Sediments above the Great Artesian Basin

Groundwater Background Paper

February 2016

Queensland Government

This publication has been compiled by Water Policy (South Region), Department of Natural Resources and Mines.

Contents

1 Sediments above the Great Artesian Basin

Sediments above the Great Artesian Basin (Sediments above the Great Artesian Basin) is a group of geological formations that contain aquifers overlying the Great Artesian Basin. These formations consist of consolidated sediments that generally 'infill' the major sub-basins of the Great Artesian Basin; for instance the Surat and Eromanga basins. The use of this name allows for water plan scale management areas which overlie the formations identified in schedule 4 of the Water Resource (Great Artesian Basin) Plan 2006.

Defining groundwater systems

Like surface water, groundwater systems are broadly defined by connectivity and interactivity. The connectivity of one groundwater system with another, will be both horizontal and vertical. As such, unlike surface water systems, groundwater connectivity cannot be determined by mapping surface contours and visible flow paths. Therefore, an additional consideration in groundwater assessment and management is the likelihood of numerous discrete (non-interacting) groundwater systems, associated with the geological formation underlying a given surface location. These hydraulically discrete systems which generally do not interact with each other in an undeveloped state, may ‘under development or stress’ have horizontal or vertical interaction with other systems.

Defining the interactivity of a groundwater system is done by establishing the interaction between stored water at numerous sample locations using bores and/or the aquifers characteristics. Bore and drilling data, which includes information relating to; transmissivity, relationship to other formations, age and the conditions which gave rise to their formation, are used to gain an understanding of the aquifer(s). For this reason, it is important to describe the formations making up the Sediments above the Great Artesian Basin in addition to providing its general description.

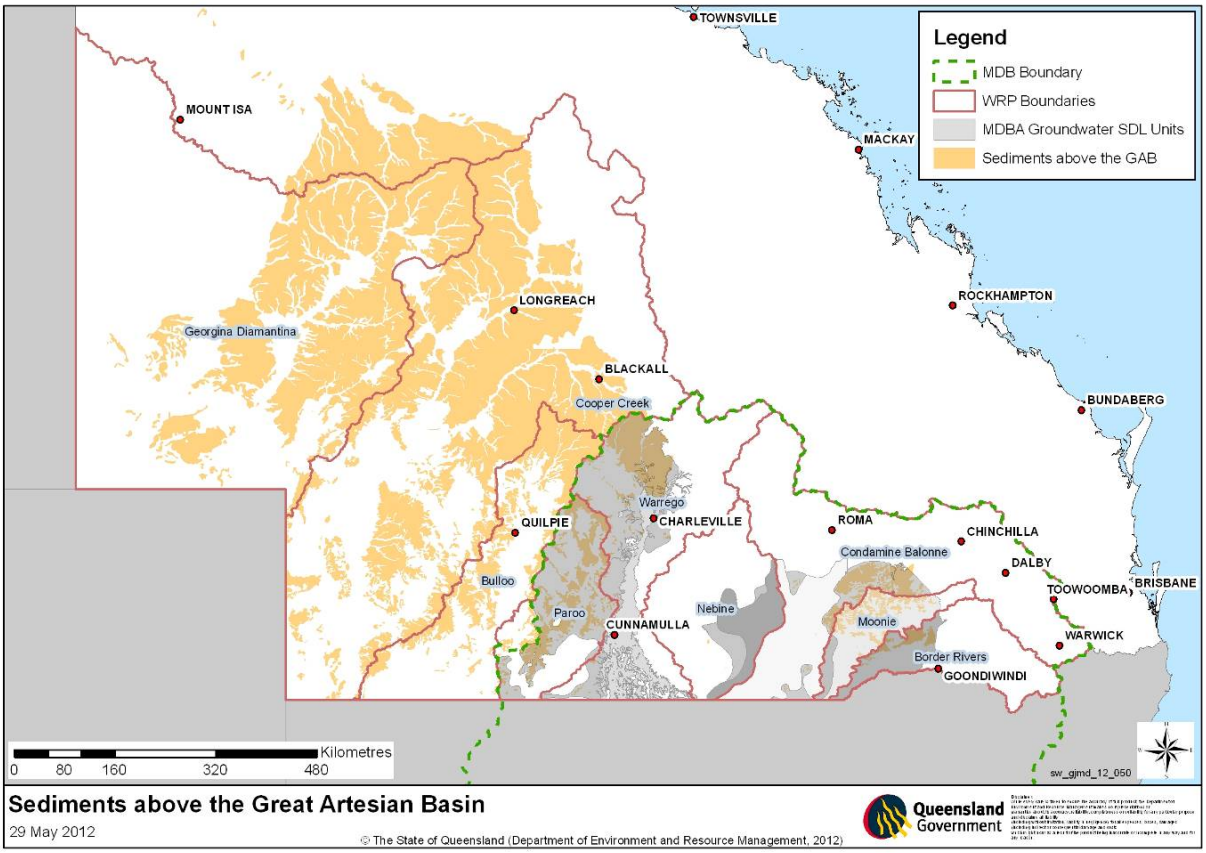


Figure 1: Sediments above the Great Artesian Basin

Table 1 details Sediments above the Great Artesian Basin formations located within each water resource plan area.

Table 1: Groundwater formations corresponding to Sediments above the Great Artesian Basin water resource plan areas (DEEDI 2009)

Water resource plan area	*Associated aquifer formations*
Border Rivers	Griman Creek Formation
Condamine and Balonne	Griman Creek Formation
Moonie	Griman Creek Formation
Warrego, Paroo, Bulloo and Nebine	Winton Formation
	Mackunda Formation
	Allaru Mudstone
	Glendower Formation

The Sediments above the Great Artesian Basin aquifer system is identified in the Murray Darling Basin Plan (the Basin Plan) as several groundwater sustainable diversion limit resources units (SDL units). SDL units are identified in relation to the Water Plan areas they underlie as follows:

Table 2: Sediments above the Great Artesian Basin—Water Plan areas and Basin Plan SDL units

Sediments above the Great Artesian Basin, Groundwater Background Paper, Department of Natural Resources and Mines

Water resource plan area	*Basin Plan SDL unit*	*SDL unit code*
Border Rivers	Sediments above the Great Artesian Basin: Border Rivers	GS57
Condamine and Balonne	Sediments above the Great Artesian Basin: Condamine-Balonne	GS58
Moonie	Sediments above the Great Artesian Basin: Moonie	GS59
Warrego, Paroo, Bulloo and Nebine	Sediments above the Great Artesian Basin: Warrego–Paroo-Nebine	GS60

1.1 Location

The plan areas are all located within the department's South region. This region extends from the Great Dividing Range, between Toowoomba and Warwick, and the western border of Queensland. The southern boundary is formed by the QLD-NSW border. The northern extent is largely formed by catchment boundaries. However, it also extends from the QLD-NT border north west of Mount Isa to the QLD-NSW border south east of Warwick.

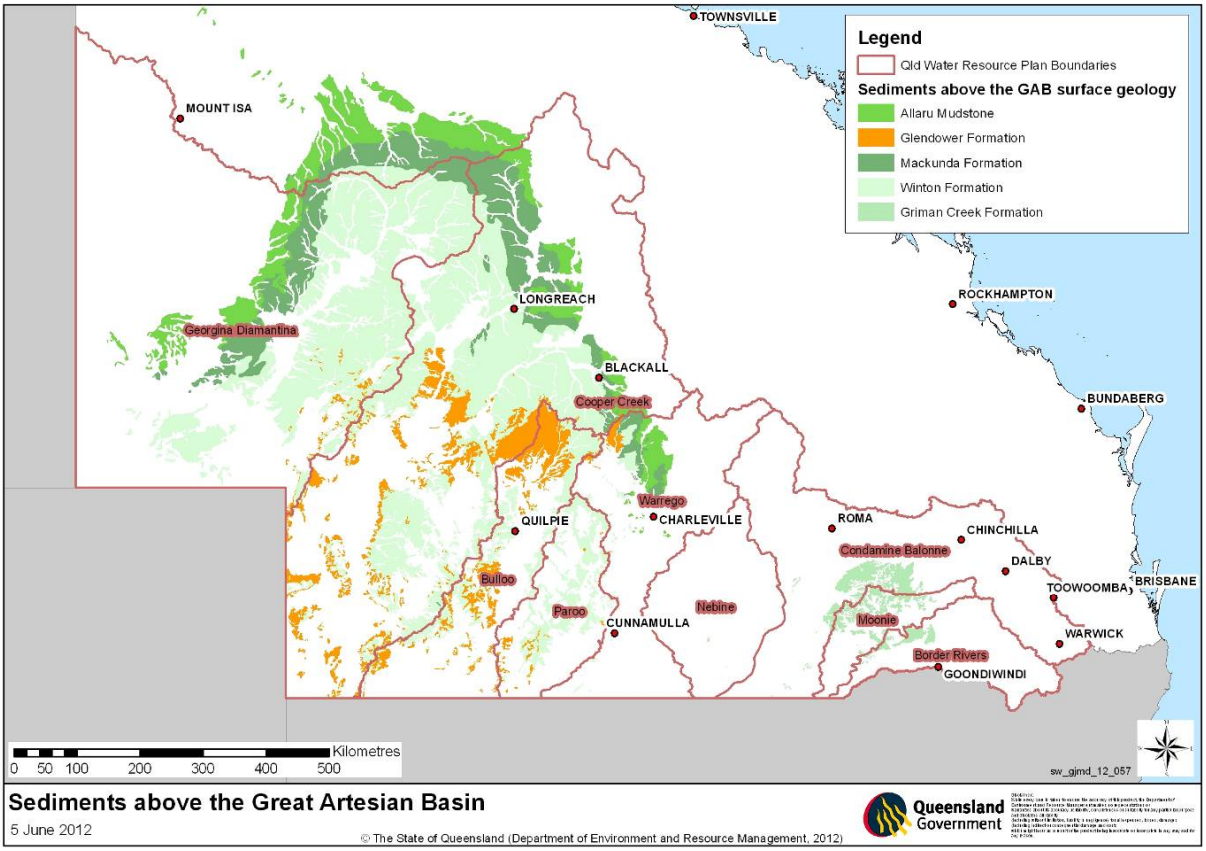


Figure 2: Sediments above the Great Artesian Basin and Qld water resource plan areas

Condamine and Balonne

Within the Condamine and Balonne catchment, the Sediments above the Great Artesian Basin area run from east of Meandarra through to Surat and cover the lower area of the Condamine/Balonne catchment. The aquifer area covers approximately 793 361 ha. The Sediments above the Great Artesian Basin lies beneath Surat which has a population of 398 people (ABS 2007).

Border Rivers

The system underlies the western part of the Border Rivers catchment, which runs westward from approximately the line of the Leichhardt Highway and covers approximately 681 810 ha. This SDL area is not considered to contain good quality water with better supplies being found below in the Great Artesian Basin sediments. Use is mainly for stock and domestic purposes due to the poor quality of the water.

Warrego, Paroo, Bulloo and Nebine

The majority of this system lies to the west of the Warrego River extending from just south of Tambo through to the Qld-NSW border. There is another separate section at the far eastern margin of the Nebine catchment which is overlain in part by the St George Alluvium to form two small separate areas. Combined, these areas cover approximately 4 867 141 ha. This area is not considered to contain good quality water with better supplies being found below in the Great Artesian Basin sediments. Use is mainly for stock and domestic purposes due to the poor quality of the water.

The largest urban centre in the catchment is Charleville, which has a resident population of around 3300. Charleville is located adjacent to the Warrego River, at the junction of the Mitchell and Warrego Highways.

Moonie

The Sediments above the Great Artesian Basin underlies the Moonie catchment area. The area covers approximately 1 152 731 ha. This SDL area is not considered to contain good quality water with better supplies being found below in the Great Artesian Basin sediments. Use is mainly for stock and domestic purposes due to the poor quality of the water.

1.2 Climate and rainfall

Each plan area relevant to this report is situated within one of two major climate classification groups. Figure 3 shows the location of the Sediments above Great Artesian Basin groundwater unit outlined on a climatic region map.

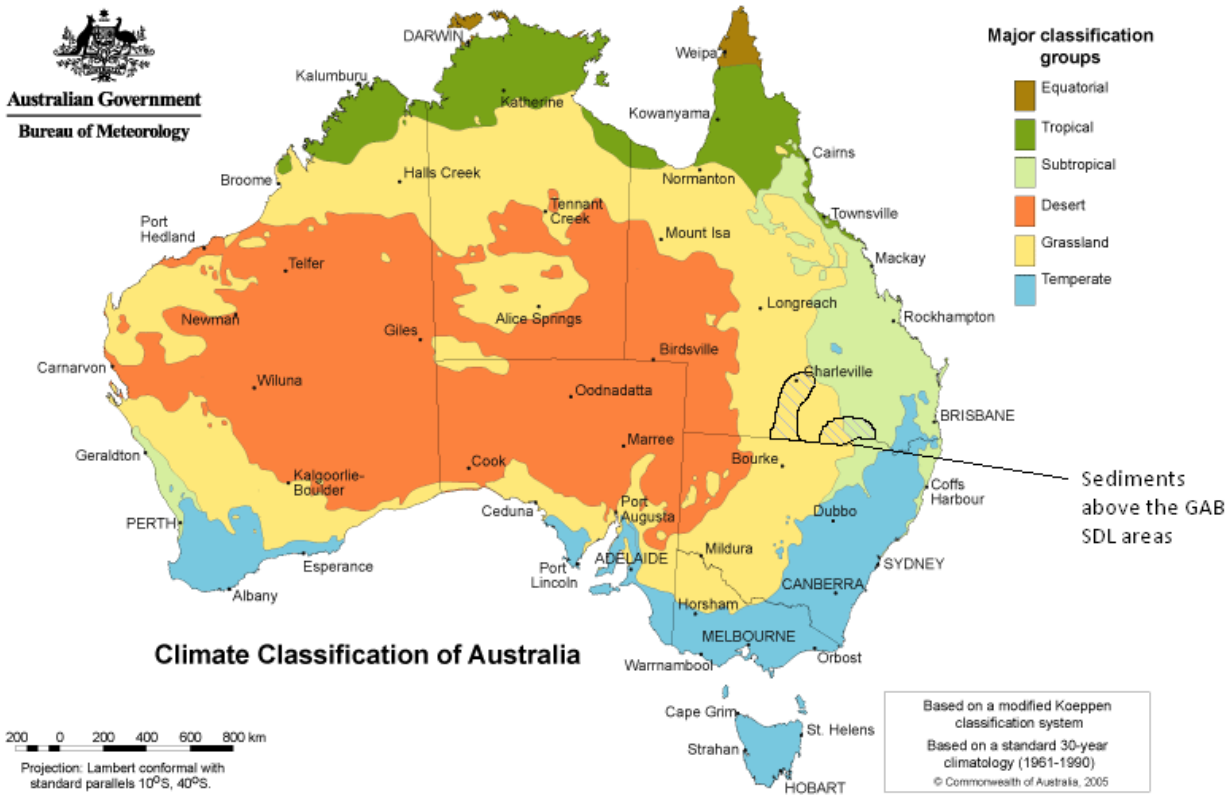


Figure 3: Climatic classifications particular to sediments above the Great Artesian Basin (BOM 2011)

Condamine and Balonne

Table 3 displays rainfall statistics for weather stations in the Condamine and Balonne plan area. 56% of rainfall occurs between the months of November and March, inclusive (COA 2009). However, interannual rainfall variability is considerable, moving from extended periods of dry weather to wet periods causing flooding and helping to replenish groundwater resources.

Table 3: Rainfall gauging sites—Condamine and Balonne

Rain gauging station	*Elevation (AHD)*	*Mean annual rainfall*	*Median annual rainfall*
Hebel Store (044042)	150 m	406.2 mm	405.4 mm
Namarah (043095)	332 m	581.4 mm	562.6 mm
Surat (043035)	246 m	580.0 mm	540.7 mm
Woodlands (044075)	283 m	515.1 mm	478.6 mm

Border Rivers

Mean annual rainfall across the Border Rivers valley is relatively low (table 4). It reduces from the east to west of the catchment and predominantly occurs in the summer months. The granite belt in the upper eastern part of the catchment has a mean annual rainfall of 800mm while the western alluvial plains from Goondiwindi to Mungindi have a mean annual rainfall of 500mm. The middle of the catchment including the area around Texas and Inglewood has a mean annual rainfall of 600mm. These mean annual rainfalls are subject to substantial variability.

Sediments above the Great Artesian Basin, Groundwater Background Paper, Department of Natural Resources and Mines

Table 4: Rainfall gauging sites—Border Rivers

Rain gauging station	*Elevation (AHD)*	*Mean annual rainfall*	*Median annual rainfall*
Talwood State School (042047)	180 m	556.2 mm	545.4 mm
Goodar Station (042087)	207 m	588.5 mm	529.5 mm

Warrego, Paroo, Bulloo and Nebine

The Warrego, Paroo, Bulloo and Nebine plan area exhibits generally low mean annual rainfall (table 5). For each catchment within the plan area, rainfall generally increases from the southern extent (the QLD/NSW border) toward the northern extremity.

Annual evaporation in all catchments far exceeds rainfall, with rainfall of between 150mm (southern Bulloo) to 700mm (northern Warrego) and evaporation of between 2100mm and 2600mm (all catchments). Due to the low mean annual rainfall across catchments and evaporation exceeding annual rainfall, groundwater is a more reliable source of water than the capture and storage of surface water.

Table 5: Rainfall gauging sites—Warrego, Paroo, Bulloo and Nebine

Rain gauging station	*Elevation (AHD)*	*Mean annual rainfall*	*Median annual rainfall*
Gumbardo (044040)	282 m	418.6 mm	373.7 mm
Spring Creek (044064)	221 m	372.1 mm	329.3 mm
North Yancho (044060)	162 m	397.6 mm	378.4 mm
Quilpie (044015)			

Moonie

In the Moonie catchment, rainfall is low, with little variation. The mean annual rainfall varies from 650 mm/yr in the upper catchment to 450 mm/yr on the lower southern flood plain. The average annual evaporation in the catchment is estimated to be between 1800 to 2200 mm.

Average annual rainfall within the catchment decreases from 650 mm in the headwaters of the catchment to 450 mm in the southern flood plains. More than three-quarters of the catchment area receives between 450 and 550 mm of rain per annum on average. Rainfall variability is high (DNR 1999). High seasonality of rainfall exists in the Moonie catchment, with almost half of the annual rain falling in the four months from November to February. Mean annual evaporation in the catchment is generally between 1800 and 2200 mm.

Table 6: Rainfall gauging sites—Mooonie

Rain gauging station	*Elevation (AHD)*	*Mean annual rainfall*	*Median annual rainfall*
Remilton (042050)	250 m	576.2 mm	529.0 mm
Nindigully (044194)	189 m	521.4 mm	513.2 mm

2 Geology and hydrogeology

The formations which are components of the Sediments above the Great Artesian Basin are mostly contained within the bounds of the Great Artesian Basin. Their relationship (interaction and connectivity) to the Great Artesian Basin depends on location, the presence or lack of confining layers, and depth of formation. Though geologically part of the Great Artesian Basin sedimentation sequence, they are generally subartesian in nature and lack the characteristics of the major aquifers with in the GAB i.e. they have highly variable transmissivity associated within limited sequences of porous consolidated sediments, poor water quality and are often considered aquicludes from a regional perpective.

For the purposes of this background report, the formations included and mentioned for each sub-area within the Water Resource (Great Artesian Basin) Plan 2006 are not sediments above the Great Artesian Basin in that area.

There are five major formations which make up the collective Sediments above the Great Artesian Basin groundwater resource unit:

- Griman Creek formation
- Mackunda formation
- Winton formation
- Glendower formation
- Allaru mudstone.

Figure 4 illustrates the five formations of the Sediments above the Great Artesian Basin as they appear within the Qld's south west water resource plan areas. Only surface geology mapping exists for these formations and in some areas the formations may be overlain by alluvial cover thereby masking their full extent. Furthermore, due to the relatively coarse scale of the existing geology mapping, all formation boundaries are approximate only.

Table 7: Major formation characteristics

Formation	*Physical condition of aquifer material*	*Thickness*
Winton formation	Interbedded bluish-grey sandstone, mudstone, and siltstone, in part calcareous; some intraformational conglomerate and coal seams. Sandstone, lithic, feldspathic, medium to very fine grained. Bedding medium or thick; crossbeds particularly in sandstones. Channel fill and lenticular beds locally.	0-300m.
Mackunda formation	Interbedded bluish-grey labile sandstone and mudstone with some calcareous siltstone. Mudstone thin to thick-bedded. Sandstone, thin-bedded and cross-laminated in places; ranges from fine sandstone to coarse siltstone. Some beds 40-60% calcite cement, in places grading into sandy limestone, and commonly concretionary. Minor cone-in-cone limestone, thin coquinite, and, near top, intraformational conglomerate.	0-150m; averages 50m
Glendower formation	Quartzose sandstone, quartz pebble conglomerate, sandy conglomerate with agate, chert, and rare volcanic clasts. Minor siltstone and mudstone. Reworked Winton Formation clasts and agate pebbles at base. Extensively silicified to silcrete.	0-70m
Griman Creek formation	Grey mudstone, red siltstone (Ironstone), sandstone and conglomerate. Shows deeply weathered profile with kaolinisation and ferruginisation.	0-100m*
Allaru mudstone	Mainly bluish-grey mudstone with interbeds of very thin to thin calcareous siltstone. Minor very fine-grained labile sandstone. Thin seams of cone-in-cone limestone along bedding planes and coating concretions.	0-270m

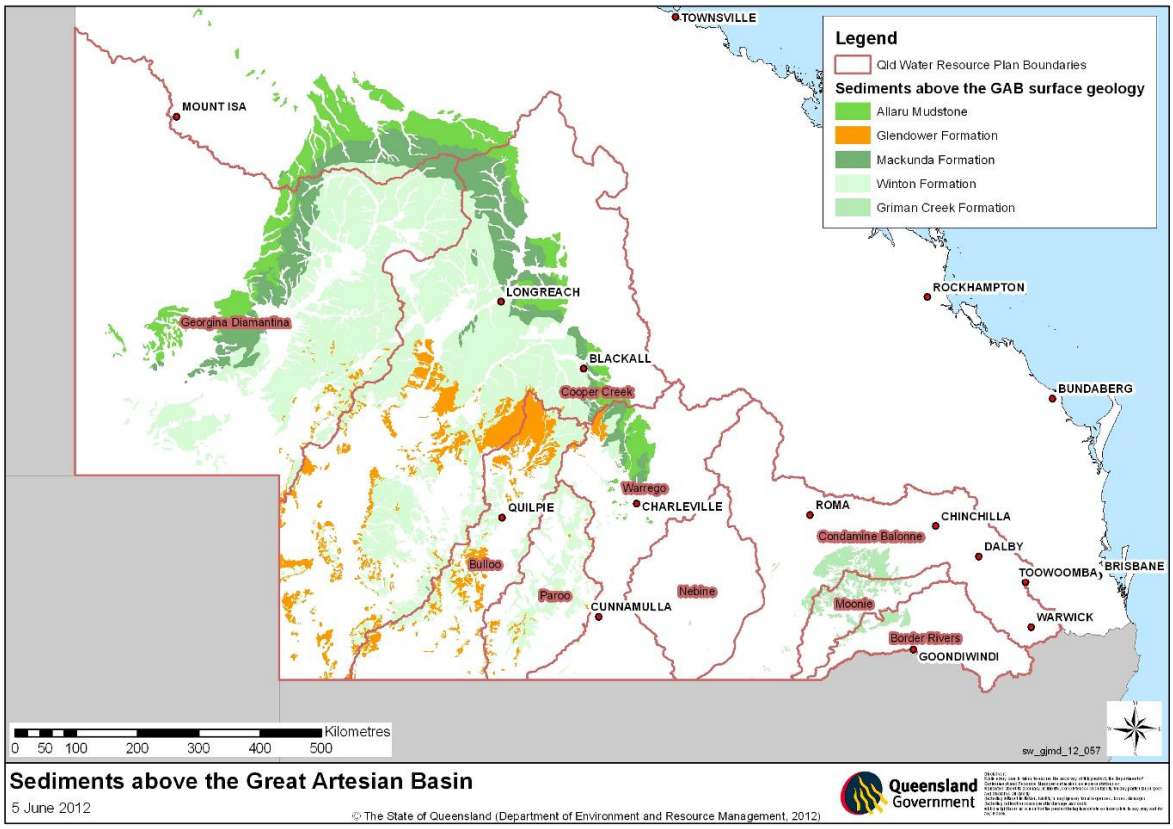
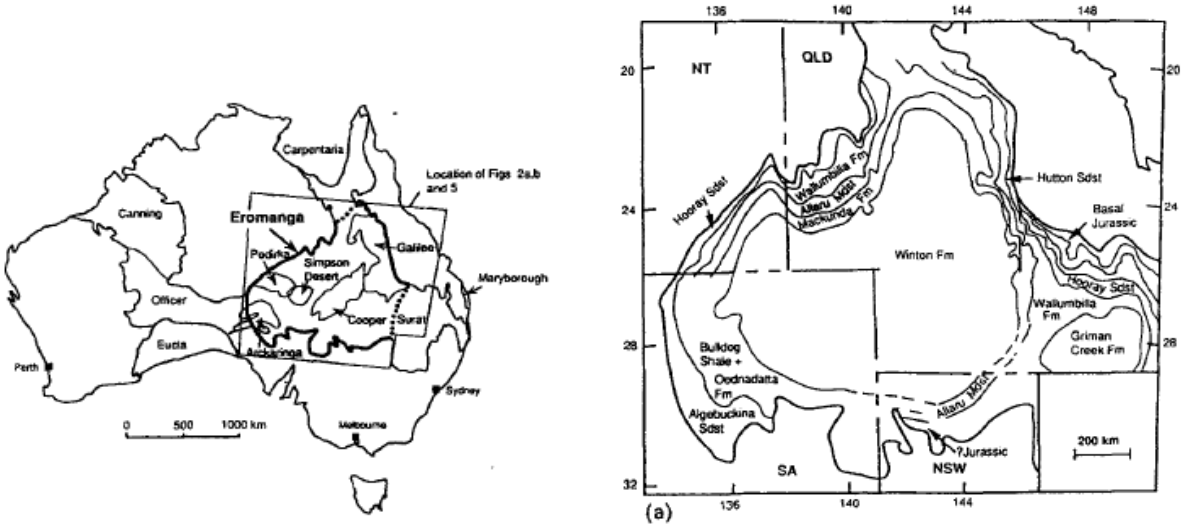


Figure 4: Sediments above the Great Artesian Basin formations and QLD's South West WRP areas

2.1 Eromanga Basin and Surat Basin

The Eromanga Basin is a large sedimentary basin in central and northern Australia. It covers parts of Qld, NT, SA and NSW, and is a major component of the Great Artesian Basin. The basin is over 1 000 000 km^2 in area and generally consists of sandstone, siltstone, mudstone, coal, shale and red beds.



Sediments above the Great Artesian Basin, Groundwater Background Paper, Department of Natural Resources and Mines

Figure 5: Contour map—Eromanga and Surat basins

2.2 Description of major formations

2.2.1 Griman Creek formation

The Griman Creek formation contains a thick succession of dominantly feldspathic sandstones, siltstones and mudstones that have undergone extensive weathering. The weathering process and the presence of salts from marine sediments lead to groundwater from the Griman Creek formation being saline in quality.

Griman Creek formation outcrops are usually highly weathered and can be seen in a number of locations in the lower Balonne, such as the riverbed at Jack Taylor weir near St George. In this location samples are a very fine grained iron rich sandstone/siltstone, white grey siltstone and mudstone. In outcrop most of the grey mudstone and red siltstone (ironstone) has weathered to kaolinitic clay and ferruginous siltstone and silty clay. In drill logs the Griman Creek formation is often described as a red siltstone (ironstone) and white mudstone. Griman Creek formation sediments can vary from soft to very hard depending on the degree of weathering (DNRM 2001).

2.2.2 Winton formation

The Winton formation consists of very labile sandstone, siltstone and mudstone, minor mudclast conglomerate and coal: all calcareous, carbonaceous, pyritic in part. In outcrop only calcareous rubble and concretions. Extensive chemical weathering profile exists, consisting of kaolinised, silicified, and ferruginised rocks.

The formation is an important source of water, because the cost of drilling to the more prolific artesian aquifers is prohibitive. The thickness of the Winton formation is quite variable; ranging from under 20 metres to more than 450 metres. Porous and permeable beds are generally thin and sporadic and good supplies are limited.

Water quality within the Winton formation is variable, ranging from fresh to highly saline. Total dissolved solids (TDS) values generally range from 1500 to 4000 mg/L, but can be over 20 000 mg/L. Fluoride levels rarely exceed one mg/L. This formation provides small subartesian supplies with pump rates of less than 1.5 L/s (DNR 2000).

2.2.3 Mackunda formation

Mackunda and Winton formations are difficult to separate in the field; their physical characteristics and composition are not dissimilar. However, the presence of marine fossils is the main criterion for distinguishing samples of the Mackunda formation (DND 1978).

The Mackunda formation consists of very labile to labile sandstone, siltstone and mudstone, calcareous in part, minor mudclast conglomerate, coquinite and cone-in-cone limestone. The presence of Inoceramus prisms is used in its identification. Chemical weathering is the same as the Winton formation.

Like the Winton formation, the Mackunda formation is an important source of water, because the cost of drilling to the more prolific artesian aquifers is prohibitive. Porous and permeable beds are generally thin and sporadic and good supplies of water are usually found by chance. The thickness of the formation can be up to 200 m but averages 60 to 70 m.

Water quality is variable, ranging from fresh to highly saline. TDS values generally range from 1500 to 4000 mg/L, but can be over 20 000 mg/L. Fluoride levels rarely exceed one

mg/L. This formation provides small subartesian supplies with pump rates of less than 1.5 L/s (DNR 2000).

2.2.4 Allaru mudstone

The Allaru mudstone formation consists of siltstone and minor limestone. Typified by blue-grey mudstone with interbeds of indurated calcareous siltstone and fine-grained very labile sandstone, and concretions, the mudstone is very thinly bedded. Where weathered, it is kaolinitic, white to pale pink or grey, and siliceous.

2.2.5 Glendower formation

The Glendower formation is made up of quartzose sandstone, sandy conglomerate, quartz pebble conglomerate, minor siltstone and silcrete.

This formation, consists mainly of quartzose rocks. It is believed to have been part of an ancient river system which drained southward to link with widespread sedimentation in broad shallow tectonic basins within the central part of the Eromanga Basin. Quartzose sandstone beds of the Glendower formation have been silicified to form silcrete (DND 1978).

3 Groundwater condition

3.1 Groundwater characteristics and conditions

Throughout the plan areas, water quality is indicative of marine sediments; generally saline and poor quality with small patches of good quality water which probably represent localised recharge in the more porous sections of the formation.

In the Border Rivers, Condamine and Balonne and Moonie plan areas the only formation present is the Griman Creek formation. In these areas, groundwater supplies are not considered to be of good quality. For this reason, it is mainly used for stock watering purposes. The Griman Creek formation is generally localised and discontinuous; leading to variable water supply.

Further to the west, within the Warrego, Paroo, Bulloo and Nebine plan area, the Winton, Mackunda, Allaru mudstone and Glendower formation are present. The Winton and Mackunda formation provide sub-artesian supplies of variable quality and quantity in the western half of the catchment at depths of less than 200 m. Water quality within both the Winton and Mackunda formations is extremely variable, ranging from fresh to highly saline. Though varying from bore to bore, it is generally suitable for stock. Within the majority of supplies, TDS values range between 500 and 4000 mg/L. Throughout the plan area these sediments provide only small sub-artesian supplies with individual bore yields rarely exceeding 1.5 L/s (DNR 2000).

While detailed knowledge of the groundwater resource in the study area is generally restricted to the Great Artesian Basin, the Winton and Mackunda formations provide small sub-artesian supplies of variable quality in the northern part of the Paroo catchment at depths of less than 300 m. These formations are important sources of water, especially where the cost of drilling to the deeper artesian aquifers can be prohibitive. The Glendower formation is the only formally recognised Tertiary aged formation. The thickness of this formation can be as much as 70 m, but is generally less than 15 m in the Paroo catchment.

Most bores in the Mackunda formation tap aquifers between 70 and 300 m deep, and in the Winton formation between near surface and nearly 270 m deep. Thickness of the Mackunda formation can be as high as 140 m, but averages less than 90 m. These formations thin and wedge out against basement highs in the Eulo area. The thickness of the Winton formation also can be as high as 270 m, but the majority of the formation is less than 100 m thick.

3.2 Recharge and discharge

There is not enough information to form a general profile for recharge and baseflow or discharge and baseflow. Due to the discontinuous nature of the formations of the Sediments above the Great Artesian Basin, it is suggested there is no significant connection between it and other surface or groundwater resources.

3.3 Groundwater chemistry

TDS values generally range from 1500 to 4000 mg/L, but can be over 20 000 mg/L. Fluoride rarely exceeds 1.5 mg/L.

3.4 Transmissivity and specific yield estimates

There is not enough information to form a general transmissivity profile.

3.5 Groundwater dependant ecological assets

There is no current evidence of groundwater dependant ecological assets reliant on the Sediments above the Great Artesian Basin. The Bureau of Metrology's Groundwater Dependant Ecosystem Atlas (BOM 2012) includes several ecological features which are classed as having low to moderate potential for reliance on groundwater interaction. See the GDE atlas for further information.

4 Entitlements and use

4.1 Specification of entitlements

Within the sediments above the GAB in the South water plan areas, there are a number of types of existing groundwater entitlements as detailed below in table 8.

Table 8: Licence type summary

Entitlement type	*Notes*
Irrigation / consumptive licences	There are 11 licences issued for water from the Sediments above the Great Artesian Basin. These access water for consumptive purposes; irrigation, stock intensive and industrial. Details of these licences are tabled in the section for each plan area. There are no multiple formation licences. It is possible that there are bores which tap more than one formation. Historically, licences for groundwater have not been issued on a formation basis. Depending how bore casings are slotted/screened, several formations may be accessed.
Stock and domestic licences	Stock and domestic take is not licenced. While stock and domestic take does occur from the Sediments above the Great Artesian Basin, no licence is required and therefore, no data exists regarding volumes taken for these purposes.
Town water supply	There are no town water supplies accessing the Sediments above the Great Artesian Basin. Town Water supply from groundwater in each plan area is predominantly from Great Artesian Basin.

4.2 Water entitlement details

Condamine and Balonne

Table 8 details entitlements accessing the Sediments above the Great Artesian Basin within the Condamine and Balonne plan area. There is no data for annual extraction as these entitlements are not metered.

Table 9: Existing groundwater entitlements located in the SAGreat Artesian Basin: Condamine Balonne SDL area

Authorisation	*Purpose*	*Formation*	*Nominal entitlement*	*Status of licence*
189950	Stock Intensive	Griman Creek	28 ML	Issued
49273N	Industrial, Irrigation	Griman Creek	40 ML	Issued

Border Rivers

There are no entitlements which access the Sediments above the Great Artesian Basin within the Border Rivers plan area.

Warrego, Paroo, Bulloo and Nebine

The table below details entitlements accessing the Sediments above the Great Artesian Basin within the Warrego, Paroo, Bulloo and Nebine plan area. There is no data for annual extraction as these entitlements are not metered.

Table 10: Existing groundwater entitlements located in the SAGreat Artesian Basin: Warrego-Paroo-Nebine SDL area

Authorisation	*Purpose*	*Formation*	*Nominal entitlement*	*Status of licence*
100180	Irrigation	—	20 ML	Issued
402760	Industrial	—	60 ML	Issued
500358	Industrial, stock, intensive	—	20 ML	Issued
12983E	Irrigation, stock	Allaru Mudstone	20 ML	Issued
50077E	Irrigation, stock	Allaru Mudstone	75 ML	Issued
50816E	Domestic, industrial, irrigation	—	20 ML	Issued

Moonie

Table 10 details entitlements accessing the Sediments above the Great Artesian Basin within the Moonie plan area. There is no data for annual extraction as these entitlements are not metered.

Table 11: Existing groundwater entitlements located in the SAGreat Artesian Basin: Moonie SDL area

Authorisation	*Purpose*	*Formation*	*Nominal entitlement*	*Status of licence*
61510R	Irrigation	Griman Creek	20 ML	Issued

5 Management arrangements

5.1 Current arrangements

Table 12 summarises the current management arrangements for groundwater in the Sediments above the Great Artesian Basin. The Sediments above the Great Artesian Basin is not subject to a moratorium on take. Take of groundwater is not metered and there is no seasonal water assignment. As mentioned above, the Sediments above the Great Artesian Basin falls within a declared subartesian area under section 102 of the Water Regulation requiring water licences for all purposes, other than stock and domestic.

Table 12: Current Sediments above the Great Artesian Basin management arrangements

Management arrangement	*Comment*
Moratorium	No
Declared Subartesian Area	Great Artesian Basin subartesian area
Water licences	Required for all purposes other than stock and domestic
Development permit for works	Required for all purposes
Water resource plan	No
Groundwater Management Area	No
Metered	No
Water Sharing Rules	n/a
Announced entitlements (range last 3 years)	n/a
Carry over	n/a
Forward draw	n/a
Seasonal water assignment	n/a
Consultation Committee	No
Section 25	Water Act 2000
Limitations on take (range last 3 years)	No
Pumping hours restrictions	No
Monitoring	No regular monitoring is undertaken. No Sediments above the Great Artesian Basin bores within the Condamine and Balonne plan area are on the monitoring network (DNRM 2014).
BDL (GL/year)	0.66 (Condamine and Balonne water resource plan area) 1.21 (Warrego, Paroo, Bulloo and Nebine water resource plan area) 0.10 (Moonie water resource plan area) 0.04 (Border Rivers water resource plan area)
SDL (GL/year)	18.1 (Condamine and Balonne water resource plan area) 99.2 (Warrego, Paroo, Bulloo and Nebine water resource plan area) 32.5 (Moonie water resource plan area) 14.4 (Border Rivers water resource plan area)

5.1 Limitations

There are no historical or existing limitations on taking water in the Sediments above the Great Artesian Basin. Similarly, there have not been any restrictions on pumping hours.

5.2 Metering

There is no standardised metering in the Sediments above the Great Artesian Basin. Metering in this groundwater area has been identified as a low priority for the proposed metering roll out program.

5.3 Monitoring

There are no monitoring bores for the Sediments above the Great Artesian Basin on the Department's Groundwater Level Network.

6 Overall status

The formations that make up the Sediments above the Great Artesian Basin underly all six south region water resource plan areas; Border Rivers, Moonie, Condamine and Balonne, Warrego, Paroo, Bulloo and Nebine, Cooper Creek and Georgina and Diamantina. The Griman Creek formation underlies a significant land area to the north-west of Goondiwindi within the Border Rivers, Moonie and Condamine and Balonne plan areas. The other formations recognised as parts of the Sediments above the Great Artesian Basin (Mackunda formation, Glendower formation, Winton formation and Allaru mudstone) underly a very large land area which, in the main, begins in the western portion of the Warrego, Paroo, Bulloo and Nebine plan area and extends west to the Queensland border.

Current take of groundwater is minimal and the prospect of future growth in demand is low. While the eastern portion (Griman Creek formation) lies in areas where there is high demand for water (irrigation and urban use), there are also numerous alternative and better water sources (surface water and better quality groundwater). Water extracted from the Griman Creek formation is predominantly poor quality and can be highly saline (up to 30 000 µS/cm).

The Sediments above the Great Artesian Basin formations which appear in the western plan areas (Mackunda formation, Glendower formation, Winton formation and Allaru mudstone) are generally less saline and suitable for stock, and in some cases irrigation. However, there is very low demand due to limited cropping activities and poor yield rates (i.e pump rates of 1-2 L/s).

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