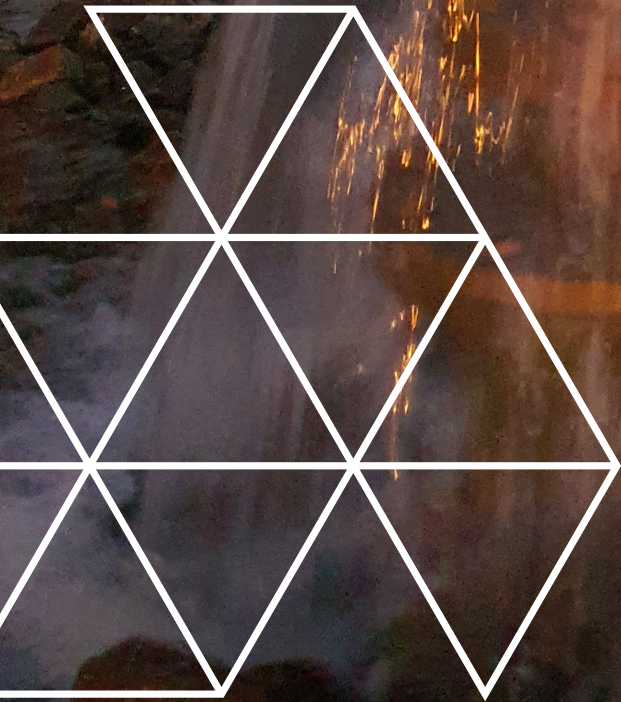


Drilling in the Great Artesian Basin

A practical guide to water bore drilling
in Queensland for bores that intersect
the Great Artesian Basin



Water bores are constructed for a wide variety of reasons. However, this information guide is aimed specifically at bores drilled in the Great Artesian Basin (GAB) and in the State of Queensland. It has been provided to better inform landowners on what is involved in having a bore drilled and will be particularly helpful for those doing it for the first time.

There are numerous things to be aware of and this booklet aims to address the important ones in relation to constructing and commissioning a bore.

Note that the booklet refers to both artesian bores (confined under pressure and flow to the surface) and sub-artesian bores (non-flowing).



Once the purpose of a bore has been determined, there are three main phases of construction to progress through:

- **Permits/licenses required**
- **Location of a suitable site**
- **Drilling, development and pumping tests.**

The use of the bore

The GAB is Australia's largest underground water basin, extending beneath 70% of Queensland. The GAB has been a vital resource in the development of rural Queensland, providing a valuable water source for many users including stock and domestic for almost 150 years. It is therefore vital that this resource continues to be protected over the long term.

The landowner needs to initially determine the amount and quality of water they require and allocate a realistic budget to achieve this. Checking with owners of nearby properties and with the nearest Queensland Department of Regional Development, Manufacturing and Water (DRDMW) office are good starting points.

The Queensland Globe website is a comprehensive database of existing bores that can be viewed by the public. Visit:

<https://qldglobe.information.qld.gov.au>

Poor quality bore construction can result in ground water contamination and loss of aquifer pressure. To prevent new bores contributing to these problems, strict bore construction standards exist and must be followed.

It is the **joint** responsibility of both the landowner and the drilling contractor to be aware of and comply with these standards.

What permits and licences are required?

In many cases, development approval will be required to construct the bore, and this can be determined by checking the GABORA Water Plan at www.business.qld.gov.au in the section on Water Plan Areas. Also, a licence or permit will be required for the taking of water which will be from one aquifer system only. To see a list of permits, go the Environment, Land and Water section on the Queensland Government's website at:

www.qld.gov.au/environment/water/permits

The minimum standards for the construction and reconditioning of water bores that intersect the sediments of artesian basins in Queensland - This document is a written guideline published by DRDMW and takes precedent over any other guidelines. *The minimum construction requirements for water bores in Australia* is a separate document for national use and is

referred to only for things that are not included in the DRDMW Queensland specific document. Both have important obligations that a reputable and licensed driller will be both familiar with and will be able to comply with.

There are different licence classes that drillers hold.

Class 1 – restricted to drilling operations in non-flowing (sub-artesian) single aquifer systems.

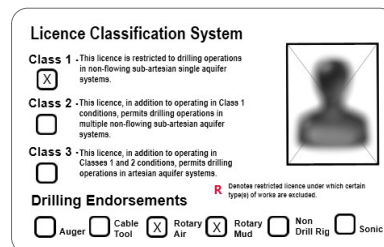
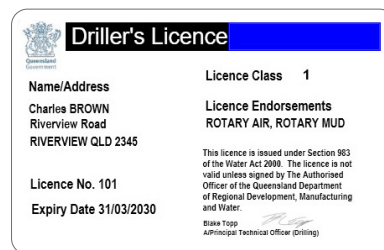
Class 2 – in addition to Class 1 conditions, permits operations in non-flowing (sub-artesian) multiple aquifer systems.

Class 3 – in addition to operating in Class 1 and 2 conditions, permits drilling in flowing (artesian) aquifer systems.

As it is the landowner's responsibility for ensuring that the driller who will construct the bore has the correct licence, the drilling company should be asked to confirm this in writing at the quotation stage. Then when work does get underway, there must be a correctly licensed driller at the job site for the duration of the bore construction.

Your best guarantee for getting the bore completed to the required standard is to use a licensed driller who has references from other satisfied clients. A list of licensed drillers can be obtained from DRDMW or from ADIA.

The bore construction permit may also contain additional specific requirements which must be followed. The use of an unlicensed driller, and drilling without the appropriate bore permit, can lead to irreparable damage to aquifers and the environment, and prosecution may ensue. It can also result in costly repair work being required to fix the works that were undertaken.



Location and siting the bore

It is the landowner's responsibility to site the bore and to ensure there is suitable access for the drill rig and its equipment. Bore location needs to consider the

(images courtesy of AgForce)

BORE CONSTRUCTION

proximity of other bores or nearby buildings, roads, overhead or underground services (Dial before you dig) and septic systems. There are also distance requirements to comply with when drilling replacement bores and whether or not a Development Permit is necessary. Therefore, local government should be contacted before drilling commences to determine what applies.

You should also advise the driller of the nearest source of water, any charges for it, or difficulty getting to it. Water is often used in part of the drilling process. If you are not comfortable with dealing with these requirements on your own, consider using a bore consultant to act on your behalf.

It is important to remember that no driller can guarantee the quality or quantity of water, and a good bore 500 meters away does not mean you will automatically be able to access the same at your identified location. The driller may therefore recommend the engagement of a suitable hydrogeologist who can provide a professional assessment at the outset.

Request a written contract

When the decision has been made to proceed with the bore, all proposed work needs to be in the form of a written contract. Ensure that the contract clearly specifies what is included for labour and materials and what will be charged for separately if the drilling plan needs to change once things get underway. It is not unusual for a driller to have to drill deeper than originally expected before water is found. Unless accounted for in the written contract, this will likely have an impact on the completion price.

Sometimes drilling results in a 'dry' bore and this should not automatically be considered a fault of the driller. It is therefore recommended that the contract recognises this on mutually agreed terms.

Drilling, development and pumping tests

The landowner is not responsible for recommending the type of drilling equipment to drill and construct the bore. Leave this to the experience of the driller. It is also good practice for the drill rig to have some additional capacity, so that if the bore needs to go deeper than originally planned, it can do so.

The driller may recommend the drilling of a pilot hole – a small diameter test hole from which they can interpret the results – before reaming the hole to a larger diameter and deciding on the final design/construction of the bore.

It is recommended that the landowner or an appointee regularly meet with the driller during the construction period to ensure that progress is going as planned and to mutually agree on any changes that the driller feels are necessary.

Construction materials

Materials to be used in the bore construction must all be onsite prior to commencing the drilling of the bore and some contingency planning should be done to cover off on any unexpected requirements. An experienced driller will know what back-up may be needed, especially if they have a history of drilling other bores in the same area.

Casing

All new artesian bores must be constructed with at least two strings of casing, with the larger diameter being the surface control casing and the smaller diameter being the production casing. The production casing must be of a minimal internal diameter of 125mm unless it is a monitoring bore. All sub-artesian bores must be constructed with at least one string of casing and be fully cased over the depth of the bore.

Due care must be given to the correct selection of the casing material. Some locations in Queensland are in a water bore corrosion area and these can be identified on the Department's website. Typical casing materials could be:

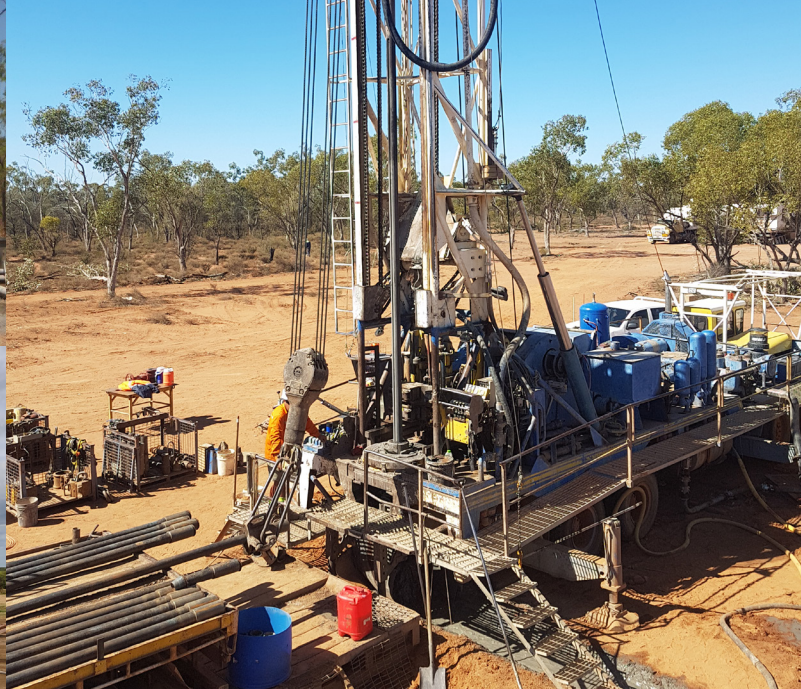
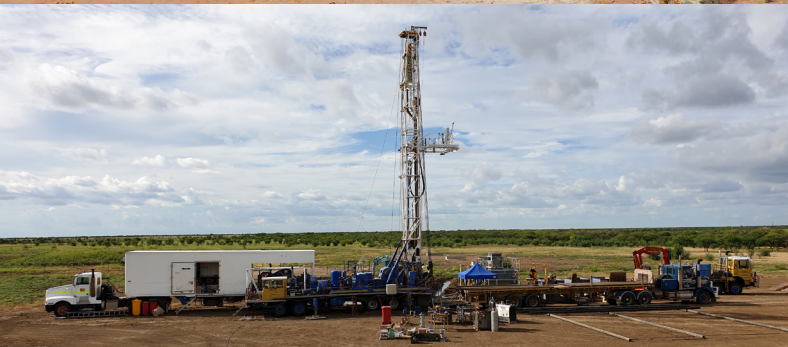
- **Mild steel** - not suitable for use in corrosive areas
- **PVC-U** - with a minimum required grade of PN9 for shallow bores only, otherwise PN12 is recommended for most construction applications. PVC can be easily damaged during bore construction and therefore is not recommended for deep bores
- **Fibreglass** - which is available in two classes, FRE (epoxy) and FRP (plastic). Both have much higher impact resistance than PVC and are therefore suitable for deeper bores. FRE has higher impact strength again than FRP and therefore may be more suitable in certain applications
- **Stainless steel** – suitable for use in corrosive areas.

Bore efficiency and water entry

Water entry into the bore is normally achieved by using casing which is slotted or perforated, or through a screen.

Slotted or perforated casing can be used in more stable formations as it allows water to enter the bore, whilst the hole is supported by the outside of the casing. The driller will need to determine the slot or perforation size to use, to allow the optimum bore yield. The driller may also decide to place a gravel pack around the casing to improve the stability of the formation.

When the water production zone is likely to be in loose and unconsolidated material such as sand and gravel, a screen should be the preferred choice. Screens offer



more open area than slotted or perforated casing and as they are normally manufactured from stainless steel, they provide for long service life. Screens are available in a multitude of aperture sizes to suit the formation into which they will be placed.

Careful selection of construction materials will generally reduce development time of the bore and will help minimize future maintenance costs.

Bore Sealing

All aquifers and permeable zones, other than the intended production zone, must be grouted to protect the groundwater resource from contamination, maintain aquifer pressures and groundwater quality, and isolate the targeted production zone from other formations.

There are stringent cement grouting requirements that a driller must follow and these are detailed in the *Minimum standards for the construction and reconditioning of water bores that intersect the sediments of artesian basins in Queensland*, the *Minimum Construction Requirements for Water Bores in Australia 4th Ed* and listed separately on the development permit.

An important mandatory requirement is that all sealing including any top up cementing, must occur before the drill rig leaves the site.

Bore Yield Testing

When construction has been completed, the driller will need to test the bore to provide you with an indicative yield. The result of the water quantity and quality will assist in the right pump selection and involves removing a known amount of water over a known period. On a flowing bore this will be done using a method to measure the volume of water coming from the head of the bore over a given time period.

On a non-flowing bore, the driller will conduct a yield test using the equipment available onsite. This can be completed using the 'air lift' or 'bail test' methods. For a more accurate assessment, landowners would need to invest in a comprehensive pumping test which requires specialist equipment to be brought to site. This will measure flow, water quality, water level drawdown and recovery over time and will assist in optimum pump selection.

Disinfecting

The landowner has an obligation under Queensland's *Biosecurity Act 2014* for the completed bore to be free of any introduced contaminants and dependent on how the bore is flowing, may require a disinfectant to be used. The driller will advise on this and use an industry approved sterilising agent if appropriate. Checks should also be made to the relevant local authority regarding the use of chemicals before commencing treatment.

Reports

Upon completion, the drilling contractor must provide the landowner with a detailed report which indicates:

- accurate location of the bore site
- start and finish dates
- the geological strata penetrated – in regular increments
- details of the aquifer, yield and water quality
- a complete casing and screen location record, showing length, diameters, and apertures for each section, plus details of any plugs or seals inserted in the bore; and
- pumping test data – if required as part of the contract.

The driller is also required to submit a bore completion report to the Department within a timeframe of 60 business days from the time of work commencement.



Headworks

Before leaving site, the driller needs to complete permanent headworks that can control the flow of water. For artesian bores, all materials used must be steel, with a stainless grade required for areas subject to corrosion. Gate valves are the only valve type permitted on artesian bores.

If the bore is in an area of potential flooding, the casing should be raised above flood level, or if this is not feasible, completely sealed to prevent the entry of floodwater.

Guarantees

You are entitled to be provided with a bore that has been constructed to comply with the minimum standards, and any aquifers located have been evaluated and developed accordingly. Despite the best endeavours of the drilling contractor, a bore may not produce the quality or quantity of water you require. Therefore, it may be necessary to enlarge the existing bore, provided it has not already been cased, or drill another one close by.

No water, or poor yield, is not enough reason to withhold payment, unless the contract between both parties has such a clause incorporated.

If you have any complaints about the workmanship or finished performance of your bore, discuss it with the driller first. If a resolution is not forthcoming, it is recommended that you contact your nearest DRDMW office or ADIA to see how they may be able to assist.

References and acknowledgements

Minimum standards for the construction and reconditioning of water bores that intersect the sediments of artesian basins in Queensland QLD
Department of Regional Development, Manufacturing and Water

Minimum Construction Requirements for Water Bores in Australia fourth edition 2020 – National Uniform Drillers Licensing Committee

ADIA would like to thank the following organisations for contributing to this guide:

- Queensland Department of Regional Development, Manufacturing and Water (DRDMW)
- AgForce Queensland
- Queensland Great Artesian Basin Advisory Council (QGABAC)

Need more information?

Copies of the construction guides referenced in this brochure are available from the waterwell resources section on ADIA's website or by contacting us direct:

T 08 6305 0466

adia.com.au/waterwell/water-bore-construction

Contact DRDMW for all matters relating to permits, licenses, and specific requirements.
www.business.qld.gov.au/industries/mining-energy-water/water/bores-and-groundwater

Driller license checks can be confirmed at
drillers.licensing@rdmw.qld.gov.au

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20 Point Checklist

Before commencing drilling

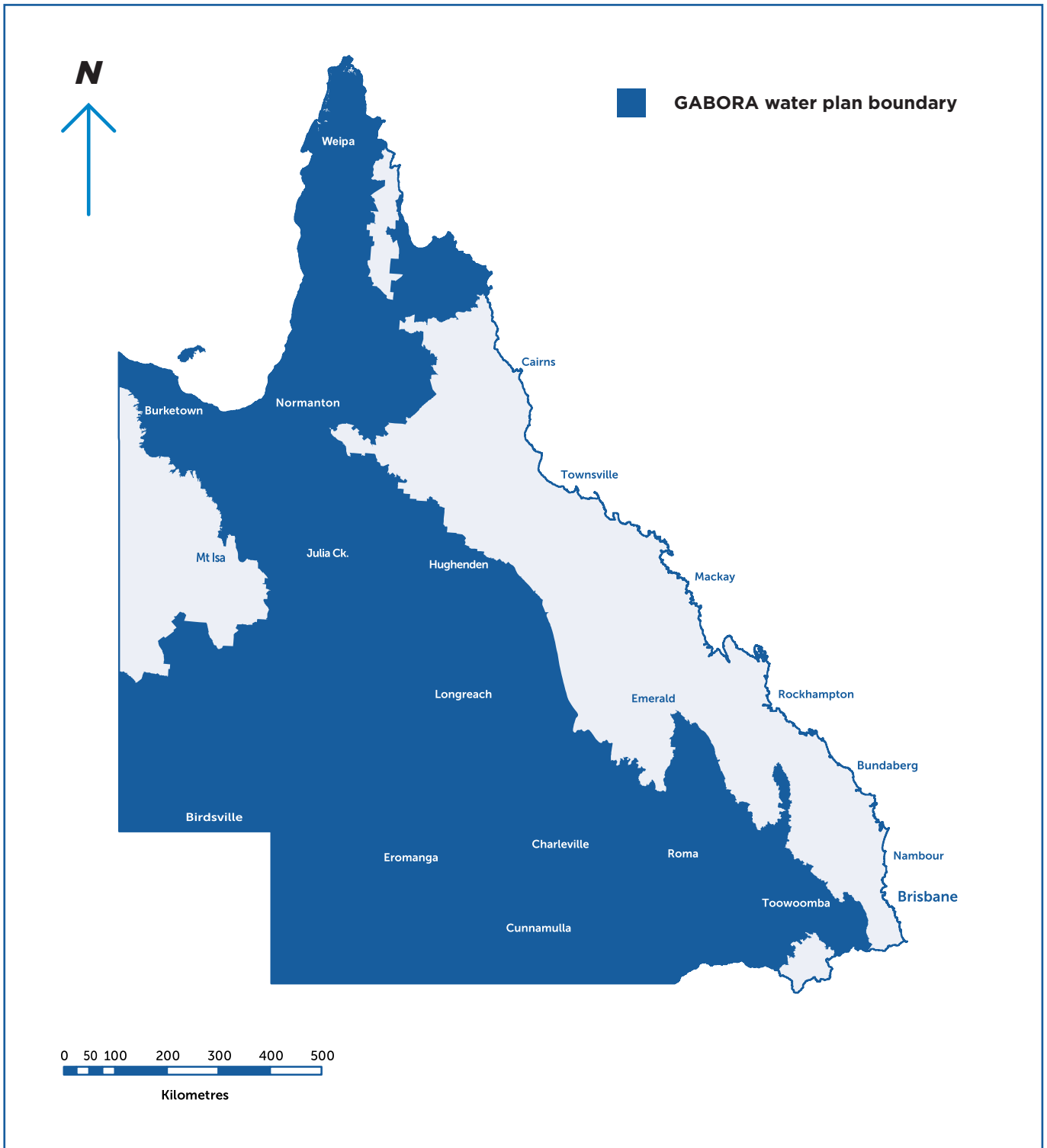
- 1 Have you determined the volume and quality of water required?
- 2 Has there been preliminary discussions with a few drillers to gain an indication of the work scope and budget price?
- 3 Has sufficient budget been set aside plus a contingency allowance?
- 4 Has the Department of Regional Development, Manufacturing and Water (DRDMW) been contacted for any necessary development approval, licenses and permits?
- 5 Does the preferred driller have experience drilling in your region and are they licensed?
- 6 Are there any specific items on the bore permit that need to be followed?
- 7 Has a site inspection of the proposed bore location been completed to ensure it is clear of obstacles and services both above and below ground?
- 8 Has the driller been advised of the proximity of water to be used during drilling operations?
- 9 Is there a written and signed contract agreeing to the terms and conditions of the proposed work?

Drilling operations

- 10 Has a licence check been done on the driller who will be onsite for the job and is their licence the correct class for the work to be done?
- 11 Has the driller confirmed the rig has some additional capacity if it is needed to go beyond the expected target depth?
- 12 Is there an agreed meeting schedule in place to enable regular dialogue with the driller?
- 13 Are all construction materials onsite prior to starting work?
- 14 Has a check been made of the selected casing material to ensure that it is fit for purpose and suitable for use in the area?

Development and completion

- 15 Has a comprehensive pumping test been scheduled if required?
- 16 Has the product being used to disinfect the bore been approved for local use?
- 17 Has the driller provided you with a written bore report?
- 18 Have all cementing operations been completed before the drill rig leaves site?
- 19 Is the headworks all steel construction and only gate valves used for controlling water flow?
- 20 If required and feasible, has the casing been raised above flood level?



DISCLAIMER NOTICE

The information contained in this Guide is designed to provide a general overview of bore construction, development and testing, as well as guidelines for anyone considering a bore on their property.

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