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Responsible use of groundwater

Reporting on the sustainability of pumping operations by
The Australian Beverages Council WA Members



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Executive summary

The Australian Beverage Council Ltd (ABCL) requested that The University of Western Australia (UWA) conduct a review of the sustainability of the groundwater pumping operations undertaken by its members in Western Australia. Public interest in the volumes of groundwater withdrawn by the beverages industry and its role in changing groundwater levels grew during extreme heat and drought conditions experienced in southwest Western Australia in 2023-2024. In consultation with the Minister at the time and the Department of Water and Environmental Regulation, ABCL facilitated a process of sustainability monitoring and reporting among Western Australian members, which has formed the basis of this review. The current review initiates a longer-term process of evaluating and reporting on the sustainability of ABCL member operations, and that ABCL is committed to a process of continuous improvement as part of this process.

Key findings

(1) ABCL member operations represent less than a one-thousandth of the total groundwater use in the Perth Peel Region

Total groundwater withdrawals made by 6 Western Australian ABCL members in 2024 was 276 ML – a volume that would fill about one-quarter of Optus Stadium.

The total amount of groundwater that is withdrawn annually across key Perth-Peel groundwater areas (Gnangara, Jandakot, Serpentine and Peel Coastal) is 388 GL – or nearly 400 Optus Stadiums.

The groundwater use by Western Australian ABCL members is 0.07% of the groundwater used in the Perth Peel region.

(2) The operations of ABCL members are managed under different regulatory frameworks. Members are meeting their regulatory obligations.

The regulatory frameworks for groundwater use are different for different ABCL members, depending on where their operations occur.

Operations in the Shire of Gingin are located within a Proclaimed Groundwater Area. The rules for their groundwater use are set by the Department of Water and Environmental Regulation.

In 2024, ABCL member operators in the Shire of Gingin used 47% of their allocated groundwater licences.

Operations in the Perth Hills are not located in a Proclaimed Groundwater Area, meaning that the Department of Water and Environmental Regulation cannot set the rules for how groundwater is used. Instead, Local Governments set groundwater extraction limits. ABCL members operate in two Local Government Areas (LGAs) in the Perth Hills.



In 2024, member operators in one LGA used 37% of their allocated groundwater. Operators in the other LGA used 99.5% of their allocated groundwater.

(3) Long term groundwater trends at ABCL member operations *most likely* reflect sustainable water use.

Long-term groundwater data provided by ABCL members indicate that maximum and minimum water table levels at operational sites are close to constant (+/- 1m groundwater variation between years) over time at most sites.

At one site, the water level dropped below the historical minimum during the 2023-2024 drought. The operators stopped pumping at this point, and water tables recovered to historical conditions in the subsequent winter.

At one site, water table levels have declined by approximately 2m over the past 15 years. Separating the effects of pumping operations from declining rainfall in the region over this timescale is difficult.

(4) Variations in groundwater levels between operational bores and monitoring bores indicate that ABCL member operations are *most likely* having minimal offsite impact.

Monitoring bores located some distance from the operational bore from where groundwater is pumped provide a way to test how far any drops in water table due to pumping can spread.

At sites where suitable monitoring bores are located, drops in water table during periods of pumping are small-to-negligible, suggesting minimal offsite impacts under normal operations.

(5) Where regional water budgets have been computed, they suggest allocation limits set for the ABCL operators are sustainable.

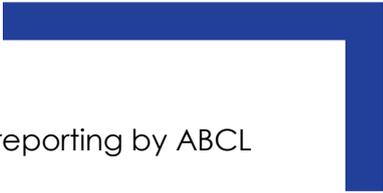
A good indicator of sustainability of a groundwater pumping operation is that more water should enter the groundwater area as recharge than is removed by pumping.

Not all ABCL members have computed the recharge for their operations.

Those which have, find that the pumping rates and allocation limits applied to the operations are lower than estimated recharge, suggesting sustainable limits have been set.

(6) Demonstrating the sustainability of ABCL member pumping operations in the Perth-Peel area will be enabled by standardisation of monitoring, analysis and reporting following best practice guidelines.

There is considerable variation in the level and quality of monitoring infrastructure and activities between different ABCL members' operations.



There is considerable variation in the issues covered by sustainability reporting by ABCL members.

Standardising monitoring infrastructure, activities, analyses and reporting across all ABCL members would enable more comparable, transparent and convincing sustainability reporting.

“In 2024, ABCL member operators in the Shire of Gingin used 47% of their allocated groundwater licences.”



Introduction

The Australian Beverage Council Ltd (ABCL) is Australia's peak national body representing the non-alcoholic bottled beverages industry. ABCL oversees a wide range of health, labelling, quality assurance and environmental initiatives aiming to implement best practices in Australia (Australian Beverages Council Ltd. 2026).

Groundwater provides a source of water for the beverages industry across Australia. Pressures on groundwater resources across the nation are increasing, driven by less predictable rainfall and recharge levels, changing catchment conditions and increasing demand for groundwater for agriculture, industry and domestic water supply (Barnett, Harrington et al. 2020). In Southwest Western Australia (SWWA), rainfall has been declining since the 1970s, and these declines have simultaneously increased reliance on groundwater to supply urban, agricultural and industrial needs, while reducing the recharge to most groundwater aquifers (Gelsinari, Bourke et al. 2024). The winter of 2023 was the driest on record in SWWA, and was followed by the driest summer on record in 2024 (Moore, Thompson et al. 2025). During this period, and prompted by regionally falling groundwater levels, public debate arose about the sustainability of groundwater use in the Perth Hills, where several groundwater pumping operations from ABCL members are located (Wynne 2024). One outcome of this debate was a commitment from ABCL to the Western Australian Government to increased communication and transparency regarding water pumping operations. In response to this commitment, ABCL facilitated sustainability monitoring and reporting from its Western Australian members. These reports were provided to UWA to review the sustainability of these operations.



Scope of report

This review was conducted by hydrologists and hydrogeologists at The University of Western Australia using independent, evidence-based assessment of operator-specific sustainability reports that were provided to the university. These reports have been examined and conclusions drawn based on established scientific methods. ABCL was independent of the work and has not influenced either the methods of analysis or conclusions drawn.

The scope of the work was to determine, based on evidence provided, whether the operations of the ABCL members pumping groundwater for bottled water operations in Western Australia were sustainable, and to provide any recommendations about how sustainability could be better established and communicated. The intention is to contribute evidence-based understanding to the public discussion about groundwater sustainability in Western Australia.

This review does not address the sustainability of groundwater pumping and bottling operations by non-ABCL members in Western Australia. The review outlines the current regulatory frameworks used to manage groundwater abstraction, but the review does not pass judgement on the suitability of these regulatory arrangements. UWA has undertaken this review while recognising that there is significant public interest in the beverage industry's groundwater use in the Perth region. This report is an independent scientific assessment which can help support informed decision-making.

The report firstly contextualises regional hydrology in the Perth area, and the water pumping by ABCL members relative to groundwater allocation volumes across key aquifers in the Perth-Peel region. The report evaluates three issues relative to sustainability: (i) water used relative to maximum permitted water use; (ii) trends in the groundwater resource at the operations; and (iii) impacts of pumping on local groundwater levels. Finally, it provides recommendations to harmonise future sustainability assessments by ABCL members.

Regional hydrology

All ABCL pumping operations occur in the Perth-Peel region of SWWA. Pumping operations occur in two broad hydrological settings: the sedimentary aquifers on the Swan Coastal Plain and the fractured rock/bedrock depression aquifers in the Darling Escarpment. The major distinction between these two settings is in the size and connectivity of the groundwater resource. In the Swan Coastal Plain, aquifers form in soils like sands, and in sedimentary rocks like sandstone (Commander 2003). In this geological setting, a lot of groundwater can be stored in the aquifer. High connectivity between different parts of the aquifer means that changes in groundwater in one location can affect more distant locations directly. The aquifers in the Perth Hills occur in harder rocks like granite. Water is stored in depressions and cracks in these rocks. This local storage is inconsistent and varies between locations – for example, previous studies suggest groundwater occurred in <50% of the area of catchments in the hills (Schofield, Stoneman et al. 1989). Because the groundwater storage is broken up in space, it is unlikely that changes to groundwater in one location will influence other locations. This does not prevent local changes in groundwater influencing a local region, or prevent changes in groundwater from having larger impacts through their influence on surface water features such as streams. For example, the long-term decline in streamflow in the Perth Hills since the 1980s, which is ongoing in the southern jarrah forest today, is attributable to drops in local water tables (George, Bell et al. 2025).

There are several important features of these aquifers which are relevant to understanding variations and trends in the groundwater resource. The first relates to climate. The Perth-Peel area has a Mediterranean-type climate with rainfall during winter and high temperatures and evaporative demand during summer. This means that during winter, groundwater can be recharged by percolating rainfall. Conversely, during summer, water will leave the landscape, largely through evaporation, and if tree roots can access the water table, groundwater will be depleted during this period. Additionally, annual rainfall naturally varies considerably from year to year. Together, these normal climatic variations lead to large differences in maximum and minimum groundwater level within most years, and potentially large differences in annual maxima (or minima) between years. This is normal, and it can make it difficult to separate the effects of small changes in groundwater due to over-abstraction from variability in groundwater that is entirely driven by climatic cycles. For this reason, it is important to explore trends in groundwater over long time periods. Such a long-term view makes it easier to distinguish trends from variability.

Beyond normal climatic variability, the rainfall in the Perth-Peel region has experienced sustained reductions since at least the 1970s. These reductions propagate into reduced groundwater recharge. Since the 1970s, annual recharge has exhibited a long-term decline (Gelsinari, Bourke et al. 2024). This decline is contributing to reduced



groundwater levels. These declines are occurring simultaneously with groundwater pumping.

The consequence of climatic variation, trends and groundwater use is that declines in groundwater level cannot necessarily be attributed to groundwater use. Declines may represent short-term drops in water availability due to seasonal variation, drops caused by dry years that will recover in wetter years, drops attributable to long term recharge declines, over-extraction by groundwater users, or a combination of these factors. With multiple factors influencing groundwater variability, attribution of changes to specific causes or effects is complex.

“In 2024, member operators in one LGA used 37% of their allocated groundwater. Operators in the other LGA used 99.5% of their allocated groundwater.”

Regional water use

Groundwater is a major water resource in Perth-Peel region, representing an estimated 70% of overall water used¹ in the region.

Across five major groundwater areas listed in Table 1, 388 GL of groundwater² are allocated for withdrawal annually.

Table 1: Groundwater allocation from different aquifers within major groundwater areas in Perth-Peel Region. Sources: 1: Department of Water and Environmental Regulation (2023), 2: Department of Water and Environmental Regulation (2022), 3: Department of Water (2015), 4: Department of Water and Environmental Regulation (2024).

Aquifer	Total Groundwater Allocation
Gnangara – Superficial ¹	186 GL/yr
Gnangara - Leederville ¹	44 GL/yr
Gnangara - Yaragadee ¹	54 GL/yr
Gnangara – Mirrabooka ¹	6 GL/yr
Jandakot Mound ²	69 GL/yr
Peel Coastal ³	11 GL/yr
Serpentine – Superficial ⁴	9 GL/yr
Serpentine - Leederville ⁴	7 GL/yr
Serpentine - Cattamarra ⁴	2 GL/yr
Total	388 GL/yr

2024 water use by ABCL members, aggregated by Local Government Area, along with the regulatory limits for water use, known as the “allocation,” in each area and the percentage of this allocation that was used in 2024, are provided in Table 2. The total extraction by ABCL members was 276 ML, less than 50% of the total allocation provided to the members. ABCL member water use represents 0.07% of the groundwater allocation for the five groundwater regions listed in Table 1.

Table 2: Water use by ABCL members in 2024.

Local Government Area	Allocation	Volume extracted in 2024	% Allocation
Shire of Gingin	498 ML	234 ML	47%
City of Gosnells	18 ML	18 ML	99.5%
City of Armadale	65 ML	24 ML	37%
Total	580 ML	276 ML	47.5%

For further context, the breakdown of groundwater licence allocations in the Gnamptu and Jandakot groundwater areas is also provided in Table 3. The 580 ML allocation and 276 ML water use by ABCL members is a factor of 100 lower than the allocations across comparable industries.

Table 3: Use of groundwater by sectors from the Gnamptu and Jandakot Groundwater Areas. Sources: 1: Department of Water and Environmental Regulation (2023), 2: Department of Water and Environmental Regulation (2022)

Groundwater Area	Users	Total Groundwater Allocation
Gnamptu ¹	Public Water Supply	111 GL (40%)
	Agriculture	62 GL (23%)
	Parks, Gardens, Recreation	45 GL (16%)
	Commercial, industrial, construction, mining, stock & domestic licences	21 GL (8%)
	Unlicensed domestic (garden bores)	36 GL (13%)
Jandakot ²	Public Water Supply	4 GL (5%)
	Private Licences (agriculture and industry)	41 GL (60%)
	Unlicensed domestic (garden bores)	24 GL (35%)

Regulation

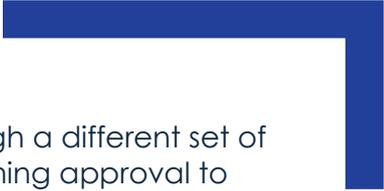
The geographic locations of the pumping operations shown in Table 2 lie in two different areas – the Shire of Gingin's Lennard Brook region, and the Perth Hills (City of Gosnells and City of Armadale). Regulation of groundwater use in these regions is different, because the Perth Hills' sites lie outside proclaimed groundwater areas, while sites in the Shire of Gingin are located within a proclaimed groundwater area. As shown in Figure 1, not all of SWWA is within a proclaimed groundwater area.

Proclamation is the legal process that enables the Western Australian Department of Water and Environmental Regulation (DWER) to manage the groundwater resource. Inside proclaimed groundwater areas, the State Government can specify the total amount of groundwater that can be used in a particular area, and issue licences to businesses or individuals to allow them to access a defined quantity of that groundwater (Department of Water and Environmental Regulation 2025). Thus, in the Shire of Gingin, groundwater allocations are regionally reviewed and updated by DWER, leading to periodic updates of licence conditions, such as the 2023 update of the Gnangara Groundwater Allocation Plan (Department of Water and Environmental Regulation 2023). DWER is also responsible for auditing water use and enforcing compliance with any conditions associated with the groundwater licence in the proclaimed groundwater areas.

In unproclaimed groundwater areas, DWER does not have legal authority to manage the groundwater resource. In these areas, any groundwater users are generally able to obtain and use groundwater without a licence.



Figure 1: Proclaimed groundwater areas in SWWA (Department of Water and Environmental Regulation 2022).



Water bottling operators in unproclaimed areas are regulated through a different set of legislation: the Planning and Development Act (2005). As part of gaining approval to run a groundwater extraction operation for bottling, Local Government Authorities (LGAs) set operating conditions, which in the Perth Hills include maximum volumes of groundwater that can be pumped each year as reported in Table 2.

There has been community scrutiny of the suitability of these regulatory arrangements in recent years. This review will not comment on the correctness or otherwise of these choices by Government, but will try to explain the reasons that these choices were made. Historically, the decision not to proclaim the Perth Hills as a groundwater area is based on the nature of the groundwater resource in the Hills (Department of Water and Environmental Regulation 2025). As outlined in the Regional Hydrology section previously, there is a large quantity of groundwater that is highly interconnected to the Swan Coastal Plain. These features underlie the reasons it is managed as a proclaimed groundwater area. Conversely, the limited scale of the groundwater resource, along with its fragmented and disconnected nature in the Perth Hills, is the main reason that the region has not been proclaimed as a groundwater resource.

Sustainability

Compliance with the regulatory limits set by State or Local Government Authorities is a legal requirement for ABCL members in Western Australia, but does not ensure sustainability of the pumping operations for two reasons.

Firstly, allocations consider the volume of pumping, but not the rate of pumping. High pumping rates have the potential to induce temporary offsite impacts by drawing down the water table. That is, if pumping rates are so high that groundwater flow from surrounding areas cannot replenish the water that is removed, a “cone of depression” may form that is large enough to influence offsite areas such as neighbouring properties, or surface water bodies such as wetlands or streams. While the formation of a cone of depression would likely be temporary and linked to the duration of high pumping rates, it could impact ecological function and groundwater resources in neighbouring areas. Examples of this are shown in the conceptual diagram in Figure 2. Consideration of the potential for groundwater declines during pumping to extend to neighbouring properties or water bodies is an important component of the sustainability of operations that is not directly covered by allocation limits.

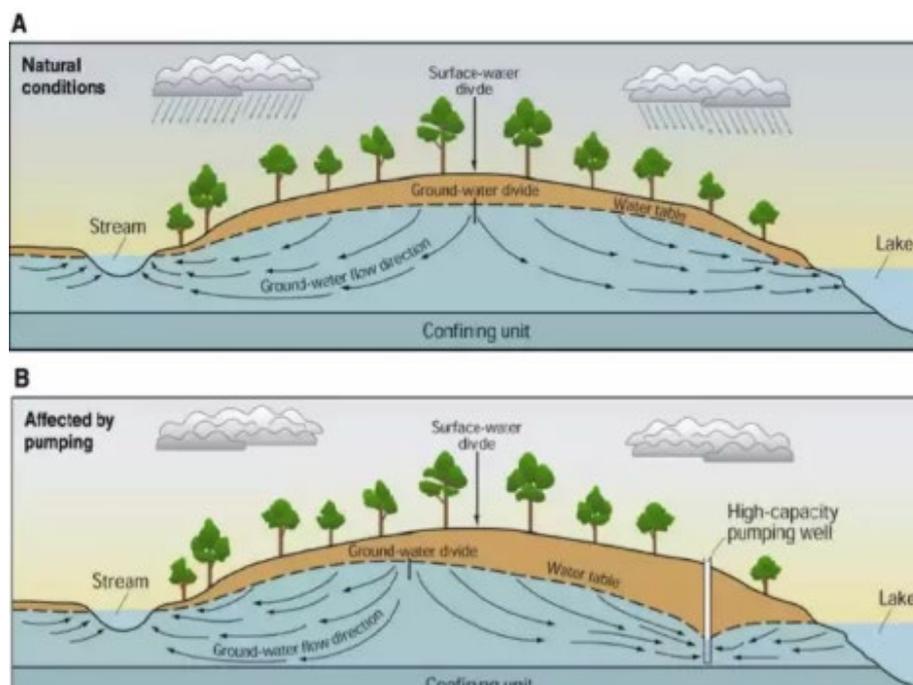
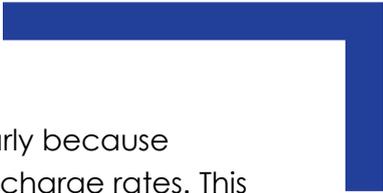


Figure 2: Conceptual diagram of the effects of rapid pumping on the water table. (A) shows conditions without pumping. (B) shows how pumping rapidly can lower the water table around the pumping well. This can alter the direction of flow of groundwater – for example from flowing into the lake to flowing from the lake, and alter the fraction of the landscape that contributes groundwater to other surface water resources – for example, there is less of the hill sending water to the stream on the left hand side of the diagram when the rapidly pumping well is operational.



Secondly, the hydrology of the Perth Basin is non-stationary, particularly because increasing temperatures and declining winter rainfall are reducing recharge rates. This raises the potential for allocation limits to become outdated. In some cases, particularly in unproclaimed areas, these allocation limits were set decades ago and are not regularly reviewed³. Testing whether there is evidence of changing water table levels during the lifetime of pumping operations is therefore important to ensure that the situation where allocation targets are met, but groundwater pumping is nonetheless unsustainable, does not arise.

For most of the ABCL members, there is sufficient information available to assess these elements of sustainability, as outlined below.

Are local groundwater resources stressed by pumping?

Two of the reports reviewed by UWA include data from monitoring wells demonstrating whether and how groundwater levels change in the monitoring well during pumping from the operational well. In these cases, there is no evidence of a large cone of depression forming. For example, at one operation, the relationship between groundwater levels at a bore 26m from the pumping well and a bore 300m from the pumping well was shown to be consistent and independent of pumping operations. This suggests that there was no influence of pumping on these monitoring bores. By having two monitoring wells - one close and one distant from the pumping well - this operation follows a best-practice approach.

At one site, modelling rather than observations was used to estimate the cone of depression from pumping operations if pumping were to occur at a maximum rate. The predicted cone of depression was contained within the property owned by the pumping operation and would not extend offsite.

At the other sites, we could not make a clear determination of whether local groundwater drawdown could be occurring in association with pumping operations.

Therefore, for the sites with suitable data to make an evaluation, we conclude that offsite impacts are unlikely to occur from pumping operations. Recommendations about monitoring, analysis and reporting standards, to ensure this evaluation can be applied to all sites, are presented in the "Best Practices" section.

Is there evidence of long-term depletion?

Groundwater histories were provided at all sites associated with pumping operations. The length of time over which trends in groundwater levels were considered varied from 3 years to 24 years. In some cases, data gaps or changes in the monitoring bore caused inconsistencies in the data record, although these do not influence the interpretation. At all but two sites, the long-term records indicate steady groundwater levels (where changes in water table level between the beginning and end of the



monitoring period are smaller than the annual variations in water levels) or increasing groundwater levels. At one site, long-term monitoring suggests that over a 15-year period, water levels have declined by approximately 2m. The extent to which this should be attributed to reductions in recharge or to pumping is unclear. Additionally, monitoring at this site is impacted by problems with data loggers and missing data.

At a different site, water levels during the 2023-2024 drought period dropped to unprecedented lows. Operators ceased pumping during this period. The following winter, water levels returned to pre-drought winter levels, suggesting full recovery of the groundwater.

Therefore, for all but one site, groundwater pumping operations have not resulted in long-term changes in water availability, and at the site where change has taken place it is not possible to directly attribute this change to pumping activities.

“Separating the effects of pumping operations from declining rainfall in the region over this timescale is difficult.”

Best practices

Future sustainability assessments will be strengthened by consistent monitoring, transparent reporting, and alignment with best-practice guidelines. The recommendations below present an opportunity for industry-led best practice.

Monitoring wells installation and instrumentation

All sites should install one or more dedicated monitoring wells. More than one well may be indicated in the Perth Hills sites where the effects of pumping may not be consistent in different directions.

Well locations should aim to be representative of conditions at the property boundary to capture any effects of pumping on neighbouring sites. Monitoring near groundwater sensitive systems such as wetlands/stream corridors/groundwater dependent vegetation is also valuable to capture ecological effects of pumping.

The surface elevation of all wells should be surveyed to ensure that groundwater depths can be meaningfully compared between wells.

Monitoring wells should ideally be fitted with sensors to measure water levels to provide continuous information about how the groundwater system responds to pumping.

Pumping wells should keep continuous records of pumping rates and water levels.

Pump tests should be used to determine how conditions in the monitoring bore respond to variable pumping rates.

Data analysis

- Monitoring well conditions should be related to abstraction rates/volumes.
- Data relating to abstraction and monitoring should cover the same time periods.
- Data should ideally be analysed in terms of absolute elevations (mAHD) to allow spatial comparisons.
- Long-term analyses should ideally use a period of at least 10 years of data to assess trends.
- Water balance calculations should be used to assess recharge at all sites. Ideally, consultants undertaking these calculations should *not* be informed of current abstraction rates, to avoid unintentionally biasing these calculations.

Data reporting

All data should be reported in a form that is auditable and can be used to reproduce the consultants' report. Protocols such as the FAIR Principles for reproducible science (<https://www.go-fair.org/fair-principles/>) should be applied for this purpose.

Conclusions

Although the groundwater use of the bottled beverages industry in the Perth area represents a trivial fraction of total groundwater use, the industry is subject to increasing public scrutiny. Detailed reporting on abstraction volumes demonstrates that groundwater pumping by ABCL members meets its regulatory requirements, that there are unlikely to be offsite impacts of the pumping in most cases, and that the operations are likely to be sustainable. The actions of one of the ABCL operators in responding to drought conditions by ceasing pumping until groundwater levels recover demonstrate a commitment to sustainability that is commendable.

At present, inconsistent monitoring, analysis and reporting on relevant elements of sustainability by industry members is responsible for caveats and cautious language in the conclusions above. As this is the first sustainability report for the industry in Western Australia, it is unsurprising that steps can be taken to move towards more standardised and comprehensive reporting. If these steps, outlined in the Best Practices section in this report and elaborated on in a separate report to the ABCL, are adopted, it will represent a meaningful step forward in transparency and clarity about the impacts and sustainability of ABCL members' groundwater pumping operations in Western Australia.

“Drops in water table during periods of pumping are small-to-negligible, suggesting minimal offsite impacts under normal operations.”

Glossary

ABCL	Australian Beverages Council, Ltd.
Allocation	The maximum quantity of groundwater that may be abstracted by a particular licence holder in one year
Cone of Depression	Localised drop of the water table in response to groundwater pumping, greatest near the pumping bore
DWER	Department of Water and Environmental Regulation
FAIR Principles	Principles for reproducible science: findability, accessibility, interoperability and reuse of digital assets.
Groundwater Areas	Regions used for groundwater management, generally aligned with specific aquifers and geological formations.
mAHD	Metres, Australian Height Datum – standard measurements of elevation in Australia, where 0 mAHD is approximately sea level.
Proclaimed Groundwater Area	A region where the Western Australian Government is legally required to allocate groundwater resources
Pump tests	A standard hydrogeological test where water is pumped from a well, revealing local impacts and groundwater recovery rates.
Recharge	The depth of water that replenishes groundwater, usually measured on an annual basis
SWWA	South West Western Australia
Unproclaimed Groundwater Area	Regions where the Western Australian Government does not have the authority to allocate groundwater resources
UWA	The University of Western Australia
Water Table	The top of the groundwater in an unconfined aquifer, where the transition between fully saturated and unsaturated soil/rock occurs.

References

(2005). Planning and Development Act. Western Australia,,
https://www.legislation.wa.gov.au/legislation/statutes.nsf/main_mrtitle_722_homepage.html.

Australian Beverages Council Ltd. (2026). "Australian Beverages." Retrieved 23 January, 2026, from <https://www.australianbeverages.org/about-us/>.

Barnett, S., et al. (2020). Groundwater in Australia: Occurrence and management issues. Sustainable groundwater management: A comparative analysis of french and australian policies and implications to other countries, Springer: 109-127.

Commander, P. (2003). "The Engineering Geology of Perth, Part 1." Australian Geomechanics, 38(3).

Department of Water (2015). Peel Coastal Groundwater Allocation Plan.

Department of Water and Environmental Regulation (2022). Environmental management of groundwater from the Jandakot Mound groundwater resources. Annual compliance assessment report July 2021–June 2022.

Department of Water and Environmental Regulation (2022). Rights in Water and Irrigation Act, 1914, Groundwater Proclamation Areas.

Department of Water and Environmental Regulation (2023). Gnamagara Groundwater Allocation Plan.

Department of Water and Environmental Regulation (2024). Waangaamaap –Serpentine groundwater allocation statement.

Department of Water and Environmental Regulation (2025). "About Water Licensing in Western Australia." Retrieved 23 January, 2026, from <https://www.wa.gov.au/service/building-utilities-and-essential-services/integrated-essential-services/about-water-licensing-western-australia#:~:text=Proclaimed%20water%20resources,taking%20and%20use%20of%20water>.

Department of Water and Environmental Regulation (2025). "Groundwater use - commercial bottled water." Retrieved 27 January, 2026, from <https://www.wa.gov.au/service/environment/environment-information-services/groundwater-use-commercial-bottled-water>.

Gelsinari, S., et al. (2024). "Nonstationary recharge responses to a drying climate in the Gnamagara Groundwater System, Western Australia." Journal of Hydrology 633: 131007.

George, R. J., et al. (2025). "A multidecadal analysis of groundwater level and streamflow decline in Southern Forest catchments, Western Australia." Journal of The Royal Society of Western Australia 108.

Moore, C. E., et al. (2025). "Biophysical response of a coastal woodland to extreme water deficit during a year of record-breaking heat." Environmental Research Letters 20(3): 034043.

Schofield, N., et al. (1989). Hydrology of the jarrah forest. The jarrah forest: a complex Mediterranean ecosystem, Springer: 179-201.

Wynne, E. (2024). Bottled water industry defends groundwater extraction in Perth Hills amid calls for transparency. Australian Broadcasting Corporation. Perth, Australian Broadcasting Corporation.



THE UNIVERSITY OF
**WESTERN
AUSTRALIA**

Professor Sally Thompson
Dr. Konrad Miotlinski
Ms. Emma Gill

Centre for Water and Spatial Science

E sally.thompson@uwa.edu.au
35 Stirling Highway, Crawley, Western Australia, 6009

uwa.edu.au