Tindall Mataranka to Daly Waters Water Advisory Committee

Meeting Record 9

21 – 22 May 2019
Day 1- Roper Gulf Regional Council Meeting Room, Jilkminggan Community, 9.45 am – 4.30 pm
Day 2 - Mataranka Community Hall, 8.30 am – 12.00 pm

Members Present

Rebecca Mohr-Bell	Independent Chair (Day 1 & 2)
Rohan Leach	Proxy for Tracey Hayes, NT Cattlemen's Association (Day 1 & 2)
Tim Helder	Proxy for Peter Rix, Quintis, Water Extraction Licence Holder (Day 1 & 2)
Clair O'Brien	Regenerative Agriculture (Day 1 & 2)
Ben Lewis	Proxy for Allister Andrews, Jawoyn Association (Day 1 only)
Vin Lange	Centrefarm / TopEnd Farm (from 2.30pm Day 1)
Sarah Kerin	Department of Tourism, Sport and Culture (Day 1 & 2)
Helena Lardy	Jilkminggan Community Aboriginal Association (Day 1 only)

Apologies

David Ciaravolo	Amateur Fishermen's Association of the Northern Territory
Sharon Hillen	Roper Gulf Regional Council

Members Absent

Jocelyn James	Jilkminggan Community Aboriginal Association
Kerry Roberts	Jilkminggan Community Aboriginal Association

Advisors Present

Christine Long	Executive Director Water Resources, DENR (Day 1 & 2)
Michelle Rodrigo	Water Planner, DENR (Day 1 & 2)
Liza Schenkel	Community Engagement Officer, DENR (Day 1 only)

Observers

Pru Ducey	DENR – Minutes (Day 1 & 2)
Rick Fletcher	Northern Land Council (from 11.45am Day 1)

1. OPENING (CHAIR)

Meeting opened at 10.15am.

The Chair thanked everyone present for attending, as well as Roper Gulf Regional Council and Helena Lardy for hosting the Committee at Jilkminggan.
Round table introductions.

1.1. Apologies

David Ciaravolo	Amateur Fishermen's Association of the Northern Territory
Sharon Hillen	Roper Gulf Regional Council – unable to send a proxy
Vin Lange	Centrefarm / TopEnd Farm (for morning of Day 1)

Helena advised that Jocelyn James may join the meeting this morning.

1.2. Confirmation of agenda

Agenda accepted without changes.

2. MINUTES AND ACTIONS (CHAIR)

2.1. Approval of Meeting 8 Minutes

- **DECISION:** The Committee agreed that the Minutes of Meeting 8 held in Katherine 18 March 2019 are a true and correct record, once the following amendments are made:

  - Agenda Item 5 Proposed Water Sharing Arrangements for Mataranka Tindall Plan - Clair O'Brien asked for it to be noted that her preference for the Plan boundary was to stay with the version which included Daly Waters and parts of the Beetaloo sub-Basin, rather than exclude the Beetaloo sub-Basin area as the new boundary now does.
  - Rohan Leach asked for the wording to be changed in both Section 5 '*Proposed Water Sharing Arrangements for Mataranka Tindall Plan – Discussion of ESY adaptation under variable climatic conditions*', and under Key Messages at '*(5) Definition of climate condition categories and the estimated sustainable yield*', as follows:

    'The Committee ~~supported~~ discussed the over-arching principle of adapting the estimated sustainable yield (ESY) to climate conditions, ~~but~~ and requested further information and definition of each category of climate condition before the Committee can provide recommendations on the setting of the ESY.'

  - Sarah Kerin and Ben Lewis approved inclusion of their emailed comments in the Minutes of Meeting 8.

- **ACTION**: Update Meeting 8 Minutes with corrections requested by Clair O'Brien and Rohan Leach, and add to the minutes the comments emailed by Sarah Kerin and Ben Lewis in relation to the Meeting 8 agenda.

2.2. Actions from Previous Meetings (Chair)

Action	Responsibility	Action	Status
8-1	Sharon Hillen	Sharon Hillen to send a list of members of the local authority.	COMPLETED
8-2	Pru Ducey/ Michelle Rodrigo	Action items from each meeting to be included on back page of Meeting Agenda.	COMPLETED

Action	Responsibility	Action	Status
8-3	Planning team – Michelle & Tim	The Department to explore options for extending the Plan boundary to include the entire river corridor and report back to the WAC.	CURRENT Discussion at Agenda Item 5 of Meeting 9
8-4	Michelle Rodrigo & Des Yin Foo (Water Assessment)	Arrange for the modelling team to run scenarios based on discussions today (noting the current capacity of the team and competing demands on their time). Committee will revisit the water-sharing arrangements when the modelling results are available.	ONGOING Modelling has commenced but further analysis is required.
8-5	Michelle Rodrigo	Planning team to revise proposed water-sharing arrangements based on median recharge over the longer climate period of 118 years (1900-2018).	CURRENT Discussion at Agenda Item 6 of Meeting 9
8-6	Michelle Rodrigo & Des Yin Foo	Planner to request further hydrological modelling to a) define a 'dry', and a 'very dry' year, starting with the scenario of 3 years of 600mm rainfall (unless the Water Assessment team recommends a more appropriate scenario), and b) to understand how the water resource is likely to respond in these climate conditions.	ONGOING Modelling has commenced but further analysis is required. Plain English summary of results and implications to be presented at next meeting.
8-7	Committee members	Members to submit any questions about the Water Reforms Directions Paper to the Chair, who will collate these and send to Christine Long. Answers provided will be circulated to members.	COMPLETED Process has closed and submissions are now being considered. As this is an ongoing process, ED Water Resources is happy to receive comments at any time from the Committee.
8-8	Michelle Rodrigo	Preferred date for Meeting 9 is to be determined via Doodle Poll organised by the Planner within the next week.	COMPLETED For future meeting dates

2.3. Recommendations Arising from Meeting 8

#	Recommendation	Status
8-1	Consider establishing a groundwater discharge protection zone around the Roper River to ensure groundwater dependent ecosystems (GDEs) likely to be impacted by groundwater extraction are properly protected.	See Meeting 9 Agenda Item 4 Paper – *Proposal for groundwater discharge protection measures*
8-2	The Plan should recognise that downstream dry season base flow in the Roper River originates from the Tindall Limestone Aquifer and that this groundwater is a key component of the	See Meeting 9 Agenda Item 5 Paper – *Proposed approach to the integration of dry season surface water extraction within water sharing arrangements*

	natural water balance and ecological function of the wider Roper system. The water-sharing arrangements established by the Plan should account for this connectivity.	
8-3	The current Water Allocation Plan is to be completed using the existing boundary, with the initial review of the Plan to occur in 2021 (2 years after commencement, and to coincide with full transition of mining and petroleum into the *Water Act*) at which point the entire Roper River should be formally incorporated into the Plan's remit.	Comments in addition to the recommendation: • Concerns shared about allocations/licences being granted before the Plan is declared • Discussion about cumulative effect of additional bore constructions on existing users and environmental/cultural values; cumulative impact is considered in licence decisions which are made separately to permits for bore construction. • Concerns shared about declining river levels and lagoons drying up • Plan will try to capture local/anecdotal observations, as well as complex technical information. • Traditional owners have economic aspirations but are also concerned about river levels. • Locals use the river as a backup food source/alternative to purchasing expensive meat products
8-4	The planning process identifies and consults with downstream stakeholders on water allocation planning.	An update on community engagement will be provided this afternoon.
8-5	Proceed with the use of 'median' values when calculating long-term annual recharge figures for the Plan area and each management zone.	Agenda Item 6 Meeting Paper - *Using median annual recharge to inform sustainable water sharing arrangement*
8-6	Median annual recharge values should be based on the longest available period of data (118 years), which is added to each year, on the basis that it provides increased security and reliability for all users, and provides greater capacity to sustainably manage water needs in the future.	
8-7	Ensure the views of members not present at the meeting today are heard on this matter, noting that those members present at the meeting prefer the use of the longer 118-year data set.	Email comments from Ben Lewis and Sarah Kerin who were unable to attend Meeting 8 are to be included in the minutes. David Ciaravolo has advised he is comfortable with longer (more conservative) approach but from a technical perspective shorter data set would also be a valid approach.

4. SEASONAL UPDATE – CURRENT AND PROJECTED GROUNDWATER LEVELS AND RIVER FLOWS

Michelle Rodrigo went through a presentation prepared by Des Yin Foo, Director Water Assessment, as a phone connection was not available for Des to dial into the meeting. The presentation provided an overview of the current condition of streamflows and groundwater levels, and projections for levels at end of 2019 dry season. A copy of the presentation is at Appendix 1.

Questions & discussion following the presentation:

- Would be interesting to compare the end of dry season projections for this year with river/groundwater conditions in a similar year in the past.
- Rainfall chart -1980s and into 90s was a dry decade for Mataranka area.
- Concerns that in the last 8 years, little offshoots of the river are drying up within a month of the wet, and little waterholes where the kids used to swim are not filling.
- Concerns that river levels have declined since the farms started up – previous river height can be seen in the lime cakes (line) on river banks. Need to understand more about these local observations. Interesting that the gauging stations show that levels fluctuate and have, on average, been steadily increasing. Might be a result of a change in the flow of the river, big floods, silt backing up, river may be using different channels. Big flows can cause big changes in the shape of the river e.g. the position and size of sandbars.
- The magnitude of the wet season will affect how low the river gets in the following dry season – baseflows may not get as low after an above average wet.
- In the past it was typical for a lot of sand to come down the river in big flows, but this hasn't happened for many years. There is now very little sand in places on the river that were once very sandy. Last time a creek ran really well here was 2008 and it hasn't reached the bridge level since.
- Bitter Springs and Rainbow Springs flows may drop, but not likely to stop in the dry because of constant groundwater discharge. Spring flows could be an indicator of not only rainfall or local groundwater extraction, but also of regional extraction further away. Flow gauging is undertaken on more than these two springs.
- For a licence application, the proposed extraction volumes can be run through the Roper hydrological model to predict the potential impact on spring and river flows over a period of time.

5. GROUNDWATER DISCHARGE PROTECTION ZONES (Planner)

Item 4 Meeting Paper – *Proposal for groundwater discharge protection measures* is at Appendix 2.

The Chair thanked the Planner for a well written meeting paper on this topic.
The proposal recommends:

- Establishment of a 1.5km buffer around key groundwater discharge features
- No further granting of new extraction points (bores) within the protection zone
- No further granting of entitlements (new or increased) within the zone
- Permanent trade of existing groundwater entitlements out of the zone to be encouraged
- Measures to mitigate the impact of extraction surrounding the protection zone

The protection zones and associated management measures relate to groundwater extraction, not surface water.

Refer to map at Appendix 2. Groundwater discharge within the zone occurs predominantly through seepage i.e. in swamps and river beds, rather than via discrete springs.

Questions and discussion

- The proposed approach is modelled on the groundwater discharge protection zone established for the Oolloo Water Allocation Plan which has a 1.5km buffer around discharge areas, increasing to 3km around Stray Creek where springs are particularly vulnerable to nearby groundwater pumping. For more background, see Section 8.4 (pg 125-127) of Tickell, S. (2011) *Assessment of Major Spring Systems in the Oolloo Dolostone, Daly River* - http://hdl.handle.net/10070/247391. Pages 126-128 are included at Appendix 3.

- No specific assessment has been undertaken for the Mataranka area, but it seems reasonable to apply the Oolloo approach to Mataranka given the similar karstic geology. Steve Tickell is providing advice on the design of the proposed discharge protection zone for Mataranka.
- There are many existing bores within the proposed buffer zone - some are licenced production bores and others are unlicenced rural stock and domestic bores. The Plan does not change existing groundwater entitlements; it can only raise awareness of the risks to spring discharges from nearby groundwater pumping. The protection zone cannot interfere with current rights under the *Water Act to* take water for stock and domestic purposes.
- An advisory factsheet could be developed to make existing water users aware of the protection zone and the purpose of it, and can offer some technical advice about locating bores away from groundwater discharge areas. Water Resources officers are also available to provide advice to applicants about siting a bore.
- In the Daly Roper Beetaloo Water Control District, a current exemption to the Water Act entitles a property to extract up to 5 ML/year without a licence. This applies to all beneficial uses, although mining, petroleum and heavy industry type operations would typically need more than 5 ML/yr and therefore require a licence.
- Plan needs to be clear about the rules for trade in the discharge protection zone i.e. no trading into the zone.
- To encourage trade out of the zone, consider whether a higher water security level could be offered.
- Similar groundwater discharge protection buffers/measures are in place in the Oolloo Plan Area (discussed above). The Western Davenport (declared) and Ti Tree (draft) water allocation plans include similar measures for protecting groundwater dependent ecosystems and cultural sites from the impact of aquifer drawdown over time.
- The 'Management of unused licenced water entitlements' policy (use it or lose it) is applicable to all licences, including those in the protection zone. Any water recouped from a licence within the protection zone should be permanent i.e. not to be re-instated within the protection zone in the future. Be clear about this in the Plan. Committee expressed some concerns that permanent loss of entitlements in this way may devalue land within the protection zone.
- Approx. 5 GL has been recouped in the Oolloo Plan area through application of the 'Management of unused licenced water entitlements' policy. Mataranka Tindall licences will eventually be assessed under this policy.
- Current proposal is for a 1.5km buffer around known discharge areas, but this is still being refined to ensure that all significant discharge areas are captured within the zone. These refinements will occur before the Plan is finalised.
- Committee acknowledged the need for the protection zone, but were concerned about implications for small block owners around Mataranka who may wish to develop small scale horticulture if they can't get a licence or increase an existing entitlement. Consider leaving scope for the Controller to grant up to 20 ML licence for small developments within the protection zone that provide high value community benefit.
- Jilkminggan may have plans for water development, but the land parcel lies within the groundwater discharge protection zone. Committee suggested the inclusion of special circumstances arrangements for water developments inside the zone which may have significant long-term community benefit.
- Future applications for new or increased groundwater extraction nearby to the zone would be assessed for potential impact on groundwater levels within the zone. If required, Water Resources would provide advice to applicants to help identify preferred extraction points or alternative pumping regimes to mitigate potential impacts.
- Assessment of new extractions close to areas of groundwater discharge are currently undertaken as a normal part of licence assessment processes, so the protection zone does not represent another layer of assessment for water users surrounding the zone.
- Adding 'land tenure' and 'land capability' (if available) layers to the protection zone map would help with assessing the implications of the zone.
- Noted that Roper Gulf Regional Council is not at this meeting, but their feedback on this proposal and implications for the Mataranka area would be very useful.

- The groundwater discharge protection zone can be evaluated and revised when the Plan is reviewed (2 years).

❖ **ACTION:** Liza Schenkel / Michelle Rodrigo to circulate report by Steve Tickell on water movement and springs in the Oolloo Plan area.

❖ **ACTION:** Seek input from Roper Gulf Regional Council on the implications of the Groundwater Discharge Protection Zone for the Mataranka town area.

❖ **ACTION:** Planner to discuss potential water development plans at Jilkminggan with Helena Lardy, to assess possible implications of the groundwater discharge protection zone.

❖ **ACTION**: Planner to consider adding special circumstances conditions to management arrangements for the groundwater discharge protection zone, to enable water developments inside the zone which may generate significant long-term community benefit.

❖ **ACTION:** Planner to review and edit the "potential implications" section of the groundwater discharge protection zone proposal based on comments provided by members at this meeting.

6. REGIONAL CONNECTIVITY OF THE ROPER RIVER AND TINDALL LIMESTONE AQUIFER

(Planner)

Item 5 Meeting Paper – *Proposed approach to the integration of dry season surface water extraction within water sharing arrangements for the Mataranka Tindall Limestone Aquifer* is at Appendix 4.

This paper describes the rationale for the management of dry season baseflow (surface water) outside of the Plan Area as part of the Mataranka Tindall water resource. This follows on from the presentation and discussions at Meeting 8 which highlighted that groundwater discharged within the Plan Area sustains dry season baseflows all the way to the Roper Bar/Ngukurr end of the river system.

Members were also referred to Figure 2 in Agenda Paper 6 which highlights the three different hydrological sections of the river. Within the Plan area the river is a 'gaining' system where groundwater from the Tindall Limestone Aquifer discharges directly into the river. At the eastern edge of the Plan area (downstream of Elsey Homestead) the river becomes a 'losing' system where there are no further groundwater inputs to the river. Beyond Roper Bar the river becomes a 'tidal' system.

At Meeting 8, the Committee discussed and acknowledged that groundwater discharge within the Plan area is supporting dry season baseflows in the Roper River down to Ngukurr. Extraction of baseflows downstream of the Plan Area should therefore be managed under the arrangements established by the Mataranka Tindall Limestone Aquifer Water Allocation Plan.

From the work being undertaken as part of the NESP (National Environmental Science Program) project, Roper River flows can be conceptualised in four different phases:

- Dry season - flow in river it almost entirely groundwater discharged from the Tindall
- Dry to wet transition– rain starts, surface flows added to groundwater baseflows
- Wet season –surface water inputs dominant the river flow
- Wet to dry transition – rains cease, surface water contribution reduces until back to groundwater-fed baseflow

It is important that the Water Allocation Plan is clear about the extent of the water resource to which water-sharing and management arrangements will apply.

Questions and discussion

- Does water use at Minyerri impact on the system? Under a 10 year water allocation plan, if water runs out at Minyerri, what aquifer will the community use?

- Bores at Minyerri are tapping into a different local aquifer that is not connected to the Mataranka Tindall Limestone Aquifer and doesn't discharge groundwater to the Roper River.
- The Mataranka Tindall Plan is very relevant to the Ngukurr community in terms of protecting baseflows to the Roper Pool. Committee indicated the Plan should seek to ensure that access to drinking water from the river at Ngukurr is not impacted by groundwater extraction upstream.
- If public water supply runs out at Minyerri or Ngukurr, we may have 'water refugees' relocating to Mataranka and increasing demand on the Mataranka Tindall Plan area; the issue of regional water resources and water 'refugees' should be a consideration.
- Hydrological understanding about the dynamics of the Roper Pool is lacking, including how extraction of groundwater and surface water upstream may impact the pool. We know that groundwater from the Tindall Limestone Aquifer contributes to baseflow at Ngukurr and mixes with tidal waters.
- Power and Water are working with Ngukurr community on future water supply and groundwater sources.
- The Plan should acknowledge the Ngukurr community as a user of the Tindall Limestone water resource.
- More monitoring and analysis is required to better understand what flow is needed upstream at Elsey Homestead to ensure dry season baseflows reach Ngukurr – currently some gaps in scientific understanding and modelling capabilities which limit our ability to determine flow requirements in these downstream reaches of the river.

Between Elsey Homestead gauging station and Roper Bar, dry season river flow declines on average by 2.5 m^3/s. The losses are mostly due to evapotranspiration. This equates to 78,840 ML/yr lost/used by vegetation in this section of the river.

Groundwater discharge from the Tindall Limestone is estimated to be approx. 112,700 ML. Of this volume, nearly 79,000 ML needs to flow past Elsey Homestead to account for evapotranspiration losses, and then more to sustain flows to Ngukurr. This understanding of groundwater-baseflow connectivity provides the basis for managing downstream Roper River flows (and extraction) within the Mataranka Tindall water allocation plan.

Setting minimum thresholds for flow at Roper Bar is challenging, especially given the inter-annual variability in this system. Cease-to-flow conditions are rare, but do occur at Roper Bar and upstream of this point. In dry years, any extraction that occurs will have an impact on flows; it's a question of managing this impact within an acceptable limit of change. One possible threshold may be to cause no increase in the occurrence of cease-to-flow events at Roper Bar as a result of groundwater extraction. More technical analysis is required to design appropriate thresholds.

The Roper Pool extends from Ngukurr to Kangaroo Island. The main channel of the river is very deep and very long. It is tidal, so there is a mixing of saltwater and freshwater. Experts suggest that saltwater may push further upstream if freshwater flows are reduced, but there has been little detailed hydrological work to determine these dynamics. Baseflows in the Wilton River from the Dook Creek geological formation can contribute freshwater flows to the Roper Pool, but this flow is unreliable. Unfortunately, very little flow data is available for the Wilton River, making it difficult to determine the significance of its flow contribution to the Roper.

The Planner spoke to each of the points (a) to (h) in section 3 of the meeting paper (listed below).

(a) Dry season surface water extraction assessed as groundwater

- **COMMITTEE RECOMMENDATION:** The Committee supports proposal (a) Dry season surface water extraction assessed as groundwater.

(b) Surface water stock and domestic use included in the water account

- **COMMITTEE RECOMMENDATION**: The Committee supported proposal (b) Surface water stock and domestic use included in water account

(c) Assessment of impact on downstream surface water users
- Authorised surface water extraction occurs at Ilmenite mine near Judy Crossing
- Currently unable to model what level of flow reduction would cause the saltwater to push upstream at the Roper Pool, so this point in the river is not a good site to attache a flow threshold to. Red Rock gauging station, above Roper Bar, is a better site than Roper Pool. Red Rock has a telemetered gauging station.
- No specific Committee recommendation

(d) Assessment of impact on downstream flow thresholds
- This should be assessed ahead of impact on downstream users; switch (c) and (d) in list.
- No specific Committee recommendation

(e) Accounting of downstream surface water extraction within the Estimated Sustainable Yield for the Mataranka Tindall WAP
- This point is about accounting for licenced downstream extraction; it is linked to accounting for unlicenced stock and domestic use at (b)
- No specific Committee recommendation

(f) Application of the Prioritising Water Extraction Licence Applications policy to the combined groundwater-surface water resource
- This is the 'first in first served' policy
- Policies that apply to groundwater in the Plan area should apply to the use of connected surface waters downstream. This means licence applications within the Plan area and those downstream are prioritised together. e.g. it could arise that a downstream application to extract baseflow from the river may be assessed ahead of an application for groundwater from within the Plan area boundary.
- Committee is supportive of the proposed holistic approach of considering downstream baseflow within the water allocation plan. This approach should stand, regardless of how a particular water policy might play out.
- Need to work through how trade is managed under this approach, as the Act permits trade only within a Plan Area, so trade of downstream entitlements may not be possible.
- All agree the resource should be considered as one pool (see Committee recommendation at (a) above), regardless of implications arising from the application of water policies.

❖ **COMMITTEE RECOMMENDATION**: The Committee supports consistency in the application of all NTG water policies. The Committee trusts that any controversial issues that arise from Meeting Paper 5 will be brought to the Committee for further consideration.

(g) Assignment of dry season surface water extraction to WAP management zones
- Need to design a fair and scientifically defensible method for apportioning downstream extraction to the Estimated Sustainable Yield (ESY) for each management zone in the Plan. e.g. how would surface water extraction at Ngukurr be apportioned to the three management zones? Hydrological modelling will help to develop an appropriate ratio.
- Another approach might be to define the river as a fourth management zone with a separate ESY.
- Not quite as simple as splitting downstream surface water extraction between the North Mataranka and South Mataranka management zones, because aquifer throughflow from the Larrimah zone also influences groundwater discharge to the river.
- If a management zone is nearing full allocation, it would be reasonable to apportion a downstream extraction to a management zone where water is available, as long as the total ESY for the Plan area was not exceeded.
- Committee suggests the principles and method for apportioning downstream extraction to management zones be based on hydrogeological rationale, followed by secondary adjustments in circumstances where a management zone may be near to or fully allocated.

- Consider a cap on what can be taken downstream i.e. determine a sustainable yield for baseflow downstream of the Plan boundary, recognising that extraction from baseflow is likely to have a greater impact on flows and downstream values than an equivalent volume pumped from the Tindall Aquifer.

❖ **COMMITTEE RECOMMENDATION**: The water allocation plan should apportion the extraction of dry season surface water to WAP management zones according to the estimated ratio of groundwater discharge from the three zones. However, where a zone is nearing or has reached full allocation, surface water extraction could be apportioned to zones where water is still available.

(h) Interaction with draft policy directions on harvesting of surface water flows
- No specific Committee recommendation

Discussion of implications for current and projected water account:
Refer Table 1 of Agenda Item 5 Meeting Paper (Appendix 4) and Strategic Aboriginal Water Reserve handout circulated at the meeting (Appendix 5)

Table 1 shows the effect of including downstream surface water extraction in the Mataranka WAP water account, which is to increase in the total volume of extraction entitlements accounted for under the WAP. Where this results in a management zone reaching its full allocation, it may mean the Strategic Aboriginal Water Reserve (SWR) for that management zone cannot be fully provisioned i.e. until such time as water is recouped through the application of water policies like 'use it or lose it'. The SWR is a priority for recouped water. The actual volumes in the SWR cannot be determined until the Estimated Sustainable Yield of each management zone is established – SWR is set as a proportion of the available consumptive pool within each ESY.

Based on preliminary ESY estimates, the South Mataranka management zone is likely to be fully allocated, which means that a 'notional' rather than a 'real' water allocation would be made to the SWR. Current usage in this zone, however, is under 30% of licenced entitlements, which means 70% of licenced water entitlements are not being utilised/extracted.

In the Daly Roper Beetaloo Water Control District a current exemption under the Water Act permits use of up to 5 ML per land parcel without a water licence for small-scale irrigation of vegetables, crops, fruit trees etc., even if the produce is sold commercially.

At 2.30pm, the meeting relocated to the banks of the Roper River for open community discussion.

7. OPEN DISCUSSION OF WATER ISSUES IMPORTANT TO LOCAL STAKEHOLDERS

Helena Lardy and other community members took the Committee to visit two sites on the Roper River - one at the confluence of the Elsey Creek and Roper River, and the other downstream of Elsey Homestead where rocks not previously visible are now seen above the water line.

Issues discussed at these sites include:
- the significance of the river to local Aboriginal people for traditional cultural practices, hunting and well-being trips with family.
- the connection between groundwater and river flows and the extent of the aquifer that supplies water to the springs.
- concerns about dropping river levels and unseasonal drying of wetland areas
- concern that groundwater extraction at farms around Mataranka and heavy use of wetlands by cattle and feral animals is causing the decline in river flows and fouling of wetland areas.

8. COMMUNITY ENGAGEMENT UPDATE (Liza Schenkel)

ACTION: Liza Schenkel to circulate a dot point update on community engagement following the meeting

End of Day 1

Day 2 – 22 May 2019 - Mataranka Community Hall

Meeting resumed 8.30am

Members Present

Rebecca Mohr-Bell	Independent Chair
Rohan Leach	Proxy for Tracey Hayes, NT Cattlemen's Association
Tim Helder	Proxy for Peter Rix, Quintis, Water Extraction Licence Holder
Clair O'Brien	Regenerative Agriculture
Vin Lange	Centrefarm / TopEnd Farm
Sarah Kerin	Department of Tourism, Sport and Culture

Member apologies

David Ciaravolo	Amateur Fishermen's Association of the Northern Territory
Sharon Hillen	Roper Gulf Regional Council – unable to send a proxy
Helena Lardy	Jilkminggan Community Aboriginal Association

Members absent

Jocelyn James	Jilkminggan Community Aboriginal Association
Kerry Roberts	Jilkminggan Community Aboriginal Association

Advisors Present

Christine Long	Executive Director Water Resources, DENR
Michelle Rodrigo	Water Planner, DENR

Observers

Pru Ducey	DENR – Minutes
Rick Fletcher	Northern Land Council

11. REFINING GROUNDWATER VALUES, PLAN OBJECTIVES AND OUTCOMES (Planner)

Outcomes and objectives

The Committee workshopped the current draft statement of outcomes and objectives for the Mataranka Tindall Limestone Aquifer Water Allocation Plan to identify any final refinements needed.

Below is a record of the Committee's recommended changes:

Outcome 1 and Objectives 1 - 7:

- Incorporate climate change into these statements, to capture how the Plan will respond to this issue over time; noted that climate change is included in Outcome 3
- Consider adding a reference to the (draft) off stream storage/flood harvesting policy, although it is acknowledged that it is outside the scope of this Plan to prescribe water management arrangements beyond groundwater and dry season baseflows; this needs to be clear in the Plan. The link may be in the role of flood flows in aquifer recharge and in the transition from wet season to dry season flows.

Outcome 2 and Objectives 8 - 10

- Revise Outcome 2 to include Aboriginal and non-Aboriginal cultural opportunities
- Strengthen wording of Objective 8 by changing '*engaged*' to '*continuously engaged'*
- Very important for Aboriginal people to have opportunities to be engaged, including downstream communities
- Suggest Objective 10 becomes part of Outcome 2 with two parts, (a) Aboriginal cultural flows and (b) recreational aspect

Outcome 3 and Objectives 11 – 12

- In objectives 11 and 12, change the term '*high security*' to '*secure*'.

Outcome 4 and Objectives 13 - 18

- In Outcome 4, replace the wording *'…while avoiding detrimental impacts on environmental and cultural values*' to *'…in line with the agreed values in this Plan*.'
- If words like '*detrimental*' are used, they need to be clearly defined in the Plan
- Include in outcome or objective statements wording such as, '*a water allocation system that gives water users confidence/certainty in water reliability'*.

Values

The Committee workshopped a summary of value statements (developed from Committee workshops in early 2018) for the Mataranka Tindall Limestone Aquifer

Value statements describe the importance we place on water resources and what we reply on water resources for. Values don't describe the actual targets/objectives of the water allocation plan.

Below is a record of the Committee's comments and recommended changes to the draft value statements:

- Reword the following value statements:
  'Reliable, quality water available for tourism, agriculture and horticulture at low or no treatment cost'; and
  'Reliable, quality, pleasant-tasting drinking water for towns and communities at low or no treatment cost'.
  - the term '*no or low treatment cost'* is too imprecise
  - replace the phrase '*Reliable, quality, pleasant-tasting drinking water*' with '*reliable drinkable water*'
  - could incorporate wording like '*within health regulations for potable water'* as this removes subjectivity
- If the water becomes unpleasant to taste, particularly at Ngukurr, people don't want to drink it and instead switch to unhealthy soft drinks; it's hard to get people, especially kids, to go back to water even when the taste has improved.

❖ **COMMITTEE RECOMMENDATION**: Committee agrees to updates to the wording of the draft Values, Outcomes and Objectives statements for the Mataranka Tindall Limestone Aquifer Water Allocation Plan, as discussed during Meeting 9.

7. DEVELOPING SUSTAINABLE WATER SHARING ARRANGEMENTS FOR THE WATER ALLOCATION PLAN

(Planner)

Item 6 Meeting Paper – *Using median annual recharge to inform sustainable water-sharing arrangements for the Mataranka Tindall Limestone Aquifer i*s Appendix 6.

❖ **ACTION**: Chair and Planner will arrange to discuss Agenda Item 6 with Ben Lewis later as the teleconference facility was not working.

At Meeting 8, the Committee made the following recommendations:

8-5 *Proceed with the use of 'median' values when calculating long-term annual recharge figures for the Plan area and each management zone.*

8-6 *Median annual recharge values should be based on the longest available period of data (118 years), which is added to each year, on the basis that it provides increased security and reliability for all users, and provides greater capacity to sustainably manage water needs in the future.*

Table 1 of Meeting Paper 6 provides median annual recharge values for both the 118 and 58 year datasets.

Median annual recharge needs to provision:

a) the water needs of the environment and cultural values within the WAP area and along the entire freshwater extent of the Roper River, and
b) the water needs of consumptive beneficial uses such as public water supply, stock watering and irrigated agriculture.

Table 2 of Meeting Paper 6 provides recharge values for each management zone, as well as volumes for current use and full use of water entitlements. The table shows volumes for 20% of recharge when the contingent 80-20 allocation of the NT Water Allocation Planning Framework (NTWAPF) is applied. 20% of median annual recharge calculated over the 118 year dataset is 28,200 ML. Full use of current water entitlements (licensed and unlicensed entitlements) is currently sitting at 26,315 ML. Under this arrangement, there is little scope for new allocations.

The NTWAP Framework provides guidelines for water allocation in Top End rivers and aquifers. If 20% of recharge is allocated to consumptive uses, the Plan must ensure that this level extraction does not cause river flows to be reduced by more than 20% at any time in any part of the river.

The scenario modelling being undertaken will help to quantify the degree of change to river flows as a result of different groundwater extraction regimes, and help to ascertain which extraction regimes meet the 20% threshold of change for river flows.

The model might predict that in 80% of years, streamflows will be within the 20% threshold of change. The 20% of years when the threshold is breached can be used as the basis for setting licence reliabilities at less than 100%. This provides water managers with a tool for reducing licence allocations in years when flow modelling predicts the threshold may be breached during the coming dry season. The Annual Announced Allocation process is the mechanism by which this reduction is applied during drier than average years.

Application of the longer dataset (i.e. from year 1900 to present) will produce a conservative ESY figure, resulting in potential over-allocation in certain management zones. Returning to allocations within the ESY and enabling 'real' allocations to the SWR, will rely in part on the effectiveness of water recoup programs.

- **COMMITTEE RECOMMENDATION**: Committee confirms its previous recommendation that median annual recharge values should be determined by the longest available period of climate data (year 1900 to present).

Committee discussed the interaction between Beneficial Uses and the ESY.

- The Committee has a role in making recommendations about the ESY for each management zone and the management arrangements which will help to achieve the ESY objectives.
- Nine beneficial uses are declared for the whole Water Control District and these apply to the Mataranka Tindall WAP. SWR will be a sub category of these declared beneficial uses, until legislative changes make it its own category of beneficial use.
- The Committee will not be asked to make recommendations about allocations to specific beneficial uses. The Plan is likely to group the consumptive beneficial uses together when allocating within the ESY, although Public Water Supply and Rural Stock & Domestic will have separate allocations within the ESY.

Discussion of using the 80/20 guideline as a starting point for determining the ESY.

- Modelling will be undertaken to simulate how dry season stream flows in the Roper River might be impacted if up to 20% of median annual recharge is extracted from the Tindall Limestone groundwater resource. Results will be provided to the Committee.
- Table 2 of Meeting Paper #6 shows figures for 20% of median annual recharge using the 118-year and the 58-year dataset; these figures do not represent the final ESY
- Committee suggest that unless there are compelling reasons to use a different ratio, that the 80/20 allocation would be reasonable; modelling will provide more information.

- **COMMITTEE RECOMMENDATION**: If modelling work indicates that an 80/20 allocation falls within the 20% threshold of acceptable change in Roper River flows, then further analysis should look at the feasibility of a 75/25 allocation.

In Table 2 of Meeting Paper #6, when figures for 20% median annual recharge are compared with volumes for full use of current entitlements, it is apparent that the South Mataranka management zone may be over allocated. Existing licences cannot be changed by the arrangements established under the new Plan. North Mataranka and Larrimah management zones may be below full allocation. However, if extraction of baseflow from the Roper River downstream of the WAP boundary is accounted for under current entitlements in the WAP (because dry season streamflow is recognised as groundwater from the Tindall), this will increase the volume of current entitlements in each management zone (because downstream take is apportioned to each zone in the WAP). Refer to Table 1 of Meeting Paper #5 for more detail on entitlements within the WAP area and those drawing from dry season baseflow in the Roper River outside the WAP boundary. The Vermelha water extraction licence application is currently being assessed. Table 1 accounts for an expansion of irrigated agriculture in the Larrimah management zone over the 10-year life of the water allocation plan.

Committee discussion:
- If all projections were to become reality, the system would end up over allocated.
- It is outside the scope of the Committee, but members would like to know the likelihood of reaching full use of entitlements and what volume might be recouped when existing under-utilised licences are assessed.
- The process of applying the unused water policy involves consultation with individual licence holders and discussions about future development plans. In the water allocation planning process, however, full use of current entitlements is assumed when modelling extraction scenarios, predicting future use and accounting for uses within the ESY, as this is the volume that can be legally extracted from the aquifer. The planning process cannot be based on what-if scenarios of water being returned to the consumptive pool. With Licensing, the Water Controller may choose to take into account the current level of use in a WAP area when making a decision on an individual licence application.

  - **ACTION:** Prepare a summary of modelling results for the Committee with key recommendations for the setting of the ESY. Members will have one week to read and absorb the recommendations, clarify any questions, and decide whether they support the recommendations.
  - **ACTION:** Planner to collate everything completed in the planning process to date, including parts of the draft Plan, to give the Committee a clearer view of the work that still needs to be undertaken.
  - **ACTION:** Invitation to be sent out to meet by teleconference on Monday 22 July 2pm to 3.30pm to consider modelling outcomes.

Tim Helder advised he is moving on and will not be in Mataranka to continue as a proxy on the Committee. Tim was asked if he would be interested in continuing with the Committee in some capacity, and indicated he would if members felt there was value in this.

Discussion of climate responsiveness in water allocations/ESY:
- At the March 2019 meeting, Committee considered a proposal for a climate-adapted ESY i.e. reductions to the ESY in below average climate conditions. This proposal was based on use of the shorter, 58-year climate period (i.e. 1960 to present)
- ESY is typically set in a Plan as a static figure, and management tools like Annual Announced Allocations (AAAs) are used to reduce annual licenced take in very dry years. AAAs enable a managed response to below average rainfall (and recharge) conditions.

- Committee indicated that use of the longer 118 year dataset to set the ESY was already setting a conservative approach to management of the resource, and expressed concerns about applying added restrictions like AAAs. Committee's preference is that a more conservative ESY would facilitate greater security of water availability across all licences, albeit from a smaller pool, and less uncertainty around access to water. Committee questioned the need for AAA assessments under already conservative ESY arrangements.
- Given there are likely to be opportunities within the regulatory environment for licenced flood harvesting in high rainfall periods, the Plan (which is about groundwater) should stay focussed on the stable, conservative approach proposed for the ESY
- The ESY will be based on median figures and is the upper limit of allowable extraction i.e. the ESY is not increased in higher than average rainfall years. However, in low rainfall years, AAAs are a tool for temporarily reducing licence entitlements if modelling shows that full use of licenced entitlements will mean flow thresholds (e.g. no more than 20% reduction in river flow) might be exceeded.
- Rohan Leach (pastoral) advised he was not supportive of having the AAA process on top of an already conservative ESY.
- The Planner clarified that all Top End licences, including those in Mataranka Tindall are currently subject to AAAs. At the end of every wet season, hydrological models are run for each WAP area to simulate resource conditions at the end of the coming dry season (nominally 1 November) based on the performance of the preceding wet season. An announcement of annual allocations for the coming water year (May to April) is made on 1 May each year, including via letters to individual licence holders. Licence conditions often include water allocations at different security levels, each with different reliabilities. The Committee needs to discuss this issue further so it can make informed recommendations about the role of AAAs in the Mataranka Tindall WAP. Need to consider if the conservative ESY alone provides adequate management and protection to the resource and existing users in below average rainfall years. AAAs can be an important management tool in very dry years.
- Some Committee members were not aware of the inclusion of such conditions in groundwater extraction licences. Licence conditions need to be clear about the likelihood and scale of reduced allocations.
- A conservative ESY based on the full climate period (1900 to present) coupled with the AAA tool for management of the resource in extreme dry conditions, negates the need for the previously proposed adjustable ESY. Committee's view is that an adjustable ESY creates too much uncertainty, including for licensing decisions.
- ESY sets an upper limit for the amount of water that can be licenced out. If we have 3 -5 years of extreme dry conditions, under a static ESY, new licences could technically be approved within the ESY limit while existing licence holders are experiencing AAA reductions.
- Committee suggests that a conservative ESY should provide a sufficient buffer until the mid-term (or earlier) review of the Plan, when ESY settings might be reset if dry conditions are ongoing.
- More regular reviews might be the way to maintain community input to management of the resource. Water licensing is controlled by the Water Controller and water legislation is the domain of legislators, but the community can have significant input to the Plan during reviews.
- Modelling will provide more information about the setting of the ESY and the frequency of years in which the environmental thresholds may be exceeded, as well as how often management interventions like AAAs would need to be activated.
- Need to make time for further Committee consideration of the AAA process. The more conservative ESY should create greater reliability of access to licenced entitlements if the overall extraction demand on the resource is lower. Several Committee members support the exclusion of AAAs from this Plan on the basis that a conservative ESY provides adequate protections to the system.
- It was noted that the Committee's role in making recommendations about trade-offs is often a difficult one, especially in finding the middle ground between environmental needs and economic development/water security.

    - ❖ **COMMITTEE RECOMMENDATION**: Committee recommends that the ESY be set as a stable figure in the Water Allocation Plan

- ❖ **COMMITTEE RECOMMENDATION**: The Committee is given further opportunity to consider the need for Annual Announced Allocations (AAAs) in the Plan given the ESY is to be set at a conservative level. Additionally, if AAAs are to be a feature of the Plan, the Committee is given an opportunity to consider the likely impacts on licence reliabilities.

- ❖ **COMMITTEE RECOMMENDATION**: Management settings in the Plan should maximise water security and reliability as much as possible, to minimise uncertainty for licence holders

- ❖ **COMMITTEE RECOMMENDATION**: Management settings in the Plan should assign the highest security level to groundwater, and a lower security level (and therefore less reliability) to surface water licences.

12. FUTURE MEETING DATES (Planner)

As per Action above, teleconference meeting to be scheduled for Monday 22 July, 2pm to 3.30pm.

13. KEY MESSAGES FROM THIS MEETING

The following is a summary of the elements of the water allocation plan which are fully supported by the Committee:

- Use of median values for recharge over the full climate period (i.e. from 1900 to present) as the starting point for determination of the estimated sustainable yield (ESY)
- Establishment of a stable and conservative ESY
- The current package of Values, Outcomes and Objectives statements, incorporating the changes requested during Meeting 9
- The Plan will recognise the connectivity of the Mataranka Tindall groundwater resource and dry season Roper River baseflows and the Plan's management arrangements will apply to this connected resource.
- Establishment of a groundwater discharge protection zone and the proposed 1500m buffer around discharge features – Committee would like to further consider community feedback on the zone and management arrangements that apply to it before it is fully finalised.

- ❖ **ACTION**: Chair and Planner to provide an update on this meeting to Ben Lewis and David Ciaravolo as they were unable to attend some or all of the meeting.

Meeting closed 11.55am

Summary of Actions arising from Meeting 9

#	Responsibility	Action	Status
8-4	Michelle Rodrigo & Des Yin Foo (Water Assessment)	Arrange for the modelling team to run scenarios based on discussions today (noting the current capacity of the team and competing demands on their time). Committee will revisit the water-sharing arrangements when the modelling results are available.	ONGOING
8-6	Michelle Rodrigo & Des Yin Foo	Planner to request further hydrological modelling to a) define a 'dry', and a 'very dry' year, starting with the scenario of 3 years of 600mm rainfall (unless the Water Assessment team recommends a more appropriate scenario), and b) to understand how the water resource is likely to respond in these climate conditions.	ONGOING
9-1	Pru Ducey & Michelle Rodrigo	Update Meeting 8 Minutes with corrections requested by Clair O'Brien and Rohan Leach, and add to the minutes the comments emailed by Sarah Kerin and Ben Lewis in relation to the Meeting 8 agenda.	NEW
9-2	Liza Schenkel & Michelle Rodrigo	Circulate report by Steve Tickell on water movement and springs in the Oolloo Plan area.	NEW
9-3	Michelle Rodrigo	Seek input from Roper Gulf Regional Council on the implications of the Groundwater Discharge Protection Zone for the Mataranka town area.	NEW
9-4	Michelle Rodrigo	Planner to discuss the plans for water developments at Jilkminggan with Helena Lardy, to assess possible implications of the groundwater discharge protection zone.	NEW
9-5	Michelle Rodrigo	Planner to consider adding special circumstances conditions to management arrangements for the groundwater discharge protection zone, to enable water developments inside the zone which may generate significant long-term community benefit.	NEW
9-6	Michelle Rodrigo	Planner to review and edit the "potential implications" section of the groundwater discharge protection zone proposal based on comments provided by members at this meeting.	NEW
9-7	Liza Schenkel	Circulate a dot point update on community engagement following the meeting.	NEW
9-8	Rebecca Mohr-Bell & Michelle	Chair and Planner will arrange to discuss Agenda Item 6 with Ben Lewis later as the teleconference facility was not working.	NEW
9-9	Michelle Rodrigo	Prepare a summary of modelling results for the Committee with key recommendations for the setting of the ESY. Members will have one week to read and absorb the recommendations, clarify any questions, and decide whether they support the recommendations.	NEW
9-10	Michelle Rodrigo	Planner to collate everything completed in the planning process to date, including parts of the draft Plan, to give the Committee a clearer view of the work that still needs to be undertaken.	NEW
9-11	Michelle Rodrigo	Send email invitation to meet by teleconference on Monday 22 July, 2pm to 3.30pm to consider modelling outcomes.	NEW

#	Responsibility	Action	Status
9-12	Rebecca & Michelle	Provide an update on this meeting to Ben Lewis and David Ciaravolo as they were unable to attend some or all of the meeting.	NEW

Decisions arising from Meeting 9

#	Decision
9-1	The Committee agreed that the Minutes of Meeting 8 held in Katherine 18 March 2019 are a true and correct record with the requested amendments recorded at Section 2.1 of the Meeting 9 minutes.

Recommendations arising from Meeting 9

#	Recommendation
9-1	With reference to Item 5 Meeting Paper, the Committee supported proposal (a) *Dry season surface water extraction assessed as groundwater*.
9-2	With reference to Item 5 Meeting Paper, the Committee supported proposal (b) *Surface water stock and domestic use included in water account*.
9-3	The Committee supports consistency in the application of all NTG water policies. The Committee trusts that any controversial issues that arise from Meeting Paper 5 will be brought to the Committee for further consideration.
9-4	The water allocation plan should apportion the extraction of dry season surface water to WAP management zones according to the estimated ratio of groundwater discharge from the three zones. However, where a zone is nearing or has reached full allocation, surface water extraction could be apportioned to zones where water is still available.
9-5	Committee agrees to the updated wording of the draft Values, Outcomes and Objectives statements for the Mataranka Tindall Limestone Aquifer Water Allocation Plan, as discussed during Meeting 9.
9-6	Committee confirms its previous recommendation that median annual recharge values should be determined by the longest available period of climate data (year 1900 to present).
9-7	If modelling work indicates that an 80/20 allocation falls within the 20% threshold of acceptable change in Roper River flows, then further analysis should look at the feasibility of a 75/25 allocation.
9-8	Committee recommends that the ESY be set as a stable figure in the Water Allocation Plan
9-9	The Committee has further opportunity to consider the need for Annual Announced Allocations (AAAs) in the Plan given the ESY is to be set at a conservative level. Additionally, if AAAs are to be a feature of the Plan, that the Committee has had opportunity to consider the likely impact on licence reliabilities.
9-10	Management settings in the Plan should maximise water security and reliability as much as possible, to minimise uncertainty for licence holders.
9-11	Management settings in the Plan should assign the highest security level to groundwater, and a lower security level (and less reliability) to surface water licences.

END

Water Allocation Plan for the Mataranka Tindall Limestone Aquifer

Seasonal Update

Des Yin Foo
Water Resources Division
21 May 2019

www.nt.gov.au

NORTHERN TERRITORY GOVERNMENT

Contents

- Seasonal Groundwater Level Response
- Current Flows in the Roper River
- Modelled Recharge
- Modelled Flows at key Roper River Indicator Sites

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NORTHERN TERRITORY GOVERNMENT

Groundwater Response to 2018/19 Wet Season

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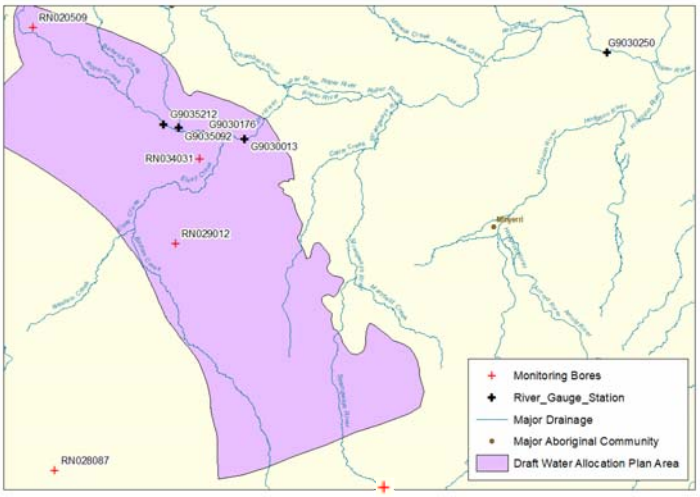
NORTHERN TERRITORY GOVERNMENT

The Groundwater Monitoring Network

- RN020509 – Maranboy 3/80
- RN034031 – Mataranka
- RN029012 – Elsey Station
- RN038812 – Nutwood Downs
- RN028087 – Tarlee Station



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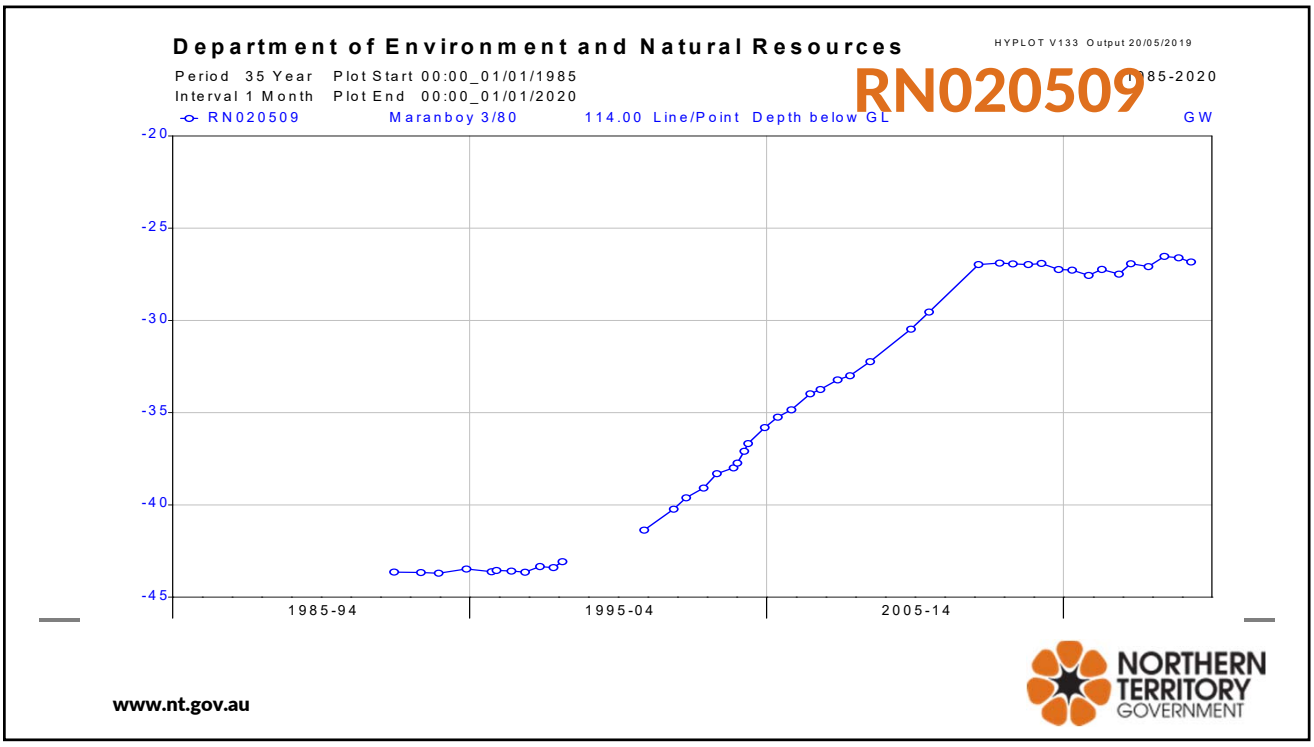
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-30
-35
-40
-45
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1995-04
2005-14
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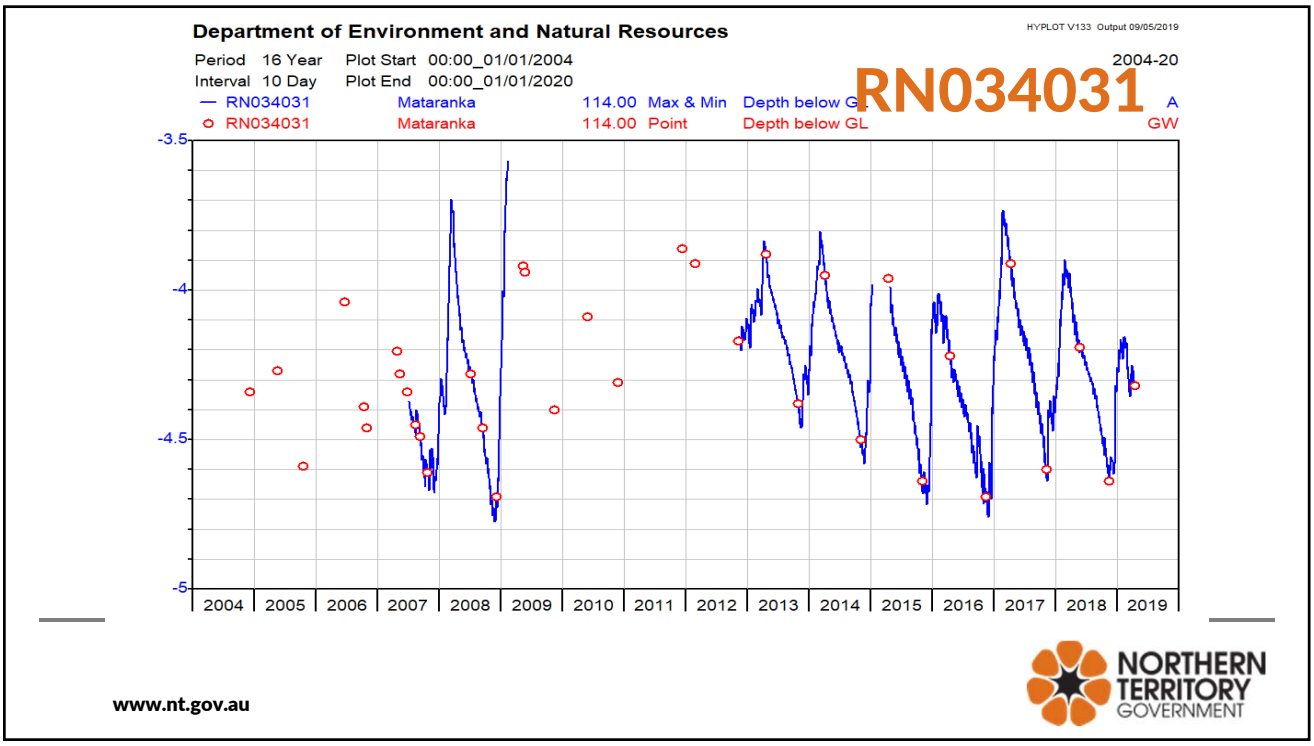
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RN034031 Mataranka 114.00 Point Depth below GL GW
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-4
-4.5
-5
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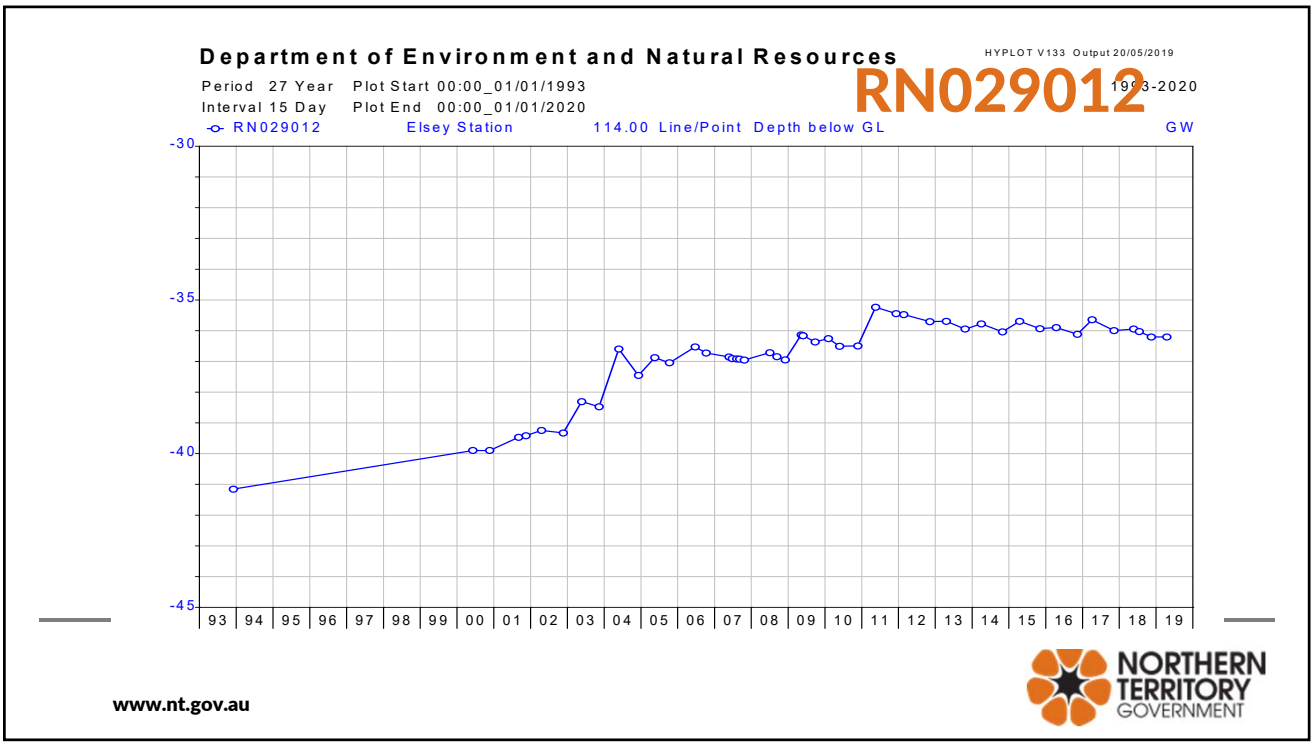
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1993-2020
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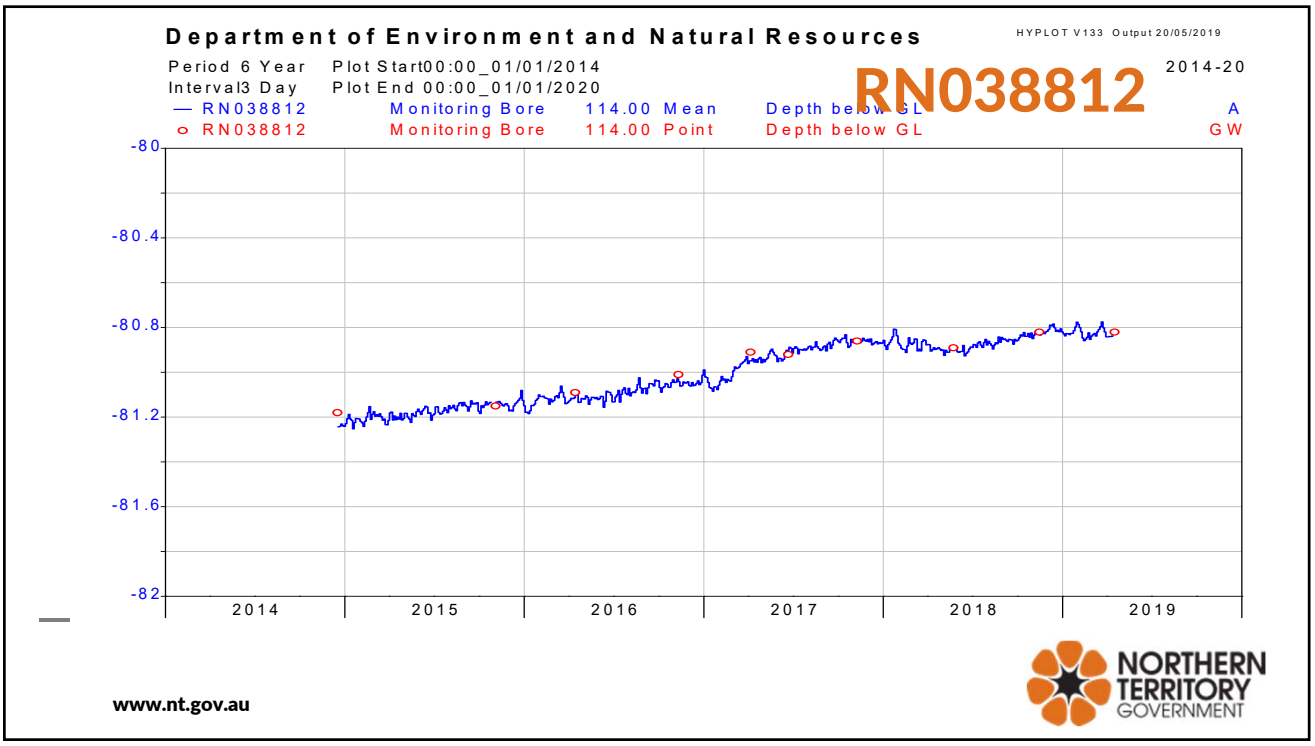
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2014-20
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RN038812 Monitoring Bore 114.00 Point Depth below GL GW
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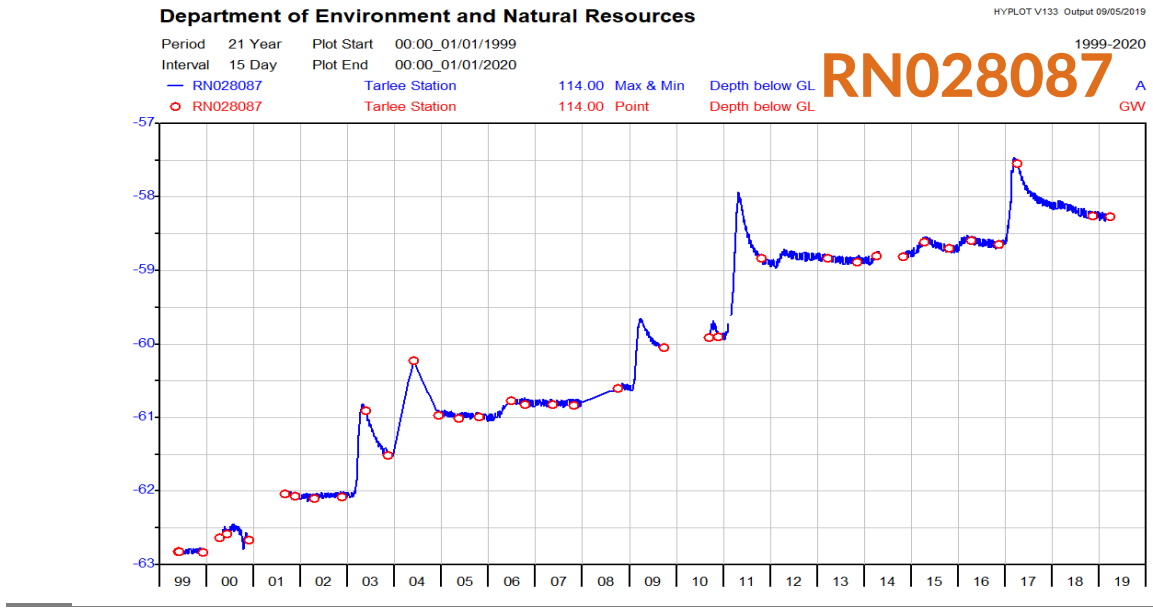

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NORTHERN TERRITORY GOVERNMENT

Roper River Flows April 2019

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NORTHERN TERRITORY GOVERNMENT

Mataranka Homestead G9030176

- Station Commenced June 1961
- Mean Flow April 26.6 cumecs
- Median Flow April 7.6 cumecs
- Mean Flow 28 April 2019 2.9 cumecs

NORTHERN TERRITORY GOVERNMENT

Elsey Homestead G9030013

- Station Re-commenced 2015
- Mean Flow April 12.7 cumecs
- Mean Flow 28 April 2019 7.2 cumecs

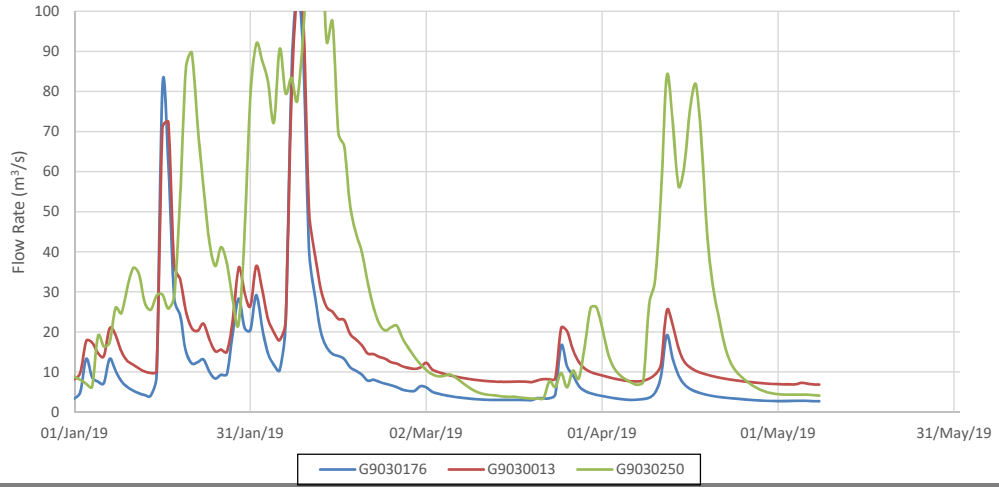
NORTHERN TERRITORY GOVERNMENT

Red Rock G9030250

- Station Commenced August 1966
- Mean Flow April 116 cumecs
- Median Flow April 21 cumecs
- Mean Flow 28 April 2019 5.5 cumecs

NORTHERN TERRITORY GOVERNMENT

Gauging Station Flow rates Jan - April 2019



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NORTHERN TERRITORY GOVERNMENT

Bitter Springs G9035212

- Station Commenced Oct 2004
- Mean Flow March-May 0.89 cumecs
- Median Flow March-May 0.86 cumecs
- Flow in 2019 No data

NORTHERN TERRITORY GOVERNMENT

Rainbow Springs G9035092

- Station Commenced Nov 2006
- Mean Flow March-May 0.42 cumecs
- Median Flow March-May 0.42 cumecs
- 17 April 2019 0.44 cumecs

NORTHERN TERRITORY GOVERNMENT

Modelled Flows Roper River

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NORTHERN TERRITORY GOVERNMENT

Elsey Homestead G9030013

- Projected Natural Flow 1 November 2019

  4.1 cumecs

- Projected Impacted Flow 1 November (under full entitlements)

  3.6 cumecs

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NORTHERN TERRITORY GOVERNMENT

Red Rock G9030250

- Projected Natural Flow 1 November 2019

  1.4 cumecs

- Projected Impacted Flow 1 November (under full entitlements)

  0.9 cumecs

NORTHERN TERRITORY GOVERNMENT

Bitter Springs (G9035212), and Rainbow Springs (G9035092)

- Projected Natural and Impacted Flow were not quantified, however based on our knowledge of the groundwater system spring flows are not expected to cease during this Dry Season.

NORTHERN TERRITORY GOVERNMENT

Appendix 2

Tindall Mataranka to Daly Waters Water Advisory Committee Meeting #9, 21-22 May 2019

Agenda Item 4 Meeting Paper

Proposal for groundwater discharge protection measures

Paper prepared by DENR Water Resources Division

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1. Purpose of groundwater discharge protection measures

Groundwater of the Tindall Limestone Aquifer comes to the surface at the lowest points in the landscape in the Mataranka district. In the Mataranka Tindall Limestone Aquifer Water Allocation Plan (WAP) area groundwater discharge is concentrated along the Roper River, Roper Creek, Waterhouse River, Elsey Creek and other smaller streams, and also in the swamp area of Elsey National Park.

The most common type of groundwater discharge in the WAP area originates from the widespread network of fractures in the limestone. Groundwater follows these fractures, eventually seeping to the surface through the bed and banks of the rivers and swamp areas. This seepage can occur along extended stretches of the river bed. In the case of Elsey Creek, seepage maintains a 20 kilometre-long waterhole upstream of the Roper Highway throughout the dry season.

Groundwater also emerges from large cavities, or cave-like openings, in the limestone, such as at Rainbow Spring (Najig[1]). The Tindall Limestone is the most cavernous of the three Daly Basin geological formations and features many such springs. Large volumes of crystal clear water flow year-round through these limestone cavities. Bitter Spring (Gorran[2]) and Rainbow Spring (Najig) discharge the most groundwater of all the cavernous springs in the WAP area, with flows averaging 130 and 300 litres per second respectively at the end of the dry season.

Discrete springs and seepages can be vulnerable to the localised effects of groundwater extraction, particularly during dry periods. This risk is exacerbated where cavernous groundwater flow paths in the karstic limestone may be intersected by a water extraction bore.

The protection measures proposed below are designed to mitigate the impact of local groundwater drawdown associated with pumping on discrete spring and seepage discharges, and assist in maintaining the direction of groundwater flow towards the river system even in very dry periods to help maintain riverine ecosystems.

2. Groundwater discharge areas

Figure 1 provides a map of groundwater discharge features located along and in the vicinity of the Roper River. The map includes discrete springs (red symbol) and the extensive zones of groundwater seepage into swamps, floodplains and stream beds (green shaded areas).

This mapping was published by DENR Water Resources Division in 2014. Further validation of the extent of key discharge areas may be required to ensure the mapping is as current as possible at the time of declaration of the Water Allocation Plan.

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[1] Mangarrayi place name (Source: Roberts, J.G. et al, 2011)
[2] Mangarrayi place name (Source: Roberts, J.G. et al, 2011)

Groundwater discharge from the Tindall Limestone Aquifer may also occur in areas away from the Roper River environs. This paper deals with establishment of a groundwater discharge protection zone in the vicinity of the Roper River, as shown in Figure 2. The approach may be applied to other potential areas of concentrated groundwater discharge in the WAP area, wherever they are identified through future hydrogeological surveys.

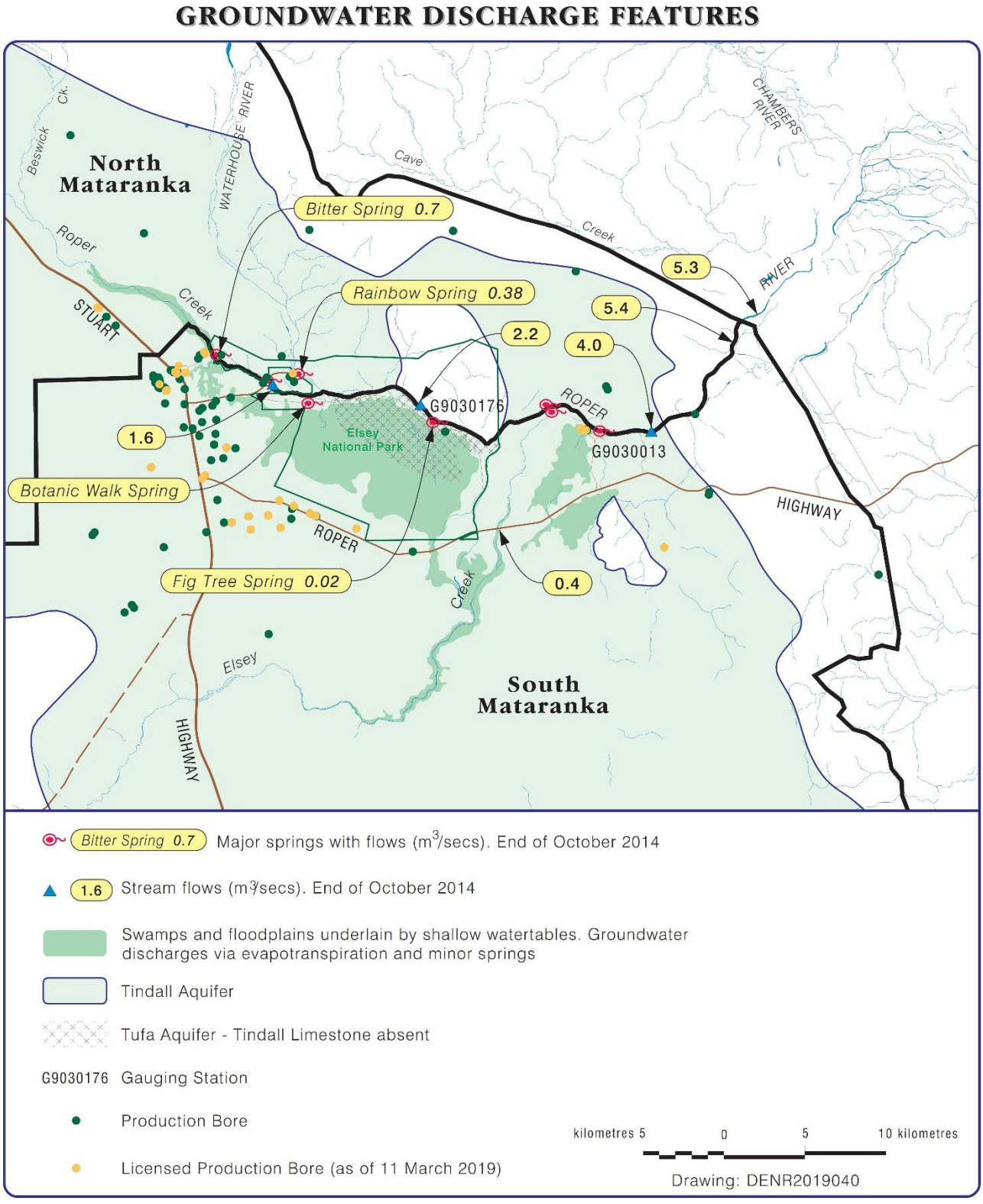

Figure 1: Groundwater discharge features of the Roper River region with location of surrounding production bores

Source: Tickell 2013, Water Resources Division, modified by Water Resources Division Geospatial Unit

3. Proposed groundwater discharge protection measures

As well as managing the overall volume of groundwater that can be taken for consumptive beneficial uses (e.g. agriculture and industry activities), the Water Allocation Plan for the Tindall Limestone Aquifer seeks to establish specific protection measures for groundwater discharge areas in the vicinity of the Roper River. The overall intent of these measures is to limit the number of groundwater extraction points and the volume of groundwater extracted, where this is likely to impact the values of the GDPA. These measures do not seek to infringe upon existing groundwater entitlements or water access rights provided for under the *NT Water Act*.

The following groundwater discharge protection measures are proposed:

1) Establishment of a Groundwater Discharge Protection Area (GDPA), creating a buffer of 1,500 metres around key groundwater discharge features (see Figure 2).
2) No new groundwater extraction points (bores) are granted within the GDPA;
3) No increases to existing water entitlements are granted within the GDPA;
4) Establishment of assessment criteria for applications of new or increased groundwater entitlements surrounding the GDPA, to mitigate the effect of groundwater drawdown at neighbouring extraction points on discharge within the GDPA.
5) Encouragement of permanent trade of existing groundwater entitlements away from the GDPA, to reduce the level of current extraction within the zone without loss of production benefit to the broader region;
6) Consistent application of the 'Management of Unused Licenced Water Entitlements' policy to existing groundwater entitlements within the zone, and avoidance of any future reactivation of these entitlements.

4. Potential implications

Natural water features (springs), abundant fishing opportunities, land suitability, access to quality groundwater and proximity to transport routes have been the draw card for the agriculture, forestry, pastoral, tourism and recreational fishing industries for many decades. Many production bores have been drilled in the vicinity of Mataranka and the Roper Highway where bore yields (flow) are generally high and reliable.

Several established production bores are located within the proposed groundwater discharge protection zone (see Figure 2). The proposed protection measures do not seek to interfere with existing bores or associated groundwater extraction entitlements. Specific recommendations in relation to the re-conditioning and replacement of bores within the GDPA will be included in the WAP to encourage relocation of bores away from discharge points, decommissioning of redundant bores and to avoid increases in bore yield capacity as a result of bore maintenance work.

Outside the discharge protection zone, there is future scope for groundwater development within the sustainable limits of the Estimated Sustainable Yield for each management zone in the WAP area. As such, the establishment of the groundwater discharge protection area and proposed management measures are not intended to be incongruous with economic development plans for the region.

The design of assessment criteria for applications of new or increased groundwater entitlements surrounding the GDPA will be based on technical considerations, such as transmissivity (rate of lateral flow through the aquifer), and hydrological modelling to determine the likely extent of groundwater drawdown in relation to the groundwater discharge protection area. The assessment will enable potential impacts to be mitigated through adjustments in the point of extraction (bore location) and/or the proposed pumping regime (timing and rate).

The groundwater discharge protection measures proposed in this paper are consistent with approaches taken in other Water Allocation Plans across the Daly Roper Beetaloo Water Control District.

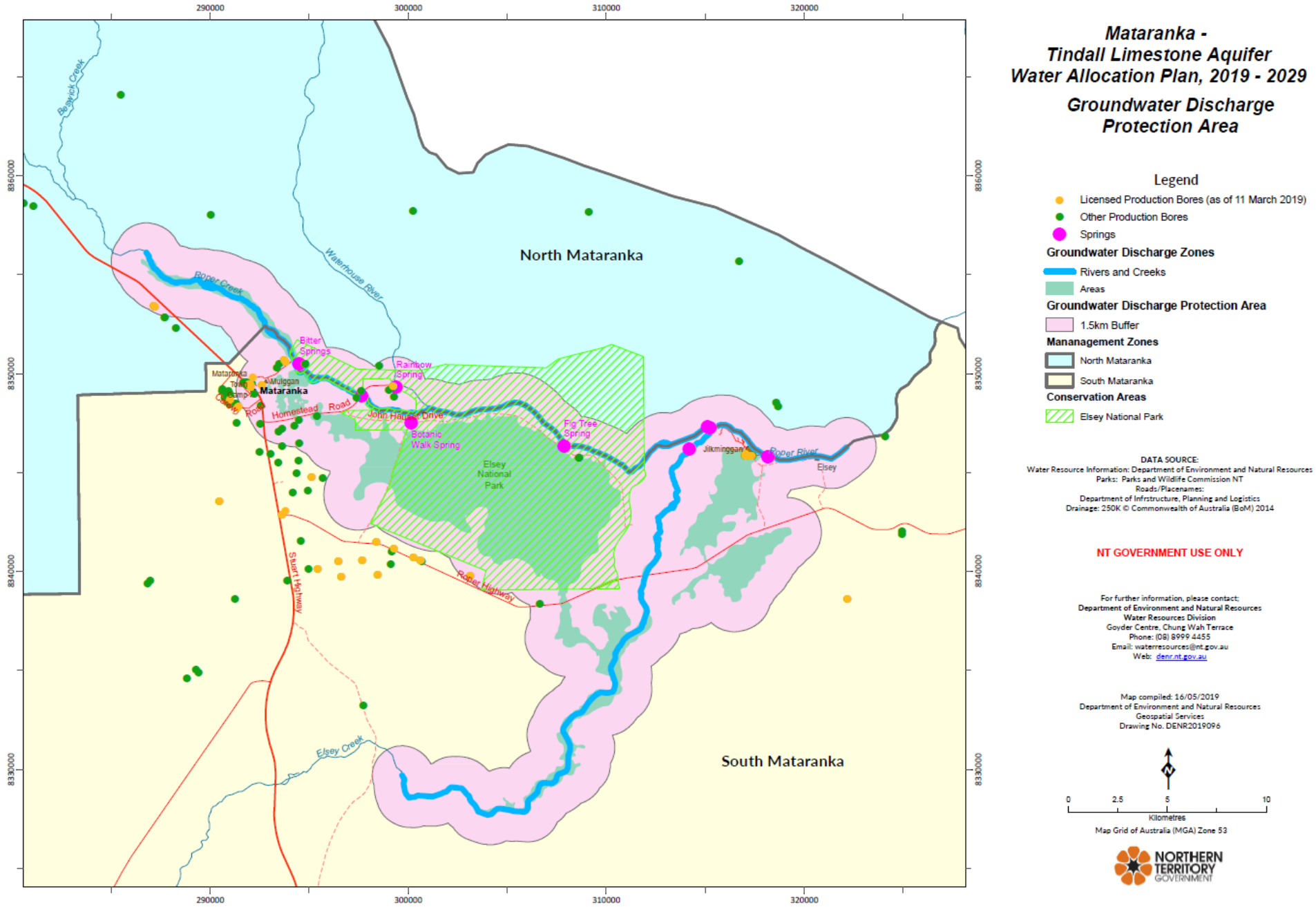

Figure 2. Proposed groundwater discharge protection zone for the Mataranka Tindall Limestone Aquifer Water Allocation Plan, showing 1,500 metre buffer around discharge areas and location of production bores (both licensed and stock and domestic)

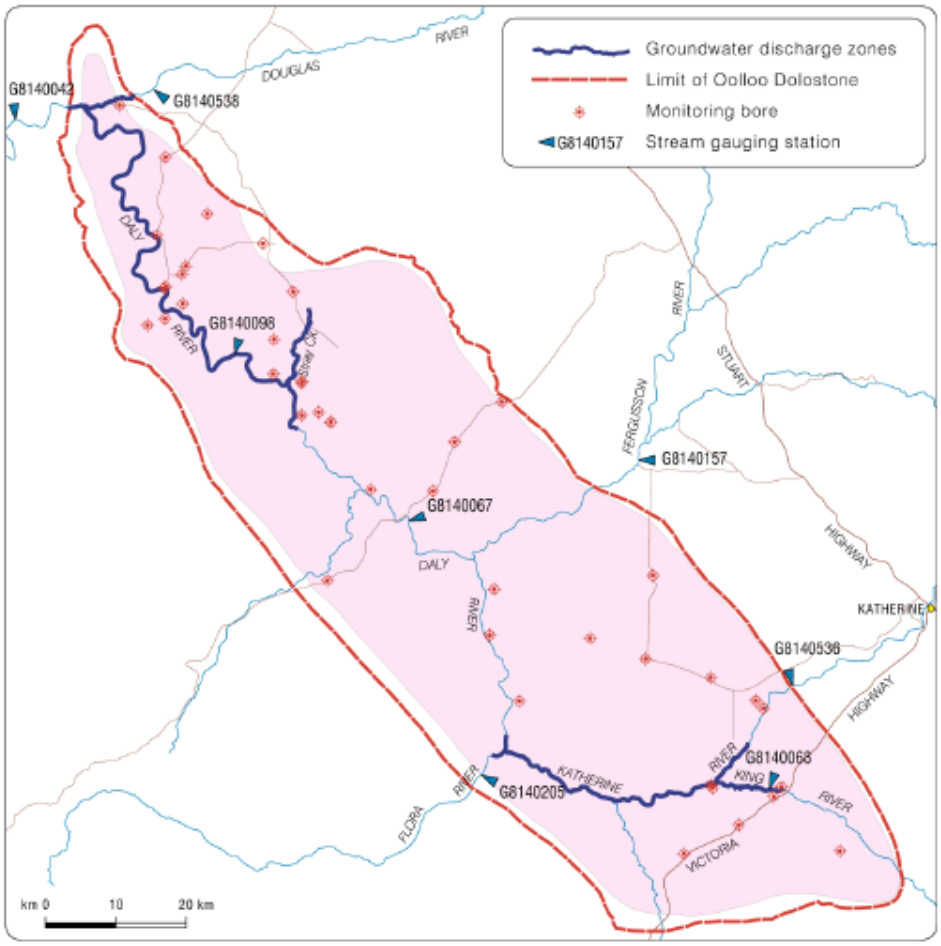

Figure 8-2 Monitoring bores and key gauging stations

8.4 *Risks to springs*

"Develop a robust workable system to identify measure and manage the risks to springs and dependent ecosystems caused by the allocation of water and land use changes in the region."

The discharge from the Oolloo aquifer comprises a multitude of individual springs and seepage zones spread out over many tens of kilometres along the river, mostly in inaccessible areas. The major portion of the discharge is unseen through the river bed. This means that in order to manage the springs they cannot be treated individually, rather they are best considered as broad zones along the rivers. Logical management zones would be the three delineated in Figure 2-8. They include the Katherine River, the Stray Creek and Daly River spring zones. The most significant in terms of discharge is the Stray Creek zone.

The management rules that specify minimum river flows at specified locations (Section 8.2) are designed to regulate the total amount of extraction permitted from the aquifer. The location of the bores is not however accounted for apart from two

broad management zones defined in the WAP, a northern and a southern one, each with their respective water allocations.

In general all groundwater extraction will eventually result in a corresponding reduction in discharge from the aquifer. The time frame that this occurs over is the important factor for maintaining environmental river flows. The location of production bores can influence this time frame. For example if a certain volume of water is pumped from bores distant from a spring, their radius of influence will likely not reach the river over a single Dry season. If the bores were located close to the spring and the same volume was pumped, groundwater levels could potentially be lowered at the spring, reducing its flow within a short time frame (hours to months). The more distant extraction will also affect spring flows but over a longer time frame (years to decades or longer).

In order to avoid direct interference of springs it would be prudent to set buffer zones around the spring zones in which new bores would not be permitted or in which maximum pumping rates would be set. There is currently a one kilometre buffer applied around streams for any land clearing application in the Daly catchment but no such buffer exists for bores. Evans (2007) discusses methods for estimating impacts on springs from groundwater extraction. These are based on the Theis equation which assumes the aquifers are of the porous media type, homogeneous and isotropic. Evans (2007) notes that "due to the complexity and variability of the natural environment there is no single robust and technically simple tool for predicting the impact of groundwater pumping on stream flow". This is particularly the case for the Oolloo aquifer which is karstic. That means that it contains macro-scale solution channels through which groundwater can move much more rapidly than through the micro scale network of pores and fractures. The use of the Theis equation is inappropriate in this case. For example if a high yielding bore tapped a major conduit its zone of influence on a spring would potentially be greater than that predicted using a method based on the Theis equation.

Despite the current lack of a rigorous scientific method for determining impacts of groundwater pumping on springs it would be prudent to set buffer zones as a precautionary measure. The nature of the three spring zones identified suggests that they can be treated differently in this regard. The main one, the Stray Creek spring zone contains individual springs with discharges up to 1 m^3/sec, suggesting that relatively large conduits are present in the aquifer. The other two zones are spread out along a much greater length of the rivers and are made up of many springs with small discharges. Groundwater levels measured on the Oolloo Crossing transect (Figure 8-3) give a broad indication of how groundwater pumping might affect the river. Under the present conditions groundwater flows towards the river where it discharges. The river is analogous to a pumping bore and the zone of significant influence on the watertable is of the order of 1,500 metres. In the absence of better information that distance could serve as a useful guideline for a buffer around the Daly River spring zone for production bores. Some large conduits almost certainly exist but a 1,500 metre buffer would protect the majority of springs and at the same time not be too greater hindrance to land owners. The Katherine River spring zone has similar characteristics so the same buffer could be applied.

The Stray Creek spring zone is more problematic because major conduits are certainly present. A buffer zone should therefore be greater than for the other two zones. The question is how extensive are large conduits? That is unknown but the current knowledge of the geology and of the distribution of caves and sinkholes suggests that large conduits are probably less common than those encountered in

the nearby Tindall aquifer. Considering the importance of this spring zone it is proposed here to double the buffer distance in this case to three kilometres.

Continued monitoring of Dry season river flows and of groundwater levels is important as buffer distances may need to be reassessed as development proceeds. It should also be noted that the current climate is wetter than the average and this is reflected in above average spring discharges (Figure 1-2 and Figure 2-10). When rainfalls revert to below average levels, groundwater levels will fall and the effects of pumping on spring flows will be more critical.

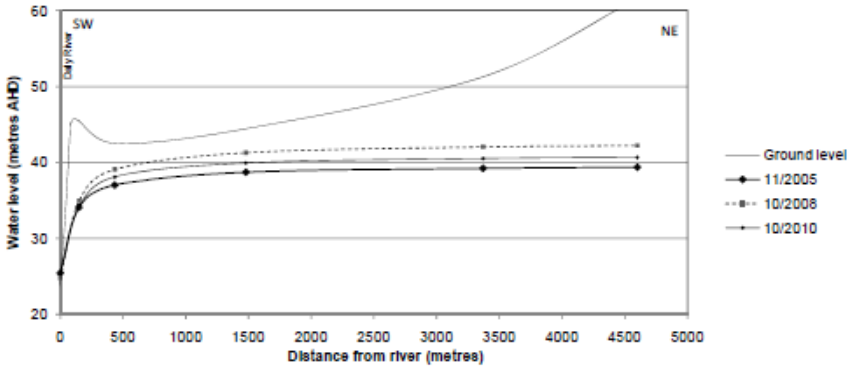

Figure 8-3 Groundwater levels at Oolloo Crossing, late Dry season, see Figure 4-1a for the location.

8.5 *Application of the study outcomes*

"Work collaboratively with water managers and industries that will depend on the water to ensure that the study outcomes are understood, relevant and applied."

The main purpose of the current study is to provide a better scientific basis for the Oolloo WAP. As such NRETAS the department responsible for managing the plan is the primary audience. The computer model used to determine water allocations has already been modified by some of the current findings. For example, the revised extent of the aquifer has been taken into account by the model.

It is anticipated that in the short term various others will also be incorporated. For example, the improved gauging data will constrain the current distribution of transfer rates used in the model. The environmental tracer data could be incorporated into the current coupled model as a comparison and validation. The new conceptualization of the aquifer (Figure 8-1) from equivalent porous media to dual continua may be implemented in the model. The assumption of little to no bank storage assumed by the current coupled model is validated.

In the longer term a soil-vegetation-atmosphere transfer (SVAT) model, such as SWAT (see: Chapter 7) could be used in combination with the current groundwater / surface water model. Previous groundwater flow modelling of the Oolloo Dolostone (Knapton, 2005; Knapton, 2006) identified that an improved estimate of recharge with

Tindall Mataranka to Daly Waters Water Advisory Committee Meeting #9, 21-22 May 2019

Agenda Item 5 Meeting Paper

Proposed approach to the integration of dry season surface water extraction within water-sharing arrangements for the Mataranka Tindall Limestone Aquifer

Paper prepared by DENR Water Resources Division

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1. Dry season groundwater-surface water connectivity

During the dry season, stream flow in the freshwater reaches of the Roper River - from the upper catchment near Mataranka to Roper Bar near Ngukurr - is sustained almost entirely by Tindall Limestone Aquifer groundwater discharge originating from springs and seepages within the Mataranka Tindall Limestone Aquifer Water Allocation Plan (WAP) area.

Throughout the wet season, most of the streamflow in the Roper River is sustained by overland flow from the catchment and is typically 100 times greater than groundwater discharge flow. During the dry season, inputs of overland flow to the river are negligible; river levels on the Roper are at their lowest and streamflow is comprised almost entirely of groundwater discharged from the Tindall Limestone Aquifer.

Figure 1 is a schematic showing a typical annual hydrological cycle for a perennial groundwater-fed river like the Roper. It highlights the significant seasonal difference in contribution of groundwater and surface water flows characterised as four key phases in the river's hydrological cycle.

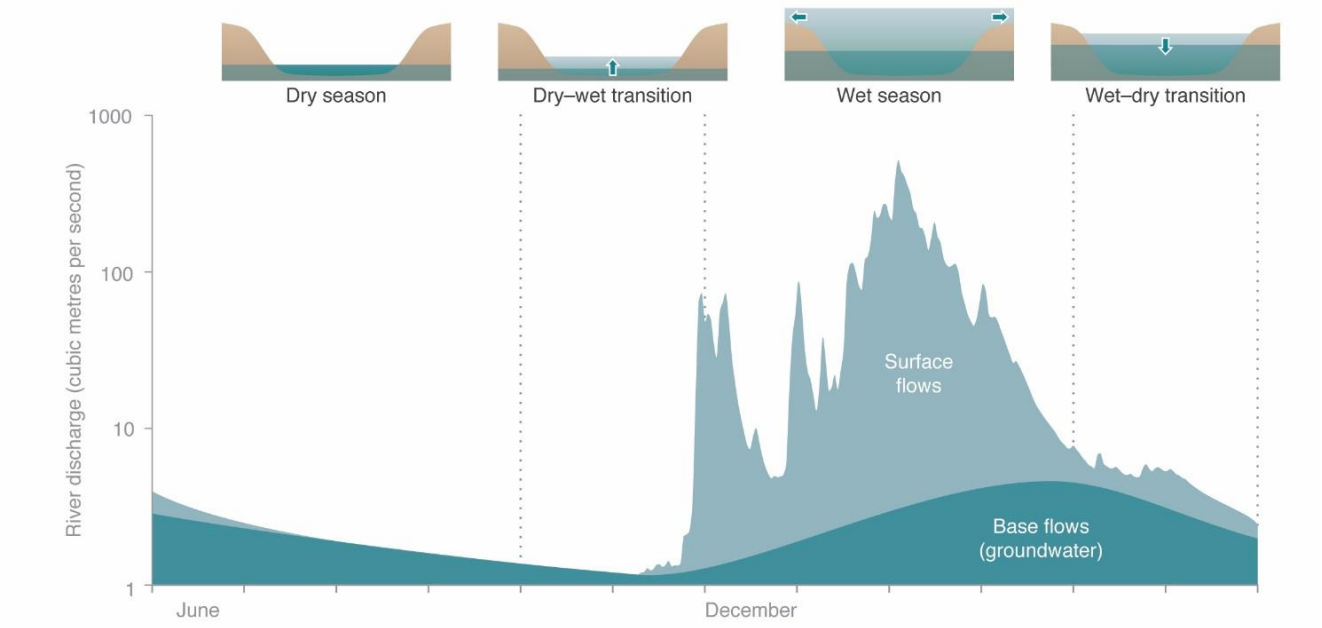

Fig. 1 Schematic hydrological cycle for a typical perennial groundwater-fed river in the Top End

Source: Research project investigating environmental flow requirements in the Daly River, funded by the Australian Government's National Environmental Science Project

The dominance of groundwater in dry season streamflow means that extraction of groundwater from bores inside the WAP area can reduce streamflow (and change water quality) in the Roper River during the drier months of the year. This could potentially impact:

a. dry season streamflow and water quality along the entire freshwater extent of the Roper River;

b. environmental and cultural values of the river dependent on natural low flows during the dry season e.g. the Livistona palm forests of Red Lily Lagoon and the many freshwater pools supporting subsistence and recreational fishing;

c. water accessibility for existing consumptive beneficial uses of surface water in the downstream reaches of the river e.g. in the Roper Valley and at Ngukurr; and

d. Increase the risk of fish kills.

2. Defining the water resource managed by the Water Allocation Plan

It is important that the Water Allocation Plan is clear about the extent of the water resource to which water-sharing and management arrangements will apply.

This paper proposes to define the extent of the water resource as:

1. *Groundwater of the Tindall Limestone Aquifer within the boundary of the Plan area; and*
2. *Dry season streamflow in the entire freshwater extent of the Roper River, including the creeks and rivers of the upper catchment near Mataranka overlaying the Tindall Limestone Aquifer and the downstream reaches of the Roper River to the Roper Pool at Ngukurr.*

This definition provides a clear acknowledgement that groundwater discharge from the Tindall Limestone Aquifer to the Roper River is considered part of the same water resource as the Tindall Limestone Aquifer. It also recognises that the entire river system is dependent on groundwater discharges flowing out of the WAP area during the drier months of the year.

Water management approaches that recognise groundwater-surface water connectivity are currently being applied in other parts of the *Daly Roper Beetaloo Water Control District* where surface water and groundwater are also highly connected, such as in the Katherine Tindall Limestone Aquifer and Oolloo Dolostone Aquifer Water Allocation Plan areas.

This approach also provides a bridge to a future integrated catchment-based water allocation planning model for the Roper catchment. The Mataranka Tindall Water Advisory Committee supports this model, recommending that the scheduled midway (5-year) review of the WAP be brought forward to year two, to quicken the transition to a catchment-based WAP model.

The 2-year WAP review is also a logical alignment with other investigations currently underway (e.g. the *Strategic Regional Environmental Baseline Assessment* (SREBA), the *Geological and Bioregional Assessment* (GBA) and updates to the Roper Hydrological Model. These projects will substantially refine our understanding of the region's major aquifers and connected surface water systems, and help to fill critical knowledge gaps in relation to the distribution and water requirements of groundwater-dependent ecosystems.

3. Integrating groundwater-surface water connectivity into water-sharing and management arrangements

This paper proposes that the dependency of dry season stream flows in the Roper River on groundwater of the Tindall Limestone Aquifer be acknowledged and operationalised within the WAP in the following ways:

a. **Dry season surface water extraction assessed as groundwater**
Dry season surface water extraction (current and proposed) from the area within the Plan boundary and the full freshwater extent of the Roper River is considered as part of the same groundwater resource under the management arrangements and environmental flow thresholds established by the Mataranka Tindall Limestone Aquifer Water Allocation Plan.

b. Surface water stock and domestic use included in water account
The volume of dry season surface water take for stock and domestic purposes from the area within the WAP boundary and downstream to Roper Bar is estimated and accounted for as groundwater drawn from the Tindall Limestone Aquifer.

c. **Assessment of impact on downstream surface water users**
New groundwater developments or dry season surface water extraction inside the WAP area should not adversely impact water reliabilities for existing downstream users of surface water.

d. **Assessment of impact on downstream flow thresholds**
New groundwater developments and dry season surface water extraction inside the WAP area and from the downstream freshwater reaches of the Roper River, should not cause a breach of the established flow threshold at Elsey or Red Rock gauging stations.

e. Accounting of downstream surface water extraction within the Estimated Sustainable Yield for the Mataranka Tindall WAP
All surface and groundwater extraction entitlements from the defined water resource will fall into one of nine categories of beneficial use declared for the *Daly Roper Beetaloo Water Control District* (April 2019). The Estimated Sustainable Yield (ESY) established by the WAP should account for the combined beneficial uses of groundwater extraction from the WAP area and dry season surface water extraction from the entire freshwater extent of the Roper River.

f. Application of the *Prioritising Water Extraction Licence Applications* policy to the combined groundwater-surface water resource
Applications for a groundwater extraction licence within the Mataranka Tindall Limestone Aquifer WAP area and applications to extract dry season flow from within the freshwater extent of the Roper River will be assessed within the Mataranka Tindall Limestone Aquifer WAP under the provisions of priority order established by the *Prioritising Water Extraction Licence Applications* policy statement i.e. on a sequential and orderly 'first-in, first-served' basis.

g. Assignment of dry season surface water extraction to WAP management zones
To properly account for dry season surface water extraction within the WAP area and in the freshwater extent of the Roper River, the volume extracted should be assigned to WAP management zones, that is, to a single zone or apportioned across multiple zones.

While it is not possible to accurately determine the management zone origin of the surface water being extracted, consideration might be given to the relative contribution of groundwater to the river system from each of the zones. Based on modelled discharge values for the last 118 years, the South Mataranka management zone contributes over 80% of the total volume of groundwater discharged to the Roper River, with less than 20% originating from the North Mataranka management zone. The Larrimah management zone does not discharge directly into the Roper River, but as it lies up-gradient of the South Mataranka management zone and is hydrologically connected to it, it would be reasonable to ascribe Roper River surface water extraction to this zone.

The following process for assigning dry season surface water extraction to a groundwater management zone is proposed.

Assessment: Is there water available within the ESY for the Mataranka Tindall Limestone Aquifer WAP?

NO - No new surface water extraction licences from the Roper River during the dry season

YES - Is the extraction from within a groundwater management zone in the Plan area?

- **YES - Is there water available within the ESY for this management zone (MZ)?**
  - YES - Granting of new surface water extraction licences from the Roper River during the dry season for this MZ is subject to all relevant factors to be considered when making a decision to grant water
  - NO - No new grants should be made for surface water extraction licences during the dry season from the Roper River.
- **NO -** Apportion water between management zones where water is available on the following basis:
  - A: 20% to the North Mataranka MZ and 80% to South Mataranka MZ, or
  - B: wherever water is available until the North Mataranka and South Mataranka MZs are fully allocated, then to the Larrimah MZ.

h. Interaction with draft policy directions on harvesting of surface water flows
Taking surface water during the wet season may impact on wet-dry transition flows (refer Figure 1) by putting more pressure on dry season groundwater discharge flows. The WAP will interact with this policy (currently in prep) to manage and account for wet season surface water harvesting that may impact on dry season flows.

4. Implications for current and projected water account

Table 1 provides figures for total and projected water use within the boundary of the Water Allocation Plan area also for the connected groundwater-surface water resource as it is defined in this paper i.e. groundwater extraction from the Mataranka Tindall Limestone Aquifer and the surface waters of the freshwater extent of the Roper River in the dry season.

Figures in the table for Rural Stock & Domestic use are preliminary estimates only, and are applied in this analysis as estimations of both current and projected use.

Strategic Aboriginal Water Reserve entitlements are yet to be included in this summary table. These allocations can only be calculated once the Estimated Sustainable Yield for each management zone is established. Preliminary figures indicate a notional entitlement of approx. 6000 ML/yr for the whole WAP area.

Table 1. Summary of current and projected water entitlements for both the WAP area and the surface waters of the Roper River.

All figures in megalitres per year (ML/yr)	Total Plan Area	Management Zone		
		North Mataranka	South Mataranka	Larrimah
Entitlements within WAP boundary				
A. Groundwater entitlements exempt from licencing				
Rural Stock & Domestic and Small Volume Uses <5ML/yr *Estimates to be refined before WAP is finalised*	690	180	360	150
B. Licensed groundwater entitlements				
Current	25,625	1,800	21,950	1,875
Projected (over 10 years) *Based on current applications for water & land clearing and general interest in water development*	32,750	1,800	21,950	9,000
Strategic Aboriginal Water Reserve (SWR) entitlements	*Volumes to be incorporated once an Estimated Sustainable Yield is established for each management zone*			
A & B. Total entitlements with WAP boundary				
Current	26,315	1,980	22,310	2,025
Projected	33,440	1,980	22,310	9,150
Additional entitlements within proposed connected water resource				
C. Surface water entitlements exempt from licencing Includes entire freshwater extent of Roper River				
Rural Stock & Domestic *Estimates to be refined before WAP is finalised*	500			
D. Licensed or authorised surface water entitlements				
Current *Mining & Public Water Supply*	1,681			
Projected (over 10 years) *Based on current applications for water*	7,500			
C & D. Total additional entitlements within proposed connected water resource				
Current	2,181			
Projected	8,000			
Total entitlements for the connected water resource, as defined in this paper				
Total current	**28,496**			
Total projected	**41,440**			

END

Strategic Aboriginal Water Reserve (SWR)

Management Zone	Land area (ha)	Area of land eligible for SWR entitlements (ha)	Proportion of zone eligible under SWR	Percentage of 'available consumptive pool' reserved in SWR
North Mataranka	269,237.6	61,551.2	22.86%	22.86%
South Mataranka	282,122.4	234,380.7	83.08%	30.00%
Larrimah	376,897.3	38,679.4	10.26%	10.26%

North Mataranka – scope to allocate an SWR, opportunity for Aboriginal economic development or benefits from trade

South Mataranka – only possible to allocate a 'notional' SWR as no water available in consumptive pool

Larrimah - scope to allocate an SWR, opportunity for Aboriginal economic development or benefits from trade

Tindall Mataranka to Daly Waters Water Advisory Committee Meeting #9, 21-22 May 2019

Agenda Item 6 Meeting Paper

Using median annual recharge to inform sustainable water-sharing arrangements for the Mataranka Tindall Limestone Aquifer

Paper prepared by DENR Water Resources Division

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1. How is the Tindall Limestone Aquifer recharged in the Water Allocation Plan (WAP) area?

Recharge is the process by which water enters an aquifer. In the WAP area, this occurs primarily through the percolation of rainfall to the underlying Tindall Limestone Aquifer. The aquifer also receives a small amount of lateral inflow from neighbouring aquifers in the Georgina Basin to the south of the Plan area.

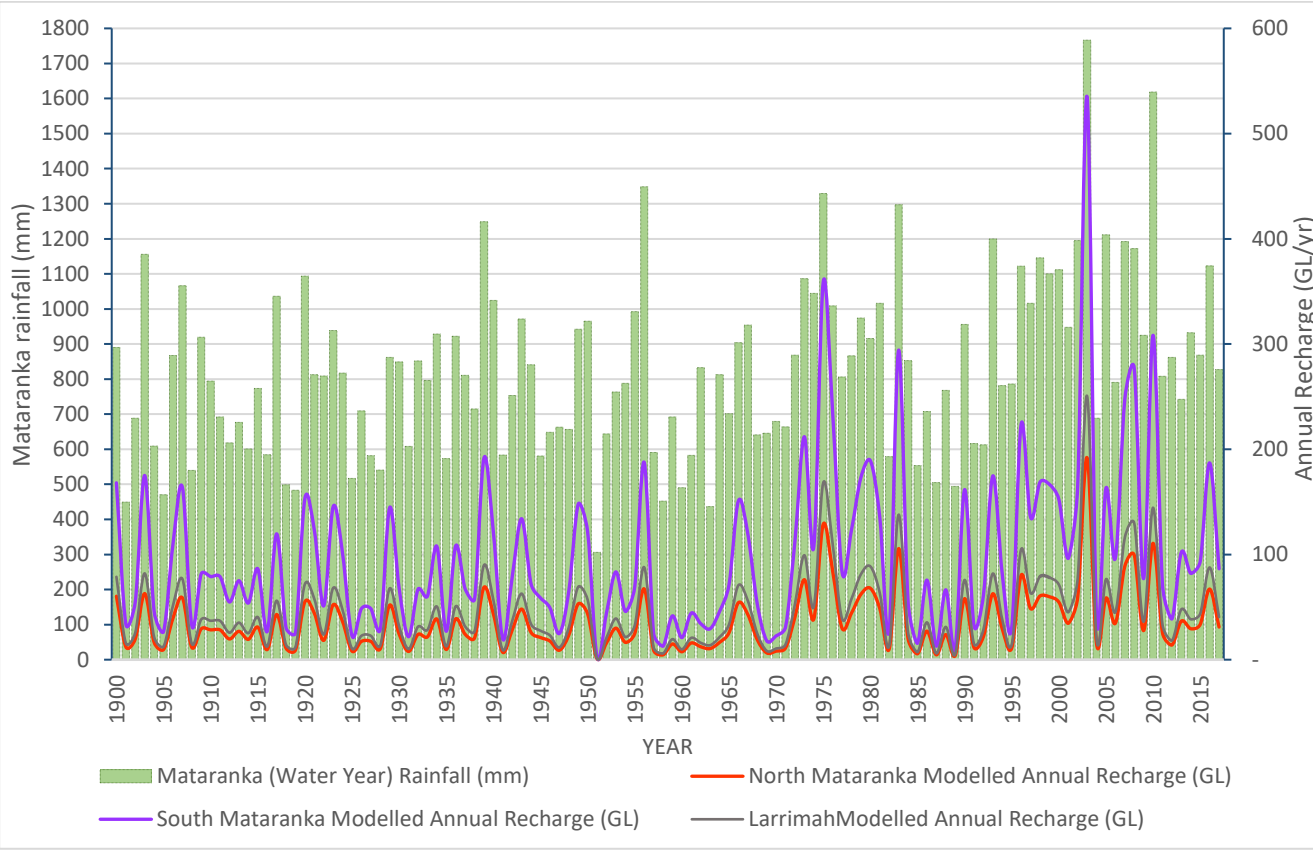
The Mataranka Tindall Limestone Aquifer WAP will include only groundwater sourced from rainfall at the land surface as aquifer recharge. It will not include lateral inflows of groundwater from neighbouring aquifers to the south in the Georgina Basin that are likely be the subject of the Beetaloo water allocation plans. Lateral inflow from the Georgina Basin will be preserved in the groundwater account, rather than included in the pool of groundwater potentially available for extraction. This preservation of lateral flow ensures 'double-dipping' for consumptive beneficial uses does not occur across the two connected WAP areas.

Aquifer recharge is influenced by rainfall amount and pattern, depth of the aquifer from the land surface to permeability of the soil and overlying strata and the land use/ land cover. The rate of aquifer recharge is variable across the three management zones in the WAP area. Figure 1 demonstrates the responsiveness of aquifer recharge to rainfall in each management zone.

In the North Mataranka and South Mataranka management zones recharge is strongly seasonal i.e. recharge (and groundwater levels) are responsive to significant rainfall events. Rainfall percolates readily through the soil and karstic limestone, especially where the limestone is exposed to or very near the surface. Aquifer recharge in the Larrimah Management Zone (MZ) is much less seasonal which means that groundwater levels are less responsive to rainfall events. The aquifer here is overlaid by a thick layer of Cretaceous sediments which are high in clay content, making them less permeable. This layer slows down the rate of rainfall percolation to the aquifer. Additionally, the more arid climate of the Larrimah MZ contributes comparatively less recharge to the aquifer than the higher rainfall management zones to the north.

There is also a relationship between recharge and discharge from the aquifer that is affected by the distance between discharge points and recharge zone and the transmissivity of the aquifer. Recharge also affects local groundwater levels. In recharge zones the groundwater level are more strongly linked to recharge events. If the aquifer is confined, there is no direct recharge.

Figure 1. Annual rainfall at Mataranka with modelled recharge for each WAP management zone for 1900-2018



2. How does recharge relate to water-sharing arrangements in the WAP?

Recharge can be used as an indicator of the total volume of water in the Mataranka Tindall Limestone Aquifer available to provision environmental and cultural needs and sustainable consumptive uses. More specifically, it is a surrogate for the groundwater needed to support ecosystems, ecological function, the cultural values of water places, and the productive base of the resource.

The Integrated Surface–Groundwater Model of the Roper River Catchment (the Roper Model) is used to make predictions about the volume of aquifer recharge (and, therefore, total water availability) that can be expected on an annual basis over the 10-year life of the Water Allocation Plan and beyond.

Decisions about water-sharing begin with determining what proportion of recharge must remain in the system to sustain environmental and cultural values.

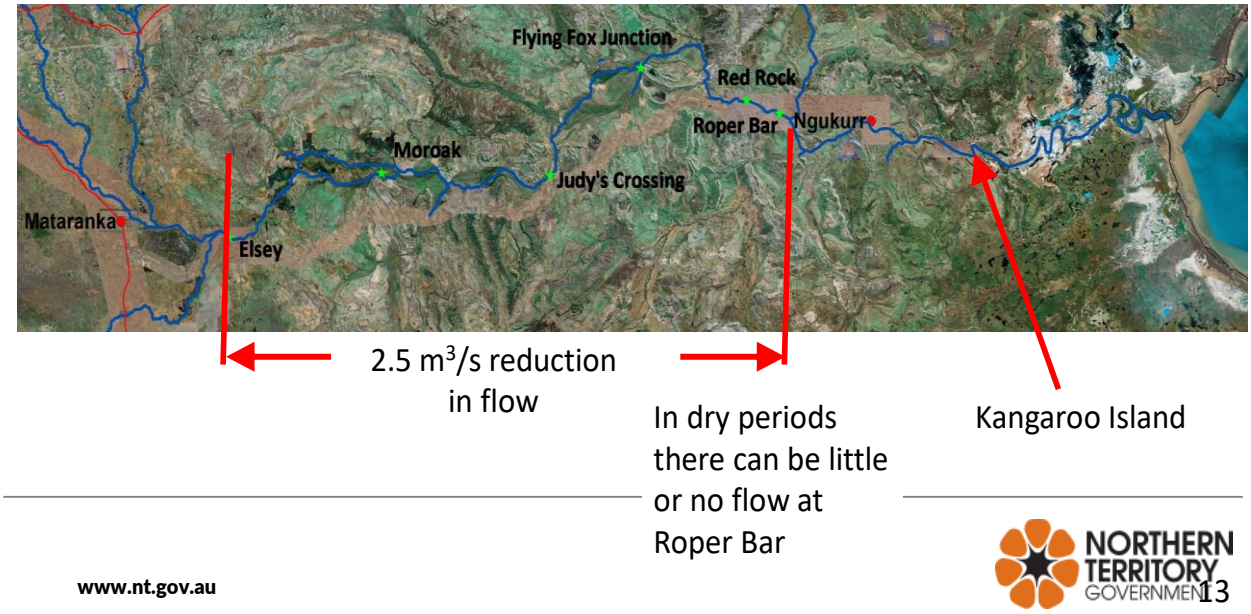
The next step is to confirm what proportion of recharge can be taken by declared beneficial uses (e.g. agriculture, public water supply), without causing detriment to environmental and cultural values. The amount of water that can be sustainably taken without compromising key environmental and cultural values is known as the Estimated Sustainable Yield, or ESY. The ESY represents the upper limit of sustainable annual groundwater extraction over the life of the Water Allocation Plan.

In the Mataranka region, the Tindall Limestone Aquifer discharges to the tributaries of the upper Roper River and surrounding floodplains and swamps. In the dry season, this discharge makes up nearly all of the streamflow in the freshwater extent of the river. Analysis of dry season losses to evapotranspiration in the 'losing' part of the Roper River between Elsey gauging station (inside the WAP area and Red Rock gauging station (upstream from Roper Bar) shows that streamflow reduces

on average by 2.5 cumecs (cubic metres per second) between these two points – see Figure 2. Converted to a flow volume, this equates to 78,840 ML/yr (megalitres per year). The natural water balance for the WAP indicates that median annual discharge (based on 118-year dataset) is 112,700 ML/yr. This means that about 70% of all the groundwater discharged from the Tindall Limestone Aquifer within the WAP area is required to support the natural process of dry season streamflow loss in the river, downstream of the WAP boundary.

Figure 2. Reaches of the Roper River showing reduction loss between Elsey and Roper Bar

Sourced from presentation by Director of Water Assessment, Des Yin Foo, at Meeting 8 of the Water Advisory Committee



This groundwater-surface flow connectivity means that the aquifer recharge in the WAP area is provisioning environmental and cultural water needs far beyond the geological extent of the Tindall Limestone Aquifer and WAP boundary.

It is proposed that the water-sharing arrangements established by the WAP will account for this regional-scale groundwater-surface water dependency. The Meeting Paper for Agenda Item 5 describes this approach in more detail.

3. How are recharge values calculated?

The Roper Model uses a combination of observed and modelled climate and hydrological data, from the year 1900 onwards, to generate values for groundwater inflows and outflows through the Tindall Limestone Aquifer and the Roper River system. This is also known as a 'water balance'. The Roper Model also uses data about geology, terrain, land cover and biophysical features to make predictions about the dynamics of the natural water balance and streamflows.

The model generates values for the volume of aquifer recharge, discharge, storage, through flow and other hydrological components of the water balance. Annual values are generated for each year from 1900 to 2018 (118 years), and for both the total WAP area and each management zone. The model can be used to look at natural conditions under different circumstances and, by introducing information about actual or proposed extraction, it can predict the impact of taking water from the water resource.

Average annual recharge is calculated by taking the 'median' of the modelled annual recharge volumes in a dataset. The median represents the middle value of each dataset i.e. half of the recharge values in the dataset will be greater than the median and half will be less. The use of 'median' values (instead of 'mean' values) is the statistical approach recommended by Water

Resources Division on the basis that 'medians' better represent the typical volume of annual recharge over the data period. This approach is also supported by the Water Advisory Committee.

A median value can be calculated for any span of years within the 118-year dataset. The Water Advisory Committee and Water Resources Division has considered the merits of two approaches to calculating median annual recharge:

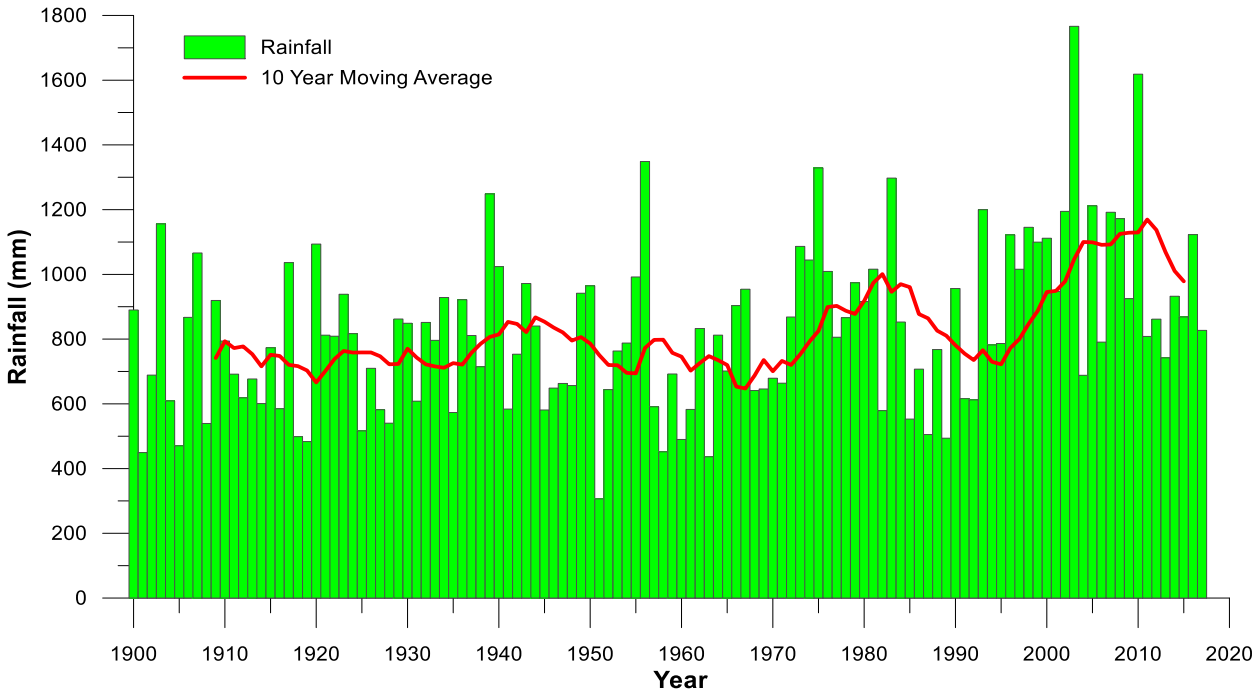
(1) use of a subset of the most recent 58 years in the dataset i.e. 1960 – 2018; and

(2) use of the full 118-year dataset.

At Meeting 8 of the Water Advisory Committee the Water Resources Division proposed the use of the 58-year dataset. After much consideration, the Water Advisory Committee expressed an alternative view, and a preference for use of the entire 118-year dataset to calculate median annual recharge values. The Committee took this position on the basis that:

- this approach captures prolonged periods of below and above average climate conditions, given the first half of the 1900s was characterised by low rainfall (and low recharge), and the latter part of the century and early 2000s by sustained periods of above average rainfall (see Fig. 3 rainfall graph below), and therefore represents a more realistic long-term figure for total water availability in the system;
- the 118-year dataset captures the decadal variability of wet and dry climate condition that is typical of this region better than the 58-year dataset;
- recharge values calculated on the full 118-year dataset will be less in volume than those for the recent 58-year dataset, thereby providing a buffer or contingency within water-sharing arrangements in the event that the current climate trends towards a prolonged , multi-year dry period; and
- water-sharing arrangements underpinned by an assumption of continued above average rainfall conditions (i.e. the 58-year period), presents a potential risk to environmental and cultural values which is concerning to the Committee.

Figure 3: Mataranka Rainfall Record 1900 to 2018



Source: DENR Water Assessment presentation (by Des Yin Foo) on the Mataranka Tindall Water Balance (March 2019)

4. Summary of median annual recharge volumes

Table 1 compares modelled median annual recharge figures for each management zone over the 58-year and the 118-year data periods.

Median annual recharge calculated over the 118-year period is 141,000 ML. This amount is lower than the median annual recharge figure calculated over the 58-year period (175,000 ML). The difference reflects the influence of the prolonged dry years of the early 1900s which are part of the longer 118-year dataset.

Table 1. Comparative median annual recharge values and land area of WAP management zones

Management Zone	Land area (ha)	% of Plan area	% recharge in each zone	Median annual recharge	
				Based on 58-year dataset (ML/yr)	Based on 118-year dataset (ML/yr)
Northern Mataranka	269,237	29.0%	20%	35,000	28,000
Southern Mataranka	282,122	30.4%	55%	96,000	77,000
Larrimah	376,898	40.6%	25%	44,000	36,000
Total WAP Area	**928,257**	**100%**	**100%**	**175,000**	**141,000**

Comparing the median annual recharge and land area of each management zone, it is evident that the more arid climate of the Larrimah MZ coupled with the less permeable Cretaceous sediments overlying the Tindall Limestone, has a tempering effect on recharge in this zone.

Similarly, recharge in the North Mataranka MZ is comparatively low due to the interception of rainfall by the Jinduckin Formation which overlies (confines) the Tindall Limestone.

Recharge is highest in the South Mataranka MZ where the Tindall Limestone is closer to and frequently outcropping at the surface, enabling rainfall to percolate into the aquifer more readily.

5. Using the NT Water Allocation Planning Framework to shape water-sharing arrangements and the Estimated Sustainable Yield

Estimated Sustainable Yield

Median annual recharge can be used in the WAP as an indicator of the total volume of groundwater within the Mataranka Tindall Limestone Aquifer WAP area, which is available for provisioning:

a) the water needs of the environment and cultural values within the WAP area and along the entire freshwater extent of the Roper River, and

b) the water needs of consumptive beneficial uses such as public water supply, stock watering and irrigated agriculture.

The Water Allocation Plan is required by the *NT Water Act* to ensure that environmental and cultural water needs are fully provisioned before water is allocated to consumptive beneficial uses. The maximum volume of water deemed to be available for consumptive beneficial uses is known as the Estimated Sustainable Yield (the ESY).

The ESY is defined as follows:

> *To meet the requirements of section 22B of the Water Act, the estimated sustainable yield is the amount of water that can be taken from the water resource to support declared beneficial uses without compromising key cultural and environmental values, or ecosystem functions or the productive base of the resource or declared water quality standards, criteria or objectives.*

An ESY will be determined for the total WAP area. A portion of the total ESY will be assigned to each of the three management zones. The ESY for each zone should reflect the characteristics of the natural water balance and ecosystem water requirements in each zone.

As a portion of the total water available in the Mataranka Tindall Limestone Aquifer, the ESY for the Water Allocation Plan is effectively a portion of the agreed median annual recharge.

Application of the NT Water Allocation Planning Framework

The *NT Water Allocation Planning Framework* (the NTWAPF) provides the policy basis for the use of recharge figures in determining the ESY, in situations where there is an absence of scientific information about of the specific water requirements of ecosystems and cultural practices.

As has been previously discussed with the Water Advisory Committee, the limitations of our current scientific understanding of the specific water requirements of environmental and cultural values within the WAP area and the freshwater reaches of the Roper River means that we have an inadequate evidence base on which to set environmental flow targets for the WAP. Such targets are important for the longer-term assessment of sustainable limits to groundwater extraction (the Estimated Sustainable Yield), and for the year-to-year assessment of licenced extractions in response to climatic pressures undertaken by the announced allocations process.

An adaptive management framework will be developed for the WAP to assist decision-making during the implementation phase of the WAP. Such a framework would aim to reduce uncertainty by monitoring water resource conditions and responses to management actions and use this information to adapt subsequent management actions over the life of the WAP.

Until such time as more scientific information is available, the NTWAPF will be used as a starting point for determining the portion of median annual recharge that should remain in the system to support environmental and cultural water needs, and the portion that can be assigned to the Estimated Sustainable Yield for use by consumptive beneficial uses.

The NTWAPF provides the following guidelines for water allocation in Top End rivers and aquifers:

> ***Rivers***
> *At least 80 per cent of flow at any time in any part of a river is allocated as water for environmental and other public benefit water provision, and extraction for consumptive uses will not exceed the threshold level equivalent to 20 per cent of flow at any time in any part of a river.*
>
> *In the event that current and/or projected consumptive use exceeds the 20 per cent threshold level, new surface water extraction licences will not be granted unless supported by directly related scientific research into environmental other public benefit requirements.*
>
> ***Aquifers***
> *At least 80 per cent of* ***annual recharge*** *is allocated as water for environmental and other public benefit water provision, and extraction for consumptive uses will not exceed the threshold level equivalent to 20 per cent of annual recharge.*
>
> *In the event that current and/or projected consumptive use exceeds the 20 per cent threshold level, new groundwater extractive licences will not be granted unless supported by either directly related scientific research into groundwater dependent ecosystem/cultural requirements, or in the*

absence of such research, hydrological modelling confirming that total groundwater discharge will not be reduced by more than 20 per cent.

Table 2 provides comparative figures for the contingent 20% proportion of modelled median annual recharge for different datasets. Figures for current and full use of existing groundwater extraction entitlements are also provided.

Table 2. Comparative proportional recharge and figures for current and full use of existing groundwater entitlements

All figures in megalitres per year	1960 – 2018 dataset		1900 - 2018 dataset		Existing licensed and un-licensed (stock & domestic) groundwater entitlements in WAP area	
Management Zone	**Median annual recharge**	**20% recharge**	**Median annual recharge**	**20% recharge**	**Current use** 28.5% of max entitlements	**Full use** 100% of max entitlements
Northern Mataranka	35,000	7,000	28,000	5,600	298	1,980
Southern Mataranka	96,000	19,200	77,000	15,400	7049	22,310
Larrimah	44,000	8,800	36,000	7,200	159	2,025
Total WAP Area	**175,000**	**35,000**	**141,000**	**28,200**	**7506**	**26,315**

To establish the ESY using the contingent 80:20 rule, the planning process must first ascertain how dry season streamflows in the Roper River might be impacted if up to 20% of median annual recharge is extracted from the groundwater resource. The Roper Model is used to simulate hydrological changes in the system and report on the magnitude of that change. Results of the modelling will determine whether the proportion of recharge available for groundwater extraction may need to be reduced to meet the 20% threshold of acceptable change in Roper River dry season streamflow recommended by the NTWAPF.

It is anticipated that modelling results for two extraction scenarios – (1) current groundwater use and (2) full use of groundwater entitlements – will be available for consideration during Meeting #9.

6. A climate-responsive approach to establishing the ESY

At Meeting 8 of the Water Advisory Committee, the Department presented a proposal for a climate-responsive approach to the ESY. This approach recommended that up to 20% of median annual recharge be allocated to the ESY, except in very dry climate conditions when it would be reduced to mitigate potential stress on environmental and cultural assets. The Committee considered this proposal but did not reach a resolution on its application to the Water Allocation Plan. At Meeting 9, the Committee will further discuss the merits of a climate-responsive approach, as well as the more typical approach of determining a static figure for the ESY.

While the Estimated Sustainable Yield of a water resource establishes an upper limit to groundwater extraction over the entire life of the Water Allocation Plan, the year-to-year management of licenced water entitlements under the Announced Allocations process takes climate pressure, such as below average rainfall, into account to determine sustainable annual extraction limits. The Mataranka Tindall Limestone Aquifer Water Allocation Plan lies within the Top End climate zone of the NT and, as such, AAAs can be applied to all extraction licences.

During Meeting 9, the Water Advisory Committee may wish to further discuss the merits of different approaches to incorporating climate-responsiveness into the water-sharing arrangements being developed.

7. Climate category determination

Table 3 is a summary of modelled data from 1900 – 2018 which has been used to determine climate condition categories for use under a climate-responsive approach to setting the ESY. Annual rainfall and annual recharge figures from the model were analysed and classified into five categories (or quintiles) – vey dry, dry, average, wet, very wet. This approach recognises that climate in this region varies significantly from year to year, and provides a framework for designing management arrangements that are responsive to this climate variation.

Table 3 Summary rainfall and modelled recharge statistics for determining climate condition categories using the 1900-2018 dataset

Climate condition determination	Quintile	Annual rainfall (mm) Mataranka	Annual recharge (ML) Total WAP area
Very dry	Minimum to 20th	306 - 606	4,300 - 58,031
Dry	20th to 40th	606 - 759	58,031 - 111, 305
Average	40th to 60th	759 - 863	111,305 - 172,647
Wet	60th to 80th	863 - 1017	172,647 - 283,161
Very wet	80th to Maximum	1017 - 1766	283,161 - 977,100
	Minimum	306.3	4300
	Median	811.2	139,600
	Maximum	1766.4	977,100

A 'quintile' is a tool used in statistics to divide a dataset into fifths. In Table 3, the *Minimum to 20th* quintile represents values in the bottom 20% of the rainfall and recharge datasets for 1900 - 2018. For annual rainfall, this means that values in the range 306 mm to 606 mm are in the driest 20% of rainfall figures for the 118–year data set. Put another way, it means that in 20% of years between 1900 and 2018, the annual rainfall was at or below 606mm.

END