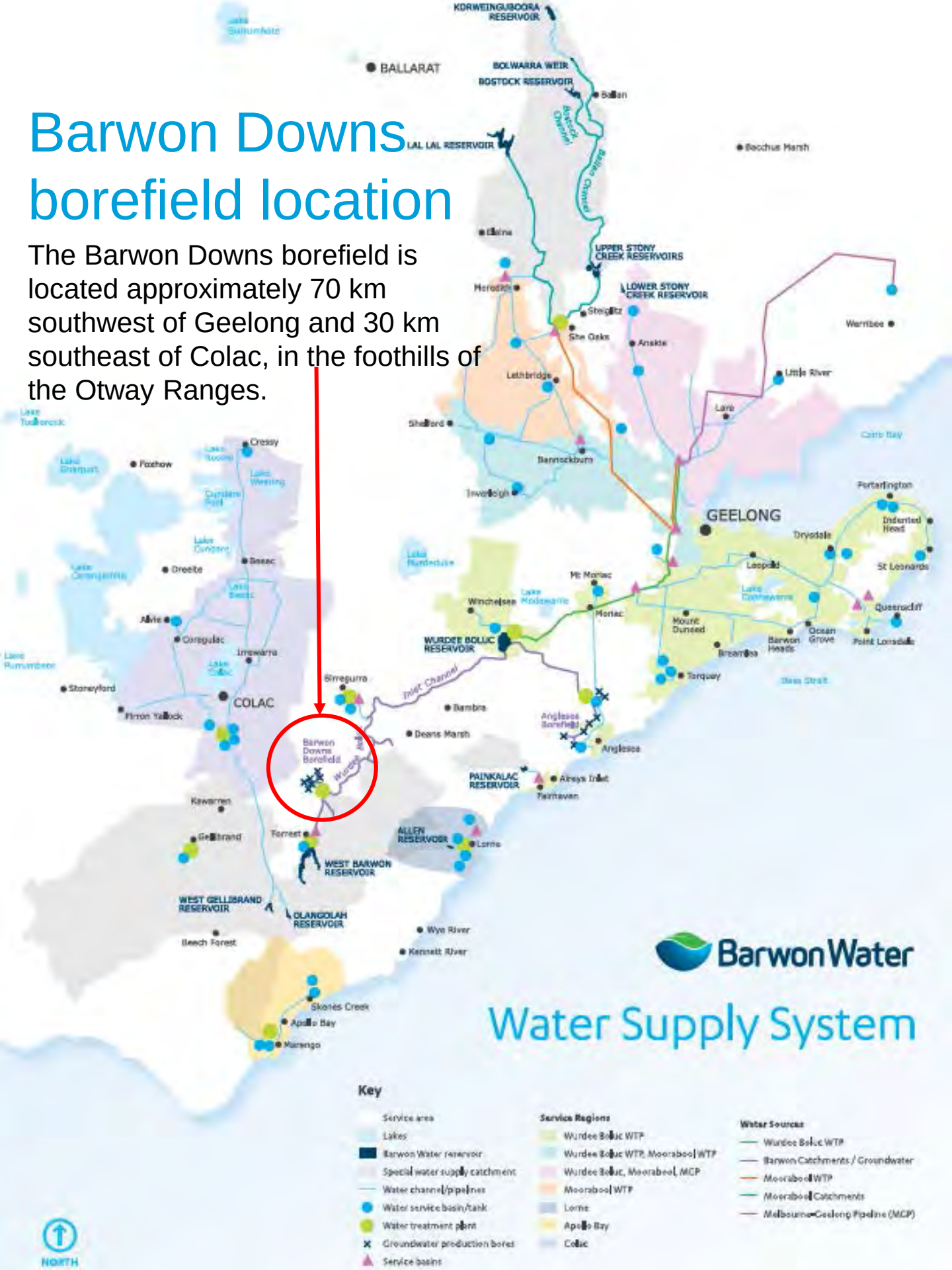
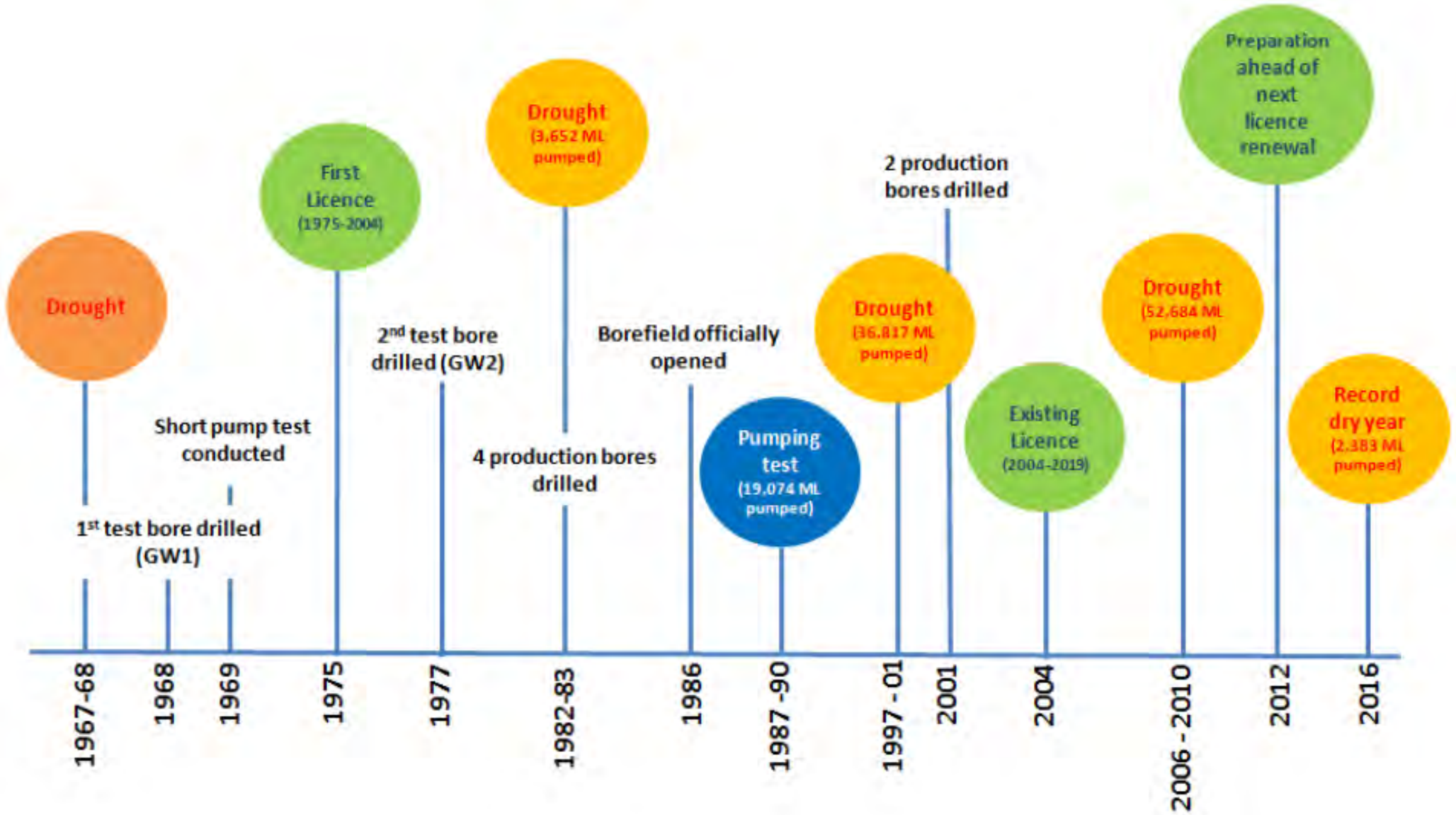
Barwon Downs borefield location

The Barwon Downs borefield is located approximately 70 km southwest of Geelong and 30 km southeast of Colac, in the foothills of the Otway Ranges.



Borefield history

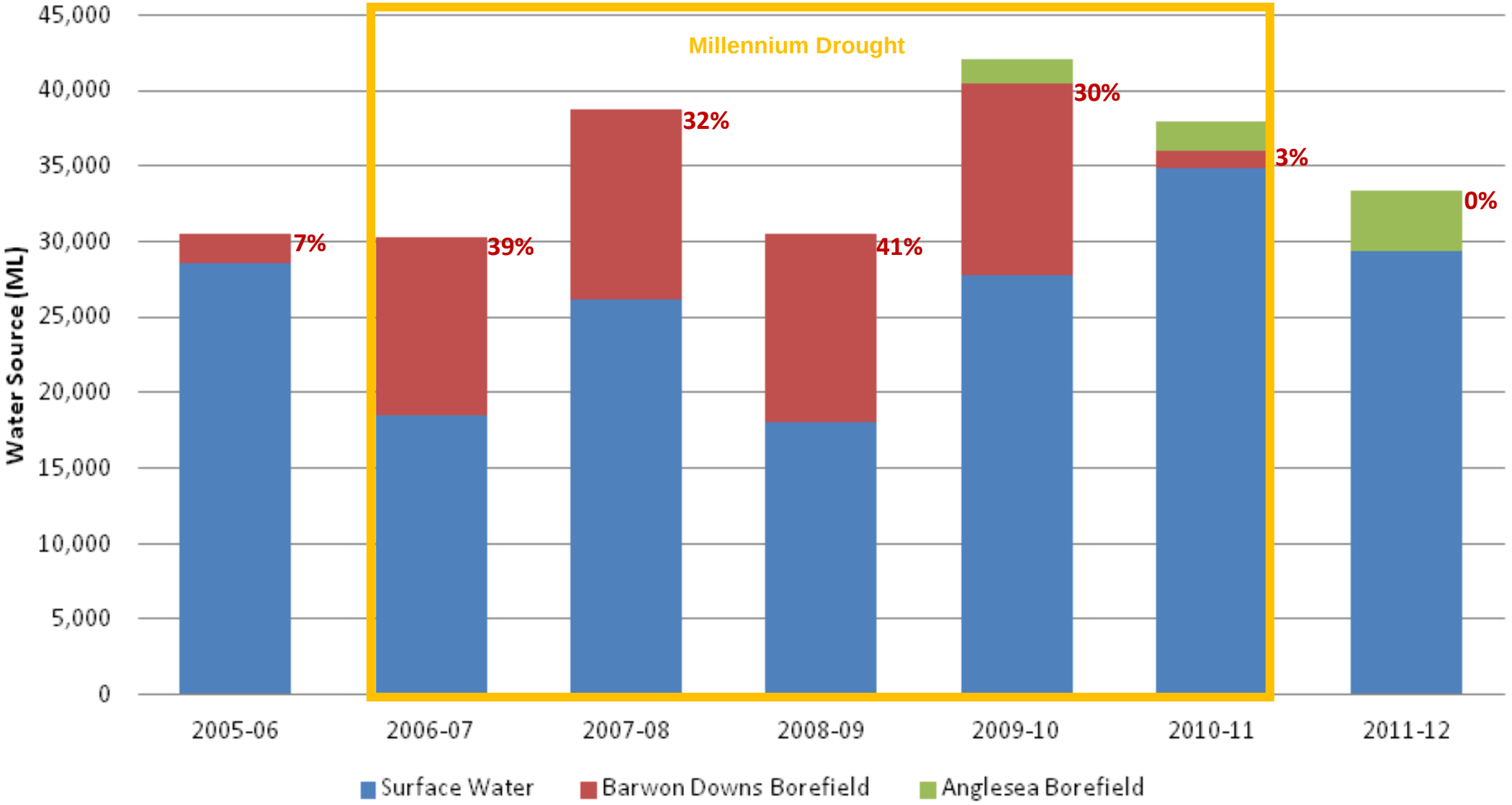


What is the Barwon Downs borefield?

The borefield taps into an underground source of water, known as the **Lower Tertiary Aquifer**, with depths of up to 600m at the borefield. The aquifer covers an underground area of around 500 km^2 and is connected to the surface in both the Barwon River catchment (Barongarook High) and the Otways Coast catchment near Gellibrand.

The borefield consists of six production bores that extract groundwater by using pumps. Groundwater is then pre-treated and transferred to the Wurdee Boluc Inlet Channel where it mixes with water from the Barwon River catchment.

The importance of the borefield



Bulk water into the Barwon and Moorabool systems (including losses)

Box 10: The importance of our Barwon Downs groundwater licence to long-term water security in the greater Geelong system

The Barwon Downs borefield is a critical resource for the greater Geelong system, including Colac. The borefield is primarily intended to be called upon during drought conditions when supplies from our traditional surface water catchments decline.

The Barwon Downs extraction licence, issued by Southern Rural Water, is due for renewal in 2019. To better understand the importance of the borefield, we have determined the yield of the system without the borefield under current climate and demand, and again in 2065 under conditions of high climate change and population growth. This demonstrates the impact on system yield if the groundwater source was no longer available.

Without access to the Barwon Downs borefield, the yield of the greater Geelong and Colac system would be reduced by 11,000 ML/year, equivalent to 20 per cent of the current yield. By 2065, under a high climate change and high population growth scenario – when runoff is forecast to be almost 50 per cent lower than that under the current climate1 – the impact of not having the groundwater resource at Barwon Downs becomes even more significant, with a reduction in yield of more than 14,000 ML/year, or more than 30 per cent.

It is important to realise that these numbers do not reflect the volume Barwon Water expects to take each year from the Barwon Downs borefield. However, they do indicate the potential impact on water security without this important part of the system.

1. Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria, 2016, DELWP

Scenario	Current yield (ML/year)	Yield without Barwon Downs (ML/year)	Reduction in yield (ML/year)
Historical climate	54,219	43,200	11,019
High climate change @ 2065	46,105	31,700	14,405

The groundwater licence renewal

Why do we need a licence?

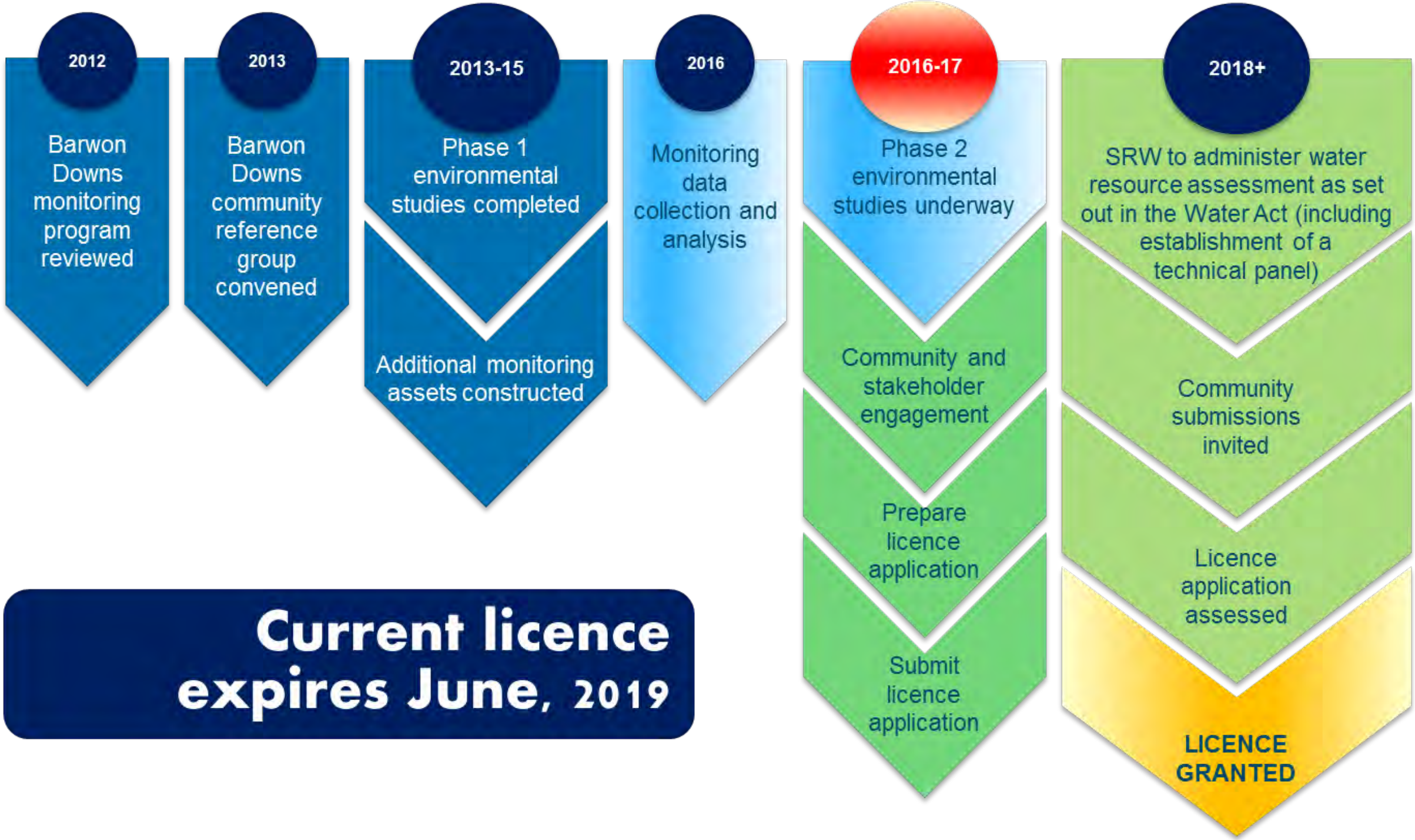
The borefield is operated under a licence issued by Southern Rural Water. The licence sets out conditions so that groundwater use is carefully monitored and managed.

What are our licence objectives?

- A groundwater licence that meets the future water resource needs of Barwon Water,
- A groundwater licence that recognises the water needs of the environment and other beneficial users, and
- Support from the community for Barwon Water to continue management of the groundwater resource within the constraints of the new licence.

Current Licence extraction limits (2004-2019)

1. Type of use: Urban Supply
2. Groundwater Area: Gerangamete
3. Max Daily rate: 72ML/day
4. Max yearly volume: 20,000ML
5. Max volume (10 years): 80,000ML
6. Max volume (100 years): 400,000ML
7. REALM modelling: 4,000ML/year


2012
Barwon Downs monitoring program reviewed
2013
Barwon Downs community reference group convened
2013-15
Phase 1 environmental studies completed
Additional monitoring assets constructed
2016
Monitoring data collection and analysis
2016-17
Phase 2 environmental studies underway
Community and stakeholder engagement
Prepare licence application
Submit licence application
2018+
SRW to administer water resource assessment as set out in the Water Act (including establishment of a technical panel)
Community submissions invited
Licence application assessed
LICENCE GRANTED
Current licence expires June, 2019

Consulting with the community

In 2013, Barwon Water established the Barwon Downs Groundwater Community Reference Group. The objectives of the group are:

- To advise on community concerns [environmental],
- To advise on community engagement, and
- Monitor program implementation.

Who are the CRG members?

Jan Greig (Chair) – Upper Barwon Landcare Network

Robin Povey – Rotary Club Geelong

Gavin Brien – CFA member

Henry Bongers – Business

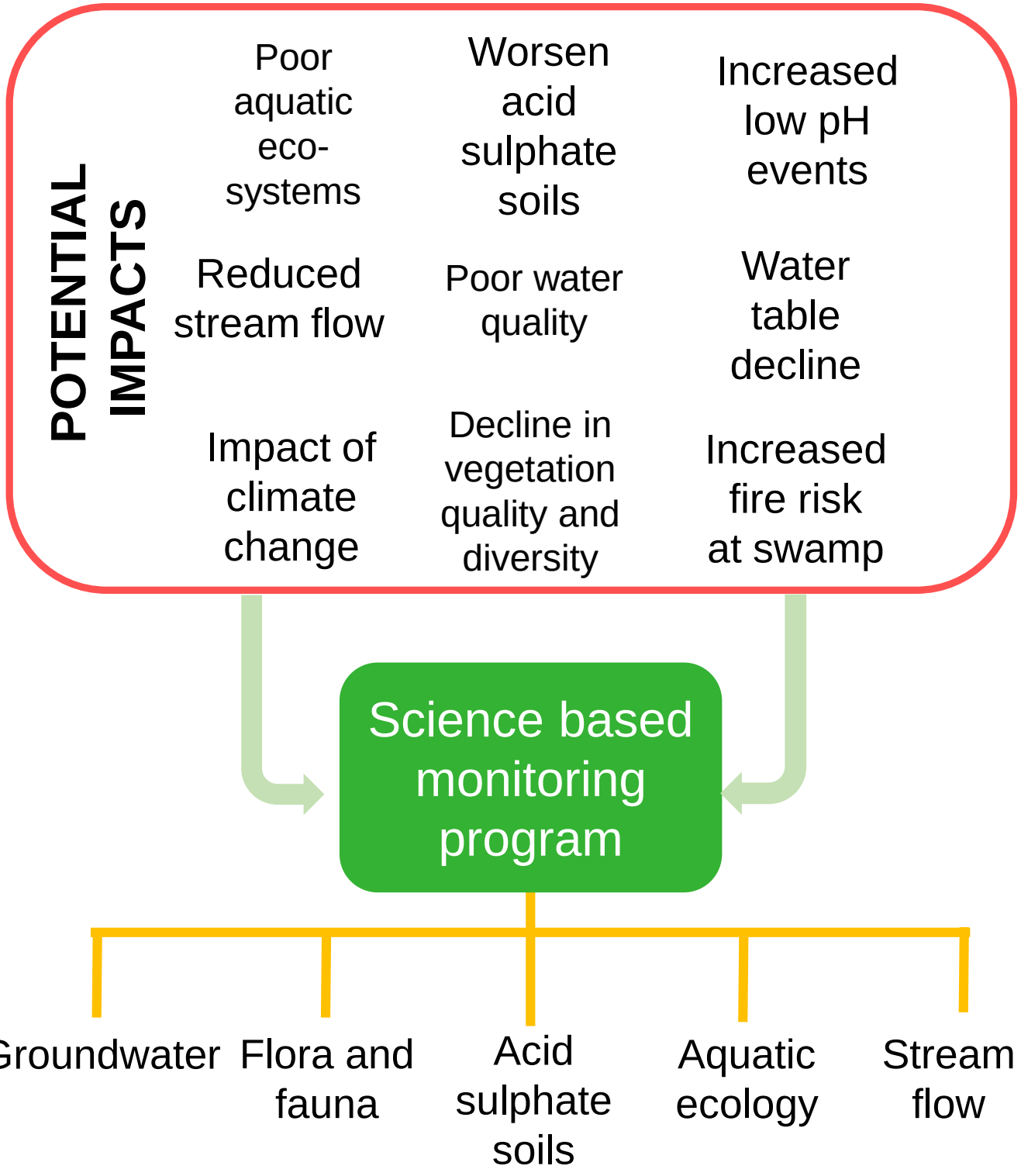
Hans Fankhanel – Otway Ranges Environment Network (OREN)

Malcolm Gardiner – Land and Water Resources Otway Catchment (LAWROC)

Robert Maxwell – Farming

Doug Chant (Deputy Chair) – Farming

Technical and community issues that need to be addressed



Enhanced monitoring program

2012 Review existing Barwon Downs monitoring program.

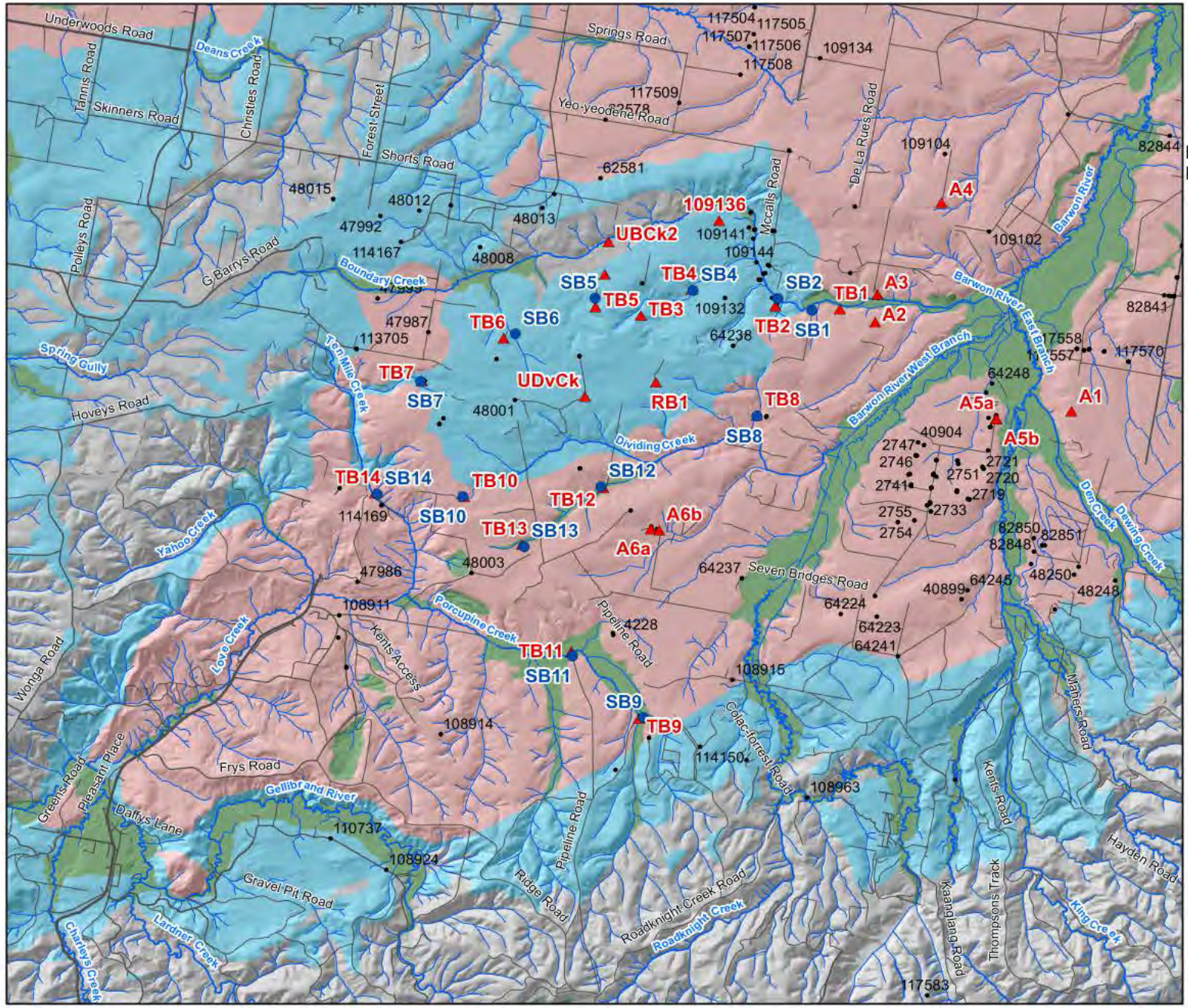
2013 New program developed to:

- Distinguish between groundwater extraction and climate change;
- Predict water table and stream flow changes; and
- Identify environmental impacts.

2014 to 2017 Barwon Water put in place the following monitoring equipment as part of the enhanced monitoring program:

- 34 new groundwater monitoring bores drilled, including the replacement of two existing bores,
- refurbishment of three existing groundwater monitoring bores,
- Six new potential acid sulphate soils monitoring bores,
- Data loggers installed in new and existing bores,
- Two new stream flow gauges installed, and
- Two existing stream flow gauges replaced.

The data obtained from the monitoring equipment has significantly improved our understanding of the groundwater system and been used to develop valuable input into the technical studies.



JACOBS

Refer to Jacobe document;
J:\IE\Projects\03_Southern\IS129200\Spatial\ArcGIS\New bores

Barwon Water Authority
Barwon Downs Monitoring Program

Location of new monitoring bores and stream gauges

- Soil bores
- New groundwater bores
- Existing bores

Conceptual Geology

- Alluvium
- Basalt
- Aquitard
- Aquifer
- Bedrock

0 1 2 4 Kilometers

It is estimated that groundwater in Southern Victoria contributes approximately **$275 million** to the State economy every year by supporting agri-business & industry. Our communities also place great value on groundwater for cultural and social reasons.

Around **one** in 20 Australians rely on groundwater for drinking

Where does groundwater come from?

Most of our groundwater comes from rainfall. All aquifers gain and lose water, this is known as recharge and discharge.

About **30%** of the world's fresh water is stored as groundwater. Less than 1% is stored as other surface water bodies

What impacts groundwater levels?

changes in climate

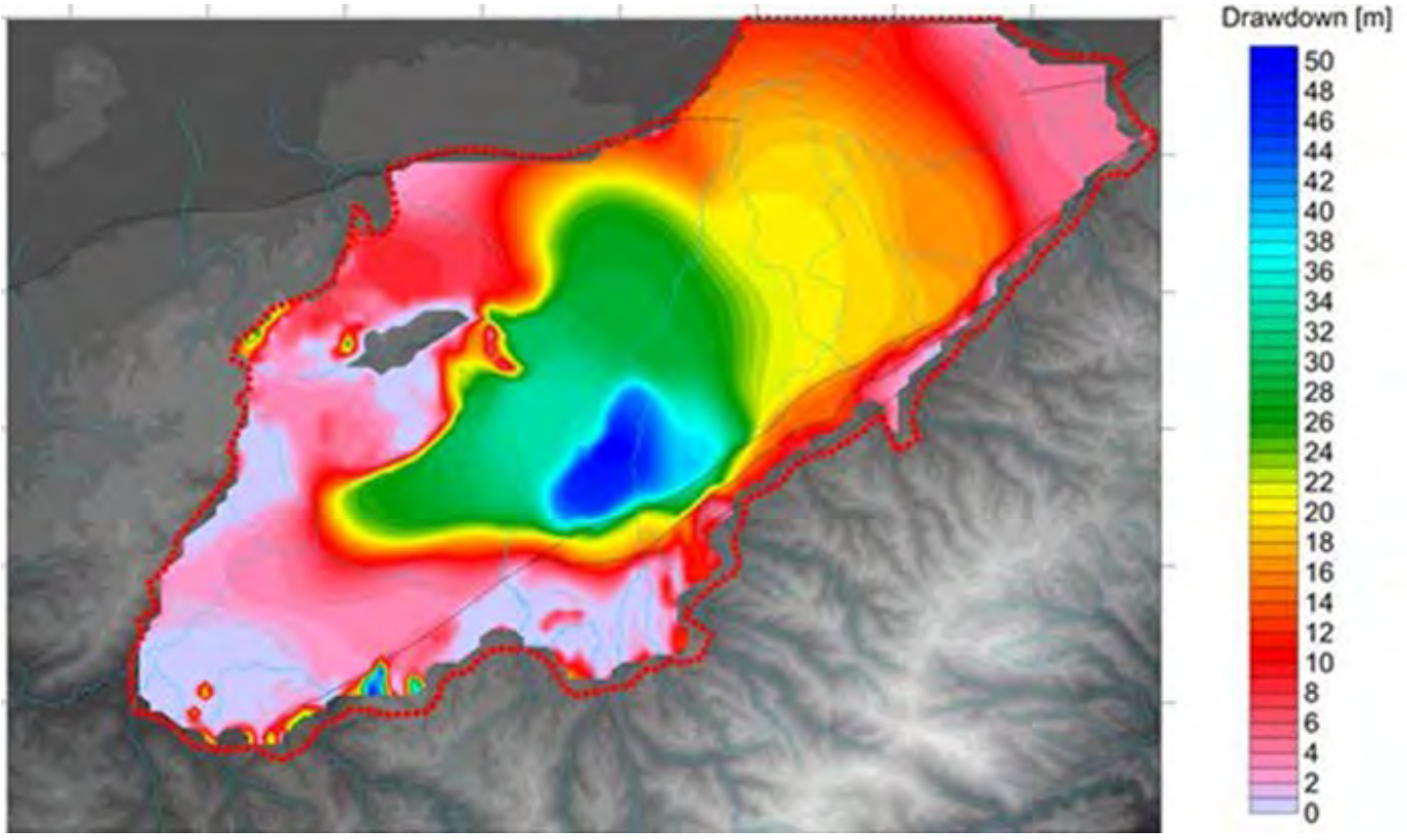
evapotranspiration

pumping

If it's close to the surface, groundwater can evaporate to the atmosphere or be used by vegetation.

Groundwater is water that is found below the ground surface.

Groundwater model



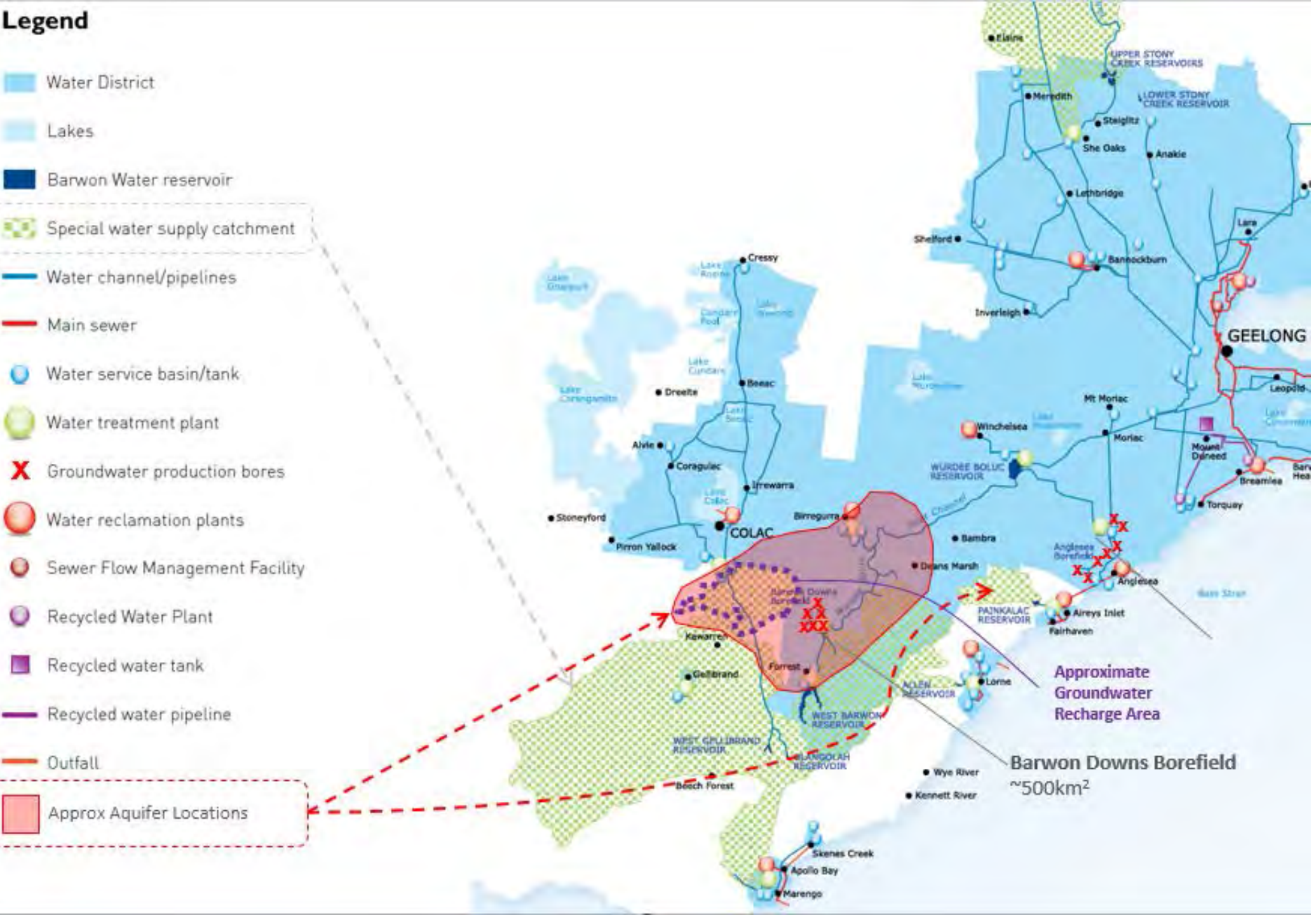
What is the model?

The computer model replicates the complex hydrogeology of the Barwon Downs groundwater system. It has been designed and built to assess any impacts of future groundwater extraction on receptors.

What are the outcomes?

The updated groundwater model:

- takes into account previous studies
- is well represented regionally, and locally in the Boundary Creek catchment
- meets the highest confidence level as set out in the Australian Groundwater Modelling Guidelines



Extent of Lower Tertiary Aquifer and recharge area

(Barongarook High)

Recharge rate assessment (2016)

Purpose
To improve understanding of rates of recharge for the Lower Tertiary Aquifer

Findings
Using independent techniques to estimate actual recharge rates.
Previous studies have provided estimates of groundwater recharge however these often used little or no field data.
This study used two field methods to estimate recharge using chemical tracers.

Conclusion
That groundwater recharge rates to the outcropping Lower Tertiary Aquifer over the last 50 years is most likely to be at a rate equivalent of 10% of annual rainfall, which is a significant improvement on previous estimates that ranged from up to 32% of rainfall.

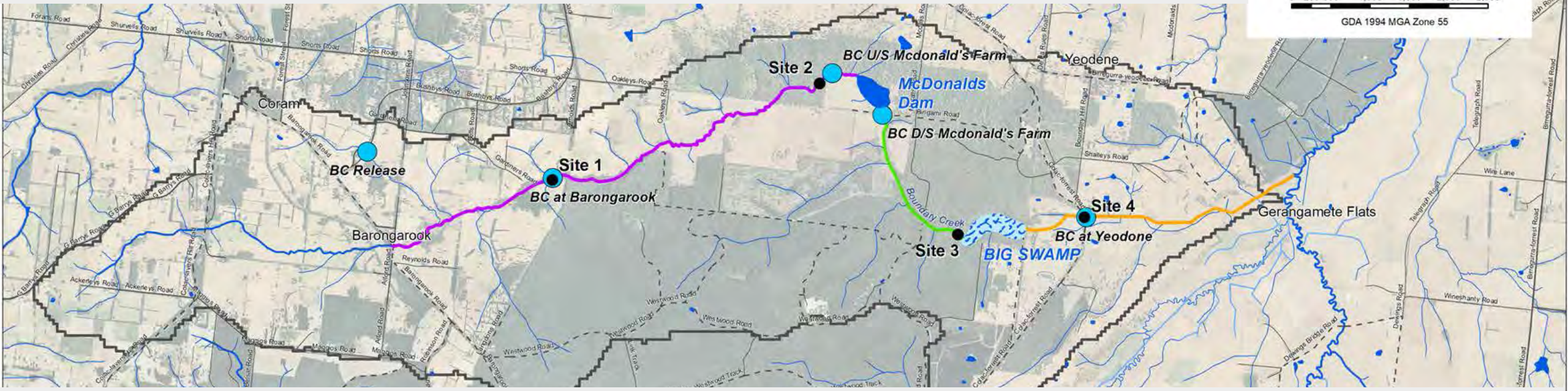
Where is Boundary Creek?

Boundary Creek begins just south of Colac and meanders in an easterly direction for 18 km before joining the Barwon River.

The upper reach contains a private dam (160ML storage).

Past the dam, the Creek has a dispersed flow path forming marshes and deeper pools (‘the damp lands’).

Downstream of this, Boundary Creek runs through a peat swamp (Big Swamp).

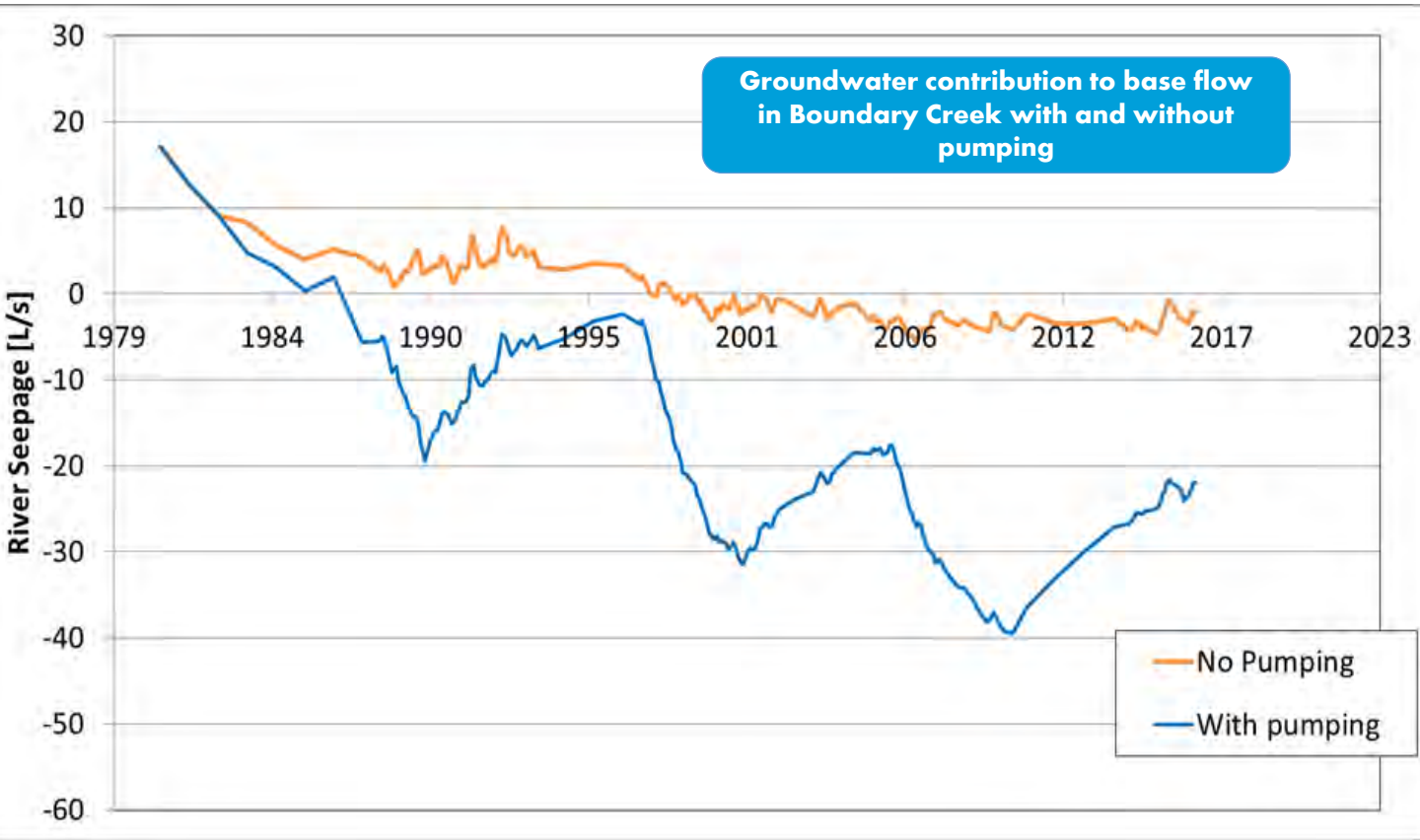


Current licence conditions for Boundary Creek

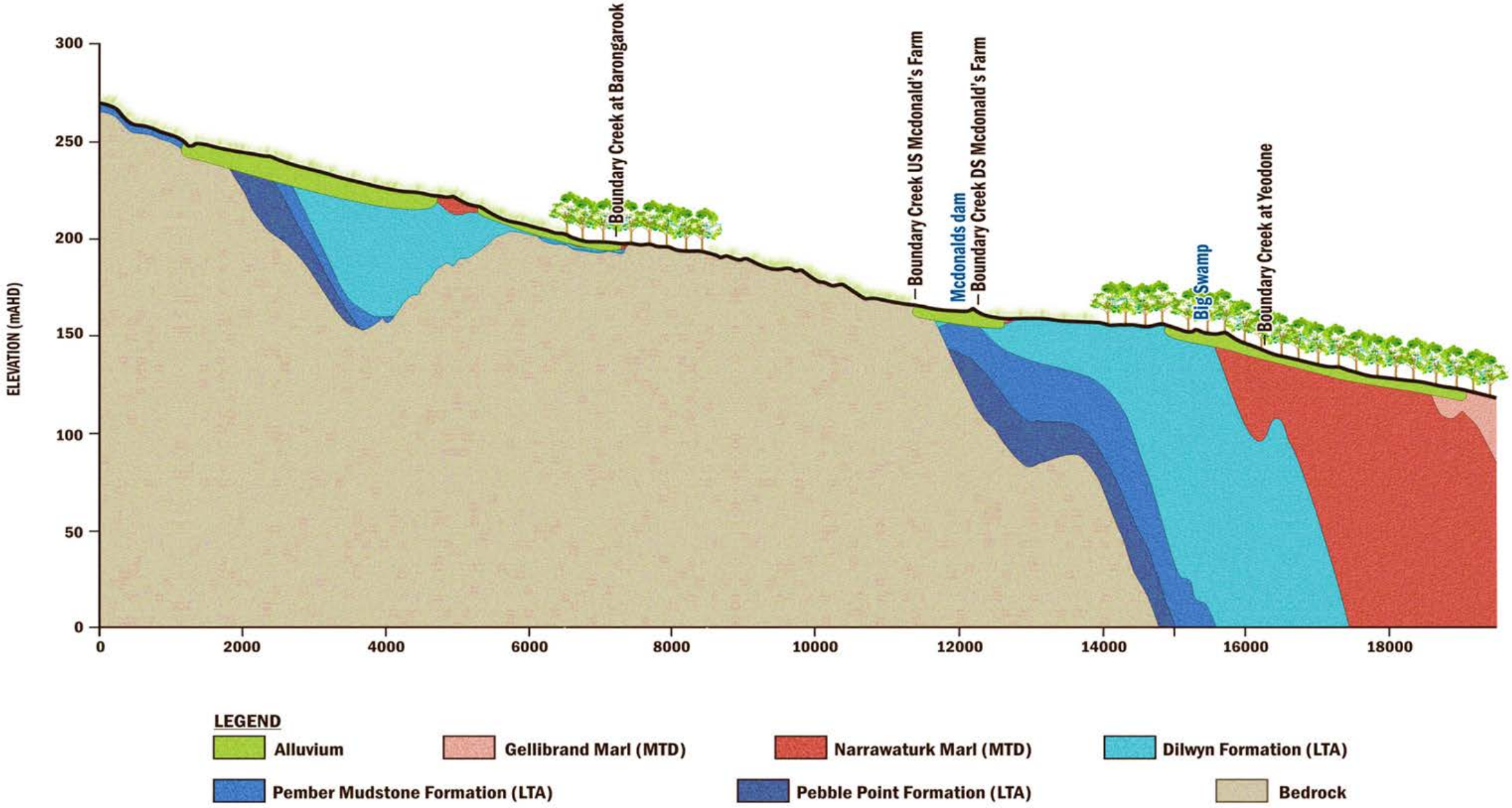
The current licence requires Barwon Water to provide a 2 ML/day supplementary flow to Boundary Creek (based on flow and groundwater draw-down triggers) to offset any potential stream flow reduction associated with the use of the borefield.

Historical impact to Boundary Creek from pumping

The borefield is responsible for **two thirds** of the reduction of base flow into Boundary Creek. The dry climate experienced during the same period accounts for the remaining **third**.



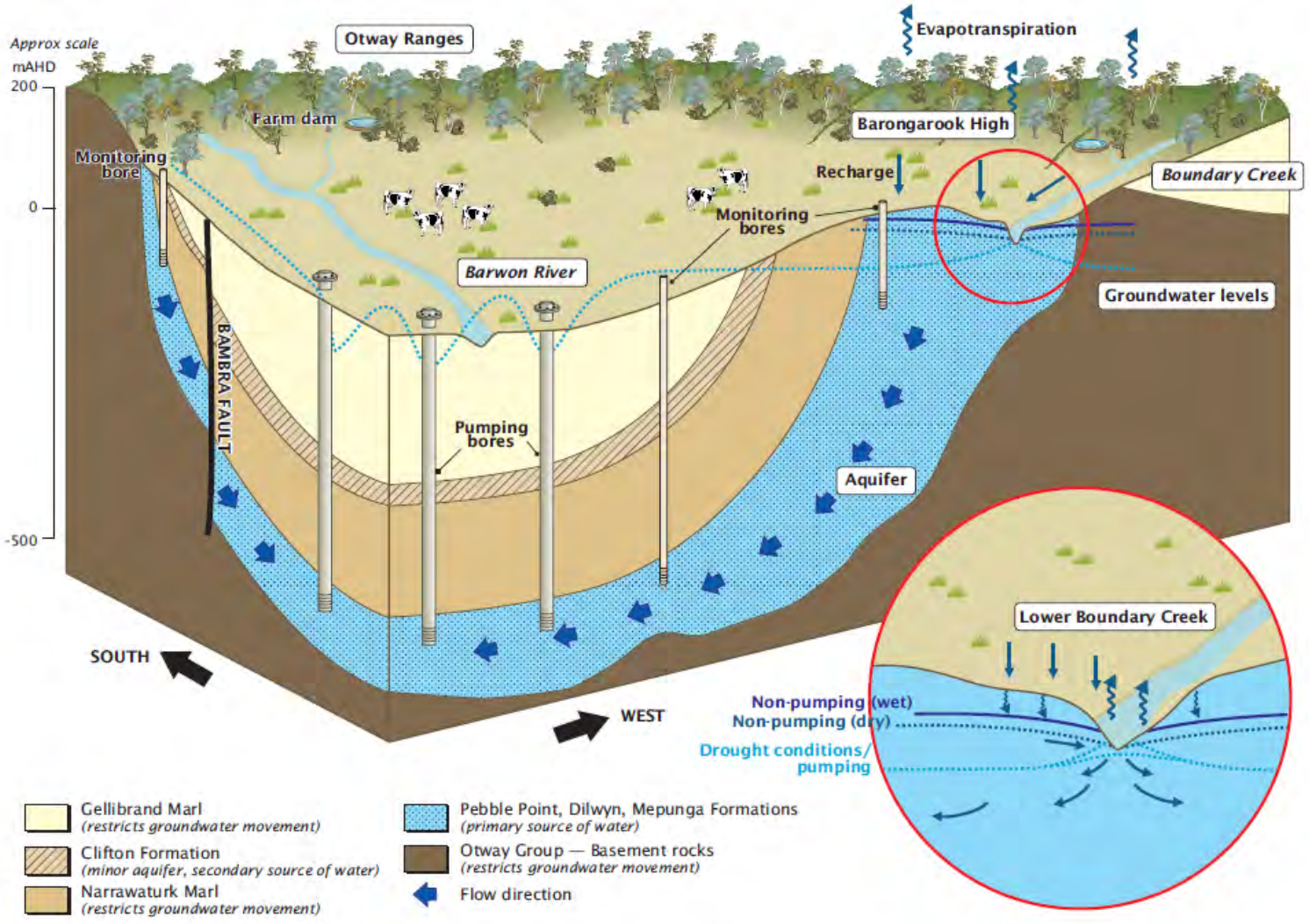
Upper sections of the Creek would likely have no flow periods during summer regardless of groundwater pumping, however pumping has increased the **frequency and duration of no flow periods** in lower sections of Boundary Creek.



What is Barwon Water doing about this?

Barwon Water will develop a flow regime for Boundary Creek as part of the licence application.

Aquatic ecology and FLOWS study



Recent technical studies have found that:

- The supplementary flow makes up a significant portion of the flow in the upper reaches of the creek during summer and autumn.
- Throughout the summer months, there is flow upstream of Yeodene Swamp, but rarely downstream of the swamp making the effect of the swamp on flow hard to determine.
- Boundary Creek rarely stopped flowing during summer months before 1999, but since then has stopped flowing for periods each summer despite the continued release of a supplementary flow to the upstream reach of the creek.

Aquatic ecology and FLOWS study

Purpose

To estimate the **aquatic plants and animals** supported by Boundary Creek and determine a flow regime suitable to maintain current habitat conditions

Findings so far

- Reach 1: Good (maintain)
- Reach 2: Good – Poor (maintain)
- Reach 3: Poor (improve)

Next steps

- Finalise flows study
- Recommend flow regime for Boundary Creek

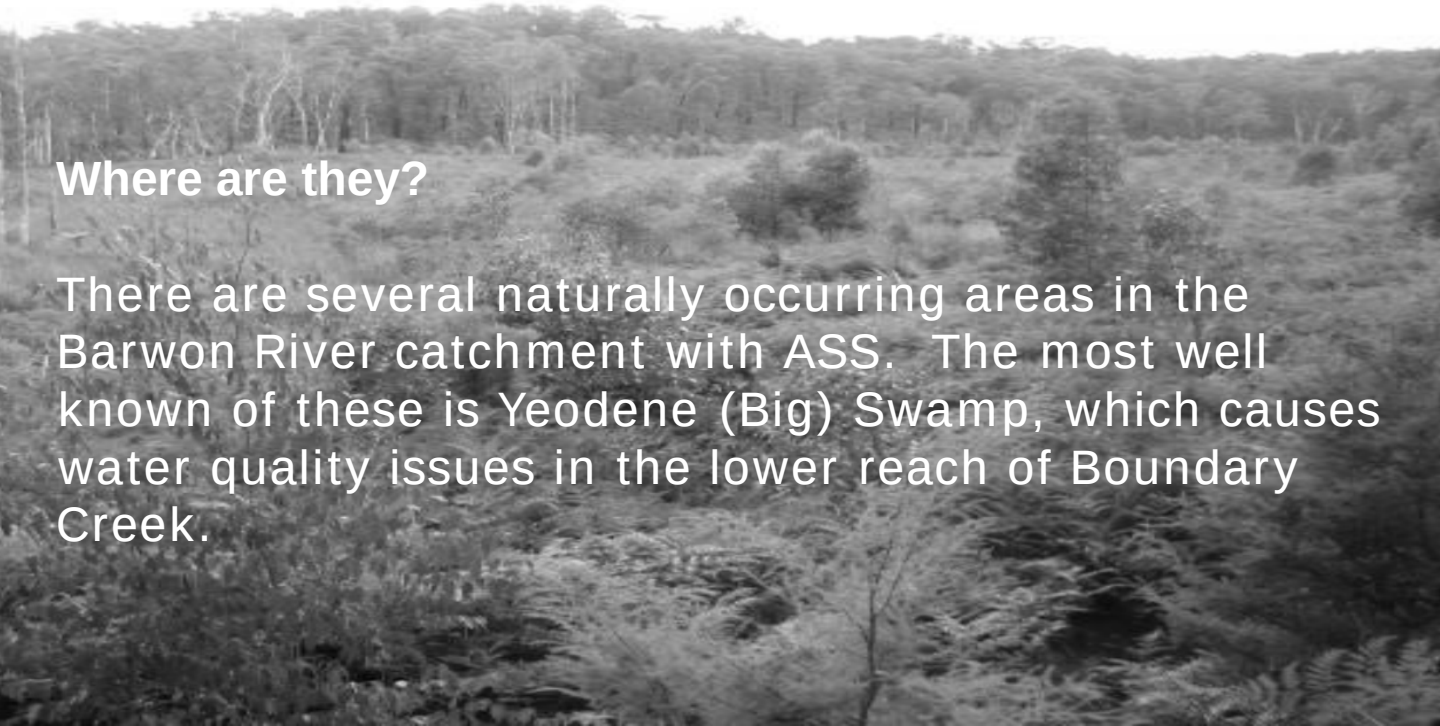
Acid Sulphate Soils

What are they?

Acid Sulphate Soils (ASS) refers to soils that contain pyrite, and form under waterlogged conditions where there is little or no oxygen available.

When saturated, these soils remain stable and are referred to as potential acid sulphate soils (PASS), posing little environmental concern.

If these soils are exposed to air (oxygen) as a result of declining groundwater levels or excavation, a natural chemical reaction takes place that produces sulphuric acid. The end result is actual acid sulphate soils (AASS).



Where are they?

There are several naturally occurring areas in the Barwon River catchment with ASS. The most well known of these is Yeodene (Big) Swamp, which causes water quality issues in the lower reach of Boundary Creek.

Acid Sulphate Soils

Barwon Water installed four new PASS monitoring sites in 2014 and has continued to monitor them.

Objective

To have a baseline condition assessment of four PASS monitoring sites so potential changes to the sites can be monitored to understand key drivers.

Findings

There are both PASS and ASS existing across the study area. Monitoring of the four sites has confirmed that these soils are stable and wet at present and that:

- Groundwater quality has not changed.
- Groundwater levels fluctuate in line with the seasons.
- Changes in surface water salinity were consistent with seasonal changes.

Barwon Water will establish a new ASS monitoring site in the **Porcupine Creek catchment** for ongoing monitoring as a precautionary measure.

Yeodene (Big) Swamp

What is the Yeodene peat swamp?

Boundary Creek runs through a peat swamp containing naturally occurring Acid Sulphate Soils. Over the past two decades this swamp has experienced:

- very dry conditions during the Millennium drought contributing to a reduction in inflows across the catchment and increased evapo-transpiration from the swamp;
- pumping from the Barwon Downs deep aquifer, together with supplementary flow releases to Boundary Creek;
- Peat fires in 1997,1998 through to 2006
- The cutting of deep trenches through and around the swamp for fire control by the CFA

Why is this an issue?

Technical studies have confirmed that this swamp contains acid sulphate soils, causing water downstream of the swamp to be highly acidic.

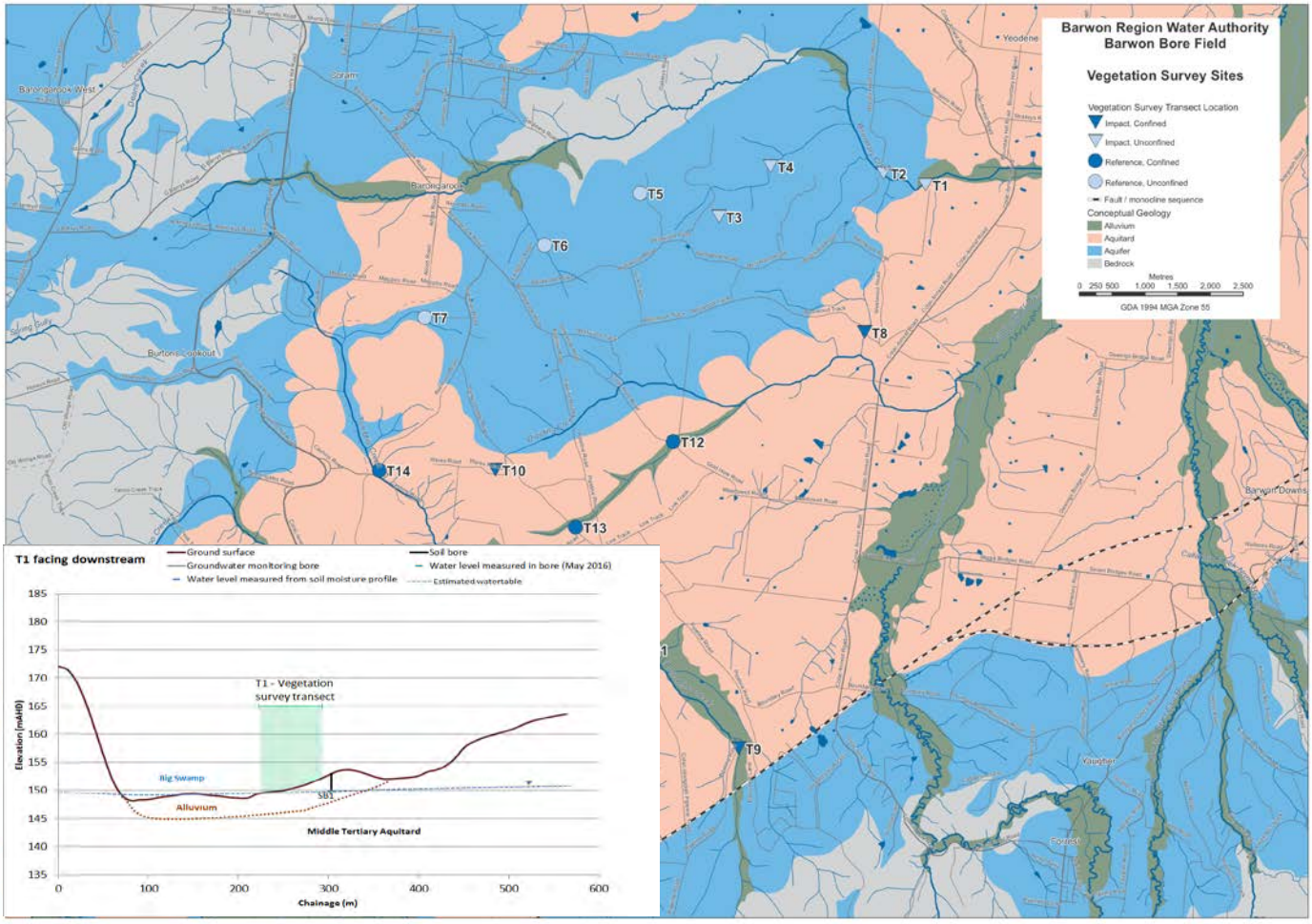
What is Barwon Water doing about this?

Barwon Water is investigating potential remediation measures to mitigate these impacts. This study will complete a significant missing element of the Boundary Creek catchment and will be completed by late 2017.

Vegetation monitoring

Completed studies:

- Tree water use study
- Vegetation monitoring (2016)
- Vegetation monitoring (2015)



Refer to Jacobs document J:\IE\Projects\03_Southern\IS129200\Spatial\Working\ArcGIS\Vegetation_monitoring_A3.mxd

Findings:

- Vegetation uses groundwater during periods of low water availability.
- No evidence linking the borefield to a negative impact on the health of deep rooted trees in the local catchment.
- No differences between impact/reference sites and confined/unconfined sites.
- Monitoring bores show declining groundwater trends in response t below average rainfall conditions.

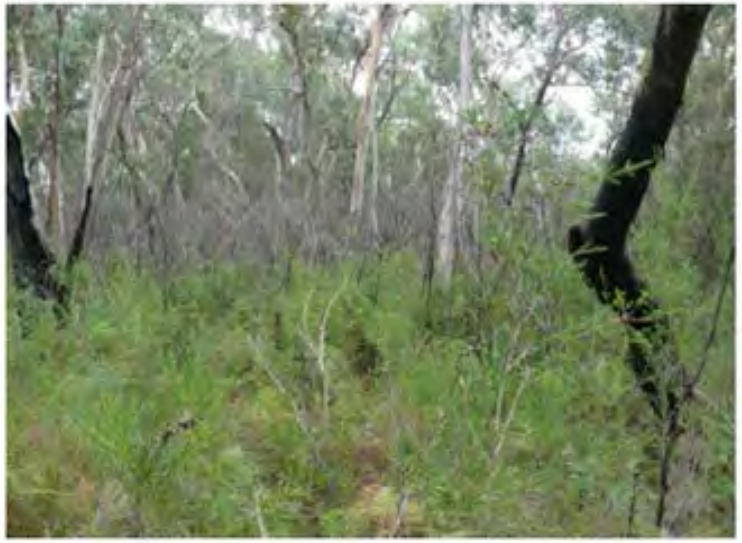
Sedgy wetland

Riparian forest

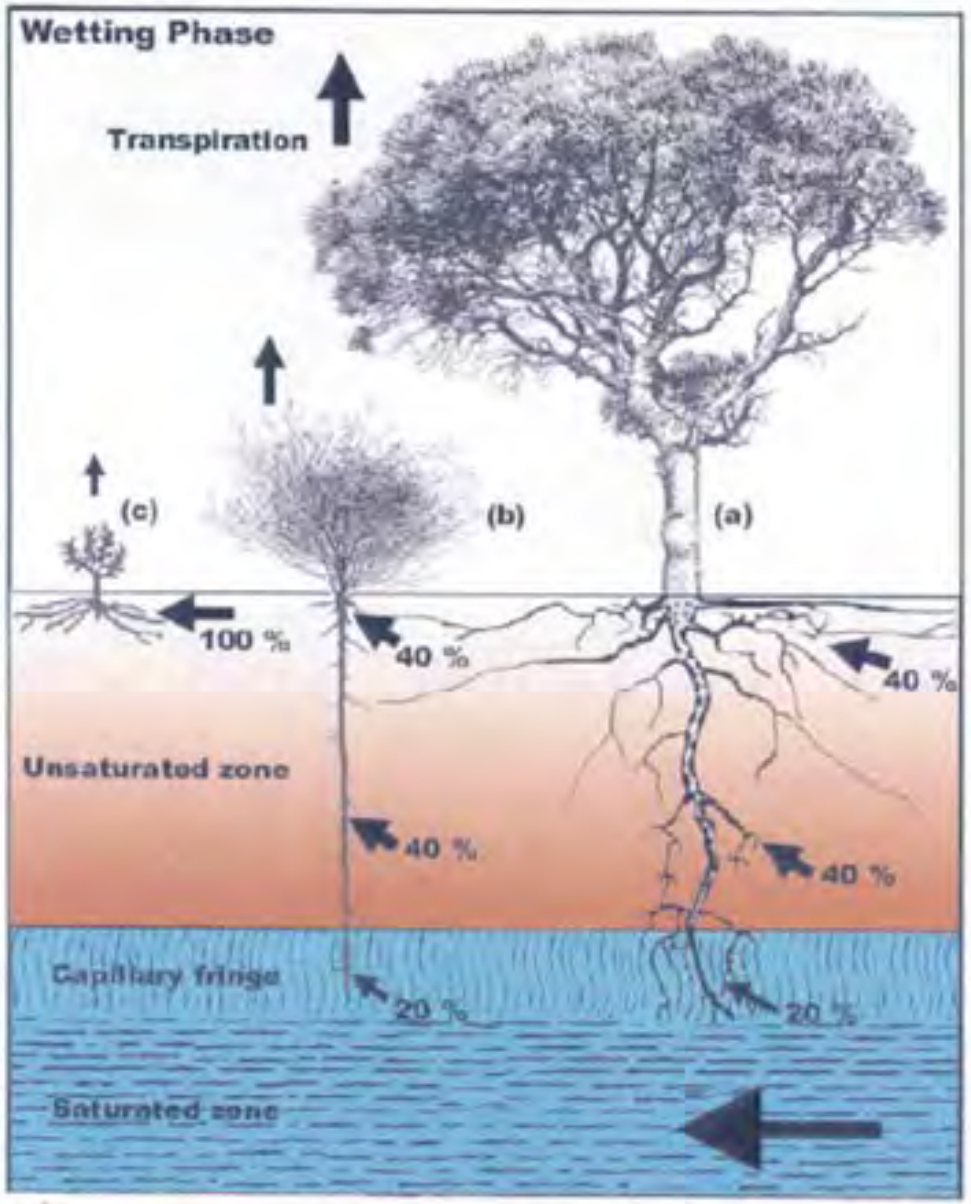
Deep rooted vegetation

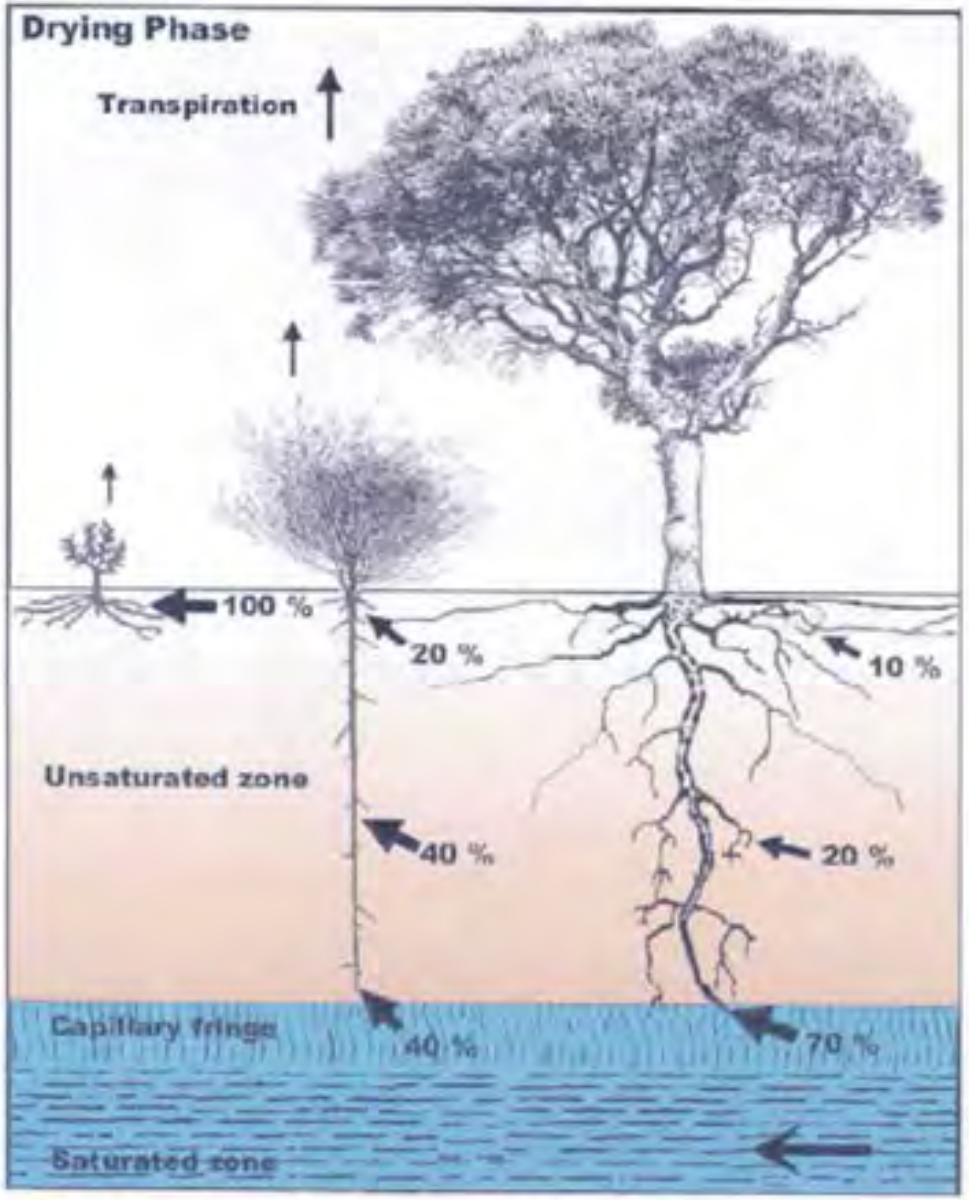
Swampy riparian woodland

Swamp scrub



Where do trees get water from under wet and dry conditions?





Gellibrand catchment

Where is the Gellibrand catchment?

The Gellibrand River rises in the Otway Ranges in southwest Victoria and meanders through the Great Otway National Park and Port Campbell National Park, joined by fourteen tributaries before reaching the ocean.

A small section of the Gellibrand River is connected to the aquifer that Barwon Water pumps from. Groundwater discharge is an important contributor to baseflow in the Gellibrand River.

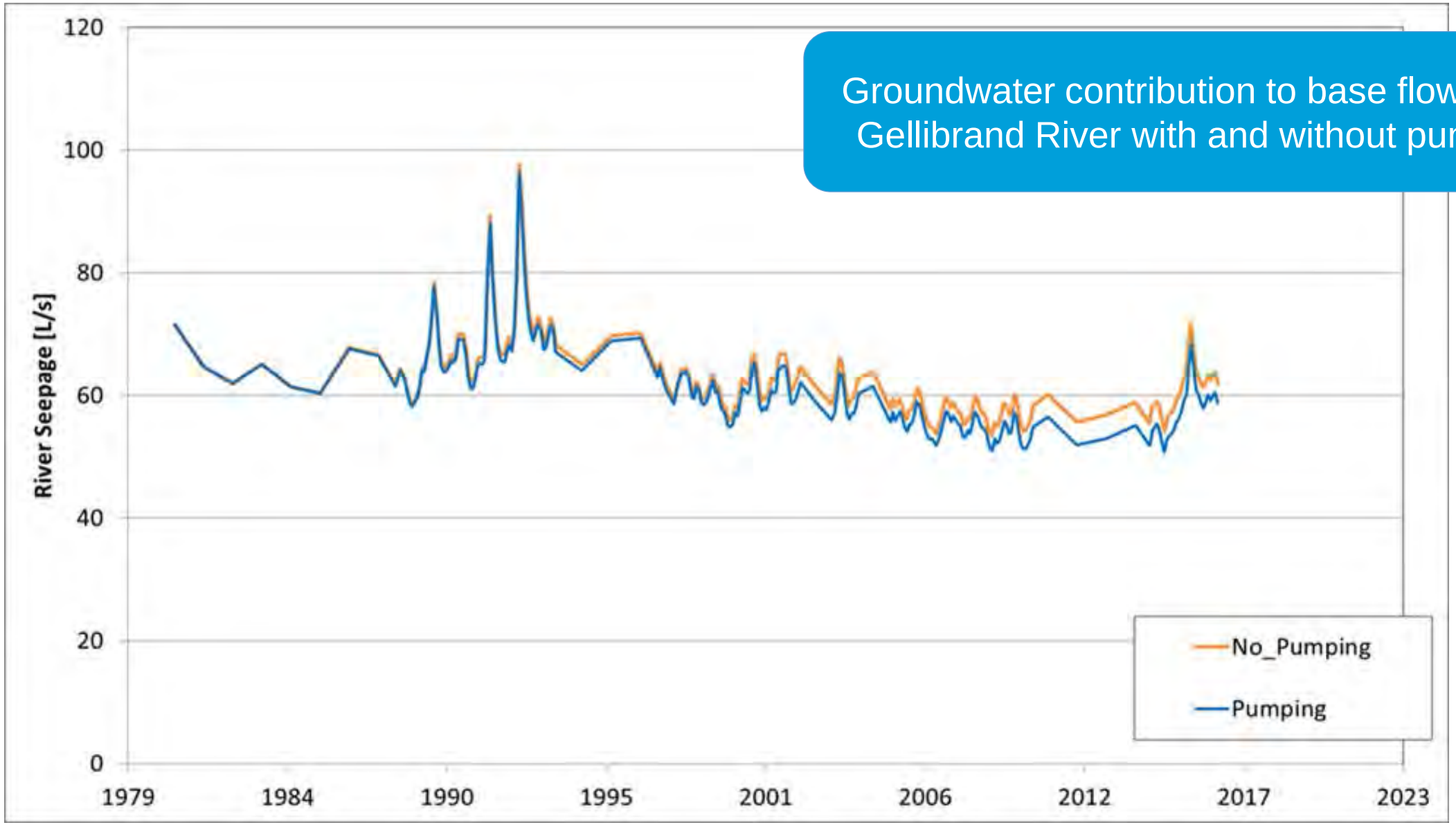
Historical impact to the Gellibrand River from pumping

Operation of the borefield has resulted in a minor reduction (0.3ML/d) in base flow in a small section of the Gellibrand River. Dry climate conditions have caused a greater reduction in base flow (0.6ML/d) than the historical borefield operation.

Future impact to Gellibrand River from pumping

Technical studies have confirmed that although a decline in groundwater levels caused by extraction does extend as far as the Gellibrand River, reduction in groundwater discharge to the Gellibrand River and associated tributaries is minimal. This number is currently being quantified.

Gellibrand catchment



Groundwater contribution to base flow in the Gellibrand River with and without pumping

Next steps

- **2012 - Barwon Downs monitoring program reviewed**
- **2013 - Barwon Downs community reference group convened**
- **2013 - 2015 - Vegetation, ecology and environmental studies undertaken**
- **2015 - Additional groundwater monitoring bores constructed**
- **2016 - 2017 - Ongoing environmental studies and monitoring**
- **June - October 2017 - Community consultation**
  Community information sessions, community reference group meetings, online consultation and workshops to be held.
- **Late 2017 - Barwon Downs borefield groundwater licence renewal application submitted to Southern Rural Water**
- **Late 2017 - Southern Rural Water to launch independent review of licence renewal application**
- **2018 - Decision on the licence renewal is made**