Alice Springs background report 2026-2036

NORTHERN TERRITORY GOVERNMENT

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Acknowledgement of Country

The Department of Lands, Planning and Environment respectfully acknowledges the Northern Territory's Aboriginal people and their rich culture and pays respect to the Elders past and present.

We acknowledge the Arrernte people as the Traditional Owners and custodians of the lands and waters of the Alice Springs water control district.

We recognise the intrinsic connection of Traditional Owners to Country and value their ongoing contribution to managing the lands and waters. We support the need for genuine and lasting partnerships with Traditional Owners to better understand cultural connections, and we will work to establish lasting partnerships to manage water together, now and into the future.

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1. Executive summary

This document supports the Alice Springs water allocation plan 2026–2036 (the plan) by providing consolidated technical summary of the hydrogeological setting, aquifer characteristics, and water resource conditions of the region. The plan replaces the Alice Springs water allocation plan 2016-2026 (previous plan) to maintain water management in the region.

The Alice Springs plan area (plan area) lies in the heart of Australia. The hot arid climate is characterised by low average annual rainfall, very high evapotranspiration and pronounced inter-annual variability. Without permanent surface water, groundwater provides the only reliable source of water for the township of Alice Springs.

The plan manages the primary groundwater resources, which are: the Mereenie Aquifer System, which provides the town's water supply; and the Town Basin, Inner Farm, Outer Farm and Wanngardi Basin aquifers, which provide for small scale irrigation, stock and domestic use. The Mereenie Aquifer System is ancient water within the Amadeus Basin that receives very little modern recharge and is moderately to highly productive. The Town Basin, Inner Farm, Outer Farm and Wanngardi Basin aquifers lie within shallow alluvial (river/stream-deposited) sediments with episodic recharge.

Licensed water entitlements in the plan area have remained consistent over the last 10 years, with public water supply the largest user. Alice Springs depends on water to support liveability, community wellbeing, and recreation. The region's economy is service based with tourism, pastoral, government, defence and Aboriginal services the backbone and playing a key role as a service hub in the desert. Water has deep cultural significance for the Arrernte people, with many sacred sites associated with rivers, waterholes, and springs. The Todd River (Lhere Mparntwe) is a major cultural site; all river red gums within its bed are sacred. Historic sites such as the Telegraph Station Waterhole and Owen Springs hold cultural and heritage importance.

The plan integrates improved scientific knowledge that suggests the resource may be larger than previously estimated and is being integrated into numerical modelling and management of the resources. The Mereenie Aquifer System is well understood with a vast storage volume and limited modern recharge that means taking water for the next 100 years will result in predictable drawdown over decades to centuries, or about 2% reduction in the total storage volume.

Plan updates and management improvements

There are four significant updates in the plan from the previous plan:

1. Refined the groundwater resources managed

   The plan area remains the same as previously defined within the water control district boundary and delineates the primary water resources into five primary zones for management. The Roe Creek and Rocky Hill management zones have been consolidated into one management zone named the Mereenie Aquifer System, with the boundary adjusted to incorporate key areas for public water supply and economic development previously outside of the management zone boundary. This is intended to improve governance and management efficiency. The underlying individual geological units will be considered in monitoring the resource and during licence application assessments.

2. Aligned the estimated sustainable yield (ESY)

   The ESY is aligned to the groundwater resources managed through the plan and accommodates an allocation to the Aboriginal water reserve. The nature of most deep groundwaters in the arid zone is to have little modern recharge. The ESY authorises groundwater drawdown to occur through extraction to meet the urban water supply needs for Alice Springs, where no other cost-effective supply exists. Consistent with earlier water planning and investigations, the Alice Springs water supply has been described as secure over very long timeframes despite the limited modern recharge.

3. Water available for Aboriginal economic development

   This plan sets aside water for Aboriginal economic development through the Aboriginal water reserve consistent with the eligible land within the plan area. This was not available in the previous plan, which predated the Strategic Aboriginal Water Reserve policy and the amendment of the Water Act in 2020.

4. Protecting groundwater dependant ecosystems

   Highly valued river red gums along the Todd River corridor in the Town management zone are protected through limits of acceptable change thresholds defined in the plan. This is informed by significant advancement in remote sensing and data analysis technology that has enabled mapping of water dependent ecosystems and changes in condition to be tracked for the plan area. There is commitment, through implementation actions, to further investigate management options for river corridors in other management zones.

The plan's adaptive management strategies ensure sustainable water resource use, ecological integrity, economic viability and respect for Aboriginal cultural values. Ongoing monitoring, advanced mapping and proactive management will safeguard environmental and community assets against future risks.

Over 70 years of regional groundwater and surface water monitoring has informed the department's understanding of Alice Springs water resources. This background report provides a consolidated technical summary of the hydrogeological setting, aquifer characteristics, and water resource conditions of the Alice Springs region to support the Alice Springs water allocation plan 2026-2036.

2. Introduction

Overview

This is the third water allocation plan for the Alice Springs area.

Water planning in the Northern Territory is guided by the National Water Initiative, which sets the framework and principles for water management around Australia.

Natural resource management has inherent uncertainties. Risk management and adaptive management tools, such as those articulated in the Alice Springs water plan and implementation actions, are aimed at improving scientific understanding and confidence in decision-making, while correspondingly reducing risks to the water resource.

2.1 Overview of water planning in Alice Springs

The Alice Springs plan area (plan area) covers an area of 4,528 km^2, which includes the Alice Springs Local Government Area of 328 km^2 that has an estimated resident population of 29,693 equating to a population density of 90.6 persons per square kilometre (Australian Bureau of Statistics, 2024). Aboriginal and Torres Strait Islander peoples make up 20.6% of the population (Australian Bureau of Statistics, 2021).

A water control district was first placed over the Alice Springs plan area through an administrative order in 1980. Following the establishment of the *Water Act* in 1992, two declarations by the Minister in 2002 and 2007 updated plan area boundaries and regulatory frameworks, enabling more robust water resource governance, including permitting, licensing, and allocation planning, for the complex groundwater and surface water systems of the region. A map of the Alice Springs water control district area and plan area is provided in Schedule C.

This is the third iteration of the plan, building on experience and updated scientific understanding. Major updates include refining the groundwater resources managed by the plan, inclusion of an Aboriginal water reserve for each management zone (where applicable) and introducing acceptable limits of change for the river red gums in the Town management zone.

Schedule D details land tenure in the plan area. Most of the land in the plan area is perpetual pastoral leases (71%) and private freehold land. Aboriginal freehold title makes up about 19% of the area, reflecting the significant presence of Aboriginal-owned land within the region. In addition, national parks and conservation areas account for approximately 10% of the plan area (Northern Territory Planning Commission, 2016).

2.2 Water allocation planning in the Northern Territory

Water allocation is the process of determining how much water must be retained within the environment to protect ecological functions and meet environmental requirements, and how much water can be made available to support social, cultural and economic uses. Water planning is governed by the *Water Act 1992* (Act). The following policies also inform water management in the Territory:

- Water allocation planning framework policy
- Strategic Aboriginal water reserve policy
- Processing water extraction licence applications policy
- Surface water take – Wet season flows policy
- Compliance and enforcement policy
- Trading licensed water entitlement policy
- Recovery of unused water licence entitlements policy.

These policies are supported by a range of procedures, guidelines and management statements, many of which are publicly available on the department's website[1].

The Northern Territory Government develops all water policies and supporting documents in the context of the National Water Initiative (NWI) (2004), which is a national agreement that identifies frameworks and principles for sustainable water management in Australia.

The application of the NWI in the Northern Territory (NT) differs in context relative to south-eastern Australia, where the experience of water allocation, land tenure, and economic development have been very different. Some points of difference include managing for groundwater, not surface water, as the dominant supply; the large proportion of Aboriginal land tenure in the NT; a lack of historical over allocation of water resources; a largely intact environment with functional ecosystem services; and the targeting of regional scale water resources for development and economic growth.

In practice, this means that the NT has placed a higher priority on NWI implementation activities associated with outcomes such as ensuring Aboriginal access to water use and that water plans provide certainty for investment and the environment, with less emphasis on activities that have dominated water reforms in south-eastern Australia, such as addressing historical over allocation and the implementation of water markets.

In 2022, the Commonwealth government committed to renewing the National Water Initiative. The NT Government actively contributed to the new National Water Agreement to ensure that the future agreement builds on the strengths of the current NWI and continues to promote flexible management approaches that are fit-for-purpose in addressing future water challenges in the NT. The National Water Agreement recognises that groundwater can be managed where drawdown is unavoidably occurring through extraction to meet urban water supply, as is the case for Alice Springs.

2.3 Role of a water advisory committee

Under section 23 of the Act, a water advisory committee may be appointed by the Minister for Water Resources. On 25 July 2024 the department sought expressions of interest from community members to provide advice to the department and the Minister on the values (social, cultural and economic) of water resources in their area. This included Alice Springs, Ti Tree and Daly River water advisory committees. Sufficient nominations were only received for Daly River and subsequently a water advisory committee was not established for Alice Springs or Ti Tree. The previous Alice Springs committee was appointed for the review of the previous plan and ceased in early 2021 when the Alice Springs review report was published.

In the absence of a water advisory committee, the department has developed the plan based on previously identified community values to set the plan objectives and informed by the updated scientific data on the resource. The department undertook a series of stakeholder briefing sessions throughout the public consultation period on the draft plan to confirm these settings. Consultation feedback has informed the final plan.

2.4 Community feedback on the plan

The draft Alice Springs water allocation plan 2026-2036 was released for public consultation from 16 February to 17 March 2026. During this period, feedback was sought from the public, stakeholders and interested parties on the proposed plan.

Submissions received demonstrated engagement with the plan materials and raised concerns about water resource management, environmental protection, Aboriginal rights and water governance. Thirty

[1] https://nt.gov.au/environment/water/management-security/water-policies-and-guidelines

submissions were received from a range of stakeholder groups including government bodies, technical stakeholders, the Central Land Council, community members and environment groups.

In response to feedback, the three plan documents were updated, including:

- Re-inclusion of management zones, Wanngardi and Inner Farm
- Revision of the ESY for each management zone
- Greater protections for public water supply

A consultation report was prepared to document the outcomes of engagement processes. It provides a record of the feedback received during the consultation period, identifies the key themes raised by stakeholders, and outlines how these matters have been considered in refining and finalising the plan. The report ensures transparency in decision-making and demonstrates how community and stakeholder input has informed the development of the final Alice Springs water allocation plan 2026-2036.

2.5 About this document

This report is one of three core documents prepared as part of the water allocation process for the plan area. The three core documents are:

Alice Springs water allocation plan 2026–2036 (the plan). Declared by the Minister under section 22B(1) of the Act. The plan establishes the area within which it operates, outlines a set of objectives and outcomes, sets the volume of water that can be extracted from the water resource (the ESY), and allocates water available under the ESY among a set of declared beneficial uses. The plan takes effect from the date it is published in the Government Gazette and will remain in force for a period of 10 years.

Alice Springs background report 2026–2036 (the background report) provides details on the information and processes that informed the plan, including available data and research on the surface water and groundwater resources of the plan area. It also describes the key environmental values of the plan area and their dependency on water resources, and the social and economic context of the region, including existing water use and projections of future water demand. The report collates the information and knowledge regarding the plan area at the time of its preparation.

Alice Springs implementation actions 2026–2036 (the implementation actions) detail how the requirements in section 34 of the Act, with respect to the water resource within the plan area, will be fulfilled. It defines a continuous program of water resource assessment, including the investigation, collection and analysis of data concerning the occurrence, volume, flow, characteristics, quality and use of water resources. The program is presented as a series of implementation actions essential for the long-term management of the plan. The department's approach to risk and adaptive management for the Alice Springs water allocation plan are also part of the implementation actions.

Information on the department's approach to water allocation planning[2] is available on the department's website. The dictionary in Schedule A defines particular words used in this report and abbreviations are provided in Schedule B. Unless otherwise stated, terms defined in the Act have the same meaning when used in this report.

[2] https://nt.gov.au/environment/water/management-security/water-allocation/water-allocation-plans

2.6 Adaptive management

Uncertainty is inherent in natural resource management, including water management. The Act recognises this, particularly regarding the determination of an ESY. The Act does not prescribe a specific method for determining an ESY; the sustainable yield must be estimated from the available evidence, considering the plan's objectives and the associated confidence in this evidence.

The department employs risk and adaptive management approaches to address uncertainty, reducing the likelihood that errors in ESY estimates will compromise the resource, environment, or water users. These approaches include ongoing data collection and analyses, scientific investigation to improve confidence and reduce uncertainty over time, and adjustments to ensure settings remain appropriate and in line with articulated objectives, risk appetite and the latest information and conditions over the life of the plan. The department also has access to a suite of regulatory and policy tools (see the Act and Section 2.2) to manage extraction over the life of the plan.

3. Arid climate

Overview

Alice Springs lies in the heart of Australia within spectacular hills of the Arunta geological formation, characterised by low and highly variable rainfall, high evaporation rates, and extended dry periods. Climate is the primary driver of groundwater recharge and represents a key source of uncertainty in water resource management.

Climate change in central Australia is projected to bring hotter conditions, longer heatwaves, more intense rainfall events, and higher evaporation. While there is significant model uncertainty, most climate model predictions indicate declining aquifer recharge under median and dry futures, with only a minority of models projecting increased recharge.

This means water resource management is focused on the efficient use of stored water that has essentially no modern recharge.

3.1 Climate and rainfall

The Alice Springs region has an arid climate, classified as hot (persistently dry) grassland to hot (persistently dry) desert under the Koppen-Geiger climate classification system (BOM, 2024). Temperatures are seasonally variable, ranging from an average maximum of 36°C during November - April months to an average minimum around 4°C during May – October months (Figure 1). Maximum daily temperatures of over 40°C are commonly recorded during the December to February period and minimums can drop below 0°C during June and July. Alice Springs township, over the last 124-year period (1900 to 2024), average annual maximum temperatures have increased by 5°C and minimum temperatures have decreased by 4°C.

The long-term average annual rainfall is 265 mm per year, where rainfall is highly variable year on year which can result in periods of extended drought. There have been five wet years where rainfall totals have exceeded 600 mm, and a similar number of dry years with total rainfall less than 100 mm. The long term average annual rainfall (1900-1973) period shows a declining trend in rainfall, with the 1974 to 2024 period mostly trending towards wetter than average conditions, despite experiencing some very dry years such as in 2019 and 2020 (Figure 1).

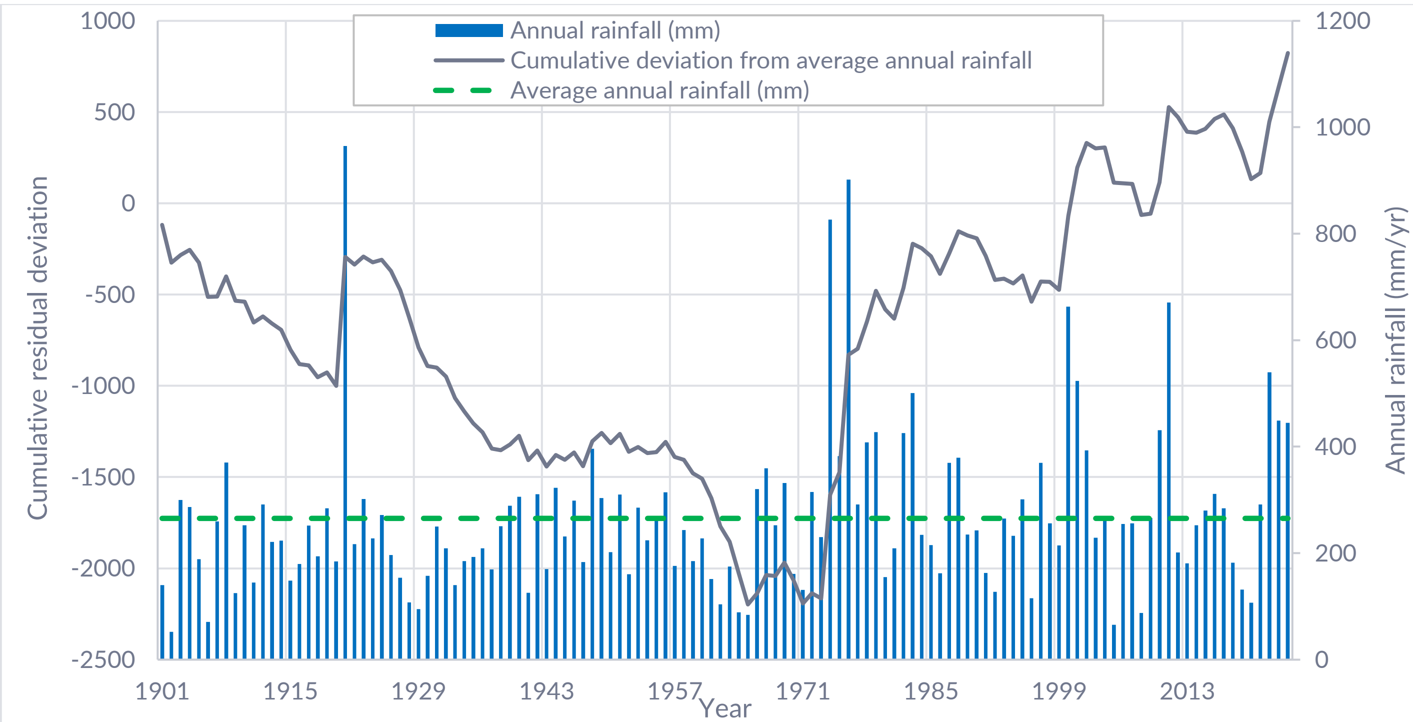


Figure 1. Annual rainfall and cumulative deviation from average annual rainfall for Alice Springs airport (SILO, 2025)

The distribution of rainfall in 30-year bands from 1901 to 2020 illustrates the increasing rainfall, however the more recent bands have an extended tail emerging towards wetter, more extreme events of over 750 mm (Figure 2).

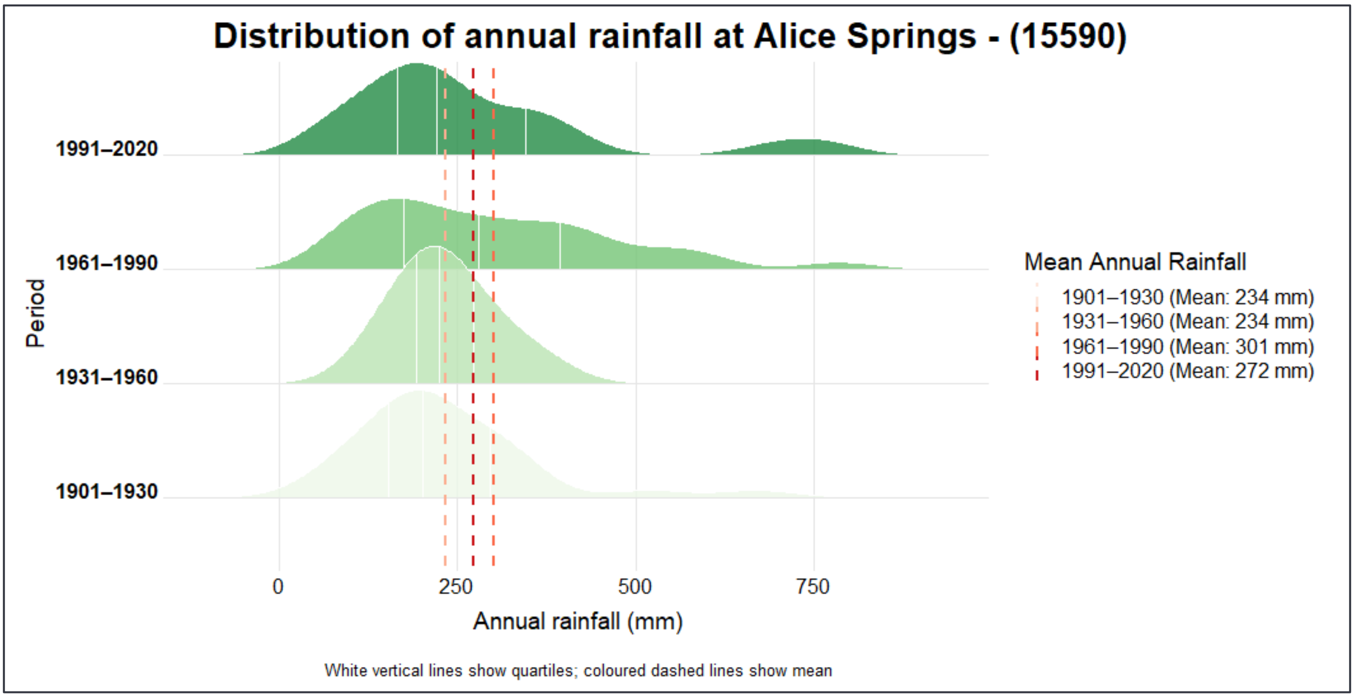


Figure 2. Rainfall distribution at Alice Springs airport (rainfall station no. 15590)

Long-term average monthly rainfall and potential evapotranspiration (1900-2024) are presented in Figure 3. Rainfall is typically higher from November to April, although rain has been known to occur at any time of the year, with low depression weather systems from the south having some influence over May to October. Average potential evapotranspiration exceeds average rainfall by a factor of some nine times, rising to 350 mm in the high temperature months of December and January, and dropping to just over 100 mm during the cooler months of June and July. High evapotranspiration leads to high evaporative losses of surface water flows, particularly for low rainfall events where most of the runoff is lost before it can be converted to river flows.

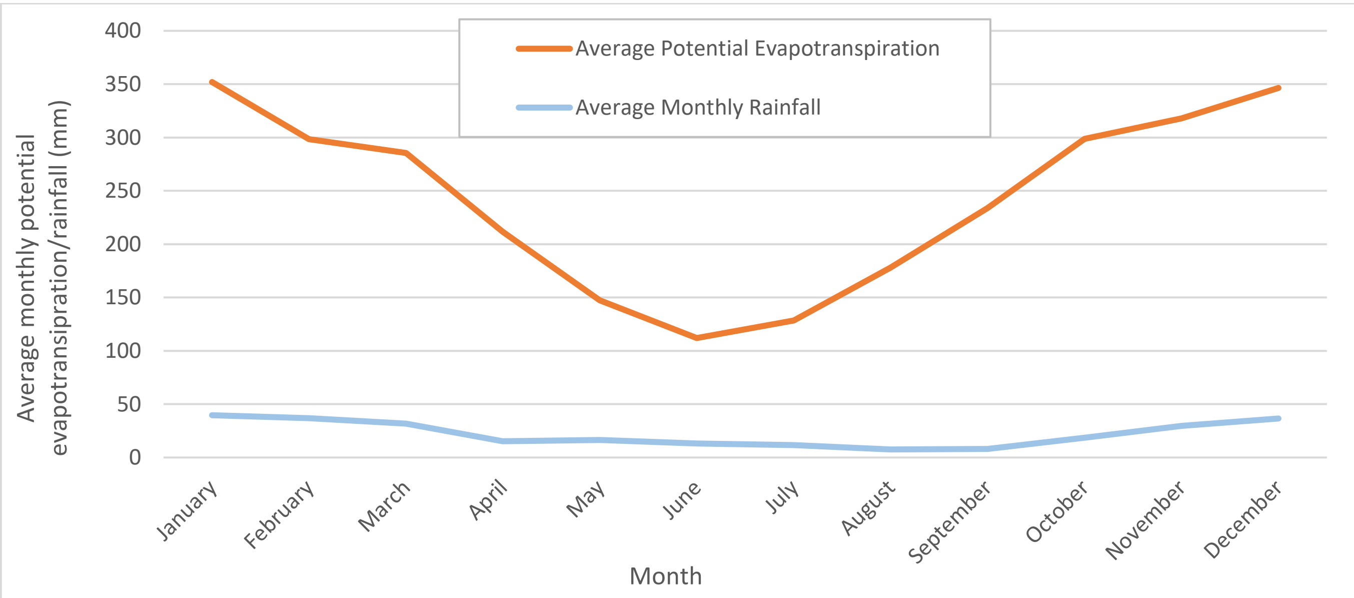


Figure 3. Average monthly rainfall and potential evapotranspiration for Alice Springs airport [Lat: -23.80 Long: 133.89] for 1900 to 2024 period (SILO, 2025)

3.2 Future climate variation

Current predictions for future climate change are forecast to result in an increasing number of warmer days with longer warmer spells and more frequent and harsh fire weather conditions across the Northern Territory (CSIRO, 2020). Potential evaporation will also increase, while heavy rainfall events are likely to become more intense. Time spent in drought could also increase, with changes in drought frequency and intensity likely. Under a high representative concentration pathway 8.5 emissions scenario, annual mean temperatures could increase by between 3.1°C and 5.6°C by 2090 for the Central and Southern (rangelands) regions of the Northern Territory compared to the 1986 to 2005 average. The number of hot days over 35°C for Alice Springs could increase from 90 (average from 1981 to 2010 period) to 172 by the end of the century (2075 to 2104) (CSIRO, 2020).

Despite uncertainty with rainfall distribution in arid zone areas, there appears to be a strong correlation between large monsoonal troughs in the Top End and significant rainfall in the Alice Springs region. Heavy rainfall events are more likely to translate to higher rates of recharge than low rainfall events, even if these are less frequent.

Modelling scenarios undertaken by Crosbie et al. (2013) incorporating future climate projections from 16 global climate models have compared the 2050 climate parameters for low, medium and high CO_2 emission scenarios relative to a baseline period (1990) to develop recharge scaling factors. Using a recharge scaling factor of one indicates no change in predicted recharge compared to the baseline, values greater than one indicate increased recharge rates, and values less than one indicate reduced recharge due to global warming. The authors note that there is a general lack of agreement between different global climate models, leading to uncertainty in increases and decreases in recharge across most of Australia.

The recharge scaling factors have been collated by Short (2019) for the plan area and district within the Northern Territory, with values for the Alice Springs plan and greater district areas assessed. Recharge scaling factors ranged from 0.81 to 0.86 under median projection scenarios, 0.57 to 0.34 for dry scenarios and 1.05 to 1.46 under wet scenarios (Table 1). It is likely therefore that rates of recharge will decrease across the region in the future.

Table 1. Recharge scaling factors for the Alice Springs plan area and control district regions (Short, 2019)

Region	Median projection			Dry projection			Wet projection		
	low	medium	high	low	medium	high	low	medium	high
Alice Springs plan	0.81	0.83	0.86	0.57	0.44	0.34	1.06	1.25	1.46
Alice Springs district (south)	0.81	0.81	0.83	0.58	0.45	0.34	1.05	1.21	1.40

3.3 Confidence level assessment of available evidence

Confidence level	Data and knowledge issues
High confidence	There is high confidence in the rainfall record for the region, with over a century of daily observations at the Alice Springs airport (15590) supported by interpolations for any missing days in the SILO gridded dataset. Confidence in projections of future temperature increases is high, and high confidence exists for increased intensity of extreme rainfall events. In the near to medium term, natural climate variability is projected to remain the dominant influence on rainfall in the region.
Low confidence and knowledge gaps	There is low confidence in the direction and magnitude of any projected changes in average rainfall or the frequency of extreme meteorological drought, due to divergence across climate models and the challenge of arid climates.

4. Reliance on groundwater

Overview

Alice Springs is characterised by striking rock outcrops like the MacDonnell Ranges that contrast with flat red desert sands and ephemeral rivers that are usually dry.

Without permanent surface water available, groundwater provides the only reliable source of water for Alice Springs. The most important aquifers lie within the Amadeus Basin south of Alice Springs, with key water bearing formations of deep sandstones, collectively termed the Mereenie Aquifer System. Local shallow alluvial aquifers that occur in river gravels and sands along the Todd River and its tributaries provide water for mainly stock and domestic use.

The Mereenie Aquifer System is ancient water within the Amadeus Basin that gets very little modern recharge and is moderately to highly productive. Because of low recharge, groundwater is considered a semi-finite resource. The Mereenie Aquifer System demonstrates persistent groundwater level declines because of extraction to supply Alice Springs with water. Since extraction began in 1960 groundwater levels have fallen by up to 60 m and is being extracted from more than 150 metres below ground level (mBGL).

The Town, Inner Farm, and Outer Farm aquifers lie within shallow alluvial (river/stream deposited) sediments where recharge is limited and mostly occurs during rare, heavy rainfall and flooding events when rivers flow and water infiltrates through sandy beds. Some recharge also seeps slowly into fractured rocks along the MacDonnell Ranges. Water levels typically fluctuate between 0 and 15 mBGL with significant flooding events along the Todd River leading to groundwater level rise.

The Wanngardi Basin aquifer is a shallow alluvial sediment which extends south from Honeymoon Gap with an average depth of 20m but reaching 30m deep in some areas. Water levels typically fluctuate between 5 and 25 mBGL.

Groundwater quality ranges from fresh to brackish. Groundwater within the alluvial aquifers is generally fresh and of good quality, reflecting its relatively young age and modern recharge. Salinity of the Amadeus Basin aquifers generally increases with depth and distance from recharge areas, with the town water supply from the Roe Creek area typically within potable thresholds.

Since the previous plan, several new datasets and investigations have been collected for the plan area, particularly within the Mereenie Aquifer System and Outer Farm Basin, that improve understanding of the structure, storage, and hydraulic properties of the Amadeus Basin aquifers. Collectively, these geophysical, hydrogeological, and geochemical/isotopic datasets provide a more detailed three-dimensional understanding of the hydrostratigraphy and aquifer properties within the Amadeus Basin.

4.1 Regional setting

The Alice Springs plan area spans two major arid zone catchments: the Finke River catchment to the south and the Todd River catchment to the north. Key surface drainage features include Roe Creek, which joins the Todd River after diverting eastwards south of Heavitree Gap, and the Hugh River, which drains south-eastwards to the Finke River. These waterways are ephemeral, flowing only in response to infrequent, high-intensity rainfall events typical of central Australia (Water Assessment Branch, 2025).

The region is underlain by some of the oldest rocks in Australia, with basement granites and metamorphic rocks exceeding 1.5 billion years in age. The Alice Springs district is founded on granitic basement of the Aileron Province, formed around 1,400 Ma and extending northwest toward the Tanami region.

To the west of Alice Springs, the Quaternary alluvial sediments form the Wanngardi Basin aquifer which is a series of shallow alluvial basins connected by Roe Creek. The alluvium overlies various rock types in the region including the Aileron Province granites in the north, Bitter Springs Group in the area of White Gums and the Arumbera Sandstone, Hugh River Shale and Goyder Formations further to the south.

South of Heavitree Gap lies the extensive Amadeus Basin, which spans approximately 300 km north–south from Alice Springs to the South Australian border and more than 750 km east–west into Western Australia (Ahmad & Munson, 2013).

The Amadeus Basin has experienced multiple phases of sedimentation and deformation, with the most significant tectonic event occurring during the late Ordovician to early Carboniferous. This event, known as the Alice Springs Orogeny (c. 400–300 Ma), formed deep structural troughs through the basin and uplifted prominent east–west trending ranges, including the MacDonnell, Ooraminna, Waterhouse and James ranges.

Remnant fault systems from this orogeny continue to influence groundwater flow pathways, while subsequent erosion of uplifted areas has produced younger alluvial sediments within valleys and palaeochannels (Carr et al., 2016).

A conceptual cross-section through the Alice Springs plan area illustrates a vertically stratified and geologically complex aquifer system (Figure 4). The uppermost 50–80 m comprises coarse to silty Quaternary alluvial sediments that form the Town Basin, Inner Farm Basin and Outer Farm Basin aquifers, which are shallow, responsive to episodic recharge and closely associated with the Todd River system.

Beneath the alluvium lies geological units, including siltstone units of the Shannon and Goyder Formation as well as Palaeozoic sandstones—principally the Mereenie, Hermannsburg and Pacoota formations—forming the regionally extensive Mereenie Aquifer System, which supplies Alice Springs' public water supply and predominantly contains waters recharged tens of thousands of years ago under much wetter palaeo-climate conditions.

Hydraulic connectivity between the shallow alluvial aquifers and the deeper Amadeus Basin aquifers is thought to be weak and highly localised, occurring only where major fractures intersect or where palaeochannels locally breach the confining strata. This stratified structure underpins the contrasting recharge behaviour, storage characteristics and management considerations of groundwater resources within the plan area. The spatial complexity and variability of these groundwater systems is further illustrated in Schedule E and Schedule F.

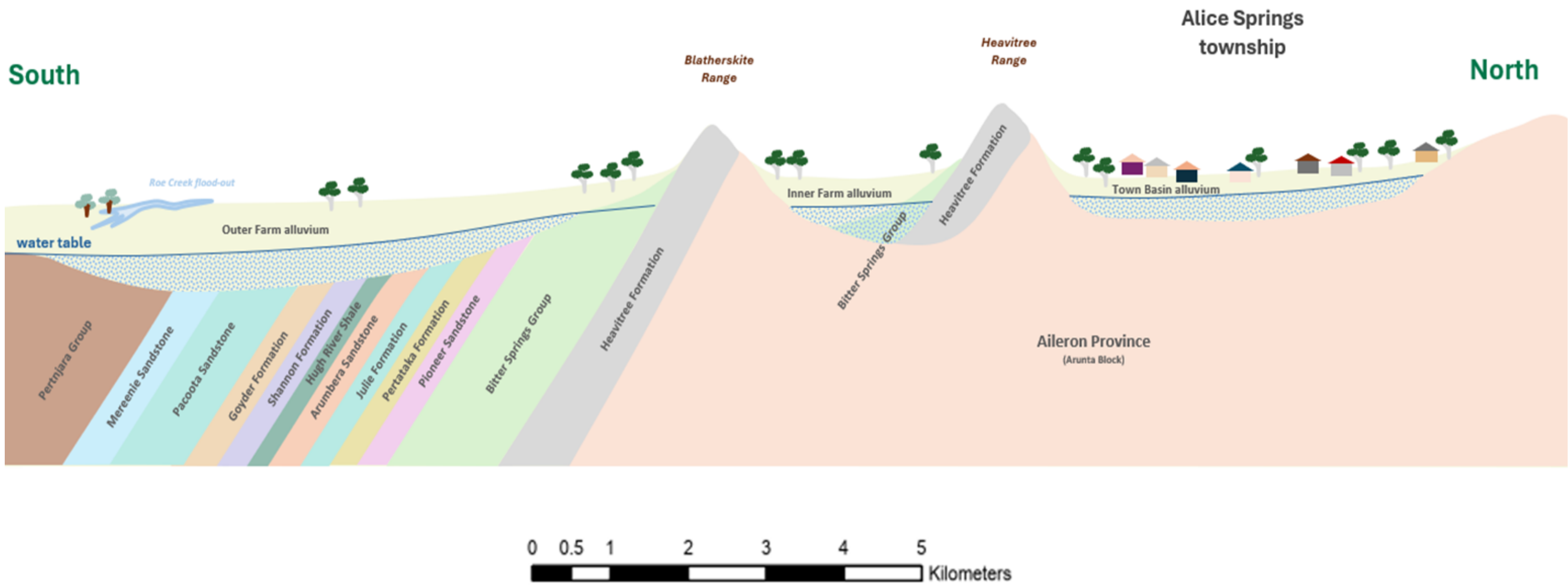


Figure 4. North-south geological cross-section through the greater Alice Springs region aligning with the Stuart Highway corridor

4.2 Improved understanding

During the years of the previous plan, several new datasets and investigations were collected across the plan area, particularly within the Mereenie Aquifer System and Outer Farm Basin (Water Assessment Branch, 2025). This has improved understanding of the structure, storage, and hydraulic properties of the Amadeus Basin aquifers. Collectively, these datasets provide a more detailed three-dimensional understanding of the hydrostratigraphy and aquifer properties within the Amadeus Basin.

The new data and knowledge fall into two main categories: geophysical and hydrogeological.

4.2.1 Geophysical data

New geophysical surveys and reinterpretation of legacy datasets have provided greater understanding of aquifer geometry and subsurface lithology:

- Airborne electromagnetic surveys: recent airborne electromagnetic lines flown across the Alice Springs–Roe Creek corridor (2020–2022) mapped the depth and continuity of conductive versus resistive lithologies to ~400 m depth. These data revealed the extent of deep palaeovalleys beneath the Outer Farm and Alice Springs airport, indicating the saturated thicknesses of alluvial and weathered material.

- Borehole geophysics: downhole gamma, resistivity, and caliper logging from monitoring and production bores.

4.2.2 Hydrogeological data

Field-based hydrogeological investigations added new insights into aquifer parameters, recharge, and connectivity:

- New bore construction and pumping tests: additional monitoring bores were drilled between in the Outer Farm and Rocky Hill areas, allowing direct testing of transmissivity, storativity, and specific yield. Pumping test analyses produced transmissivity values up to 11,000 m^2/d in fractured zones of the Mereenie, and 20 to 3,000 m^2/d in Rocky Hill.

- Hydraulic head and hydrograph data: extended time-series datasets now cover more than 60 years of observation, enabling quantification of long-term trends and recharge responses. Several bores captured rising water level trends associated with palaeovalley dynamics.

- Aquifer test integration: collation of historic and new aquifer test results into a single digital database (Knapton, 2022) provides a more robust regional dataset for calibration of future models.

4.3 Groundwater flow and levels

Groundwater flow within the Alice Springs plan area is characterised by two primary regional-scale flow paths, with higher groundwater levels to the northwest of the Amadeus Basin, driven by mountain-front recharge from the West MacDonnell Ranges. Structural features associated with the Waterhouse Range and adjacent higher relief areas to the southwest influence groundwater movement, either by enhancing local recharge or acting as partial barriers to regional flow, resulting in elevated groundwater levels in these zones.

A distinct localised flow system has developed around the Roe Creek borefield, commissioned in 1964 after the Town Basin alluvial aquifer could no longer sustain Alice Springs' growing water demand. Sustained extraction over the past six decades has produced groundwater declines of up to 60 m, forming a pronounced drawdown cone and locally reversing natural hydraulic gradients toward the borefield. This response demonstrates strong hydraulic connectivity within the deep Amadeus Basin aquifers in the Mereenie Sandstone between the areas previously understood to be Roe Creek and Rocky Hill management zones.

Across most of the plan area, groundwater occurs at depths suitable for economic extraction, generally less than 100 mBGL. Shallower groundwater is associated with the alluvial basins and low-relief areas east of Rocky Hill and south between the Waterhouse and Ooraminna ranges. In contrast, groundwater depths exceed 160 mBGL at the centre of the Roe Creek borefield and are also greater beneath higher elevation ranges.

In the Town Basin, groundwater levels in the shallow alluvial aquifer fluctuate between 0 and 10 mBGL in response to episodic flooding of the Todd River. Following the exceptionally wet 2010–11 season (670 mm), groundwater rose close to ground surface in some locations, whereas prolonged dry conditions culminated in historically low levels by November 2020, with declines of 4 to 7 m relative to 2011, reflecting the strong climate sensitivity of shallow alluvial systems (Figure 5).

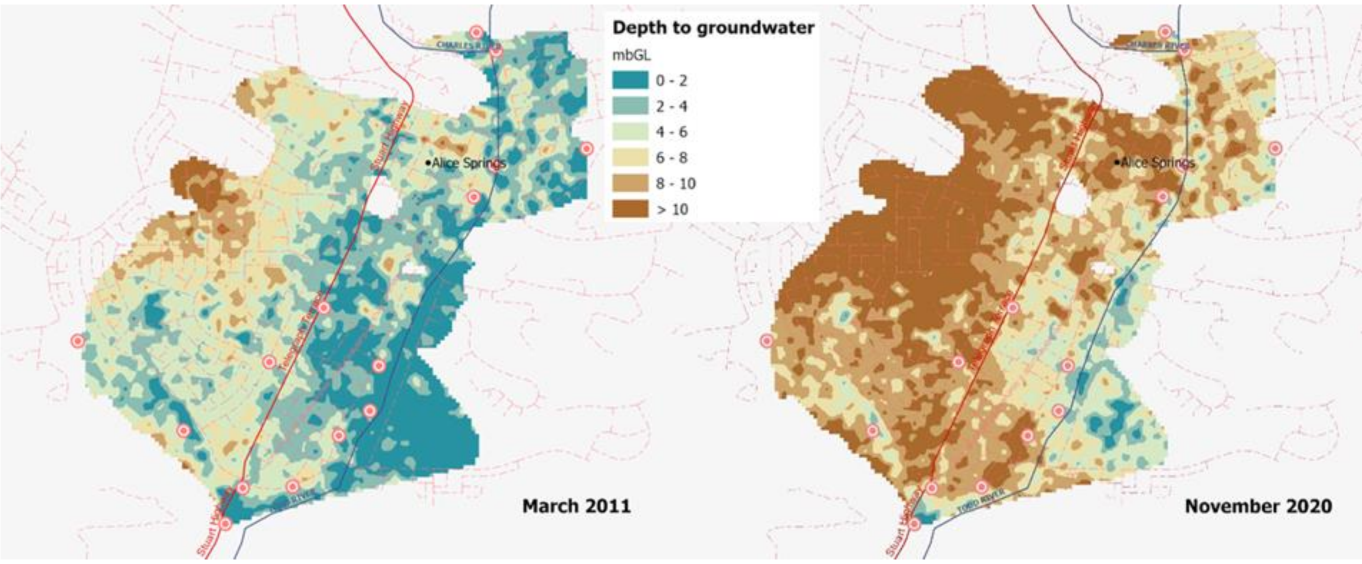


Figure 5. Depth to groundwater projections for the Alice Springs Town Basin following a major recharge event (March 2011) and an extended dry period (November 2020) (Water Assessment Branch, 2025)

This is important for water resources management as neither the very dry nor very wet conditions are optimal. The river red gums that line the Todd River are healthiest when the water table fluctuates between 6 to 8 mBGL (SKM, 2001) This means that some extraction in the Town Basin can be beneficial when combined with water management to maintain minimum water table thresholds that sustain groundwater dependant ecosystem health.

4.4 Groundwater recharge and surface water connectivity

Groundwater recharge within the Alice Springs plan area differs markedly between shallow alluvial aquifers and the deep Amadeus Basin aquifers. The Mereenie Aquifer System functions as a large but very slowly renewing groundwater reservoir in the present arid climate. Natural recharge is extremely limited and substantially lower than extraction in many areas. Recharge occurs only through restricted pathways, primarily where sandstone units are exposed at the surface, along fractured zones associated with the MacDonnell Ranges, or through highly localised leakage from overlying alluvial systems. Thick intervening aquitards significantly limit vertical recharge, resulting in weak and spatially constrained connectivity with surface water systems.

Groundwater movement within the Mereenie system is slow, reflecting semi-confined to confined conditions and generally low to moderate transmissivity. Travel times from recharge areas to production borefields are long, commonly spanning decades to centuries. As a result, much of the aquifer effectively operates as a groundwater mining system where groundwater is extracted at a rate which exceeds natural recharge, drawing on large volumes of stored water that were recharged under past, wetter climatic conditions. Present-day interaction with surface water is minimal, with only minor fluxes occurring at isolated outcrop and fracture zones.

In contrast, the shallow alluvial aquifers of the Alice Springs district, including the Town Basin, Inner Farm Basin and Outer Farm Basin, are strongly connected to surface water. These aquifers were developed within Quaternary River sediments along the Todd River corridor and are recharged primarily through episodic streamflow events. During floods, infiltration through highly permeable channel sands and gravels rapidly replenishes groundwater, producing pronounced and rapid water-level responses. Diffuse rainfall infiltration provides a secondary but relatively minor contribution, and groundwater flows progressively downgradient between adjacent basins toward Roe Creek.

The Town Basin, Inner Farm Basin and Wanngardi Basin are small in storage and highly responsive to recharge but vulnerable to prolonged dry periods, while the Outer Farm Basin has greater capacity yet remains sensitive to climate variability and episodic recharge. Managed aquifer recharge initiatives, including soil aquifer treatment schemes, supplement natural recharge in parts of the alluvial system. Groundwater in these aquifers is generally fresh and relatively young, with residence times ranging from years to decades, and their high hydraulic conductivity supports rapid lateral flow.

Overall, the alluvial aquifers represent renewable but highly variable water resources closely linked to flood frequency and intensity, whereas the deep Amadeus Basin aquifers are dominated by palaeo-recharge and renew very slowly. Sustainable water management therefore relies on recognising the limited modern recharge of the Mereenie system while carefully managing and protecting the climate-sensitive, surface-connected alluvial aquifers.

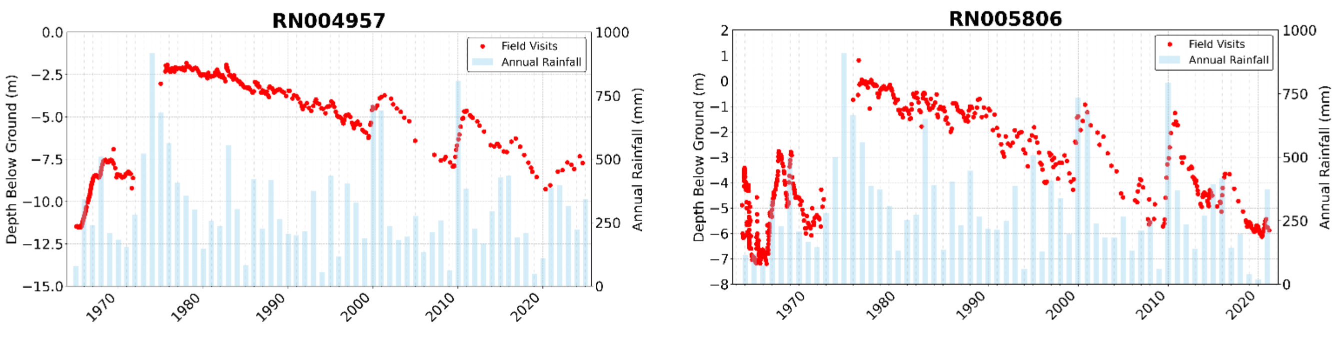
4.5 Primary aquifers

This report focuses on the resources that are managed in the plan through water management zones Schedule E.

4.5.1 Town Basin Aquifer

The Town Basin is dominated by brown and grey silt-rich alluvial sediments which cover around 80% of the basin and generally form lower-yielding aquifers than the coarser sands and gravels adjacent to the Todd River channel. Typical bore yields are less than 5 L/s, although localised higher-yield zones of up to 19 L/s occur where coarser sediments or palaeochannels are present. Regolith and colluvial deposits along basin margins are hydraulically connected to the main alluvium, whereas small aquifers in weathered bedrock and thin Quaternary sediments outside the alluvial extent are generally disconnected, often saline, and only intermittently saturated (PWA, 1992).

Long-term monitoring data from 16 bores (records commencing in 1952) show groundwater levels generally between 3 and 10 mBGL, with fluctuations driven by flood recharge, evapotranspiration from groundwater-dependent vegetation, and extraction. Although major recharge events in 2001, 2011 and 2017 produced temporary rises of 2 to 5 m, water levels have shown an overall declining trend since their peak in the mid-1970s following an exceptionally wet climatic period (Figure 6).



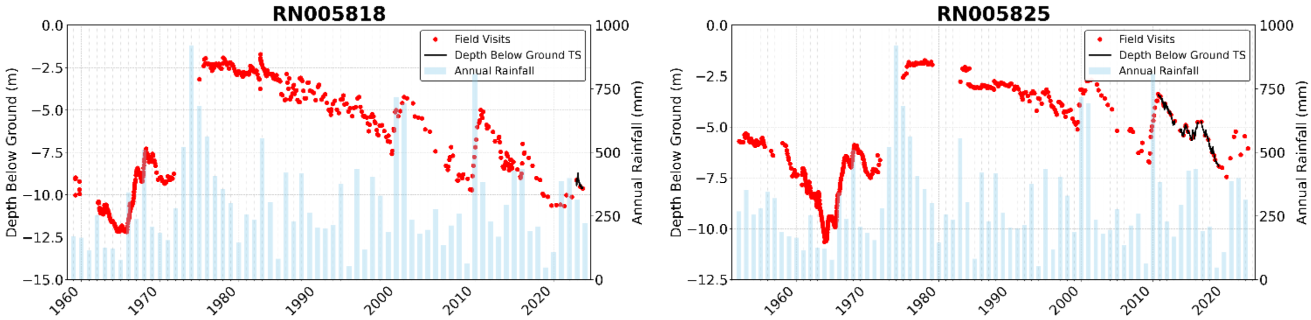


Figure 6. Selection of Town Basin monitoring bore hydrographs displaying seasonal water level fluctuations 1960 to 2025 (Water Assessment Branch, 2025)

Continuous monitoring is available for a small number of monitoring sites, between years 2015 and 2025, which shows pronounced seasonal responses to episodic recharge events. Bore RN003064, the most southerly in the Town Basin and located adjacent to the Todd River near Heavitree Gap, records water levels that rise close to, and occasionally above, ground surface during major recharge events. By contrast, bore RN014871 exhibits a more subdued response, with gentler rises and falls in water levels following floods. This attenuation is due to the greater thickness of overlying clay sediments, and its position further upstream in the catchment near the confluence of the Charles and Todd rivers, where greater bypass flow may occur.

Over the past decade, water levels have generally declined between 2016 and 2020, before recovering in response to above average rainfall in subsequent years. Notably, the 208 mm rainfall event of November 2021 generated a water level rise of 3.67 m in RN003064, with comparable responses recorded in nearby bores. On average, current groundwater levels in the Town Basin are broadly consistent with those recorded a decade ago.

4.5.2 Inner Farm Basin Aquifer

Most bores in the Inner Farm Basin are constructed in relatively shallow Quaternary fluvial sediments and underlying Neogene–Palaeogene alluvium, with some extending to depths of about 70 m into the Bitter Springs Formation. The Cenozoic aquifers are hydraulically connected to each other and to a thin (at least ~13 m) weathered layer of Aileron Province sediments. Typical bore yields are low (generally <5 L/s), although higher yields of up to 15 L/s occur near the Todd River. Groundwater quality is usually fresh to brackish (TDS <5,000 mg/L), but salinity increases further from the river, particularly to the west. Although the Bitter Springs Formation is not generally considered hydraulically connected to the overlying alluvium, localised connection may occur due to poor bore construction.

Hydrograph data from 10 monitoring bores show that groundwater levels fluctuate seasonally in response to recharge, typically ranging from 5 to 20 mBGL (Figure 7). Long-term trends indicate declining dry-season water levels since peaks in the mid-1970s, mirroring patterns observed in the Town Basin. Between 2017 and 2021, a series of drier years led to continued declines in groundwater levels across both Inner and Outer Farm areas. Current water levels are, on average, at or slightly below those recorded a decade ago.

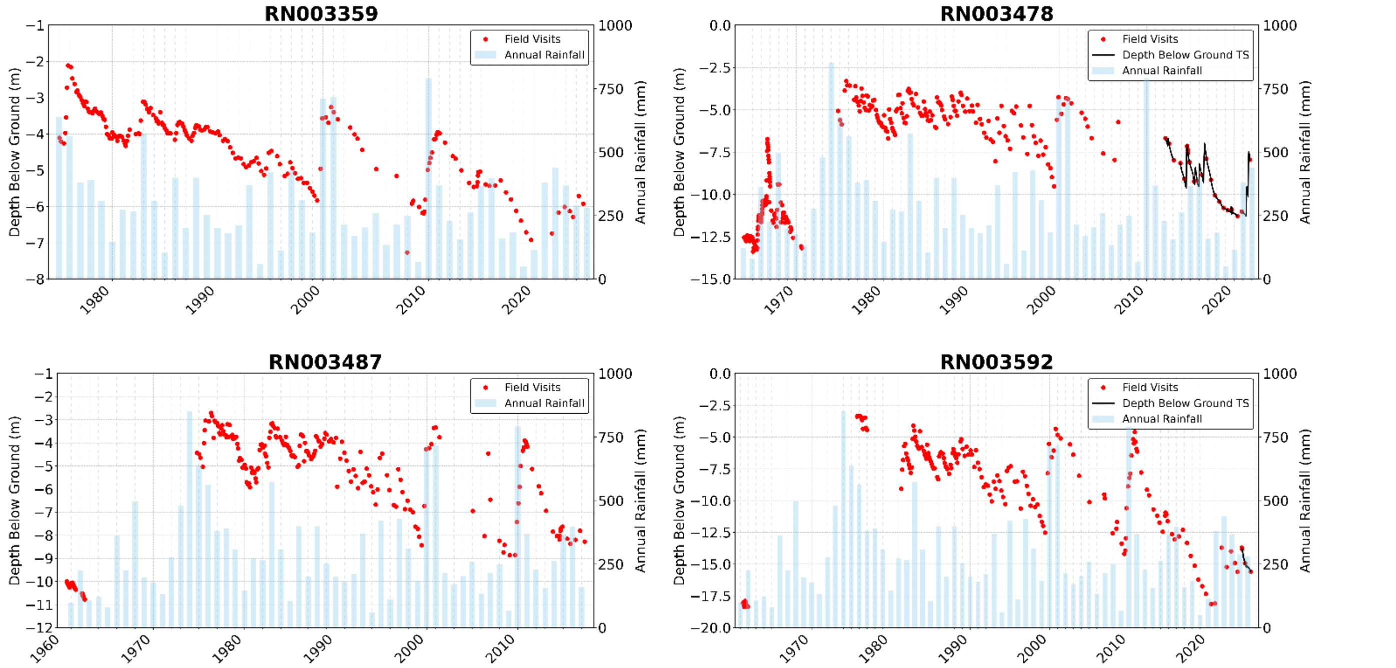


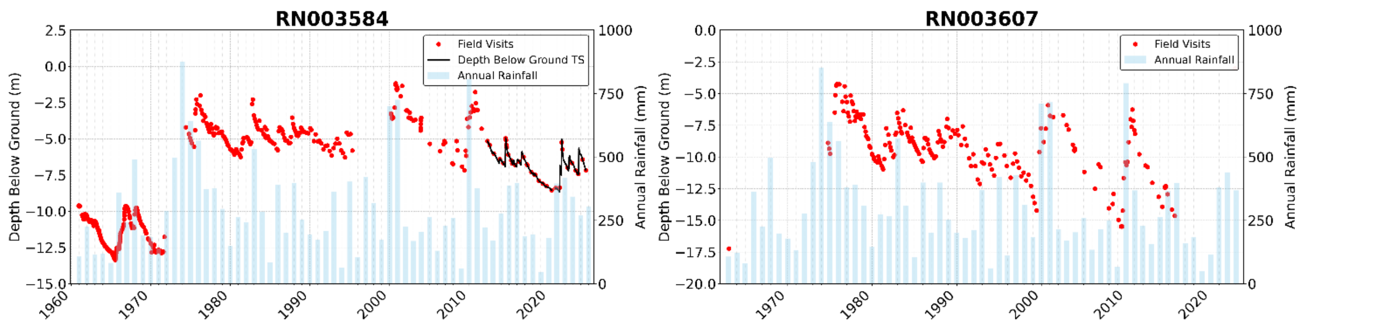
Figure 7. Inner Farm monitoring bore hydrographs showing seasonal water level fluctuations 1960 to 2025 (Water Assessment Branch, 2025)

In some bores within the Todd River, groundwater levels fell below the 8 mBGL threshold considered important for sustaining river red gums during 2018–2021. At bore RN003685, levels have remained below this threshold throughout the plan period, although this may reflect possible connection with the deeper Bitter Springs Formation. Despite seasonal recharge responses, prolonged low water levels have been recorded, with a minimum of 18.5 mBGL in November 2023. These observations suggest river red gums may be capable of tolerating extended periods of deeper groundwater levels.

4.5.3 Outer Farm Basin Aquifer

The Outer Farm Basin comprises alluvial aquifers extending south from Blatherskite Gap toward Alice Springs Airport and east toward Rocky Hill, broadly aligned with the Todd River and Roe Creek drainage corridors. The most productive zones occur in coarse sand and gravel deposits adjacent to the Todd River, where bore yields commonly reach up to 20 L/s. Slightly higher yields, up to 25 L/s, have been recorded in deeper bores intersecting units of the Bitter Springs Group further north. Depth to groundwater commonly ranges between 5 and 20 mBGL, and long-term monitoring indicates an overall decline in groundwater levels since the mid-1970s, reflecting climatic variability and extraction pressures.

Monitoring records from 30 bores (with data extending back to 1958) show a clear seasonal and episodic response to recharge events (Figure 8). Shallow alluvial bores respond rapidly to flood recharge, while deeper bores exhibit more muted and delayed responses due to thicker unsaturated zones and longer recharge lag times. Consistent with trends observed in the Town Basin, groundwater levels declined during the dry period from 2017 to 2021 before partially recovering following above-average rainfall in 2021–22.



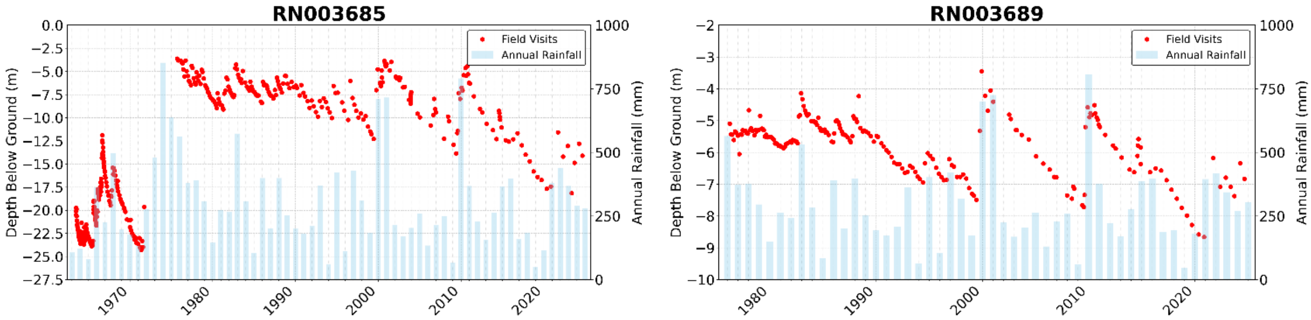


Figure 8. Selection of Outer Farm zone monitoring bore hydrographs showing seasonal water level fluctuations 1960 to 2025 (Water Assessment Branch, 2025)

Groundwater flow within the Outer Farm region is influenced by a deep palaeovalley system beneath the Alice Springs Airport area, interpreted to extend to depths of up to ~400 mBGL (Knapton, 2022). The deepest bore in this zone, RN017598, intersected thick clay-dominated sequences to 468 mBGL. Stratigraphic interpretation indicates weathered Goyder Formation sediments between 192–280 mBGL and weathered Shannon Formation from 280–468 mBGL (Read, 2003). A nearby bore, RN017850, encountered a similarly thick sequence (324 m) of interpreted Cenozoic clay-rich sediments.

Long-term monitoring data from RN017598 and adjacent palaeovalley bores RN004481 and RN004464 show sustained groundwater level rises since monitoring commenced in the early 1960s, contrasting with declining trends in nearby bores screened in Palaeozoic aquifers (Figure 9). Water levels in RN017598 increased by more than 15 m between 2002 and 2025, whereas surrounding Amadeus Basin bores exhibit steady long-term drawdown over the same period.

This divergent behaviour suggests that the palaeovalley sediments are hydraulically weakly connected or locally disconnected from the underlying Amadeus Basin aquifers. An alternative interpretation is that very slow vertical leakage from deeper units contributes to the observed rises, consistent with the gradual tapering of water-level increases in RN004464 and RN004481 over the past decade. The apparent independence of palaeovalley water levels from extraction impacts at the Roe Creek borefield indicates a distinct hydrogeological response, and this zone remains a priority for further investigation to refine understanding of its connectivity and role in regional groundwater dynamics (Read, 2003; Knapton, 2022).

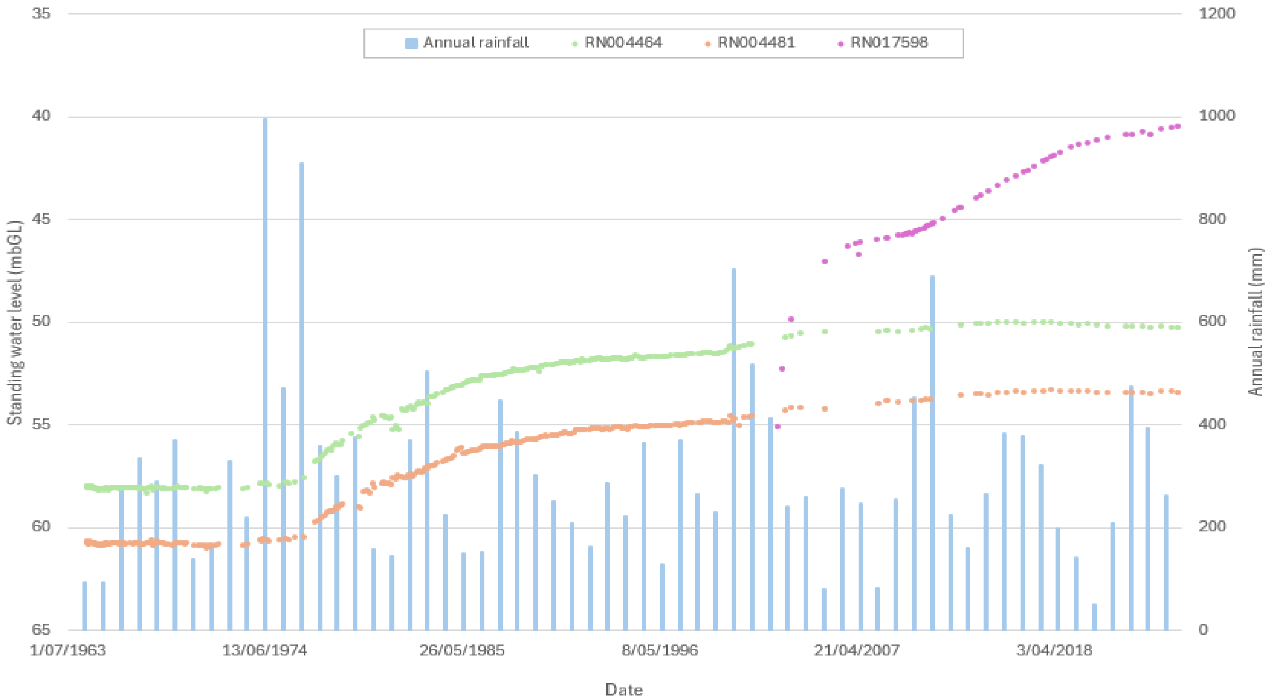


Figure 9. Time series bores hydrographs for Outer Farm palaeovalley bores 1964 to 2025 (Water Assessment Branch, 2025)

4.5.4 Wanngardi Basin Aquifer

The Wanngardi alluvial aquifers occur in a series of shallow basin depressions along Roe Creek from Honeymoon Gap to the Roe Creek borefield. These aquifers are generally hydraulically separate but may connect during extended surface flows. In the White Gums area, the alluvium is hydraulically connected to underlying weathered granites of the Aileron Province.

Bore yields in the alluvium are typically low (<5 L/s), increasing to up to 15 L/s in the deeper Bitter Springs Formation. Groundwater quality is usually fresh to brackish (TDS <5,000 mg/L), though some deeper northern bores encounter highly saline water (>12,000 mg/L).

Monitoring since 1992 shows groundwater levels in the alluvium fluctuate seasonally between 5 and 25 mBGL, with no significant long-term decline in most bores (Figure 10). An exception is bore RN014215 (Arumbera Sandstone), where water levels have dropped more than 4 m since 2003/04, likely due to nearby groundwater extraction.

Near the Roe Creek borefield, the alluvium becomes unsaturated but may still enable vertical recharge to deeper aquifers such as the Mereenie Sandstone. However, the extent of hydraulic connection with these deeper Palaeozoic aquifers remains uncertain due to deep water levels and the influence of pumping.

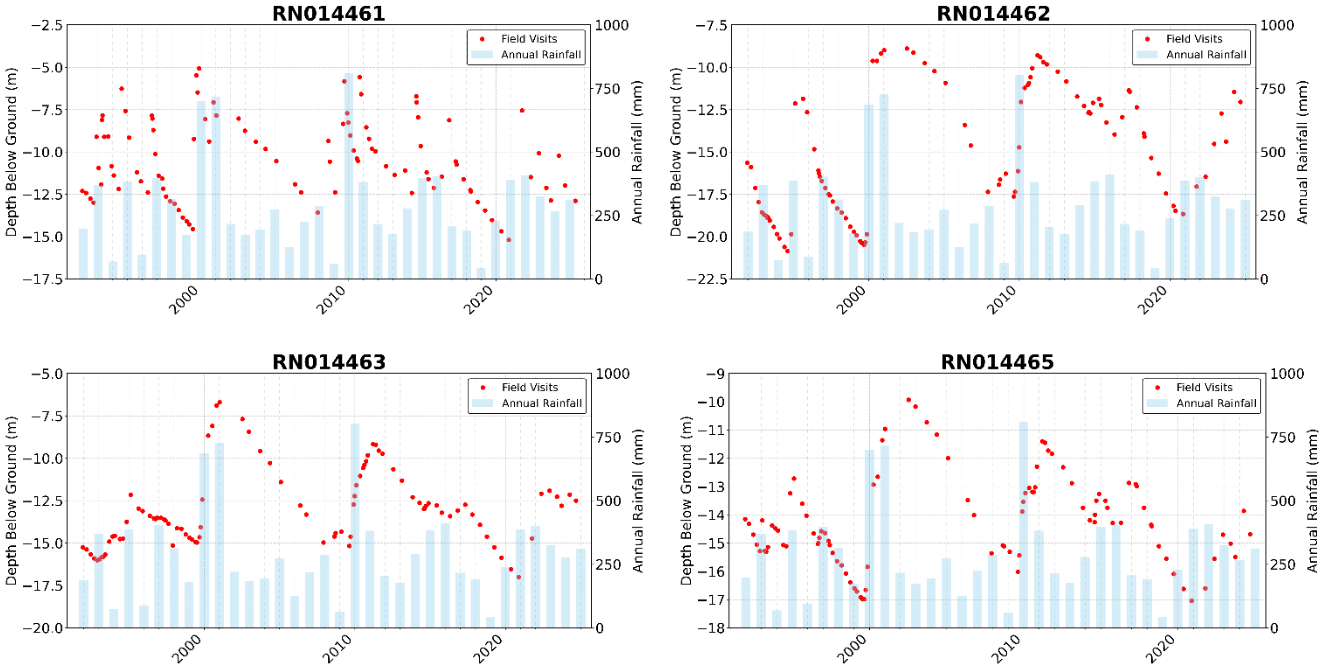


Figure 10. Selection of Wanngardi Basin monitoring bore hydrographs showing seasonal water level fluctuations (Water Assessment Branch, 2025)

4.5.5 Mereenie Aquifer System

The Mereenie Aquifer System comprises the Goyder Formation, Shannon Formation, Pacoota Sandstone, Mereenie Sandstone and Hermannsburg Sandstone within the Amadeus Basin. These units were previously managed as the Roe Creek and Rocky Hill aquifers or management zones. Collectively, they form a regionally extensive system of fractured Palaeozoic sandstones with moderate to high transmissivity relative to the shallow alluvial aquifers.

Bore yields commonly exceed 20 L/s, with highly fractured zones at Roe Creek borefield producing in excess of 100 L/s. Groundwater levels at Roe Creek typically occur between 95 and 165 m below ground, with monitoring records extending back to 1962. Hydrographs show a strong extraction signal, with bores close to pumping centres exhibiting rapid drawdown and partial recovery when pumping ceases, while more distant bores display subdued, long-term declines (Figure 11). Recharge signals are generally absent at Roe Creek, reflecting the depth of the water table (>70 mBGL) and limited modern recharge.

Within the Shannon Formation, drawdown responses are locally amplified due to lower permeability. Temporary cessation of pumping has resulted in rapid recoveries exceeding 13 m in some monitoring bores, indicating large volumes of water in storage that moderate drawdown impacts once extraction pressure is reduced. Overall, groundwater behaviour within the Mereenie Aquifer System reflects a deep, highly productive but slowly renewing resource that is strongly influenced by long-term extraction rather than short-term climatic recharge.

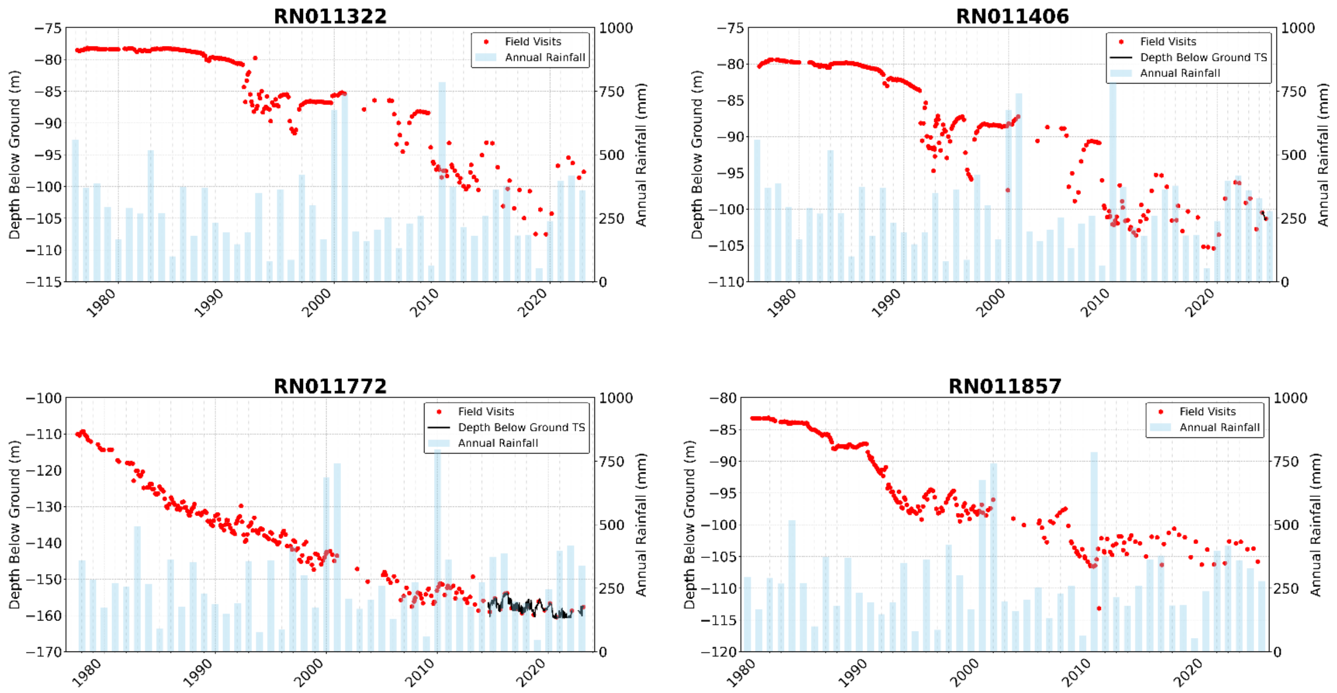


Figure 11. Selection of Roe Creek monitoring bores showing impact of extraction further from the Roe Creek borefield east of the Stuart Highway (Water Assessment Branch, 2025)

Monitoring records at Rocky Hill date back to 1964. Water levels typically range from 45 to 85 mBGL but may be as shallow as 25 mBGL near the Todd River or as deep as 120 mBGL toward the Ooraminna Range. Despite episodic recharge during wet years, most Rocky Hill bores have shown a consistent decline since the 1970s. Long-term declines vary spatially: bores east of the proposed borefield e.g. RN011152 and RN011184, have fallen 3.5 to 4 m, while RN011320 (closer to Roe Creek) has declined by >10 m, indicating the influence of the Roe Creek borefield's drawdown cone. Over the last decade, monitoring bores have continued a steady decline (~2 to 3 m between 2015 and 2025), with little seasonal recovery even during above-average rainfall (Figure 12).

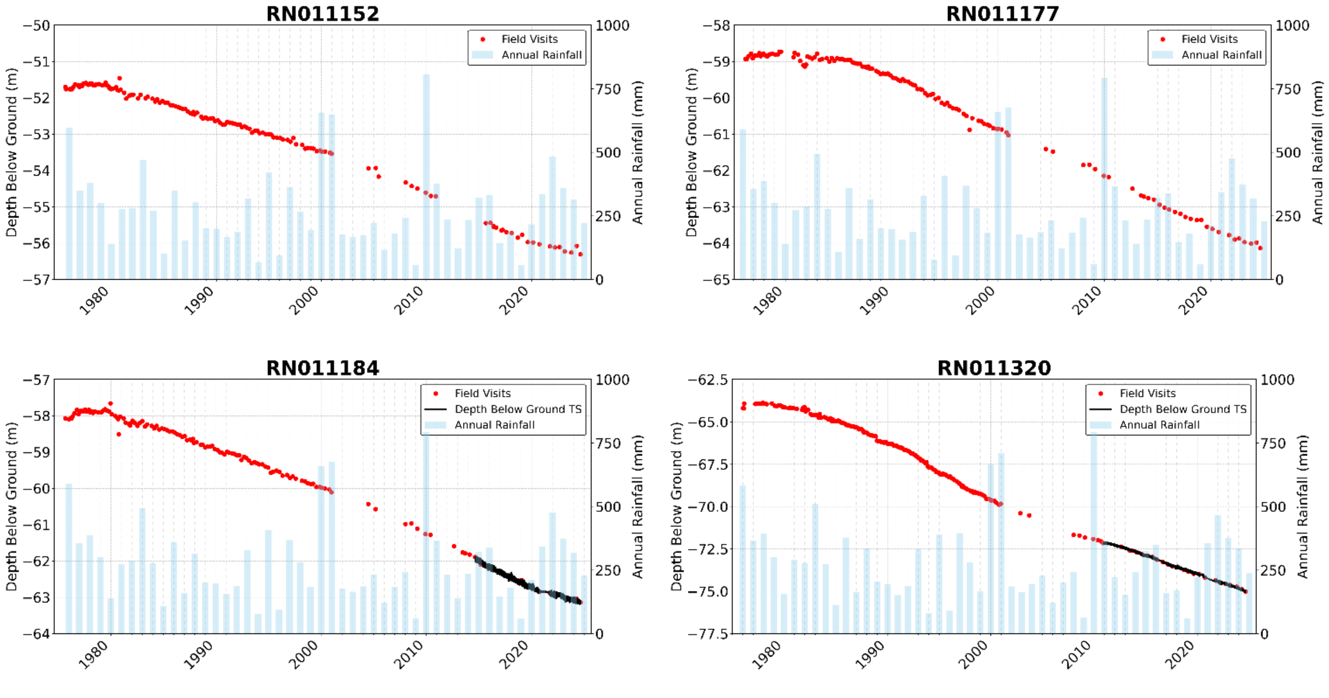


Figure 12. Selection of Rocky Hill monitoring bore hydrographs showing long-term water level decline 1960 to 2025

The Mereenie Aquifer System demonstrates groundwater level declines despite the large storage volumes. Roe Creek is strongly influenced by direct extraction, while Rocky Hill reflects a regional drawdown cone extending from Roe Creek. Recharge responses are minimal, with storage replenishment far below extraction rates. These trends highlight the semi-finite nature of the resource and the need for conservative management to sustain long-term supply for Alice Springs.

Previous groundwater management zones overlying the Amadeus Basin incidentally excluded part of the Roe Creek and future Rocky Hill borefields, as well as some licensed bores for agriculture and industry uses. To provide greater administrative clarity on water management in the region, the Mereenie Aquifer System management zone boundary has been adjusted to incorporate the areas of land currently being developed and where water extraction licences are located. Water bores that were located outside of the previous management zones had been taking from the same water resource and have been managed as part of water management zones.

4.5.6 Inter-intra aquifer connectivity

Long-term groundwater level records from monitoring bores in the Outer Farm and Rocky Hill zones provide insights into the degree of vertical connection between the Outer Farm alluvium and the underlying Palaeozoic formations of the Amadeus Basin. In the Rocky Hill zone, all monitoring bores show consistent declines since around 1980, with some falling by up to 18 m. Notably, bores RN011488 and RN011489, constructed in the Mereenie Sandstone south of Alice Springs airport near the tail end of the Roe Creek floodout, have recorded declines exceeding 18 m since monitoring began in 1977. These declines are interpreted as the result of drawdown from extraction at the Roe Creek borefield located approximately 14 km to the northwest.

Several bores located 5.5 to 8.5 km northwest of these sites show sustained water level rises since the late 1970s, in contrast to the widespread declines in Rocky Hill. Bores RN004464 and RN004481, positioned between the Roe Creek and Todd River channels and screened in clay-rich palaeovalley sediments, each recorded rises of ~7.3 m between 1977 and 2018 before plateauing. Similarly, RN017598, located 2.1 km north, shows a ~15 m rise between 2003 and 2025, while RN004461, situated nearby, rose by 12.3 m between 1976 and 2004.

These rising trends suggest a groundwater mounding effect, most likely driven by the presence of thick clay lithologies that restrict vertical leakage, or by other geological barriers to flow. This indicates limited vertical hydraulic connection between the Outer Farm palaeovalley sediments and the underlying Palaeozoic aquifers, particularly the Mereenie Sandstone. The plateauing of levels since 2018 may reflect long-term below-average rainfall, or slow overflow leakage into surrounding Palaeozoic formations; however, this requires further investigation.

Beyond the palaeovalley, the degree of connectivity within the Amadeus Basin is highly dependent on local lithologies and the extent of secondary porosity (fracturing and faulting) that enhances flow. Hydraulic parameter estimates compiled by Knapton (2022) from pumping test data support this variability. In the Roe Creek area, transmissivity values for the Mereenie Aquifer System (Mereenie and Hermannsburg Sandstones) range from 1,000 to 11,000 m^2/d, averaging ~360 m^2/d outside fractured zones. In the Rocky Hill region, transmissivity is lower, between 20 to 3,000 m^2/d. Specific yield (Sy) derived from core testing ranges from 0.05 to 0.66 in Roe Creek samples and 0.05 to 0.23 in Rocky Hill samples, with an overall mean of 0.16. These results support the application of a conservative Sy value of 0.10 in regional groundwater models (Knapton, 2022).

4.6 Water availability

The natural water balance is a core concept of water resource management, enabling an assessment of water availability within a region. For the Alice Springs plan area, the natural water balance was calculated using the department's integrated surface water-groundwater model (Knapton, 2022; Water Assessment Branch, 2025). The water balance quantifies water inflows (recharge, inflow), outflows (runoff, discharge, evapotranspiration), and changes in water storage over time, represented by the simple flux equation:

$$\text{Inflow} = \text{Outflow} \pm \text{Change in Storage}$$

The water balance includes the volume of water in storage, combined with the inputs (recharge, inflow), outputs (discharge, transfer in/out and evapotranspiration) and changes to storage. The Alice Springs groundwater systems are dynamic with inputs, outputs and storage continually changing seasonally and annually with the intermittent nature of major rainfall events in the Arid Zone. The components of the water balance have been averaged over 54 years from 1970 to 2024 to assume long-term steady state conditions.

Separate water balances have been completed for each of the primary aquifers in the Alluvial Basin, the Town Basin and Outer Farm Basin. The Amadeus Basin aquifers have been combined into a single water balance representing the Mereenie Aquifer System, determined collectively from the Hermannsburg Sandstone, Mereenie Sandstone and upper Pacoota Sandstone (Jolly et al., 2005). Water balances have been updated using the most recent monitoring data and information available for the study area and the Mereenie groundwater model. Relevant studies used for calculation of water balance estimates are provided in Table 2.

Table 2. Studies utilised for calculation of updated water balances

Study areas	Reference
Town Basin Aquifer	Tickell, S. (2011). Review of the Alice Springs Water Strategy, Northern Territory Department of Natural Resources, Environment, The Arts and Sport Technical Report No. 14/2011A. Read, R.E. (2003). Alice Springs Town Basin, Review 2003. Technical Report 42/2003A. Natural Resources Division, Alice Springs.
Inner Farm Basin Aquifer	Berry, K. (1991). Monitoring Development Alice Springs Commonage. Water Resources Branch, Alice Springs NT. Vanderzalm, J.L., Jeuken, B.M., Wischusen, J.D.H., Pavelic, P., Le Gal La Salle, C., Knapton, A., & Dillon, P.J. (2011). Recharge sources of hydrogeochemical evolution of groundwater in alluvial basins in arid central Australia. Journal of Hydrology, Vol. 397(2011). pp. 71-82.
Outer Farm Basin Aquifer	Vanderzalm, J.L., Jeuken, B.M., Wischusen, J.D.H., Pavelic, P., Le Gal La Salle, C., Knapton, A., & Dillon, P.J. (2011). Recharge sources of hydrogeochemical evolution of groundwater in alluvial basins in arid central Australia. Journal of Hydrology, Vol. 397(2011). pp. 71-82. Woolley, D. (1966). Geohydrology of the Emily and Bremer Plains Area, Alice Springs NT.
Wanngardi Basin Aquifer	Tickell, S. (2011). Review of the Alice Springs Water Strategy, Northern Territory Department of Natural Resources, Environment, The Arts and Sport Technical Report No. 14/2011A.
Mereenie Aquifer System	Read, R.E., & Paul, R.J. (2002*). Rocky Hill – Ooraminna Groundwater Investigation 2000 (Report No. 05/2000A)*. Natural Resources Division, Department of Infrastructure, Planning and Environment, Alice Springs. Jolly, P., Knapton, A., Read, R., Paul, R., & Wischusen, J., (2005). Volume of groundwater stored in the Mereenie Aquifer System - In the Pine Gap / Roe Creek to Rocky Hill / Ooraminna Region(Report No. 36/2005A). Natural Resources Division, NTG. Alice Springs. Knapton, A. (2022). Development of a Groundwater Model for the Mereenie Aquifer System (Version 0.9 April 2022). CloudGMS, prepared for Department of Environment and Natural Resources.

A schematic diagram of the water balance is depicted in Figure 13. Basin storage calculations have been updated from previous water balances using the full estimated volume in storage from saturated thickness in monitoring bores and data on Sy, where available. Variations in water quality within the basins have not been applied to storage estimates.

Groundwater storage within the Mereenie Aquifer System has been modelled at 102,000,000 ML for the basin extent of 16,146 km^2. An economic depth of extraction (<300 mBGL) for the same basin extent has been used to determine an accessible volume of groundwater storage within the Mereenie Aquifer System as 10,240,000 ML using Sy = 0.1 for the Mereenie Aquifer System (Knapton, 2022).

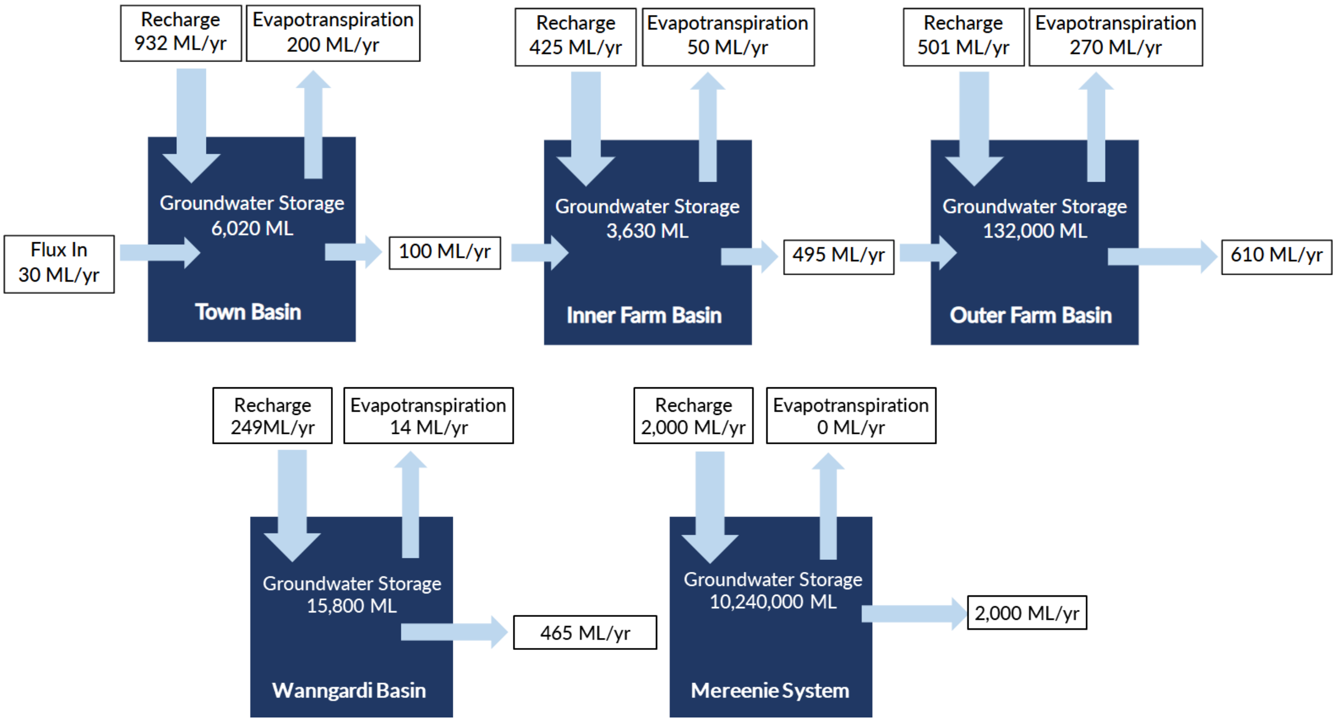


Figure 13. Modelled water balance for most significant groundwater resources in the Alice Springs plan.

4.7 Water quality

Groundwater quality within the Town Basin is typically fresh to brackish (TDS <5,000 mg/L), with salinity increasing with depth and distance from the Todd River due to reduced recharge dilution. Significantly higher salinities (> 20,000 mg/L) occur in bores intersecting weathered basement rocks of the Aileron Province. Fresher groundwater is commonly associated with narrow buried sand and gravel palaeochannels aligned with the Todd River, which act as preferential recharge and flow pathways.

Similarly, groundwater in the Inner Farm, Outer Farm and Wanngardi alluvium is typically fresh to brackish, with total dissolved solids typically below 5,000 mg/L. Although, in Outer Farm a small number of water samples marginally exceed 5,000 mg/L and some bores in the Wanngardi screened in the Bitter Springs Formation encounter saline waters exceeding 12,000 mg/L.

Groundwater within the Mereenie Aquifer System is generally fresh to brackish, with salinity increasing with depth and distance from recharge areas. In the Rocky Hill area, total dissolved solids (TDS) can reach up to approximately 7,600 mg/L, reflecting longer residence times and limited flushing. In contrast, relatively fresh groundwater pockets (<600 mg/L TDS) occur near the confluence of the Todd River and Roe Creek, indicating zones of localised recharge. Groundwater extracted from the Roe Creek borefield is typically within potable thresholds and remains suitable for public water supply under current management. In summary, groundwater quality across the Alice Springs plan area ranges from fresh to brackish, with differences between shallow alluvial aquifers and deeper Amadeus Basin (Mereenie) aquifers. Water quality is generally influenced by depth, distance from recharge areas, aquifer type, and residence time.

4.8 Confidence level assessment of available evidence

Confidence level	Data and knowledge issues
High confidence	There is high confidence in the conceptual understanding and characterisation of the groundwater resources in the plan area as the resources are performing broadly within expectations. Monitoring of groundwater levels has been occurring since the 1950s. There is high confidence in the 3D geological model which is based on the latest geophysical, seismic reflection, hydrogeological, hydro chemical and isotopic data. The Mereenie sandstone has a numerical model, with Class 3 confidence level (high predictive confidence) in the Roe Creek to Rocky Hill Region, and a Class 2 confidence level for the remainder to the domain (moderate predictive confidence). Knowledge about Town Basin aquifer response is based upon long-term empirical data measurements in monitoring bores and flow gauging so has relatively high confidence.
Moderate confidence	There is greater uncertainty associated with the Wanngardi Basin, Inner Farm Basin and Outer Farm Basin due to lack of drilling and stratigraphic data. As a groundwater source with low levels of use, higher confidence is only required in the longer term if it becomes a more significant water source.
Low confidence and knowledge gaps	In the long term, further investigation is needed to better understand the rising water levels in the Outer Farm Basin, and connection with water extraction in the Roe Creek borefield. There is limited knowledge in the Deep Well area to the south and the western boundary which are potential areas of recharge and groundwater inflows. There is uncertainty around the evapotranspiration losses particularly to the east of the plan area. Certainty can be improved with field studies.

5. Water related values and use

Overview

The striking landscape of Alice Springs and its surrounds is not only iconic but also underpins many of the region's environmental and ecological values. Water has deep cultural significance for the Arrernte people, with many sacred sites associated with rivers, waterholes, and springs. The Todd River is a major cultural site; all river red gums within its bed are sacred. Historic sites such as the Telegraph Station Waterhole and Owen Springs hold cultural and heritage importance.

As the Territory's second largest town, and its importance as the centre of arid Australia, water resources in the Alice Springs region underpin the social and economic viability of central Australia, supporting urban water supply, tourism, horticulture, pastoral and industrial development, and community livelihoods.

Water in Alice Springs has multiple values, sustaining Aboriginal culture and sacred sites, supporting fragile desert ecosystems, underpinning social amenity and recreation, and driving economic activities from urban supply to horticulture and tourism. These values guide allocation rules to balance cultural, environmental, and commercial water use.

Supporting Aboriginal people to access water for economic development is a government priority.
The Aboriginal water reserve is fully provisioned in the Mereenie and Inner Farm management zones of the plan with potential to be fully provisioned in the Outer Farm and Town management zones.

5.1 Environmental values

The MacDonnell Ranges and surrounding outcrops create a dramatic topography of ridges, gorges, and valleys that channel and store water in an otherwise arid desert. These formations provide unique habitats such as shaded gorges, rocky escarpments, and water-retaining rock holes, which act as refugia for plants and animals during hot and dry periods. The geology also controls groundwater systems, with fractured sandstones, palaeovalleys, and alluvial deposits creating aquifers that sustain ecosystems.

The Todd River and its tributaries carve corridors through the desert landscape, lined with river red gums and coolibahs that form an "urban forest" through Alice Springs. Ephemeral wetlands such as Ilparpa Swamp and permanent/semi-permanent waterholes in the ranges (e.g. Simpsons Gap, Ellery Creek Big Hole) are biodiversity hotspots that would not exist without the surrounding geomorphology. These places act as environmental refuges, sustaining life in a region where surface water is scarce and highly seasonal.

The dramatic scenery is deeply woven into Arrernte cultural stories and Dreaming tracks, which follow the lines of rivers, ridges, and waterholes. These features embody both ecological and spiritual meaning. For residents and visitors alike, the striking backdrop of the ranges, river corridors, and desert plains provides an aesthetic and recreational value that defines Alice Springs identity and supports tourism.

The plan recognises these physical systems as the basis for setting water management zones (Town Basin, Inner Farm, Outer Farm, Wanngardi and the Mereenie) acknowledging that each zone's aquifer properties arise from its geological and landscape context. For example, the Town Basin's shallow aquifers sustain the river red gums along the Todd River, while the deeper Mereenie systems draws on the fractured sandstones of the Amadeus Basin.

The plan identifies groundwater dependent ecosystems as priority assets, particularly where the landscape concentrates water into river corridors.

5.1.1 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) rely on groundwater to maintain their ecological structure, composition and functioning, either permanently or seasonally, and include a range of groundwater dependent vegetation (GDV) communities that access groundwater directly through their root systems to survive periods of limited rainfall.

A study of the probable occurrence of groundwater dependent vegetation in the Alice Springs plan area was completed by the department in 2025 (Box & Brim Box, 2025). The report develops probability models and maps of groundwater dependent vegetation across the plan area. It supports water management by identifying where ecosystems are most likely reliant on groundwater, helping manage extraction to protect environmental and cultural values.

The mapping identified GDV within shallow aquifers and includes perched aquifers, run-on/run-off areas, and broader potential GDV habitats.

The study combined remote sensing, field surveys, and statistical modelling to map the likelihood of GDV across the Alice Springs water allocation plan area. Vegetation indices (NDVI, EVI, NDWI) were derived from Landsat 8 satellite imagery (2015 to 2024) and analysed using singular value decomposition to capture temporal vegetation greenness and water dependence signals. To validate and ground truth these remote sensing patterns, 292 field survey sites were assessed between 2020 and 2024, with vegetation classified as groundwater dependent, facultative, or non-dependent based on rooting depth and proximity to groundwater levels recorded in monitoring bores. A logistic regression framework, supplemented with neural network validation, was applied to link vegetation index behaviour to observed GDV presence. The model outputs were converted into probability surfaces (rasters) for the plan area, presented as P50 and P70 probability thresholds for both “aquifer-only” and “all-potential” GDV occurrence.

This methodology provides a spatially explicit, statistically robust mapping tool to:

- identify priority groundwater dependent ecosystem zones for monitoring and protection
- support allocation decisions ensuring environmental water provisions are met
- track ecological risks from groundwater drawdown in shallow alluvial basins (e.g. Town Basin river red gums).

Alluvial aquifers in the plan area provide irrigation water that offsets demand for public drinking water supplies and provides for unlicensed stock and domestic use. Paige (1985) noted that shallow groundwater levels in the Town Basin were implicated in poor river red gum health following the increase in groundwater levels post 1976, which may be due to an increase in groundwater salinity. SKM (2001) recommended an optimal groundwater level of 6 to 8 m below ground for the river red gums, at which point groundwater levels should not be allowed to decline further or to rise to shallower levels.

Consistent with the previous plan, the latest mapping supports the limits of acceptable change (section 4.3 the plan) being applied through water extraction licences. The plan supports that water taken under a groundwater extraction licence should not result in groundwater levels declining more than 8 m below ground in the Todd River corridor.

However, this limit of acceptable change has not been applied to Inner Farm, Outer Farm or Wanngardi basins in the current water allocation plan due to groundwater levels averaging more than 8 m below ground and with licensed use remaining quite low in these aquifers (refer to sections 5.4 and 5.5 for further information about licensed and unlicensed use). Further investigation of GDV requirements in these areas are required to support limits of acceptable change in the future.

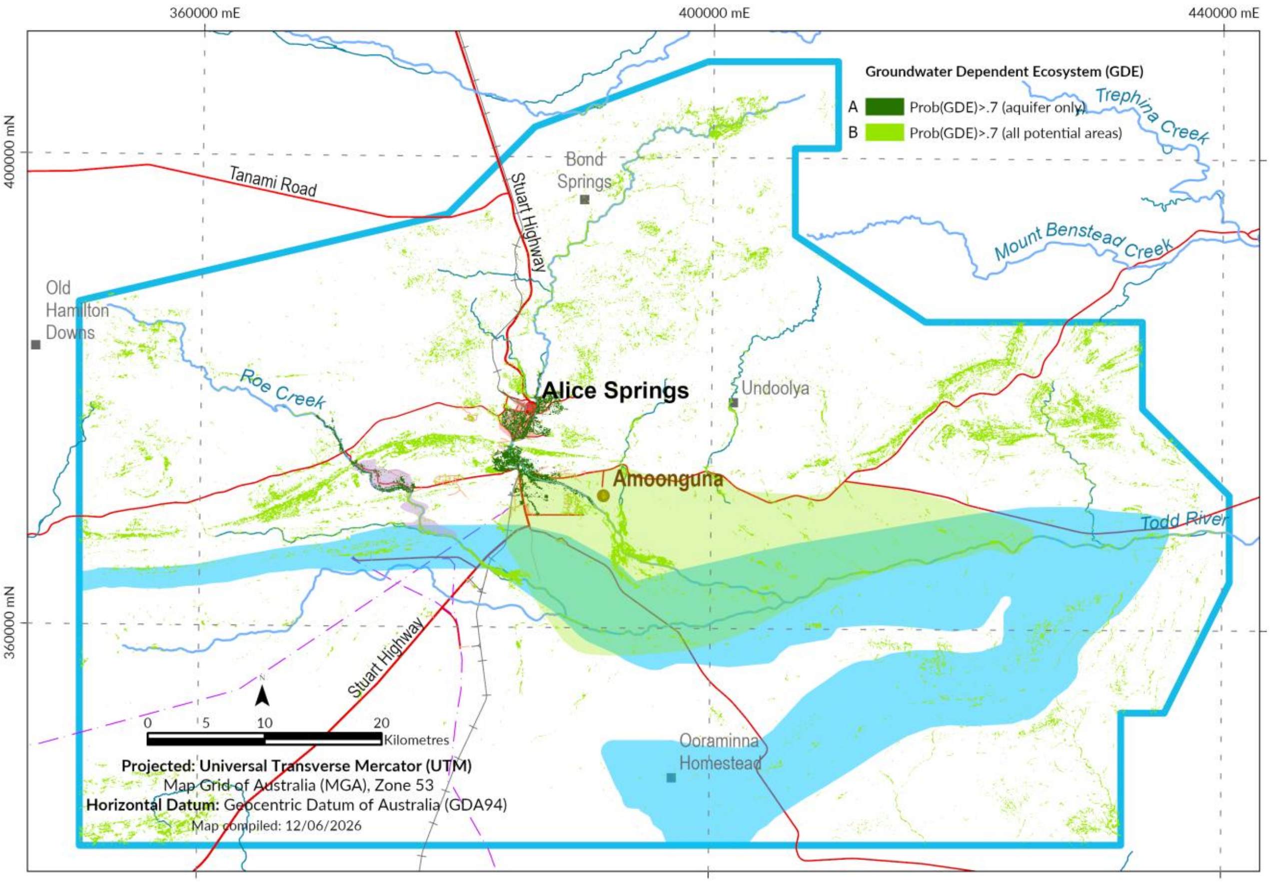


Figure 14. Probability of Groundwater Dependent Ecosystems (GDE) within the Alice Spring water allocation plan area

In Figure 14, the GDE P70 represents sites with a probability of 70% or greater likely to be groundwater dependent sites. GDE identified in the figure with dark green colour (A) is limited only to where the aquifer is known to be shallow in areas close to Alice Springs, Roe Creek, and the Hugh River. The light green colour (B) identifies all potential areas where GDE are likely to be supported by perched aquifers, run-on or run-off areas, or other forms of local storage.

5.2 Aboriginal cultural values

The first Aboriginal people of the Alice Springs (Mparntwe) region are the Arrernte people who are recognised as the Traditional Owners of the area. Stone artefacts, rock shelters, and ochre use demonstrate a very long connection with the land and its water sources.

For the Arrernte people, water is not simply a physical resource but a living part of Country, law and identity. The water resources of Alice Springs have supported the Arrernte people for many thousands of years. The rivers, soaks, springs, and waterholes across the Alice Springs region are central to Dreaming tracks and song lines, carrying ancestral stories that explain the creation of the landscape and the responsibilities of its custodians. Each water place, whether a permanent soak, an ephemeral claypan, or a rock hole in the hills, has a specific name, history, and set of cultural protocols that define how it should be cared for. This detailed naming system encodes ecological knowledge, distinguishing between water features by permanence, quality, and the way they respond to rain and flood.

Waterholes and river corridors like the Todd River (Lhere Mparntwe) and Charles River (Anthelke Ulpeye) are also cultural corridors, binding together sacred sites and song lines that extend far beyond the Alice Springs plan area. The river red gums lining the Todd River are not only ecological keystones but are also sacred beings in their own right, linked to ancestral presence and cultural law. Protecting the health of these trees is seen as inseparable from protecting the cultural health of the community.

Oral histories record great floods and prolonged droughts, passed through generations as both memory and warning. This knowledge reflects a deep awareness of water's variability in the desert, with people adapting seasonal movements and practices to the rhythms of dry years and wet years. Waterholes and soaks have long served as refuges in drought, sustaining people, animals, and plants, and they remain vital gathering and ceremony places. These refuges are increasingly important today as climate change intensifies drought and heatwaves. Water sites are also places of healing, ceremony, and teaching, where cultural knowledge is passed on. Films such as Kwatja Ngkama (Talking Water) reinforce these connections by sharing Aboriginal perspectives on water as a living presence, with rights and responsibilities attached.

5.3 Socio-economic context

The plan area includes the township of Alice Springs, the second largest population centre in the Northern Territory and the economic, business and service hub for the region. Sixteen percent (41,545) of Territorians live in the central Australia region (RDA, 2024) that services surrounding remote communities, including Amoonguna within the plan area. Residents from remote areas of South Australia, Western Australia and Queensland also access many services from Alice Springs such as health and retail.

The district is also home to major tourist attractions including the MacDonnell Ranges, the Tjoritja/West MacDonnell National Park and Owen Springs Reserve. There are also several other small permanent landholdings excised from larger pastoral blocks, which are associated with horticultural enterprises producing table grapes, dates, irrigated pasture, and other fodder and horticultural crops. The Pine Gap Joint Defence Facility is located near Alice Springs and houses a significant number of American defence staff, Australian support staff and families.

Alice Springs depends on water to support liveability, community wellbeing, and recreation. The region's economy is service based with tourism, pastoral, government, defence and Aboriginal services, forming the economic backbone of the town and playing a key role as a service hub in the desert. The Alice Springs region contributes approximately $2.9 billion to the economy (≈18 % of Northern Territory gross state product) and supports ~14,000 local jobs (Northern Territory Government, 2013). Water is an enabling factor for several key sectors.

Tourism generates approximately $280 million Gross Value Added (GVA) annually (≈9 % of regional GVA), with water critical for accommodation, recreation, and landscape amenity. Groundwater supports intensive irrigated production within the Outer Farm and zones. Expansion potential exists for high-value crops (table grapes, bush foods, horticultural trials) but is limited by salinity, transport costs, and water allocation caps. Several existing and proposed projects within the Amadeus Basin and central Australian region (e.g. Brewer Industrial Estate, Chandler Salt, Nolan's Rare Earth Project) depend on secure groundwater access for processing, dust suppression, and camp supply.

5.3.1 Land tenure

There is a mix of land tenures in the Alice Springs region (Table 3), with the large majority (over 53%) being private land (Schedule D). The second largest proportion of land in the area is held by the Northern Territory Government where 86% of the land they manage falls under perpetual pastoral lease and 10% under vacant crown land. The future proposed Rocky Hill borefield is an essential parcel of land set aside for Alice Springs' water security. Aboriginal land makes up about 19.4% of land where most of it is scheduled under ALRA. The Commonwealth Government holds a small portion of land (1.19%) which is mostly used for housing, administrative and airport facilities. The Joint Defence Facility Pine Gap is an intelligence collection facility shared between the Australian and American governments. It is a major land use in the region, located in the west of the plan area.

Table 3. Land tenure ownership by area (square kilometres) and proportions based on cadastre area (%)

Ownership category	Area sqkm	Proportions based on cadastre area (%)
Aboriginal Land (NT enhanced freehold)	**13.7**	**0.30**
Aboriginal Land (Scheduled under ALRA)	860.6	19.10
Commonwealth Government	53.5	1.19
Local Government Council	2.8	0.06
Northern Territory Government	1133.1	25.15
Private	2431.2	53.96
Others (owner not specified)	10.3	0.23
Total[3]	**4505.2**	**100.00**

5.3.2 Eligible land for the Aboriginal water reserve

In 2017, the Northern Territory Government approved the Strategic Aboriginal Water Reserves Policy Framework (policy framework) to provide Aboriginal people with increased opportunities to access water resources for economic benefit. The amount of water allocated to that reserve was to be proportionate to the amount of eligible Aboriginal land in the plan area. In 2020 and 2025 the Act was amended to give legislative effect to the framework policy.

In broad terms, a water allocation plan must allocate water to an Aboriginal water reserve if any of the land in the water control district (district) to which the plan relates is eligible land.

Geographical information systems have been used to systematically review land data for the plan area, including the Digital Cadastre Database of the Northern Territory and the National Native Title Tribunal's Native Title determinations.

Parcels that meet both eligibility criteria in section 4B of the Act and designation criteria under section 22C of the Act, have been identified as eligible land. The land parcels and their landowners are identified in Schedules F and G of the plan respectively. The amount of water allocated for Aboriginal economic development through the Aboriginal water reserve was determined based on the proportion of eligible land in the plan area and guidance in the policy framework.

The plan provisions the Aboriginal water reserve for the first time in the plan area, with allocations fully available from the Mereenie Aquifer System and Inner Farm Basin. Provisions from the Outer Farm Basin and Town Basin will be available following recovery or surrendering of existing licensed entitlements. This is due to licensing decisions pre-dating the policy framework. Due to no eligible land being identified in the Wanngardi Basin, there is no provision for an Aboriginal water reserve in this management zone. Further legislative changes to the Act in May 2025 have made the Aboriginal water reserve easier to access, in an attempt to encourage water use from the reserve.

[3] The total area of land tenure ownership is less than the total area of the plan due to exclusion of transport corridors such as main roads and road reserves.

5.4 Licensed water use

The number of licences over the last 10 years has been relatively consistent, changing by no more than one licence per year. Total annual licensed entitlements for the plan area are around 18,000 ML per year for agricultural, industry and public water supply uses.

Table 4 shows the distribution of the licensed entitlements by beneficial use. Public water supply has the largest licensed entitlements accounting for around 72% of licensed volume.

Table 4. Licensed entitlements by beneficial use category

Beneficial use category	Licensed entitlement (ML per year)	Licensed entitlement reported used (%)	Proportion of total volume (%)
Industry	1,695	61.4	9.4
Agriculture	3,203	0.2	17.9
Public water supply	13,000	61.3	72.6
Other	12	100	0.1
Total	**17,910**		**100**

Similar to the rest of the Territory, only a small proportion of water licences use their full entitlements each year, with about 54% of licensed water entitlements in the Alice Springs plan area being used (on average) between 2016 to 2025 (Figure 15).

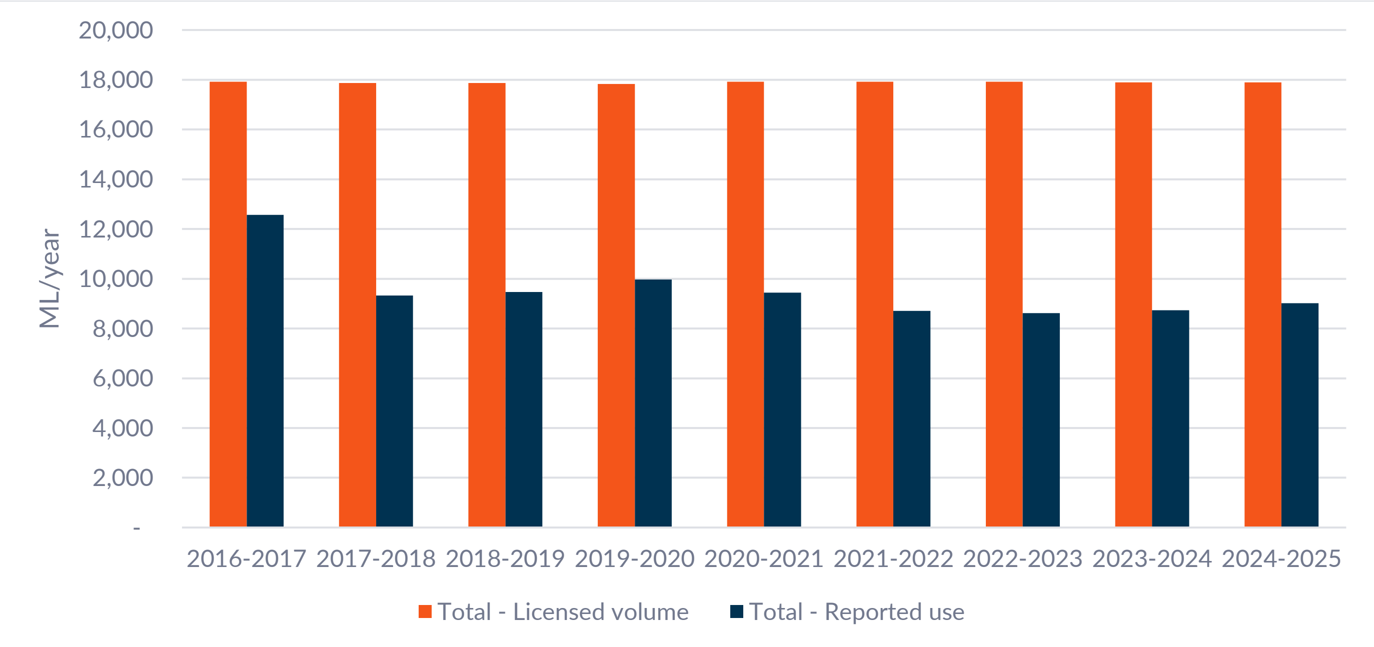


Figure 15. Comparison during 2016 to 2025 of the total licensed entitlements for all beneficial uses and groundwater sources to actual reported use

5.5 Unlicensed water use

Rural stock and domestic water use does not require licensing. Section 11 and 14 of the Act provides that, the owner or occupier of land on or immediately adjacent to which there is a waterway or groundwater from beneath the land may take water for:

a) the use of the owner or occupier or the owner's or occupier's family and employees, for domestic purposes on the land or

b) drinking water for grazing stock on the land or

c) irrigating a garden, not exceeding 0.5 hectares, which is part of the land and used solely in connection with a dwelling.

Rural domestic use includes the water used by outstations from a source other than a public water supply and domestic use on pastoral properties.

Unlicensed water extraction estimates are calculated from limited information; they are intended to be indicative for precautionary management and may not accurately represent actual use. The method used to estimate rural stock and domestic use in this plan differs from past methods which have produced larger estimated volumes.

Water management zone	Estimated use (ML per year)[4]	Proportion of ESY (%) for each zone
Town	528.5	26.6%
Inner Farm	196	61.3%
Outer Farm	812	72.5%
Wanngardi	175	51.5%
Mereenie	119	0.6%

5.6 Confidence assessment of available data

Confidence level	Data and knowledge issues
High confidence	Metered bore extraction data (derived from direct measurement and regular monitoring; variability due to under-utilisation by licence holders). Economic information is recent, accurate and appropriate to use in this context. High GDE model accuracy: 89% overall (true positive rate ~80%, specificity ~94%) with high confidence in likelihood of GDE.
Moderate confidence	Land tenure data was manually sorted using the detailed descriptors of the data set. While the grouping is logical and systematic, it is not automatic and relies on manual interpretation. Parcels of land for designation for the Aboriginal Water Reserve have been identified by systematically analysing land data. Some land may have been unintentionally overlooked due to the complexities of land titles and ownership records in the NT. Unlicensed water extraction estimates are calculated from limited information; they are intended to be indicative for precautionary management and not precise quantitative assessments.
Low confidence and knowledge gaps	Defined Aboriginal cultural sites identified, and their water requirements met. Extraction volumes exempt from water licensing under Gazette G13 of 20 June 2024.

[4] As unlicensed use is not subject to reporting and metering requirements, all unlicensed use is estimated. Stock and domestic use (including gardens) has been estimated based on 3.5 ML per land parcel for properties greater than 0.5 ha. Volumes used in the water plan have been rounded to the nearest 10.

6. Water security and drawdown

Overview

This section summarises the alignment of the ESY with the primary groundwater resource managed by the plan to meet the plan objectives of maintaining ecological health, supporting Aboriginal culture and broader social values, safeguarding long-term water security and enabling regional and Aboriginal economic development.

The water management zones managed by the plan differ from the previous plan. Surface water in the catchment has been removed from the Plan and will be managed through policy rather than within the plan. The resources within the Amadeus Basin have been consolidated due to their hydraulic connection and similar characteristics. These changes improve management clarity, monitoring efficiency, and stakeholder engagement to manage the five most significant resources in the plan area.

The total ESY for the plan is set at 23,540 ML per year. This water is allocated to beneficial uses including economic development and public water supply, as well as environment and rural stock and domestic which were accounted for differently in the previous plan. The Mereenie Aquifer System can continue meeting Alice Springs' long-term water needs, despite the recognition that it is a finite groundwater resource with limited modern recharge. Critical management strategies in the plan include prioritisation of public water supply, regularly monitoring and reporting groundwater levels, and implementing thresholds to protect groundwater dependant ecosystems.

6.1 Primary aquifers

The plan reduces the number of water resources managed under the plan due to the consolidation of resources to five management zones within the plan area. The plan manages the most significant or primary aquifers in the plan area, rather than all geologically defined resources of the previous plan. Surface water in the catchment will be managed through policy and regulation rather than additional measures under the plan. The remaining resources within the Amadeus Basin have been consolidated due to their hydraulic conductivity and similar characteristics. The alignment of changes between this plan and the previous plan is provided in Table 5.

Table 5. Alignment of water resources managed through the plan compared to the previous plan

<table>
<tr><th rowspan="2">Water resource management</th><th colspan="3">Current plan (2026-2036)</th><th>Previous plan (2016-2026)</th></tr>
<tr><th>Water resources</th><th>Licences</th><th>Unlicensed bores</th><th>Water resources</th></tr>
<tr><td rowspan="8">Within plan management zones</td><td>Town Basin</td><td>3</td><td>175</td><td>Town Basin</td></tr>
<tr><td>Inner Farm Basin</td><td>1</td><td>76</td><td>Inner Farm Basin</td></tr>
<tr><td>Outer Farm Basin</td><td>2</td><td>119</td><td>Outer Farm Basin</td></tr>
<tr><td>Wanngardi Basin</td><td>3</td><td>77</td><td>Wanngardi Basin</td></tr>
<tr><td rowspan="4">Mereenie Aquifer System (Goyder Formation, Shannon Formation, Pacoota Sandstone, Mereenie Sandstone and Hermannsburg Sandstone)</td><td rowspan="4">7</td><td rowspan="4">15</td><td>Mereenie aquifer system</td></tr>
<tr><td>Goyder formation</td></tr>
<tr><td>Pacoota sandstone</td></tr>
<tr><td>Shannon formation</td></tr>
<tr><td>Outside of plan management zones</td><td>Managed through policy</td><td>0</td><td>N/A</td><td>Upper and lower catchment consistent with policy</td></tr>
</table>

The distribution of licences across the plan area and aquifers has consistently demonstrated very little competition over the last 10 years. Water for stock and domestic use does not require a licence under the Act. The distribution of these bores across the aquifers demonstrates the low level of potential additional pressure on the resources. The ephemeral nature of surface water in the arid zone means that any use is opportunistic rather than a reliable source for sustained use, and as such is not to be managed under this plan.

6.2 Estimated sustainable yield

The total ESY for Alice Springs is 23,540 ML per year. It is comprised of ESYs for each water management zone which are as follows:

- Town: 2,000 ML per year
- Inner Farm: 320 ML per year
- Outer Farm: 1,120 ML per year
- Wanngardi: 340 ML per year
- Mereenie: 19,760 ML per year

The ESY operationalises water sharing objectives by balancing ecological sustainability, cultural values, social wellbeing, and economic development. The ESY is estimated in the context of uncertainties surrounding some evidence and is guided by clearly defined management priorities, ecological constraints, and community values.

The ESY is informed by:

- water availability
- ecological considerations, particularly maintaining the health of aquatic and groundwater dependent ecosystems
- balancing economic and social benefits within ecological limits
- accepting aquifer drawdown to meet urban supply needs.

The ESY is an estimation of what water can be sustainably taken, while enabling adequate water supply for the social, cultural and economic needs of the Alice Springs region. Setting the ESY is consistent with the hydrogeological domains in the plan area, the alluvial aquifers, including the Town Basin, Inner Farm, Outer Farm Basin and Wanngardi Basin and the Amadeus Basin's Mereenie Aquifer System.

The Town Basin ESY is set using a water balance approach with consideration of water storage volumes and allocations under the previous water plan. The Town Basin ESY has been adjusted to safeguard ecological assets (river red gums), cultural values, and water quality, while recognising the need for controlled drawdown in an arid zone supply system. Long-term monitoring of water levels (since 1952) informs understanding of recharge responsiveness and ecological thresholds. The water balance, settings under the previous water plan, and rural stock and domestic water requirements informed decisions about the amount of water available for allocation, noting there are still uncertainties in recharge and discharge processes.

The Inner Farm Basin is much smaller and localised than the Town Basin, with the aquifer surface area a quarter of the size of Town Basin but extending deeper. Water extraction from this resource is minimal and the ESY primarily considered the Maximum Allowable Yield under the previous plan, lack of competition for water, lack of evidence to suggest that the ESY set under the previous plan is inappropriate, and accounting for rural stock and domestic water requirements.

The Outer Farm Basin is more extensive than the Town Basin and Inner Farm Basin, however, it is not sustainable as a primary water supply because of its climate-dependence, salinity risks, and shallow aquifer dynamics. The ESY is set primarily considering larger water storage volumes, with consideration of the Maximum Allowable Yield under the previous plan and accounting for rural stock and domestic water requirements. The Outer Farm Basin plays a supporting role, helping diversify supply and providing alternatives for local irrigation and small-scale use.

The Wanngardi Basin is more extensive than the Town Basin and Inner Farm Basins but less extensive than Outer Farm Basin. The Maximum Allowable Yield from the previous water plan was considered along with existing allocations and water requirements for rural stock and domestic use.

The basis of the Mereenie Aquifer System ESY reflects demand for public water supply, taking into consideration the large aquifer storage volumes and acceptance of long-term drawdown. It assumes that the aquifers can sustainably provide Alice Springs' urban water under controlled extraction because of the vast stored volume of palaeo groundwater, even though recharge is far less than annual use. The ESY was determined using water balance modelling that included recharge, throughflow, and extraction, alongside large aquifer storage volumes, consideration of the Maximum Allowable Yields in the previous water plan and water requirements for rural stock and domestic use. The large storage capacity of the Mereenie Aquifer System is slowly and predictably drawing down over decades to centuries. Consistent with the National Water Agreement, groundwater drawdown is unavoidably occurring through extraction to meet urban water supply needs.

As an arid zone resource (Short & Bond, 2021) the allocations are considered over the long term to account for sporadic recharge events and typically more extensive storage volumes. Taking the ESY over 100 years will result in about a 2% reduction in groundwater storage within the Mereenie Aquifer System.

Non-consumptive environmental provisions are set aside prior to the calculation of the ESY. However, section 22B (6) of the *Water Act 1992* requires that the plan include an allocation to the environment from the ESY. Although the majority of the water balance remains unallocated to maintain environmental water requirements, to ensure the plan is compliant with the Act, a small allocation to the environment is also provided from the ESY.

6.3 Public water supply and security

Earlier water allocation planning and technical investigations consistently described the Alice Springs water supply as secure over very long timeframes. The 2016–2026 Water Allocation Plan, supported by foundational hydrogeological studies including Tickell (2011), Read (2003) and Jolly et al. (2005), concluded that the Mereenie Aquifer System contained extremely large volumes of palaeo-recharged groundwater — estimated at approximately 70,000,000 to 100,000,000 ML. Modelling available at the time demonstrated that groundwater extraction of around 9,000 to 11,000 ML per year would reduce overall storage only marginally, with declines occurring slowly and predictably over centuries. As a result, public communication and planning advice routinely characterised the resource as capable of sustaining "several hundred years" of supply under current usage. This earlier understanding established a high level of confidence that the Mereenie Aquifer System could continue meeting Alice Springs' long-term water needs, despite the recognition that it is a finite groundwater resource with limited modern recharge.

These earlier assessments also highlighted the significant depth of the resource and the economic feasibility of long-term pumping. Groundwater levels in the Mereenie Aquifer System typically range from 90 m to more than 160 mBGL in the Roe Creek borefield, and between 45 m and 120 m in the Rocky Hill region, well within economically viable pumping depths. Previous modelling acknowledged that extraction would continue to draw down water levels over time; however, even with ongoing decline, groundwater would remain accessible within feasible pumping depths for many decades to centuries. The large vertical extent of saturated sandstone and the high transmissivity of fractured zones supports assessments that borefield operations can continue through progressive pump deepening or construction of new production bores as needed. Collectively, the depth, storage volume and predictable drawdown behaviour are central to the longstanding interpretation that the Mereenie Aquifer System can reliably support Alice Springs' water requirements over a timeframe of several hundred years or more.

Under the Act, water allocation plans enact water security by providing a long-term plan for the management of a resource, and a clear articulation of impacts and trade-offs. In addition, the prioritisation of water allocation under the Act directly aligns to water security objectives, with water for stock and domestic the highest priority for extraction, which is enshrined in legislation as a statutory right, followed by water licences for public water supply as the second priority, with these licences having a higher level of protection relative to other water extraction licences.

Water extraction licences for public water supply in Alice Springs are held by Power and Water Corporation, who have legislative responsibilities for water supply and delivery in the Territory under the *Power and Water Corporation Act 1987*. The majority (>70%) of the water allocated in the plan is for long-term public water supply and prioritising urban water supply needs.

6.4 Confidence assessment of available data

Confidence level	Data and knowledge issues
High confidence	The Mereenie Aquifer System can continue meeting Alice Springs' long-term water needs, despite the recognition that it is a semi-finite groundwater resource with limited modern recharge. The majority (>70%) of the water within the ESY defined by the plan is for long-term public water supply and prioritising urban water supply needs.

7. Conclusion

This report provides an overview of the evidence available to support decisions about the Alice Springs water allocation plan. The report synthesises scientific analyses and detailed hydrological assessments that underscore the management of groundwater resources in the arid zone.

This is the third iteration of the plan which builds on experience and improved scientific understanding of groundwater in the plan area. The plan primarily allocates groundwater from the Mereenie Aquifer System to meet the urban water supply needs of Alice Springs. The plan acknowledges the lack of alternative, cost-effective supply options and accepts the level of drawn down occurring in this resource. . The aquifer is vast with a storage capacity greater than 100,000,000 ML, with predictable drawdown behaviour over decades to centuries.

Water has been allocated specifically for Aboriginal economic development to ensure that the benefits of the water are shared.

The report also documents the varying confidence levels associated with some critical evidence. There is high confidence in data related to metered water extraction, aquifer extent, groundwater dependent ecosystems across the whole plan area and regional-scale groundwater trends. Notable uncertainties persist with water quality variability particularly in alluvial basins, the rising groundwater levels in the Outer Farm and climate change impacts. To address these uncertainties, the plan emphasises precautionary and adaptive management strategies, such as maintaining the ESY, targeted monitoring, and supporting Aboriginal economic development opportunities. This balanced approach will help safeguard water-related ecological, cultural, social, and economic values of the Alice Springs region over the next decade.

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Schedule A. Dictionary

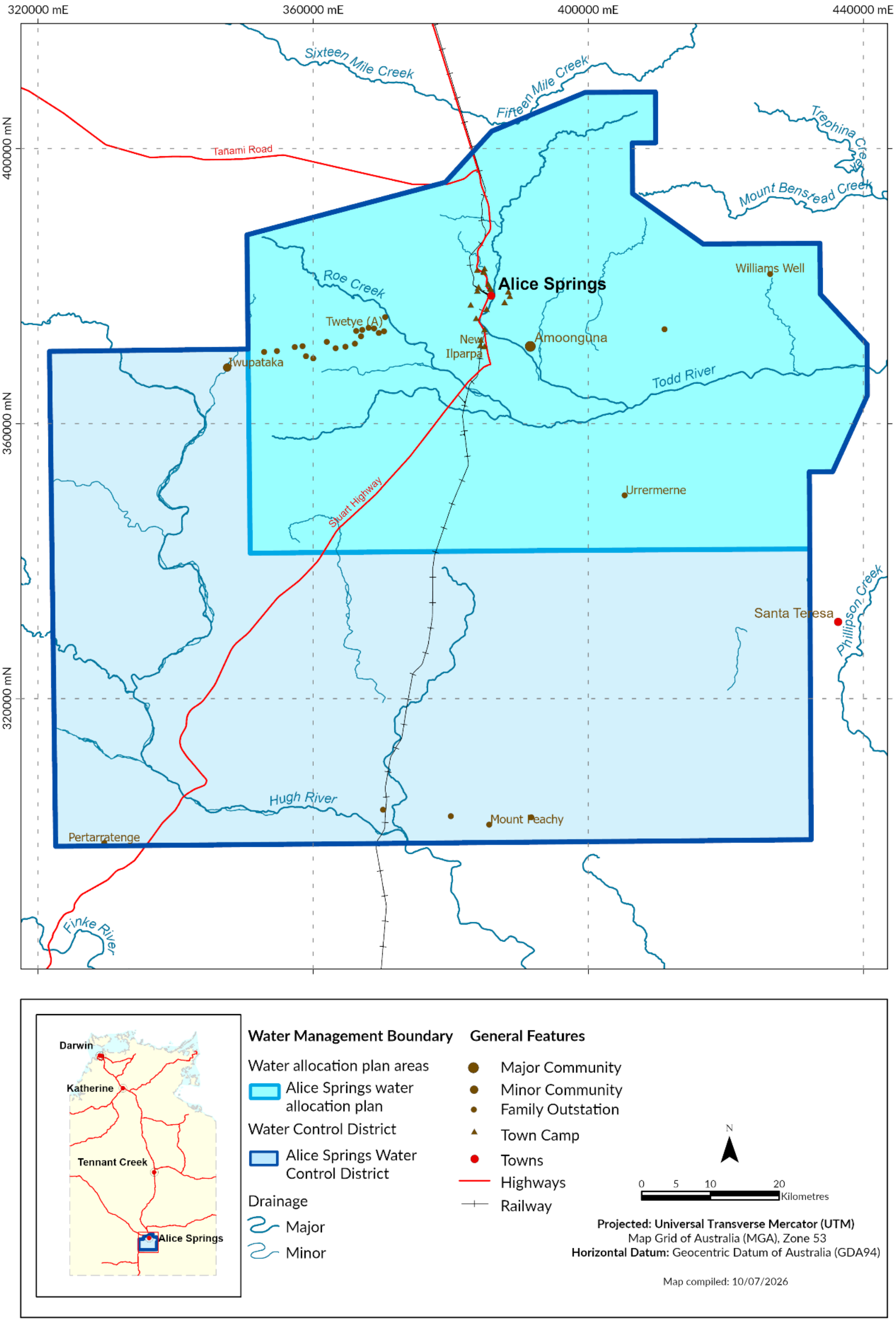
Term	Definition or reference
Aboriginal water reserve	Aboriginal water reserve is a portion of water set aside in a water plan for the economic benefit of eligible Aboriginal people (refer *Water Act 1992*, section 4(1))
Act	the *Water Act 1992*
Controller	the Controller of Water Resources appointed under the *Water Act 1992*, section 18
department	the department with the responsibility for administering the *Water Act 1992*, according to the Northern Territory of Australia Administrative Arrangements Order
eligible Aboriginal people	see *Water Act 1992*, section 4(1)
eligible land	see *Water Act 1992*, section 4B
estimated sustainable yield	the amount of water that can be allocated from the water resource to support declared beneficial uses that is sustainable
groundwater	see *Water Act 1992*, section 4(1)
groundwater dependent ecosystem	an ecosystem that requires access to groundwater to meet all or some of their water requirements
licence holder	the person granted a licence to take water under section 45 or section 60 of the *Water Act 1992*
Minister	the Minister[5] responsible for the *Water Act 1992*
plan area	the area to which this water allocation plan applies as shown in Schedule C
specific yield (Sy)	The ratio of the volume of water that rock or soil will release by gravity drainage to the volume of the rock or soil
water licence / water extraction licence	see *Water Act 1992*, section 4(1)
waterway	see *Water Act 1992*, section 4(1)

[5] Currently the Minister for Water Resources

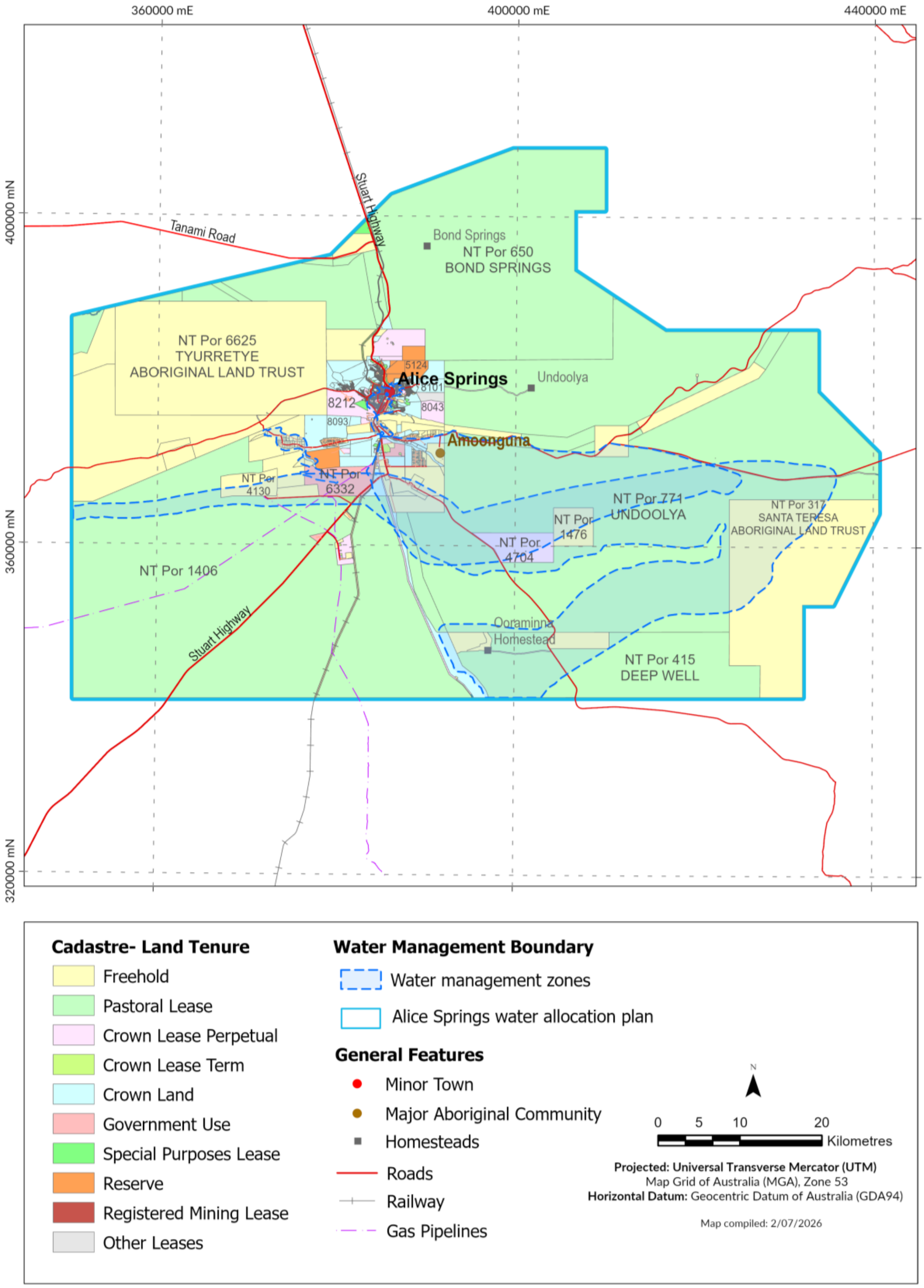
Schedule B. List of abbreviations and acronyms

Term	Full form
°C	degrees celsius
ESY	estimated sustainable yield
GDE	groundwater dependent ecosystem
GDV	groundwater dependent vegetation
GL	gigalitre
km	kilometre
km^2	square kilometre
L/s	litres per second
m	metre
m^2/d	metres squared per day
Ma	one million years
mBGL	metres below ground level
mg/L	milligrams per litre
ML	megalitre
mm	millimetres
NT	Northern Territory
NWI	National Water Initiative
Sy	specific yield
TDS	total dissolved solids

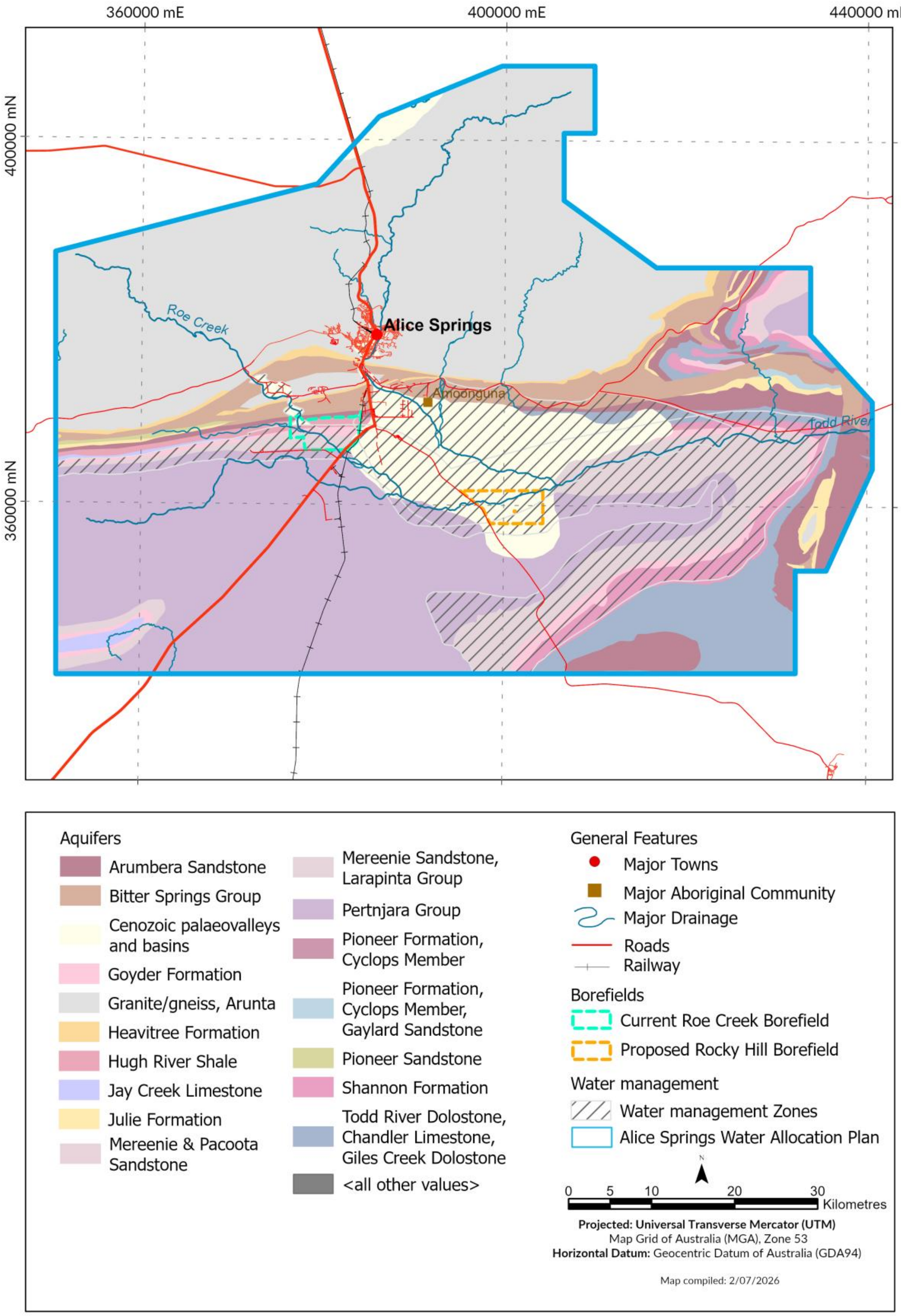
Schedule C. Alice Springs water control district area and Alice Springs plan area



Schedule D. Land tenure in the Alice Springs plan area



Schedule E. Groundwater resources in Alice Springs plan area



Schedule F. Groundwater depths and flow paths in Alice Springs plan area