

Information Report for the Ooloo Dolostone Aquifer Water Allocation Plan



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For further information:

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Cover Photo: Ooloo Dolostone Formation (Steven Tickell)

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1 Introduction

The Northern Territory is fortunate to have a range of near pristine, unique ecosystems supported by connected surface water and groundwater systems. Many communities also rely on these water systems to support economic growth through the development of agriculture and other industries.

Recent annual rainfall trends in the Top End are in stark contrast to drought conditions in southern Australia, and there is now increasing development pressure associated with the perception that vast water resources are available. However, whilst significant rainfall occurs in the wet season from November to April, the remainder of each year is completely dry.

When the rain stops, discharge from connected groundwater systems keep the rivers flowing. If too much groundwater is extracted, there is potential for river flows during the dry season to decline or cease. As experienced elsewhere in Australia, this can lead to a decline in river health by degrading water quality, reducing wetland areas and habitat available to native fish and aquatic plants.

Water allocation plans are a tool used across Australia to set rules for the allocation and management of water. They are now being developed across the Territory to ensure adequate provision of water for environmental, social and cultural purposes whilst fostering sustainable water use and development.

The Ooloo Dolostone Aquifer is the uppermost formation of the Daly groundwater basin and occurs just north of the Douglas and Daly River confluence and extends south-east to beyond the Katherine River. This aquifer currently provides reliable, good quality water supply for agricultural production and maintains ecosystem health by contributing to base flows in the Daly River. Water from the Ooloo Aquifer also maintains the condition of places that are culturally important to Aboriginal people in the Daly region.

A water allocation plan is now being developed for the Ooloo Aquifer to ensure it continues to support the ongoing health of the Daly River as well as economic growth through agriculture and tourism.

1.1 Purpose of this report

This document is designed to introduce stakeholders and the community to the water allocation planning process for the Ooloo Aquifer and provides information about:

- Water allocation planning in Australia and the Northern Territory
- The purpose of the Ooloo Water Allocation Plan
- The proposed plan area and water resources that will be covered
- Characteristics of the Ooloo Aquifer and current uses
- How the public will be consulted
- Key water issues that will affect the development of the plan
- Technical assessments that will support the development of the plan
- How to make a submission about the plan

2 Context

2.1 Water reform in Australia

As Australia's population increases, so does the pressure on our water resources to accommodate expanding urban and agricultural water demands. It is critical that all levels of Government act to ensure an ongoing water supply to support our consumptive needs, whilst maintaining highly valued environmental and cultural assets. Water allocation planning processes are underway in all jurisdictions of Australia and have the common goal of providing secure access to water users whilst protecting environmental requirements. Water allocation plans define rules for the distribution and management of water resources and introduce market based trading mechanisms to encourage water use efficiency and provide for new uses without increasing demand.

The National Water Initiative (NWI) is a blueprint for water reform and was established by the Council of Australian Governments in 2004 to create a more cohesive national approach to water resource management. All States and Territories are signatories to the NWI which seeks to achieve the following:

- Transparent, statutory based water planning
- More confidence for investment through defined water licence security
- Provision of water for environmental flows and other public benefit outcomes
- Provision of water to meet the needs of Indigenous people
- Water trading for more profitable use of water
- Enhanced water use efficiency in urban and rural areas
- Water use metering to provide accurate information for planning and management
- Recognition of the connectivity between surface and groundwater

2.2 Water planning in the Northern Territory

In accordance with the NWI, the Northern Territory Government will undertake water planning supported by the best available information. Water Allocation Plans have been created, are underway or proposed in places where current or potential water use could pose a possible risk to the ongoing availability and health of the resource.

To date, priorities for water allocation planning in the Territory have been focused on groundwater resources that support reticulated urban water supply systems and/or increasing agricultural development. Groundwater accounts for 90% of freshwater use in the Territory, largely due to limitations associated with the capture and storage of surface water flows. In Central Australia, rivers flow infrequently and cannot provide a secure water supply. In the top end, storage yields are generally poor because high temperatures and regional geology result in significant losses through evaporation and seepage.

Within the Territory, water allocation plans have been declared for the Alice Springs and Ti Tree regions in Central Australia and for the Tindall Limestone Aquifer in the Katherine region. Planning processes for the Ooloo Aquifer in the Daly region and the Tindall Aquifer around Mataranka commenced in 2008, whilst water planning for the Tiwi Islands commenced in 2009.

The Northern Territory *Water Act 1992* (the Water Act) is the legislation which provides for the investigation, allocation, use, control, protection, management and administration of water resources. The Water Act allows the declaration of water allocation plans within water control districts and requires that such plans allocate water to beneficial uses. Water control districts and beneficial uses are described in section 3 of this document.

2.3 Water allocation planning for the Ooloo Dolostone Aquifer

It is clear that water within the Ooloo Aquifer is valued by a range of people in a number of ways. The Ooloo Aquifer is an important water source for agricultural development and also contributes to base flows in the Daly River which is critical for maintaining the health of its unique aquatic ecosystems. Developing a water allocation plan for the Ooloo Aquifer is a way of protecting environmental and cultural assets and providing secure access to water users by ensuring water is allocated in a manner that can be sustained into the future.

Why is the Ooloo Aquifer Important?

Agriculture

The Ooloo Aquifer supports expanding water consumptive industries including irrigated agriculture and horticulture, forestry and pastoral operations. Beef and grain farming represented the largest employment sector in the Daly Statistical Region in 2005/06 behind government administration, social assistance services, education and accommodation. In the same year, fruit and vegetable production in the Daly region had an estimated value of \$3.3 million and field crops had an estimated worth of \$4.8 million. This respectively represents 5% and 40% of the Territory's total production by value.



*Centre pivot in Daly Region
(photo: Daniel Connor)*

Tourism

Many people visit the Daly region as a place for leisure, sightseeing, camping and fishing and enjoy the abundance of water and wildlife. Within the Daly region, an average of 283,000 tourists visited each year between 2004 and 2006. Each domestic visitor spent approximately \$370 which is the equivalent to over \$85 million per year. Much of this income is generated through accommodation services in the Daly River region, many of which come for the popular annual Barramundi fishing competitions.



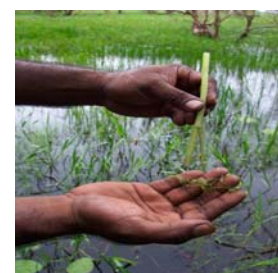
*Pig nosed turtles
(photo: John Cann)*

Groundwater dependant ecosystems

The Ooloo Aquifer also supports numerous groundwater dependent ecosystems, including the Daly River which has the highest recorded late dry season flow of any river in the Territory. When the rain stops water from the Ooloo Aquifer discharges via springs and seepages along the Daly River and this keeps it flowing all year round. The Daly River supports the greatest number of freshwater turtle species in Australia, including the largest population of pig nosed turtle, a species endemic to the NT. Several nationally threatened or rare fish species live in the Daly River and estuary, such as the freshwater sawfish and freshwater whipray. There are also extensive wetlands occurring across the Daly River floodplain which provide critical breeding areas and dry season habitat for many species of waterbirds.

Indigenous culture

For Aboriginal groups in the Daly River region, water resources are highly significant to their way of life, identity and family history. Many of the sacred sites recorded within the Daly region by the Aboriginal Areas Protection Authority are associated directly with the Daly River and its tributaries. Aboriginal people rely on the Daly River being kept in good health as it is used for drinking purposes, fishing and collecting food, fibre and medicines. Aboriginal people also have customary obligations associated with water including the



*Indigenous resource use
(photo: Bill Panton)*

responsibility of keeping the water clean, protecting access to particular places along the river, protecting cultural knowledge, providing cultural education and sharing songs and stories involving the river.

3 Scope

3.1 Ooloo Aquifer water allocation planning area

The Ooloo Aquifer Water Allocation Plan will apply to all water contained within the Ooloo Dolostone Aquifer (Figure 1). This aquifer stretches beneath the Daly River from southwest of Katherine and extends northwest to just beyond the Douglas River. The Ooloo Aquifer lies wholly within the Daly Roper Water Control District.

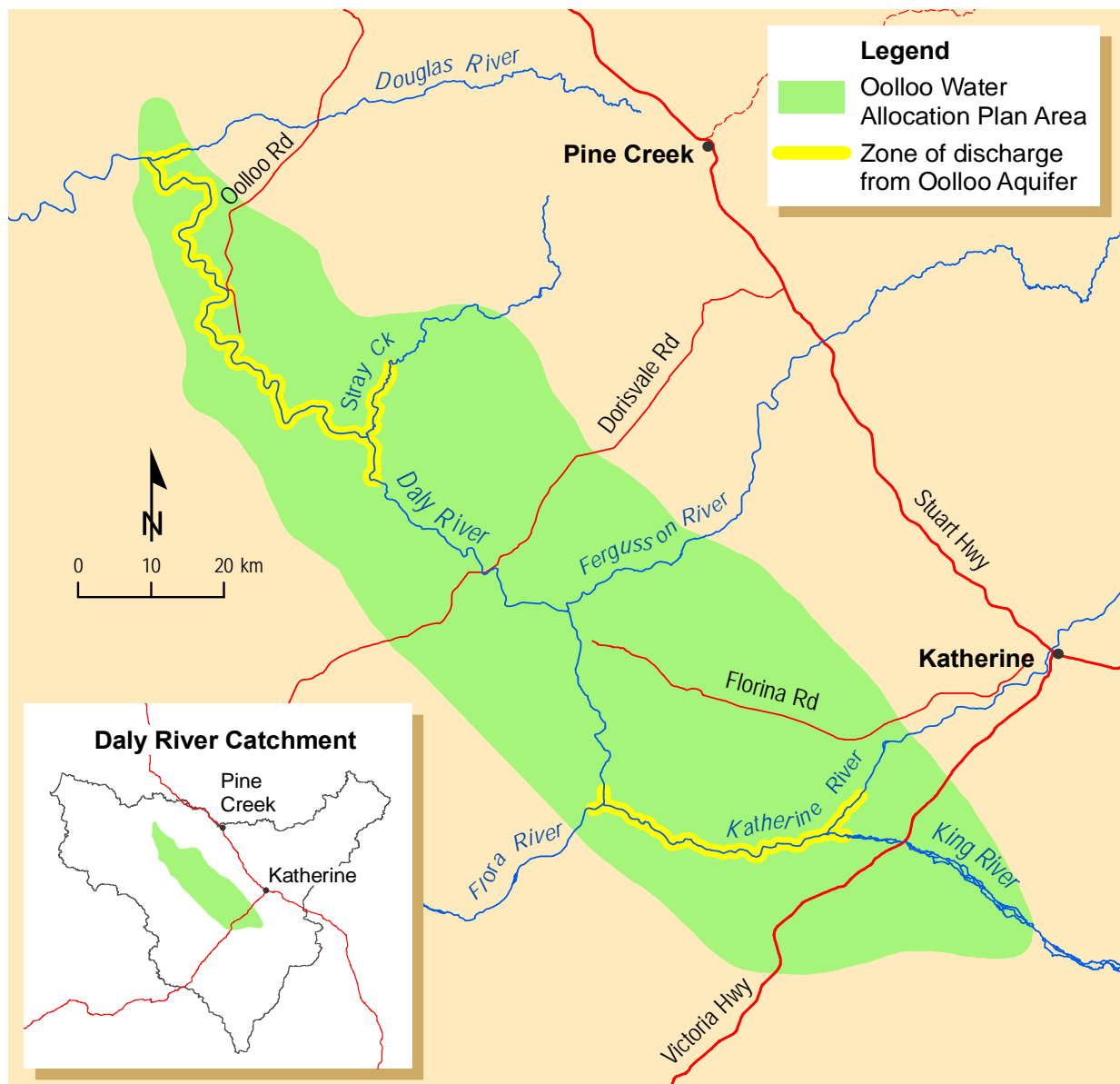


Figure 1: Ooloo Aquifer Water Allocation Plan area

3.2 Daly Roper Water Control District

The Daly Roper Water Control District (Figure 2) was declared by the Minister for Natural Resources, Environment and Heritage on 8 December 2008. The Daly Roper Water Control District includes the Daly and Roper River catchments and the entire extent of the Daly sedimentary Basin. A Water Control District (WCD) is a statutory instrument under the Water Act that provides for enhanced water management.

Within a WCD:

- All groundwater and surface water extraction, excluding for stock and domestic purposes, must be licensed (an exemption applies for the Daly Roper WCD, where usage for any purpose not exceeding 5ML/year does not require a licence)
- Bore construction permits with minimum construction standards designed to prevent contamination are required
- Water allocation plans may be declared

The Daly Roper WCD will provide for the declaration of water allocation plans for the Ooloo Aquifer, Tindall Aquifer (Katherine) and Tindall Aquifer (Mataranka). The WCD will improve our knowledge of water resource condition and use across the Daly and Roper River catchments through water extraction licensing and metering and protect water quality in groundwater systems with the implementation of bore construction standards.

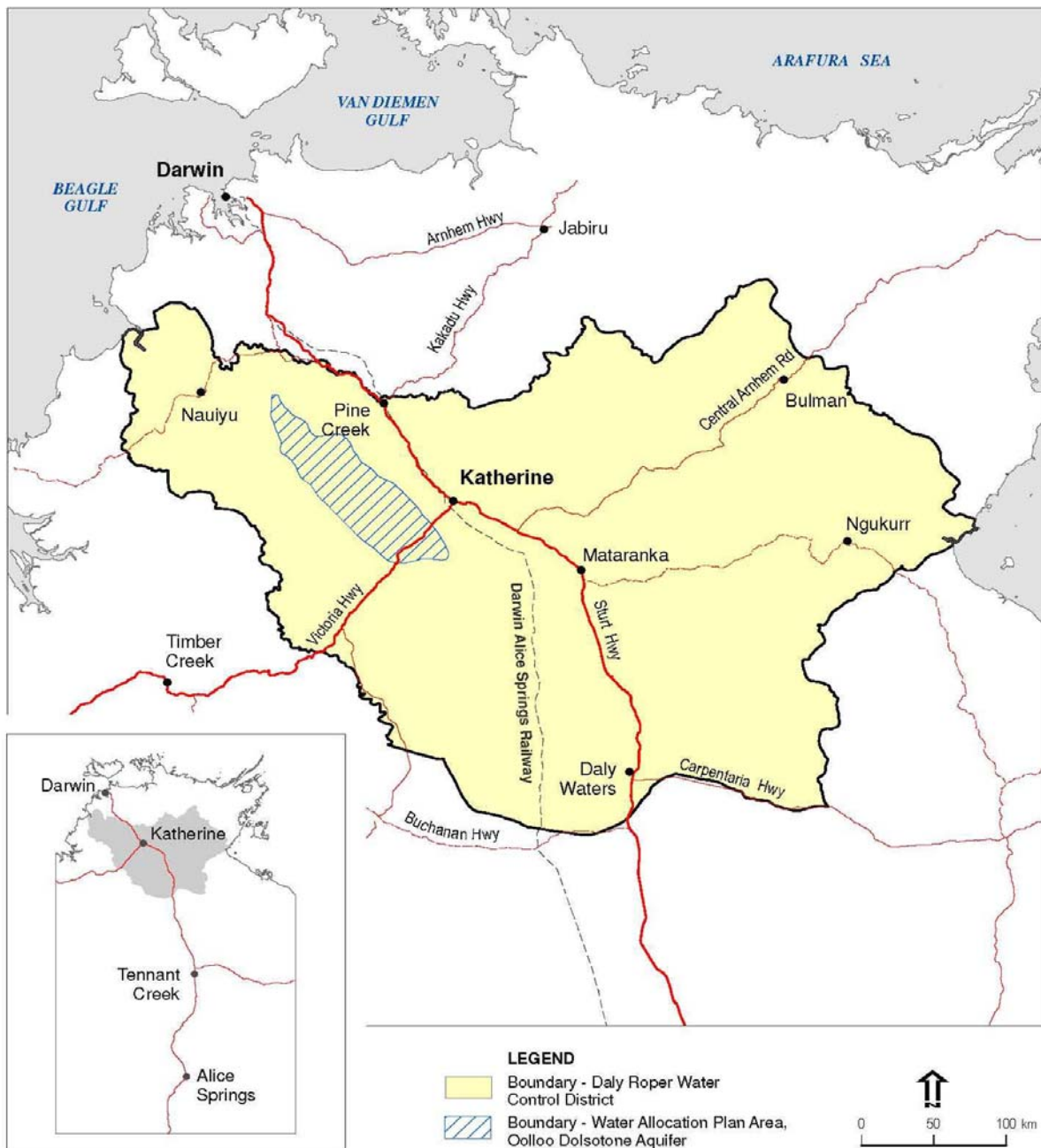


Figure 2: Daly Roper Water Control District showing Ooloo Water Allocation Plan area

3.3 Beneficial uses

As specified within the Water Act, a Water Allocation Plan (WAP) must allocate water to beneficial uses to ensure all user groups, including the environment, are accounted for and managed accordingly.

Beneficial uses are a way of describing the different purposes for which water is valued. They are separated into two categories, non-consumptive uses and consumptive uses. Non-consumptive uses include environmental, cultural and recreational uses of water, where it is used within the natural system. Consumptive uses include irrigation and drinking water supplies where water is extracted and used elsewhere.

The beneficial use categories described in the Water Act are:

Non-consumptive

- Environmental (ecosystems that depend on access to good quality water)
- Cultural (such as Indigenous living and ceremony, camping, fishing and recreational activities)

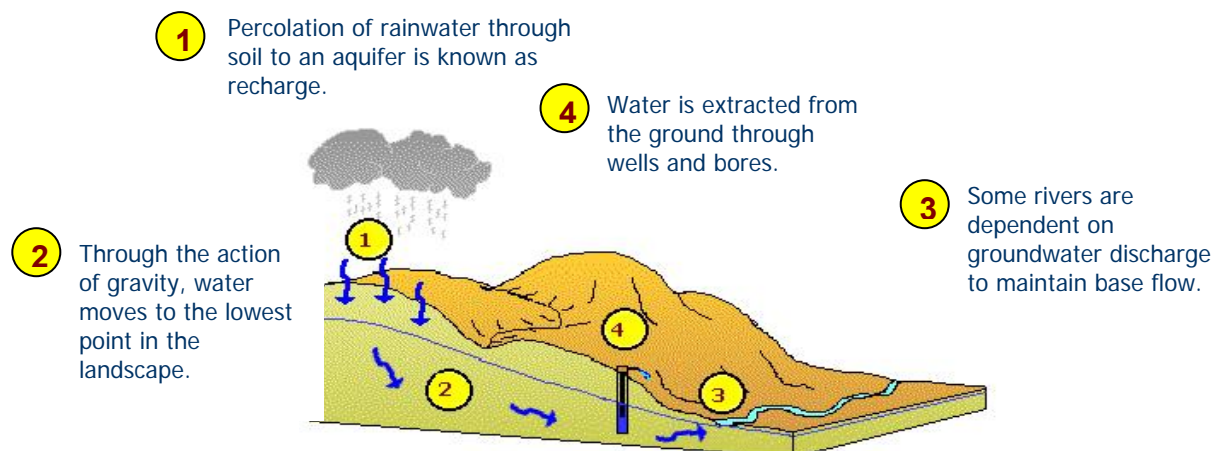
Consumptive

- Public Water Supply (drinking water delivered through a reticulated system)
- Rural Stock and Domestic (rural household use and drinking water for stock)
- Agriculture (irrigation of crops or forestry)
- Industry (commercial uses other than primary production)
- Aquaculture (commercial production of fish and other aquatic species)

4 Groundwater and the Oolloo Aquifer

4.1 The Water Cycle and Groundwater

When rain falls on the land, some water evaporates, some flows to creeks and rivers, and some seeps into the soil and is absorbed by plant roots. Excess water in the soil may percolate further down until it reaches a level known as the water table where all the pores or openings in the soil or rock are saturated with water. Water in this saturated zone below the water table is referred to as groundwater.



An aquifer is a body of rock or sediment that holds groundwater and is capable of yielding usable quantities of water through bores or springs. Recharge is the process where water is added to an aquifer and can occur via diffuse seepage downward from the soil surface, seepage through stream beds or through a point source such as a sinkhole.

Once water enters an aquifer, it is constantly moving underground due to gravitation pull. Groundwater generally flows towards the lower parts of the aquifer, where it often discharges back to the ground surface through springs. When recharge occurs during the wet season the volume of water stored in the aquifer increases and the water table rises. When the rainfall stops, the groundwater levels begin to decline because groundwater continues to drain to discharge zones.

4.2 Groundwater in the Daly Basin

The Daly Basin is a large geological basin spanning beneath the Daly and Roper River catchments. The Daly basin is made up of three distinct layers; from bottom to top they are the Tindall Limestone, the Jinduckin and Ooloo Dolostone formations as shown in Figure 3. The two major aquifers are the Tindall Limestone and Ooloo Dolostone which are formed from networks of connected fractures and solution cavities. These aquifers store large volumes of water and have potential for high yields as water can move easily through the fractures and cavities.

Contrasting these two aquifers is the Jinduckin formation. It is made up mostly of siltstone which has a low storage capacity and potential yield and is therefore not generally referred to as an aquifer, although there are some small localised limestone beds that are productive. The siltstone within the Jinduckin formation acts as a barrier preventing groundwater from moving between the Tindall Limestone and Ooloo Dolostone aquifers.

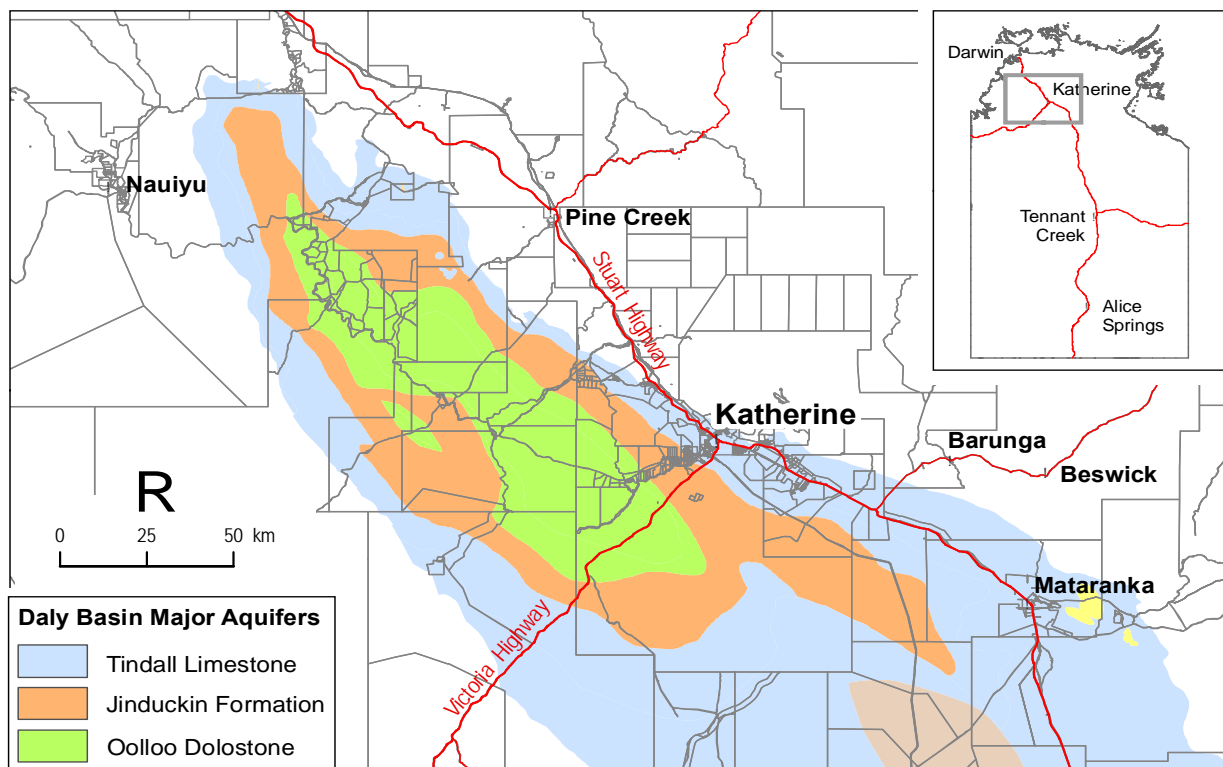


Figure 3: Daly Basin Aquifers

4.3 The Ooloo Dolostone Aquifer

The Ooloo Dolostone Aquifer is the youngest and uppermost formation of the Daly Basin. In some areas the aquifer is overlain by cretaceous rocks and this can reduce the amount of recharge that occurs. Groundwater flows continuously through the aquifer from the south east to the lower parts of the aquifer in the northwest. The majority of discharge from the Ooloo Aquifer flows into the Daly River, predominantly around its confluence with Stray Creek. There is also some discharge to the Katherine River. Discharge zones are shown in Figure 1.

During the dry season in the Top End, all river water is sourced from groundwater. The majority of rivers in the Top End stop flowing early in the dry season, soon after the rain stops. The Daly and Katherine Rivers are perennial, which means they continue to flow through the entire dry season and this occurs because water stored in the Tindall and Oolloo Aquifers discharges into these rivers all year.

Figure 4 is a conceptual diagram showing the various inputs (eg. rainfall, recharge into sinkholes) and outputs (eg. discharge to rivers, evapotranspiration and extraction) to the Oolloo Aquifer. It shows how the Jinduckin formation separates the Oolloo and Tindall Aquifers and the general direction of groundwater flow.

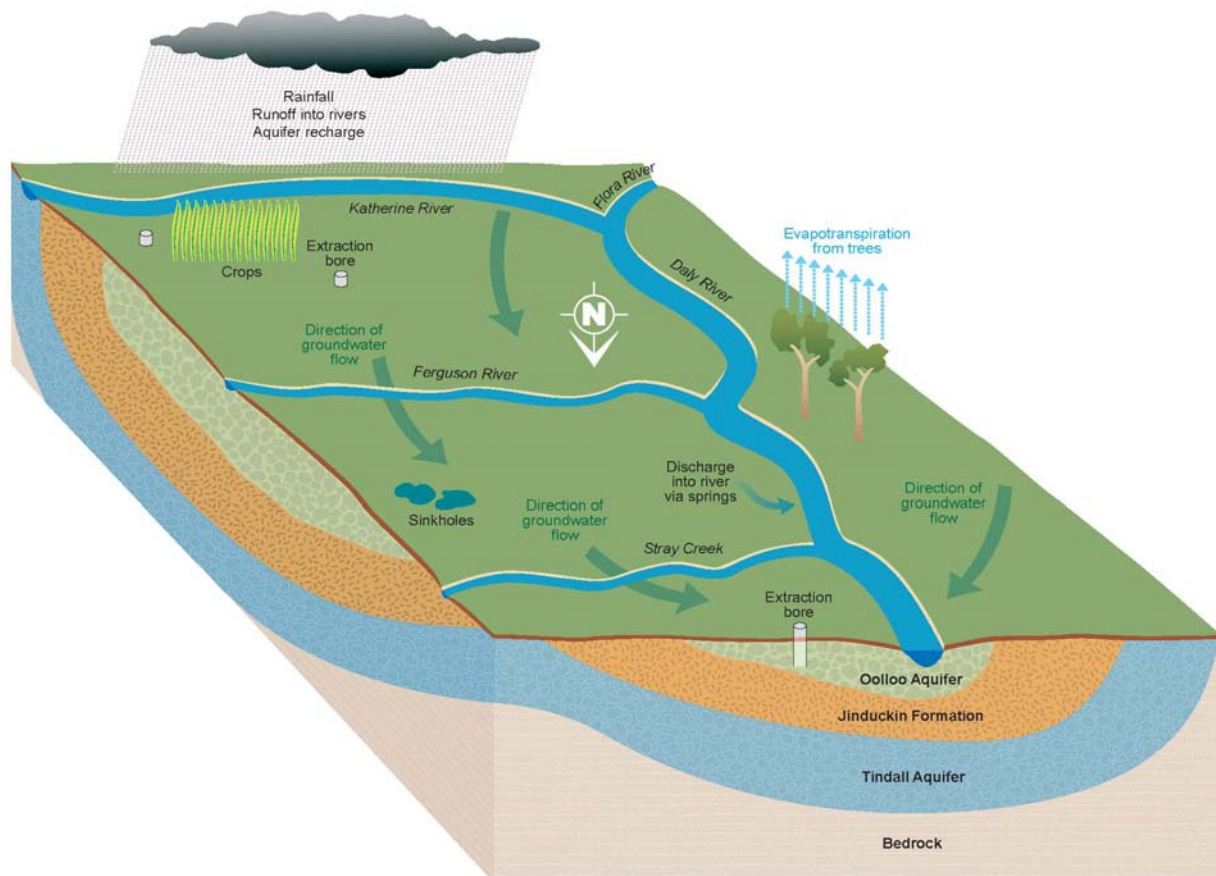


Figure 4: Oolloo Aquifer conceptual diagram

5 Water availability and use

5.1 Climate and rainfall

The extent of the Oolloo Aquifer falls within the wet-dry tropics, having a distinct wet and dry season. The wet season occurs from December through to April, when the area is under the influence of the monsoon and intense rain depressions occurring as a result of decaying tropical cyclones. Annual rainfall is highly variable from month to month as well as from year to year. Annual rainfall at Douglas River averages 1175mm and ranges from 641mm (1970) to 1750mm (1974). Annual rainfall at Katherine averages 1134mm and ranges from 678mm (1970) to 1773mm (1998).

Annual pan evaporation is high across the region at around 2300mm. Evaporation rates are highest around October and lowest around February. Despite high rainfall during each wet season, the region is generally water deficient, whereby total evaporation exceeds total rainfall. Figures 5 and 6 illustrate average monthly rainfall and evaporation totals for Douglas River and Katherine respectively. These figures show the distinct variation in rainfall between the wet and dry months and illustrate where evaporation rates exceed rainfall, particularly during the dry season.

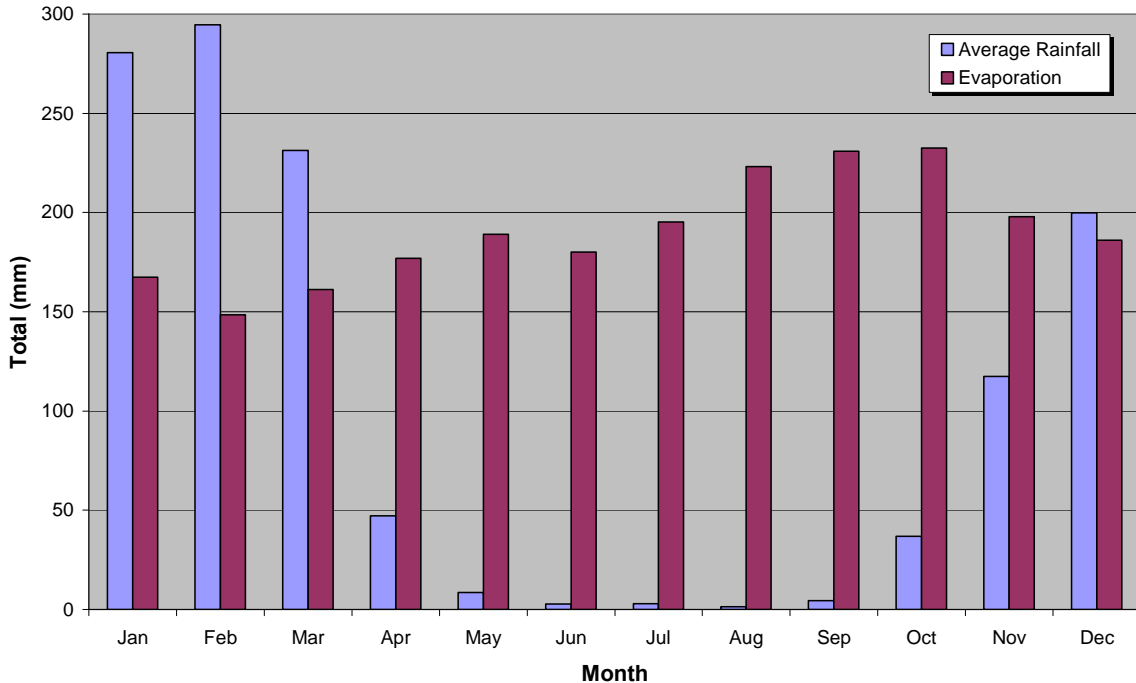


Figure 5: Monthly average rainfall and evaporation at Douglas River
(Source: Commonwealth of Australia 2009, Bureau of Meteorology)

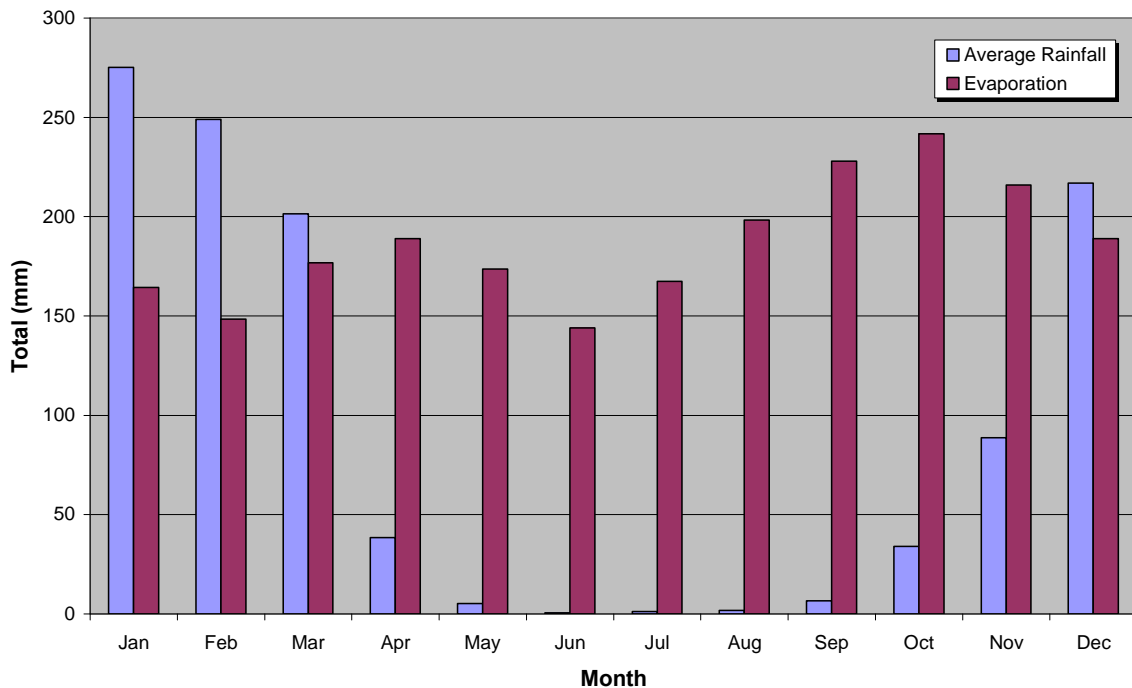


Figure 6: Monthly average rainfall and evaporation at Katherine Aviation Museum
(Source: Commonwealth of Australia 2009, Bureau of Meteorology)

5.2 Ooloo Aquifer recharge

The amount of recharge to the Ooloo Aquifer depends on rainfall, and therefore varies from year to year. Recharge is also variable across the aquifer depending on local geology, soil and vegetation types. Recharge rates are greatest where the Ooloo Dolostone formation outcrops or is close to the ground surface. Where the Ooloo Aquifer is overlain by younger sedimentary rocks, clay and sandstone, the amount of recharge is reduced because water must first filter through these additional layers to reach the aquifer.



*Ooloo Dolostone outcrop
(photo: Steven Tickell)*

Part of the water allocation planning process will be to determine annual recharge to the Ooloo Aquifer as accurately as possible. Understanding how much recharge occurs and how water moves through the Ooloo Aquifer into the Daly River will help us determine much water can be used without compromising the environment. A mathematical computer model has been developed to represent how the Ooloo Aquifer functions and will be used to predict how much recharge will go into the aquifer based on the amount rainfall received.

5.3 Current use

The greatest consumptive demand for water from the Ooloo Dolostone Aquifer is for irrigated agriculture and horticulture. A variety of crops are irrigated including avocados, bananas, mangoes, melons, pumpkins, peanuts, maize and fodder crops such as forage sorghum, leucaena and rhodes grass. Water from the Ooloo Aquifer is also used for stock and domestic purposes.

Outside declared Water Control Districts, bore construction permits are not required and groundwater extraction licences are only required if the extraction rate exceeds 15 litres per second (L/s). This was the case for the Ooloo WAP area prior to the declaration of the Daly Roper WCD on 8 December 2008. As a result, there is limited information about historic water use in the area. Despite this, all irrigation currently occurring in the Ooloo WAP area is now licensed. It is a condition on groundwater extraction licences that a meter be installed and water usage reported on a monthly basis. Licensees have up to 12 months from the issue of their license to ensure an appropriate meter is installed.

Purpose of Licence	Number of licences	Maximum annual extraction volume (2009)	Reported usage 2008/09*
Agriculture	14	24341 ML	4204 ML
Industry	1	510 ML	73 ML

Table 1: Current groundwater extraction licences and reported usage for the Ooloo Dolostone Aquifer. (Note: 1ML = 1 million litres).

For licence holders, stock and domestic requirements have been included as part of the licence volume. For properties without a licence, an assessment of stock and domestic water use has been undertaken based on existing registered bores within the Ooloo Aquifer, through direct survey of landowners and with data collated from a voluntary bore metering project. This project provided willing participants with free installation of meters as a means of measuring rural domestic water use and better estimating the volume of unlicensed extraction.

Potential domestic use is estimated based on the number of registered bores in use that are known not be used for irrigation or monitoring purposes. Maximum potential domestic use was calculated at 5.5ML per year per bore, equating to 346.5ML. 5.5ML is the average water use recorded in 2008 by domestic users in the Katherine and Daly regions who have a meter installed as part of the voluntary bore metering project.

* Some licensees did not have a meter installed at the commencement of the 2008/09 water accounting year (1 May 2008 – 31 April 2009) and as such reported usage is likely to be less than actual usage during this time.

Stock water requirements are estimated at 50 litres per day, per head of cattle. Based on landowner estimates of maximum stocking rates, there may be up to 40, 439 head of cattle run within the Ooloo WAP area, requiring approximately 736ML per year. It is likely that a proportion of the required stock drinking water is accessed from other water sources such as the Daly River, particularly during the wet season.

5.4 Future use

It is important that we understand how much water can be extracted from the Ooloo Aquifer without adverse environmental impacts. It is equally important for water users that future developments are based on sustainable water supply. The planning process will determine the long term availability of water from the Ooloo Aquifer based on environmental, social and economic needs. Existing water users in the Ooloo Aquifer have been issued with annual water licences to allow for continued operation whilst the WAP is being developed. It is proposed that 10 year water licences be issued upon declaration of the WAP.

To assess future water use requirements, water users prepare a 10 year property development plan, including details of proposed crops types and areas to be planted. These plans are assessed against standardised crop water use requirements to determine how much water the proposed development will need. Priority will be given to current users when allocating available water to ensure existing investments are protected.

5.5 Water Trading

Water trading is the exchange of water access rights between users and is being introduced through water allocation plans across Australia. It is a way of accommodating new or expanding water dependant developments without increasing the total volume of water allocated within a system. The purchaser does not need to have an existing water licence and may use the water in a different location within defined management zones.

Instead of issuing new licences, water trading allows water to be sourced from an existing licence holder who is willing to trade all or part of their access rights. The ability to sell water that is not being used may also encourage the adoption of more efficient water use practices.

Arrangements for water trading will be included in the Ooloo Aquifer WAP and trading will be available once the WAP is declared.

5.6 Environmental water requirements

The Daly River is arguably one of the most significant natural ecosystems in the Top End because unlike most other rivers in the region which periodically dry out, the Daly River is perennial, which means it continues to flow throughout every year. This allows the Daly River to support a variety of aquatic habitats not found in any other river system in the Territory (Erskine *et al* 2003).

Discharge from the Ooloo Aquifer to the Daly River during the dry season is the reason why the Daly River continues to flow without rainfall and this allows it to provide permanent habitats for:

- Eight of the nine species of freshwater turtles found in the Northern Territory
- The best Australian populations of the Pig-nosed turtle, a flagship species found only in the Daly and Mary Rivers
- The Freshwater whipray – listed as critically endangered
- The Freshwater sawfish – listed as vulnerable

The middle reaches of the Daly River are also listed as an important wetland area on the National Register as they provide habitat area and support key breeding events for many flora and fauna during the dry season. These wetlands are also important for Indigenous subsistence because they are easily accessible for hunting and gathering of food sources such as turtles, lilies and fish.

Research into flow regimes and environmental water requirements of the Daly River and its tributaries was undertaken in 2003 by Erskine *et al* to provide appropriate scientific advice for water allocation and management. This research included five sub-projects aimed at maintaining the biota and wider ecosystem values of the Daly River:

- Predicting the impact of water extraction on pig nosed turtles
- Tree water use in riparian vegetation
- Water requirements of the aquatic plant, *Vallisneria nana*
- Algal responses to reduced dry season flows
- Inventory and risk assessment of water dependant ecosystems

A summary report of this research, *Recommended environmental water requirements for the Daly River, Northern Territory, based on ecological, hydrological and biological principles*, provides recommended environmental water allocations for the Daly River. These recommendations were later revised and updated in a report titled *Environmental Water Requirements of the Daly River: Review of Recommendations of Erskine et al (2003)*. Both reports are publicly available.

The water allocation planning process will assess how changes in groundwater discharge from the Ooloo Aquifer to the Daly River caused by proposed future water extraction may impact on these recommended environmental water requirements. If practicable, additional research currently underway in the Daly Basin under the auspices of the Tropical Rivers and Coastal Knowledge Research hub will also be considered when determining the environmental water allocation for the Ooloo Aquifer.

6 The planning process

The time it takes to develop a water allocation plan depends on the complexity of the resource and its range of uses. Generally the process is expected to take approximately two years and includes a series of key stages as follows:

Characterising the Water Resource

At the commencement of a water planning process, relevant information about the water resource is collected, including what is known about how the resource functions, how historic climate has affected water availability, existing uses and environmental water requirements. Following this process knowledge gaps are identified and further research and consultation is undertaken to fill these gaps.

Water Advisory Committee

A Water Advisory Committee is usually appointed soon after the initial commencement of a planning process. The Minister will appoint members to advise the government during the water allocation planning process. Committee members represent a range of community values and stakeholders interests in the resource.

Matters that are considered

The Water Advisory Committee will meet regularly to discuss and advise on the development the water allocation plan. Matters that are considered include (but are not limited to):

- Area and waters to be managed under the Plan;
- Relevant information about the resource, dependant values and uses;

- Outcomes for the plan based on the range of community aspirations for the resource;
- How much water different users need, including the environment;
- The effect of proposed future water use on environmental and cultural outcomes;
- Strategies for sharing water and managing use to achieve the desired outcomes; and
- Water use accounting and ecosystem monitoring.

Draft Water Allocation Plan

A draft water allocation plan is developed over the planning period and released for a formal public comments period. During this period submissions are accepted from interested individuals or groups. Community meetings, public displays and targeted consultation with key stakeholder groups will also occur at this time.

All submissions received during this period are analysed and reviewed. Issues raised are validated and recommendations for addressing those issues are presented to the Advisory Committee for consideration before changes are made to the final Plan.

Implementation

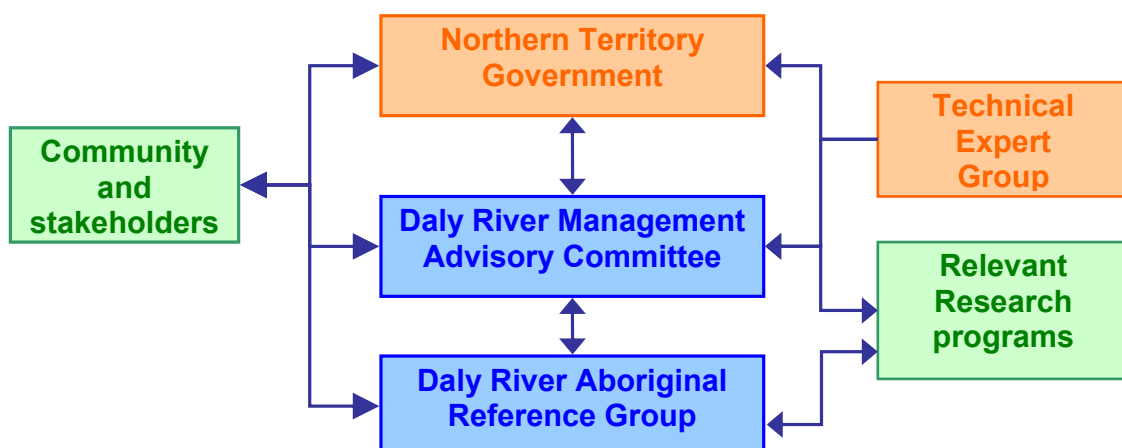
Once the Plan is finalised and declared by the Minister for Natural Resources, Environment and Heritage an implementation strategy is developed to ensure the Plan's outcomes, objectives and strategies are achieved. The implementation strategy includes arrangements for the day-to-day management of the Plan, including a detailed monitoring and compliance program. Ongoing monitoring and assessment of the Plan's performance will be used at the five year review and ten year renewal of the Plan where changes to the Plan may occur.

7 Community consultation

7.1 Daly River Management Advisory Committee

On 19 July 2006, the Minister for Natural Resources, Environment and Heritage established and appointed members to the Daly River Management Advisory Committee (DRMAC) to advise on issues related to the sustainable use and conservation of the natural resources of the whole Daly River Catchment. The Daly River Catchment includes all of the surface and groundwater systems which feed into the Daly River, including the Ooloo Aquifer. DRMAC is responsible for providing advice in regards to all water allocation planning in the Daly Catchment and have agreed to act as the water advisory committee and participate directly in the development of the Ooloo WAP.

As DRMAC considers all natural resource management issues in the Daly Catchment, including land clearing and conservation planning, they are best placed to ensure that proposed water management strategies for the Ooloo Aquifer compliment other planning processes in the Daly region.



DRMAC membership reflects equity and diversity with representatives from major stakeholders groups within the region and community. The members of DRMAC have skills, knowledge and experience in the Daly region and will be able to incorporate community values and beliefs in to the water allocation planning process. The following stakeholder groups and organisations are represented on DRMAC:

- Northern Territory Cattleman's Association
- Northern Territory Agricultural Association
- Northern Territory Horticultural Association
- Environment Centre Northern Territory
- Katherine Region Tourist Association
- Indigenous Landowners (Aboriginal Reference Group)
- Amateur Fisherman's Association Northern Territory

DRMAC is supported by the following government agencies:

- Department of Natural Resources, Environment, The Arts and Sport (Water Resources)
- Department of Resources (Primary Industry)
- Department of Lands and Planning (Land Use Planning)
- Department of Housing, Local Government and Regional Services (Regional Development Planning)

7.2 Aboriginal Reference Group

The Daly River Aboriginal Reference Group (DRARG) functions as the peak body for indigenous landowners on all NRM issues in the Daly River catchment and operates as a sub committee of DRMAC. The group includes representatives from eight language groups in the Daly Catchment. At least two traditional owners from each language group are represented on the DRARG.

DRMAC works closely with the DRARG to ensure their traditional connection to landscape is recognised and adequate consideration is given to how management decisions may affect Indigenous cultural and social values. This includes involving Indigenous people in economic development opportunities and ensuring they have significant input into policy development, planning and management. Three members of DRARG are also members of DRMAC and ensure ongoing communication between these groups. Additional opportunities to consult with local indigenous communities will also be sought and ideally facilitated by the relevant ARG member.

The following language groups are represented on the DRARG. All groups residing within the Oolloo WAP area are represented:

- Wadjigan
- Malak Malak
- Maranunngu
- Kamu
- Larbagunyun
- Wagiman South
- Wagiman North
- Dagoman (Wujalawun)
- Wardaman (Wungayatiawun)
- Wardaman (Yubulyawun)

7.3 Stakeholder analysis

A stakeholder analysis was carried out at the commencement of the Oolloo planning process to identify all stakeholders that may be affected by the water allocation plan. Whilst the primary stakeholder groups are represented on the DRMAC, a consultation plan has been developed which identifies communication and engagement methods to consult with all stakeholder groups. The consultation plan includes preferred methods and timing for communicating with each group.

The stakeholder analysis and communication plan will ensure that all groups with an interest in the Oolloo Aquifer, regardless of their significance or size, are made aware of the planning process and have the opportunity to submit their views. Identified stakeholders and engagement methods are provided in Appendix 1.

8 Identified knowledge gaps

At the commencement of the planning process, key issues were identified to be addressed by the Plan. Existing information was collected to inform the Plans development, but in some cases knowledge gaps were identified where there was little or no relevant information available.

Whilst good general knowledge exists regarding the Oolloo Aquifer and Daly River, details on the subjects of sustainable water supply, current and proposed future water use and cultural water requirements are limited. Before these key issues can be provided for in the Plan, further research and knowledge is required.

Table 2 summarises knowledge gaps and proposes investigations to help inform the planning process.

Knowledge Gap	Proposed Investigation
Extent and capacity of the Oolloo Dolostone Aquifer	<ul style="list-style-type: none"> Develop and refine computerised model of the Oolloo Aquifer, considering ground and surface water interaction; Enhance monitoring network to improve understand of the Oolloo Aquifer's hydrogeological processes.
Current water use	<ul style="list-style-type: none"> Investigate pumpage data on all licensed and metered use; Estimate demand based on existing property development where use is not currently licensed or metered; Estimate stock and domestic demands based on rural households and stocking rates
Future water use	<ul style="list-style-type: none"> Assess the future development proposals of existing and proposed water users; Estimate future stock water use based on proposed stocking rates Quantify non-consumptive environmental/cultural requirements
Groundwater dependant ecosystem requirements	<ul style="list-style-type: none"> Draw on current and ongoing TRaCK research Develop monitoring program to assess baseline conditions
Risks associated with changes in groundwater levels and surface water flows associated with extractive use	<ul style="list-style-type: none"> Develop a computerised hydrologic model that represents the Oolloo Aquifer and its connection to the Daly River Model various extraction scenarios to predict impacts of a range of possible extraction levels on groundwater dependent ecosystems including flows in the Daly River.
Possible effects of climatic variability on availability of groundwater	<ul style="list-style-type: none"> Use of computerised model; CSIRO North Australian Sustainable Yields Project

Cultural water requirements	<ul style="list-style-type: none"> • TRaCK research project: Indigenous socio-economic values and river flows
Indigenous aspirations for future water dependant development on Aboriginal Land	<ul style="list-style-type: none"> • Consultation with Indigenous Traditional Owners • Consultation with relevant Indigenous organisations (NLC, NAILSMA) • Advice from DRARG and DRMAC

Table.2 Knowledge gaps and related investigations

9 Key assessments to be undertaken

As part of the Ooloo water allocation planning process, several projects will take place to help bridge some of the identified knowledge gaps.

9.1 Refining Extent and Capacity of the Resource

Improvements to our knowledge about key hydrogeological processes such as groundwater discharge to the Daly River are vital for appropriate management of the Ooloo Aquifer.

Currently, stream gauging data suggests that several discharge processes are involved as groundwater progressively drains from the Ooloo Aquifer to the Katherine and Daly rivers. Apart from the drainage from the regional watertable, water stored in the river banks may also contribute to the total discharge. These processes are not well presently understood, nor are the relative contributions from each discharge source known.

An assessment of Major Spring Systems in the Ooloo Dolostone is currently underway. The drilling of strategic boreholes in data poor areas will enable better regional characterisation of the aquifer system and establish a more comprehensive monitoring bore network, particularly in those areas where developments are likely to occur and significant risk to the spring flow regimes are identified. The knowledge gained about the discharge processes will assist to refine the computerised model.

9.2 Ooloo Aquifer Computer Model

A mathematical computer model will be developed to represent how the Ooloo Aquifer functions in real life. The model can be used to predict what will happen to groundwater levels and surface water flows in the Daly River under different levels of extraction. It will be used to assess how much water can be extracted from the Ooloo Aquifer without causing an unacceptable impact to the environment.

The model will be built using data recorded from monitoring bores and stream gaugings and creates relationships between rainfall, groundwater levels and river flows. These relationships are tested against actual recorded data to ensure that the model does predict what we see in reality as closely as possible.

9.3 Future consumptive water use

A key part of the planning process will be to determine how much water can be used from this resource whilst maintaining sufficient discharge for environmental and cultural requirements. It is important that the total allocation is within sustainable limits so that future developments are viable and environmental values are protected.

To capture all licensed use from the Ooloo Aquifer, water existing and proposed water users will be required to complete a property development plan which will identify the area and type of crops proposed to be irrigated. The property development plans will be used to in conjunction with crop water use models to determine water demands in the future.

Given the Daly Roper Water Control District was only recently declared, there may be some properties within the Plan area where landowners are using water from the Ooloo Aquifer without a licence. These landowners will be surveyed to determine whether they are using water from the Ooloo Aquifer and if this use requires a licence.

9.4 Indigenous aspirations for water

For Aboriginal groups in the Daly River region, water resources are highly significant to their way of life, identity and family history. In addition, many sacred sites recorded within the Daly region are associated directly with the Daly River and its tributaries. It's important that the Ooloo Water Allocation Plan recognises and provides for these values.

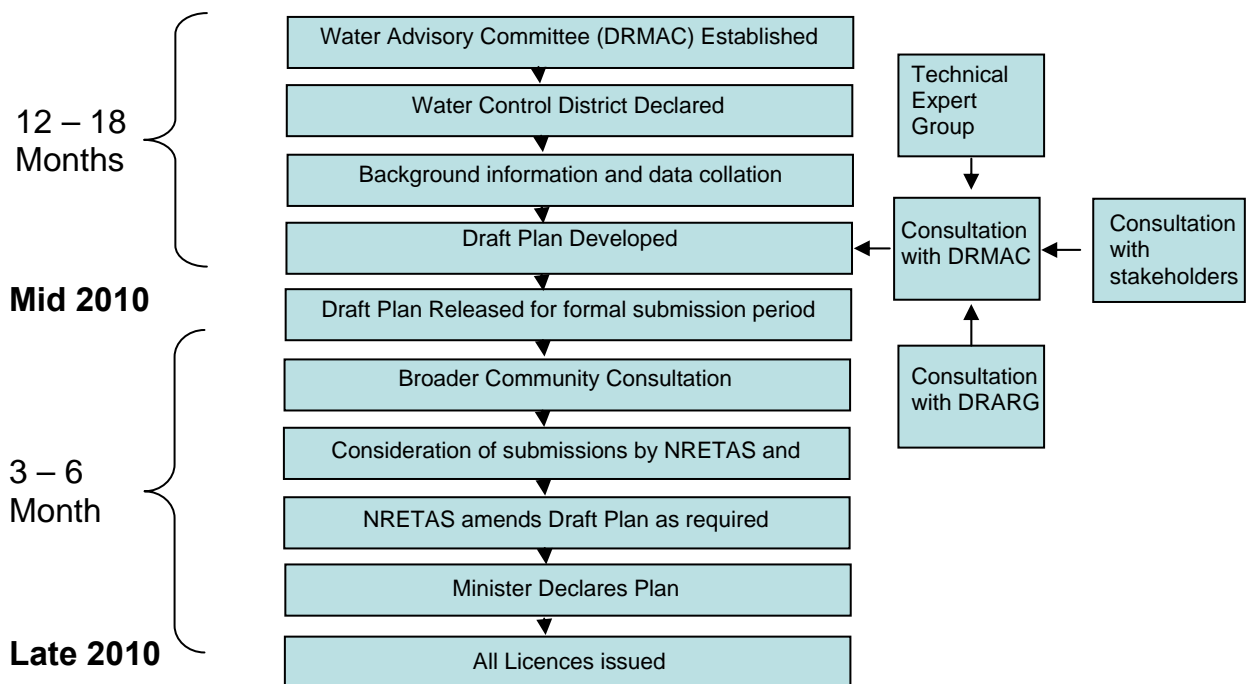
A significant amount of land within the planning area is owned and operated by Aboriginal people. It is recognised that the provision of water for future Indigenous economic development is necessary to secure future opportunities for their livelihood. The Plan will include strategies that ensure protection of water dependant development opportunities for Indigenous people.

Traditional Owners represented on the DRARG and organisations such as NAILSMA and the NLC will be approached to help facilitate engagement in relation to:

- Identifying cultural water requirements;
- Indigenous aspirations for future water dependant development on Aboriginal Land.

10 Planning schedule

The time it takes to develop a water allocation plan can vary depending on the complexity of the resource and a range of other factors. The following diagram depicts planning milestones and indicative time frames for preparing the Ooloo Aquifer Water Allocation Plan.



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APPENDIX 1 Dates	Commencement				On-going/regular							Draft Release					Finalisation	
	April 2008-Oct 2008				On-going							September 2010					December 2010	
	Consultation and Advice				Information sharing and active participation							Consultation		Active Participation			Consultation	
Communication Mechanisms	Daly River Management Advisory Committee	Aboriginal Reference Group	Technical Expert Group	Information Report, Fact sheets & Website	DRMAC & DRARG	Technical Expert Group	Community forums	Public Displays	Presentations to organisations	Media releases	Website updates and project briefings	Public Displays, advertisements, information to licensees, update website, media releases	Background document and supporting material	Stakeholder Group and community meetings	One-on-one meetings	Submission period	DRMAC & DRARG	Consultation report, media release
Stakeholder Groups																		
NT Cattlemen's Association	■			■			■	■	■	■	■	■	■	■		■		■
NT Horticultural Association	■			■	■		■	■	■	■	■	■	■	■		■	■	■
NT Agricultural Association	■			■			■	■	■	■	■	■	■	■		■		■
Katherine Region Tourist Association	■			■	■		■	■	■	■	■	■	■	■		■	■	■
Wangamatty (Lower Daly) Landcare Group	■			■			■	■		■	■	■	■	■		■	■	■
Amateur Fishermen's Association of the NT	■			■	■		■	■	■	■	■	■	■	■		■	■	■
World Wildlife Foundation				■	■		■			■	■	■	■			■	■	■
Environment Centre NT	■			■			■		■	■	■	■	■	■		■		■
Ooloo Aquifer groundwater extraction licence holders and applicants				■			■	■		■	■	■	■	■	■			■
Power Water Corporation				■			■			■	■	■	■	■		■		■
Forestry				■			■			■	■	■	■	■		■		■
Mining				■			■			■	■	■	■	■		■		■
Charles Darwin University				■			■			■	■	■	■	■		■		■
CSIRO				■			■			■	■	■	■	■		■		■
Douglas Daly Development Community Association				■			■		■	■	■	■	■	■		■		■
Chamber of Commerce							■			■	■	■	■		■			■
Environmental Protection Authority							■			■	■	■	■		■			■
Daly River Progress Association				■			■		■	■	■	■	■	■		■		■
Victoria Daly Shire Council				■			■			■	■	■	■		■			■
Indigenous Stakeholder Groups																		
Northern Land Council				■			■		■	■	■	■	■	■		■		■
North Australian Land & Sea Management Alliance				■			■		■	■	■	■	■	■		■		■
Daly River Aboriginal Reference Group	■						■		■								■	■
Malak Malak		■		■	■		■	■				■	■	■	■		■	■
Maranunggu		■		■	■		■	■				■	■	■	■		■	■

Dates	Commencement				On-going/regular							Draft Release					Finalisation	
	April 2008-Oct 2008				On-going							September 2010					December 2010	
	Consultation and Advice				Information sharing and active participation							Consultation		Active Participation			Consultation	
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Indigenous Stakeholder Groups cont.																		
Kamu		■		■	■		■	■				■	■	■	■	■	■	■
Larbagunyan		■		■	■		■	■				■	■	■	■	■	■	■
Wagiman (South)		■		■	■		■	■				■	■	■	■	■	■	■
Wagiman (North)		■		■	■		■	■				■	■	■	■	■	■	■
Dagoman (Jarrolam)		■		■	■		■	■				■	■	■	■	■	■	■
Dagoman (Wujalawun)		■		■	■		■	■				■	■	■	■	■	■	■
Wardaman (Wungayatjawun)		■		■	■		■	■				■	■	■	■	■	■	■
Wardaman (Yubulyawun)		■		■	■		■	■				■	■	■	■	■	■	■
Wadjigan		■		■	■		■	■				■	■	■	■	■	■	■
Government Agencies																		
Department of Resources	■				■		■				■	■	■			■	■	■
Department of Business and Employment	■				■		■				■	■	■			■	■	■
Tourism NT	■				■		■				■	■	■			■		■
Department of Lands and Planning	■				■		■				■	■	■			■	■	■
Department of Health and Families							■			■		■	■			■		■
Department of Housing, Local Government and Regional Services							■			■		■	■			■		■
Department of Chief Minister							■			■	■	■	■			■		■
External public																		
Media				■	■		■	■		■	■	■		■		■		■
Naiyu Community				■			■	■				■	■	■	■	■		■
Katherine Community				■			■	■		■		■	■	■	■	■		■
Douglas Daly Community				■			■	■		■		■	■	■	■	■		■