



# Central Victorian Mineral Springs Groundwater Management Area

## Local Management Plan

July 2013



Goulburn-Murray Water  
40 Casey Street, Tatura  
PO Box 165 Tatura  
VICTORIA 3616

Telephone 1800 013 357  
[www.g-mwater.com.au](http://www.g-mwater.com.au)

Cover photos: Groundwater irrigation at Musk; State observation bores at Musk;  
Loddon River at Newstead

### **Disclaimer**

This publication may be of assistance to you but Goulburn-Murray Water and its employees do no guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

## Quick reference guide to the Plan rules

This section lists the Plan rules for quick reference. The reader should refer to the relevant chapter of the Plan for more information about the Rule.

### **Rule 1: Cap on licence entitlement (refer page 18)**

GMW may issue a groundwater licence under Section 51 of the Act provided that the Permissible Consumptive Volume for the Central Victorian Mineral Springs GMA is not exceeded.

### **Rule 2: Transfer of licence entitlement (refer page 21)**

GMW may approve an application to transfer licence entitlement under section 62 of the Act provided matters under section 53 have been considered and the following conditions are satisfied:

- a) For a permanent trade, the following zone limits are not exceeded:

Zone	Entitlement limit (ML/yr)
Campaspe	1,150
Coliban	2,144
Loddon	2,730

- b) The buyer's licensed bores are metered.  
c) The seller's licensed bores are metered or not equipped.

### **Rule 3: Groundwater salinity monitoring (refer page 24)**

GMW will:

- (a) Upon request from a groundwater user, provide a bottle for groundwater sampling.  
(b) Upon return of the sample that season, measure the groundwater salinity and advise the groundwater user of the result.  
(c) Record the groundwater salinity result in the State groundwater database and consider the data as part of the Plan review.

### **Rule 4: Metering (refer page 24)**

GMW will read flow meters on licensed bores at least once annually, record usage in the Victorian Water Register and consider the data as part of the Plan review.

### **Rule 5: Communications (refer page 26)**

By 1 October each year GMW will post on its website a newsletter summarising the resource status and reporting on licensed groundwater use and trade activity for the previous season and any need to amend the Plan.

### **Rule 6: Plan review (refer page 26)**

GMW will:

- (a) Review the need for any amendments to the Plan on an annual basis.  
(b) Consult with the Loddon Campaspe Regional Water Services Committee on proposed amendments and, if any amendments might impact on rights of access to water, consult with licence holders and other stake holders.

## Endorsement

The Central Victorian Mineral Springs Groundwater Management Area Local Management Plan has been prepared to address Action 4.6 of the Northern Region Sustainable Water Strategy (DSE, 2009).

The Plan has been developed by Goulburn-Murray Water in consultation with the North Central Catchment Management Authority, the Department of Environment and Primary Industries, urban water authorities, groundwater users and the local community.

The Plan provides the local community, and in particular licensed groundwater users, with information about the groundwater system and rules describing how the resource is managed.



Simon Cowan  
Goulburn-Murray Water  
Manager Groundwater and Streams

Date: 23/8/2013



Dale McGraw  
Goulburn-Murray Water  
Customer Services Manager Diversions – West

Date: 26/8/2013

## Acknowledgements

Goulburn-Murray Water recognises the value of local knowledge and undertook to consult widely with the local community during the development of this Plan. This included a public meeting at the commencement of the process, a survey of groundwater users and the appointment of a Reference Group comprised of groundwater users and other stakeholders.

Goulburn-Murray Water would like express its appreciation to those who attended the first public meeting and participated in a workshop to develop the objectives for the Plan.

Goulburn-Murray Water would also like to thank those who completed the survey. This information proved invaluable in drafting the Plan.

Finally, Goulburn-Murray Water would like to sincerely thank Reference Group members for their contribution to refine the objectives and comment on management proposals. The Reference Group included:

Tim Carey	Groundwater user
Arnold Diss	Groundwater user
Phil Dyson	North Central Catchment Management Authority
David Endacott	Victorian Mineral Water Committee
John Frdelja	Central Highlands Water
DaleTonkinson	Hepburn Shire Council
Andre Hopfner	Groundwater user
Hilary Jankelson	Groundwater user
Heerbod Jahanbani	Coliban Water
Patrick O'Halloran	Department of Environment and Primary Industries
Mike Opie	Groundwater user
Mark Reid	Trentham Landcare Group
Tom Walsh	Groundwater user

The Reference Group was supported by the Goulburn-Murray Water project team, which included Karina Joy, Brendan Cossens and Lynley Strachan.

## Glossary

Term/Acronym	Description
Act	Victorian Water Act 1989
AHD	Australian height datum is the mean sea level for 1966-1968 and is assigned a value of zero. Groundwater levels may be reported as metres above the Australian height datum to determine hydraulic gradients.
Allocation	A percentage of licence volume that can be extracted in season.
Aquifer	An underground layer of rock or sand or other geological unit that contains water
GMW	Goulburn-Murray Rural Water Corporation (trading as Goulburn-Murray Water)
Drawdown	The groundwater level difference between pumping and non-pumping conditions
DEPI	Department of Environment and Primary Industries
Entitlement	Licensed volume of groundwater specified as megalitres per year
GDE	Groundwater dependent ecosystem
GL	One gigalitre; which is equal to one thousand megalitres
GMA	Groundwater Management Area
GMU	Groundwater Management Unit
Licence	Licence issued to take and use groundwater under section 51 of the Water Act.
m	Metre
ML	Megalitre or one million litres
PCV	Permissible Consumptive Volume is the volume of groundwater that the Minister for Water has declared may be extracted from a defined area in a season
Plan	Local management plan
Recovery	The level to which groundwater rises during winter/spring each year
Season	Period of 12 calendar months beginning on 1 July in any year and ending on 30 June in the following year
Trade	The transfer of a groundwater licence
WSPA	Water Supply Protection Area
Zone	A defined part of the groundwater management area

## Table of Contents

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	BACKGROUND.....	1
1.2	CENTRAL VICTORIAN MINERAL SPRING GMA.....	1
1.3	DEVELOPMENT OF GROUNDWATER RESOURCES.....	3
1.4	PLAN OBJECTIVES .....	4
<b>2</b>	<b>GROUNDWATER SYSTEM .....</b>	<b>5</b>
2.1	AQUIFERS.....	5
2.2	GROUNDWATER RECHARGE .....	7
2.3	GROUNDWATER LEVELS .....	7
2.4	GROUNDWATER SALINITY.....	8
2.5	GROUNDWATER FLOW .....	8
2.6	GROUNDWATER DISCHARGE .....	8
2.7	MANAGEMENT ZONES .....	9
<b>3</b>	<b>GROUNDWATER USE AND IMPACTS .....</b>	<b>11</b>
3.1.1	<i>Licensed use.....</i>	11
3.1.2	<i>Domestic and stock use.....</i>	12
3.2	ENVIRONMENTAL CONSIDERATIONS .....	12
3.2.1	<i>Groundwater salinity .....</i>	12
3.2.2	<i>Groundwater interaction with surface water .....</i>	13
3.2.3	<i>Groundwater dependent ecosystems.....</i>	14
3.2.4	<i>Mineral springs.....</i>	16
<b>4</b>	<b>GROUNDWATER MANAGEMENT .....</b>	<b>18</b>
4.1	LICENCE ENTITLEMENT .....	18
4.2	GROUNDWATER LICENSING.....	18
4.3	MANAGING EXTRACTIONS .....	19
4.3.1	<i>Interference.....</i>	19
4.3.2	<i>Restrictions.....</i>	20
4.4	GROUNDWATER TRADING .....	21
4.5	CARRYOVER .....	21
<b>5</b>	<b>MONITORING PROGRAM .....</b>	<b>22</b>
5.1	GROUNDWATER LEVELS .....	22
5.2	GROUNDWATER SALINITY.....	24
5.3	METERED USE.....	24
5.4	SURFACE WATER MONITORING .....	24
<b>6</b>	<b>PLAN IMPLEMENTATION .....</b>	<b>26</b>
6.1	COMMUNICATIONS.....	26
6.2	PLAN REVIEW .....	26
6.3	RECOMMENDED WORKS.....	26
<b>7</b>	<b>REFERENCES .....</b>	<b>28</b>
	<b>APPENDIX A .....</b>	<b>29</b>

# 1 Introduction

## 1.1 Background

Groundwater in the Central Victorian Mineral Springs Groundwater Management area (GMA) is highly valued. It is shared between the environment, domestic and stock users, irrigated agriculture, commercial users and growing urban communities. The region is unique because of naturally occurring carbonated mineral water springs dotted across the region which have long been valued for health benefits, commercial bottling and tourism. These uses significantly contribute to the region's economy.

Groundwater in Victoria is managed under the *Water Act 1989* (the Act). The Department of Environment and Primary Industries (DEPI) is responsible for monitoring and management of groundwater resources in Victoria. DEPI provides advice to the Minister for Water on groundwater policy and management. More information about groundwater and DEPI's role can be found on the website: <http://www.depi.vic.gov.au/water/groundwater>

Goulburn-Murray Rural Water Corporation (GMW) is responsible for issuing groundwater licences and for managing and administering groundwater use in accordance with the Act. These responsibilities include developing and implementing a local management plan in the Central Victorian Mineral Springs GMA.



*Groundwater used for irrigation*



*Groundwater used for water bottling*

## 1.2 Central Victorian Mineral Spring GMA

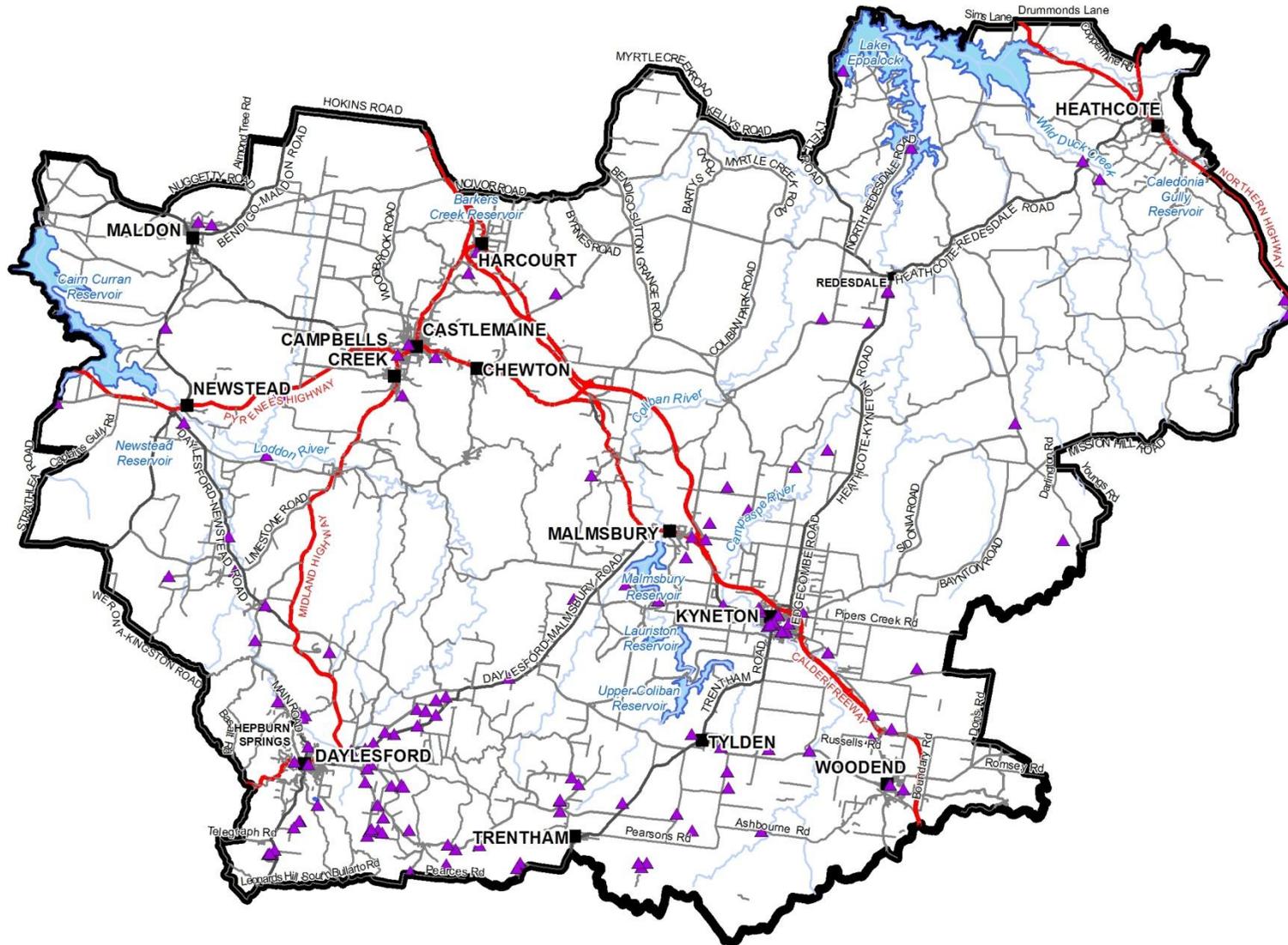
The Central Victorian Mineral Springs GMA is located in central Victoria, extending north from the Great Dividing Range to Cairn Curran Reservoir and Lake Eppalock (Figure 1). It includes the townships of Daylesford, Trentham, Tylden, Woodend, Newstead, Maldon, Castlemaine, Harcourt, Malmsberry, Kyneton, Redesdale and Heathcote.

It covers an area of approximately 3,118 km<sup>2</sup>. The depth limit has been set as 200 m below the natural surface, or 50 m below the base of the basalt or deep lead, whichever is the greater, based on DSE (2012).

The Central Victorian Mineral Springs GMA is part of the Murray-Darling Basin and straddles the Loddon and Campaspe Groundwater Catchment Units (DSE, 2012). It encompasses all of the upper Campaspe catchment south of Lake Eppalock as well as the eastern portion of the upper Loddon catchment. Its western boundary abuts the Loddon Highlands Water Supply Protection Area (WSPA) and the northern boundary abuts the Lower Campaspe Valley WSPA.

**FIGURE 1: CENTRAL VICTORIAN MINERAL SPRINGS GMA LICENSED BORES**

GOULBURN-MURRAY WATER



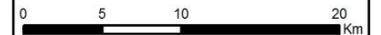
  
**GMW-13-033**  
 18 Jul 2013  
 GOULBURN-MURRAY WATER  
 40 CASEY STREET (PO BOX 165)  
 TATURA VIC 3616  
 Ph (03) 5833 5500 Fax (03) 58245827  
 gmsupport@gm-water.com.au



**Legend**

-  Licensed Bore
-  Freeway/ Highway
-  Major Road
-  Semi-Major Road
-  Minor Road
-  Waterway
-  Waterbody
-  Central Victorian Mineral Springs GMA

SCALE AT A4 1:450,000



The content of this product is provided for information purposes only. No claim is made as to the accuracy of authenticity of the content of the product. In no event will G-MW, its agents, instrumentalities and employees be liable for the accuracy of the information contained within this product nor its use of reliance placed on it. The information used within this product is provided on the basis that all persons accessing the information undertake responsibility for assessing the relevance and accuracy of its content.

2/2013\_Products/GMW-13-033/GMW-13-033\_CVMS\_licensedbores\_Fig1\_A4.mxd

### 1.3 Development of groundwater resources

Groundwater extraction in the Central Victorian Mineral Springs GMA dates back to the middle of the 19th century and the dewatering of mines during the gold rush. The value of the naturally occurring mineral water was realised through the establishment of the Hepburn Mineral Springs Reserve in 1865 (DSE, 2010a).

Development of groundwater resources for agricultural purposes grew steadily from the 1970s with sharp increases during dry periods.

Groundwater resources have also been developed to meet demand from growing urban communities around Trentham and Daylesford. For more information on groundwater use for urban supply visit Coliban Water at <http://www.coliban.com.au/> or Central Highlands Water at <http://www.chw.net.au/>.



*Kyneton mineral spring*



*Coliban Water Trentham urban supply*

The opportunity for future groundwater enterprises is recognised by local communities given the quality and properties of the water, fertile soils, rainfall patterns, population growth in parts of the GMA and proximity to markets. The region is renowned for supplying niche markets based on these unique properties. Sustainable management of the resource is considered paramount as the opportunities for development are realised.



*Spring water*



*Irrigated walnut orchard*

## 1.4 Plan objectives

The aim of the Plan is to manage groundwater in an equitable manner so as to ensure long term sustainability of the resource.

Through broad consultation with stakeholders GMW (2012) has identified the following key objectives:

1. effectively communicate information on management and status of groundwater resources; and
2. protect existing groundwater users, river flows and the environment while supporting the development of groundwater resources in an adaptive and cost effective manner.

There are a number of components that underlie these objectives which are described in Appendix A.



*Public meeting July 2012*



*Reference Group meeting May 2013*

## **2 Groundwater system**

### **2.1 Aquifers**

There are five main aquifers in the CVMS GMA, namely: Ordovician sedimentary bedrock; granite; deep leads, basalt and shallow alluvial (SKM, 2011a). A summary of the understanding of the groundwater system is provided in Figure 2.

#### **Ordovician sedimentary bedrock**

The Ordovician sedimentary bedrock aquifer comprises fractured sandstones siltstones and mudstones and dominates the surface geology of the Central Victorian Mineral Springs GMA. The bedrock aquifer comprises two types of groundwater flow systems: shallow local systems with short flow paths up to a few kilometres, and deeper systems that include those that host carbonated mineral water with flow paths extending up to 40 km from the Great Dividing Range. Yields from the bedrock aquifer are typically low and groundwater salinities are low in the south and become higher in the north.

#### **Granite**

Granite outcrops in the north of the region around Maldon and Harcourt and east of Kyneton. The granite is a comparatively poor aquifer in the area with low yields and variable groundwater salinity, but it can provide useful domestic and stock supply.

#### **Deep leads**

The deep leads are unconsolidated sands and gravels of ancestral streams that are buried beneath basalt around Trentham, Malmsbury, Kyneton, Daylesford and Guildford. The deep leads have been mined in some places for gold, leaving behind open mine voids. Higher yields can be achieved locally from the deep lead aquifer and the groundwater salinity is usually low. The deep leads tend to be quite narrow and difficult to locate. They are also mostly overlain by thick basalt which commonly yields sufficient groundwater supply to meet domestic and stock requirements or small-scale irrigation needs. Therefore, to date there is little groundwater extraction from this aquifer in the GMA.

#### **Basalt**

Basalt, which can be up to around 100 m thick, is found around Daylesford, Trentham, Kyneton, Malmsbury and Woodend. The basalt aquifer is occasionally capable of producing moderate yields (of the order of 1 ML/day) but lower yields are more common. Groundwater quality is generally very good. Most licensed extraction is from the basalt aquifer.

#### **Shallow alluvial**

Shallow alluvial aquifers, comprised of sand, silt and clay occupy valleys along present day streams and are likely to be well connected to waterways. These aquifers are relatively thin, with a maximum thickness of around 10 m. There are very few bores developing these aquifers due to their limited extent and dominantly clayey nature.

### Aquifers

Key aquifers in the Central Victorian Mineral Springs GMA are the Ordovician sedimentary bedrock, granite, basalt, deep leads and alluvium. Yields from the bedrock aquifer are low and groundwater is more saline in the north. The granite is a comparatively poor aquifer in the area with low yields and higher groundwater salinity. Higher yields can be obtained from the deep leads but they are difficult to locate as they are buried beneath basalt. The basalt aquifer has variable yields and groundwater quality is generally good. Shallow alluvial aquifers occupy valleys along present day streams and are likely to be well connected to waterways.

### Groundwater recharge and flow

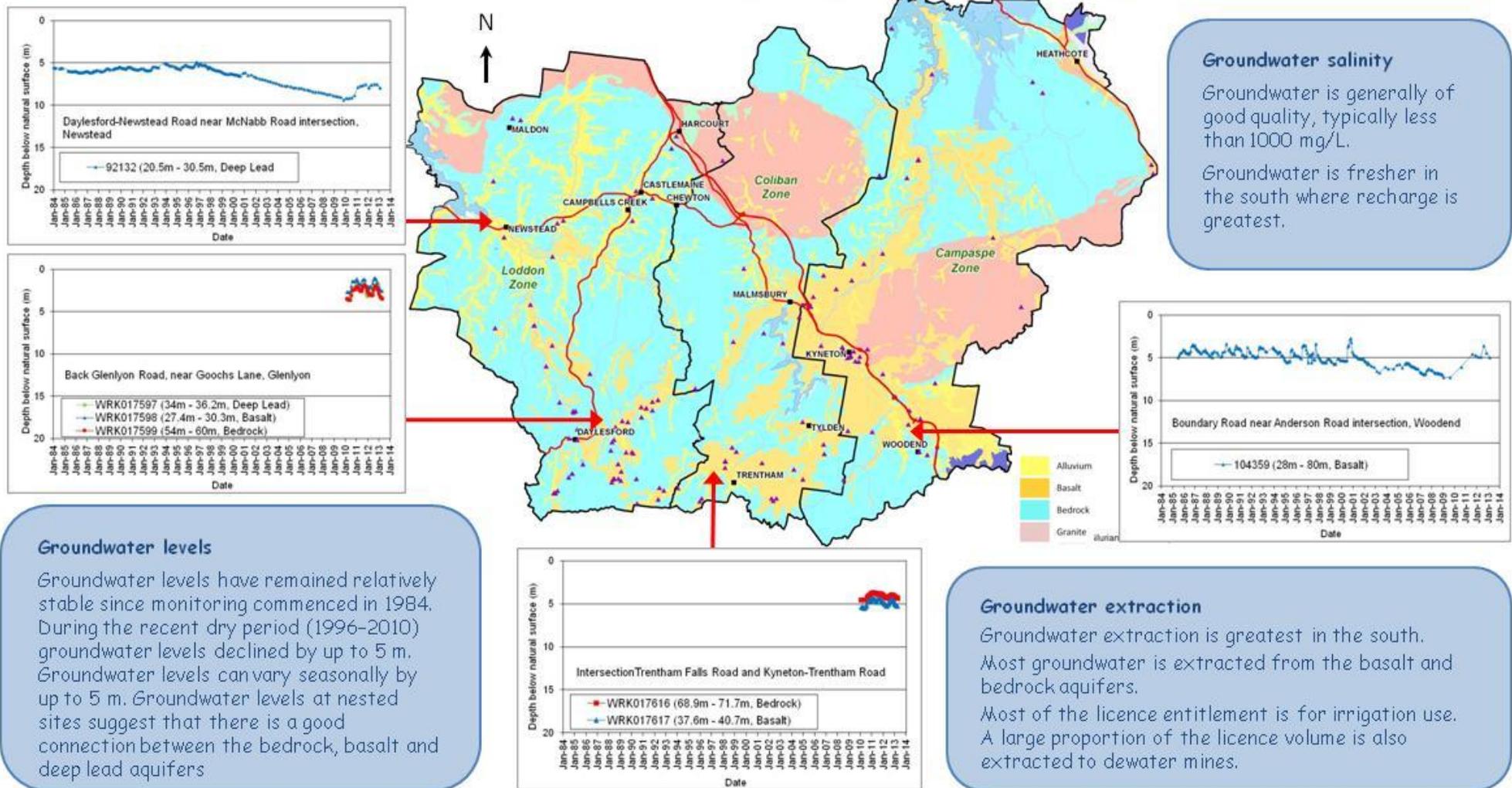
Groundwater recharge occurs across the region largely from rainfall and is highest along the Great Dividing Range and around volcanic cones. Regional groundwater flow is to the north.

### Springs

Groundwater discharges as springs or base flow to streams in the upper catchment or in low lying parts of the landscape. Mineral water discharges from the Ordovician bedrock aquifer.

### Groundwater salinity

Groundwater is generally of good quality, typically less than 1000 mg/L. Groundwater is fresher in the south where recharge is greatest.



### Groundwater levels

Groundwater levels have remained relatively stable since monitoring commenced in 1984. During the recent dry period (1996-2010) groundwater levels declined by up to 5 m. Groundwater levels can vary seasonally by up to 5 m. Groundwater levels at nested sites suggest that there is a good connection between the bedrock, basalt and deep lead aquifers

### Groundwater extraction

Groundwater extraction is greatest in the south. Most groundwater is extracted from the basalt and bedrock aquifers. Most of the licence entitlement is for irrigation use. A large proportion of the licence volume is also extracted to dewater mines.

Figure 2 Central Victorian Mineral Springs Groundwater Management Area groundwater system

## 2.2 Groundwater recharge

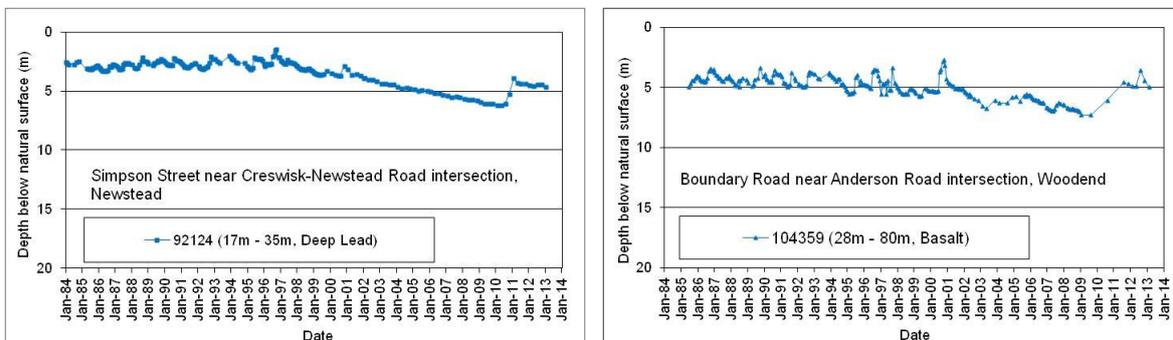
The groundwater system is largely recharged from rainfall across the area. Recharge is higher in the south where annual rainfall is greater. Recharge also occurs from streams leaking to the groundwater system, flood events and from deep percolation of irrigation water. Annual average recharge to the groundwater system in the Central Victorian Mineral Springs GMA was calculated to be around 156 GL/yr (Table 1) (SKM, 2011a).

**Table 1 Recharge to groundwater system**

Management zone	Recharge (GL/yr)
Loddon	50.7
Coliban	56.6
Campaspe	48.5
TOTAL	155.8

## 2.3 Groundwater levels

Groundwater levels have remained relatively stable in the Central Victorian Mineral Springs GMA since monitoring commenced in 1984. During the recent dry period (1996–2010) the largest groundwater level decline observed was approximately 5 m at Newstead and Woodend (Figure 3). This is a relatively small decline in comparison to the neighbouring Loddon Highlands WSPA which experienced groundwater level declines of up to 20 m over the same period in areas of concentrated groundwater pumping. Groundwater levels recovered well in 2010/11 in response to high rainfall.



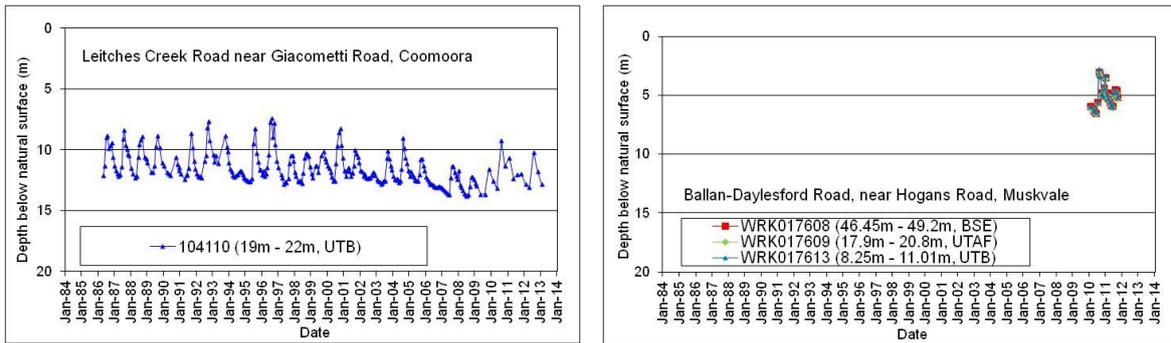
(a) Groundwater levels at Newstead

(b) Groundwater levels at Woodend

### Figure 3 Groundwater levels

Seasonal fluctuation is evident in some hydrographs; particularly bore 104110 at Coomoora with levels varying by up to 5 m largely in response to local usage (Figure 4(a)). In comparison, seasonal drawdown (the groundwater level difference between pumping and non-pumping conditions) in the Loddon Highlands WSPA can be up to 20 m.

Groundwater levels at nested sites in the GMA suggest that there is generally a good hydraulic connection between the bedrock, basalt and deep lead aquifers as illustrated in Figure 4(b).



(a) Groundwater levels at Coomoora

(b) Nested bore groundwater at Muskvale

**Figure 4 Seasonal variation**

## 2.4 Groundwater salinity

Groundwater in the Central Victorian Mineral Springs GMA is generally of good quality, with salinity levels typically being less than 1000 mg/L total dissolved solids or 1600 EC ( $\mu\text{s}/\text{cm}$ ). Highest recorded groundwater salinities are in the north in the bedrock and granite aquifers.

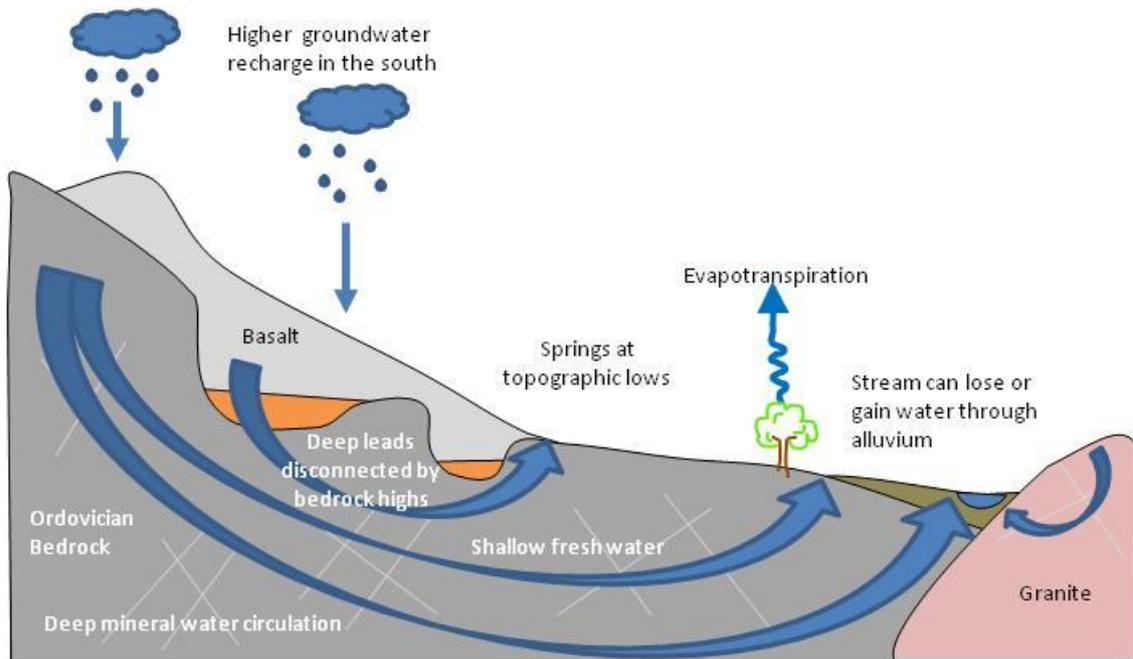
Groundwater salinity is lowest around areas of high rainfall and recharge, particularly along the Great Dividing Range and around volcanic cones of the basalt aquifer (GMW, 2013).

## 2.5 Groundwater flow

Regional groundwater flow is generally from south to north in the Central Victorian Mineral Springs GMA (Figure 5). Groundwater levels and chemistry suggests that there is generally a good hydraulic connection between different aquifers (GMW, 2013).

## 2.6 Groundwater discharge

Groundwater discharges as springs or base flow in the upper catchment or in low lying parts of the landscape. Some of this is trapped or harvested by dams. Old mines can also provide a conduit for groundwater discharge. Groundwater is also lost to evapotranspiration and aquifer throughflow to the Mid-Loddon GMA and the Lower Campaspe Valley WSPA. The volume of groundwater extracted in the Central Victorian Mineral Springs GMA each year is small and estimated to be around 1% of the water balance.



**Figure 5 Schematic of regional groundwater system in the Central Victorian Mineral Springs GMA**

## 2.7 Management zones

The Central Victorian Mineral Springs GMA has been divided into the following three management zones (Figure 6):

1. Loddon
2. Coliban
3. Campaspe

The management zones are based on surface water catchments which enables consideration of all available water in the GMA.

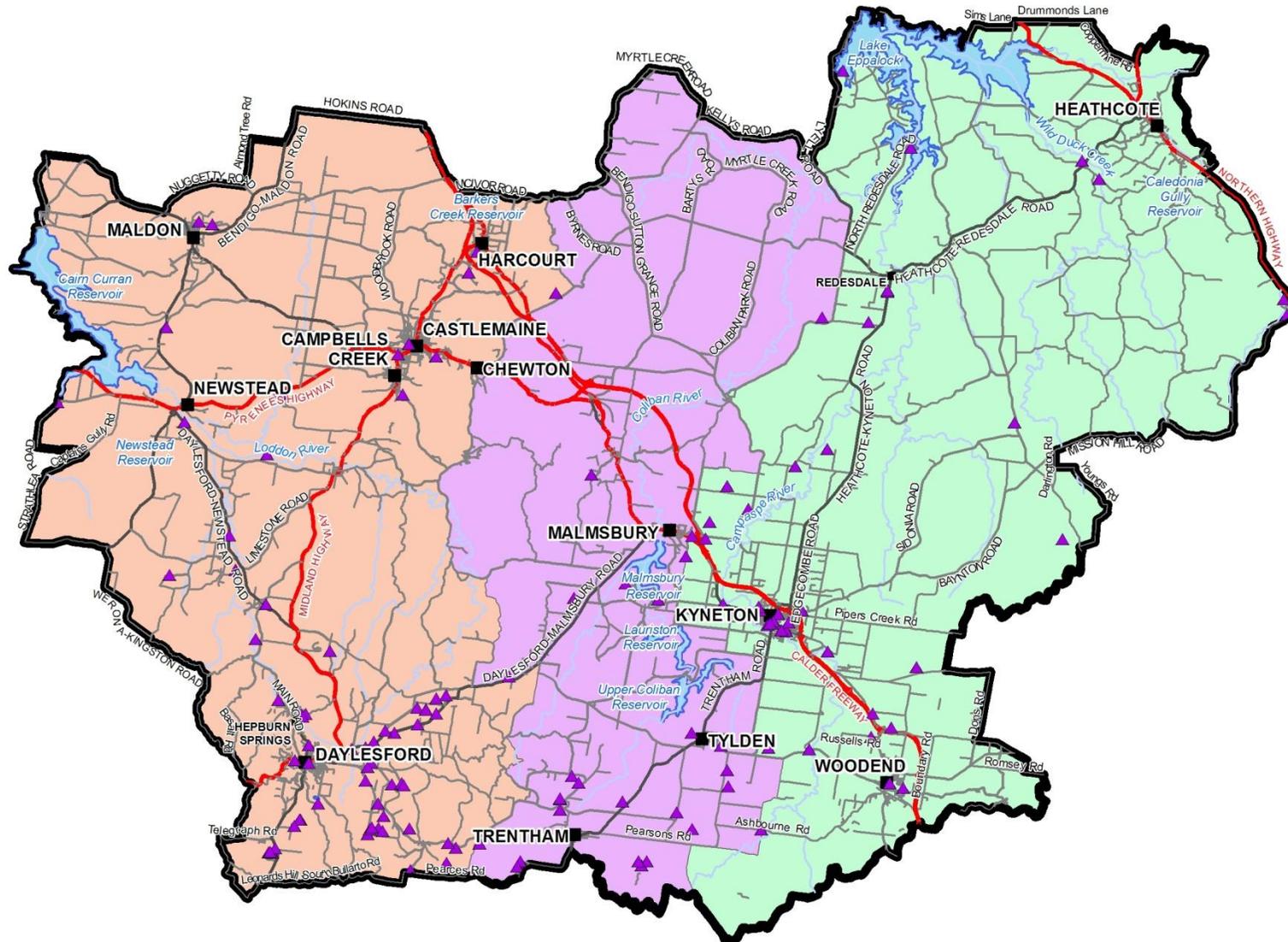
The Loddon Zone includes the towns of Daylesford, Hepburn, Newstead, Castlemaine, Maldon and Harcourt. There is a greater concentration of carbonated mineral springs in the Loddon Zone.

The Coliban Zone includes the towns of Trentham, Tylden and Malmsbury.

The Campaspe Zone includes the Campaspe River and Wild Duck Creek catchments and the towns of Woodend, Kyneton, Redesdale and Heathcote. There are a larger number of domestic and stock bores in the Campaspe Zone.

**FIGURE 6: CENTRAL VICTORIAN MINERAL SPRINGS GMA TRADING ZONES**

GOULBURN-MURRAY WATER



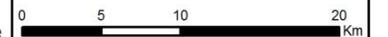
**GOULBURN-MURRAY WATER**  
  
 GMW-13-033  
 18 Jul 2013



**Legend**

- Licensed Bore
- Freeway/ Highway
- Major Road
- Semi-Major Road
- Minor Road
- Waterway
- Waterbody
- Central Victorian Mineral Springs GMA
- Coliban Zone
- Campaspe Zone
- Loddon Zone

SCALE AT A4 1:450,000



The content of this product is provided for information purposes only. No claim is made as to the accuracy or authenticity of the content of the product. In no event will G-MW, its agents, instrumentalities and employees be liable for the accuracy of the information contained within this product nor its use of reliance placed on it. The information used within this product is provided on the basis that all persons accessing the information undertake responsibility for assessing the relevance and accuracy of its content.

GOULBURN-MURRAY WATER  
 40 CASEY STREET (PO BOX 165)  
 TATURA VIC 3616  
 Ph (03) 5833 5500 Fax (03) 58245827  
 gmsupport@g-m-water.com.au

### 3 Groundwater use and impacts

#### 3.1.1 Licensed use

The total licence entitlement volume in the Central Victorian Mineral Springs GMA is 4,923 ML/year. Over 50% of entitlement is in the Loddon Zone (Table 2).

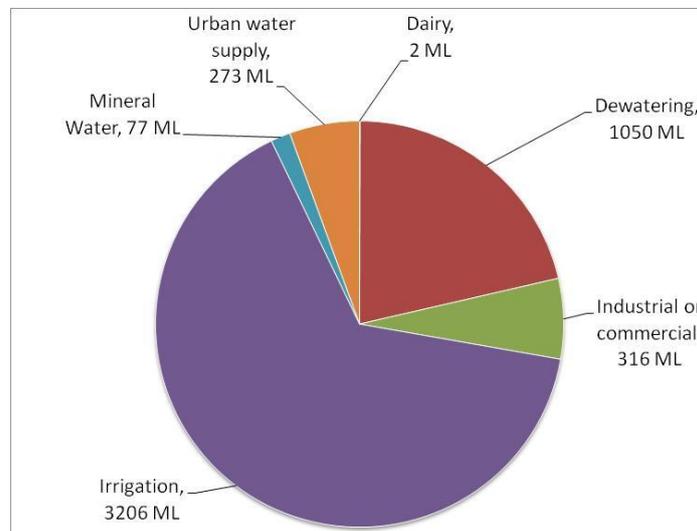
**Table 2 Licence entitlement in June 2013**

Management zone	Number of licences	Licence volume (ML/year)
Loddon	71	2,730
Coliban	28	1,043
Campaspe	42	1,150
TOTAL	141	4,923

There is limited metered usage data in the Central Victorian Mineral Springs GMA as metering has only been introduced in recent years. Metered use from other upland areas suggests that average usage is typically not greater than 40% of entitlement and can increase to around 50% in dry seasons.

Extraction from all licensed bores is metered except those licensed for less than 20 ML/yr prior to 2004 as they were exempt under the state wide metering program (DSE, 2010b). As such, there are 33 unmetered licensed bores that have a combined licence volume of around 350 ML/yr. This is less than 10% of the licence volume in the Central Victorian Mineral Springs GMA.

Most entitlement in the Central Victorian Mineral Springs GMA is licensed for irrigation use (Figure 7). A large proportion of the licence volume is to dewater mines.



**Figure 7 Licence groundwater use type**

Licence applications are considered on their merits and, provided that water use is authorised in accordance with the Act, use types are treated equally.

For information on using groundwater for agriculture, including water use efficiency, contact the DEPI at <http://www.depi.vic.gov.au/home>.

For information relating to mining visit the Department of State Development, Business and Innovation website at <http://www.dsdbi.vic.gov.au/>.

For information on the bottled water industry visit their website <http://www.bottledwater.org.au/>.

### 3.1.2 Domestic and stock use

Domestic and stock access to groundwater is a statutory right under section 8 of the Act. Landholders can apply to GMW for a works licence to construct a bore for domestic and stock purposes (refer to chapter 4.2).

It is estimated that there are 1,634 active domestic and stock bores in the Central Victorian Mineral Springs GMA (GMW, 2013). Many of the bores are concentrated around townships including Coomoora, Glenlyon and Kyneton.

Most domestic and stock bores are registered in a State groundwater database when they have been constructed; however the operating status of these bores is not known. Typically, it is assumed that domestic and stock users extract around 2 ML/yr each, which equates to 3,268 ML/yr (Table 3). This is equivalent to about two thirds of the total licence volume in the Central Victorian Mineral Springs GMA, and in the Campaspe Zone domestic and stock use is estimated to be more than the licensed volume. This could indicate an overestimate in domestic and stock use and indicates that further investigations are required to confirm usage. GMW will monitor growth in the number of domestic and stock bores and consider implications for resource management at Plan review (refer chapter 6.2).

**Table 3 Estimated domestic and stock use in June 2013**

Management zone	Estimated number of bores	Use (ML/year)
Loddon	567	1,134
Coliban	343	686
Campaspe	724	1,448
TOTAL	1,634	3,268

During dry periods groundwater levels can fall. Therefore domestic and stock bores should be constructed to a depth that considers seasonal variations in groundwater levels. Further, pumping from nearby bores can result in groundwater level drawdown, particularly during the summer. Constructing the bore to an appropriate depth can ensure security of access to the resource.

GMW considers impacts on domestic and stock bores when making licensing decisions. For this reason domestic and stock users are encouraged to ensure that their bore is registered.

## 3.2 Environmental considerations

### 3.2.1 Groundwater salinity

There is little risk to groundwater salinity from extraction of groundwater because of the generally low salt content, high recharge flushing the system and little drawdown resulting from present groundwater pumping.

Locally, groundwater pumping could sometimes result in greater mixing of water from different aquifers, but based on available information, there is little risk to beneficial uses as described in the State Environment Protection Policy (Groundwaters of Victoria) (EPA, 1997).

Groundwater licence conditions require that a bore must be constructed and operated in a manner that avoids contaminating native vegetation, waterways, aquifers, the riverine environment or another person's property. This includes the construction and maintenance of bund walls around any hydrocarbon-fuel-driven engine, motor, fuel storage, or chemical storage used in connection a groundwater licence.

Any matters relating to contamination should be referred to the Environment Protection Authority at <http://www.epa.vic.gov.au>.

Groundwater is not fit for any use that may involve human consumption, directly or indirectly, without first being properly treated.

Regular monitoring of groundwater salinity should be undertaken to provide early identification of any unexpected changes (refer chapter 5.2).

### 3.2.2 Groundwater interaction with surface water

The major rivers within the GMA are the Loddon, Campaspe and Coliban. The rivers supply water to downstream users, provide important habitat for aquatic and terrestrial species and are the focus for many communities.

The Loddon River begins in the Great Dividing Range near Daylesford and flows northerly through Newstead to the Cairn Curran Reservoir. There are many threatened flora and fauna species in the Loddon River catchment that are dependent upon the aquatic and terrestrial riparian environment (NCCMA, 2005). Flora species include the pale spike-sedge, woolly waterlily, river leafless bossiaea, swamp diuris and pale swamp everlasting. Threatened fauna species include the intermediate egret, freckled duck, murray cod, silver perch, and white-bellied sea-eagle.

The Coliban River, which is a tributary of the Campaspe River, begins west of Trentham and flows to Lake Eppalock. Flows in the Coliban River are regulated by releases from the Upper Coliban, Lauriston and Malmsbury Reservoirs.

The Campaspe River begins east of Trentham and flows north to Lake Eppalock. There are many threatened flora and fauna species that are dependent upon the aquatic and terrestrial riparian environment in the Campaspe catchment (NCCMA, 2005). Flora species include river swamp wallabygrass and swamp bush-pea. Threatened fauna species include the murray cod, royal spoonbill and the growling grass frog.

In the upper catchments, groundwater generally discharges to streams providing baseflow. However, over some reaches streams leak and recharge the groundwater system.

If groundwater levels decline there can be a reduction in the volume of groundwater discharging to waterways, or an increase in the volume of water that leaks from waterways into the groundwater system. This can impact on flows in streams and is particularly important during dry periods when baseflow may provide an important supply for downstream users and the environment.



*Loddon River at Loddon Falls*



*Campaspe River at Turpin's Falls*

The relative impacts of licensed groundwater extraction on flows in the Campaspe, Coliban and Loddon Rivers have been considered to establish a cap for groundwater extraction in the Central Victorian Mineral Springs GMA. Putting in place such a cap will make an important contribution to protecting springs and baseflow in the area.

Impacts to waterways and springs will be considered when assessing groundwater licence applications in accordance with section 40 of the Act.

Monitoring will also be undertaken to assist in improving the understanding of the interaction between groundwater and surface water and the impacts of groundwater pumping relative to other impacts on stream flow (refer chapter 5).

### 3.2.3 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems that utilise groundwater to meet some or all of their water requirements. Some investigations have been conducted to identify GDEs (DPI, 2010; SKM, 2011b), but more work is required to map GDEs, assess their value and determine their reliance on groundwater and sensitivity to change (Figure 8).

Baseflow provides an important supply during dry periods to support species such as the platypus (*Ornithorhynchus anatinus*) in the Coliban and Loddon catchments and the endangered growling grass frog (*Litoria raniformis*) in Jim Crow Creek in the Loddon Catchment. Terrestrial vegetation including red gums, melaleuca and swamp species are likely to be using groundwater near surface water features where groundwater is shallow.

Many springs have been altered from their natural state. In the upper catchment springs have been dammed as they provide a reliable stock water supply. The carbonated mineral water springs have been modified to supply tourists in a park setting. Lowering of groundwater levels could impact on the availability of water to GDEs by decreasing discharge to creeks and springs or falling below plant root depth.

Impacts from groundwater pumping to high value GDEs that rely on regional and intermediate scale groundwater flow systems (where the flow path from recharge to discharge is greater than 5 km) will be managed by capping groundwater licence entitlement. Impacts to GDEs with high environmental values that rely on the surface expression of local scale groundwater systems (flow path only a few kilometres) will be considered when assessing groundwater licence applications in accordance with section 40 of the Act.

More information on GDEs is available from the National GDE Atlas at <http://www.bom.gov.au/water/groundwater/gde/>.



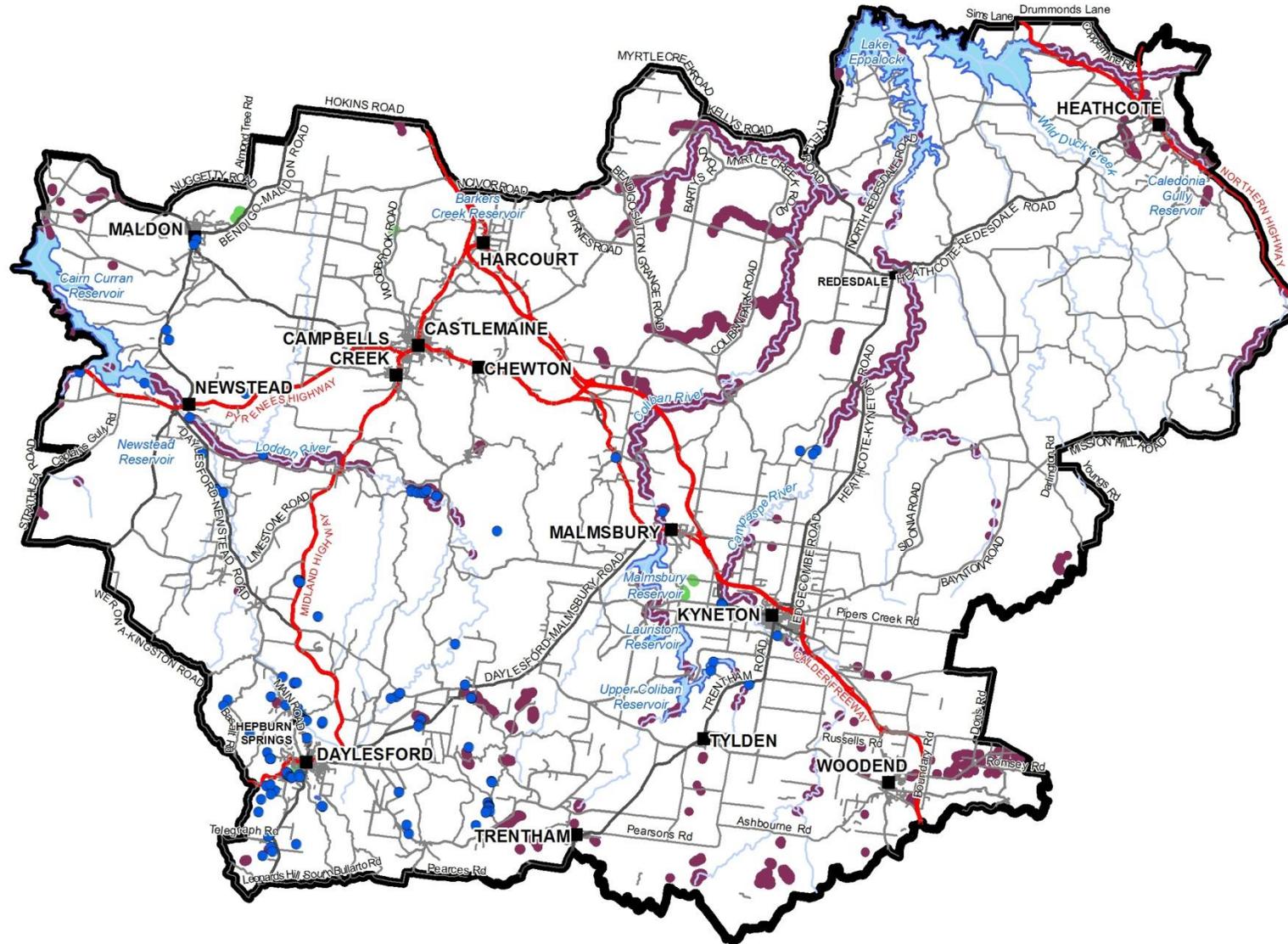
*Red Gums along Loddon River*



*Spring feeding Wombat Creek*

**FIGURE 8: CENTRAL VICTORIAN MINERAL SPRINGS GMA POTENTIAL GROUNDWATER DEPENDENT ECOSYSTEMS AND MAPPED MINERAL SPRINGS**

GOULBURN-MURRAY WATER



GMW-13-033  
18 Jul 2013

GOULBURN-MURRAY WATER  
40 CASEY STREET (PO BOX 165)  
TATURA VIC 3616  
Ph (03) 5833 5500 Fax (03) 58245827  
gmsupport@gmwater.com.au



**Legend**

- Mineral Spring
- Freeway/ Highway
- Semi-Major Road
- Minor Road
- Major Road
- Waterway
- Waterbody
- Central Victorian Mineral Springs GMA
- Potential wetland GDE
- Potential Riparian vegetation GDE

SCALE AT A4 1:450,000



The content of this product is provided for information purposes only. No claim is made as to the accuracy or authenticity of the content of the product. In no event will G.M.W., its agents, instrumentalities and employees be liable for the accuracy of the information contained within this product nor its use of reliance placed on it. The information used within this product is provided on the basis that all persons accessing the information undertake responsibility for assessing the relevance and accuracy of its content.

Z:\2013\_Products\GMW-13-033\GMW-13-033\_CVM5\_MineralSprings\_GDE\_Fig8\_A4L.mxd

### 3.2.4 Mineral springs

Mineral water has been defined as groundwater which, in its natural state, contains carbon dioxide and other soluble matter in sufficient concentration to cause effervescence or impart a distinctive taste. There are over 100 recognised mineral springs in Victoria (Shugg & Knight 1994) (Figure 9).

The concentration of mineral springs around Daylesford and Hepburn, which discharge from the fractured Ordovician bedrock aquifer, is unique in Australia. Mineral springs have long been valued for their health benefits, commercial bottling and tourist attraction (DSE, 2010a).

The Victorian Mineral Water Committee has been established to enhance mineral spring reserves and ensure that appropriate policies and plans are in place to protect and promote Victoria's natural mineral water resources. For further information on mineral springs refer to the Victorian Mineral Water Committee's website <http://www.mineralwater.vic.gov.au/footer/victorian-mineral-water-committee/>

Impacts from groundwater pumping on mineral springs that rely on regional and intermediate scale groundwater systems will be managed by capping groundwater licence entitlement.

Impacts to mineral springs with high environmental values that rely on local scale groundwater systems will be considered when assessing groundwater licence applications in accordance with section 40 of the Act.

Consideration will also be given to the impacts of licensing bores in the main groundwater recharge belt (Figure 9).



*Hepburn Mineral Reserve*



*Commercial water bottling*

**FIGURE 9: CENTRAL VICTORIAN MINERAL SPRINGS GMA MINERAL SPRINGS AND RECHARGE BELT**

GOULBURN-MURRAY WATER



GMW-13-033  
18 Jul 2013

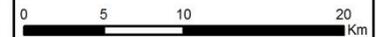
GOULBURN-MURRAY WATER  
40 CASEY STREET (PO BOX 165)  
TATURA VIC 3616  
Ph (03) 5833 5500 Fax (03) 58245827  
gmsupport@gmwater.com.au



**Legend**

- Mineral Spring
- Freeway/ Highway
- Major Road
- Semi-Major Road
- Minor Road
- Waterway
- Waterbody
- Central Victorian Mineral Springs GMA
- Fracture Zone (after Shugg 1944)
- Recharge Belt (after Shugg 1994)

SCALE AT A4 1:450,000



The content of this product is provided for information purposes only. No claim is made as to the accuracy or authenticity of the content of the product. In no event will GMW, its agents, instrumentalities and employees be liable for the accuracy of the information contained within this product nor its use of reliance placed on it. The information used within this product is provided on the basis that all persons accessing the information undertake responsibility for assessing the relevance and accuracy of its content.

Z:\2013\_Products\GMW-13-033\GMW-13-033\_CVM5\_MineralSprings\_Recharge\_Fig9\_A4.mxd

## 4 Groundwater management

### 4.1 Licence entitlement

While the groundwater system is not considered to be under any significant stress, a cap on licence entitlement provides greater certainty and security of access to existing groundwater users and limits impacts to streams (GMW, 2013).

Farm dams and surface water diversions may have an adverse impact on stream flow, particularly during low flow periods. However, there is considerable uncertainty about the extent to which groundwater use further impacts on stream flow.

Given the uncertainty of impacts to streams and considering that groundwater usage is no greater than 50% of entitlement (even in dry periods), it is considered prudent to introduce a preliminary cap and encourage groundwater trading. This will reduce the risk of requiring future restrictions and provides a mechanism to obtain access to water to support further development.

GMW will make an application to the Minister for Water to cap entitlement in the Central Victorian Mineral Springs GMA and declare the Permissible Consumptive Volume of 6,024 ML/yr. This cap is based on entitlement as a percentage of recharge, on the potential for unacceptable impacts to streams and an understanding of community values (GMW, 2013).

The cap limits entitlement in the Loddon and Campaspe Zones at current volumes and provides for further development in the Coliban Zone. Licence volume and domestic and stock use in the Coliban Zone is a smaller proportion of recharge than in the Loddon and Campaspe Zones. Those seeking entitlement in the Loddon and Campaspe Zones can transfer from existing licence holders (refer chapter 4.4).

When usage exceeds 70% in any catchment, which would demonstrate a real increase in demand for groundwater, consideration should be given to increasing the limits on groundwater entitlement in that catchment if it can be demonstrated there will not be any unacceptable impacts. This may require more information on the impacts from farm dams, surface water diversions and domestic and stock use on streams.

#### **Rule 1: Cap on licence entitlement**

GMW may issue a groundwater licence under Section 51 of the Act provided that the Permissible Consumptive Volume for the Central Victorian Mineral Springs GMA is not exceeded.

### 4.2 Groundwater licensing

Bore construction and groundwater extraction are managed through licensing.

A works licence must be obtained from GMW to drill and construct a bore under section 67 of the Act. Groundwater bores must be drilled by a licensed driller. The Australian Drilling Industry Association ([www.adia.com.au](http://www.adia.com.au)) provides contact details of its members.

A take and use licence is required to extract groundwater for irrigation, commercial, dewatering and urban use under section 51 of the Act. A licence may be obtained by submitting an application to GMW. A range of matters will be considered when assessing the application, including the potential impacts to existing authorised users, stream flow and the environment.

Licences may be issued for up to 15 years with conditions relating to the exact location and depth from which groundwater can be extracted, the annual volume of water that can be pumped and the rate at which pumping can occur.

If groundwater is used exclusively for domestic and stock purposes, a take and use licence is not required (refer to chapter 3.1.2).

GMW incurs a range of costs in providing water related services. These costs are recovered from customers including irrigators, commercial users, urban water corporations and environmental managers. GMW prices are developed in consultation with customers and approved by the Essential Services Commission.

More information on groundwater licensing, including fees and charges, is available on GMW's website <http://www.g-mwater.com.au/>.

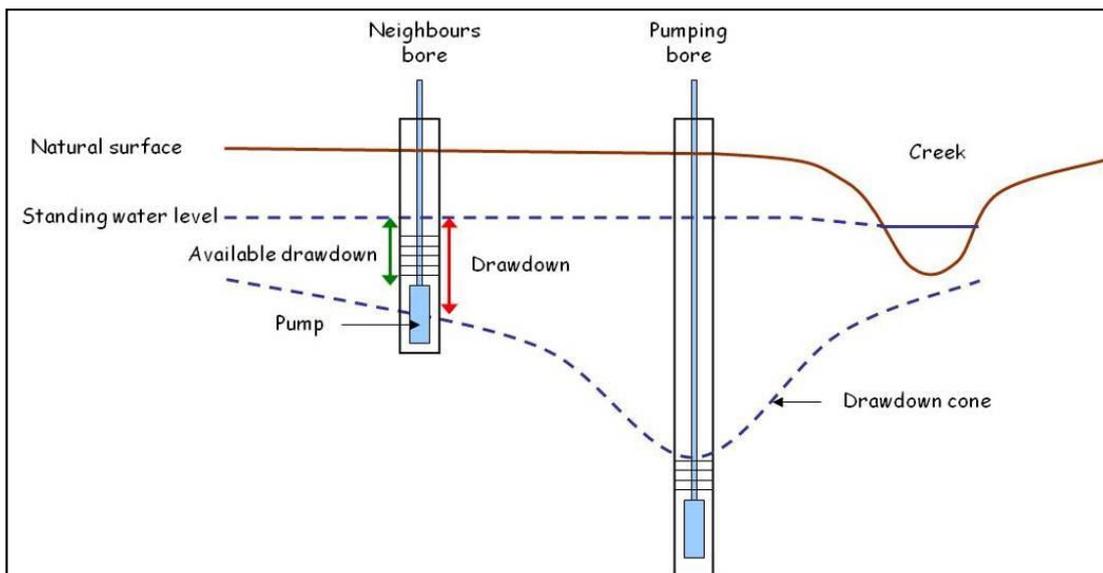
All incidents of the unlawful take or use of water should be reported to GMW. The incidents are dealt with under the Act in a manner consistent with the National Framework for Compliance and Enforcement Systems for Water Resource Management (DSEWPC, 2012).

### 4.3 Managing extractions

#### 4.3.1 Interference

Groundwater pumping lowers the groundwater level around the bore being pumped. This decline in groundwater level is referred to as the drawdown cone (Figure 10). The size and shape of the drawdown cone depends primarily on the nature of the aquifer as well as the pumping rate and duration. Drawdown decreases with distance from the bore, and the cone expands in size whilst pumping continues until steady-state conditions are reached.

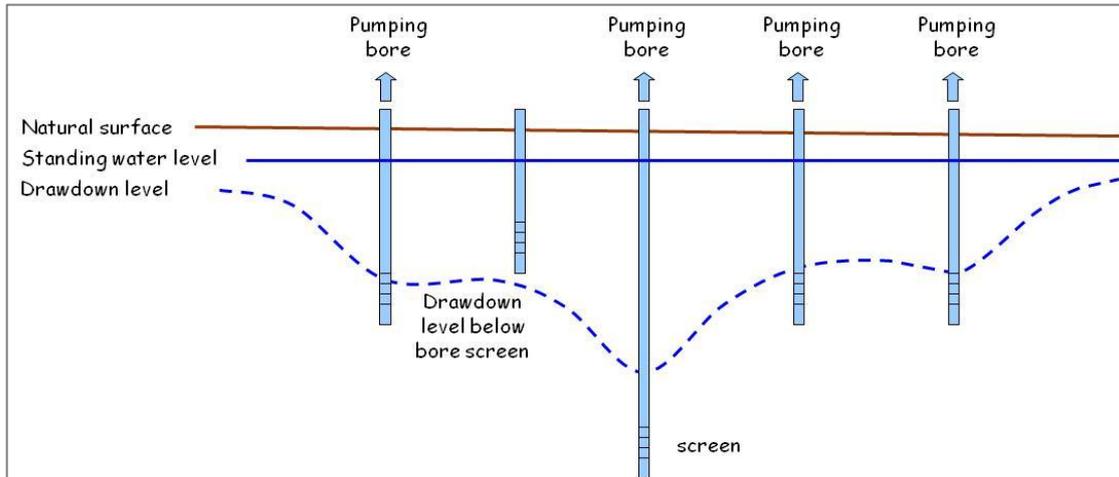
Groundwater level interference can occur when the drawdown cone intersects a neighbouring bore or environmental feature such as a stream or a spring. The impacts from groundwater pumping are site specific as the pumping requirements are likely to be different and aquifer hydraulic characteristics can vary, particularly in the fractured rock aquifers.



**Figure 10 Drawdown cone resulting from groundwater pumping**

When bores located in close proximity are extracting from the same aquifer it can result in intersecting drawdown cones. Unacceptable drawdown levels can be a

consequence of the cumulative impacts of a number of pumps operating in a local area (intensive groundwater pumping) (Figure 11).



**Figure 11 Interference caused by cumulative impacts of groundwater pumping**

There is a higher density of bores around Daylesford, Glenlyon, Musk, Trentham, Tylden, Kyneton and Malmsbury (Figure 6), but monitoring suggests seasonal drawdown is less than 5 m.

Interference is considered by GMW when assessing groundwater licence applications. This includes the potential impacts to existing groundwater users and the environment as detailed in sections 40, 53 and 68 of the Act. Where there are concerns about pumping impacts, the applicant may be required to undertake their own detailed investigations to satisfy GMW that no unacceptable impacts will result.

Groundwater users who believe that they are being adversely impacted by interference from neighbouring groundwater pumping can report their concerns to GMW for investigation. Groundwater users should ensure that their bore is functioning correctly and that they have a record of groundwater levels in their bore over time to assist with any investigations.

#### 4.3.2 Restrictions

Restrictions are typically introduced through the use of allocations to limit groundwater extractions and manage groundwater levels. Allocations are a percentage of licence volume that can be extracted in season.

In the Central Victorian Mineral Springs GMA, the groundwater system is not considered to be under stress. Even with the dry conditions and droughts experienced from the mid 1990s to 2010 groundwater levels remained relatively steady with groundwater recovery levels only falling by up to 5 metres (around 0.3 m/yr on average).

Given the modest fall in groundwater levels during the recent dry period, and the small level of seasonal drawdown observed in response to pumping, it is not currently considered necessary to include any restrictions in this Plan. However, GMW may consider the need for restrictions should circumstances arise that require attention.

If in a local or wider area there is a significant fall in groundwater levels observed over time (i.e. greater than 5 m decline over 3 years), or large seasonal drawdown (i.e. greater than 10 m), then GMW will investigate the cause and, if necessary, engage with local groundwater users to assess the need for restrictions.

The need for restrictions will also be considered as part of the annual review.

#### 4.4 Groundwater trading

Groundwater trading allows for entitlement to be transferred to develop new opportunities or grow existing businesses. It also provides licence holders with greater flexibility to manage production in response to seasonal demands or climatic conditions.

To undertake a trade, a licence holder can advertise their intent to sell or buy groundwater entitlement, or use a water broker. The price for the transfer of entitlement is negotiated between the buyer and the seller. Once the buyer and seller have come to an agreement, an application to transfer a licence must be made to GMW. Licence holders should apply well in advance of requiring the water as it can take a number of weeks to process an application. The trade must be approved in writing by GMW before the water may be taken.

Licence entitlement may be transferred temporarily within zones or between zones. This recognises present low usage and provides greater opportunity for groundwater trading.

Licence entitlement may be permanently transferred within or between zones provided that zone caps are not exceeded. Entitlement within each zone is capped to avoid large volumes being transferred into any one zone which could result in unacceptable impacts. The caps provide for further development of groundwater resources in the Coliban catchment where the current licence entitlement is small relative to recharge (refer chapter 3.1.1).

GMW will consider a range of matters when assessing an application to transfer licence entitlement, including the potential impacts to existing authorised users and the environment.

Licence entitlement may be transferred in to or out of the Central Victorian Mineral Springs GMA provided that the PCV is not exceeded.

#### **Rule 2: Transfer of licence entitlement**

GMW may approve an application to transfer licence entitlement under section 62 of the Act provided matters under section 53 have been considered and the following conditions are satisfied:

- a) For a permanent trade, the following zone limits are not exceeded:

<b>Zone</b>	<b>Entitlement limit (ML/yr)</b>
Campaspe	1,150
Coliban	2,144
Loddon	2,730

- b) The buyer's licensed bores are metered.  
 c) The seller's licensed bores are metered or not equipped.

#### 4.5 Carryover

Carryover, which is unused seasonal allocation that may be used in the following season, is not available in the Central Victorian Mineral Springs GMA as not all licensed bores in the area are metered and there remains some uncertainty around the impacts to streams (refer section 4.1).

## 5 Monitoring program

Monitoring, evaluation and reporting are important elements which lead to improved groundwater resource management.

### 5.1 Groundwater levels

Monitoring groundwater levels on a regular basis provides important information on the availability of groundwater and how groundwater levels change over time. This is important to assess the impacts of groundwater pumping and climate on the resource.

Groundwater level monitoring is also important to assist with understanding recharge and the interaction between aquifers and between groundwater and surface water. Groundwater level monitoring is used to assess licence applications, including trading, and inform management decisions such as the need for restrictions.

There are forty seven State observation bores in the Central Victorian Mineral Spring GMA that are currently monitored on a quarterly basis in February, May, August and November by the DEPI (Figure 12).

There are clusters of monitoring bores around the mineral springs and across the upper part of the catchment where development is greatest. There is limited monitoring in the granite, but there is little groundwater pumping from this aquifer and at this stage there is no recommendation for additional monitoring bores in this aquifer.

Additional monitoring should be considered in the recharge belt region of the mineral springs to provide early warning of any change in conditions. Additional monitoring should also be considered to assist in improving the understanding of the interaction between groundwater and surface water and the water requirements of high value GDEs.

GMW will continue to support a baseline of groundwater level monitoring from State observation bores to assist with resource management decisions and use the data to review the Plan.

Groundwater users are encouraged to monitor the groundwater levels in their bores over time so that they know the available drawdown.



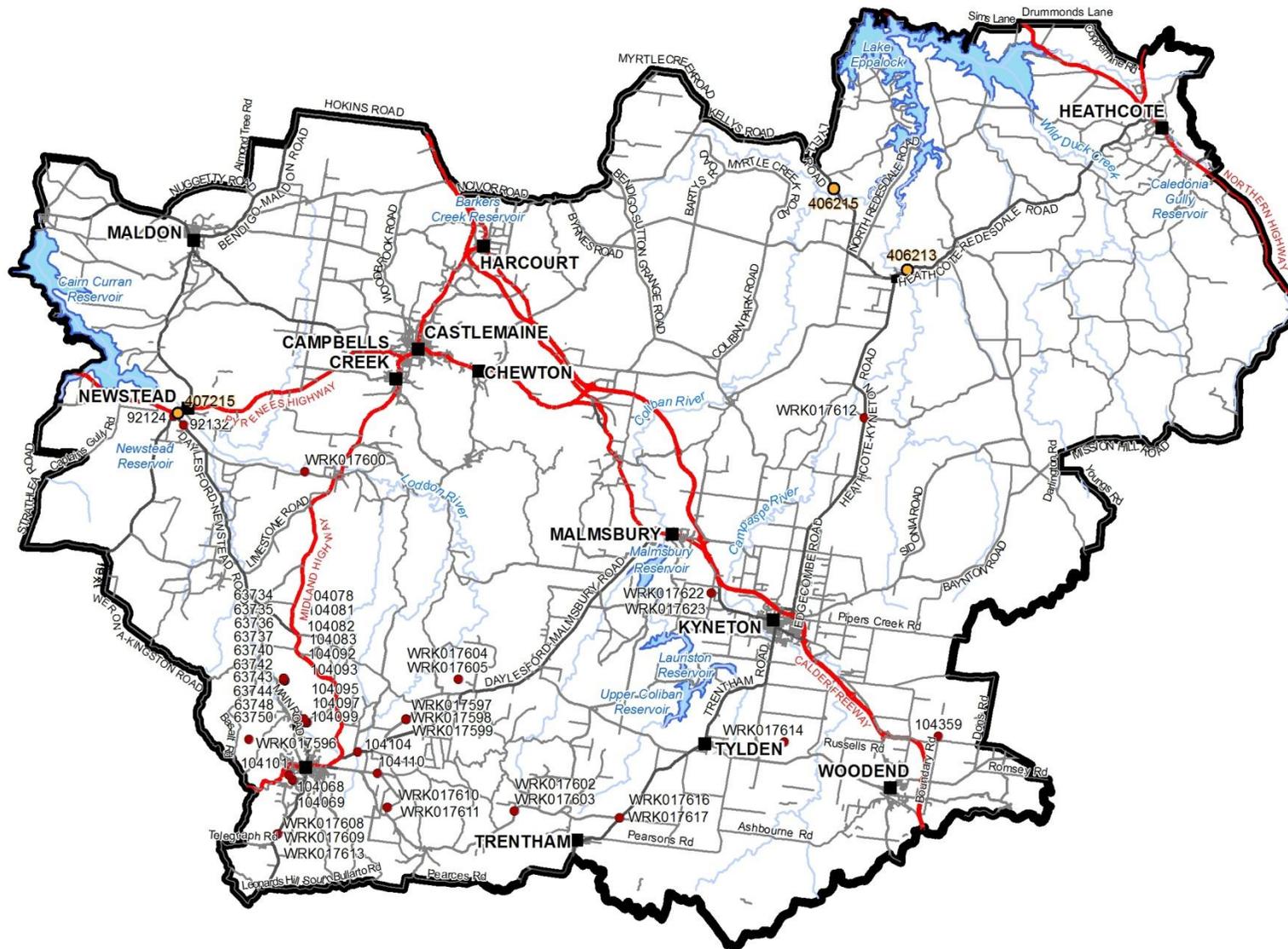
*Nestled State monitoring bores at Lauriston*



*Nestled State monitoring bores at Musk*

**FIGURE 12: CENTRAL VICTORIAN MINERAL SPRINGS GMASTATE OBSERVATION BORES AND RIVER GAUGE STATIONS**

GOLBURN-MURRAY WATER



GMW-13-033  
22 Jul 2013

GOLBURN-MURRAY WATER  
40 CASEY STREET (PO BOX 165)  
TATURA VIC 3616  
Ph (03) 5833 5500 Fax (03) 5824 5827  
gmsupport@gmwater.com.au



**Legend**

- Gauging Station
- State Observation Bore
- Freeway/ Highway
- Major Road
- Semi-Major Road
- Minor Road
- Waterway
- Waterbody
- Central Victorian Mineral Springs GMA

SCALE AT A4 1:450,000



The content of this product is provided for information purposes only. No claim is made as to the accuracy or authenticity of the content of the product. In no event will GMW, its agents, instrumentalities and employees be liable for the accuracy of the information contained within this product nor its use of reliance placed on it. The information used within this product is provided on the basis that all persons accessing the information undertake responsibility for assessing the relevance and accuracy of its content.

## 5.2 Groundwater salinity

The risk to groundwater salinity from pumping is considered to be very low based on available information (GMW, 2013). Monitoring of groundwater salinity is encouraged to identify any unexpected changes.

Upon request, GMW will provide groundwater users with a bottle to allow a sample to be collected and groundwater salinity measured. GMW will advise the groundwater user of the result and use the data to inform the review of the Plan.

### Rule 3: Groundwater salinity monitoring

GMW will:

- (a) Upon request from a groundwater user, provide a bottle for groundwater sampling.
- (b) Upon return of the sample that season, measure the groundwater salinity and advise the groundwater user of the result.
- (c) Record the groundwater salinity result in the State groundwater database and consider the data as part of the Plan review.

## 5.3 Metered use

Recording groundwater usage is important to gauge the actual level of use relative to the licensed volumes, understand how the groundwater system responds and ensure that users comply with their licence conditions.

Meters will be read at least once each season. In drier seasons, when usage is greater they may be read more frequently.

Meter readings will be stored in the Victorian Water Register to enable reporting on use.

While most licensed bores are metered, those that were licensed prior to 2004 for less than 20 ML/yr may not be metered as they were exempt under the metering program (DSE, 2010). Where a meter is not available, usage will be estimated to assist with accounting for use.

It is the responsibility of the licence holder to monitor their groundwater usage. If a licence holder intends to use more than their allocation in a season, it is the responsibility of that licence holder to secure a licence transfer and obtain written approval from GMW before any additional water is extracted.

### Rule 4: Metering

GMW will read flow meters on licensed bores at least once annually, record usage in the Victorian Water Register and consider the data as part of the Plan review.

## 5.4 Surface water monitoring

The cumulative impacts of dams, surface water abstraction, domestic and stock use and licensed groundwater extraction could potentially have adverse impacts on stream flow, particularly during dry periods (GMW, 2013). Further work is required to reduce uncertainty and gauge data from the sites identified in Table 4 is important for these assessments.

**Table 4 River gauge stations**

<b>River</b>	<b>Gauge</b>
Loddon River at Newstead	407215
Coliban River at Lyell	406215
Campaspe River at Redesdale	406213

These gauges are used by different stakeholders including the Bureau of Meteorology, Coliban Water, North Central Catchment Management Authority and GMW to support a range of surface water management objectives. From a groundwater resource management perspective, the gauge data enables an estimate of groundwater discharge to streams and can provide information on the risk to environmental, social and economic values from groundwater pumping.

GMW will continue to support monitoring of surface water gauges 407215, 406215 and 406213 and consider the data as part of the Plan review.

## 6 Plan implementation

### 6.1 Communications

Each year GMW will prepare a newsletter to provide information on groundwater levels, usage and trade and summarise outcomes from the Plan review.

The newsletter will be made available on GMW's website <http://www.g-mwater.com.au/>.

Customers are encouraged to visit the website and subscribe for the latest news.

#### **Rule 5: Communications**

By 1 October each year GMW will post on its website a newsletter summarising the resource status and reporting on licensed groundwater use and trade activity for the previous season and any need to amend the Plan.

### 6.2 Plan review

Local management plans are designed to be adaptive. As new information becomes available and policy changes, amendments to the Plan may be necessary.

At the time of the development of this Plan, implementation of the Murray Darling basin Plan (MDBP) had commenced. As requirements of the MDBP become clearer, this Plan may need to be reviewed to ensure it is up to date and reflects the requirements of the MDBP.

A review of the Plan will be undertaken annually and an assessment made of the Plan rules.

Any suggestions for how the Plan could be improved can be sent to GMW via their website [www.g-mwater.com.au](http://www.g-mwater.com.au) or by calling GMW on 1800 013 357.

GMW will consult with the Loddon Campaspe Regional Water Service Committee on any proposed amendments and, if the amendments are likely to impact on rights of access to water, consult with licence holders and other affected stakeholders.

Any significant amendments to the Plan must be based on sound technical understanding or a change in policy.

#### **Rule 6: Plan review**

GMW will:

- (a) Review the need for any amendments to the Plan on an annual basis.
- (b) Consult with the Loddon Campaspe Regional Water Services Committee on proposed amendments and, if any amendments might impact on rights of access to water, consult with licence holders and other stakeholders.

### 6.3 Recommended works

Works that would improve groundwater resource management in the Central Victorian Mineral Springs GMA and inform the review of the Plan are provided in Table 5.

**Table 5 Recommended works to inform Plan review**

<b>Works</b>	<b>Description</b>
Review entitlement cap of each zone	More accurately quantify the impacts to streams from farm dams, surface water abstraction, domestic and stock use and licensed groundwater extraction to review the licence cap.
Identify risk to high value GDEs	Map high value GDEs and establish a monitoring program to determine their groundwater dependence and sensitivity to change
Assess potential for conjunctive management	Consider how groundwater and surface water could be monitored and managed conjunctively with respect to climate and time lags to best meet flow objectives and water use demands

GMW will pursue these recommendations with the North Central Catchment Management Authority and DEPI.

## 7 References

Department of Sustainability and Environment, 2009. Northern Region Sustainable Water Strategy. Victorian, Department of Sustainability and Environment, Melbourne.

Department of Primary Industries, 2010. Prediction of potential aquatic groundwater dependent ecosystems in the North Central CMA region. Department of Primary Industries, Bendigo

Department of Sustainability and Environment, 2010a. Spa Country. Victoria's Mineral Springs. Victorian Government Department of Sustainability and Environment in conjunction with the Victorian Mineral Water Committee, Melbourne.

Department of Sustainability and Environment, 2010b. National Framework for Non-urban metering. Victorian State Implementation Plan. March 2010. Volume 1. Victorian, Department of Sustainability and Environment, Melbourne. Reference DM3346997

Department of Sustainability and Environment, 2011. Policy Paper. Improving management of Victoria's groundwater resources. Victorian Government Department of Sustainability and Environment, Melbourne.

Department of Sustainability and Environment, 2012. Groundwater management framework for Victoria, viewed 10 May, 2013. <http://www.water.vic.gov.au/environment/groundwater/management/groundwater-management-framework>

Department of Sustainability, Environment, Water, Population and Communities, 2012. National Framework for Compliance and Enforcement Systems for Water Resource Management, viewed 10 May, 2013. <http://www.environment.gov.au/water/publications/agriculture/ris-water-compliance-enforcement.html>

Environment Protection Authority, 1997. State Environment Protection Policy (Groundwaters of Victoria), viewed 10 May, 2013. [http://www.epa.vic.gov.au/about\\_us/legislation/land.asp#sepp\\_groundwaters](http://www.epa.vic.gov.au/about_us/legislation/land.asp#sepp_groundwaters)

Goulburn-Murray Water, 2012. Central Victorian Mineral Springs Groundwater Management Area Community Engagement. Unpublished report held by Goulburn-Murray Water, Tatura, Victoria. Reference DM3432033

Goulburn-Murray Water, 2013. Draft Central Victorian Mineral Springs Groundwater Management Area Background Report. Unpublished report held by Goulburn-Murray Water, Tatura, Victoria. Reference DM3484918

North Central Catchment Management Authority, 2005. North Central River Health Strategy. North Central Catchment Management Authority, Huntly, Victoria

Shugg, A and Knight, MJ. 2004. Hydrogeology of the Mineral Springs of Central Victoria [online]. In: Water Down Under 94: Groundwater Papers; Preprints of Papers. Barton, ACT: Institution of Engineers, Australia, 1994: 215-221. National conference publication (Institution of Engineers, Australia); no. 94/14.

Sinclair Knight Merz, 2011a. Groundwater Resource Appraisal – Upper Loddon and Campaspe catchments, Report prepared for Goulburn-Murray Water. Reference DM3057283.

Sinclair Knight Merz, 2011b. GDE Triggers Project. Analysis of remotely sensed evapotranspiration data to aid the management of groundwater dependent ecosystems. Unpublished report held by Goulburn-Murray Water, Tatura, Victoria. Reference DM 3277396.

Victorian Water Act 1989, viewed 10 May, 2013 [http://www.austlii.edu.au/au/legis/vic/consol\\_act/wa198983/](http://www.austlii.edu.au/au/legis/vic/consol_act/wa198983/)

## Appendix A

Components that underlie the Plan objectives identified through community consultation.

Objectives	Plan chapter reference	How objective is addressed
<b>1. Effectively communicate information on management of groundwater resources</b>		
1.1 Description of the groundwater system including the interaction with surface water	2 and 3.2	<ul style="list-style-type: none"> <li>Groundwater system and impacts from groundwater pumping described in Plan and technical report available on GMW website</li> </ul>
1.2 Describe the value of groundwater	1.1, 1.3, and 3	<ul style="list-style-type: none"> <li>Groundwater use types, history and impacts of groundwater extraction on the environment described in Plan and technical report available on GMW website</li> </ul>
1.3 Describe roles and responsibilities in groundwater management (including compliance) and how to get access to groundwater e.g. licensing process and licence period	1.1, 3.1.1, 3.1.2, 4.1, and 4.2	<ul style="list-style-type: none"> <li>Roles and responsibilities described in Plan and technical report available on GMW website</li> <li>Information on licensing provided in the Plan</li> <li>Links to relevant agencies provided in Plan</li> </ul>
1.4 Describe how groundwater can be used i.e. considerations for commercial operators and irrigators e.g. water use efficiency	4.2	<ul style="list-style-type: none"> <li>Authorised use described in Plan and technical report available on GMW website</li> <li>Links to information on industries provided in Plan</li> </ul>
1.5 Develop transparent rules for management of the resource	4.1, 4.4, 5.2, 5.3, 6.1, and 6.2	<ul style="list-style-type: none"> <li>Rules clearly described in Plan</li> <li>Quick Reference guide to rules provided at front of Plan</li> </ul>
1.6 Detail how to get information on groundwater fees and charges	4.2	<ul style="list-style-type: none"> <li>Information on fees provided in Plan and technical report and available on GMW website</li> <li>Links to GMW website and telephone number provided</li> </ul>
1.7 Provide information on the risk of groundwater contamination and where to get more information	3.2.1	<ul style="list-style-type: none"> <li>EPA contact details provided in Plan and technical report available on GMW website</li> </ul>
1.8 Describe how the resource status, including metered use and levels, will be communicated over time	6.1	<ul style="list-style-type: none"> <li>Publication of annual newsletter on GMW website</li> <li>Groundwater levels available from GMW website</li> </ul>
1.9 Identify where a person can obtain information on the management and maintenance of bores	1.1 and 4.2	<ul style="list-style-type: none"> <li>Information on drilling and constructing a bore, licensing and resource management provided in Plan and technical report with referral contact details</li> </ul>
1.10 Identify investigations that could be undertaken to enhance the understanding of groundwater system and the impacts on pumping to inform resource management	6.3	<ul style="list-style-type: none"> <li>Recommended works to enhance groundwater resource management described in Plan and technical report available on GMW website</li> </ul>

Objectives	Plan chapter reference	How objective is addressed
<b>2. Protect existing groundwater users and the environment while supporting the sustainable and equitable development of groundwater resources in an adaptive and cost effective manner</b>		
2.1 Document how groundwater extractions will be managed in a sustainable manner, with consideration of climate variability, to protect existing groundwater users and the environment which includes springs, unregulated waterways, wetlands, terrestrial vegetation and the aquifer (i.e. groundwater quality and structure)	3.2, 4.1 and 4.3.2	<ul style="list-style-type: none"> <li>• Cap on licence entitlement</li> <li>• Process for restrictions documented in Plan</li> </ul>
2.2 Document mechanisms to identify times of water shortage and rules for the equitable share of the available resource in such times	4.3.2	<ul style="list-style-type: none"> <li>• Process for restrictions documented in Plan</li> </ul>
2.3 Document how drawdown levels are to be managed to protect existing groundwater users and the environment	4.1, 4.3.1 and 4.3.2	<ul style="list-style-type: none"> <li>• Cap on licence entitlement</li> <li>• Interference managed through licensing decisions</li> <li>• Process for restrictions documented in Plan</li> </ul>
2.4 Document rules for the transfer of groundwater licence entitlement and any conditions to be considered	4.4	<ul style="list-style-type: none"> <li>• Rule in Plan clearly describing trading options</li> </ul>
2.5 Document how carryover may be introduced	4.5	<ul style="list-style-type: none"> <li>• Carryover considered in Plan development, but not currently available</li> </ul>
2.6 Document how the rules may be adapted over time to accommodate changes in policy and an improved understanding of the groundwater system	6.2	<ul style="list-style-type: none"> <li>• Rule in Plan documenting annual review</li> <li>• Documented in Plan how the rules may be adapted over time</li> </ul>
2.7 Document how domestic and stock use will be considered	3.1.2 and 4.2	<ul style="list-style-type: none"> <li>• Plan states that D&amp;S is a statutory right</li> <li>• D&amp;S use considered in assessing caps</li> <li>• D&amp;S bore access to water requires drilling to depth that considers seasonal conditions</li> <li>• D&amp;S bores should be registered</li> <li>• Licensing requirements outlined</li> </ul>
2.8 Document monitoring and metering requirements	5	<ul style="list-style-type: none"> <li>• Support baseline groundwater level monitoring</li> <li>• Provide service to users to measure groundwater EC</li> <li>• Support surface water gauging stations</li> <li>• Rule to read metered bores at least once a year</li> </ul>