

DEPARTMENT OF LAND RESOURCE MANAGEMENT

# DRAFT Great Artesian Basin (NT) Water Allocation Plan 2013-2023



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National Water Commission

This Plan was prepared with funding assistance of the National Water Commission.

#### How to read this document

This document has been structured to suit a range of audiences.

Part One provides background information on the policy settings for water planning, the region, the water resource, and current and future water use in the area.

Part Two sets out the Objectives of the Plan, details about the Consumptive Pool, details about obtaining licences and permits under the Plan and the provisions for water trading.

Part Two also details the implementation strategies of the Plan and how knowledge gaps will be addressed to inform the review and improve the Plan.

Front Page Photo: Old Andado Homestead, March 2010 © Colleen Costello

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### **Executive Summary**

The Northern Territory Government is committed to the long term sustainable management of water resources. This Great Artesian Basin Water Allocation Plan (the Plan) has been developed in accordance with the *Water Act 1992 (NT)* (the Act) and will assist the Northern Territory to meet its obligations under the Great Artesian Basin (GAB) Strategic Management Plan 2000. This Plan will regulate water resource management of all water extraction required to be licensed under the Act for the whole of the GAB Water Control District (the District).

The principal objectives of the Plan are to:

- Maintain public water supply;
- Protect the environment;
- Support Indigenous culture and communities; and
- Ensure sustainable development.

The Plan applies to the declared District in the south-east corner of the Northern Territory, which is equivalent to about six per cent of the Northern Territory. This area of approximately 86 500 km<sup>2</sup>, is based upon the sediments and outcropping of the Eromanga Basin within the Northern Territory. It applies to all surface water and groundwater, including but not limited to water in the GAB aquifer, within the District.

There is currently no significant or licensed surface water extraction within the District. Surface water is important because of its environmental and cultural significance and as a source of recharge to the relevant groundwater resources. Groundwater is the important consumptive water resource within the District and is currently extracted for unlicensed stock and domestic use, and for a licensed public water supply to the community of Finke/Apatula. The most likely future use for water in the District is associated with the current wave of oil, coal and gas mining exploration. Water use associated with mining activities is currently exempt from water licensing requirements under the Act and therefore cannot be regulated by the Plan. Nevertheless, any water allocations permitted under the Plan will need to be considered in the context of any water extraction made for mining purposes.

The most significant consumptive groundwater resource within the District is the water from the GAB, which is also believed to support important interstate GAB springs in South Australia and Queensland. However up to a third of current water use within the District, particularly for pastoral purposes, is thought to be from non-GAB aquifers. Due to the relative paucity of available information about the groundwater resources within the District, the whole of the District will be considered as a single management zone for the purposes of the Plan.

Licences for allocations available for surface water shall not exceed a volume more than five per cent of flow at any time in any part of a river. Licences for allocations from the GAB aquifer are based on 70% of estimated recharge and the total licensed volume of water from the GAB District shall not exceed 9.7 GL/yr. Any licence application for access to other groundwater resources within the District would generally need to be accompanied by hydrogeological evidence indicating that the proposed extraction would not negatively impact on the water quality of that resource or on the environmental values of any dependent ecosystem.

The granting and trading of licences is provided for in the Act. Further rules for granting of licences and for the trading of licensed allocations are set out in detail in the Plan. All licences must meet the requirements of the Act and the Water Regulations. Licences will generally be granted for a period not exceeding 10 years and are renewable upon application.

In accordance with the Act, the Plan will be declared for 10 years and must be reviewed at intervals of not longer than five years. The review will be informed by the outcomes of the monitoring program, Northern Territory and national research findings, as well as by community consultation.

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# 1. Introduction

The Northern Territory Government is committed to the long term management of water resources. Water Allocation Plans (WAPs) provide the framework for sustainable water management and allocation strategies which are developed in consultation with the community. This enables regional development to be balanced with the conservation of the Northern Territory's water resources. WAPs are made under s.22B of the *Water Act 1992(NT)* (the Act).

The Great Artesian Basin (GAB) is Australia's largest water resource and one of the largest artesian groundwater basins in the world. It extends over 1.7 million km<sup>2</sup> or 22 % of the Australian continent and underlies large areas of Queensland, New South Wales, South Australia and the Northern Territory (See Figure 1).

The GAB Water Control District (the District) in the Northern Territory covers just less than five per cent of the total GAB. To date, water extraction in the District has been mainly used for domestic purposes by the community and for watering stock. There are also mining and gas exploration<sup>1</sup> activities currently occurring in the area and these could have significant impacts on future water use in the District. A WAP will help ensure that this regional development continues to proceed on a sustainable basis.

The GAB Strategic Management Plan was developed by the GAB Consultative Council for the whole of the GAB in 2000 with a key objective of encouraging legislative and administrative frameworks for sustainable water management and water use within the GAB. The Strategic Management Plan was adopted by all Governments responsible for GAB management. This Plan has been developed to assist the Northern Territory to meet its obligations under the GAB Strategic Management Plan.

This Plan will regulate management of all water extraction required to be licensed under the Act for the whole of the District as shown in Figure 2. The District has been geographically defined to encompass the Northern Territory portion of the GAB. However, the Plan applies to both surface and groundwater resources, including but not limited to the water in the GAB aquifer, within the District.

This Plan takes effect from the date of its declaration by the Minister for Land Resource Management (the Minister), and will remain in force for a period of 10 years. In accordance with the Act, the Plan must be reviewed at intervals not longer than five years.

<sup>&</sup>lt;sup>1</sup> Exploration drilling uses only limited amounts of water compared to a mining operation. Until this exploration activity translates into mining proposals the amount of water which would be used in mining operations and associated mineral processing, and any potential water co-production from any gas extraction cannot be quantified.





# 2. Water Allocation Planning Policy and Process

### 2.1 The *Water Act* and planning framework

Under s.22B of the Act, the Minister may declare a WAP in respect of a District for a period of up to 10 years, with provision for five yearly reviews. WAPs take their legal force from the Act, which remains the main source of legal rights and obligations affecting the use of water resources in the Northern Territory. Although the Plan contains summaries of the effect of certain provisions of the Act, those summaries are provided for information only. The Plan should be read in conjunction with the Act, and will be subject to any amendments which may be made to the Act after the declaration of the Plan.

WAPs establish a framework to share water between human and environmental needs. Water resource management in any Water Control District (WCD) is to be in accordance with such a plan. A WAP is declared to ensure that water within a Water Control District is allocated within the estimated beneficial yield to beneficial uses, as defined in s4 (3) of the Act. The defined beneficial uses of water include agriculture, public water supply, the environment, cultural needs, industrial needs, aquaculture and to provide water for rural stock and domestic purposes.

Total water use from an aquifer or waterway within a Water Control District must be within the estimated sustainable yield for that aquifer or waterway. Assuming that all licensed extraction will be from groundwater, sustainable yield is defined for the purposes of the Plan as the amount of groundwater that can be extracted from an aquifer on a sustained basis without impairing water quality or causing environmental damage (Fetter, 2000).

The Plan is intended to ensure the fair and equitable sharing of the water resources of the District.

### 2.2 National Water Initiative

The National Water Initiative 2004 (NWI) is the major policy document of the Federal, Territory and State governments in relation to water allocation and planning. Its basic premise is that governments have a responsibility to ensure that water is allocated and used to achieve socially and economically beneficial outcomes in a manner that is environmentally sustainable. The Northern Territory Government agreed to an NWI Implementation Plan in 2006.

### 2.3 Great Artesian Basin Strategic Management Plan

The GAB underlies about one fifth of the Australian continent and extends into Queensland, New South Wales and South Australia as well as the Northern Territory. A Strategic Management Plan was developed for the whole of the GAB in 2000 by the GAB Consultative Council. One of its key objectives was to encourage the establishment of legislative and administrative frameworks for sustainable water management and water use within the GAB. Since then the other three states have adopted their own WAPs for their respective portions of the GAB. The development of the Plan, funded by the National Water Commission under a funding agreement between the Northern Territory and Commonwealth Governments, will assist the Territory Government to meet its obligations under the GAB Strategic Management Plan.

### 2.4 Environment Protection and Biodiversity Conservation Act 1999 (CW)

In February 2010, the Commonwealth adopted a Recovery Plan for the community of native species dependent on natural discharge of groundwater from the GAB. This community and some individual species were listed as 'endangered' in 2001 under the *Environment Protection and Biodiversity Conservation* Act 1999(CW) (EPBCA). One of the objectives of the Recovery Plan is

to 'maintain or enhance groundwater supplies to GAB discharge spring wetlands<sup>2</sup> which are found on the margins of the GAB in Queensland, New South Wales and South Australia (Fensham 2010). This has significance for the Northern Territory because research is being undertaken at the time of preparation of the Plan to determine whether the water in the Northern Territory's portion of the GAB eventually discharges at Dalhousie Springs in South Australia where a number of these species are located.

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the Committee) was appointed under the EPBCA in November 2012 to provide scientific advice to governments. The committee may be required to comment on proposed coal seam gas and large coal mining approvals where they have significant impacts on water within the District. If the Northern Territory becomes a signatory to the associated National Partnership Agreement, there may be a requirement to take into account the advice of the Committee in the assessment and approval decision in relation to any such project within the District.

### 2.5 Community Consultation

Community consultation is a key part of the water allocation planning process and helps inform values to be protected by the Plan. The public and key stakeholders were invited to participate in this planning process by attending community and private meetings, and kept informed of planning progress through the dedicated website <u>www.nt.gov.au/gabwap</u> and email correspondence. Information sessions have been held about the GAB planning process in Alice Springs and in the shire offices at Finke/Apatula. Traditional Owners in the District were advised of and consulted about the planning process by a private consultant. Interstate stakeholders were consulted by an exchange of emails between government agencies and regular updates to the GAB Consultative Committee.

<sup>&</sup>lt;sup>2</sup> Generally the springs dependent on discharge from the GAB are known as GAB springs; however in South Australia they are often referred to as mound springs reflecting their local characteristic appearance of an elevated mound of carbonate cementation with a vent at the top.

# 3. The GAB Water Control District

Under s.22 of the Act the Minister may declare a part of the Northern Territory to be a WCD. The GAB District was declared by the Minister on 22 January 2010. The District covers the south-east corner of the Northern Territory, an area of approximately 86 500 km<sup>2</sup>. This is equivalent to about six per cent of the Northern Territory. It is bounded to the south by the South Australian border, to the east by the Queensland border and extends west to include part of Goyder Creek. Then running south of Lilla Creek it continues north to the tail end of the Field River. The northern boundary is close to the northern margin of the Simpson Desert. All the major rivers that run into the Simpson Desert from the north flow into the District with the exception of the Field River. The District encompasses all outcrops of sandstone associated with the main GAB aquifer in the Northern Territory.

The District incorporates several large ephemeral rivers including the Hay, Plenty, Hale, Todd and Finke Rivers and Illogwa Creek. The northern rivers typically run parallel to the Simpson Desert dunefields and drain into and terminate in floodouts in the District. The more southern Finke River and Goyder Creek have a more classic meandering form and the Finke River passes through a large floodout near the South Australian border. There are also several large ephemeral playa lakes in the interior of the Simpson Desert, which fall within the District, including Lake Caroline, the Plenty Lakes and the group of playa lakes near Poeppels Corner as shown in Figure 3.

The District extends over all of New Crown and most of Andado Stations and intersects another five cattle stations. It includes all of one Aboriginal Land Trust (ALT) and the bulk of two other ALTs as shown in Figure 2. The community of Finke/Aputula located in the south-west of the District has an estimated population of 240 and is the only sizeable community within the District. There are estimated to be less than 100 other permanent residents in the District living on outstations and station homesteads. The District was traditionally occupied by Eastern and Southern Arrente people, and Wangkangurru peoples. There are also Pitjantjajara, Yankunytjatjara and Luritja people living at Finke/Aputula<sup>3</sup>. Nearly the entire District is covered by the Macdonnell Shire, with a small section towards the north-east covered by the Central Desert Shire.

The ground surface across the District is low lying with a gentle descending gradient, of around 400 m Australian Height Datum (AHD) elevation, running from the western and northern edges towards the south-east corner of the District (around 50 m AHD). The landscape of the District is dominated by the dunefields of the Simpson Desert, which form long linear dunes with a north and north-west orientation. The average height of the sand dunes varies from two m at the outer edges to 15 m closer to Poeppels Corner. Using the Alice Springs Land Systems mapping, the District is dominated by the parallel red sand dunes of the Simpson land unit which are covered in spinifex. There are also patches of the Endinda land unit dominated by broadly undulating stony plains which are open or sparsely covered by saltbush or southern bluebush on Andado and New Crown stations (Perry et al, 1962).

The Simpson Strzelecki Dunefields Bioregion which covers over 90% of the District contains long parallel sand dunes, fringing dunefields, extensive saltpans, sand plains and dry watercourses, vegetated with sparse shrubland and spinifex grassland. The Finke bioregion in the south-west of the District encompasses the floodplains of the Finke River and is characterised by arid sand plains with deeply cut elevations and valleys. Mulga woodland is the dominant vegetation there with various senna, eremophila and acacia species present. The adjacent Stoney Plains bioregion which occurs over a small strip of land along the South Australian border is characterised by low lowland sand and stony plains covered by stone or gibber. It is sparsely vegetated by low chenopod shrublands, with gidgee, river red gums and coolibah along the creek lines (DEWHA, 2002).

<sup>&</sup>lt;sup>3</sup> The latter peoples, originally from the Western Desert, moved to Finke in two major periods of migration: the first in the late 1910s after the 'Spanish influenza' epidemic had decimated the existing Aboriginal population; and secondly during the extended drought of the 1930s. Other movements of many Aboriginal people into the area continued from the 1960s until the early 1990s. This resulted in ritual and economic alliances between the lower Southern Arrente and the Western Desert peoples in this community, rather than displacement.



# 4. The Resource

There are presently no known or significant surface water extraction activities in the District. The total of the current licensed and unlicensed groundwater extraction per annum is calculated to be 3.5 GL/yr (Fulton, 2012). The total storage of the main GAB aquifer in the District was last estimated to be one million GL<sup>4</sup> (Matthews, 1996). Consequently the water resources of the District are considered to be in healthy condition.

A technical assessment of the groundwater resources in the District was produced by the Department of Land Resource Management (DLRM) to provide a sound scientific basis on which to base the Plan and to calculate sustainable yield. The report is titled "Technical Report: Great Artesian Basin Resource Assessment" (Fulton 2012). This section summarises some of its findings and conclusions.

It should be noted that it is implicit throughout the Fulton 2012 report, and particularly in its recommendations, that the available information which underpins its estimates of the water resources of the District is limited. The report recommends that much more research needs to be undertaken to improve scientific knowledge about these water resources and their characteristics. These recommendations have been incorporated into s.14.1 of the Plan.

### 4.1 Climate

The District has an arid climate. It experiences a large temperature range with summer daytime temperatures known to exceed 48° C and winter night-time temperatures falling below 0° C. At Finke/Aputula, in the south-west of the District, the mean monthly minimum temperature ranges from six to 23° C and the mean monthly maximum temperature varies from 29 to 38°C.

The annual average rainfall is 200 to 300 mm in the north-east of the District and reduces to less than 150 mm in the south. There is great variability from year to year. Monthly rainfall averages are higher during summer, particularly in the north of the District. Evaporation significantly exceeds rainfall year round. Average annual pan evaporation is in excess of 3 000 mm.

### 4.2 Surface Water

Surface water in the District is ephemeral and there is not the same issue of connectivity that arises in temperate or tropical climates in terms of groundwater supplying base flow to the permanent watercourses of the area. The unreliability of surface water as a resource for consumption means that surface water and groundwater operate as two distinct consumptive resources within the District. Nevertheless physical connectivity between these two resources is important because it is surface water flows that recharge the groundwater system and which support terrestrial biodiversity in the District.

The District is located in the Lake Eyre Drainage Division (surface water basin) and contains a number of internally draining ephemeral rivers and creeks including the Finke, Todd, Hale, Plenty, and Hay Rivers and Illogwa Creek. The headwaters of all these rivers are located outside the District to the north and west of the GAB. All of the rivers flood out into the dunefields of the Simpson Desert. Only the Finke River extends beyond the District into South Australia.

The Finke is the largest river and has no surface water connection to the other rivers. It is distinct from the other rivers entering the District in that it receives input from substantial tributaries within the District. The Todd River and Hale River both have floodouts which follow a linear path between the sand dunes of the northern Simpson Desert. Unlike the other main rivers, the Todd River has a major floodout between hills at the northern margin of the Simpson Desert and its water flows and channel form are greatly diminished before reaching the District. The Plenty and Hay Rivers are

<sup>&</sup>lt;sup>4</sup> This is not the same as the amount which can be extracted from the aquifer.

connected by a distributary channel, the Marshall river which is outside the District, before each runs south and south-east into the northern Simpson Desert, as shown in Figure 3.

Wetlands of the District include riverine waterholes, swamps and lakes filled from the rivers and isolated swamps, claypans and saline lakes. The majority of wetlands are not filled from the rivers. The District is notable for several large aggregations of claypans, lakes and swamps. Some of the recognised wetland areas include the Finke River floodouts (the floodout forest and Snake Creek interdunal lakes), Lake Caroline and the Plenty lakes, and swamps on Andado Station (e.g. Andado Swamp, Indinda Swamps, Indemina Swamp). Also of note are the braided floodout of the Hay River south of Lake Caroline, the McDills No 1 bore fed wetland, and the aggregation of saline lakes in the south-east corner of the Northern Territory. There are no natural groundwater dependent wetlands within the District.

The Finke River floodout is a large forest just north of the South Australian border, unique within the Northern Territory, containing braided channels and waterholes, and associated with adjacent interdunal swamps. The floodout woodlands of the Plenty River are less dense but probably the most extensive in the District. They span many interdunes with substantial low lying swamp areas and extend many kilometres south of the end of the main sandy channel.

At least some of the major aggregations of wetlands are likely to occupy low points in the landscape that would have been river valleys before the current landscape and climate developed. The Lake Caroline group of lakes and Plenty Lakes receive surface water mainly from local runoff, although some of the lakes may receive water from the nearby rivers in large floods. The aggregation of wetlands includes some interdune (swale) swamps close to the river and it is likely that these are inundated from the high flows in the river overtopping the banks (Duguid & Albrecht 2008).

### 4.3 Geology

The GAB is divided into the Eromanga, Carpentaria and Surat Basins. The Eromanga Basin, which represents the western GAB, extends over all of the GAB within the Northern Territory. In the east and south of the District the Eromanga Basin overlies the Triassic aged Simpson Basin. In the west of the District the Eromanga Basin overlies the Permian Pedirka Basin. Seismic and gravity surveys have also identified a number of regional geological structures that potentially affect the GAB aquifer including the McDills Anticlinal Trend, the Border-Colson Trend, the Eringa Trough, Madigan Trough and the Hale River Fault.

The main geological components of the Eromanga Basin within the District are the Rolling Downs Group, the Cadna-owie Formation, the De Souza or Algebuckina Sandstone and the Poolowanna Formation (which is the basal unit of the GAB sequence). The Rolling Downs Group, which includes the Wallumbilla Formation (known in the Northern Territory as Rumbulara Shale and as Bulldog Shale in South Australia), acts as an aquitard or confining bed over the Jurassic (J) aquifer. This group forms a continuous, basin wide cap and within the District attains a maximum recorded thickness of 1390 m at Thomas No 1 oil well. The distribution and thickness of this unit limits access to the water resources in the J aquifer.

The Cadna-owie Formation is a thin sandstone, mudstone and shale unit that marks the transition from the Algebuckina Sandstone to the Rolling Downs Group.

The Algebuckina Sandstone (also known as De Souza, Longsight or Hooray Sandstone) is a Jurassic to late Cretaceous sandstone that covers the whole of the District. Within the District, the principal groundwater resource, the J aquifer, is located in the Algebuckina Sandstone. The formation reaches a maximum recorded thickness of 637 m in Thomas No. 1 oil exploration well in the south-east of the Territory, but at the northern and western edges of the District is closer to 100 to 200 m thick.

More detailed information on the geology of the District is available in the Fulton (2012) report.

### 4.4 Hydrogeology

### 4.4.1 The GAB J Aquifer

The GAB consists of a series of discrete, laterally extensive sandstone aquifers separated by mudstone and siltstone aquitards. Within the District the only regionally significant water resource is in the GAB J aquifer, comprised of the Cadna-owie Formation and the Algebuckina Sandstone (known locally as the De Souza Sandstone). The J aquifer contains groundwater across more than 90 % of the District as shown in Figure 4. Properly constructed bores in the J aquifer can be capable of very high bore yields. McDills (a failed oil exploration well that was partially converted to a water bore) was free flowing at an estimated 125 L/s prior to being controlled in 2002. In the unconfined portion of the aquifer DLRM has recently tested a bore capable of yields over 30 L/s.

The groundwater in the J aquifer has an average salinity (TDS) of 550 mg/l which means it is the only extensive aquifer in the District which can reliably provide potable water from appropriately constructed bores. There have been some bores drilled in the centre of the District which have exhibited poor water quality. Typically these bores have not intersected the J aquifer and are extracting poorer quality water from sandstone interbeds within the Wallumbilla Formation.

There is very limited information available on aquifer transmissivity and/or hydraulic conductivity in the District. Mathews (1995) states that values of transmissivity of the De Souza Sandstone aquifer can range from ten to several hundred  $m^2$ /day. The value of hydraulic conductivity is likely to range from several to ten's of metres per day. There is no data available on Northern Territory specific yield, storativity or storage coefficients. Habermehl (1980) reports an average storage coefficient of  $10^{-5}$  for the confined portion of the regional GAB aquifer. The absence of firm hydraulic conductivity, transmissivity and storage coefficients represents a key information gap for the Plan.

Regionally, groundwater flows in a south-east direction away from the edges of the GAB and toward the South Australian and Queensland border. Regional groundwater gradients are very low. Existing water level data is concentrated in a relatively small area along the western and north-western margin of the GAB. In the eastern half of the District there are no water level measurements for the J aquifer. Groundwater flow directions in this area are inferred from water levels in bores across the state borders and should be viewed with a low level of confidence (see Figure 4).

### 4.4.2 Alluvial Aquifers

Groundwater resources are also present in alluvial aquifers connected to existing water courses in the District. These aquifers appear to be restricted to the areas around the present day drainage lines. Along some systems such as the Finke River the alluvial aquifer can extend for several kilometres either side of the current channel.

Water quality is variable. In some instances groundwater in these systems is potable but it can also be highly saline. The availability and quality of groundwater in the alluvial aquifers is strongly influenced by infrequent flow events in the rivers which represent the principal recharge mechanism to these aquifers. The alluvial aquifers may also provide a conduit for flood water to recharge the J aquifer, including in some of the northern river systems such as the Plenty and Hale Rivers and Illogwa Creek. No information is available on aquifer parameters or bore yields for the alluvial aquifers in the District.

### 4.4.3 Rolling Downs Group Aquifers

Groundwater is present in sandstone layers within the Rolling Downs Group. However, within the Northern Territory this groundwater is generally of poor quality and is not laterally continuous. This groundwater is typically highly saline, up to 9 450 mg/l TDS in a roads bore recently drilled for Central Petroleum exploration. Groundwater of poor quality also occurs at the base of the Wallumbilla Formation.









River Basins (ASWMA)

Topography from Geoscience Australia. The Northern Territory of Australia does not warrant that the product or any part of it is correct or complete and will not be liable for any loss, damage or injury suffered by any person as a result of its inaccuracy or incompleteness

Figure 4 Great Artesian Basin (NT) Water Control District GROUNDWATER FLOW DIRECTION

### 4.4.4 Crown Point Formation Groundwater

Groundwater is also present in the Crown Point Formation (part of the Pedirka Basin), which underlies the J aquifer along the western margin of the District. Little information is available regarding groundwater and aquifer properties in the Crown Point Formation and most data occurs at the edge of the GAB basin where the J aquifer becomes unsaturated. In these areas it appears that groundwater in the Crown Point Formation may flow laterally into the J aquifer. Generally water resources in the Crown Point are of a higher salinity compared with the J aquifer, and while generally still suitable for stock watering, the resource is not potable for human consumption.

### 4.5 Pressure

The GAB consists of a multilayered confined aquifer system. Confined or artesian aquifers contain groundwater which is under pressure and held between relatively impermeable layers. Artesian water when intersected will flow freely above ground level. This water level in a sealed bore is known as the potentiometric surface and results from the pressure of the confining geological layers on the groundwater. Subartesian bores are not free flowing at the ground surface and need to be pumped to ground level, although the water may still rise above the aquifer.

Pressure as well as water is a resource of the GAB. Natural springs occur in clusters across the GAB (outside of the District) where breaks in the confining layers allow artesian water through to the ground surface. If the pressure in the aquifer drops as a result of excessive extraction and free flowing bores, this can have economic implications for those needing to pump water to the surface and for flows to the groundwater dependent ecosystems of the GAB springs.

Three groundwater zones are recognised within the J aquifer in the District: the unconfined margins, the confined sub-artesian zone and the artesian zone. At the edge of the District the J aquifer is unconfined and water can infiltrate from the surface. Water levels are very deep in this section and can be up more than 100 m below ground level in some areas. Further away from the edge of the District the J aquifer is confined by the overlying mudstones of the Rolling Downs group. It is necessary to drill through the Rolling Downs Group in order to access the J aquifer. Where the aquifer is intersected in the confined section the water levels are shallower. This is due to the land surface elevation decreasing more markedly than the water level within the aquifer. All productive consumptive water use from the J aquifer in the District is from this sub-artesian area.

Only towards the south-east corner of the District does the J aquifer become artesian from the effects of the land surface dropping below the potentiometric surface, enabling water to flow to the surface. To access artesian water, drilling more than 500 m may be required, which generally makes it uneconomic for stock watering. The J aquifer is buried as deep as 1 400 m in the south-east corner of the District.

In the Northern Territory only a few bores have been drilled in the artesian area and only three artesian water bores have been drilled deep enough to reach flowing water. This means that available information on the artesian nature of the J aquifer in the District is limited. All three were open and free flowing for at least several decades but are now controlled. In subsequent rehabilitation attempts to these three bores, the bore known as Dakota was cemented off below the surface. Anacoora had upward losses of GAB water successfully controlled with no residual flows and McDills was rehabilitated with a controlled environmental flow (Humphreys & Kunde 2008). It is intended that the Anacoora and McDills bore will have pressure monitoring headworks installed within the next two years with funding from the GAB Sustainability Initiative<sup>5</sup> program.

### 4.6 Groundwater Storage

Matthews (1996) estimated that total groundwater storage in the J aquifer within the Northern Territory to be one million GL, however the water which can be extracted from the aquifer may only

<sup>&</sup>lt;sup>5</sup> For more information see http://www.environment.gov.au/water/policy-programs/gabsi/index.html

be a small fraction of this volume. The groundwater within the J aquifer and away from the recharge sections at the margins of the District has been estimated to be at least as old as 30 000 to 50 000 years old using Carbon 14 data. Groundwater transition times across the District are extremely slow and it is estimated it would take over 30 000 years for a single water molecule to travel from Illogwa Creek to the South Australian border. There are preliminary indications that in the south-eastern edges of the District, groundwater in the J aquifer may be more than 200 000 years old, so transition times may be even longer (Mahara et al, 2009). Hydrogeochemical work establishing the age of GAB water in some parts of the District has been conducted as part of the National Water Commission funded South Australian managed "Allocating Water and Maintaining Springs in the GAB" (South Australian Mound Springs) project <sup>6</sup>. More information on this project will be publicly available in 2013.

### 4.7 Recharge

There are considered to be two main recharge mechanisms which replenish groundwater to the J aquifer in the District; direct infiltration and recharge through flooding in ephemeral rivers<sup>7</sup>. Recharge rates through direct and indirect infiltration are considered to be almost negligible. They have been estimated at 0.3 mm/year along the western GAB margin in South Australia (Herzceg & Love, 2007). This is primarily due to the arid climate, very high evaporation rates and low average rainfall rates.

Ephemeral river recharge therefore represents the key contemporary recharge mechanism for the J aquifer in the District. At the edge of the basin where the GAB aquifer is exposed and rivers flow across the aquifer outcrop, there is potential for direct infiltration of floodwater to the groundwater system. This process is considered to represent the dominant source of recharge to the GAB along its western margin (Radke *et al*, 2000).

Surface water flow events are highly episodic and are commonly driven by large rainfall systems associated with the southerly movement of monsoonal rains from north-western Australia and/or extreme weather caused from cyclonic lows. Due to the large evaporation rates and predominantly summer rainfall, only large rainfall events significantly recharge the GAB aquifer. The availability of gauging data on the rivers is very limited both in terms of spatial coverage and extent of record. All existing gauging stations on rivers in the District rivers are located in the upper to mid catchments and consequently do not provide an accurate measure of flow duration or magnitude where the rivers cross the GAB recharge zone. The lack of stage height and flow data for the reaches of the rivers coincident with the GAB recharge zones represents a key data gap.

Small flow events occur with reasonable frequency. The majority are short lived and are driven by very localised storm activity. In the case of the Finke River these small events often result in only a section of the river flowing. Large events for the Finke are anecdotally characterised as those where the river flows simultaneously along its entire length from Hermannsburg through to the floodout on Andado. Larger flow events occur around every 10 years (1988, 2000, 2010). They often involve multiple flow events (2000, 2010) and can result in the rivers running for weeks as opposed to days for small flow events. Some sections of the Finke are known to run for months in very wet years. It is the large flow events in the Finke River that are considered to provide more significant recharge to the GAB aquifer.

A groundwater mound is present in the J aquifer under the Finke River where it flows through Finke/Aputula Community. Groundwater levels in this area are 10 to 15 m higher than regional water levels in the aquifer and clearly indicate a zone of enhanced recharge around the Finke River. Elevated groundwater levels may also occur around Illogwa Creek and the Plenty River suggesting recharge could be occurring through sections of these rivers.

<sup>&</sup>lt;sup>6</sup> For more information see http://www.nwc.gov.au/www/html/546-allocating-water-and-maintaining-springs

<sup>&</sup>lt;sup>7</sup> Another potential source of inflow is lateral or interformation flow from the Crown Point formation.

Recharge rates calculated from water table fluctuations in the J aquifer underneath the Finke River estimate annualised recharge to the J aquifer from flows in the Finke River to be 5 650 ML. Ephemeral river recharge is also thought to operate on the Hale and Plenty Rivers and Illogwa Creek. It is therefore assumed that total annualised recharge to the J aquifer within the District will be 17 000 ML.

More information will be available about recharge to the Northern Territory portion of the GAB when the DLRM component of the South Australian Mound Springs project is published in 2013.

### 4.8 Discharge

There is no known natural discharge from the J aquifer to the surface within the District although significant discharge occurs through the Dalhousie and Mulligan spring complexes in South Australia and Queensland respectively that are adjacent to the District. Discharge due to evapotranspiration from the J aquifer within the District can be considered negligible. This is due to the very deep unsaturated zone in the unconfined portion of the aquifer, which limits the potential for evapotranspiration of groundwater from the J aquifer.

### 4.9 Regional Water Balance

Work recently undertaken in the area of the recharge zone beneath the Finke River estimates the annualised recharge to be 5 650 ML for this part of the system alone. Recharge is also believed to occur through the beds of other river systems, such as the Hale and Plenty River and Illogwa Creek systems to the north. These systems are characterised by lower frequency of flows. However, if it were considered that a similar figure could be applied, the total annualised recharge for the District would equate to approximately 17 000 ML.

Due to the complexity of the groundwater flow regime in terms of flow path, direction and supporting data, the scarcity of aquifer hydraulic data, the uncertainty regarding aquifer geometry, and recharge rate, the calculated throughflow can only be derived within an order of magnitude<sup>8</sup> margin of error. This has been attempted using traditional flow analysis on a portion of the regime. The calculated figure for throughflow provides an approximate measure of recharge to the system. Based on an estimated representative transmissivity of 250 m<sup>2</sup>/d for the Algebuckina Sandstone, an average gradient of 1:2 000 across a flow width of 300 km in the District as represented in Figure 4, the annualised flow equates to 15 000 ML/year. This is within a similar order of magnitude.

<sup>&</sup>lt;sup>8</sup> An estimate of size or magnitude expressed as a power of 10.





# CROSS SECTION A-B-C



### 5. Water Use

### 5.1 Current licensed groundwater use

Groundwater is the main water resource for consumptive use in the southern region of the Northern Territory. A significant use of groundwater in the District which does not require licensing or metering is for stock and domestic uses. The District has only one issued extraction license of 96 ML groundwater per year to Power Water Corporation for public water supply to the community of Finke/Aputula. For all water extraction licences in the District, water usage is and will be metered, and annual extraction amounts reported to DLRM.

### 5.2 Current unlicensed groundwater use

The Act does not require a licence for water extraction which is to be used for stock and domestic purposes, for water extraction associated with mining activities, nor for water extraction associated with road construction<sup>9</sup>.

The first known bore was drilled into the Northern Territory GAB in 1894 near the South Australian border to supply water to the Charlotte Waters telegraph station. In 1898 the first artesian bore Anacoora was completed, also in the south of the District. Over the last 110 years another 182 bores have been drilled and constructed in the GAB aquifer in the Northern Territory. Of these bores it is estimated that 52 bores are currently being used for groundwater extraction, 17 bores are actively used in groundwater investigations or monitoring and the remaining 113 bores are either abandoned or are not equipped (Fulton 2012).

Most of the bores being used in the District are used for stock and domestic water supply for pastoral enterprises (71% of bores). Other bores in the District are used for groundwater investigation and monitoring (13%), community and outstation water supply (11%), water supply for mineral exploration (4%) and roads bores (<1%) (Fulton 2012).

Total current groundwater extraction in the District is estimated at 3 500 ML/year<sup>10</sup>. Approximately 2 240 ML/year is sourced from the J aquifer with a further 1 260 ML/year extracted from non-GAB aquifers within the District.

Water from the J aquifer in the District is used for stock and domestic purposes, environmental discharge and public water supply. Around 1 890 ML/year is extracted from the J aquifer for stock and domestic supply. Stock and domestic extraction was estimated assuming a continuous pump rate of 2 l/s per stock bore. Thirty bores were assessed as extracting groundwater wholly or in part from the J aquifer. Environmental discharge from the J aquifer at McDills bore is estimated to be 250 ML/year.<sup>11</sup> Public water supply of just under 100 ML/year for Finke/Aputula, which is licensed, accounts for the remaining extraction from the J aquifer (Fulton 2012).

### 5.3 Current cultural use

The Northern Territory portion of the GAB was traditionally occupied by Eastern and Southern Arrente people, and Wangkangurru peoples. Important cultural sites, many associated with swamps, claypans and creeks, were first described by David Lindsay in 1886 and comprehensively documented as early as the 1930s by T.G.H Strehlow. Early settlers also took advantage of

<sup>&</sup>lt;sup>9</sup> Territory Government Gazette S35, 30 June 1992

<sup>&</sup>lt;sup>10</sup> This is significantly more than the figure used in the Background Report which was based on a different methodology of estimating water use at 50 kl/head/day by cattle. It is considered that use of a constant pump rate at the bore rather than consumption is more accurate for the purposes of the Plan.

<sup>&</sup>lt;sup>11</sup> The discharge at McDills is restricted to approximately 8 l/s by the size of the casing installed and is based on the estimated flow required to maintain a "small wetland". Prior to control works there was a much larger wetland at McDills.

Aboriginal knowledge of the area with many early bores and wells sited on or near pre-existing Aboriginal or native wells and soaks (Hercus, 1986).

As might be expected, many of the dreaming trails which cross the Northern Territory section of the GAB move across interstate boundaries. For example, the area of Acacia peuce at the Mac Clark reserve is part of both the Urumbulla dreaming and the Perentie dreaming. The Urumbulla dreaming is known to run north from Port Augusta in South Australia up to Renner Springs in the Northern Territory. It refers to a story about youths (also Native Cats) crossing the country from the south, and splitting into four groups on the Southern Finke and pass variously through the east and west Macdonnell Ranges. The Perentie Dreaming travelled south through the Northern Territory part of the Simpson Desert, passing through *Utjirra*, a large freshwater claypan on the western side of the Plenty River deep in the Desert, towards Macumba River country and it also passes through Dalhousie Springs (Kimber, 1986).

Rain or *Kwatye* dreaming trails within the GAB WCD include the Arrente dreaming which has recorded sites along the Goyder Creek. The Plover is associated with that rain dreaming because it followed the rain to Charlotte Waters. Further to the east, some of the swamps and claypans<sup>12</sup> on Old Andado Station are associated with the two carpet snake dreaming. East beyond the Hay River, there is a dreaming associated with two poisonous snakes that travelled south from *Cootha Kartnathunkita*, an old spring or water hole in Wangkangurru country, which is in extreme southern Plenty River country (Kimber, 1986).

Although Strehlow recorded sites in the Wangkangurru area, which is Simpson Desert sandhill country, he did not visit them. There are Dreaming trails associated with that country however few people have been able to document the specific sites. The Wangkangurru stopped living in the Simpson Desert in the summer of 1899-1900 (Hercus, 1985). The last Wangkangurru man born deep in the desert, Mick MacLean, who died in 1977, travelled through some of that country in the early 1960s with linguist Luise Hercus. Hercus noted four Simpson Desert Rain histories including that from *Ilbora* on the South Australian section of the Finke River, and the eastern Simpson Desert Rain story connected with Lake Mirranponga Pongunna in the far south-east corner of the Northern Territory. The four stories are all distantly connected by clouds drifting all over Wangkangurru country (Hercus, 1986).



Near the South Australian border and Lake Mirranponga Pongunna. May 2010, Plate 1 In the most southeastern corner of the GAB District there are three *mikiri*, which were deep soaks or wells centred on low lying depressions in gypseous interdunal flats. where water was obtained from long narrow tunnels as deep as 7 m underground. One of these sites is known as Kilpatha and was associated with the eastern Simpson Desert rain cycle. In this dreaming the rain ancestor Kutikutihirinha comes from the east and wants to take two beautiful young girls away from a camp. The

<sup>12</sup> Claypans are *irpi* and swamps *ikara* in Wangkkanguruu (Hercus, 1985)

only way he can get them is to destroy everyone else with lightening; so he practices his power by destroying trees and dunes with lightening as he travels along and ultimately he kills all the inhabitants of the camp at Lake Mirranponga Pongunna (Hercus, 1986).

The District also encompasses other individual important water sites. *Tjiparta* was the main soak east of Andado, on the Hale River which was previously used for Arrente rainmaking ceremonies (Kimber 1986). Another example is *Ilanja*, a big waterhole at the base of a hill in the southern end of the Plenty River, which is a reliable soak in dry times.

Other water sites were some of the most important full scale ceremonial sites and are associated with ephemeral water sites. They did not provide refuge during droughts. Many of the largest ceremonies could only be performed in the best seasons when rain had filled these swamps and floodouts (Strehlow 1970).

### 5.4 Current environmental use within the District

There are no GAB springs or known natural ecosystems dependent on groundwater from the J aquifer within the District. Virtually all surface water and natural wetland features in the GAB District, as shown in Figure 3, are not dependent on groundwater which means that groundwater extraction within the District is unlikely to affect their long term health. There are no known terrestrial groundwater dependent ecosystems within the District.

Further work is needed for a more complete understanding of where the wetlands and surface water ecosystems are located, their hydrological regimes, the connectivity between rivers, the plants and animals they sustain, their ecological function and their role in aquifer recharge and discharge. Work should include further ground inspections, biological survey, analysis of satellite imagery from various dates and discussions with landholders.

### 5.5 Current environmental use downstream from the District

Significant groundwater dependent ecosystems do exist close to the Northern Territorian and South Australian border at Dalhousie Springs Complex, and near the Northern Territorian and Queensland border at the Mulligan River Springs Supergroup<sup>13</sup>. The Mulligan River Springs Super complex has nine active springs and three springs with indeterminate activity. No endemic species are recorded at this spring's complex. Only some of the springs in this complex discharge GAB water, as some of them are fed by recharge rejection (Fensham, 2003). The supergroup's daily discharge flow rate is estimated to be 0.09 ML/day (Fensham, 2010).

Dalhousie Springs is the largest artesian spring complex in Australia. It is located approximately 50 km south of the Northern Territory and South Australian border. The Dalhousie Spring complex comprises more than 100 springs and associated mounds, over 60 of which are active springs. The largest pool is about 50 m long and 10 m deep. Many of the springs have large circular mounds up to 100 m in diameter, ranging up to 10 m in height. The discharge from the Springs ranges from seepages to discharges of more than 150 l/s. The associated wetlands are RAMSAR listed and support a diverse range of terrestrial and aquatic flora and fauna including several endemic species (DSEWPC, 1993). It also has significant cultural, heritage and tourism value. The South Australian Mound Springs project has investigated the hydrogeological link from the upgradient District<sup>14</sup>.

### 5.6 Future prospects for use

It is possible that further groundwater extraction licence applications could be made for horticultural enterprises, such as date plantations, in the next decade. This would be most likely to occur on

<sup>&</sup>lt;sup>13</sup> A supergroup is a major regional cluster of spring-complexes with some consistent hydrogeological characteristics.

<sup>&</sup>lt;sup>14</sup> Although it may be noted that the project made no provision to install any pressure monitoring bores upgradient of the Dalhousie spring complex that would accurately record baseline pressure and detect any drop in pressure resulting from upgradient water extraction.

land under licence from Aboriginal Land Trusts. However there does not appear to be any such projects planned for the next five years. DLRM will endeavour to provide as much assistance as possible to organisations that have the support of traditional Aboriginal landowners, in order to enable the grant of water extraction licenses for economic development projects on Indigenous owned land within the estimated sustainable yield of the relevant aquifer.

Future tourism enterprises in the District are likely to be relatively small and are unlikely to result in any significant increase in water extraction in the District. It is not anticipated that unirrigated plantation forestry requiring a water extraction license will occur within the District. It is also not anticipated that there will be any significant increase in unlicensed water use for stock and domestic purposes for the duration of the Plan.

The most likely future use for water in the District is associated with the current wave of oil, coal and gas mining exploration. The focus of recent exploration has shifted to identifying coal reserves thought to occur in the Permian sequence underlying the GAB. Water use associated with mining activities is currently exempt from water licensing requirements under the Act and therefore cannot be regulated by the Plan. Nevertheless any extraction made for mining purposes will still have to be considered in the context of any allocations permitted under the Plan<sup>15</sup>. Therefore any approval of a Mine Management Plan that allows large scale unlicensed water extraction in the District with the potential to impact on the GAB springs or other consumptive users will trigger an immediate review of the Plan, subject to the requirements of the Act.

These forms of development are the only form of manmade land use changes anticipated within the District and are not expected to impact on recharge to the water resources of the District. However they will involve further extraction of water from the Consumptive Pool described in the Plan and therefore impact on the amount of water left in natural storage.

### 5.7 Potential impacts of extraction

In the Northern Territory there is a scarcity of data in relation to current impacts, if any, on the J aquifer. It is however generally believed that there has been almost no regional drawdown because of the lack of artesian bores within the District (Matthews, 1995). It is unlikely because of the sheer volume of the resource that continued extraction at current rates will have any significant impact on the J aquifer. It is however possible that large scale extraction would lower the potentiometric surface in the J aquifer resulting in localised interference with stock bores necessitating additional pumping costs associated with a lower water level. In the event that there are any reports of borefield interference or aquifer contamination impacts resulting from extraction within the District, they will be investigated by DLRM as part of standard compliance procedures.

Analytical modelling and the collation of baseline data by project proponents should be required in order to anticipate drawdown impacts before large scale water extraction projects are permitted to proceed. If significant extraction were to occur near the interstate borders adjacent to Dalhousie or Mulligan River Spring complexes, (downstream groundwater dependent ecosystems) there is a possibility that reduction in pressure would eventually affect discharge rates at these interstate springs<sup>16</sup>. Any indication of such potential for adverse impacts would be likely to trigger the application of the EPBCA.

<sup>&</sup>lt;sup>15</sup> Note previous comments about the difficulty of quantifying potential water extraction associated with mining activity when all current mining projects in the District are still at exploration phase.

<sup>&</sup>lt;sup>16</sup> For example calculations using the Theiss equation suggest that a continuous extraction of 1 GL/yr will result in drawdown 100 km away of 9 cm after 10 years and 17 cm after 25 years. Continuous extraction of 0.5 GL/yr is estimated to result in drawdown 100 km away of 4 cm after 10 years and 8 cm after 25 years. These calculations are very dependent on storage co-efficient and aquifer transmissivity.

# 6. Objectives and Strategies

Objectives of the Plan	Strategies to achieve this include:	Performance Indicators (Clause 14.1)
1. <u>Maintain public water supply</u> . To ensure a safe water supply, sufficient in volume and quality for essential services to communities as well as for rural stock and domestic water requirements.	<ul> <li>Regional groundwater quality and water levels will be monitored for long and short term changes. (cl. 14.1)</li> <li>There will be compliance monitoring of conditions on water extraction licences and bore construction permits (cl. 14.1).</li> <li>Legal action may be used to effect compliance of these conditions at the discretion of DLRM (cl.10.1).</li> <li>General rules will be developed for buffer zones around potential sources of pollution and for the siting of production bores, subject to the requirements of the Act or any other relevant legislation (cl.10.2, Appendix 1).</li> <li>Conditions on public water supply licences will require water quality standards to be met (cl.10.2).</li> <li>Any reports of bore field interference or contamination of aquifers will be investigated (cl. 5.7)</li> <li>In the event that DLRM introduces a policy on backflow prevention, it is likely that backflow devices will be required for licensed production bores as a means of minimising risk of pollution to aquifers (Appendix 1).</li> </ul>	Changes in water quality in aquifers that are being used for licensed water extraction (Action 1). Incidence of disruption to water supply for communities and pastoral properties (Action1). Change in groundwater levels and potentiometric head (Action1). Incidence of pollution events (Action 5). Compliance with installation of appropriate backflow prevention and metering devices (Action 4).

Objectives of the Plan	Strategies to achieve this include:	Performance Indicators (Clause 14.1)
2. Protect the environment To maintain and protect good water quality and flows in water dependent environmental sites.	<ul> <li>Preserve 95% of surface water flows for the environment and non consumptive cultural needs (cl. 7).</li> <li>No cumulative extraction of 1 GL/year or above from the J aquifer can occur in the District within a 100 km radius of Dalhousie or Mulligan GAB springs, unless the proponent can demonstrate no potential short or long term impact on the potentiometric surface, water quality and ecosystems of the relevant spring complex<sup>17</sup> (cl.8.2,10.2)</li> <li>Any license application which has the potential to result in a predicted cumulative drawdown of more than 10 % of the potentiometric surface above ground level at the interstate border will trigger interstate consultation as part of the Controller's consideration of that licence application. (cl. 8.2,10.3)</li> </ul>	Reported incidence of environmental degradation that can be attributed to water extraction (Action 5). Any evidence of vertical leakage of more saline water into the J aquifer (Action 5). Compliance with requirement for bores in confined area of the J aquifer to isolate other aquifers (e.g. the Wallumbilla Formation) to prevent intermixing of groundwater (Action 4). Any evidence of declining potentiometric surfaces in the monitoring bore to be installed upgradient from Dalhousie Springs (Action 3).

<sup>&</sup>lt;sup>17</sup> The buffer zone of 100 km is based on Theiss equation calculations referred to above.

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Objectives of the Plan	Strategies to achieve this include:	Performance Indicators (Clause 14.1)
3. <u>Support Indigenous culture &amp; communities</u> Maintain and support traditional cultural values on Indigenous owned land through the protection of culturally significant water dependent sites, as well as providing access to water for commercial development.	<ul> <li>Preserve 95% of surface water flows for the environment and non consumptive cultural needs (cl.7).</li> <li>Work with organisations that have the support of the traditional Aboriginal landowners, to provide water for economic development projects on Indigenous owned land within the sustainable yield of the relevant aquifer (cl.5.6).</li> </ul>	Reported incidence of environmental degradation of culturally significant water dependent sites that can be attributed to water extraction (Action 5). Whether commercial development projects on Indigenous owned land have been impeded by lack of access to water resources (Action 7).
4. <u>Ensure sustainable development</u> Development of sustainable water consumptive industries to form a significant part of the region's economy will be conducted within a sustainable framework.	<ul> <li>Water extraction licences will be available for amounts within the estimated sustainable yield of the relevant aquifer (cl.8.2, 8.3).</li> <li>Water trading will be permitted (cl.11).</li> <li>Cooperation will be given to organisations that have the support of the traditional Aboriginal landowners, in order to provide water for economic development projects on Indigenous owned land within the estimated sustainable yield of the relevant aquifer (cl.5.6).</li> </ul>	Whether sustainable regional development projects have been impeded by lack of access to water resources (Action 7).

# 7. Water for non consumptive purposes

In the arid zone the Northern Territory Government has followed the principle that 95% of surfacewater flows shall be reserved for environmental, aesthetic, recreational, Indigenous cultural and other public benefit outcomes. This Plan allocates 95% of streamflow or surface water catchment flow under the Plan for environmental and cultural needs. This will preserve surface water features, the health of the environment and maintain regional catchment recharge into aquifers within the District. It is assumed that this protection of environmental values will also maintain the condition of places that are valued by Indigenous people for cultural purposes.

In the arid zone the Northern Territory Government has followed the principle that in the absence of adequate scientific information, total extraction of groundwater over a century should not exceed 80% of the estimated total aquifer storage. The consumptive pool allocated under the Plan is equal to 70% of annualised recharge of the J aquifer which is a negligible fraction of J aquifer storage. Accordingly any changes to storage due to consumptive use will be miniscule relative to the total storage volume; and as the consumptive use is less than the annualised recharge there will be no long term decline in the storage volume. Accordingly a volume of water equivalent to 30% of estimated annualised recharge to the J aquifer is allocated for the environment and non consumptive cultural needs as described in s.4(3) of the Act.

# 8. Consumptive Pool

### 8.1 Surface water

At the time of preparation of the Plan, only one surface water extraction license is issued in the whole of the southern region of the Northern Territory, and none in the District. Because of its ephemeral nature in the arid zone, surface water is generally considered an opportunistic rather than a reliable resource. Surface water is most likely to be used in the southern region for dams for stock and domestic use which do not generally require licenses under the Act. The approach of DLRM in relation to any surface water extraction in the District is that no more than five per cent of any river flow events at any time can be extracted for consumptive use from any river or watercourse. This is a conservative approach which allows limited surface water use while still protecting the environmental and cultural values that are often associated with riparian areas in the arid zone.

### 8.2 Ground water from the J aquifer

For the purposes of the Plan sustainable yield is taken to mean the amount of groundwater that can be extracted from an aquifer on a sustained basis without impairing water quality or causing environmental damage. Because of the groundwater levels in the J aquifer in the unconfined portion of the aquifer and the ephemeral nature of the surface water systems in the District it is acknowledged that groundwater extraction from the J aquifer is unlikely to affect surface water ecosystems within the District.

The resource in the J aquifer is significant and there is considered to be negligible threat to existing users from current and projected water use. Nevertheless there is the potential for pressure reduction to result from any large scale water extraction in the artesian portion of the District. The most important environmental values which could be impacted by pressure reduction in the J aquifer in the District are the interstate GAB springs identified above. In all the interstate GAB water allocation plans, buffer zones have been used to counteract any potential environmental damage to GAB springs, including impacts from pressure reduction.

In order to prevent deleterious changes to groundwater discharges to the interstate GAB springs, no license for cumulative water extraction of 1 GL/year or more from the J aquifer in the District within a 100 km radius of those spring complexes will be permitted under the Plan, unless the application is accompanied by hydrogeological assessment which demonstrates no potential short or long term impact on the potentiometric surface, water quality and ecosystems of the relevant

spring complex. Furthermore, any extraction license application which has the potential to result in a predicted cumulative drawdown of more than 10% of the potentiometric surface at the interstate border will trigger interstate consultation prior to consideration of that licence application. It is also likely that any project proposal for licensed or unlicensed water extraction which has the potential to impact on Dalhousie Springs where there are endemic species will trigger an environmental impact assessment under the EPBCA.

If sustainable yield is interpreted as a proportion of recharge to the system, total recharge must be estimated. Annualised recharge in the context of the District recognises that eight major recorded recharge events have occurred in the last 24 years, and divides that estimated amount from such major events into an amount per year. It is estimated that total annualised recharge to the J aquifer in the District is 17 000 ML/year (or 17 GL/year) (Fulton, 2012).

No water quality impacts on the aquifer or effects to the environmental values of the interstate GAB springs have been identified under the current level of extraction. A volume of water equivalent to 70% of estimated annualised recharge into the J aquifer in the District, 11.9 GL/yr, is allocated to the consumptive pool and is available for extraction under the Plan<sup>18</sup>. Under episodic recharge conditions, groundwater extraction will draw upon storage until recharge occurs. It is considered that the high storage volume in relation to annualised annual recharge and extraction limits from the J aquifer will result in the groundwater system being in equilibrium over the long term (GHD, 2011).

Unlicensed extraction from the J aquifer within the District is estimated to be 2.2 GL/year. The total licensed volume available for licensed extraction from the J aquifer in the District for the consumptive beneficial uses of agriculture, aquaculture, public water supply, industry and rural stock and domestic purposes as described in s.4(3) of the Act shall not exceed 9.7 GL/year.

Due to the relative scarcity of available information about the resource, no management arrangements will be made distinguishing between the unconfined, subartesian and artesian portions of the J aquifer.

As further modelling and hydrogeological information is obtained, the available allocation may be revised during the life of the Plan to reflect improved understanding of estimated sustainable yield.

#### 8.3 Other groundwater resources

Approximately one third of current water extraction within the District, i.e. 1.2 GL/yr, is taken from groundwater resources other than the J aquifer. This extraction is wholly for stock and domestic, or road construction purposes, which are not required to be licensed under the Act. There is very little information available about the parameters of these groundwater resources. In the absence of storage estimates and using the definition of sustainable yield referred to at the beginning of cl 8.2, all water in these groundwater resources which is required to maintain water quality and dependent environmental systems is allocated to cultural and non consumptive use. All water which is not required to maintain water quality and dependent environmental systems is allocated for significant access to these resources would need to be accompanied by hydrogeological evidence indicating that the proposed extraction would not negatively impact on the water quality of that resource or on the environmental values of any dependent ecosystem<sup>19</sup>.

<sup>&</sup>lt;sup>18</sup> This is consistent with the approach taken in the New South Wales GAB WAP which is the only other GAB WAP to tie the allocation under the relevant water allocation plan to a percentage of recharge for at least part of the Plan area. It also reflects the buffer to potential impacts provided by the immense storage in the resource. However in the event that significant unlicensed water extraction for mining is permitted within the District this amount would have to be appropriately reduced to reflect that change to total extraction from the J aquifer.

<sup>&</sup>lt;sup>19</sup> The level of evidence required would be commensurate with the proposed level of water extraction.

# 9. Permits for water extraction

### 9.1 Surface water extraction and interception

Under the Act, a permit is generally required to construct a dam. However, across the Northern Territory, rural dams of less than three metres bank height and a catchment area of less than five km<sup>2</sup> have been exempted from permit and licensing requirements<sup>20</sup>.

Regardless of these exemptions, any construction of dams or water-intercepting/diverting works may require a permit under other legislation (particularly the Sacred Sites Act). As such it is the landowner's responsibility to ensure all appropriate permits and approvals have been granted before any construction begins. This would include ensuring that the proposed works comply with the Act.

The allocation made under the Plan of 95% of all surface water in the District to the environment and non consumptive cultural use will be considered relevant by the Controller of Water Resources (the Controller) in respect of any decisions made regarding licensing of surface water use and construction permits for dams or other water control structures. (See Part 5 of the Act)

### 9.2 Groundwater

Once a District has been declared, a bore construction permit is required under s.57 of the Act for the construction of all water bores greater than three metres deep within the District irrespective of their intended use or capacity<sup>21</sup>. This means that bore construction permits are required for water bores to be used for unlicensed extraction, such as stock and domestic purposes. Bores must be constructed by a Northern Territory licensed driller. Bore construction permits will require compliance with the *Minimum construction requirements for water bores in Australia 3<sup>rd</sup> ed* (NUDLC, 2011).

Bores drilled into the confined portion of the J aquifer must be drilled by a driller with an appropriate class of license and have a construction that adequately prevents inter-aquifer contamination. The construction of these bores should be designed to isolate the Wallumbilla Formation in order to prevent the downward leakage of groundwater.

Standard conditions will be imposed by the Controller on all bore construction permits issued in the District to achieve the objectives of the Plan. Granting of bore construction permits will not absolve the permit holder from any responsibilities they may have under any sacred sites, heritage conservation or other applicable legislation.

### 10. Licences for water extraction

### 10.1 Licensing under the Act

- I. The taking of surfacewater without a licence within the District is prohibited unless provided for under the Act<sup>22</sup>.
- II. The taking of groundwater without a licence within the District is prohibited unless provided for under the Act.
- III. All licences must meet the requirements of the Act and its Regulations and associated approved forms. Except in special circumstances, licences will not be granted for a period exceeding 10 years. Licences will be renewable upon application one month before expiry of the licence.

<sup>&</sup>lt;sup>20</sup> Northern Territory Government Gazette S35, 30 June 1992

<sup>&</sup>lt;sup>21</sup> Permits are not required for bores deeper than three metres drilled in connection with the supply of utilities, public drains, or road and building construction. *Northern Territory Government Gazette S35, 30 June 1992* 

<sup>&</sup>lt;sup>22</sup> As there is only one surface water licence currently issued in the whole of the NT south of Elliott and this situation is not expected to change, the licensing provisions below relate to groundwater.

- IV. All licence applicants are required to complete and submit the approved application form under the Water Regulations.
- V. All applications for licence/s made under the Plan will be published in accordance with the Act. All decisions on applications for licence/s to take groundwater will be published in accordance with the Act, and a copy of the full decision will be made publicly available including the reasons for the decisions and how these were taken into account in accordance with the Act.
- VI. Licences for groundwater extraction of a specified volume may be granted under the Plan by the Controller in accordance with s.60 of the Act.
- VII. The details of licence/s will be contained on a register posted on the Northern Territory Government website in accordance with the Act.
- VIII. Failures to meet licence conditions may result in prosecution of the licensee and/or revocation or modification of the licence.

### 10.2 Licensing under the Plan

#### 10.2.1 General

For the purposes of the Plan, and without limiting s.90 of the Act, the following matters are identified as generally relevant to the Controllers decision whether to grant an application for a groundwater extraction licence:

- I. An application for a licence will not be granted if it will result in a breach of the limit on extraction set out in clause 8 of the Plan.
- II. Licences for the extraction of any groundwater, irrespective of salinity levels, may be granted under the Plan at the discretion of the Controller.
- III. All groundwater licences issued within the District managed by the Plan will have equal levels of reliability under the Plan.
- IV. Standard licence conditions, as outlined in the Water Regulations and associated approved forms, may be imposed by the Controller to achieve the objectives of the Plan.
- V. Licences granted under the Plan will be in the standard Form determined from time to time under the Act. An example of the current Form with sample terms and conditions relevant to the Plan is shown Appendix 1.
- VI. Groundwater extraction licence applications will be considered in the context of licences already issued within the District, and any other existing knowledge about the resource. In particular, water extraction for public water supply and for unlicensed rural stock and domestic uses existing at the date of declaration of the Plan will always be given consideration before licence applications for other consumptive beneficial uses will be granted.

### 10.2.2 Matters to consider when granting Licences and Permits

For the purposes of the Plan, and without limiting s.90 of the Act, the following matters are identified as generally relevant to the Controllers decision whether to grant an application for a groundwater extraction licence:

- VII. Whether access to the resource and a capacity to undertake the proposed development can be demonstrated,
- VIII. Whether the proposed production bore/s will negatively impact on existing production or stock and domestic bores, and the provision of any supporting hydrogeological analysis, if appropriate,
- IX. Whether the proposed development will compromise the environmental and/or cultural objectives of the Plan, and the provision of any supporting hydrogeological and/or cultural and ecological information, if appropriate,
- X. Whether the applicant proposes to implement water efficiency and water protection principles in the use of water extracted under the licence,
- XI. The capacity of proposed production bore/s and their location relative to existing operational bore/s, and the provision of evidence demonstrating minimum potential for impact,

- XII. The location of a proposed production bore relative to a potential pollution source, including without limitation, old and current landfill sites, septic tanks and/or unbunded fuel or chemical depots and the provision of evidence demonstrating minimum potential for water quality impacts (it being recognised for the purposes of the Plan that it is generally undesirable for a bore to be constructed within 100 m of such a source),
- XIII. Whether a monitoring bore will be constructed no closer than 750 m away from any proposed artesian bore anticipated to be produce more than 1 ML/day,
- XIV. Whether any proposed artesian borefield with a cumulative extraction equal to or over 1 GL/year located within a 100 km radius of interstate GAB springs is supported by the provision of hydrogeological information demonstrating no potential short or long term impact on the potentiometric surface, water quality and ecosystems of the relevant spring complex,
- XV. (In the case of applications for licences for public water supply) the projected demand for water supply, including population projections and per capita demand, and whether the extracted water will achieve water quality targets guided by the Australian Drinking Water Guidelines, 2004,
- XVI. The provision of evidence from any further hydrogeological, ecological or cultural investigations undertaken by the licence applicant in response to comments made under s.71B(4) of the Act, and
- XVII. Any other information or evidence considered by the Controller as relevant to the particular application.

### 10.3 Interstate consultation

Where a licence application may result in a predicted cumulative drawdown of more than 10% of the potentiometric surface above ground level at the interstate border, the Controller will initiate interstate consultation prior to consideration of that licence application.

### 10.4 Transfer of licences as a result of Sale of Property

Where a Northern Territory Portion is sold, a new licence will be issued to reflect the change of ownership once the sale of a property is confirmed with the DLRM Water Resources Branch. In situations where a Northern Territory Portion is sold and the new owner's water demands are greater than the volume specified on the existing licence, the new owner must apply for an increase in the volume specified on the licence in accordance with the Act.

### 10.5 Assignment of Risk

It must be understood by all water users in the Northern Territory that their rights to extract and use water, whether under the Act (for example for stock and domestic purposes) or under a licence, are not, and cannot be, guaranteed by the Northern Territory Government. It must be understood that they bear the risks of any reductions to water availability under their licence resulting from seasonal or long term changes in climate and from periodic natural events such as drought or contamination; and that they bear the risk of reduced water availability under a water licence arising as a result of bona fide improvements in the knowledge about the water sources capacity to sustain particular extraction levels.

### 10.6 Fees and Charges

There is currently no agreed policy on the introduction of fees and charges for water resource management within the Northern Territory but these may be considered in the future. The licensee is expected to bear the monitoring and reporting costs associated with providing any necessary data or information required by conditions in the licence.

### 10.7 Emergency Powers to Limit Rights to Take Water

In times of actual or likely water shortage or otherwise under the emergency powers as set out in s.96 of the Act, the Minister may place water restrictions on licensees in the District as well as on stock and/or domestic and any other groundwater users.

# 11. Water Trading

Current projected demand on the water resource within the District indicates that water trading is unlikely to occur within the 10 years of the Plan. If this situation changes more detailed trading rules may be developed.

#### 11.1 Trading Rules

- I. The right to take and use water under a licence granted in accordance with the Plan is able to be traded in part or in full in accordance with the following provisions. The procedure to be followed when trading depends upon whether the trade is intended to be temporary or permanent.
- II. Temporary trades are trades on an annual basis and are only effective during the current year. In situations involving a temporary trade to a person who already holds a water extraction licence, the Controller will issue that person with an 'own motion' licence (for the traded allocation) under section 60 of the Act. If the person does not already hold a licence, they will need to apply for a water extraction licence and the process in Part 6A of the Act will apply.
- III. Under a permanent trade a licensee's entitlements for the remainder of their licence are traded to another person. The trade may relate to the entire licensed volume or a part of it. An applicant for a permanent trade will need to apply for a water extraction licence and the process in Part 6A of the Act will apply. It is not expected that permanent trades will occur until the consumptive pool is completely allocated.
- IV. Trade in licensed entitlements to groundwater is permitted only where extraction will continue to be from the same aquifer.
- V. Prior to consideration of any application to trade a water licence which has the potential to result in a predicted cumulative drawdown of more than 10 % of the potentiometric surface above ground level at the interstate border, the Controller will initiate interstate consultation.

# **12. Limitations and Assumptions**

### 12.1 Climate Change

Allocation and licence limits in the Plan have been determined based on historic climatic data only and do not consider the possible effect of climate change on the long term availability of water from this water source. Although it is anticipated that temperature and therefore evaporation will increase in the District, an increase in intensity of storm events projected under current climate change modelling may also increase recharge to the groundwater resource. When the Plan is reviewed, the latest climatic data will be used to take account of information on projected future climate change.

### **12.2 Protection of Environmental and Cultural Values**

This Plan assumes that the provision for protection of environmental values will also maintain the condition of places that are valued by Indigenous people for cultural purposes. It recognises that any new research on specific environmental water requirements will be considered as part of the review process. It also recognises that cultural water requirements may not align entirely with environmental requirements and that any new research on specific cultural water requirements will be independently considered as part of the review process.

# 13. Review of the Plan

In accordance with the Act, the Plan must be reviewed at intervals not longer than five years. The review shall consider the extent to which the Plan has achieved its objectives and evaluate the efficacy of the strategies adopted to achieve those objectives. This Plan will be modified to reflect

improved knowledge based upon the review. It is anticipated that the review will be generally informed by the outcomes of the monitoring program, and research findings as well as community consultation. In particular the review may modify the amount of water provided for environmental, Indigenous cultural and other public benefit outcomes if the results of the monitoring program, or new research findings, demonstrate that it is necessary to do so. All public submissions, as well as any Northern Territory Government or regional policies or agreements coming into force after the initial declaration and with relevance to the Plan, will be considered at the review. It should also be noted that if a Mine Management Plan is approved that allows large scale unlicensed water extraction in the District with the potential to impact on the GAB springs or other consumptive users, an immediate review of the Plan is likely to be triggered.

# 14. Monitoring and performance evaluation

Extraction licences issued under the Plan will carry conditions including appropriate metering and reporting of usage. Most licences are required to report usage on at least an annual basis. Reported usages are checked against licensed volumes and major variations investigated.

The Northern Territory Government maintains a network of monitoring bores and surface water gauging stations and is responsible for water resource investigation studies and water resource modelling. The monitoring program for the District will be further developed in line with the implementation targets below. The implementation targets will be used to help tailor the monitoring program to ensure that it adequately assesses the performance of the Plan as well as identifying where further research is required to better inform the five year review of the Plan. Performance evaluation of the Plan, in particular for the five yearly review of the Plan, will take into consideration the degree to which the actions listed in the implementation targets have been achieved.

### **14.1 Implementation Targets**

These targets will be prioritised on the basis of available resources and form part of the Implementation of the Plan.

ACTION		TARGET
1	Monitor regional rainfall, stream flow, groundwater levels, pressure levels and groundwater quality.	Ongoing
2	Monitor water and pressure levels of the existing artesian bores McDills and Anacoora.	Ongoing
3	Installation of a monitoring bore in the confined section of the aquifer near the South Australian border upgradient from Dalhousie Springs.	Before the five year review
4	Conduct regular compliance inspections for mandatory conditions for the construction of bores, metering, extraction, use of groundwater and use of surface water and all other licence conditions.	Annual
5	Investigate any reported pollution events or reported degradation to water dependent ecosystems resulting from groundwater extraction within the District.	As required
6	Review all licensed entitlements on the basis of estimated sustainable yield in the District.	Every five years
7	Review and advise on the sustainability of proposed water resource use by regional development projects.	Ongoing

If resourcing permits, the following activities could be undertaken to further enhance understanding of the hydrogeological system within the District.

ACTION
Preparation of a conceptual hydrogeological model for the District.
Further investigation of aquifer recharge, recharge areas (in order to protect water quality), throughflow and change in storage.
Installation or re-instatement of gauges on the Finke, Hale, Plenty Rivers as well as Illogwa Creek in the recharge section of the J aquifer to further enhance understanding and knowledge about recharge and therefore sustainable yield in the District.
Reassess sustainable yield for the District, in particular, focusing on recharge, water quality and water pressure changes.
Preparation of a formal water balance for the District.
Installation of key monitoring bores in the confined portion of the aquifer.
Determine environmental and cultural water requirements for surface and groundwater resources in District.
Develop and implement programs to monitor health of key water dependent ecosystems and cultural places that are vulnerable to change due to water extraction.
Further investigative drilling in little drilled areas within the District to improve knowledge of regional groundwater changes.
Review regional monitoring programs for monitoring groundwater levels and artesian water pressure and recommend improvements to assist in determining sustainable yield.

# 15. Glossary

Allocation	Ongoing access to a share of water from a specified consumptive pool. The total licensed entitlements for a particular beneficial use cannot exceed the specified allocation as defined in the relevant WAP.
Aguifer	A water bearing geological formation.
Aquitard	Relatively impermeable geological layer which confines or restricts the flow of groundwater.
Artesian	(Water) rising to the surface under internal hydrostatic pressure.
Catchment	A drainage basin that 'catches' rainfall to supply a river, aquifer, or lake.
Consumptive pool	The amount of water resources that can be made available for consumptive use in a particular water resource plan area under the rules of the plan for that plan area.
Ephemeral	Not permanent.
Environmental water	Descriptions of flow regimes (e.g. volume, timing,
requirements	seasonality, duration) that are needed to sustain the ecological values of aquatic or floodout ecosystems, including their processes and biological diversity.
GL	One gigalitre is 1 000 000 000 litres or 1000 megalitres.
Groundwater	The water contained in saturated rock or soil located below the water table.
Groundwater dependent	Ecosystem that is dependent on groundwater for its
ecosystem (GDE)	existence and health.
Hydrogeology	The study of the interrelationship between geology and water, particularly groundwater.
Hydrographs	A graph showing the properties of water.
Jurassic	A period of geological time between 146 and 200 million
	years ago.
KL	one kilolitre is 1000 litres.
Licence	A licence to extract water granted to a person by the
	conditions as are specified in the license document
Liconcod ontitlomont	The specific volume of water licensed under the Act for
	extraction in a given period (typically annually), according to rules established in the relevant water allocation plan and offered within the sustainable yield. Subject to change if sustainable yield is altered during review periods (five or 10 years).
ML	One megalitre is 1 000 000 litres.
Permian	A period of geological time between 251 and 299 million years ago.
Potentiometric surface	The level to which water will rise in a bore, for example a water table.
RAMSAR	International 1971 RAMSAR Convention listing Wetlands of International Importance.
Surface water	The water found in rock holes, rivers, creeks and floodouts sometimes called free water, to distinguish it from water in soil; springs are places where discharging groundwater becomes surface water; in the arid zone, nearly all surface water is the result of rainfall that has run off rather than
	Inflitrated soil.
Sustainable yield	I he amount of groundwater that can be extracted from an aquifer on a sustained basis without impairing water quality or causing environmental damage.

TDS	Total dissolved solids – a measurement of salinity.
Throughflow	Water that infiltrates the soil surface and then moves
-	laterally through the upper soil horizon often as shallow
	perched saturated flow above the main groundwater table.
Transmissivity	The rate at which water is transmitted horizontally through a
	unit width of an aquifer.
Triassic	a period of geological time between 200 and 251 million
	years ago.

# **Abbreviations**

Act	Water Act 1992 (NT)		
ADWG	Australian Drinking Water Guidelines		
AHD	Australian Height Datum – national standard for height		
	above sea level		
ALT	Aboriginal Land Trust		
Committee	Independent Expert Scientific Committee on Coal Seam		
	Gas and Large Coal Mining Development		
Controller	Northern Territory Controller of Water Resources appointed		
	under s.18 of the Act		
CW	Commonwealth		
<u>℃</u>	Degrees Celsius		
DLRM	Department of Land Resource Management		
District	Great Artesian Basin (NT) Water Control District		
EPBCA	Environment Protection and Biodiversity Conservation Act		
	1999 (CW)		
GAB	Great Artesian Basin		
GL	Gigalitre		
<u>J</u>	Jurassic		
KL	Kilolitre		
km	Kilometre		
<u>m</u>	Metre		
m²/d	Square metre per day		
mm	Millimetre		
/s	Litres per second.		
Mg/I	Milligrams per litre		
Minister	Minister for the Department of Land Resource Management		
ML	Megalitre		
NWI	National Water Initiative		
Plan	Great Artesian Basin Water Allocation Plan		
TDS	Total dissolved solids		
WAP	Water Allocation Plan		
WCD	Water Control District		

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### Appendix 1: Standard Licence Terms & Conditions

#### NORTHERN TERRITORY OF AUSTRALIA APPROVED FORM 15 (xx/xx/2010) LICENCE TO TAKE GROUNDWATER Pursuant to section 60 of the *Water* Act

Licence No: .....

Name:	
Address:	
Expiry Date: (day/month/year)	
Water Control District: (if applicable)	
Groundwater Resource: (Name and managem	nent zone)
Registered Bore Number(s):	
Property(s) on which water to be used:	

Beneficial Use	Security Level (if applicable)	Maximum Water Entitlement (Ml/Yr)	Trading available?

Terms:

- 1. The holder of this licence must take or use no more than the quantity of groundwater stated as the maximum water entitlement, subject to annual water allocation renouncement's, if applicable, and subject to the provisions of the *NT Water Act*, the Water Regulations and the terms and conditions stated on this licence.
- 2. The licence is valid until the expiry date stated on the licence subject to notice 3 and 5.
- 3. The licence may be revoked, suspended or modified at any time by the Controller as provided for in section 93 of the *Water Act*.
- 4. The licensee can surrender or apply for modification of the licence at any time.
- 5. Non use of the water entitlement conferred under the licence may result in full or partial revocation by the Controller.
- 6. If a Water Allocation Plan (WAP) has been declared for the stated Water Control District under section 22B of the *Water Act*, the licensed water entitlement may be able to be traded to another person in full or part, permanently or temporarily, subject to WAP rules.
- 7. Chemical and/or fertiliser injection systems shall not be installed into the pump discharge lines without the prior approval of the Controller of Water Resources.

8. No guarantee is given or implied by this licence that water will be available from the water resource at any given time.

#### **Conditions**

- 1. The water entitlement shown for each beneficial use must be used for no other purpose than that beneficial use, without approval of the Controller of Water Resources.
- 2. Pumpage for each month from the listed bore(s) must be recorded by a meter supplied, installed and maintained by the licence holder to the satisfaction of the Controller of Water Resources.
- 3. The record of pumpage for each month shall be supplied to the Controller of Water Resources within two weeks of each reporting period stated as stated in the specific conditions of this licence.
- 4. The following specific conditions apply:
  - a. The bores must be drilled within twelve (12) months from the granting of this licence or this licence may be revoked
  - b. Conductivity readings must be taken each six months for the above listed production bore(s)
  - c. Standing water levels must be recorded every month for the above listed production bore(s)
  - d. Groundwater samples from the above listed production bore(s) shall be submitted annually for a standard chemical and heavy metal analysis
  - e. A monitoring bore capable of measuring potentiometric head will be constructed no closer than 750 m away from any artesian production bore anticipated to produce more water than 1 ML/day.

Controller of Water Resources: ...... Date: ......