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Report

Berry Springs Water Allocation Plan Review

PREPARED FOR:

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CDM Smith
listen. think. deliver.

Acknowledgement of Country

The Department of Environment, Parks and Water Security proudly acknowledges the Northern Territory's Aboriginal communities and their rich culture, and pays respect to the Elders past and present.

We acknowledge Aboriginal peoples as the Traditional Owners and custodians of the lands and waters on which we all rely.

We recognise the intrinsic connection of Traditional Owners to Country and value their contribution to managing the lands, waters and landscapes. We support the need for genuine and lasting partnerships with Traditional Owners to understand their culture and connections to Country in the way we plan and manage the water resources of the Darwin Rural water control district.

Executive summary

Overview

A Water Allocation Plan is required under section 22B of the Northern Territory (NT) *Water Act 1992*[1] (the Act) where water is allocated to beneficial uses including non-consumptive and consumptive use activities. Since 2017 water is also allocated to the Aboriginal water reserve through the declaration of a water allocation plan.

Recently the NT has refined its approach to the water allocation process, setting out that the process consists of three core documents; a water allocation plan, a background report and implementation actions (NT water allocation plan documents overview, 2022).

Berry Springs plan area and target resource

The Berry Springs plan area is located within the Darwin Rural water control district and provides a framework for allocation of water from the Berry Springs Dolostone Aquifer. This aquifer sustains an iconic spring complex in the lower reach of Berry Creek which is of great significance to Aboriginal groups, and also forms part of the unique ecology within the Territory Wildlife Park. It is this spring complex that gives its name to the aquifer and the plan.

Groundwater in the aquifer provides reliable, good quality water supply for beneficial uses within the plan area including residents in over 430[2] households, extensive irrigated horticulture, ecotourism and 2 commercial hubs.

Berry Springs water allocation plan

The Berry Springs water allocation plan (plan) was declared in August 2016, and expires in August 2026. The plan specifies 5 key objectives:

1. Maintain sustainable water supplies for consumptive and environmental uses
2. Improve management of the aquifer
3. Protect the environment
4. Support Aboriginal culture and communities
5. Ensure regional economic development is sustainable.

Scope of the plan review

The review considers the advice from the Department of Environment, Parks and Water Security (Department), the Berry Springs Water Advisory Committee and public submissions and has been undertaken as per section 22B(3) of the Act.

The review reflects the application of legislative amendments and applying recovery of unused water in the plan area over the next 2 years as well as the updated the Berry Springs Groundwater Flow Model (Knapton, 2016) model in 2021.

The review is focused on the delivery of the plan objectives, the status of risk in the plan area, compliance with the Act and providing recommended actions to respond to changing conditions.

Status update of changes since 2016

The status update outlines the key changes that have occurred that have affected the plan since it was declared in 2016. The legislative changes include:

- removal of the 15 L/sec exemption in the Darwin Rural water control district in 2016 and in 2023 the introduction of a requirement for a licence to take water for previously exempt activities which expires by 31 July 2025
- the Water Legislation Amendment Act 2018 that was introduced to amend the *Water Act 1992* to require mining and petroleum activities to be included in the water licencing framework
- the Water Further Amendment Act 2019 that provided for a new beneficial use category related to Aboriginal economic development and the establishment of a Aboriginal water reserve.

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[1] https://legislation.nt.gov.au/en/Legislation/WATER-ACT-1992

[2] 2021 Berry Springs, Census All persons QuickStats | Australian Bureau of Statistics (abs.gov.au)

Water extraction

No significant changes in water extraction have taken place since declaration of the plan, as the Environmental Sustainable Yield (ESY) is considered to be fully allocated. While no new water use activities have been considered, a number of groundwater and surface water extraction licences have been issued for existing water use activities. This has resulted in an increase in the number of extraction licences from 5 licences in 2016-2017, to 54 licenses in 2022-2023. There is an estimated outstanding volume of 1,000-2,000 ML/yr of unlicensed use.

Delivery of plan objectives

A review of the delivery of plan objectives concluded the following:

- Maintain sustainable water supplies for consumptive use: **achieved**
- Maintain sustainable groundwater levels and spring discharge for environmental uses: **partially achieved**
- Improve management of the aquifer: **partially achieved**
- Protect the environment: **partially achieved**
- Support Aboriginal culture and communities: **partially achieved**
- Ensure regional economic development is sustainable: **achieved**

Review of risks

The plan identified key risks associated with the groundwater resource, this review has reset the activities to be completed before the end of the plan.

Review compliance with the Water Act 1992

The legal requirements of the plan were reviewed and two components were not achieved:

1. The allocated use marginally exceeds the ESY in the amount of 185 ML/yr or 2%. This is a result of transitioning previously exempt groundwater extraction into licenced use. The process for licensing historic use is ongoing and in many cases has resulted in granted entitlements being in excess of what was, and is, actually required.
2. There is no Aboriginal water reserve allocation in the plan. This is because the legislative requirements came into effect in 2019 after the plan was declared.

Recommendations for the remaining period of the plan

Recommended actions are included in the following core documents that support the plan:

- Water Allocation Plan
  - the Water Allocation Plan should be simplified from its current form into 3 core documents that support the plan.
- Background Report
  - the environmental water requirements including groundwater and surface water systems. Hydrogeological assessment of the aquifer including hydro stratigraphy, connectivity, mapping of springs and discharge zones, identification of karstic recharge features such as sinkholes and wetlands
  - confirm and update the sustainable yield of the aquifer
  - recalibration of the groundwater model to enable differentiation of groundwater management zones for the Berry Creek and the Darwin River drainage systems, and to carry out testing of management scenarios to improve environmental and cultural outcomes within each zone
  - assess future water demands, including sustainability of drinking water supply to domestic households and consideration of climate change.
- Implementation Actions
  - alignment of plan objectives, actions and performance indicators
  - a simplified list of actions and performance indicators that are SMART (Specific, Measurable, Achievable, Relevant and Timely) which should be linked to the ESY
  - a detailed monitoring program linked to triggers
  - identification of essential tasks to be completed prior to the next plan, including determination of the Aboriginal Water Reserve (AWR), determination of environmental flow requirements for the Berry Creek pools and groundwater limits for groundwater dependent ecosystems, updating the ESY.

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Section 1 Introduction

1.1 What is a Water Allocation Plan

A Water Allocation Plan (plan) is required under section 22B of the Act. Section 22B(5) of the Act sets out that water allocation plans for a water control district are to ensure that:

a. water is allocated within the estimated sustainable yield to beneficial uses;

b. the total water use for all beneficial uses (including those provided through rural stock and domestic use and licences granted under sections 45 and 60) is less than the sum of the allocations to each beneficial use;

c. the right to take water under a licence granted under section 45 or 60 is able to be traded (in part or in full); and

d. as far as possible – the full cost for water resources management is to be recovered through administrative charges to licensees and operational contributions from licensees.

Plans establish how water will be shared within a specific water control district. Each plan should:

- describe the area and the water resources contained within
- include the objectives, rules and operating mechanisms for water sharing between beneficial uses
- outline monitoring and reporting programs that evaluate the plan's performance; and
- identify risks and actions for sustainable resource management.

Beneficial uses include non-consumptive uses such as environment, cultural and consumptive uses such as rural supply and demand (S&D), public water supply, aquaculture, industry and agriculture. Recently, extraction for mining and petroleum activities has been brought under the licencing provisions of the Act. In addition, a Aboriginal water reserve has been incorporated as a beneficial use within each plan. Beneficial uses are also defined by specific water quality criteria, and a plan has to have regard to maintaining the water quality such that a beneficial use is maintained.

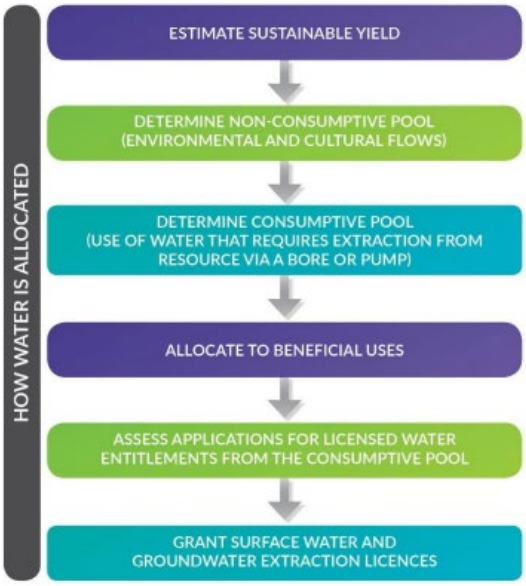

Figure 1-1 The process for allocation of water under a plan (NT Water Regulatory Reform, 2019[3])

[3] https://haveyoursay.nt.gov.au/waterreform

The NT plans consist of three core documents; the water allocation plan, a background report and a programme of implementation actions (NT water allocation plan document overview, 2022).

1.2 Berry Springs plan area and water resource

The Berry Springs plan area is located approximately 50 km south of Darwin and resides within the broader Darwin Rural water control district. The plan area includes the Berry Spring Dolostone Aquifer, which is karstic in nature and forms a small oval shaped basin structure.

The Berry Springs Dolostone Aquifer is a 'fill-and-spill' aquifer that typically fills to saturation during the monsoonal wet season. Discharge from the aquifer sustains springs and river flow during the dry season along the Darwin River and through the pool section of the Berry Creek down to the confluence with the Blackmore River which is saline. The Darwin River is tidal and affected by saltwater mixing up to the Cox Peninsula Road. The Berry Creek pools are freshwater and protected from saltwater intrusion by the Marsh Fly Weir. Water from the aquifer maintains unique ecosystems such as monsoon vine thicket, places of cultural importance to the Kungarakan and Larrakia people and flows in the pools at Berry Springs nature park. Upstream of Cox Peninsula Road the Berry Creek is seasonal with surface flow ceasing around July of each year.

Flow in the Darwin River is perennial, which is influenced by the 25 L/sec seasonal environmental releases from the upstream Darwin River Dam. In the Darwin River downstream of Cox Peninsula Road to the confluence with the Blackmore River, the flow is tidal and the water quality is saline due to marine incursion from the Blackmore River.

Groundwater in the aquifer provides reliable, good quality water supply for residents, horticultural enterprises, ecotourism activities and 2 commercial hubs.

1.3 The Berry Springs plan

The Berry Springs plan was declared in August 2016, and expires in August 2026. The plan specifies the management of groundwater resources and groundwater-fed springs and pools and defines how much water can be sustainably taken from groundwater resources for consumptive purposes. The objectives, strategies and performance indicators are presented in Appendix A.

The plan uses average annualised groundwater recharge over the period 1986-2015 as the basis for determining the ESY. The averag[4]e annual volume of recharge is 44,600 ML. Consistent with the NT Water Allocation Planning Framework, 20% (8,920 ML/yr) is set as the ESY available for consumptive use and the remaining 80% (35,680 ML/yr) is allocated to the environment non-consumptive use.

The plan defines five key objectives and these are to:

1. Maintain sustainable water supplies for consumptive and environmental uses
2. Improve management of the aquifer
3. Protect the environment
4. Support Aboriginal culture and communities
5. Ensure regional economic development is sustainable.

The plan includes 32 performance indicators, grouped against the five objectives of the plan and there are 40 actions identified in the plan, some of which have been linked to a performance indicator and grouped according to either:

1. monitoring resources conditions (13 actions)
2. monitoring environmental and cultural value (11 actions) or
3. monitoring plan (16 actions).

[4] https://nt.gov.au/environment/water/management-security/water-allocation/water-allocation-framework

Section 2 Scope of review

The review considered advice from the Department, the Berry Springs Water Advisory Committee (the Committee) and public submissions provided over the last fifteen months. The Committee was appointed by the Minister in 2022 and first met in July 2022. The Committee has had two meeting to date, to provide advice on the review. There were effectively nil submissions received via the "Have your Say" website or directly during the submission period July-August 2022.

Noting the review was conducted outside of the mandated timeframe (requiring it to be completed by the 1st August 2021), the review was conducted in alignment with the requirements of a plan review under section 22B(3) of the Act.

The primary piece of scientific work underpinning the review, is the Berry Springs Groundwater Flow Model.

The review process has 5 key components:

1. provide a status update of the key changes that have occurred from 2016 to 2023
2. review the delivery of the plan objectives
3. review the risks identified in the plan
4. review compliance with the *Water Act 1992*
5. recommended actions to respond to changing conditions.

The review process is transparent and evidence based and undertaken with advice from the Committee. Public consultation via the Northern Territory Governments Have Your Say website[5] in July-August 2022 invited comment and response on the effectiveness of the plan to meet the stated objectives. Community response was effectively nil.

In the assessment of the plan success, there has been recognition of the complexities associated with managing legacy water access and the process required to balance water use needs and progressively develop sufficient knowledge to build in protections for environmental and aboriginal values.

A staged approach and prioritisation of effort is required to achieve the intent of the plan. Subsequently, as endorsed by the Department, the following criteria have been utilised in this review.

Achieved: satisfactory controls and system knowledge in place to achieve the intent of the plan objective.

Partially achieved: controls and system knowledge requires further implementation to achieve the intent of the plan objective.

Section 5 of this report presents recommendations and prioritisation of actions based on progressing the plan objectives over the next two years.

[5] https://haveyoursay.nt.gov.au/berry-springs

Section 3 Status update on key changes since 2016

This status update provides a summary of the key changes that have occurred since 2016 that have the potential to impact the plan. This includes changes to; legislation, the environment, the way water use is measured and the volume of water that is licensed and used.

The outcome of this status update is then considered within the context of the delivery of plan objectives, in the subsequent section 4) of this report.

3.1 Legislative changes since plan declaration (2016)

3.1.1 Exemptions in the Darwin Rural water control district 2016 and 2023

An exemption for water extractions from bores equipped to pump less than 15 L/sec in the Darwin Rural area (which includes the Berry Springs area) was in place since 1992. This exemption was revoked in July 2016 due to risks to water sustainability and water quality. Revoking the exemption means that existing users are now subject to the same licensing requirements as apply in other water control districts in the NT. The exemption does not apply to groundwater use for domestic or household irrigation of less than 0.5 Ha connected directly to the household.

The change in policy is supported by a priority approach to ensure that previously exempt users are included in the licencing regime as fast and as efficiently as possible. It is acknowledged that accounting for all water use in the plan area may result in the metered extraction exceeding the sustainable yield of the water resource.

Most recently in 2023, the Act was amended through section 71M that sets a two year timeframe to finish the transition of previously exempt water users in the Darwin Rural water control district into the licensing system.

3.1.2 Water licences for mining activities - Water Legislation Amendment Act 2018

The Water Legislation Amendment Act 2018[6] was introduced to amend the Water Act to require mining and petroleum activities to be included in the water licencing framework. The original timeframe was further amended in 2019 to accelerate the incorporation of mining operations into the water licencing framework.

3.1.3 Water Further Amendment Act 2019

The Water Further Amendment Act 2019[7] provided for a new beneficial use category related to Aboriginal economic development. The Aboriginal water reserves are a reserved percentage of water from the consumptive pool within a plan that are exclusively accessible to eligible Aboriginal people to use or trade.

3.2 Management of consumptive use

3.2.1 Groundwater metering

3.2.1.1 Licensed groundwater extraction metering

The plan discusses water extraction licences in the plan area, water usage is and will be metered and annual extraction amounts reported, although the estimated sustainable yield managed through the plan is groundwater only.

Table 3-1 summarises the number of groundwater and surface water extraction licences in the plan area and indicates that they have increased from 2 licences in 2016-2017, to 54 licenses in 2022-2023. This increase is driven by the legislative change that occurred in 2016. As the previously unlicensed bores were licensed, they were also required to meter groundwater use and this is evident in Table 3-1, which shows that by 2022-2023, 81% of the 54 licenses have reported metered use. Compliance and enforcement activities are being implemented for non-compliant licence holders[8].

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[6] https://legislation.nt.gov.au/en/LegislationPortal/Acts/~/link.aspx?_id=8A8A4398F9584EBCA6CCA7C2BC1249A2&_z=z&format=assented

[7] https://legislation.nt.gov.au/en/Bills/Water-Further-Amendment-Bill-2019-S-100

[8] https://nt.gov.au/__data/assets/pdf_file/0006/1300101/compliance-and-enforcement-priorities-report-card-2022-23.pdf

Table 3-1 Summary of groundwater & surface water extraction licences and metering in the plan area

	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
No. groundwater extraction licenses	2	30	54	6054	54	54	54
No. groundwater extraction licenses reporting metered use	1	2	29	44	46	52	53
% groundwater licences reporting metered use	50%	7%	54%	81%	85%	96%	98%
No. surface water extraction licences	3	3	3	3	3	3	3
No. surface water extraction licenses reporting metered use	0	1	1	1	1	1	2
% surface water licences reporting metered use	0%	33%	33%	33%	33%	33%	67%

3.2.1.2 Unlicensed groundwater extraction estimates

There are two components of unlicensed groundwater extraction:

1. Stock and domestic use, which is not required to be licensed under the current provision of the Act and therefore use can only be estimated. The Department estimates 3.5 ML/yr per property, which for the plan area is approximately 1,005 ML/yr.
2. Unlicensed commercial groundwater use, has required licencing since the lift of the exemption for the Darwin Rural water control district. The majority of commercial groundwater is now licenced and current Department estimates indicate there remains a small unlicensed portion (approximately 1,043 ML/yr.)

This significant reduction in unlicensed groundwater use in the plan area since the plan was established means that approximately 2,000 ML/yr is unlicensed and about half is expected to complete the transition to licencing during 2023-2025.

3.2.2 Groundwater licence entitlement and use

Table 3-2 summarises the change in groundwater licence entitlement and use since the plan was declared (2016-2017 water year compared to the 2022-2023 water year) and indicates:

- **Licensed entitlements has significantly increased** from 651 ML/yr. to 7,304.85 ML/yr, which is largely attributed to the removal of the exemption under the Act, which was enforced from July 2016 until 2019.
- **Total licence entitlement is less than estimated sustainable yield** at 7,305 ML/yr relative to 8,920 ML/yr ESY although actual water reported as being used is much lower at 29% of total licence entitlement.

The significant increase in groundwater licence entitlement is a necessary first step and a significant improvement in the status of the plan area that will allow for more confidence in future management of the resource.

Table 3-2 Summary of Berry Springs groundwater extraction licences (GWELs) entitlement and water use between 2016-2017 and 2022-2023 (provided by the Department 2023)

GWELs	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
Total number	2	30	54	54	54	54	54
Number reporting use	1	2	29	44	46	52	53
Total licence entitlement (ML/yr)	651	4,265	6,304	7,145.75	7,170.85	7,304.85	7,304.85
Reported use (ML/yr)	144.14	200.12	474.88	1,598.75	1,862.22	2,173.98	2,097.56

3.2.3 Announced allocations

The plan stipulates that all licenses in the plan areas will be subject to announced allocations and that modelling of the aquifer will be undertaken at the end of each wet season to determine the availability of water for consumptive use for the following water year.

An announced allocations is expressed as a percentage and is applied to the maximum licensed entitlement defined in a water extraction licence. These are applied annually to licences that take water from water resources that are classified as Top End, including Berry Springs. Every year on May 1, the Controller of Water Resources[9] announces how much water a licence holder can use for the upcoming year.

The known connectivity between groundwater and surface water in the plan area means that groundwater extraction reduces dry season flows in Berry Creek and the Darwin River. Using the groundwater model, flow reduction at Marsh Fly is the order of 50% at the end of the dry season. Similar reduction in dry season flow in the Darwin River is inferred.

Since 2016, announcements for Berry Springs have maintained 100% of the maximum licensed entitlement. This is because the plan is still transitioning to users being licenced, as announced allocations would disproportionately effect those who have already transitioned.

3.2.4 Trade

The plan allows for temporary (one-year) and longer where ongoing trade of groundwater licences where the extraction continues from the same aquifer and the water is used within the plan area.

There have been no temporary or ongoing trades since the plan was implemented in 2016.

3.3 Ecosystem function

3.3.1 General background

Ecosystem function is the physicochemical and biological processes that occur within the ecosystem to maintain terrestrial life. The Aquatic Ecosystems Toolkit (AETG, 2012) was developed in response to the National Water Initiative and provides relevant guidance on how to classify aquatic ecosystems based on a systematic description of its characteristics (e.g. geomorphology, hydrology, chemistry and vegetation). This presents a nationwide approach to classifying groundwater dependent aquatic ecosystems and an alternative to attempting to delineate detailed biodiversity or ecological function. Once the key aspects of the ecosystem have been classified (e.g. its wetting and drying regime and salinity regime), ecological endpoints can be determined which represent the minimum thresholds required to maintain the ecosystem function.

3.3.2 Berry Springs ecosystem function

Groundwater Dependent Ecosystems (GDEs) can be divided into six general types (wetlands, terrestrial vegetation, river baseflow systems, cave and aquifer systems, terrestrial fauna and estuarine and near shore marine systems) and the Berry Springs plan acknowledges that "*virtually all of these ecosystems are present within the plan area*".

To date there has not been specific studies in the plan area to support the understanding of the GDE function and associated ecological endpoints that could form the basis of quantitative performance indicators of the ecosystem. Without having established these indicators, it is difficult to establish if the ecosystems are being impacted due to the groundwater extraction regime. It is also difficult to implement restrictions on extraction (such as announced allocations).

The Berry Springs groundwater flow model considers the impacts of groundwater extraction on end of season flows and uses a threshold of a 20 % reduction in flow as the basis for the model either meeting or failing the overall objective. This is consistent with policy and is considered a starting point for establishing flow thresholds where the majority of ecological functions are maintained.

[9] https://nt.gov.au/environment/water/management-security/water-allocation/announced-water-allocations

3.3.3 Current status

The risk to the ecosystem function of the Berry Spring complex from groundwater extraction has been analysed using the Berry Springs Groundwater Flow Model of Knapton (2012; cited in NT Government, 2016), which has been updated twice since it was developed (Knapton, 2016; Knapton, 2021). Table 3-3 summarises the findings of the models, in terms of the predicted impact on the Berry Springs flows, associated with a certain amount of extraction. The model results indicate that, at the levels of pumping included in the respective models, there is a predicted increase in the cease to flow conditions by more than 20%, which has been used as a surrogate for ecosystem function.

Although this review cannot consider the ecosystem function against a defined ecological endpoint, based on the results of the modelling undertaken to date, it is possible that there will be a decline in ecosystem function associated with current groundwater extraction impacts on low flows. This is indicated by the work of Knapton (2016) that considered the impact of 5,900 ML/yr groundwater use on the environment, which is comparable to the current regime (5,700 ML/yr) and resulted in significant reductions in low flows (between 30-40% and at times up to 100%).

The plan acknowledges that these potential environmental risks are present in the plan area in 2016.

The recent modelling of the Berry Springs aquifer and analysis of streamflow data indicates that water use is approaching or has reached the limits of sustainable extraction, and this presents risks in relation to the following:

- *sustainable yield*
- *reduction in springflow and the impact of this on water quality and availability; and*
- *elevated bacterial levels in the water at the Berry Springs, requiring the closure of the springs to swimming.*

Table 3-3 Summary of Berry Springs groundwater flow model results

	Knapton (2012)*	Knapton (2016)	2021 update
Groundwater use included in model development scenario	**Total use: 8,600 ML/yr** Licensed use: 651 ML/yr Unlicensed use (<15L/s): 6,944 ML/yr S&D use: 1,005 ML/yr	**Total use: 5,879ML/yr** Irrigation use: 5,186 ML/yr S&D use: 693 ML/yr	**Total use: 9,440 ML/yr** Production: 8,436 ML/yr S&D Use: 1,004 ML/yr
Results of Model		Model objective 1: Instantaneous flows in rivers are impacted by <20% Model result: objective not met; **minimum flows are reduced by 30-40%** and at times up to 100%	>20% reduction in end of dry season discharge in all years (2014-2021 period) Without pumping, cease to flow would not have occurred at any time in the 2014-2021 assessment period **Cease to flows are reduced by 46%**

*Information sourced from plan (2016), not directly from Knapton (2012) report.

Section 4 Review of the delivery of plan objectives

4.1.1 Maintain sustainable water supplies for consumptive and environmental uses

The plan objective is to maintain groundwater levels and water quality sufficient to meet the minimum requirements of current consumptive and environmental uses.

The Department maintains 20 monitoring sites, including 14 bores with continuous water level loggers and 6 surface water sites which are manually gauged in the plan area, this includes 3 newly drilled bores to replace existing bores.

Since the declaration of the plan, the Department has focused on transitioning existing users into the licencing framework, which has increased the number of groundwater licences from 2 licences to 54 over the review period. However, this has resulted in the total licenced volume exceeding the nominated sustainable yield adopted in 2016 in the plan. In 2023 (following the uncertainty of the last few years with COVID), the Department commenced actively implementing the recovery of unused water policy[10] in the plan area. This policy along with the Darwin Rural Water Regulation Strategy[11] will better align water use with total licence entitlements before the new plan.

This review concludes that the objective to maintain a sustainable water supply is partially achieved as the objective to maintain a sustainable water supply has been achieved for consumptive uses within the plan area, including S&D, horticulture, commercial and ecotourism enterprise. Sustainable water supply for the environment has been maintained for all locations within the plan, except at Marsh Fly Weir where reduction in predicted flows range from 15% in 2022 to 86% in 2019. The 2018-2019 wet season was an exceptionally low rainfall year and the model predictions were unable to match recorded flows at Marsh Fly Weir. Section 6 of this report provides advice on further activities to improve this performance to the end of the plan period in 2026, including setting environmental flow requirements for the Darwin River and for Berry Creek.

4.1.2 Improve management of the aquifer

The plan objective to improve the management of the aquifer has performance indicators associated with it that relate to implementing legislative changes and strategies around the development of specific groundwater triggers.

The legislative changes that have occurred since the plan was implemented have improved the management of the aquifer. The removal of the 15 L/sec exemption in the Darwin Rural water control district means that there has been a significant reduction in unlicensed groundwater use in the plan area since the plan was established, with an additional 6,700 ML/yr. of licence entitlement now managed under the plan. The completion of this transition during 2023-2025 will occur with the legislative changes through section 71M of the Act.

Additionally, the Department has also enforced licence compliance with water users reporting their actual usage combined with regular audits and checks of licence records to identify any breaches of licence conditions. Inspections have also been carried out to investigate potential activities that may require a water licence. This review concludes that this objective has been partially met. There have been significant improvements in the management of the Berry Springs aquifer, via the implementation of legislative changes, there remains aspects of aquifer management that need to be improved in the future. For example, a critical action identified in the plan was the development of groundwater triggers to address the risk from over-extraction. Section 6 of this report provides advice on further activities to improve this performance to the end of the plan period in 2026. As a fill and spill aquifer where groundwater levels are reset each wet season, improving the management is best achieved by identifying zones where bores impact upon the springs within the forthcoming dry season (ie have a travel time of <12 months to the nearest spring).

4.1.3 Protect the environment

The plan objective to protect the environment is focused on the maintenance and protection of good water quality and flows in water dependent environmental sites and to maintain natural variability in flows. The strategies described in the plan to achieve this objective include addressing the knowledge gaps around GDEs and establishing minimum flow thresholds in Berry Springs.

[10] https://nt.gov.au/__data/assets/pdf_file/0010/1299853/recovery-of-unused-licensed-water-entitlements-policy.pdf
[11] https://depws.nt.gov.au/__data/assets/pdf_file/0014/1260005/darwin-rural-water-regulation-strategy-2023-26-summary.pdf

A preliminary map of GDEs has been completed for the plan area with the methodology for further assessment being currently finalised that will enable the next phase on ground site visits to occur.

Minimum flow requirements in the Berry Springs pools and in the Darwin River have not been determined, and it is not currently possible to ascertain the extent of impacts on the ecological function on these flowing systems.

In most years the flows in Berry Springs are reduced by more than 20% towards the late dry season. Based upon an environmental objective of no more than 20% flow reduction, application of the generic rule to this catchment may not be productive in consideration of the urban setting and current use. Noting further work is required to better understand the competing needs of environment and stakeholders, revised criteria may be appropriate to align with the objective to effectively manage the resource with competing demands and values.

This review concludes that the objective to protect the environment has been partially achieved to date and Section 6 of this report provides advice for further activities to improve this performance to the end of the plan period in 2026.

4.1.4 Support Aboriginal culture and communities

The plan objective to support Aboriginal culture and communities is focused on maintaining and supporting traditional cultural values on Aboriginal owned land through the protection of culturally significant water dependent sites, as well as providing access to water for commercial development.

The Water Further Amendment Act 2019 presents a legislative platform to support this objective and aims to set aside a portion of the water from the consumptive pool, to an AWR. This is implemented when making licence decisions in the plan area that have consideration to AWR estimates. The Strategic Aboriginal Water Reserve Policy Framework 2017[12] also outlines the process for water entitlements returned through surrender, that are amended or cancelled, can be reallocated to AWR and if water isn't available how 'notional' AWR allocations are provisioned.

Furthermore, since the plan was implemented, the Department has also started work to establish Aboriginal reference groups, which will provide a culturally safe space for Aboriginal voices from across the Northern Territory to be heard on local water management issues. Specialist Aboriginal consultants have been engaged to develop a framework for the Aboriginal reference groups and includes consulting with prescribed body corporates, Aboriginal land holders, land councils, Aboriginal Areas Protection Authority and other relevant stakeholders.

This review concludes that the objective to support Aboriginal culture and communities has been partially achieved. The establishment of the Aboriginal reference groups, the engagement of specialist Aboriginal consultants and the legislative platform and policy framework to establish an AWR in the next plan, demonstrates significant progress against this objective.

Allocations to AWR will be included in the next plan, and further details are outlined in Section 6 of this report.

4.1.5 Ensure regional economic development is sustainable

The plan objective to ensure regional economic development is sustainable, is focused on the development of water consumptive industries being conducted within an equitable and sustainable framework that considers the impacts of cumulative water use from the Berry Springs Dolostone Aquifer in the context of land use planning and approvals.

This review finds that this objective of the plan has been achieved via the following mechanisms:

- Education to encourage greater water efficiency is facilitated by the Department's installation of groundwater level signage on roadsides in the plan area, which will raise awareness within the community of the variable nature of the resource.
- Engagement and collaboration with industry such as the NT Farmers Association to better understand industry needs and explore water use efficiencies.
- The Darwin Rural Area Groundwater Watch[13] platform has been updated (mid-2023) and provides a user friendly and informative information source for all groundwater users, to enhance their understanding of the water resource.
- Water trading is permitted within the plan area, however to date, no trades have been recorded.

[12] https://depws.nt.gov.au/__data/assets/pdf_file/0011/457553/SWRC-Policy-Framework_A4_V1.pdf
[13] https://waterresources.nt.gov.au/groundwaterwatch/

Section 5 Review of plan area risks and priority actions

The plan identifies eight key risks associated with the groundwater resource:

1. Berry Springs and other discharge springs will stop flowing earlier in the dry season under the current extraction regime
2. ecosystem functions are not fully identified and protected
3. Water quality will deteriorate
4. future development will result in over extraction
5. over extraction is already happening
6. ecosystem values important to Aboriginal people are not identified and protected
7. residential water users will be metered and charged for water; and
8. mining within the plan area would affect water availability and water quality.

Noting the interrelationship of many of these risks, five categories outlined in Table 5-1 were used to organise the risks and improvement actions identified. Appendix B presents the full 42 actions classified into action categories and prioritisation assigned based on recommendations to achieve best possible outcomes over the next 2 years of the plan. Where actions have been classified as low priority this has been on the basis that they are either addressed through one of the 12 high priority actions, or they are recommended to be postponed to 2026 because they are dependent on prior tasks, or they are a 'reactionary' action that may or may not need to occur over the plan lifecycle (e.g. action to report any disruptions that might occur to the water supply).

Table 5-1 Action categories for plan area risks

Action category	
1	Maintain groundwater levels and water quality
2	Improve aquifer management
3	Protect the environment
4	Support Aboriginal culture and communities
5	Ensure regional economic development is sustainable

Table 5-2 High priority implementation actions by category

1. Actions related to maintaining groundwater levels and water quality

Outcomes of water sharing	Updated actions	KPI	Timeframe	Agreed WAC priority
1.1.1 The amount of water needed to support consumptive uses continues to be met	(A1) Regularly monitor regional rainfall, stream flow, groundwater levels and groundwater/surface water quality	Monitoring completed and data available Public annual status of the resource report	Annually	High
1.1.2 The quality of water sourced for consumptive uses is maintained	(A3) Conduct comprehensive water quality sampling across the aquifer (including nutrients and farm chemicals)	Monitoring completed and data available	Post-2026	Low

2. Actions related to improving management of the aquifer

Outcomes of water sharing	Updated actions	KPI	Timeframe	Agreed WAC priority
1.2.1 All groundwater use is accounted for and managed under the WAP	(C1) Licence all commercial water use – legislative change for 2 years to complete transition	All commercial water use is licensed and metering is established	Pre-2026	High
1.2.2 Ensure the WAP is meeting the objectives of groundwater management	(C1) Undertake a WAP review – completed in December 2023	WAP review report completed	Pre-2026	Medium
1.2.3 Key knowledge gaps are identified, and work undertaken to increase the knowledge of the water system	(A6) Undertake a hydrogeological assessment program to improve ecohydrogeological conceptual model of the area	Hydrogeological assessment report completed	Pre-2026	Medium
1.2.4 Education of broader community about the plan, and its role in managing the aquifer	(C4) Produce educational material about water planning and the aquifer and introduce incentives to encourage efficient water use	Monitoring data and educational material accessible to community Public annual status of the resource report	Pre-2026	High/ Medium

3. Actions related to protection of the environment

Outcomes of water sharing	Updated actions	KPI	Timeframe	Agreed WAC priority
1.3.1 There is an improved understanding of ecosystem function and environmental values	(B4) Improve knowledge of spring and baseflow ecohydrological requirements	Determine baseflow requirements Investigate additional legislative mechanisms to provide groundwater protection zones in the area	Pre-2026	Very high
1.3.2 The condition of groundwater dependent ecosystems (GDE) is known and monitored as far as practicable and accounted for in water planning and licensing	GDE mapping using image analysis GDE verified on-site visits	GDE probability map completed	2025	Very high
1.3.3 Key environmental values are appropriately accounted for in water planning and licensing	(B6) Develop triggers and thresholds for Berry Springs to protect ecosystem value and function	Triggers and thresholds developed	Post-2026	High

4. Actions related to key Aboriginal and other cultural values associated with water

Outcomes of water sharing	Updated actions	KPI	Timeframe	Agreed WAC priority
1.4.1 There is an improved understanding of Aboriginal cultural values and other cultural values associated with the water resource	Information sharing with broader community about the water resource	Aboriginal ecology signage at Berry Springs and Territory Wildlife Park	Pre-2026	Medium
1.4.2 Key Aboriginal cultural sites that rely on water are monitored and potential impacts on such sites are appropriately accounted for in water planning and licensing	(B5) Develop and implement programs to monitor health of key water dependent ecosystems and cultural places that are vulnerable to change due to water extraction	Monitoring completed	Post-2026	Medium

5. Actions related to water for sustainable development in the region

Outcomes of water sharing	Actions	KPI	Timeframe	Agreed WAC priority
1.5.1 Water is available to support sustainable economic development in the region	(C14) Review and advise on the sustainability of proposed water resource use by regional development projects NEW Understand the reasonable buffer required in water licenses to account for seasonal variation of water requirements for irrigation NEW Partner to improve estimate of crop water requirements and opportunities for water efficiency	Development projects reviewed from sustainability perspective	Ongoing	Medium

Section 6 Recommendations for future plan updates

The NT water allocation plan documents overview) sets out the basis for three core documents – a Water Allocation Plan, a Background Report and an Implementation Actions (Figure 6-1). This section presents a discussion of each of the core documents and recommendations for further development.

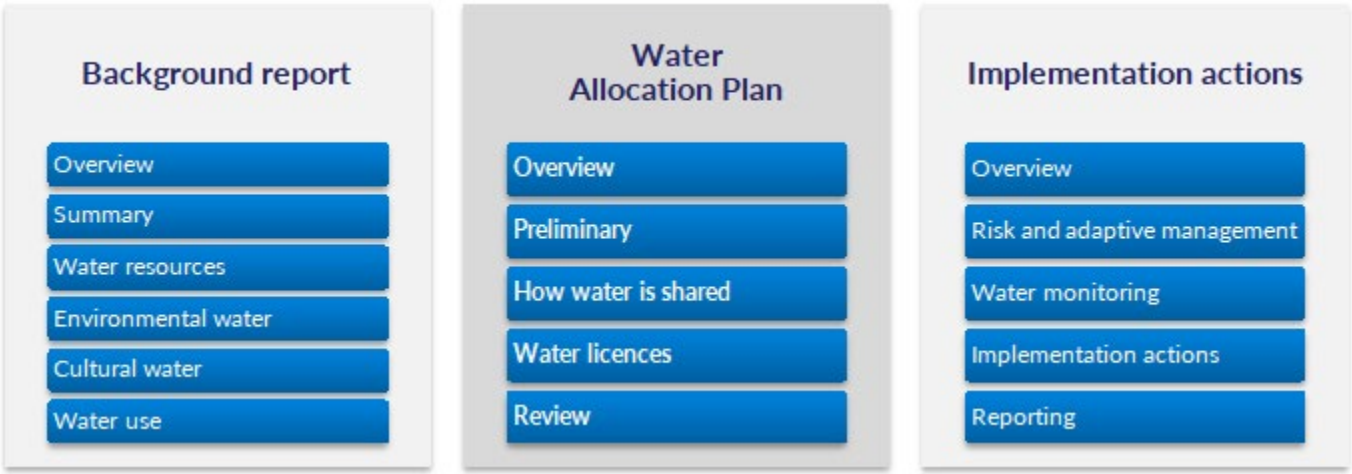

Figure 6-1 Key components of the core documents that underpin a plan

6.1 Water Allocation Plan

The plan provides a clear approach and rules to the allocation of resources within Berry Springs.

The plan will be simplified from its current form to set out the operational rules for allocation and adaptive restrictions during annual announced allocations. The plan will address options for trading, and address rules that apply across any protection zones that are identified during the ecohydrological investigation.

6.2 Background Report

The Background Report supports the plan with detailed information including available data and the results of research on the water resources of the plan area. It describes the key environmental values and their water dependency.

The Background Report describes the social and development context of the region, including cultural values and significance.

A Background Report for the Berry Springs plan area will be further developed with the following components:

1. Assessment of the groundwater dependent ecosystem and establish environmental flow requirements and water levels.
2. Undertake a hydrogeological assessment of the aquifer including an analysis of hydrostratigraphy, pumping tests, water chemistry.
3. Update and recalibrate the groundwater model:
   a. update the water balance for the aquifer
   b. test the ecosystem requirements using a range of scenarios to identify an appropriate ESY
   c. identify groundwater flow zones based upon travel times to the springs as potential protection zones
   d. undertake climate change predictions for low, median and high rainfall scenarios.
4. Assessment of future water demand. This would include horticultural expansion, water saving options from irrigation efficiencies, ecotourism development and property subdivisions that might lead to S&D extraction.

6.3 Implementation Actions

The Implementation Actions defines a continuous program for the monitoring of the water resource throughout the term of the plan, and specifically the performance of the plan in achieving its objectives.

The Implementation Actions should include:

- revision and alignment of plan objectives, actions and performance indicators, so that it is clear what is being achieved and how they will be assessed. The Georgina Wiso Implementation Actions is a good example. Monitoring programs based upon findings of the ecohydrological assessment including groundwater monitoring, spring flow monitoring, mapped extent of GDE and protection zones.

Section 7 References

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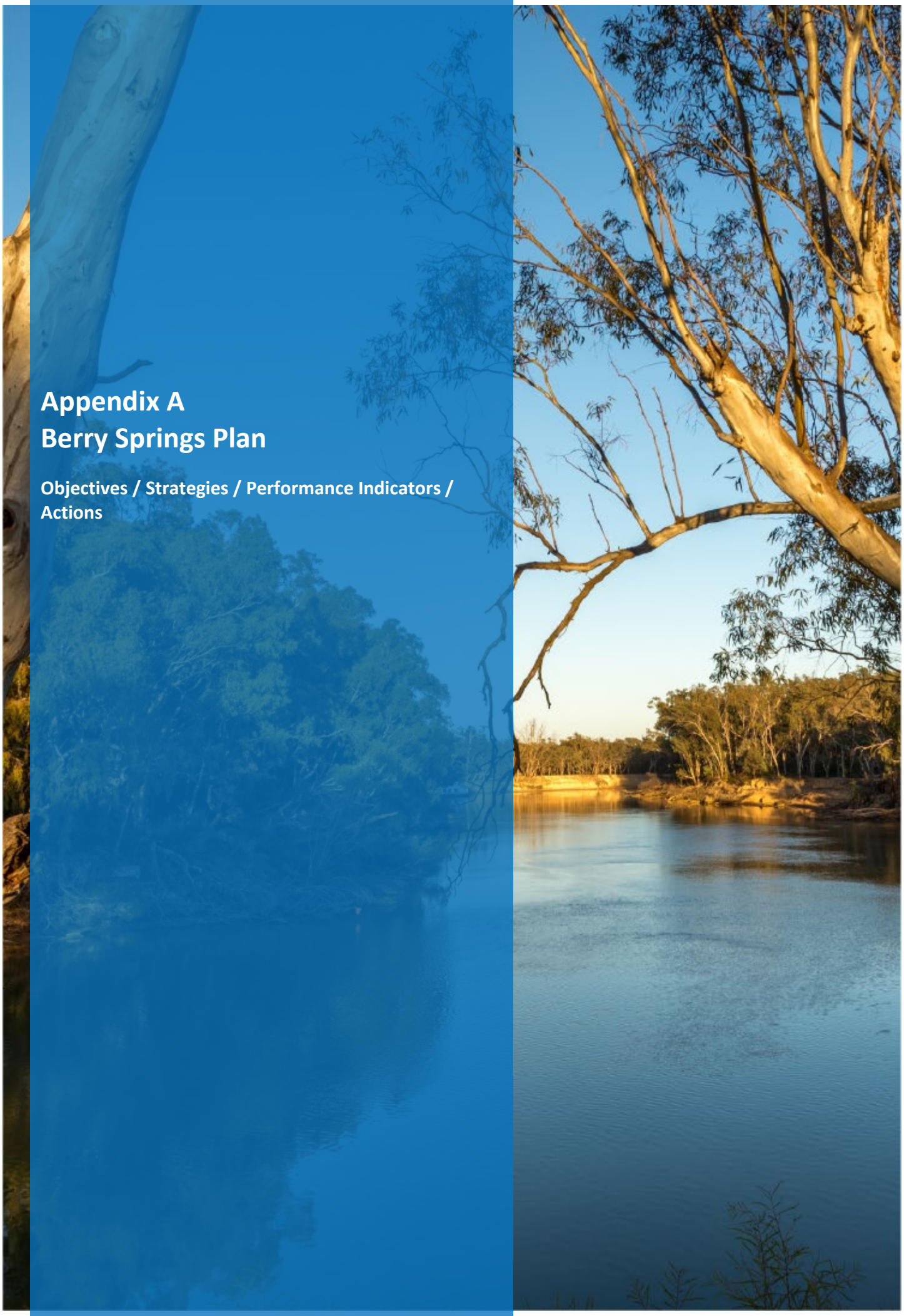


Appendix A
Berry Springs Plan

Objectives / Strategies / Performance Indicators / Actions

A.1 Berry Springs plan objectives, strategies and performance indicators (from Berry Springs Water Allocation Plan 2016-2026)

Objectives of the plan	Strategies to achieve this include:	Performance Indicators (Clause 16.1)
1. To maintain groundwater levels and water quality sufficient to meet the minimum requirements of current consumptive and environmental users.	▪ Groundwater quality and water levels across the aquifer will be monitored for long and short term changes. ▪ Conduct comprehensive water quality sampling across the aquifer to establish current water quality parameters for the aquifer. ▪ Maintain groundwater quality levels in the aquifer for the relevant targets set out in the Water Quality Protection Plan (WQPP) for Darwin Harbour and in the existing beneficial use declaration made in relation to the Blackmore Rivers Region Groundwater. ▪ Compliance monitoring of conditions on current water extraction licences and bore construction permits. ▪ Bore construction permits will be limited to replacement bores only. ▪ Legal action may be used to effect compliance of licence and permit conditions at the discretion of the Department. ▪ Bore construction permits will not be issued for construction of new bores within 100 m of septic tanks or other potential sources of pollution. ▪ Conditions on any public water supply licences will require water quality standards to be met. ▪ Any reports of bore field interference or contamination of the aquifer will be investigated. ▪ Backflow devices will be recommended for licensed production bores as a means of minimising risk of pollution to aquifers. ▪ Backflow devices will be recommended for bores used to supply domestic drinking water. ▪ Establish buffers where necessary to protect sinkholes and direct recharge areas.	▪ Change in groundwater levels beyond normal seasonal variability (A1, A2). ▪ Changes in water quality in the aquifer (A1, A3, A4). ▪ Whether the groundwater parameters set in the WQPP for Darwin Harbour to maintain Electrical Conductivity (EC) between 350-400 µS/cm have been exceeded in nominated monitoring bores (A4). ▪ Whether any such exceedance has been used as an interim trigger for further water quality investigations to establish revised trigger parameters if appropriate (A4). ▪ Whether water quality sampling and trend data are made publicly and annually available (C9). ▪ Whether the potential for saline intrusion into the aquifer has been investigated within two years of the plan being declared (A7). ▪ Incidence of disruption to water supply for residents or commercial users within the plan area (C11). ▪ Incidence of pollution events reported to the Department (C10). ▪ Number of backflow devices on commercial and residential bores within the plan area (C5). ▪ Educate landholders about sinkholes/connectivity to the aquifer (C4).
2. Improve management of the aquifer	▪ Remove 15 L/sec exemption and licence all commercial users. ▪ Ensure equal levels of security of tenure for all water users. ▪ Develop a schedule of water restrictions linked to groundwater triggers to address the risk from over extraction after two sequential dry 'wet seasons'. ▪ Ensure that restrictions on supply to protect the aquifer against over extraction in the context of two sequential dry wet seasons apply equally to residential and commercial users. ▪ Improve data for licensed and unlicensed water extraction from the aquifer. ▪ Education of broader community about water allocation planning which conveys that planning is about managing the aquifer and improving water efficiency, and is not a precursor to charging for water. ▪ Develop educational resources specific to the aquifer (including sinkholes).	▪ Level of compliance with installation of appropriate backflow prevention and metering devices on licensed bores (C6). ▪ Number of spot compliance inspections for licensed users (C6). ▪ Level of uptake of voluntary metering of residential users to provide better data on average unlicensed domestic use (C3). ▪ Uptake of recommended pump size designed to encourage residential water efficiency and result in an average residential use of 3.5 ML/yr (C4). ▪ Number of updates made to the plan website per annum (C16). ▪ Amount of water planning and other educational resources available to the public from the plan website or from the Department (C4). ▪ Whether regular reporting has been made publicly available of the licensing, and resource monitoring data collected (C9).

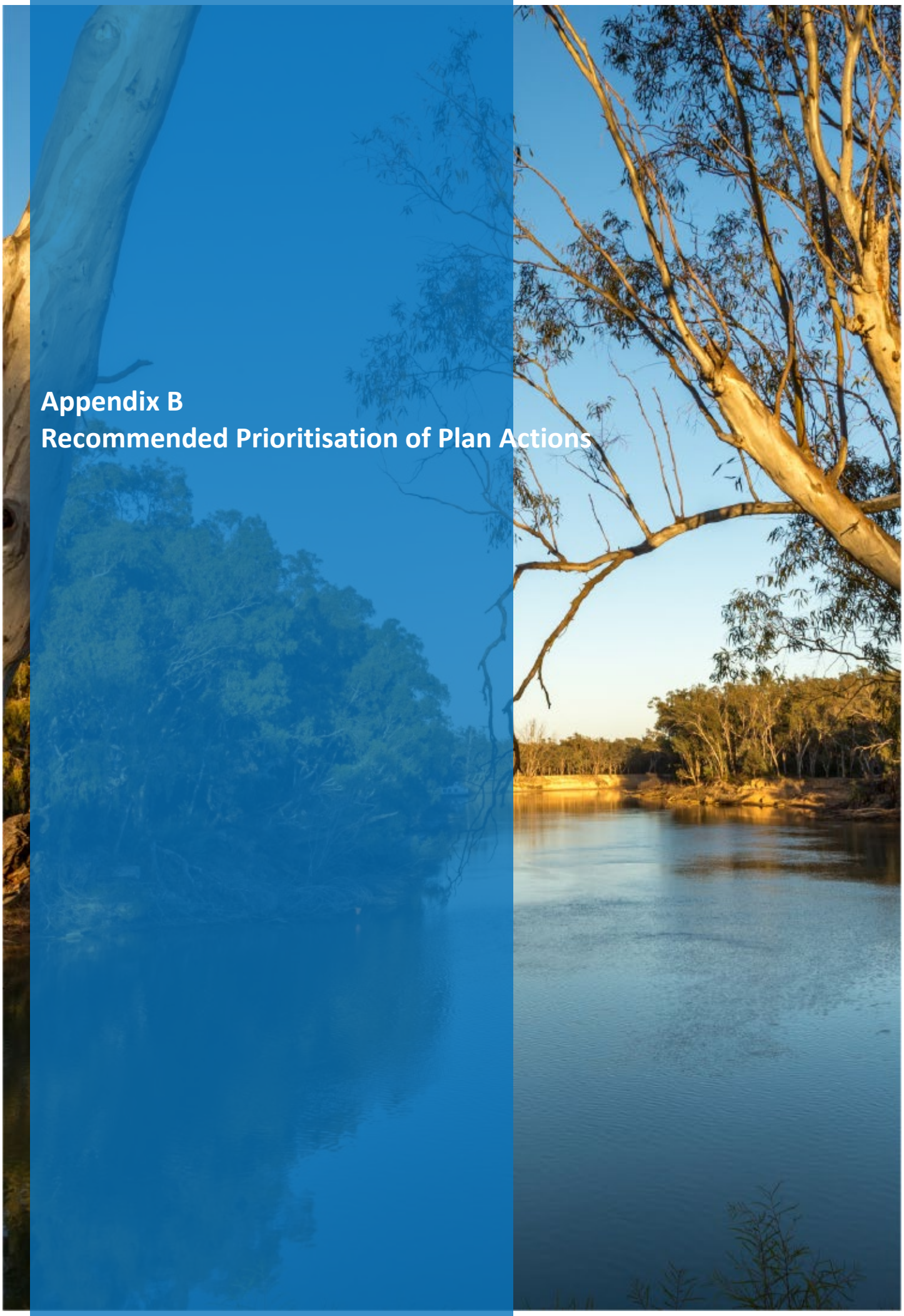
Objectives of the plan	Strategies to achieve this include:	Performance Indicators (Clause 16.1)
3. Protect the environment. To maintain and protect good water quality and flows in water dependent environmental sites and to maintain natural variability in flows.	▪ Preserve 80% of surface water flows for the environment and non- consumptive cultural needs. ▪ Undertake the necessary science to establish minimum environmental flow thresholds at Marsh Fly Weir. ▪ In order to prevent any further impacts on the springs, a buffer zone of 500 m from Berry, Parson and Twin Farm springs for standard septic systems will be put in place. ▪ Seek funding opportunities and otherwise commission research to address knowledge gaps about groundwater dependant ecosystems and minimum flow thresholds in Berry Springs. ▪ Establish environmental flow requirements for key environmental and cultural sites. ▪ Survey identified sinkholes within the plan area and classify their recharge potential. ▪ Link with Biodiversity Committee from Territory Wildlife Park to promote the importance of biodiversity conservation and ecosystem function services to the community.	▪ Reported incidence of environmental degradation that can be attributed to water extraction (B4, B5, and B6). ▪ Collection of baseline information and ongoing condition monitoring of key environmental sites (B5). ▪ Incidence and duration of cease to flow events in Berry Creek and Darwin River (B5). ▪ Whether the water quality parameters for aquifer fed springs set in the WQPP for DH which assume EC between 320-390 µS/cm are exceeded (B5). ▪ Whether hydrogeological investigation and confirmation of suspected preferential recharge zones has occurred (A10). ▪ Whether web and public access for (telemetered) environmental flow conditions has been established (C9). ▪ Whether regular reporting been made publicly available of the environmental data collected (C9).
4. Support Aboriginal culture & communities. Maintain and support traditional cultural values on Aboriginal owned land through the protection of culturally significant water dependent sites, as well as providing access to water for commercial development.	▪ Ensure Kungarakan and Larrakia ranger groups are closely involved with regular monitoring work on the health of the springs and other water dependent ecosystems. ▪ Work with Kungarakan and Larrakia Traditional Owners to better document local cultural values and develop educational materials based on those values for public distribution.	▪ Reported incidence of environmental degradation of culturally significant water dependent sites that can be attributed to water extraction (B5). ▪ Whether commercial development projects on Aboriginal owned land have been impeded by lack of access to water resources (C15). ▪ Number of monitoring visits to nominated water sites per year by Traditional Owner ranger groups (B8). ▪ Annual reports on monitoring activities and data outcomes from these ranger groups (B8).
5. Ensure regional economic development is sustainable. Ensure that development of water consumptive industries will be conducted within an equitable and sustainable framework that considers the impacts of cumulative water use from the Berry Springs Dolostone aquifer in the context of land use planning approvals.	▪ Future development including residential subdivisions to be compliant with the plan. ▪ Strategies to ensure collaboration between relevant government agencies and other stakeholders. ▪ Incentives and education to encourage greater water efficiency. ▪ Water trading will be permitted provided that purchasers have a clear development plan for use of that water and that all residential blocks dependent on bore water have a non- tradeable access to 3.5 ML/yr.	▪ Number of development applications commented on by water management in relation to land use developments within plan area (C14). ▪ Availability of incentives to Darwin Rural residents to reduce water consumption in their homes and to obtain alternative water supplies such as rainwater tanks (C4). ▪ Whether sustainable regional development projects have been impeded by lack of access to water resources (C14). ▪ Number of water trades publicly reported (C8).

A.2 Berry Springs plan actions (from Berry Springs Water Allocation Plan 2016-2026)

Action		Target
A: Monitoring resource condition performance indicators		
1	Monitor regional rainfall, stream flow, groundwater levels and groundwater quality. Because of rapid fluctuation, groundwater levels should be monitored at the same time annually (in May and October), and within a period of 3 days. It would be desirable to install loggers in selected monitoring bores.	Ongoing Monitoring of SWLS at least twice annually
2	In the event that more than 50% of the monitoring bores standing water levels at the end of the wet season fail to recover to within a level to be determined of the previous year for at least two consecutive years, a management strategy will be developed for the plan area which reduces commercial and residential water use until there is an acceptable recovery in seasonal standing water levels.	As required
3	Conduct a comprehensive water quality sampling program across the aquifer (which encompasses nutrient and farm chemical analysis) to identify baseline water quality values for the aquifer and publish a report on the findings.	As soon as possible
4	In the event of indications of declining water quality within the plan area, the Department of Land Resource Management, now the Department of Environment and Water Resources (DEPWS), will identify any potential causes, consider if reductions in allocations are required and implement the appropriate course of action.	As required
5	Reinstate telemetered monitoring gauge at Darwin River @ Old Army Road Crossing G8150153.	As soon as possible
6	Improve data and knowledge of discharge from the aquifer through the springs and baseflow to surface water courses and publish an updated hydrogeological assessment report.	Prior to 5 year review
7	Investigate, quantify and document risk of salt water intrusion of the aquifer (using monitoring bores RN29384 and 29383) and develop recommendations for mitigation management strategies.	Within 2 years
8	Review the hydrogeological model prepared for the aquifer incorporating any new data and publish an updated report on the model.	Prior to 5 year review
9	Survey all identified sinkholes within the plan area and determine classification of their recharge potential.	Within 2 years
10	Improve data and knowledge of any preferential recharge zones within the plan area.	Prior to 5 year review
11	Annually analyse any trends in resource condition monitoring data and internally report to DEPWS water management.	Annual
12	Reassess sustainable yield for the plan area, in particular, focussing on recharge, water quality and water level changes.	Every 5 years
13	Review regional monitoring programs for monitoring trends in groundwater levels and water quality and recommend improvements to assist in determining sustainable yield.	Every 5 years

Action		Target
B: Monitoring environmental and cultural value indicators		
1	Monitor flow rates at identified springs at regular intervals throughout the dry season.	At least 4 x per dry season
2	Identify all springs within plan area and confirm through hydrogeochemistry their connection to the aquifer.	Prior to 5 year review
3	Identify through hydrogeochemistry the proportional contribution of baseflow to dry season flows in the major water courses in the plan area from the aquifer.	Within 2 years
4	Determine environmental flow requirements for the springs, discharge dependent lagoons and the water courses.	Prior to 5 year review
5	Develop and implement programs to monitor health of key water dependent ecosystems and cultural places that are vulnerable to change due to water extraction.	Within 2 years
6	Develop minimum flow rates for Berry Springs which if exceeded may trigger a management strategy being developed for the plan area which reduces water allocations for commercial and residential water use until there is an acceptable recovery in those flow rates.	Within 2 years
7	In the event that Berry Springs cease to flow in two consecutive years, the Department will consider if reductions in allocations to commercial and residential water users are necessary and implement an appropriate course of action.	As required
8	Identify funding opportunities for Kungarakan and Larrakia ranger groups to continue to monitor key water dependent sites within the plan area.	As soon as possible
9	Prepare annual reports on Aboriginal ranger monitoring activities and findings at key water dependent sites within plan area.	Annual
10	Better document and disseminate the cultural water requirements for surface and groundwater resources in plan area.	Before the 5 year review
11	Work with the Territory Wildlife Park Biodiversity Committee to promote the environmental values of the plan area.	Ongoing
C: Monitoring plan performance indicators		
1	Licence all commercial water users within the plan area within 2 years of the declaration of the plan.	Within 2 years
2	Improve data on all residential water use within the plan area; undertake a water use survey of all residents.	Ongoing and as soon as possible
3	Encourage residential participation in the voluntary bore metering project to improve estimates of unlicensed residential water use within the plan area.	Ongoing
4	Introduce incentives and educational material which encourages residential water users to use an average of 3.5 ML/yr and provides additional information about water planning and the aquifer.	Before the 5 year review
5	Develop educational material which illustrates the benefits of backflow devices being installed on bores used to supply drinking water.	Before the 5 year review

Action		Target
6	Conduct regular compliance inspections for mandatory conditions for the construction of bores, metering, extraction, use of groundwater and use of surface water and all other licence conditions.	Annual Minimum of 20% of licensees subject to annual inspection
7	Report annually and publicly on level of bore permit and licence condition compliance, and on amount of licensed water extraction.	Annual
8	Publicly report on any trades of water licences within the plan area.	Annual
9	Make all monitoring data publicly available on the DEPWS website.	Ongoing
10	Investigate any reported pollution events or reported degradation to water dependent ecosystems resulting from groundwater extraction within the plan area and publish an annual report in the event of any such investigation occurring.	As required
11	Investigate any reported disruption to water supply from the aquifer which is likely to be caused by over extraction.	As required
12	Review all licensed entitlements on the basis of estimated sustainable yield in the plan area.	Every 5 years
13	Publish an evaluation report of the plan.	Every 5 years
14	Review and advise on the sustainability of proposed water resource use by regional development projects.	Ongoing
15	Investigate any reports of commercial developments on Aboriginal land being impeded by lack of access to water resources.	As required
16	Regularly update the relevant plan website and publish any new and relevant reports on that website.	Ongoing



Appendix B
Recommended Prioritisation of Plan Actions

Action ID	Action description	Target	Action description	Priority	Timeframe
A1	Monitor regional rainfall, stream flow, groundwater levels and groundwater quality. Because of rapid fluctuation, groundwater levels should be monitored at the same time annually (in May and October), and within a period of 3 days. It would be desirable to install loggers in selected monitoring bores.	Ongoing. Monitoring of SWLS at least twice annually	Regularly monitor regional rainfall, stream flow, groundwater levels and groundwater/surface water quality	High	Biannually
A3	Conduct a comprehensive water quality sampling program across the aquifer (which encompasses nutrient and farm chemical analysis) to identify baseline water quality values for the aquifer and publish a report on the findings.	As soon as possible	Conduct a comprehensive water quality sampling program across the aquifer (including nutrients and farm chemicals).	High	Pre-2026
A6	Improve data and knowledge of discharge from the aquifer through the springs and baseflow to surface water courses and publish an updated hydrogeological assessment report.	Prior to 5 year review	Undertake a hydrogeological assessment program to improve ecohydrogeological conceptual model of the area.	High	Pre-2026
C4	Introduce incentives and educational material which encourages residential water users to use an average of 3.5 ML/yr and provides additional information about water planning and the aquifer.	Before the 5 year review	Produce educational material about water planning and the aquifer and introduce incentives to encourage efficient water use.	High	Pre-2026
C1	Licence all commercial water users within the Plan Area within 2 years of the declaration of the plan.	Within 2 years	Licence all commercial water use.	High	Pre-2026
C13	Publish an evaluation report of the plan.	Every 5 years	Undertake a WAP review.	High	Pre-2026
B4	Determine environmental flow requirements for the springs , discharge dependent lagoons and the water courses.	Prior to 5 year review	Improve knowledge of spring and baseflow ecohydrological requirements.	High	Pre-2026
B1	Monitor flow rates at identified springs at regular intervals throughout the dry season.	At least x4 per dry season	Monitor condition (flow rates and chemistry) at identified springs during the dry season.	High	Annually
B6	Develop minimum flow rates for Berry Springs which if exceeded may trigger a management strategy being developed for the plan area which reduces water allocations for commercial and residential water use until there is an acceptable recovery in those flow rates.	Within 2 years	Develop triggers and thresholds for Berry Springs to protect ecosystem value & function.	High	Pre-2026

Action ID	Action description	Target	Action description	Priority	Timeframe
B10	Better documentation and dissemination the cultural water requirements for surface and groundwater resources in plan area.	Before the 5 year review	Document and disseminate the cultural water requirements for surface and groundwater resources in the plan area.	High	Pre-2026
B5	Develop and implement programs to monitor health of key water dependent ecosystems and cultural places that are vulnerable to change due to water extraction.	Within 2 years	Develop and implement programs to monitor health of key water dependent ecosystems and cultural places that are vulnerable to change due to water extraction.	High	Pre-2026
C14	Review and advise on the sustainability of proposed water resource use by regional development projects.	Ongoing	Review and advise on the sustainability of proposed water resource use by regional development projects.	High	Ongoing
Low priority actions (actions are dependent on outcomes of high priority actions or are reactionary)					
A2	In the event that more than 50% of the monitoring bores standing water levels at the end of the wet season fail to recover to within a level to be determined of the previous year for at least two consecutive years, a management strategy will be developed for the plan area which reduces commercial and residential water use until there is an acceptable recovery in seasonal standing water levels.	As required	TBC	Low - reactionary action	
A4	In the event of indications of declining water quality within the plan area, the DEPWS will identify any potential causes, consider if reductions in allocations are required and implement the appropriate course of action.	As required	TBC	Low - reactionary action	
B7	In the event that Berry Springs cease to flow in two consecutive years, the Department will consider if reductions in allocations to commercial and residential water users are necessary and implement an appropriate course of action.	As required	TBC	Low - reactionary action	
C15	Investigate any reports of commercial developments on Aboriginal land being impeded by .lack of access to water resources	As required	TBC	Low - reactionary action	

Action ID	Action description	Target	Action description	Priority	Timeframe
C10	Investigate any reported pollution events or reported degradation to water dependent ecosystems resulting from groundwater extraction within the plan area and publish an annual report in the event of any such investigation occurring.	As required	TBC	Low - reactionary action	
C11	Investigate any reported disruption to water supply from the aquifer which is likely to be caused by over-extraction.	As required	TBC	Low - reactionary action	
B2	Identify all springs within plan area and confirm through hydrogeochemistry their connection to the aquifer.	Prior to 5 year review	TBC	Low - achieved via other action: B4	
A9	Survey all identified sinkholes within the plan area and determine classification of their recharge potential.	Within 2 years	TBC	Low - achieved via other action: A6	
A10	Improve data and knowledge of any preferential recharge zones within the plan area.	Prior to 5 year review	TBC	Low - achieved via other action: A6	
A11	Annually analyse any trends in resource condition monitoring data and internally report to DEPWS water management.	Annual	TBC	Low - achieved via other action: A1	
C16	Regularly update the relevant plan website and publish any new and relevant reports on that website.	Ongoing	TBC	Low - achieved via other action: C4	
C2	Improve data on all residential water use within the plan area; undertake a water use survey of all residents.	Ongoing and as soon as possible	TBC	Low - achieved via other action: C4	
C3	Encourage residential participation in the voluntary bore metering project to improve estimates of unlicensed residential water use within the plan area.	Ongoing	TBC	Low - achieved via other action: C4	
C5	Develop educational material which illustrates the benefits of backflow devices being installed on bores used to supply drinking water.	Before the 5 year review	TBC	Low - achieved via other action: C4	
C7	Report annually and publicly on level of bore permit and licence condition compliance, and on amount of licensed water extraction.	Annual	TBC	Low - achieved via other action: C4	
C8	Publicly report on any trades of water licences within the plan area.	Annual	TBC	Low - achieved via other action: C4	

Action ID	Action description	Target	Action description	Priority	Timeframe
C9	Make all monitoring data publicly available on the DEPWS website.	Ongoing	TBC	Low - achieved via other action: C4	
B11	Work with the Territory Wildlife Park Biodiversity Committee to promote the environmental values of the plan area.	Ongoing	TBC	Low - achieved via other action: B10	
B3	Identify through hydrogeochemistry the proportional contribution of baseflow to dry season flows in the major water courses in the plan area from the aquifer.	Within 2 years	TBC	Low - achieved via other action: B4	
A7	Investigate, quantify and document risk of salt water intrusion of the aquifer (using monitoring bores RN29384 and 29383) and develop recommendations for mitigation management strategies.	Within 2 years	TBC	Low - achieved via other action: A3	
A13	Review regional monitoring programs for monitoring trends in groundwater levels and water quality and recommend improvements to assist in determining sustainable yield.	Every 5 years	TBC	Low - achieved via other action: A1	
A5	Reinstate telemetered monitoring gauge at Darwin River @ Old Army Road Crossing G8150153.	As soon as possible	TBC	Low - achieved via other action: A1	
C6	Conduct regular compliance inspections for mandatory conditions for the construction of bores, metering, extraction, use of groundwater and use of surface water and all other licence conditions.	Annual. Minimum of 20% of licensees subject to annual inspection	TBC	Low - achieved via other action: C1	
A8	Review the hydrogeological model prepared for the aquifer incorporating any new data and publish an updated report on the model.	Prior to 5 year review	TBC	Key focus of post 2026 & dependent on other actions occurring first	
A12	Reassess sustainable yield for the plan area, in particular, focussing on recharge, water quality and water level changes.	Post 2026	TBC	Key focus of post 2026 & dependent on other actions occurring first	

Action ID	Action description	Target	Action description	Priority	Timeframe
C12	Review all licensed entitlements on the basis of estimated sustainable yield in the plan area.	Every 5 years	TBC	Key focus of post 2026 & dependent on other actions occurring first	
B8	Identify funding opportunities for Kungarakan and Larrakia ranger groups to continue to monitor key water dependent sites within the plan area.	As soon as possible	TBC	Key focus of post 2026 & dependent on other actions occurring first	
B9	Prepare annual reports on Aboriginal ranger monitoring activities and findings at key water dependent sites within plan area.	Annual	TBC	Key focus of post 2026 & dependent on other actions occurring first	
B10	Better document and disseminate the cultural water requirements for surface and groundwater resources in plan area.	Before the 5 year review	TBC	Key focus of post 2026 & dependent on other actions occurring first	
B5	Develop and implement programs to monitor health of key water dependent ecosystems and cultural places that are vulnerable to change due to water extraction.	Within 2 years	TBC	Key focus of post 2026 & dependent on other actions occurring first	