

Memorandum

To: Director Water Licensing and Regulation TRM No: <TRM number>
Through: N/A Date: 20 November 2020
From: Director Water Planning and Engagement
Re: GWEL application KG08988 - NT Land Corp at Larrimah

Background

In December 2019 the Northern Territory Land Corporation (NTLC) applied for a groundwater extraction licence (GWEL) for 12,500 megalitres (ML) to take water from the Mataranka Tindall Limestone Aquifer from NT Portions 04478 and 04663 near the town of Larrimah.

Water Assessment Branch has prepared the *Tindall Limestone Aquifer (Mataranka): NT Land Corporation Larrimah Water Resources Division Technical Report 45/2020*. This report uses modelling to quantify the impact of taking 12,500 ML of water on neighbouring users, the aquifer and groundwater discharges to the Roper River.

Water Planning and Engagement Branch is drafting the Mataranka Tindall Limestone Aquifer Water Allocation Plan, which includes the aquifer this application proposes to take water. The draft WAP is at a stage where environmental and cultural values have been mostly identified; however their water requirements have not been quantified. Three draft groundwater management zones (Map 1) have been agreed based on the hydrogeological characteristics for the aquifer in consultation with Water Assessment Branch. The application is within the Larrimah draft groundwater management zone. The Water Assessment Branch has drafted a report on the natural water balance for the aquifer and its three groundwater management zones.

The natural water balance for the Roper River has not been determined and modelling of groundwater extraction scenarios to help determine the estimated sustainable yield for the Mataranka Tindall Limestone Aquifer have not commenced.

Where a water allocation plan has not been declared water availability for consumptive use is guided by the Northern Territory Water Allocation Planning Framework (NTG 2000). The framework requires that water requirements for key environmental and cultural values are met before allocating water to consumptive beneficial use.

Considerations

This advice considers four elements;

- environmental and cultural water requirements
- estimated sustainable yield
- impact on existing users
- dealing with uncertainty

These considerations are presented in the context of section 90 of the Water Act addressing specifically the following parts of section 90;

- (a) The availability of water in the area in question
- (ab) any water allocation plan applying to the area in question
- (k) other factors the Controller considers should be taken into account or that the Controller is required to take into account under any other law in force in the Territory.

There is a lot of uncertainty associated with the Mataranka Tindall Limestone Aquifer and the non-consumptive (environmental and cultural) water requirements. This leads to uncertainty about the size of the consumptive pool to make allocations to beneficial uses. This memo attempts to identify the uncertainties and provide advice on the options for making a water allocation with conditions.

WPE assessment of relevant Section 90 factors

The following factors under section 90 of the Water Act relate to matters that might be considered in a water allocation plan.

(a) the availability of water in the area in question;

The extraction site is within the part of the Top End climate zone which is considered marginal where aquifers may behave more like an Arid Zone aquifer, i.e. recharge changes from being regular to episodic. At Larrimah this change can be attributed to increased depth to groundwater, a covering of less transmissive cretaceous sediments and lower, less reliable rainfall. Significant recharge (more than 100GL in the Larrimah Groundwater management zone) only occurs in years where rainfall is greater than 1100mm for the wet season. All five significant recharge events have occurred since 1974. See figure 28 and 29 in Yin Foo, D. A. and Dilshad, M. (2018). Figure 3-2 in Technical report 45/2020 (Water Assessment 2020) shows groundwater storage levels have been increased since 1992 in bores RN29012, RN029013 and RN035796 but not in bores closer to the Roper River (RN028082 and RN034230). The area of the Tindal Limestone aquifer close to the river is characterised as a "fill and spill" aquifer with no capacity to store large quantities of recharge as shown by the lack of increase in groundwater levels in RN028082 and RN034230. Indicating the aquifer may rely on maintaining through flow from the southern part of the aquifer closer to Larrimah.

The behaviour of the Mataranka Tindall Limestone aquifer transitions from behaving more like an Arid Zone aquifer south of Larrimah to behaving like a Top End aquifer where the aquifer discharges to the Roper River in the north. In the south the aquifer has storage capacity and in the north the aquifer exhibits a "fill and spill" behaviour.

The NT Water Allocation Planning Framework, contingent allocation for the Arid Zone, says there will be no deleterious change in groundwater discharges to dependent ecosystems, and total extraction over a period of at least 100 years will not exceed 80 per cent of the total aquifer storage at start of extraction. The Mataranka Tindall Limestone aquifer has significant environmental and cultural values associated with it based on groundwater discharge to springs (Rainbow and Bitter Springs), the Roper River, Little Roper River, Waterhouse River and Elsey Creek, large areas of shallow groundwater that support groundwater dependent terrestrial ecosystems and aquifer conditions suitable to support stygofauna communities. Groundwater base flows down the Roper River support extensive areas of riparian rainforest and melaleuca forest and woodland.

Wetlands

The Directory of Important Wetlands of Australia lists the Mataranka thermal pools as nationally recognised wetland values associated with discharge from the Mataranka Tindall Limestone Aquifer along the Roper River (Environment Australia 2001, p. 51). The Mataranka Thermal Pools are also considered a site of conservation significance of national significance (Harrison et.al. 2009) “where groundwater discharges support a lush oasis in the transition zone between the tropical and drier savannah regions of northern Australia”. These discharges are also feed key national tourism sites at Bitter Springs and Rainbow Springs. Many of these values are associated with Elsey National Park however some of these values occur on private land and the Mangarrayi Aboriginal Land Trust.

Groundwater dependent ecosystems

Table 11 in Technical Report 45/2020 shows changes in depth to groundwater as a result of current entitlements and authorised use and proposed take of 12.5GL by the NT Land Corp. Terrestrial GDEs are most likely to occur where depth to groundwater is less than 15 metres (Cook and Eamus 2018). Sites 3, 6, 7, 8, 10, 11, 12 and 13 range in depth from 8.57 to 14.7 metres below ground level. The maximum change in depth to groundwater as a result of taking groundwater as proposed at shallow groundwater sites will reduce groundwater levels between 0.37m at site 10 to 1.38m at site 8 during the 59 years of modelling.

The full extent of GDEs hasn't been determined. Short 2020 gives an indication of the extent of GDEs however this information has not been validated by field data. These GDEs are known to rely on shallow groundwater. Further work is required to better understand the water requirements of terrestrial GDEs that rely on access to water at greater depths.

Stygofauna

The GISERA and CSIRO (2020) characterisation of stygofauna project reports indicate several species of stygofauna have been collected from bores in the Larrimah and Mataranka area. Some genera and most species are new to science and awaiting proper taxonomic identification, which is expected to find most are endemic to the Tindall Limestone Aquifer Jenny Davies (pers. comm. 2020). Their significance is yet to be determined but the sampling program shows most species to be wide-spread through the aquifer. Little is known about the threats to stygofauna, however their occurrence is controlled by oxygen levels in groundwater, concentration of key nutrients (C, N and P), water salinity and the pore size within the aquifer. The size of stygofauna found in the Tindall aquifer range from more than 20mm long to less than 2mm. It is possible that larger species survive in the weathered top of the aquifer which would make them susceptible to lowered groundwater levels. Taking water under this proposal is probably a low risk to the survival of stygofauna in the Tindal Limestone aquifer.

Roper River

Taking water from the Mataranka Tindall Limestone aquifer potentially impacts on environmental and cultural values associated with the Roper River, which is dependent on discharge from the Mataranka Tindall Limestone aquifer to maintain dry season base flow to the Roper Bar where the river is tidally influenced. This base flow in the Roper River is considered to be part of the Mataranka Tindall Limestone aquifer water resource and water extraction from both the aquifer and the river needs to be considered in managing the base flow to maintain environmental and cultural values associated with the Roper River.

The Australian Ilmenite Mine is authorised to take 1.69GL of water from the Roper River downstream of the extent of the Mataranka Tindall Limestone. This area is also subject to use for stock and domestic purposes, which has initially been estimated to be 1GL.

NT WAP Framework

The application of the NT WAP Framework to this part of the Mataranka Tindall Limestone aquifer needs to be cautious because although the south Mataranka area assessed in technical report 45/2020 identifies that the aquifer in this area behaves like an Arid Zone aquifer it is strongly connected to the rest of the aquifer that behaves like a Top End aquifer to the extent that the areas where groundwater is shallow and rainfall is higher the aquifer behaves like a fill and spill aquifer with very limited capacity to store water which emphasises the reliance on more southern portions of the aquifer to store water and maintain through flow to discharge in the Roper River.

Drawing down storage by 80% as proposed by the contingent allocations in the NT WAP Framework will not provide for the environmental and cultural water requirements supported by the aquifer. The lowering of the height of the upper surface of the aquifer after 100 years of extraction has the potential to reverse the hydraulic gradient removing through flow to areas near the southern side of the Roper River and cause water to flow in the opposite direction towards Larrimah.

There is not enough information to determine the size and rate of draw down that would still support the environmental and cultural water requirements. However the combined impact of all entitlements and SC8.3 does have the effect of reducing through flow at the northern boundary of the south Mataranka water resource by 41.5% after 50 years (table 4 in TR45/2020).

(ab) any water allocation plan applying to the area in question;

There is no water allocation plan declared for the area. The [Mataranka Water Advisory Committee](#) was established in 2017 to provide advice on the preparation of the water allocation plan. The site for the proposed take of water is in the area of the proposed [Mataranka Tindall Limestone Aquifer Water Allocation Plan](#).

Three proposed groundwater management zones (Map 1) have been identified based on the hydrogeological characteristics for the aquifer in consultation with Water Assessment Branch. The application is within the proposed Larrimah Management Zone.

The Mataranka Water Advisory Committee (WAC) has been considering elements of the Mataranka Tindall Limestone Water Allocation Plan. The key pieces of the advice from the WAC are there have been significant changes in climate since climate records began. There has been a significant change in rainfall, recharge and aquifer storage since 1900. The last 30 years have been significantly wetter than the 120 year medians. Recent dry years may be an indication that the climate is becoming drier and there may be less water available. Preliminary advice from the WAC is to base water allocation decisions on the longer and lower median values as the WAC feels there is considerable uncertainty about future climate especially with the experience of the last three less than average years. The WAC also supports the three proposed groundwater management zones as being suitable for the sustainable management of groundwater in the Mataranka Tindall Limestone Aquifer.

The principles for setting the estimated sustainable yield for the Mataranka Tindall Limestone aquifer or the management zones have not been discussed by the Water Advisory Committee. Initial discussions within DEPWS and with the committee have considered how the contingent allocations in the NTWAP Framework are applied to the Southern Mataranka Management Zone, Northern Mataranka Management Zone and Larrimah Management Zone and the need to manage base flows in the Roper River to Roper Bar. This provides the opportunity to balance the estimated sustainable yield in management zones to meet demand for consumptive and non-consumptive use in the River, which provides flexibility in deciding from which consumptive pool the water is allocated if there aren't already existing entitlements. This approach only works if the whole Mataranka Tindall Limestone aquifer is managed as a Top End aquifer. Further

modelling is required to determine the estimated sustainable yield for the Mataranka Tindall Limestone aquifer and how it is apportioned between the groundwater management zones in the plan.

See the response under (k) other factors later in the report for a description of the water required to provision the Aboriginal water reserve.

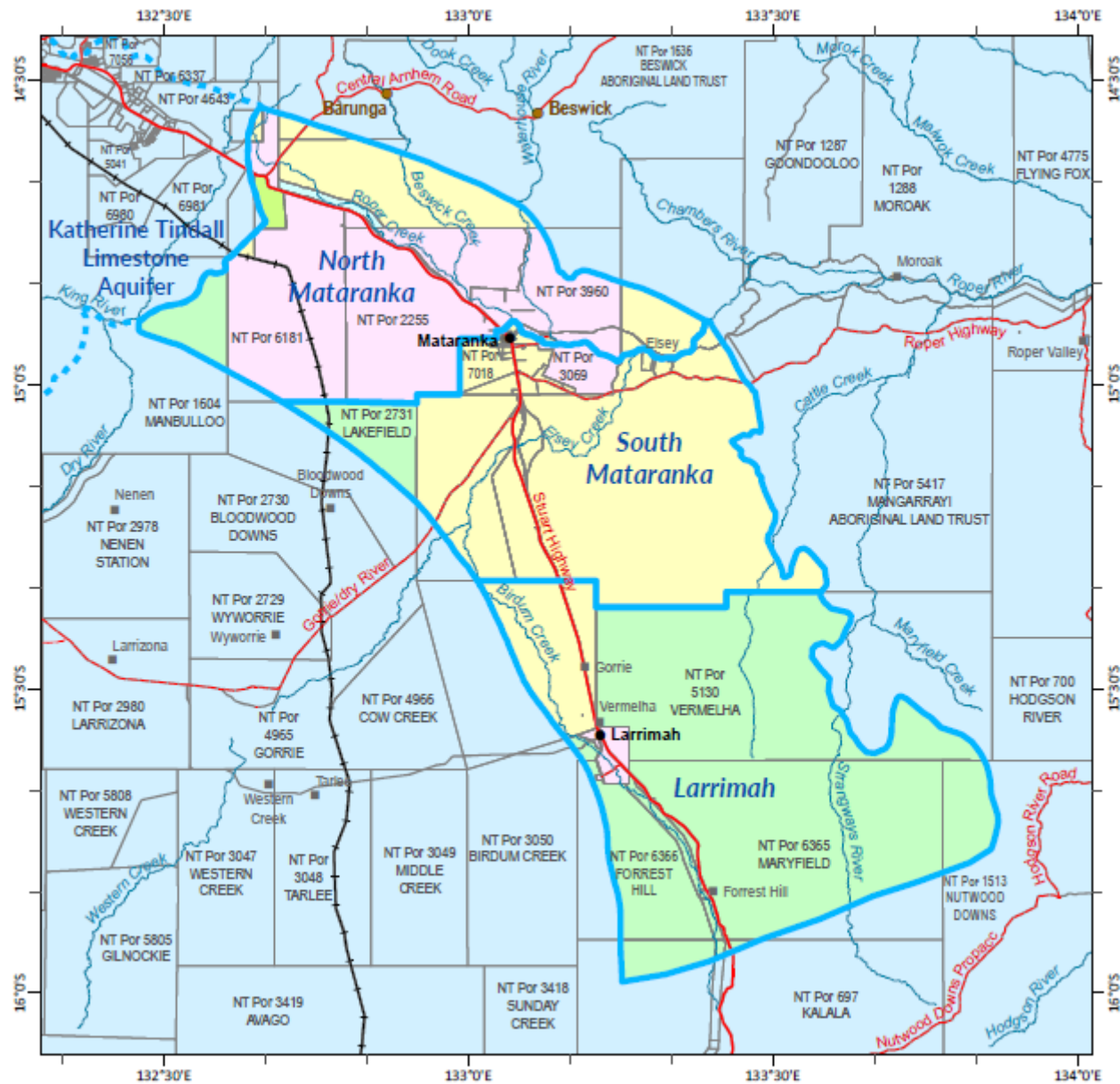


Figure 1 Proposed Mataranka Tindall Limestone Aquifer water allocation plan boundary and management zones

Environmental and cultural water requirements

The application is seeking to take groundwater therefore the assessment needs to take into account the water requirements of cultural and environmental values associated with groundwater. This association is through access to groundwater within the aquifer or access to the discharge from the aquifer. The draft Mataranka Water Allocation Plan will document the environmental and cultural values and determine their water requirements using best available science and the NT WAP Framework as a guide. The draft plan is expected to be available in mid-2021.

Aboriginal cultural water values

Rivers, soaks, swamps and springs in the Mataranka Tindall Water Allocation Plan area rely entirely on groundwater discharge during the dry season to sustain their function as wildlife habitat and as places regularly visited by Aboriginal people for traditional cultural purposes and for harvesting essential food resources. These are the cultural and environmental water values that must first be protected by a water allocation plan before water can be allocated for consumptive uses.

Aboriginal people of the Mataranka-Roper region have been actively involved in the development of the Mataranka Tindall Water Allocation Plan over the past three years. This engagement has led to:

- Improved knowledge of the groundwater resource, including new information about the location and behaviour of groundwater discharge points in the vicinity of Elsey Creek
- A better understanding of community concerns about the condition of spring and river flows during the current dry period (2 years) of below average rainfall
- A better understanding of the impact that dry conditions are having on sites of cultural significance, for example, senior Traditional Owners are troubled by sections of the Roper River where rocks usually submerged are now exposed, and where certain food plants which were once abundant along the lower Elsey Creek are now hard to find.
- A better understanding of the reliance of Aboriginal people on the ability to harvest food resources on country, including growing concerns that typical dry season fishing areas on the Roper River have dried up or been reduced to small hot pools of trapped fish, forcing Aboriginal people to travel further to hunt and fish or spend a greater portion of the family income on purchasing food from the supermarket.
- Aboriginal people expressing concerns about the intensive extraction of groundwater for agriculture near the Roper River and the contribution this is making to the dry condition of spring, rivers, swamps and surrounding landscapes.
- Suggestions by Aboriginal people about improvements in water use efficiency, particularly in the area of stock water delivery systems and minimising water losses to evaporation
- Aboriginal people expressing concerns about equity of access to groundwater resources for economic benefit, and the possibility that Aboriginal Water Reserves will not be provisioned because available water has already been licenced.

Concerns about the condition of significant water places and the surrounding landscape are being considered in the development of the Mataranka Tindall Water Allocation Plan. This is particularly important given the low rate of groundwater licence utilisation (approx. 40%) at present, and no experience of resource performance (flows, water quality and groundwater levels) under full utilisation of current entitlements, or the potential impact of full utilisation on cultural water values. The low rate of licence utilisation during the current dry conditions may be mitigating potential impacts on cultural water values across the Plan area. Ongoing dry conditions will likely lead to increased utilisation of existing licence entitlements, potentially exacerbating impacts on cultural water values currently being observed and experienced by Aboriginal people. This risk could be further enhanced by additional groundwater extraction in the Larrimah area, although given the slow travel time of groundwater from Larrimah to the Roper River, it may be more than 50 years before the full impact of additional take in this region is observed.

The water requirements for Aboriginal cultural values have not been determined. Many values are associated with environmental water values.

Estimated sustainable yield

Determining the estimated sustainable yield and the allocation to beneficial uses is a requirement of section 22B of the Water Act (1992) when the Minister declares a water allocation plan. The water

allocation plan for the Mataranka Tindall Limestone Aquifer hasn't been drafted yet. The water allocation plan and the assessment of the GWEL application should take into consideration the Northern Territory Water Allocation Planning Framework.

Aboriginal Water Reserve

Recent changes to the Water Act, section 22B(7) and 22C, now require that an allocation is made to the Aboriginal Water Reserve (AWR) if there is eligible land over or adjacent the water resource. Provisioning the Aboriginal Water Reserve should be taken into consideration when the Controller for Water Resources makes a decision to grant or amend water extraction licences even when a water allocation plan hasn't been declared.

In the South Mataranka management zone approximately 83% of land is eligible Aboriginal land. Under the Strategic Aboriginal Water Reserve Policy Framework eligible Aboriginal groups are entitled to a 30% allocation from the consumptive pool. The existing level of agricultural activity in the South Mataranka management zone makes it highly likely that the planning process will determine that current levels of groundwater extraction are at (and possibly in exceedance of) the estimated sustainable yield for this zone. As a fully allocated (and possibly over-allocated) management zone, water will not be available to provision the AWR at the time of Plan declaration in 2021.

Approximately 22% of the North Mataranka management zone is eligible Aboriginal land under the AWR. The current relatively low level of groundwater extraction in this zone means it is more likely that an AWR allocation can be provisioned by the Plan on declaration.

In the Larrimah management zone, just over 10% of the land area is eligible for an AWR allocation. The Wubalawun Aboriginal Land Trust is the only entity eligible for AWR in this zone. The estimated sustainable yield for this zone is yet to be determined and is awaiting scenario modelling and analysis. Granting of the Larrimah GWEL applications needs to consider an allocation to the AWR that can be provisioned in the Larrimah management zone.

If the Mataranka-south area considered in the TR45/2020 was assessed to determine the allocation to an Aboriginal Water Reserve all this additional land to Larrimah management zone is in the Mangarrayi Aboriginal Land Trust. About 33% of the Mataranka-south area is Aboriginal Land, which under the Strategic Aboriginal Water Reserve Policy Framework, eligible Aboriginal groups are entitled to a 30% allocation from the consumptive pool.

Water allocation plan

Declaring a water allocation plan will provide the evidence and logic for setting the non-consumptive and consumptive pools in the various management zones for the Mataranka Tindal Limestone Aquifer. It is expected that groundwater protection areas will be established to manage the impact of taking groundwater in environmentally and culturally significant areas.

A plan is required to establish an estimated sustainable yield and make allocations to consumptive beneficial uses within the estimated sustainable yield. It make an allocation to the environment and, if eligible land is present, an allocation to the Aboriginal Water Reserve.

A declared plan enables water entitlements to be traded in accordance with the guidelines set out in the water allocation plan.

The water allocation plan will also provide guidelines for managing the water such as flow thresholds to guide permit and licence decisions, and announced allocation decisions.

(k) Other factors the Controller considers should be taken into account or that the Controller is required to take into account under any other law in force in the Territory.

Announced allocations

Annual announced allocations is an important adaptive management tool for sustaining environmental and cultural water requirements during years when climate conditions put pressure on the water availability. Recharge in the Larrimah management zone is highly episodic, with effective recharge events occurring in only five of the last 120 years (Yin Foo & Dilshad, 2018, unpublished). While there may be a substantial lag in the influence of these recharge events on the South Mataranka management zone to the north, the two zones remain highly connected through lateral flows, which have been shown in the NT Land Corp licence assessment report to be susceptible to increased levels of extraction at Larrimah within the 59 year modelling period. The draft water allocation plan is likely to recommend that annual announced allocation conditions be applied to all licences (not including public water supply) within the Plan area.

Summary of advice from WPE

Maintaining nationally significant environmental and cultural values associated with the wetlands, groundwater dependent ecosystems and the Roper River are the primary focus of a water allocation made under the guidance of the Northern Territory Water Allocation Planning Framework.

There is a high degree of uncertainty regarding the performance of the Mataranka Tindall Limestone Aquifer. Given this uncertainty estimates of water availability need to be conservative and take a precautionary approach. Water management and use needs to be adaptive, reflected in the licence conditions.

The Mataranka Tindall Limestone Aquifer is in the Top End zone of the Northern Territory Water Allocation Planning Framework. The proposed Larrimah management zone is in the marginal area of the Top End zone and behaves more like an Arid zone aquifer subject to episodic recharge compared with the regular recharge that occurs in the North Mataranka and South Mataranka management zones.

The whole of the Mataranka Tindal Limestone Aquifer is considered a Top End aquifer.

The last 59 years of climate has resulted increased recharge, groundwater levels, aquifer storage and discharge to the Roper River. The last few years have been some of the driest on record and may indicate the start of a drier climate period. A precautionary approach would warrant allocating water on the basis of long term median values rather than the last 30 years. The difference between the values can be seen in Figure 2.2 of TR45/2020 where the 118 year median rainfall is only 731mm which is only 85% of the 30 year median rainfall. This same period included the largest recharge events in 2003/4, 2010/11 and 2008/9 as shown in Figure4-1 of TR45/2020.

Impact on spring flow, river flow are within the NTWAP framework 20% (Tables 5, 6 and 7 in TR45/2020) and don't decrease by more than 20% for Top End Aquifers. Absolute changes in depth to groundwater in areas less than 15m over 59 years are moderate and at rates that GDEs are likely to be able to adapt to changed water availability. Through flow across the northern boundary of the TLA (Mataranka - South) in table 4 of TR45/2020 decreases by 41.5% in one ten year period. This result could be significant. The model could be run for a longer to see if there are the impacts on the springs in the Roper River or shallow groundwater areas where GDEs occur.

Aquifer draw down at Larrimah has implications for the rest of the Mataranka Tindal Limestone Aquifer and the management of the Georgina Basin to the south.

Opportunities for developing the water allocation plan

Technical report 45/2020 does not include an allowance for the take of water from the northern part of the Mataranka Tindal Limestone Aquifer north of the town of Mataranka. Take in this area will probably impact on discharges in the Waterhouse, Little Roper and Roper Rivers. Based on the NT Water Allocation Planning Framework the contingent level of take based on taking 20% of median recharge over the last 59 or 118 years is 9.4GL and 6.4GL respectively. Current licensed and authorised use in the North Mataranka management zone is estimated to be 1.7GL p.a.

The technical report models 59 years of extraction. The residence time from the extraction point to the discharge point is not indicated in the technical report. If the groundwater travel time is more than 59 years then the impact of extraction will not be seen in the analysis of based flows as shown in tables 5 and 6 of the technical report. Bruwer & Tickell (2015) estimate the groundwater travel time between the southern boundary of the WAP South Mataranka management zone and the Roper River is approximately 50 years, over a distance of about 70 km. This makes the results in tables, 5, 6, 7 and parts of 11 in TR45/2020 likely to be missing the impact of extraction under this proposal.

Change in the through flow regime across the southern boundary of the TLA (Mataranka - South) in table 3 of TR45/2020 show an increasing trend for the whole assessment period. There is not a long enough modelling period to determine if this trend will slow down and stabilise. This impacts on management of water in the northern portion of the Georgina Basin which overlies the Beetaloo sub-basin. There is a similar opposite trend in through flow across the northern boundary of the TLA (Mataranka - South) in table 4 of TR45/2020 shows an increasing trend for the assessment period except at 59 years which had 60% more natural through flow than average.

Further information and modelling is required to determine the non-consumptive water requirements to maintain groundwater levels in Larrimah that preserves a hydraulic gradient to sustain environmental values associated with the Roper River and shallow groundwater. Greater through flow on the southern boundary of the Mataranka south area shown in table 3 of TR45/2020 potentially reduces the size of the consumptive pool in the Georgina Basin, which will need to be taken into consideration when developing a water allocation plan for the Georgina Basin.

Understanding the implications for managing the Larrimah area for storage decline (that is like in the marginal part of the Top End) is not possible with the information provided in the technical report. Further modelling is required for the whole aquifer and base flows in the Roper River to test acceptable limits to change to river and spring flow, and regional groundwater levels.

The technical report doesn't consider the impact of take from the aquifer or the Roper River on the end of system flows at Roper Bar (extrapolated from the Red Rock gauging station). It is estimated that rural stock and domestic use and mining activities are authorised to take about 2.5 GL from the Roper River outside the proposed plan area. The Ngukurr community is concerned about maintaining flows at Roper Bar.

Further modelling is required to test limits of acceptable change. Modelling a run of 118 years may show the long term impact of drawdown of aquifer storage on the environmental values and regional groundwater levels. The recommended modelling scenario is taking a volume in the Larrimah management zone that is predicted to draw down the aquifer by 15 metres below natural levels over 100 years.

Further work is required to better understand the environmental and cultural water requirements. The Geological and Bioregional Assessment of the Beetaloo Sub-Basin by Geoscience Australia, the Roper River Water Resources Assessment by CSIRO, projects undertaken by GISERA and the Strategic Regional

Environmental and Baseline Assessment being led by the Department of Environment, Parks and Water Security are currently underway. This work will provide new information about the water resources and their environmental and cultural values.

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Tim Bond

Director Water Planning and Engagement