

West Goulburn Groundwater Management Area Local Management Plan

July 2017

Cover photos taken by J. Richardson and K. Joy: (l-r) cows at Mount Piper; kangaroos at Barmah National Park; Lake Cooper from west shore

All photos in text taken by J. Richardson and K.Joy, except for Figure 23 photograph of Costerfield mine site – provided by Mandalay Resources Pty Ltd.

Goulburn-Murray Water

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Quick reference guide to the Plan rules

Rule 1 Groundwater level trigger *(page 21)*

If average groundwater level decline equal to or greater than 3.0 m over three years is observed in key State observation bores (54456, 73403, 80757 and 98371), Goulburn-Murray Water may consider the introduction of a cap on entitlement.

Rule 2 Management zone limits *(page 21)*

Goulburn-Murray Water may issue a groundwater licence provided that the following management zone limits are not exceeded:

Management zone	Management zone limit (ML/yr)
Kyabram Zone	1,000
Puckapunyal Zone	2,500
Cornella Zone	500
Corop Lakes Zone	500

Rule 3 Transfer of groundwater entitlement (*page 23)*

Goulburn-Murray Water may approve a transfer of groundwater entitlement under section 62 of the Act provided that relevant matters under the Act have been considered and that it accords with the following:

(a) The approval of a permanent transfer must not cause the management zone limits in Rule 2 to be exceeded.

(b) The buyer has a bore with a metered diversion point.

(c) The seller's licensed bore(s) is/are either metered or not equipped for use.

Rule 4 Record meter readings *(page 26)*

Goulburn-Murray Water will read flow meters on licensed bores at least once annually and record usage in the Victorian Water Register.

Rule 5 Annual newsletter *(page 27)*

By 1 October each year, Goulburn-Murray Water will post on its website a newsletter reporting on groundwater resource status, licensed groundwater use and trade activity for the previous season. The newsletter will also identify the need for any changes to the Plan.

Rule 6 Review of the Plan *(page 27)*

Goulburn-Murray Water will consider the need for any amendments to the Plan on a yearly basis, in conjunction with the release of the annual newsletter.

If amendments are proposed, Goulburn-Murray Water will consult with the Goulburn-Broken Regional Water Services Committee and other stakeholders.

Endorsement

This local management plan (the Plan) has been developed to provide a clear operational framework for managing groundwater resources in the West Goulburn Groundwater Management Area (GMA) and provides specific information to Goulburn-Murray Water's customers about the taking and using of groundwater in this area.

The Plan fulfils Sustainable Water Strategy obligations and relevant Ministerial guidelines by explaining to Goulburn-Murray Water's customers and the broader community the specific management arrangements governing the licensed extraction of groundwater in the West Goulburn GMA.

The development of the Plan has relied on valuable guidance and feedback from Goulburn-Murray Water's customers and key stakeholders.

The Plan aims to provide simple and flexible rules to support groundwater use while recognising the need to protect social, cultural and economic features.

The Plan will require periodic review particularly as the Murray Darling Basin Plan is implemented, as changes to Victoria's groundwater management framework take effect and as information about groundwater resources in the West Goulburn GMA improves.

Goulburn-Murray Water will continue to work with customers, local communities and other stakeholders to ensure that the Plan is reviewed and updated as necessary.

Matthew Pethybridge

MANAGER GROUNDWATER AND STREAMS

Goulburn-Murray Water Rural Water Corporation

Date: 25 July 2017

Cathy Wood

CUSTOMER SERVICES MANAGER – DIVERSIONS CENTRAL

Goulburn-Murray Water Rural Water Corporation

Date: 26 July 2017

Acknowledgements

Goulburn-Murray Water would like to express its appreciation to the Goulburn-Broken Regional Water Service Committee, the Goulburn-Broken Catchment Management Authority the Taungurung Clans Aboriginal Corporation and Goulburn Valley Water for their input to the Plan, and is grateful to groundwater customers who took the time to provide feedback on groundwater resource management values and issues. This feedback has been invaluable in helping to test and refine the information contained in the Plan.

The Plan acknowledges and pays respect to the people of the Taungurung Clans and the Yorta Yorta Nation, as the Traditional Owners of this region. The Plan recognises and acknowledges that the Traditional Owners and their Nations have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters.

Glossary

Term/ Acronym	Description
The Act	Water Act 1989 (Victoria)
Aquifer	A geological structure or formation or an artificial land fill permeated or capable of being permeated permanently or intermittently with water
DBNS	Depth below natural surface
Drawdown	Decline in groundwater level as a result of pumping
GMA	Groundwater Management Area
GMW	Goulburn-Murray Water Rural Water Corporation acting as a delegate of the Victorian Minister for Water
Groundwater	Water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations
Groundwater entitlement	The licensed volume issued under Section 51 of the Act
Groundwater licence	Licence issued to take and use groundwater under section 51 of the Act
km	Kilometre
m	Metre
mg/L	Milligrams per litre; a unit of measure of water salinity
ML	Megalitre (or one million litres)
ML/yr	Megalitres per year
Management zone	A part of a Groundwater Management Area defined for management purposes
Millennium Drought	Severe drought which affected south-east Australia between 1997 and 2009
The Plan	West Goulburn Groundwater Management Area Local Management Plan
Recovery level	Level to which groundwater will recover or rise in a bore
SDL	Sustainable Diversion Limit
Season	Period of 12 months commencing 1 July
SIR	Shepparton Irrigation Region
SOBN	State Observation Bore Network
State	Refers to the state of Victoria
TDS	Total Dissolved Solids; a measure of water salinity
Trade	Trade and transfer are used interchangeable to mean the transfer of licence entitlement from one entity to another

Contents

1 Introduction

1.1 Background

Groundwater in Victoria is managed under the *Water Act 1989* (the Act). The Department of Environment, Land, Water and Planning (DELWP) is responsible for the monitoring and management of groundwater of Victoria. DELWP provides advice to the Minister for Water (the Minister) on groundwater policy and management. More information about groundwater and DELWP's role can be found on the website:

https://www.water.vic.gov.au/groundwater/managing-groundwater

Goulburn-Murray Water (GMW) is responsible for issuing groundwater licences and for managing and administering groundwater use under delegation from the Minister. These responsibilities include developing and implementing local management plans.

This local management plan has been developed to provide groundwater users with clear, cost effective and adaptive rules which facilitate the use of groundwater in the West Goulburn Groundwater Management Area (GMA). The West Goulburn GMA Local Management Plan (the Plan) has been developed by GMW in consultation with groundwater users and relevant stakeholder agencies.

1.2 West Goulburn Groundwater Management Area

The West Goulburn GMA is located in the Goulburn River Catchment in northern Victoria and is part of the Murray Darling Basin. It extends from the Great Dividing Range in the south to the River Murray in the north, incorporating the towns of Kilmore, Broadford, Rushworth, Kyabram and Barmah (Figure 1).

The eastern boundary of the West Goulburn GMA aligns with the boundaries of the Katunga Water Supply Protection Area, the Mid Goulburn GMA, the Strathbogie GMA and the Upper Goulburn GMA. In the west, the West Goulburn GMA abuts the Central Victorian Mineral Springs GMA and the Lower Campaspe Valley Water Supply Protection Area.

The north of the West Goulburn GMA is overlain by the Shepparton Irrigation Region (SIR) GMA. The SIR GMA includes groundwater resources to a maximum depth of 25 m below the ground surface. Where it intersects with the SIR GMA, the West Goulburn GMA covers groundwater resources at depths greater than 25 m below the ground surface.

The Murray Darling Basin Plan (the Basin Plan) defines groundwater Sustainable Diversion Limit (SDL) units and has set caps on groundwater use within these units. The West Goulburn GMA occurs across two SDL units (Figure 2): the Goulburn-Murray Sedimentary Plain SDL unit which predominantly occurs across the north of the West Goulburn GMA and encompasses sedimentary aquifers that comprise sand, gravel, clay and silt; and the Goulburn-Murray Highlands SDL unit which occurs across most of the south of the West Goulburn GMA and comprises fractured rock aquifers.

The Plan applies to groundwater resources to a depth of 200 m below ground surface in the West Goulburn GMA, or 50 m below the base of the Tertiary sediments, in line with the Victorian Groundwater Management Framework (DSE, 2012), as shown in Figure 3.

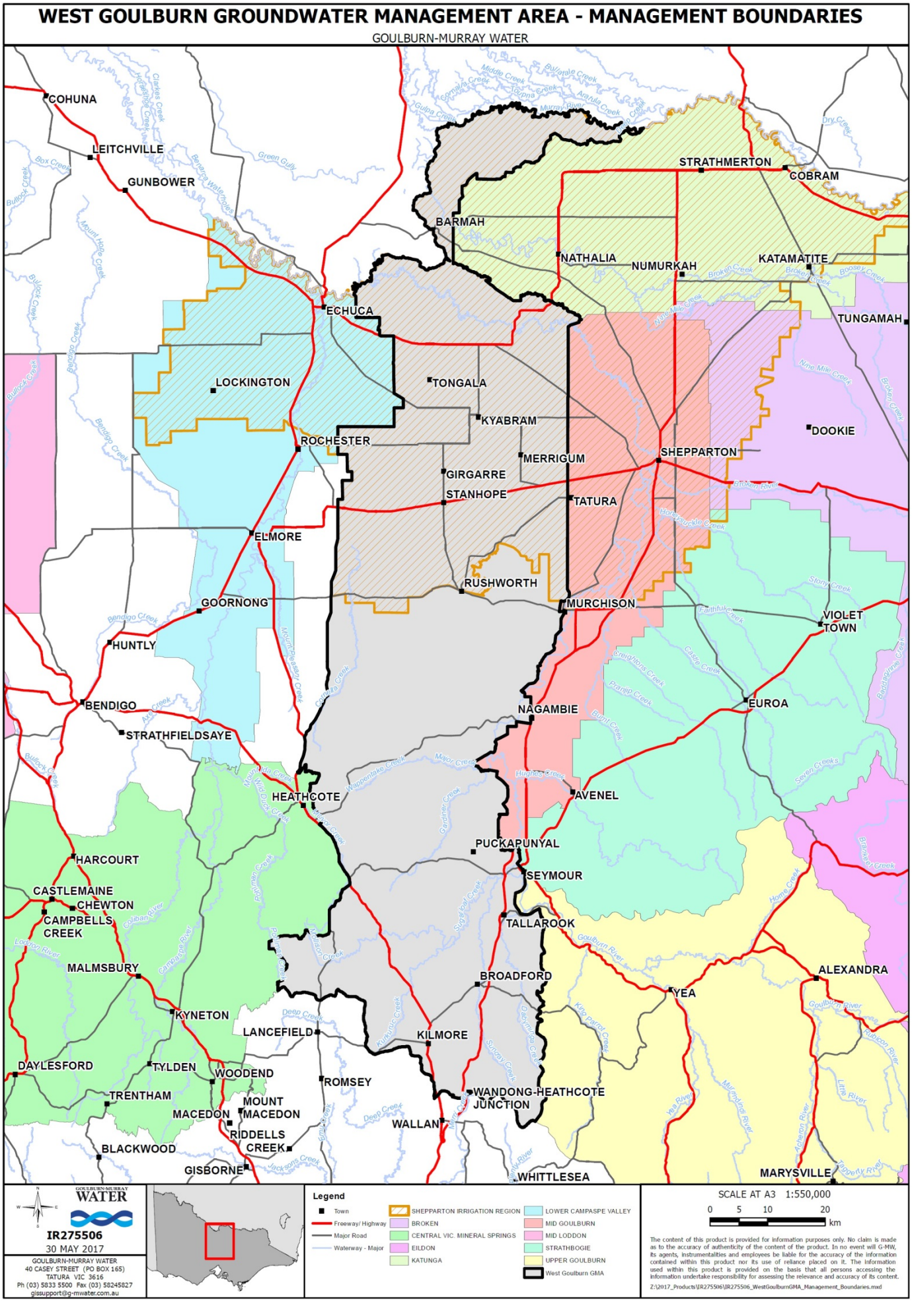

Figure 1 West Goulburn GMA and surrounding Groundwater Management Units

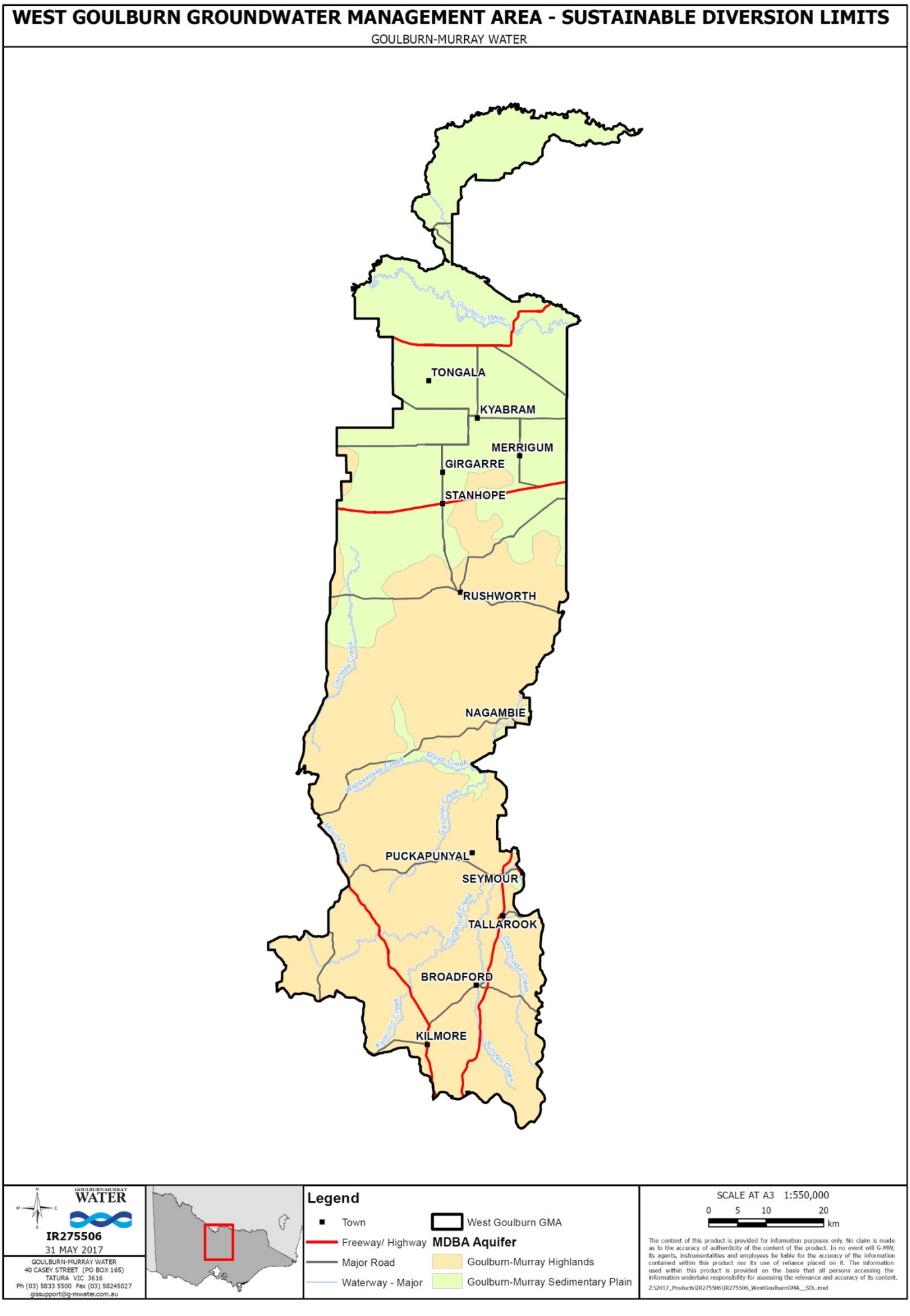

Figure 2 Sustainable Diversion Limit units within the West Goulburn GMA

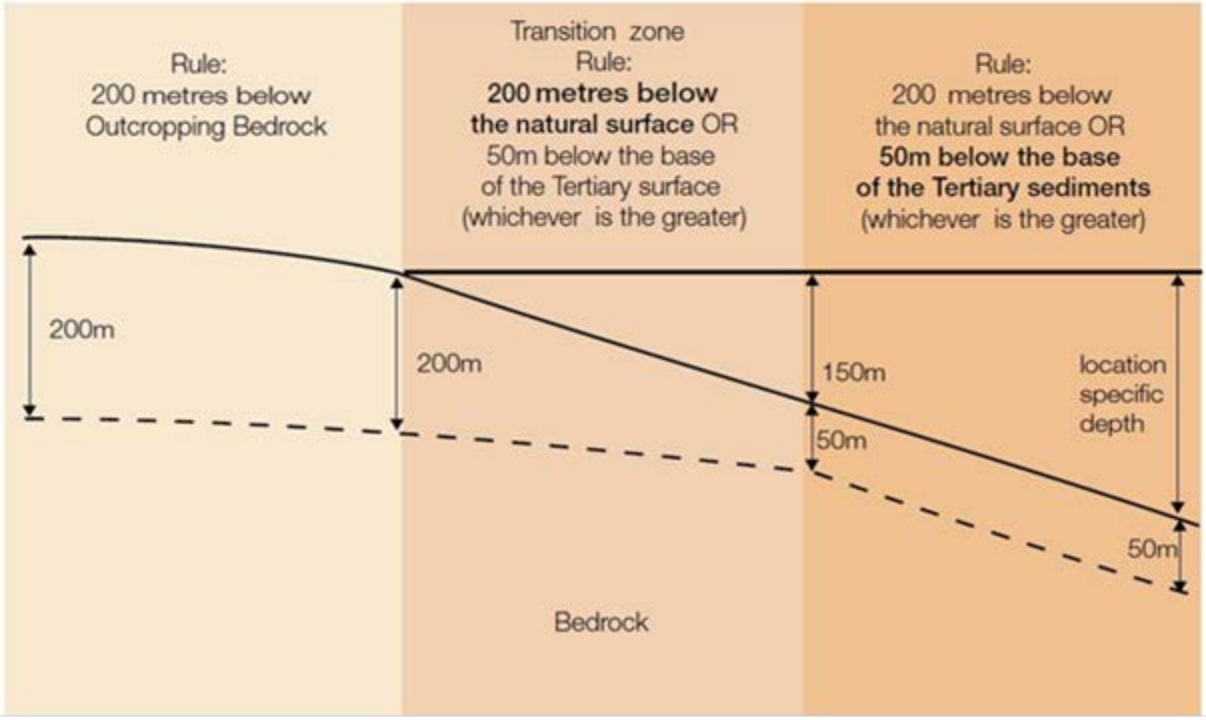

Figure 3 Groundwater management framework depth boundaries (DSE, 2012)

1.3 Plan objectives

The aim of the Plan is to ensure the equitable sharing of available water between licensed water users, to protect the environment and ensure the long-term sustainability of the water resource in the West Goulburn GMA. To meet this aim, the following objectives have been developed:

- Protect social, economic and environmental groundwater dependent values from groundwater extraction through establishing trigger levels on groundwater level decline;
- Improve trading opportunities through introduction of easy to understand trading rules;
- Improve understanding of groundwater management through effective communication with groundwater users and stakeholders; and
- Recognise the value of existing entitlements through cost effective adaptive management.

The performance of the Plan against these objectives will be assessed on an annual basis and summarised in a newsletter that will be provided to all groundwater licence holders in the West Goulburn GMA.

2 Groundwater System

2.1 Surface geology

In the south of the West Goulburn GMA, bedrock (both sedimentary and igneous) occurs at the surface across most of the area (Figure 4). There are alluvial deposits (gravel, silt, sand and clay deposited by waterways) that occur in association with waterways and a small area of basalt from Kilmore to Tallarook.

In the north of the West Goulburn GMA, the Shepparton Formation occurs from the surface across most of the area (Figure 4). There are some areas of lake and lunette deposits associated with wetlands and the Corop Lakes system; and younger alluvial deposits associated with waterways and the Barmah Forest. Where the West Goulburn GMA incorporates the foothills of the Mount Camel Range there are colluvial deposits (gravel, silt, sand and clay deposits from weathering of the mountain range) at the surface (Figure 4).

2.2 Aquifers

There are five aquifers in the West Goulburn GMA:

1. Coonambidgal Formation
2. Shepparton Formation
3. Basalt
4. Deep Lead
5. Bedrock

2.2.1 Coonambidgal Formation

The Coonambidgal Formation (Quaternary Aquifer) is the youngest aquifer in the West Goulburn GMA. It comprises sands, gravels and clay of varying sizes and is associated with waterways.

It is difficult to differentiate this formation from the underlying Shepparton Formation, so its thickness is not defined (GHD, 2010). The Coonambidgal Formation is not widely used for groundwater extraction.

2.2.2 Shepparton Formation

The Shepparton Formation (Upper Tertiary/Quaternary Aquifer), comprising clay, silt and discontinuous sand lenses, is found at the surface across much of the northern half of the West Goulburn GMA (Figure 4). The Shepparton Formation increases in thickness to the north, where it is over 100 m thick. Yields and groundwater salinity can be highly variable. It overlies either the Deep Lead (where present) or bedrock aquifers.

2.2.3 Basalt

There is a narrow flow of basalt (Upper Tertiary/Quaternary Aquifer – Newer Volcanics) extending from Kilmore in the south of the West Goulburn GMA to Tallarook (extent shown on Figure 4 as “volcanic rock”). Basalt occurs at the surface to depths generally less than

10 m DBNS. Groundwater levels are generally deeper than 10 m DBNS so basalt is unlikely to be utilised for water supply in the West Goulburn GMA.

2.2.4 Deep Lead

The Deep Lead, comprised of the Calivil Formation and the Renmark Group, is an ancient river bed consisting of coarse sand and gravel with some clay.

In the West Goulburn GMA, the Deep Lead extends from the Cornella Creek in the south and fans out around Timmering where it merges into the Murray paleo-valley (Figure 5).

The Deep Lead increases in thickness and depth from south to north, occurring from around 30 m DBNS to 50 m DBNS in the south to approximately 50 m DBNS to 110 m DBNS in the north.

The Deep Lead is higher yielding than the overlying Shepparton Formation.

2.2.5 Bedrock

The Bedrock is mostly sedimentary shale, slate and sandstone with some intrusive granites and granodiorites occurring in the south-west and south-east (Figure 4).

The Bedrock is a fractured rock aquifer, with variable yields and salinity and is the main aquifer utilised in the south of the West Goulburn GMA.

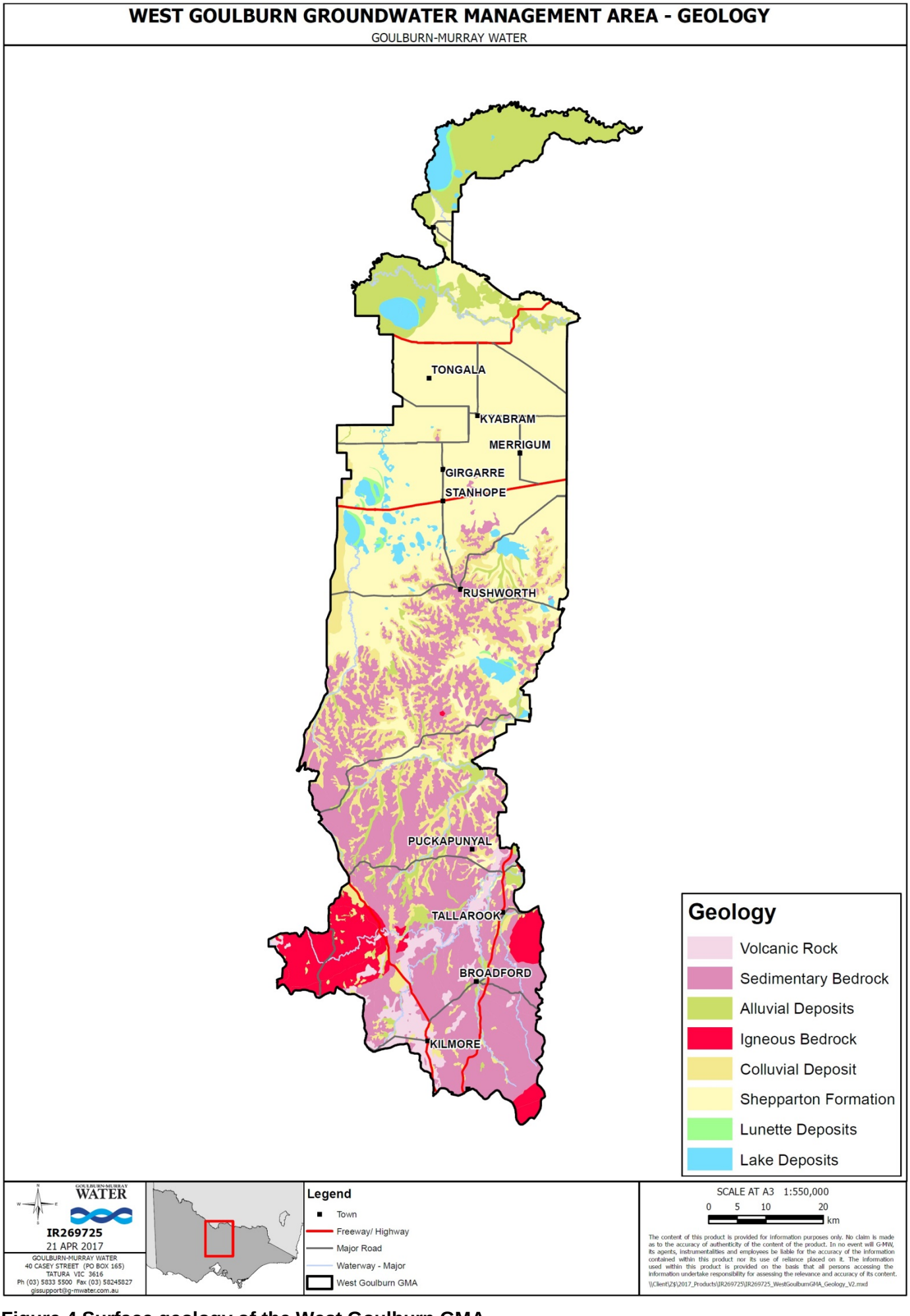

Figure 4 Surface geology of the West Goulburn GMA

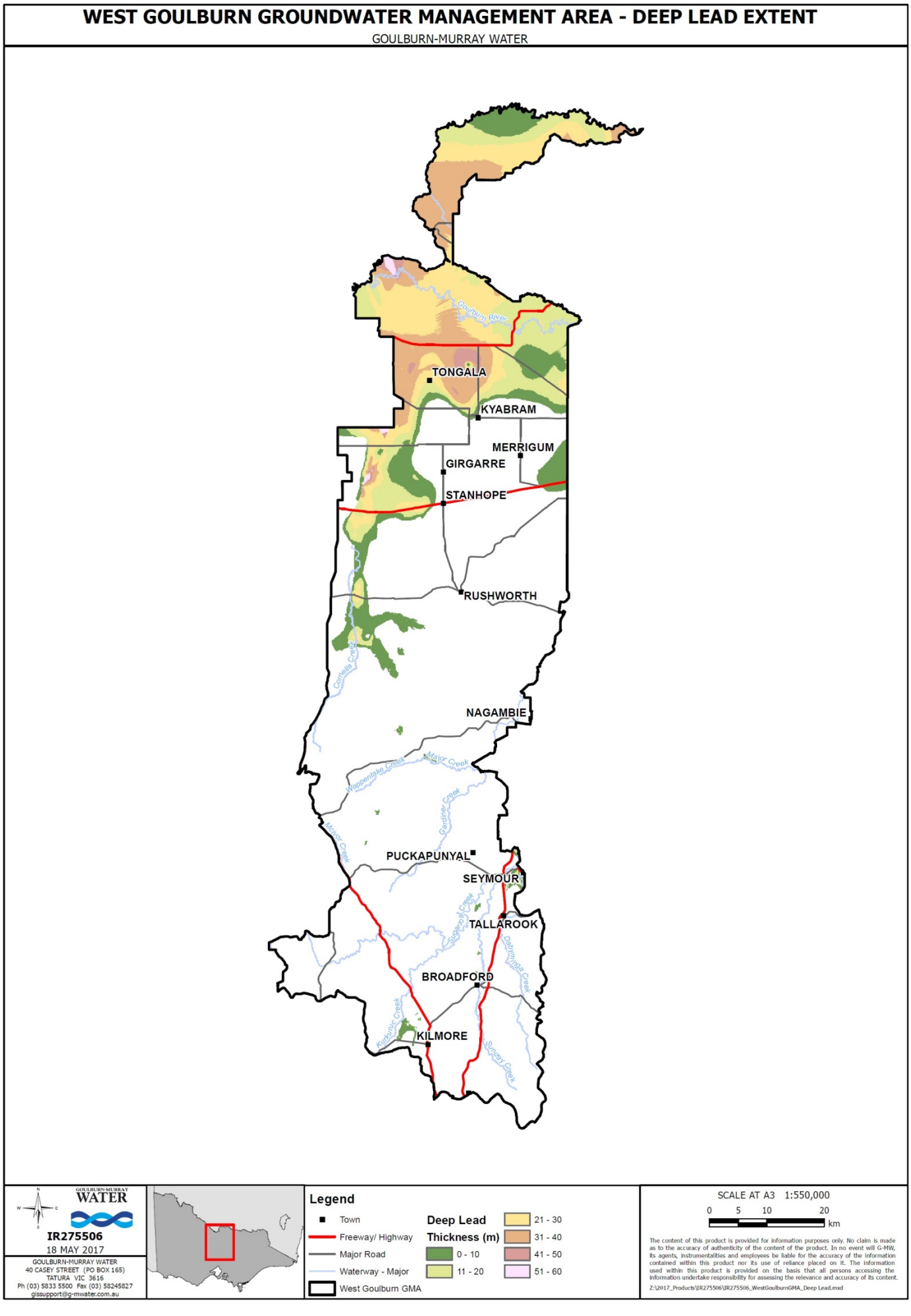

Figure 5 Extent of the Deep Lead in the West Goulburn GMA

2.3 Groundwater recharge, discharge and flow

Groundwater recharge in the West Goulburn GMA occurs through direct infiltration of rainfall in the areas of bedrock outcrop in the south. In the north, recharge occurs through rainfall infiltrating the Shepparton Formation then leaking to underlying aquifers (Tickell & Humphries, 1987).

Groundwater flow generally follows surface water flow, moving from south to north and discharging into the Murray paleo-valley. Groundwater discharge also occurs through groundwater extraction and discharge to waterways and wetlands.

2.4 Groundwater levels

There are 61 State observation bores within the West Goulburn GMA; groundwater levels were monitored in 45 of those during the 2016/17 season.

Groundwater levels in the upper Shepparton Formation are generally within 5 m of the surface. The high water table has led to waterlogging and land salinity issues in the area.

Greater seasonal fluctuation is observed in the upper Shepparton Formation groundwater levels, which is likely to be caused by rainfall, irrigation, evapotranspiration and groundwater pumping (Figure 6, Figure 7).

Over the Millennium Drought (severe drought which affected south-east Australia between 1997 and 2009), groundwater levels declined in response to less rainfall and irrigation recharge.

Groundwater levels in the Deep Lead generally show declining trends (Figure 8, Figure **9**) in the West Goulburn GMA; declining by around 10 m over the Millennium Drought at Wyuna (Figure 8).

At Tatura, groundwater levels recorded in the Bedrock and Shepparton Formation aquifers show a high level of interaction (Figure 7).

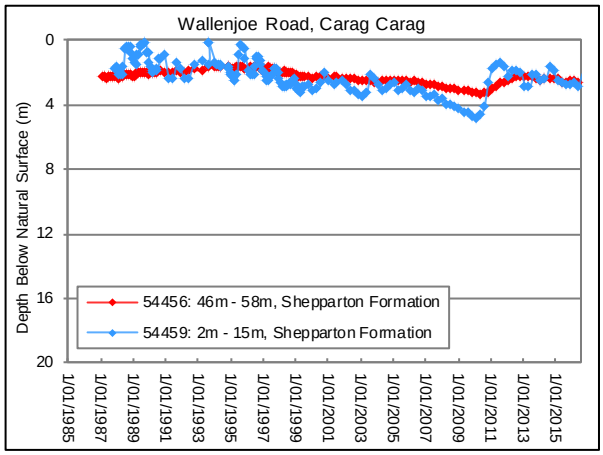

Figure 6 Groundwater levels at Wallenjoe Road, Carag Carag

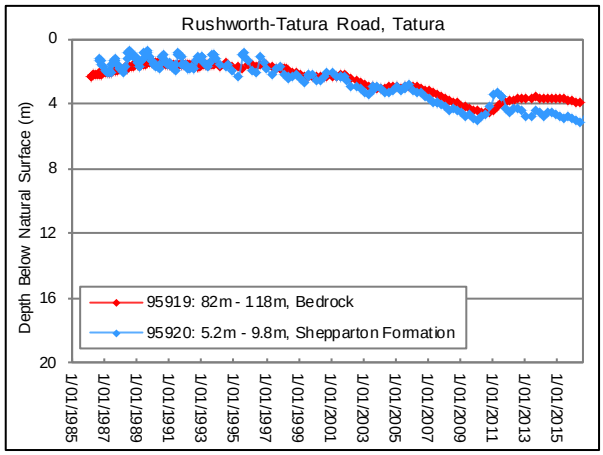

Figure 7 Groundwater levels at Rushworth-Tatura Road, Tatura

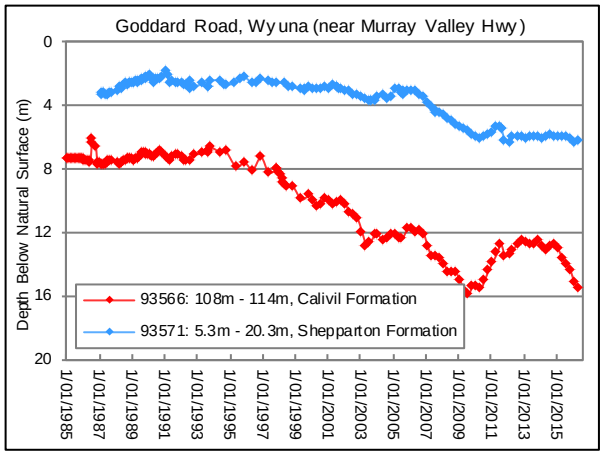

Figure 8 Groundwater levels at Goddard Road, Wyuna

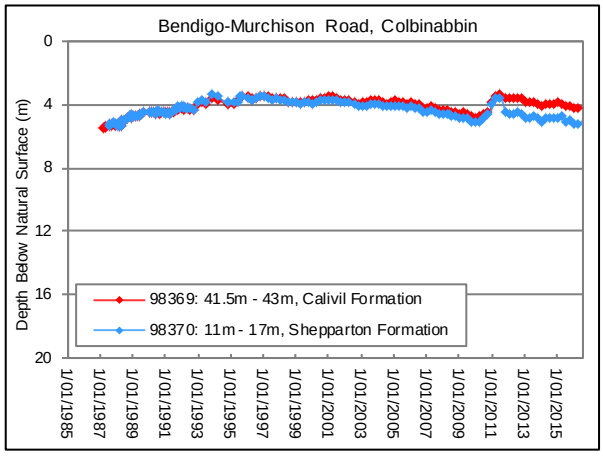

Figure 9 Groundwater levels at Bendigo-Murchison Road, Colbinabbin

2.5 Groundwater salinity

Groundwater salinity is generally between 1,000 and 3,500 mg/L TDS in the Bedrock aquifer in the south and in the upper Shepparton Formation near the lower Goulburn River in the north (GHD, 2010) (Figure 10).

Around Rushworth, salinity increases in these aquifers; ranging from 3,500 mg/L TDS to more than 13,000 mg/L TDS. In the north, aligning with the Barmah National Park, groundwater salinity in the upper Shepparton Formation is considerably lower, generally less than 500 mg/L TDS, probably due to flooding of the forest.

The Deep Lead is generally saline in the West Goulburn GMA. In the southern extent of the Deep Lead, around Corop, salinity is high (greater than 13,000 mg/L TDS) due to subsurface drainage conditions (GHD, 2010). Along the lower Goulburn River, salinity in the Deep Lead ranges from 3,500 to 13,000 mg/L TDS. Less salty groundwater occurs in the Deep Lead north of Nathalia (GHD, 2010) (Figure 11).

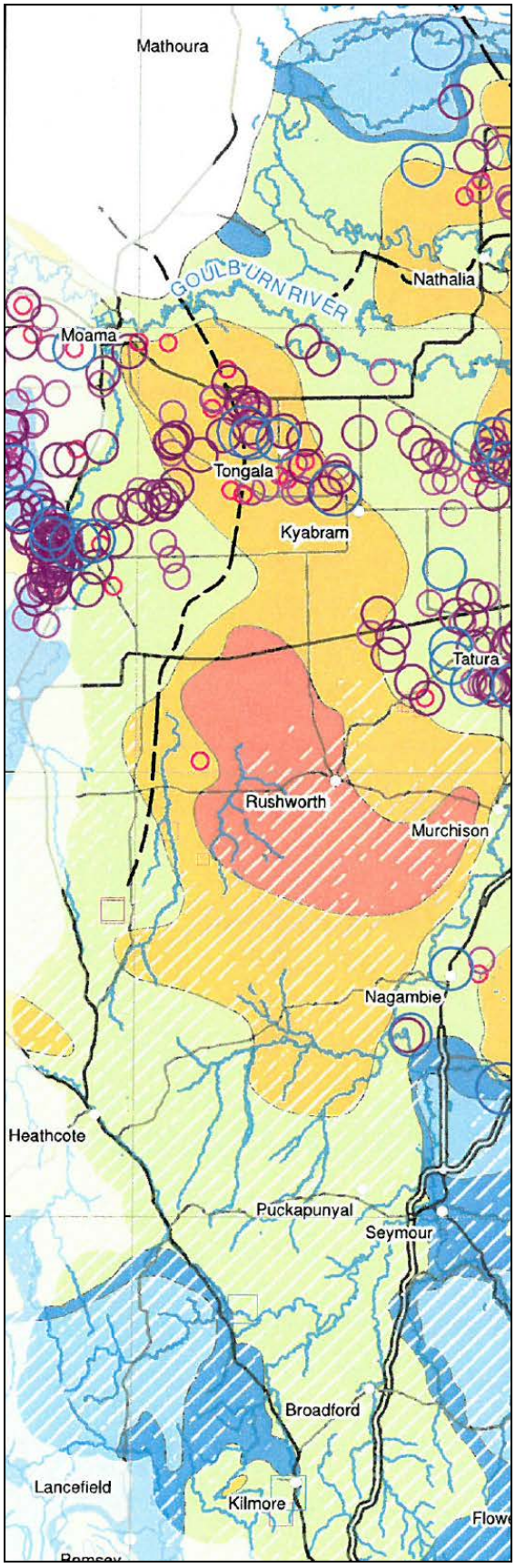

Figure 10 Groundwater salinity in the Shepparton Formation and Bedrock aquifers (taken from GHD, 2010; Figure 20)

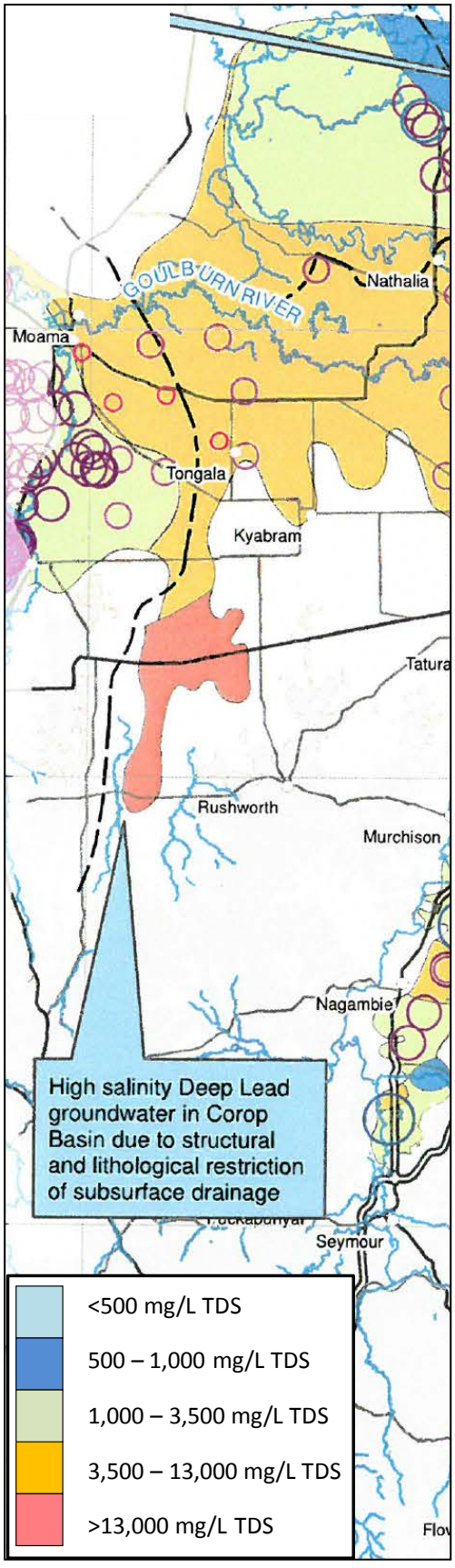

Figure 11 Groundwater salinity in the Deep Lead (Calivil Formation) aquifer (taken from GHD, 2010; Figure 20)

2.6 Management zones

Based on the characteristics of the groundwater system, existing administrative boundaries and surface water boundaries, four management zones (Figure 12) have been established:

- Puckapunyal Zone;
- Kyabram Zone;
- Cornella Zone; and
- Corop Lakes Zone.

Management zones enable reporting on groundwater use and trading activities to meet reporting requirements at State and Murray Darling Basin levels.

The Cornella and Puckapunyal management zones cover the areas to the south where bedrock is found at the surface, and groundwater pumping is largely from the Bedrock aquifer.

The Kyabram and Corop Lakes management zones cover those areas to the north where the Shepparton Formation is found at the surface.

2.7 Water balance

A water balance has been developed to assess the impacts of groundwater extraction for various climatic conditions (GMW, 2017). The water balance indicates that the greatest input to the groundwater system in the West Goulburn GMA is rainfall recharge in the Puckapunyal Zone.

The greatest output from the groundwater system is through-flow to the Murray Valley Deep Lead system. Groundwater extraction is a small component of the water balance.

The water balance indicates that the aquifer is not under stress and groundwater levels would remain relatively steady under average climatic conditions if historical groundwater use were to continue.

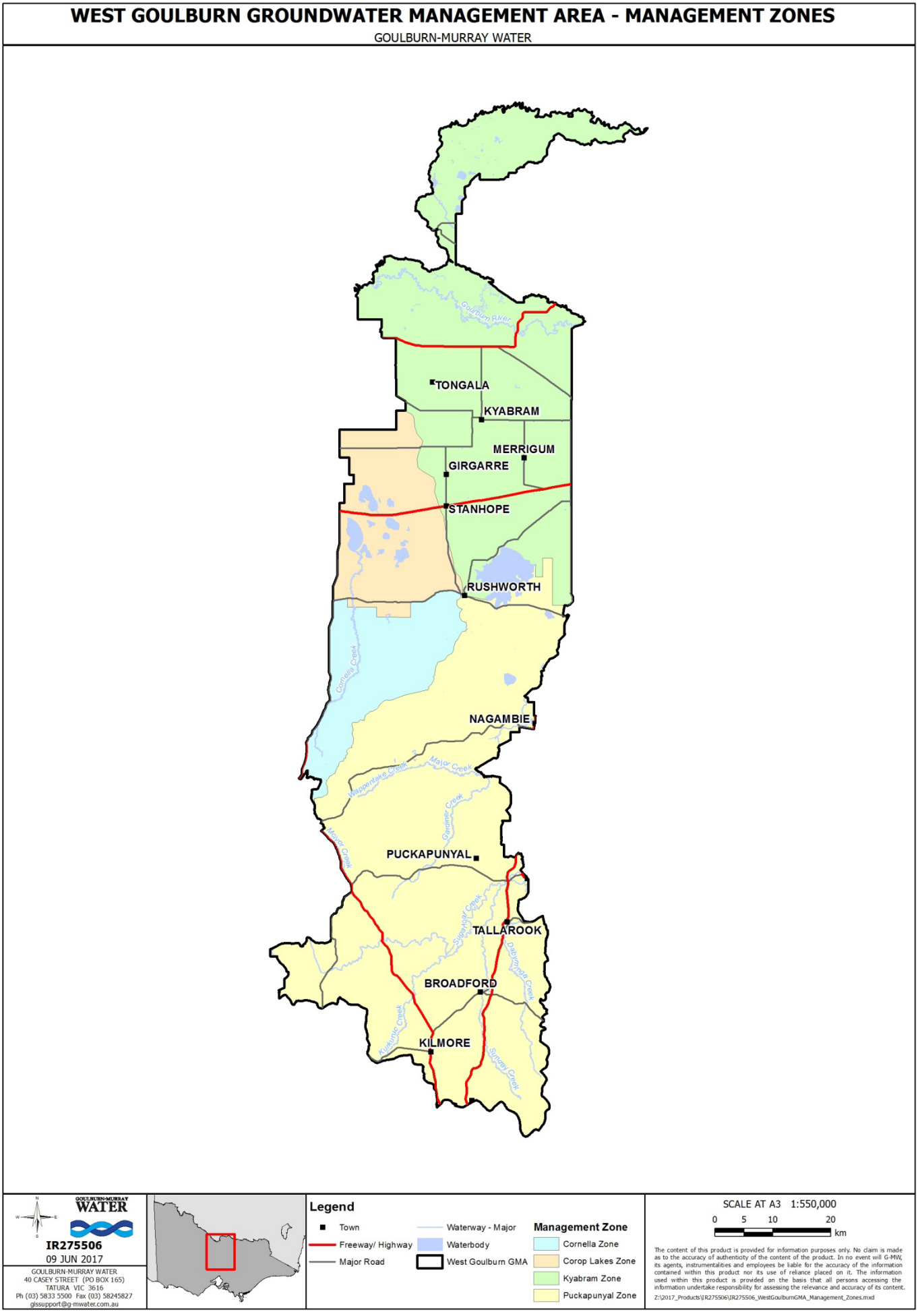

Figure 12 West Goulburn GMA management zones

3 Groundwater dependent values and pumping impacts

3.1 Groundwater pumping impacts

Groundwater pumping lowers the groundwater level around the bore being pumped. This decline in groundwater level is referred to as drawdown cone (Figure 13). The extent of drawdown depends primarily on the nature of the aquifer, as well as the pumping rate and duration. Drawdown decreases with distance from the pumping bore.

Other groundwater users and environmental features such as waterways, springs or vegetation can be impacted when drawdown intersects them. The impacts from groundwater pumping are site-specific as pumping requirements of nearby users, the level of groundwater dependence of environmental features and the hydraulic characteristics of aquifer can all vary. These local impacts are considered when GMW assesses licence applications.

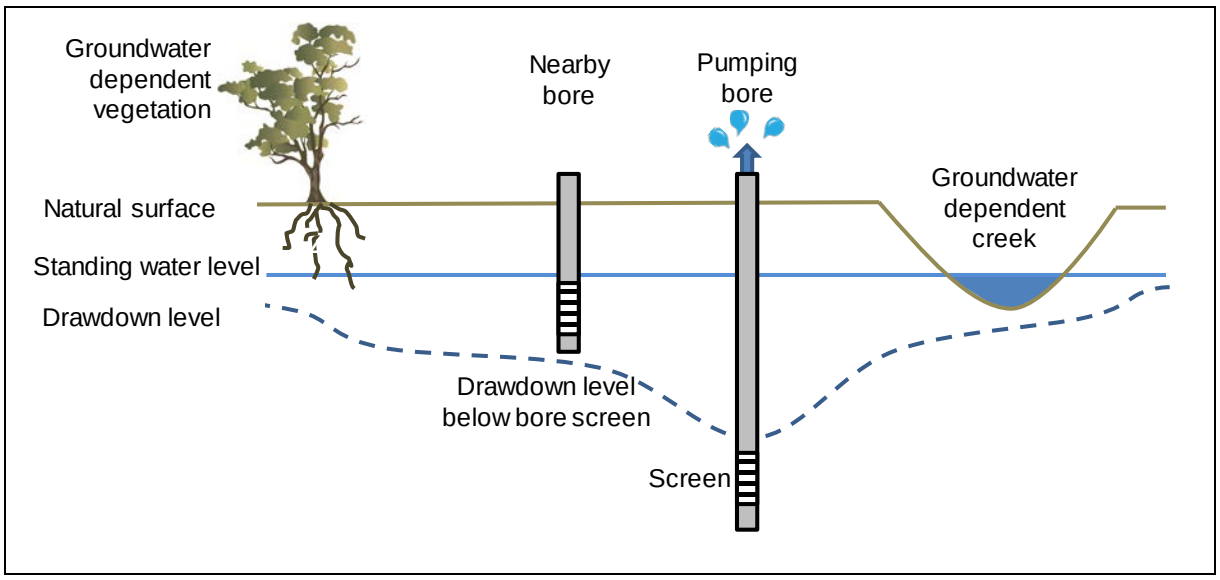

Figure 13 Drawdown in groundwater level caused by groundwater pumping

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 14).

Where groundwater is extracted beyond sustainable limits at local or regional scales groundwater dependent values can be impacted. For example, groundwater pumping may reduce the amount of groundwater that discharges into streams (baseflow) which can be important in dry periods. It should be noted that there is generally a time lag between when groundwater is pumped and when the impacts on stream-flow may occur.

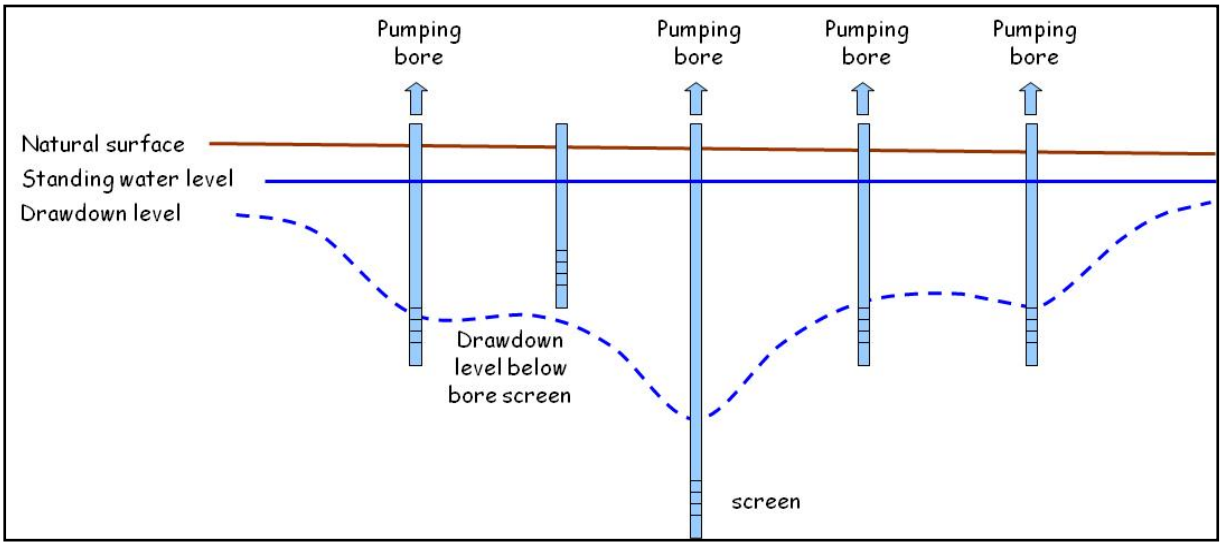

Figure 14 Interference caused by cumulative impacts of groundwater pumping

3.2 Groundwater dependent values

After consulting with groundwater users and key stakeholders, a number of groundwater dependent values have been identified within the West Goulburn GMA (Table 1). These values have informed the development of management objectives.

Some of these values are linked; for example, licensed groundwater use and the business activities supported by that use. The primary values are considered groundwater dependent ecosystems, waterways, cultural values and groundwater use (licensed and domestic and stock). These values are discussed further in the following sections.

Table 1 Groundwater dependent values in the West Goulburn GMA

Environmental	Social	Economic
• Groundwater dependent ecosystems (e.g. terrestrial environment, aquatic pools, wetlands and swamps) • Goulburn River and tributaries • River Murray and tributaries	• Recreation associated with the natural environment • Water supply from waterways • Stock and domestic groundwater use • Licensed groundwater use • Cultural values	• Business activities supported by groundwater • Recreation and tourism • Groundwater extraction infrastructure

3.2.1 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) use groundwater to support some or all of their water needs. Examples of GDEs include stands of trees that have root systems that access groundwater; aquatic pools along waterways that are fed by groundwater in dry periods; and springs where groundwater discharges at the ground surface.

Based on the Bureau of Meteorology Atlas of Groundwater Dependent Ecosystems (the Atlas), GDEs in the West Goulburn GMA are mostly associated with waterways, for instance vegetation along waterways, billabongs, swamps and aquatic pools. The Atlas also indicates that the Corop Lakes region (Figure 15), Barmah Forest (Figure 16), Kanyapella Basin, Lower Goulburn River floodplain and Wallenjoe Swamp may receive groundwater, however further work is required to understand this better.

These regions are largely within the Shepparton Irrigation Region where high water tables have resulted in waterlogging and land salinity issues.

Lower groundwater levels may reduce the amount of water available to GDEs however in the West Goulburn GMA groundwater levels have been fairly stable over the past ten years; ranging from 5 m below the ground surface in the plains to 35 m below the ground surface in the foothills.

Impacts of groundwater extraction are largely managed through the Shepparton Irrigation Region GMA Local Management Plan 2015. Risks to specific GDEs are considered when GMW assesses a licence application.

Figure 15 Lake Cooper near Corop

Figure 16 Barmah Forest

3.2.2 Waterways

The Goulburn River and its tributaries are the main waterways in the West Goulburn GMA. The River Murray forms the northern boundary of the GMA. Flows in the River Murray and the Goulburn River are regulated. The remainder of waterways are unregulated and managed according to Local Management Rules (refer to www.gmwater.com.au). These waterways generally have periods of no flow.

Where groundwater levels are lower than surface water levels, there is potential for surface water to leak into the groundwater system; referred to as a losing stream. Where groundwater levels are higher than surface water levels, there is potential for groundwater to discharge to the stream; referred to as a gaining stream. In some cases groundwater may discharge to the stream and then leak back into the groundwater system further downstream.

In the West Goulburn GMA interactions between groundwater and surface water are variable. For example, Majors Creek at Graytown is well-connected to groundwater; it receives groundwater during low flow periods, and becomes a losing stream when the flow is

high. During the Millennium Drought when flow was intermittent and waterways were dry, some waterways became disconnected from the groundwater system (GMW, 2017).

Due to the small volume of groundwater extracted, impacts on waterways are considered low risk in the West Goulburn GMA.

3.2.3 Cultural values

The West Goulburn GMA encompasses Yorta Yorta Country and Taungurung Country. The traditional owners remain connected to country which includes having a strong affinity with the land, waterways and local ecology (GBCMA, 2014). In particular, Barmah Forest (Figure 17) and Kanyapella Basin (Figure 18) have been identified as highly valued culturally in the region.

The Goulburn Broken Waterway Strategy (2014) makes reference to a number of important values including the totem of the Yorta Yorta people, the Broad Shelled Turtle, populations of which can be impacted by watering regimes. Less tangible values include the cultural importance of simply being by the river.

As groundwater extraction is low in the region, potential risks to cultural values are considered low. Impacts to specific areas of cultural significance are considered when assessing licence applications.

Figure 17 Oven mound at Barmah Forest

Figure 18 Kanyapella Basin

3.2.4 Licensed groundwater use

Groundwater use has locally significant social and economic value in the West Goulburn GMA. The total entitlement held in the West Goulburn GMA is 2,834.4 ML/yr. The majority of licensed bores and entitlement are in the Puckapunyal Zone (Figure 19, Table 2).

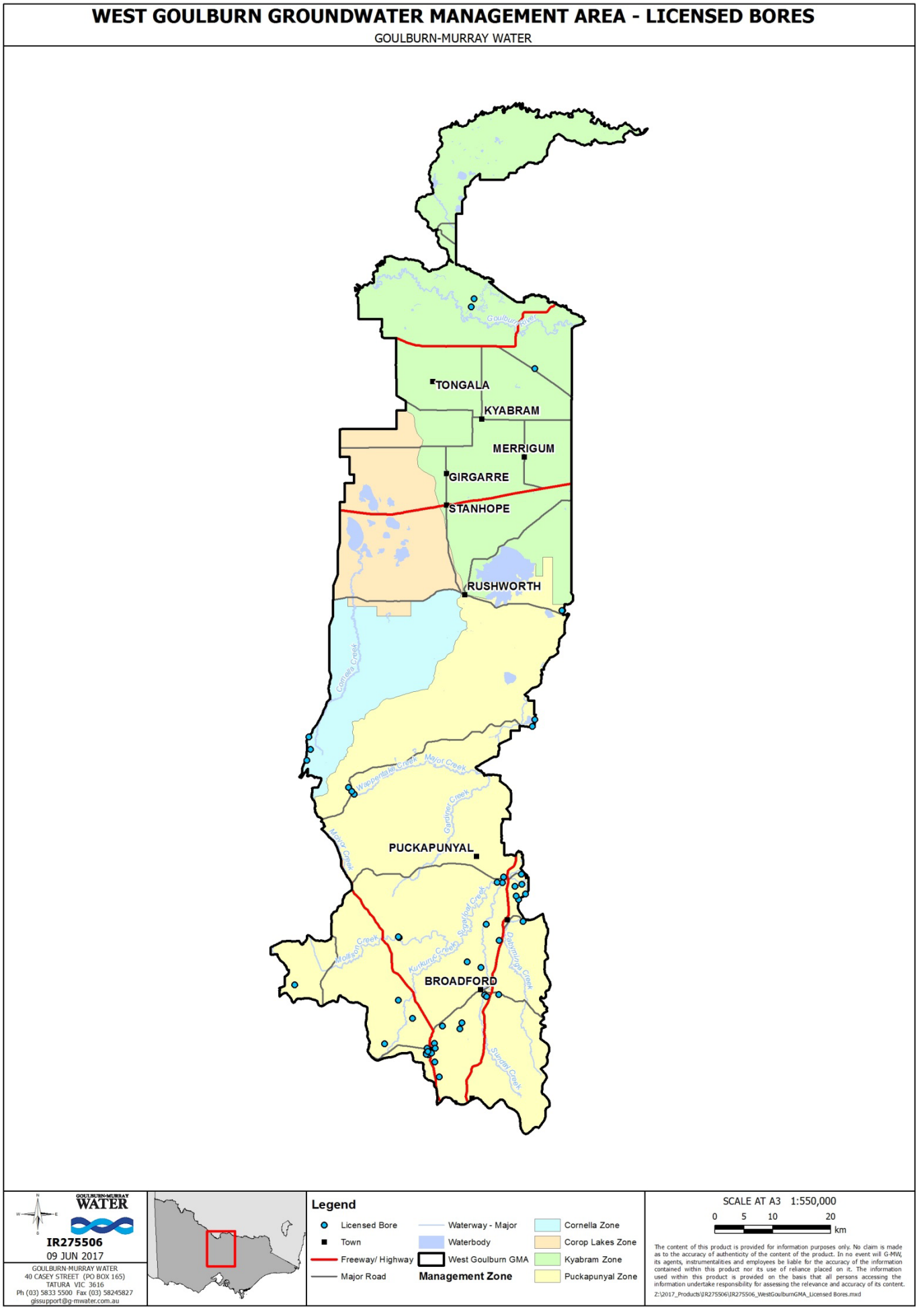

Figure 19 Licensed bores in the West Goulburn GMA

Table 2 Licensed groundwater entitlement in the West Goulburn GMA

Management zone	No. licences	No. licensed bores	Entitlement (ML/yr)
Kyabram Zone	3	3	750.0
Puckapunyal Zone	39	53	1,982.4
Cornella Zone	3	3	102.0
Corop Lakes Zone	0	0	0
Total West Goulburn GMA	**45**	**59**	**2,834.4**

Meter reading of licensed use in the West Goulburn GMA commenced in the 2010/11 season. Use is typically less than 30% of entitlement in the West Goulburn GMA however in 2015/16 use went up to 64% of entitlement (Figure 20). Groundwater use is generally related to climatic conditions and availability of surface water; in 2015/16, drier than average conditions saw groundwater use increase across the GMW region.

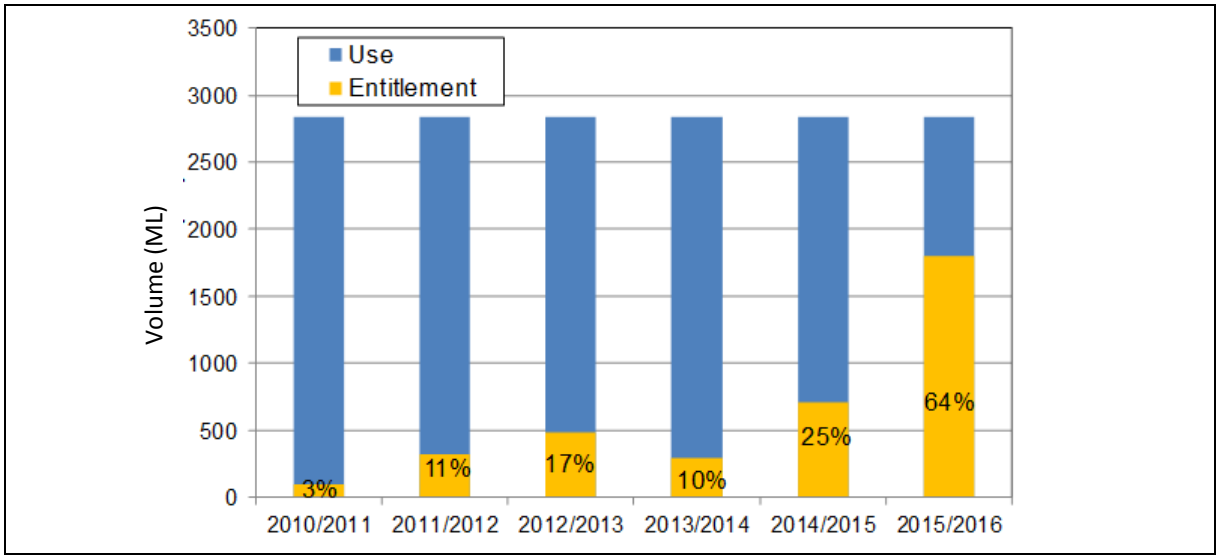

Figure 20 Groundwater entitlement and use in the West Goulburn GMA

The majority of groundwater entitlement in the West Goulburn GMA is held for irrigation purposes (Figure 21, Figure 22), approximately a quarter is used for industrial or commercial purposes (Figure 23) and only 6 ML for dairy wash-down purposes (Figure 24).

Figure 21 Vineyard at Corop

Figure 22 Recreation reserve at Kilmore

Figure 23 Costerfield mine site

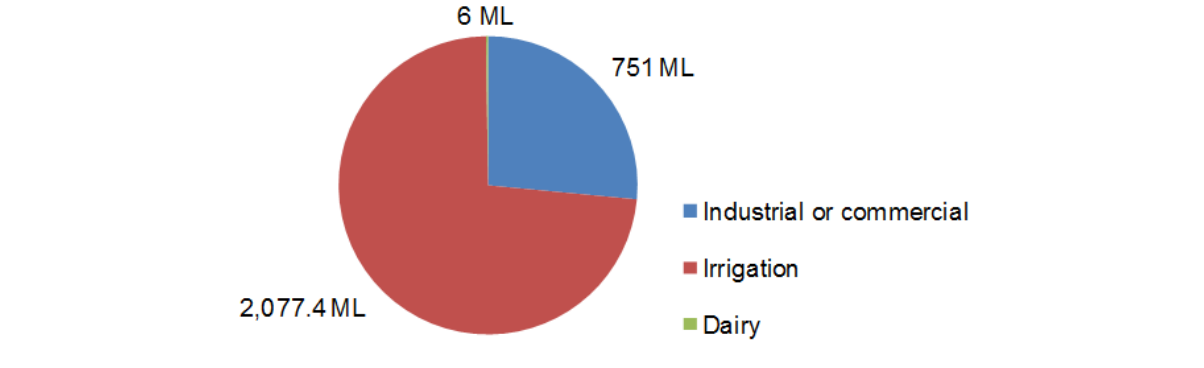

Figure 24 Licensed purposes in the West Goulburn GMA

3.2.5 Domestic and stock use

Domestic and stock use of groundwater (Figure 25, Figure 26) is a statutory right under section 8 of the Act and is not required to be metered. Use for domestic and stock purposes has been estimated based on the number of bores listed in the State groundwater database (Water Management Information System) that were drilled after 1980 and assigning an assumed annual use per bore of 2 ML. This is slightly more conservative than the method proposed by RMCG (2011) to estimate groundwater use so may be an overestimate of groundwater used for domestic and stock purposes. It suggests that a large proportion of groundwater extraction (more than half in most years) is for domestic and stock use.

The majority of the domestic and stock bores are located in the Puckapunyal Zone (Table 3).

Table 3 Estimated domestic and stock use in the West Goulburn GMA

Management zone	Number of domestic and stock bores	Assumed annual use (ML)
Kyabram Zone	67	134
Puckapunyal Zone	442	884
Cornella Zone	22	44
Corop Lakes Zone	8	16
Total West Goulburn GMA	539	1,078

Figure 25 Windmill at Corop

Figure 26 Livestock at Colbinabbin

4 Groundwater Management

4.1 Licence entitlement

The groundwater system in the West Goulburn GMA is not considered to be under significant stress and the water balance (GMW, 2017) indicates that groundwater extraction is a small component of the overall water balance. As such, setting a cap on the whole GMA is not considered necessary at this point in time. Limits have been put in place on individual zones to prevent intense areas of groundwater use developing.

To manage potential impacts of groundwater use in the West Goulburn GMA, groundwater levels will be monitored annually in May, following the irrigation season. If an average decline of 3.0 m over three years in groundwater recovery levels is observed in the following key State observation bores, GMW will review the need to introduce a cap on entitlement:

- 54456, located in the Corop Lakes Zone;
- 73403, located in the Kyabram Zone;
- 80757, located in the Puckapunyal Zone; and
- 98371, located in the Cornella Zone.

This trigger level is informed by the current available drawdown in licensed and domestic and stock bores in the West Goulburn GMA (GMW, 2017).

Rule 1 Groundwater level trigger

If average groundwater level decline equal to or greater than 3.0 m over three years is observed in key State observation bores (54456, 73403, 80757 and 98371), Goulburn-Murray Water may consider the introduction of a cap on entitlement.

4.2 Management zone limits

Currently, the majority of groundwater entitlement is held in the Puckapunyal Zone. To prevent intense areas of groundwater use developing, management zone limits have been established. These limits have been informed by a water balance to manage impacts on groundwater levels. They allow for further development of the resource and the impacts of increased use to be observed.

Rule 2 Management zone limits

Goulburn-Murray Water may issue a groundwater licence provided that the following management zone limits are not exceeded:

Management zone	Management zone limit (ML/yr)
Kyabram Zone	1,000
Puckapunyal Zone	2,500
Cornella Zone	500
Corop Lakes Zone	500

4.3 Groundwater licensing

Bore construction and groundwater extraction are managed by GMW in accordance with the licensing provisions defined in the Act and associated Ministerial policies.

A works licence must be obtained from GMW to drill and construct a bore. Groundwater bores must be drilled by a licensed driller. The Australian Drilling Industry Association (www.adia.com.au) provides contact details of its members.

A take and use licence must be obtained from GMW to extract groundwater for irrigation, commercial, industrial, dewatering and urban use.

A range of matters are considered by GMW when assessing applications for works licences and take and use licences, including the potential for unacceptable impacts to existing authorised users, stream flow and the environment.

If groundwater is used exclusively for domestic and stock purposes, a take and use licence is not required.

More information on groundwater licensing, including fees and charges, is available on GMW's website: www.gmwater.com.au.

4.4 Transfer of groundwater licence entitlement

Transferring groundwater licence entitlement provides opportunities for new development or enables existing businesses to grow.

To undertake a licence transfer, 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 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. Penalties apply for unauthorised take and use.

Entitlement may be temporarily transferred within or between management zones in the West Goulburn GMA for a period of up to five years. This recognises the low use in the West Goulburn GMA and provides greater trading opportunities.

Entitlement may be permanently transferred within or between management zones in the West Goulburn GMA provided that management zone limits are not exceeded.

Rule 3 Transfer of groundwater entitlement

Goulburn-Murray Water may approve a transfer of groundwater entitlement under section 62 of the Act provided that relevant matters under the Act have been considered and that it accords with the following:

(a) The approval of a permanent transfer must not cause the management zone limits in Rule 2 to be exceeded.

(b) The buyer has a bore with a metered diversion point.

(c) The seller's licensed bore(s) is/are either metered or not equipped for use.

4.5 Carryover

Carryover is the ability for licence holders to bank some of their unused entitlement from one season, to use in the following season. This provides greater flexibility for licence holders to manage their entitlement. To access carryover, licence holders must have a bore with a metered diversion point.

To enable the use of carryover, GMW will apply to the Minister to declare the availability of carryover up to a maximum of 10% of entitlement each season in the West Goulburn GMA.

An example of how carryover is calculated and can be used is shown below.

Example

A licence holder has a licence with 100 ML/yr groundwater entitlement and can carryover a maximum of 10% of their entitlement (10 ML).

Season	1	2	3
Entitlement (ML)	100	100	100
Carryover (ML)	0	10	5
Trade in (ML)	0	0	0
TOTAL AVAILABLE	100	110	105
Trade out (ML)	0	-35	-25
Use (ML)	-70	-70	-70
TOTAL OUT	-70	-105	-95
Balance (ML)	30	5	10
Available for carryover (ML)	10	5	10

In season 1 the licence holder uses 70 ML and has 30 ML remaining. Only a maximum of 10% of entitlement (10 ML) can be carried over to season 2.

In season 2 the licence holder has 110 ML available to use. The licence holder trades out 35 ML and uses 70 ML. This leaves 5 ML available to carryover to season 3.

In season 3 the licence holder has 105 ML available to use. The licence holder trades out 25 ML and uses 70 ML. This leaves 10 ML remaining to carryover to the following season.

5 Monitoring program

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

5.1 Groundwater levels

The Department of Environment, Land, Water and Planning (DELWP) manages the State Observation Bore Network (SOBN) which monitors groundwater levels and quality throughout the State.

State observation bores in the West Goulburn GMA (Figure 27) are monitored at quarterly intervals. Groundwater data is publicly available online from DELWP (currently via the Water Measurement Information System).

These bores enable the groundwater resource condition to be understood, in particular:

- Groundwater interactions with surface water
- Groundwater dependent ecosystems
- Groundwater system response to recharge
- Impacts from groundwater extraction

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

Throughout the West Goulburn GMA there is no evidence that groundwater extraction is causing any significant reduction in groundwater levels or is impacting upon resource availability. This is not surprising given the low levels of use.

GMW will continue to support a baseline level of groundwater level monitoring in the West Goulburn GMA.

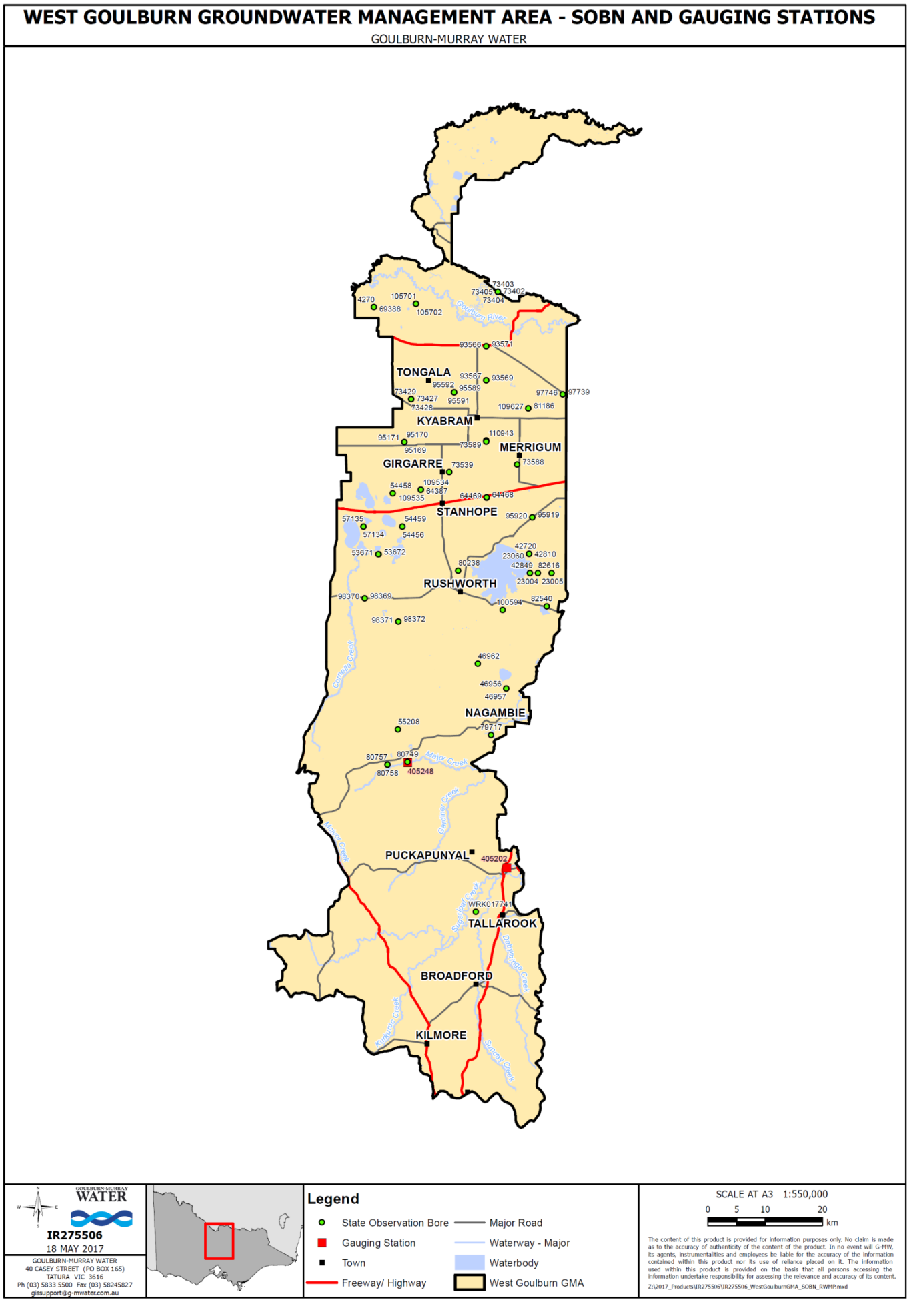

Figure 27 Observation bores and river gauging stations in the West Goulburn GMA

5.2 Groundwater use

Recording groundwater use is an important part of resource management as it will assist with improving the water balance and better understand the impacts of groundwater extraction.

Currently there is only a limited amount of metered data for this area. Continued recording of groundwater use will help to better understand the relationship between groundwater use and climate and gain a clearer indication of the volumes of groundwater pumped during dry periods. This will help GMW assess the potential risk of pumping on surface water resources when reviewing the Plan in future.

All existing licensed and operational bores, with a licence volume equal to or greater than 20 ML/yr are fitted with a flow meter. For any operational bore with licence volume less than 20 ML/yr, use is estimated.

Meters will be read at least once annually. Use data will be stored in the Victorian Water Register.

Rule 4 Record meter readings

Goulburn-Murray Water will read flow meters on licensed bores at least once annually and record usage in the Victorian Water Register.

6 Implementation

6.1 Annual newsletter

GMW will prepare an annual newsletter for the Plan. This newsletter will summarise groundwater entitlement, use and transfers in each management zone; and the overall resource position based on available monitoring data. The newsletter will help GMW to keep customers and stakeholders informed and engaged. The newsletter will be made available on the GMW website: www.gmwater.com.au.

Rule 5 Annual newsletter

By 1 October each year, Goulburn-Murray Water will post on its website a newsletter reporting on groundwater resource status, licensed groundwater use and trade activity for the previous season. The newsletter will also identify the need for any changes to the Plan.

6.2 Review of the Plan

Over time, the Plan may need to be adapted in response to policy changes in groundwater resource management, as our understanding of the aquifer system increases and as management improvements are identified.

At the time of the development of the Plan, implementation of the Murray Darling Basin Plan (the Basin Plan) had commenced. The Plan may need to be reviewed to ensure it is kept up-to-date and reflects the requirements of the Basin Plan.

Each year, during the preparation of the annual newsletter, GMW will review the Plan's operation and compliance with the Basin Plan and consider the need to make amendments to the Plan.

GMW will consult with the Goulburn-Broken Regional Water Services Committee on any proposed changes to the Plan, and other stakeholders where the proposed amendments may impact on licence entitlements.

Rule 6 Review of the Plan

Goulburn-Murray Water will consider the need for any amendments to the Plan on a yearly basis, in conjunction with the release of the annual newsletter.

If amendments are proposed, Goulburn-Murray Water will consult with the Goulburn-Broken Regional Water Services Committee and other stakeholders.

7 References

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