BUSH TECH #21

Water bores

More than 80% of Indigenous communities rely on groundwater for their water supply. The quality and quantity of groundwater resources vary in different parts of the country. Bores are deep drilled holes that let you pump water up from the aquifer (water bearing rock). This BUSH TECH is about how to look after a bore. Some of this information is shown in the wall poster 'How to look after your bore'; if you would like a copy, telephone 08 8951 4311.

Drilling a water bore

A bore must be drilled by a licensed driller. A bore consists of pipes (casing) extending into the ground. The casing prevents rocks and earth collapsing into the bore and contamination by surface runoff.

Three types of casing material are normally used:

Steel casing has advantages in that it requires a smaller diameter hole, produces a straighter bore and is stronger both in tension and compression. It can be cemented around the annulus (the gap between the earth and the casing) more easily because of its weight and rigidity

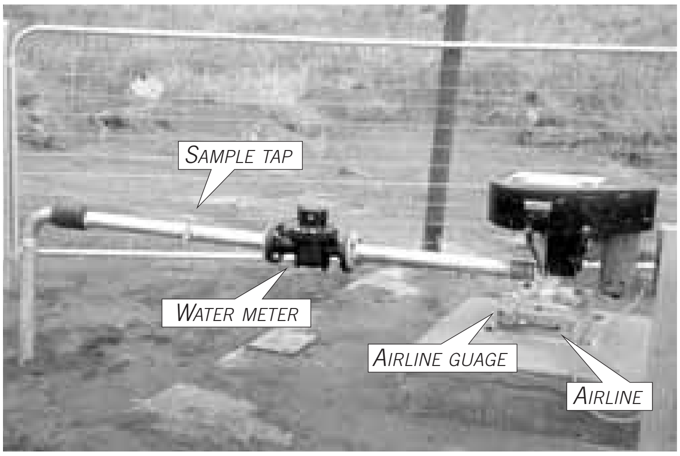
Poly Vinyl Chloride (PVC) is used extensively for shallow low yielding bores and can be used where the water may be corrosive to steel. When exposed to direct sunlight for long periods, PVC will become brittle. Exposed surface casing should be protected

Acrylonitrile Butadiene Styrene (ABS) casing is light, easy to handle and, like PVC, can be used where the water is corrosive to steel (such as water with a low pH). It is tougher and less brittle than PVC.

The top of the bore must be constructed so that the water is protected from contamination. The bore should be sealed to keep out lizards, dust and dirt. A pad (at least one metre square) which is raised above the natural surface around the bore casing should prevent surface water entering the bore.

When a bore is first drilled, a pumping test should be conducted to find how much water it can produce and the kind of pump needed. This test must be carried out by a specialist crew. The pumping test measures the water pumped from the bore (discharge) and the changing water levels in the bore. Commonly, several short tests are conducted at different rates and a 24-hour test at a constant rate. These measure the hydraulic properties of the bore, and the rate at which the water level falls gives an indication of whether the aquifer will continue to produce water in the long term.

Many bores and pumps fail because they are not maintained properly or noone notices that they are gradually deteriorating. Installation of an airline with the pump allows for measurement of water levels and diagnosis of problems. If a water meter is fitted to the discharge line it is possible to carry out a 'specific capacity' test and monitor bore performance. *(see over page)*



Looking after your water bore

Following these tips will help you to keep your bore working well for as long as possible. Many bores and pumps fail because they are not maintained properly. Others deteriorate slowly, and changes aren't noticed until there is a crisis.

1. Record the 'standing water level' (which is the water level when the pump has been shut off overnight) once a month. The standing water level may fall in droughts, or because the aquifer is small relative to the amount of water pumped from it. Record the water meter reading at the same time.
2. Conduct a specific capacity test at least once a year. By comparing the measurements year to year, you can calculate if the bore is deteriorating.
3. Sample the water at least once a year, after the pump has been running for 20 to 30 minutes, and have the water quality tested.
4. Maintain the pump according to the manufacturer's specifications. Keep it regularly serviced. Avoid having electrical components in connection with the casing as this can cause corrosion.
5. Check the water for suspended solids by collecting a water sample in a bucket or drum and allow any material to settle.
6. Do not over-pump the bore by altering the pump setting, even for short periods.
7. Keep detailed records of your bore, its construction and its performance, the pump and column installed in it and any maintenance done on it or the pump. It is particularly important to have a record of any pumps and column that may have been lost in the bore.
8. Ensure the headworks and surrounds are sealed and well drained to prevent contaminants from entering the gap between pump column and casing.

BOX 1

Choosing a pump for a water bore

Choosing an appropriate pump for a community or outstation is very important because selecting the wrong pump may lead to high pumping costs and poor pump performance. A pumping test is the only way to obtain proper information to select a suitable pump. The choice of a pump will depend on the availability of power, bore diameter, pumping rate and the total head (that is pumping water level plus height of the tank above the bore plus friction losses). There are a variety of pumps available each having features which make them suitable for certain applications.

Piston Pumps use a piston to push the water upward. Piston pumps are commonly used with windmills and generally have small discharges.

Submersible pumps comprise an electric motor and impeller unit that operates under water in the bore, eliminating the long-drive shafts and bearing assemblies needed by conventional turbine pumps.

Centrifugal pumps draw water through the centre of a set of impeller blades rotating in a case. These pumps can only be used when water is within five metres of the surface.

Jet (venturi) pumps use a centrifugal pump as above. Part of the discharge is injected at high velocity down an additional pipe in the bore to the jet. Water is forced up the other tube from a greater depth than would be possible with a centrifugal pump alone.

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Water bores (continued)

Specific capacity test

If a specific capacity test is carried out once a year it is possible to monitor the bore's performance; to check if the bore is deteriorating. The test consists of measuring the 'drawdown' (the drop in water level from before pumping starts) at a given discharge rate and times (say at one minute intervals for ten minutes, and five minute intervals for the next 30 minutes) after the pump was turned on.

If there is a water meter in the discharge line, flow rate can be found by reading the meter at known times, and dividing the volume pumped by the time. If there is no meter discharge, the flow rate can be measured by timing how long it takes to fill a container of known volume. WARNING: If the discharge line is disconnected to do this, the pumping head and the discharge rate will change. It is essential that the discharge rate is kept constant during the specific capacity test.

The specific capacity should be established early in the life of the bore. Blocked screens or perforations will decrease specific capacity. The pump-test prior to installing the production pump will be a reference against which future tests can be compared. (See Box 2, below, for short specific capacity tests to be carried out by the owner.)

BOX 2

Specific capacity test

Example calculation

Pressure on gauge, before pump starts, 23 psi
Pump intake is 46.72 m below ground level
Airline end is 0.83 m above the pump intake
Standing water level is:
46.72 – 0.83 – 23 X 0.70 m below ground level
=29.8 m

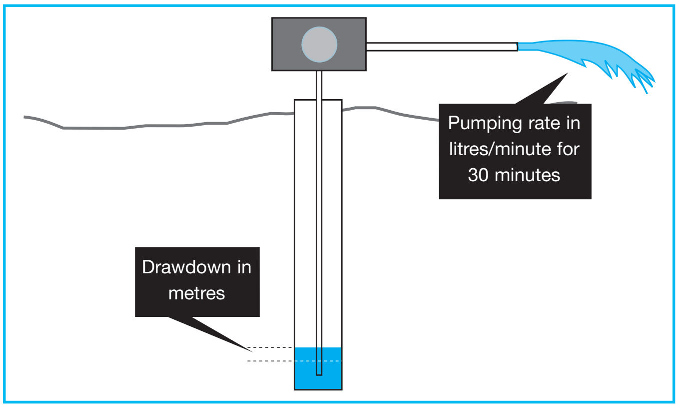
Pressure on gauge, after 30 minute pumping, 12 psi
Drawdown, or fall in water level is:
23psi – 12psi = 11 psi
= 11 X 0.70 (conversion factor)
= 7.7 m approx

Water meter reading before test 1 131 576 Litres
Water meter reading at 30 minutes 1 136 942 Litres
Volume pumped is:
(Water meter reading at 30 minutes minus the original reading)
1131 576 – 1136 942 = 5 376 L
Pump rate is: 5376/(30 X 60) = 2.99 L/s
Volume pumped divided by the time pumped (in minutes) times 60 (to convert to seconds)

$$\frac{5376}{(30 \times 60)} = 2.99 \text{/Litres per second.}$$

Specific capacity is 7.7 / 2.99 = 2.6 L/s/m

NOTE that specific capacity may be lower at higher pumping rates



Measuring specific capacity

Measuring water levels with an airline

When a new bore is equipped, insist that the pump contractor installs an airline. An airline is a small diameter pipe (usually 6.5mm plastic pipe) that is taped onto the pump column with the bottom at a measured distance (usually one metre) above the pump intake. The depth of the bottom of the pipe must be recorded.

To use this, connect a pressure gauge and air pump to the upper end and pump air into the airline until air bubbles out of the bottom, and the pressure stops increasing. The air pressure required to empty a line extending into the water equals the pressure exerted by the water column on the outside air. When fully displaced the airline pressure corresponds to the depth of water.

Some airline gauges are marked in metres so the depth can be read directly. Otherwise an ordinary pressure gauge can be used and the reading converted:

1 psi = 0.7 m head of water

1 kPa = 0.1 m head of water

Ensure that the airline is re-installed if the pump is pulled for maintenance.

Decommissioning a water bore

Bores may outlive their usefulness, or be beyond repair. A failed or poorly maintained bore is a risk to public health and to the long-term quality of the groundwater resource. Decommissioning (closing up the bore properly) ensures that the groundwater quality is maintained. This can only be done by a licensed driller.

Further information

Advice about groundwater and water bores can be found in your State or Territory Government water agency. They can also help with contact information about licensed drillers operating in your area.

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