# Keep that garden alive!!

*A DIY guide to installing a bladder tank under your house or deck*

BY GEOFF THOMPSON

In March 2007, Brisbane City Council limited daily water consumption to 140 litres per person and banned the hosing of gardens. Our long-established cottage garden slowly withered and died in the summer heat due to lack of water, and we contemplated its future under climate change.

We live in a small gable ended cottage on a tight block. The house is surrounded by narrow brick pathways, garden beds, trees and timber archways and has low windowsills with verandahs at front and rear. Nowhere on the block could we find to install a conventional rainwater tank of any significant size.

External round tank sizes vary but are typically 2.1m high x 1.4m diameter for 3000 litres and 2.1 x 2.2m for 7000 litres. More expensive slimline tanks range from 2.1m high x 2.5m long x 0.8m wide (3000 litres) to 2.0 x 2.5 x 1.2m (5000 litres).

In addition, Council's regulations restrict both distance to property boundaries and tank height, effectively ruling out any idea of a conventional tank.

We followed up on advertisements for the installation of under-house bladder tanks and called for quotes. Such was the demand, and so few the installers, that not only were prices greatly inflated but construction could not be started for at least three months. By then we would have been well into the normal 'dry' season, and our garden likely deceased.

We decided to buy bladders direct from the suppliers and install them ourselves. Their great advantage is that they can be easily carried and manoeuvred in the tightest situations before assembling the cradles and unfolding them.

Tanks that are not connected into the house plumbing system may be installed without a plumbing licence – and at the time of our installation, could still qualify for government and/or local authority rebates. Should we ever consider connecting our toilet and washing machine to the tanks, it will be a simple, cheap and quick job for a plumber to do.

This is how we set about planning and installing our bladder tanks and how we maximized the collection of rainwater from the roof.

## Preparing the plan

This was probably the most important part of the whole operation.

We measured up the external dimensions of the house and roof overhangs then plotted a plan at a scale of 1cm = 1 metre (1 in 100). This showed that we had a total roof area of 150 square metres with six down-pipes discharging to ground or to a single soakage pit.

Since our house is on low concrete stumps, we plotted the position of the stumps together with the location of sewerage traps, airconditioning plant and other services to which we would need to make allowance for access for maintenance. We took particular note of the distance between stumps, which would govern the width of the bladders we could install.

Bladders vary greatly in length and width but generally have a maximum height of 500 to 600mm. Manufacturers recommend that there is at least 200mm clearance below structural members, plumbing fixtures etc. With our house, clearance between bearers and ground varied from 200mm to 1100mm.

**Figure 1** shows the results of our measurements and the location we chose to install two linked tanks.

## What size tank storage?

We determined our likely weekly garden usage in litres/minute by observing the time taken to fill a 20-litre bucket using a 'normal' hand hose watering nozzle. We recorded the average time spent each week watering our plants during a dry spell and used a low cost moisture meter to determine which plants needed water more often. We arrived at an average minimum figure of 1200 litres per week to ensure the garden's survival in drought over the hot summer months.

The Bureau of Meteorology website *(www.bom.gov.au)* gave us an indication of the median monthly rainfall records for our area. We also took into account the climate change predictions of much longer periods between rain periods, especially outside the tropics.

We adopted a 'worst case' scenario of eight weeks without rain and aimed for 10,000 litres storage capacity as a minimum.

## Choosing the tanks

We used the internet to do our initial investigations, and were confronted with a range of bladder tanks to consider including:

*www.newwater.com.au,*
*www.aussiebladda.com.au,*
*www.ecosac.com.au,*
*www.budgettanks.com.au,*
*www.onewater.com.au,*
*www.wetearth.com.au* and
*www.nylexwater.com.au.*

Issues we considered were: height at full level, width and length, cradle and sling provision, UV resistance, potability of the stored water, overflow arrangements, delivery time, size of bladder inlet/outlet, warranty period.

The distance between our house stumps is slightly less than 1.8m, and so we chose two 1.7 x 5.0m bladders of 5100 litre capacity, each mounted in easily assembled cradles with geofabric slings for stability.

We had the space on our plan to increase the total length of the tanks to 7.0m (7100 litre), but clearance below floor level (see **Figure 2**) would have made hand excavation of the additional area by pick and shovel even more onerous than it turned out to be.

It is important to allow at least 50mm clearance between the bladders and any structural elements at full tank capacity, to avoid the risk of putting pressure on walls or stumps, or of chafing a hole in the bladder as its level rises and falls. For this reason we chose the cradle mounted bladders to ensure there was no lateral movement during filling.

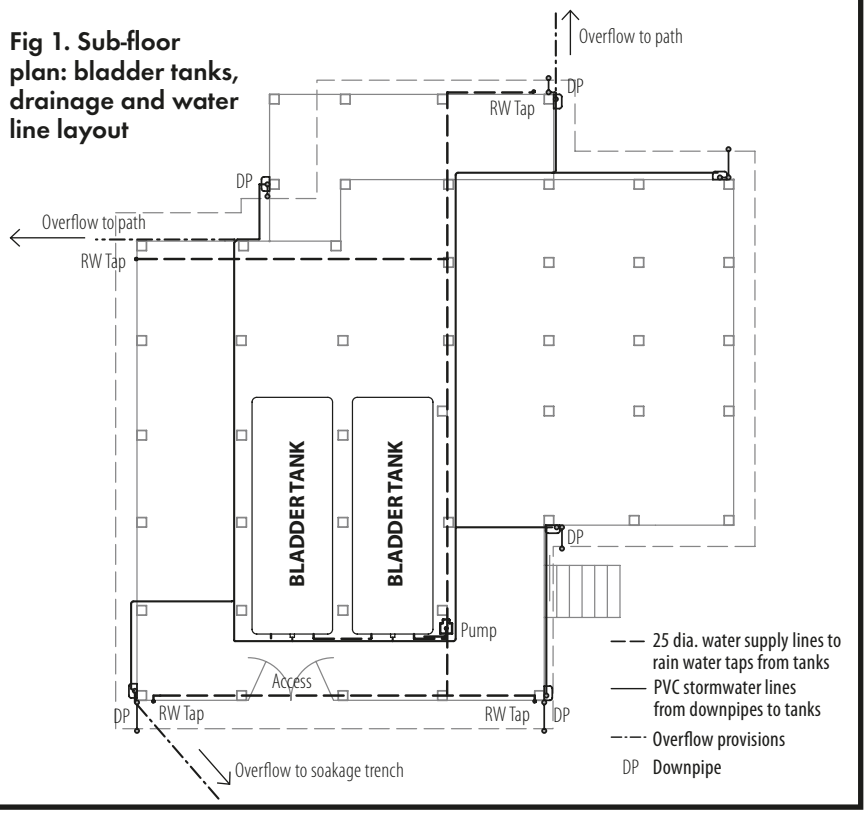
## Collecting roof run-off

A real advantage of bladder tanks is that, in many cases, they can combine collection of rainwater from all of the house downpipes – instead of just one or two, as is often the case with external tanks. Thus run-off is maximized and less rainfall is required to replenish the storage.

**Table 1** shows that our tanks would initially fill with about 80mm of rain by interconnecting the six roof down-pipes below the house. These figures have been conservatively derived on the basis that 20% of the first 5mm to 10mm of rainfall will be lost in evaporation and initial gutter 'storage,' reducing to a 10% loss when rainfall rises to 25mm or more.

Having made an informed guess at 'worst case' future rainfall patterns, we

**Fig 1. Sub-floor plan: bladder tanks, drainage and water line layout**



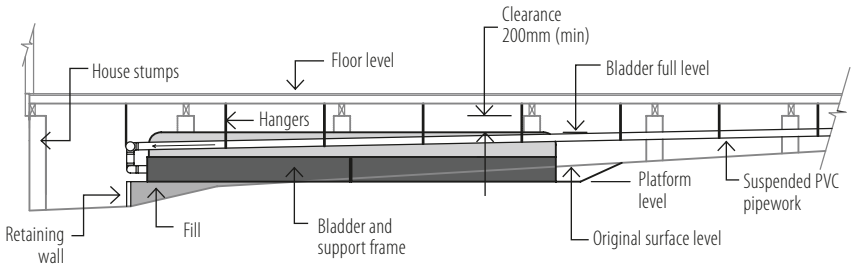




**Fig 2. Section through house**

**Table 1. Rainfall runoff volumes from various roof areas (litres)**

| Rainfall (mm) | Roof area in square metres | | | | |
|---|---|---|---|---|---|
| | 100 | 150 | 200 | 250 | 300 |
| 5* | 400 | 600 | 800 | 1000 | 1200 |
| 10 | 825 | 1240 | 1650 | 2060 | 2475 |
| 25 | 2250 | 3375 | 4500 | 5625 | 6750 |
| 50 | 4500 | 6750 | 9000 | 11250 | 13500 |
| 75 | 6750 | 10125 | 13500 | 16875 | 20250 |
| 100 | 9000 | 13500 | 18000 | 22500 | 27000 |

* Assumes 80% run-off, increases to 90% at 25mm+

believed that our 10,000 litre capacity would meet our minimum demands for the garden in most years. After one year we haven't been disappointed.

Our outline plan (**Figure 1**) was marked up to show how the downpipes could be combined to feed into the tanks. We also needed to consider making allowance for adequate overflow at the 'tank full' condition, as tales of bulging verandah decks after heavy rain may be apocryphal, but we didn't want it happening to us!

The initial system overflow is to a 1.5 x 1.5m soakage pit, which originally served just one downpipe. Two additional overflows to ground have been provided, and are set to operate when the main overflow is running at a quarter and then half full, to eliminate the risk of over-pressurising the bladder.

## Constructing the platform

A level platform, approximately 6.5 x 4.5m in area, was built by part excavation and part filling with crusher dust. Crusher dust was chosen because the restriction on height precluded the use of any excavation or compaction equipment. A daily soaking of the dust with water followed by light tamping, over a week, took up any settlement and produced a hard concrete-like finished surface. The platform was easily checked for level during construction by using a length of 50mm PVC pipe or timber as a gauge – cut to the fixed distance required between floor level and finished platform level. Of course, that is assuming that your floor is level to begin with – and if not, that is another matter all together.

A very real advantage of bladders over large solid tanks is that they do not require a concrete base. Any minor settlement that occurs over time in the ground below the tanks is taken up by each bladder. It is strongly recommended that the bladders be laid on a minimum 50mm of sand or crusher dust bedding to prevent puncturing by any sharp objects in the soil underneath.

To keep the fill in place, a timber retaining wall up to 300mm high was constructed using 200 x 50mm treated pine sleepers, held in position by 600mm long star pickets driven into the ground at 600mm intervals, level with the wall top.

The platform construction was by far the hardest part of the job, due to the cramped conditions and steep ground slope (about 1 in 14, or 7%). This may well not be an issue on level sites with plenty of clearance.

**The approximate breakdown of our 10,200-litre tank installation (in mid 2007), excluding labour, was:**

| | |
|---|---|
| 1 Bladder platform earthworks including retaining wall materials and crusher dust fill | $300 |
| 2 Bladder purchase incl. freight. (2 x 5100 litres) | $4800 |
| 3 PVC pipes, fittings, brackets, adhesives, rainheads, first flush devices etc | $700 |
| 4 Water supply pipe, fittings, brackets, taps etc | $350 |
| 5 Pump and electrical installation | $500 |
| **TOTAL** (Materials only) | **$6650** |

## Installing the bladders

The two bladders were supplied with easily assembled cradles made from 25 x 25mm galvanized RHS sections, predrilled for easy assembly with standard 15mm hex-headed screws. Before connecting up the sections, the thick geofabric cloth cradle was fed on and spread evenly. To ensure the load on the corner and middle feet of the frame was distributed evenly on the platform, 100 x 100mm squares of 16mm thick timber were placed under each leg. Alternatively, pavers could be used.

Each of the bladders was rolled out into its cradle and the 100mm inlet pipes positioned through the end mounting plates in accordance with the installation instructions.

## Now for the plumbing

### Downpipes

Each of the six downpipes was fitted with a first flush diverter and a rainhead before extending the outlet to the collection lines.

Diverters bleed off the first flow from the roof and gutter, which may contain some fine sediment and pollutants such as bird droppings and fine leaf compost. However, a 2.4m long first flush diverter will only retain the first 15 litres of runoff – a relatively insignificant proportion of the total inflow after any significant rainfall. In hindsight, I believe the first flush diverter is not a 'must have' in a rainwater storage system. They in no way guarantee pollutant free water and the money saved in omitting them would, in my opinion, be better spent towards a high quality gutter protection mesh system, or even a filter.

Rainheads come in various shapes, sizes and costs. Some are specifically designed to be mounted immediately on or just below the gutter and fascia and to be 'self cleansing.' These dearer models are usually used when the external tank inlet is high above ground and there is not much fall available from the gutter spout. We chose to install much higher capacity (and also much cheaper) leaf and debris catchers on each downpipe, just above bladder 'full' level. They are therefore at a level where they can be easily inspected and maintained without having to use a ladder.

High-level rainheads can cause additional surcharge to full bladders during intense rainfall as water banks up in the system. Bladders act as a 'spring' during heavy rainfall, as the overflow to waste lags significantly behind inflow, and are consequently subjected to swelling under the increased water pressure. The higher the rainhead is placed, the greater the pressure and risk of leaks or even bursting.

Check out *www.rainharvesting.com.au* for details of rainheads and first flush diverters.

### Pipework

Since most bladder installations are fed by a 'wet' water-filled pipe system for at least part of its length, it is important that all joints be properly primed and glued if they are not to leak under pressure. Don't skimp on the solvent cement applied to both surfaces. Before priming and gluing it is a good idea to assemble the joint and mark the correct configuration with a permanent marker. There's nothing more annoying than to find the joint quickly and irrevocably

glued in the wrong position!

Our suspended pipework was attached to bearers or joists by hangers at 1.2m (max) centres, or to walls by DN90 (90mm nominal size) saddle clips. We used 25 x 0.6mm perforated builders strapping for hangers, cut into lengths and attached around the PVC pipe with two 42 x 3mm rivets through the smaller strap perforations.

After using tacks to temporarily suspend pipework at an even grade (1 in 200, or 0.5%, is the minimum I would recommend), the strapping was then fastened to the joists or bearers by two 10 x 12mm self tapping screws through the larger strapping perforations.

If your pipework is installed where it is readily visible then you may choose to use purpose made clamps and straps to improve appearance, but this is a matter of personal preference and your budget.

A couple of 22.5° bends were used to form a weir in each of the three overflows, at and slightly above, 'tank full' level. The main overflow is to an existing soakage trench at the rear of the house.

Two additional overflows at the front of the house were set about 20mm and 45mm higher to discharge to pathways in very heavy rainfall conditions as a precaution. These were fitted with flap valves and stainless screens to prevent insects or small animals getting into the system.

## Rainwater pressure lines

The two tanks were interlinked and connected to the pump by 32mm high pressure PN12.5 (nominal working pressure of 1.25 MPa at 20°) poly pipe.

Four new taps were located at each corner of the house for ease of use, and connected to the pump using 25mm poly pipe attached to joists and bearers by poly saddle clips with self tapping screws. Don't be tempted to use 20mm diameter pipe – it has approximately three times the pressure loss of 25mm pipe.

Plumbing in poly pipe is a breeze. Compression tees, bends, tap T-heads and adaptors are easily installed – but make sure you trim any burrs from the ends of cut poly pipe with a Stanley knife or a tool made for the purpose.

## Selecting a pump

Take advice in selecting a pump. Cheap pumps are a dime a dozen but may disappoint when it comes to flow, pressure and lifespan.

We checked the flow at one of our garden taps using a 20 litre bucket and stopwatch to get a 'feel' on what delivery we would like in our new system. The better rainwater pump models will provide 15 to 17 litres per minute at the end of a standard 12mm garden hose with a spray head.

Water pressure from the pump may also be important to you if it is installed at the low end of a steep block or you are using the pump for domestic supply. Pumps that turn on and off automatically when you turn the tap on are easiest to use. Switching on and off manually can be inconvenient. Most pumps are relatively quiet, but if it is an issue, seek advice.

We chose a pressure switch model with constant non-cycling and thermal overload protection, as well as protection against dry running – in the event that the bladders run dry. Buying from a reputable dealer through *eBay*,

### Some suggested hints and moneysaving ideas

- When **estimating the length of PVC pipe and fittings** needed, err on the generous side. Most of the large hardware chains will allow refunds on surplus fittings at the end of the job – provided you keep the dockets.
- A **cheap effective gutter protection system** can be provided by placing 65mm diameter slotted pipe in clean gutters, then covering with fine (5mm) aperture PVC gutter mesh. The pipe keeps the gutter dry after rain and leaf sediment cannot cause gutter blockage because of the clear pipe waterway. It provides much longer periods between cleaning out.
- Place a layer of fine shade mesh on top of the rainhead filters for **additional water purity**. Clean out regularly.

- An **external water volume gauge** (right) can be made from 20mm diameter clear poly connected to the spare outlet on the bladder with 12mm irrigation tube. Draw the gauge up on cardboard, (subdivide as for the tape gauge) and laminate.
- If you use **first flush devices**, make them as long as possible, to be effective, and provide plenty of bracket support as they will be heavy when full! (over 15kg for a 2.4metre length).
- A **simple volume gauge** (left) can be made with a short steel tape. Fasten the base to the bladder with silicon and further secure with gaffer tape. Screw the end of the tape to the joist or bearer above, ensuring that the tape lock is left unengaged to allow the tape to run smoothly. Mark the tape with a permanent marker to show the empty and full conditions. Subdivide the distance between the marks by the total volume stored in kilolitres. (e.g. 600mm height for 12,000L = 50mm per 1000L).

## Rebates

*Contact your local council for details of additional rebates they may have available.*

**Qld**
*1800 243 585, www.nrw.qld.gov.au*
The rebate for rainwater tanks increased to $1,500 and will only be available for rainwater tanks 3000 litres or bigger which are internally plumbed to either a laundry cold water tap or toilet suite.
Queensland Government rebates are also available to help you buy appliances and other water-saving devices. Some councils, including the Brisbane City Council, also offer generous rebates.

**NSW**
*1300 361 967, www.environment.nsw.gov.au*
The tank must have a minimum 2000-litre capacity to be eligible. Households not connected to the mains supply are eligible for a rebate for the purchase of the tank only. Rainwater tanks installed to comply with BASIX for new homes, major renovations or a pool installation are not eligible for a rebate. The rebate is based on the size of the tank and whether the rainwater is plumbed into your toilet or washing machine, and ranges from $150 through to $1500.

**Vic**
*13 61 86, www.ourwater.vic.gov.au*
Households on a reticulated water supply are eligible for rebates of up to $1000 on the purchase and installation of a large rainwater tank (5000+ litres) connected to a toilet and/or laundry and installed by a licensed plumber, and up to $300 for a small tank (600–5000 litres).

**SA**
*1800 130 952, www.sawater.com.au*
A rebate of between $200 and $1000 is being offered towards the cost of purchasing and plumbing a rainwater tank to retrofit into your home for uses such as toilet flushing, clothes washing and for hot water supply.

**WA**
*1300 133 646, http://portal.water.wa.gov.au*
A Waterwise Rebate of up to $600 is available for the purchase and installation of new tanks for domestic use, that are plumbed in for toilet and/or washing machine use.

**NT**
*08 8951 9209, www.nt.gov.au*
A plumbing rebate of up to $500 is available to households in Alice Springs and Tennant Creek for the following services performed by a *GreenPlumber:* plumbing services associated with connecting a rainwater tank to a household hot water system, toilet, washing machine, airconditioner or to supplement household drinking water supplies. Minimum tank size eligibility is 1000 litres.

**ACT**
*13 22 81, www.thinkwater.act.gov.au*
A new rainwater tank with an internal plumbing connection (e.g. to the toilet or washing machine) is eligible for a rebate of between $750 and $1000.
Installation of plumbing for internal connection only of existing tanks may attract a rebate of $600.

**Tas**
Some local councils in Tasmania are offering rebates on a variety of water-saving products. For example, Hobart City Council offers the following: rainwater storage for garden watering (tanks greater than 1,600 litres) – $200; installation of rainwater storage for toilet flushing (600 litres or greater, specifically designed for this purpose) – $300.

## Signage

Some councils require rainwater taps to be clearly marked. This applies even where rainwater is used outdoors only.


Above or below ground distribution pipes must be continuously marked 'Rainwater' in accordance with AS 1345 'Identification of the contents of pipes, conduits and ducts.'

Every rainwater tank outlet and all taps, valves and rainwater tank apertures must also be identified as 'Rainwater' with a sign complying with AS 1319 'Safety Signs for the Occupational Environment,' or with a green-coloured indicator with the letters 'RW.' Alternatively, a permanent sign, at the front of the premises and visible to all visitors, may be displayed advising that rainwater is in use.

we saved enough to cover the cost for an electrician to install a waterproof power point above the pump.

The pump was mounted on a paving slab adjacent to the bladders and connected into the new under-house poly pipe system.

A good article on rainwater pumps is available at *www.choice.com.au,* for a cost of $13.95.

## So what did it all cost?

Bladders are initially more expensive than conventional external round poly tanks. However, take into account the cost of constructing a foundation concrete slab, which is strongly recommended in poor ground conditions to prevent settlement and consequent rupture with conventional tanks.

The supply cost of bladders compares well against rectangular and oval tanks, used when lot space is limited. They

have the advantage of not only being able to use space denied to most solid tanks, but can also be installed out of sight, freeing up garden space.

Rebates from both State and Local Government amounted to $1750, reducing our nett cost to less than $5000.

*Ed's note: these rebates may no longer be available for rainwater storage that is not connected into house plumbing. Please check your State and Local rebate schemes.*

## Was it worth it?

It is now almost a year since we installed the bladder tanks and we wonder how our garden would have survived without them.

It took a few months before the first rain fell to partly fill the tanks, but it was the start we needed. Since then we have had unlimited access to water without the tanks running dry. Our garden is thriving and we can also hose the car or fill the kiddies paddle pool whenever the mood takes us.

In the event our calculations were wrong we've even worked out where to install an additional bladder to add another 5000 litres! ■

*Should anyone like to contact me, I am happy to be in touch via email thommoshigh@hotmail.com*

**• Target 140**

*www.target140.com.au*

Target 140 is the Queensland Water Commission's achievable campaign that encourages all residents of South East Queensland to use on average 140 litres of water a day. Under the latest Brisbane City Council plans, an average family of five who meets Target 140 won't face a higher bill. However, the same average family who use about 180 litres of water a day per person could expect to pay $109 more for water per year.

1. *The pump was carefully chosen to match system requirements for output flow.*
2. *Bladder tanks near full condition.*
3. *Inlet pipework to tanks.*
4. *Cradle installation.*
5. *Empty bladders connected to pipework.*
6. *Rainhead and initial overflow to soakage trench.*
7. *External pipework, rainheads and back-up overflow outlet.*
8. *Overflow flap valve.*