Department of Regional Development, Manufacturing and Water

# Goondiwindi, Texas and Yelarbon UWSA

## Urban water security assessment

Goondiwindi Regional Council

Queensland Government

**Acknowledgement of Traditional Owners**

Council acknowledges Aboriginal and Torres Strait Islander peoples as the original inhabitants of Australia and recognises these unique cultures as part of the cultural heritage of all Australians.

We pay our respect to the Elders of this land; past, present and future and the significant contribution they have made in shaping the identity of the Goondiwindi Region and Australia.

The Department of Regional Development, Manufacturing and Water also respectfully acknowledges the Traditional Custodians of Country. We recognise the ongoing spiritual and cultural connection Aboriginal peoples and Torres Strait Islander peoples have with land, water, sea and sky. We pay our deep respects to their Elders past and present, support future leaders, and acknowledge First Nations peoples' right to self-determination.

This publication has been compiled by the Department of Regional Development, Manufacturing and Water



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# Overview

The Goondiwindi region, located on the Queensland Darling Downs adjacent to the New South Wales border, has a rich history of early European exploration, pioneering and agriculture. Agricultural production is the mainstay of the region's local economy. The Bigambul people are the traditional owners of most of the Goondiwindi region, and the word 'Goondiwindi' is derived from a Bigambul word 'Goonawinna' meaning 'the resting place of the birds'.

Goondiwindi Regional Council is a registered water service provider supplying potable water to about 7500 customers in the region. Safe, secure, and reliable water supply is essential to support the growth, health, and wellbeing of communities, and also provides opportunities for economic and community development. This Urban Water Security Assessment (UWSA) is for the towns of Goondiwindi, Texas and Yelarbon, located within the Border Rivers catchment.

Goondiwindi is an attractive Darling Downs town on the northern bank of the Macintyre River which forms the border between New South Wales and Queensland. It is the major urban centre within the Goondiwindi Regional Council area and is home to most of the region's industrial, commercial, and retail activities. It has a population of approximately 5580 (June 2022) and is located some 220 km from Toowoomba and 350 km from Brisbane by road.

Texas is a small urban centre located on the banks of the picturesque Dumaresq River. It has a population of approximately 735 (June 2022) and is located approximately 90 km east-south-east of Goondiwindi (lineal distance) and 50 km southeast of Yelarbon (lineal distance).

Yelarbon is a small town some 6.5 km north of the confluence of Macintyre Brook with the Dumaresq River and is on the Cunningham Highway midway between Goondiwindi and Inglewood. It has a population of approximately 230 (June 2022).

The Department of Regional Development, Manufacturing and Water (DRDMW) and Goondiwindi Regional Council (Council) have undertaken this UWSA in partnership to investigate the existing security of sources of water supply for the Goondiwindi, Texas and Yelarbon urban water supply systems, and their capacity to support current demands and future growth. (It assumes that the condition and capacity of the water treatment and reticulation systems will be maintained over time to meet customer service requirements and will not cause major reliability of supply concerns.) This report identifies, for each community, the current water supply system capability, projected water demands, and the likelihood, timing, and magnitude of potential water supply risks. It informs the community about the urban water supply security for these communities and provides information that may be useful for future water supply planning and management purposes by Council.

Hydrological modelling indicates that, based on QGSO population projections, the combined surface water and groundwater supplies for Goondiwindi, Texas and Yelarbon are likely to be adequate to meet projected water demands to at least 2050 with a reliability of supply that is appropriate to the size of the communities. Hydrological modelling also indicates that, based on current understandings, the projected impacts of climate change (to 2050) on urban water security are likely to be relatively small for the Goondiwindi region communities.

Notwithstanding the modelling outcomes, the recent drought experience (2019–2021) in the Goondiwindi region demonstrates that there is still potential for a future water supply shortfall to occur; for example, as a result of a future drought worse than has occurred during the historical period. For such circumstances, there is a need to have an appropriate Drought Response Strategy in place including access to additional supplies.
There may, at times, also be reliability issues for the supply to Texas when the river is low and surface water supplies are unavailable. This is because the capacity of the alluvial groundwater bore used for Texas can reduce when the river is low. However, Texas and Yelarbon are both small communities and carting of supplies or other contingency supply arrangements could potentially meet any anticipated infrequent short duration water supply shortfalls that might occur.


# Water supply sources

Goondiwindi, Texas and Yelarbon are primarily supplied from the Border Rivers Water Supply Scheme (BRWSS), supplemented by water from groundwater bores.

The storages within the scheme supporting the water supplies for the three towns are Glenlyon Dam (Pikes Creek, Qld); Boggabilla Weir (Macintyre River, Qld), and Goondiwindi Weir (Macintyre River, Qld). Of these, Glenlyon Dam is the main surface-water source of supply (in addition to natural flows) for Goondiwindi, Texas, and Yelarbon, and has a water storage capacity (full supply volume) of 254 000 megalitres (ML). Glenlyon Dam is shared between NSW and Queensland in a ratio of 57:43%. The BRWSS is supplied from the Queensland share.

Water for meeting Goondiwindi's urban demand is primarily extracted from the Macintyre River (part of the BRWSS) upstream of the Goondiwindi town weir, with supplementation from two Great Artesian Basin (GAB) groundwater bores located adjacent to the water treatment plant. Goondiwindi (Hilton) Weir has a storage capacity of around 1800 ML, with council's existing water intake infrastructure enabling access to about the top 640 ML of this volume. Approximately 8km upstream from Goondiwindi is the Boggabilla Weir (which also supplies the small NSW community of Boggabilla—population around 550), which has a storage capacity of around 5850 ML and a minimum operating volume of about 415 ML, with a resulting accessible storage capacity of around 5435 ML The GAB bores were installed in response to the 2019-2021 drought, with one being 562 m deep and located in the Gubberamunda Sandstone and the other being 1030 m deep in the Hutton Sandstone.

The main surface water quality issues that Council has faced (historically) are increases in turbidity when there are high flows, and blue-green algae during low flow. Groundwater from the Hutton bore has fluoride levels above the Australian Drinking Water Guidelines (ADWG) health limits and therefore requires either treatment (such as reverse osmosis) or blending with surface water to reduce the fluoride concentrations. Groundwater from both the Hutton and Gubberamunda bores also have levels of total dissolved solids and sodium above the ADWG aesthetic limits (which can effectively be reduced through blending with surface water or removed through reverse osmosis).

Texas and Yelarbon are both supplied with surface water and groundwater, with supply able to be alternated between these sources or comprise a combination of the two. Surface water is sourced from natural pondages in the Dumaresq River (part of the BRWSS) and is generally of good quality with the exception of turbidity which can be elevated in high-flow events. Groundwater is extracted from alluvial bores (one for each community) which were constructed in 2019. However, the alluvial bore for Texas has reduced capacity when the river level is low, potentially impacting the reliability of supply.

Figure 1 shows the location of the towns, and the surface water supply infrastructure.

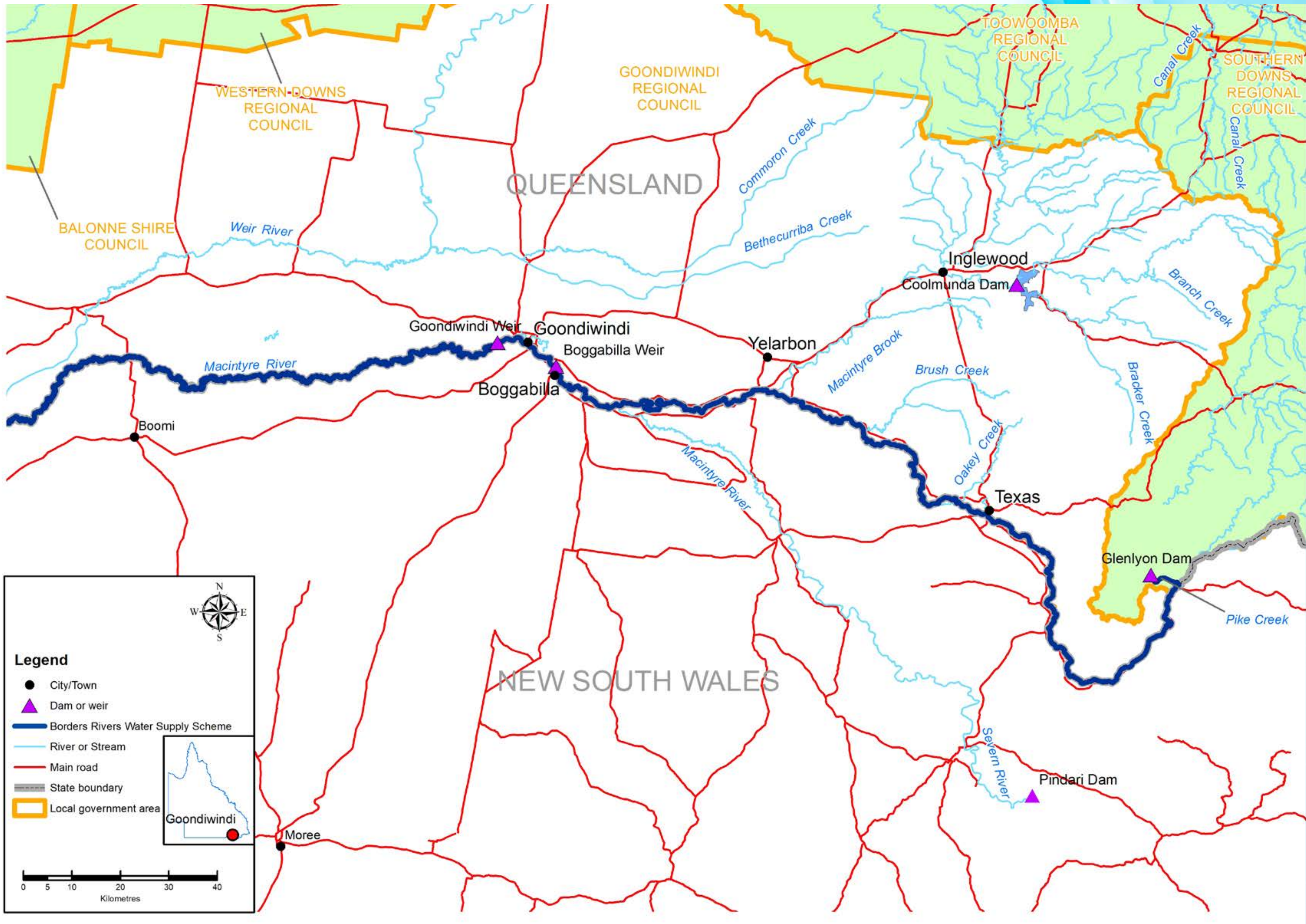


**Figure 1:** Location of Goondiwindi, Texas and Yelarbon and their surface water supply sources

## Water entitlements

To meet Goondiwindi's urban water demand, Council holds a total of 2100 ML/annum (ML/a) of high priority supplemented water allocation from Zone B of the BRWSS (extracted from the Macintyre River), in addition to two GAB groundwater licences (240 ML/a from the Hutton Sandstone, and 140 ML/a from the Gubberamunda sandstone).

In addition to the urban entitlements, Council also holds a 1222 ML/a unsupplemented water allocation (nominal volume 489 ML/a) which is subject to high-flow conditions and is generally used for purposes such as supporting the botanic gardens, and a 1150 ML/a medium priority water allocation from Water NSW (which is used to provide water, when available, to Council's Water Park on the outskirts of town). Council also holds two small entitlements totalling 4.1 ML/a to take water from the Macintyre River Alluvium for irrigation or municipal use.

Council's water entitlements for Yelarbon include a 106 ML/a high priority supplemented surface water allocation from the BRWSS (extracted from the Dumaresq River), and a groundwater entitlement for 150 ML/a from the Border Rivers Alluvium. Additionally, Council holds a groundwater entitlement for 200 ML/a from the GAB (Gubberamunda Sandstone), which is currently undeveloped.

Council entitlements for Texas comprise a 270 ML/a high priority supplemented surface water allocation from the BRWSS (extracted from the Dumaresq River) and a groundwater entitlement for 350 ML/a from the Border Rivers Alluvium.

## Management of the Border Rivers

The regulated section of the Dumaresq, Macintyre and Barwon rivers is a border stream with NSW and, as such, the water within the stream is a shared resource. The Dumaresq–Barwon Border Rivers Commission (the BRC) was established by the NSW and Queensland Governments under the provisions of the New South Wales–Queensland Border Rivers Act (Qld 1946, NSW 1947) to operate and maintain jointly owned water infrastructure and to implement agreed water sharing arrangements in the Queensland–NSW border region in accordance with the New South Wales–Queensland Border Rivers Intergovernmental Agreement 2008 (the IGA). Additionally, Queensland has an accredited water resource plan that complies with the Basin Plan 2012 and provides rules for the management of surface water and groundwater in the Queensland section of the Border Rivers catchment. NSW's water resource plan for the NSW section is currently being assessed by the Murray–Darling Basin Authority. These water resource plans replace the states' previous water planning instruments.

The recent drought experience (2019–2021) in the Goondiwindi region, which saw water supplies nearing critical levels for several communities including Goondiwindi, Texas, and Yelarbon, highlights the need for all involved parties to actively engage in a highly cooperative approach to management of the system, particularly when drought response is required. This is discussed in more detail in the section on 'Drought response' toward the end of this document.

# Water users and water demand

In 2021–22, Goondiwindi Regional Council provided reticulated water for urban purposes to around 5580 residents of Goondiwindi, 735 residents of Texas and 230 residents of Yelarbon.

## Reticulation network demands

The 10-year (2012–13 to 2021–22) average annual water demands and 'per person' water demands for Goondiwindi, Texas. and Yelarbon are shown in Table 1. The 10-year average per-person (total) water demands, expressed as litres per person per day (L/p/d), were broadly similar for the three communities, ranging from 723–969 L/p/d. Residential demands varied more widely and ranged from 284–467 L/p/d, with Goondiwindi having the highest average demand.

**Table 1**: Average water demands for Goondiwindi, Texas and Yelarbon

| | 10-year average demand (& range)—2012–13 to 2021–22 | | |
|---|---|---|---|
| Demand | Goondiwindi | Texas | Yelarbon |
| Total demand (ML/a) | 1719 | 191 | 81 |
| (Range) (ML/a) | (1197–2257) | (138–267) | (48–120) |
| Total demand (L/p/d) | 838 | 723 | 969 |
| (Range) (L/p/d) | (597–1107) | (526–982) | (581–1431) |
| Residential demand (ML/a) | 958 | 75 | 30 |
| (Range) (ML/a) | (708–1177) | (55–101) | (20–41) |
| Residential demand (L/p/d) | 467 | 284 | 354 |
| (Range) (L/p/d) | (348–578) | (207–370) | (233–486) |

Average annual water demands and per person daily demands for the 10–year period are also illustrated in Figures 2 and 3, respectively, along with demands for commercial, municipal, and industrial purposes. Figure 2 shows that average total annual water demands for Texas and Yelarbon are relatively small when compared to Goondiwindi's demands, due to their considerably smaller populations.

Figure 3 shows that while average per-person residential demand is higher for Goondiwindi than for Texas or Yelarbon, the average per-person water demand for commercial, industrial, and municipal use is broadly similar for the three communities.

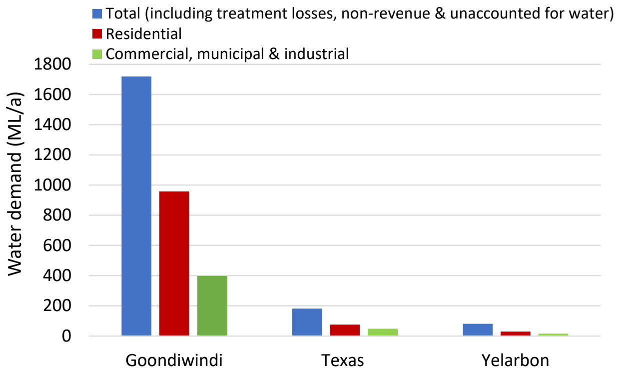


**Figure 2:** Average total water demands, showing that annual water demands for Texas and Yelarbon are relatively small compared to Goondiwindi

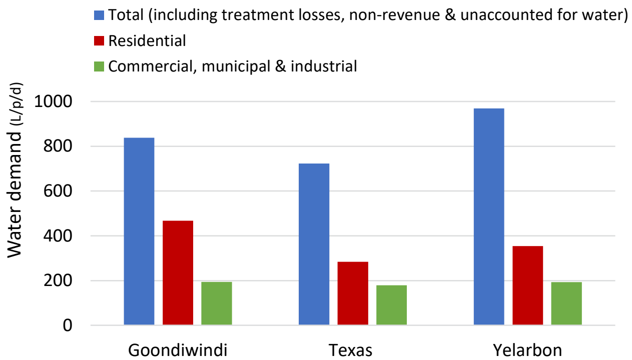


**Figure 3:** Average per person water demands, showing that residential demand (red bar) is higher for Goondiwindi than for Texas or Yelarbon, while commercial, industrial and municipal demand (green bar) is broadly similar for all three communities.

## Water losses

This assessment broadly considered two sources of system water losses:

- Production losses—i.e. losses occurring between the raw water source and the (metered) potable water produced from the water treatment plant (which includes, for example, water used for back-flushing of filters)
- Distribution losses—i.e. losses in the reticulation network (which also includes non-billed authorised water use such as for firefighting and flushing of pipes).

The available data (for the 10–year period 2012–13 to 2021–22) indicates that 'production' losses for Goondiwindi averaged around 10% of the volume of the total water sourced, while reticulation network distribution losses accounted for around 11% of the volume of potable water produced. While these water losses may be considered typical for a Queensland community like Goondiwindi (located west of the range and using typical/conventional treatment processes), there may be some potential to reduce these losses and in turn reduce total water demand and operating costs.

For Texas and Yelarbon, distribution losses averaged around 26% and 21% (respectively) of potable water produced, which is considered quite high and is potentially due to ageing distribution networks. While average 'production' losses for Texas were within a normal range (<10%), these losses for Yelarbon were relatively high (around 22%).

Addressing high system water losses could provide scope for growth in the communities (through increased water availability), and Council has recommended in its recently developed Drought Resilience Plan that a review of systems be undertaken to identify improvements for water use efficiency by minimising water losses.

## Recycled water

Council produces recycled water which is primarily used for irrigation of Goondiwindi's golf course (up to 400 ML/a), racecourse, and sewage treatment plant grounds, with any excess discharged to Crooked Creek. Ultimately, about 18% of the total volume of potable water produced and supplied into Goondiwindi's water supply system ended up being recycled after initial use (average for the 10–year period 2012–13 to 2021–22).

Neither Yelarbon nor Texas recorded any recycled water use over this period.

## Water use is impacted by climate variability

Urban water use varies between years and within each year, depending on various factors including climatic conditions, with higher use usually occurring during drier and hotter periods. However, water use may also decrease during extended dry periods as a result of water restrictions being applied, or from community awareness of potential water shortages. These are important considerations when forecasting future water demands.

There is also variation in use from month-to-month in any year and from day-to-day in any month. The impact of the fluctuating month-to-month and day-to-day demands is generally accommodated by treatment and reservoir capacity, while fluctuating seasonal and yearly demands are generally accommodated by major storages. In the case of Goondiwindi, the reliability of the town supply is generally sustained by releases made from the BRWSS storages (e.g. Boggabilla Weir and Glenlyon Dam) for agricultural purposes (primarily irrigation).

Long-term rainfall data for Goondiwindi, Yelarbon, and Texas are provided in Table 2 below.

**Table 2:** Long-term rainfall data for Goondiwindi, Yelarbon and Texas (Source: SILO)

| Location | Annual Rainfall (mm) (1889–2022) | | | |
|---|---|---|---|---|
| | Mean | Median | Lowest | Highest |
| Goondiwindi & Yelarbon | 611 | 599 | 266 (year 1915) | 1019 (year 1983) |
| Texas | 662 | 659 | 163 (year 2019) | 1079 (year 1892) |

Figures 4, 5 and 6 show the relationship between the annual (July–June) rainfall and water use for Goondiwindi, Yelarbon, and Texas (respectively) for the 10-year period 2012–13 to 2021–22. The figures illustrate that there is generally an inverse correlation between average annual water use (per person) and annual rainfall, as is typical of most Queensland towns due to increased outdoor water use, and in drier regions like Goondiwindi also due to the increased use of evaporative airconditioners.

Water use by Goondiwindi and Yelarbon during this period was highest in 2017–18, during which year the lowest annual rainfall occurred. Conversely, during 2021–22 when rainfall was the highest, water use by these communities was the lowest (excluding years which included strong water restrictions).

Similarly, the above (inverse correlation) relationship was broadly evident for Texas, with particularly high water use during the dry year of 2017–18. The highest water use for Texas was during 2018–19 when Texas experienced its lowest annual rainfall and, conversely, water use was lowest during 2021–22 when rainfall was highest (excluding years which included strong water restrictions).

Figures 4–6 highlight that demands tend to increase in periods of lower rainfall and that water restrictions imposed from around June 2019 to January 2021 (in response to drought) resulted in a significant reduction in demands for the Goondiwindi, Texas and Yelarbon communities, and this significant reduction continued through the relatively wet latter half of 2020–21 and throughout 2021–22 (without restrictions).

In addition to the use of water restrictions when required, a common practice for many water service providers is to also implement a system of permanent water conservation measures (PWCM), which are typically rules that govern how and when water can be used for purposes such as watering gardens and lawns, pool filling, car washing, and cleaning, before water restrictions are imposed. It is recommended that a system of PWCM be put in place for the Goondiwindi region to promote everyday conservation of water, encouraging the community to continue to save water for the future.

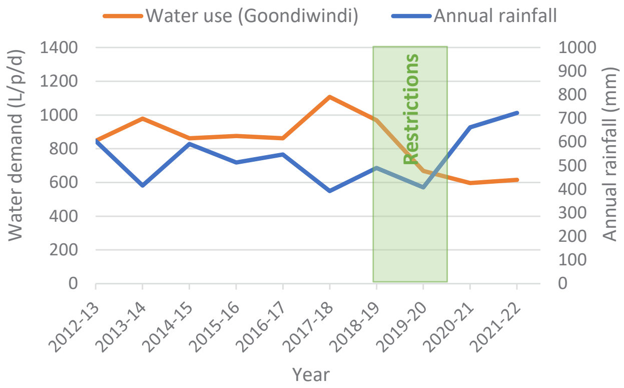


**Figure 4:** Total water use and rainfall for Goondiwindi, showing that water demands are generally higher during hotter, drier periods (without restrictions)

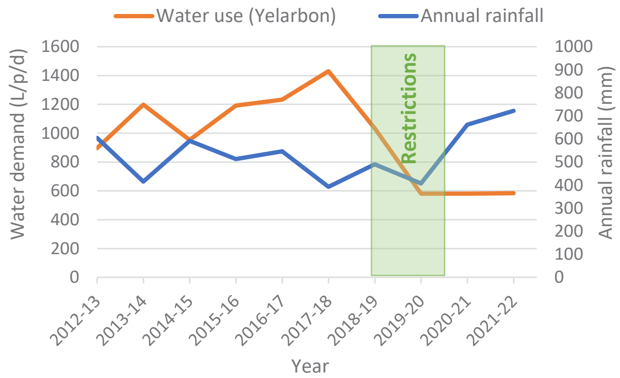


**Figure 5:** Total water use and rainfall for Yelarbon, showing that water demands are generally higher during hotter, drier periods (without restrictions)

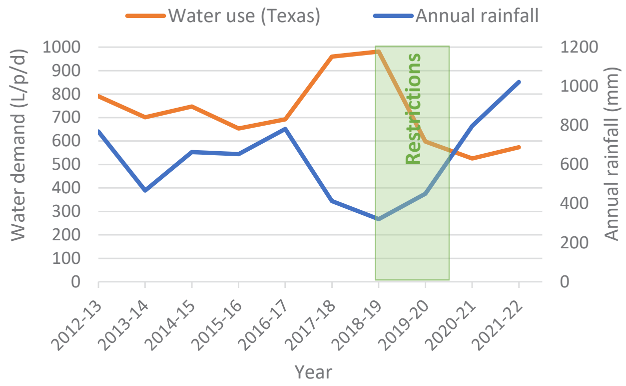


**Figure 6:** Total water use and rainfall for Texas, showing that water demands are generally higher during hotter, drier periods (without restrictions)

## Climate change

Climate change is a shift in the long-term average weather patterns or trends over many decades.

The Queensland Government provides climate change projections (based on an ensemble of climate models) for local government areas (LGAs), including for the Goondiwindi Regional Council area. These projections are publicly available on the Queensland Future Climate Dashboard[1]. The climate change projections are reviewed and revised as new data and improved methodologies become available.

In general, Queensland's future climate is projected to be warmer and drier, with increased evaporation and a potential increase in the annual and inter-annual variability. Similar trends are also projected for the Goondiwindi LGA, with increased temperatures and evaporation. However, Goondiwindi is not projected to experience a reduction in average annual rainfall. The projected climatic changes for Goondiwindi indicate that by 2050 seasonal variations may include:

- slightly wetter summers, with drier winter and spring
- warmer temperatures for each season (average, minimum, and maximum)
- higher evaporation rates for each season.

Climate change projections (projected annual changes) for the Goondiwindi LGA are shown in Table 3 for temperature, evaporation, and rainfall, centred around the years 2030 and 2050, under a lower / 'middle of the road' and 'worst case' greenhouse gas emission scenarios (RCP 4.5 and RCP 8.5[2] , respectively).

**Table 3:** Climate change projections

| Climate indicator | | 2030 | | 2050 | |
|---|---|---|---|---|---|
| | | RCP 4.5 | RCP 8.5 | RCP 4.5 | RCP 8.5 |
| Average mean annual temperature (°C change) | Median | 0.96 | 0.98 | 1.5 | 2.1 |
| | (range) | (0.72 to 1.5) | (0.71 to 1.4) | (0.94 to 2.1) | (1.4 to 2.6) |
| Annual potential pan evaporation (% change) | Median | 6 | 5.9 | 12 | 18.0 |
| | (range) | (2.2 to 14.0) | (0.88 to 14.0) | (2.6 to 17) | (7.4 to 21.0) |
| Annual rainfall (% change) | Median | -2.1 | 1.5 | 0.52 | 1.7 |
| | (range) | (-10.0 to 6.0) | (-8.0 to 10.0) | (-4.2 to 5.9) | (-8.6 to 7.0) |

The analysis of historical water demand data for the Goondiwindi region in the previous section shows that water demands are considerably higher during hotter, drier periods (as is the case for most regions). The projected hotter conditions and associated higher evaporation are likely to increase water demands (while higher evaporation may also impact water supplies). This is discussed further in a later section ('Impacts of dry periods on water demand').

## Other Border Rivers demand considerations

### Other urban areas

The small NSW community of Boggabilla (population around 550) is located approximately 8km upstream from Goondiwindi. Boggabilla draws its urban water supply from Boggabilla Weir on the Macintyre River in accordance with NSW's water sharing rules. Due to the relatively small size of Boggabilla's population (around 10% of Goondiwindi's population) the impact of this demand on available supply for Goondiwindi is generally not considered to be particularly significant—noting however, during extreme drought when inflows to the system may cease, the combined demands on (and supply from) Boggabilla Weir and Goondiwindi Weir

[1] https://www.longpaddock.qld.gov.au/qld-future-climate/dashboard/

[2] RCP stands for Representative Concentration Pathway–the potential global greenhouse gas concentration trajectory scenarios adopted in the IPCC's fifth report for predicting climate change impacts. RCP8.5 is the 'worst-case' climate change scenario (sometimes referred to as 'business as usual', although this is likely an overestimation). The RCP 4.5 pathway is an intermediate pathway which sees growth in emissions of both carbon dioxide and methane (from human activities) cease and start to decline by mid-century, resulting from some effective change(s) being made to emissions output, potentially through new or alternative technologies.

become an important factor. This is discussed further in a later section ('Weir depletion assessments').

## Agriculture

Agricultural production is the mainstay of the Goondiwindi and Border Rivers area regional economy and earns much needed export income for Australia. The fertile heavy clay soils of the river valleys and the generally reliable rainfall ensure a continuing strong demand for farming and grazing land. Demand for water upstream of Yelarbon (in the Dumaresq River) is primarily met through supplemented water from the BRWSS and groundwater from the Border Rivers Alluvium. Water users in the downstream section (Macintyre and Barwon rivers) rely mainly on unsupplemented water (water harvesting and overland flow), and to a lesser extent on supplemented water from the BRWSS. The volume of water that can be taken is managed through conditions on entitlements and water sharing rules stipulated in Queensland's Water Plan (Border Rivers and Moonie) 2019 (the Water Plan).

The majority of water entitlements in the Queensland Border Rivers catchment are primarily used for agriculture. The volume of water taken in the catchment is limited to the sustainable diversion level (SDL) stated in the Basin Plan 2012. Hence, there is not expected to be any future growth in agricultural demand that would significantly impact on the water supply security of Goondiwindi, Texas and Yelarbon.

## Mining and industry

Goondiwindi is also home to a large cotton gin situated approximately 2km southeast of town and run by Namoi Cotton. However, the cotton gin is not connected to the reticulation network, managing within its own small water entitlements (2 entitlements of 1 ML/a each[3]). There are no mining activities that are considered to have a significant impact on the urban water supplies. Only a relatively small proportion of all water entitlements in the Border Rivers areas have a purpose of 'urban', 'mining', 'industrial', or other purposes (which combined are < 1% of total entitlements in the catchment).

Nonetheless, population growth (and therefore water demand) can be impacted by factors such as large-scale construction or new industrial activities, such as the anticipated construction of the Australian Rail Track Corporation (ARTC) Inland Rail project, which may see 300–500 person worker camps established and reliant on local urban water supplies. Allowing for 300 L/p/d, a single camp could add around 55 ML/a to Goondiwindi's demand (for several years). More significantly, the realisation of a potential new abattoir at Goondiwindi could result in an increase in population of around 1000 people (including families associated with workers), potentially adding approximately 300 ML/a to Goondiwindi's existing demand—an increase of around 17%, assuming that the abattoir sources its own water for processing purposes.

## Performance of the BRWSS and Goondiwindi surface water supplies

Goondiwindi Weir receives regulated inflows from the BRWSS via Boggabilla Weir, including supply from Glenlyon Dam, as well as the natural inflows entering the system.

Historically, Goondiwindi Weir has benefited from its location immediately downstream of the junction of the Dumaresq and Macintyre rivers, which tend to maintain a naturally occurring flow, except in drier times—resulting in both Goondiwindi Weir and Boggabilla Weir being maintained above their full supply levels for long periods. However, during extremely dry periods, water may cease to flow over the weir at Goondiwindi. Figure 7 shows the historical recorded water levels at Goondiwindi Weir from January 1997 to December 2022 (for illustrative purposes the gauge height shown is limited to 1.85m, as flows will often be several metres in height above this level during high-flow events). The impact of the 2019–21 drought on water levels at the weir is clearly evident in Figure 7.

There is significant storage volume in the weir below the current 'cease pumping' level. This could potentially be partially accessed (i.e., around an extra 785 ML, or around 2 months' demand under high level restrictions) by lowering the intake (see Weir depletion assessments)

Glenlyon Dam has a storage capacity of 254 000 ML, with levels fluctuating markedly due to releases for (primarily) agricultural purposes. A historical low of 2.2% of storage capacity was recorded on 25 December 1994. Figure 8 shows the historical storage volume of Glenlyon Dam over the historical period 1978 to late 2022.

[3] Namoi Cotton holds a 1 ML/a medium priority water allocation from Zone B of BRWSS (extracting from the Macintyre River upstream of the weir) and a 1 ML/a alluvial groundwater entitlement.

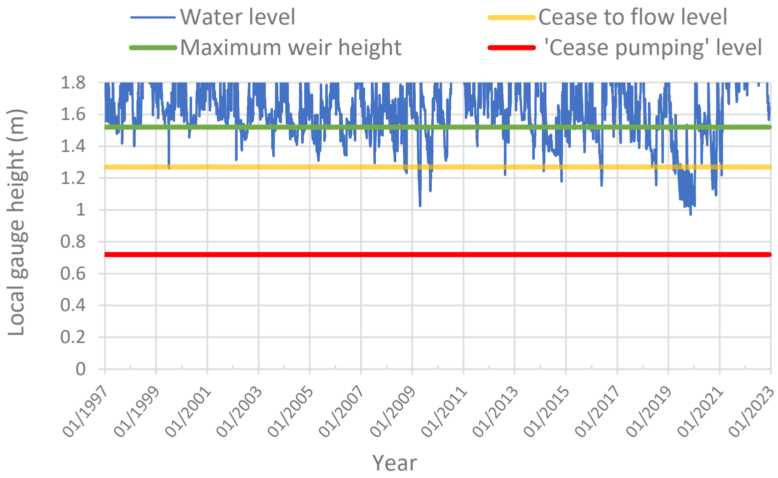


**Figure 7:** Historical recorded water levels at Goondiwindi Weir, showing low water levels during the prolonged 2019–21 drought

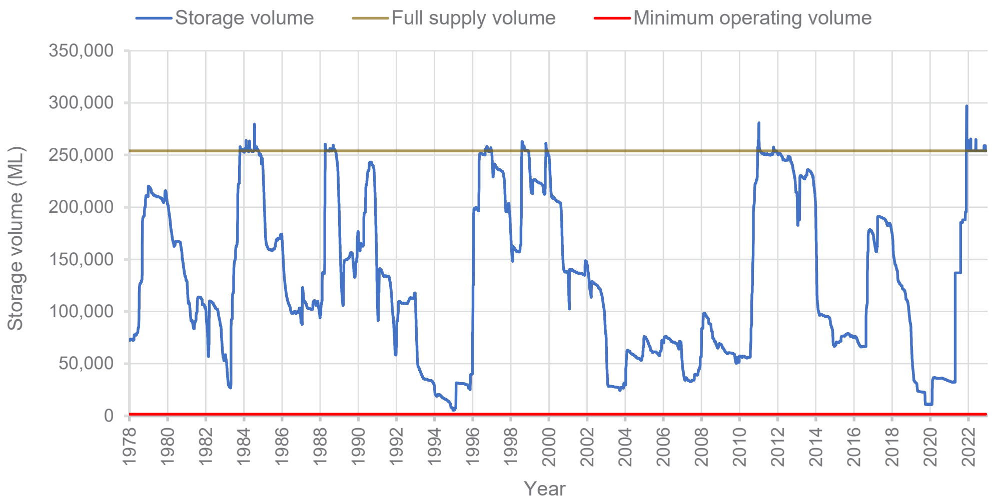


**Figure 8:** Historical storage behaviour of Glenlyon Dam, showing significant fluctuations over relatively short time periods (1–2 years)

# Future water demands

Effective water supply planning needs to consider likely and possible changes in future water demand.

## Impact of population growth on water demand

Population growth is a key driver of increasing water demands. Two future population growth rates have been considered for Goondiwindi, Texas, and Yelarbon up to the year 2050, as follows:

1. 0% per annum population growth rate (in line with the current growth projections (to 2041) by the Queensland Government Statisticians Office (QGSO) for both the Goondiwindi Local Government Area and the smaller Goondiwindi Statistical Area Level 2 (SA2 area))
2. 1% per annum population growth rate (considered unlikely for Goondiwindi and Yelarbon, but possible for Texas based on growth over the last 10 years).

Table 4 shows the projected populations for the three communities under a 0% and a 1% population growth scenario to 2050.

**Table 4:** Populations of Goondiwindi, Texas and Yelarbon under growth scenarios of 0% & 1% per annum

| | 0% population growth (Estimated 2022 population*) | 1% per annum growth population at (year): | | |
|---|---|---|---|---|
| | | 2030 | 2040 | 2050 |
| Goondiwindi | 5580 | 6043 | 6675 | 7373 |
| Texas | 735 | 796 | 879 | 971 |
| Yelarbon | 230 | 249 | 275 | 304 |

*Above data are based on Australian Bureau of Statistics (ABS), Australian Statistical Geography Standard (ASGS), July 2021 (which uses adjusted 2016 Census data), for Goondiwindi SA2, along with QGSO Urban Centre and Locality data published 05 December 2022.

## Impacts of dry periods on water demand

In planning future water supplies, consideration needs to be given to both projected average demands and extended dry period demands to determine when demand is likely to exceed available supply.

As mentioned earlier, analysis of historical water demand data for the Goondiwindi region shows that water demands were considerably higher during hotter, drier periods. During the driest of the past 10 years, Goondiwindi's urban demands were around 32% above average, at 1107 L/p/d (in 2017–18). Similarly, the highest demands in Texas were around 36% above average demands (at 982 L/p/d in 2018–19), and the highest demands in Yelarbon were around 48% higher than average (at 1431 L/p/d in 2017–18). The climate change projections for the Goondiwindi region include higher temperatures and higher evaporation, suggesting that higher water demands may occur more frequently in the future.

Projected demands for each of the communities are therefore provided for both 'average demand' and a potential (higher) 'dry period' demand for both the 0% and 1% population growth scenarios, based on the above (higher) L/p/d figures (and the 'average' L/p/d figures from Table 1) and the population projections shown in Table 4. The resulting projections are provided in Table 5 and illustrated in Figures 9 to 11.

As indicated in the earlier section–'Other Border Rivers demand considerations'–Council may also need to plan for increases in shorter term demands of between 55 ML/a and 355 ML/a associated with the Inland Rail project and an abattoir.

**Table 5:** Projected water demands for Goondiwindi, Texas, and Yelarbon

| | Projected 2050 demands (ML/a) | | | |
|---|---|---|---|---|
| | Average annual demand | | Unrestricted 'dry period' demand | |
| Population growth | 0% per annum | 1% per annum | 0% per annum | 1% per annum |
| Goondiwindi | 1719 | 2255 | 2255 | 2979 |
| Texas | 191 | 256 | 263 | 348 |
| Yelarbon | 81 | 108 | 120 | 159 |

## Goondiwindi's reticulation network

Figure 9 illustrates that, based on the QGSO projected population growth rate (0%), the average annual total water demand for Goondiwindi is projected to remain at around 1719 ML/a (in line with the 10-year historical period from 2012–13 to 2021–22). However, unrestricted demands during hotter drier years could be considerably higher at around 2255 ML/a (based on historical dry period use).

Under a 1% population growth scenario, the average demand figure by the year 2050 is also 2255 ML/a, with a potential 'dry period' demand at 2050 under this growth scenario reaching 2979 ML/a. A review as recommended under Council's Drought Resilience Plan could identify improvements for water use efficiency, minimising water losses and potentially increasing water supplies for future growth.

As mentioned earlier, Council has high priority surface water entitlements of 2100 ML/a and GAB bore allocations of 380 ML/a available for Goondiwindi's urban water supply. Therefore, based on 1% population growth, unrestricted dry period demands for Goondiwindi could potentially exceed the combined volume of Council's high priority surface water entitlements and GAB groundwater entitlements by around the year 2032. This highlights the need for the ongoing monitoring of population levels, appropriate restrictions policy and effective ongoing demand management practices to be included as part of future urban water supply planning and management activities.

Additionally, as discussed earlier, there is potential for a spike in water demand (of up to 355 ML/a) resulting from the establishment of worker camps (reliant on urban water supplies) associated with the anticipated construction of the ARTC Inland Rail project, and from the realisation of a potential new abattoir at Goondiwindi (which may see an increase in new families moving to the area). The potential for these increased demands further highlights the need for demand management practices, particularly during dry periods, and for ensuring the reliability of additional supplies (such as the GAB bores).

## Texas' reticulation network

Figure 10 illustrates that, based on the QGSO projected population growth rate (0%), the average annual total water demand for Texas is projected to remain at around 191 ML/a (in line with the 10-year historical period from 2012–13 to 2021–22). However, unrestricted higher demands during hotter drier years could be considerably higher at around 256 ML/a (based on historical use).

Under a 1% population growth scenario, the average demand by the year 2050 is projected to reach 263 ML/a, with a potential unrestricted 'dry period' demand of 348 ML/a.

As described earlier, Council has both a Border Rivers Alluvium groundwater entitlement of 350 ML/a and a BRWSS surface water entitlement of 270 ML/a (total 620 ML/a) for supplying water to Texas, which provide adequate scope to service the potential range of demands for Texas (see Fig 10). However, both these sources are subject to prevailing conditions and hence access to these entitlements could be constrained during extended dry weather/drought.

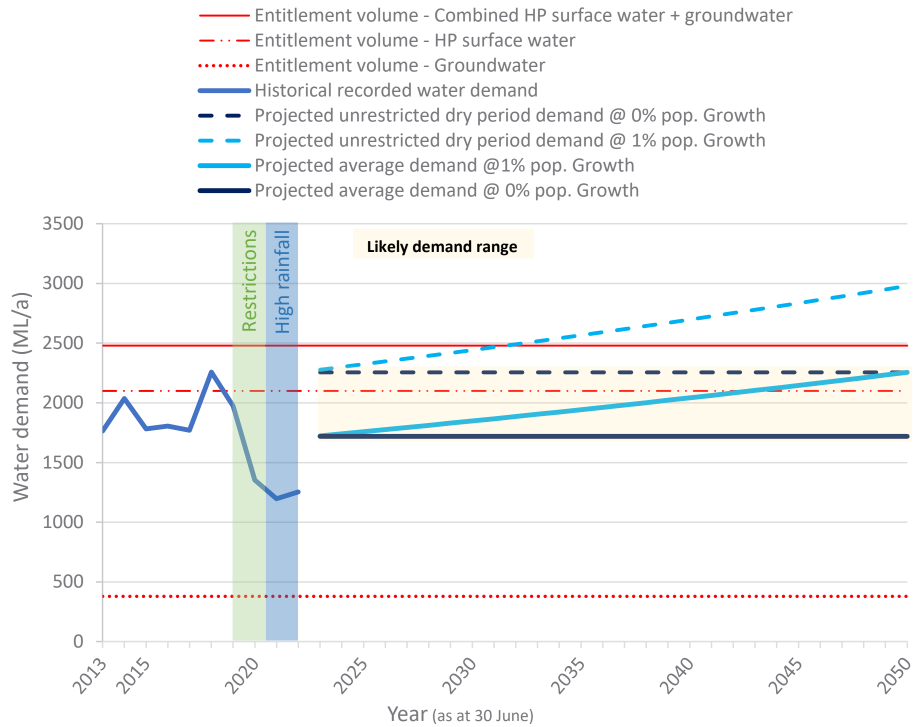


**Figure 9:** Goondiwindi historical and projected water demands, showing the likely range of future demands

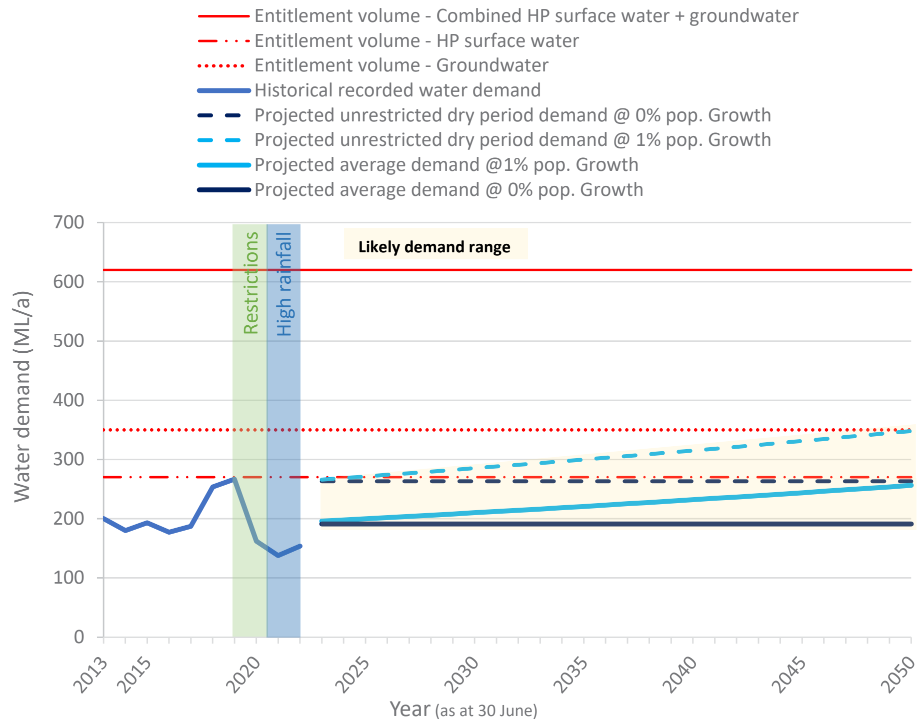


**Figure 10:** Texas historical and projected water demands, showing the likely range of future demands

## Yelarbon's reticulation network

Figure 11 illustrates that, based on the QGSO projected population growth rate (0%), the average annual total water demand for Yelarbon is projected to remain at around 81 ML/a (in line with the 10-year historical period from 2012–13 to 2021–22). However, unrestricted higher demands during hotter drier years could be considerably higher at around 108 ML/a (based on historical use).

Under a 1% population growth scenario, the average demand by the year 2050 is projected to reach 120 ML/a, with a potential 'dry period' demand of 159 ML/a.

As described earlier, Council has both a Border Rivers Alluvium groundwater entitlement of 150 ML/a and a BRWSS surface water entitlement of 106 ML/a (total 256 ML/a) for supplying water to Yelarbon, which provide adequate scope to service the potential range of demands for Yelarbon (see Fig 11). However, both these sources are subject to prevailing conditions and hence access to these entitlements could be constrained during extended dry weather/drought.

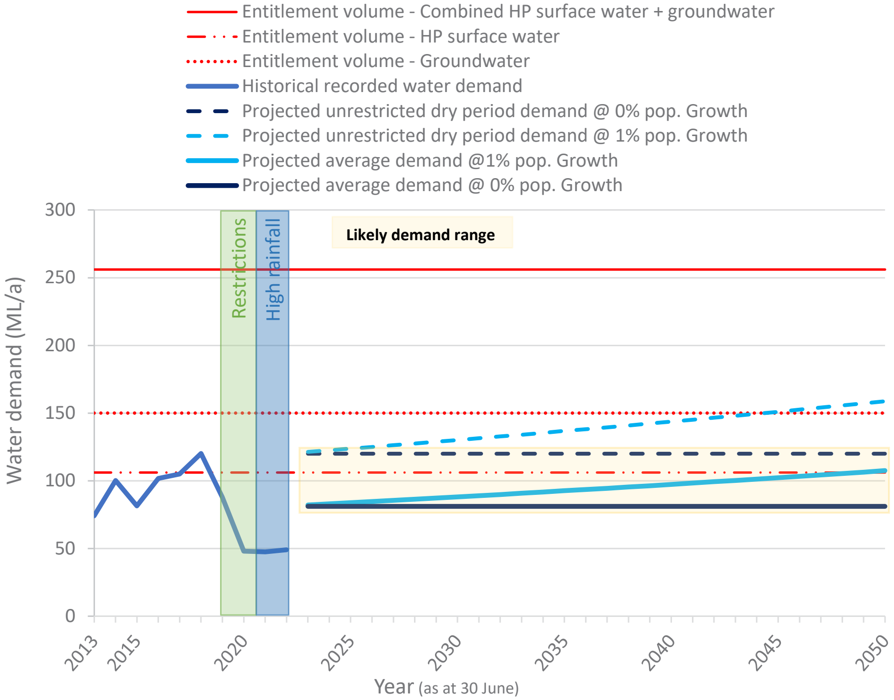


**Figure 11:** Yelarbon historical and projected water demands, showing the likely range of future demands

# Water supply system capability

Hydrologic assessments have been undertaken to assess the capability of the water supply systems for Goondiwindi, Texas, and Yelarbon to meet current and future water demands.

## Hydrologic assessments

Historical modelling was undertaken to simulate the performance of the water supplies for Goondiwindi, Texas, and Yelarbon. Historical modelling demonstrates how the existing water supply sources would have performed under historical climatic conditions (1890 to 2020) for a range of demand levels and operating scenarios.

Climate change modelling was also undertaken to investigate the potential impacts of future climate change on urban water security for Goondiwindi under emissions scenarios RCP 4.5 and RCP 8.5.

The hydrologic modelling that has been undertaken is a simplification of the real-world hydrology but greatly assists in understanding, predicting, and managing water resources. Simulating the hydrologic performance of catchments and water supplies is challenging, especially in systems with complex operating arrangements like the Border Rivers, which has a relatively small volume of water used for urban supplies (less than 1%) compared with the overall volume of other water entitlements in the system. Despite these complexities (which introduce uncertainty), the ability of the model to reasonably simulate the performance of the system provides a highly valuable tool that can be used by water planners to better understand the likely future performance of the system under different scenarios, enabling sound decision making.

## Hydrological modelling scenarios

A number of modelling scenarios were undertaken, for a range of urban water demands and operating arrangements. The hydrologic model used is a surface water model which does not simulate the performance of groundwater sources. Therefore, demands for each scenario were only those that were being placed on the surface water. The modelling included consideration of:

- supply from both surface water and groundwater, with groundwater being available when required (within the allocation limits)
- supply from surface water only (i.e. no groundwater contribution)
- assessment of the impact of water restrictions.

Based on the projected water demands for Goondiwindi, Texas and Yelarbon shown in Table 5, Table 6 shows the adopted surface water demands for each community for scenarios where supply is also being provided by groundwater (i.e. 380 ML/a groundwater for Goondiwindi, and half of the total demand each for Texas and Yelarbon). This assumes that groundwater is always available when required—which is a reasonable assumption for Goondiwindi's GAB bores but may not be the case in very dry periods for the alluvial bores at Texas and Yelarbon.

**Table 6:** Projected 2050 annual surface water demands for Goondiwindi, Texas and Yelarbon

| | Average annual demands | | Potential (higher) 'Dry period' demands | |
|---|---|---|---|---|
| | 0% pop. growth (ML/a) | 1% pop. growth (ML/a) | 0% pop. growth (ML/a) | 1% pop. growth (ML/a) |
| Goondiwindi | 1339 | 1875 | 1875 | 2599 |
| Texas | 96 | 128 | 132 | 174 |
| Yelarbon | 41 | 54 | 60 | 80 |

Notes:

1. Based on 380 ML/a groundwater for Goondiwindi, and groundwater supplying half of the total demand each for Texas and Yelarbon
2. Groundwater assumed as always available when required which is the most likely case for Goondiwindi's GAB bores but may not be the case for the alluvial bores at Texas and Yelarbon

## Water restrictions

Water restrictions are generally imposed to reduce water consumption and prolong supply. Water restrictions typically target, among other things, outdoor water uses (including watering gardens and irrigating sports fields) and water use efficiency for industry.

For the purpose of the hydrological assessments (and storage depletion assessments for Boggabilla and Goondiwindi Weirs), the three levels of restrictions from Council's Drought Management Plan–May 2020 were adopted (high, medium and low) with each assumed to achieve the targeted demand reduction. The resulting restricted demands used in the modelling are indicated in Table 7.

**Table 7**: Assumed demands under water restrictions

| Effect of restrictions | Restriction Level | | |
|---|---|---|---|
| | Low | Medium | High |
| Restricted residential demand (L/p/d) | 350 | 250 | 150 |
| Reduction in commercial, municipal, and industrial demand | 5% | 10% | 15% |

For modelling purposes, low, medium and high-level water restrictions were triggered when the volume of water in Boggabilla Weir and Goondiwindi Weir fell to 75%, 50% and 15% (respectively) of their combined accessible storage capacity. Each trigger was also subject to a supplementary condition that Glenlyon Dam was below 50 000 ML—an additional modelling scenario which reduced the supplementary condition for Glenlyon Dam (to below 25 000 ML) was also trialed and resulted in less frequent restrictions.

These rules for triggering restrictions were used for modelling purposes only (to indicate their potential effect), and do not necessarily reflect when Council will choose to implement restrictions.

## Blending of surface and ground waters

As mentioned earlier, the Hutton bore has fluoride levels above the Australian Drinking Water Guidelines (ADWG) health limits and therefore requires either treatment (such as reverse osmosis) or blending with surface water and/or the Gubberamunda bore water to reduce the fluoride concentrations. Groundwater from both the Hutton and Gubberamunda bores also have levels of total dissolved solids and sodium above the ADWG aesthetic limits (which can effectively be reduced through blending with surface water or removed through reverse osmosis).

The hydrological modelling of scenarios where surface and groundwater are used together to meet demands has assumed that a suitable blend ratio of groundwater to surface water was used to enable full use of both groundwater entitlements. For Goondiwindi's current average demand (1719 ML/a), full use of the groundwater entitlements (380 ML/a) blended with surface water (1339 ML/a) results in a fluoride concentration for the blend of around 0.9 mg/L (well below the ADWG limit of 1.5 mg/L), and even lower concentrations for higher demands.

Council is trialling a number of blend ratios to achieve the appropriate balance of water quality, cost and maximisation of available supply.



# Water supply security outcomes

## Goondiwindi's reticulation network

A water supply shortfall was considered to occur if:

- the modelling indicated that Goondiwindi Weir and Boggabilla Weir were both at or below their minimum extraction level; or
- the demand on the available surface water and groundwater supply sources exceeded the combined entitlement volume.

Modelling indicated that surface water demands—up to the limit of Goondiwindi's high-priority surface water entitlements (2100 ML/a)—could be met from the system without supply shortfalls occurring.

Modelling of a higher surface water demand for Goondiwindi (~2250 ML/a) was undertaken as a sensitivity assessment, and this scenario indicated no supply shortfalls occurring (albeit this volume would exceed Council's high-priority entitlement).

Figure 12 provides an indication of the performance of Goondiwindi's surface water supply system under water restrictions, indicating the likelihoods that water restrictions could be triggered, for a range of annual surface water demands.

Figure 12 also shows that the frequency of reaching the 'high' level water restriction trigger level tends to increase as surface water demand increases (while there is less noticeable impact on the 'low' and 'medium' level

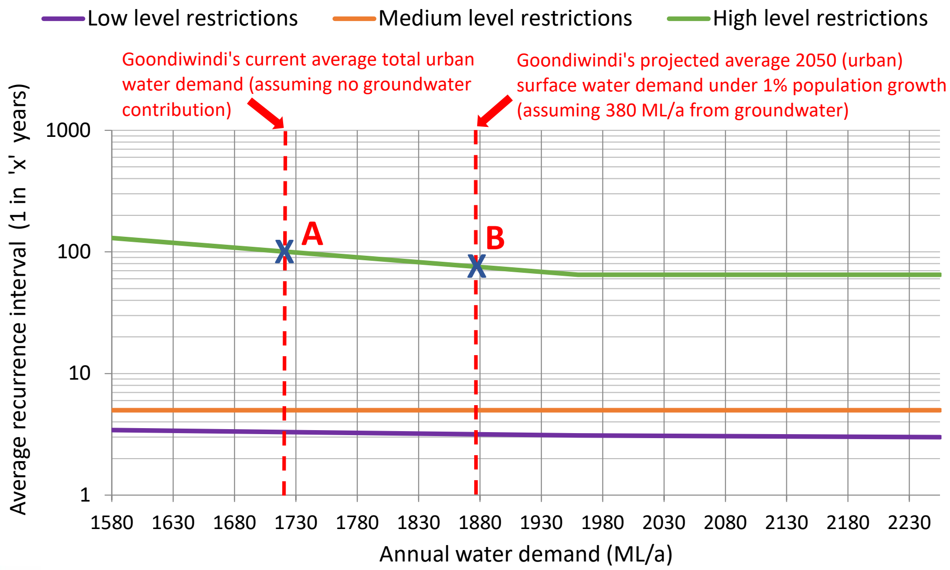



**Figure 12:** Frequency of water restrictions against total annual demand

restrictions for the demands shown). For example, at Goondiwindi's current average total annual demand of about 1719 ML/a (refer Table 5 on page 15), if supplied solely from surface water, 'high' level water restrictions are estimated to occur about once every 100 years on average (see label 'A' on graph). At a higher surface water demand of, say, 1875 ML/a (which, combined with groundwater, would meet average 2050 demands under a 1% growth scenario), the frequency of 'high' level restrictions increases to about once every 75 years on average (see label 'B' on graph).

The scenario based on the combination of 1% population growth and 'dry period' demands (2979 ML/a—Table 5) would far exceed Goondiwindi's high-priority surface water entitlement (requiring 2599 ML/a of surface water—Table 6), and therefore would potentially result in a water supply shortfall. However, while this scenario is not considered likely to occur, it is included to highlight the need for ongoing diligence in managing demand and monitoring of potential population growth impacts.

These results indicate that (with the restriction regime modelled):

- For the zero-growth case, the reliability of Goondiwindi's supply should be acceptable up to the 2050 planning horizon (although the dry period 2050 demand scenario of 2255 ML/a would require use of both the weir and the GAB bores).
- For the 1% growth case and average demand, the reliability of Goondiwindi's supply remaining acceptable will depend on using the GAB supply together with water from the weir. However, for the 2050 dry period demand scenario of 2979 ML/a, reliability would deteriorate even with the GAB bores, and harsher restrictions would be required.
- The ability to use some additional surface water (i.e. approx. 150 ML/a more than Goondiwindi's current entitlement) does not appear to reduce reliability (note: the 'no increase in take' conditions of the Border Rivers water plan mean any additional entitlement would need to be acquired through trading or dealings).

Historical modelling indicates that, overall, Goondiwindi's water supply may be considered sufficiently reliable for a community of its size and location. However, it can be expected that from time to time (every 50 years or so on average) there may be challenging situations that will need to be managed but are most likely able to be negotiated through a combination of restrictions and blending of available surface and groundwater supplies. Nonetheless, every drought is different, and the need for a coordinated approach between all managing parties is required, and this is discussed further in the later section on 'Drought response'.

As indicated earlier, the modelling results should be treated with caution given the complexity of the Border Rivers hydrologic model and the relatively small demands of Goondiwindi, Texas and Yelarbon compared with the overall Border Rivers Water Supply Scheme.

The modelling undertaken is simply a tool to help improve our understanding of supply risks and, albeit a low risk, there is still potential for a future water supply shortfall to occur, e.g. as a result of a future drought worse than has occurred during the historical period. In such circumstances there would be a need to have a 'ready to action' plan for additional supply sources, such as groundwater.

Goondiwindi's existing GAB groundwater allocations (380 ML/a) are highly reliable, and alone are capable (subject to appropriate treatment) of providing emergency ongoing supplies of at least 150 L/p/d for residents of Goondiwindi (plus Texas and Yelarbon if required, based on current populations), which provides a baseline level of security (this figure is based on the annual volumetric limits for the relevant entitlements, and therefore a higher level of supply could be provided for periods shorter than a year, or if additional temporary entitlement was available (e.g. in exceptional circumstances)). It is considered that 250 L/p/d is a more appropriate minimum target level of supply for urban communities during severe drought periods to meet commercial and residential demands—noting this could mean higher treatment costs.

## Yelarbon and Texas' reticulation networks

Yelarbon can access water from a significant waterhole in the Dumaresq River and also has a new alluvial bore which is considered reliable. The allocation from the new bore (150 ML/a) alone exceeds Yelarbon's projected average 2050 demand of around 108 ML/a (assuming a 1% population growth rate) and is nearly sufficient to meet the higher potential 'dry period' 2050 demand of 159 ML/a. Based on 50% of supply from the alluvial bore and 50% supply from surface water, hydrological modelling indicates that there are no periods of unmet demand for Yelarbon for all scenarios.

Hydrological modelling for Texas indicates some potential for short periods during which demand may not be met from surface water (in part or full), although none are greater than one month duration if effective water restrictions are imposed when triggered (and none are greater than three months' duration under any scenarios). Annual reliability varies from around 95% to around 98% for the scenarios considered. Texas' alluvial bore allocation (350 ML/a) alone exceeds Texas' projected 2050 average demand of 256 ML/a (assuming a 1% population growth rate); however, there are some concerns regarding a potential reduction in its capacity when the river is low (when surface water is also likely to be less available). It is noted that, given the reliance placed on the availability of groundwater for Texas during dry conditions, there is some risk associated with the current dependence on a single groundwater bore—it is therefore recommended that Council consider mitigation measures such as having a stand-by pump on hand to minimise potential impacts to the community from any interruption to their groundwater supplies (e.g. from pump failure).

An important factor regarding urban water supply security for Texas and Yelarbon is that these are small communities and carting of supplies (from Goondiwindi) or other contingency supply arrangements should be able to meet any anticipated infrequent short duration water supply shortfalls that might occur.

## Frequency, duration and severity of water restrictions

Although the frequency of water restrictions is an important consideration, the duration and severity of each restriction period may be more important for many water users. For example, it may be more acceptable to experience less severe and/or shorter periods of water restrictions more frequently, than to experience more severe and/or longer periods of water restrictions less frequently.

Figure 13 shows the modelled number of occurrences of storage volumes (i.e. Goondiwindi Weir & Boggabilla Weir, and Glenlyon Dam) falling below the trigger for 'low' water restrictions and remaining below that volume for longer than 1 month, 3 months and 6 months over the historical 130-year period for a range of demands above and below Goondiwindi's current demand. Figure 13 shows that, over a 130-year period, at a surface water demand of 1580 ML/a there are 25 occurrences of the storage volumes falling below the trigger for 'low' water restrictions and remaining below that volume for longer than 1 month, of which around half last longer than 3 months with 1 lasting longer than 6 months.

Figure 14 shows the number of occurrences that the storage volumes continue to fall and trigger 'medium' water restrictions and remain below that trigger level for longer than 1 month, 3 months and 6 months.

Both Figure 13 and 14 also show that under an increasing level of water demand, there is relatively little change in the number of occurrences of water restrictions being triggered—this is attributable to the fact that the total urban demands from Goondiwindi (and Texas and Yelarbon) are very small when compared with total demands supplied by the BRWSS system (<1%). However, assessment of the storage depletion times for Boggabilla Weir and Goondiwindi Weir (discussed in the next section) shows that, under conditions where the weirs have stopped overflowing and releases can no longer be made from Glenlyon Dam (and there are no other inflows to the weirs), restrictions can prolong the duration of available (restricted) supplies for Goondiwindi by around 3 months (which could be of significant benefit, potentially providing continued supplies through to the next rainfall event).

Together, the frequency, severity, and duration of water restrictions, along with the ability to maintain a minimum supply during drought, are fundamental parts of water supply planning and form part of the 'level of service'.

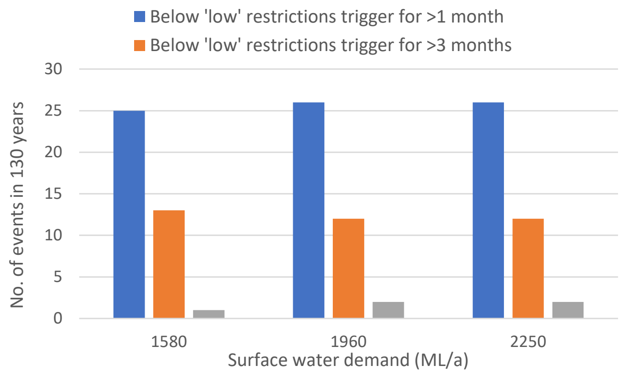


**Figure 13:** Number and duration of events where storage volumes fall below the trigger for 'low' level water restrictions at various annual water demands, showing relatively little difference in the number of events at the various demand levels

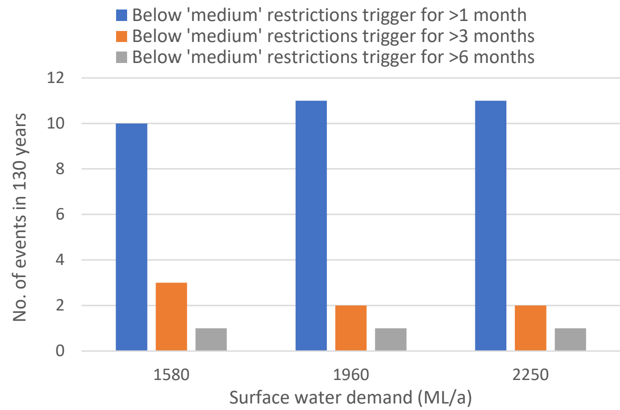


**Figure 14:** Number and duration of events where storage volumes fall below the trigger for 'medium' level water restrictions at various annual water demands, showing relatively little difference in the number of events at the various demand levels

The appropriate 'level of service' for Goondiwindi is a matter for Council to determine.

## Weir depletion assessments

With no inflow to Boggabilla and Goondiwindi Weirs for a prolonged period, for instance as might occur in the event of a drought that is worse than on historical record, Goondiwindi supply would be reliant on the storage in Boggabilla and Goondiwindi Weirs and the two GAB bores.

The observed storage performance of Boggabilla and Goondiwindi weirs during the 2019/20 drought period indicated they may be depleted in around nine months if no further inflows occurred (assuming no groundwater take, and with or without restrictions).

Preliminary depletion assessments indicated that in such an emergency situation, assuming contribution of groundwater (~1 ML/day under low and medium restrictions, increasing to ~3 ML/day under high level restrictions) and with water restrictions achieving the target reductions indicated in Council's Drought Management Plan (see Table 7), the time to depletion from the low-level restriction trigger point may be up to 12–13 months.

Without restrictions (but assuming groundwater contribution), the time to depletion from the low-level restriction trigger point is estimated to be around 10 months, i.e. a reduction of around 2–3 months of useable supply, thereby indicating a significant water security benefit from imposing restrictions when the weirs have stopped overflowing.

These estimates take into account the potential water needs of the Boggabilla community, but are preliminary estimates and subject to the relevant authorities in Queensland and New South Wales agreeing the appropriate operational arrangements.

It should also be noted these estimated depletion times are based on a range of assumptions, including (among other things) both weirs being full at the commencement of the depletion calculation period (which may not be the case in practice). These estimates should therefore be considered only as a guide, and a more detailed assessment should be undertaken should such a situation arise.

The assessment also found that lowering the level of Council's intake in Goondiwindi Weir (e.g. through a temporary emergency provision) to facilitate water being extracted down to about 500 ML storage volume could potentially add around 2 months of additional supply under high level restrictions.

## Climate change modelling

Modelling was undertaken to assess the potential climate change impacts on the surface water supplies for Goondiwindi at 2050 for two emission scenarios (RCP 8.5 and RCP 4.5). The methodology uses regional climate models (RCMs) developed for Queensland by the Department of Environment and Science from 11 general circulation models (GCMs) considered to be the best at reproducing the known historical climatic conditions for Queensland.

The ensemble of RCMs provides a range of possible climate futures. The median result from the ensemble for each climatic variable is considered the 'best estimate' while the 10th and 90th percentiles, forming approximately the 80% confidence interval, provide an indication of the uncertainty of the projection (values within this range should also be considered as plausible climate futures).

As shown in Figure 15 (numbers provided in Table 8), the median values from the modelling results show that there is a small difference (range: 0–0.7%) in the mean annual diversions of surface water (i.e. the average volume of surface water extracted) for Goondiwindi under each scenario when seeking to service a demand of approximately 2250 ML/a[4] solely from surface water (i.e. approximately the 2050 projected '1% growth' average demand, which is slightly above Goondiwindi's surface water entitlements of 2100 ML/a). This median result therefore indicates that the mean annual volume of water able to be supplied does not significantly change for any of the scenarios; however, a small level of impact is evident (as shown by the numbers in Table 8).

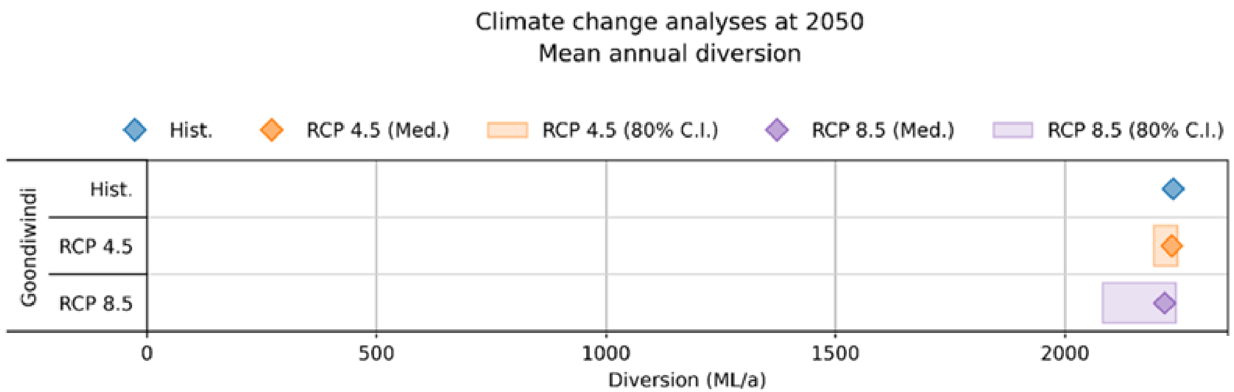


**Figure 15:** Mean annual diversions of surface water for Goondiwindi

[4]Actual demand modelled was 2246 ML/a

**Table 8:** Mean annual diversions of surface water for Goondiwindi (ML/a)

| Details | Historical | RCP 4.5 | | | RCP 8.5 | | |
|---|---|---|---|---|---|---|---|
| | | 10th percentile | Median | 90th percentile | 10th percentile | Median | 90th percentile |
| Mean annual diversions for Goondiwindi (ML/a) | 2,240 | 2,190 | 2,230 | 2,240 | 2,080 | 2,220 | 2,240 |

Figure 15 also shows that there is a relatively narrow range of results from the various RCMs used for the RCP 4.5 emissions scenario, as shown by the 80% confidence interval (80% C.I.), meaning that the model outputs are in relatively close agreement for this emissions scenario. However, the numbers (Table 8) show that, under the RCP 8.5 scenario for Goondiwindi, the range of results for the 'mean annual diversion' (i.e. average annual volume of water extracted) extends from 2080–2240 ML/a. Consequently, the annual reliability of Goondiwindi's supply (as shown in Figure 16 and Table 9) ranges from 99.2% (10th percentile) to 100% (median, and 90th percentile). While this difference is relatively small, the lower value (99.2%) shows that, under RCP 8.5, the reliability of the system may be marginally impacted (i.e. a water supply shortfall could actually occur)—bearing in mind that this is the 'worst-case' climate scenario for a relatively high projected demand level (which is slightly above Council's surface water entitlement limit).

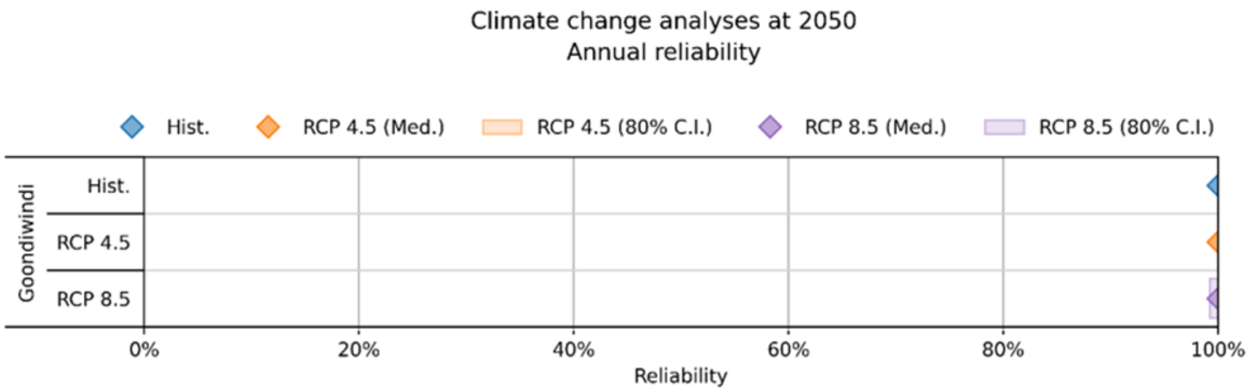


**Figure 16:** Annual reliability of surface water

**Table 9:** Annual reliability of surface water for Goondiwindi (%)

| Details | Historical | RCP 4.5 | | | RCP 8.5 | | |
|---|---|---|---|---|---|---|---|
| | | Lower 80.0% C.I. | Median | Upper 80.0% C.I. | Lower 80.0% C.I. | Median | Upper 80.0% C.I. |
| Annual reliability (%) | 100% | 100% | 100% | 100% | 99.2% | 100% | 100% |

Overall, the climate change modelling results indicate that Goondiwindi's water supply is unlikely to be impacted to any significant extent by climate change to 2050, but there is a chance that a minor impact may be experienced.

## Future supply management

As previously mentioned, Goondiwindi's urban water demand could significantly increase over a short timeframe; for example, as a result of new workers' camps associated with the construction of the Inland Rail project and the realisation of a potential new abattoir at Goondiwindi. Council needs to plan for such circumstances. Goondiwindi's urban water supply would become reliant on the availability of both surface water and GAB groundwater to meet demands, particularly during dry periods.

Given Goondiwindi's potential reliance on GAB groundwater (which would significantly increase during drought), understanding the sustainable yield from the existing GAB bores is vital for effective supply planning. Therefore, it is recommended that Council complete 100-hour bore pump tests to determine the sustainable yield from each of the GAB bores to facilitate effective planning for the future, and particularly for ensuring the availability of ongoing supply during drought.

## Drought response

As mentioned earlier, the recent drought experience (2019–2021) in the Goondiwindi region saw water supplies nearing critical levels for several communities including Goondiwindi, Texas, and Yelarbon. Every drought is different, and each comes with its own challenges, with different communities being affected to different extents at different times—therefore, appropriate operating arrangements will need to be agreed between the relevant parties at the time.

Clearly identified 'trigger points' should be used to initiate actions by Council such as imposing restrictions, accessing GAB groundwater, and commencing blending of groundwater and surface water. Similarly, trigger points and timeframes should be clearly identified and used to commence conversations between all involved parties (e.g. Council and relevant government agencies in Queensland and NSW), who will need to engage in a cooperative and coordinated response to protect urban supplies after a collective risk assessment of all towns in the basin when entering drought conditions.

This also highlights the need for Council to investigate options and develop an appropriate Drought Response Strategy, with triggers and timeframes identified for more substantial potential actions/works such as (for example):

- management of other (individual small) extractions from the Boggabilla/Goondiwindi Weir pool where a domestic supply is available under the town reticulation system
- management of groundwater from the alluvial aquifer within the town environs where a domestic supply is available under the town reticulation system
- modifying the town water supply pump suction and treatment arrangements to access water below the current minimum operating level of Goondiwindi Weir (potentially providing access to an additional 785 ML, or around 2 months' additional supply under high level restrictions)–for example, at the proposed new water treatment plant location
- undertaking instream works to facilitate the movement of water between isolated water holes upstream of Goondiwindi Weir when water levels are low (e.g. during drought conditions), potentially as part of (or in conjunction with) the proposed new water treatment plant works
- investigating treatment methods for GAB water (e.g. the use of activated carbon and coagulants, or reverse osmosis) for removal of fluorides and blending options during restricted supply operations to effectively manage fluoride concentrations
- securing additional temporary groundwater supplies/entitlement in an emergency
- undertaking further research regarding the impacts of using additional water from the Gubberamunda (GAB), and treatment options
- investigating the viability of a pipeline from Boggabilla Weir to Goondiwindi to reduce losses
- having options in place for carting of water to smaller communities when/if required
- education and communication strategies to ensure communities understand the situation, what Council's options are, and how individuals need to respond
- meeting regularly with stakeholders from NSW and Queensland to maintain discussions regarding the management of the Border Rivers.

An appropriate strategy may involve several options being implemented either simultaneously or in succession. Most options are likely to take time to implement (e.g. a temporary desalination plant may take several months to establish) and require preliminary work to be undertaken in preparation. Therefore, appropriate triggers that will allow sufficient time for practical implementation of the solutions need to be clearly identified and incorporated into a Drought Response Strategy. As far as reasonably possible, Council should be prepared and ready to act for when and if such a response may be required in the future, which in turn will maximise the water security for the community.

# Conclusions and recommendations

Hydrological modelling has indicated that, based on QGSO population projections (0% growth), the combined surface water and groundwater supplies for Goondiwindi, Texas and Yelarbon are likely to be adequate to meet projected water demands to around 2050 with a reliability of supply that is appropriate to the size of the communities.

Modelling also indicated that, based on 1% population growth to the year 2050, average water demands can likely be met for all three communities with a reliability of supply that is appropriate to the size of the communities–especially if system water losses can be reduced. However, under this population growth scenario, the potentially higher 'dry period' demands for Goondiwindi would exceed Council's existing water entitlements by about the year 2032. Although this population growth rate is not currently considered likely to eventuate, this scenario nonetheless highlights the importance of Council continuing to manage demand and monitor population growth impacts.

Notwithstanding the modelling outcomes, the recent drought experience (2019–2021) in the Goondiwindi region demonstrates that there is still potential for a future water supply shortfall to occur; for example, as a result of a future drought worse than has occurred during the historical period (i.e., 130 years of records up to 2020). For such circumstances, there is a need to have an appropriate Drought Response Strategy in place which includes accessing additional supplies, and it is recommended that such a strategy be developed by Council.

Council also needs to plan for future potential increases in water demand such as that associated with the Inland Rail project or an abattoir. Given the relatively full allocation of surface and ground water in the area such planning will need to be developed working largely within existing available water entitlements (blending supplies as necessary to achieve appropriate water quality outcomes) and ensuring that Council has an appropriate drought response as discussed below.

Under normal operating arrangements, the reliability of Goondiwindi's town water supply is generally sustained by (and reliant on) releases which are made from the BRWSS storages (e.g. Glenlyon Dam and Boggabilla Weir) for agricultural purposes (primarily irrigation). However under extreme drought conditions, Goondiwindi supply could become reliant on the storage in Boggabilla and Goondiwindi weirs and the two GAB bores. With effective restrictions in place, and subject to the relevant authorities in Queensland and New South Wales agreeing the appropriate operational arrangements, these supplies could potentially supply Goondiwindi for around 12–13 months. There are a range of other options, including potentially accessing water below the current minimum

operating level of Goondiwindi Weir, which could potentially be implemented to help prolong the duration of supplies in such an emergency—it is essential that investigations and planning are undertaken so that appropriate emergency actions are identified and ready to be implemented by Council for when and if such an emergency situation occurs in the future, including triggers for commencing such actions.

The GAB bores alone could provide ongoing emergency supplies of at least 150 L/p/d for residents of Goondiwindi (plus Texas and Yelarbon if required, based on their current populations), which provides a baseline ‘emergency’ level of security. However, this would be subject to the ability to appropriately treat the bore water, or use of an alternative supply of water for drinking only. This figure of around 150 L/p/d is based on the annual volumetric limits on the relevant entitlements, and therefore a higher level of supply could be provided for periods shorter than a year, or if a temporary increase in entitlement volume is permitted in such an emergency (e.g. under special arrangements). It is considered that 250 L/p/d is a more appropriate minimum target level of supply for urban communities during severe drought periods to meet commercial and residential demands—noting this could mean higher treatment costs.

Given the reliance on the GAB groundwater for Goondiwindi under higher water demands and during drought or prolonged dry periods, it is recommended that Council complete 100-hour bore pump tests to determine the sustainable yield from each of the GAB bores to facilitate effective planning for the future, including for ongoing supply during drought.

Given the reliance placed on the availability of groundwater for Texas during dry conditions, currently supplied from a single groundwater bore, it is recommended that Council consider mitigation measures such as having a stand-by pump on hand to minimise potential impacts to the community from any interruption to their groundwater supplies for Texas (e.g. from pump failure).

Additionally, managing water demands and addressing system water losses (to the extent reasonably practical) may reduce total water demands and provide scope for growth in the communities by way of the additional water entitlement availability. Council have identified the need to review their systems towards achieving this aim as one of several actions in their Drought Resilience Plan. It is recommended that a system of PWCM be implemented for the Goondiwindi region to promote everyday conservation of water and encourage the community to continue to save water for the future.

Climate change projections to 2050 for the Goondiwindi region include higher temperatures and higher evaporation, which are likely to increase water demand, particularly for outdoor use. A minor impact on volumes supplied (mean annual diversions) is also evident from the hydrologic modelling. However, as rainfall is not projected to decline in the region, the assessed impact of climate change to 2050 based on modelling which uses dry weather demands is overall relatively small for the Goondiwindi region.

# Moving forward

This urban water security assessment represents a collaborative approach between the Queensland Government and Goondiwindi Regional Council to establish a shared understanding of the existing water supply security for Goondiwindi, Texas, and Yelarbon, including its capacity to support future growth.

Goondiwindi Regional Council is committed to ensuring that the water security needs of its communities are met now and into the future, not only to maintain the health, well-being and lifestyle of its residents but also to provide an appropriate environment for economic growth.

Council will continue to proactively manage and monitor its community's valuable water resources and investigate options for improving water security over time.

Council plans to investigate and consider a range of short, medium, and longer-term water security options, including:

- leakage reduction investigation and action
- encouraging replacement of inefficient water devices with water-efficient devices
- implementing a system of permanent water conservation measures for their communities
- diversifying recycled water use (and potentially improving its quality to facilitate use for other applications), e.g. municipal watering, road construction, etc. (also, encouraging use of raw bore water instead of town water for such uses)
- implementing improved procedures to reduce water losses through the treatment plant process
- investigate the processes and infrastructure required to reuse supernatant water from sludge settling ponds to reduce water losses through treatment process
- introduce continual blending of groundwater to support efficient use of water allocations and reduce surface water impacts, thereby mitigating future water supply issues and ensuring continued support for the growing communities
- investigating treatment methods (e.g. the use of activated carbon and coagulants for removal of fluorides) and blending options during restricted supply operations for Goondiwindi's water supply to effectively manage fluoride concentrations when the GAB bores are in use
- modifying/extending the Goondiwindi intake pipework to access water below its current minimum operating level (also potentially relocating the intake, as part of the proposed new water treatment location, providing access to additional water)
- optimising the use of Council's existing water entitlements, and planning for future potential increases in water demand (such as from the Inland Rail project or an abattoir)
- ensuring a stand-by pump is readily available for the Texas bore
- developing a Drought Response Strategy that sets out:
  - appropriate triggers for defined drought-response actions (including water restrictions, and drought response strategies undertaken cooperatively with other parties)
  - an established formal process to manage supplies during critical periods (e.g. in response to drought) by engaging with the Border Rivers Commission and the relevant authorities in Queensland and New South Wales
  - implementation of drought response infrastructure (e.g. changes to water treatment processes, or the temporary/permanent use of a portable desalination plant, to remove/reduce fluoride concentrations in water sourced from the GAB (Hutton) bore (e.g. for emergency supply purposes); and/or a pipeline from Boggabilla Weir)
  - other demand management options.

Council acknowledges that it has an important role to play in educating and informing the region's communities regarding water conservation and ensuring that the available water resources are effectively managed. Council will continue to work with its communities to maintain an appropriate level of service and water supply security, which will involve balancing an acceptable level of water availability with the lifestyle and expectations of the community. By continuing to pursue an appropriate level of water supply security for the region, Council is ensuring that the right environment exists for the communities, businesses, industry, and tourism to thrive.