# Lower Ovens
# Groundwater Management Area

# Local Management Plan

August 2012

GOULBURN-MURRAY WATER

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## Endorsement

This Local Management Plan has been endorsed by Goulburn-Murray Water's delegate for licensing functions undertaken in accordance with the *Water Act 1989*. This plan contains an operational framework for the management of groundwater resources in the Lower Ovens Groundwater Management Area and provides specific guidance and information to Goulburn-Murray Water's customers relating to the take and use of groundwater in this area.

The development of this Local Management Plan has relied on guidance and feedback from Goulburn-Murray Water's customers and key stakeholders. The development of this Plan fulfils an obligation of the Northern Region Sustainable Water Strategy. The Plan is also consistent with relevant Ministerial guidelines in that it explains to groundwater users and the broader community the specific management arrangements governing the extraction of groundwater in the Lower Ovens and King River Valleys.

This plan seeks to strike the right balance between recognising the benefit of using groundwater while also protecting high value environmental assets such as stream flows and groundwater dependent ecosystems during critical low-flow periods. The plan also seeks to be proactive in its approach, by giving guidance about where groundwater development may occur; particularly in underutilised aquifers that have limited connection to surface water flows.

It is expected that this Local Management Plan will require periodic review particularly in light of the Murray-Darling Basin Plan, as changes to Victoria's groundwater management framework take effect and as information about groundwater resources in the Lower Ovens Groundwater Management Area improves.

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## Acknowledgements

Goulburn-Murray Water (G-MW) would like to express its appreciation to the Lower Ovens Groundwater Reference Group including irrigator representatives Kerry Murphy, Rod Newton and Peter Antonello and representatives from agencies including the North East Catchment Management Authority, Department of Sustainability and Environment, North East Water, Rural City of Wangaratta and the Alpine Shire. Feedback from the reference group members has been invaluable in helping to test and refine the information contained in the Local Management Plan.

G-MW has used the most robust technical information available in developing this LMP and has relied on extensive technical expertise and support. The contributions of Will Minchin (GHD), Meg Humphrys (G-MW), Katie Fox (G-MW), Matthew Pethybridge (G-MW) and Faye Williamson (G-MW) are acknowledged.

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Contributions from the National Water Commission towards the Ovens Valley Water Resource Appraisal (Stage B) are acknowledged by G-MW. Stage B included technical investigations and further model development. The findings of the Ovens Valley Resource Appraisal are summarised in the *Technical Summary Report* (2012).

## Glossary

| Term/Acronym | Description |
|---|---|
| Act | *Victorian Water Act 1989* |
| AHD | The reference level for groundwater levels is the Australian Height Datum (AHD), the geodetic datum for altitude measurement in Australia. It is the mean sea level for 1966-1968 and is assigned the value of zero. |
| Aquifer | An underground layer of rock or sand or other geological unit that contains water |
| Aquitard or confining layer | A solid rock or clay layer that restricts flow of water from one aquifer to another. It acts as barrier to the flow of groundwater. |
| Aquitard, semi-confining | Also referred to as a 'semi-confining layer'. This layer is an aquitard that partially restricts the flow of water from one aquifer to another. |
| Available drawdown | The depth of water in the bore minus 2 metres to account for pump depth setting |
| Back trade | The opportunity for trade into a capped zone up to the maximum previously traded out of the management zone. |
| Carryover | Carryover is unused allocation that may be used in subsequent years |
| Drawdown | Groundwater level fall from the standing water level due to groundwater extraction |
| Dept h below natural surface (DBNS) | Measured in metres, it is the depth to which groundwater can be found beneath the ground surface. |
| Entitlement | Licensed volume of groundwater specified as megalitres per year |
| GDE | Groundwater dependent ecosystem. An ecosystem that relies on access to groundwater for some or all of its water needs to maintain health and vitality. |
| GMA | Groundwater Management Area |
| Goulburn-Murray Water | Goulburn-Murray Water Rural Water Corporation acting as a delegate of the Minister |
| Groundwater licence | Licence issued to take and use groundwater under section 51 of the Act |
| Groundwater Reference Group | A group of stakeholder representatives consulted during the development and implementation of the LMP |
| LMP | The Lower Ovens Groundwater Management Area Local Management Plan |
| Permissible Consumptive Volume (PCV) | Permissible Consumptive Volume is the volume of groundwater that the Minister has declared may be extracted from a defined area in a season |
| Seasonal Allocation | The amount of licence entitlement that can be used in any given season e.g. during times of water shortage a seasonal allocation may be 75% of the licence entitlement. |
| Transfer | Transfer of groundwater licence entitlement from one licence holder to another |
| ML | Megalitre or one million litres |
| Maximum groundwater level recovery | The highest level to which the groundwater will return to after pumping has ceased |
| Season | Period of 12 months commencing 1 July |
| NRSWS | The Northern Region Sustainable Water Strategy, which was released in 2009. |
| Zone | A part of the groundwater management area defined for management purposes |

## Table of Contents

# 1 Introduction

The Lower Ovens Groundwater Management Area (GMA) Local Management Plan (LMP) has been prepared to provide groundwater users with a detailed, system-specific management framework. The LMP has been developed by Goulburn-Murray Rural Water Corporation (G-MW) in consultation with a Reference Group made up of key representatives from relevant stakeholder and agency groups, such as:

- Department of Sustainability and Environment,
- North East Catchment Management Authority,
- The local irrigation community,
- Regional Water Service Committees,
- North East Water,
- Rural City of Wangaratta, and
- Alpine Shire

The development of the LMP is a requirement of Action 4.6 in the Northern Region Sustainable Water Strategy (2009) and has been driven by community concerns regarding the security of the water resource supplies (both groundwater and surface water) in the Ovens Valley during the 2006/07 drought.

## 1.1 Aim

The aim of this LMP is to ensure that groundwater resources in the Lower Ovens GMA are managed in an equitable and sustainable manner; taking into account the connectivity between groundwater and surface water resources and the benefit that groundwater provides to rural and urban communities during times of water shortage.

## 1.2 Objectives

The specific objectives of the LMP are to:

- Provide a clear and proactive management framework which enables the benefits of groundwater to be maximised in an equitable and sustainable manner
- Use improved knowledge to manage the impact of groundwater extraction on high value environmental assets; such as river flow and groundwater dependent ecosystems;
- Where necessary, provide clear sharing arrangements for times of groundwater shortage and decline.

## 1.3 Background

A vast amount of technical work has been undertaken, which underpins the LMP. This work has been described in the *Technical Summary Report* (Goulburn-Murray Water 2012); which summarises all technical work relevant to the development of the LMP.

The technical work undertaken includes:

- A thorough review of all technical studies in the Ovens Valley catchment
- Development of a conceptual and hybrid[1] numerical model for the Ovens Valley
- An assessment of different extraction and climate change scenarios (using the numerical model)
- Testing and validation of the numerical model using additional information from field investigations
- Re-calibration of the models from field results
- Scenario model runs testing possible management rules

The rules contained in the LMP have been developed to be adaptive so they can be amended where necessary to incorporate new knowledge or policy changes as they emerge (refer to Rule 8). It is noted that in some cases where there is currently insufficient information to be able to consider all issues comprehensively; further work will be recommended to enable improvements to this plan to be made over time.

## 1.4 The Lower Ovens Groundwater Management Area

The Lower Ovens GMA covers the Ovens Catchment downstream of Myrtleford. This includes the upper reaches of the King and Buffalo Rivers and extends north along the floodplain toward the Murray River.

The GMA includes all major aquifers in this region, including the Calivil Formation (Deep Lead), the Shepparton Formation, including the sub-member Laceby Gravels, the overlying Coonambidigal Formation and the fractured bedrock aquifer. No depth limit has been specified for the GMA to ensure management of all aquifers.

The GMA also includes four management zones:

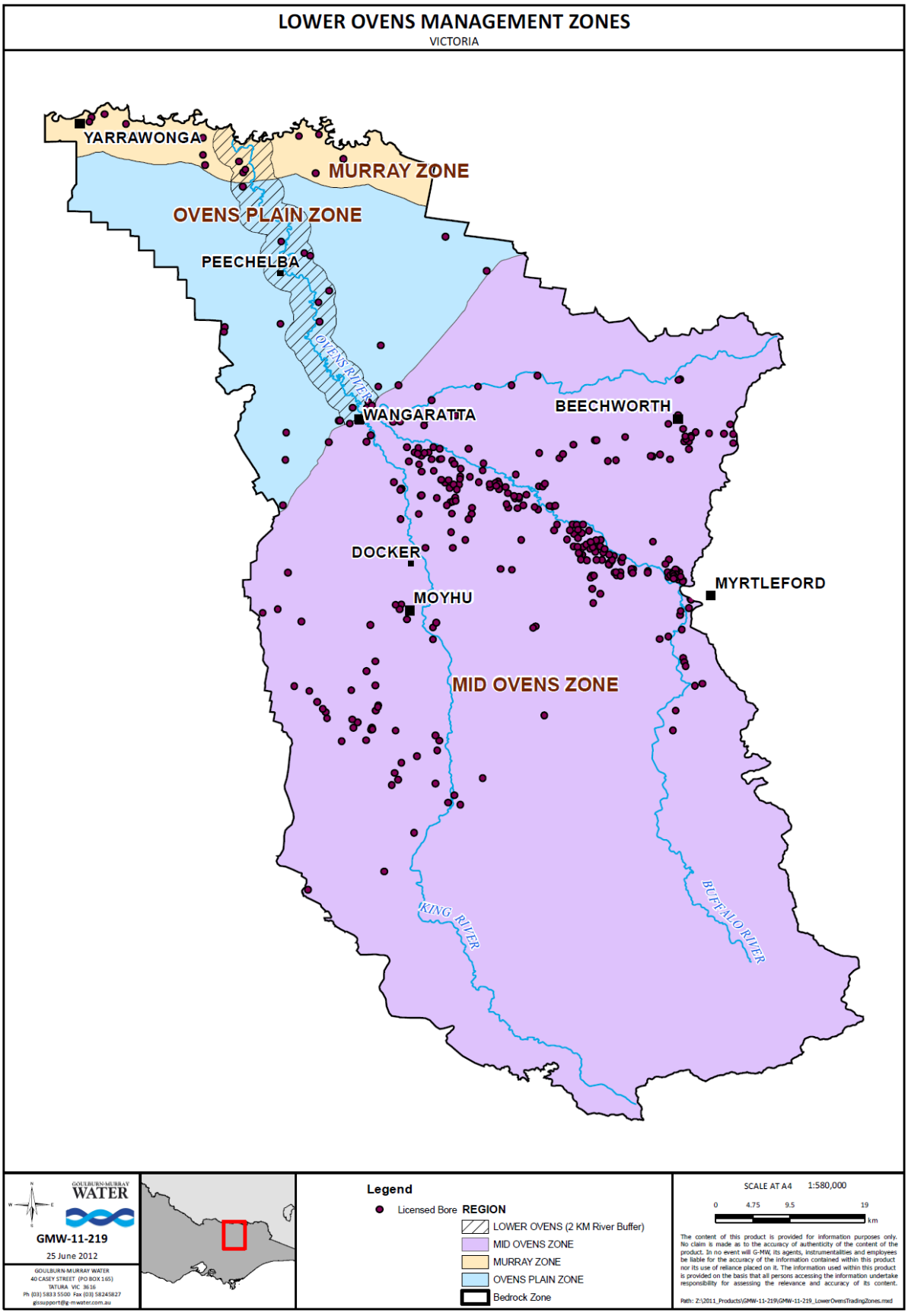
1. Mid Ovens Zone (which includes the narrow alluvial aquifers in the upper Buffalo and King Catchments and in the mid Ovens south of Wangaratta)
2. Ovens Plain Zone (which includes the floodplain north of Wangaratta to north of Peechelba)
3. Murray Zone (which includes the floodplain areas north of Peechelba to the Murray River)
4. Bedrock Zone (which includes the bedrock aquifer across the entire Lower Ovens GMA).

These zones are described in detail in Section 3.

The Lower Ovens GMA and management zone boundaries are presented in Figure 1.

[1] Incorporates recharge and groundwater data

**Figure 1 Lower Ovens Groundwater Management Area, showing management zones and licensed groundwater bore locations**



# 2 Groundwater Resources

## 2.1 Groundwater System

### 2.1.1 Aquifers

Groundwater resources within the Ovens catchment broadly occur within fractured rock formations (mostly greater than 350 million years old) and within much younger unconsolidated alluvial deposits (less than 5 million years old) that infill the valleys. The fractured rock aquifer is typically a low permeability aquifer with generally low storage capacity which limits the flow of groundwater through it. However, zones of dense fracturing within the bedrock can locally increase aquifer permeability and therefore storage capacity.

The alluvial deposits are the primary source of groundwater for irrigation, urban and domestic and stock use in the catchment. There are several distinct, definable formations within the alluvial sediments (Figure 2).

#### 2.1.1.1 The Laceby Gravel member (a definable sub unit of the Shepparton Formation)

The Laceby Gravel is a gravely horizon within the Shepparton Formation (described below) which is associated with the alluvial floodplain of the Lower Ovens River at around 10 – 40 m below ground. Most of the groundwater pumped from the Shepparton Formation is sourced from the Laceby Gravel member.

#### 2.1.1.2 The Shepparton Formation

The Shepparton Formation extends from the surface to around 50 – 70 m depth. This formation is typically composed of silt and clays with minor zones of gravel and sand that form localised aquifers. Groundwater within the Shepparton Formation tends to be more saline than that of the Deep Lead.

#### 2.1.1.3 The Upper Tertiary Aquitard

The Upper Tertiary Aquitard is a semi-confining clay layer that occurs at the base of the Shepparton Formation and slows the groundwater interaction between the Shepparton Formation and the Deep Lead. This layer is thin and not typically continuous around Myrtleford and Everton to the west, but increases in thickness north of Wangaratta.

#### 2.1.1.4 The Calivil Formation (also referred to as the Deep Lead)

The Calivil Formation is the deepest and oldest alluvial formation primarily comprised of sand and gravel. This formation generally supports a high yielding aquifer with good water quality and is found buried along the larger river valleys, such as the Ovens and King River valleys and around Chiltern.

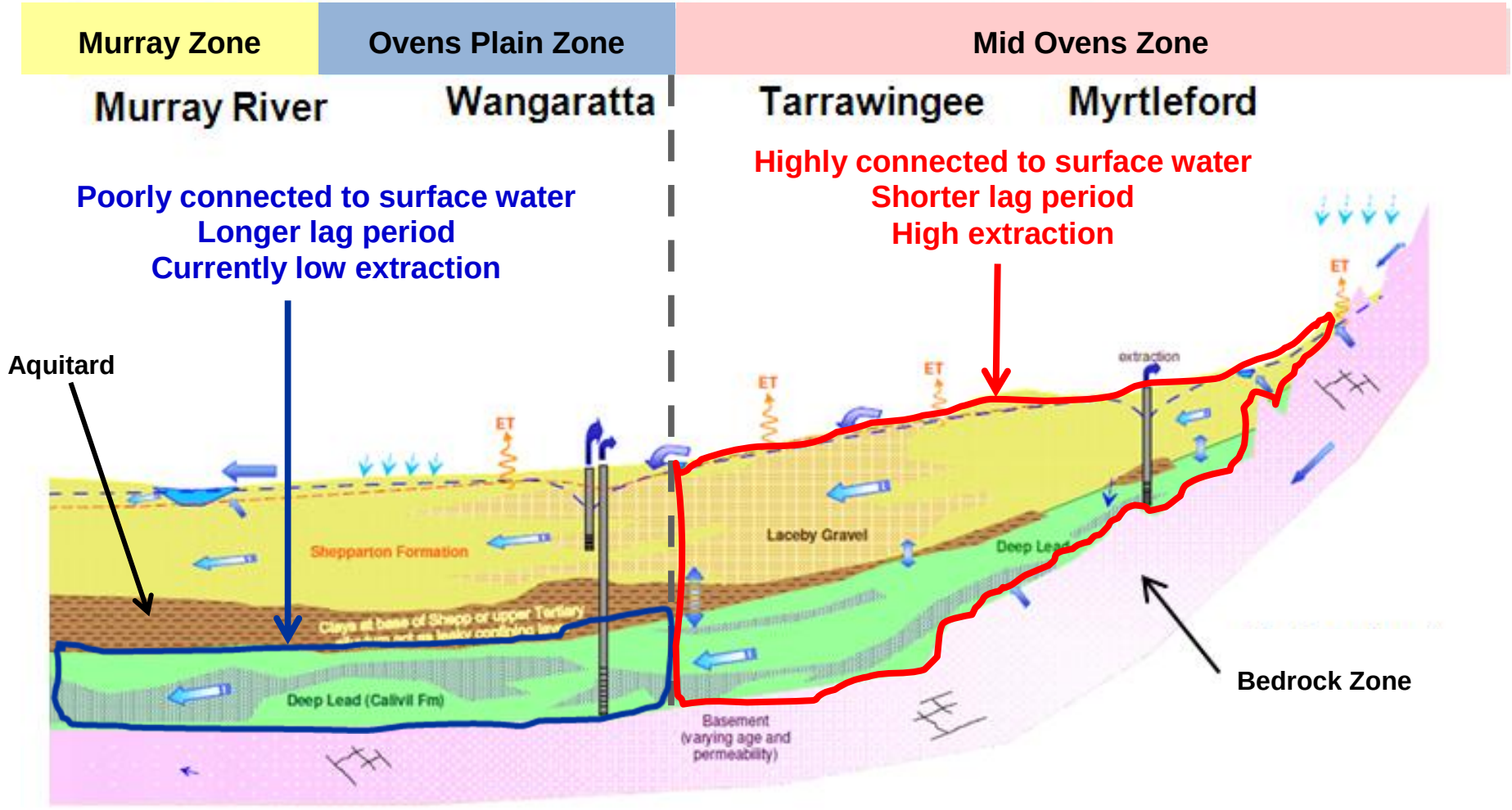



**Figure 2 Conceptual Diagram of the Lower Ovens GMA and Management Zones**

### 2.1.2 Groundwater Flow

Groundwater flow is generally northwards towards the Murray River where it enters the larger regional groundwater flow system of the Murray Basin. River flow in the alluvial filled valleys of the Ovens River and its tributaries is primarily derived from runoff from the bedrock hills and from stream baseflow (groundwater discharge) from the alluvial aquifers. River flow is also regulated by releases from Lake Buffalo and Lake William Hovell, although these storages are relatively small and releases have a relatively minor bearing on the surface water flows except during dry periods.

Generally, more recharge occurs to aquifers in the upper catchment and mid Ovens areas between Bright and Tarrawingee (due to higher rainfall) than to the north near Peechelba and the Murray River. There is higher connectivity between groundwater and surface water due to the narrow alluvial filled valleys in the highland catchments and the lack of a well developed clay aquitard layer separating shallow and deep aquifers in the mid Ovens. Due to this close connectivity, the lag period between increase or declines in surface water flows and observed shallow groundwater levels are relatively short; in order of weeks to months.

The Calivil Formation north of Wangaratta is poorly connected to shallow aquifers and surface water due to the development of the semi-confining layer (aquitard) at the base of the Shepparton Formation. Due to this poor connectivity, the lag period between changes observed in deep groundwater levels and potential changes in shallow groundwater or surface water resources is long, in the order of many months to years. The nature of the hydrogeological system is further explained in Section 3.2 and described in greater detail the *Technical Summary Report* (Goulburn-Murray Water 2012).

## 2.2 Consumptive use

There are two key types of consumptive groundwater use in the Lower Ovens GMA. The first is use for purposes such as irrigation, urban supply, commercial or industrial uses. These uses require a licence under section 51 of the Act. The second is use for domestic and stock (D&S) purposes which is statutory right described in section 8 of the Act (i.e. a licence is not required to take water for D&S purposes).

### 2.2.1 Volume of licence entitlement

There are currently 353 bores (271 groundwater licences) authorised to extract a total of 20,304 ML per year from the Lower Ovens GMA. The total volume of licence entitlement in the GMA makes up approximately 5% of average annual groundwater recharge (431,000 ML per year)[2].

### 2.2.2 Distribution of bores use for licensed purposes

The distribution of bores subject to a groundwater licence (s51 licence) is shown in Figure 1. Approximately 76% of groundwater entitlement in the Lower Ovens GMA comes from the Shepparton Formation (Table 1). Of the 353 groundwater licensed extraction bores in the Lower Ovens GMA, 248 bores are located south of Wangaratta and extract from the Shepparton Formation, where shallow and deep aquifers are not well separated, and where groundwater and surface water connectivity tends to be stronger. This is discussed further in Section 3.1 and 3.2.

[2] Ovens Valley Water Resource Appraisal (Stage B)

**Table 1: Bore distribution by aquifer type**

| Aquifer | No. of Licensed Bores | Total Licence Volume (ML/year) | Percentage of Total Licence Volume |
|---|---|---|---|
| Shepparton Formation | 285 | 15,440 | 76% |
| Deep Lead | 17 | 3,366 | 17% |
| Bedrock | 51 | 1,498 | 7% |
| TOTALS | 353 | 20,304 | 100% |

### 2.2.3 Metered Use

Groundwater use varies from season to season, and higher groundwater use tends to correlate with lower rainfall years. Generally, actual groundwater use accounts for approximately 20 – 30 % of the total licence volume. This indicates a significant volume of groundwater can be utilised or transferred for future development.

Meters were installed between 2007 and 2009 on all licensed operational groundwater bores with a licence entitlement equal to or greater than 20 ML per year. Metered data and groundwater use estimates will continue to improve in the future and will provide valuable information to allow for informed management decisions.

### 2.2.4 Domestic and Stock Use

Domestic and stock bores, in the Lower Ovens GMA, are largely found in the shallow alluvial aquifers of the Shepparton Formation and Laceby Gravels. There are approximately 1,883 bores used for D&S purposes in the Lower Ovens GMA (based on DSE Victorian Water Accounts data from 2009-10). However, the accuracy of this figure is unknown as the operating status of D&S bores is not monitored and there are likely to be a number of unregistered domestic and stock bores. As D&S access to groundwater is a statutory right (private right) under section 8 of the Act, new bores may be developed for this purpose. A licence is however required to construct a new D&S bore (section 67 of the Act). G-MW registers new bores that are drilled for D&S use, and encourages registration of any currently unregistered bores.

## 2.3 Environmental Considerations

### 2.3.1 Groundwater Interaction with Surface Water

Within the Ovens Valley the interaction between groundwater and surface water resources occurs over a short time period (days to weeks to months). Upstream of Myrtleford, in the adjacent Upper Ovens Water Supply Protection Area (WSPA), where the interaction between groundwater and surface water occurs over days to weeks, a statutory water management plan addresses this high connectivity through conjunctive surface water and groundwater management arrangements.

Unlike the Upper Ovens WSPA, the Lower Ovens LMP does not have conjunctive surface water and groundwater management arrangements but the Plan does take into account the connectivity between the two resources. Technical work, summarised in the *Technical Summary Report* (2012), showed that integrated management for the Lower Ovens GMA was not the most efficient management option for protecting

environmental assets as the impact from extraction from the Shepparton Formation during dry periods on the surface water features was shown to be minimal.

### 2.3.2 Social and Environmental Values of Water in the Lower Ovens GMA

There are many ecosystems throughout the Lower Ovens GMA that rely on access to groundwater and surface water to maintain health and ecological function. Those ecosystems that require access to groundwater are known as Groundwater Dependent Ecosystems or GDEs. GDEs within the Lower Ovens GMA include the Ovens River itself and many of its tributaries, numerous swamps and wetlands and some terrestrial vegetation.

GDEs provide many ecosystem services including;

- water quality protection;
- habitats for fish and wildlife, including breeding sites for waterbirds;
- natural floodwater storage and;
- reducing the impacts of erosion from surface water flows.

Healthy ecosystems also have a high social value. The Lower Ovens River and its tributaries are culturally important and support a wide range of recreational activities including; camping, fishing, swimming and motor boating.

### 2.3.3 Consideration of Environmental Values

One of the key objectives of the LMP is to use management rules to manage the potential for groundwater extraction to adversely impact environmental assets; such as river flows and GDEs.

This Plan considers environmental assets in several different ways by:

- Placing a cap on the amount of licence entitlement accessing groundwater in the Deep Lead and Shepparton Formation aquifers in the Mid Ovens Zone, which are known to have connection to the Ovens River and its tributaries;
- Creating a 2 km buffer zone adjacent to the Ovens River, in the Ovens Plain Zone and the Murray Zone, which will cap the amount of licence entitlement able to access groundwater in the Shepparton Formation in these zones (and where a high connection with the Ovens River is known to exist);
- Allowing development of the Deep Lead aquifer in the Ovens Plain Zone, which is known to have a significantly reduced impact on surface water flows when compared with a similar volume extracted from the Shepparton Formation.

In addition, potential risks to ecosystems use and function must be considered at a local scale as part of individual groundwater licence assessments in accordance with section 53 of the *Water Act 1989*.

### 2.3.4 Groundwater Salinity

While the quality of the groundwater in the Ovens Valley is typically fresh, salinity increases on the eastern and western fringes of the Ovens Basin. If the development of groundwater resources in the Ovens Plain Zone increases there is some potential for the migration of poorer quality water from the shallow Shepparton Formation (which is typically more saline in the fringes) to the Deep Lead. As the risk of significant salinity changes is considered low, no specific management actions are required. But G-MW will monitor the salinity through current monitoring programs and projects which will be reviewed as needed.

# 3 Groundwater Management

## 3.1 Licence Entitlement

In an effort to protect existing authorised groundwater users, preserve the integrity of regional aquifers and address uncertainties associated with the understanding of the groundwater resources, licence entitlement for the GMA was capped through the declaration of the Permissible Consumptive Volume (PCV) in 2011 (Victorian Government Gazette G28). The PCV is currently set at 25,200 ML/a.

The PCV does not account for domestic and stock use and G-MW may seek to amend the PCV to overcome any administrative oversight, error or other anomaly which occurred prior to the approval of this management plan.

When assessing groundwater licence applications, G-MW is required to make sure that particular matters, including the PCV, are considered in accordance with section 53 of the *Water Act 1989*. In addition, G-MW will take a precautionary approach to its consideration of new groundwater licence applications to protect the resources and have particular regard for:

a) any future obligations and requirements set by the Murray-Darling Basin Plan;

b) contemporary Victorian Government policy relating to the revision of groundwater management unit boundaries, determination of resource capacity and changes to caps on licence entitlement;

c) contemporary Victorian Government policy on the preferred method of allocating any new licence entitlement.

New groundwater development may occur through the transfer of existing groundwater licence entitlement.

**Rule 1: Cap on licence entitlement**

Goulburn-Murray Water may only issue groundwater licence entitlement if in doing so it:

(i) Does not exceed the Permissible Consumptive Volume established for the Lower Ovens Groundwater Management Area (Plan LEGL/06-494)

(ii) Is satisfied that all relevant matters have been considered in accordance with section 53 of the *Water Act 1989*

(iii) Has regard for relevant Victorian Government policies on the preferred method of allocating new licence entitlement

## 3.2 Groundwater Management Zones

The groundwater management zones, illustrated in Figure 1, are based on the hydrogeological features of the Ovens valley groundwater system. The management zones have been established taking into account risks based on increases or changes to groundwater development. The risk framework is based around the density of existing groundwater users (see Figure 1) and the connectivity between aquifers and surface water flows. A conceptual cross-section of the hydrogeology of the Ovens Valley and hydrogeological basis for the management zones is shown in Figure 2 (page 5).

### 3.2.1 Mid Ovens Zone

The Mid Ovens Zone comprises the narrow alluvial valleys of the upland catchments in the King and Buffalo catchment and extend to the north near Wangaratta. This zone typically lacks significant confining sequences and groundwater is well connected between the alluvial aquifers and also with surface water flows. The Mid Ovens Zone contains 190 licensed groundwater extraction bores which comprise 58% of the licensed groundwater entitlement of the Lower Ovens GMA.

### 3.2.2 Ovens Plain Zone

The Ovens Plain Zone includes the area where a confining (~ 30 m thick) clay layer or aquitard limits groundwater flow between the shallow alluvial Shepparton Formation aquifer to the Deep Lead aquifer. Groundwater levels in the confined system may differ significantly from levels in the shallow system due to the limited connectivity between the shallow and deep aquifers. Furthermore, modelling suggests that groundwater from the Deep Lead aquifer has a “lag period” in terms of its connection with the overlying Shepparton Formation. This means that pumping from the Deep Lead aquifer is unlikely to induce leakage from rivers though the overlying Shepparton Formation within the same irrigation season.

Groundwater entitlement in the Deep Lead aquifer within this zone makes up just 4% of the total licence entitlement volume in the Lower Ovens GMA. Currently it is relatively underdeveloped and there is opportunity for increased development from this aquifer. Conceptual (Figure 2) and numerical modelling has shown that groundwater extraction from the Deep Lead aquifer has a significantly reduced risk of contributing to depletion of surface water flows or compromising groundwater dependent ecosystems during the same irrigation season. Transferring entitlement to, and increasing extraction from, the Deep Lead aquifer therefore provides an opportunity to mitigate adverse effects of surface water flow depletion by reducing groundwater extraction from the adjacent Shepparton Formation. Connectivity between the Shepparton Formation and the Ovens River is highest within 2 km of the river. Recognising the potential impacts extraction can have on the river and environment, licence entitlement within the Shepparton Formation has been capped at current entitlement within a 2km buffer zone (Table 4).

### 3.2.3 Murray Zone

The area north of Peechelba to the Murray River is the Murray Zone. This zone contains 19 licensed groundwater extraction bores and about 19% of groundwater licence entitlement in the Lower Ovens GMA. Within this zone the Deep Lead aquifer is typically confined and extends into NSW. G-MW and NSW groundwater resource managers have recognised the need to consider the impacts of groundwater extraction on the Murray River and groundwater flow through to NSW from this zone. The interactions between different aquifers and surface water within this zone are not fully understood so a precautionary approach has been taken regarding groundwater

development and management within the zone. Taking these issues into consideration the zone has been created by placing a 5km buffer along the Murray River. Due to the presence of high value environmental assets the Shepparton Formation within 2km of the Ovens River, the Murray Zone has been capped at current licence entitlement to ensure that there will be no increased impact on these ecosystems.

### 3.2.4 Bedrock Zone

The Bedrock Zone includes all fractured bedrock aquifers in the Lower Ovens GMA. Groundwater can be transferred to the bedrock aquifer from all other management zones within the Lower Ovens GMA. Groundwater within the fractured bedrock aquifer is typically low yielding, but is an important resource for many licence holders as this is often the only source of water in upland areas. It is considered a low risk that extraction from the bedrock will adversely impact on surface water flows or the environment, with local impacts requiring assessment for individual licence transfers.

**Table 2: Distribution of Licence Entitlement in Management Zones as of July 2012**

| Management Zone | Number of Licences | Total Licence Volume (ML/yr) | % of Total Licence |
|---|---|---|---|
| **Mid Ovens** | 192 | 11,860 | 58% |
| **Ovens Plain**<br>*Shepparton Formation within 2 km of Ovens River* | 12<br>*7* | 1,110<br>*1,940* | 5%<br>*10%* |
| **Murray**<br>*Shepparton Formation within 2 km of Ovens River* | 18<br>*1* | 3,764<br>*132* | 19 %<br>*1 %* |
| **Bedrock** | 41 | 1,498 | 7 % |

## 3.3 Licence Transfers

Licence transfer rules have been developed to:

- increase flexibility for licensed groundwater users to manage production in response to seasonal or climatic conditions;
- improve groundwater management through redistribution of licence entitlement from areas with higher ecological risk and connectivity to surface water flows, to areas with lower ecological risk and lower connectivity;
- allow licensed groundwater holders to realise the value of their licence if they choose not to use it.

As discussed the Lower Ovens GMA has been divided into four management zones (refer to section 3.2):

1. Mid Ovens Zone
2. Ovens Plain Zone
3. Murray Zone
4. Bedrock Zone

Temporary and permanent transfer of groundwater entitlement is permitted within and between zones subject to conditions that protect the integrity of the aquifer, consider environmental values and minimise the potential for unacceptable impacts on existing groundwater users. Within the Mid Ovens and Murray zones, no transfers can take place into these zones except through back trade; so as to limit impacts of existing use in the zones. Transfers are permitted into the Bedrock and Ovens Plain zones (see Table 3 below).

**Table 3. Description of the permitted trades**

| Management Zone | Aquifer | Trade From | Trade To |
|---|---|---|---|
| **Mid Ovens** | Deep Lead & Shepparton Formation* | Mid Ovens – Deep Lead & Shepparton Formation | Mid Ovens – Deep Lead & Shepparton Formation<br>Ovens Plain – Deep Lead<br>Bedrock |
| **Ovens Plain** | Deep Lead & Shepparton Formation | All zones and aquifers | Bedrock |
| | *Shepparton Fm within 2 km of Ovens River** | *Ovens Plain - Shepparton Fm within 2 km of Ovens River* | *Ovens Plain - Shepparton Fm within 2 km of Ovens River*<br>Ovens Plain – Deep Lead<br>Bedrock |
| **Murray** | Deep Lead & Shepparton Formation* | Murray - Deep Lead & Shepparton | Murray - Deep Lead & Shepparton<br>Ovens Plain – Deep Lead<br>Bedrock |
| | *Shepparton Fm within 2 km of Ovens River** | *Murray - Shepparton Fm within 2 km of Ovens River* | *Murray - Shepparton Fm within 2 km of Ovens River*<br>Ovens Plain – Deep Lead<br>Bedrock |
| **Bedrock** | Fractured bedrock | All zones and aquifers | Bedrock<br>Ovens Plain – Deep Lead |

* Can trade to and from zones via back trade if cap is not exceeded and section 53 matters are satisfied.

A buffer distance has been applied to zone boundaries (excluding Bedrock Zone) to provide an opportunity for licence holders with bores situated near these boundaries to temporarily transfer licence entitlement to neighbouring properties. This buffer rule will enable groundwater licence entitlement to be temporarily transferred between bores within 2 km of each other across zone boundaries, provided that relevant matters under section 53 of the Act are taken into account.

Licence holders applying to transfer groundwater licence entitlement must have received written approval from G-MW before groundwater is extracted.

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

1. Goulburn-Murray Water may approve a transfer of groundwater licence entitlement under section 62 of the Act provided that relevant matters under section 53 of the Act have been considered and that the following conditions are satisfied:

   (a) The transfer of licence entitlement occurs between groundwater licence holders located within the Lower Ovens GMA; and,

   (b) The buyer has a bore with a metered diversion point; and,

   (c) The approval of a transfer must not cause the sum of total licence entitlement to exceed any cap which applies to a management zone as shown below in Table 4.

**Table 4. Maximum licence volumes permitted**

| Management Zone | Aquifer | Maximum licence volume permitted, ML |
|---|---|---|
| Mid Ovens | Deep Lead & Shepparton Formation | 11,893 |
| Ovens Plain | Deep Lead & Shepparton Formation | N/A* |
| | *Shepparton Fm within 2 km of Ovens River* | *1,940* |
| Murray | Deep Lead & Shepparton Formation | 3,764 |
| | *Shepparton Fm within 2 km of Ovens River* | *132* |
| Bedrock | Fractured bedrock | N/A* |

* within permissible consumptive volume

2. A temporary transfer of licence entitlement may be permitted between bores up to a maximum of 2km apart, across internal management zone boundaries.

## 3.4 Managing Groundwater Levels

### 3.4.1 Trigger Levels and Restrictions

Across the Lower Ovens GMA, based on the historic record, groundwater levels in the alluvial aquifers tend to show small seasonal fluctuations and a general decline of about 2 to 4 m. There were slightly declining trends during years 2000 to 2009, which can be attributed to the impact of reduced rainfall recharge during the prolonged drought, rather than a decline being caused by groundwater extraction. Groundwater levels in all aquifers, including the fractured bedrock, are observed to be recovering due to the higher recharge due to rainfall and floods experienced during the past two years (refer to Figure 4).

Based on the management zone limits set in the LMP and supported by recent technical work, the greatest potential for increased development and usage exists in the Deep Lead aquifer north of Wangaratta (in the Ovens Plain and Murray Zones).

While the current technical understanding would suggest risks are relatively low, increased groundwater utilisation of, and transfer of entitlement to, the Deep Lead aquifer nonetheless increases the risk of:

- localised increases in seasonal drawdown affecting the ability of some existing users to access groundwater;
- induced leakage from shallow aquifers and/or surface water;
- increasing groundwater salinity; and
- reducing groundwater flow to NSW.

As a precautionary measure, restriction trigger levels have been established to manage these potential risks associated with Deep Lead groundwater resource decline. The restriction triggers apply to groundwater users who extract from the Deep Lead aquifer in the Ovens Plain and Murray Zones. Trigger levels which form the basis for seasonal allocations are displayed in Figures 4 and 5.

Two trigger levels have been set to inform seasonal allocations using information gathered from State Observation Bores and analysis of numerical modelling results. A range of factors supported the determination of the trigger levels in the Deep Lead in the Ovens Plain Zone and the Murray Zone including historical maximum drawdowns and maintaining a gradient.

The highest maximum drawdown was recorded in 2009, with a drawdown of over 4m from the maximum recovery level. Although there were no reported issues from users within the Deep Lead during this period, impacts occurring to current and future users and the environment below the trigger levels are unknown, supporting the decision to establish triggers as a precautionary approach. It is reasonable to assume that future use within the Deep Lead will be from new enterprises that will more than likely use their full entitlement, so placing restrictions on entitlement in these zones would reduce the rate of fall within the aquifer.

To provide some flexibility and avoid an overly reactive response to falling groundwater levels due to dry conditions, a rolling average will be applied based on measured groundwater recovery over a 3 year period. Seasonal allocations will therefore be determined by measuring the annual maximum groundwater recovery levels in each of bores 62864 and 50893 from the three previous seasons.

Restrictions will be imposed more promptly should groundwater recovery levels fall at a greater rate than anticipated. Therefore restrictions will also be introduced in both the Ovens Plain and Murray Zones if the fall in measured maximum recovery level over two successive seasons in either bore 62864 or 50893 is greater than 1 metre. This option provides a mechanism to respond quickly to unforeseen decline and increases the likelihood that groundwater level decline can be slowed (and impacts resulting from such a decline lessened).

Hydrogeological studies and modelling undertaken to support the LMP indicates that there is likely to be very little benefit to the management of surface water flows (or environmental assets dependent on shallow groundwater) by placing seasonal restrictions on groundwater extractions in the Shepparton Formation; in either of the Ovens Plain or Murray Zones. For example, modelling shows that impacts on surface water during low flow periods, based on restricting groundwater extraction to 50% of entitlement in the Shepparton Formation, are indistinguishable from a scenario that does not impose any restriction on extraction of shallow groundwater. Further discussion on the merits of groundwater restrictions to manage shallow groundwater impacts on surface water low flows is included in section 3.4.2.

A trigger level and associated seasonal allocation is also not deemed necessary for the Mid Ovens Zone. This is because the trading framework which provides a cap limiting an increase in entitlement into the Mid Ovens Zone negates the need for a groundwater level based trigger. In other words, opportunities for further development in this zone are already restricted. Further to this the potential impacts arising from several management scenarios; particularly in which groundwater extraction increases to the full licence entitlement permitted in each of these management zones, has been tested using a numerical model. Modelling suggests that risks to groundwater resources from increased development to be very low (see further discussion in Section 3.4.2).

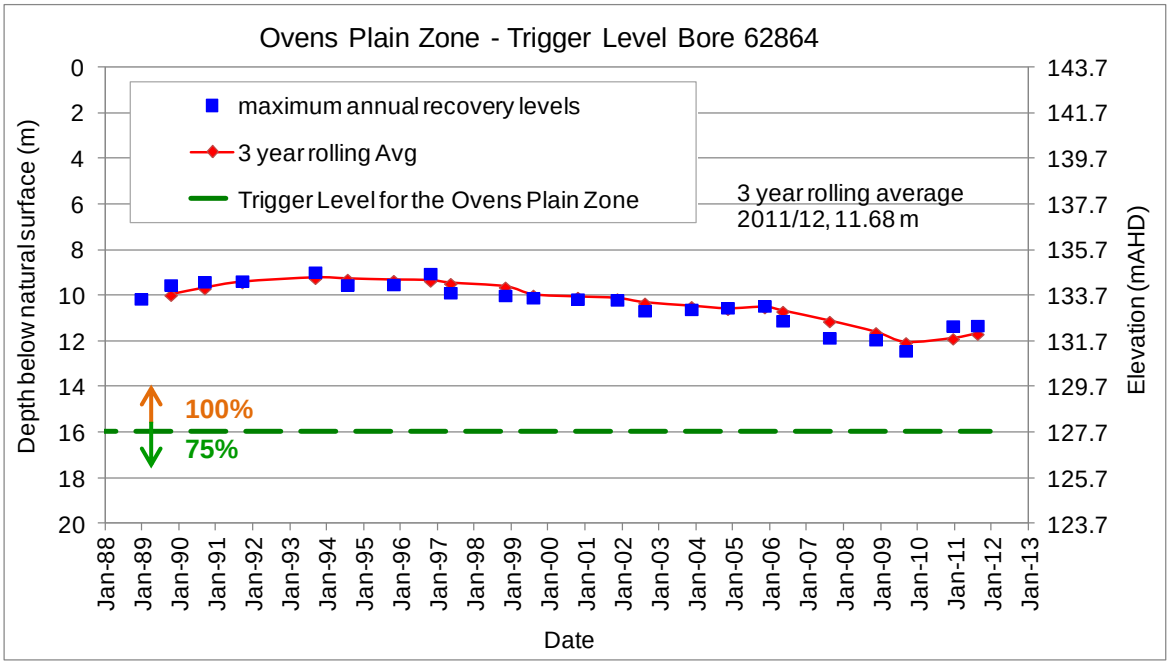



**Figure 3 Trigger Level Bore 62864 - Ovens Plain Zone**

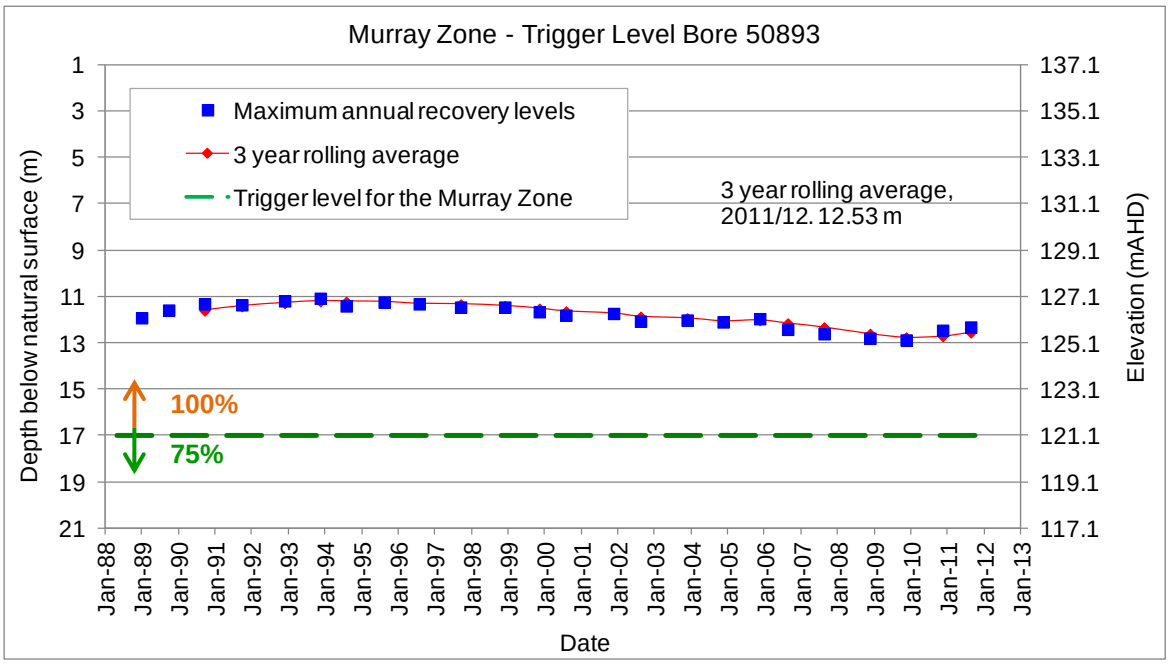



**Figure 4 Trigger Level Bore 50893 - Murray Zone**

**Rule 3: Triggers and Seasonal Allocation for the Deep Lead aquifer of the Lower Ovens & Murray Zones**

(a) By 1 July each year Goulburn-Murray Water will assess the maximum annual recovery level for Bore 62864 and Bore 50893 and declare a water shortage under section 33AAA of the *Water Act 1989* if:

i. The rolling average of the maximum annual groundwater recovery levels recorded at Bore 62864 from the preceding three seasons falls beyond 16m below natural surface; and/or,

ii. The rolling average of the maximum annual groundwater recovery levels recorded at Bore 50893 from the preceding three seasons falls beyond 17m below natural surface; and/or,

iii. The measured maximum groundwater recovery level fall over two successive seasons is greater than 1 metre in either bore 62864 or 50893.

(b) If a water shortage is declared Goulburn-Murray Water will, for the Ovens Plain and/or Murray Zones, announce a 75% seasonal allocation which will apply to licensed groundwater use from the Calivil Formation (Deep Lead) for that season.

(c) A seasonal allocation of 100% of licence entitlement volume will be announced if the assessment described in (a) above does not lead to a water shortage being declared.

(d) Seasonal allocations will be announced by listing them on the Goulburn-Murray Water website. Seasonal allocations will also be listed in an annual newsletter that summarises the annual report for the Lower Ovens GMA.

The trigger levels and seasonal allocations are also summarised below in Tables 3 and 4.

**Table 3. Ovens Plain Zone trigger level:**

| **Bore 62864** | |
|---|---|
| Trigger level (depth below natural surface) | Allocation |
| *16m and above | 100% |
| Below 16m | 75% |

**Table 4. Murray Zone trigger level:**

| **Bore 50893** | |
|---|---|
| Trigger level (depth below natural surface) | Allocation |
| *17m and above | 100% |
| Below 17m | 75% |

*Note that the Murray Zone trigger level is set 1 m below that of the Ovens Plain Zone. This is due to account for the northward flow of groundwater in this catchment relative level change caused by a change in gradient.

### 3.4.2 Assessment of Benefits in Restricting Groundwater for Surface Water Flow

Groundwater levels in the Mid Ovens Zone typically show peaky, seasonal fluctuations. These fluctuations are largely due to interactions between surface water and shallow groundwater. Most of the groundwater extractions from this management zone are from shallow alluvial bores in relatively close proximity to surface water.

The potential benefit to surface water flows by restricting groundwater extractions during critical low-flow periods has been assessed. This approach was not considered appropriate to be incorporated into this LMP, as groundwater extraction during critical low-flow periods has been identified to be sufficiently buffered by aquifer storage rather than depleting river flows during critical low-flow periods. Stream depletion from pumping groundwater during such critical low-flow periods typically is delayed such that it does not occur until wetter months and consequently after the critical low-flow period has passed.

Therefore, limiting groundwater extraction is not considered to be an appropriate management measure to apply with the aim of maintaining stream flow during critical low-flow periods. A more appropriate future drought response management measure may be to encourage surface water diverters (who also use groundwater) to use groundwater rather than surface water during such critical low flow periods. Many surface water users already do this.

## 3.5 Carryover

Carryover enables a licence holder's unused seasonal allocation to be used in a subsequent water season. Carryover can increase security of access and support greater flexibility to manage water use, particularly during times of water shortage.

Carryover can be considered where aquifer storage is large relative to the amount of licence entitlement.

Carryover reduces the need for licence holders to pump unused allocation to storage at the end of the irrigation season. Rather, unused allocation will remain in the aquifer.

To enable the use of carryover the G-MW would need to apply to the Minister for Water under section 62A of the Act to declare availability of carryover in the Lower Ovens GMA.

At this stage the introduction of carryover is currently being considered within the Deep Lead (Calivil Formation) and will be examined by G-MW in detail during the next 12 months, with the potential for introduction in 2013.

# 4 Monitoring

Monitoring, evaluation and reporting are vital elements to enable adaptive and improved resource management to occur. The results of groundwater monitoring and evaluation activities directly shape future management actions and planning.

## 4.1 Groundwater levels

There are over 60 strategically located State Observation Bores in the Lower Ovens GMA that are monitored quarterly to provide important data relating to the availability of and changes to groundwater resources.

Continued monitoring of groundwater levels is required to improve our understanding of how the groundwater system responds to different stresses, such as changing climatic conditions and shifts in the distribution of groundwater extractions resulting from the transfer of groundwater licences. This in turn supports responsible resource management decision making.

Of the strategically located monitoring bores available, 15 have been selected for reporting purposes within the LMP (refer to Figure 6 and Schedule 1). These 15 bores best reflect the groundwater resource availability and distribution and provide valuable data on:

- Groundwater interactions with surface water
- Groundwater dependent ecosystems
- Groundwater quality
- Aquifer interaction
- Resource availability by supporting trigger levels as a basis for setting seasonal allocations

For reference to the monitoring bores refer to Schedule 1.

**Rule 4: Monitor groundwater levels**

Goulburn-Murray Water will obtain groundwater levels from key State Observation Bores in the Lower Ovens Groundwater Management Area as identified in Schedule 1.

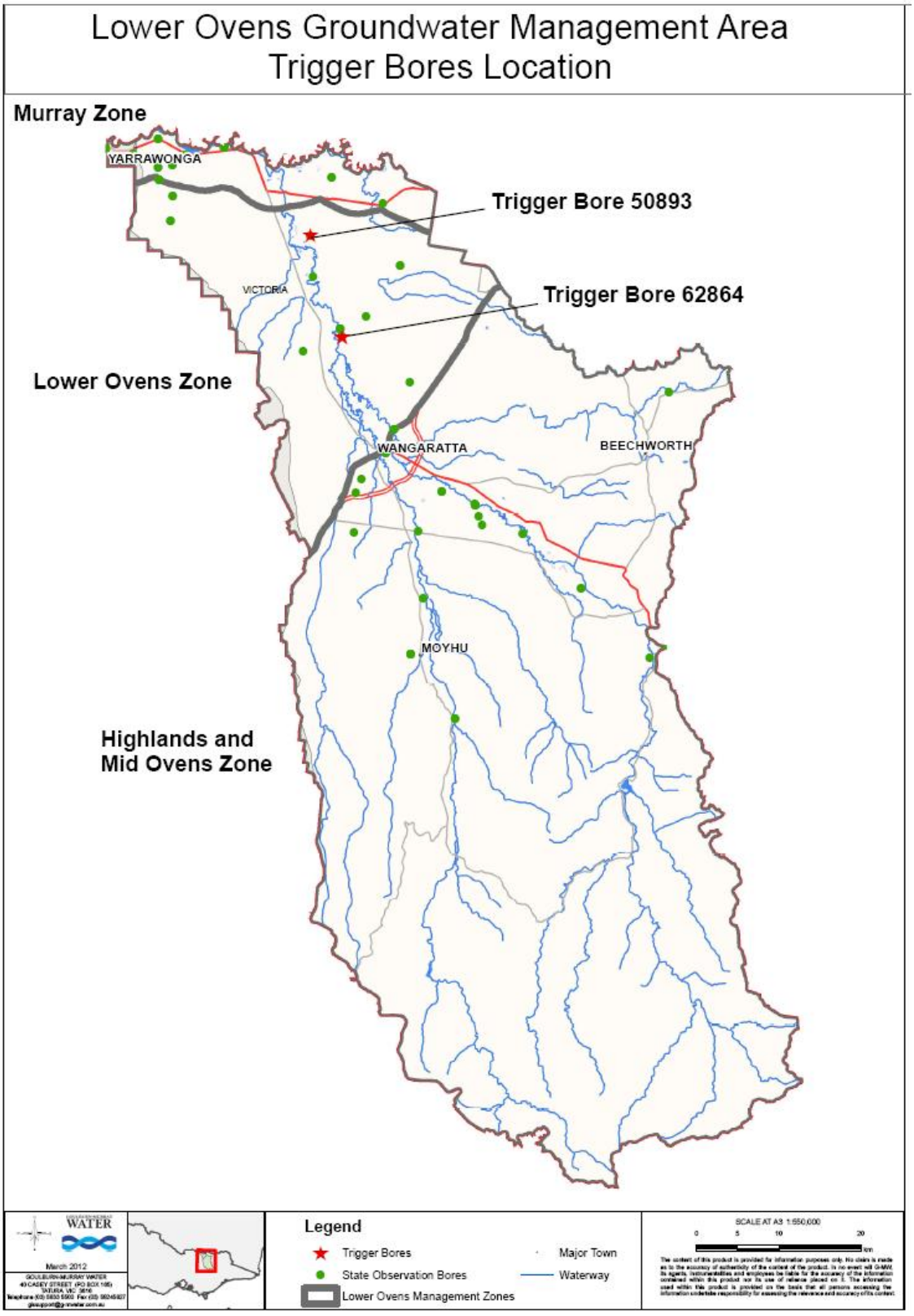



**Figure 5 Lower Ovens GMA Trigger Sites and State Observation Bore Locations**

## 4.2 Meter readings

Recording groundwater usage is critical for resource management. Groundwater usage is an important component of the water budget of the Ovens valley, as it helps to better understand aquifer system response and to highlight any potential risk of adverse impact; such as on surface water resources. All existing licensed and operational bores, with a licensed volume equal to or greater than 20 ML/a (or at G-MW's discretion) are fitted with a flow meter. Any new licensed bore must also be metered.

Meters will be read at least once annually. The information will be stored in the Victorian Water Register database to assist with reporting on usage and compliance as well as assisting in improving groundwater knowledge and management over time.

**Rule 5: Record meter readings**

Goulburn-Murray Water will:

(a) ensure that a flow meter is fitted to all existing licensed operational bores in the Lower Ovens GMA (which are associated with a licence entitlement equal to or greater than 20 ML/a or at G-MW's discretion)

(b) ensure that any new licensed operational bores are fitted with a flow meter

(c) read each meter at least once annually; and

(d) enter into the Victorian Water Register database, all metered groundwater use.

# 5 Reporting

G-MW will prepare an annual report for the Lower Ovens GMA LMP. This report will contain analysis of groundwater entitlement, monitoring data and transfers in each management zone, which will help G-MW to manage groundwater resource more effectively and inform any recommendations for changes to the LMP in the future. The annual report is also an important source of information for customers.

**Rule 6: Annual reporting**

Goulburn-Murray Water will, by 1 October of each year, prepare an annual report to 30 June of that year on the Lower Ovens GMA which will include reporting and analysis of:

(a) groundwater monitoring;

(b) groundwater entitlement per zone, including temporary and permanent transfers;

(c) groundwater use per zone and any metering issues;

(d) announcement of seasonal allocations;

(e) any new technical information or change in policy; and

(f) the need for any changes to the LMP.

# 6 Consultation

Goulburn-Murray Water will provide on its website this LMP, annual reports and other information relating to the management of groundwater resources in the Lower Ovens GMA. This website is accessed from the link shown below:

www.g-mwater.com.au

**Rule 7: Communication**

Goulburn-Murray Water will post on its website in October of each year the Lower Ovens GMA LMP annual report. Upon request the annual report can also be sent to interested licence holders and the general community.

Goulburn-Murray Water will post on its website:

(a) this LMP and supporting reports;

(b) announcement of seasonal allocations; and

(c) the annual report.

Goulburn-Murray Water will display hydrographs for key compliance bores in the Lower Ovens GMA on its website and update these each quarter.

# 7 Review of the LMP

Over time this LMP will need to be adapted in response to policy changes in groundwater resource management, as well as to improved understanding of the aquifer system and appropriate management arrangements.

Each year G-MW will consider the need to make amendments to the LMP.

Any significant changes to the LMP must be based on sound technical understanding of the issues and subject to consultation.

A comprehensive review of the LMP will be undertaken after an implementation period of 5 years to ensure ongoing relevance of the Plan.

**Rule 8: Review of the LMP**

Goulburn-Murray Water will review the LMP and consider the need for any amendments on a yearly basis in conjunction with the release of the annual report.

If amendments are proposed that directly impact rights of access to water, Goulburn-Murray Water will consult groundwater users in the Lower Ovens GMA on the proposed changes to the LMP.

Goulburn-Murray Water may undertake consultation on any proposed amendments via a mail out to licence holders, a public meeting; and through advertisements placed in local newspapers.

The LMP will be comprehensively reviewed after an implementation period of 5 years.

# 8 Recommendations for further work to inform the LMP

There were several recommendations for further work in the Ovens Valley Water Resource Appraisal. This further work would increase resource understanding and potential bring about improvements to the LMP. The recommendations include:

- A consideration of a cap for the Deep Lead north of Wangaratta
- Monitoring water quality in the Deep Lead north of Wangaratta
- Consideration of NSW extractions on the '*Murray Zone'*
- Assessment for groundwater carryover in the Lower Ovens GMA
- A review of the boundary of the Lower Ovens GMA.

The recommendations are being addressed through current and future projects as well as through core business operations of groundwater resource management across G-MW. The recommendations for further work are discussed in more detail and with approximate timelines in the *Technical Summary Report* (2012).

## Schedule 1. Key State Observation Bores

| State Observation Bore | Management Zone | Aquifer |
|---|---|---|
| 50893 | Ovens Plain | Deep Lead |
| 62863 | Ovens Plain | Deep Lead |
| 302296 | Ovens Plain | Deep Lead |
| WRK053382 | Mid Ovens | Bedrock |
| WRK053412 | Ovens Plain | Shepparton |
| WRK053414 | Mid Ovens | Deep Lead |
| WRK053427 | Mid Ovens | Shepparton |
| WRK053428 | Mid Ovens | Shepparton |
| WRK054465 | Mid Ovens | Bedrock |
| WRK054467 | Ovens Plain | Shepparton |
| WRK054468 | Murray | Deep Lead |
| WRK054546 | Ovens Plain | Shepparton |
| WRK054547 | Murray | Shepparton |
| WRK060757 | Ovens Plain | Deep Lead |

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