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Managing groundwater in South Australia's rangelands

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Abstract

Ground water is the only reliable water source in the Far North of South Australia with approximately 70% of the water take coming from the Great Artesian Basin (GAB). Management of the GAB resources is critical to the health of ecological communities including GAB Springs and the viability of the pastoral, mining and tourism industries in the South Australian Arid Lands region. Demands on the GAB are likely to increase in the future due to the projected growth in mining, petroleum, and geothermal industries.

Much of South Australia's pastoral region falls within the Far North Prescribed Wells Area where water take is managed through licenced allocation. The South Australian Licenced Water Use Metering Policy requires licensed water to be taken through an approved method. Water meters are the default method for accounting for groundwater take however alternatives to water metering can be considered and documented within a meter implementation plan.

With guidance from an advisory group consisting of pastoral industry members with an interest or experience in groundwater management, along with government representation, field trials are in progress testing water accounting solutions against key criteria of reliability, practicality, cost and accuracy.

Trial sites have been selected to ensure water accounting methods are tested across a variety of land types, hydrogeological conditions, and consider water consumption of native and feral animals. The results of the field trials will guide development of policy and accounting methods that meet the requirements associated with managing a prescribed groundwater resource in a way that does not significantly impact a pastoral business; ideally adding value to the businesses such as improved understanding of stock water requirements and water point management and security.

The presentation will provide background on groundwater policy in South Australia and an overview of the field trials including progress and learnings.

Introduction

South Australia's Far North Prescribed Wells Area (FNPWA) is an area of over 315 000 square kilometres covering much of the South Australia's arid area (Fig. 1). Groundwater is the principal source of water for

town water supply, domestic, watering stock, petroleum and mining production purposes. The springs fed by the Great Artesian Basin aquifers support rare and vulnerable flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and hold significant Aboriginal cultural values.

Pursuant to the Water Resources Act 1997, the wells in the Far North PWA were declared as prescribed wells on 27 March 2003 as a means of encouraging responsible use of groundwater. Subsequently a Water Allocation Plan (WAP) was developed in accordance with the Natural Resources Management Act 2004 enabling a licencing and compliance system to manage the groundwater resources, to ensure extraction is undertaken in a sustainable manner and to protect the Great Artesian Basin springs.

Licenced stock allocations are determined at a rate of 100 L per day per head of cattle and 20 L per day per head of sheep with an additional buffer of 20% to account for water use by native and feral animals from stock watering points (SAAL Board 2021). Groundwater extraction by the Pastoral industry for stock and domestic purposes is estimated to be 15% of the overall groundwater extraction in the Far North PWA (SAAL Board 2021). However, despite South Australia's policy that all licenced water use needs to be metered (DEW 2019), measurement of the actual use has not been implemented, contributing to significant uncertainty in water balance calculations and groundwater modelling.

The Accounting for Groundwater Take in the Far North PWA project has been developed in response to community concern, raised in 2019/20 during consultation on the Water Allocation Plan for the FNPWA, about the potential impact of water metering on pastoral businesses in the Far North. Concerns centred on the practicality and cost to purchase, install, maintain and monitor meters in remote areas, compounded by the number of bores many landholders utilise and the high temperature and pressures experienced in the central and northern areas of the PWA.

Whilst metering of water extraction is considered the most accurate method of determining take, alternative approaches to water accounting, including non-meter options, can be considered in accordance with principle 1.7 of the SA Licensed Water Use Metering Policy which is flexible and recognises on-ground regional implementation issues. Flexibility provisions including alternatives for metering must be documented in a meter implementation plan (MIP) for a prescribed water resource and made publicly available.

SA Arid Lands (SAAL) Landscape Board and Department for Environment and Water (DEW) are investigating various water accounting options including alternatives to water metering to enable development of an appropriate MIP (referred to as a Water Accounting Implementation Plan in the WAP) for the FNPWA.

Landholder participation in the planning and conduct of the Accounting for Groundwater Take project will be critical to ensure the trial is representative of the on-ground conditions.

Methods

Project Governance

The delivery of the Accounting for Groundwater Take project is reliant on groups and units within government and the community. A supportive program governance framework was developed to provide the structure, decision making process, roles and responsibilities for managing the program.

An advisory group of 5 pastoralists and property managers in the FNPWA was established through an expression of interest (EOI) process. All had an interest and experience in groundwater management for cattle and/or sheep enterprises. A chair for the group was selected from outside the pastoral region to ensure neutrality and to bring a different perspective to the group. The advisory group is also supported by staff from the SAAL Board and DEW.

The group met regularly at the early stages of the project to establish and investigate water accounting options; provide advice regarding the suitability of potential water accounting methods for trialling in the Far North; and support the trials, including identifying participants, expertise and reviewing progress.

Field Trial Methodology and Selection

Six trial sites (pastoral leases, 'stations') were selected for this project; three from Expressions of Interest and three "shoulder tapped" to ensure a broad array of stock, hydrogeological and geographical land systems were captured in the trial sites. The stations selected have both hydrogeological conditions with high artesian temperatures and pressures, and non-artesian conditions where water extraction was by submersible pump connected to solar power. Having a diversity of land systems recognises stock water requirements will vary with grazing conditions, vegetation type and water quality. Figure 1 provides the location of the participating stations within the FNPWA, with the different scenarios of the 6 stations provided in Table 1.

Within the stations, trial sites were carefully selected to maximise the trial's success in determining stock water consumption. Fenced paddocks with no open water storage such as dams or waterholes were chosen. Bores and associated water points (tanks and troughs) and water distribution pipework were required to be in good condition and free of open or uncontrolled flows. Stock type and number, including stock movements into or out of the paddock, had to be known and recorded.

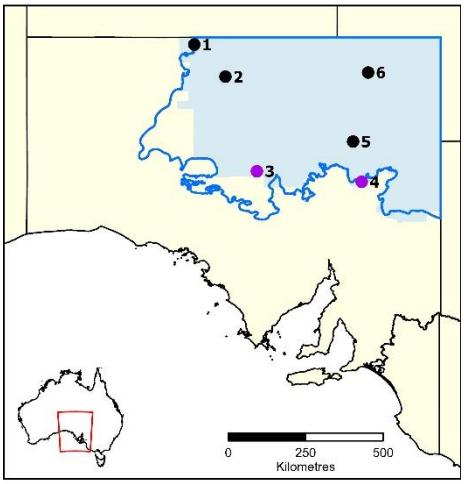

Fig. 1. Location of participating stations (numbered) in the Far North PWA (blue shading); extent of the Great Artesian Basin (blue line); black markers = cattle enterprises, purple = sheep enterprises.

Table 1. Water accounting monitoring scenarios

Station	Stock-Cattle Consumption	Stock-Sheep Consumption	Sub Artesian (pumped bore)	Artesian Bore	Artesian Bore - high temp./pres.
1	✓		✓		
2	✓		✓		
3		✓ (Merino)	✓		
4		✓ (Dorper)	✓		
5	✓			✓	
6	✓				✓

Water meters of varying types are utilised in all trials to-date, to enable monitoring of water consumption, to determine the accuracy of an alternate accounting method and to assess reliability of the meter itself. Meters are connected to telemetry where practicable to enable remote access to the data. Video or still photos from field cameras installed at water points enables identification of water consumption from non-native (e.g. camels and horses) and native animals. Rainfall, temperature and evaporation data was also collected, either on-site at the water points where sensors are installed, or from the nearest Bureau of Meteorology (BOM) weather station.

The land managers at each station provided regular information during the trials including; stock numbers and movement, stock type (e.g. heifers, calves), presence of surface water after rain events, manual instrument reads and assistance with trouble shooting.

Trials have progressively commenced since 2023 and will run for a minimum of 18 months subject to weather conditions. Trials may need to run significantly longer if the seasons are mild or experience above average rainfall.

All findings and observations will be documented and a report will be provided to the Department for Environment and Water to assist the development of a Water Accounting Implementation Plan suitable for the region. This plan may include one or potentially multiple approved water accounting methods that can be adopted by a licence holder depending on their on-ground conditions.

Results

At time of writing Station 2 and 3 (Fig. 1) had commenced trials with preliminary results obtained. Both trials aimed to determine stock water consumption by measuring the total water usage within a paddock and dividing that by the known head of stock. Footage from field cameras enabled analysis of other animal take from the waterpoint/s.

Water Usage - Cattle

Over 12 months from November 2023, water usage from the Station 2 field trial has ranged from 28 L/head of cattle during the cooler months to 79 L/head during summer, with an average of 38 L/head. Field cameras have identified that other animals including camels, kangaroos, reptiles, birds and dingoes are also drinking at the water points.

Water Usage - Sheep
The Station 3 trial commenced in August 2024 and based on the first 3 months water take has averaged 5 L/head of sheep. This includes other take identified in video by kangaroos and a small number of cattle that have managed to push through fences and accessed the water points at times.

Equipment Reliability
A total of 7 installed turbine water meters have been utilised in the trials to date, operating without issue once successfully installed and configured.

Troubleshooting has been necessary at both trial sites with difficulties in correct installation of meters and connection to telemetry and has been complicated by the remoteness of the sites which has significantly delayed site preparation.

One equipment failure has been experienced to-date with a single water meter no longer reporting to telemetry. Field investigation is required to confirm the cause of the issue.

Equipment Cost
The equipment cost of individual trials was anticipated to vary depending on the accounting method and existing infrastructure. Equipment (meters, cables, telemetry components) for individual trial sites were expected to cost between $5000 and $15000 depending on number of water points and meters.

The cost of installation of the trials has been higher than estimated averaging over $15,000. The additional costs can be contributed to additional equipment needed to install meters and link-in with either existing or new telemetry.

Professional installation of meters will be implemented for future trial sites which is expected to increase the cost of each trial by $8,000 - $15,000 depending on the number of meters and pipework modifications required.

Discussion
Early trial results for the first 2 stations indicate water take for cattle and sheep is significantly less than the 100 L per day per head of cattle and 20 L per day per head of sheep as prescribed in the Far North WAP. This includes take by other animals, both native and non-native, evaporation and other losses such as regular trough maintenance.

The results to date are very site specific given the size and diversity of the SA Arid Lands Region. The locations of this study have also not been in drought conditions and other trial sites may return different usage numbers which will need to be considered against the many factors that may influence the results, such as stock breed, age, weather and the on-ground conditions.

While the results are insufficient for in-depth evaluation there are early learnings on water usage for the active trial sites and observations on technical, logistical matters and costs associated with installing meters and other technology in the pastoral region.

While equipment reliability has generally been good over the relatively short time the trials have been running, the lack of services and the remoteness of the area has complicated and delayed installation, troubleshooting and repairs, contributing to the costs of the trials being higher than originally estimated.

All findings and observation will be documented and will assist the development of a Water Accounting Implementation Plan suitable for the region.

Acknowledgements
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