LWMP. Please provide feedback to:

Mandy Coulson, North Central CMA by email mandy.coulson@nccma.vic.gov.au.

This is requested by 31 January 2020.

1 Introduction

1.1 Purpose

The purpose of this Draft discussion paper is to seek feedback for the finalisation of the renewed Loddon Campaspe Irrigation Region Land and Water Management Plan (LCIR LWMP).

The LWMP's vision is ***"Using water for healthy, productive, sustainable irrigated food and fibre[2]"***

To achieve this, the LWMP needs to work towards the following long-term outcomes over the next 5-10 years:

- Sustainable, profitable, adaptive and innovative farming practices.
- Empowered and informed irrigation community.
- Protected and improved condition of environmental assets and values.
- Active involvement of Aboriginal peoples and communities.

This depends on achieving the following medium-term outcomes over the next 1-5 years:

- More efficient and integrated irrigation (on and off farm).
- Improved on-farm irrigation, nutrient and soil management.
- Improved regional irrigation drainage infrastructure and management.
- Impacts of irrigation on salinity, biodiversity and water quality managed within agreed limits.
- New and significant irrigation redevelopments are best practice.
- Increased community awareness and involvement in plan activities.
- Impacts of irrigation on other third parties are better understood and managed e.g. recreation and users downstream.
- Aboriginal values are better understood and integrated into management decisions.

The Plan's outcomes are underpinned by the following themes: planning and development, land management, water management, biodiversity management and community capacity. These themes cover the areas of feedback provided throughout the consultation process.

The new directions are a direct response to a rapidly changing operating environment for irrigation, the lessons and results achieved from the previous LWMP, feedback from focus group meetings and the Victorian Government's directions under *Water for Victoria.*

The North Central Catchment Management Authority (CMA) has established focus groups and a steering committee of community and agency representatives to oversee the process for developing the new plan. Feedback from two rounds of consultation is incorporated into this Draft.

[2] The intent is to encompass all irrigated production, including the main irrigated land use of mixed irrigation, dairying, irrigated cropping, irrigated grazing, grass, hay, wool, beef, fruit, nuts, grapes, vegetables, nurseries and cut flowers.

The remaining steps in the development of the new LCIR LWMP are:

- Broader community consultation will begin early December 2019 and will close 31 January 2020.
- Sign off by LWMP LCIR community steering committee late February 2020.
- Final approval by the North Central CMA Board sought. Proposed April/May Board meeting, 2020.
- Commence implementation of the new LCIR LWMP (July 2020).

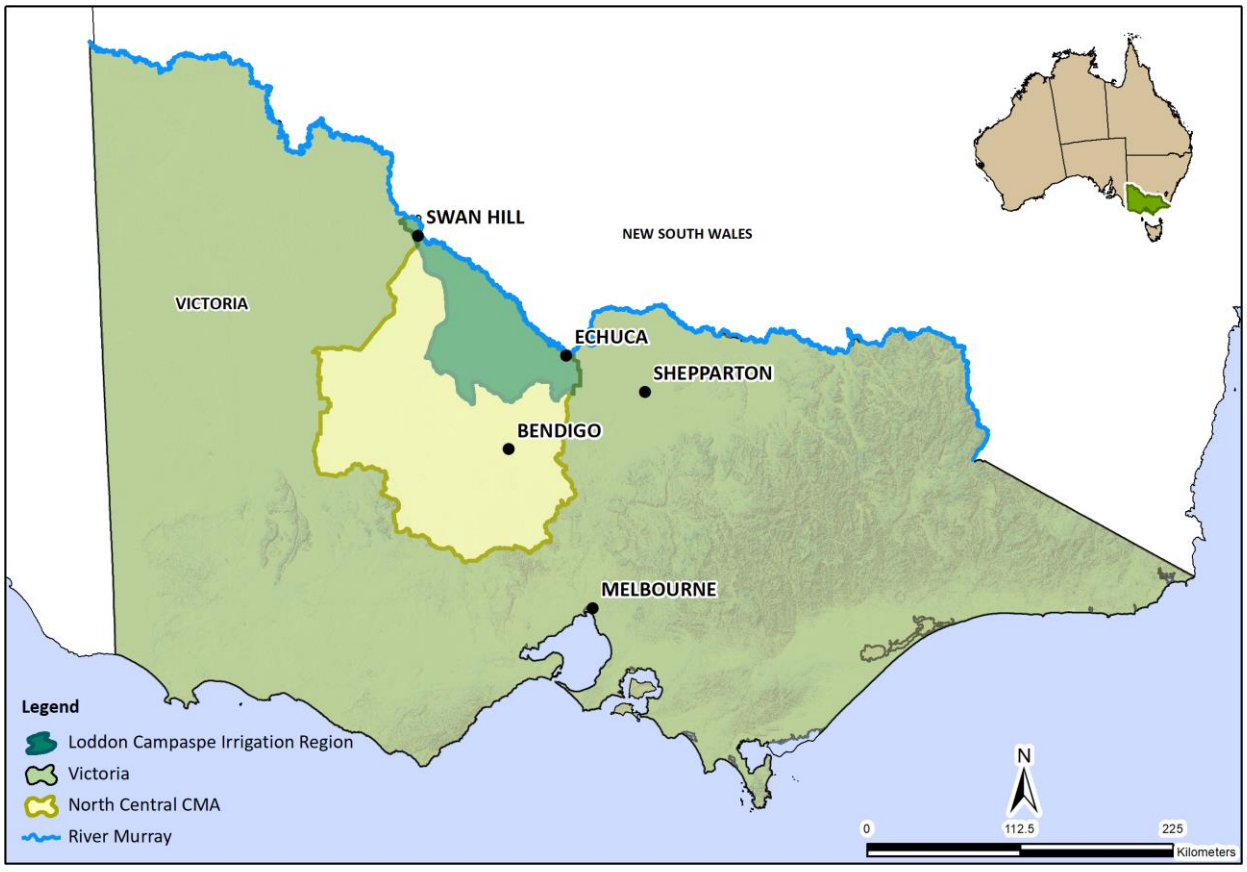

Figure 1-1: Loddon Campaspe Irrigation Region - location in State

1.2 Context

Under the *Catchment and Land Protection Act 1994* (Vic) LWMPs have been developed to guide government investment in natural resource management across designated irrigation areas. The LCIR LWMP guides government investment in land and water management in the LCIR (Figure 1-1). The Plan is a sub-strategy of the North Central Regional Catchment Strategy focussing on irrigation and is due for renewal.

The current LWMP is a broad document covering several themes such as: land management; water management; biodiversity enhancement; community capacity; and planning and development. Some of these themes are now covered by other sub-strategies developed under the Regional Catchment Strategy (RCS) including the: Climate Adaptation and Mitigation Plan, Regional

Floodplain Management Strategy, Waterway Strategy, Regional Sustainable Agriculture Strategy, and Soil Health Action Plan.

To avoid overlap with other RCS sub-strategies, the renewed LWMP, in accordance with the Victorian Government's LWMP guidelines, will highlight where related actions are being addressed in other strategies. This will also allow for improved targeting of actions in the LWMP to improve the sustainability of irrigation. The key focus is therefore to deliver public benefits from irrigation associated with the following which have been built into the longer-term outcomes (Section 4.1):

- **Enabling adjustment to changing water availability by improving water efficiency and regional productivity through irrigation system modernisation**: achieving a vibrant, productive and sustainable irrigation sector in Victoria depends on using water resources efficiently across all irrigation industries. This is integral for improving resilience to drought and climate change while continuing to adapt to water recovery and includes consideration of any expansion of irrigation and managing a changing irrigation footprint.
- **Creating more opportunity for the active involvement of Aboriginal peoples and communities**: by working with Traditional Owners and aboriginal landholders the LWMP programs will be adapted to incorporate traditional knowledge and participation on an ongoing basis.
- **Protecting the health of waterways and maintenance of water quality**: by achieving reduced salinity and nutrient loads from irrigation to help protect the health of waterways and managing uncontrolled surface run-off to minimise the risk of eutrophication of regional waterways and the Murray River.
- **Protecting land from salinisation and shallow watertables**: by reducing accessions into groundwater to reduce the risk of waterlogging and secondary salinisation of land, which occurs due to excess water from rainfall in conjunction with irrigation. Continuing to reduce soil salinisation and waterlogging will assist agricultural productivity and enhance environmental values.
- **Ensuring biodiversity is protected from any offsite impacts from irrigation**: by improving irrigation efficiency, ensuring natural assets are protected and enhanced in the whole farm planning process and by ensuring new irrigation development guidelines provide adequate environmental protection.

It is important to note that while the LWMP endeavours to protect water quality, it does not include the broader management and allocation of water resources or the operation of the water market. That work is done at a state and at Murray-Darling Basin scale; i.e. through trading rules set by the Victorian Minister for Water, the Victorian Water Register and consistent with principles and rules in the Murray-Darling Basin Plan.

1.3 Overview of region and planning framework

The dominant irrigated enterprise in the LCIR is irrigated pasture, then irrigated mixed farming. There are also small areas of irrigated perennial horticulture which make a large contribution to the region's economy.

Prior to 2002, five salinity management plans and one regional development plan covered the LCIR. The six plans were known as the Tragowel Plains Salinity Management Plan (SMP); Kerang-Swan Hill SMP; Boort West of Loddon SMP; Torrumbarry East of Loddon SMP; Campaspe West SMP and

the Loddon Murray 2000 Plus regional development initiative. In 2002 these six plans were combined into one integrated regional strategy - the Loddon Murray Land and Water Management Strategy (LMLWMS). The integrated approach continued with the completion of the current LCIR LWMP in 2011.

In common with other irrigation regions, there has been a focus on community engagement, improving farm water use efficiency, drainage and groundwater management to control salinity and nutrients. To aid in delivery, the LWMP is aligned to regional natural resource management actions with the Goulburn-Murray Water Connections Project and farm modernisation programs.

The key drivers of change for irrigation enterprises in the region include climate change (a drier, hotter climate and increased climate variability), drought, irrigation modernisation, changing water policy[3], water trade out of the region and fluctuating commodity prices. These drivers have reduced the amount of irrigation in the region, changed the mix of irrigation enterprise types, changed irrigation businesses and changed surface and subsurface drainage requirements. All these changes affect the implementation of the LWMP and the magnitude of targets and the type of actions the plan should be targeting in the future.

LWMPs are essential in translating national and Victorian laws and policies into practical on-ground actions supported by regional communities. The renewal must be undertaken in line with the LWMP guidelines, developed by the Department of Environment, Land, Water and Planning (DELWP). The guidelines specify that the LWMP must demonstrate clear links between plan actions and objectives and summarise this in a program logic (see Figure 4-1).

The renewed plan will detail and justify works and measures to achieve five-year and longer-term targets.

A monitoring, evaluation, reporting and learning (MERL) framework for the plan will provide accountability and feedback to enable an adaptive management approach. It will be important to make the path from investment, to outputs and deliverables (Management Action Targets [MATs]) and results and outcomes (Resource Condition Targets [RCTs]) clear.

The scope of the LWMP is private land that holds an irrigation water use licence where the cumulative impacts of irrigation has the potential to affect public or offsite values. This applies to all irrigation in the North Central CMA region and to dryland that retains an irrigation water use licence[4].

The LWMP does not cover the management of public land or public waterways and wetlands. These are covered by other sub-strategies in the RCS. Feedback from consultation on issues related to other sub-strategies is recorded in the Appendices so the North Central CMA can refer to community feedback when these sub-strategies are reviewed and updated.

The Plan will also apply to land without a water use licence that has the potential to be irrigated. Such land becomes eligible for some Plan programs when issued with a new water use licence under irrigation development guidelines. The Victorian government policy is that as part of the approval conditions for new developments license holders must fully fund the cost of meeting best

[3] Water policy changes have also been in response to changing environmental conditions and priorities.

[4] Also including Take and Use Licences covering irrigation from unregulated streams and from groundwater.

practice standards aren't eligible for farm incentives under the Plan adoption programs. However, developments are eligible to participate in other programs.

The main area of focus is expected to be within the Goulburn-Murray Irrigation District (GMID), which, in North Central CMA region, comprises the Torrumbarry, Loddon Valley and parts of the Rochester Water Service Areas (Figure 2-1). Private diversion irrigation or groundwater pumping outside of the GMID are also covered where there is potential to significantly impact on public or offsite values. Note that the Rochester Irrigation Area is included in the Shepparton Irrigation Region Land and Water Management Plan.

The vision and objectives of the LWMP align with the Victorian Sustainable Irrigation Program (SIP) and are part of the North Central RCS. This approach ensures the overarching Victorian Government's program and regional priorities are central to the LWMP.

Broader issues that are not specific to irrigated land are also important and are covered by other strategies in the RCS. The LWMP has an important role in signposting these other strategies (Appendix 2).

2 The Region

2.1 The Loddon Campaspe Irrigation Region

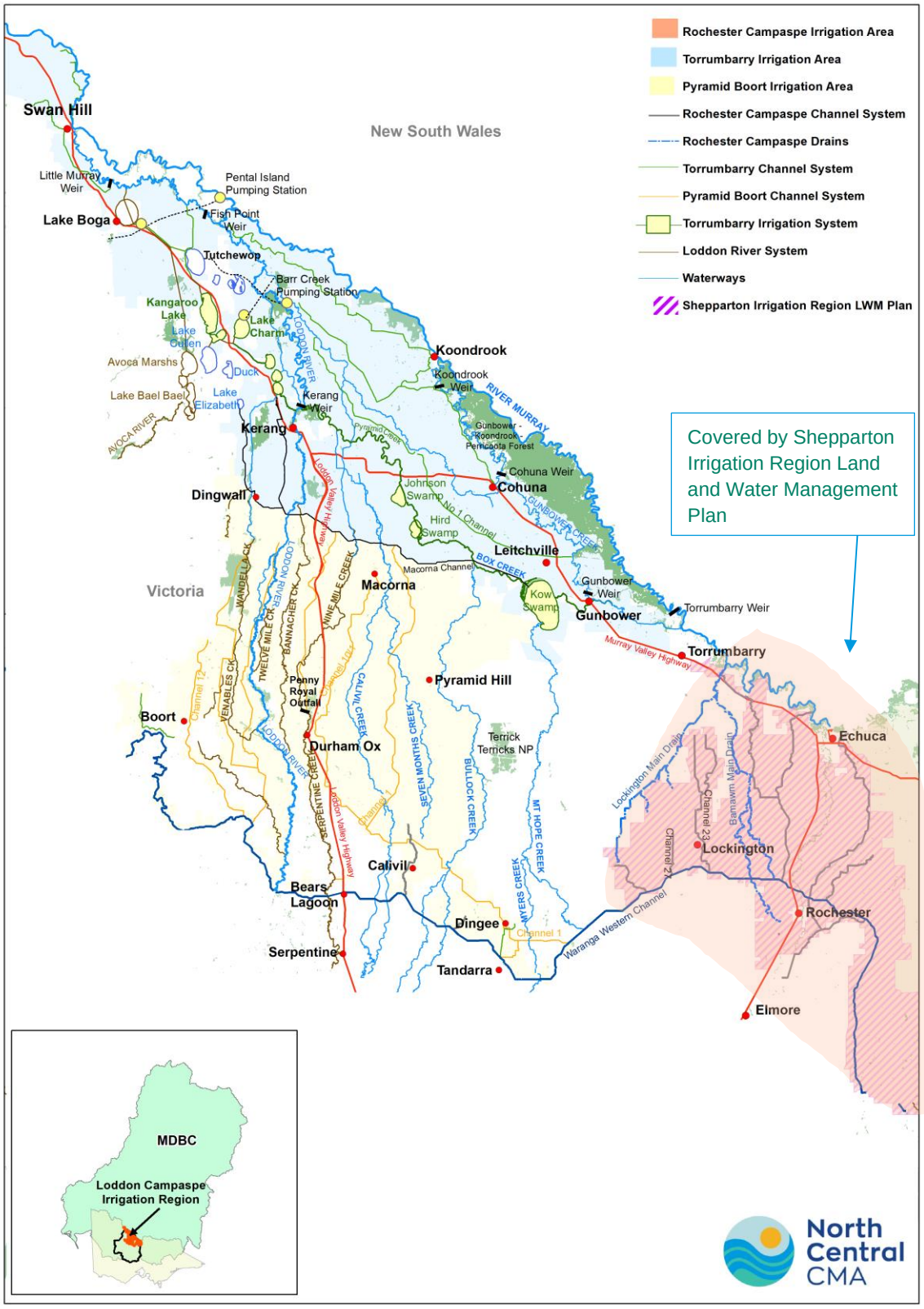

Figure 2-1: Loddon Campaspe Irrigation Region – regional features

2.2 Why does the region need a plan?

The Plan is designed to address the following needs within the LCIR (Figure 2-1):

- Declining water availability, which is creating land use change and farm adjustment and is a result of:
  - Climate change. The CSIRO projections for climate change (Timbal. 2015), indicate that the Murray cluster region may experience: higher temperatures, more frequent hot days, less rainfall in the cool season, increased intensity of heavy rainfall events, extended drought periods, increased evaporation rates, and reduced soil moisture. Therefore, climate change will result in a smaller irrigation footprint and more unirrigated areas.
  - Water reform such as water recovery and water trade.
- The potential re-emergence of salinity from high watertables causing salinization of land and watercourses; and the need to meet salinity accountability commitments, i.e. report on salinity impacts to the Murray River.
  - Most of the region is underlain by highly saline watertables which developed following land clearing and the introduction of irrigation. During the last century the irrigated area had watertables less than two metres from the surface, which resulted in extensive soil and watercourse salinisation. While the threat has greatly diminished with a smaller irrigation area, improved farm and distribution system efficiency and a drier climate, salinity continues to affect areas of irrigated land and valuable wetlands. This is usually at the lowest points in the landscape and can re-emerge especially after extended wet periods.
- Poor water quality from farm run-off, especially nutrients and sediments and effluent management that may impact on downstream values and beneficial uses.
- Inappropriate floodplain management that does not balance biodiversity with upstream and downstream drainage needs or account for instream barriers for native fish.
- Insufficient recognition of cultural heritage values and access to natural resources for Aboriginal people.
- Potential loss of terrestrial biodiversity from habitat loss and fragmentation on farms, fire and pest, plants and animals.

Without a plan there is a lack of coordination of federal and state government investment and programs to address these issues. This means the costs incurred by the community are much greater.

The regional assets that need attention include: Aboriginal cultural heritage, irrigation districts and land used for other purposes, geology and soils, waterways, floodways and wetlands, biodiversity and the community. These assets are described further in Section 2.3.

2.3 The region's assets

2.3.1 Traditional Owners

First Nations Aboriginal people have cared for land and water for millennia and strong connections with the landscape exist for Traditional Owners today.

Aboriginal heritage sites and places are at the core of their people's physical, spiritual and cultural existence and identity. Aboriginal Victoria and the relevant Registered Aboriginal Party (RAP) must be consulted regarding identification, protection and enhancement of sites and places.

Across the region approximately 1,700 archaeological sites have been identified and placed on the Victorian Aboriginal Site Registry. Archaeological sites include isolated artefacts; shell middens; cooking mounds; rock shelters and caves; scarred trees; and sacred burial sites. It is important to note that less 2% of the state has been surveyed for Aboriginal cultural heritage and countless unrecorded sites exist, often in the vicinity of waterways and wetlands. All Aboriginal cultural heritage sites and areas are protected by legislation under the *Aboriginal Heritage Act 2006* and *Aboriginal Heritage Regulations 2018*.

Many Traditional Owner groups have developed Country Plans to articulate their goals and further opportunities for more stewardship of the landscape.

Implementation of Victoria's North and Murray Water Resource Plans, prepared by DELWP, for the Murray-Darling Basin Plan (Section 3.4.1) includes:

- Recognise Aboriginal values and objectives of water.
- Include Aboriginal values and traditional ecological knowledge in water planning.
- Support Aboriginal access to water for economic development.
- Build capacity to increase Aboriginal participation in water management.

A key outcome for this LWMP is to acknowledge Traditional Owner and Aboriginal landholder interests and create more opportunities for the self-determined involvement of Traditional Owners and Aboriginal landholders in land and water management.

2.3.2 The Goulburn-Murray Irrigation District

The 1840s saw the establishment of sheep and cattle runs, mostly as large pastoral holdings. In the decades following, farmers struggled to deal with periods of extreme climatic conditions and farming in a low-rainfall region. To overcome these problems landholders began experimenting with irrigating land to increase its productivity. Despite the relatively small scale of these schemes, waterlogging and land clearing caused watertables to rise. Salinity soon emerged as a problem for the region.

In the early 1900s, driven by the need to create employment, the Victorian government developed policies for closer settlement. In 1905 the State Rivers and Water Supply Commission was established to advance policy. This was a predecessor of GMW. After taking over the smaller irrigation trusts it developed the GMID which included areas in the LCIR. Irrigation water was supplied by four natural river systems – the Murray, Goulburn, Campaspe and Loddon – and was delivered to irrigators through the region's extensive network of natural waterways and man-made distribution supply channels. Land continued to be developed for closer settlement right up until the 1960s when the Campaspe Irrigation District and Lake Eppalock was developed. Following the Millennium Drought the Campaspe District was voluntarily closed down after a vote was taken by local irrigators as part of the Northern Victoria Irrigation Renewal Project (NVIRP)/GMW Connections Project.

The irrigation areas are embedded in a complex system of waterways (Figure 2-1).

The region has been facing declining water availability, reduced inflows and the introduction of allocation policies to secure water supplies in a drier climate, e.g. carryover and a more conservative reserve policy. With increased scarcity, water prices have increased across the whole of the GMID. The Torrumbarry system faces increasing pressure since tighter restrictions on water trade out of the Goulburn were applied in August 2019 which has led to even higher prices for water in areas downstream of the Barmah Choke and Goulburn, i.e. Zone 7 Murray.

Figure 2-2 shows irrigation usage has declined by 50% from its peak in the 1990s. This reduces the agricultural output unless it can be offset by improving the efficiency of water use and increasing irrigated production per megalitre (ML). Significant progress to lift production per ML has been made, but ongoing improvement is essential for the region to remain competitive in the water market. Therefore, continuing to drive water use efficiency and improve returns per ML is critical for the future and assisting this is an important role for the Plan.

Redevelopment and new irrigation opportunities will need to be developed through the Plan. The GMID Masterplan is an overarching strategy currently in preparation that will also provide new opportunities for industries and communities in the LCIR.

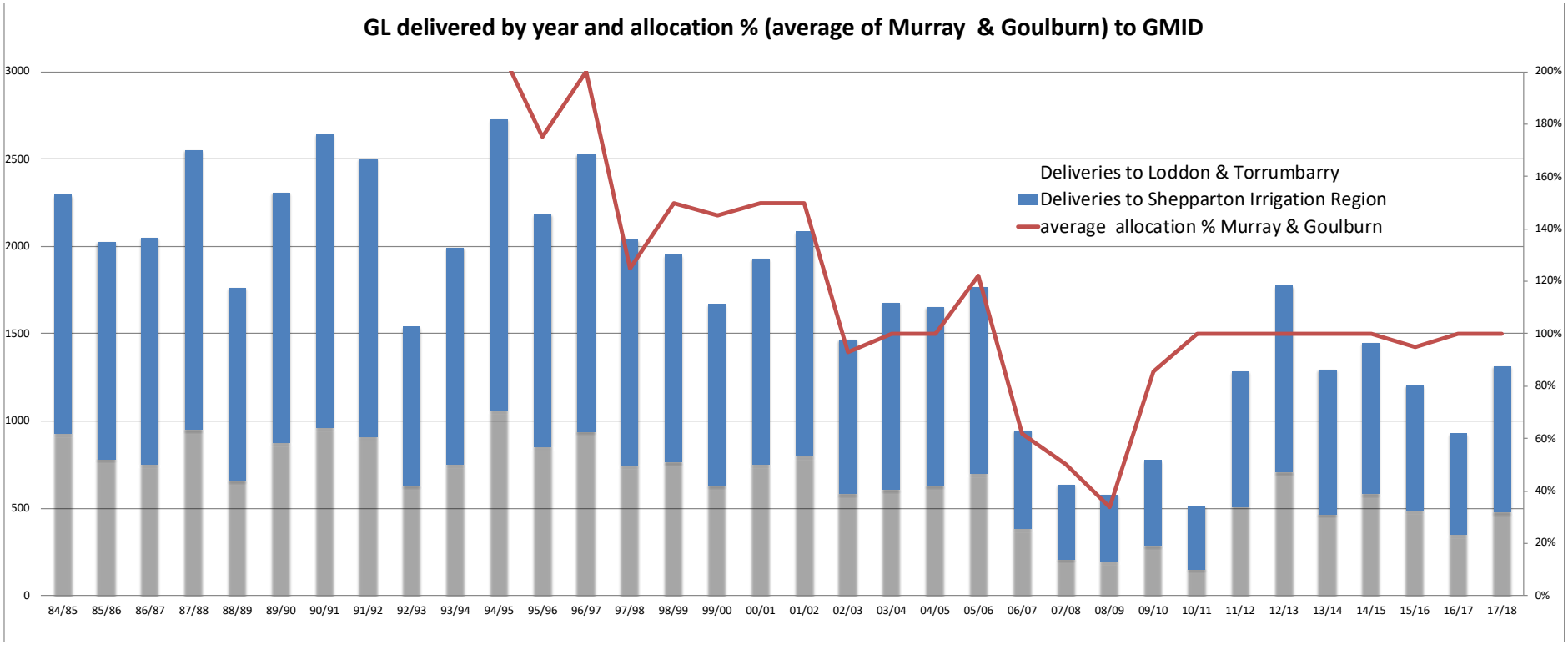

Figure 2-2: GMID Irrigation water deliveries – Torrumbarry and Pyramid Boort (Loddon-Murray) shown in light green

2.3.3 Land-use and value of production

In 2017-18 the North Central CMA region held approximately 1,400 farm businesses[5] which irrigated 200,000 ha and used 590 GL of water for irrigation. Table 2-1 provides a summary of the major irrigated land and water use.

Table 2-1 Major irrigated land and water use in the North Central CMA region, ABS 2017/18[6]

Irrigated crop	Area watered (ha)	Volume of irrigation water used (ML)	No. of businesses
Fruit trees, nut trees, plantation or berry fruits	5,630	23,002	132
Grapevines	2,381	7,113	87
Other broadacre crops	9,591	18,387	78
Other cereals for grain or seed (e.g. wheat, oats, maize)	38,666	75,861	259
Other crops (not elsewhere classified)	1,027	2;559	259
Pastures (including lucerne) and cereal crops cut for hay	20,095	58,798	286
Pastures (including lucerne) and cereal crops cut for silage	15,964	30,695	123
Pastures (including lucerne) and cereal crops used for grazing or fed off	103,211	363,281	981
Vegetables for human consumption	2,445	10,925	76
Other irrigated crops	394	1,838	unknown
Totals	**199,405**	**592,458**	**1,386[7]**

In 2017-18 irrigation in the region generated around $800 M at the farm gate (Table 2-2) and supported farm employment and off-farm employment through associated manufacturing, food processing and industries servicing agriculture. Broadly horticulture generates around $2,000 to $5,000/ML, dairying generates around $900/ML and mixed farming generates approximately $300/ML. In total irrigated agriculture in the region generates around 4,000 farm jobs. Regional food processing generates similar jobs when done in the region, which is usually the case for perishable products such as dairy, fruit and vegetables. The number of jobs is tabulated in Section 2.3.7.

[5] A farm business is defined as having an estimated value of agricultural operations > $40,000/year. There are also approximately 3,000 irrigation properties that do not meet the ABS definition of a farm business. While large in number, these do not manage large area or ML use.

[6] ABS 46180DO001_201718 Water use on Australian Farms 2017-18

[7] This total is less than the sum of businesses for each crop as some businesses operate more than one enterprise.

Table 2-2 Gross Value of Irrigated Agriculture Production in the North Central Region, ABS 2017/18[8]

Crop types	Sum of Gross Value of Irrigated Production ($)
Dairy production	$236,722,274
Fruit and nuts (excluding grapes)	$101,177,390
Grapes	$12,350,497
Hay	$18,131,744
Other broadacre crops	$10,421,439
Production from meat cattle	$71,533,644
Production from sheep and other livestock	$176,105,482
Other	$95,288,095
Vegetables	$55,040,177
Total	**$776,770,745**

The current state and outlook for each of the main irrigation industries is shown in Table 2-3.

Table 2-3: Irrigation industry trends

Industry	Current state	Outlook	Trend	Challenges/opportunities
Dairy	Dominates parts of the region, e.g. Cohuna and Rochester, but low confidence.	Steady. Trend to larger herds and total mixed rations. Exposed in drought years.	Decline	Continuing to improve water use efficiency. Access to capital. Large land parcels. Milking areas needing high water security.
Horticulture	Positive, switch to fresh fruit. High $/ML.	Increasing value, may expand more rapidly if export markets develop.	Expanding	Market development, quality focus, labour costs, access to capital. Need high water security and service.
Mixed and dryland farming	Positive, but low $/ML and declining irrigation use. High $/ML for domestic and stock (D&S).	Needs scale, difficult to compete with NSW. Expanding area of dryland.	Decline in water use, expanding land area.	Flexibility to move in and out of irrigation. Need large land parcels. Declining water use with large numbers of nil/low water use outlets. Increasing rural residential (right to farm).
Specialist and emerging	Expanding large scale operations. Very high $/ML.	Large growth in poultry. Growth in pork. Growth in glasshouses.	Expanding	Land use planning. Environmental approvals. Proximity to abattoir for chickens. Proximity to feed for piggeries. Proximity to skilled workforce and services for glasshouses. High value industries with large employment needing high quality services.

[8] ABS 4610055008DO001_201718 Gross Value of Irrigated Agricultural Production 2017-18

2.3.4 Geology and soils

Geology

The region is part of the northern Victorian Riverine Plains. It is located in the Murray Basin - a shallow basin that formed around 65 million years ago. The basin is filled with tertiary sediments laid down between 65 and 1.8 million years ago, and more recent quaternary sediments (less than 1.8 million years old). The base of the Murray Basin rests upon a highly deformed structure of sedimentary and crystalline rock.

The surface and subsurface geology of the North Central CMA region is diverse, ranging from the Palaeozoic metasediments and Devonian granites in the uplands through to recent geological formations of the Murray Basin along the Murray River (Figure 2-3).

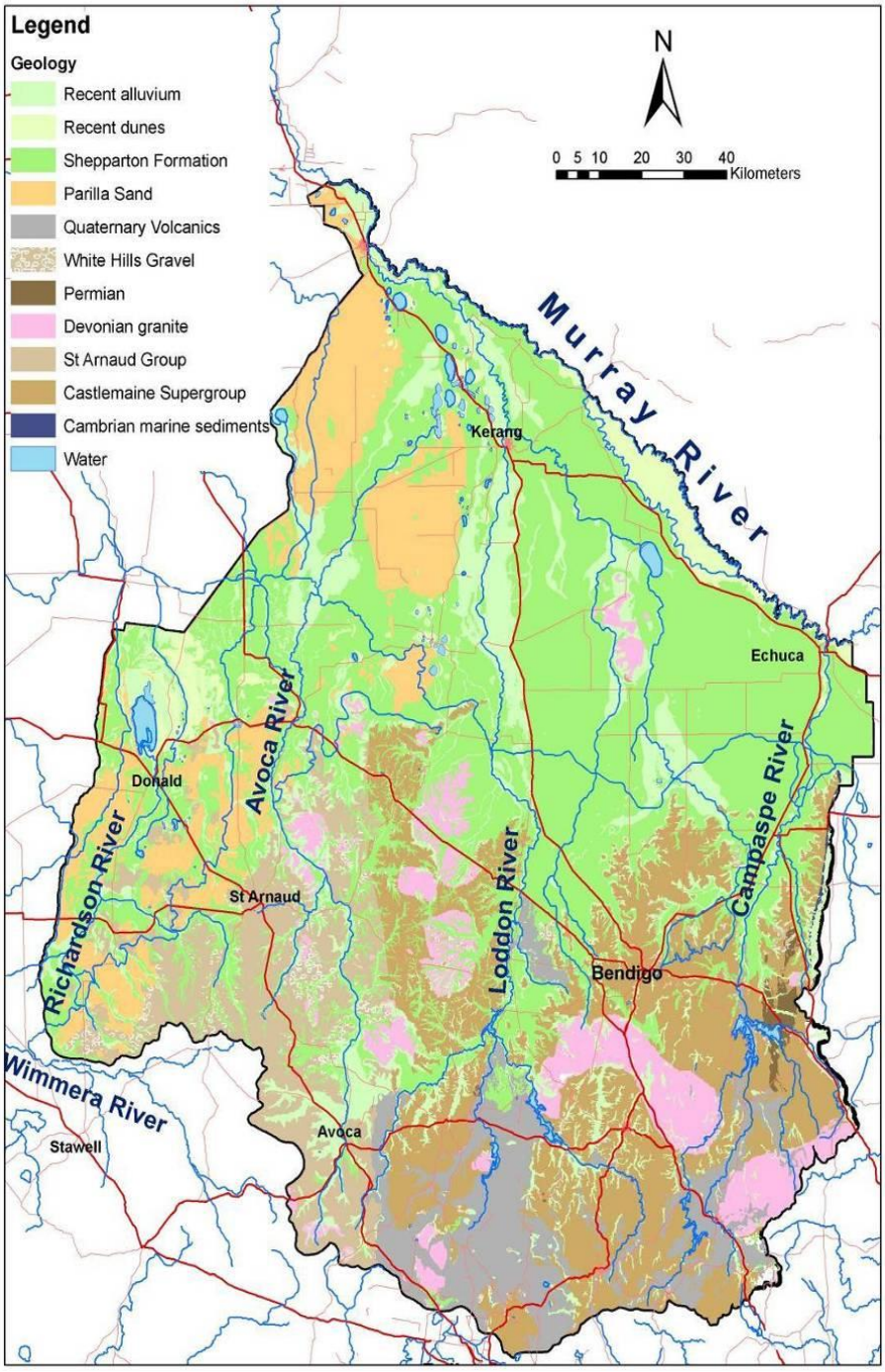

Figure 2-3: Surface geology of the North Central CMA region.

Groundwater

The North Central CMA region comprises at least 20 different groundwater systems. Fractured rock aquifers are common within the bedrock uplands, as are localised flow systems. Much larger aquifers comprising alluvial sands and gravels are found within the northern plains. In the north and west, sediment deposited during the last marine incursion forms a sheet-like body of fine sands that function as an unconfined aquifer.

The large alluvial aquifers provide a substantive resource and groundwater usage is commonplace, particularly on the northern plains. Groundwater is used to supplement surface water for the purposes of irrigation and stock and domestic supplies. Groundwater in many areas is saline and can cause substantial salinity problems where it comes close to the surface. Saline groundwater discharge and salinity issues are widespread throughout the region and extend from the smaller groundwater flow systems common to the uplands through to the regional aquifers of the northern plains.

In moving from the uplands to the immediate Riverine Plains deep leads escape the confines of the narrow upland valleys and fan out reflecting a network of anastomising streams across the floor of the basin. In these areas expansive areas of Calivil Formation extend laterally for more than 10 kilometres and form an extensive aquifer in the region of Goornong in the Campaspe Valley (Macumber 2008) and at Derby, north of Leichardt in the Loddon Valley.

As the deep leads pass further northward into the Riverine Plains the valleys containing them are incised into the alluvial and paludal sediments of the Renmark Group. These strata form the basal sediments of the southern Murray Basin. Two units are recognised. The lowermost is the Warina Sand, a sheet-like body of coarse sand and minor gravels distributed over the bedrock floor of the basin. This varies considerably in thickness and texture in sympathy with bedrock topography.

The Calivil Formation of the lower Loddon and Campaspe valley plains is deposited within trenches cut within the upper surface of the Olney Clay. It is not clear whether groundwater in the Calivil Formation is in hydraulic connection with the underlying Warina Sands. The Olney Formation is known to be a confining layer to the Warina Sand beneath the marine sediments of the Wimmera, but the relationship between the two units is less clear in the eastern sector of the Riverine Plains.

In northern Victoria the Early Oligocene transgression resulted in the deposition of the Geera Clay and a local variant, the Torrumbarry Silt. These fine-grained clay-rich strata were established under the shallow water marine conditions that prevailed along the coastal margins extending westerly from Cohuna/Kerang along the highland front through to Wycheproof and Donald.

A continuous thick layer of fine-grained sand and stranded beach ridges formed as the sea retreated from the Murray Basin during the final regression. A blanket of this semi-consolidated sand, the ‘Parilla Sand’, up to 50 metres thick, now rests over the Mologa Surface above the Geera Clay. It is the uppermost stratigraphic unit and outcrops over large areas of northern Victoria where it forms a continuous unconfined aquifer. In the North Central CMA region, it is found between Cohuna/Kerang in the east and stretches to Donald in the west. It extends both northward and westward into the Victorian Mallee.

Groundwater within the Parilla Sand aquifer is saline with total dissolved salts ranging in concentration from about 20,000 through to about 30,000 mg/L. In some areas, saline groundwater discharges to landscape depressions forming salinas. Some of these are natural (primary), whilst others are relicts of past episodes of salinity reactivated by contemporary land use (secondary).

The Late Miocene/Early Pliocene regression drowned the deep lead channels that had cut into the Upper Renmark Group, and subsequent deposition of Parilla Sand backfilled and buried them beneath the sandy aquifer. The deep leads, thus, extend below the Parilla Sand. In regions distant from the highlands, the channels diminish and ultimately terminate. Here the deep leads discharge to the overlying unconfined Parilla Sand and the consequent dramatic reduction in transmissivity promotes regional saline groundwater discharge, and the characteristic salina/lunette complexes. These phenomena are particularly evident where the Loddon deep lead terminates in the Kerang/Cohuna region and where the Avon-Richardson deep lead terminates below the Parilla Sand west of Donald.

Salinity from rising groundwater levels has been a major threat historically and the focus of much investment both within the LCIR and more broadly across the Murray-Darling Basin. In response to several changes, salinity threats have reduced overall in the Loddon and Campaspe catchments. The watertable is now lower (below the critical 2 metres from soil surface level) most of the time, with fluctuations following wet periods (Figure 2-4 and Figure 2-5). For example, the floods of 2010-11 caused rapid increases in watertable levels and renewed salinity threats. Figure 2-4 illustrates the indicative changes in LCIR watertable levels in recent years.

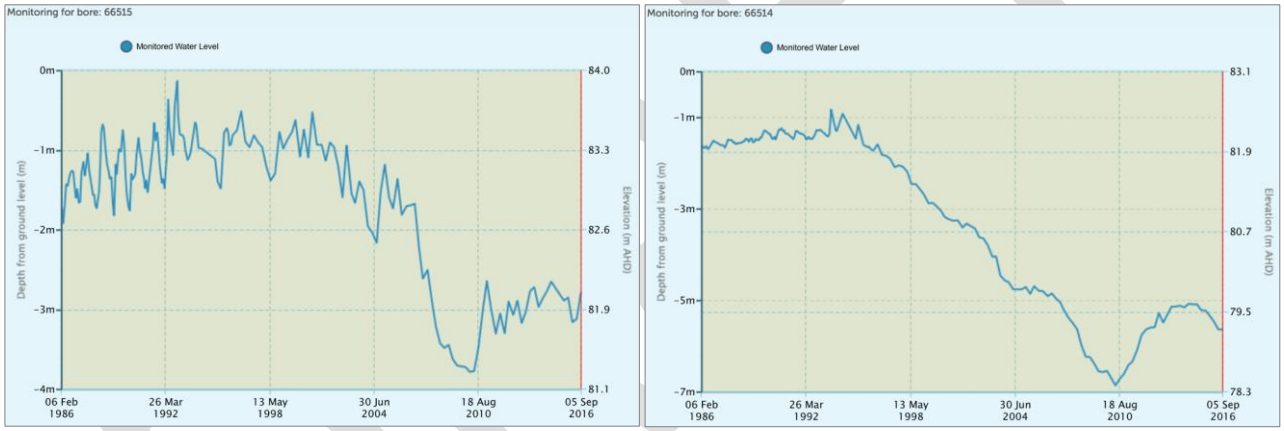

Figure 2-4: Changes in depth to watertable near Gunbower[9]

Source: Visualising Victoria's Groundwater 2017 www.vvg.org.au

[9] Bore 66515 monitors the shallow groundwater (known as the Shepparton Formation). Bore 66514 monitors the deep groundwater (known as the Calivil/Renmark Formation). Location is between Leitchville and Gunbower adjacent to Murray Valley Highway.

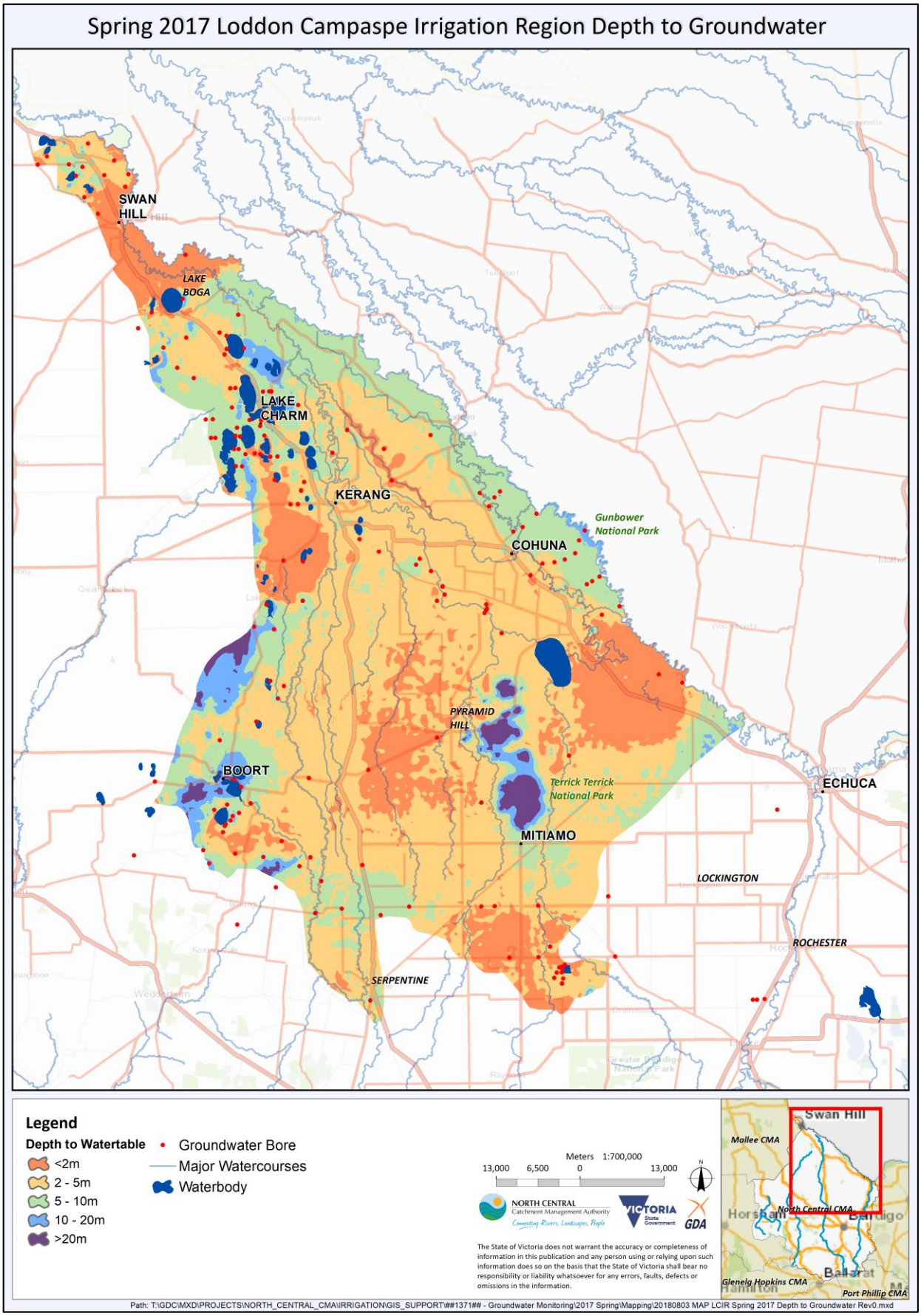

Figure 2-5: Depth to watertable map for the LCIR (Spring 2017)

The ongoing reduction in salinity threat from lower watertables can be attributed to the following changes in the LCIR since 2011:

- **Climate change** – reduced winter and spring rainfall (DELWP 2016) has been a major driver of continued reductions in groundwater recharge.
- **Water use efficiency (WUE) on-farm** – in response to low water availability, higher water prices and government programs (such as the Farm Water Program), irrigation efficiency has continued to improve on-farm, e.g. growth in centre pivot irrigation in Boort, funding of laser grading and drainage reuse systems under the Farm Water Program. In doing so, accessions to groundwater have reduced.
- **GMW Connections Program** – decommissioning of irrigation channels and channel lining has reduced accessions to groundwater from irrigation seepage (as some areas of irrigation are converted to dryland farming following channel decommissioning) and channel leakage in recent years.
- **Water trade** – high prices for both allocation trade (temporary water) and water share trade (permanent water) has continued to promote the movement of water out of the LCIR and the reduction in irrigation area. Accessions to groundwater have therefore reduced.
- **Land use change** – the area and intensity of irrigation has continued to reduce overall in response to different crops being grown, leading to less groundwater recharge from irrigation seepage. This has occurred for several reasons. As some landholders have improved irrigation efficiency, they have moved to higher value crops with higher water use but over a much smaller area. There has been a shift from perennial to annual pastures which use less water over time. For example, land use in the upper Barr Creek, Tyntynder Flats, Lockington, Bamawm and Rochester areas was traditionally dominated by intensive dairying on perennial pastures with water use from 8 to 15 ML/ha/y. This is now a much smaller proportion of the landscape. Irrigation is now often tailored to crops that maximise dry matter per ML, which has meant that there is a greater emphasis on annual pastures with water use typically 0 to 6 ML/ha/y. More opportunistic irrigation patterns are also apparent such that irrigation only occurs when the commodity price is likely to be affordable relative to the water price.
- **Lower dairy prices relative to water price** – resulting in less milk production, less irrigation of perennial pastures and therefore reduced accessions to groundwater.
- **Expanded groundwater pumping on farm** – this has reduced the pressure on the Deep Leads groundwater aquifer in the upper catchments.

The reduction in salinity threat is expected to continue in the future, while noting that periods of salinity impact may occur following extended wet periods. Recent reviews of salinity register entries such as the Barr Creek Catchment Strategy, found that salt loads to the Murray River are much lower than those expected when entries were first prepared – from the early 1990s onwards. This means salinity risks have declined, perhaps by as much as 90% from the peak loads[10], but a 'watching brief' is still required given the high potential for mobilising salt from the region following a change in climatic or water use conditions. Nevertheless, there is potential to claim additional salt credits, possibly an additional -25.6 EC compared to the -7.7 EC that is currently allocated on the register (The Wedge Group, hydrogeologic, Woodwater, Jacobs, RMCG, 2018).

[10] Salt loads in the Barr Creek peaked at around 250,000t/y in the 1990s, but over the last 25 years have fallen to 25,000t/y, except for in high rainfall years.

The North Central CMA has commenced work on the development of a fit-for-purpose integrated accounting model to assess its accountable actions.

There are Australian and Victorian government commitments regarding salinity management, e.g. the Basin Salinity Management 2030 strategy (BSM2030), which supports management of salinity in catchments through LWMPs. Responsibility to manage salinity impacts, including monitoring and reporting, is delegated to CMAs by the Victorian Government. Therefore, salinity management must continue to be a focus for future investment and should remain a key priority in the LCIR LWMP.

Soils

The region has many diverse and variable soil types including red and yellow duplex soils; red friable earths; red and grey loams; pure grey, grey and red clays; grey sands and stony mottled duplex soils. The most common soil type in the region is the red duplex soil. The most productive soils have good access to irrigation and drainage.

Improving farm management practices helps to reduce excessive leaching through highly permeable soils and waterlogging of low-lying and impermeable soils, which in turn helps to manage land deterioration threats. Figure 2-6 illustrates the soil types and their location within the region.

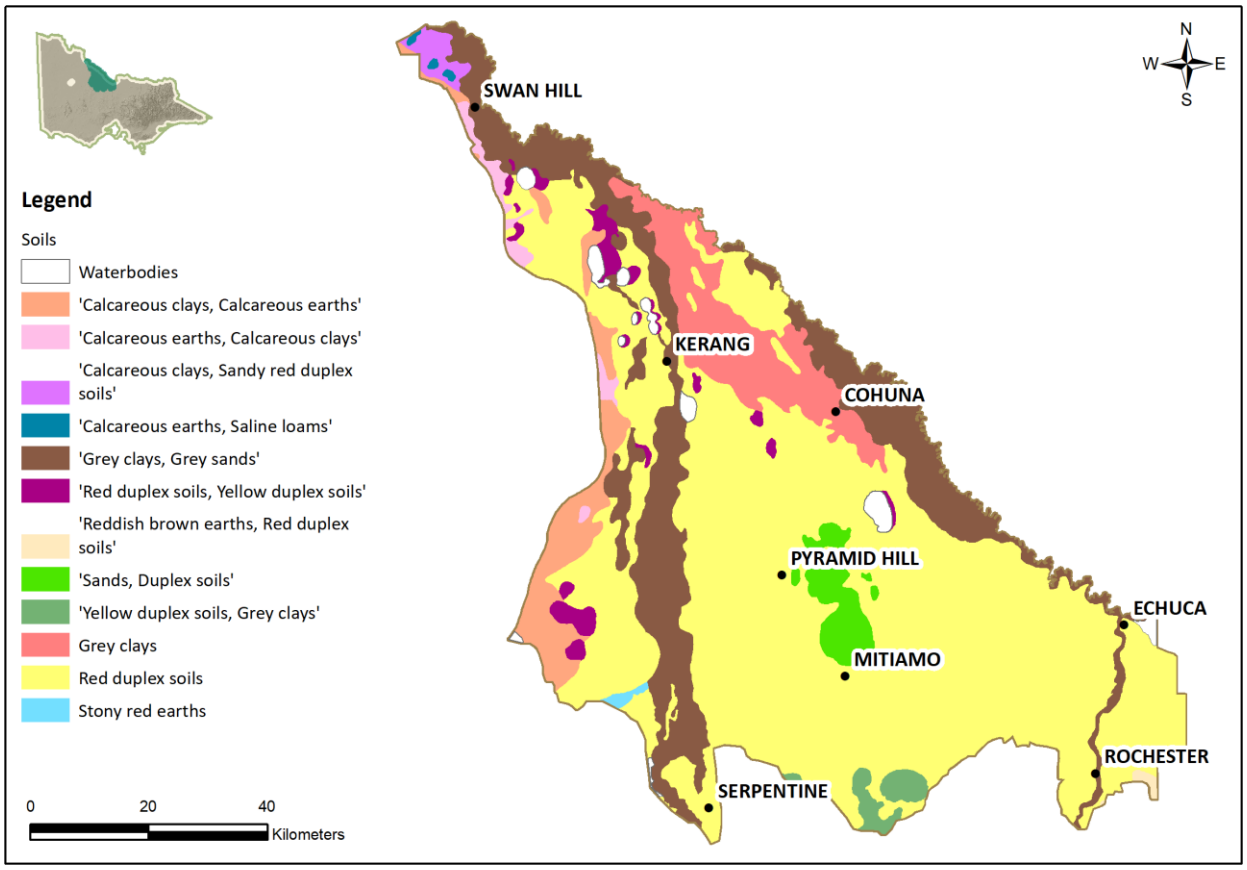

Figure 2-6: Soils types and their location within the Loddon Campaspe Irrigation Region

2.3.5 Waterways, floodways and wetlands

Waterways

The LCIR includes a complex system of waterways, many being flood distributaries across the floodplain. These are illustrated in Figure 2-7. The region contains 24,892 km of waterways. The region's major river systems are the lower stretches of the Loddon, Avoca and the Campaspe, with the Murray River forming the northern boundary. Other important waterways include Gunbower, Bullock, Mount Hope, Pyramid, Barr and Sheep Wash creeks. The region's waterways support a range of iconic native fauna such as the Murray Cod.

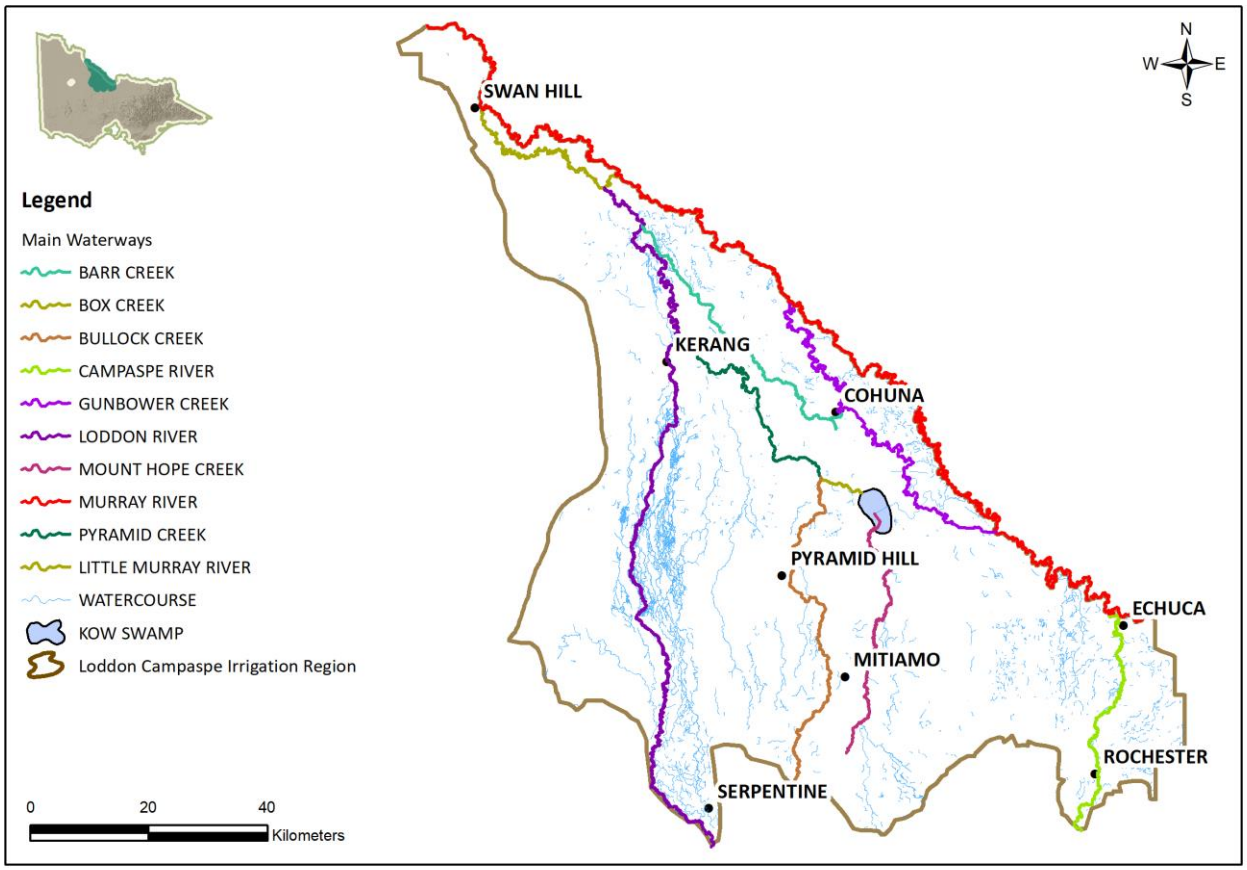

Figure 2-7: Loddon Campaspe Irrigation Region's extensive network of waterways.

Floodways

The lower portions of the Loddon, Avoca and Campaspe floodplains cover a large area of the region. These floodplains play an integral role in mitigating the adverse impacts of flooding. These floodplains have become highly modified as a result of the patterns of settlement and agricultural development that has occurred throughout the region. Modifying these floodplains has altered their hydraulic function and their connections to the natural waterways and wetlands across the LCIR.

The system of private and public levees constructed to control floodwater during flood has changed the natural paths of floods. Many of the privately constructed levee systems have degraded over time, reducing their effectiveness to mitigate flood impacts and risks. In some locations the growth of instream vegetation, such as lignum, may impede the effectiveness of the floodplain in slowing the flow of flood waters and artificially increase the height of, and prolong, the flood. The North

Central CMA has undertaken floodplain studies to develop a greater understanding of the current state of the region's floodplains and levee systems.

A program implemented post the 2011 floods was to purchase agricultural enterprises established on marginal land bordering designated floodplains. The strategic purchase of such properties can enable the natural connectivity of the floodplain to be reinstated. The increased storage capacity of the floodplain also allows for better management of the localised and downstream impacts of flooding.

A major floodway system begins at Serpentine and follows the Loddon River north, running into an extensive system of wetlands located between Kerang and Swan Hill. Another important floodway in the region starts at the southern boundary of the catchment south east of Mitiamo and flows in a northerly direction into Kow Swamp. A smaller network of floodways originates in the eastern corner of the catchment at Rochester and follows the Campaspe River north to Echuca. Figure 2-8 illustrates the extensive network of floodways contained within the region. The region's floodways provide habitat for birds such as Brolgas, which can be found among water bodies near Durham Ox and the Kerang Lakes.

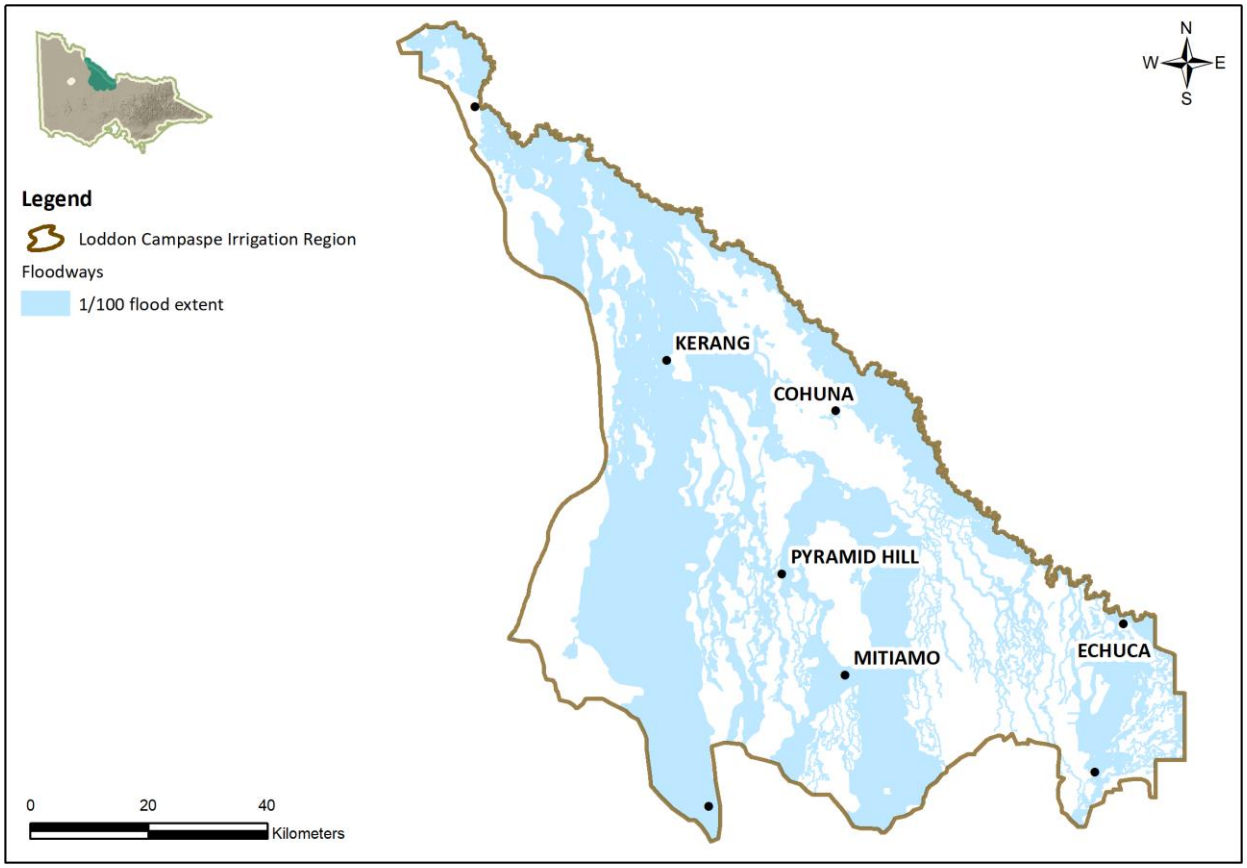

Figure 2-8: Floodways across the LCIR.

Wetlands

The region has an extensive network of more than 120 significant wetlands, ranging from freshwater to hypersaline (Figure 2-9). The wetlands vary from permanent water bodies to ephemeral wetlands and cover 39,796 ha or 5.6 per cent of the region's total land mass. While the majority of these significant wetlands are located on public land, there are a small number of wetlands on private land.

Of the 120 wetlands, 23 are listed under the *Ramsar Convention* as being wetlands of international importance.

The LCIR's wetlands now exist in a highly modified hydrological state. Their natural flooding cycles have been altered by roads, levee banks, irrigation infrastructure and, agricultural activity by blocking flow paths. The region's wetlands are now used for multiple beneficial uses and values. These include cultural heritage, irrigation storage, salt disposal storage, drainage water storage, recreation, tourism, or a combination of these.

The region also has 25 wetlands listed in the Directory of Important Wetlands in Australia and six wetlands that are listed on the *Register of National Estate*. These wetlands provide an important habitat for a variety of native fauna such as the Freckled Duck and the Growling Grass Frog.

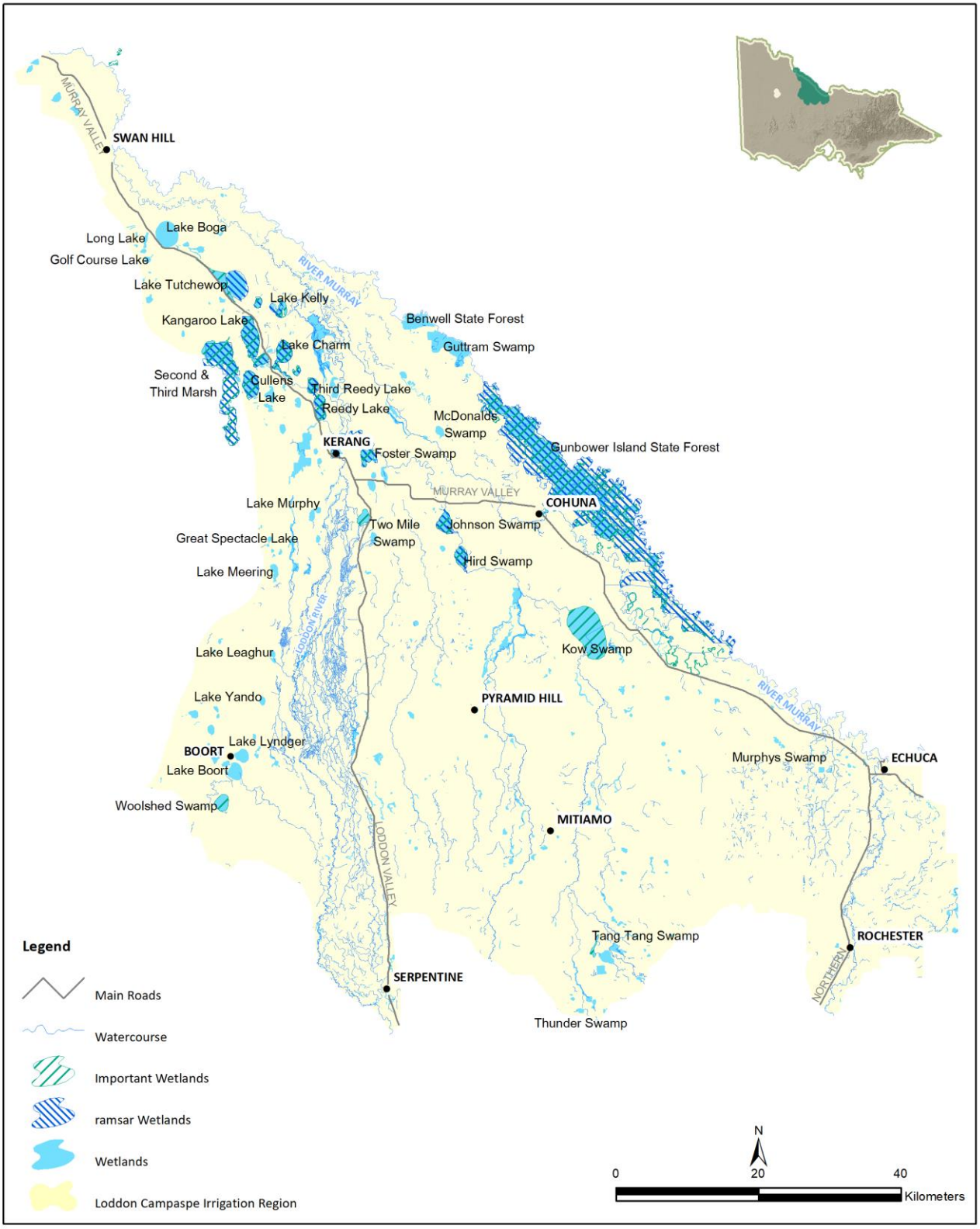

Figure 2-9: Significant wetlands of the LCIR.

The region's wetlands and waterways are highly valued due to:

- Significant areas of cultural heritage.
- A mix of wetland types including permanent open freshwater, permanent saline, semi-permanent saline and shallow freshwater marsh systems.
- The Kerang Wetlands Ramsar site, which has 156 species of indigenous flora – eight of which are listed as Threatened in Victoria.[11] This site also has more than 102 species of indigenous terrestrial fauna. Of these, 24 species are listed under the Victorian *Flora and Fauna Guarantee Act 1988*. In addition, 32 species listed as Threatened in Victoria have been recorded at the Kerang Wetlands Ramsar site with a further 17 species near-Threatened.[12]
- Gunbower Forest Ramsar Site. The Gunbower Forest, near Cohuna, lies on the floodplain between the Murray River and Gunbower Creek. 50 km long, and with a water frontage of 130 km, it is characterised by swamps, river red gums and – on the higher ground – box forest. The Victorian Government created the Gunbower National Park in June 2010. Gunbower Forest is also one of Australia's 53 Ramsar-listed sites, where numerous varieties of waterbirds are a feature. Gunbower Forest supports a diversity of native animals (including kangaroos, emus, goannas, possums and snakes) and 160 bird species.
- Wetlands include the presence of Murray Hardyhead *(Craterocephalus Fluviatilis)* which is considered Threatened under the *Environmental Protection and Biodiversity Conservation Act 1999*.
- Migratory birds listed under the Japan Australia Migratory Bird Agreement (JAMBA), China Australia Migratory Bird Agreement (CAMBA) and Korea Australia Migratory Bird Agreement (KAMBA) are particularly abundant and diverse across the region.

2.3.6 Biodiversity

Much of the biodiversity in the LCIR is associated with wetlands and waterways on the floodplain. Wetlands underpin the environmental values of the region. The main wetland types in order of value are:

- Shallow freshwater marsh
- Deep freshwater marsh
- Permanent saline
- Semi-permanent saline
- Permanent open freshwater
- Hypersaline lakes.

The region contains a mixture of these wetlands but is overrepresented in the last two types, which have lower value. Wetlands and watercourses that are part of the regulated irrigation system are generally permanent open freshwater systems that are likely to remain in their current condition and improvements in biodiversity are limited by lack of flow variability.

[11] Victorian Flora Information System Department of Sustainability and Environment, 2003b.

[12] Atlas of Victorian Wildlife, Department of Sustainability and Environment, 2003a.

1,367 native flora and fauna species have been recorded across the region, but only 12 per cent of the region's original native vegetation remains. Habitat loss, fragmentation, salinity, altered flooding regimes, declining water quality, urban development, agricultural activities, inappropriate recreation, pest plants and animals, changes to fire regimes, and climate change have all impacted upon the extent and health of the region's native vegetation.

The region supports 978 species of remnant vegetation. Fifteen per cent of these native species of flora is listed as being rare or threatened.[13] The Plains Grasslands, which dominated the landscape prior to European settlement, now covers only two per cent of the region. Similarly, the Plains Woodland now covers one per cent. The Chenopod Grassland and the Riverine Chenopod Woodland also cover just one per cent. Pockets of remnant vegetation are found on private land and whilst this is highly fragmented across the landscape, they are still significant for maintaining biodiversity. Protecting these small remaining areas on private land is vital.

Adjacent to farmland are areas of remnant vegetation on public land. These include the Terrick Terrick National Park (3,880 ha), Koorangie Wildlife Reserve (3,254 ha), Leaghur State Park (1,522 ha); Wandella Flora & Fauna Reserve (956 ha); Gunbower Island State Forest (17,621 ha), Guttrum State Forest (1,151 ha), Benwell State Forest (561 ha) and Dartagook Wildlife Reserve (502 ha).

The region includes the largest ibis breeding colonies in Victoria, as well as numerous species listed under International Migratory Birds agreements. Species include the Eurasian Coot; Grey Teal; Freckled Duck; Blue-billed Duck; Pink-eared Duck; Pacific black Duck; More Duck; Great Cormorant; Little black Cormorant; Little red Cormorant; Little Bittern; Great crested Grebe; Hoary headed Grebe; and the Australian Shelduck. The region's lakes act as refuges for waterbirds during drought.

Ecosystems containing many different species are resilient, as they can reorganise after disturbances. Building the resilience of ecosystems by sustaining biodiversity and ecological stocks or processes will allow ecosystems to adapt and self-organise as circumstances change. However, many of the connections between natural habitats have been severed by changed land uses, leaving some habitats isolated within a matrix of farmland, urban land and other altered areas. Establishing biolinks and improving ecological connectivity will increase the potential for plants and animals to disperse, recolonise and adapt to climate change. Biolinks are broad geographic areas identified for targeted action to increase ecological function and connectivity.

The Plan encourages land managers to be active in their role as environmental stewards. The plan puts systems and processes in place to support farmers and to safeguard the health of the natural environment through a mixture of information, incentives and regulations. Farmers will be encouraged to incorporate environmental objectives into their farm plans to enhance regional biodiversity values. Through improved environmental management and the adoption of sustainable practices, farmers can increase the resilience and long-term productivity of farm ecosystems.

[13] (CMA, North Central 2011)

2.3.7 Community

The LCIR has been strongly influenced by proximity to the Murray River, with all the larger towns - Echuca, Kerang and Swan Hill - located on or near the river. The location of the smaller inland settlements is influenced by the river crossings and railways for the collection of grains and other agricultural produce. The region's 2016 population was approximately 53,000[14] (ABS 2016). The biggest increase in population has occurred around Echuca – about a 50 per cent increase from 1981 to 2006. Almost 70 per cent of the regional population is classified as urban, but the largest industry providing employment is agriculture. This employs more than 5,500 people, with irrigated agriculture generating around 4,000 jobs on farm (Table 2-4).

The region offers a wide range of lifestyles – rural, small town or farming environments and has excellent facilities, services and amenities for business, industry and the community. The region has high amenity values and is a drawcard for tourists who come for the excellent food and wines, and recreational facilities on the Murray, Loddon and Campaspe rivers, and associated lakes and creeks. Recreational water use is expanding with growth and tourism but can be threatened by blue green algae and low waterbody levels.

Table 2-4 Regional employment ABS 2016 (Not all of the Rural City of Swan Hill or Campaspe Shire is in the LCIR)

ABS data	Campaspe	Gannawarra	Loddon	Swan Hill
Agriculture, Forestry and Fishing	13.3%	24%	35.5%	17.6%
Mining	0.5%	1.1%	0.7%	0.3%
Manufacturing	12.4%	6.4%	7.5%	7.7%
Electricity, Gas, Water & Waste Services	1.4%	2%	0.8%	0.9%
Construction	7.9%	7.3%	4.4%	6.5%
Wholesale trade	2%	2%	2.1%	2.8%
Retail trade	10.4%	10.4%	6.6%	10.3%
Accommodation and food services	7.1%	4.4%	3.3%	6.8%
Transport, postal and warehousing	3.8%	4.1%	3.6%	4.3%
Information media and telecommunications	0.6%	0.4%	0.4%	0.6%
Financial and insurance services	1.3%	1.2%	1.2%	1.6%
Rental, hiring, & real estate services	0.9%	0.5%	0.3%	0.6%
Professional scientific & technical services	3.2%	2.8%	1.8%	3.1%
Administrative and support services	2.2%	1.8%	1.9%	2.8%
Public administration and safety	3.7%	5%	4.4%	4.5%
Education and training	6.8%	5.6%	6.2%	8.3%
Health care and social assistance	13.4%	11.9%	11%	11.6%
Arts and recreation services	1.2%	0.9%	0.7%	1.1%
Other services	4%	3.5%	2.1%	3.7%
Total persons employed (no.)	**15,950**	**4,404**	**2,838**	**8,568**
Total for all shires - all industries	**31,760**			
Agricultural jobs	2,121	1,057	1,007	1,508
less non GMID/dryland estimated	100	100	500	750
GMID estimated jobs	2,021	957	507	758
Estimated irrigation farm jobs	**4,243**			

[14] 7,516 Loddon plus 10,549 Gannawarra plus estimated 80% of 20,584 Swan Hill plus estimated 50% of 37,061 in Campaspe

3 Context for the new Plan

3.1 Achievements of the previous Land and Water Management Plan

The previous Plan was broad in scope and covered activities now covered in separate strategies under the RCS, such as Floodplain Management, Sustainable Agriculture, Soil Health, Environmental Flows and River Health.

Figure 3-1 below illustrates the program logic of the previous LWMP.

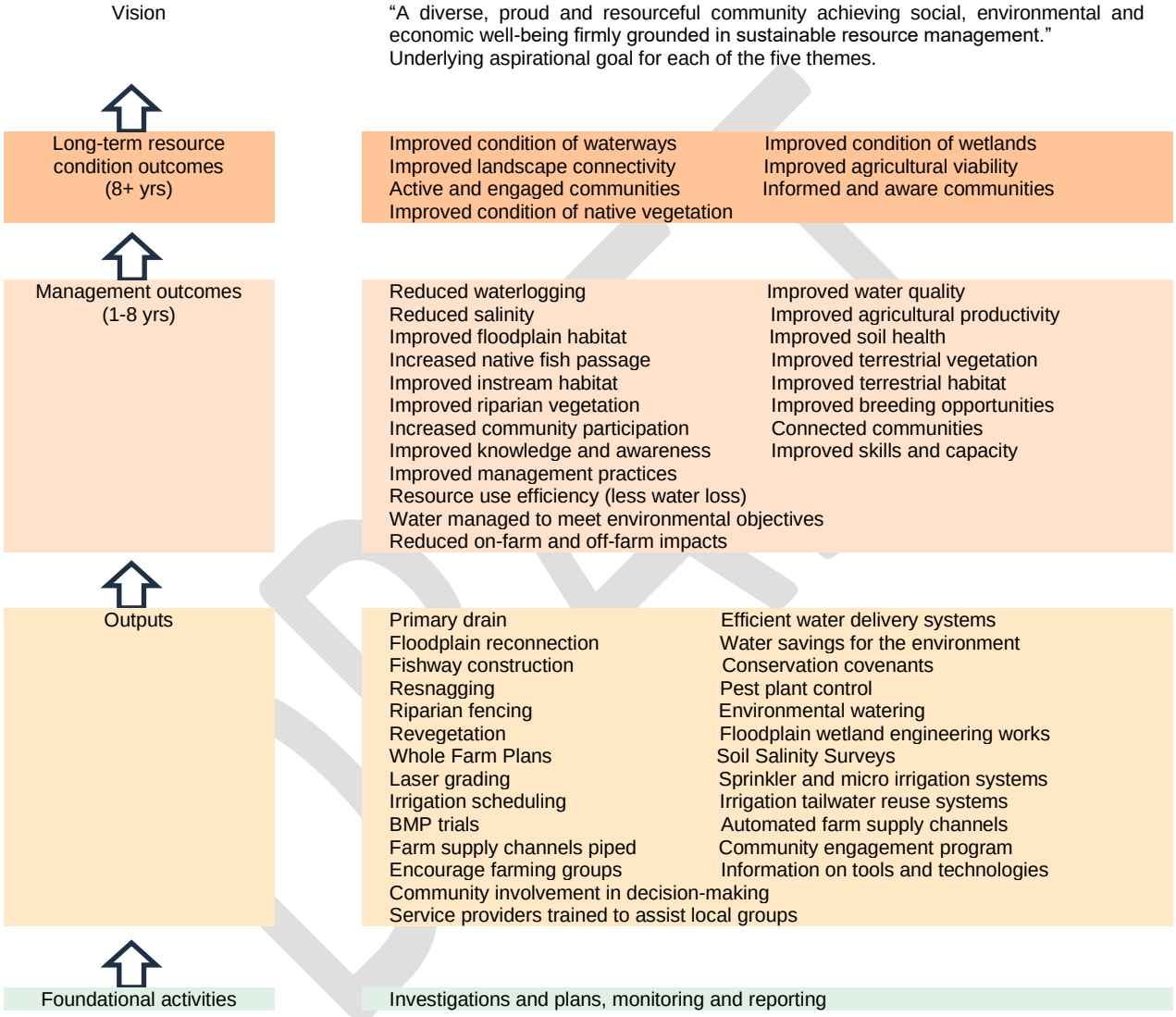

Figure 3-1: Program logic for 2011 LCIR LWMP - relationship between outputs and outcomes

In 2017 the initial LWMP was reviewed. The review found:

- Substantial progress implementing the management activities intended under the Plan. Of the outputs that were reported on:
  - 6 out of 10 water management outputs had at least 60% of intended progress achieved
  - 9 out of 11 biodiversity enhancement outputs had at least 60% of intended progress achieved
  - 4 out of 9 land management outputs had at least 50% (approx.) of intended progress achieved
  - 5 out of 7 community capacity outputs had all intended progress achieved
  - 14 out of 16 planning and development outputs had all intended progress achieved.
- Progress against most (18 out of 20) management outcomes intended 1-8 years after implementation.
- Progress regarding the long-term resource condition outcomes (intended >8 years after implementation), with overall improvements detected in waterway condition, agricultural viability and community capacity.
- Issues exist with recording and extracting management output data. Information availability varies for management outcomes and long-term resource condition outcomes.

The review also identified several areas where the current LWMP could be improved:

- Clarification regarding scope and purpose. There is strong support for community engagement and sustainable agriculture being a core focus of the Plan. Having two separate, but linked, documents may be one option to achieve the balance needed between detailed, integrated natural resource management (NRM) and simplicity for reporting purposes.
- Vision and aspirational goals – retain the current vision and aspirational goals, but amend to incorporate cultural aspects, maintenance requirements, Monitoring Evaluation Reporting and Learning (MERL), and the need for an adaptable and flexible community.
- Planning framework – include a simple and regularly updated planning document hierarchy to illustrate the relationship between the LWMP and other North Central CMA plans. This would improve planning cohesion, transparency and understanding of how management activities fit together and contribute towards “big picture” aspirational goals.
- Asset based approach – identify the spatial assets that are a priority for management. Where possible, these should be aligned with the priority assets already identified in existing North Central CMA plans (that include the LCIR in their area of influence).
- A summary of how the 10 primary threats identified in the previous LWMP have changed since 2011 and how the LCIR LWMP should respond is provided in Table 3-1.
- New threats – the review identified three new threats to assets within the LCIR for inclusion in the list of primary threats when the Plan is updated – recreational water use and demand, loss of cultural services and access to natural resources and existing instream barriers.
- Management Action Targets (MATs) – amend targets including metrics where required. Focus on reducing the number of MATs (77), as part of the next update.
- Resource Condition Targets (RCTs) – streamline the number of targets (46)
- Implementation – Describe the partnership arrangements and the roles and responsibilities of key stakeholders in relation to delivery of ongoing management activities. Use property planning tools better to achieve outcomes intended under the LWMP, on private land.

These recommendations have been considered in the preparation of this draft Plan.

Table 3-1: Changes in the primary threats to natural assets and LCIR LWMP implications

Threat	Trend since 2011	Drivers of change	Implication for LCIR LWMP
1. Climate change	Increasing	Global climate drivers	Remains a primary threat. Latest climate projections and impacts should be included. Focus management on mitigation activities where available (e.g. to manage increases in other threats) and ensure alignment with the North Central Climate Change Adaptation and Mitigation Plan and other relevant planning documents.
2. Salinity	Fluctuating	Climate change, on-farm WUE, Connections Program, water trade, land use change, groundwater pumping	Remains a primary threat due to risk post wet periods. Ensure management activities reflect direction of latest policies and plans, e.g. BSM2030.
3. Flooding of a floodway	Variable – increase overall with reductions in specific locations	Climate change, waterway maintenance, works on regional drains and levees, buy-back of land, ongoing development controls, activities under strategies, studies and plans	Remains a primary threat but is also beneficial to some assets. The 2010/11 flood event, latest flood management activities and implications (both positive and negative) for assets should be included. Focus management on protecting negatively impacted assets and promoting flooding of positively impacted assets. Ensure alignment with the Victorian Floodplain Management Strategy, Rochester Flood Management Plan and Echuca Flood Study.
4. Habitat loss and fragmentation	Increasing	Climate change, “extinction debt”	Remains a primary threat. Relevant information from recent strategies and plans should be included, e.g. RCS, North Central Climate Change Adaptation and Mitigation Plan. Ensure management activities align with the Native Vegetation Plan.
5. Declining water quality	Variable concentrations, loads fluctuate with flows	Climate change, improved irrigation drainage management	Remains a primary threat. Focus irrigation drainage management on farm measures and ensuring that natural drainage courses are not blocked, in line with Water for Victoria (DELWP 2016). Align broader catchment management activities to improve water quality with other relevant plans, e.g. RCS, North Central Waterway Strategy.
6. Fire	Increasing	Climate change, higher fuel loads in forests receiving environmental water	Remains a primary threat. Ensure management activities reflect direction of latest policies and plans, e.g. Mallee and Murray Goulburn bushfire risk landscape (BRL) and associated strategic bushfire management plan.
7. Pest plants and animals	Increasing	Climate change	Remains a primary threat. Ensure management activities reflect direction of latest policies and plans e.g. North Central Invasive Plants and Animals Strategy.
8. Farm dams and afforestation in the upper catchments	Increasing	Climate change	Remains a primary threat. Assess periodically to identify new information.
9. Water reform policy and land use change	Increasing	Climate change, water trade, Basin Plan	Remains a primary threat to the viability of the irrigation sector. Information on the latest reforms and changes should be included, e.g. Basin Plan.
10. Social change	Increasing	Market drivers, water trade, Basin Plan, farm succession	Remains a primary threat.

3.2 Feedback from initial consultation

As part of the development of the new plan the North Central CMA engaged Leanganook Yarn to undertake independent consultation with stakeholders to identify the land and water management issues that were of concern. During March 2019 focus group meetings were held in Pyramid Hill, Cohuna, Swan Hill and Boort and there was also an agency focus group meeting in Huntly.

As would be expected a range of issues was raised at the meetings, some of which have a broader focus than the remit of a LWMP as defined by the Victorian Government's guidelines and the investment priorities for sustainable irrigation.

Findings and analysis from the focus group consultation has been documented in the Leanganook Yarn report. In Appendix 1 we have categorised these findings and have provided a suggested response about how these may fit in the new LWMP. The broader NRM issues that were raised have been documented in Appendix 2. It is recommended that the broader issues be considered by the North Central CMA in the renewal of the RCS and its other sub-strategies.

In addition to Leanganook Yarn's focus group report, RMCG staff attended several focus group sessions and recorded irrigation specific issues and actions that could be considered in the new LWMP. A list of these is provided in Appendix 3.

The following provides a summary of the key directions from the consultation.

Integrated catchment management

A common theme throughout initial consultation was to take an integrated approach to implementation of the new LWMP. This includes better integrating:

- Delivery of RCS sub-strategies.
- With other irrigation related programs such as the GMW Connections Project and Transformation Program.
- With local councils on approvals for earthworks and drainage works.

"There needs to be better synchronisation between agencies, for example with GMW to manage flood regimes better, and running joint field days with multiple activities and angles." ~ Leanganook Yarn consultation report

"The CMA needs to work to ensure the involvement of council in the LWMPs, so they really understand it and embrace the plans." ~ Leanganook Yarn consultation report

Natural resource management priorities

LWMPs have traditionally focused on managing NRM issues related to the impacts of irrigation such as salinisation and waterlogging of land and water and nutrification of waterways. Although these issues must continue to be managed, they were not necessarily the most important issues raised in initial consultations. The most important NRM issues raised were the management and/or improvement of:

- Biodiversity and vegetation corridors.
- Pest plants and animals (PPA).
- Private wetlands.
- C and D class soils following the cessation of irrigation.

"There is a need for further work on organising groups to create more connected landscapes – with public and private biodiversity corridors and refugia integrated into the productive farming landscape." ~ Leanganook Yarn consultation report

"Agencies need to run better integrated programs on pest plants and animals (PPA)." ~ Leanganook Yarn consultation report

"The C & D class land is going to be completely drained, and this is untenable." ~ Leanganook Yarn consultation report

"Farmers should be recognised and valued as environmentalists and the expansion of environmental outcomes, can undertake real management, stewardship payments, tie this into the business model, support for covenants, wetlands on private land etc." ~ Leanganook Yarn consultation report

These issues won't necessarily be funded by DELWP's Sustainable Irrigation Program (SIP), traditionally the major funder of LWMP planning and implementation activities. There are other RCS sub-strategies that directly address these issues, including:

- Native Vegetation Management Plan
- Waterway Management Strategy
- Invasive Plant & Animal Strategy.

Therefore, the new LWMP must signpost opportunities to manage and improve these issues and ensure these are communicated to the relevant program managers to pursue. One way to do this would be through a revised whole farming planning program.

Legislation, regulation and standards are also important considerations driving NRM issues. These matters are discussed in Section 3.4.

On the ground people and on-ground action

A priority from numerous focus group sessions was to ensure the bulk of funding leads to more people on the ground and more on-ground action, not more planning or people in offices. This is a challenge for all programs and one that the new LWMP must make a priority. From a practical perspective for the LWMP this probably translates to more extension/training staff interacting with landholders more often.

"You have to have a local agency rep to coordinate this (on the ground) though - 'you need a face at the end of the phone' – needs joint action with community and agencies." ~ Leanganook Yarn consultation report

Growing the region culturally and economically

The rapid changes in climate, water availability and cost, water trade, commodity prices and enterprise type are all putting pressure on communities, irrigated agriculture and the economic viability of the region. There is also a growing awareness of the importance of the region's cultural heritage and the need to work with Traditional Owners and Aboriginal Victorians to understand and protect it. Initial feedback is that the new LWMP must prioritise improving the economic future of the region and incorporate Traditional Owner and Aboriginal values and uses of water in decision making about water. The CMA and its partners are potential leaders on these matters. These issues are broader than the new LMWP, but the Plan must contribute towards them.

"[There is] desire to engage with Aboriginal people and appropriately protect aboriginal heritage." ~ Leanganook Yarn consultation report

One way the new LWMP can do this is to deliver two-way education programs that inform practical actions that can be implemented by landholders. Those implementing the LWMP should be learning from landholders and adapting right throughout its implementation, not just when developing it. Potential topics raised during consultation included:

- Understanding the water market.
- Understanding GMW's Connections Project and Transformation Program and opportunities they present. Also proposed changes to delivery shares and other initiatives.
- Information materials for new landholders.
- Continuation of Future Farming workshops.
- Continuation of Plan 2 Farm.
- Cultural heritage training in the context of changes to farm infrastructure and management.
- Updates on changes to irrigation related trends (Andy Macalister's work).
- Native vegetation protection and improvement.

Whole farm planning (WFP)

WFP is possibly the best long-term success story of the LWMP implementation. Community feedback indicates the WFP program is well regarded because it helps improve farm productivity and provides an opportunity for agency staff to work directly with landholders. The program enables agency staff to see practical ways to integrate RCS programs and supports integration of on and off farm NRM outcomes. It is important that the WFP program continue to be supported, improved and potentially increased in scope. For example, it could:

- Maintain and improve links with the GMW Connections Project and Transformation Program.
- Be broadened to include improved advice/referrals/modules on biodiversity, native vegetation, cultural heritage, riparian zone fencing and management of private wetlands.
- Adapt to service hobby and boutique farms.
- Build cooperate arrangements with agencies with regulator responsibilities, including local government and the EPA.

"Whole Farm Planning is strongly supported. The WFP redesigned from 100 bays down to 22. 'I can live in town and not sleep by the Dethridge Wheel'. WFP has been very good and needs to continue." ~ Leanganook Yarn consultation report.

3.3 Changing water availability and demand

The region is part of the southern connected Murray-Darling Basin (sMDB) (Figure 3-2) and the amount of water available to the GMID is highly influenced by the water available in the sMDB and trade between industries. Since the 1990s when irrigation use across the sMDB was at its peak, the regional changes have been:

- SA Riverland region, mostly horticulture, has expanded[15], but more slowly than the Victorian Mallee.
- Victorian/NSW Mallee region, which is dominated by horticulture, has expanded its water use significantly, in recent years this has been driven by almonds.
- NSW Murrumbidgee has maintained its High Security (HS) water use on horticulture but decreased its General Security (GS) water use. However, the decrease in water use has been offset by the expansion of cotton which uses less water per ha than the rice it has replaced.
- NSW Murray Irrigation has significantly reduced its water use as the rice industry responded to less water.

[15] While horticulture has expanded other forms of irrigation such as dairying on the Lower Murray has declined. Total diversions by SA have declined.

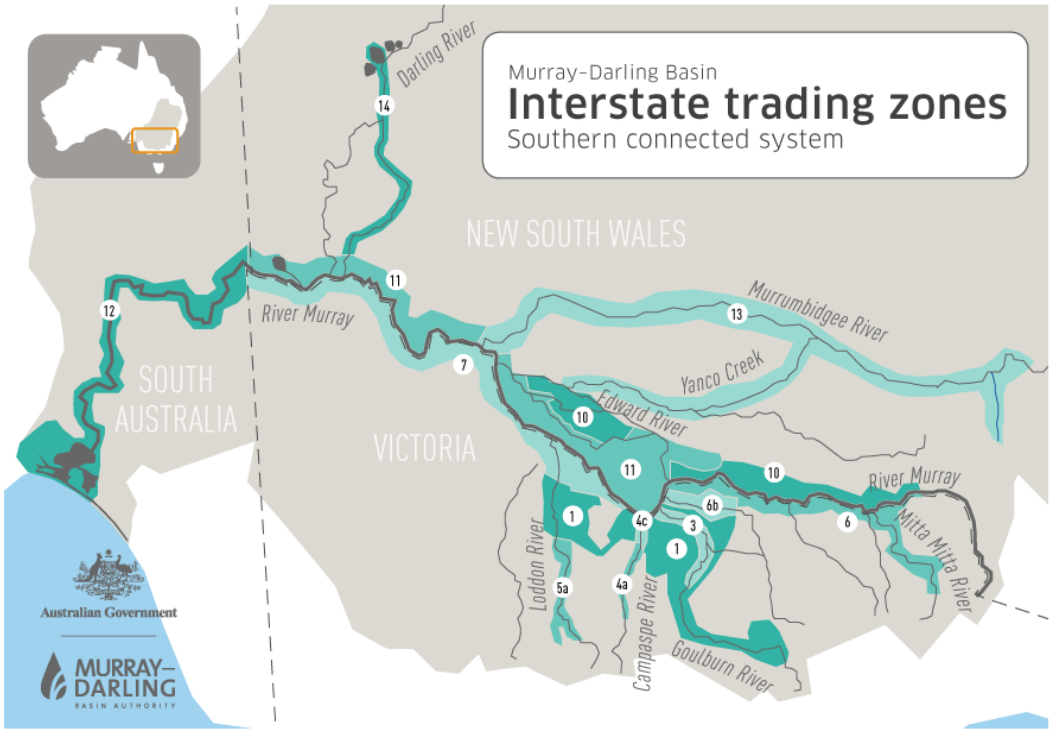

Figure 3-2: southern connected Murray Darling Basin (source: MDBA)

The GMID, including the LCIR, has significantly reduced its water use with a large decline in water use by the dairy industry and mixed farming. As part of the Basin Plan there has been 417 GL of the buyback and farm efficiency High Reliability Water Share (HRWS) entitlements coming directly from the GMID, and additional indirect back trade of water out of the GMID to other regions where water was recovered. This has resulted in a 500 GL/y reduction in water use in the GMID.

Over the past twenty years the GMID as a whole has had a net decline in water use of 1,000 GL/y (almost 50%), with half of this due to the Basin Plan and the other 500 GL/y due to water trade, climate, carryover, new reserve policies and earlier water recovery such as the Living Murray.

Torrumbarry is particularly exposed because the expansion of horticulture, once fully mature, now exceeds the privately held volume of Murray Zone 7 HRWS available downstream of the choke and relies upon trade from other zones, especially the Goulburn. The August 2019 restrictions to protect the health of the lower Goulburn from high flows will restrict the volume available. The next below 100% allocation year poses a number of challenges for the region, such as:

- Deliveries will be much lower than during the last drought, so can GMW run the system with such low deliveries.
- Low water use in drought years will place increased pressure on GMW to operate the delivery system in new ways that minimise losses. A more flexible GMW operational plan for its delivery system may be required.
- The opportunity to enhance security of supply in drought. Can additional operational losses be converted to allocation by reducing supply to strategically targeted areas with high losses.
- Infrastructure costs are largely fixed. The GMID faces a quandary in that if delivery share charges were reduced for dryland (previously irrigated land) then it would mean that charges for irrigated land would rise, which may act as a barrier for irrigation expansion and irrigation competitiveness.
- Risk of further environmental water recoveries. For example, the Basin Plan's Up-water program proposes removal of an additional 450 GL of water from the southern Basin. This is expected to reduce deliveries in the GMID and the LCIR, by around 20%,

- Further removal of water and then drought could threaten parts of the GMID and result in a scenario like that in the Campaspe Irrigation District, where irrigators voted to close down the system in the last drought.

At the same time the GMID has been a net purchaser of water in average and wet years, so maintaining and enhancing access to the sMDB water market so the region has the ability to expand its production and buy water from other areas (NSW) is important.

The area of irrigation and total water use in the region increases when water prices are low and more affordable but decreases when water prices are high. Water prices are influenced by the total water available in the sMDB, which is largely influenced by NSW general security allocations, which are more variable than Victorian HRWS allocations. The community has also expressed concern about the influence of speculators and investors on the market, especially since water was unbundled from land so that non irrigators could trade water.

3.4 Policies, priorities and guidelines

3.4.1 Legislation

Land and Water Management Plans

Victoria's framework for the integrated management of catchments is established under the *Catchment and Land Protection Act 1994* (the *CaLP Act*). CMAs are responsible for the integrated planning and coordination of land, water and biodiversity management in each catchment and land protection region. RCSs provide the primary integrated planning framework for the management of land, water and biodiversity resources. They provide high level guidance associated with both dryland and irrigation areas. They seek to integrate community values and regional priorities with state and federal legislation and policies.

In Victoria's major irrigation districts, CMAs prepare and implement regional LWMPs to reduce the environmental and third-party impacts of irrigation and improve farm water use efficiency. LWMPs are critical to ensuring governments and government agencies can demonstrate they are managing the impacts of irrigation consistent with legislation and regulation. As such the new LWMP must include activities that implement:

- Relevant clauses of the State Environment Protection Policy (Waters)
- The Basin Salinity Management 2030 strategy (BSM2030)
- Salinity and water quality aspects of the Basin Plan.

And comply with:

- *Water Act 1989* obligations, especially those relating to water use licences, e.g. irrigation development guidelines, annual use limits (AULs) and review of water use objectives and standard and specific conditions. This includes Section 51 take and use licences and is partially implemented through the application of new irrigation development guidelines.
- Schedule B (Salinity Management) of Schedule 1 of the *Water Act 2007* (Cth).
- *CALP Act 1994* – under the Statement of Obligations (2018) for the Act CMAs are required to develop and coordinate the implementation and review of LWMPs (clauses 23.1 and 23.5)
- New (October 2018) State Environment Protection Policy (Waters) requirements for LWMPs:
  - water quality targets
  - clause 35 Management of saline discharges
  - clause 36 Management of irrigation drains and channels on receiving waters

  - clause 37 Responsibilities of irrigation drains
  - possibly cooperation on dairy effluent management systems.
- Guidelines/planning reforms for intensive livestock developments.

Water use licences

Section 64L of the *Victorian Water Act 1989* specifies that a person requires a water use licence to use water on land for irrigation purposes if the water is taken from a declared water system, i.e. from the Murray or Goulburn systems. The license authorises the use of water from a regulated system for the purposes of irrigation on the land specified under that license. It sets out the conditions for use, such as how much water can be used on the specified parcel of land in a single irrigation season. This is called the annual use limit or AUL.

New development requires several approvals to be met before a new license can be issued. When issuing a new license under 64M of the Act GMW is required to consider:

- Impacts the proposed use may have on other persons or the environment (in particular water logging, salinity and nutrient impacts);
- Whether or not the proposed use can meet Standard Water Use Conditions that would apply to the license, if granted;
- Any comments received from the CMA, if the application was referred to the CMA and comments received within 30 days of the referral; and
- Any other matters the Minister considers relevant to that corporation.

A Ministerial Determination sets out five Water Use Objectives that water use licences must meet. These are conditions for:

- Managing groundwater infiltration
- Managing disposal of drainage
- Minimising salinity
- Protecting biodiversity
- Minimising cumulative effects of water use.

New Irrigation Development Guidelines provide a guide for government agencies to process applications for new irrigation development. Such as:

- The roles and responsibilities of agencies.
- The communication protocols between agencies.
- The relevant legislation that underpins the approval to issue new planning approvals, works licences, water-use licences or take-and-use licences with site-specific conditions (including AULs) that reflect the outcomes of the approvals processes.
- The approval processes used by agency staff.
- The development standards required to manage impacts on the environment and other values.
- Linkages to other environmental or cultural heritage protection measures and agencies.

Basin Salinity Management Strategy 2030

BSM2030 provides guidance and support to local communities and governments within the Murray-Darling Basin to:

- Ensure salinity levels in the shared water resources of the Murray-Darling river system are managed appropriately to ensure the protection of the environment while observing economic, cultural and social values.
- Manage salinity in the shared water resources through agreed works and measures introduced by partner governments with their local communities.
- Monitor and assess salinity levels and salt loads across the Basin to identify salinity risks and to support the implementation of cost-effective measures to protect the shared water resources and local assets.
- Identify salinity risks and, where appropriate, contribute to the maintenance of appropriate salinity levels for the protection of local assets and downstream water resources through water resource plans, land and water management plans or other relevant statutory instruments.
- Facilitate continuous improvement and provide assurance that flow management that affects the shared water resources is collectively undertaken in ways that have regard to the Basin Plan salinity targets.
- Optimise the benefits of salinity control for economic, environmental, cultural and social values across the Basin.

Victoria remains compliant with Schedule B to the Murray-Darling Basin Agreement (Schedule 1 to the *Water Act 2007*). Victoria's net balance of salinity credits as of 30 June 2017 is -32.33 EC (modelled at Morgan in SA) or $6 million/year which remain unused. Within the North Central Region the accountable actions on salinity Register A as of September 2016 were:

- Barr Creek Catchment Strategy credit -7.7 EC (Victorian measure)
- Church's Cut decommissioning credit -0.3 EC (Victorian measure)
- Pyramid Creek Salt Interception Scheme credit -0.6 EC (This is a joint works & measures shared by all jurisdictions)
- New operating rules for Barr Creek pumps credit -0.9 EC (This is a joint works & measure shared by all jurisdictions)
- Tragowel Plains Drains debit of +0.2 EC (Victorian measure)
- Kerang Lakes/Swan Hill Salinity Management Plan debit of +1.6 EC (Victorian measure)
- Campaspe West debit of +0.3 EC (Victorian measure)
- Woorinen Irrigation District Excision debit of +0.8 EC (Victorian measure)

Victoria is progressing work to assess new Accountable Actions. This includes an upgrade of the Kerang Lakes Model to enable estimation of the salinity impact of the Victorian Mid-Murray Storages, salinity impacts of the GMW Connections Project and a preliminary salinity impact assessment of the Benwell drainage system. As mentioned in Section 2.3.4 there is potential to progress possible additional EC credits from the changes that have occurred in Barr Creek.

Murray-Darling Basin Plan

In 2007, the Australian government assumed a greater role in water management across the Murray-Darling Basin when it passed the *Commonwealth Water Act.* This Act integrated the management of water resources, including new limits on how much water can be taken from the Murray-Darling Basin's surface and groundwater systems. It established the independent Murray-Darling Basin Authority (MDBA), which was charged with preparing a Basin Plan.

Under the Basin Plan, the volume that can be diverted is called the sustainable diversion limit (SDL) which is calculated as a long-term average. Implementation of the SDL has required government buy backs of water entitlements from irrigators and investment in water saving measures both on fand off-farm.

Governments have agreed that a long-term average annual volume of 2,750 gigalitres (GL) of water for the environment would be recovered across the Basin. Victoria's share is a long-term average annual volume of 1,075 GL, which is about 40% of total Basin water recovery.

The Basin Plan requires all states to prepare water resource plans. Victoria's North and Murray Water Resource Plans, prepared by DELWP, are relevant to the LCIR. They demonstrate how Victoria will meet the requirements of the Basin Plan (Figure 3-3).

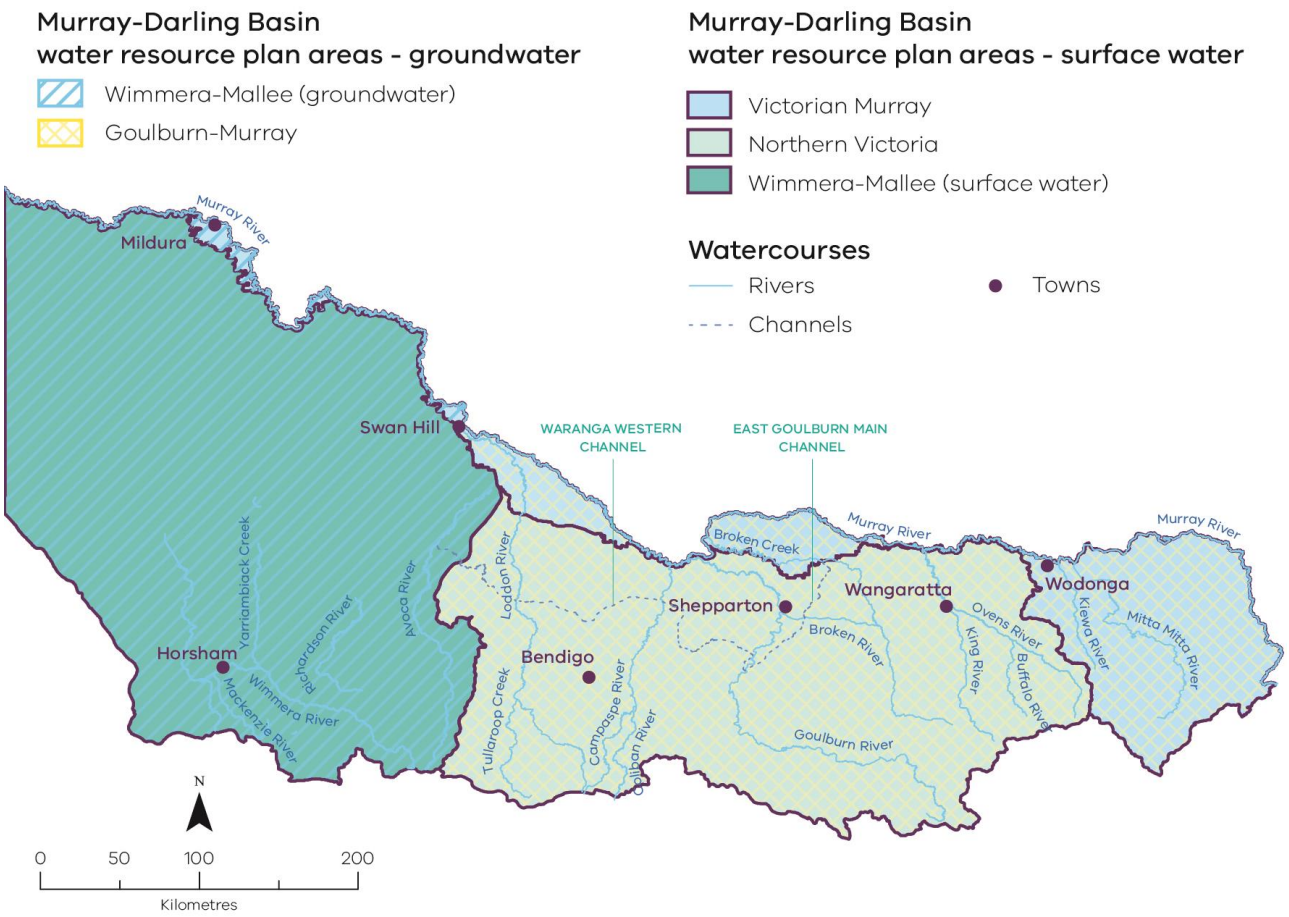

Figure 3-3: Victorian Water Resource Management Plan areas (map curtesy of the Department of Environment, Land, Water and Planning)

3.4.2 State priorities for irrigation

Sustainable Irrigation Program

The Victorian government's Sustainable Irrigation Program (SIP), administered and funded by DELWP, is the major investor in the LWMP.

SIP issues guidelines for the development of LWMPs that provide direction on the priorities, structure, development and content of LWMPs. This includes matters relating to government policy priorities, planning, incentives, regulations/standards, education and training, research and monitoring and drainage infrastructure development and operations. The Guidelines are designed to be flexible and allow for regional differences. However, opportunities to secure funding from the SIP will be increased if the broad expectations of the Guidelines are followed. The expectations of the SIP are for the LWMP to progress:

- **Planning:** with communities for irrigation policy and managing impacts, via the LWMPs including community, Aboriginal and recreational user engagement, strategic directions for drainage and input into relevant policy areas.
- **Incentives:** providing financial and technical support to irrigators to improve farm practice, including whole farm planning, farm irrigation works and other irrigation related projects.
- **Regulation/Standards:** setting and implementing requirements for managing irrigation impacts, including: Water Use Licences, Irrigation Development Guidelines, Basin Plan and BSM2030 requirements and salinity accountability (A and B Registers).
- **Education and Training:** building irrigator capacity to adapt to change and improve water use efficiency including: whole farm planning, extension programs, case management of irrigation development, cultural heritage training in the context of changes to farm infrastructure and management, active involvement of Aboriginal people, impacts of irrigation on recreational use, Aboriginal values are better understood and managed, climate change and adaptation.
- **Research and Monitoring:** measuring and improving the effectiveness of activities, including: innovation, new technologies, program evaluation, baseline conditions and trends over time and environmental asset conditions.
- **Drainage Infrastructure Development and Operations:** investing in construction, maintenance and operation of infrastructure to manage irrigation impacts such as: irrigation drainage channels, public groundwater pumps, cooperation across agencies with an Irrigation drainage memorandum of understanding (MOU).

Water for Victoria: Water Plan

Consistent with Water for Victoria the LWMP pursues the joint objectives of facilitating irrigated agricultural development while managing impacts on the environment and third parties. Specific actions that will need to be incorporated into the LWMP include:

- Action 4.4 – reduce barriers to change and support communities in irrigation districts.
- Action 4.5 – improve water delivery efficiency in irrigation districts including improved monitoring and reporting of farm water use efficiency (WUE).
- Action 4.6 – manage salinity, waterlogging and water quality including developing priorities for the Victorian Irrigation Drainage Program.
- Action 4.7 – manage irrigation development.
- Consideration of actions in Chapter 6 which include recognising and managing for Aboriginal values.

3.4.3 Draft Drainage strategy

The Draft Loddon Murray Irrigation Region Surface Water Management Strategy (L-MIRSWMS) was developed in 2018. It covers all drainage catchments in the Loddon Murray Irrigation Region, which covers the Torrumbarry Irrigation Area and the Loddon Valley Irrigation Area. It does not cover Rochester or any other of the Campaspe catchments, because these drainage catchments are covered by the Shepparton Irrigation Region Drainage Strategy that is overseen by the Goulburn Broken CMA.

The previous 2001 Surface Water Management Strategy required updating to match future drainage needs for irrigated land, given the significant regional change that has occurred in the last decade, in particular the large reduction in water used for irrigation.

The new strategy addresses the issue of surface water management from a 'whole of catchment' approach. This means the focus is not purely on implementing regional works and measures, but also includes on-farm actions that will minimise downstream impacts, through improving irrigation practices and better managing irrigation tailwater on farms.

The region is 510,000 ha and has a drainage network that covers 181,000 ha. This includes GMW drains, North Central CMA drains and community drains, but only the GMW drains have a formal rating base and maintenance program. There is around 138,000 ha classified as potentially needing drainage/undrained with the remainder being unclassified or classed as drainage not required.

The drivers for installing drainage in the original Strategy that was developed twenty years ago included less water logging, less salinity and opportunities to increase agricultural production. These drivers were amplified by higher water availability, a larger irrigation footprint, higher-than-average rainfall, high watertables and extensive salinity.

Implementation of the original Strategy has been delayed due to drier conditions, lower drivers for drainage and lower funding. The total irrigation water applied and the footprint of irrigation has approximately halved since peaking in the 1990s and this reduced the need for drainage, because:

- The irrigated areas at risk have reduced.
- The ability to relocate irrigated areas within farms away from risk areas has increased.
- The ability to relocate farms to unirrigated areas with drainage is now possible.

In 2013-14, a typical year for contemporary conditions, 44% of the region was not irrigated, 46% received less than 3 ML/ha/y, and 10% had more than 3 ML/ha/y. Of the 50,000 ha of high intensity irrigation that received more than 3 ML/ha/y, which is the area most at risk, 15,000 ha was classified as potentially needing drainage/undrained.

An examination of the rate of drainage following the January 2011 flood event indicates the undrained areas drained at a rate that was similar to drained areas. This indicates the remaining undrained areas have sufficient natural drainage or have private drains that are unmapped. An examination of regional trends in land use, irrigation intensity and drainage flows show that the risk of drainage problems developing is continuing to decline. Also, an economic analysis indicates that installing new drainage is not economic for the undrained areas in most of the Loddon Murray region.

Therefore, the revised drainage strategy proposes:

- The strategy should provide ongoing management arrangements for all existing drains. Declaring Drainage Course Declarations (DCDs) over existing North Central CMA drains and Community Drains is a suitable low cost solution for improving the governance of these networks. DCDs do not require rating and provide improved legal protection for maintaining a drainage line. The cost of removing unauthorised blockages is levied to (the) offending landholder(s) only. It is recommended that further discussions centre on existing community surface drains and North Central CMA drains being declared DCDs and that GMW become the responsible authority. GMW drains would continue under current arrangements.
- Farm reuse should be encouraged by extension and whole farm planning and incentives, targeting undrained areas, especially where there is unauthorised disposal to public land and to GMW channels.
- Overall the cost of constructing new drains in undrained areas is not justified by the benefits and there is potential for further decline in the irrigation area and this reduces the need and affordability of additional new drains. Therefore, new drainage should not be implemented unless there is a compelling case to demonstrate that the irrigation area is unlikely to reduce in that area and the new drains are viable and attractive for landholders.
- A lower priority is to investigate the practicalities of implementing DCDs on drainage courses that may exist in “undrained” areas. Undrained areas with a high level of benefit should be looked at initially. The economic analysis identified undrained parts of the Loddon, Barr Creek and Wandella Catchments as areas where DCDs may be economic.

3.5 Challenges and opportunities

The region has faced major challenges and has already adapted. Many of these challenges are ongoing and the ones that the LWMP seeks to address include declining water availability, potential re-emergence of salinity, poor water quality from farm runoff, floodplain management, incorporating cultural heritage values and access to natural resources for Aboriginal people and loss of terrestrial biodiversity.

The opportunities are to deliver public benefits by improving irrigation on private land through:

- **Enabling adjustment to changing water availability by improving water efficiency and regional productivity through irrigation system modernisation:** achieving a vibrant, productive and sustainable irrigation sector in Victoria depends on using water resources efficiently across all irrigation industries. This is integral for improving resilience to drought and climate change while continuing to adapt to water recovery and includes consideration of any expansion of irrigation and managing a changing irrigation footprint.
- **Creating more opportunity for the active involvement of Aboriginal peoples and communities:** by working with Traditional Owners the LWMP programs will be adapted to incorporate traditional knowledge and participation on an ongoing basis.
- **Protecting the health of waterways and maintenance of water quality:** by achieving reduced salinity and nutrient loads from irrigation to help protect the health of waterways. Managing uncontrolled surface run-off to minimise the risk of eutrophication of regional waterways.
- **Protecting land from salinisation and shallow watertables:** by reducing accessions into watertables this will reduce the risk of waterlogging and secondary salinisation of land, which occurs due to excess water from rainfall in conjunction with irrigation. Continuing to reduce soil salinisation and waterlogging will assist agricultural productivity and enhance environmental values.
- **Ensuring biodiversity is protected from any offsite impacts from irrigation:** This will be achieved through improved irrigation efficiency, ensuring natural assets are protected and enhanced in the whole farm planning process and by ensuring new irrigation development guidelines provide adequate environmental protection.

4 Framework for the Plan

4.1 Overall framework and program logic

The overall framework includes an aspirational goal that is supported by objectives and outcomes, targets to be achieved through the delivery of LWMP programs. This is illustrated in the program logic presented in Figure 4-1.

The LWMP vision l is ***"Using water for healthy, productive, sustainable irrigated food and fibre[16]"***

To achieve this, the plan needs to work towards the following long-term outcomes over the next 5-10 years:

- Sustainable, profitable, adaptive and innovative farming practices
  - Enabling adjustment to changing water availability by improving water efficiency and regional productivity through irrigation system modernisation: achieving a vibrant, productive and sustainable irrigation sector in Victoria depends on using water resources efficiently across all irrigation industries. This is integral for improving resilience to drought and climate change while continuing to adapt to water recovery and includes consideration of any expansion of irrigation and managing a changing irrigation footprint.
- Active involvement of Aboriginal peoples and communities
  - Creating more opportunities for the active involvement of Aboriginal peoples and communities: by working with Traditional Owners the LWMP programs will be adapted to incorporate traditional knowledge and participation on an ongoing basis.
- Protected and improved condition of environmental assets and values
  - Protecting the health of waterways and maintenance of water quality: by achieving reduced salinity and nutrient loads from irrigation to help protect the health of waterways and managing uncontrolled surface run-off to minimise the risk of eutrophication of regional waterways and the Murray River.
  - Protecting land from salinisation and shallow watertables: by reducing accessions into groundwater to reduce the risk of waterlogging and secondary salinisation of land, which occurs due to excess water from rainfall in conjunction with irrigation. Continuing to reduce soil salinisation and waterlogging will assist agricultural productivity and enhance environmental values.
  - Ensuring biodiversity is protected from any offsite impacts from irrigation: by improving irrigation efficiency, ensuring natural assets are protected and enhanced in the whole farm planning process and by ensuring new irrigation development guidelines provide adequate environmental protection
- An empowered and informed irrigation community
- Adoption of practices that achieve the above outcomes will depend upon having an empowered and informed irrigation community that engages with the Plan and drives positive change.

This, in turn, will require the following medium-term outcomes to be achieved over the next 1-5 years:

- More efficient and integrated irrigation (on and off farm).
- Improved on-farm irrigation, nutrient and soil management.
- Improved regional irrigation drainage infrastructure and management.
- Impacts of irrigation on salinity, biodiversity and water quality managed within agreed limits.

[16] The intent is to encompass all irrigated production, including the main irrigated land use of mixed irrigation, dairying, irrigated cropping, irrigated grazing, grass, hay, wool, beef, fruit, nuts, grapes, vegetables, nurseries and cut flowers.

- New and significant irrigation redevelopments are best practice.
- Increased community awareness and involvement in plan activities.
- Impacts of irrigation on other third parties are better understood and managed, e.g. recreation and users downstream.
- Aboriginal values are better understood and integrated into management decisions.

These outcomes are underpinned by the following themes planning and development; land management; water management; biodiversity management and community capacity.

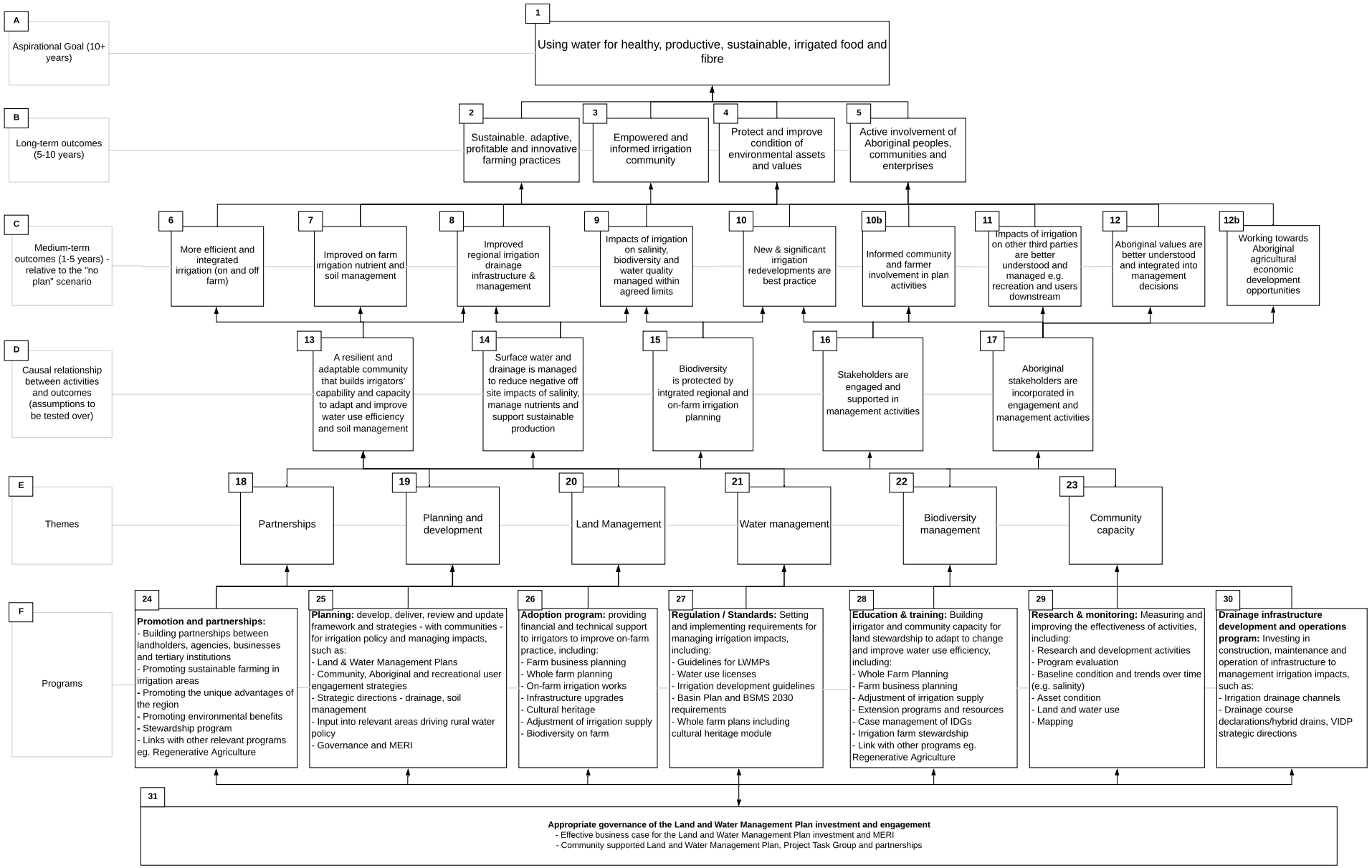

Figure 4-1: Proposed program logic that links the LWMP vision with the possible LWMP programs.

4.2 Causal relationships in the program logic

The long-term and medium-term outcomes in the LWMP require programs which:

- Achieve a more resilient and adaptable community that builds irrigators' capability and capacity to adapt and improve water use efficiency and soil management.
- Manage surface water and drainage to reduce negative offsite impacts of salinity, nutrients and supports sustainable production.
- Protect biodiversity by integrating regional and on-farm irrigation planning.
- Engage and support stakeholders in management activities.
- Incorporate Aboriginal stakeholders in engagement and management activities.

This means that management skills will be required to support the implementation of the plan under the themes of partnerships, planning and development, land management, water management, biodiversity management and community capacity.

Funding will also be required to implement the following proposed LWMP programs:

- Promotion and Partnerships
- Planning
- Adoption
- Regulation / standard
- Education and Training
- Research and Monitoring
- Drainage Infrastructure Development and Operations p

These proposed programs are further detailed in Section 5.

4.3 Adaptive management and measuring success

A community steering committee is in place to oversee the development of the LWMP. Once the Plan has been developed and approved then the steering committee should continue to oversee implementation of the programs.

The logic underpinning the LCIR LWMP is that if sufficient investment is attracted to implement programs and associated actions then, over the life of the plan, progress will be made towards change as measured by targets for medium- and long-term outcomes. The process for evaluation will be guided by a Monitoring, Evaluation, Reporting and Learning (MERL) plan which will include reporting against the objectives and targets listed in Table 4-1, Table 4-2 and Table 5-1.

Monitoring and reporting will be proportionate to the level of investment and be designed to support adaptive management. Annual, five yearly and end of life (10 year) reporting and review of plan implementation will be undertaken and shared with stakeholders.

The resources committed to the end of life reporting, review and improvement will be significantly greater than five yearly reporting, review and improvement which will again be greater than annual reporting. As part of an adaptive management approach it is expected that minor changes to how the plan is implemented will be made at the end of each year, with the possibility of more significant changes following the five-year review. If continuation of the program is required, the 10-year review would result in more significant changes again as part of plan renewal.

4.4 Targets

Quantitative targets will be developed for long-term outcomes, medium-term outcomes and programs listed in Table 4-1, Table 4-2 and Table 5-1. These targets will need to be defined for the amount of change the LWMP creates against the trajectory for what would be expected to happen without a LWMP, i.e. relative to the 'no plan' scenario. The difference being the expected plan outcomes.

Table 4-1 Proposed long-term targets

Long term outcomes (5-10 years)	Proposed targets for further development in the plan	Without plan 2030	With plan 2030	Expected plan outcome
Sustainable, profitable, adaptive and innovative farming practices	GL/y average water use. This reflects innovation, profitability and competitiveness with other Regions. Competition from horticulture and water recovery for environment are key challenges.	Expect 20% decline in 500 GL/y average use to 400 GL/y	Expect 10 % decline to 450 GL/y average use.	Additional 50 GL/y average use.
Empowered and informed irrigation community	Survey of irrigation community knowledge and awareness of issues and responses (could link to other existing surveys, e.g. Regional Land and Water Use Mapping in the GMID).	To be developed.	To be developed.	To be developed.
Protected and improved condition of environmental assets and values	Downstream water quality, Index of stream condition, index of wetland condition and measures of terrestrial biodiversity (ha and condition scores) Ha of improved riparian zone protection and management.	No change in trajectory.	Improve reginal biodiversity and environmental values and measures by 3% above trajectory.	Improve reginal biodiversity and environmental values and measures by 3% by condition.
Active involvement of Aboriginal peoples and communities	Levels of participation in LWMP programs.	No change	Traditional Owners and Aboriginal landholders are aware, knowledgeable, skilled and resourced to actively participate.	Traditional Owners and Aboriginal landholders are aware, knowledgeable, skilled and resourced to actively participate.

Table 4-2: Proposed medium-term targets

Medium term outcome (1-5 years)	Proposed targets for development	Without plan 2025	With plan 2025	Expected plan outcome
More efficient and integrated irrigation (on and off farm)	Production per ML increasing. Reduction in system losses (on & off farm).	No increase beyond expected ongoing efficiency improvements.	Additional $10/ML gross margin on 100 GL/y	Additional $10/ML gross margin on 100 GL/y
Improved on-farm irrigation, nutrient and soil management	Number and ha of updated whole farm plans.	Farm modernisation occurring without WFP standards.	17,500 ha of new WFP (3,500 ha/y for 5 years).	17,500 ha of new WFP (3,500 ha/y for 5 years).
Improved regional irrigation drainage infrastructure and management	Implement improved drainage management, e.g. number and ha of Drainage Course Declarations. Installed ha and ML of reuse systems.	No change to current status.	No. of sub-catchments & landholders engaged in the development of improved institutional arrangements.	No. of sub-catchments & landholders engaged in the development of improved institutional arrangements.
Impacts of irrigation on salinity, biodiversity and water quality managed within agreed limits	Meeting BSMS 2030 salinity targets. Meeting SEPP water quality targets.	No change.	Possible additional EC credits.	Possible additional EC credits.
New and significant irrigation redevelopments are best practice	100% compliance with standards in new irrigation development guidelines.	Low area of new development.	Additional area of development.	Additional area of development.
Impacts of irrigation on other third parties are better understood and managed e.g. recreation and users downstream	Monitoring of water quality and research into downstream impacts.	Salinity and water quality meet IDMOU targets.	Salinity and water quality below IDMOU targets.	Salinity and water quality below IDMOU targets.
Aboriginal values are better understood and integrated into management decisions	All agency staff and interested landholders undertake field based cultural heritage training. Cultural heritage module for WFP led and developed by Traditional Owners and Aboriginal landholders. Support DELWP's Aboriginal access to water for economic development program.	No change.	Traditional Owners and Aboriginal landholders are aware, knowledgeable, skilled and resourced to actively participate.	Traditional Owners and Aboriginal landholders are aware, knowledgeable, skilled and resourced to actively participate.
Informed community and farmer involvement in plan activities	Levels of participation in LWMP programs, No. per year, ha per year.	No participation.	250 active irrigators engaged with some form of program within the Plan.	250 active irrigators engaged with some form of program within the Plan.

5 Proposed programs

5.1 Overview of programs

Table 5-1 sets out the objectives, elements, targets and responsibilities for the proposed programs.

Table 5-1 Proposed programs

Program	Objective	Program elements	Program targets	Delivery Responsibility
Promotion and Partnerships	To coordinate, collaborate and work with industry programs, other CMA programs and other government programs. This will avoid duplication of effort and ensure a greater return on investment. Promoting stewardship of region. Undertake engagement with stakeholders. Understand and engage with the community on social impacts.	Develop stewardship program. Joint research, development and extension activities, e.g. field days, publications, trials. In instances where the opportunity is broader than the irrigation community this may be pursued by the Sustainable Agriculture Strategy or other North Central CMA Programs. Linkages to other programs identified by this Program, e.g. Regenerative Agriculture and Soil Health Action Plan (North Central CMA n.d.).	No specific targets have been developed for this program, as it will depend on the opportunities outside of the LWMP.	North Central CMA LWMP officer. Mutually beneficial partnerships with a range of organisations will be developed to assist in delivering the LWMP programs.
Planning	To ensure the programs remain relevant to the operating environment of the LCIR, including social impacts.	Governance arrangements and a transparent and defendable MERI framework that includes adapting programs to changing circumstances.	LWMP steering committee meets four times per year to review progress reported by agencies. Output mapping, photo-point mapping, event evaluation, stories of change, case studies and project evaluation. Program expenditure.	North Central CMA and LWMP community steering committee.

Program	Objective	Program elements	Program targets	Delivery Responsibility
Adoption *For efficient water use and linking farm to catchment environmental program*	To build irrigator capacity to improve: • water use efficiency • nutrient management and soil health • reduce surface runoff • farm biodiversity and regional biolinks • cultural heritage awareness • business performance.	Financial and technical support for: Whole farm planning program Soil assessments Farm business planning related to irrigation future intentions On farm irrigation works Irrigation system checks Irrigation scheduling tools and related new technology Infrastructure upgrades Farm adjustment packages e.g. exiting irrigation supply, rationalising supply points, amalgamating farms, relocating to main channels etc. Transitioning to higher value or to dryland Fencing and replanting native vegetation in sensitive[17] areas and on regional bio-links Awareness of importance of cultural heritage Protection of cultural heritage.	No. of farms, Ha and ML participating in each type of incentive. Stream sides and bio-links Km fenced, protected and enhanced. Ha and no. of farms with cultural heritage recognised and protected. Program expenditure.	Agriculture Victoria and GMW North Central CMA
Regulation / Standard	To ensure best practice for new irrigation development and lift standards for	New irrigation development guidelines. Incentive guidelines for assessing public benefits of farm projects	Preparation and use of guidelines and standards. Level of engagement of Traditional Owners in whole farm	Agriculture Victoria, North Central CMA, Traditional Owners, GMW

[17] Sensitive in this context means where the most environmental benefit can be achieved.

Program	Objective	Program elements	Program targets	Delivery Responsibility
	redevelopment of existing irrigation. Meet salinity accountability and reporting requirements. Meet State Environment Protection Policy targets. Meet cultural heritage requirements.	Standards for Whole Farm Plans so they incorporate biodiversity, bio-links and cultural heritage values. Cultural heritage module for WFP developed (by Traditional Owners) and applied. Monitoring and reviews of Salinity Register items.	plans to better incorporate cultural heritage values. Biodiversity improvements incorporated into whole farm plans. End of Valley salinity targets, SEPP and other water quality targets met. Program expenditure.	
Education and Training	Building capacity for stewardship, adaptability and resilience. To increase the skills and capacity of agencies and the community by identifying gaps/opportunities and implementing training programs.	Extension specific to LWMP programs, linked with adoption program and regulation/standards program. Including irrigated soils and nutrient management, that is relevant to the type of farmer operations (organic or conventional). Link with Regenerative Agriculture Program/ Soil Health Action Plan. All North Central CMA and partner agency staff and interested landholders undertake field based cultural heritage training. Where appropriate support DELWP's Aboriginal access to water for economic development program, e.g. through provision of WFP advice.	Publications and training courses and number of participants. Program expenditure.	Agriculture Victoria and North Central CMA. Potential partners: Vic No Till, Murray Dairy, Hort Innovation, Irrigated Cropping Council (ICC), Victorian Cropping Council, Victorian Farmers Federation, Grains Research and Development Corporation (GRDC), Meat and Livestock Australia (MLA), Soils CRC, Vic No Till.
Research and Monitoring	To measure and improve the effectiveness of the Plan activities	Investigate and fund research into new water use efficiency technologies, e.g. The internet of things. Land and water use changes (Geospatial mapping and reporting). Improving understanding of soil health under irrigation. Monitoring Evaluation Reporting and Improvement (MERI) process of LWMP programs.	No.of trials in partnership with landholders, industries, Universities, CSIRO etc. Research reports. Program expenditure. MERI targets developed as per Section 4.4.	Agriculture Victoria, GMW, North Central CMA Potential partners: Universities (i.e. Federation University, Charles Sturt University, La Trobe University), TAFE (Bendigo TAFE), ICC, MLA, GRDC, Vic No Till, Soil CRC

Program	Objective	Program elements	Program targets	Delivery Responsibility
Drainage Infrastructure Development and Operations	Drainage is affordable and fit for purpose. There is ongoing management in place for existing drainage infrastructure.	Drainage Course Declarations are implemented on existing North Central CMA drains to ensure that they are appropriately managed. Farm reuse is encouraged. New drains are implemented if a compelling case can be demonstrated.	Additional number of hectares served and ML captured in reuse systems. Area and length of drains that are protected with drainage course declarations. Program expenditure.	Agriculture Victoria, GMW, North Central CMA

5.2 Details of each program

5.2.1 Promotion and Partnerships program

Rationale

To coordinate, collaborate and work with industry programs, other CMA programs and other government programs. This will avoid duplication of effort and ensure a greater return on investment.

It will also promote stewardship of the region, particularly the ecosystem services and habitat values that are enhanced by active biodiversity enhancement that will be undertaken by farmers participating in the LWMP programs. It will also provide pathways to programs for controlling pest plants and animals.

This program will provide the funding for North Central CMA LWMP staff to create partnerships with industries, local government, government departments, tertiary organisations and farmer groups that will progress the objectives of the LWMP.

This program will undertake engagement with stakeholders such as field days, farm walks and expos. It will provide opportunities for two -engagement with the broader community so the social change occurring in the community is understood and plan programs are responsive to changing circumstances.

Actions

To develop a stewardship program to engage landholders and to work with the industry groups and other farmer service providers to plan, develop and deliver joint research, development and extension activities, e.g. field days, publications, trials and other best practice information sharing with global leaders via podcasts etc.

In instances where the opportunity is broader than the irrigation community this may be pursued by the Sustainable Agriculture Strategy or other North Central CMA Programs. Linkages to other programs will be identified by this Program, e.g. Regenerative Agriculture and Soil Health Action Plan (North Central CMA n.d.).

No specific targets have been developed for this program, as it will largely depend on opportunities to partner with groups outside of the LWMP.

Benefits

Mutually beneficial partnerships with a range of organisations will be developed to assist in delivering the LWMP programs. This is expected to create significant environmental benefits as well as enhancing sustainable production and regional identity and brand.

Agriculture in the LCIR is uniquely woven within a mosaic of wetlands and natural water courses, many of which are internationally recognised. Therefore, through improved environmental stewardship the LWMP will assist governments meet national and international environmental commitments under Ramsar, CAMBA/JAMBA and the *Environmental Protection Biodiversity Conservation Act 1999*.

The economic benefits of the Promotion and Partnerships program on its own have not been quantified, and in any case, the legal obligations to protect the environmental values and character require that the assets have appropriate active management to ensure agriculture enhances the environmental features. Examples, of this include water birds, such as the ibis, which depend on neighbouring irrigation land for feeding and nest in the adjacent wetlands.

Instead the economic benefits of an improved environment have been assessed for the LWMP as a whole. This is detailed in Appendix 5 and summarised in Section 5.3.

Costs

The cost of this program is based on a full time North Central CMA LWMP officer dedicated 100% of their time on stewardship, promotions and partnerships. They will achieve mutually beneficial partnerships with a range of organisations that will assist in delivering the LWMP programs. It is recommended that this position be based in the LCIR region in Kerang.

This is estimated to cost $200,000 per year including salary, on-costs and an operating budget (Table 5-2).

Table 5-2 Indicative cost of Promotion and Partnerships program subject to funding availability

Program element	Delivery mechanism	Annual cost
Planning Officer	100% of a full time North Central CMA officer and operating costs	$200,000

5.2.2 Planning program

Rationale

To ensure the programs remain relevant to the operating environment of the LCIR, including changing economic, social and environmental circumstances. The region is going through enormous change and the dynamic nature of these changes means that the LWMP programs need to be flexible and adaptive to changing circumstances.

Actions

This program will fund the LWMP community steering committee to meet four times per year to review progress reported on by each agency involved in the Plan's programs. It will also enable the steering committee to go and inspect programs being delivered on the ground.

This program will provide governance arrangements and a transparent and defendable MERI framework that includes adapting programs to changing circumstances.

The MERI framework will need to fund project output mapping (works done), photo-point mapping, event evaluation, stories of change, case studies and project evaluation.

The LWMP community steering committee will oversee program expenditure.

Benefits

The economic benefits have not been quantified, but the program will underpin the benefits of each of the other programs that the LWMP Community Steering Committee oversees.

Costs

It is envisaged that this will program be delivered through the North Central CMA and the LWMP community steering committee.

The costs of the program are expected to be 20% of a full-time officer who will support the steering committee and manage the MERI plan. This is estimated to be $50,000/year, comprising $40,000 for the officer and operating costs; with community steering committee costs of $10,000/year (see Table 5-3).

Table 5-3 Indicative cost of planning program subject to funding availability

Program element	Delivery mechanism	Annual cost
Planning Officer and community steering committee	20% of a full-time North Central CMA officer $10,000 steering committee costs	$50,000

5.2.3 Adoption program

Rationale

To deliver on-ground farm practice change. The change is intended to drive efficient water use and align farm actions with broader environmental objectives. The adoption program will build irrigator capacity to improve:

- Water use efficiency.
- Nutrient management and soil health.
- Surface runoff.
- Farm biodiversity and regional bio-links.
- Cultural heritage awareness.
- Business performance – based on water planning scenarios for low, medium and high-water price years and the areas irrigated in these scenarios.
- Irrigation infrastructure – where identified by the farmer this can facilitate farmer-initiated irrigation infrastructure adjustment to changing water availability and water prices. This will include both farm infrastructure, and where agreed, GMW infrastructure. This is also expected to result in reduced delivery share fees and discounted termination fees where farmer plans align with agreed opportunities to rationalise GMW infrastructure/costs[18].
- Long -erm water supply and drainage needs – through cooperative group action by neighbours to progress rationalisation and reconfiguration to reflect their long-term water supply and drainage needs. It is expected that this process will start at the end of spurs and progress upstream, rather than the other way around, which can result in GMW still maintaining infrastructure for downstream customers.

This program recognises that in 2020 the GMW Connections Project is due to finish, but after this date there will be an ongoing need to reduce GMW and farmer owned infrastructure costs. The program provides the opportunity to continue that process, but in a ‘bottom up’ longer timeframe that

[18] This progresses actions 1.4 and 1.5 from the 2018 Delivery Share Review, (DELWP 2018).

better matches farm business planning horizons, rather than that driven by the Connections Project, which was a more ‘top down’ approach.

The framework outlining the linkage between the LWMP and farm decision making is outlined in Figure 5-1. Delivery will be achieved through a combination of both farm planning, incentives and information transfer. A key step will be to provide the information and a decision-making framework for individual landholders to clarify their business goals and future farming system for a range of different water prices before they decide how much area they will irrigate in high, medium and low priced water years and which paddocks and practices are most relevant for their whole farm plan.

This program will continue the current Plan2Farm business planning program delivered by the North Central CMA which encourages individuals to set clear goals and develop a farm plan that is consistent with these goals. This then informs decision making about farm enterprises, areas irrigated in different water price scenarios and type of irrigation supply needed.

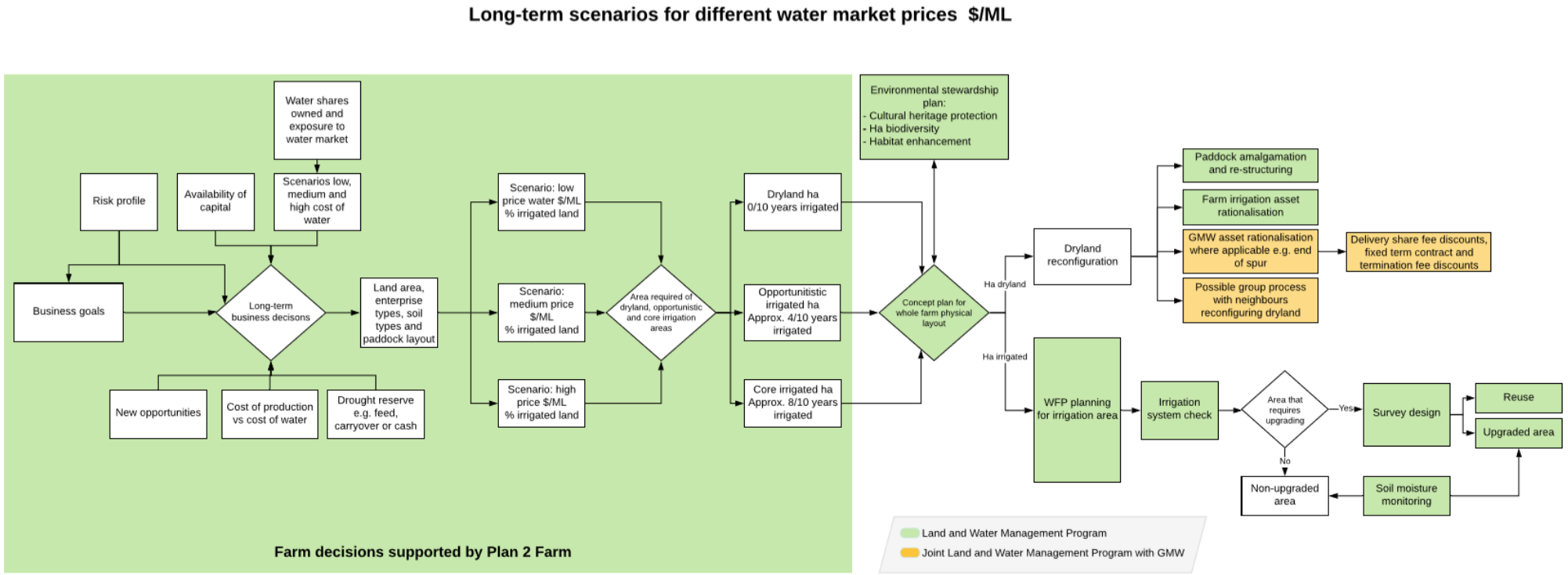

Figure 5-1: Linkage between LWMP adoption programs and long-term farm business decisions and water market scenarios

Note irrigators can join program at any one point. The program will aim to attract and retain water in the region by lifting water use efficiency and creating opportunities for higher value irrigation i.e. $/ML returns.

The process will provide the strategic basis for farmer driven decisions about irrigation modernisation and rationalisation that best suits the long-term needs of irrigation businesses.

The program will provide a list of referrals to other relevant services such as providers of succession planning, rural financial counsellors, employment agencies and other providers. Therefore, the program may facilitate the succession of farm businesses to the next generation or to new entrants.

Whilst the program will use the Plan2Farm process for goal setting, farm planning and to facilitate discussions and information sharing, it will recognise that individual farm business decisions are commercial decisions best left to individual businesses. The landholders will complete the individual workbooks on goal setting and decisions on farm plans using the knowledge of their own individual circumstances and attitude to risk.

The practical landholder led approach is based on the following principles:

- People need to firstly establish their goals to design their future farm systems and layout of irrigation and dryland.
- Farm layouts and different scenarios (high water price, medium water price and low water price) will inform their irrigation areas and GMW supply.
- GMW infrastructure will be optimised if neighbours work together.
- A process that is landholder owned with an independent facilitator will provide a trusted process.
- A trusted independent process will be more efficient in time and dollars.
- Farmers are best placed to provide GMW with clear signals for where infrastructure should be removed, reconfigured or maintained to most effectively manage and share costs.

The rationale of this program is to ensure landholders are clear about their business direction before deciding upon an infrastructure configuration and funding agreement – this enables landholder goals to align with GMW's supply infrastructure and service.

Implement will progress Outcome 1 of the Delivery Share Review (DELWP 2018) "*Help irrigators adjust delivery shares to better signal infrastructure requirements*". It will also enable participating irrigators to access both the termination fee discounts and the limited service contracts for delivery shares.

The linkages with GMW are important, it makes sense that GMW identify landholder groupings with common infrastructure. However, farm goals and decision making should be made independently by landholders so that they get the outcome that best suits their business.

The role of the LWMP is to provide an independent process that will assist landholders to be clear about what their long-term future and goals are. Plan2Farm followed by a whole farm plan is the vehicle to facilitate this.

Actions

This is the foundation of the LWMP. By integrating good information with long-term strategic decision-making landholders and Government will achieve environmental, social and economic goals.

Incentives are proposed to be made available for:

- Plan2Farm to determine future goals, new opportunities and irrigation intentions – including scenario planning for irrigation areas in low/medium/ high water prices.
- Whole Farm Plans – Concept Plan including entire property that includes soils assessments, dryland and irrigated land, environmental features, biodiversity areas, cultural heritage areas, floodways, drainage lines, effluent ponds etc.
- Systems check to evaluate performance of existing irrigation systems.
- Farm adjustment packages if transitioning out of irrigation, e.g. assistance to move unwanted infrastructure and achieve larger paddock sizes, existing irrigation supply, rationalising supply points, amalgamating farms, relocating to main channels etc.
- Survey for irrigation upgrades that are identified in the WFP.
- Design for irrigation upgrades that are identified in the WFP.
- Infrastructure upgrades.
- Irrigation scheduling tools and related technologies.
- Fencing and replanting native vegetation in sensitive areas and on regional bio-links.
- Incorporating cultural heritage values.

The framework being informed by a farm concept plan and environmental stewardship plan.

Historically the LWMP has not offered any incentives for the Mallee horticulture areas around Swan Hill, e.g. in Woorinen and Tresco. It is proposed that this area be serviced by the Mallee Irrigation Incentives Program that is available through the Mallee CMA.

The transition to cut and carry and total mixed ration and barn dairy systems has been identified as a key strategy for dairy farmers to improve their water use efficiency and production per ML. This strategy is a 'capital intensive' option for farmers, but the high value of water is making these systems more attractive. As part of the Plan2Farm business program and water budgeting scenarios this program may refer dairy farmers who are interested in pursuing these directions to relevant expertise and information.

The program will encourage land managers to be active environmental stewards through a mixture of information and incentives. Farmers will be encouraged to incorporate environmental objectives into their farm plans to enhance regional biodiversity values to increase the resilience and long-term productivity of farm ecosystems.

Benefits

The benefits of this action will depend on the number of landholders that participate in this Program and the benefit received by each landowner as a consequence of being part of this Action Program.

There are at least 500 full time large irrigation farms in the region. The plan is to engage with at least half of these over the next five years; this is at least 50 per year, with around 30 per year expected to undertake whole farm plans and irrigation upgrades. Smaller part time farmers may also participate in the program. This is expected to create private benefits in terms of improved productivity and saved water, which would be retained by the irrigator and available for increased farm production. The private benefit is estimated at $13.3 M (refer to Appendix 5 for detail).

In addition, there would also be public benefits due to:

- The saved costs from less public GMW infrastructure valued at $2.8 M (Appendix 5). This is a benefit for GMW customers in the GMID.
- Enhanced public benefits associated with the enhanced protection of environmental sites on neighbouring public land and also on private land. This would include wetlands, water courses and terrestrial remnant vegetation. This has been valued at $13 M (Appendix 5).

The public benefit of this program of $15.8 M is not entirely due to the adoption program and depends on other contributing programs, such as the Education and Training program, which will assist in the delivery of the benefits.

Costs

The costs of the program are tabulated in Table 5-4.

Table 5-4 Indicative cost of adoption program subject to funding availability

Program element	Delivery mechanism	No. of Farms	Cost per farm	Annual cost
Plan2Farm	Consultants and trained agency staff with 1:1 farmer meetings	30	$15,000	$450,000
Whole Farm Plan – Concept Plan	Consultants and trained agency staff with 1:1 farmer meetings	30	$10,000	$300,000
Incorporating cultural heritage values	Engagement with Traditional Owners in the WFP-Concept Plan	10	$10,000	$100,000
Systems check	Consultants/ Irrigation specialists, e.g. with Irrimate to test layout/flow rates	30	$10,000	$300,000
Farm adjustment packages if transitioning out of irrigation	Incentives for reconfiguring to dryland	30	$10,000	$300,000
Survey for irrigation upgrades that are identified in the WFP	Incentive for surveys	30	$5,000	$150,000
Design for irrigation upgrades that are identified in the WFP	Incentive for design	30	$5,000	$150,000
Infrastructure upgrades	Incentive for approved systems meeting minimum standards	30	$10,000	$300,000
Irrigation scheduling tools and related technologies	Incentive for approved systems	30	$1,000	$30,000
Fencing and replanting native vegetation in sensitive areas and on regional bio-links	Incentive for approved plantings	30	$10,000	$300,000
Total				**$2,380,000**

The level of incentives, which determines the cost share between government and landholders for the above program elements will be determined through guidelines developed by the steering committee with relevant agencies. The intent is to develop guidelines that will enable an assessment of the public benefits of an individual farm project. For example, the area set aside and values created for native vegetation, cultural heritage or waterway protection.

The incentive levels may also be higher for those farmers that participate in whole farm planning and courses run by the education and training program.

5.2.4 Regulation / Standard program

Rationale

To ensure best practice for new irrigation development and lift standards for redevelopment of existing irrigation. It will also specify the minimum standards and incentive levels for the adoption program.

It will also fund the actions required to meet Victoria's commitments delegated to the North Central CMA under BSM2030 salinity accountability and reporting requirements. This includes managing the register entries that are listed in Section 3.4.1. This program will also ensure the LWMP meets State Environment Protection Policy (Waters) requirements, including:

- Water quality targets. Targets were previously developed for irrigation nutrient loads in the Loddon and Campaspe Water Quality Strategies. These targets have been met and there is a role in the LWMP to review and reset new targets for both nutrient loads and concentrations. The salinity targets for the region are also an important component of compliance with BSM2030.
- Clause 35 management of saline discharges. This clause requires the discharge of saline wastewater, including discharges from groundwater pumping for salinity management and irrigation drains, must be managed to minimise the risks to the beneficial uses of receiving waters, so far as reasonably practicable. This is relevant to management of the Barr Creek Diversion Scheme and to the Pyramid Creek Salt Interception Scheme. Therefore, monitoring of salt harvesting and monitoring of impacts is an important requirement for these schemes. The clause also requires Councils and other Government authorities to account for salinity in planning schemes, planning referrals and approvals.
- Clause 36 (Management of irrigation drains and channels on receiving waters). This clause requires irrigation drains to be designed and managed to minimise risks to beneficial uses of receiving waters, so far as reasonably practicable, with particular regard to flow, sediment, nutrients, salt and other pollutants. And that constructed irrigation channels and drains be designed and managed so that they are not harmful to human health, plants or animals.
- Clause 37 sets out the responsibilities for irrigation drains and irrigation water use licenses. In particular, land and water management plans should encourage the adoption of on-farm best management practices in order to reduce pollution into irrigation drains and seek to identify and implement cost-effective improvements to the management of outfalls from irrigation drains. Also, irrigation development guidelines require the adoption of on-farm best management practices for new irrigation developments and significant redevelopments.

Actions

The actions proposed under this program include working jointly with the Goulburn Broken CMA, GMW, DELWP and EPA on:

- The Northern Victorian Irrigation Development Guidelines coordination of new development.
- Incentive guidelines.
- The management of irrigation drains through the Irrigation Drainage Memorandum of Understanding between DELWP, Agriculture Victoria, EPA and the Goulburn Broken CMA.
- Involvement in the Victorian Salt Disposal Working Group.
- Monitoring and reporting required for BSM2030.
- Other reporting as required for the Murray-Darling Basin Plan and the Northern Victorian Water Resource Plan.

Benefits

The benefits of these actions are not costed as they are broader responsibilities that are legislatively required. Where required Regulatory Impacts Statements will have been prepared to demonstrate the overall benefits of regulations to Victorian communities. There is also the potential for claiming further EC credits such as in Barr Creek, which have a very high economic value[19] and are potentially the same order of magnitude as the other public benefits created by the LWMP.

Costs

The costs of the program are presented in Table 5-5.

Table 5-5 Indicative cost of regulations/standards program subject to funding availability

Program element	Delivery mechanism	Annual cost
Northern Victorian Irrigation Development Guidelines.	Work jointly with DELWP, GMW, North East and Goulburn Broken CMA. Guidelines already funded. 25% of a full-time irrigation development coordinator. 25% of $200,000 = $50,000 funding to Agriculture Victoria.	$50,000
Incentive guidelines	Steering committee and supporting agencies to develop guidelines to determine individual farm project incentive levels based on public benefits	Covered in Planning Program and Adoption Program budgets
Management of irrigation drains through the Irrigation Drainage Memorandum of Understanding between DELWP, Agriculture Victoria, EPA, Goulburn Broken CMA.	Work jointly with DELWP, Agriculture Victoria, GMW, EPA and Goulburn Broken CMA. 25% of a full time North Central CMA officer. 25% of $200,000 = $50,000	$50,000

[19] For example, EC credits were valued at $112,000 /y by the MDBC in year 2000 dollars. Capitalised this is $1.5 M at 4% over 20 years, after inflation to $2019 this is approximately $2.5 M value per EC. With the potential for 25 EC credits in Barr Creek. This could be worth $63 M if they were required. But currently, Registers are in balance and there is a surplus of credits. Therefore, this benefit has not been costed, but the LWMP will help preserve these credits for future use if circumstances change.
Also, the expected annual benefits of nutrient reductions to the Murray River were calculated to be $22.9 M/year in1999 (LWRDDC/ Atech Group 1999). Allowing for inflation this is $38 M/y and if the LWMP were to contribute just 0.5% to nutrient reduction benefits on the Murray it would provide a public benefit of approximately $2.6 M present value 4%, 20 years.

Program element	Delivery mechanism	Annual cost
Monitoring and reporting required for BSM2030 Involvement in the Victorian Salt Disposal Working Group Other reporting as required for the Murray-Darling Basin Plan and the Northern Victorian Water Resource Plan.	50% of a full time North Central CMA officer. $100,000 Plus investigations and monitoring $100,000	$200,000
Total		**$300,000**

5.2.5 Education and Training program

Rationale

To improve knowledge of crops and sustainable farming systems that improve returns per ML and returns per ha and enhance environmental outcomes. The program will build on existing knowledge and skills to enhance the competitive advantages for profitable opportunistic irrigation, dryland, high value irrigation and other opportunities. Addressing emerging pest plant and animal control is becoming increasing important as the number of farms in the landscape decreases and more land is not actively farmed.

To increase the likelihood of adaption the program will ensure that there is locally relevant agricultural research and development.

The program will also work to establish relationships and collaborative projects with industry bodies and the Victorian Government to secure support for and co-investment in actions to improve dairy water use efficiency, develop new technologies and farm practices for the grains industry and sheep and beef production. Collaboration and co-investment in pest plant and animal control and soil health management also offer opportunities to enhance water use efficiency.

This program will also work closely with the rural research and development corporations in developing its projects. It will build on work already started by North Central CMA, which has established that there is a high level of interest in new land use options.

Actions

This program will work closely with local landholders to identify and trial new crops and pastures, develop alternative irrigated crops, new technologies and reduce the cost of production of existing enterprises. Productivity improvements will be identified and communicated through practice change programs. Information on the economics of new enterprises will also be developed.

The program will also include environmental management and sustainability so that the outcomes provide public as well as private benefits. For example, pest plant and animal control, salinity and sodicity management has environmental and productivity benefits. This program will explore the possibility of co-investing with other Victorian Government programs funding pest plant and animal control.

It will be delivered by funding Agriculture Victoria and the North Central CMA to work together. Agriculture Victoria and the North Central CMA will be accountable for and funded to deliver the

program. They will work with a local landholder steering committee on the development and extension of new practices and enterprises for the Region.

Building on the previous success of the North Central CMA “Adopting Sustainable Farming Practices”, “Sustainable Soils” and “Regenerative Agriculture” projects and farmer preferences for practical demonstrations, a large part of the program will be based on trials and field days. These paddock-based activities will demonstrate to landholders the various options and generate confidence to adapt and change farming practices.

Specific activities could include field days on alternative crops, regional seminars, information sessions, development of new initiatives to employ young people in agriculture and provision of fact sheets on water use efficiency case studies.

Benefits

The benefits will depend on commodity prices, water prices and a range of factors outside the direct control of the Program.

The gain in agricultural production from irrigation and dryland agriculture we have targeted from this program is $1 million/year increase in gross margin. It represents a small increase on the $776 M/y gross value of irrigated agriculture production. This is a private benefit with a present value of $13.6 million at 4 % over 20 years. This benefit will also be delivered through improved knowledge from the research and monitoring program.

There will also be public benefits achieved with improved environmental outcomes, such as healthier soil, and better pest plant and animal control from better land management associated with this Program. It will also support delivery of the adoption program and the improved environmental benefits that were described in the adoption program.

Costs

Program costs include two full-time equivalent positions in each of North Central CMA and Agriculture Victoria. That is, four positions in total, plus operating costs to set up field sites, trials, and extension costs. This will require funding of $400,000 per year to the North Central CMA and $400,000 per year to Agriculture Victoria.

Community feedback is that these positions should be based in the irrigation region, e.g. Kerang.

This is a cost of $800,000 per year for five years. Funding will be sought from State and Federal governments and rural research and development corporations. Support and co-investment from industry will be essential.

The costs of the program are presented in Table 5-6.

Table 5-6 Indicative cost of program subject to funding availability

Program element	Delivery mechanism	Annual cost
2 North Central CMA extension staff and 2 Agriculture Victoria staff based in Kerang	$200,000/staff member including operating budgets	$800,000

5.2.6 Research and Monitoring program

Rationale

The rationale of this program is to measure and better understand environmental change so that the effectiveness of activities undertaken by the plan can be continuously improved.

Actions

The actions proposed include:

- Investigate and fund research into new water use efficiency technologies, e.g. The internet of things.
- Land and water use changes (Geospatial mapping and reporting).
- Improving understanding of soil health under irrigation.
- Monitoring Evaluation Reporting and Improvement (MERI) process of LWMP programs.

Benefits

The benefits of this program are that plan effectiveness will be improved and that the knowledge base of the region is enhanced. Benefits have not been costed, but previous evaluations of natural resource research programs in Australia typically value the benefits much higher than the cost of research. For example, the Australian research in irrigation programs were calculated to have a benefit cost ratio of 1:2.8 and research into water use efficiency had a benefit cost ratio of 1:5.4. (Chudleigh 2006). A conservative benefit 1:1 has been assumed.

Costs

The costs of the Research and Monitoring program are presented in Table 5-7.

Table 5-7 Indicative costs of program subject to funding availability

Program element	Delivery mechanism	Annual cost
Investigate and fund research into new water use efficiency technologies, e.g. The internet of things.	Funding for research trials to tertiary organisations, Agriculture Victoria and other groups.	$100,000
Land and water use changes (Geospatial mapping and reporting).	Funding of Agriculture Victoria.	$100,000
Improving understanding of soil health under irrigation.	Funding of Agriculture Victoria.	$100,000
Monitoring Evaluation Reporting and Improvement (MERI) process of LWMP programs.	CMA staff. 25% of full-time project officer including operating.	$50,000
Total		**$350,000**

5.2.7 Drainage Infrastructure Development and Operations program

Rationale

The rationale for this program is to ensure drainage is affordable and fit for purpose. Existing management arrangements for GMW drains are not replicated. The focus is on providing more certainty over North Central CMA and community surface drains.

The approach is outlined in the Draft Drainage Strategy (L-MIRSWMS) which recommends DCDs be implemented on existing North Central CMA drains to ensure that they are appropriately managed.

Farm reuse will also be encouraged and targeted to undrained areas as a priority. New drains will be implemented if a compelling case can be demonstrated.

Actions

Actions are to create additional reuse systems, hectares served and ML captured in these farm systems. This will be delivered as per the existing pilot DROP Program, which targets areas without access to drainage.

A process will be developed with GMW to work with the community to increase the area and length of drains that are protected with DCDs. North Central CMA and GMW will develop and implement the approach. Funding for DCDs requires projects to be economically feasible, to support improved environmental outcomes, and importantly to show evidence of strong community support (including how landowner engagement and addressing landowner concerns has been undertaken). The steps in the DCD investigation and approval process include:

- Business case/ proposed project logic clearly mapped out, i.e. define the extent/ scope of issues the DCDs will address.
- Develop a ‘high level’ concept plan and confirm economic and technical feasibility.
- Test the concept with community, gauge interest, support and drainage needs, i.e. understanding of what a DCD will and won’t do, ongoing costs and expectations.
- Formally engage with GMW to determine specific requirements. GMW will require: a) strong community support, acceptance and long-term identification about need for surface drainage; and b) alignment with current and future projected and identified drainage benefits to GMW customers.
- The ongoing costs for DCD administration/ management are estimated to be low, but it is important that costs are made clear during community engagement.

DCD administration and enforcement activities and ongoing drain asset management/ ownership issues are separate issues to ownership. Applying DCDs over existing North Central CMA drains and private community drains won't change the ownership of the drains.

Therefore, DCD compliance under the Victorian Water Act would not include management/ maintenance of existing North Central CMA drains and private community drains. Only obstructions identified as part of the DCD would form part of GMW’s compliance if GMW is the responsible Authority for a DCD.

Therefore, North Central CMA drains and private community drains may need to have defined guidelines developed to communicate ongoing asset management, drain maintenance (spraying and asset remediation/replacement) and defined paths for conflict resolution for drainage enquiries.

The DCDs being implemented in the Shepparton Irrigation Region have strong community support, which is assisted by the current drainage program (Victorian Sustainable Irrigation Program) funding of an obstruction removal program upfront. Although the Water Act allows for enforcement of unauthorised blockages to be levied to offending landowners, adopting this method of obstruction removal at DCD implementation stage could put landowner support at risk – so an upfront funded DCD obstruction removal program is likely to be a key ingredient to success and harnessing community support.

Benefits

Benefits include reduced waterlogging and drainage losses and reduced salinity risks on both agricultural and environmental assets. Benefits have been costed for undrained land in the Draft Loddon Murray Irrigation Region Surface Water Management Strategy, 2019 (RMCG 2019). The benefits of providing certainty of service for existing drainage lines through DCDs are expected to be $7.2 M (present value of benefit) and are detailed in Appendix 5.

There would also be additional benefits associated with improved water use efficiency and nutrient capture from the additional reuse systems. This is estimated to have a private benefit of $4.9 M (saved water value) and a public benefit of $0.9 M. These figures are explained in more detail in Appendix 5.

Costs

Table 5-8 outlines the expected costs of the Drainage program.

Table 5-8 Indicative cost of program subject to funding availability

Program element	Delivery mechanism	Annual cost
Irrigation reuse incentives – eg. DROP program.	Through Agriculture Victoria.	$700,000
DCD implementation.	North Central CMA with GMW.	$700,000
Total		$1,400,000

5.3 Summary of costs and benefits

Table 5-9 outlines the expected costs and benefits from a public and private perspective of the programs. Detail on the assumptions are documented in Appendix 5.

Table 5-9 Estimated cost and benefits of programs at 4% over 20 years

	Public costs and benefits			Private costs and benefits		Total	
Program	**Annual government cost of programs**	**Present Value of government cost (5yrs)**	**Present value of public benefits created by LWMP**	**Present value of additional[20] private costs created by LWMP**	**Present value of additional private benefits created by LWMP**	**Costs**	**Benefits**
Promotion and partnerships program	$200,000	$0.9 M	Un-costed	In kind community participants time not costed	Un-costed	$0.9 M plus un-costed	Un-costed
Planning program	$50,000	$0.2 M	Un-costed	In kind community participants time not costed	Un-costed	$0.2 M plus un-costed	Un-costed
Adoption program	$2,380,000	$11.0 M	$2.8 M GMW infrastructure $13.0 M environment	Nil cost improved standards $4.1 M (additional farm modernisation)	$7.8 M improved standards $5.5 M additional farm modernisation	$15.1 M	$29.1 M
Regulation / standard program	$300,000	$1.4 M	Un-costed. But with potential to generate significant EC credits.	Un-costed	Un-costed	$1.4 M plus un-costed	Un-costed
Education and training program	$800,000	$3.7 M	Included under adoption program	Nil additional costs (existing training time is made more effective)	$13.6 M irrigation gross margin improvement	$3.7 M	$13.6 M
Research and monitoring	$350,000	$1.6 M	$1.6 M	Some In kind community time not costed	Included in education and training program above	$1.6 M	$1.6 M

[20] This is on top of the investment of $10 million to $30 million per year by irrigation farmers on their systems that would occur even without a LWMP

	Public costs and benefits			Private costs and benefits		Total	
Program	**Annual government cost of programs**	**Present Value of government cost (5yrs)**	**Present value of public benefits created by LWMP**	**Present value of additional[20] private costs created by LWMP**	**Present value of additional private benefits created by LWMP**	**Costs**	**Benefits**
Drainage infrastructure development and operations program.	$700,000 Institutional framework implementation	$3.2 M institutional framework	$7.2 M institutional framework through DCDs. 70% of benefits are public.	Nil private costs	Included in public benefit of drainage.	$3.2 M	$7.2 M
	$700,000 reuse program	$3.2 M reuse incentives	$0.9 M reduced drainage damages plus uncosted water quality benefits	$1.4 M (will vary depending on reuse incentive level adopted)	$4.9 M saved water	$4.6 M	$5.8 M
Totals subject to rounding.	$5,480,000/year for 5 years	**$25.4 M**	**$25.5 M.**[21]	**$5.5 M** plus uncosted	**$31.8 M** plus uncosted	**$30.9 M** plus uncosted	**$57.3 M** plus uncosted

21 For example, the potential for 25 EC credits in Barr Creek could be worth an additional $63 M

Key points from the economic analysis

- The total of the benefits of the LWMP are $57.3 M and the costs are $30.9 M. This means that the plan is economic, with a positive net present value (NPV) of $26.4 M. It has a cost:benefit ratio of 1:1.9.
- From a public investment point of view it is important to consider the public benefit against the public cost. The present value of government costs over the next 5 years is $25.4 M. This is expected to generate at least $25.5 M of public benefits plus significant additional un-costed public benefits worth millions, such as that associated with water quality improvements.[22]
- There are also regional recreation and tourism benefits[23] arising from the investment in the Plan.
- Therefore, from a public investment perspective this LWMP has a positive NPV as the public benefit exceeds the public costs. It represents a sound investment for Government. It also facilitates a partnership with the irrigation community to assist with the regional economy.
- The private benefits also exceed private costs. This means that the LWMP programs will be attractive for farmers to participate in. This will enable a partnership between the Government and Community by implementing LWMP programs to tackle environmental improvement and irrigated farm adjustment.

The tailored nature of the programs means that they are inter-dependent. The synergy created through the combination of programs will help address declining water availability through improved water use efficiency, restructuring and achieving enhanced environmental outcomes. This in turn will increase regional pride and sustainability.

The LWMP is value for money for landholders, governments, industry and by tacking on farm improvements will enhance our precious land and water resources – land, waterways, wetlands and birds, fish, plants and animals.

In summary, with adequate funding, the LWMP is well placed to achieve its aspirational goal of

"Using water for healthy, productive, sustainable irrigated food and fibre" and its long-term outcomes of:

- Sustainable, profitable, adaptive and innovative farming practices
  - Enabling adjustment to changing water availability by improving water efficiency and regional productivity through irrigation system modernisation: achieving a vibrant,

[22] For example, EC credits were valued at $112,000 /y by the MDBC in year 2000 dollars. Capitalised this is $1.5 M at 4% over 20 years, after inflation to $2019 this is approximately $2.5 M value per EC. With the potential for 25 EC credits in Barr Creek could be worth $63 M if they were required. But currently, Registers are in balance and there is a surplus of credits. Therefore, this benefit has not been costed, but the LWMP will help preserve these credits for future use if circumstances change.

Also, the expected annual benefits of nutrient reductions to the Murray River were calculated to be $22.9 M/year in 1999 (LWRDDC/ Atech Group 1999). Allowing for inflation this is $38 M/y and if the LWMP were to contribute just 0.5% to nutrient reduction benefits on the Murray it would provide a public benefit of approximately $2.6 M present value 4%, 20 years.

[23] The Gannawarra Shire estimated the direct economic impact of domestic overnight visitation to the shire at $40.87 million per annum (Gannawarra Shire Council 2014). A 1% increase in tourism would be worth $5.5 M as a present value. Although some of this benefit may be double counted in the public benefit of environmental improvement under the Adoption Program.

productive and sustainable irrigation sector in Victoria depends on using water resources efficiently across all irrigation industries. This is integral for improving resilience to drought and climate change while continuing to adapt to water recovery and includes consideration of any expansion of irrigation and managing a changing irrigation footprint.

- Active involvement of Aboriginal peoples and communities.
  - Creating more opportunity for the active involvement of Aboriginal peoples and communities: by working with Traditional Owners the LWMP programs will be adapted to incorporate traditional knowledge and participation on an ongoing basis.
- Protected and improved condition of environmental assets and values.
  - Protecting the health of waterways and maintenance of water quality: by achieving reduced salinity and nutrient loads from irrigation to help protect the health of waterways and managing uncontrolled surface run-off to minimise the risk of eutrophication of regional waterways and the Murray River.
  - Protecting land from salinisation and shallow watertables: by reducing accessions into groundwater to reduce the risk of waterlogging and secondary salinisation of land, which occurs due to excess water from rainfall in conjunction with irrigation. Continuing to reduce soil salinisation and waterlogging will assist agricultural productivity and enhance environmental values.
  - Ensuring biodiversity is protected from any offsite impacts from irrigation: by improving irrigation efficiency, ensuring natural assets are protected and enhanced in the whole farm planning process and by ensuring new irrigation development guidelines provide adequate environmental protection
- Empowered and informed irrigation community. Adoption of practices that achieve the above outcomes will depend upon having an empowered and informed irrigation community that engages with the Plan and drives positive change.

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Appendix 1: Initial Consultation Findings

As part of the development of the new plan the CMA engaged Leanganook Yarn to undertake independent consultation with stakeholders to identify the land and water management issues that were of concern. During March 2019 focus group meetings were held in Pyramid Hill, Cohuna, Swan Hill and Boort and there was also an agency focus group meeting in Huntly.

As would be expected a broad range of issues were raised at the meetings, some of which have a broader focus than the remit of a Land and Water Management Plan as defined by the Government guidelines and the investment priorities listed in current policy documents (section 3.4).

Therefore, in order to ensure that the broader findings and analysis reported by Leanganook Yarn can be used to sign post the community and inform the relevant CMA and other government plans they have been grouped according to the four categories below:

1) Relevant to sustainable irrigation and of direct applicability to the LWMP and the Sustainable Irrigation Program that will be a funding source for the Plan. The Government criteria for this are listed in 3.4.

2) Relevant to the North Central CMA Sustainable Agriculture Strategy

3) Relevant to the renewal of the North Central Regional Catchment Strategy and its supporting plans such as the River Health Strategy, Waterway Management Strategy, Environmental Watering Plan, Native Vegetation Management Plan, Floodplain Management Strategy, Invasive Plant & Animal Strategy, Regional Growth Plans, Climate Adaptation and Mitigation Plan, Waterway Strategy, and Soil Health Action Plan.

4) Relevant to broader Government plans/strategies.

Findings and analysis from the focus group consultation has been documented in the Leanganook Yarn report. In Table A1 below we have categorised these findings by each of the four categories listed above and have provided a suggested response for the new LWMP.

Broader NRM issues raised in the consultation have been documented in Appendix 2. It is recommended that these be considered by the North Central CMA in the renewal of the RCS and its sub-strategies.

Table A1: Leanganook Yarn findings/analysis with category and suggested response

Theme	Finding/Analysis	Category	Suggested Response in LWMP
Overview	*People are feeling the pain of the water reform, the price of water and the current drought (and the effects of climate change). LWMP needs to contribute to the creation of certainty and getting confidence back.*	1	Identify key opportunities for higher more profitable water use.
Planning and Development	*There is a perception of a disconnection of the CMA and other agencies with the community on the ground. Farmers are experiencing insufficient resources getting to the ground. They recognize that:* *The CMA is insufficiently funded to undertake on-ground management* *Local knowledge and corporate knowledge are not being effectively shared and exchanged, though this would improve outcomes that are sought by the Regional Catchment Strategy.;* *There is a need for improved collaboration and cohesion between agencies;* *To maintain credibility, agencies need to be good land managers of their own estate (manage Crown land well).*	1	Develop credible business case for LWMP to attract government and private investment and resources into the LWMP. This will require demonstrating how it delivers Government objectives and that the community supports the initiatives.
	A common wish was to have more agency field officers based in the community and from the community [There was high praise for competent, diligent locally based government officers, and a real wish to see more staff on ground and in the field]; One focus group even proposed a ratio of "at least 1 field officer for every 3 that are sitting in the office"; and recommended that various agencies "ensure their field officers attend at all different field days to introduce the environmental agenda".	1	Resourcing will depend on strong business case and LWMP should reflect community desire for more locally based field staff.
	Groups recommended that the LWMP needs features the benefits of the Loddon Campaspe Irrigation Region and its strategic advantages in the state and national water market.	1	The sustainable competitive advantages of irrigation in the Region need to be highlighted. New opportunities for higher value should be covered.
Landscape management	*The Future Farming workshops were very good, and there is a need for these types of future crop workshops again. These would be a good platform from which to offer customised follow-up services such as Plan 2 Farm.*	1 & 2	Extension programs to be designed to match the LWMP programs. Broader farming extension part of sustainable agriculture strategy.
	There was strong interest expressed for the re-creation of incentives for farmers to undertake revegetation. While this may be from grants or incentives, it may also be from the CMA playing a more active role in brokering farmer engagement with the carbon market and Emission Reduction Fund (ERF) opportunities.	1 ,2 & 3	Revegetation to be part of LWMP program.
	Whole farm plans (WFP) are widely regarded and considered positive. They identified a need for a process to revisit WFP when properties change hands, or other circumstances change. WFP can go deeper and push for further improvements and better integration with local area planning, and better management of rainfall in non-irrigated parts of farms. There may be a need to adapt WFP to follow shifts in farming – i.e. WFP package designed for new hobby and 'boutique' farmers.	1	Continue WFP with adaptation to different irrigators.

Theme	Finding/Analysis	Category	Suggested Response in LWMP
	There needs to be deliberate structuring of landscape change to create opportunities and healthy communities. There is a need for further work on organising groups to create more connected landscapes – with public and private biodiversity corridors and refugia integrated into the productive farming landscape.	1, 2 & 3	Regional biodiversity plantings to create connected landscapes are integrated in whole farm plans.
	Approaches need to integrate whole health of the community [social, economic, environmental].	1, 2,3	LWMP to provide social, economic and environmental net benefits for its own scope.
Water management	*'We have the most modernised, efficient irrigation system in the world, but we can't afford to use it'.*	1	LWMP to promote more profitable water use.
	It was observed more than once that it is only when farmers are making money that they can achieve good stewardship.	1	LWMP to promote more profitable water use.
	Stewardship guidelines and a definition of what stewardship looks like are both needed.	1	Extension program.
	If it is true that middle-sized farms are disappearing, then there needs to be considered view of what wider social and environmental obligations go with these changes – in relation to keeping the infrastructure affordable, and tests of overall improved prosperity for the district.	4	Goulburn Murray Water (GMW) need to address this issue.
	There was criticism of the current environmental watering program for 'tunnel vision' and focus groups recommended that it needs to have better processes to take on local knowledge about pockets of habitat that should be maintained, which have built up around 100 years of irrigation channel infrastructure.	1, 3 & 4	Environmental watering programs should include watering private wetlands in seasonal water priority setting.
	There is real concern about the 12% of people who own water but don't own land and who don't pay service delivery fees.	4	This is Australian Competition & Consumer Commission (ACCC) issue regarding functioning of water markets nationally.
	Research is needed into a feasible ceiling for high-value water in irrigation districts, and this needs to be included into the process for approving new irrigation developments as well as built into regulation. The perception at least is that there is unchecked irrigation development downstream.	4	This a DELWP/ACCC/MDBA issue regarding functioning of water markets nationally. Also being considered as part of MINCO deliverability and water availability work.
	Landholders expressed the need for leadership to directly address the patchwork quilt of irrigation now, which is becoming an unaffordable game. There is no future for the LCIR if it is uncompetitive and people can make more money selling the water to somewhere else.	1	Increase competitiveness of LCIR GMW transformation?
	Landholders want to ensure the adaptability in the water system –to enable change between industries without completely re-designing / rebuilding the infrastructure.	1, 4	GMW have a role.

Theme	Finding/Analysis	Category	Suggested Response in LWMP
	The focus groups acknowledged that improved drainage and the community surface drainage and the re-use dams have contributed to saving the whole area from salinization and high-watertables.	1	Implementation of the LCIR Drainage Strategy is part of LWMP. Maintain existing infrastructure and promote for new/re-developments.
	Where farmers voluntarily relinquish their irrigation rights, which results in reducing infrastructure costs, there are mutual benefits which should be investigated, including exemption from payment of termination fees.	1, 4	GMW have a role – yes was proposed in Delivery Share Review and GMW Transformation.
Biodiversity	*Appreciated initiatives include: fish ladders; Plains Wanderer work; in-stream habitat creation for platypus and turtles; revegetation programs i.e. fencing off and exclusion of stock from waterways and increasing public access and awareness of wetland habitats.*	3	Other RCS Strategies will cover this. But could also consider in WFPs, i.e. notify River Health Programs of opportunities.
	There is a strong desire for another significant investment in biodiversity / revegetation and ecosystem health.	1, 3	Whole Farm Planning with direction from other RCS Strategies.
	Previous revegetation programs (Landcare / NHT) have been great. Farmers particularly mentioned the fencing off and exclusion of stock from waterways. There is a need for enforcement or other follow-up where properties change hands, and assistance and advice on undertaking pest, plant and animal control.	1, 3	Whole Farm Planning with direction from other RCS Strategies.
	More information on ways to allow native animals to exist with and be supported by agriculture e.g. types of fencing.	1, 2, 3	Whole Farm Planning with direction from other RCS Strategies.
	Further investment in the roll out of the Regenerative Agriculture program.	2	This is broader than the irrigation Region.
Community Capacity	*Deep understanding of changing social dynamics will enable the LWMP to implement its mandate effectively. Communities have to be at the centre of the LWMP process, because without activated communities there will be no change (or reversal of gains) in the other thematic areas.*	1	Governance arrangements should build new connections and activate landholders currently disengaged.
	Landcare is struggling because of lack of funding for coordinators. There is a need for people to be employed to run the farmers' groups and distribute results and maintain communication.	3	Broader RCS issue
	Landcare could be the vehicle for localisation of planning, but this needs to be framed within community renewal, and include a wide coalition including sports & recreation, community health, neighbourhood houses.	3	Broader RCS issue
	Community change is happening, with new families and businesses coming in to work in intensive industries and immigrants taking up jobs. This is good, but there needs to be a supported transition, and active processes to transfer knowledge, skills and history to younger or new actors.	1, 2, 3, 4	Incorporates broader regional responsibilities.

Theme	Finding/Analysis	Category	Suggested Response in LWMP
	Participants observed a real rift between the CMA and communities at present, and the CMA needs to change its mindset from 'business as usual' and work to heal that division, or it will lose its mandate from the community to operate.	3	Broader RCS issue
	Leaders need courage to lead and ground themselves in local advice and awareness.	1, 2, 3, 4	Incorporates broader regional responsibilities.
	Getting confidence back into the LCIR is crucial to achieving LWMP outcomes.	1	Develop credible business case for LWMP to attract government and private investment and resources into the LWMP. This will require demonstrating how it delivers Government objectives and that the community supports the initiatives.
	There is concern that the trend towards corporate farming will erode communities and lead to a reduced level of engagement with the catchment-wide environmental agenda. The volunteerism of the local community is an enormous contribution to landscape management and rural resilience.	1	The LWMP should engage with all landholder types including corporate.
	It should not be assumed that all corporatisation leads to improved water and production efficiencies as focus groups gave numerous examples of the failure of these corporate models.	1	Noted. Potential issue for Irrigation Development Guidelines.
	It should not be assumed that new businesses have the same values or knowledge of stewardship hence induction to the area and a stewardship code is needed.	1	LWMP should provide an extension package for new irrigators. Potential issue for Irrigation Development Guidelines.
Agency Management	*People see inconsistencies between agency expectations and their own management.*	1, 2	LWMP must include effective extension that is two way learning.
	There needs to be better synchronisation between agencies, for example with GMW to manage flood regimes better, and running joint field days with multiple activities and angles.	1, 2, 3, 4	Noted. Improved connections between RCS programs and between RCS programs and other land and water agencies.
	Agencies need to understand each other's roles and responsibilities better and be able to speak together.	1, 2, 3, 4	LWMP needs to define clear roles and responsibilities.
	Agencies need to run better integrated programs on pest plants and animals (PPA).	3, 4	RCS - Invasive Plant and Animal Strategy. Links to WFP?
	There was high praise for competent, diligent locally based government officers, and a real wish to see more staff on ground and in the field.	1, 2, 3, 4	Note desire for local contact in LWMP.
	The CMA needs to work to ensure the involvement of council in the LWMPs, so they really understand it and embrace the plans. There is strong scope for joint work with local governments on nature-based tourism; information materials for new landholders, and whole-of-community provision of services and information.	1, 3, 4	Role of Local Govt in LWMP needs to be defined in LWMP.

Theme	Finding/Analysis	Category	Suggested Response in LWMP
Analysis of - Challenges and opportunities of the renewal	*Frame the LWMP planning process as community renewal, so that it is considered as nourishing the whole community – by a wide coalition of effort including:* *employment opportunities (how do we keep our people?);* *sports and recreation;* *health, neighbourhood houses etc;* *engagement needs to avoid the usual suspects; community inclusion is needed.*	4, 5	LWMP has a role within this much broader objective.
	There is a need for the CMA to drive community renewal to maintain an integrated landscape /wholistic catchment approach	3	The LWMP is a sub-strategy of the RCS, which provides the integration.
	Take a broader approach to Irrigation – Irrigation is one of four sources of water to manage the land: rainfall, floods, channel irrigation and diversion from river, creek and lake systems. Hence it is a mistake to take too narrow a definition of irrigation, particularly in the changing context of the LCIR.	1	It is suggested that the scope of the Land and Water Management Plan be private land that holds a water use licence where the cumulative impacts of irrigation has the potential to affect public or offsite values.
	We need stronger rural communities, ideas and planning driven by local groups, achieving local ownership in the way that was achieved by the Salinity Management Committees. There has to be both local ownership and landscape scale planning. Place-based landscape actions are needed. There are advantages of an area-based plan that has strong community ownership, over a series of generalised, thematically-based strategies.	1	The LWMP should have a regionally based governance and reporting. Improved linkages between RCS and RCS programs
	The LWMP should recognise and have a significant focus on the role and potential of Regenerative Agriculture in increasing resilient food production in the LCIR.	1, 2	Regenerative agriculture is broader than irrigation and applies to all agriculture. Its role should be investigated and demonstrated in LWMP.
Analysis of - Support needs Farmers, landholders and communities need support to:	*Redefine themselves in the light of new realities brought about by water market reform, the MDBP and climate change.*	1, 2	Transition out of irrigation to new industries is part of the LWMP and already happening at a fast rate.
	Gain new knowledge and techniques for sustainable agriculture (Regenerative Agriculture), that focus on deep knowledge of soil development processes, and recognising that irrigation will be more episodic and opportunistic, depending upon water availability and affordability.	1, 2	Regenerative agriculture is broader than irrigation and applies to all agriculture. Its role should be investigated and demonstrated in LWMP.

Theme	Finding/Analysis	Category	Suggested Response in LWMP
	Assert the balance between perennial horticulture and other industries, recognizing the importance of local employment and production, the maintenance of communities and viable irrigation infrastructure and take into account the risks associated with crops which have a fixed seasonal water demand.	1, 4, 5	While the LWMP can assist with adjustment. The water market rules are set by ACCC/MDBA/DELWP. But where market failures create environmental risk LWMP can develop programs.
	Significantly improve the connectivity and extent of remnant native vegetation and habitat which is largely concentrated along riparian ecosystems, and which largely remains in the private land estate.	3	Broader RCS. Possible considerable in WFP.
	Understand and develop opportunities for payment for protection of ecosystem services (including healthy productive soils) through engagement with carbon markets.	2	Broader Sustainable Ag. Strategy. Noting that carbon farming proposals to date have brought a low return as carbon price is too low.
	Engage with the opportunities in emerging renewable and bioenergy markets (biogas, biofuels, solar installations) and integrate these into their farming vision and landscape.	2	Broader Sustainable Ag. Strategy. Noting that carbon farming proposals to date have brought a low return as carbon price is too low.
Analysis of - Training and communication	*There is a need for increased community engagement and awareness, so that people know what the CMA does and ways for the community to support each other.* *The structured communication processes that the agencies have need to be re-invigorated.* *CMA communication needs to be robust, more frequent, and not just oriented around plans, but also around connecting plans, activities and directions.*	1, 3	Broader RCS and clear roles of LWMP delivery staff.
	Education and leadership is a key part of the CMA mandate that should be reflected in the LWMP, and this is evidenced by various references in the DELWP Guidelines with phrases such as "enable devolved, adaptive management" and "maintain strong engagement with irrigators, stakeholders and delivery partners". Some examples of the types of education mentioned by focus groups included: *Different marketing of farm produce to show all the PPA work of farmers and support for stewardship payments for farmers and tying this into a regional business model for the LCIR.* *Coordination of training to facilitate farming businesses, mindful that environmental improvements only occur when landholders are profitable.* *More information on management of native grasslands.*	1, 2, 3	Broader RCS and Sustainable Ag. Strategy also part of this. Linkage with industry programs is also key, which is part of the Sustainable Ag. Strategy.

Appendix 2: Priorities relating to broader natural resource management

REGIONAL CATCHMENT STRATEGY PRIORITIES

The role of the LWMP is to provide a focus for on-farm activities to improve the sustainability of irrigation. Broader natural resource management is managed by a range of strategies and plans under the Regional Catchment Strategy.

This section 'sign posts' those other strategies and plans.

The North Central Regional Catchment Strategy encompasses a range of supporting documents. These include the River Health Strategy, Waterway Management Strategy, Environmental Watering Plan, Native Vegetation Management Plan, Floodplain Management Strategy, Invasive Plant & Animal Strategy, Regional Growth Plans, Climate Adaptation and Mitigation Plan, Waterway Strategy, and Soil Health Action Plan.

The Regional Catchment Strategy priorities are:

- Community engagement in natural resource management.
- Protecting and enhancing waterway and river assets: Lower Avoca River, Upper Avoca River, Low Campaspe River, Lower Loddon River, Upper Loddon River, Coliban River and Gunbower Creek.
- Improving native vegetation extent and condition across the North Central region.
- Land protection through better land management and soils protection.
- Protecting and enhancing wetland assets: Gunbower forest, Kerang Ramsar Wetlands, Central Murray Wetlands, Mid Loddon Wetlands, York Plains Wetlands, Moolort Plains Wetlands, Kamarooka Wetland Complex.

The relevant North Central CMA Programs include:

- Sustainable Agriculture
  - Soil Health Action Plan
  - Regenerative Agriculture
  - Healthy Productive Landscapes
  - Regional Landcare Facilitator
  - Plan 2 Farm
  - eXtension Aus
- Rivers and wetlands
  - Campaspe River
  - Coliban River
  - Guttrum and Benwell forests
  - Gunbower
  - Kerang and Gunbower Ramsar Wetland Project
  - Loddon Murray Wetlands
  - Loddon River
  - Wimmera-Mallee Wetlands
  - Native Fish Recovery
- Biodiversity
  - Bringing Back the Bittern

  - Plains for Wanderers
- Floodplain management.

CONSULTATION FEEDBACK THAT IS RELEVANT TO BROADER NATURAL RESOURCE MANAGEMENT PLANS/STRATEGIES

Table A2 below records broader natural resource management issues that were raised in consultation. Note the suggested actions listed, do not necessarily correspond with the issues raised.

Table A2: Issues and actions feedback sorted by North Central CMA Program

Relevant CMA Programs	Issues raised in consultation	Suggested actions raised in consultation
Sustainable Agriculture	▪ Need a paid for facilitator to run community groups. The farmers want to participate but do not have the time to organise group sessions and putting in funding applications. ▪ Frustration with the connections program because of delays and lack of local knowledge ▪ Protection of native vegetation versus reduced production capacity ▪ Lacking support for better grazing management ▪ Resilient long-term fodder ▪ Farming with native fauna and flora ▪ Support for better grazing management ▪ Paid coordination for a Landcare or CMA facilitator ▪ Data is gathered through landholders i.e. Farming for Sustainable Soils and also gathered during seasonal events through different metering systems but landholders are not permitted to access the data. It inhibits farmers from being able to use it to make good decisions. ▪ There is no follow-up on the investments, for example a $3mil fencing program was great but let go into disrepair, no education on grazing for new landholders and no on-going maintenance. ▪ Sustainable soils report not fed back ▪ Uncertainty for Crown lease renewal ▪ Certainty for lease renewal and conditions ▪ Succession planning for both farms and environmental knowledge ▪ Investigate bio-energy ▪ Create the ability to scale the whole farm plan to small landholders ▪ Create an opportunity for environmental water to be available for private land ▪ Public funding for local seed banks ▪ Balance the intensification of animal industries for nutrients and biosecurity	▪ Create better information sharing mechanisms ▪ Help farmers be recognised as environmentalists i.e. farming marketing plan ▪ Acknowledge wetland environment on private land ▪ Maintain long-term waterfront leases for pest, plant and animal control ▪ Need a framework for managing land to a certain standard i.e. to encourage good neighbours ▪ Stronger compliance needed for pest, plants and animals ▪ Foster partnerships between state government, local government and farmers for pest plant and animal control ▪ Enable green manure / waste re-use and establishment of viable dryland pastures ▪ Native animals existing with farms – how should farmers do it ▪ Integrated pest management training for farmers ▪ Enable farmers to be adaptable during the seasons ▪ Revegetation projects need another wave ▪ Future farming workshops need to run again ▪ Need more Landcare groups ▪ Repair riparian fencing ▪ Education program in the plan for the whole community – schools etc. ▪ Information and training on cultural heritage to protect Aboriginal history while farming

Relevant CMA Programs	Issues raised in consultation	Suggested actions raised in consultation
	▪ Improve the geographical integration of farm types ▪ Build knowledge and capacity amongst new farmers and facilitate knowledge sharing ▪ Farmers need the ability to be able to make decisions ▪ The temperature of the water released can be too cold from some locations ▪ Fencing of waterways has reduced capability to manage pest plants and animals ▪ Neighbours, particularly the Crown, not managing their land for pest plants and animals ▪ Pest plant and animal control ▪ Accessibility to fenced off areas ▪ Compliance by authorities is non-existent i.e. pest plants and animals on neighbouring properties ▪ Pest plant and animal control is extending into cultural sites ▪ Feral pigs are a biosecurity risk ▪ Parks Victoria and Vic Rail aren't managing their land for PPA ▪ Integrated pest management needed.	
Rivers and wetlands	▪ Some pest plant and animal control is not prioritised effectively, for example Gunbower Creek was sprayed but the lagoons upstream were not so weeds progressed down-stream to Gunbower Creek. ▪ Storage management plans for Lake Boga, Kow Swamp and other storages/wetlands to encourage multi-use values e.g. bike tracks, cultural heritage and app based tours ▪ Deal with constraints on Gunbower creek when environment and irrigators want water at the same time ▪ Cultural water ▪ Consider recreational values of irrigation systems	▪ Wetland and environmental areas are set aside in the "big picture" i.e. the balance must include water for ecosystems along channels and how flood events force animals onto farms ▪ Make channel and waterway monitoring data available to farmers
Biodiversity	▪ Fish habitat – fish screens are required on private channels but are not implemented on public channels. "Blackhole" for information relating to what plant species to plant, fence ▪ Limited funding now for revegetation and lack of information out there in how to do it	▪ Have a link between water bodies and nature-based tourism ▪ Rail trail with environmental features

Relevant CMA Programs	Issues raised in consultation	Suggested actions raised in consultation
	▪ Fencing ▪ Protection needed for native vegetation	
Flood plain management	▪ Flood mapping – the CMA needs accurate flood data ▪ The flood data is "incorrect" and the property probably shouldn't have an inundation overlay so it is impacting the connections project. The connections project requires a planning permit. ▪ Three regional flood studies but none of them have been implemented ▪ Flood warning system- lack of stations on the Loddon ▪ Poor road management during flood events (Pyramid Hill region) ▪ Access to monitoring data ▪ Joint PPA works with Parks Victoria ▪ Improve landscape connectivity / biodiversity habitat	▪ Make channel and waterway monitoring data available to farmers
Other	▪ Community engagement versus community awareness ▪ Middle sized family farms are disappearing. It is having impacts on community dynamics and organisations such as footy clubs. Small towns rely on volunteers for a lot of work i.e. Landcare ▪ Inequity in funding across the region ▪ Ethical sourcing of labour ▪ The communication has been lost between agencies and communities – there's no one on the ground to facilitate the two-way communication between farmers/community members and the agencies ▪ Money for plans and no money for implementation ▪ The CMA is never in the community ▪ The decisions about how funding should be spent in an area are not made by the community ▪ Lack of systems knowledge in the Catchment Management Authority ▪ Business sustainability and resources versus community growth ▪ Need to attract people / jobs ▪ Lack of young people	▪ Build capacity within governing agencies to recognise the needs of the communities ▪ Have transparent communication between agencies i.e. DELWP and CMA on issues that affect all landholders ▪ How to ethically source on-farm labour ▪ Have a field officer in every regional town to: bring people to events, have slide shows about environmental issues at other community events, facilitate knowledge exchange, provide access to scientists etc. - 1 field officer for every 3 in the office ▪ Embed CMA staff in community ▪ Control wastage grant money ▪ Enable the LWMP to integrate with Council Plans (assist councils to understand the important and liveability) ▪ Establish a use for dead carp ▪ Not a lot of people left to volunteers – need to pay community volunteers.

Appendix 3: Irrigation issues and actions raised during first round consultation

The Table below records sustainable irrigation issues that were raised in first round consultation. Note the suggested actions listed, do not necessarily correspond with the issues raised.

Table A-3: Consultation Issues and actions feedback sorted by North Central CMA Program

Relevant LWMP themes	Issues raised in consultation	Suggested actions raised in consultation
Planning and development	▪ Need planning scenarios for irrigation water versus environmental water ▪ Plans are not being implemented because the CMA is risk averse ▪ Lack of money to implement plans ▪ Affordability of water and business viability ▪ Adaptation in 7 years is too short. It is a lot to ask one generation of farmers to absorb when there are also droughts, floods, production down-turn and the expectation to invest in capital. ▪ "It is a better option to sell the water to someone else and get out, that is devastating to the community" – 30 farms leaving Cohuna in the last 8 weeks ▪ Encourage development within the GMID rather than outside it ▪ CMA changes its focus, for example, the Connections Program – it was happening elsewhere but the channel the person was on made them ineligible. The channel became eligible later and by then all the funding opportunities had passed ▪ Financial viability of GMID is under threat	▪ Maintaining salt disposal schemes ▪ Landcare plans for wetlands for landholder groups ▪ New irrigation development approvals streamlined ▪ Maximise opportunities for new irrigation development e.g. Melbourne vegetable farmers re-locating and glasshouses ideally within existing GMID ▪ Incorporate cultural heritage into plans ▪ Better protection of middens and cultural heritage sites especially when undertaking pest, plant and animal control ▪ Partnership with GMW – ensure CMA and Dept of Ag are involved with water services committees ▪ Link the WFP to Council with a permit system (a similar model to that in Shepparton) so the permit enables the landholder to fulfil the works as set out in the WFP. ▪ Balance water needs (environment and irrigators)
Land management	▪ Crown land is operated by agencies but not managed by agencies ▪ Lifestyle properties ▪ Irrigation districts are shrinking, and more dryland areas are in amongst the irrigation	▪ Need lifestyle property planning e.g. at Tyntynder Flats – desperately needs a Landcare group ▪ Create the ability to scale the whole farm plan to small landholders ▪ Assist adaptation to less water by transitioning to dryland and intensive animals

Relevant LWMP themes	Issues raised in consultation	Suggested actions raised in consultation
	▪ Plan needed for newly de-watered land and what do to with it (managing C&D classed land) ▪ Regulation isn't happening because the authorities do not have the capacity to respond i.e. illegal levee banks built	▪ River frontage management for pest, plant and animal management ▪ New enterprises for de-watered land
Water management	▪ Groundwater protection infrastructure is old and protects certain areas, it requires upgrading ▪ 30% of outlets are only delivering 10ML (they cost $50,000 to put in). ▪ More people are trading in water that don't irrigate ▪ Existing structures aren't being used to their potential ▪ Some people are paying for the infrastructure even though they aren't using any water ▪ Expanses of channel structures doesn't enable the water to get there quickly. Pumps don't stop running whereas outlets do when the water level drops. It can take 10 hours for the water level to rise again. ▪ Uncertainty about irrigation going forward so is limiting confidence to invest in infrastructure ▪ Farmers don't get the benefits of water savings ▪ Frustration that modernisation is not working on long channels where distance between control structures is too large ▪ Stranded assets because water dried off ▪ Mid-Loddon groundwater irrigation is not available for irrigation incentive ▪ Salt is under control ▪ De-watered land has already been addressed by farmers (except for small blocks in Tyntynder) ▪ People have adapted to lower rainfall in the dryland ▪ Loddon Valley has adjusted to lower water use whereas Cohuna has not ▪ Channel capacity at Little Murray Weir	▪ Increase investment in the WFP and on-farm modernisation ▪ Expand Plan 2 Farm for new enterprises ▪ Amalgamation of small blocks to attract scale for investors ▪ Stewardship covenants payments for protecting the environment ▪ Incentives for water use efficiency ▪ Continue to fund farmer Landcare / productivity groups and their facilitators e.g. Normanville, Pyramid Hill ▪ Consistent incentives for those outside the GMID i.e. the WFP incentive is lower for groundwater users ▪ Better standards for irrigation designs ▪ Recommissioning of ground water monitoring with private monitoring e.g. Kilter (monitoring 40 bores) ▪ Flexibility in GMID water services to assist industries to adapt and to fine tune level of service to their need e.g. horticulture vs opportunistic ▪ Re-visit Lake Meran operational plan – community has no confidence in data setting operational rules ▪ Sensible GMW rationalisation to reduce costs ▪ Information and training on cultural heritage to protect Aboriginal history ▪ How to manage C & D classed land in the irrigation district – need to make sure irrigation is on the best soils ▪ Set up people to monitor and gather results ▪ Monitoring data is not accessible to farmers i.e. flood data ▪ Undertake a climate change impact study on the GMID ▪ Research, development and extension on farm wetlands and their watering needs to demonstrate a case for environmental water ▪ Salt monitoring on Little Murray Weir

Relevant LWMP themes	Issues raised in consultation	Suggested actions raised in consultation
	▪ Inequitable funding opportunities across irrigators in the Connections Program ▪ Irrigation attracting rain – community concern catch 22 (less irrigation = less rain) ▪ Poor regional drainage designs i.e. dry lagoons ▪ Drain and waterway management responsibility is falling on farmers ‘ ▪ Need for drainage much reduced as landscape has dried up ▪ CMA is exploring landholders taking over CMA drains – this is not supported by landholders	▪ Address 30% of modernised outlets delivering less than 10ML per year vs equity for those who want 20ML per day outlets GMW reconfiguration crossing floodways putting blockages across floodways. ▪ Drainage infrastructure development and operations -Better manage drainage systems ▪ Drainage needs to reconnect lagoons
Biodiversity management	▪ Loss of native vegetation and local ecological systems due to channel lining ▪ Screens on CMA water structures for carp control ▪ Upgrading channels has been detrimental to animals/ habitat ▪ Removed vegetation 12m each side of channel ▪ Did not relocate wildlife so they washed up in paddocks ▪ Lack of seepage form the channel increased water use efficiency but killed localised habitat that relied on seepage ▪ No offsets ▪ Channels are a dead-end for water fauna ▪ Fish and turtles are vulnerable to pumps (need screens) ▪ Gravity systems replaced with pumps and no alternative power supply ▪ Fencing channels has stopped wildlife from being able to access water to drink ▪ Native fauna forced onto farms during forest watering	▪ Better biodiversity input into irrigation upgrade planning.
Community capacity	▪ Cultural heritage and WFP – how to manage it?	▪ New lifestyle landholders increasing – they have little experience and need greater support e.g. for pest, plants and animals and environmental works

Appendix 4: Feedback on discussion paper in second round consultation

INTRODUCTION

In August and September 2019 RMCG and the North Central CMA met with several communities to discuss the programs in the Land and Water Management Plan. The workshops were held in: Swan Hill, Kerang (agencies), Pyramid Hill, Boort, Kerang (community) and Gunbower. A summary of the discussion points from each workshop are in the following sections.

SWAN HILL

- Remodelling Whole farm planning to include:
  - Business planning
  - Audit of physical resources
  - Scenarios: high medium low water availability
  - Soil salinity survey
  - Options to make the most of dryland – removing fences and lane ways, amalgamating blocks etc
  - System check audit
- Extension needs for:
  - Abandonment of orchards in the Tresco – pest plant and animal issue, biosecurity issue with fruit fly
  - Tyntynder flats – extension and land use planning- a special planning zone?
  - Pest plants and animals – there has been land that used to be irrigated that still holds a water use licence and is starting to harbour pests
- Removing delivery shares when rationalising
- Mallee incentives - Capturing Tresco and Woorinen horticulture under the Mallee incentives program
- Revisit soil salinity maps
- Understanding water markets and water use efficiency
- Salinity – monitoring and precursor to WFP
- Water holding capacity soil assessments would be useful
- GMW channel rationalisation should start from the bottom up
- Potential industry partners need to be included
- Increased water needed – another dam?

KERANG – AGENCIES

- Demand for reuse incentive is high and should continue
- Farms are expanding in size
- Dairy farms are exiting and in transition to mixed farming or expanding and adopting total mixed ration systems/ barns
- New Irrigation development -centre pivots needing vegetation removal is an issue, not always going through the necessary approvals
- Pivots being installed on the wrong soil types
- Field days are supported with broad agency participation and community engagement
- Change thinking around corporate farming; can be positive
- Ramsar and high value wetlands are a reason for government to invest
- Effluent management for intensive animals industries – dairy, chicken, piggeries
- Irrigation system check incentive would be supported
- Soil moisture probes incentive would be supported
- Soil suitability assessment incentive would be supported
- Council want a bigger role and want intensive animal industries
- Post connections irrigation program to assist GMW reconfiguration.
- WFP to be at a higher level -> Plan 2 Farm Resources Audit -> Scenario planning High, Medium, Low water prices-> Layout plus GMW supply rationalisation
- Compulsory training a precursor to receive incentives
- Stewardship - field days, break thinking around corporates, opportunity with factories to the east, secondary value add
- Adoption program- range of scenarios around availability, broader whole farm planning, centre pivots and laterals- irrigation system checks, water use licence - SMM probes, irrigation course, energy efficiency, matching irrigation system with soil
- Council greater role, transitioning little pockets and how are they going to be managed, capability of modernisation, re-use and high flow

PYRAMID HILL

- Illegal native vegetation clearing – compliance and lack of resources for Councils
- Increasing biodiversity and trees on farms and linking it with Whole Farm Planning strongly supported
- Want to see tree planting and fencing incentives
- Want to see what cultural heritage programs might be
- Support for Plan 2 Farm, but it should not be compulsory. Succession planning is important.
- Sustainable soils groups supported
- Soil salinity maps still important
- Whole farm planning mixed support, many do works without a formal WFP
- Rationalisation of GMW supply and outlets should be considered with reduced delivery shares
- Support to convert to dryland opportunities
- Open to irrigation system checks, uniformity and power use
- Incentive for re use systems supported
- WFP for those who need it - linking and protecting trees on farm, tree belts and shelter for shade
- Irrigation scheduling supported- soil moisture probes
- Research and development - water use efficiencies species/ pastures
- Wetlands - intermittent, permanent. Modernisation has reduced wetland areas when channels decommissioned/pipelined.
- Water for private wetlands and farm biodiversity supported
- Local knowledge important to include

BOORT

- Big concern over high water prices and water leaving the district
- Lake Meran is an issue for the people who pump from it. The water is too salty. Need a new management plan.
- Illegal native vegetation clearing – more understanding needed of the pathways for vegetation clearing. Funding needed for extension to build capacity within the shires. Local people unwilling to report.

- Education of native vegetation clearance and other regulations is required by/for Councils. An extension person for each shire on native vegetation and biodiversity is needed.
- Extension and education around land stewardship, rules and regulations of native veg
- Intermittent wetlands on private land needs managing
- Do not want to see GMW irrigation system rationalised as we cannot predict future. Water may return. Loddon valley has been doing okay in recent years and has its place. Now not losing as much water as other parts of GMID.
- Boort has had new pivots and new development.
- Cost of delivery shares is an issue and reducing delivery shares may impact on irrigators.
- Solar farms and potential erosion and drainage from panel run-off
- Farm business planning – Plan 2 Farm supported
- Whole farm planning - incentives need to be consistent between diverters and districts. Incentives for private diverters and irrigation district irrigators need to be the same rates and rules.
- Irrigation scheduling – soil moisture monitoring and weather stations supported
- WFP - shelter belts/trees/ farm biodiversity need to be included.
- Incentives required for landholders to protect biodiversity
- Certified whole farm plans would be useful, but if the process is too hard people do not do them and this means the opportunity to address environmental improvements is lost.
- Community engagement with - sustainable soils program, farm walks supported
- Pest plants and animal risks increase as irrigation retreats and dryland not yet viable units
- Local experience sharing is important. Sustainable soils program is successful and should continue.
- Encouraging young farmers is important
- Education - making things accessible, understand yield bite sized chunks local people delivery
- Group community-based model for delivery. Landcare an important player
- Community - irrigation drives community. Retaining the water and GMW system. Many modernised outlets with little use, means we are worse off.
- Keeping communities together, losing jobs is big concern. Want vibrant sustainable agriculture communities
- Gold miners entering the Region may have impacts on surface water and groundwater.
- Lignum in drainage lines blocking drainage flows needs to be addressed.

KERANG [COMMUNITY]

- Natural resource management issues on public land need to be recognised so public land manager's address, e.g. erosion around mid-river storages when they are kept at full supply (Kow Swamp, Kangaroo, Charm, Boga). Also, joint action on pest plants and animals need to involve public land manager.
- Whole farm planning – follow up on previous WFP on the earth works implemented. Current 5 year time frame seems reasonable to revise WFP. New technology always changing designs eg. bigger bays. And now seeing parts of the farm modernised. Plus larger paddocks for cropping. Property ownership changes often trigger need to revise WFP as enterprises and options change.
- Irrigation systems checks would be useful and also need to consider energy requirements of the irrigation system.
- Checklist in producing WFP design: Encourage contractors input into preliminary design of the whole farm plan. Consult with those who are doing the work.
- Dynamic future water environment requires business planning to scope options for low, medium and high water price scenarios. Link to Plan 2 Farm program. Enable farmers to look into options for their business so they can transform given the change that is happening with the water market
- WFP could include identifying opportunities to rationalise GMW infrastructure/outlets and be proactive for discounted termination fees and limited term contracts – delivery share review.
- Assist farm amalgamation and explanation by removing barriers e.g. delivery shares /termination fees make land unattractive to buy and restricts entry of next generation and new enterprises.
- Increasing pressure for remaining irrigators if the costs of GMW infrastructure are not reduced.
- Increasing intensification (e.g. feed pads) of farms requires business plans (P2F) as does transition out of irrigation.
- Big changes occurring 180 dairy farms (Cohuna area) and 30 already gone this year and 38 on the verge of going.
- Extension to support all of the above is required. Business planning needs to be delivered by expert consultants as it is a highly specialised area and do not want businesses committing to poorly developed directions.
- Soil assessments to include: soil capability, matching soil type and irrigation infrastructure (e.g. centre pivots are not ideal on heavy clay soils), optimising soil health, sink hole potential

- Research: Deep soil analysis to further understand sink holes given the growing interest in ground water pumping and the dryer environment. Is regional groundwater pumping in Vic/NSW contributing to this problem?
- Locals are not satisfied with the Lake Meran management plan. They believe insufficient irrigation allocation and usage in the management plan is making lake saline.
- Tyntynder flats is an example of an area that is transitioning out of irrigation to rural living
- Irrigation tools: interest in soil moisture monitoring
- Streamlined process for implementing incentives program
- Make incentive payments direct to farmer rather than provider
- Incentives on best practice and to young farmers
- Address issues so that land is not abandoned
- Need to brand our product
- Need to provide information on new crops and higher value enterprises for irrigation
- Investigate if Drainage Course Declarations approach could lower the cost of GMW owned drains.

G U N B O W E R

- Continue to support WFP, plus irrigation scheduling tools and infrastructure upgrades
- Support for transitioning to higher value crops (eg. turf) or to dryland
- Need to recognise the environmental impact of shrinking irrigation area and biodiversity and that this needs to be offset with environmental works on farms. eg. habitat trees.
- Research into understanding the impacts of drying land on biodiversity (dairy farms used to be wetlands)
- It is too hard to access incentives: process is too complex and transaction cost for farmers is too high
- There is interest in alternative high value irrigation, new enterprises are looking to enter the area i.e. turf
- Concerns about transitioning to dryland and removing GMW infrastructure i.e. it is like removing under used railway lines
- Alternative fertilisers/ composts needs more research - link with effluent ponds and opportunity to use nutrients for production and energy production (Methane) especially with increasing intensification.
- Biowaste opportunities.
- All industries need to expand, cannot be small anymore. But possibly a 2,000 cow herd is practical maximum due to nutrient balances?
- Need streamlined process for irrigators/investors to obtain new information.
- Mining companies looking at prospects in the area: LWMP should emphasise that there should be no negative impacts on natural environment or the irrigation industry.
- Further engagement needed with dairy industry, no turnout at Gunbower.
- Resources are chewed up in planning rather than action on the ground, need to make it easier process. And need people on the ground.
- Need to promote the Region in partnerships program and link with Councils economic development programs. Agencies need to proactively seek new industries and businesses to the area.

As per the first round of consultation the above list has been grouped according to the four categories below to ‘sign post’ issues and to inform the relevant CMA and other government plans:

1) Relevant to sustainable irrigation and of direct applicability to the LWMP and the Sustainable Irrigation Program that will be a funding source for the Plan. The Government criteria for this are listed in 3.4.

2) Relevant to the North Central CMA Sustainable Agriculture Strategy

3) Relevant to the renewal of the North Central Regional Catchment Strategy and its supporting plans such as the River Health Strategy, Waterway Management Strategy, Environmental Watering Plan, Native Vegetation Management Plan, Floodplain Management Strategy, Invasive Plant & Animal Strategy, Regional Growth Plans, Climate Adaptation and Mitigation Plan, Waterway Strategy, and Soil Health Action Plan.

4) Relevant to broader Government plans/strategies.

Findings and analysis from the focus group consultation has been documented in Table A4 below. We have categorised these findings by each of the four categories listed above and have provided a suggested response for the new LWMP.

Table A4: Issues and actions feedback sorted by North Central CMA Program

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
Sustainable Irrigation - LWMP	1	▪ Remodelling Whole farm planning to include: - Business planning - Audit of physical resources - Scenarios: high medium low water availability - Soil salinity survey - Options to make the most of dryland – removing fences and lane ways, amalgamating blocks etc - System check audit	Whole farm planning under the LWMP Adoption program
	1	▪ Extension needs for: - Abandonment of orchards in the Tresco – pest plant and animal issue, biosecurity issue with fruit fly - Tyntynder flats – extension and land use planning- a special planning zone? - Pest plants and animals – there has been land that used to be irrigated that still holds a water use licence and is starting to harbour pests	LWMP education and training program
	1	▪ Removing delivery shares when rationalising	Joint Land and Water Management Program with GMW under the LWMP adoption program
	1	▪ Revisit soil salinity maps	Whole farm planning under the LWMP adoption program
	1	▪ Understanding water markets and water use efficiency	LWMP education and training program
	1	▪ Mallee incentives - Capturing Tresco and Woorinen horticulture under the Mallee incentives program	Mallee Irrigation Incentives Program
	1	▪ Salinity – monitoring and precursor to WFP.	Whole farm planning under the LWMP adoption program
	1	▪ Water holding capacity soil assessments would be useful4	Whole farming planning and education and training under LWMP adoption program

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
	1	▪ GMW channel rationalisation should start from the bottom up	Joint Land and Water Management Program with GMW under the LWMP adoption program
	1	▪ Potential industry partners need to be included	LWMP promotion and partnerships program
	1	▪ Demand for reuse incentive is high and should continue	Whole farm plan for irrigation area – reuse under LWMP adoption program and drainage program
	1	▪ Farms are expanding in size.	Plan 2 Farm for irrigation area under the LWMP adoption program
	1	▪ Dairy farms are exiting and in transition to mixed farming or expanding and adopting total mixed ration systems/ barns.	Plan 2 Farm under the LWMP adoption program
	1	▪ New Irrigation development -centre pivots needing vegetation removal is an issue, not always going through the necessary approvals.	Northern Victoria Irrigation Development Guidelines
	1	▪ Pivots being installed on the wrong soil types.	Whole farm planning under the adoption program and the education and training program under the LWMP
	1	▪ Field days are supported with broad agency participation and community engagement.	LWMP promotion and partnerships program. This is also covered under the Sustainable Agriculture Strategy
	1	▪ Change thinking around corporate farming; can be positive.	LWMP promotion and partnerships
	1	▪ Ramsar and high value wetlands are a reason for government to invest.	Environmental Stewardship Plan under the LWMP adoption program
	1	▪ Irrigation system check incentive would be supported.	Whole farm planning under the LWMP adoption program
	1	▪ Soil moisture probes incentive would be supported.	Whole farm planning under the LWMP adoption program
	1	▪ Soil suitability assessment incentive would be supported.	Whole farm planning under the LWMP adoption program
	1	▪ Post Connections irrigation program to assist GMW reconfiguration.	Joint Land and Water Management Program with GMW under the LWMP adoption program

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
	1	▪ WFP to be at a higher level -> Plan 2 Farm Resources Audit -> Scenario planning High, Medium, Low water prices-> Layout plus GMW supply rationalisation.	Whole farm planning / Concept Plan supported by Plan 2 Farm under the LWMP adoption program
	1	▪ Compulsory training a precursor to receive incentives.	LWMP education and training program to be considered by implementation committee
	1	▪ Stewardship - field days, break thinking around corporates, opportunity with factories to the east, secondary value add.	LWMP education and training program
	1	▪ Adoption program- range of scenarios around availability, broader whole farm planning, centre pivots and laterals- irrigation system checks, water use licence - SMM probes, irrigation course, energy efficiency, matching irrigation system with soil.	Whole farm planning / Concept Plan supported by Plan 2 Farm under the LWMP adoption program
	1	▪ Council greater role, transitioning little pockets and how are they going to be managed, capability of modernisation, re-use and high flow.	LWMP promotion and partnerships and education and training program under LWMP e.g. field days
	1	▪ Support for Plan 2 Farm, but it should not be compulsory. Succession planning is important.	Whole farm planning supported by Plan 2 Farm under the LWMP adoption program
	1	▪ Want to see tree planting and fencing incentives.	Environmental Stewardship Plan under the LWMP adoption program
	1	▪ Want to see what cultural heritage programs might be.	Environmental Stewardship Plan and Whole Farm Plan under the LWMP adoption program
	1	▪ Sustainable soils groups supported.	LWMP education and training program
	1	▪ Soil salinity maps still important.	Whole farm planning under the LWMP adoption program
	1	▪ Whole farm planning mixed support, many do works without a formal WFP.	Whole farm planning under the LWMP adoption program
	1	▪ Rationalisation of GMW supply and outlets should be considered with reduced delivery shares.	Joint Land and Water Management Program with GMW under the LWMP adoption program
	1	▪ Support to convert to dryland opportunities.	Plan 2 Farm and Concept Plan under the LWMP adoption program

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
	1	▪ Open to irrigation system checks, uniformity and power use	Whole farm planning under the LWMP adoption program
	1	▪ Incentive for re use systems supported.	Whole farm planning under the LWMP adoption program and drainage program
	1	▪ WFP for those who need it - linking and protecting trees on farm, tree belts and shelter for shade	Whole farm planning and Environmental Stewardship Plan under the LWMP adoption program
	1	▪ Irrigation scheduling supported- soil moisture probes.	Whole farm planning under the LWMP adoption program
	1	▪ Research and development - water use efficiencies species/ pastures.	LWMP research and development program
	1	▪ Wetlands - intermittent, permanent. Modernisation has reduced wetland areas when channels decommissioned/pipelined.	Private wetlands will be covered by the Environmental Stewardship Plan under the LWMP adoption program. Public Wetlands covered by the RCS Rivers and Wetlands Sub-Stratgey
	1	▪ Water for private wetlands and farm biodiversity supported.	Environmental Stewardship Plan under the LWMP adoption program
	1	▪ Local knowledge important to include in WFP.	Whole farm planning under the LWMP adoption program
	1	▪ Do not want to see GMW irrigation system rationalised as we cannot predict future. Water may return. Loddon valley has been doing okay in recent years and has its place. Now not losing as much water as other parts of GMID.	Adoption program to ensure reconfiguration is farmer driven through Joint Land and Water Management Program with GMW
	1	▪ Boort has had new pivots and new development.	Northern Victorian Irrigation Development Guidelines and Concept Plan for whole physical layout under the LWMP adoption program
	1	▪ Cost of delivery shares is an issue and reducing delivery shares may impact on irrigators.	Dryland reconfiguration and Joint Land and Water Management Program with GMW under the LWMP adoption program
	1	▪ Whole farm planning - incentives need to be consistent between diverters and districts. Incentives for private diverters and irrigation district irrigators need to be the same rates and rules.	Whole farm planning under the LWMP adoption program
	1	▪ Irrigation scheduling – soil moisture monitoring and weather stations supported.	Whole farm planning under the LWMP adoption program

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
	1	▪ WFP - shelter belts/trees/ farm biodiversity need to be included.	Environmental Stewardship Plan under the LWMP adoption program
	1	▪ Incentives required for landholders to protect biodiversity.	Environmental Stewardship Plan under the LWMP adoption program
	1	▪ Certified whole farm plans would be useful, but if the process is too hard people do not do them and this means the opportunity to address environmental improvements is lost.	Whole farm planning through the adoption program and education and training support under the LWMP
	1	▪ Education - making things accessible, understand yield bite sized chunks local people delivery.	LWMP education and training program
	1	▪ Group community-based model for delivery. Landcare an important player.	LWMP education and training program
	1	▪ Whole farm planning – follow up on previous WFP on the earth works implemented. Current 5 year time frame seems reasonable to revise WFP. New technology always changing designs e.g. bigger bays. And now seeing parts of the farm modernised. Plus larger paddocks for cropping. Property ownership changes often trigger need to revise WFP as enterprises and options change.	Whole farm planning and concept plan under the LWMP adoption program
	1	▪ Irrigation systems checks would be useful and also need to consider energy requirements of the irrigation system.	Whole farm planning under the LWMP adoption program
	1	▪ Checklist in producing WFP design: Encourage contractors input into preliminary design of the whole farm plan. Consult with those who are doing the work.	Whole farm planning under the LWMP adoption program
	1	▪ Dynamic future water environment requires business planning to scope options for low, medium and high water price scenarios. Link to Plan 2 Farm program. Enable farmers to look into options for their business so they can transform given the change that is happening with the water market.	Whole farm planning and Concept Plan supported by Plan 2 Farm under the LWMP adoption program
	1	▪ WFP could include identifying opportunities to rationalise GMW infrastructure/outlets and be proactive for discounted termination fees and limited term contracts – delivery share review.	Whole farm planning and Joint Land and Water Management Program with GMW under the LWMP adoption program

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
	1	▪ Assist farm amalgamation and explanation by removing barriers e.g. delivery shares /termination fees make land unattractive to buy and restricts entry of next generation and new enterprises.	Dryland re-configuration and Joint Land and Water Management Program with GMW under LWMP adoption program
	1	▪ Increasing pressure for remaining irrigators if the costs of GMW infrastructure are not reduced.	Farm decisions supported by Plan 2 Farm and Joint Land and Water Management Program with GMW under LWMP adoption program
	1	▪ Extension to support all of the above is required. Business planning needs to be delivered by expert consultants as it is a highly specialised area and do not want businesses committing to poorly developed directions.	Plan 2 Farm (adoption program) supported by the education and training program under the LWMP
	1	▪ Soil assessments to include: soil capability, matching soil type and irrigation infrastructure (e.g. centre pivots are not ideal on heavy clay soils), optimising soil health, sink hole potential.	Whole farm planning under the LWMP adoption program supported by the research and monitoring program
	1	▪ Research: Deep soil analysis to further understand sink holes given the growing interest in ground water pumping and the dryer environment. Is regional groundwater pumping in Vic/NSW contributing to this problem?	LWMP research and monitoring program
	1	▪ Tyntynder flats is an example of an area that is transitioning out of irrigation to rural living.	LWMP promotion and partnerships program supported by the and Joint Land and Water Management Program with GMW under LWMP adoption program
	1	▪ Irrigation tools: interest in soil moisture monitoring.	Whole farm planning under the LWMP adoption program
	1	▪ Streamlined process for implementing incentives program.	LWMP adoption program
	1	▪ Make incentive payments direct to farmer rather than provider.	LWMP adoption program
	1	▪ Incentives on best practice and to young farmers.	Whole farm planning and Plan 2 Farm under the LWMP adoption program and supported by the education and training program
	1	▪ Address issues so that land is not abandoned.	Environmental Stewardship Plan through whole farm planning under LWMP adoption program
	1	▪ Need to brand our product.	LWMP promotion and partnerships program

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
	1	▪ Need to provide information on new crops and higher value enterprises for irrigation.	LWMP research and monitoring program
		▪ Investigate if Drainage Course Declarations approach could lower the cost of GMW owned drains.	LWMP drainage infrastructure development and operations program
	1	▪ Continue to support WFP, plus irrigation scheduling tools and infrastructure upgrades.	Whole farm planning under the LWMP adoption program
	1	▪ Support for transitioning to higher value crops (e.g. turf) or to dryland.	Whole farm planning and Plan 2 Farm under the LWMP adoption program
	1	▪ Need to recognise the environmental impact of shrinking irrigation area and biodiversity and that this needs to be offset with environmental works on farms. E.g. habitat trees.	Environmental Stewardship Plan under LWMP adoption program
	1	▪ Research into understanding the impacts of drying land on biodiversity (dairy farms used to be wetlands).	LWMP research and monitoring program
	1	▪ It is too hard to access incentives: process is too complex and transaction cost for farmers is too high.	LWMP adoption program – education and training program to support applications
	1	▪ There is interest in alternative high value irrigation, new enterprises are looking to enter the area i.e. turf.	LWMP promotion and partnerships
	1	▪ Concerns about transitioning to dryland and removing GMW infrastructure i.e. it is like removing under used railway lines.	Joint Land and Water Management Program with GMW under LWMP adoption program
	1	▪ Need streamlined process for irrigators/investors to obtain new information.	LWMP education and training program and promotion and partnerships
	1	▪ Resources are chewed up in planning rather than action on the ground, need to make it an easier process. And need people on the ground.	LWMP planning program to address governance issues
	1	▪ Need to promote the Region in partnerships program and link with Councils economic development programs. Agencies need to proactively seek new industries and businesses to the area.	LWMP promotion and partnerships

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
	1	▪ Increasing biodiversity and trees on farms and linking it with Whole Farm Planning strongly supported	Whole farm planning and Environmental Stewardship Plan under the LWMP adoption program
	1	▪ Farm business planning – Plan 2 Farm supported.	Whole farm planning under the LWMP adoption program
	1	▪ Increasing intensification (e.g. feed pads) of farms requires business plans (P2F) as does transition out of irrigation.	Whole farming planning supported by Plan 2 Farm under the LWMP adoption program
	1	▪ Encouraging young farmers is important	LWMP Plan 2 Farm and Education and training
	1	▪ Big changes occurring 180 dairy farms (Cohuna area) and 30 already gone this year and 38 on the verge of going.	Farm decisions supported by Plan 2 Farm under the LWMP adoption program
	1	▪ Intermittent wetlands on private land needs managing.	Environmental Stewardship Plan under the LWMP adoption program
	1	▪ Extension and education around land stewardship, rules and regulations of native vegetation.	Environmental Stewardship Plan under the LWMP adoption program supported by the education and training program
	1	▪ Community - irrigation drives community. Retaining the water and GMW system. Many modernised outlets with little use, means we are worse off	LWMP promotion and partnerships program
	1	▪ Keeping communities together, losing jobs is big concern. Want vibrant sustainable agriculture communities.	LWMP promotion and partnerships program
	1	▪ Further engagement needed with dairy industry, no turnout at Gunbower.	LWMP promotion and partnerships program
Sustainable Agriculture	2	▪ Community engagement with - sustainable soils program, farm walks supported.	Regenerative Agriculture project under the Sustainable Agriculture Strategy
	2	▪ Local experience sharing is important. Sustainable soils program is successful and should continue.	Regenerative agriculture project under the Sustainable Agriculture Strategy and LWMP education and training program
	2	▪ Alternative fertilisers/ composts needs more research- link with effluent ponds and opportunity to use nutrients for production and energy production (Methane) especially with increasing intensification.	Sustainable Agriculture Strategy

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
	2	▪ Biowaste opportunities.	Sustainable Agriculture Strategy
	2	▪ All industries need to expand, cannot be small anymore. But possibly a 2,000 cow herd is practical maximum due to nutrient balances?	Sustainable Agriculture Strategy
	2	▪ Effluent management for intensive animals industries – dairy, chicken, piggeries.	Sustainable Agriculture Strategy
	2	▪ Council want a bigger role and want intensive animal industries.	Sustainable Agriculture Strategy
Rivers and wetlands	3	▪ Natural resource management issues on public land need to be recognised so public land manager's address, e.g. erosion around mid-river storages when they are kept at full supply (Kow Swamp, Kangaroo, Charm, Boga). Also, joint action on pest plants and animals need to involve public land manager.	CMA to work with the Public Land Manager
	3	▪ Locals are not satisfied with the Lake Meran management plan. They believe insufficient irrigation allocation and usage in the management plan is making lake saline.	Managed under the Loddon Murray Wetlands
	3	▪ Lake Meran is still an issue for the people who pump from it. The water is too salty. Need a new management plan.	Managed under the Loddon Murray Wetlands
Biodiversity	3	▪ Pest plants and animal risks increase as irrigation retreats and dryland not yet viable units.	Invasive Pest Plant & Animal Strategy
Flood plain management	3	▪ Lignum in drainage lines blocking drainage flows needs to be addressed	Flood plain management.
Other	4	▪ Big concern over high water prices and water leaving the district.	Murray Darling Basin Plan and Australian Competition and Consumer Commission
	4	▪ Solar farms and potential erosion and drainage from panel run-off.	Responsibility of local government
	4	▪ Gold miners entering the Region may have impacts on surface water and groundwater.	Earth Resources Regulation

Relevant CMA Program	Category	Issues raised in consultation	Signpost to relevant sub-strategy
	4	▪ Mining companies looking at prospects in the area: LWMP should emphasise that there should be no negative impacts on natural environment or the irrigation industry.	Earth Resources Regulation
	4	▪ Increased water needed – another dam?	Relevant to State and Federal water resource policy
	4	▪ Illegal native vegetation clearing – compliance and lack of resources for Councils.	Council responsibility with support from DELWP
	4	▪ Illegal native vegetation clearing – more understanding needed of the pathways for vegetation clearing. Funding needed for extension to build capacity within the shires. Local people unwilling to report.	Council responsibility with support from DELWP
	4	▪ Education of native vegetation clearance and other regulations is required by/for Councils. An extension person for each shire on native vegetation and biodiversity is needed.	Council responsibility with support from DELWP

Appendix 5: Economic analysis

Private benefits from the adoption program

Generally, irrigation systems have a life of around 20 - 40 years before they need upgrading in some form. This means that of the 200,000 ha irrigated in the LCIR under contemporary conditions, there would be between 5,000 ha to 10,000 ha per year upgraded on average. This is expected to cost irrigators $10 million to $30 million per year and is a private cost that would occur even without a LWMP. The 'additionality' created by the LWMP is more likely to be an improved standard of the works and their environmental benefit rather than an additional area, although it is recognised some irrigators will bring forward investment as a result of the LWMP programs. This 'additionality' creates both private and public benefits.

Private benefits have been based on case studies from the Farm Water Program. This generated on-farm irrigation modernisation, within a whole farm plan that had minimum standards and the benefits were:

- Net productivity of $300/ha/year gross margin improvement
- Water efficiency benefits of 1.8 ML/ha/y saving valued at value of $175/ML, which is $315/ha/year. This water saving is frequently used to double crop or move to a higher water use crop/s that are enabled by the more efficient system; this benefit is in addition to the $300/ha/year benefit above for the production gain on the same crop.
- Labour savings $140/ha/y
- This provides an annual benefit of $755/ha/y.

The value created through the LWMP is a higher standard of works and also some additional works encouraged. The attribution of the total benefit to the LWMP funded programs as a result of higher standards is estimated to 5% of the $755/ha/y or $38/ha/y in private benefit[24]. Assuming that:

- No additional private costs associated with this benefit, as the whole farm planning process may save costs for some and incur additional transaction costs for others, so that overall it is cost neutral
- 3,500 ha/y[25] of the 5,000 ha/y to 10,000 ha/y being upgraded in some form going through the LWMP adoption program whole farm planning process.
- Then there would be 3,500 ha x $38/ha/y = $133,000/y additional benefit at year 1, increasing at the same rate each year to $655,000/y benefit from 17,500 ha at year 5. This has a present value of $7.8 M at 4% over 20 years.

[24] This is $74/ha additional benefit that would have occurred in the counterfactual or 'without plan case'.

[25] This compares with 51,630 ha of whole farm plan designs being undertaken between 2007/8 and 2015/16 which was 6,454 ha/year in the LCIR. But this included acceleration due to the Farm Water Program, so a lower value of 3,500 ha/y has been used.

Higher WFP standards	
Year	**Benefits**
0	
1	133,000
2	266,000
3	399,000
4	532,000
5	665,000
6	665,000
7	665,000
8	665,000
9	665,000
10	665,000
11	665,000
12	665,000
13	665,000
14	665,000
15	665,000
16	665,000
17	665,000
18	665,000
19	665,000
20	665,000
Present Value 4%	**$ 7,806,968.64**

In terms of additional area modernised or significantly brought forward in time. It has been assumed that 5 farms per year doing an additional area of irrigation upgrade of 25 ha per farm, which they otherwise would either not have done or have done many years later[26] this is 125 ha/y. Over 5 years this is 625 ha.

- 625 ha x $755/ha/y = $471,875/year additional private benefits, at year 5. Capitalised using a discount rate of 4% over 20 years provides a present value of benefits of $5.5 M at 4% over 20 years
- Less additional capital development costs irrigation and associated infrastructure at $7,000/ha (lasering, pipe & riser, reuse, drip etc), which for 625 ha spread over 5 years is 125 ha for each of the 5 years of the program at $7,000/ha or $875,000/y cost for 5 years. Present value of costs is $4.1 M
- This gives a Net Present Value of $1.5 M, private benefits less private costs for this component.

Farm costs and benefits with additional modernised area			
Year	**Costs**	**Benefits**	**Benefits-costs**
0	(875,000)		(875,000)
1	(875,000)	94,375	(780,625)
2	(875,000)	188,750	(686,250)
3	(875,000)	283,125	(591,875)
4	(875,000)	377,500	(497,500)
5		471,875	471,875
6		471,875	471,875
7		471,875	471,875
8		471,875	471,875
9		471,875	471,875
10		471,875	471,875
11		471,875	471,875
12		471,875	471,875
13		471,875	471,875
14		471,875	471,875
15		471,875	471,875
16		471,875	471,875
17		471,875	471,875
18		471,875	471,875
19		471,875	471,875
20		471,875	471,875
Present Value 4%	**-$ 4,051,158.32**	**$ 5,539,719.29**	**$ 1,488,560.97**

The sum of the private benefits is $5.5 M plus $7.8 M, which is $13.3 M.

The Plan2 Farm component within the adoption program also generates intangible, un-costed benefits from the farm strategic management decisions, e.g. from seeing an accountant, succession planning, restructuring debt, checking insurance, making wills etc.

[26] This is 125 ha/y above the base rate of adoption that would have occurred in the counterfactual or 'without plan case'.

Private Benefits through the education and training and the research and development programs

A modest benefit has been attributed to the benefits of extension for the education and training program with the research and development program.

This is estimated to achieve an additional $1 million per year from irrigated agriculture through an additional $10/ML gross margin return on 100,000 ML. This is in the context of the Region using between 200,000 to 600,000 ML/year depending on the year and that gross returns vary from around $300/ML for mixed farming to $5,000/ML for high value horticulture with dairying around $1,000/ML (gross margins are approximately half the gross returns per ML).

The total gain in agricultural gross margins represents a small increase of approximately $2 M (gross value is approximately double gross margin) on the $776 M/y gross value of irrigated agriculture production and is a deliberately conservative assessment of benefits.

This is a private benefit with a present value of the gross margin of $1 M/y being $13.6 million at 4 % over 20 years.

Public benefits

Public benefits are expected due to:

- The saved costs from less public GMW infrastructure being required to be modernised or replaced. It is assumed that 10 additional farmers per year will change GMW infrastructure at an average capital saving of $60,000 per farm in saved costs[27]. This saves $0.6 million/year for five years of the program. The present value of this is $2.8 M at 4% over 20 years. This is a benefit for GMW customers.

Year	Benefits
0	600,000
1	600,000
2	600,000
3	600,000
4	600,000
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
Present Value 4%	$ 2,777,937.13

- Enhanced public benefits associated with the enhanced protection of environmental sites on neighbouring public land and also on private land. This would include wetlands, water courses and terrestrial remnant vegetation.

  There are approximately 40,000 ha of wetlands in the area (Figure 2-9), the majority of which are on public land, but conservatively it is estimated that there are at least 4,000 ha (10% of the 40,000 ha) within influence of practices on private land and would benefit from improved stewardship on farm as

[27] Rationalisation of GMW infrastructure at $60,000 per farm. Note one outlet cost saved is more than $40,000 and there is also associated channel decommissioning and other GMW structures. Often several outlets are decommissioned per farm, so $60,000 is a conservative (low) level of benefit.

a result of this LWMP. After identifying key high value areas for targeting action on individual farms in the adoption program, the actions that would be encouraged include reconnecting to floodplain, replanting, fencing, weed control and environmental watering[28]. The program will improve environmental health and create biodiversity linkages and corridors across farms in order to create regional scale improvements eg. along waterways and linking wetlands.

Estimating the benefit generated by environmental improvements is a challenge. In an economic evaluation for the MDBA (Morrison 2010) the Loddon Avoca Region was assessed to have a benefit of $3,363,000 to $5,403,000 for every 1% increase in healthy vegetation.

Using this valuation with an expected 30% improvement in the health of 4,000 ha (10% of wetlands) as a result of the plan would be equivalent to a 3% increase in healthy vegetation in the region and would have a benefit of around $10 million to $16 million. The mid-point value of $13 million benefit has been assumed as a result of implementing this LWMP.

Drainage benefits

Institutional framework/ DCDs

The economic value of drainage includes benefits to agriculture, roads and environmental values. In the Calivil Creek and Pyramid Creek drainage systems, which are mostly served by North Central CMA drains that are earmarked as possible DCDs, it has been calculated that the annual value of the benefit from drainage services is $2.3 M/year. Approximately seventy percent of this value is associated with public benefits associated with roads and the environment. This has been calculated using the framework for assessing benefits from drainage that was developed for the Draft Loddon Murray Irrigation Region Surface Water Management Strategy, 2019 (RMCG 2019).

Without institutional protection and a management regime the drainage infrastructure would be expected to decline. It is assumed that the drainage system would depreciate over 40 years (2.5% per year decline in benefits) and after this time it would be no longer effective.

The LWMP/Drainage Strategy will preserve these benefits. Assuming that the program prevents the decline in benefits at the same rate of 2.5% per year ($57,500) then the benefit of providing the program is $7.2 M at 4% over 20 years. A time period of twenty years, compared to the 40 year depreciation, has been used due to the uncertainty of benefits with regard to landscape change.

[28] The North Central CMA has already undertaken environmental watering of private wetlands in the Wirra-lo Wetland Complex, which is a 66 hectare series of swamps, creeks, depressions and associated margins located on 150 hectares of private land

Drainage benefits	
Year	**Benefits**
0	
1	57,500
2	115,000
3	172,500
4	230,000
5	287,500
6	345,000
7	402,500
8	460,000
9	517,500
10	575,000
11	632,500
12	690,000
13	747,500
14	805,000
15	862,500
16	920,000
17	977,500
18	1,035,000
19	1,092,500
20	1,150,000
Present Value 4%	**$ 7,196,413.18**

Drainage reuse program

In terms of the drainage reuse program. It is assumed:

- additional adoption of 20 reuse systems per year for five years.
- After 5 years resulting in 100 reuse systems servicing 40 ha each.
- This is 4,000 ha capturing an additional 0.7 ML/ha/y [29]of surface runoff or 2,800 ML/y water value.
- An annual water value of $150/ML (after pumping costs), which is after 5 years this is $420,000/year in water value, which being retained by the farmer is a private benefit. Capitalised at 4% over 20 years the saved water value provides $4.9 M private benefits and there would be additional public benefits in water quality improvement
- A public benefit associated with reduced drainage problems as a result of the reuse. The actual area downstream with less drainage issues will vary but is assumed to be the same area of 4,000 ha.
- Installing drains in the LCIR undrained areas provides an average benefit of $27/ha/year (Draft Loddon Murray Irrigation Region Surface Water Management Strategy, 2019 (RMCG 2019). Assuming reuse is targeted to high priority areas with higher benefits, but also that reuse achieves a lower benefit compared to a regional drain as it is less capable in high rainfall events, a benefit of $20/ha/year over 4,000 ha has been assumed. This generates an annual benefit after 5 years of $80,000/year (4,000x 20). This has a present value of benefits of $0.9 M.
- Costs of construction are estimated at $50,000 each for twenty; or $1M/y which is capitalised to be $4.6 M in costs. This cost is to be shared between Government incentives, program management and the irrigators participating depending on the incentive level offered.

Reuse	
Year	**Benefits**
0	0
1	84,000
2	168,000
3	252,000
4	336,000
5	420,000
6	420,000
7	420,000
8	420,000
9	420,000
10	420,000
11	420,000
12	420,000
13	420,000
14	420,000
15	420,000
16	420,000
17	420,000
18	420,000
19	420,000
20	420,000
Present Value 4%	**$ 4,930,717.04**

reuse benefits to region	
Year	**Benefits**
0	
1	16,000
2	32,000
3	48,000
4	64,000
5	80,000
6	80,000
7	80,000
8	80,000
9	80,000
10	80,000
11	80,000
12	80,000
13	80,000
14	80,000
15	80,000
16	80,000
17	80,000
18	80,000
19	80,000
20	80,000
Present Value 4%	**$ 939,184.20**

Reuse	
Year	**Costs**
0	1,000,000
1	1,000,000
2	1,000,000
3	1,000,000
4	1,000,000
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
Present Value 4%	**$ 4,629,895.22**

[29] Based on 10% of rainfall at 300 mm and 10% of annual usage at 400 mm. This is a low level of capture compared to previous analysis eg. Holmes, 2007 due to higher water values, more opportunistic irrigation and a greater level of efficiency now.

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