GWMWater

West Wimmera Groundwater Management Strategy

JUNE 2011

Contents

Foreword

As a GWMWater Board Director and Chairman of the West Wimmera Groundwater Management Area Advisory Committee (the Committee) it is my pleasure to present the West Wimmera Groundwater Management Strategy (the Strategy) to you.

The decision to develop a single integrated groundwater management strategy for the West Wimmera recognises the critical value of the resource for the region and its communities. This Strategy is supported by expert studies of hydrogeology and socio-economic value of groundwater to the region. The studies reinforce the need for action as well as an evidence-based adaptive, long-term approach that considers regional impacts. The approach should also be able to be adjusted to account for observed changes in groundwater resources and new knowledge gained over time.

The Strategy seeks to balance the need to arrest unacceptable declines in groundwater levels in some areas with the desire to provide opportunities for appropriate development in other areas.

The Committee, which included representation from various groundwater areas and users across the region, government agencies and GWMWater, has developed the Strategy. Committee members brought a range of perspectives, experience and knowledge about groundwater in the region to the Strategy.

Throughout the Strategy development process, I saw first-hand the passion and commitment of groundwater users and managers in the region. There was certainly vigorous discussion, and all perspectives around the table received a fair hearing. The Committee sought to achieve well-considered, fair and practical solutions, staying true to its principles and recognising that tough decisions were often required. I applaud the persistence and acumen of the Committee and the GWMWater team who shaped this Strategy.

The feedback and perspective of the broader West Wimmera community has been sought and incorporated into the final Strategy. Thank you to those who made submissions during the consultation process.

On behalf of GWMWater, I now look forward to the support of the West Wimmera community to implement this Strategy to ensure the ongoing availability of this valuable groundwater resource to support the people and environment of that region.

Bonnie Thompson
Chairman
West Wimmera GMA Advisory Committee

1 Introduction

1.1 Background and Purpose

The West Wimmera area of Victoria is underlain by a significant groundwater resource in three aquifers that form part of the Murray groundwater basin located in the southern part of the Murray-Darling Basin. Groundwater is the primary source of water in this area. There are no reliable sources of surface water, with the creeks and rivers within and flanking the area being intermittent or ephemeral.

The status of the groundwater resource varies across this Groundwater Management Area (GMA). Stable groundwater levels exist where groundwater use is low. Some parts are however exhibiting declining levels. The declines primarily since 1997 can be attributed to intensive extraction within the Neuarpur area and to reduced rainfall in the southern fringe of the GMA.

Within the West Wimmera GMA there is an immediate need to manage the current utilisation of the resource to ensure it is able to meet consumptive and environmental requirements in the long term. In some parts of the GMA, the opportunity exists to licence additional extractions. In other areas, reductions in use are required to ensure the resource remains viable.

This West Wimmera Groundwater Management Strategy (the Strategy) presents a long-term management framework for the groundwater resources of the West Wimmera GMA.

The Strategy considers the availability of groundwater as well as the water needs of landholders, towns, agriculture and the environment. It also considers potential impacts of groundwater use and climate change and variability on the resource. The Strategy describes the management concepts and rules adopted by the GWMWater Board that will apply to GWMWater, licence holders and other stakeholders in managing this groundwater resource.

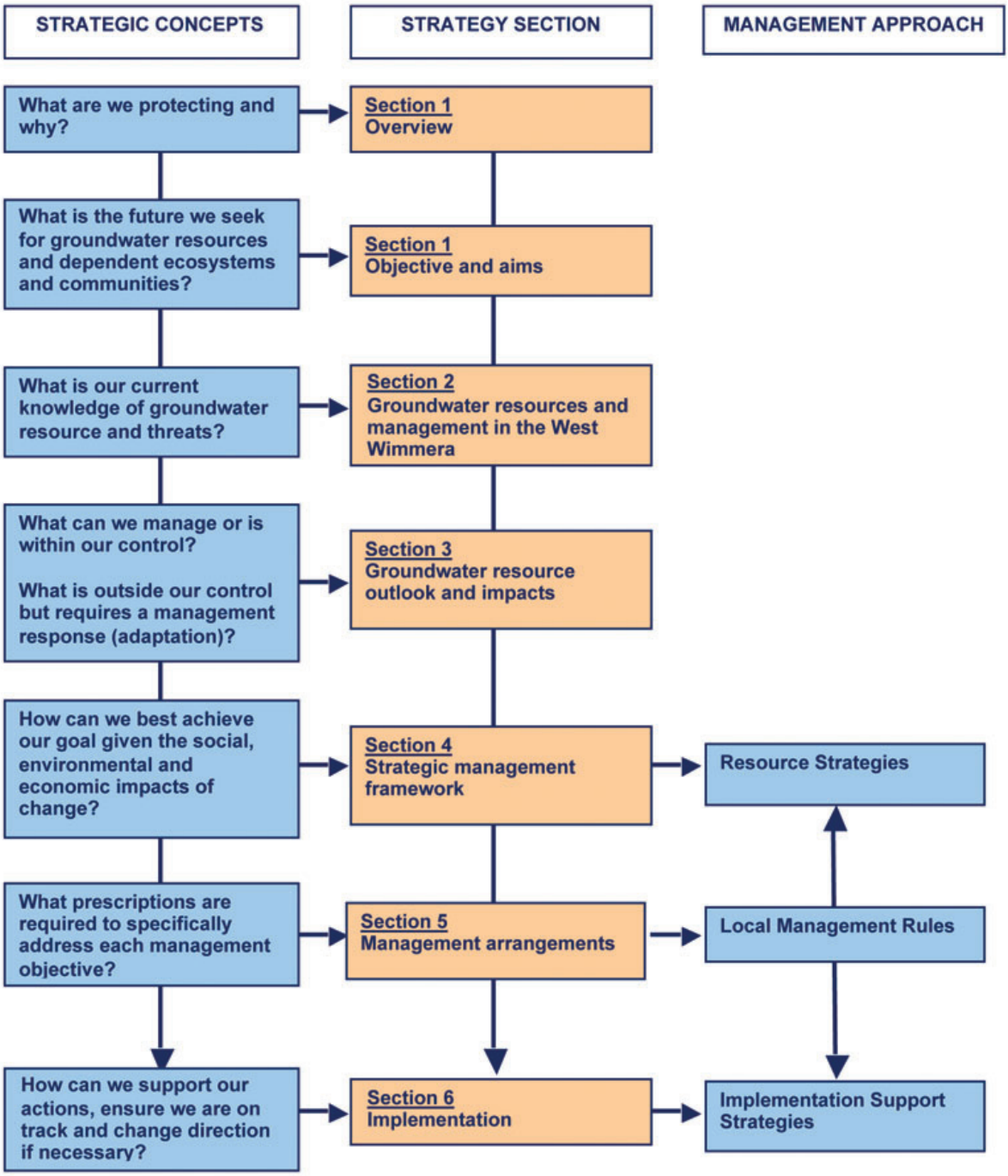
The Strategy incorporates new government policies relating to the management of groundwater across Victoria as outlined in *the Northern Region Sustainable Water Strategy (2009)* and the *Draft Western Region Sustainable Water Strategy (2010)*.

This final version of the Strategy was developed following a community consultation process conducted in early 2011. Comments from that process were assessed by the West Wimmera Groundwater Management Area Advisory Committee (the Committee), and led to some minor, but important changes in this Strategy. A list of committee members is provided in Table 1.1.

Implementation of some elements of the Strategy requires consideration by the Minister for Water.

Figure 1.1 shows how the Strategy integrates broad management concepts into specific management proposals.

Figure 1.1 Strategy outline



1.1.1 Objective

The objective of this Strategy is to ensure the groundwater resource of the area is managed in an equitable manner to achieve the long-term sustainability of the resource and maintain the social, environmental and economic benefits that groundwater provides to the region.

Within the context of this Strategy, long-term sustainability of groundwater is the achievement of a stable trend at a level that does not degrade consumptive or ecological uses of the resource, or the resource itself.

To achieve this objective the Strategy incorporates the following aims:

1. Improved understanding of the resource

1.1. Report on groundwater availability and use, and the current understanding of groundwater replenishment across the GMA;

1.2. Identify and understand the potential impacts on groundwater availability from use, climate change and variability;

1.3. Identify deficiencies in understanding of the resource and propose programs for investigation, monitoring and metering; and

1.4. Establish arrangements and measures for implementing the Strategy, its periodic review, reporting and communication.

2. Managing the use of the resource

2.1. Manage potential threats to the health and condition of the groundwater resource and preserve the environmental values of associated water resources and groundwater-dependent ecosystems;

2.2. Ensure the resource is maintained for domestic, stock and urban water supply purposes;

2.3. Encourage development of best-practice irrigation and water use provided it is within the bounds of sustainability;

2.4. Develop arrangements to help licensees adjust to reduced groundwater availability to address declining groundwater level trends where these are evident;

As the groundwater resource extends beyond the Victorian border into South Australia, the Strategy has also considered the potential for a consistent management approach across the border.

1.2 The West Wimmera Groundwater Management Area

1.2.1 Groundwater and surface water

The West Wimmera GMA encompasses useable groundwater resources in the southern part of the Murray groundwater basin. There are three main aquifers, which are regional, extensive and flat-lying. These continue northwards and westwards into South Australia. The aquifers are:

1. Pliocene Sands Aquifer (also referred to as the Parilla Sands Aquifer);
2. Tertiary Limestone Aquifer (also sometimes referred to as the Murray Group Limestone Aquifer); and
3. Tertiary Confined Sands Aquifer.

The area has a temperate climate, tending to semi-arid in the northern section. It covers parts of four surface water drainage divisions. These are Mallee, Wimmera-Avon, Millicent Coast and a very small part of the Glenelg. In many years little surface water is generated in the GMA. Mosquito Creek in the southern part of the area experiences groundwater-fed baseflows in some years. Several small creeks maintain good flows during winter and spring in wetter years. Some of these creeks flow into South Australia. These surface water resources are not reliable and have not been developed for use. Some catchment dams harvest water in wetter years only. The Wimmera River is adjacent to the eastern boundary of the GMA.

Much of the surface water drains into numerous wetlands and waterways that are located in the GMA. These wetlands and waterways are critical for sustaining environmental values in the landscape.

The West Wimmera is recognised as a 'flagship area' in the *Victorian Land and Biodiversity White Paper (2009)*. There are over 2000 wetlands, about one quarter of Victoria's total, many of which are listed as nationally significant. The wetlands in this area support significant flora and fauna, whether they are wet or dry, including threatened bird and frog species such as brolgas and growling grass frogs. Some of these are groundwater-fed wetlands such as Heard's Lake and White Lake.

The groundwater contributions are critical for maintaining vegetation communities and infiltrating into the wetlands for the many species that are dependent on surface water for survival. The groundwater-fed wetlands of the Natimuk-Douglas chain of lakes support migratory birds recognised for protection under international agreements and Australian Government legislation.

Mosquito Creek is the main watercourse in the region and is of a high value due to the threatened fish species that inhabit it such as the Yarra pygmy perch. It is also the main water source for the Ramsar-listed wetland of Bool Lagoon in South Australia. Groundwater-fed pools are critical for the survival of fish and macro-invertebrates because of the ephemeral nature of flow in Mosquito Creek.

1.2.2 Land and groundwater use

The dominant land use within the GMA is dryland agriculture for cropping and livestock production. A significant part of the area is public land, including the Little Desert and Big Desert national parks.

Groundwater is used for a variety of consumptive purposes within the GMA. The main uses are irrigation, urban water supply, domestic and stock. Commercial use has been established for intensive agriculture including feedlots, piggeries and poultry. Domestic and stock, and agricultural industry bores are spread uniformly across the GMA. The concentration of extraction for irrigation purposes is focused primarily in an area within about 40 kilometres of the South Australian border. This is due to the generally higher yield and better quality of the resource in that area.

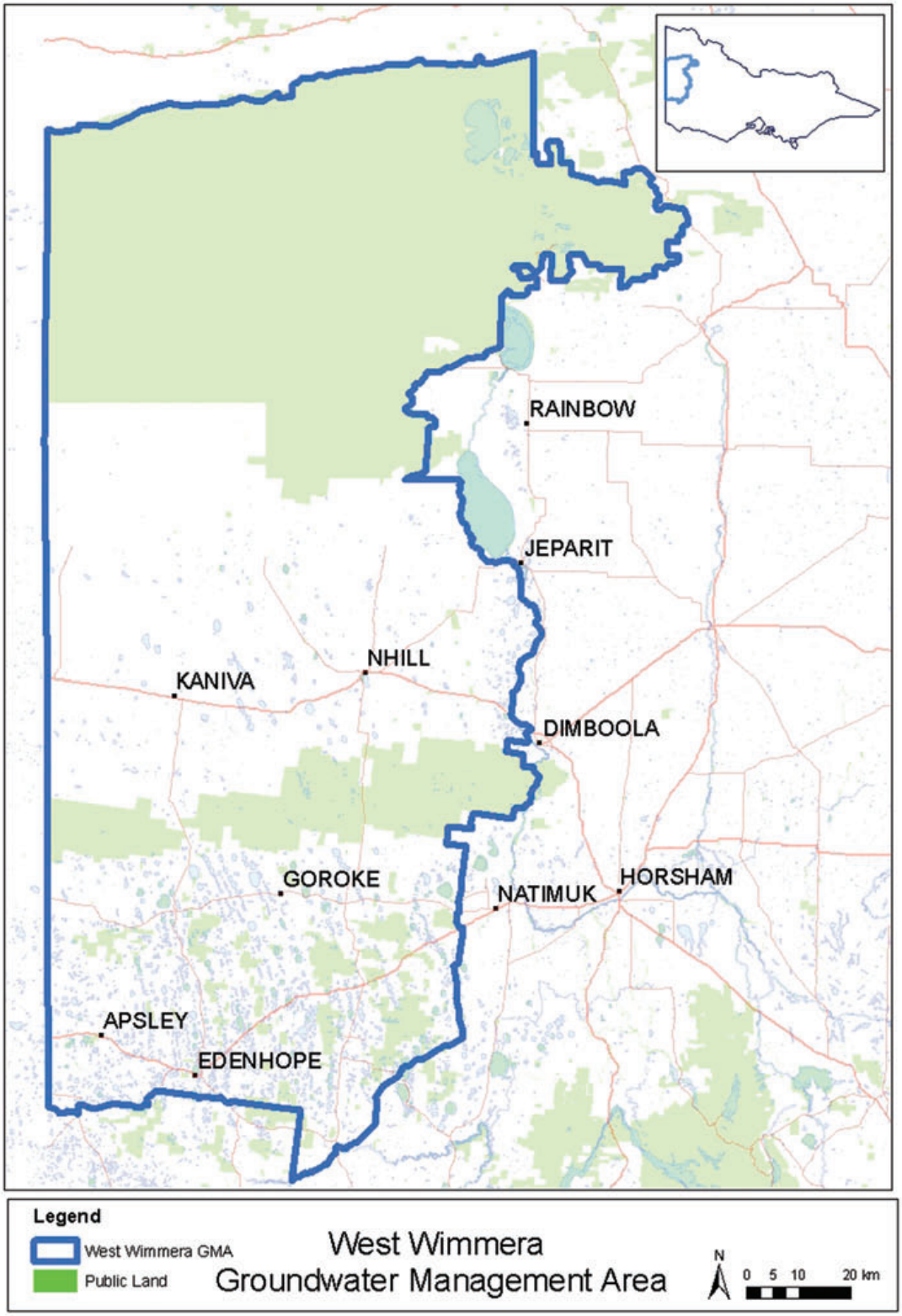
1.2.3 Socio-economic status of the West Wimmera GMA

As part of the development of the Strategy, the Committee undertook a socio-economic assessment of the GMA to determine the current value of groundwater to the area. This assessment also looked at the effect of changes in groundwater availability on socio-economic status.

The URS report "West Wimmera Socio-Economic Study" concluded that groundwater is an extremely important and valuable resource to the West Wimmera community because it is the only significant source of water in the region. The value of groundwater to the community by way of the irrigated and intensive livestock systems combined with dryland systems which are reliant on groundwater for domestic and stock use is estimated at about $69 million per year and it generates regional economic activity of around $121 million per year (URS, 2009).

The study also found that the 'highest value' consumptive uses were domestic and stock and town usage. Therefore, to protect the highest value users, the impacts of any increases or decreases in groundwater availability will be experienced mostly by irrigators. This will have flow-on effects for the local community and the broader West Wimmera region.

Figure 1.2 The West Wimmera Groundwater Management Area



1.3 Strategy Development Process

Following approval from the Minister for Water in 2007, GWMWater established an advisory committee of regional stakeholders to steer development of this Strategy. The members of the Committee are listed in Table 1.1 and include landholders, technical experts and government agencies.

Table 1.1 West Wimmera Groundwater Management Area Advisory Committee

Bonnie Thompson	Chairman, GWMWater Board Director
Jim Fischer	Landholder, Telopea Downs area
Cr Ron Hawkins	Landholder, Telopea Downs area
Barry Williams	Landholder, Kaniva area
David Wallis	Landholder, Kaniva area
Neil Ottoson	Landholder, Neuarpur area
Charles Koch	Landholder, Neuarpur area
Jo Murdoch	Landholder, Apsley area
Trevor Domaschenz	Landholder, Apsley area
Lester Maybery	Landholder, Gymbowen area
Roma Sampson	Landholder, Gymbowen area
Geoffrey Maddern	Landholder, Nhill and surrounding area
Ross McDonald	Landholder, Nhill and surrounding area
Randal Nott	Department of Sustainability and Environment
Terry Lewis	Department of Primary Industries
Hugh Christie, Greg Fletcher	Wimmera Catchment Management Authority
Director Assets (or delegate)	Hindmarsh Shire
Cr Bruce Meyer	West Wimmera Shire
Observer members	
Fiona Rasheed, David Williamson	South East Natural Resources Management Board, SA
Max Burns	Border Groundwaters Agreement Review Committee

This final Strategy presents to the community in the West Wimmera the endorsed arrangements for groundwater management in this area, based on the work of the Committee and input on draft proposals gained through a public consultation process.

1.3.1 Public Consultation Process Undertaken

The West Wimmera Draft Groundwater Management Strategy was available for community comment from Monday 21 February 2011 to Wednesday 30 March 2011. During this period copies of the draft strategy and associated documents were available in hard copy or online from GWMWater, and the West Wimmera and Hindmarsh Shire Council Offices. Copies of the strategy with a covering letter encouraging submissions were also sent to a range of stakeholders.

Press releases, advertisements in local newspapers including the Wimmera Mail-Times, Goroke Free Press, Wimmera Messenger, West Wimmera Advocate and ABC radio were all used to promote the draft plan and encourage submissions for review.

Community information sessions were held in Edenhope and Nhill on 10 March 2011. Briefings were also provided at a meeting of Neuarpur irrigators on 8 March 2011 and to regional staff of the Department of Sustainability and Environment on 24 March 2011.

All submissions except those marked confidential are available on the GWMWater website.

The information provided in submissions was used by the Advisory Committee in development of the final version of the Strategy. A number of minor, though important changes were made as a result of the submissions. None of these changes are considered to significantly change the intent of this Strategy.

1.4 Groundwater Legislative, Planning and Management Framework

1.4.1 Legislative

The Water Act 1989 (Victoria) provides the legislative framework for managing Victoria's groundwater and surface water resources. References to 'the Act' in this Strategy refer to this Act, unless specifically stated.

Other relevant legislation includes:

- *Flora and Fauna Guarantee Act 1988.*
- *Environment Protection Act, 1970.*
- *Groundwater (Border Agreement) Act, 1985.*

A range of State Government water policy documents are especially relevant to this Strategy:

- *Northern Region Sustainable Water Strategy (Northern Region SWS, 2009).*
- *Western Region Sustainable Water Strategy (Western Region SWS, draft 2010).*

While still in a draft form, the Western Region SWS reinforces some key statewide policies established in the Northern Region SWS. These are incorporated into this Strategy. The most current information and policy directions available from the Western Region SWS have been incorporated in preparing this final version of the Strategy.

Other relevant Victorian Government policies include:

- *State Environment Protection Policy - Groundwaters of Victoria.*
- *Growing Victoria Together – A Vision for 2010 and Beyond.*
- *State Planning Policy Framework.*
- *Our Environment, Our Future - Sustainability Action Statement 2006.*
- *Victoria's Biodiversity Strategy 2010-2015 (Draft).*
- *Land and Biodiversity White Paper, 2009.*

The Groundwater (Border Agreement) Act 1985 came into effect in January 1986 to cooperatively manage the groundwater resources along the border of South Australia and Victoria. The Agreement sets out the framework for groundwater management in the 'Designated Area', a 40-kilometre wide strip centred on the border and extending its full length. Details are outlined in a separate information sheet *West Wimmera Groundwater Management Strategy – Managing Groundwater Across the Border – The Border Groundwaters Agreement.*

The Murray-Darling Basin Authority was established under the *Commonwealth Water Act 2007*. A section of the West Wimmera GMA lies within the Murray-Darling Basin for which a Basin Plan is being developed under the National Plan for Water Security. The Basin Plan is due for release in 2011. Victoria will be required to implement the requirements of this plan from 2019. Further details of the Murray-Darling Basin Authority are outlined in the separate information sheet *West Wimmera Groundwater Management Strategy – Murray-Darling Basin.*

1.4.2 Planning

Statewide groundwater is managed according to geographical areas known as Groundwater Management Units (GMU), the extents of which are generally determined by the underlying aquifers. Groundwater Management Units can be Water Supply Protection Areas (WSPA), Groundwater Management Areas (GMA) or Unincorporated Areas.

A number of WSPAs and GMAs have already been defined in the West Wimmera area. WSPAs have been declared for the following areas, all of which relate to the Tertiary Limestone Aquifer:

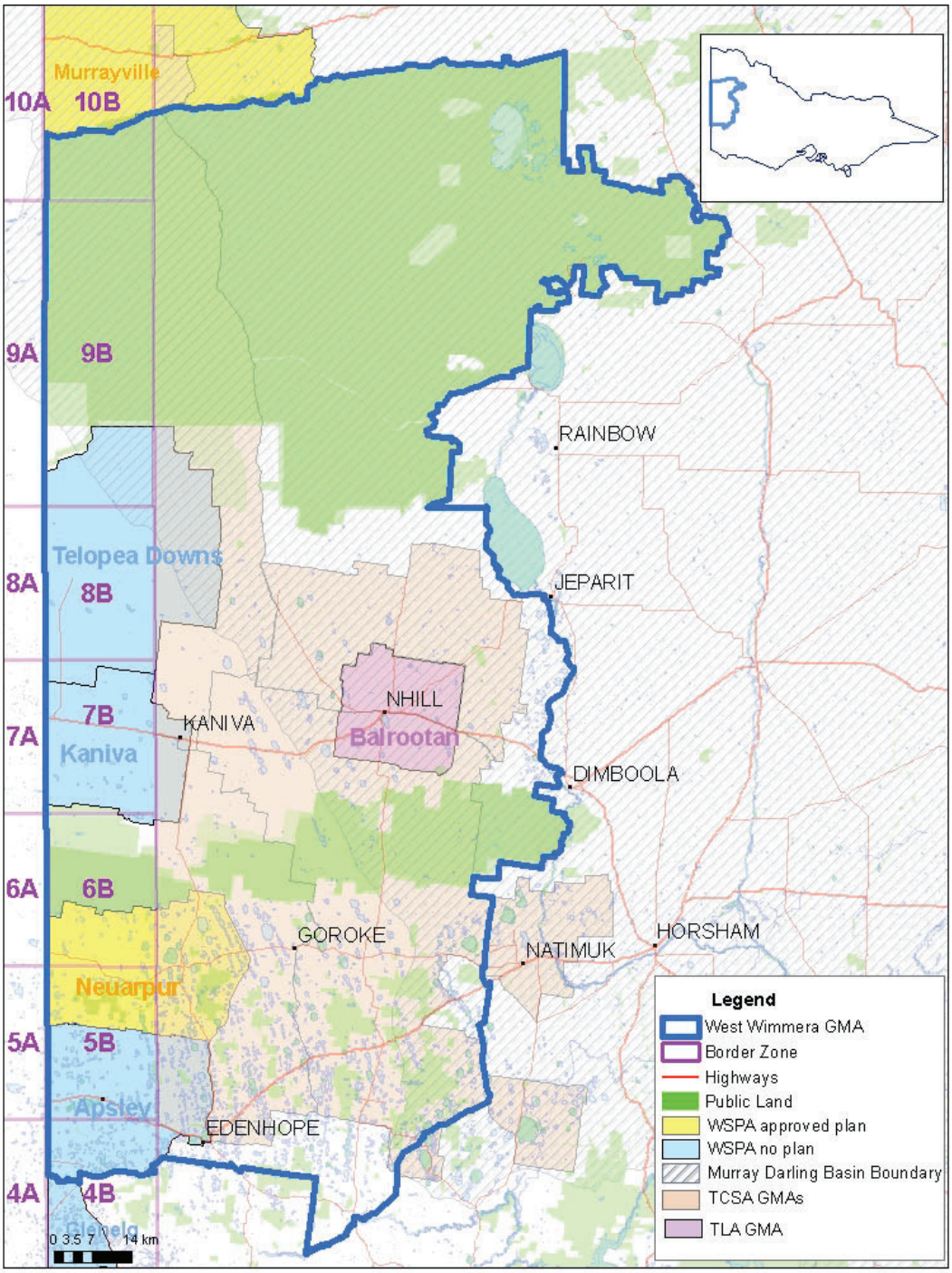
- Neuarpur
- Apsley
- Kaniva
- Telopea Downs

Within the West Wimmera GMA, there is one formal WSPA Groundwater Management Plan. It is for the Neuarpur area.

The development of this integrated Strategy has arisen due to recognition that aquifers within this area are connected across GMAs, and impacts in one GMA may affect the resource in an adjacent GMA.

Implementation of the Strategy will be the responsibility of GWMWater with the support and advice of the Implementation Committee (see Section 6.3).

Figure 1.3 Existing groundwater management overlays in the West Wimmera



West Wimmera Groundwater Management Area
Existing Groundwater Management Overlays

N

1.4.3 Local Management Rules

Both the Western Region SWS and Northern Region SWS outline a new planning option for managing groundwater systems, which can be applied depending on the required level of management in a given system.

Local Management Rules can be established where water resources can be managed without the need to change licence conditions. The major issues within the scope of Local Management Rules as outlined in the SWS policy documents include the following:

i. The area to which they apply.
ii. Management objectives.
iii. Any limits including sustainable diversion limits, permissible consumptive volumes or extraction limits that apply to the area/system.
iv. Trigger levels for applying restrictions on groundwater licences.
v. Groundwater carryover.
vi. Trading zones and rules.
vii. Monitoring and reporting requirements.

It is proposed that Local Management Rules will apply in the West Wimmera GMA, and that these rules will supersede the Neuarpur Area Groundwater Management Plan. Local Management Rules will be subject to approval by the GWMWater Board.

Within this Strategy, proposals for management of the GMA are presented at both strategic and operational levels.

The proposals at the strategic level will outline the broad direction of the management approach in relation to specific resource management issues. These strategic proposals are generally in Section 4 and are described as Resource Strategies.

The operational level of these Resource Strategies will then be provided in the Local Management Rules and Implementation Support Strategies in Section 5 and Section 6.

Resource Strategy 1.1 - Establish Local Management Rules

GWMWater will establish a set of Local Management Rules for managing groundwater in the West Wimmera GMA. These Local Management Rules will replace existing Groundwater Management Plans.

Several supporting management strategies have also been identified that describe the proposed approach for a number of matters related to the implementation of the Strategy, but which do not directly relate to the management of the resource or the licensing function of GWMWater. These are referred to as Implementation Support Strategies.

1.4.4 Licensing of groundwater use

GWMWater administers the licensing of groundwater as a delegated function on behalf of the Minister for Water.

Licences to take and use groundwater

Licences allow for the taking of groundwater from aquifers for irrigation and commercial water use. Licences are normally issued for a 15-year period with a range of conditions to protect the water resource, other groundwater users and the environment.

Existing groundwater licences in the West Wimmera have a range of standard conditions, including the provision to restrict use if GWMWater considers extractions to be adversely affecting any person, the environment or the resource.

Domestic and stock rights

Domestic and stock use is defined as water used for household purposes, watering of animals kept as pets, watering of cattle and other stock, or irrigation of a garden.

The Act provides that an individual has the right to take and use groundwater for domestic and stock use without a licence. However, a bore construction licence is required before any bore, including domestic and stock bores, can be installed.

Permissible Consumptive Volumes (PCV)

A PCV is the maximum volume of groundwater that can be used for consumptive purposes per year. PCVs are set by the Minister for a groundwater management area and the management zones within a GMA. Any alteration to the PCV must also be by the Minister. Licences will not be issued if the issuing or renewal of the licence would cause the sum of the entitlement for the zone to exceed the PCV. PCVs will be established for each management zone within the West Wimmera GMA.

2 Groundwater Resources and Management in the West Wimmera

2.1 Overview of Surface Water and Groundwater

2.1.1 Groundwater resources

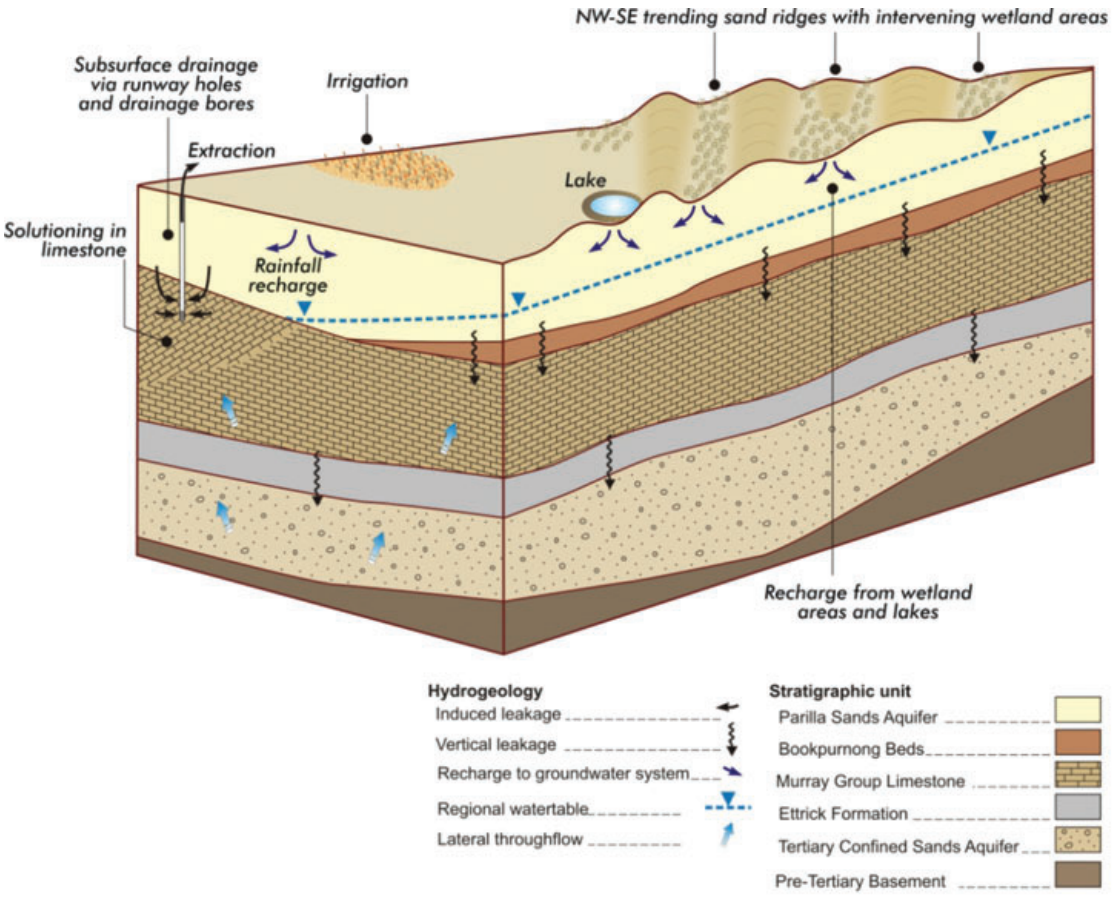
This section is largely based on the Sinclair Knight Merz (SKM) report *West Wimmera Hydrogeological Study* produced in 2009.

The West Wimmera region is generally underlain by three primary groundwater aquifers:

1. The shallow Pliocene (Parilla) Sands Aquifer (PSA).
2. Tertiary Limestone Aquifer (TLA).
3. The deeper Tertiary Confined Sands Aquifer (TCSA).

For much of the area there are layers of clay between these aquifers. These clay layers confine the groundwater to within the aquifers and impede the movement of water between the aquifers. Figure 2.1 provides a diagrammatic representation of the aquifer systems and their interaction with the landscape.

Figure 2.1 West Wimmera groundwater conceptual model (SKM, 2009)



The following provides a brief outline of the key characteristics of the main aquifers within the area.

Pliocene (Parilla) Sands Aquifer (PSA)
The PSA is present across much of the region but becomes progressively thinner and eventually unsaturated in the west of the area.

The salinity generally varies between 1,000 and 3,000 milligrams per litre (mg/L) (1,600 to 5,000 EC), and is less than 1,000 mg/L (1,600 EC) through the central part of the region. Salinity increases towards the east to quite high levels. Salinity is more than 7000 mg/L (11,600 EC) in the north-eastern corner of the area. The PSA is low yielding and its use is limited to domestic and stock purposes.

Tertiary Limestone Aquifer (TLA)
This is the most significant aquifer in the region. Most of the groundwater in the West Wimmera GMA is extracted from this aquifer.

The thickness of the TLA varies from less than 20 metres in southern areas to 100 metres in the north.

The TLA is generally unconfined, however it becomes partially confined by the overlying Bookpurnong Beds (aquitard) to the north and the east.

A number of sink holes and karstic features exist in the south-west of the area which allow localised point source recharge of the aquifer.

The transmissivity of the TLA is relatively high, typically 200 to 1,000 square metres per day (m^2/day). It decreases significantly in the confined areas in the east and the south-west portion, south of Neuarpur, to 20 to 50 m^2/day.

Figure 2.2 illustrates the variability of the aquifer's salinity.

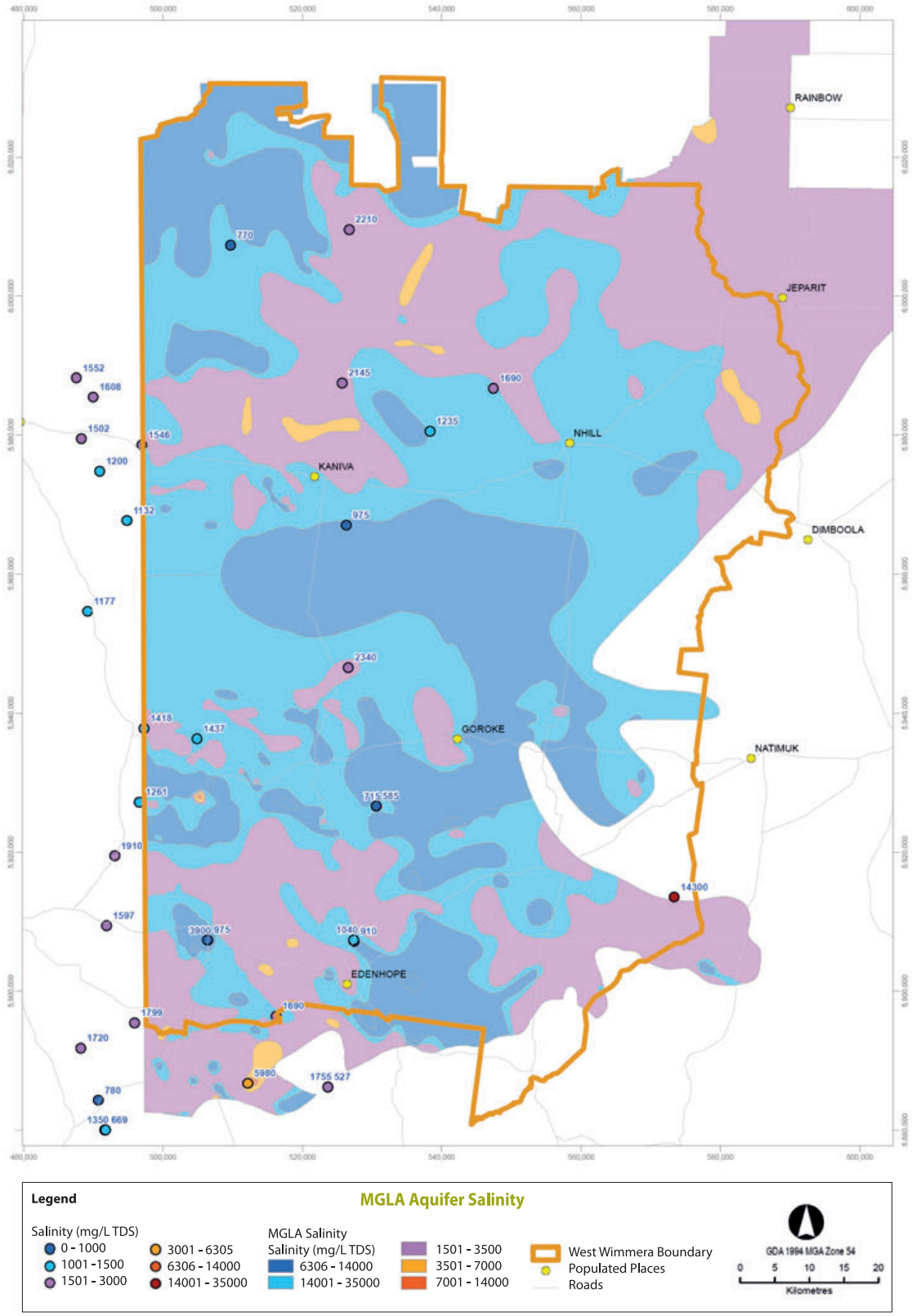
Tertiary Confined Sands Aquifer (TCSA)
The TCSA occurs at varying depths within the area, ranging from 140 to 200 metres. Drilling since the SKM (2009) report indicates that in some areas the thickness of this aquifer may be less than interpreted in previous studies.

This is particularly the case in the area near Nhill, where the SKM report interprets the TCSA to be up to 140 metres thick. More recent drilling has reported thicknesses of the sand of only up to six metres, and that it occurs at greater depths than previously thought. The results of this recent drilling are considered preliminary, but give reason to adopt a cautious approach regarding proposals to the setting of PCVs for the TCSA.

The transmissivity of the aquifer ranges between 100-500 m^2/day, and owing generally to its depth, no water is extracted from this aquifer.

Figure 2.2 Groundwater salinity in the TLA (SKM, 2009)

Labelled salinity values are post-2000 data points for comparison purposes



Groundwater age and replenishment

The groundwater in much of the TLA had previously been considered a modern resource receiving an annual diffuse recharge supplemented by multiple point source recharge (eg sink holes). Though local anecdotal observations vary, technical assessments and reviews such as the Neuarpur Technical Review and subsequent Technical Audit Panel review in 2005 and the Border Groundwaters Agreement Review Committee (BGARC) in 2007 indicate that this resource should be considered as ancient and mainly originating from recharge received during a much wetter period about 20,000 years ago. Based on these assessments and the CSIRO report by Leaney and Herczeg (1999), modern vertical recharge is assumed to be minimal across most of the area, just a few millimetres per year, and not a significant influence on groundwater levels in the TLA. A notable exception is the south-west area where there is some indication of groundwater levels responding to rain events during the dry period from 1997 to 2009.

Groundwater interaction with surface water and ecosystems

Wetlands and waterways, particularly within the area south of the Little Desert, sustain environmental values which in turn provide social and economic benefits to the community. In some parts of the area, groundwater is a critical element of healthy wetlands and waterways. Groundwater may interact to varying extents with natural surface water features through both recharge and discharge processes. Lakes, wetlands and swamps are important point sources of recharge to unconfined aquifers.

In some parts of the region groundwater also discharges to some wetlands and waterways and therefore supports associated groundwater-dependent ecosystems (GDE). Groundwater also supports different vegetation communities depending on its proximity to the surface. This mainly occurs in the southern part of the area and in the south-east in the vicinity of the Natimuk-Douglas chain of lakes, west of Mt Arapiles. Local groundwater discharge to low lying areas within the interdunal systems of the PSA also supports wetland systems, although these are sometimes perched and therefore not part of the regional PSA.

The main streams receiving groundwater discharge within the area are Mosquito Creek in the south-west of the GMA, the Glenelg River in the far south-east and the Wimmera River at the north-east boundary. The Wimmera River receives highly saline groundwater discharge from the PSA. Aquatic communities in the Mosquito Creek catchment are sustained via a baseflow during most years, except in the north of the creek's catchment near Apsley where the watertable deepens. In dry years, spring-fed pools in the creek are critical refuges for threatened fish and other fauna because there is a lack of other connected surface water in the landscape. Importantly, Mosquito Creek flows into South Australia to the Ramsar-listed Bool and Hacks lagoons.

The SKM report (2009) established that GDEs are generally not connected with the TLA, with the exception of the south-western corner of the area in the Mosquito Creek catchment, where the contribution to baseflow is supported by the shallow depth to water table (typically 5 metres below the surface in the south).

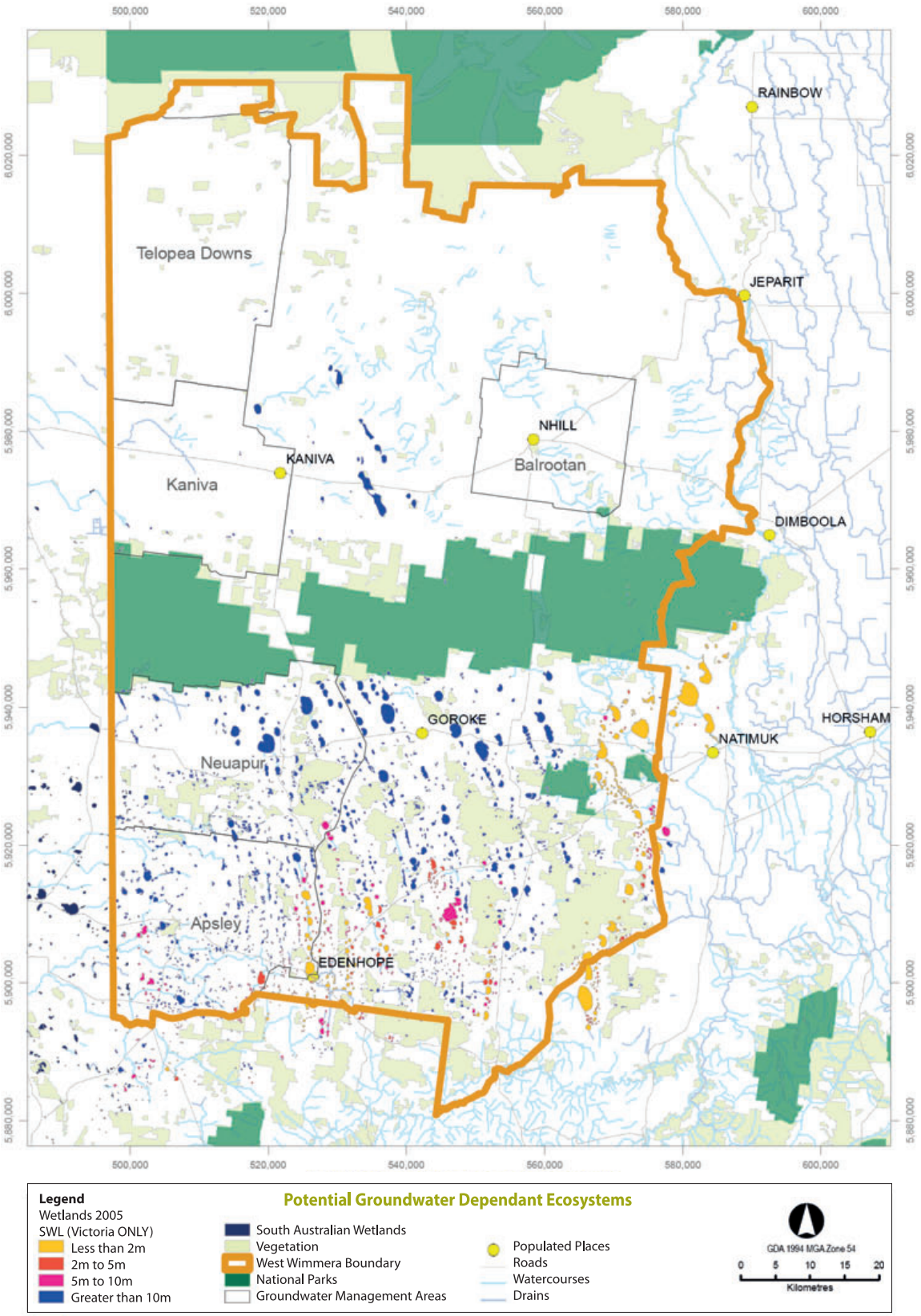
The understanding of the locations and water needs of GDEs is in its early stages. Due to the presence of perched GDEs in the PSA, most GDEs are not threatened by groundwater extraction. GDEs that are reliant on the regional PSA, such as the Natimuk-Douglas chain of lakes, are potentially threatened by increased infiltration into the TLA brought about by extraction. However, they are typically at the eastern edge of the GMA and are therefore distant from the main areas of extraction. As such, reduced rainfall is the key threat.

Groundwater and surface water are considered to make significant contributions to water bodies in the south-west of the region such as Lake Wallace and Mosquito Creek. Declining groundwater levels in this part of the region are considered to be mostly due to reductions in rainfall and changes in land use. There are risks, however, especially in a localised sense, that groundwater extraction may impact on these GDEs.

The Implementation Committee will propose a setback distance for new bores to protect GDEs.

Future research should be directed towards the key threats to GDEs which may in turn accurately identify where extraction is impacting on or has the potential to impact on these ecosystems. Further research should also be made to investigate the interconnection between surface water and groundwater in the Southern Zone.

Figure 2.3 Potential groundwater dependent ecosystems (SKM, 2009)



2.1.2 Groundwater level trends

Trends in groundwater levels vary across the West Wimmera GMA. For both the PSA and the TLA where the watertable is deep, the levels are relatively stable. However, groundwater levels have been observed to have fallen in all aquifers where the groundwater is shallow or where there is considerable extraction from the TLA. For more information on hydrographs of currently monitored observation bores, refer to GWMWater's separate information sheet, 'Observation Bores.' Selected hydrographs illustrating the groundwater levels for some of the observation bores can be viewed in the strategy section 'Groundwater Hydrographs.'

Pliocene (Parilla) Sands Aquifer (PSA)
In the PSA, declines of between one and five metres have occurred since the early to mid-1990s in the south-west, south and east of the GMA. In the eastern and southern areas, where groundwater is shallow, the decline is most likely due to reduced rainfall recharge. In areas where extraction from the TLA occurs, the decline is likely to be due to induced downward leakage from the PSA to the TLA. Where the watertable is deep, the trend is relatively stable.

It is also likely that the groundwater system in some areas is establishing a new equilibrium following wet periods in the 1970s and early 1990s where groundwater levels were higher.

Tertiary Limestone Aquifer (TLA)
In the TLA, groundwater level declines of up to two to three metres have occurred in some parts of the aquifer since the early to mid-1990s, particularly where there is concentrated groundwater extraction in Neuarpur. Groundwater levels in these areas do not appear to be reaching a new steady state. There is a high concentration of extraction in the Neuarpur area, which is primarily a reflection on the high-yielding nature of the TLA in this area and the suitability of soils for irrigated agriculture.

In the Apsley WSPA, groundwater levels show steady declines of more than a metre in the last 10 years, with the exception of the north-east corner where the watertable is deep and levels are stable or only slightly declining.

In the southern Apsley area, where groundwater is within 10 to 15 metres below the surface, the decline is primarily because there have been relatively few runoff/recharge events (Parsons Brinckerhoff, 2010).

In the Kaniva WSPA, groundwater levels are considered stable with the exception of slight declining trends of 0.2-0.5m/yr in the east. This is consistent with greater use in this area. Similarly, levels in the Telopea Downs WSPA are stable with the exception of one bore located close to a concentrated area of extraction. In the Balrootan GMA, levels are stable over time but fluctuate seasonally with the influence of extractions to supply Nhill township.

Observation bores in the Gymbowen area indicate that the trends in the groundwater levels vary from stable to slightly declining and show similar trends in the PSA. Away from these established management areas, levels are generally stable.

Tertiary Confined Sands Aquifer (TCSA)
The TCSA generally shows stable levels across most of the GMA. The exceptions are southern parts where declining trends in the TCSA are evident. These areas are interpreted to be the recharge areas for the TCSA, as the water table is relatively shallow and rainfall is relatively high.

It is possible that in the south-west of the GMA, extraction from the TLA has reduced downward leakage to the TCSA and has contributed to declining levels in this area. However, the evidence is not clear.

An area east of Nhill is showing increasing levels in the TCSA.

2.1.3 Groundwater availability and use

Groundwater is the only reliable water source in the GMA. It is used extensively for domestic and stock supply for up to 1,400 bores. Groundwater is the source of urban water supply for Nhill and Kaniva and the smaller towns of Goroke, Edenhope, Apsley, Kiata, Harrow, Lillimur and Serviceton. Until 2000, Edenhope received its supply primarily from Lake Wallace, but the extended drought period from 1997-2009 has shown this source cannot be relied upon to supply the town.

The largest usage in volumetric terms is for irrigated agriculture with total licences authorised to extract up to 52,850 megalitres per year (ML/yr). Since 2005 about half the annual entitlement volume has been extracted. The Neuarpur WSPA dominates the total use and also uses a high proportion of its licensed entitlement compared with other areas within the GMA.

Usage for domestic and stock purposes is estimated to be 2,800 ML/yr. There is no metering of domestic and stock use.

3 Groundwater Resource Outlook and Impacts

This section examines how climate change, drought and current and future water use might impact on the amount of groundwater in storage and the potential effects on groundwater users and the environment.

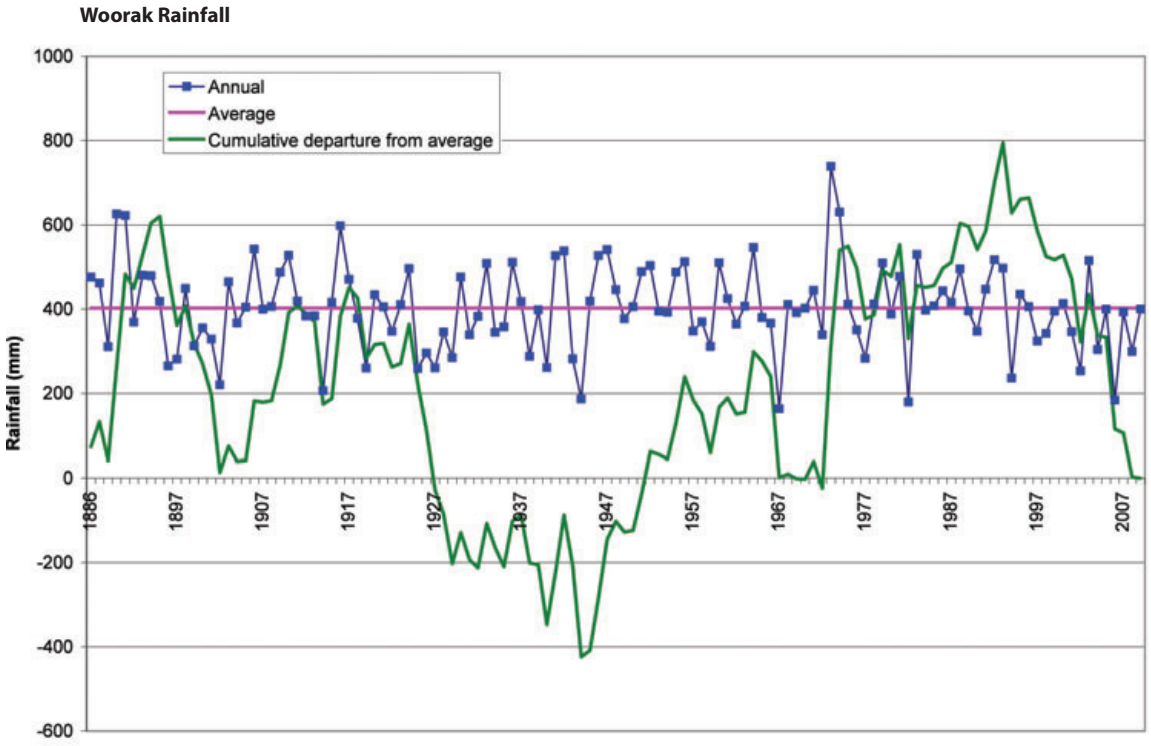
3.1 Climate Change and Variability

Rainfall across almost all of Victoria has been well below average since the late 1990s. In addition, the area has experienced higher average daily maximum temperatures. The reduced frequency of high rainfall years and a notable shift in the seasonality of rainfall, with autumn and winter receiving less rainfall, has caused the catchment to be generally drier. Consequently when rain does occur, a large proportion is required to saturate the soil, resulting in little run off. The effect in the southern margins of the West Wimmera GMA is evident where drying out of shallow lakes is associated with declines in the watertable.

Figure 3.1 shows the trend in rainfall patterns, with a distinct drier period evident since the mid-1990s and a sharp decline in the cumulative rainfall compared to average for the rainfall station at Woorak near Nhill.

However, as most of the groundwater is understood to be an ancient resource and the long-term recharge rate is very small, the volume of groundwater in store is thought to be not significantly affected by climate change or climate variability in the planning horizon. Droughts will have limited impact on the volume of groundwater in store apart from influencing the volume pumped for irrigation and some reduction in the recharge volume via sinkholes.

Figure 3.1 Cumulative rainfall compared to average (Woorak, north of Nhill)



CSIRO (2008) projections for climate change in the Wimmera indicate continued warming, higher evaporation and lower rainfall over the long term. These projections have implications for water use, crop types, surface water flows and recharge to groundwater aquifers.

The vulnerability of a system is influenced by its depth, whether it is confined or unconfined, and the size of the aquifer storage.

Western Region SWS (Draft) - Page 63

"The CSIRO Murray-Darling Basin Sustainable Yields Project investigated the potential impact of climate change on groundwater in the Wimmera. In general terms, given the depth and nature of the systems, groundwater in this area is a relatively secure resource compared with surface water. Recharge to this system occurs very slowly. The study found that at a regional scale, the impact (by 2030) of all climate change scenarios on rainfall recharge and groundwater levels in this area would be minor compared with the impacts resulting from current and additional future extraction."

The Western Region SWS also recognises some uncertainty in predicting what may happen to groundwater availability over time and reinforces the importance of a management framework that adapts to changed climate conditions.

3.2 Impacts of Continued Groundwater Extraction

Declining water level trends in the TLA are being observed around Neuarpur and the adjoining Frances area in South Australia, both of which are areas of concentrated groundwater extraction. The TLA in the Neuarpur area is the prime focus in this section of the Strategy.

Groundwater levels have declined by 2.3 to 3 metres between 1997 and 2008, primarily as a result of groundwater extraction. Groundwater levels are likely to continue to decline in Neuarpur under the continued rates of extraction. Also, the drawdown may expand in area.

SKM indicates that continuation of the current rate of groundwater level decline is likely to have a significant impact on supply to existing domestic and stock bores over the next 20 to 50 years.

Within the Southern Zone, all sub-zones except Ullswater are exhibiting declining trends in TLA levels, although there are some indications of recharge during wetter periods. Section 5.1 provides an explanation of management zones and sub-zones. Hence there is some uncertainty about the extent to which these zones are experiencing recharge, and the extent to which groundwater levels are being impacted upon by extraction, climate or the extent of plantation use.

The volumes extracted elsewhere in the West Wimmera GMA are significantly less than in the Neuarpur area and hence the impact on water levels is much less. Under current extraction rates groundwater levels in these areas are expected to vary annually but remain close to stable over the long-term.

3.3 Threats to Groundwater-dependent Ecosystems

The most significant threats to GDEs within the West Wimmera GMA are declining groundwater levels and declining water quality. These may be associated with climate variation and impacts of indirect groundwater extraction.

While most of the GDEs are not connected to the TLA where most of the groundwater extraction is sourced, there is potential in some parts of the south-west of the GMA for impacts on GDEs.

SKM (2009) considered that a drawdown of half a metre in groundwater levels below current levels was of potential significance for GDEs such as wetlands and fringing vegetation that are groundwater dependent.

3.4 Other Threats

3.4.1 Salinisation from land clearing

SKM (2009) concluded that the threat of land clearing increasing salt movement into groundwater aquifers over the next 50 years was relatively low in areas of high groundwater extraction such as Neuarpur and Apsley when compared with other threats facing the aquifer system. However, in areas of sandy soils such as south of the Big Desert, this risk is potentially high.

3.4.2 Bore failure

The groundwater resource may be threatened by the presence of failed or failing groundwater bores, particularly in areas where the limestone aquifer is overlain by a moderately saline PSA. The older bores drilled into the limestone aquifer are likely to deteriorate as the steel casing corrodes, allowing water from the saline PSA to enter the fresher limestone aquifer and cause contamination.

Proper capping and decommissioning of old bores is important to maintain water quality in the TLA, particularly where the overlying PSA is of high salinity.

3.4.3 Land use change

Land use change can impact significantly on groundwater resources. The impact on recharge and groundwater levels from changing to perennial woody vegetation has been well established in the south-west areas of Victoria. Areas of plantations have been established in parts of the Langkoop sub-zone. These plantations are believed to be contributing to declining groundwater levels in this area.

Drainage works have reduced infiltration to many wetlands, and other earthworks such as laser levelling and raising levees to stop water reaching sinkholes have also impacted on the natural water system across the region.

3.4.4 Assessment of impacts

A management approach which maintains stable or near-stable levels in most of the West Wimmera GMA will avoid adverse impacts on the groundwater resource associated with groundwater extraction. In the Neuarpur area, continued declining levels will eventually lead to depletion of the resource.

Some impacts on domestic and stock bores may occur within 10 years. Impacts on GDEs are likely within 50 years. A goal of stable levels within 20 years is considered to represent the maximum timeframe for achieving stabilised levels. However it is critical that a reduction in the rate of decline starts now to ensure the impacts on users remain manageable.

The Southern Zone sub-zones of Apsley, Langkoop and Edenhope are exhibiting declining trends in the groundwater level. The rates of decline in this area appear to be greater than would be expected based on the levels of usage, and the extent of any recharge. A review of this area in three to five years would provide greater confidence about the long-term impacts of use on the resource. A reduction in extractions can be deferred in the Southern Zone until that review.

4 Strategic Management Framework

Groundwater is the key water source in the West Wimmera. The Committee's role has been to develop a Strategy that strikes a balance between maintaining and enhancing the productive use of the resource and the longer-term need to preserve the resource for the economic, environmental and social values it provides.

The Intergovernmental Agreement on a National Water Initiative (CoAG, 2004) states that the term 'environmentally sustainable level of extraction' means:

The level of water extraction from a particular system which, if exceeded, would compromise key environmental assets, or ecosystem functions and the productive base of the resource.

This groundwater management Strategy is considered by GWMWater to comply with the above definition.

4.1 Guiding Principles

The guiding principles for developing the management arrangements for groundwater resources in the West Wimmera GMA are:

The resource

- Groundwater is the only reliable water source in the region. Therefore the primary objective is protecting the quality and yield for domestic and stock use, town water supplies and the environment.

Achieving stability

- Regional groundwater level declines from groundwater extraction will be avoided and if they occur, they will be managed and controlled.
- Where groundwater utilisation is relatively low and there is no discernible change to groundwater levels, new licences may be issued. These will be subject to restrictions or other review on the same basis as existing licences if groundwater decline occurs.
- In areas where groundwater level decline is caused by groundwater utilisation, the resource is overcommitted and continued use at current levels is unsustainable in the long term. No additional entitlements are to be licensed in areas of declining groundwater trends. Staged restrictions on use shall be applied to control declines, and these will be reviewed annually.
- Licensed entitlements shall be monitored, reviewed and amended in accordance with the adaptive management approach.

Trading

- Impediments to trades of licence entitlements are reduced and carryover is introduced to allow flexibility and maximise the benefit from utilisation of the resource.

4.2 Socio-economic Value of Groundwater

Despite the current economic value, it is agreed that the future risk posed to the community of unsustainable groundwater use in certain areas is unacceptable and that changes to current arrangements need to occur.

The socio-economic impact of adjustments to annual restrictions is dependent on their scale and the time period for implementation. The URS (2009) study found that incremental change over a longer timeframe is preferable to immediate and sizeable cuts, provided the condition of the resource can be maintained.

4.3 Strategic Concepts

4.3.1 Adaptive management approach – dealing with uncertainty

A number of hydrogeological studies have been conducted in the West Wimmera in developing previous management plans for the area. There is significant uncertainty associated with these studies, largely due to the variations in the unseen geological formations and the lack of sufficient investigation bores to fully describe these variations.

A major area of uncertainty associated with groundwater is the accurate setting of PCVs based on assumed recharge volumes or through-flow in an aquifer, which aim to define a sustainable yield of the resource.

This Strategy takes an alternative management approach, namely an adaptive management approach, to deal with the uncertainty. This approach uses groundwater levels and intensity of use as measurement tools.

This adaptive management approach is preferred when dealing with scientific uncertainty. Adaptive management allows management regimes to be implemented and subsequently refined through monitoring of the impacts on the resource condition. Adaptive management is an iterative implementation and learning process, where adjustments occur in a timely way based on social, economic and environmental considerations, and by monitoring feedback. In the case of groundwater in West Wimmera, this feedback will be in the form of information about groundwater levels.

Groundwater levels provide an indication of the resource that is subject to reduced uncertainty. Further, where the objective is to manage the resource to achieve stable levels as is the case in West Wimmera, a direct management approach is preferable. Managing by levels also addresses future impacts on the yield of the resource associated with climate change, as indicated in section 3.1.

A study undertaken by the BGARC established the concept of a threshold level of irrigation intensity (ML per km^2) at which groundwater levels change from being stable to declining. The exact threshold level is not precisely known, but the rate of decline of groundwater levels indicate whether the threshold is being exceeded or not.

In Neuarpur the threshold is being exceeded. This is not the case in the rest of the West Wimmera, although there is uncertainty in this regard in the Apsley and Langkoop sub-zones of the Southern Zone.

This Strategy proposes to apply the 'intensity of entitlement' threshold concept to areas of common hydrogeology. The concept will provide a guide to the sustainable levels of use, but the actual groundwater level trend will be the true indicator of sustainable use of the resource.

Adjustments will be made to annual restrictions to licence entitlements to manage the volume of extractions and achieve stable levels over the desired time frame.

Resource Strategy 4.1 - Adaptive Management Approach

An adaptive management approach will be used for management of the groundwater resource in the West Wimmera GMA.

There is always a degree of uncertainty when managing complex natural systems. Groundwater management involves careful judgements based on the best available information and local, practical knowledge. However, the absence of full certainty does not preclude immediate action. This is known as the precautionary principle.

The Act requires (s 93 (e)) that "…if there are threats of serious or irreversible environmental damage, lack of full scientific certainty as to measures to address the threat should not be used as a reason for postponing such measures."

Resource Strategy 4.2 - Precautionary Principle

A precautionary approach will be used to deal with uncertainty about future impacts on the health of groundwater, interconnected/related surface water resources, the environment that depends on this resource, and the social and economic impacts on the communities that benefit from the management of the groundwater resource in the West Wimmera GMA.

Over time, the acquisition of further knowledge will reduce the extent of uncertainty for which a precautionary approach is needed.

4.3.2 Management zones

Zoning is a structured way of managing areas with different characteristics and issues.

Many of the management rules, such as the setting of PCVs and annual restrictions are made at the zone level. Sub-zoning is used to distinguish areas where particular rules are applied differently within a zone.

Resource Strategy 4.3 - Management Zones

Zones will be established which have similar hydrogeological characteristics, use or management requirements to facilitate management of the resource.

4.3.3 Management objectives

Objectives are used to define the desired outcomes for a particular zone. Across the West Wimmera GMA the common management objective is for 'stable levels', however the timeframe to achieve this goal varies.

In areas where levels have been shown to be relatively stable over a number of years, additional extractions may be possible provided that levels remain stable and entitlements do not exceed a defined maximum intensity. In zones where levels are declining there can be no additional licences granted.

Resource Strategy 4.4 - Objectives

Across the West Wimmera GMA the common management objective is for 'stable levels', however, the timeframe to achieve this goal varies.

Where the objective for a zone requires a reduction in groundwater extraction to achieve a stable level it is proposed to introduce an annual restriction for that zone. This will be in accordance with the adaptive management model from the draft Western Region SWS.

In the Edenhope and Ullswater sub-zones the current licence volumes are very small and a small increase in these volumes is not considered to present a further risk.

4.3.4 Assisting transition

Sufficient time is needed for groundwater users to respond to change where changes may be significant. The rate of acceptable transition is dependent on knowledge about the resilience of the resource and the extent of impacts on people and the environment.

Resource Strategy 4.5 - Timeframes

A balance will be struck between the time required to enable people to adjust to the changed management requirements introduced in this Strategy, and the capability of managing the resource and the impacts upon it.

Trade of licence volumes, either temporarily or permanently, can be an effective mechanism for individual licence holders to flexibly manage annual variations in water availability and demand.

Resource Strategy 4.6 - Trading

Trade shall be permitted as far as possible where it is consistent with the capability of the resource and management objectives of the zone.

The Western Region SWS establishes a policy of annual carryover of a proportion of groundwater entitlements to manage water availability risks and adjust water use to meet the needs of entitlement holders. This ability to manage water use across two seasons is another tool to help licence holders adjust to changes proposed in this Strategy.

Resource Strategy 4.7 - Carryover

Carryover shall be available to assist flexible management of groundwater resources. Controls on the use of carryover will be established to ensure that it does not create or exacerbate impacts on other groundwater users or the environment.

4.3.5 Recognition of all entitlements

The draft Western Region SWS proposes a new policy for treatment of undeveloped or partly-developed licences. These licences, called 'sleeper licences' in the past, are now to be treated as follows (draft Western Region SWS Policy 4.2):

The rights of Section 51 licence-holders will continue to be recognised, independent of their historic water use and if activated, will be subject to the same management rules applied to active licence-holders (for example, restrictions or bans at times of scarcity).

This policy supersedes the approach commonly adopted in earlier plans, including the Neuarpur Area Groundwater Plan, 2001, where licences were only able to be traded to the extent that the volume had been developed.

This policy also has implications for new licences, which will not be conditional on development within a certain timeframe.

4.3.6 Integrated management of all aquifers

While the TLA is the primary focus for management prescriptions, this Strategy recognises interaction over varying extents and timescales between the TLA and the shallower PSA and deeper TCSA aquifers.

Resource Strategy 4.8 - Whole of resource

Management prescriptions in this Strategy shall consider the impacts on the three regional aquifers identified in the West Wimmera GMA.

5 Management Arrangements

5.1 Management Zones

Six management zones are proposed for the West Wimmera GMA. Some of these zones also have sub-zones, where the management objectives are essentially the same but slightly different management is required. The zones and their proposed names are as follows:

1. Northern Zone - the Yanipy sub-zone covers the south-western corner of this zone.
2. Neuarpur Zone – this has two sub-zones known as Neuarpur sub-zone 1 and Neuarpur sub-zone 2.
3. Gymbowen Zone.
4. Southern Zone - the four sub-zones within the Southern Zone are Ullswater, Edenhope, Apsley and Langkoop.
5. Big Desert Zone.
6. Little Desert Zone.

These zones are illustrated in Figure 5.1.

Table 5.1 below outlines the basis for establishment of each zone.

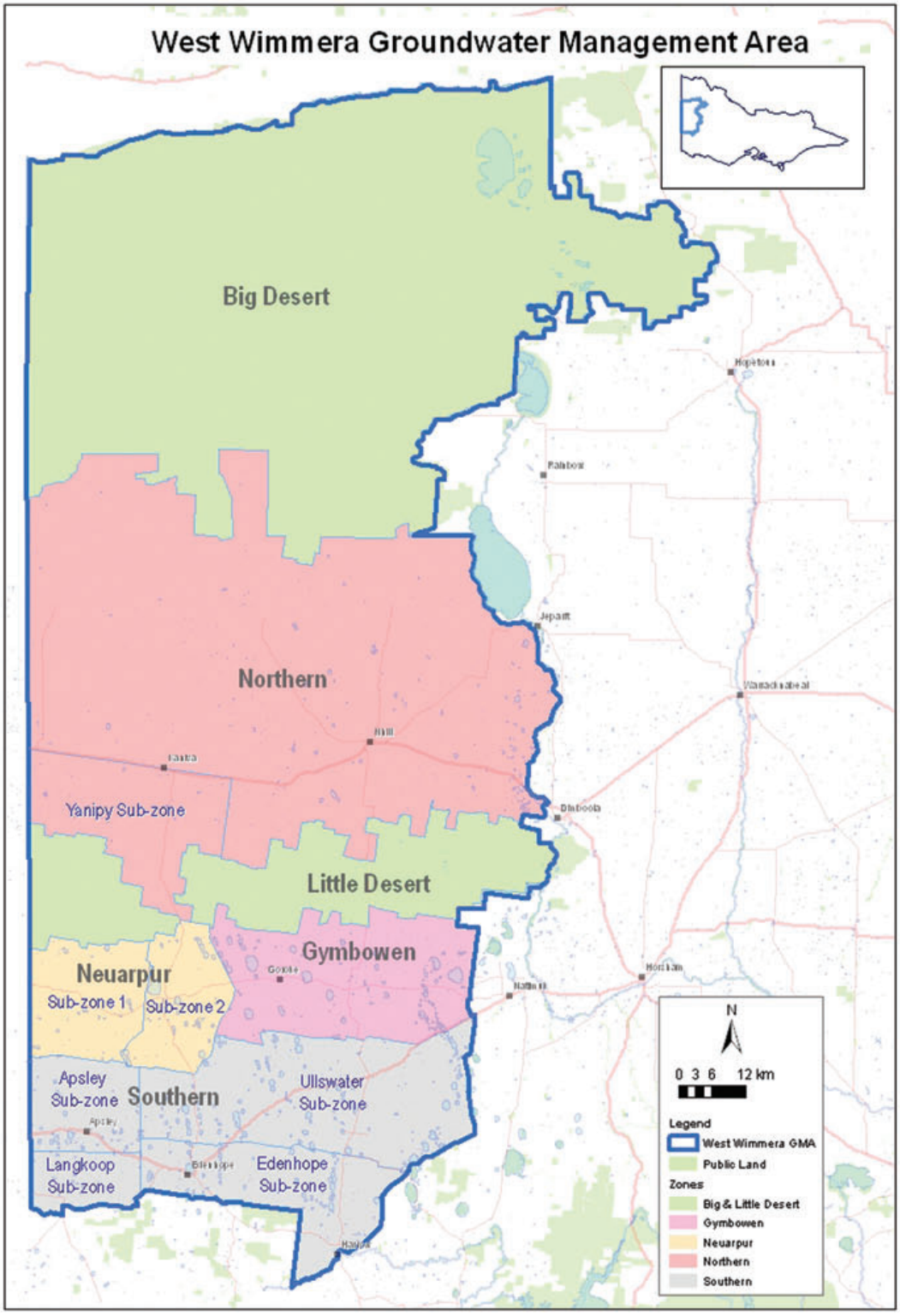
Table 5.1 Zone establishment

Zone	Basis for establishment	Management Objectives
Big Desert	The land in this area comprises the Big Desert National Park and adjacent conservation zones. The land is not available for commercial or agricultural development. There are currently no licences issued in this area. Groundwater levels are stable.	Limit groundwater diversions to maintain current stable groundwater levels.
Northern	The Northern Zone includes all the area between the Little Desert and Big Desert zones. This area is considered to have consistent hydrogeology, and stable groundwater levels. A small area in the south-west of this zone has been identified as a distinct sub-zone within the Northern Zone to avoid the potential for increased entitlements within this sub-zone, which might lead to regionally-declining groundwater levels. The annual average use (2003-10) for the Northern Zone is 8,550 ML.	Maintain stable levels across the zone, allowing: • Trade out of, but not into areas of existing high intensity of use. • New entitlements within the area subject to an acceptable level of intensity of entitlements.
Little Desert	The land in this area comprises the Little Desert National Park and adjacent public land. The land is not available for commercial or agricultural development. There are currently no licences issued in this area. Groundwater levels are stable.	Limit groundwater diversions to maintain current stable groundwater levels.

Zone	Basis for establishment	Management Objectives
Neuarpur	The Neuarpur Zone is proposed to remain the same area as that currently defined as the Neuarpur WSPA, with the two existing sub-zones of that area also remaining in place. The boundary between Neuarpur sub-zone 1 and sub-zone 2 does not exactly match the Border Zone eastern boundary, however, it is proposed to leave the sub-zone boundary unchanged. The Neuarpur Zone is an area of intense use and groundwater levels are declining in sub-zone 1. The annual average use (2003-10) for the Neuarpur Zone is 16,663 ML.	To achieve stabilised groundwater levels over a period of about 20 years. Maintain stable levels in sub-zone 2.
Gymbowen	The Gymbowen Zone differs from the Neuarpur Zone as the yield of the aquifer progressively reduces from the west of the zone, abutting Neuarpur, moving to the east. There is only a relatively small amount of use in this zone at present with an average annual use (2003-10) of 508 ML.	Maintain stable levels. Allow new developments subject to a maximum allowable intensity of entitlement. Release parcels of water progressively to ensure that stable levels are maintained with each parcel release.
Southern	The Southern Zone represents an area in which groundwater levels are declining to slightly declining. The aquifer is markedly lower-yielding than the Neuarpur area which is adjacent to parts of this zone. It is thought that some recharge is occurring through to the TLA in response to rain events. The zone is divided into four sub-zones as follows: 1. Apsley, the Border Zone 5B part of the area. 2. Langkoop, the Border Zone 4B part of the area. 3. Ullswater, the area outside the Border Zone encompassing Patyah, Ullswater and Miga Lake. 4. Edenhope, including the Edenhope/Harrow area. The annual average use (2003-10) for the Southern Zone is 2,180 ML.	Maintain stable or stabilise levels. Continue to monitor the resource to determine if there is a climate-related link to water levels in this area. Within five years conduct a further review of levels in this zone and, if required, introduce annual restrictions in a progressive manner to reduce usage with the objective of stabilising water levels. Within the Ullswater sub-zone allow smaller new developments (up to 50 ML) subject to a maximum allowable intensity of entitlements. Similarly in Edenhope sub-zone allow smaller new developments (up to 20 ML).

The zones associated with the Victorian–South Australian Border Agreement will remain in place, and in effect act as sub-zones within the above six zones.

Figure 5.1 Management zones



Local Management Rule 5.1 – Management zones and sub-zones

Management zones and sub-zones as shown in Figure 5.1 will be adopted as the basis for management of groundwater in the West Wimmera GMA.

5.2 Limits on Water Entitlements

5.2.1 Permissible consumptive volumes (PCV)

Proposed PCVs

A key groundwater management provision under the *Water Act* (1989) is the setting of a cap on extractions. The Minister for Water may make an order declaring the total volume of water that may be taken from the area specified in the order, for a specified period, usually a 12 month period, as defined in Section 22A of the Act. This is known as the Permissible Consumptive Volume (PCV). PCVs are proposed for the various zones and sub-zones identified in this Strategy.

Where a PCV is established, GWMWater may issue a new groundwater licence provided that in doing so the total licence entitlement does not exceed the PCV for that area. In areas where the licensed volume is at the PCV limit, new groundwater development may occur through the trade of existing groundwater licence entitlements (see section 5.3). This is subject to other rules that might also impact on the trade.

All proposals for changes to PCVs require Ministerial approval.

Separate Permissible Annual Volumes (PAV) also exist for each of the Border zones. These PAVs are established by the BGARC. GWMWater is required to recognise these PAVs, hence they also apply in this Strategy.

Tertiary Limestone Aquifer (TLA)

Big Desert and Little Desert Zones **-** A nominal volume of 25 ML in each zone is proposed to allow for potential use associated with management of the parks. This low level of entitlement is unlikely to be fully utilised, but if it is, it will not impact on groundwater levels in these zones due to the exceptionally low intensity of the entitlement.

Northern Zone **-** The current licensed entitlement in this zone is 22,390 ML, which is mostly concentrated in the western part towards the South Australian border. Groundwater use is approximately 9,500 ML. Groundwater levels are generally stable in this zone, although there is some localised decline in part of the Yanipy sub-zone.

The maximum PCV for this area would be based on applying the current intensity of use in the Telopea Downs and Kaniva WSPAs (i.e. 4.1 ML/km^2) across the whole of this resource zone for areas where the salinity of the TLA is less than 1,500 mg/L. This volume reflects the intensity of use that maintains stable groundwater levels in the Telopea Downs and Kaniva WSPAs.

Using this approach, the PCV could conceptually be up to 26,385 ML. If the PCV was set at this volume, a volume of 3,928 ML of water entitlement would be available for new development.

There is a risk with this approach, however, if usage of the existing under-utilised licences increases up to the entitlement volumes. Potentially, this could lead to a situation where groundwater levels decline. Under this scenario, the merit of setting the PCV greater than the current licensed volume would be questionable.

To manage this risk, it is proposed that a two-stage approach be adopted for the Northern Zone:

1. Set the initial PCV at the current licensed volume. New licences could be established through trade of existing licences. Local Management Rule 5.6 Entitlement Intensity Limits will encourage trading towards the east of the zone. This is desirable as it will reduce the risk of groundwater decline in the west of the zone.
2. Annual reviews of use and hydrographs in the Border Zone and Yanipy sub-zones of the Northern Zone will be conducted to determine if usage has increased to 85 percent of the licensed volume in those areas. If hydrographs show stable levels at this level of usage, then a recommendation may be made to the Minister for the PCV for the Northern Zone to be increased to 26,385 ML.

The Yanipy sub-zone has been established in the south-west of this zone because it is an area where localised drawdown is occurring in response to high levels of groundwater use in part of the area. It is proposed that the PCV for this sub-zone be set at the current volume of licences of 6,103 ML. This volume is included as part of the overall Northern Zone PCV. It is proposed that trade will not be permitted into this zone because part of the zone is showing localised drawdown.

Neuarpur Zone - The intensity of groundwater use across the West Wimmera is highest in Neuarpur. The intensity of use in Neuarpur sub-zone 2 is approaching the threshold at which declining levels occur, and in sub-zone 1 the intensity of use is clearly exceeding the threshold.

For these reasons, it is proposed to maintain the Neuarpur PCV at the current level of 24,750 ML. Each sub-zone has its own PCV under the Neuarpur WSPA Groundwater Management Plan 2001. These are 20,700 ML for sub-zone 1 and 4,050 ML for sub-zone 2.

Annual restrictions will be introduced to manage the declining trend in groundwater levels in Neuarpur sub-zone 1. Details of proposed restrictions are described further in section 5.2.2.

Trading into Neuarpur sub-zone 1 will not be permitted, either permanently or temporarily. This is due to the high intensity of use already occurring.

Trading into sub-zone 2 will not be allowed on a permanent basis because this could lead to the intensity of use in sub-zone 2 becoming larger, leading to declining groundwater levels and restrictions in that sub-zone.

Temporary trade into sub-zone 2 will be permitted.

Gymbowen Zone - The estimated maximum intensity of entitlement for stable groundwater levels in the Gymbowen Zone is 5 ML/km^2. This intensity is proposed because it is half the current intensity of use in the adjoining Neuarpur sub-zone 2, reflecting the reduced water availability in the Gymbowen Zone. The area of the Gymbowen Zone is 944 km^2.

At this intensity, the total PCV for this area would be 4,720 ML. However, as this would provide the potential for a significant increase in use, it is proposed to progressively step the PCV up to this ultimate volume over a period of years; regularly monitoring the PCV to ensure extra use does not lead to declining groundwater levels.

Hence, the initial PCV for this area is proposed to be 2,000 ML. This is an increase of about 1,200 ML on current entitlements. Subsequent staged releases of 1,000 ML would be available after five years of monitoring at the new levels of use associated with each release, and on review by the GWMWater Board. This ultimate PCV will be foreshadowed in recommendations to the Minister.

Southern Zone - The two western sub-zones of the Southern Zone are Apsley and Langkoop. They have a significant volume of licensed entitlement. Actual use is about 40 percent of licensed volume. These sub-zones are showing trends of declining groundwater levels. In these two sub-zones there is a significant risk of exacerbating groundwater declines should use increase towards the total licensed volume. Section 4.3.4 of this Strategy describes the proposed approach, which is to continue to monitor levels to determine if restrictions should be introduced. The PCV should be retained at current licensed volumes until further information about levels is gained over the next five years.

The two eastern sub-zones of the Southern Zone are Edenhope and Ullswater. In these sub-zones there is limited monitoring of groundwater levels. Declining groundwater levels are evident along the southern fringe of the Edenhope sub-zone, and near the Edenhope township.

The licensed volume in these sub-zones is also quite small, with only 480 ML and 388 ML licensed in Edenhope and Ullswater respectively. The intensities of entitlement in these areas are low, 0.9 and 0.3 ML/km^2 respectively. This is about an order of magnitude (ten times) lower than all other zones in the West Wimmera GMA. The risk of small additional entitlements in these sub-zones is considered to be low.

Limited development will be permitted in the Ullswater sub-zone with an additional new volume of 500 ML being available in parcels of up to 50 ML. Similarly, limited development will be permitted in the Edenhope sub-zone with an additional volume of 200 ML being available in parcels of up to 20 ML.

The proposed PCVs for each Southern sub-zone are:

1. Apsley sub-zone at the current licensed volume of 2,901ML.
2. Langkoop sub-zone at the current licensed volume of 2,000 ML.
3. Ullswater sub-zone at 888 ML.
4. Edenhope sub-zone at 680 ML.

Hence the total proposed PCV for the Southern Zone is 6,469 ML.

Trading within the Southern Zone will be limited as follows:

a. Trade will be allowed within sub-zones.
b. No trade will be allowed between sub-zones until a review of data in 5 years
c. Trade within sub-zones will be subject to the 'Entitlement intensity limits' rule.

For the Southern Zone, the intensity of entitlement limit for new developments is proposed to be 2 ML/km^2, representing half the current intensity of use in the Apsley and Langkoop sub-zones where declining levels are evident.

There is a marked difference in the characteristics of the TLA between Neuarpur sub-zone 1 and the Apsley sub-zone. While both of these sub-zones are within Border Zone 5B, it is considered that these two sub-zones should be managed separately due to their different characteristics, both within this Strategy and in the management of the Border Zone by the BGARC. This sub-zoning of Border Zone 5B will be recommended to the BGARC.

Resource Strategy 5.1 - Management zones and sub-zones

GWMWater will recommend to the BGARC the sub-zoning of Border Zone 5B, following the common boundary of Southern and Neuarpur zones.

The table "Zone and sub-zone PCVs and entitlement limits for the TLA" within Local Management Rule 5.2 summarises the proposed PCVs for each area. The table also includes the maximum intensity of entitlements proposed for each zone, which have been used as the basis for establishing PCVs in some of these zones. These intensities are also relevant to the entitlement intensity limits rule in section 5.2.3.

Local Management Rule 5.2 - PCVs and intensity of entitlement limits for the TLA

It is proposed that the values shown in the table "Zone and sub-zone PCVs and intensity limits for the TLA" be established as the PCVs and intensity of entitlement limits for each zone and sub-zone in the TLA.

Table: Zone and sub-zone PCVs and entitlement intensity limits for the TLA

Zone	Tertiary Limestone Aquifer (TLA) Zone PCV (ML)	Sub-zone	Sub-zone PCV (ML)	Maximum Intensity of Entitlements ML/km^2
Big Desert	25			-
Northern	22,390	Yanipy	6,103	4.1
Little Desert	25			-
Neuarpur	24,750	Sub-zone 1 Sub-zone 2	20,700 4,050	# 15.8
Gymbowen	2,000			5
Southern	6,469	Apsley Langkoop Ullswater Edenhope	2,901 2,000 888 680	2 2 2 2
Total	**55,659**			**-**

Note: # No intensity of entitlement limit applies to Neuarpur sub-zone 1 because overall use is too high to practically apply this concept. This will be progressively reviewed as the Strategy is implemented.

Tertiary Confined Sands Aquifer (TCSA)

There are no groundwater use licences in the TCSA of West Wimmera GMA. Nominal volumes are proposed to be established as PCVs. This has also included recommendations for the TCSA in adjoining areas covering an area similar to the West Wimmera GMA. Figure 1.3 illustrates the existing management areas where they apply within the TCSA, and Figure 5.2 illustrates the West Wimmera GMA TSCA zones. The following proposals are made in relation to the TCSA in the West Wimmera GMA.

Local Management Rule 5.3 – Tertiary Confined Sands Aquifer (TCSA)

a. The zones adopted by the West Wimmera GMA Advisory Committee also apply to the TCSA, including the retention of the Border Zones.

b. The portions of the existing TCSA GMA that extend beyond the West Wimmera GMA boundary to be treated as being part of the Southern zone or Gymbowen zone as appropriate, but without changing these boundaries for other aquifers..

c. The management objective for the TCSA to be 'that the TCSA enable development over the long-term in accordance with the condition of the resource.

d. The total PCV for the TCSA to be 1,550 ML, apportioned to zones as presented in the following table 'West Wimmera GMA TCSA PCVs'.

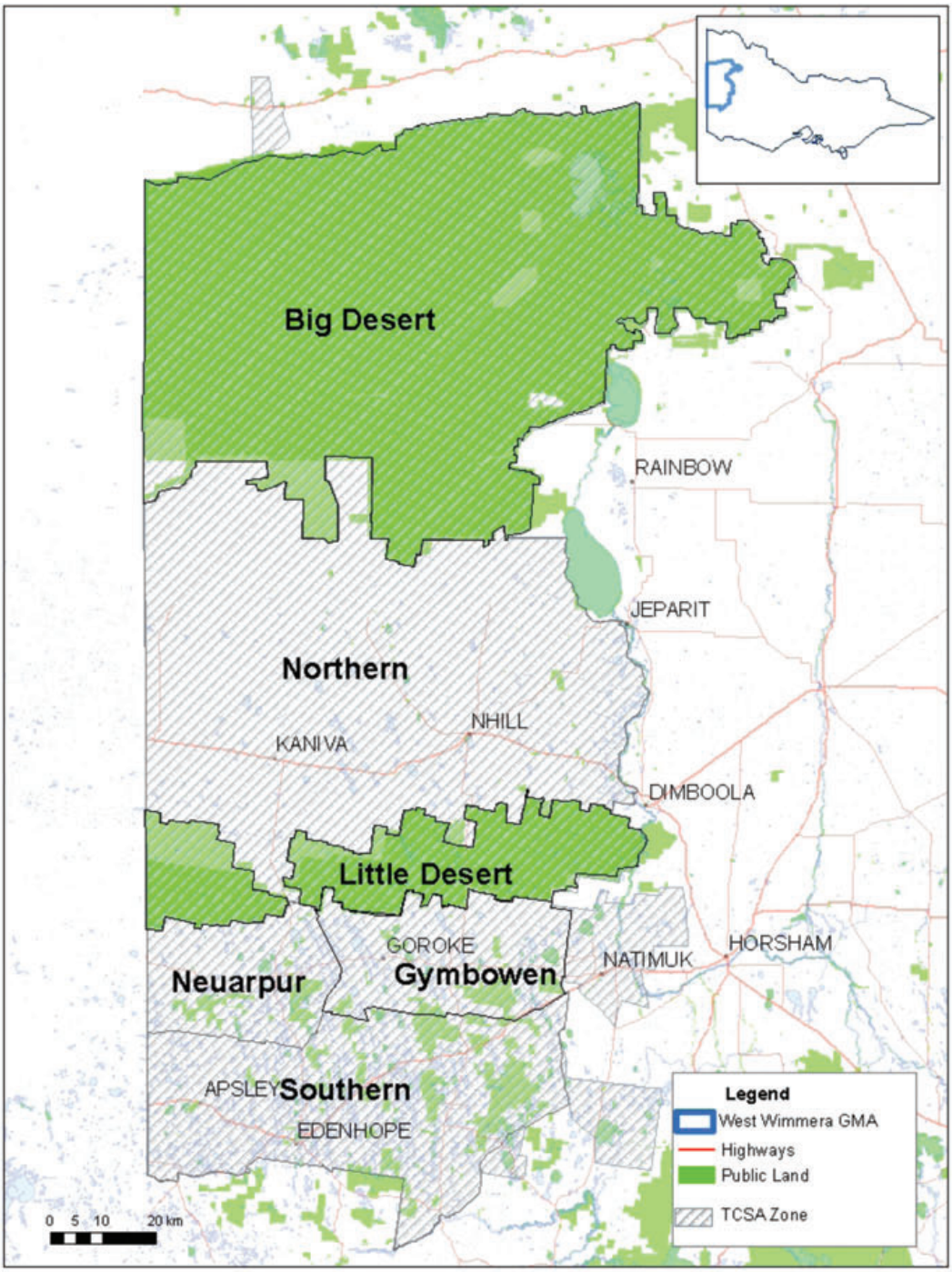
e. The following conditions apply to management of the TCSA:
(i) No bore construction licences will be issued to access the TCSA, except for investigation or monitoring purposes, pending further investigation and monitoring which demonstrate through a public engagement process adequate groundwater resources are available to sustain future development.
(ii) Access to the TCSA will be based on conditions developed through the implementation of the Strategy in accordance with the precautionary principle.

Recent investigations suggest the capacity of this aquifer may be much less than previously understood. It is proposed to freeze the issue of new entitlements for the TCSA until such time as further investigations and monitoring demonstrate, with a reasonable level of certainty, the capacity of the aquifer to sustain future development.

Table: West Wimmera GMA TCSA PCVs

Zone	Tertiary Confined Sands Aquifer (TCSA) PCV (ML)	Sub-zone	TCSA Sub-zone PCV (ML)
Big Desert	0		
Northern	500	Yanipy	50
Little Desert	0		
Neuarpur	400	Sub-zone 1 Sub-zone 2	200 200
Gymbowen	200		
Southern	450	Apsley Langkoop Ullswater Edenhope	200 100 100 50
Zone Total	**1,550**		

Figure 5.2 West Wimmera GMA TCSA zone



The establishment of these areas followed a recommendation from the 1996-2000 Five Year Management Review by the BGARC (2002) to base the PCVs for the TCSA on a conservative proportion of throughflow.

The total of the PCVs determined by the BGARC was 8,140 ML.

The proposed PCVs for the TCSA aquifer for this Strategy using the amended zones are set at a lower total limit of 1,550 ML. They recognise:

- The preliminary results of recent drilling which suggest that the TCSA may not be as large a resource as previously interpreted, requiring a precautionary approach until this new information is assessed further.
- The proposed approach to preserve the TCSA for future use if the condition of the TLA deteriorates, while still taking into account the BGARC methodology.

Pliocene Sands Aquifer (PSA)

There are no groundwater use licences in the PSA of the West Wimmera GMA. The aquifer is low yielding and saline in places and is therefore unlikely to be developed as a useable resource. In some parts of the region the quality of the PSA is suitable for domestic and stock use, but the resource is generally only suited to small-volume domestic and stock developments. The PSA is not present in the western part of the GMA.

There is a lack of a clear demarcation between the PSA and TLA in some eastern parts of the Southern Zone. Management of these aquifers needs to take this into consideration. Proposals for larger groundwater extraction, for example mineral sand mining, should be considered on the basis of the potential impact of any significant use of the PSA on the underlying aquifers and environmental values.

It is therefore proposed that small PCVs be assigned for the PSA to allow modest incidental use in pockets where the resource is suitable.

Where there is a lack of clear demarcation between the PSA and the TLA, any proposal for use of this resource should be considered based on the merit of the application. Consideration could be given to increasing the PCV for the PSA if local studies indicate the suitability of the resource for this use, and provided there are no adverse impacts on other aquifers.

Local Management Rule 5.4 – PCV for Pliocene Sands Aquifer

PCVs for the PSA are set in accordance with the volumes shown in the table 'West Wimmera GMA PSA PCVs'.

Table: West Wimmera GMA PSA PCVs

Zone	Pliocene Sands Aquifer (PSA) PCV (ML)	Sub-zone	PSA Sub-zone PCV (ML)
Big Desert	0		
Northern	50	Yanipy	0
Little Desert	0		
Neuarpur	0	Sub-zone 1 Sub-zone 2	0 0
Gymbowen	50		
Southern	100	Apsley Langkoop Ullswater Edenhope	0 0 50 50
Zone Total	**200**		

5.2.2 Introduction of water use restrictions

Restrictions on groundwater extraction are proposed to arrest the declining trends in groundwater levels in Neuarpur sub-zone 1. The restrictions are proposed with consideration that:

- The resource is relatively large and while there is a consistent, significant downward trend in groundwater levels in Neuarpur sub-zone 1, some continued drawdown can still occur with limited impact on other groundwater users in the short-to-medium-term and without adversely impacting on the overall status of the resource or any environmental attributes.
- A sudden change in water use would significantly impact on the incomes of those who rely on the water resource, and hence on the broader regional economy. A gradual change would provide people with the opportunity to adapt to the changed water availability.
- There is an element of uncertainty about the annual volume of extraction that will lead to stabilisation in groundwater levels.

Restiction decisions will be made based on the adaptive management approach. The restriction will be expressed as a percentage of licence volume permitted to be pumped that season. As an example, for a groundwater licence with a 200 ML entitlement, a restriction to 80% of licence volume would allow the licence holder to use no more than 160 ML during that water year (12 months commencing 1 July).

The magnitude of the restriction or seasonal allocation required to achieve stabilisation of groundwater levels in Neuarpur sub-zone 1 is not precisely known. An adaptive management approach will be applied to successively increase restrictions until stable levels are achieved.

The proposed approach is:

1. The restriction for licensed irrigators within the Neuarpur managment zone (sub-zone 1) for the 2011-12 season will be 96 percent of the licensed volume. Restictions for successive years through to 2015/16 will be reviewed annually, but are proposed to be increased by four percent per year for five years to reach a restriction to 80 percent of licence volume by 2015/16. Subsequent increased restrictions will be required if levels do not stabilise during this time.
2. The restrictions will be announced annually on 1 March, to apply for the season commencing 1 July of that same year.
3. Groundwater levels are to be reviewed annually against the trigger level target band, with restrictions able to be adjusted after two annual readings outside the target band.

Subsequent increased restrictions of licence volume are likely to be required assuming that declines in groundwater levels continue to occur after the initial restrictions.

It is worth noting that easing of restrictions could occur in response to persistently higher groundwater levels.

It is proposed that stable groundwater levels should be achieved in Neuarpur sub-zone 1 within 20 years with signs of stabilisation being evident within 10 years. This is based on the combined understanding of the capability of the resource and the socio-economic impact of a more rapid reduction in groundwater extractions.

Resource Strategy 5.2 – Neuarpur sub-zone 1

An adaptive management approach utilising restrictions and groundwater level monitoring will be applied to Neuarpur sub-zone 1 to achieve stable groundwater levels in a 20- year period from the approval of this Strategy.

Restriction announcements will be confirmed by 1 March each year to enable irrigators to plan for the season ahead.

Restrictions may be applied outside Neuarpur sub-zone 1 if significant and unacceptable declines in groundwater levels are observed in other zones.

The extent of decline which is unacceptable will be defined for each zone in the form of a 'trigger'. The exact trigger level will be established as part of the implementation of this Strategy. Triggers will be established using as many observation bores as possible within the zone, rather than being reliant on a single 'representative' bore.

For example, in Neuarpur sub-zone 1 at bore 92808 the decline in levels has been less than three metres over the past 15 years. This rate of decline should not be exceeded as a stable level is reached. A rate of decline exceeding this would warrant a review of restriction levels.

In zones where levels are currently stable, some minor variation around the stable level is acceptable, as long as no clear trend starts to develop. Declines of greater than 1.5 metres below 2010 levels would not be seen as being consistent with minor variations, and would trigger a review of management arrangements. The exact triggers for each zone will be developed early in the implementation phase of this Strategy.

Local Management Rule 5.5 – Restrictions

a. GWMWater will announce an initial restriction to 96 percent of licence volume for Neuarpur sub-zone 1 by 1 March 2011, to apply in the 2011-12 season commencing 1 July 2011. Restrictions for successive years through to 2015-16 will be reviewed annually, but are recommended to be increased by four percent per year and reach 80 percent of licence volume by 2015/16.

b. Subsequent restrictions will be determined based on responses observed in groundwater levels, and will be announced by 1 March of any year to apply from 1 July of that year for the following 12 months.

c. GWMWater will announce all restriction regimes on its website, via public notices in the regional newspapers and also provide advice via letters to licensed groundwater users.

d. Groundwater levels are to be reviewed annually against trigger levels, with restrictions able to be adjusted after two annual readings outside the target band.

e. Initially there will be no restrictions applied to the other West Wimmera zones. This may be reviewed should unacceptable declines develop, with the triggers to be defined for each zone or sub-zone in consultation with the Implementation Committee.

5.2.3 Intensity of licensed extraction

PCVs for some of the West Wimmera zones have been set on the basis of a maximum intensity of groundwater entitlement, beyond which declines in groundwater level trends could occur.

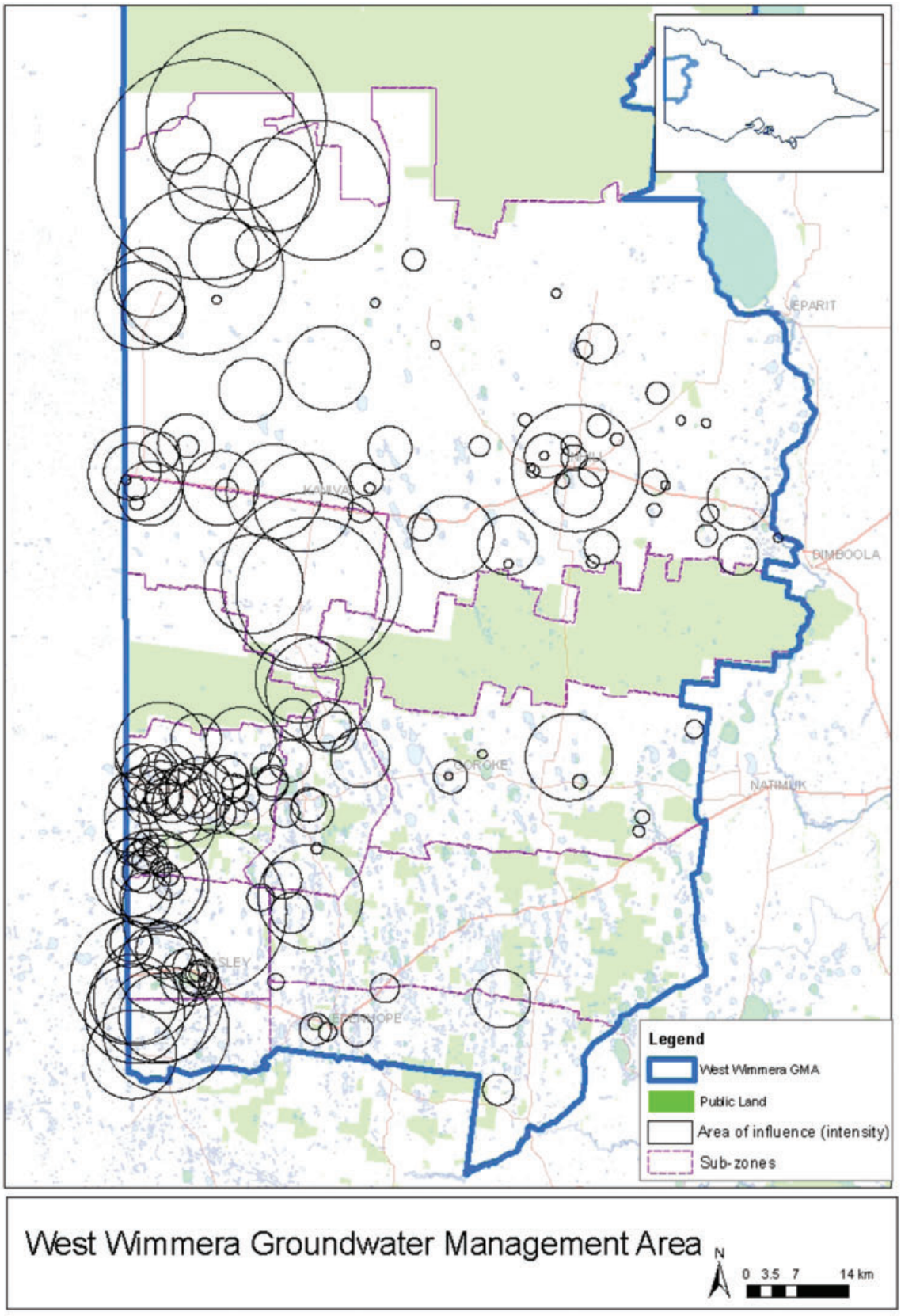
These intensity limits are proposed to apply to manage the local intensity of entitlements to individual new licences or trades within a zone. The proposed intensity of entitlement limits for each zone are provided in a table within Local Management Rule 5.2.

Where an application for a new licence or trade is received by GWMWater, a calculation will determine if the new licence will exceed the intensity of entitlement limit in the local area. The Implementation Committee, in collaboration with the Department of Sustainability and Environment (DSE), will develop a detailed procedure for this calculation. In summary, the procedure will apply as follows:

1. The volume of the application and its location are received by GWMWater.
2. The area of influence for the new application will be determined as a circle that has an area equal to the volume of the application divided by the intensity of entitlement limit for that zone.
3. This area will be plotted on a map showing the areas of influence of all existing licences within the West Wimmera GMA.
4. If the new application overlaps any existing area of influence circle, the application will not be approved. The application volume may be reduced to establish a smaller licence volume that would not overlap any other existing licence's area of influence.

Figure 5.3 shows the areas of influence of existing licences in the West Wimmera that have been determined in accordance with the above procedure.

Figure 5.3 Plot of indicative areas of influence of West Wimmera licences based on intensity of entitlement limits



Applications for licences or trades of licences of 20 ML or less will not be subject to these rules because they are not considered to cause undesirable drawdowns.

Trades within Neuarpur sub-zone 1 will also not be subject to this rule because trades within this sub-zone will not materially change the intensity of use in this area. This is because the whole zone is currently exceeding the target intensity.

Despite these exemptions, GWMWater will still be required to consider the impact of new licences or trades on existing uses of the resource to prevent, for example, multiple small applications in a local area.

Local Management Rule 5.6 - Entitlement intensity limits

a. GWMWater may approve an application for a new licence or trade provided that the application does not exceed the intensity of entitlement limit, in accordance with a procedure to be developed by the Implementation Committee and DSE based on the intensity of entitlement limits in Local Management Rule 5.2.

b. This rule does not apply to:
(i) Bore construction licences for the purposes of replacing an existing bore where the new location is within 100 metres of the original groundwater bore and is sourced from the same aquifer.
(ii) An amendment to a groundwater licence where the occupier of the bore proposes to reduce the entitlement on the licence at the same location.
(iii) Trades within Neuarpur sub-zone 1.
(iv) New licences or trades where the volume is 20 ML or less.

5.2.4 Localised bore interference

Managing localised drawdown

Localised bore interference occurs when the drawdown cone intersects a neighbouring bore. The impacts from groundwater pumping are site-specific because the aquifer characteristics and extraction patterns can vary.

GWMWater has well-developed procedures and policies to assess the potential risk for groundwater level interference from new groundwater licence applications. These procedures address matters in section 40 of the Act, which include impacts on surrounding groundwater users and the environment. Local Management Rule 5.6, relating to managing the intensity of entitlement, will reduce the likelihood of local interference. However, for larger new applications or trades requiring a new bore, it is proposed to ensure there is sufficient local monitoring to properly assess any potential impacts.

Local Management Rule 5.7 - Localised bore interference

a. New use of a volume greater than 399 ML per year, located more than five kilometres from an existing approved observation bore monitoring the water level in the TLA, will require the construction of a monitoring bore to be included in the bore observation network for the West Wimmera GMA at the user's expense.

b. GWMWater may restrict the volume that can be used on an individual groundwater use licence if the observed drawdown for observation bores in the area is determined by GWMWater to be adversely impacting on other authorised users or the environment.

c. Clause (b) above will not apply to address impacts on another authorised user where it is determined that the impact is primarily due to the user's bore not being constructed or operated to an appropriate standard or level of efficiency.

This proposed management rule does not remove existing requirements for GWMWater to manage current licences that cause unacceptable interference on nearby bores. Existing licence conditions for groundwater take and use licences give GWMWater the ability to reduce or restrict the volume taken by a licence holder should these situations arise.

Compensation scheme for domestic and stock bores
Declining groundwater levels can cause adverse impacts on authorised groundwater users, which includes domestic and stock users.

In many cases the impacts on a domestic and stock bore can be overcome by installing an additional length of pipe to the pump or windmill to restore flow. In some cases a bore may need to be deepened.

It is proposed that irrigators provide reimbursement to landholders for costs incurred in lowering or deepening domestic and stock pumps, mills and bores where it is demonstrated that they are impacted by lower water levels as a result of irrigation. Provision for this will be through licence revenue that GWMWater collects. GWMWater will administer the reimbursement scheme.

The procedure for affected landholders to access compensation is further explained in a separate information sheet, Bore interference/compensation. A comprehensive survey of domestic and stock bores will also provide accurate base information for assessing impacts. This survey is discussed in Section 5.8.2.

Implementation Support Strategy 5.1 - Compensation Scheme for Domestic and Stock Bores

a. Through a tariff on all licensed groundwater users in the West Wimmera GMA, GWMWater may provide reimbursement to domestic and stock users who require bores or pumps to be lowered as a result of a decline in water levels associated with licensed groundwater extraction.

b. Reimbursement to restore works will be in accordance with guidelines to be developed in consultation with the Implementation Committee.

c. The Implementation Committee will be consulted on applications for reimbursement which are considered to warrant special consideration.

d. Reimbursement will not apply where groundwater level decline is primarily due to the impact of plantations through groundwater use or interception.

5.3 Trade of Groundwater Licence Entitlements

Groundwater trading:

- Provides greater flexibility for licensed groundwater users to manage production.
- Enables new developments to occur in systems where all available resources have been allocated (i.e. entitlement limits have been reached).
- Provides licensed groundwater users the ability to better manage the risks of drought and reduced water availability.
- Enables water to move from lower value to higher value uses, boosting the returns from water use.
- Enables entitlements to be transferred where there are reduced environmental impacts.

Trading rules in the West Wimmera have been developed to increase opportunities for groundwater trading while preserving the management objectives of each zone.

Temporary and permanent trade of groundwater entitlements are permitted within zones subject to conditions that:

- Protect the integrity of the aquifer.
- Provide environmental benefits.
- Minimise the potential for unacceptable impacts on existing groundwater users.

Trading can only occur within the same aquifer and cannot occur between zones. There are some limitations on trades between sub-zones within zones, aimed primarily at reducing the intensity of use within these sub-zones. These sub-zones have been identified in Section 5.2.1. Table 5.2 provides a summary of sub-zone trading. The status of trading into the sub-zones of the Southern Zone will be reviewed in five years.

Table 5.2 Sub-zone trading

Zone	Sub-zone	Trading
Big Desert		N/A (restricted to Parks use only)
Northern		Trade permitted within Northern Zone
	Yanipy	No trade permitted into Yanipy
Little Desert		N/A (restricted to Parks use only)
Neuarpur		
	Sub-zone 1	No trade permitted into Neuarpur sub-zone 1
	Sub-zone 2	*Temporary trade only permitted into Neuarpur sub-zone 2
Gymbowen		Trade permitted within Gymbowen Zone
Southern		Trade permitted within sub-zones of the Southern Zone. Trade is not permitted across sub-zones.
	Apsley	No trade permitted into Apsley
	Langkoop	No trade permitted into Langkoop
	Ullswater	No trade permitted into Ullswater
	Edenhope	No trade permitted into Edenhope

Note: Any trading is subject to sub-zone PCV availability and intensity of entitlement limits.

Licence holders applying to temporarily or permanently trade groundwater licence entitlements must receive written approval from GWMWater before they use this water.

Local Management Rule 5.8 - Trade of groundwater licence entitlement

a. GWMWater may approve a trade of groundwater licence entitlement under section 62 of the Act provided the following conditions are satisfied:
(i) The trade of the entitlement is within the same management zone and aquifer.
(ii) The land to which the water is traded has a site use plan approved through the process developed by Wimmera Catchment Management Authority (Wimmera CMA) which is suitable for the proposed use of water.

b. Trading will not be allowed if the trade:
(i) Would result in exceeding the PCV for a West Wimmera zone.
(ii) Would result in exceeding the PAV for a Border Zone.
(iii) Would result in exceeding the intensity of entitlement limit as per Local Management Rule 5.6.
(iv) Results in water being moved into the following sub-zones - Neuarpur sub-zone 1, Neuarpur sub-zone 2 (permanent only), Apsley, Langkoop, Edenhope, Ullswater or Yanipy.

c. GWMWater will process temporary transfer applications in the order they are received. If there is more than one application received on the same day and insufficient volume is available, the remaining volume will be equally divided between the applicants.

d. An application relating to the transfer or conveyance of land on which the water is taken under a licence is able to be transferred to the successor in the Title of that land and is exempt from rule (a) above.

GWMWater will establish an education program on trading to help develop the water market in the West Wimmera area.

5.4 New Entitlements and Developments

New entitlements are available in areas where the full PCV has not been licensed. In the West Wimmera GMA this applies to the Northern, Southern (Ullswater sub-zone) and Gymbowen zones.

New entitlements will be available for sale in accordance with State Government requirements that significant new volumes are available for sale through an auction or tender process. This process will be developed by the Implementation Committee in consultation with the community during the implementation phase of this Strategy.

New developments, associated with either new entitlements or trades to areas that have not previously been developed, will require a site use plan to be developed which meets the requirements of the CMA, Department of Primary Industries (DPI) and DSE in relation to irrigation, drainage and environmental management. The site use plan will require approval prior to construction of the irrigation bore.

There is a risk that new licences could cause the threshold level of stable groundwater levels to be exceeded, as these threshold levels are not precisely known.

5.4.1 Site use plans

Site use plans provide a means of ensuring that new developments, either as a result of trade, new or existing entitlements, can occur in a sustainable manner. They also ensure that the proposed use of water will not have adverse effects on the environment or the groundwater resource.

Information that must be included in a site use plan includes:

- Details of the proposed method of irrigation, including layout of irrigation equipment, application rates, scheduling and crop types.
- A soil survey highlighting the water-holding capacity of the soil and the potential for surface and sub-surface drainage problems, as well as ways to address these issues.
- An environmental checklist that covers a range of issues such as native vegetation status.

The detailed requirements for site use plans will be developed during the implementation phase of this Strategy.

These plans will be referred to the CMA, Local Government, DPI and DSE for comment and endorsement. These agencies may also propose additional information requirements for site use plans.

The approval of a site use plan does not remove a developer's requirement to seek a planning permit from Local Government where this may be required, for example in relation to native vegetation removal.

Implementation Support Strategy 5.2 - Site use plans

a. New developments will require a site use plan and/or site management plan to be approved prior to the issue of a bore construction licence.

b. This requirement will apply for new licence volumes, trades, or re-location of existing entitlements to land that does not have a history of irrigation use.

5.5 Carryover

Carryover is a concept that is supported by state and national water management frameworks. Carryover provides the ability for a licence holder's unused available licence volume to be used in the following season. In that next season, any volume carried over would be the first water to be used. This approach provides licence holders flexibility to respond to variable seasonal conditions. The carryover applies only to the next season.

A three-year averaging rule currently applies in the Neuarpur Zone, where licence holders are allowed to use up to 20 percent more than their licence volume provided that the average use over each three years does not exceed their licence volume.

Carryover is preferred to, and will replace, the three year averaging rule because it is less complex and it requires licence holders to build up a volume of credit before this volume can be used.

It is proposed that carryover be permitted in the West Wimmera to:

1. Offer greater flexibility for licence holders to manage their entitlement in response to variable seasonal conditions.
2. Provide flexibility to licence holders to assist in adapting to the restricted licence volume.
3. Treat all entitlements more equitably, by not forcing licence holders to use their entitlement inefficiently under a 'use it or lose it' approach.

The draft Western Region SWS proposes that a maximum of 30 percent of a licence entitlement may be retained as carryover in any season. This becomes part of the total water available to a licence holder in the following season. For this Strategy, it is proposed that the limit on carryover be set at 30 percent in accordance with the Western Region SWS. The Western Region SWS notes (p130) that carryover is a new tool for groundwater users and a staged introduction is recommended to help develop an understanding of how to use this new tool. This means the Implementation Committee will be able to review, and if appropriate recommend, a change to this limit after experience is gained in using carryover.

Local Management Rule 5.9 - Carryover

GWMWater may permit a maximum of 30 percent of licence entitlement to be retained as carryover from one season to the next, and only the next, subject to the following rules:

a. The volume able to be carried over from one year to the next is based on the restriction regime in the first year, and is not subject to further restriction in the subsequent year.

b. The licence holder must obtain approval from GWMWater prior to extraction of the water before using any carryover volume that will result in usage exceeding the restricted volume.

Assuming that this Strategy is adopted at the start of the 2011-12 season, licence volumes not used in the 2010-11 season will be carried over in accordance with this proposal.

GWMWater will develop an education program to support the community's understanding of how carryover works.This will focus on the limits on being able to trade this water and how carryover water is accounted for.

Carryover may only be implemented to the extent permissible under the provisions of the *Groundwater (Border Agreement) Act 1985*, in the Border zones. Unless otherwise amended the relevant management rule will need to be modified so that the Permissible Annual Volume (PAV) for that zone is not exceeded by carryover. To give effect to this, an individual licence holder will not be able to carryover a volume that would cause the volume able to be extracted by that licence to exceed 100% of the licence volume.

Refer to the information sheet, Carryover for an example of calculation.

5.6 Monitoring and Review

5.6.1 Monitoring

Groundwater levels

Monitoring climate, groundwater extractions, levels, quality and land use is critical to inform future management actions and planning. In particular, monitoring groundwater levels is an essential step in the adaptive management approach proposed for the West Wimmera GMA because responses in groundwater levels will provide the trigger for changed restrictions of groundwater use.

A network of up to 160 observation bores covers the West Wimmera GMA. Most of these are monitored monthly. Many of these are part of the State Observation Bore Network, for which installation, maintenance and monitoring are currently funded by DSE.

Metering

All usage from licensed bores is metered and read twice a year, generally in late January to early February and in late May to early June.

Meters are calibrated, maintained and replaced in accordance with requirements of the National Metering Framework.

The Implementation Committee will consider future metering requirements. Two new areas of development are:

1. Installing more reliable and accurate electromagnetic flow meters, often referred to as magflow meters. The replacement cost of these is higher than standard meters, but their improved accuracy and longer life make them a favourable alternative for meter replacement.
2. Utilising remote meter-reading technology. This would allow real-time monitoring of water usage for GWMWater and irrigators and provide cost efficiencies by eliminating the need for staff to physically read meters.

The costs of these proposed metering requirements will be met by licence holders through their water tariff.

Water quality

A program will be established to monitor water quality in a representative selection of bores across the region. The extent of this program will be developed in consultation with the Implementation Committee.

Additionally, GWMWater will provide groundwater users with an opportunity to have the groundwater salinity tested from their private bores so they can monitor any change in groundwater salinity over time.

Water use plans

Annual water use plans provide a means for GWMWater to assess the potential effect of irrigation on the aquifer each season, particularly where irrigation use is high.

All licence holders operating centre pivot irrigators will be required to submit annual water use plans which will include the crop type, area of crop and expected water use for each site.

Licence holders excluded from completing an annual water use plan include intensive industries, orchards, olive groves, aquaculture or any activity that has a set area which operates from year to year without change.

5.6.2 Review

GWMWater will review the monitoring data each year and will present this as part of an annual report for West Wimmera GMA (see 6.5.1).

As per section 5.6, detailed information on groundwater levels, extraction, and quality will be presented to the Implementation Committee, as well as information on climate trends and land use which may impact groundwater quality or levels. This information will allow the representative trends of levels in an area to be established. It will help determine if there is a need to modify rerstrictions in Neuarpur sub-zone 1, or consider the introduction of restrictions in other zones.

Three essential forms of groundwater level information will be presented to the Implementation Committee:

1. Individual bore hydrographs.
2. An area-weighted average hydrograph for each zone and sub-zone.
3. Contours of trends shown on a plan of each sub-zone to provide an aerial representation of the groundwater level trends.

Implementation Support Strategy 5.3 - Improving Irrigation Efficiency

GWMWater will work with the West Wimmera Groundwater Implementation Committee and local irrigators to pursue funding opportunities for irrigation management education programs. It will also investigate if grants are available to partially offset the cost of upgrading the efficiency of existing irrigation systems.

Local Management Rule 5.10 - Groundwater monitoring and investigations

a. GWMWater will obtain and review groundwater levels from the observation bores in the West Wimmera, as well as any additional bores established in the network.

b. GWMWater will:
(i) Ensure that a meter is fitted to all equipped bores in the West Wimmera GMA other than those used solely for domestic and stock purposes.
(ii) Read each meter at least two times each year.
(iii) Maintain a database of all metered groundwater use.

c. GWMWater will obtain and review groundwater quality analysis results for selected active domestic and stock bores in the West Wimmera GMA to ascertain a representation of water quality across the GMA.

d. Changes in groundwater level and quality beyond a trigger set by the Implementation Committee could lead to a review of the Local Management Rules, and possibly the introduction of restrictions.

e. GWMWater will present detailed information to the Implementation Committee each year to help it make recommendations to the GWMWater Board on the restriction levels for each zone in the West Wimmera GMA.

5.7 Improving Irrigation Efficiency

It is important for all water users in the West Wimmera to maintain and improve their irrigation practice and systems to achieve efficient application of irrigation water.

Improving the efficiency of irrigation will provide the opportunity to partially offset the impact of restrictions in Neuarpur sub-zone 1 where the proposed reductions to water availability will adversely impact on some licence holders.

While it is the responsibility of irrigators to improve the irrigation efficiency of their systems, it is proposed that assistance will be provided by way of exploring funding opportunities to provide irrigation management education programs that improve system efficiency. In the process, the potential of identifying funding to partially offset the cost of system upgrades will also be explored. However, none have been identified to date.

5.8 Other Influences on the Groundwater Resource

5.8.1 Enhanced point source recharge

Enhancing the recharge of surface water, through structures to divert water into drainage bores or natural sink-holes, provides an opportunity to supplement the groundwater resource. Increasing recharge may have impacts on water quality and availability and environmental and social values, which are discussed later in this section. Approvals are required to construct a drainage bore or similar works that lead to artifical recharge of the aquifer, and also to dispose of water underground. GWMWater is the primary approval authority for these types of works in the West Wimmera area.

Managed aquifer recharge (MAR) is a specific system of artificial recharge where the water recharged is sought to be recovered. MAR has been utilised in various parts of Australia to augment water supplies.

Detailed guidelines have been developed to assess the acceptability of MAR projects. These include policies issued by the Minister for Water on 21 September 2010 and the National Guidelines (Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2): Managed Aquifer Recharge). The requirements focus on protecting the rights of existing water users, human health and the environment.

Water that is recharged through an MAR scheme becomes the property of the Crown and can only be recovered through a 'take and use' licence.

The drainage bores and natural sink-holes that already exist in the West Wimmera are not direct examples of MAR schemes, as there is no relationship between volumes recharged to the groundwater and individual licences. However, the MAR policies provide a sound framework to consider the impacts of proposals for new drainage bores or similar works, and are referenced in this Strategy as a basis for the development of specific artificial recharge policies.

Recharge for 'common' benefit

This strategy proposes that should any recharge proposal be approved, water which is recharged will provide a common benefit for all groundwater users, rather than any individual, and therefore may potentially be extracted at a point quite separate from that of injection. This is possible because of the open (karstic) nature of the TLA in the far south-west of the area. Such a scheme would be intended to improve the reliability of existing entitlements rather than generate capacity for additional entitlements to be created or to increase PCVs. This type of scheme differs from the current MAR approach, hence the Implementation Committee will need to further consider if and how artificial recharge should be encouraged in the West Wimmera.

Risks to the environment and social values

The artificial recharge of surface water into groundwater can have adverse impacts on wetlands that rely on surface flows to maintain biodiversity.

Much of the south-west Wimmera is recognised as a 'flagship area' in the Victorian Land and Biodiversity White Paper due to its high environmental values and wetlands. Measures to modify wetland hydrology in this region would impact on state and regional priorities around wetland health and the south-west Wimmera flagship area.

Land use change, especially in the Mosquito Creek catchment, has also been raised as an issue in the draft Western Region SWS with respect to its impact on water availability. This too is likely to decrease flows to wetlands. It will be increasingly critical that surface water remains in wetlands as long as possible for wetlands to retain their natural values.

Risks to water availability

Climate change has been highlighted in the draft Western Region SWS as having the potential to severely impact on surface water availability in the West Wimmera. This will have additional negative impacts on wetland hydrology and severely limit the volume and frequency of surface water availability for enhancing recharge.

Much of the water that fills a wetland infiltrates into an aquifer. The material benefit of artificially enhancing recharge in increasing water availability in an aquifer is questionable and problematic when it comes to accounting for any additional recharge that may be provided by a scheme compared to what would naturally take place.

The MAR policies require that all source waters must have an entitlement, they are therefore subject to any restrictions that would apply to all surface water entitlements.

Water quality risk
Introducing surface water to the aquifer creates the potential for contamination, either through undesirable organic matter such as animal faeces, or pesticides and herbicides used in agricultural production. Existing and potential beneficial uses of groundwater are protected through the State Environment Protection Policy (Groundwaters of Victoria).

Addressing the risks associated with enhanced aquifer recharge
The risks associated with enhanced aquifer recharge will be managed through existing licensing provisions under the Water Act, MAR policies and the National MAR guidelines.

Recharge though a bore requires a surface water diversion licence (e.g. a registration licence) and a licence for disposal of water underground. Assessments for these licences include suitable measures to protect other groundwater users and environment and social values.

The Implementation Committee and GWMWater Board will further consider the issues relating to artificially enhancing recharge in the West Wimmera. GWMWater is bound to consider any MAR application it receives in accordance with the MAR Policies and the National Guidelines.

Implementation Support Strategy 5.4 - Enhanced Aquifer Recharge

GWMWater, in conjunction with the Implementation Committee, will fully consider the potential for artificial enhancement of recharge and develop appropriate local management rules, consistent with MAR and other government policies.

5.8.2 Bore failure and decommissioning

Section 3.4.2 outlines the potential for failure of the casing of old bores leading to the contamination of an aquifer (typically the TLA).

While decommissioning of failed and redundant bores is the responsibility of landholders, GWMWater will seek financial support for a decommissioning program. The decommissioning program will identify bores for decommissioning and ensure that work is completed in a coordinated way. It will also provide the opportunity to promote the risk of bores that require decommissioning through an education program. The success of such a program will be dependent on the availability of funding to encourage or provide an incentive for landowners to decommission bores.

The completion of a comprehensive domestic and stock bore survey will help identify bores that may require decommissioning. This survey will involve field staff working directly with local landholders and mill repairers to identify the location and use status of existing bores.

Implementation Support Strategy 5.5 - Bore decommissioning

GWMWater will seek funding for a program to identify domestic and stock bores and assist landholders who are responsible to decommission high risk bores that could potentially contaminate aquifers in the West Wimmera GMA. Funding proposals will be developed through the Implementation Committee.

5.8.3 Plantation forestry and other land use change

The draft Western Region SWS provides a detailed review of the understanding of the impacts of plantations and other land use changes on water resources in the Western region. The document indicates that:

The potential impacts of land use change on water resources are now reasonably well understood at a local scale, particularly for plantation forestry. However, more detailed understanding of water use will be the basis for more effective management. This includes:

- *Refining estimates of water use by different types of vegetation in different areas.*
- *Establishing baselines, e.g. for land use, aquifer levels and recharge rates.*
- *Defining the location of important groundwater recharge zones more accurately.*
- *Development of better monitoring technologies, including remote sensing and use of satellite images.*

Better quantification of water use by different land uses will enable accounting of that use. It will also allow us to determine when an increase in water use becomes significant – causing unacceptable impacts on other water users or the environment.

The impact of plantations is considered to be significant in the Langkoop sub-zone, and possibly in other areas in the Southern Zone.

The completion of the final Western Region SWS will provide a direction for policy development in regards to plantations. It is planned that this issue is addressed during the implementation phase of this Strategy and as the state policy framework develops.

Implementation Support Strategy 5.6 - Groundwater impacts of ground use change

On completion of the Western Region SWS, GWMWater and the Implementation Committee will work with DSE and the BGARC to develop a policy approach to manage the groundwater impacts of land use changes including plantation forestry.

5.9 Border Designated Area

The following table is a summary of the PAVs, permissible distance and permissible potentiometric surface lowering for the zones of the Border Designated Area that fall either partly or wholly within the bounds of the West Wimmera GMA. These values are established by the BGARC and not by this Strategy. The BGARC would consider a recommendation from the GWMWater Board to review these values on the advice of the Implementation Committee, subject to appropriate justification.

Table 5.3 PAVs and other limits set by the BGARC for the Border Designated Area

Zone	Permissible Annual Volume		Permissible Distance (km)		Permissible Potentiometric Surface Lowering (m/yr)
	TLA (ML)	TCSA (ML)	TLA	TCSA	
9B	5,960	630	1	3	0.65
8B	3,500	330	1	3	0.65
7B	5,782	350	1	3	0.05
6B	10,811	360	1	3	0.2
5B	12,201	570	1	3	0.2
4B	14,000	300	1	3	0.25

A proposal currently being considered by the BGARC is aimed at providing flexibility in the management of PAVs to allow for carryover within the Border Zone.

The permissible distance is the distance from the border within which all applications for a groundwater use licence must be forwarded to the BGARC.

The permissible potentiometric surface lowering is the rate of drawdown that must not be exceeded in one year.

Trading will be allowed between the Border zones and West Wimmera zones in which these lie, subject to other PCVs which will take precedence. Where a Border Zone is split into separate West Wimmera zones, the Border Zone entitlements will be managed separately. No trading will be allowed between these split zones.

6 Implementation of the Strategy

6.1 Legal Requirements

The Northern Region SWS and more recently the draft Western Region SWS have established that Local Management Rules generally provide a suitable mechanism for managing groundwater diversion licences and related matters.

It is therefore considered that a WSPA Groundwater Management Plan is not required for the West Wimmera GMA.

Further, it is considered that the WSPA Groundwater Management Plan for the Neuarpur area is no longer required and will be superseded by this Strategy and its associated Local Management Rules.

There is a requirement for a formal notice inviting submissions on these proposals, which are to be considered by the Minister before making a decision regarding the proposals.

The application of carryover requires a declaration by the Minister.

Application will also be made to the Minister requesting the declaration under section 62A of the *Water Act 1989* to provide for the taking of water in a subsequent water season.

Resource Strategy 6.1 - Abolish existing WSPAs

GWMWater will request to the Minister for Water that:

1. The Apsley, Kaniva, Neuarpur and Telopea Downs WSPAs be abolished.
2. The Neuarpur WSPA Groundwater Management Plan be revoked, in accordance with the required statutory processes.
3. The Neuarpur Groundwater Supply Protection Area Groundwater Licence Transfer Order 2001 be revoked.

The Strategy proposes PCVs for each zone and sub-zone in the West Wimmera GMA. A PCV can only be established for a declared GMA. Existing PCVs and GMAs are mostly superseded by this Strategy.

The exception is Balrootan GMA around Nhill township which was declared to provide protection to the groundwater supply for town. Figure 5.3 shows that the proposed application of the intensity of entitlement rule would provide sufficient protection to the Nhill township supply, hence it is proposed to also abolish the Balrootan GMA.

Resource Strategy 6.2 - Declaration of new West Wimmera GMA

GWMWater will recommend to the Minister for Water:

a. The revocation of all existing GMAs and PCVs relating to the TLA and the TCSA.

b. The establishment of the West Wimmera GMA as shown in Figure 5.1, including all aquifers in this area, and sub-divided into the management zones also identified in Figure 5.1.

c. The setting of PCVs in accordance with the recommendations for each zone or sub-zone as identified in this Strategy.

Resource Strategy 6.3 – Declaration for carryover

GWMWater will request that the Minister make a declaration under section 62A of the *Water Act 1989* to provide for the taking of water in a subsequent water season.

6.2 GWMWater Board Endorsement

The GWMWater Board endorsed this Strategy at its meeting on 1 June 2011.

Subject to the Minister's approval of the Resource Strategies 6.1, 6.2 and 6.3, the GWMWater Board can implement the remainder of the Strategy. This includes establishing the Local Management Rules as the basis for management of the groundwater resource and licences for its use.

The draft Western Region SWS indicates that 'Local Management Rules will be formally documented, adopted and published for all surface water and groundwater systems that are not part of a water supply protection area.' It is proposed to give effect to this requirement as follows:

Resource Strategy 6.4 - Establish Local Management Rules

GWMWater will establish Local Management Rules as described in this Strategy and will disseminate these by:

a. Sending a copy of the Local Management Rules to all groundwater and surface water licence holders, and key stakeholders in the West Wimmera GMA.

b. Publishing a copy of the Local Management Rules on the GWMWater website, and with their approval, on the websites of other stakeholders.

c. Advertising the availability of the Local Management Rules in newspapers across the area.

6.3 Implementation Committee

The GWMWater Board will establish the West Wimmera Groundwater Implementation Committee for the implementation of this Strategy. Membership on this committee will be similar to that of the Advisory Committee established for Strategy development. It will include:

- Landholder representatives from each zone.
- Agency representatives.
- Other key stakeholder representatives.

This Implementation Committee will be established under terms of reference approved by the GWMWater Board, subsequent to adoption of this Strategy. These terms of reference will include at least the following matters:

- Consider changes to or additions to Local Management Rules.
- Comment on proposals for matters that are not clearly addressed by Local Management Rules.
- Review the water resource status, including recommendations on restrictions required to achieve management objectives of each zone.
- Review monitoring and compliance information, including preparation of an annual report regarding implementation of the Strategy across the West Wimmera GMA.
- Identify new issues requiring consideration by the GWMWater Board in relation to management and licensing of the groundwater resource in the West Wimmera GMA.
- Identify matters to be communicated to the broader community, or on matters which they should be consulted about.
- Governance arrangements, including the term of Committee member tenure.

Resource Strategy 6.5 - Implementation Committee

A West Wimmera Groundwater Implementation Committee will be established by the GWMWater Board to provide advice to the Board about management and licensing of groundwater in West Wimmera GMA.

6.4 Review of Rules

It is understood that the Local Management Rules proposed in this Strategy are consistent with new Victorian guidelines which are anticipated to be released in the near future. Further, the consultation conducted for preparation of this Strategy meets the consultation requirements expected to be outlined in those guidelines.

In the future, the Local Management Rules contained within this Strategy may need to be amended in response to State or National policy changes in groundwater resource management, or improved understanding of the aquifer system and its response to management arrangements.

Any changes to the Local Management Rules must be based on sound technical understanding of the issues, and be subject to consultation with the broader West Wimmera community. The exception will be minor changes such as providing clarity to the Strategy.

Any proposed changes to the Local Management Rules will be considered by the GWMWater Board based on recommendations of the Implementation Committee.

A comprehensive review of the Local Management Rules must be undertaken after an implementation period of five years. A critical component of this review will be to consider the continued requirement for restrictions, as well as other appropriate mechanisms for long-term management of the Neuarpur sub-zone 1. This five-year review will consider the requirement for and appropriateness of permanent reductions to licence volumes in different areas, based on the improved understanding of the resource, and the effectiveness of measures to achieve stabilised groundwater levels in the period leading up to that review.

The period of renewal of licences will be linked to the timing of this review so that licences are able to be amended based on the outcomes of the review.

Resource Strategy 6.6 - Review of rules

a. GWMWater will meet with the West Wimmera Groundwater Implementation Committee at least twice a year, and at any other time as considered necessary, to review the Local Management Rules and consider the need for any amendments.

b. Groundwater users in the West Wimmera GMA are to be informed of any proposed amendments via a mailout to licence holders, a public meeting and/or through advertisements placed in local newspapers.

c. The Local Management Rules will be reviewed within each five-year period from the approval of this Strategy.

d. Licences in the West Wimmera GMA will not be renewed for a period beyond 30 June 2016 to enable licence conditions, including licence entitlements, to be modified if considered necessary as a result of a review of Local Management Rules to be conducted at that time. Beyond 30 June 2016, licences will only be able to be renewed annually until the outcomes of the five-year review are considered, at which time, licences may be able to be renewed for longer periods up to that defined in the Act.

6.5 Annual Report and Communication

6.5.1 Annual report

GWMWater, in consultation with the Implementation Committee, will prepare an annual report on the implementation of this Strategy, and an annual newsletter to groundwater users. This will detail the status of groundwater resources, including groundwater levels from key bores, and activities undertaken during the year. These will be available on GWMWater's website.

Preparing annual reports is a statutory requirement for formal plans developed for WSPAs. DSE issues guidelines on requirements for annual reports. GWMWater will continue to report on the implementation of this Strategy using the guidelines established for WSPA management plan reporting.

6.5.2 Communication and consultation

A communications plan has been developed to keep the community informed of the groundwater resource status and implementation of this Strategy. The communications plan sets out the consultation process as part of Strategy development and aims to provide groundwater users with information to demonstrate that the aquifer is being managed sustainably.

It also provides the framework to provide notification of the restriction level to be applied in zones where they are implemented.

A key element of the communications plan is distributing an annual newsletter to provide an update on the status of groundwater resources in the West Wimmera GMA and summarise outcomes from the annual report.

GWMWater will place this Strategy document, annual reports and other information relating to the management of groundwater resources in the West Wimmera GMA including groundwater levels from key bores on its website www.gwmwater.org.au. Information about the Victorian Water Resources Data Warehouse will also be provided so that landholders can access information on all bores that are actively monitored in the area.

Implementation Support Strategy 6.1 - Communications

a. GWMWater will prepare an annual report for the year ending 30 June, by 30 September of the same year, on implementation of this Strategy which will include reporting and analysis of:
    - (i) Groundwater level monitoring.
    - (ii) Groundwater quality and salinity monitoring.
    - (iii) Groundwater entitlement per zone, including trade and carryover.
    - (iv) Groundwater use per zone and any metering issues.
    - (v) The restriction level in each zone.
    - (vi) Compliance issues.
    - (vii) Any new technical information or change in policy.
    - (viii) Work undertaken on groundwater-dependent ecosystems.
    - (ix) Any proposed or actual amendments to the local management rules.

b. In October of each year GWMWater will send newsletters to all licence holders and relevant agencies in the West Wimmera. Domestic and stock users may receive a newsletter on request. The newsletter will state the resource position and summarise outcomes from the annual report.

c. GWMWater will post on its website www.gwmwater.org.au:
    - (i) Local Management Rules for the West Wimmera GMA and supporting reports.
    - (ii) Annual newsletters.
    - (iii) The annual report.
    - (iv) Other relevant information at the request of the Implementation Committee.

6.6 Implementation Costs

Since the formation of GWMWater in 2004 there has been little review of pricing policies as they apply to GWMWater's groundwater activities. The prices in place generally reflect the uniform pricing policies previously established, with indexing over time. With the advent of groundwater protection areas, prices were adjusted to reflect the additional costs of administering these arrangements.

With the introduction of independent economic and service regulation of the water industry by the Essential Services Commission (ESC) there is an expectation that water businesses achieve full cost recovery. GWMWater had deferred its assessment of costs and how this translates into groundwater prices and tariffs because Wimmera Mallee Pipeline-related pricing policies and further urban tariff rebalancing were given priority.

It is anticipated that additional costs will be incurred by GWMWater to meet its groundwater management obligations in the West Wimmera as a consequence of proposals in this Strategy.

Specific areas where additional costs will be incurred are as follows:

- Groundwater level monitoring undertaken by GWMWater beyond that undertaken by DSE as part of the state observation bore network.
- Water quality monitoring undertaken by GWMWater.
- Support to the Implementation Committee, including meetings and preparation of information for these meetings.
- Preparation of proposals for grants and subsequent administration.
- Education programs developed during implementation.
- Community information, including the preparation and distribution of newsletters and other information.
- A Bore Compensation scheme to offset the impacts of lower water levels on domestic and stock users.

Where a requirement for further studies is identified, GWMWater will pursue external funding opportunities as they arise.

It has been GWMWater's intention that the review of groundwater pricing be informed by the outcome of this Strategy. This will be further informed by any groundwater management policies that arise from the Western Region SWS.

GWMWater has refined its systems to better capture the costs of undertaking its water and wastewater management activities consistent with the requirements of the ESC regulatory accounting code. This will be developed into pricing proposals to support the performance of groundwater management activities. It is envisaged that this review of groundwater pricing will commence in 2010/11. This review will be coordinated through GWMWater's Pricing and Tariff Working Group which comprises a broad range of customer representatives.

The West Wimmera Groundwater Implementation Committee will be actively consulted in this review.

Implementation Support Strategy 6.2 - Implementation costs

GWMWater will develop pricing proposals for the groundwater management services in consultation with its customer representative Pricing and Tariff Working Group.

Bibliography

Border Groundwaters Agreement Review Committee (2002) Five Year Management Review Report 1996-2000

CoAG, (2004) The Intergovernmental Agreement on a National Water Initiative

CSIRO (2008) Climate Change in the Wimmera, Department of Sustainability and Environment, Victorian Government

DSE (2005) Technical Audit Panel Review of Neuarpur WSPA Five Year Technical Review

Herczeg, A.L., Leaney, F.W.J., Stadter, M.F., Allan, G.L., and Fifield, L.K. (1997) Chemical and isotopic indicators of point source recharge to a karst aquifer, South Australia. Journal of Hydrology 192 (1997) p271-299.

Neuarpur Groundwater Supply Protection Area Consultative Committee (2001) Neuarpur Area Groundwater Plan

Parsons Brinckerhoff (2010) Peer Review for the West Wimmera Area, Report for Department of Sustainability and Environment

SKM (2009) West Wimmera Hydrogeological Study, Final Report

URS (2009) West Wimmera Socio-Economic Study, Final Report, December 2009

Victorian Government (2009) Northern Region Sustainable Water Strategy

Victorian Government (2009) *Victorian Land and Biodiversity White Paper*

Victorian Government (2010) Western Region Sustainable Water Strategy (draft)

Glossary

Term/Acronym	Definition
Acceptable	Balances the critical needs of the environment, people and the economy. These needs are complementary rather than competing and not promoted to the detriment of one another. Outcomes that the general population can understand and be comfortable with.
Act	The Water Act 1989 (Victoria) unless specifically stated otherwise.
Aquifer	A geological structure or formation permeated or capable of being permeated permanently or intermittently with water.
Aquitard	An impermeable layer (eg clay) that allows very little or no groundwater to pass readily through it, including recharge from the ground surface.
Artificial recharge	Deliberate diversion of surface waters into a groundwater aquifer via physical works such as a bore or a natural recharge feature such as sinkhole. Also referred to as Managed Artificial Recharge, or MAR.
BGARC	Border Groundwaters Agreement Review Committee, established by the Groundwater (Border Agreement) Act 1985 which cooperatively manages the groundwater resource along the state border of South Australia and Victoria.
Bookpurnong beds	Upper tertiary aquitard confining the tertiary limestone aquifer (TLA).
Border (Groundwater Agreement) Act 1985	This Act came into effect in 1986 to cooperatively manage the groundwater resources along the State border of South Australia and Victoria.
Bore	A bore, well or excavation or any artificially constructed underground cavity used for intercepting, collecting, storing or extracting groundwater.
Bore construction licence	A licence to construct a bore under section 67 of the Act.
Climate change	A noticeable long term trend away from average. Changes to climatic variables such as temperature, rainfall, evaporation and extreme weather phenomenon, whether or not attributed to human induced factors.
Cone of depression	The cone-shaped depression, produced in the groundwater surface, around a bore, or series of bores, caused by the extraction of groundwater at a given rate. The cone is characterised by a centre, where drawdown is greatest, and an edge, beyond which the extraction has no influence on the groundwater level.

Confined aquifer	A confined aquifer is an aquifer that is trapped by a layer of impermeable material above it. Most confined aquifers are under pressure and if a bore intersects a confined aquifer, water will rise up the bore until the pressure is equalised, sometimes the bore will flow to the surface. Often there is an unconfined aquifer on top of the confined aquifer.
Depletion	Reduction in the net storage of groundwater within an aquifer.
Designated Area	A 40 km wide strip centred on the border of South Australia and Victoria and extending for its full length. The area is designated by the Groundwater (Border Agreement) Act 1985, and is divided into 22 management zones (11 in each state).
Domestic and stock use	Water used for household purposes, watering of animals kept as pets, watering of cattle and other stock, or irrigation of a kitchen garden of not more that 0.4 hectares. It does not include use for dairies, piggeries, feedlots, poultry or any other intensive or commercial use. Watering of the curtilage of a house for fire prevention purposes is also included.
Drawdown	The difference between the observed water level before and after groundwater pumping occurs.
DSE	Department of Sustainability and Environment.
DPI	Department of Primary Industries.
EC	Electrical Conductivity is a measure of the ability of a solution to pass an electric current. The higher the concentration of dissolved salts, the higher the electrical conductivity. One EC unit equals about 0.6 mg/L (milligrams per litre).
Equitable	Based on reason, conscience, and a natural sense of fairness to all.
ESC	Essential Services Commission.
GDE	Groundwater-dependent Ecosystem.
GMA	Groundwater Management Area.
GWMWater	Grampians Wimmera Mallee Water Corporation.
Groundwater licence	A licence to take and use groundwater issued under section 51 of the Act.
Groundwater licence entitlement	The total amount of groundwater authorised to be taken each year under a groundwater licence.
Groundwater management area	Discrete areas where groundwater resources have been sufficiently developed to warrant careful management. An area for which a PCV is set.
Groundwater use	The volume of groundwater extracted from a bore that has been measured by a meter or has been estimated where a meter is not fitted.

Hydrogeology	The science that deals with subsurface waters and related geological aspects.
Hydrograph	The plot of water levels in a bore against time in the form of a graph.
Karstic	An aquifer within a karst limestone rock matrix. Such aquifers are normally characterized by large void spaces, relatively high values for hydraulic conductivity, flat watertables, and extensive networks of solution channels.
Licensed bore	A bore licensed for irrigation or commercial purposes under the Act to authorise water to be taken and used.
Managed aquifer recharge (MAR)	Refer to 'Artificial Recharge'.
Management zone	An area of a groundwater management area named and delineated on a map.
Megalitre (ML)	One million litres, or 100 mm over 1 hectare.
mg/L	Milligrams per litre.
MGLA	Murray Group Limestone Aquifer (also known as Tertiary Limestone Aquifer (TLA)
ML/yr	One megalitre per year.
Non-renewable groundwater	A groundwater resource where recharge has ceased or is very small.
PAV	Permissible Annual Volume – now referred to as PCV, though this term still applies to the Border Zone.
PCV	Permissible Consumptive Volume, the volume of water approved by the Minister under Section 22A of the *Water Act 1989*, to be able to be taken in a period, usually a year.
Perched (aquifer)	Used typically in association with the upper level formations, a perched aquifer is one that sits above the more regionally extensive aquifers formed by mounding of groundwater above a localised barrier.
Permanent trade	Transfer of a water licence.
PSA	Pliocene (Parilla) Sands Aquifer: Shallowest of aquifers in the Murray Darling Basin sequence. Also known as Loxton Parilla Sands.
Potentiometric level	Also known as the pressure level, the depth below ground surface to which the groundwater level will rise when a well is drilled into a confined aquifer.

Recharge	The process of replenishment to an aquifer due to the infiltration from rainfall or from surface water bodies such as lakes and streams. Recharge to an aquifer may also occur by leakage from overlying or underlying aquifer systems. Recharge may be either: • Diffuse – recharge occurring generally across the landscape; or • Point Source – localised recharge at a defined point in the landscape eg runaway holes.
Salinity	The concentration of dissolved salts. Usually measured in milligrams per litre (mg/L), parts per million (ppm) or electrical conductivity (EC) units, expressed as micro-Siemens per centimetre (uS/cm). EC units are approximately equal to mg/L x 0.6. 1 mg/L equals 1 ppm.
Seasonal allocation	The percentage of a groundwater licence allowed to be taken and used annually.
Site use licence (or water use licence)	An authority to use water for irrigation on a property where the water is taken from a declared water system. Land that has a history of use will be issued with, or deemed to hold, a site use licence commensurate with their existing use arrangements.
Stabilised	Zero rate of change in a condition indicator, measured annually, and compared to acceptable levels and variability.
Sustainability	Sustainability of the aquifer is maintaining an acceptable, stable water level and water quality which is also able to sustain the ecological, social and economic resources for future generations.
Sustainable	Able to be maintained over the long term.
TAP	Technical Audit Panel.
Temporary trade	Transfer of a seasonal allocation.
TCSA	Tertiary Confined Sands Aquifer comprising the Renmark Group of the Murray Basin also known as Olney Formation.
Theis equation	An analytical method used to determine aquifer characteristics from a pump test.
TLA	Tertiary Limestone Aquifer consisting of the Murray Group Limestone Aquifer of the Murray Basin or the Duddo Limestone.
Transmissivity	The ability of water to move within the aquifer. Used when calculating aquifer throughflow volumes which is an important component of the PAV value for confined parts of the Tertiary Limestone aquifer. Transmissivity is equal to the hydraulic conductivity times the thickness of the aquifer.
Unconfined aquifer	An aquifer that does not have an impermeable layer between the aquifer and the ground's surface.
Unincorporated Area	An area of groundwater management not contained in a declared GMA or WSPA.

Victorian Water Resources Data Warehouse	An internet based database of groundwater and surface water data accessible to the public.
Water Supply Protection Area (WSPA)	An area declared by the Minister for Water for the protection of the groundwater resources or surface water resources or both, for which a formal management plan has been or is being prepared.
Water table	The 'phreatic' or 'free' surface within an unconfined aquifer. The saturated-unsaturated interface within the ground.
Wimmera CMA	Wimmera Catchment Management Authority.
Yield	The amount of water pumped from a well, commonly measured in litres per second.
Zone/sub-zone	A defined area within a groundwater management area where specific conditions may apply.

Acronyms

BGARC	Border Groundwaters Agreement Review Committee
CMA	Catchment Management Authority
CoAG	Council of Australian Governments
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
EC	Electrical conductivity units (salinity)
EPA	Environment Protection Authority
GDE	Groundwater-dependent Ecosystem
GMA	Groundwater Management Area
GMU	Groundwater Management Unit
MAR	Managed Aquifer Recharge
ML	Megalitre
PAV	Permissible annual volume
PCV	Permissible consumptive volume
PSA	Pliocene (Parilla) Sands Aquifer
SENRMB	South East Natural Resource Management Board (South Australia)
SKM	Sinclair Knight Merz
SWS	Sustainable Water Strategy
TAP	Technical Audit Panel
TCSA	Tertiary Confined Sands Aquifer
TLA	Tertiary Limestone Aquifer
WSPA	Water Supply Protection Area

Assumptions

Assumptions define the underlying premises of the recommendations made by the Committee. The Committee's assumptions were:

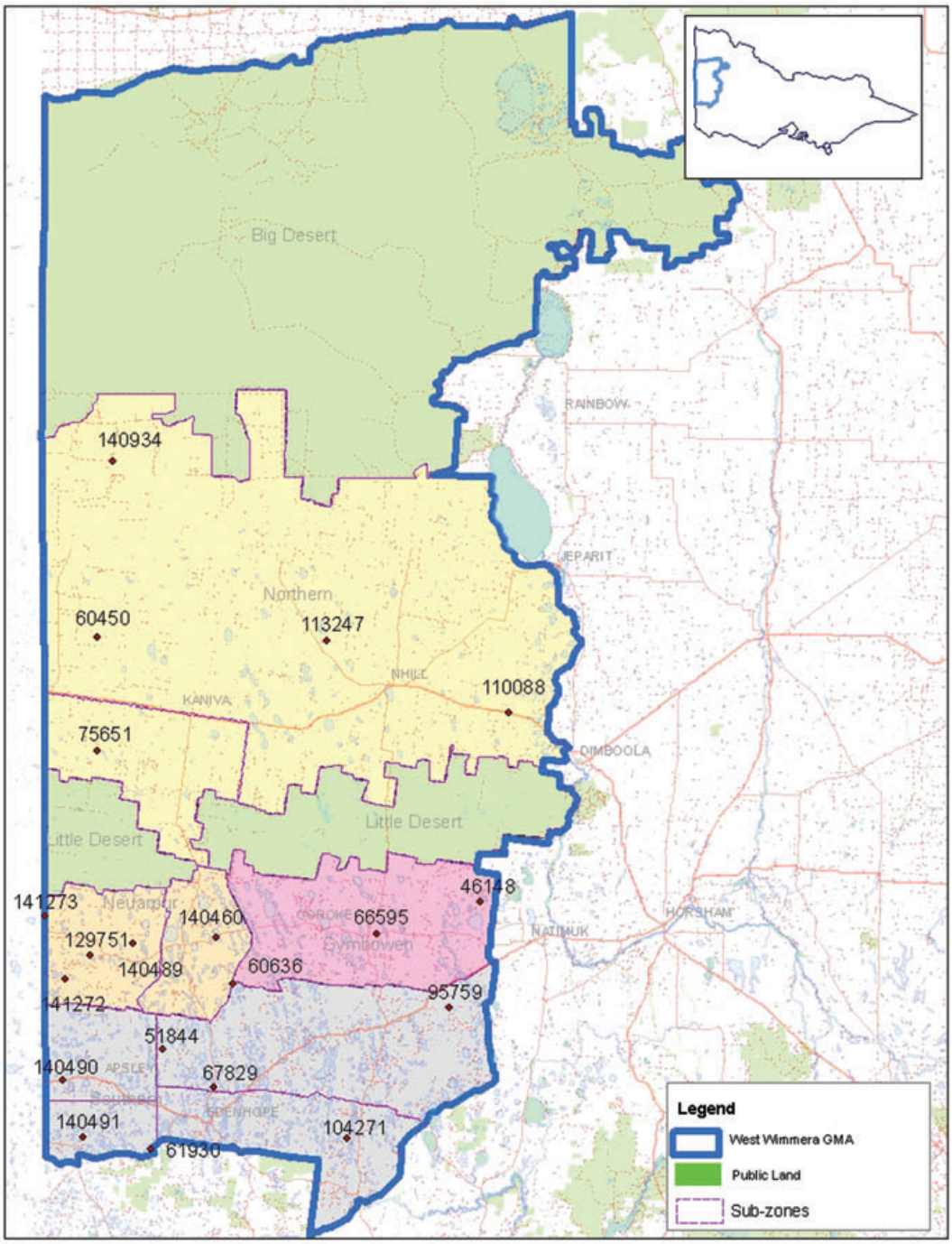
1. Clarity of language will assist in developing recommendations.
2. GWMWater will communicate to the community the progress of developing the Strategy's recommendations.
3. Equitable means that everyone is treated fairly.
4. We come into this process with a blank canvas.
5. We will develop a regional plan, inclusive of both broader and local community considerations.
6. We will develop strategic directions in consultation with the wider community.
7. The Strategy will be consistent with State and Federal legislation.
8. The science of groundwater is complex and not fully understood. We seek the best available science as the basis of an adaptive management approach which will be continually refined as we learn more through our monitoring and investigations programs.
9. Entitlements will be managed to achieve a sustainable water resource.
10. The recommendations of the Committee will be presented to the GWMWater Board for consideration and implementation.
11. We will develop a single Strategy for the whole area. However management rules may be set for defined areas.
12. The Strategy will not define acceptable uses for groundwater but rather rely on existing market and environmental factors to influence land use.
13. We will develop a Strategy for sustainable use of groundwater resources.

These assumptions guided the work of the Committee in the development of the draft Strategy.

Groundwater Hydrographs

There are many observation bores in the West Wimmera GMA. Not all observation bores are monitored on a regular basis, however at June 2011, there were approximately 160 bores being monitored regularly with between four to twelve measurements per year. The majority of the bores monitor the groundwater level within the TLA. There are many bores that are monitoring the PSA, TCSA, and other formations such as the Ettrick marl, bedrock, Winnambool and Shepparton formations.

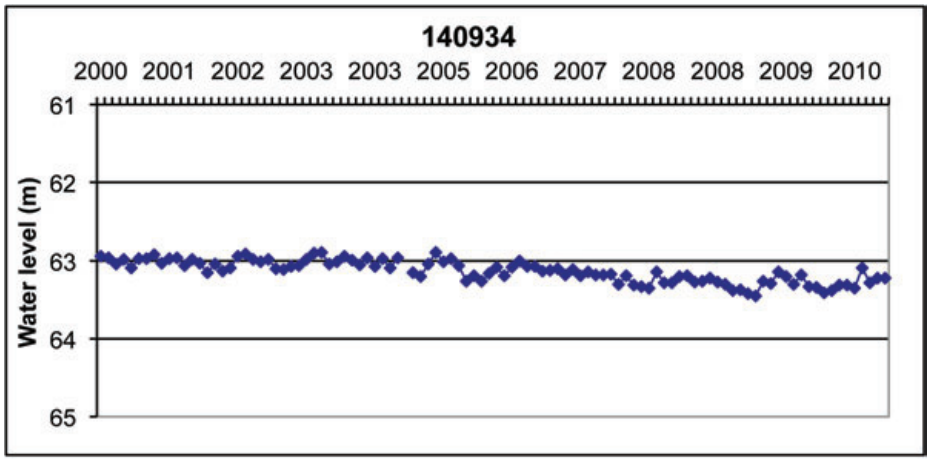
The following figure illustrates the location of selected observation bores. The hydrographs are also illustrated.

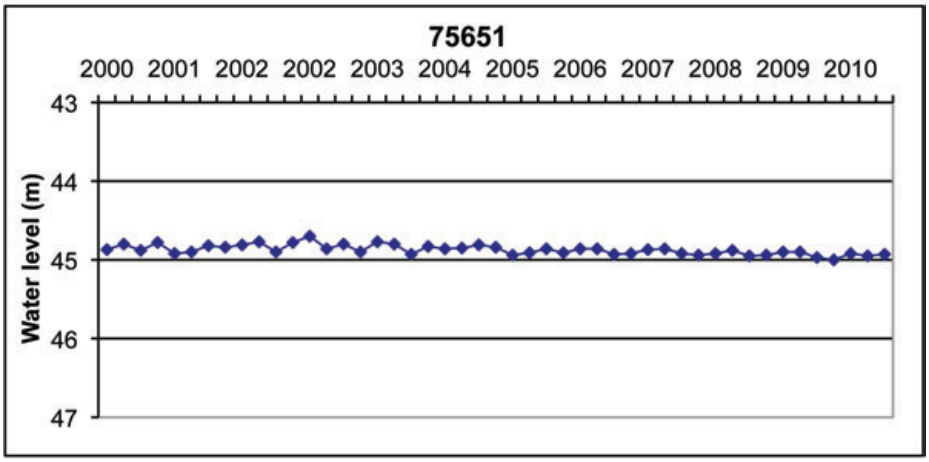


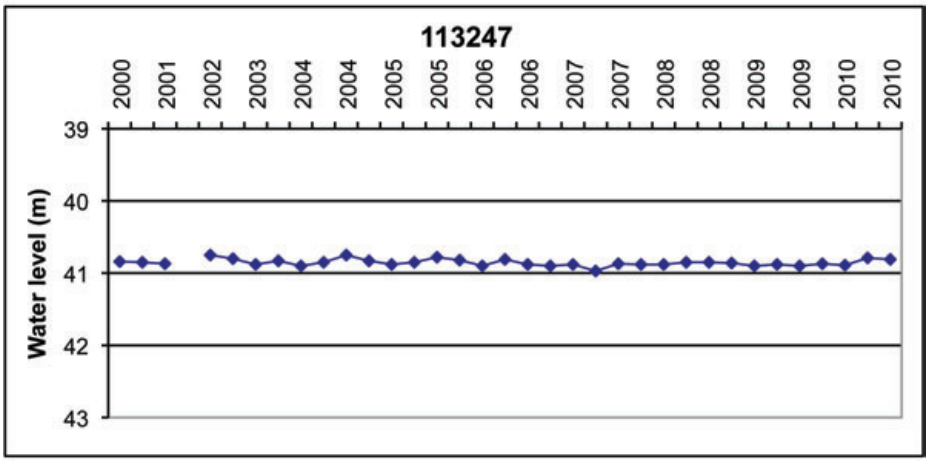
West Wimmera Groundwater Management Area
Selected Observation Bores (TLA)

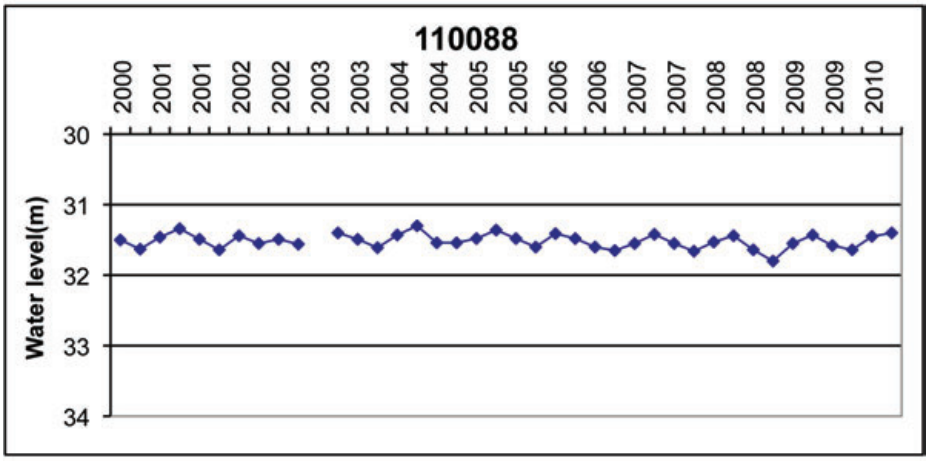
N

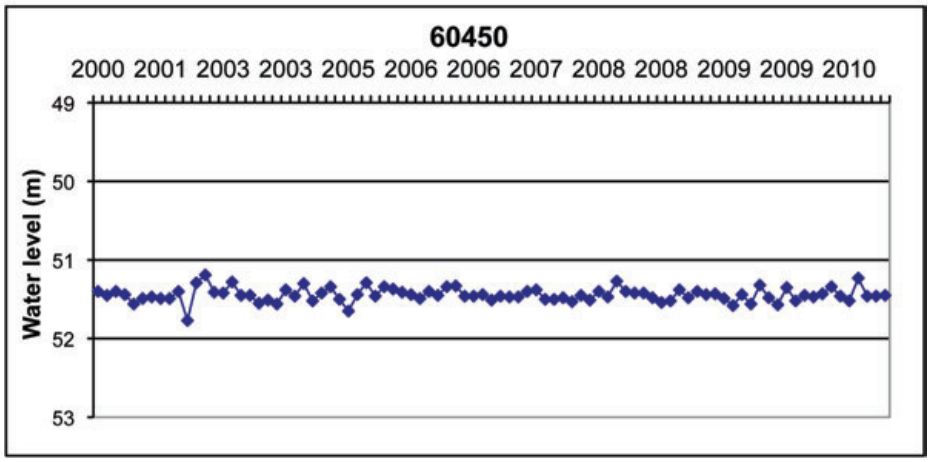
0 4.5 9 18 km

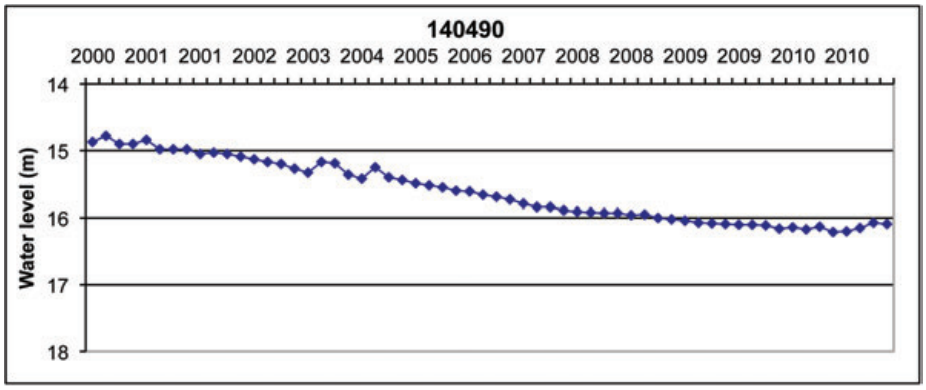

140934
2000 2001 2002 2003 2003 2005 2006 2007 2008 2008 2009 2010
Water level (m)
61
62
63
64
65

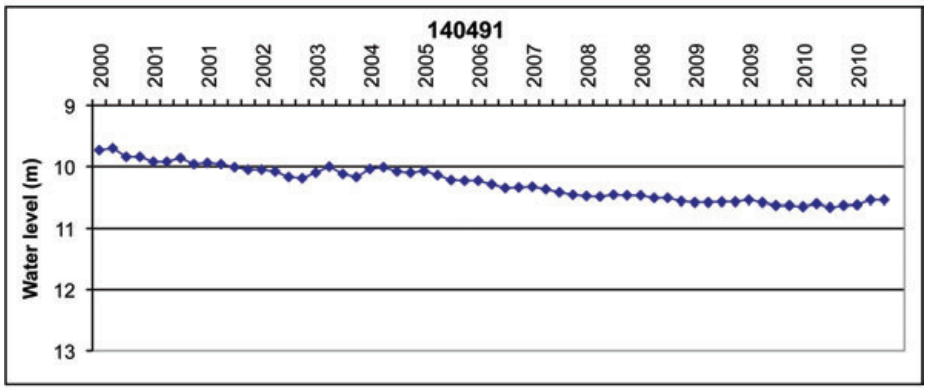

75651
2000 2001 2002 2002 2003 2004 2005 2006 2007 2008 2009 2010
Water level (m)
43
44
45
46
47

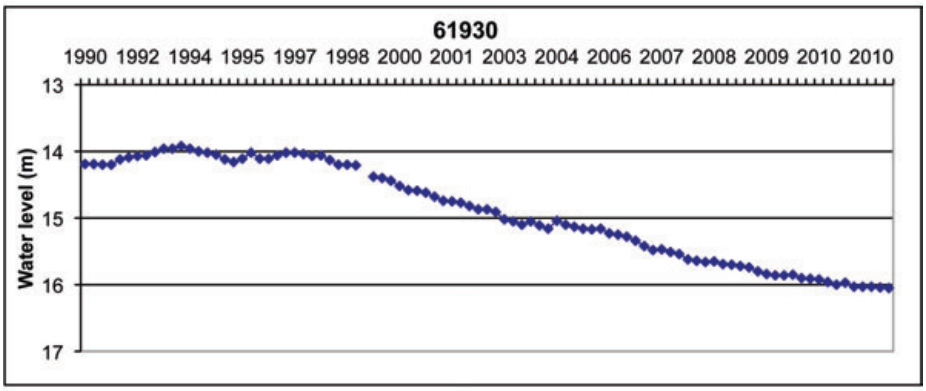

113247
2000 2001 2002 2003 2004 2004 2005 2005 2006 2006 2007 2007 2008 2008 2009 2009 2010 2010
Water level (m)
39
40
41
42
43

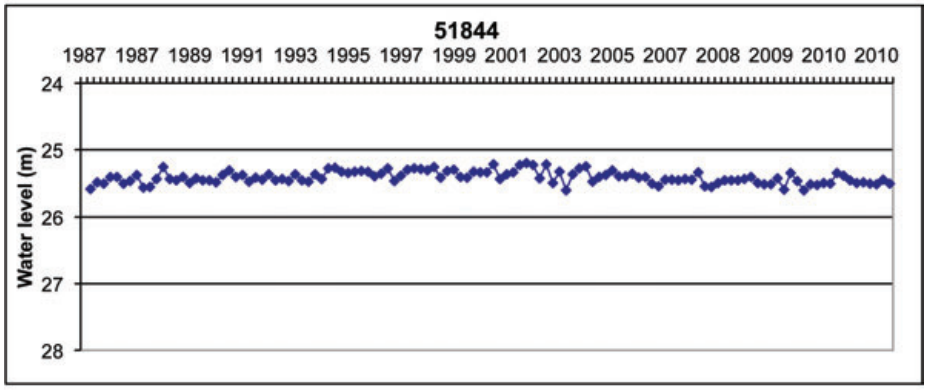

110088
2000 2001 2001 2002 2002 2003 2003 2004 2004 2005 2005 2006 2006 2007 2007 2008 2008 2009 2009 2010
Water level(m)
30
31
32
33
34

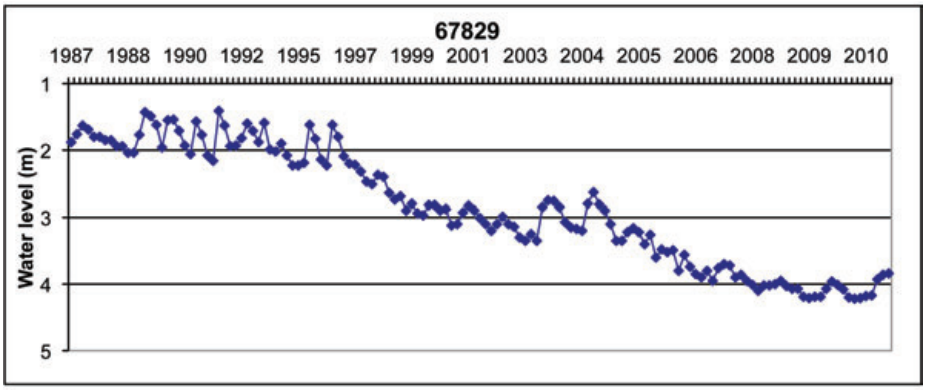

60450
2000 2001 2003 2003 2005 2006 2006 2007 2008 2008 2009 2009 2010
Water level (m)
49
50
51
52
53

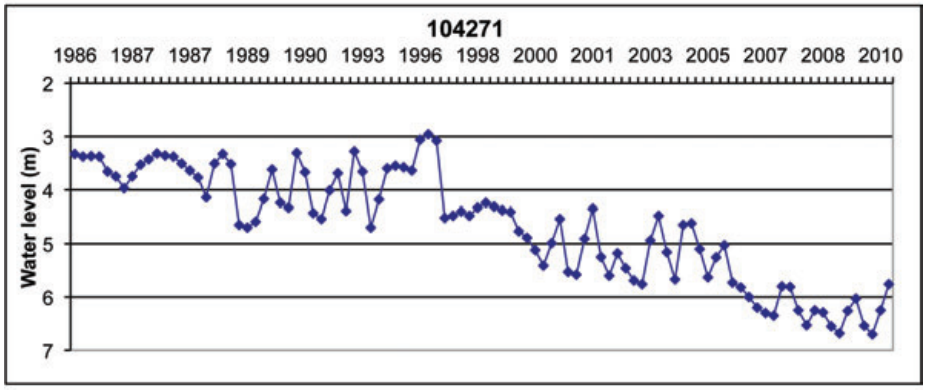

140490
2000 2001 2001 2002 2003 2004 2005 2006 2007 2008 2008 2009 2009 2010 2010
Water level (m)
14
15
16
17
18

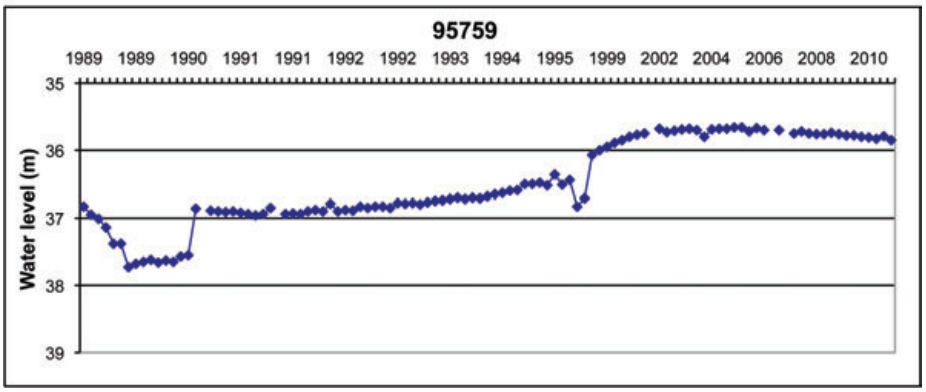

140491
2000 2001 2001 2002 2003 2004 2005 2006 2007 2008 2008 2009 2009 2010 2010
Water level (m)
9
10
11
12
13

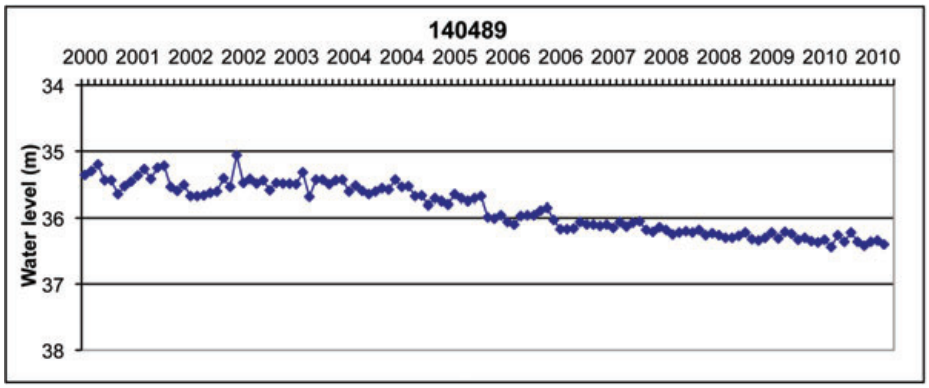

61930
1990 1992 1994 1995 1997 1998 2000 2001 2003 2004 2006 2007 2008 2009 2010 2010
Water level (m)
13
14
15
16
17

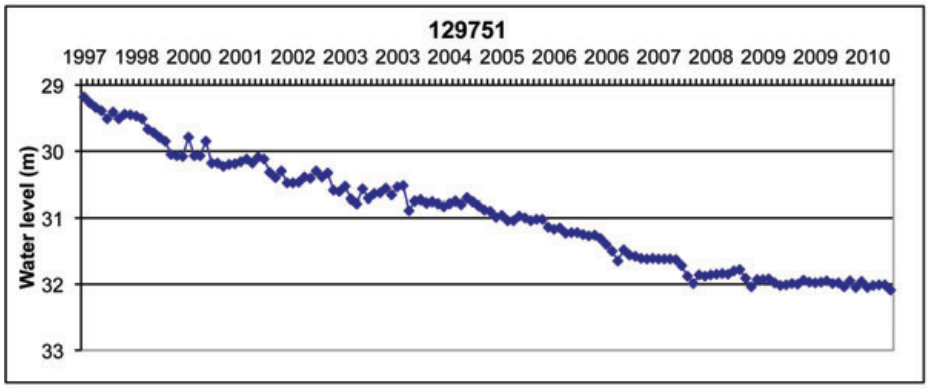

51844
1987 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2008 2009 2010 2010
Water level (m)
24
25
26
27
28

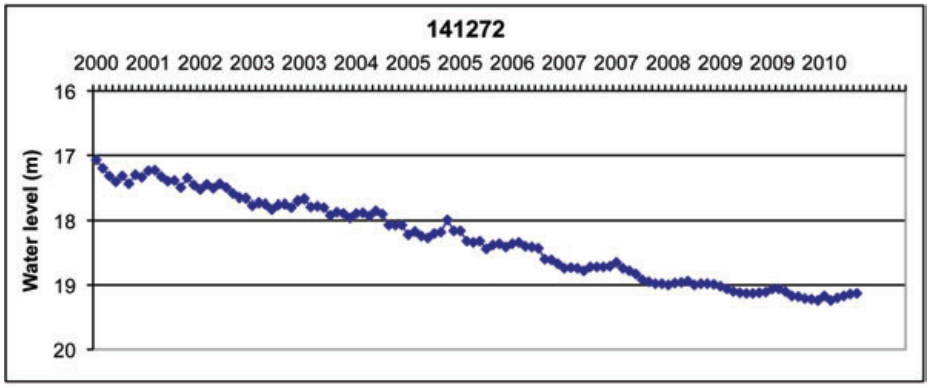

67829
1987 1988 1990 1992 1995 1997 1999 2001 2003 2004 2005 2006 2008 2009 2010
Water level (m)
1
2
3
4
5

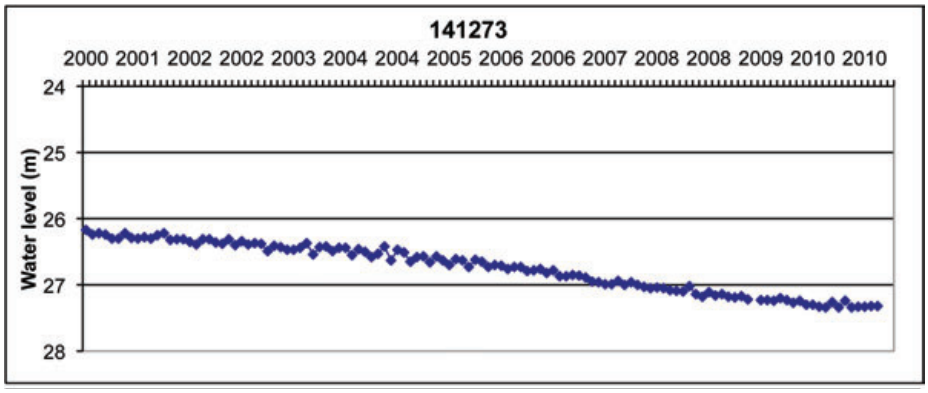

104271
1986 1987 1987 1989 1990 1993 1996 1998 2000 2001 2003 2005 2007 2008 2010
Water level (m)
2
3
4
5
6
7

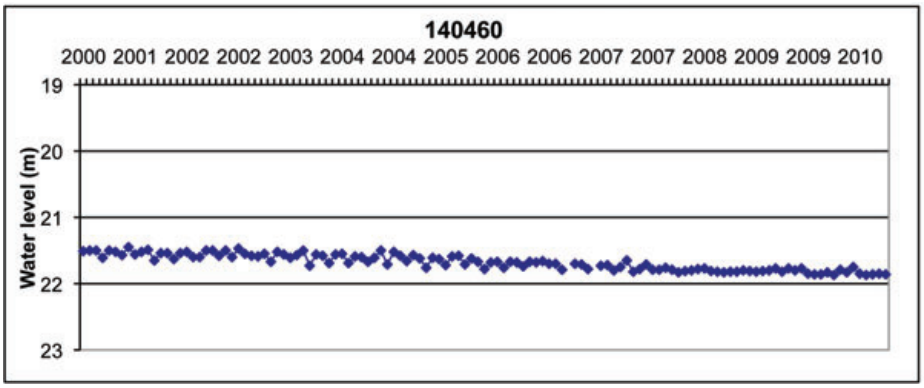

95759
1989 1989 1990 1991 1991 1992 1992 1993 1994 1995 1999 2002 2004 2006 2008 2010
Water level (m)
35
36
37
38
39

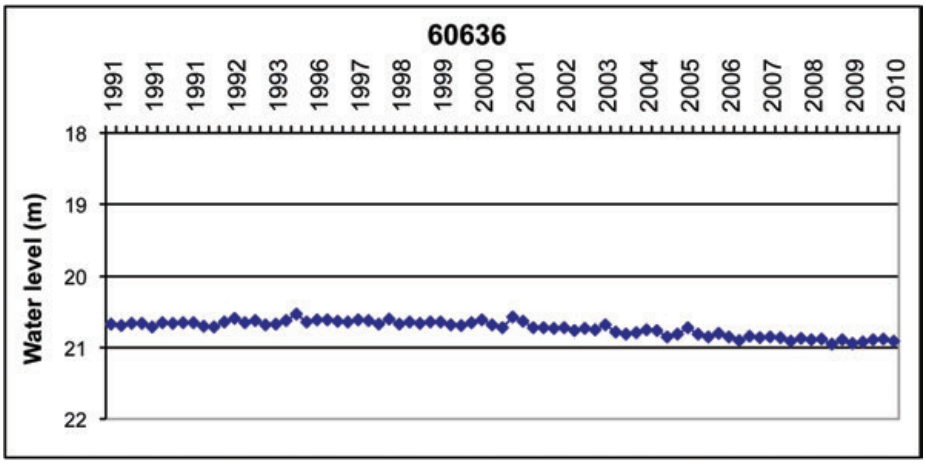

140489
2000 2001 2002 2002 2003 2004 2004 2005 2006 2006 2007 2008 2008 2009 2010 2010
Water level (m)
34
35
36
37
38

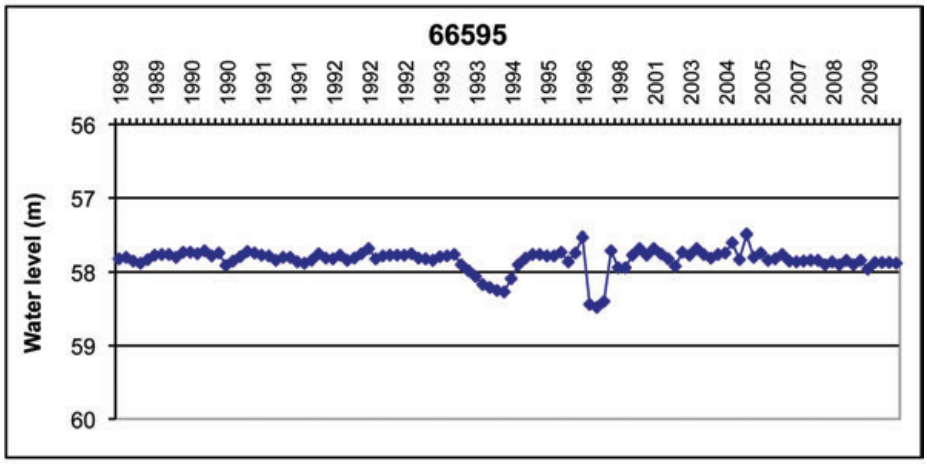

129751
1997 1998 2000 2001 2002 2003 2003 2004 2005 2006 2006 2007 2008 2009 2009 2010
Water level (m)
29
30
31
32
33

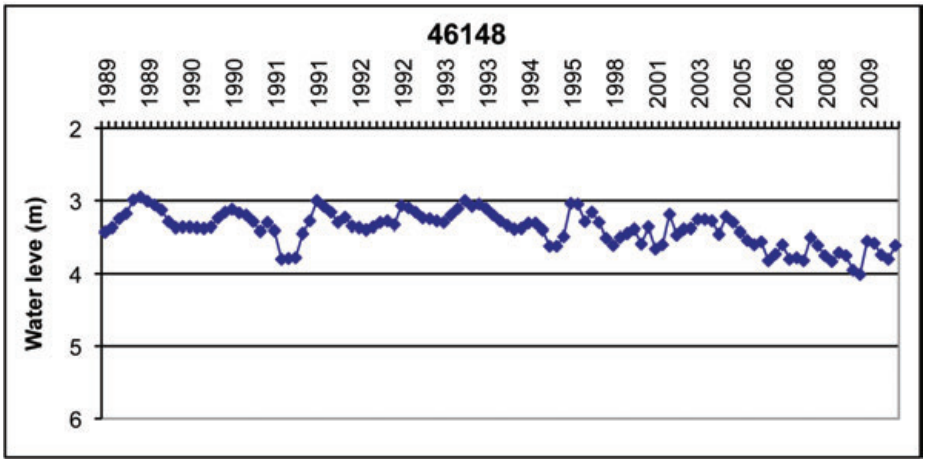

141272
2000 2001 2002 2003 2003 2004 2005 2005 2006 2007 2007 2008 2009 2009 2010
Water level (m)
16
17
18
19
20


141273
2000 2001 2002 2002 2003 2004 2004 2005 2006 2006 2007 2008 2008 2009 2010 2010
Water level (m)
24
25
26
27
28


140460
2000 2001 2002 2002 2003 2004 2004 2005 2006 2006 2007 2007 2008 2009 2009 2010
Water level (m)
19
20
21
22
23


60636
1991 1991 1991 1992 1993 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Water level (m)
18
19
20
21
22


66595
1989 1989 1990 1990 1991 1991 1992 1992 1992 1993 1993 1994 1995 1996 1998 2001 2003 2004 2005 2007 2008 2009
Water level (m)
56
57
58
59
60


46148
1989 1989 1990 1990 1991 1991 1992 1992 1993 1993 1994 1995 1998 2001 2003 2005 2006 2008 2009
Water leve (m)
2
3
4
5
6

Summary of Resource Strategies, Local Management Rules and Implementation Support Strategies

Section 1 – Introduction

Resource Strategy 1.1	Establish Local Management Rules

Section 4 – Strategic Management Framework

Resource Strategy 4.1	Adaptive Management Approach
Resource Strategy 4.2	Precautionary Principle
Resource Strategy 4.3	Management Zones
Resource Strategy 4.4	Objectives
Resource Strategy 4.5	Timeframes
Resource Strategy 4.6	Trading
Resource Strategy 4.7	Carryover
Resource Strategy 4.8	Whole of resource

Section 5 – Management Arrangements

Resource Strategy 5.1	Management zones and sub-zones
Resource Strategy 5.2	Neuarpur sub-zone 1
Local Management Rule 5.1	Management zones and sub-zones
Local Management Rule 5.2	PCVs and intensity of entitlement limits for the TLA, TCSA and PSA
Local Management Rule 5.3	Tertiary Confined Sands Aquifer (TCSA)
Local Management Rule 5.4	PCV for PSA
Local Management Rule 5.5	Seasonal allocations
Local Management Rule 5.6	Entitlement intensity limits
Local Management Rule 5.7	Localised bore interference
Local Management Rule 5.8	Trade of groundwater licence entitlement
Local Management Rule 5.9	Carryover
Local Management Rule 5.10	Groundwater monitoring and investigations
Implementation Support Strategy 5.1	Compensation Scheme for Domestic and Stock Bores
Implementation Support Strategy 5.2	Site use plans
Implementation Support Strategy 5.3	Improving Irrigation Efficiency
Implementation Support Strategy 5.4	Enhanced Aquifer Recharge
Implementation Support Strategy 5.5	Bore decommissioning
Implementation Support Strategy 5.6	Groundwater impacts of land use change

Section 6 – Implementation of the Strategy

Resource Strategy 6.1	Abolish existing WSPAs
Resource Strategy 6.2	Declaration of new West Wimmera GMA
Resource Strategy 6.3	Declaration for carryover
Resource Strategy 6.4	Establish Local Management Rules
Resource Strategy 6.5	Implementation Committee
Resource Strategy 6.6	Review of rules
Implementation Support Strategy 6.1	Communications
Implementation Support Strategy 6.2	Implementation Costs