Water Extraction Licence Decision

This notice of a water extraction licence decision is given in accordance with section 71D of the Water Act and is in regard to the following applications for licences to take groundwater under section 60 of the Act:

Applicant: Nicholas John Kostowski
Type of application: New Licence to Take Groundwater
Maximum Entitlement: 1,868 ML/year
Location: NTP2978
Water Source: Tindall Limestone Aquifer – Flora

Decision

The Controller of Water Resources has decided to grant new Licence TLAF01 with medium security maximum water entitlement of 1,868ML/year. The reasons for this decision, and the consideration given to relevant factors under section 90 (1) of the Act and any comments received under section 71B (4) of the Act, are outlined below.

Reasons for the decision

Total extraction of water from the Tindall Limestone Aquifer - Flora, including the maximum entitlements permitted through annual announced allocations applying with the granting of the new licence, will remain within the estimated sustainable yield of the aquifer, and will not adversely affect security and reliability of water supplies in the aquifer or cause adverse environmental effects in the Flora River and Daly River.

The granted licence authorises the new extraction of up to 1,868 ML/year for agricultural use and will not impact on water quality in the Tindall Limestone Aquifer to the detriment of the declared beneficial uses for that aquifer.

Consideration of Factors under Section 90(1) of the Water Act

Section 90(1)(j) Provisions under the Planning Act relating to the Development or Use of Land

NT Portion 2978 (Perpetual Pastoral Lease 1186) is unzoned under the Planning Act. The development and use of land associated with the licence are consistent with the provisions under the Planning Act and the Pastoral Land Act.

Section 90(1)(d) Quantity or Quality of Water to which the Applicant is or may be Entitled to from Other Sources

The Tindall Limestone Aquifer - Flora is the only viable water supply source in terms of proximity and required quantity and quality for the proposed agriculture beneficial use.

Section 90(1)(e) Designated Beneficial Uses of the Water and the Quality Criteria Pertaining to the Beneficial Use
Raw water for drinking, raw water for agriculture and raw water for industrial purposes were declared in 1999 as beneficial uses for all groundwater resources in the Katherine Area including the Tindall Limestone Aquifer – Flora (Government Gazette No. G22, 9 June 1999, see Attachment A).

The new licence allows groundwater extraction for agricultural use and will not impact on water quality in the Tindall Limestone Aquifer – Flora to the detriment of the declared beneficial uses.

Section 90(1)(ab) Any Water Allocation Plan Applying to the Area in Question

The area in question (see Attachment B) is within the Daly-Roper Water Control District and includes all land overlying the Tindall Limestone Aquifer, Flora and the Ooloo Dolostone Aquifer.

The Tindall Limestone Aquifer, Flora is not covered by a water allocation plan.

The Tindall Limestone Aquifer, Katherine, located to the east of the area in question is covered by the declared water allocation plan for the Tindall Limestone Aquifer, Katherine 2016-2019. The groundwater entitlements in this area affect the availability of water in the rest of the Katherine-Daly catchment, and whilst these entitlements have been taken into account in the modelling predictions that inform this decision, the granting of licences downstream of the WAP area cannot affect water availability within the WAP area. Therefore, the area in question does not include the Tindall Limestone Aquifer, Katherine.

The Ooloo Dolostone Aquifer is covered by the draft water allocation plan for the Ooloo Dolostone Aquifer. This plan has not been finalised yet but clarifications to the scientifically determined environmental flow requirements for the Daly River were agreed to by the Daly River Management Advisory Committee in May 2013. Specifically, this replaced the Beeboom reporting site with Mount Nancar, in line with the environmental flow assessment locations of Erskine et al (2004).

Extractions from both the Tindall Limestone Aquifer and the Ooloo Dolostone Aquifer may reduce flows in the Daly River. Therefore, the environmental flow requirements for the Daly River, set out in the Draft Water Allocation Plan for the Ooloo Aquifer (2013) have been taken into account in granting this licence.

Section 90(1)(a) Availability of Water in the Area in Question

Availability of water throughout the area in question is determined by the limits that apply to all surface water and groundwater extractions in the Daly River Catchment. This aims to ensure that environmental flows in the Katherine River, Flora River and Daly River will be maintained.

The limits to water extraction for consumptive uses are set out by the Northern Territory Water Allocation Planning Framework (Attachment C), the declared Water Allocation Plan for the Tindall Limestone Aquifer, Katherine 2016-2019 and the draft water allocation plan for the Ooloo Dolostone Aquifer.

The following environmental flow triggers have been used to assess the availability of water in the area in question:

- The combined effect of all groundwater and surface water extractions upstream of Mount Nancar should not reduce the average daily natural flow rate in the Daly River:
  
  (a) at Dorisvale Crossing Gauge Station G8140067 by
     
     (i) >8% whenever natural flow is ≤6.2 cumecs; or
(ii) >20% whenever natural flow is >6.2 cumecs; and

(b) at Ooloo Crossing Gauge Station G8140038 by
   (i) >8% whenever natural flow is ≤12 cumecs; or
   (ii) >20% whenever natural flow is >12 cumecs; and

(c) at Mount Nancar Gauge Station G8140040 by
   (i) >8% whenever natural flow is ≤12 cumecs; or
   (ii) >20% whenever natural flow is >12 cumecs

- The combined effect of all groundwater and surface water extractions should not reduce
  natural flows at any time in the Flora River at Flora River Gauge Station G8140205 by
  more than 20%.

In assessing this licence application, the Department of Land Resource Management
considers that the best guide to the availability of water for at least the next 10 years is given
by the river flows in the area in question over the 30 years since 1986. Over this period:

- Measured natural river flows at Dorisvale Crossing G8140067 were ≤6.2 cumecs in 13
- Modelled natural river flows at Ooloo Crossing G8140038 were ≤12 cumecs in 11 years
- Measured natural river flows at Mount Nancar G8140040 did not fall to ≤12 cumecs at
  any time.

River flows are predicted using the integrated groundwater and surface water models for the
Daly River Catchment which provides coordinated accounting of all water extractions
throughout the Daly River catchment including existing licensed and unlicensed uses in the
Tindall Limestone Aquifer and the Ooloo Dolostone Aquifer.

A detailed summary of the assessment approach is included in Attachment C.

**Existing Water Extraction Entitlements in the Area in Question**

**Tindall Limestone Aquifer, Katherine**

Maximum total extraction permitted from the Tindall Limestone Aquifer, Katherine (when
predicted flow in the Katherine River (G8140222) on 1 November is >2.2 cumecs) is
38,391ML/year.

Unlicensed and licensed entitlements are:

- Unlicensed stock & domestic total security entitlements up to 1,300ML/year in total; and
- 1 licence for public water supply with total security entitlement up to 1,876ML/year; high
  security entitlement up to 483ML/year; and low security entitlement up to 1,717ML/year; and
- 71 licences with high security entitlements up to 22,722ML/year in total for agriculture
  and industry; medium security entitlements up to 4,344ML/year in total for agriculture
  and industry; and low security entitlements up to 4,151ML/year in total for agriculture

**Tindall Limestone Aquifer, Douglas**

There is one licence in the Tindall Limestone Aquifer, Douglas which permits a maximum
annual extraction of 1,407 ML/year. There is no current estimate of stock and domestic use
in this aquifer but it is considered to be relatively low.
Tindall Limestone Aquifer, Flora

No previous licences have been granted in the Tindall Limestone Aquifer, Flora. Unlicensed stock and domestic use in the Tindall Limestone Aquifer, Flora is estimated to be a maximum of 70 ML/year.

With the grant of the new licence, the maximum total licenced extraction that is permitted from the Tindall Limestone Aquifer, Flora rises from 0 ML/year to 1,868 ML/year.

Katherine River and Daly River (surface water)

The maximum total surface water extractions permitted directly from the Katherine River and from tributaries of the Daly River are 12,610.9 ML/year and include:

(a) Katherine River:

(i) Unlicensed stock & domestic use estimated to be 1,025 ML/year;
(ii) 1 licence for public water supply with total security entitlement up to 3,267 ML/year;
(iii) 4 licences for total extraction up to 99 ML/year for industry use;
(iv) 1 licence for total extraction up to 331.3 ML/year for agriculture and industry use; and
(v) 15 licences for total extraction up to 4742.4 ML/year for agriculture.

(b) Daly River Tributaries:

(i) Unlicensed stock & domestic use estimated to be 2,421 ML/year;
(ii) 3 licences on Edith River for total extraction up to 483 ML/year for agriculture
(iii) 1 licence on Copperfield Creek to extract up to 150 ML/year for public water supply;
(iv) 1 licence on Stray Creek to extract up to 5 ML/year for stock & domestic; and
(v) 1 licence on Douglas River with maximum entitlement of 87.2 ML/year for industry use.

Ooloo Aquifer

Total maximum groundwater extraction permitted from the Ooloo Dolostone Aquifer is 67,366 ML/year, through the following unlicensed and licensed groundwater entitlements:

(a) Ooloo Aquifer Southern Zone:

(i) Unlicensed stock & domestic total security entitlements up to 643 ML/year in total; and
(ii) 10 licences with high security entitlements up to 16,265.1 ML/year in total, and medium security entitlements up to 5,620 ML/year in total; all for agriculture

(b) Ooloo Aquifer Central Zone:

(i) Unlicensed stock & domestic total security entitlements up to 403 ML/year in total; and
(ii) 6 licences with medium security entitlement up to 19,506 ML/year in total for agriculture

(c) Ooloo Aquifer North Zone:

(i) Unlicensed stock & domestic total security entitlements up to 338 ML/year in total; and
(ii) 10 licences with high security entitlements up to 8,371 ML/year in total, and medium security entitlements up to 16,208 ML/year in total; all for agriculture; and 1 licence with 12 ML/year of stock and domestic entitlement.

Section 90(1)(b) Existing and Likely Future Demand for Water for Domestic Purposes in the Area in Question;

Surface Water

Total unlicensed stock & domestic extraction from the Katherine River and Daly River for the next 10 years is estimated to be no greater than 1,025 ML/year and 2,421 ML/year respectively.
Extraction of up to 3,267ML/year from the Katherine River at Donkey Camp Weir is licensed for public water supply.

**Groundwater**

For the next 10 years, total unlicensed stock & domestic extraction from the Tindall Limestone Aquifer and Ooloo Aquifer is estimated to be no greater than 1,300ML/year and 1,384ML/year, respectively.

Extraction of up to 4,076ML/year from Tindall Limestone Aquifer, Katherine is licensed for public water supply.

**Section 90(1)(c) Adverse Effects Likely to be Created as a Result of Activities under the Licence on the Supply of Water to which any Person other than the Applicant is Entitled under the Act**

Two types of adverse effect have been taken into account in granting the new licence:

1. The potential to reduce flow in the Flora River or the Daly River below minimum thresholds specified for these waterways (see 90(1)(a) above).

   **Description of the potential adverse effect:** Reductions below these thresholds may adversely affect continued non-consumptive uses of the Flora River and the Daly River; including maintenance of aquatic ecosystems, traditional Indigenous cultural uses, and recreational and aesthetic values, including recreational fishing.

2. The potential to change the reliability of existing water extraction licences.

   **Description of the potential adverse effect:** The reliabilities of existing water extraction licences could be reduced because of the need to accommodate additional total extraction by the granted licences from the finite (but variable) annual consumptive pool.

In order to consider the potential adverse effects of granting this new licence, modelling of flows in the Flora River and the Daly River for the 30 year period from 1986 to 2015 was undertaken to account for the combined effect of all existing extractions plus the additional licence on NT Portion 2978. These flows were then analysed against the environmental flow thresholds set for the Flora and Daly Rivers. A detailed overview of the assessment approach is provided in Attachment C.

**1. The potential to reduce flow in the Flora River or the Daly River below minimum thresholds specified for these waterways Threshold constraints**

**Existing Licences**

Modelling of existing licenced extractions at their maximum entitlement for the recharge and river flow conditions of the past 30 years showed that threshold constraints on available water would have been satisfied in all years in the Flora River, 25 out of 30 years at Mount Nancar, 17 out of 30 years at Ooloo Crossing and in 13 out of 30 years at Dorisvale Crossing.

Existing Licences plus the additional licence on NT Portion 2978

Modelling of existing licenced extractions at their maximum entitlement plus the additional licenced extraction of 1,868 ML/year on NT Portion 2978, for the recharge and river flow conditions of the past 30 years showed that the number of years when the threshold constraints on available water were satisfied does not change, relative to those for the existing licenced extractions.

Prevention of this adverse effect

Adverse effects on the flows in the Flora River and the Daly River will not arise because, as is the case for all groundwater extraction licences granted for the Tindall Limestone Aquifer and the Ooloo Dolostone Aquifer, licences are granted with conditions that set annual extraction limits via an annual announced allocation. The annual announced allocation ensures that the cumulative effects of all surface water and groundwater extractions will not reduce river flows below the allowable minimum thresholds.

In years when the cumulative effects of all maximum unlicensed and licensed water extractions would reduce river flows below the allowable thresholds, water entitlements will be systematically reduced throughout the interconnected water resources of the Katherine River, Daly River, Tindall Limestone Aquifer and Ooloo Dolostone Aquifer via an Annual Announced Allocation made on 1 May each year.

Where necessary for preservation of minimum flow thresholds, this announced allocation process will reduce all low security entitlements first, then medium security entitlements if necessary, followed by high security entitlements next if necessary, and lastly and if necessary, total security entitlements – until the thresholds are achieved.

2. The potential to change the reliability of existing water extraction licences

Reliability is the estimate of how many years the maximum water entitlement of a licence would be available in full without reducing river flows by more than the allowable thresholds on any given day in any year for the period 1986 to 2015.

There has been a significant change to the way that reliability is estimated using the modelled river flow data due to the identification of calibration improvements required of the integrated Daly River model during December 2015. The change in the way reliability is analysed has resulted in lower estimated reliabilities for existing licences, as well as for new entitlements assessed as part of this decision.

An independent review of the approach used to estimate licence reliability was sought by the Controller of Water Resources in early 2016 to assure the Controller that the method neither put the environmental and cultural values of the Daly River at risk, or injudiciously restricted the volume of water that can be expected to be sustainably extracted from the aquifers for non-consumptive beneficial uses. The review confirmed that the approach is appropriate for the determination of licence reliabilities which underpins the decision about whether water is available for granting additional licences. Further detail is reported in Attachment C.

Existing Licences

The overall reliability of existing licenced groundwater entitlements prior to granting the additional licence was 43%, i.e. the total volume of licences is expected to be available in full, in 13 out of 30 years.

Existing Licences plus the additional licence on NT Portion 2978

The overall reliability of existing licenced groundwater entitlements plus the additional licence on NT Portion 2978 is 43%, i.e. the total volume of licences is expected to be available in full, in 13 out of 30 years. Estimated overall reliability of existing licences is not changed as a result of issuing this additional licence.
Prevention of this adverse effect

When modelling shows that the overall reliability of pre-existing licenced groundwater entitlements would be reduced by the grant of a new licence, the new licence will be granted with a lower level of security than provided for the pre-existing licences. If modelling shows that pre-existing licence reliabilities would be reduced by the grant of a new licence and low security licences already exist, the additional licence will not be granted.

This licence has been granted with medium security water entitlement of 1,868 ML for the following reasons:

- The lowest groundwater licence security class issued downstream of the Tindall Limestone Aquifer, Katherine Water Allocation Plan area is medium security;
- The reliability of the pre-existing licences is not altered by granting this new licence.

**Section 90(1)(g)**

Existing or Proposed Facilities on, or in the Area of, the Land in Question for the Retention, Recovery or Release of Drainage water, whether surface or subsurface drainage water;

**Section 90(1)(h)**

Adverse Effects, if any, Likely to be Created by such Drainage Water resulting from Activities under the Licence on the Quality of any other Water or on the Use or Potential Use of any other Land;

None of the factors above are relevant to the decision to grant these licences.

**Section 90(1)(f)**

Provisions of any Agreement made by or on behalf of the Territory with a State or the Commonwealth concerning Sharing of Water;

There is no agreement made by or on behalf of the Territory with a State or the Commonwealth concerning sharing of water that is directly relevant to the decision to grant this licence, other than the Inter-Governmental Agreement on a National Water Initiative (NWI). Having taken the draft water allocation plan for the Ooloo Dolostone Aquifer, and the Northern Territory Water Allocation Planning Framework that was accredited under the NWI, into account, this decision is consistent with the commitments made to implementing the NWI.

**Section 90(1)(k)**

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

There are no other factors that should be taken into account or that are required to be taken into account under any other law in force in the Territory.

**Consideration of Comments Received under Section 71B(4) of the Water Act**

In accordance with section 71B of the Water Act, a Notice of Intention to Make a Water Extraction Licence Decision for this licence application was published in the Northern Territory News on Tuesday 22nd December 2015. As also required under the Act, a copy of the notice was given to the owners and occupiers of land immediately adjacent to the land associated with the application.
Three written submissions relating to the application were received.

NT Salt Supply expressed support for the advertised application.

The Northern Land Council and Northern Territory Farmers Association Inc. raised concerns about the granting of this licence.

The Northern Land Council was concerned that:

- The licence would be granted in the absence of an appropriate water planning framework which includes community consultation and scientifically based decision making.
- The cumulative effect of granting this licence along with other licences would fully allocate the Tindall Limestone Aquifer and the Ooloo Aquifer raising equity concerns for future parties interested in accessing water resources and advocated for the establishment of Strategic Indigenous Reserves.
- There was not an adequate level of public access to the science and information that underpins water allocation decisions. In particular, further information on how reliability is determined, what the risks to flows are, how risks will be monitored and what indicators and triggers will be used as measures to mitigate impacts to flows.
- More regional and local advisory group input to water management decisions is required and that the Department of Land Resource Management’s approach to indigenous stakeholder engagement in water planning is not consistent with national guidelines.
- It is unclear what measures are used by the Department in assessing applications, particularly monitoring of licensed water users including regimes, risks and triggers and compliance measures.
- A moratorium should be placed on water allocations until Water Allocation Plans are in place.

NT Farmers Association were concerned that the grant of this licence along with the estimate of reliability would cause significant concern to irrigators in the Katherine region.

NT Farmers Association reiterated its position on the principles that should underpin management of water. Summarily, these are:

- that the process for managing allocations is clear and consistent;
- the issue of licences is fair and open to all;
- there is certainty about the volume of water that will be available to licence holders each year and new licences do not adversely affect the security or reliability of existing licences; and
- the sustainable yield should be established using a scientifically robust method to ensure that beneficial and non-beneficial uses are protected into the future.

NT Farmers Association were also concerned that:

- in the absence of declared Water Allocations Plans guaranteeing how allocations are managed, there are risks to existing licence holder’s reliability; and
- a change in the modelling approach has made the model results less conservative for predicting water availability with respect to dry periods.

NT Farmers Association stated they would like to see licences granted for a longer tenure than 10 years as they perceive 10 years as being too short to ensure the level of confidence required for major investment decisions.

In accounting for the concerns of the NLC and NT Farmers, a key consideration has been to assess the potential cumulative effects on river flows of all groundwater and surface water
extractions and to ensure that these are acceptable within the guidelines set out by the NT Water Allocation Framework and the draft Ooloo Aquifer Water Allocation Plan. Whilst the Ooloo Aquifer Water Allocation Plan is still in draft, it provides a decision making framework to allocate water between consumptive and non-consumptive uses, based on minimum environmental flow thresholds determined for the Daly River.

In consideration of the imperative to ensure access to water for economic development without impinging on the rights already conveyed to water users through existing entitlements, new licences will not be issued that impact upon the security level or the reliability of existing licences. When modelling shows that the overall reliability of pre-existing licenced groundwater entitlements would be reduced by the grant of a new licence, the new licence will be granted with a lower level of security than provided for the pre-existing licences. If modelling shows that pre-existing licence reliabilities would be reduced by the grant of a new licence and low security licences already exist, the additional licence will not be granted. An independent review of the approach to estimating reliabilities for licences for which Notices of Intention were published on 22nd December, was commissioned by the department. The review confirmed that the method is appropriate and adequate for estimating licence reliability.

In consideration of NT Farmers concerns about whether the model is sufficiently conservative to indicate water availability during dry periods, as outlined in Attachment C, the method of assessment estimates water availability based on the aquifer recharge and river flow conditions of the past 30 years. Licences are issued for a period of 10 years. The past 30 years of observed conditions is considered to be a good guide to water availability for the coming 10 years.

In consideration of the need for clarity around monitoring existing users and compliance measures, all licences are issued with conditions that require licenced bores to be metered and which require meter readings to be supplied to the department's water regulation and compliance officers on a monthly basis. The department records this information in a database which is regularly interrogated. Compliance inspections occur on an annual basis.

The department also maintains an extensive network of groundwater and surface water monitoring sites across the Daly River Region. These sites ensure that information is collected at regular intervals to ensure that we have adequate information to understand and manage the water resources. This network is reviewed annually to keep it up to date with the information requirements of the Water Resources Division within the department. Continuous improvement of the linked river and aquifer model for the Daly system ensures that as more data and knowledge is collected, it can be integrated into the water allocation decision making frameworks outlined in this statement of decision.

Account was also taken of the Cabinet decision made in March 2013 that water allocation plans should not provide Strategic Indigenous Reserves.

**Review of Decision**

A person who is aggrieved by this decision may apply for a review under section 30 of the Act. An application for review is available at [www.nt.gov.au/environment/water](http://www.nt.gov.au/environment/water) or may be obtained by contacting the Katherine Office on 08 8973 8831.

Alastair Shields  
Controller of Water Resources

Date 3/5/2016
Notes:
1; Beneficial Uses are raw water for drinking water, raw water for agriculture, and raw water for industrial purposes.
2; For declaration and description see Northern Territory Government Gazette No. G22, 9 June 1999.
3; Prepared by Natural Resources Division, September 1999.

DECLARATION OF BENEFICIAL USES AND QUALITY STANDARDS OF GROUNDWATER
KATHERINE AREA
Attachment C – The Department’s approach to assessing water extraction licence applications

Background
Groundwater extractions from the Tindall Limestone Aquifer and the Oolloo Dolostone aquifer have the potential to impact on flows in the Katherine and Daly Rivers. When assessing new licences, consideration is given to:

- the Northern Territory Water Allocation Framework;
- the declared Tindall Water Allocation Plan, Katherine;
- the draft Oolloo Aquifer Water Allocation Plan; and
- the connected and cumulative nature of potential impacts from existing and new water extraction licences.

Underpinning the assessment are the tools and management criteria that have been developed for the Daly Basin aquifers and the Daly River Catchment over the last 10 years. These tools and management criteria have informed the development of the existing declared and draft in progress Water Allocation Plans:

- The integrated groundwater and surface water models for the Daly River Catchment which provide coordinated accounting of all water extractions throughout the Daly River catchment including existing licensed and unlicensed uses.
- Northern Territory Water Allocation Planning Framework, which was included in the Implementation Plan for the National Water Initiative that was accredited by the National Water Commission in 2006 (see annex A).
- The declared Tindall Limestone Aquifer, Katherine Water Allocation Plan and the draft in-progress Oolloo Aquifer Water Allocation Plan. Both these plans were developed in consultation with community members and relevant stakeholders and were informed by the models and the environmental water requirements report described above.

Overview of the modelling undertaken
Licences are issued for a period of 10 years. Estimated water availability for at least the next 10 years is based on river flows over the last 30 years. This approach is considered the best approach by the department.

Each new licence application was assessed using the integrated surface water and groundwater models to develop an understanding of how flows in the Flora and Daly Rivers are likely to be altered as a result of the extractions sought for each new licence.
The model results were assessed against the environmental flow requirements of the Daly River and Flora River for the 30 year period since 1986. Put another way, the modelling approach enables us to investigate the following question:

*If all existing licences plus each new additional licence were extracted at their maximum entitlement for 30 years, under the same aquifer recharge and river flow conditions that have been observed over the last 30 years, what would the flow in the river be, and would this flow be acceptable for the maintenance of existing licence reliabilities and environmental flow requirements?*

The modelling of each licence was undertaken sequentially in order of the date each application was finalised and accepted. Thus, the modelling assessment scenarios were as follows:

- **Baseline scenario** - natural river flows (i.e. no extractions).
- **Existing entitlement scenario** (i.e. all licensed and unlicensed extractions prior to the determination of the new licence applications)
- **Five sequential new licence scenarios:**
  - Scenario a): Existing entitlements plus new entitlement for NT Portion 2978
  - Scenario b): Scenario a) plus new entitlement for NT Portion 2530
  - Scenario c): Scenario b) plus new entitlement for NT Portion 709
  - Scenario d): Scenario c) plus new entitlement for NT Portion 2532
  - Scenario e): Scenario d) plus new entitlement for NT Portion 1166 & 4305

**Environmental Flow Criteria**

The environmental flow criteria used to assess the availability of water for the newly proposed licences are outlined below.

Consistent with the environmental water requirements of the Daly River (Erskine et al. 2004), the combined effect of all groundwater and surface water extractions should not reduce natural flows in the Daly River:

(a) at Dorisvale Crossing gauge station G8140067 by
   - (i) >8% whenever natural flow is ≤6.2 cubic metres per second; or
   - (ii) >20% whenever natural flow is >6.2 cubic metres per second

(b) at Oolloo Crossing gauge station G8140038 by
   - (i) >8% whenever natural flow is ≤12 cubic metres per second; or
   - (ii) >20% whenever natural flow is >12 cubic metres per second

(c) at Mount Nancar gauge station G8140040 by
   - (i) >8% whenever natural flow is ≤12 cubic metres per second; or
   - (ii) >20% whenever natural flow is >12 cubic metres per second

As specific scientific work has not been undertaken to develop environmental flow triggers for the Flora River, and consistent with the Northern Territory Water Allocation Planning
Framework, the combined effect of all groundwater and surface water extractions should not reduce natural flows at Flora River gauge station G8140205 by more than 20%.

Reliability Analysis
Reliability is the estimate of how many years the licence volume would be available in full without reducing natural flows by more than the change allowed by the environmental flow criteria on any given day in any year for the period 1986 to 2015.

Annual announced allocations operate to limit licensed extractions in years when predicted flow reductions in the river exceed the environmental flow criteria for the Daly River and Flora River.

Analysis of impacts to flow in the Daly River

There has been a significant change to the way that reliability is estimated using the modelled river flow data. In December 2015, Water Resources Division staff undertook an audit of the predicted versus observed natural flows for the Daly river at Dorisvale Crossing, Oolloo Crossing and Mount Nancar. This audit was undertaken as part of the quality assurance checking of model predictions used for decision making. The model provides sound estimates of the reduction in river flows caused by surface water and groundwater extractions. However, the audit found that estimates of actual river flows are generally greater than the monitored data available for the Daly River at Dorisvale Crossing gauge station (G8140067) and Mount Nancar gauge station (G8140040). At Oolloo Crossing gauging location, G8140038, it was found that the model tends to slightly over-predict river flow when the observed flow is below 20 cumecs.

As such, in order to avoid overestimating reliability based on modelled Daly River flows, the predicted flows at Dorisvale Crossing and Mount Nancar were analysed in the following way:

- The cumulative change in flow resulting from each new licence operating at maximum extraction level for the period 1986 to 2015 was calculated for each day.
- The change in flow was assessed against measured flows at Dorisvale Crossing and Mount Nancar rather than modelled natural flows.
- Modelled change in flow divided by measured flow in the Daly River at Dorisvale Crossing and Mount Nancar was expressed as a percentage on each day for the period 1986 to 2015. The licence reliability is then determined by comparing the percentage change for each day to the environmental flow requirements at each site.

Unlike the measured flow record at Dorisvale Crossing and Mount Nancar, a long record of continuous, rated, flow data is not available at Oolloo Crossing. However, regular gaugings which measure stream flow are collected at least twice a year. Data pairs of stream flow gaugings and modelled flows were used to derive a correlation between modelled natural and measured natural flows. This correlation was used to adjust modelled flows at Oolloo Crossing to achieve more conservative estimates of modelled natural and modelled altered flows. Modelled change in flow divided by modelled natural flow at Oolloo crossing was expressed as a percentage on each day for the period 1986 to 2015. The licence reliability was then determined by comparing the percentage change for each day to the environmental flow requirements at Oolloo Crossing.
Previously, reliability had been estimated using modelled flows only, i.e. at all gauging stations, the percentage change in flow was estimated by the difference in modelled flows for the natural (no pumping) and altered (with pumping) scenarios, divided by the modelled natural flow. The outcome of changing the way reliability is analysed, is that reliabilities for all existing licences and for the newly granted licences is lower than was previously estimated. The finding resulted in readvertising of the Notices of Intention to Make a Decision in December.

An independent review of the approach used to estimate licence reliability was sought by the Controller of Water Resources in early 2016 to assure the Controller that the method neither put the environmental and cultural values of the Daly River at risk, or injudiciously restricted the volume of water that can be expected to be sustainably extracted from the aquifers for non-consumptive beneficial uses. The review confirmed that the approach is appropriate for the determination of licence reliabilities which underpins the decision about whether water is available for granting additional licences.

**Analysis of impacts to flow in the Flora River**

There has been limited model calibration in the Flora region of the integrated Daly Basin model due to a lack of hydrological information. A new gauging station (G8140205) was installed and data collection commenced in 2009, providing measurements from 6 dry seasons that have been used to implement model calibration in the lower reach of the Flora River. The model will be continuously improved as more data is collected in the region.

Using the existing model, predictions of the likely change to streamflow resulting from granting the new licence on NT Portion 2978 have been made. Modelled change in flow at gauging station G8140205 was assessed against modelled natural flow and expressed as a percentage for each day for the period 1986 to 2015. The resulting changes to daily flows are very low (between 0% and 1%).

These results are as expected, due to the relatively low licence volume (1,868 ML/year), and its location in the unconfined part of the Tindall Limestone, approximately 100 km south-east from the Flora River. The distance from the Flora River results in attenuation of drawdown by the groundwater system well before it is possible to impact flow the Flora River. It is also worth noting that there are no other water extraction licences located in the Tindall Limestone Aquifer, Flora recharge area.
NORTHERN TERRITORY WATER ALLOCATION PLANNING FRAMEWORK

All available scientific research directly related to environmental and other public benefit requirements for the water resource will be applied in setting water allocations for non-consumptive use as the first priority, with allocations for consumptive use made subsequently within the remaining available water resource.

In the absence of directly related research, contingent allocations are made for environmental and other public benefit water provisions and consumptive use. These are explained below.

Top End (northern one third of the Northern Territory)

**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 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 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.

Arid Zone (southern two thirds of the Northern Territory)

**Rivers**
At least 95 per cent of flow at any time in any part of a river is allocated as environmental and other public benefit water provision, and extraction for consumptive uses will not exceed the threshold level equivalent to five 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 threshold levels of five per cent for river flow, new surface water Licences will not be granted unless supported by directly related scientific research into environmental other public benefit requirements.

**Aquifers**
There will be no deleterious change in groundwater discharges to dependent ecosystems, and total extraction over a period of at least 100 years will not exceed 80 per cent of the total aquifer storage at start of extraction.

In the event that current and/or projected consumptive use exceeds the threshold levels of 80 per cent of the consumptive pool for aquifers, or groundwater discharges to groundwater dependent ecosystems are impacted, new groundwater Licences will not be granted unless supported by directly related scientific research into groundwater dependent ecosystem/cultural requirements.