DOMESTIC RAINWATER HARVESTING IN QUEENSLAND

A guide to Positioning, Installation, Connection and Maintenance of Domestic Rainwater Tanks and their associated Roof Water Collection Systems

BSA

Helping Queenslanders Build Better

The aim of this booklet is to help you play your part in the harvesting and conservation of water in Queensland.

Initiatives introduced by the Queensland Government have made rainwater tank installation a major focus in the building industry.

As a contractor, or as a consumer, you may become involved in water tank installation.

Whether it's preparing a base, plumbing a tank into a home or simply deciding where a tank will be positioned on site, you need to ensure you have the best building practice in mind.

This booklet brings together all aspects of rainwater tank installation - from the BSA licence necessary - to the maintenance required after installation.

It provides a clear and comprehensive guide to the installation of rainwater tanks and their associated roof water collection systems and covers all types and styles for new and existing homes.

I invite you to read, understand, and enjoy this booklet. Together let's ensure the future of water conservation in Queensland is built on a solid foundation.

Hon. Robert Schwarten MP
Minister for Public Works, Housing and
Information and Communication Technology

CONTENTS

INTRODUCTION

Drought conditions have prevailed throughout much of Australia in recent years. Nowhere have the effects of drought been more significant than Central and South East Queensland. The prospect of global warming contributing to future prolonged periods of dry weather is also a daunting prospect facing Queenslanders.

Reduced rainfall and possibly hotter temperatures coupled with an ever increasing demand for water reserves have forced governments and the community at large to consider a range of water conservation strategies. These include reduced consumption, alternative water production methods and greater and more comprehensive water storage measures.

As a result of these concerns the Queensland Government has implemented mandatory water saving targets for new homes through the Queensland Development Code.

DEVELOPMENT ASSESSMENT (BUILDING) AND PLUMBING APPROVAL

Any new building or structure constructed in Queensland requires Development Assessment (DA) Approval in accordance with the *Sustainable Planning Act 2009, Building Act 1975, Building Regulation 2006 and the Queensland Development Code (QDC)*

DA Approval must be undertaken by building certifiers licensed with the Building Services Authority. Building certifiers may be privately employed or work for local councils.

DA approval for tanks constructed as part of a new house contract is generally sought and granted as part of the dwelling approval. DA Approval requirements for tanks proposed to be installed separate to the construction of a new dwelling are dependent upon the size and location of the tank and whether or not the tank is to be connected to any plumbing fixtures or taps. It is essential that specific Development Approval requirements for any site are checked with a building certifier during the planning process and before the tank is installed.

Examples of when DA approval and certifier inspection on site will be required to verify compliance with the approval are provided below. It must be emphasised that these are examples only and specific requirements in relation to any particular application or site should be checked with the certifier.

- Tanks, irrespective of size, that are constructed from combustible material when the tank is proposed to be located within 450mm of any property boundary.
- Tanks more than 2.4 metres high including the stand.
- Tanks that have a base measuring more than 10 square metres on plan.
- Tanks with sides more than 5 metres in length.
- Tanks located in ground or partly in ground where any part of the tank is more than 1 metre below ground level.
- Tanks constructed of combustible material that are attached to a building (eg a shed or house) and are closer than 900mm to another building.

Additionally siting requirements stipulated in the local council planning scheme should be checked to determine if relaxation approval for siting needs will be required.

Some examples of when relaxation approval for siting is often required are noted below, however it must be emphasised that these are only examples and the specific requirements for any site will be determined by the local council planning scheme.

The tank is more than 1 metre high and is located within 6 metres of the front boundary.

The tank is more than 2.4 metres high including the stand and is located within 1.5 metres of the side or rear boundaries.

Additionally, plumbing approval will be required if the water from the tank is connected to any plumbing fixture (including external taps) with the exception of a tap that is used exclusively for the purpose of irrigating gardens and the like.

Plumbing approval is also required where the tank is being supplied with town water supply back-up. Such approval must be made by the local council in accordance with the *Plumbing and Drainage Act 2002* and the *Standard Plumbing and Drainage Regulation 2003*.

MANDATORY WATER SAVING TARGETS FOR QUEENSLAND

From 1 January 2007, the QDC introduced mandatory water saving targets in South East Queensland. These provisons are stipulated in Part MP4.2 of the QDC, were most recently updated in January 2009 and now apply to all of Queensland.

In relation to domestic construction, mandatory requirements apply to Class 1 buildings defined in the Building Code of Australia as;

Class 1 – means one or more buildings which in association constitute-

Class 1a – a single dwelling being –
a detached house, or
one of a group of two or more attached dwellings, each being a building, separated by a fire-resisting wall, including a row house, terrace house, town house or villa unit, or;

Class 1b – a boarding house, guest house, hostel or the like –
with a total area of all floors not exceeding 300m2 measured over the enclosing walls of the Class 1b, and;
in which not more than 12 persons would ordinarily be resident,
which is not located above or below another dwelling or another Class of building other than a private garage.

These mandatory water saving initiatives can be met through a number of options with an "acceptable solution" being the installation of water tanks that comply with the requirements summarised in Table 1.

TABLE 1 - QUEENSLAND DEVELOPMENT CODE REQUIREMENTS (Mandatory for new homes)

Size	Install either: Tank/s with a minimum total capacity of 5000 Litres (detached dwellings), OR Tank/s with a minimum total capacity of 3000 Litres (attached dwellings).
Roof Catchment	Collect water from either: ½ of total roof area, OR 100m2 (whichever is the lesser).
Plumbing Connection	Connect tank to each of the following: External use* AND Toilet cisterns, AND Washing machine cold water taps (other than those connected to a grey water treatment plant or alternative water substitution measure). * (External use means for gardening, irrigation, ponds, swimming pools and outdoor cleaning).
Contaminant Protection	Install both: Screened downpipe rainhead with 4-6mm mesh, installed on each downpipe, AND where connected to showers, wash basins, kitchen or hot water services - 20 Litres of the first flush diverted/discarded before entering the rainwater tank.
Mosquito/Vermin Protection	Install either: Mosquito-proof screens (brass, copper, aluminium, stainless steel) up to 1mm mesh OR Flap valves at every tank opening and A vermin trap or where a wet system is used, mosquito proofing in accordance with standard HB230.
Connection to Mains	Install either: Automatic switching device to provide water from the town supply OR A trickle top up system to provide water from the town supply with: Minimum flow rate of 2L/minute Maximum flow rate of 4L/minute Top up valves in accessible location Maximum town water supply top up of 1000 Litres.
Tank Openings	Seal tank to prevent surface stormwater and groundwater entering tank AND Locate access lids so that : Non water-tight access lids are either sealed or terminate 150mm above ground level Stormwater flows with the ground sloped away from the lid Water-tight access lids can finish flush with finished surface level.

Tank Discharge	Install a physical air break or non-return valve on outlet from overflow before connecting to stormwater drainage system AND Connect overflow (complying with AS/NZS 3500 : 2003) to one of the following : Existing stormwater system Kerb and channel Inter-allotment stormwater pit (pits must be approved by Council).
Interconnection	Install a backflow prevention device in accordance with AS/NZS 3500:2003.
Material Types	Use one of the following materials : Polyethylene Galvanised steel Stainless steel Concrete Underground water cell.
Tank Stands	Stand to comply with both : AS/NZS 1170.1 : 2002 and AS/NZS 1170.2 : 2002.

Note that certain local government planning instruments may specify requirements exceeding those specified by the QDC. It is important contractors check requirements with the relevant local council prior to quoting for or commencing work.

BSA LICENSING REQUIREMENTS

The installation of rainwater tanks constitutes 'building work' as defined by the *Queensland Building Services Authority Act 1991* and accordingly the contractor undertaking the installation works is required to hold an appropriate BSA licence. Various licences are appropriate depending on the type of tank being installed and these are detailed in Table 2.

A licence is not required to manufacture the tank off-site or to deliver and place the tank on a pre-prepared base. A licence is however required to construct the tank on-site or to backfill and anchor the tank in the ground where the aggregate value of this work exceeds $3,300. Similarly a licence is required to construct the tank stand or base on site where the aggregate value of this work exceeds $3,300.

A Plumbing and Drainage licence is required to connect the tank to the water supply to a building for example to the laundry, kitchen, cistern, or an outside tap - and to connect town water back up supply to the tank irrespective of the value of this work. If a contractor is required to be licensed and is not, that contractor may not be entitled to payment for his own labour and any profit and may be prosecuted for breaches of the Act. It is also an offence for builders to engage sub-contractors that do not hold the appropriate class of licence.

Further information in relation to BSA licensing requirements for tanks can be obtained from the BSA website at **www.bsa.qld.gov.au.**

TABLE 2 BUILDING SERVICES AUTHORITY (BSA) LICENSING REQUIREMENTS

CONSTRUCTION TYPE	APPROPRIATE BSA LICENCE
Installation of polyethylene, galvanised steel, stainless steel, or prefabricated concrete rainwater tanks either above ground or wholly or partially in ground.	Any Builder or Builder Restricted class of licence Carpentry Plumbing and Drainage Drainage Irrigation Structural Metal Fabrication and Erection Non-structural Metal Fabrication and Installation Metal Fascias and Gutters Roof and Wall Cladding Sheds, Carports and Garages Structural Landscaping (Trade)
Construction of in-situ concrete rainwater tanks either above ground or wholly or partially below ground	Any Builder or Builder Restricted class of licence Concreting
Construction of a concrete slab base for a tank	Any Builder or Builder Restricted class of licence Carpentry Concreting Bricklaying and Blocklaying Brick and Segmental Paving
Construction of a timber tank stand	Any Builder or Builder Restricted class of licence Carpentry
Construction of a metal tank stand	Any Builder or Builder Restricted class of licence Carpentry Structural Metal Fabrication and Erection

QUOTES AND CONTRACTS

In Queensland, the *Queensland Building Services Authority Act 1991* and the *Domestic Building Contracts Act 2000* determine the legislative requirements in relation to contracts for 'building work'. Essentially it is the nature of the building work to be performed (domestic or commercial), and for whom the contractor will be performing the work (ie dealing directly with the home owner or sub-contracting to a principal contractor or commercial building owner), that determine the applicable legislation and the format of contract required. It is very important that contractors understand their contractual obligations and use appropriate contract documentation, as failure to do so may result in costly disputes, leave the contractor exposed to the risk of prosecution, or give rise to contract termination and loss of revenue.

DOMESTIC BUILDING CONTRACTS ACT 2000

Domestic building work that is carried out directly for the homeowner and exceeds $3,300 in value (inclusive of labour, materials and GST) is governed by the *Domestic Building Contracts Act 2000 (the DBC Act).* The DBC Act requires that contracts meet a number of stringent mandatory conditions. Some of the key provisions of this legislation are listed below however for further and more comprehensive details of this Act contractors should refer to BSA's booklet titled **'The Domestic Building Contracts Act – What Contractors Need To Know'**, and the Fact Sheet titled **'Contract Checklist'** on BSA's website under **Builders/Contractors**.

Homeowners should refer to **www.bsa.qld.gov.au** under **Consumers.**

Some key provisions are:

- Contracts must be in writing and signed by both parties
- Deposits must not exceed a mandated maximum amount - namely 10% for work valued at less than $20,000 and 5% for work valued in excess of $20,000.
- Progress payment stages must be clearly defined and payment for any work shall not be made unless the work has been carried out.
- The contractor must provide the homeowner with a BSA approved Information Statement and a signed copy of the contract within 5 business days of entering into the contract.
- The contract is subject to a 5 business day cooling off period to protect homeowners from high pressure salesmanship.
- Generally variations must be recorded in writing and signed by the homeowner prior to the work being carried out.
- Cost plus contracts are unlawful in most situations.

QUEENSLAND BUILDING SERVICES AUTHORITY ACT 1991

If a contractor has no direct contractual arrangement with the homeowner (eg either because the work is commercial or because

the contract is a sub-contract with a principal contractor), the requirements of the *Domestic Building Contracts Act 2000* do not apply. Instead the provisions of Part 4A of the *Queensland Building Services Authority Act 1991* ("QBSA Act") have effect. These contractual provisions are less onerous than those applying to 'domestic building work' and apply to building work valued at $3,300 or more. Some key provisions of the QBSA Act include:

- A written contract is required for work valued at $3,300 or more - or for work of any value if the work is undertaken by a contractor holding a BSA licence in Plumbing and Drainage or Drainage.

- The obligation to have a contract in writing rests with both the principal contractor and the sub-contractor.

- The contract must include the scope of services to be provided, the contractor's name and licence number, the value - or the method by which the value of the contract will be calculated, the payment arrangements, any retentions or securities, the completion date, the address of the site of works and the need to record any directions given under the contract in writing.

Further information in relation to commercial contracts or sub-contracts can be obtained from BSA's Fact Book titled **'Contractor Information on Contractual Obligations, Demerit Points and Bans'** or the Fact sheet titled **'Commercial Contracts and Subcontracts.'** These documents are available on BSA's website at **www.bsa.qld.gov.au.**

CONTRACTS

Although it is possible to personally draft (with legal assistance) contracts compliant with the legislation, the easiest way to satisfy the legislative requirements is to use an appropriate contract that has already been developed and where appropriate, has an Information Statement already approved by BSA. BSA produces contracts for domestic building work and building work valued at less than $3,300 and has these available at no charge for downloading from its website. Major industry associations also produce and offer for sale both commercial and domestic building contracts.

BSA also produces subcontracts that are available for downloading free of charge at **www.bsa.qld.gov.au.**

HOME WARRANTY INSURANCE

Construction or installation of a water tank becomes insurable work requiring payment of a BSA insurance premium where such work;

- Is valued over $3,300 and comprises the construction or installation of a tank that is associated with the primary water supply for the residence or related roofed building; and

- Is undertaken directly for the home owner and the home owner does not hold an owner builder permit for the work.

More information for contractors in relation to BSA's Home Warranty Insurance Scheme can be obtained from BSA's booklet **'Facts**

for Licensees' and for the Homeowner from the booklet **'Smart Building & Renovating.'** This information is also available from BSA's website at **www.bsa.qld.gov.au.**

MONETARY REBATES

Some local governments provide rebates to home owners who install water saving initiatives including rainwater tanks. These vary from council to council and homeowners should contact their local council to determine what, if any, rebates are available.

The birth of a polyethelene rainwater tank as it exits the mould.

ROOF WATER COLLECTION SYSTEMS

Many factors impact on the type of rainwater harvesting system utilised on any project and it is important that a holistic approach is adopted by designers, builders and homeowners when considering the most appropriate system for any site. Factors that may influence the design include:

- The area and location of roof that will be collecting the water;
- The type and size of tank to be used;
- The type and size of the tank base or stand;
- The purpose to which the stored water will be put (eg potable water for human consumption);
- Whether town water supply back-up will be required and if so, which system will be used;
- The type of roofing material used including any flashings and cappings, the size and profile of gutters, the size and profile of down pipes, the size, type and system of pipe work carrying roof water from the roof to the tank;
- Effects the tank installation will have on the general amenity of the occupants of the home and their neighbours including issues such as the effect on natural lighting and ventilation, any restriction of outlook or views and the visual aesthetics of the installations;
- The proposed water distribution method – pump or gravity fed.

ROOF AREA AND LOCATION

Tanks associated with the construction of Class 1 dwellings that are required to meet Part MP4.2 of the QDC requirements must collect water from half the roof area or 100m^2 of roof area whichever is the lesser. Whilst this is the minimum required it is usually beneficial to collect water from as much roof area as possible within any constraining site, budget and construction limitations.
The amount of water likely to be collected is determined by the amount of rain that falls and the catchment area. Historical rainfall figures for particular areas can be obtained from the Bureau of Meteorology or their website at **www.bom.gov.au** under **Climate Services.**

Big roof areas offer the opportunity to collect large quantities of rainwater for domestic use.

It should be acknowledged that over recent years with ongoing drought conditions prevailing, the intensity and frequency of rainfall in most districts has become highly variable from one year to the next.

Once the historical quantity and frequency of rainfall has been determined, the approximate quantity of water likely to be collected in the tank can be calculated by multiplying the area of the catchment by the quantity of rain. That is, for every 1mm of rain that falls across 1 square metre of catchment area, 1 litre of water is collected. So, a roof area of 100m^2 will collect 100 litres of water for each 1mm of rainfall.

TYPE AND SIZE OF TANK

The minimum provisions of the QDC require that a 5000 litre (detached dwellings) or 3000 litre tank (attached dwellings) be provided to new dwellings. This capacity can be achieved by installing one tank or by the combined installation of a number of smaller tanks. Rainwater tanks can be manufactured from a range of materials and those approved by the QDC include galvanised and stainless steel, polyethylene (rigid and flexible), concrete and underground water cell tanks.

Table 3 lists some of the more common tank types, their relative advantages and disadvantages and the Australian Standards relevant to their manufacture.
Should tanks be intended for potable water storage they should preferably comply with Australian Standard AS/NZS 4020 - 'Testing of products for use in contact with drinking water.'

Tanks are manufactured in many different profiles designed to meet specific customer requirements including 'squat' tanks with reduced total inlet height, narrow or elliptical tanks designed to fit under eaves or adjacent to buildings and modular type systems that connect together in a variety of forms to achieve the required water tank capacity. Irrespective of the material used to construct the tank, installation methods generally fall into one of three categories dependent upon whether the tank is installed on the ground, below ground or above the ground.

TABLE 3	COMMON TYPES OF RAINWATER TANKS	
Type	**Description** **Advantages and Disadvantages**	**Relevant** **Australian Standards**
Galvanised Steel	Used for above ground installations. May be lined internally with a polymer film to preserve water quality and increase corrosion resistance. May be pre-finished externally to provide an aesthetically pleasing appearance. Generally lower cost. Care should be taken to ensure roof catchment metal materials are compatible with materials used in the construction of the tank. Easily damaged during transport and installation if handled incorrectly. Usually requires the installation of a central support pole to support the top of the tank. When installed must be tied down or partly filled immediately after installation to ensure the tank remains in place in the event of high winds or storms.	AS 1397:2001 Steel sheet and strip – hot dipped zinc coated.
Stainless Steel	Used for above ground installations. High level of corrosion resistance and good longevity. Often more costly than other materials. When installed above ground must be tied down or partly filled immediately after installation to ensure the tank remains in place in the event of high winds or storms.	ASTM A240/A240M-05 Standard specification for chromium and chromium-nickel stainless steel plate, sheet and strip for pressure vessels and for general applications.
Polyethylene	Used for above and below ground installations. Robust. Some may require the installation of a central support pole to support the top of the tank. When installed above ground must be tied down or partly filled immediately after installation to ensure the tank remains in place in the event of high winds or storms. Size generally limited to approximately 30,000 Litres.	AS/NZS 4766:2002 Polyethylene storage tanks for water and chemicals. For tanks used for potable water – AS 2070 Plastics materials for food contact use.

Concrete	Used for above and below ground installations. Robust and long lasting. Precast units are available up to approximately 30,000 litre capacity. In situ constructions are commonly constructed to 100, 000 Litre capacity. Cost effective with larger installations.	AS 3735-2001 Concrete structures retaining liquids.
Bladder (Heavy duty flexible plastic)	Used for above ground installations. Come in many shapes and sizes and can be installed in confined spaces for example under suspended floors. Are more difficult to clean accumulated sludge from than conventional polyethylene, concrete or steel tanks.	AS/NZS 4766:2002 Polyethylene storage tanks for water and chemicals. For tanks used for potable water – AS 2070 Plastics materials for food contact use.
Under ground water cell	Used for below ground installations. Not suitable for potable water. Care must be taken to ensure the constructions and installations do not impact on the footings of the residence. Generally constructed by specialist contractors.	Non potable water only and must comply with Vertical Axis Type Section 10 of AS/NZS 1546.1 1998 On site domestic wastewater treatment units – septic tanks.

INSTALLATIONS ON GROUND

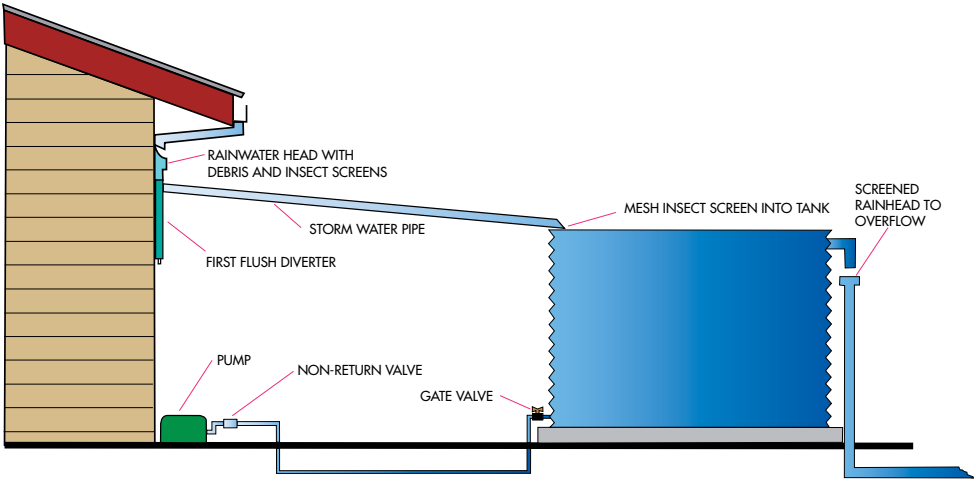
Generally, polyethylene, galvanised steel, stainless steel, bladder, precast and cast in-situ concrete tanks are commonly used in on ground installations.

On ground installations may be installed on a compacted earth, sand or crusher dust base or alternatively a concrete slab. If an earth, sand or crusher dust base is used it is important that the base is properly compacted and is adequately restrained or battered to prevent erosion by rainfall.

Bladder tanks also require a compacted base that is level across the width of the tank but has a slight slope along the length of the tank towards the outlet.

Rainwater delivery from the roof gutters to tanks on ground is generally achieved by one of two systems known as wet or dry systems and each of these has specific characteristics.

FIGURE 1



DRY SYSTEM RAINWATER COLLECTION

DRY SYSTEM

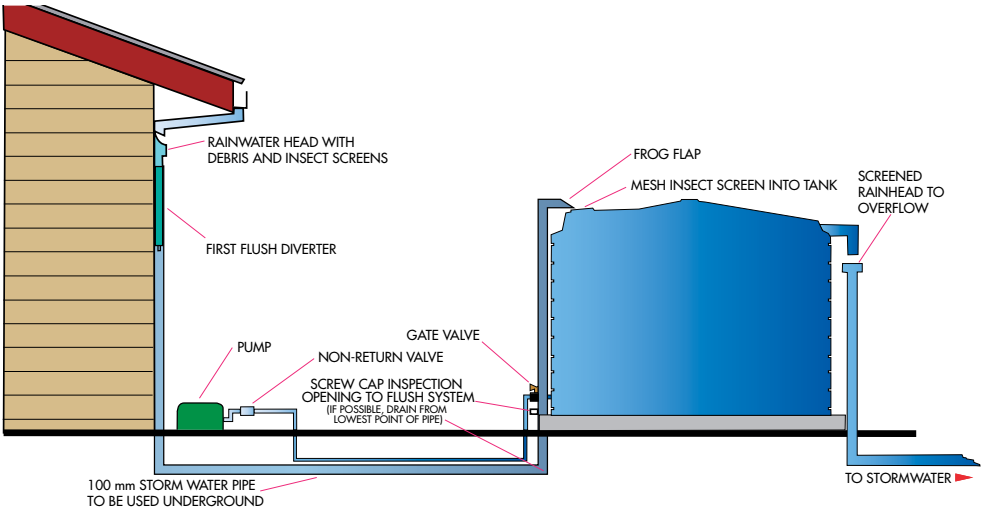
The dry system as illustrated in Figure 1 involves collection of the rain water from gutters and conveying the water directly into the inlet opening in the tank. Using this system places some limitation on the amount of roof area that water can be collected from without excessively large gutters being used or excessive and unsightly lengths of downpipes being attached to walls, soffits and the like.
In these systems rainwater collection pipes should generally be run at a minimum grade of 1 in 60.
This system has the advantage of being totally self draining and dry during non-rain periods.

WET SYSTEM

As illustrated in Figure 2, the wet system conveys water through downpipes to below ground level, along underground pipe work and then up a vertical riser pipe and into the inlet of the tank. This system has the advantage of being able to convey roof water unobtrusively from any downpipe around the dwelling up and into the tank. It is recommended that the pipe at its lowest point in the ground be capable of being drained after rain and ideally that an inspection opening in the pipe should also be incorporated.

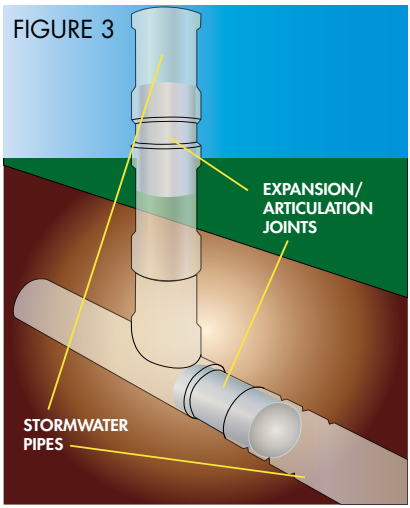
CAUTION!
Care should be taken to ensure that any pipework laid in reactive clay sites is appropriately articulated with flexible joints and couplings to accommodate any differential soil movement.

FIGURE 2



WET SYSTEM RAINWATER COLLECTION

Figure 3 illustrates an appropriate system for incorporating such articulation into storm water pipework. It is also recommended that any in ground pipe work laid in reactive soils be constructed of 100mm uPVC pipe work or larger. 90mm pipe work is more readily prone to breakages than the thicker gauge 100mm pipe work should differential soil movement occur.



TERMITE MANAGEMENT SYSTEMS

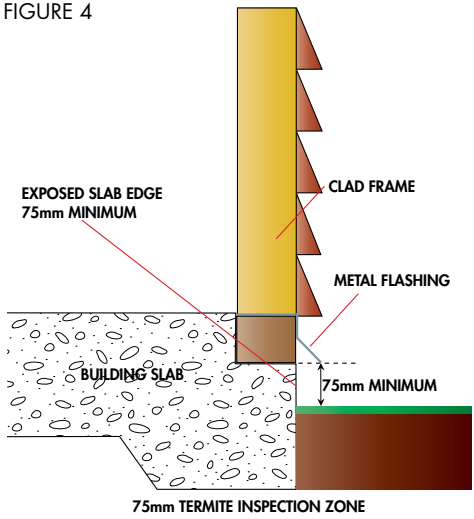
Before installing a rainwater tank or any pipework adjacent to a home it is essential the contractor is aware of and understands the type of termite protection system installed to protect the building. Any construction near the home may compromise the system with disastrous consequences. Although many different methods are available to protect homes against subterranean termite attack, protection systems generally rely on a chemical barrier, a physical barrier or a combination of chemical and physical barriers to protect the home.

Chemical barriers may require replenishment if disturbed by installation of the rainwater tank or any of its associated pipework, fittings or accessories and all systems rely to some extent on a specific 75mm inspection zone around the perimeter of the home.

Automatic switching device installed in waterproof cover with in-built 75mm termite inspection port

As illustrated in Figure 4, this zone must be clearly visible at all times and access for persons to view the zone must not be unreasonably restricted. It is therefore strongly recommended that prior to installation of the rainwater harvesting system intended construction is discussed with the termite management contractor who will be installing the protection system to the home.

FIGURE 4



If tanks are being installed in an existing residence, the intended construction should be discussed with the termite management contractor who installed or maintains the protection system around the home.

The introduction or retention of moisture is often an attractant to termites who require the moisture to build their nests and trails. Accordingly, care should be taken to ensure that all pipework is watertight and that the tank itself does not retain moisture under or around it. This is particularly important when bladder type tanks are installed under a residence where access is restricted, ventilation limited and moisture retention highly likely. In such instances it may be advisable to have additional termite barriers installed. It is also advisable to check with the bladder tank manufacturer to determine whether the tank itself is susceptible to termite attack and requires protection.

Bladder tank installed under house and full of rainwater

Further information in relation to Termite Management Systems for contractors and Homeowners can be obtained from BSA's Booklet titled **"Termite Management Systems"** or from BSA's website at **www.bsa.qld.gov.au.**

FOOTINGS AND FOUNDATIONS

Care should be taken when excavating near any footings to ensure footings are not undermined in any way or that a pathway is not formed to facilitate water saturating ground around the footings. This is particularly important on reactive clay sites that are very susceptible to movement due to moisture variation. Such differential movement can often lead to brickwork, plasterboard and finishes cracking and doors and windows binding. Accordingly it is extremely important that pipework on these sites is provided with sufficient flexibility to accommodate any likely movement and that pipework is watertight.

EXISTING SERVICES

Particularly when installing tanks or tank bases on sites where a home already exists, it is essential to locate any underground pipes or services in the area. This will avoid rupturing these services during excavation and ensure future access to the services through construction of the tank stand or installation of the tank.

It is important that in addition to carrying out their own investigations, contractors interview home owners to determine if they have any knowledge of concealed or buried services in the area of the proposed constructions.

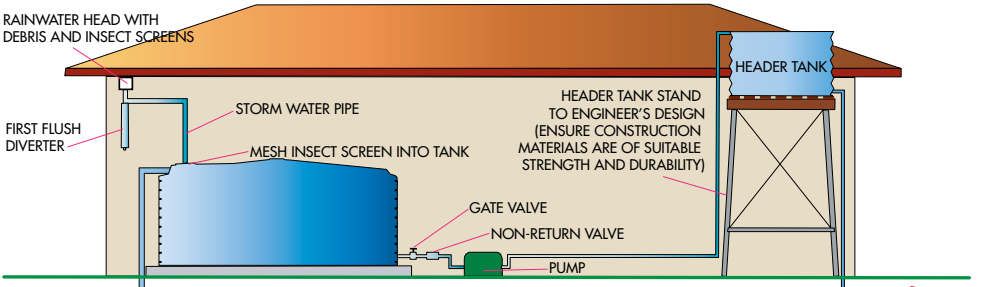
INSTALLATIONS ABOVE GROUND

In some instances where the roof is of sufficient height or the location of the tank is is on a downward slope from the house, tanks can be installed on low tank stands using the dry or wet system of roof water collection and a pressure pump delivery system. Alternatively a header tank system can be utilised as illustrated in Figure 5.

Tank stands may be constructed from either timber or steel however their construction must comply with the provisions of Australian standard AS 1170.1 2002 permanent, imposed and other actions and AS/NZS 1170.2 2002 wind actions.
Additionally the steel used to construct the stands must be adequately protected from corrosion by galvanising or painting as required by Section 3.4.4.2 of the Building Code of Australia.

The Code provides that the level of protection required is dependent upon the location of the construction.

FIGURE 5



HEADER TANK SYSTEM

In construction more than 1km from breaking surf or 100 metres from salt water that is not subject to breaking surf the protection required is either;

1. 2 coats of alkyd primer, or;
2. 2 coats of alkyd gloss, or;
3. Hot dip galvanising to 300g/m2
4. Hot dip galvanising to 100g/m2 minimum plus either 1 coat of solvent based vinyl primer or 1 coat of vinyl gloss or alkyd.

In construction less than 1km from breaking surf or within 100 metres of salt water that is not subject to breaking surf the protection required is either;

1. Inorganic zinc primer plus 2 coats of vinyl gloss finishing coats, or
2. Hot dip galvanise 300g/m2 minimum,
   or
3. Hot dip galvanising to 100g/m2 minimum plus either 2 coats of solvent based vinyl primer or 2 coats of vinyl gloss or alkyd.

Stands constructed from timber must be suitable for hazard class H5 applications. Timbers of natural durability class 1 or 2 (eg Ironbark, Forest Red Gum) with sapwoods removed or preservative treated to H5; or alternatively softwoods preservative treated to H5 are suitable for these applications. Contractors should check with their timber supplier to ensure timbers are of the required durability class.

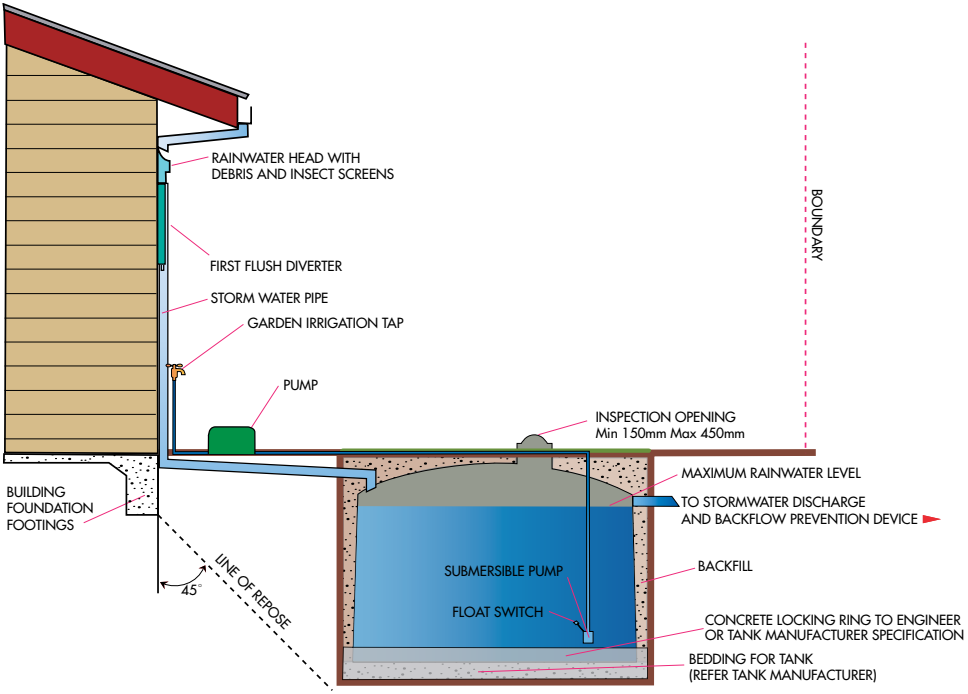
It is essential contractors quote for and utilise materials that are of suitable durability and fit for purpose to avoid costly future rectification work.

This concrete tank was built on site

INSTALLATIONS BELOW GROUND

Generally only concrete tanks and certain polyethylene tanks are suitable for below ground installations. Concrete tanks may be precast in which case their size is generally limited to capacities of around 30,000 litres, or constructed in situ in which case their capacity is unlimited with 100,000 litre tanks not being uncommon.

FIGURE 6



UNDERGROUND RAINWATER COLLECTION SYSTEM

Figure 6 provides an illustration of a typical in-ground rain water tank installation
In underground installations ground surface water must be prevented from entering the tank and the overflow to stormwater must be designed to stop any surcharge from the stormwater from entering the underground rainwater tank. Additionally tank access lids must be designed to prevent child access and storm water ingress.

Another major consideration with underground tanks is the necessity to design and install tanks to prevent hydrostatic uplift. Hydrostatic uplift is the tendency of ground water to lift or cause in-ground tanks to 'float' becoming unlevel or in extreme cases 'popping' out of the ground.

Amongst other things any movement in the tank is likely to cause breakage of pipework connected to the tank.

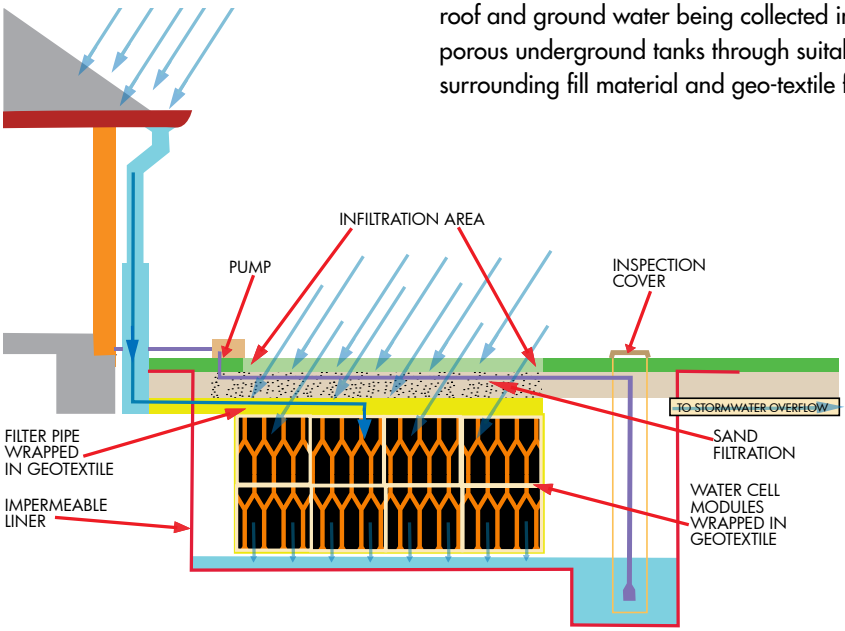
Resistance to hydrostatic uplift can be achieved by installation of ground anchors which tie or anchor the tank into the ground or by utilising ballast in the tanks. Design to resist hydrostatic uplift should preferably be undertaken by an engineer. Indeed, certifiers may require engineering certification in relation to the structural integrity of the constructions and their ability to resist hydrostatic uplift prior to Development Assessment Approval being given.
This particularly applies to concrete tanks. Manufacturer's installation instructions for polyethylene tanks to be installed in

ground should have had such engineering calculations already undertaken and the tank and its fixings or anchors designed to resist anticipated hydrostatic uplift. It is essential that manufacturer's installation instructions are stringently adhered to. Such instructions often require the tank to be wholly or partially filled after installation, require the construction of a concrete anchor ring around the base of the tank, and require the use of particular types of backfill.

TERMITE MANAGEMENT SYSTEMS

As mentioned in relation to tanks on ground the importance of maintaining the termite protection barrier around a home can not be over emphasised. Similarly with in ground tanks it is important that the barrier is not disturbed or breached by either the construction of the tank or the installation of pipework.

FIGURE 7



FOOTINGS AND FOUNDATIONS

Due to their depth, underground tanks must be placed a considerable distance away from the footings of a home to ensure they do not undermine the structural integrity of the footing system. It is also critical that underground tanks are watertight to prevent moisture affecting the footings of the adjacent home or possibly causing the tanks to move out of level. The minimum distance an underground tank should be constructed away from the home is related to the respective depths of both the tank and the footings of the home and is determined by the line of repose as illustrated in Figure 6.

UNDERGROUND WATER CELLS

Figure 7 illustrates these specialist systems that are approved for use by the Queensland Development Code but are not suitable for potable water. The systems rely on roof and ground water being collected in porous underground tanks through suitable surrounding fill material and geo-textile fabric.

INTENDED WATER USE

Provided that the roof and gutters are kept clean, rainwater collected from an urban roof is generally suitable for toilet flushing, washing clothes, filling swimming pools, outdoor cleaning and garden irrigation. Queensland Health does not recommend the use of rainwater for drinking and food preparation if a potable reticulated water supply is available.

In areas of Queensland where water stored in rainwater tanks is the sole water supply it is advisable that the recommendations provided in the enHealth Council Publication **"Guidance on the use of Rainwater Tanks"** or the consumer brochure of the same name are followed. These publications can be accessed by visiting their website at **http://enhealth.nphp.gov.au.**

Where water stored in rainwater tanks is the sole water supply and is being supplied to higher risk persons such as the elderly, very young or immuno-compromised (eg cancer,AIDS, HIV patients, transplant recipients, those on dialysis),Queensland Health does not recommend this water be used for drinking and food preparation unless the water meets the Australian Drinking Water Guidelines for microbiological quality.

ROOFING MATERIALS

Care should be taken when collecting rainwater from metal roofs, gutters and downpipes to ensure that the metals on the roof are compatible with the metals used in construction of the rainwater tank. Contractors should consider and discuss with their Plumber roofing and tank material compatibility. Information in relation to acceptability of contact between different roofing materials is provided in Table 3.5.1.2 of the Building Code of Australia.

Lead flashings should not be used on roofs that are collecting rainwater unless they are entirely and appropriately painted.

Asbestos roofs are generally suitable for the collection of rainwater provided the roofs are reasonably clean and the asbestos is not disturbed or cleaned with high pressure water cleaners and the like.

GUTTERS AND DOWN PIPES

When installing a rainwater collection system there is often a temptation to fall all or most of the gutters to one or two downpipes immediately adjacent to the rainwater tank. This results in gutters being unable to cope with the volume of water present in moderate and heavy rains with significant amounts of water overflowing the gutters. Such constructions are contrary to the requirements of Section 3.5.2.of the Building Code of Australia (BCA) and can cause problems with the footing system of the home (if the soil becomes inundated with large quantities of water) and can result in leaks into the home or soffit.
The provisions of the BCA must be adhered to whether a rainwater collection system is in place or not. Section 3.5.2 of the BCA provides tables based on local rainfall statistics to enable gutter sizes and the size and number of downpipes to be calculated and requires, amongst other things, that the distance between downpipes does not exceed

12 metres and that generally a downpipe is provided within 1.2 metres of a valley eaves gutter junction.

In accordance with the requirements of the QDC any rainwater collection system must be provided with a number of devices to minimise any threat to the health or safety of those utilising the water. These include the installation of downpipe rainwater heads on each downpipe that incorporate 4-6mm debris screens and 1mm mosquito screening. If the water from the tank is connected to any fixtures other than external taps, toilet cisterns and washing machine cold water taps - for example a shower, handbasin or sink, first flush devices designed to prevent the first 20 litres of water from each downpipe from entering the tank must also be installed. At least one tank manufacturer has incorporated a first flush diverter within the construction of the tank, thereby negating the need to install individual units on each downpipe.

Built-in first flush device

Another important but often overlooked factor to be considered when connecting a rainwater tank to an existing residence is the necessity to check and ensure that gutters are falling to the downpipes.

Over time the fall on gutters can be altered by level changes caused by differential soil movement and by sag or other deterioration of timbers supporting gutters. This can result in gutters falling away from downpipes and may result in minimal rainfall entering the tank and gutters overflowing. Similarly when installing new downpipes it is important to adjust the fall on existing gutters to ensure they fall to the new downpipe locations.

Leaf & debris screen on rainwater head

TOWN WATER SUPPLY BACK-UP AND TRICKLE FEED SYSTEMS

The QDC requires that rainwater tanks in new homes are connected to a town water supply back-up system. This can comprise an automatic switching device or alternatively a trickle top up system.

This requirement ensures internal fixtures supplied from the rainwater tank have a continuous supply of water irrespective of the availability of rainwater.

Additionally, and to ensure that water from the tank does not contaminate the town water supply, a construction method preventing

backflow into the town supply must be incorporated.

An automatic switching device ensures continuous water supply by automatically switching to the town water supply when rainwater levels are low.

AUTOMATIC SWITCHING DEVICE

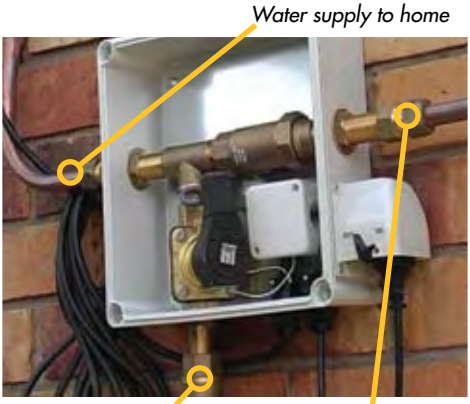


Figure 8 provides an illustration of a compliant continuous water supply system utilising an

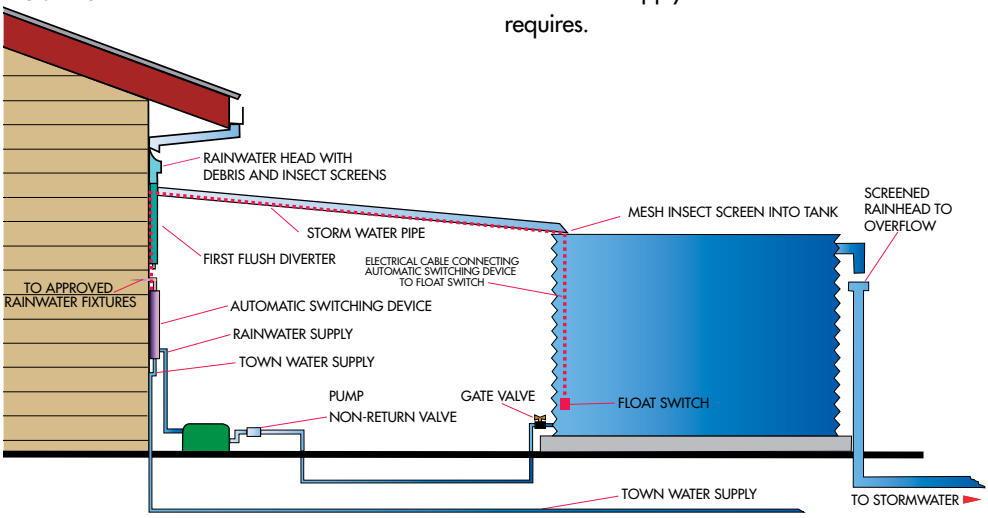
Alternative style of automatic switching device

automatic switching device and a backflow prevention device. Additionally this system must incorporate a dual check valve.

A trickle top up system as shown in Figure 9 relies on a minimum 2 Litres per minute and maximum 4 Litres per minute trickle town water supply feed to the tank and incorporates a physical air gap between the town water supply pipe and the top of the tank to provide backflow prevention.

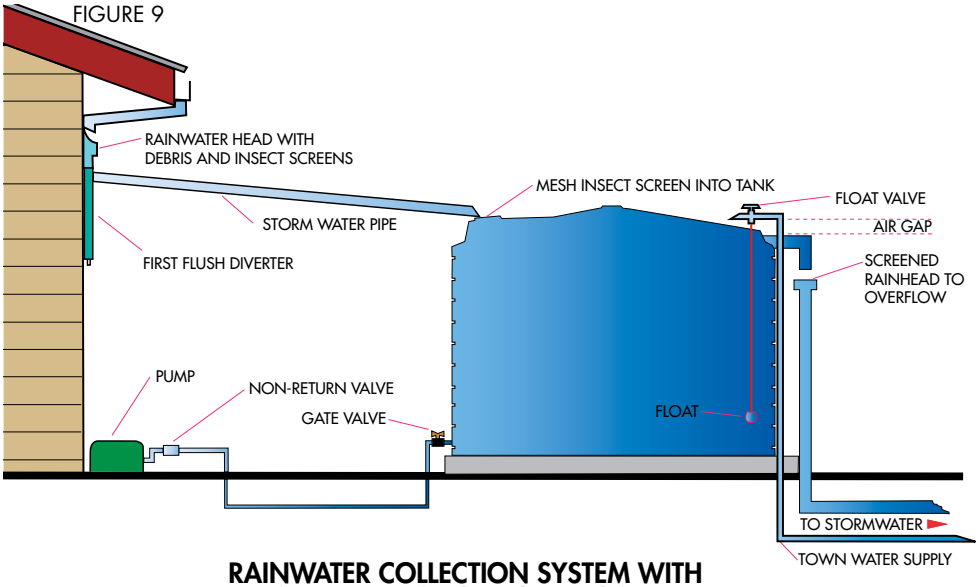
When minimum and maximum water limits are met a float activates a valve either turning the town water supply off or on as the circumstance requires.

FIGURE 8



RAINWATER COLLECTION SYSTEM WITH TOWN WATER SUPPLY BACK-UP & AUTOMATIC SWITCHING DEVICE

FIGURE 9



RAINWATER COLLECTION SYSTEM WITH TRICKLE FEED TOWN WATER BACK-UP

Both the Trickle top up system and the automatic switching device system must be approved by the local council and must comply with AS/NZS 3500.1 and the *Plumbing and Drainage Act 2002*. An advantage of the automatic switching device over the trickle feed system is that the automatic switching device automatically switches to town water supply in the event of power failure.
Power failure with the trickle feed system results in the pump being inoperable and accordingly no water can be supplied to the residence during the period of the power outage.

Float switch for Automatic switching device is installed to tank

PRESSURE AND PUMP REQUIREMENTS

Pressure and flow rates for pumps are governed by Australian Standard AS/NZS 3500.1 that stipulates that pressure shall not exceed 500 kPa and pressures at the most disadvantaged plumbing fixture or outlet shall not be less than 50 kPa at the minimum flow rate required.

Minimum and maximum flow rates at plumbing outlets are governed by local regulatory authority requirements and Australian Standard AS 3500.1. A general guide is provided in Table 4 although it is important that local authority requirements are checked prior to any decision being made in relation to pump systems.

Selection of a pump suitable to achieve the required flow rates and pressures is, (in other

than the most basic installations), a task more appropriate for a specialised pump consultant, pump supplier or plumber and is dependent upon a number of design variables including the number of plumbing fixtures, the number of occupants, the height of the building and its plumbing fixtures and the installation of any filtering systems.

TABLE 4 MINIMUM AND MAXIMUM FLOW RATES

Plumbing tap fixtures	Minimum flow rates (l/m)	Maximum flow rates (l/m)
Basin	6	9
Bath	18	18
Dishwasher	12	12
Hose tap – 15mm	12	12
Hose tap – 20mm	18	18
Kitchen sink	7	9
Laundry tub	7	9
Shower	6	9
Washing machine	12	12
WC	6	6

Additionally, pump systems must be installed so the noise they create does not cause a disturbance to the occupants of the building or any neighbours.
Assessment of the likely noise from any pump system is critical and should be considered in conjunction with the location of the pump and any noise attenuation strategies such as noise barriers or acoustic enclosures.

In circumstances where disturbance to the occupants of the dwelling or their neighbours from pump noise is difficult to avoid, an automatic switching device as described earlier in this publication can be fitted with a timer.
This can be programmed to switch off the rainwater supply and divert to town water supply at a prescribed time each evening, thereby minimising inconvenience when persons are sleeping and background noise is minimal.

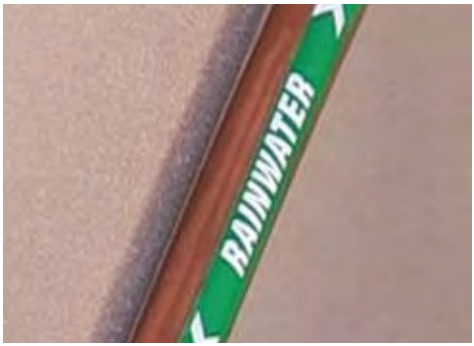
PLUMBING AND ELECTRICAL CONNECTION

Plumbing and electrical connections to the tank must only be undertaken by appropriately licensed professionals.
An electrical connection, usually by way of an external power point either fixed to a nearby wall or a stand pipe, will be required for the electric pump and any solenoid operated valve as used in trickle feed and automatic switching devices for town water supply back up systems. These power points must be installed by a licensed electrician in accordance with AS 3000.

HEALTH AND SAFETY CONSIDERATIONS

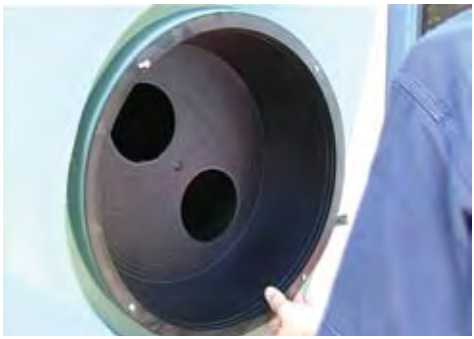
Water supply systems from a rainwater tank are required to be labelled in accordance with Australian Standard AS 3500.1;

- Pipework less than 40mm in diameter is required to be identified with the words 'RAINWATER' in not less than 4mm upper case letters placed longitudinally along the pipe.



- Rainwater outlets must be identified in green as 'RAINWATER' with a rainwater tap or the letters 'RW'.

It is recommended that access openings to tanks be covered to prevent light entering the tank and thereby preventing the growth of algae.



Depending upon the end use of the water, some form of filtration may be warranted. Filtration systems generally remove sediment from the water but do not remove all bacteria or viruses.

Standard three cartridge water filter

Ultraviolet radiation and reverse osmosis filters are now available for domestic use and are effective in removing most bacteria and viruses if installed strictly in accordance with manufacturer's instructions.
It is important in ultraviolet filtration systems that the filter is able to accommodate the flow rate provided by the pump.

Flow rates in excess of the filter's capacity will result in inadequate filtration and disinfection and accordingly microbiological activity may not be removed. It is also important that the ultraviolet light is checked periodically to ensure it is operating effectively.

Ultra-violet water filter.

Lead flashings used on older roofs and on some tiled roofs may lead to contamination of rain water with excessive lead levels. Existing lead flashings should be removed and replaced or alternatively thoroughly and appropriately painted to prevent any direct contact between the lead and the water. Similarly water should not be collected from collection areas coated with lead based paints (generally pre 1970).

Some uPVC pipework may contain residues of lead that could be hazardous to health. Only pipes and fittings manufactured from food grade plastic should be used, particularly if the rainwater is to be used as potable water.

Rain water that has contacted chemically treated timbers should also not be collected. Bitumen or tar based coatings used on the rain water collection area can effect the taste and smell of the water and should not be used.

Overflows or discharge pipes from roof mounted appliances such as air conditioning units and hot water systems should not have their discharge feed into the rainwater tank.

It is generally good practice to discard the rainwater collected from the first few storms on a newly constructed rain harvesting system to enable release agents and protective coatings used on roof materials to dissipate and to enable any detergents incorporated in modern acrylic paints to dissolve and be removed.

MAINTENANCE

Rain water collection systems are generally low maintenance but are not maintenance free systems. Some routine recommended maintenance procedures are provided in Table 5. It is recommended that contractors advise home owners of their maintenance responsibilities in accordance with this Table and any additional maintenance requirements stipulated by the manufacturers of the tank, rainwater diverters, the trickle feed or automatic switching device systems, the pump and the filtration system.

TABLE 5 MAINTENANCE OF RAINWATER TANKS AND FITTINGS

RECOMMENDED MAINTENANCE ACTION	REGULARITY
Check operation of solenoid valves on automatic town water supply back up devices by switching the power off and on and listening for the valve to operate.	1 month
Check inlet and overflow debris screens are in place, in good condition and clean as necessary.	3 months
Check insect screening on rain water heads is in place, is in good condition and clean as necessary.	3 months
Check and clean first flush devices.	3 months
Replace cartridges in water filters, uv lights on sterilisers and chemicals or components in water treatment units strictly in accordance with manufacturer's instructions.	In accordance with manufacturer's recommendations
Check roof and gutters for the presence of accumulated leaf, plant and other debris, clean as necessary and clear any overhanging tree branches and foliage.	6 months
Check for evidence of animal, bird or insect access including mosquito larvae. If present, identify and close access points.	6 months
Check for evidence of algal growth. If present, find and close points of light entry.	6 months
Check tank and fittings for any leaks and defects and repair as necessary.	6 months
Licensed plumber to check that solenoid valves and floats are working correctly on trickle feed and automatic switching device town water back up systems.	12 months or in accordance with local council requirements
Check and clean the tank to remove accumulated sediment.	2-3 years

TROUBLE SHOOTING

Table 6 lists a number of common problems sometimes experienced with rainwater collection systems and some possible solutions in relation to these problems. If the problems persist, home owners should contact their tank installer or a licensed plumber for further advice.

TABLE 6 - TROUBLE SHOOTING GUIDE

Issue	Solution
Dirty water in toilets or from taps	Leaf and vermin screens in rainwater heads may be missing or need cleaning. Pipes between the house and tank may be broken. Water level in the tank may be low. Tank may need de-sludging.
Toilet not filling but other rainwater taps are working	Check cistern float and inlet valve for blockages or broken or inoperable components
Water overflowing from rainwater heads or first flush diverter	Check if leaf screen or insect screen is blocked and clean as necessary. If problem persists, remove the leaf and insect screen and clean out first flush diverter. Check that the inlet or the outlet to the tank is not blocked.
No water coming out of downpipe into the rainwater heads	Check that the downpipe or the opening in the gutter into the downpipe is not blocked and clear as necessary.
No water coming out of taps when they are turned on	Check power is on. Check pump is connected to power and power is turned on. Check water pipe work from the tank to the pump and from the pump to the fixtures for leaks. Water level in tank may be too low. If trickle feed town water back-up is connected, wait 15 minutes for tank to top up and try again. If trickle feed supply is connected and no water is flowing into the tank, check that town water supply is turned on. If automatic switching device is fitted, check that town water supply is turned on and that solenoid valve is working.
Pump coming on when not using water	Check all taps and toilets connected to the tank for leaks. Check pipes between pump and fixtures for leaks. Remove control box lid and check fittings and hoses for leaks.

CHECKLIST

Prior to commencing installation of a rainwater tank, providing a quotation for the tank and installation or entering into a contract, it is recommended that contractors consider the items on the following checklist and discuss them with their clients.

TABLE 7	32 POINT RAINWATER TANK CHECKLIST
1	Is Development Assessment Approval and/or Plumbing Approval required? – Contact local council.
2	Who will obtain DA and/or Plumbing approval – Contractor/Owner?
3	Does the tank installer /contractor or plumber hold the appropriate BSA licence?
4	Are any monetary rebates available from the state government or local council for your proposed installation/s?
5	If rebates are available, do your proposed installations meet the eligibility criteria to receive the rebate{s}?
6	What type and size of tank is best suited to the site and purpose and does it comply with the relevant Australian Standards?
7	Are there any difficulties with access to install the type and size of tank chosen by the client?
8	What type of tank stand or base has been agreed upon?
9	If a tank stand is to be used do the proposed construction materials meet durability standards?
10	Are there any access restrictions in relation to pouring a concrete base and compacting a fill base? Has this been allowed for in the quote?
11	Will the type of pump selected meet required council pressure and flow rates?
12	Will an additional power point be needed and if so has this been allowed for in the contract?
13	What type of filter system (if any) will be used and what effect will this have on the pressure and flow rates?

14	What plumbing outlets will the rainwater service?
15	What affect will the tank, stand and pump have on the general amenity and enjoyment of the home and those of the neighbours?
16	Is town water supply back up required and if so will it be provided with an automatic switching device or a trickle feed system?
17	What area of roof will collect the rainwater?
18	Is the constructions and materials used on the existing roof, gutters and downpipes suitable for use in a rainwater collection system or is some rectification or remedial work required? Has this been allowed for in the quote?
19	Are gutters falling appropriately to downpipes that will feed the tank? If not does the quotation allow to re-fall the gutters or install additional downpipes?
20	Will a 'dry' or 'wet' system of rainwater delivery to the tank be used?
21	If a 'wet' system of rainwater delivery is proposed and the home is built on clay soils has an allowance been made for installation of adequate flexibility to the pipework?
22	What type of first flush diverter will be installed – on each downpipe, or one on or in the tank?
23	What effect will the proposed installations have on the termite protection system utilised to protect the home? Is further protection or reinstatement required and has this been allowed for in the quote?
24	Will the proposed installations have an effect on the footings of the home and if so what can be done about this and has it been allowed for?
25	Are any services such as plumbing and irrigation pipes, electrical and telephone cables or underground taps and switches likely to be affected or concealed by the proposed installations?
26	If the tank is to be installed below ground have the effects of potential hydrostatic lift been considered and compensated for?

27	Is the work valued at more than $3300 and if so is it intended that a contract that complies with the Domestic Building Contracts Act 2000 will be used?
28	Does the proposed contract have a compliant Information statement?
29	Do the Contractor and the Homeowner understand and agree with all the provisions of the contract?
30	Is the required deposit a maximum of 10% of the contract value if the value is less than $20,000 and no more than 5% if the contract value is $20,000 or more?
31	Are payment stages clearly defined?
32	Is BSA insurance payable and if so does the Contractor's quote include payment of the insurance premium? Homeowner's should be aware that BSA insurance is being paid so they can ensure that any competitive quotes they receive also allow for this insurance.

FOR MORE INFORMATION

BSA
BUILDING SERVICES AUTHORITY

Helping Queenslanders Build Better

TELEPHONE STATEWIDE
1300 272 272
www.bsa.qld.gov.au

BSA

BUILDING SERVICES AUTHORITY

Helping Queenslanders Build Better

BRISBANE
299 Montague Road
West End QLD 4101
Facsimile 3225 2999

GOLD COAST
Robina Super Centre
86 Robina Town Centre Drive
Robina QLD 4226
Facsimile 5575 7666

SUNSHINE COAST
6 Pikki Street
Maroochydore QLD 4558
Facsimile 5459 9655

TOOWOOMBA
Clestrain Mall
131A Herries Street
Toowoomba QLD 4350
Facsimile 4638 1917

MARYBOROUGH
208 Lennox Street
Maryborough QLD 4650
Facsimile 4122 3814

ROCKHAMPTON
164 Berserker Street
(Cnr Elphinstone Street)
North Rockhampton
QLD 4701
Facsimile 4926 1377

MACKAY
25 River Street
Mackay QLD 4740
Facsimile 4953 4151

TOWNSVILLE
287 Ross River Road
Aitkenvale QLD 4814
Facsimile 4725 3401

INNISFAIL
8 Fitzgerald Esplande
Innisfail QLD 4860
Facsimile 4048 3386

CAIRNS
181 Aumuller Street
Westcourt QLD 4870
Facsimile 4048 1124

GPO BOX 5099, Brisbane QLD 4001

www.bsa.qld.gov.au

Queensland
Government