Part B: Health and Housing

Poor environmental and living conditions promote the spread of infectious diseases. To achieve good health outcomes, most houses in a community must have health hardware functioning most of the time. Houses must be designed well, soundly constructed and regularly maintained.

This section of the Guide provides information on the health hardware required to ensure the nine Healthy Living Practices are taken into account when designing, upgrading or maintaining a house.

Functioning health hardware and the capacity to perform Healthy Living Practices reduce the pool of infectious organisms and, therefore, rates of diarrhoeal disease, skin infection, pneumonia, eye infection and other transmissible diseases. These diseases are common in many Indigenous communities in remote areas.

B1 Washing people

B1 Washing people

Poor hygiene increases the transmission of diseases, including diarrhoeal disease, respiratory disease, hepatitis and infections. The rates of these diseases in some Indigenous communities are as high as in many developing countries and are many times higher than for non-Indigenous children.

Diarrhoeal and respiratory diseases, in particular, are the major causes of illness among Indigenous children and also play a major role in malnutrition in the first three years of life. Skin infection is one of the most common problems of Indigenous children and causes chronic illness and discomfort. Recurrent or persistent skin infection is known to increase the risk of developing kidney disease and rheumatic fever.

Washing children daily is likely to reduce the frequency and spread of these diseases.

- Having functional washing facilities in the house will reduce diarrhoeal disease because organisms are less likely to be transmitted between people, particularly between children and adults.
- Respiratory disease is primarily spread by aerosol droplet transmission. However, it has been shown in Papua New Guinea that a micro-organism that causes pneumonia was found on the hands of mothers who had been handling children[6]. This type of transmission is likely to be even more common in Australian Indigenous children, who have higher rates of nasal discharge and face secretions than children in Papua New Guinea. Other studies have also demonstrated strong evidence for 'secretion swapping' as a method of spreading the micro-organisms responsible for respiratory infections. Washing will reduce the amount of infected secretions on people's faces and hands, and may reduce transmission both by aerosol and by direct contact.
- Persistent scabies infections can lead to an increased risk of infection by other bacteria, especially Group A streptococci associated with impetigo. These infections are most effectively treated by frequent washing and removing the crusting around weeping sores that protects and encourages organism growth. Washing skin sores will not only reduce discomfort and frequency, but will also help to reduce the consequent high rates of renal disease, rheumatic fever and rheumatic heart disease.[7]
- In many regions, Indigenous children have high rates of trachoma and bacterial eye infections. Trachoma is known to be associated with poverty and poor living conditions. Studies have shown regular face washing can reduce the amount of eye infection.
- Washing hands after using the toilet can significantly reduce the transmission of hepatitis.

The health hardware required to support the first healthy living practice[8]: the ability to wash people, particularly children includes a private, functional wet area with hot and cold water supply, shower, a bath or tub for washing children, a hand basin, and working drainage.

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6 Pickering, H. & Rose, G. 1988, 'Nasal and hand carriage of Streptococcus pneumoniae in children and mothers in the Tari basin of Papua New Guinea', *Transactions of the Royal Society of Tropical Medicine and Hygeine*, 82:911-13

7 Pholeros, P, Rainow, S & Torzillo, P 1993, *Housing for Health, Towards a Healthy Living Environment for Aboriginal Australia*, Healthabitat, Newport Beach.

8 Nganampa Health Council Inc., South Australian Health Commission and Aboriginal Health Organisation of South Australia 1987, *Report of Uwankara Palyanyku Kanyintjaku, An Environmental and Public Health Review within the Anangu Pitjantjatjara Lands*, Alice Springs.

B1.1 Wet area design

Wet areas, including bathrooms, toilets and laundries, need to be designed to suit the needs of the residents and local climatic conditions such as:

- responding to the needs of a large family by providing a large enough space for an adult to wash two children and/or separating the toilet and the laundry from the washing areas to allow several people to use the facilities at the same time
- locating the wet area so that it does not open off living areas or other public spaces and can be used privately by all members of the household at all times
- locating the wet area to catch and store the morning sun for warmth in winter
- providing adequate ventilation so that the wet area is not too hot and humid in summer
- ensuring wet areas are accessible to elderly people and people with disabilities.

A well designed wet area will include hardware such as shelves, cabinets, benches, hooks and towel rails to prevent clothes, towels and toiletries being put on the floor, which could block the drains. A well designed wet area will also have natural light and ventilation to reduce mould and bacteria, and decrease running and maintenance costs.

Wet areas need to be robust because they are high use areas in houses. Waterproofing is required to prevent damage to the building fabric and to stop water penetrating into other rooms. Weather protected electrical fittings should be used and all floors should fall to floor drains so that water does not pool or pond against the walls. Fixtures such as towel rails and toilet roll holders should be well secured to the walls.

Where there is a high incidence of chronic illness, for example home dialysis treatments are required, consider including a 'home clinic' within some houses. This could include a separate toilet, a hobless shower for easy access, a tub for washing young children, a lockable medicine cabinet and adequate space for a bed for the isolation or treatment of sick people. Ideally, this space would have a northerly aspect in cold climates, catch the breezes in tropical climates, have views and access to a private outdoor area.

Survey data show that a majority of houses (74 per cent) have separated shower, laundry and toilet facilities, however this figure has declined since 2003. Separated facilities give people greater access to services but detailed design issues involving floor grades and fixtures require attention.

The high proportion of houses containing residents that are frail aged or have a disability (20 per cent) highlights the need to consider access issues and detailed design for all community residents.

Design and specification

Ensure:

- the extent of waterproofing is specified, the product used is compatible with adhesives used in floor tiles or vinyls and that it complies with AS 3740 *Waterproofing of wet areas*
- there are floor drains in the bathroom and the falls to these drains are clearly specified and allow access by people with disabilities
- the wet area can be accessed discreetly and independently by all members of the household including young children, frail aged people and people with disabilities
- the layout, dimensions, surface detailing, materials, fixtures and floor drainage of at least one bathroom and toilet area are designed to comply with the Adaptable Housing Standard (Category C) as a minimum
- at least one toilet has a minimum clear width of 900mm and a minimum depth in front of the pan of 1250mm, excluding door swings, hand basins and other fixtures
- a privacy snib type lock, with emergency release, is specified with the door handles
- flooring has a non-slip finish
- that, if there is only one shower and toilet in the house, wet area facilities such as toilet, laundry, shower and tub are not located in one room
- there are hand washing facilities including a basin or tub near to each toilet
- taps have 'capstan' or lever handles with a single outlet (spout) that can be used by people with limited mobility
- there is provision for hanging towels and clothes, and storage space in showers and next to the bath for toiletries including soap/shampoo
- that, in stud wall framed construction, additional structure such as studs, noggins or structural plywood are specified for fixing taps, towel rails, grab rails in the shower and toilet, shower seats, slider grab rail for hand held shower rose, shelves, hooks and toilet roll holder
- power points, lights and switches are located away from plumbing fittings and that there is a double power point beside the mirror where possible
- there is natural light and ventilation that does not compromise the privacy of the people, by using high level windows, skylights and ducted roof vents
- ventilation in humid locations to control mould
- bathroom joinery is constructed using only waterproof materials.

Consider:

- designing all wet areas so that they can be easily adapted to allow frail aged people or people with disabilities full access to, and use of, wet areas (AS 1428.1 *Design for access and mobility*)
- using grab rails instead of using towel rails throughout the wet area to provide more secure hand holds

- recessing toilet roll holders and soap shelves to reduce the likelihood of injury
- separating the toilet, vanity and shower/bath areas to allow three people to use the wet area at one time
- providing a second bathroom or toilet area, which can be easily accessed from outside the house
- improving comfort in cold climates by ensuring internal access from living areas, making provision for ventilation to be closed, having the wet area facing east to maximise exposure to the warm morning sun and maximising the effectiveness of ceiling and wall insulation
- options for installing 'fail safe' drains to divert waste water away from living areas
- using lift-off hinges for all wet area doors and cutting down the doors to allow easy removal
- specifying anti-mould additives for paints, silicones and grouts
- protecting against water damage to doors, by using solid doors with timber edge trims and not using steel door frames in wet areas
- using a 'wet-seal' product on the entire wet area room substructure before trays and wall linings are installed, and/or using water resistant products throughout, such as sheet products for wall linings and ceilings, and/or welded sheet vinyl for floors and wall linings
- using wall hung cabinets in wet areas, mounted at least 300mm above the floor, to prevent water damage and make cleaning easier
- using weather protected power points and light switches in all wet areas
- providing secure, child proof storage for medicines and first aid kits
- incorporating a bench seat next to the shower for use by children, the frail aged and people with disabilities
- making provision for future installation of hand basins in one or more bedrooms if required by residents with specific medical needs.

Quality control

During construction and before making the final payment, check that:

- door swings do not restrict use of the wet area
- fittings such as locks, clothes hooks, grab rails, towel rails, cabinets, benches and shelves are securely fixed to the structure
- floor grades fall to the floor drains and there is no part of the floor where water ponds
- floor, wall and ceiling finishes are as specified and properly installed without gaps
- all power points are located safe distances from plumbing fittings
- waterproofing has been installed and has been covered by warranty

In cold climates, check that:

- the floor and wall junctions in wet areas are well sealed
- ventilation does not cause the wet area to become draughty.

In warm climates, check that:

- there is good natural ventilation and additional mechanical ventilation if required
- paint, silicones and grouts contain anti-mould additives.

Maintenance

As part of cyclical maintenance:

- maintain and repair bathroom, shower and toilet windows, doors and locks to provide privacy
- repair or replace broken or missing hooks, towel rails, grab rails and shelves
- replace standard power points with weather protected power points in wet areas
- patch or repair holes in floors, walls and ceiling linings
- replace missing and cracked floor and wall tiles.

Survey data

Wet area design	Percentage of houses	Total houses surveyed	Change since 2003*
Wet area layout			
Shower, toilet and laundry are separated and can be used independently	74%	3,660	‹
Shower, toilet and laundry are partly combined	21%	3,660	
Shower, toilet and laundry are fully combined	5%	3,660	
No shower	1%	1,699	
Only 1 shower	90%	3,097	
More than 1 shower	9%	3,097	
No flush toilet	1%	1,699	
Only 1 toilet	83%	3,099	
More than 1 toilet	16%	3,099	
No hand basin	14%	1,699	
Only 1 hand basin	79%	3,072	
More than 1 hand basin	13%	3,072	

Wet area design	Percentage of houses	Total houses surveyed	Change since 2003*
Showers, bath and toilets			
Functional shower rose	62%	3,643	
Shower waste diameter adequate (more than 100mm)	65%	3,082	
Functional shower room door and lock (inside only)	65%	3,640	
Shower floor graded to floor drain	66%	3,642	
Shower room ventilation	87%	3,643	
Functional clothes hook(s) in shower room	34%	3,644	‹
Functional towel rail(s) in shower room	48%	3,644	+
Functional shelves in shower room	39%	3,643	
Houses with baths	58%	2,145	
Bath secure	94%	2,133	
Bath area – floor finish OK	81%	2,134	
Bath area floor graded to floor drain	66%	2,133	
Combined bath and shower	51%	2,135	
Functional bath spout	79%	2,129	
Functional bath drainage	90%	2,130	
Single flush cistern	37%	3,639	
Dual flush cistern	63%	3,639	‹
Full flush test OK (a standard flush test)	86%	3,639	
Toilet area floor graded to floor drain	50%	3,660	
Toilet ventilation	88%	3,661	
Functional shelves in toilet area	27%	3,660	
Functional toilet roll holder	58%	3,661	
Disabled and frail aged			
Houses used by disabled or frail aged users as reported by residents	20%	3,099	
Disabled or frail aged users present and reported – adequate access	11%	3,099	
Disabled or frail aged users present and reported – poor access	8%	3,099	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS 3740 – 2004, *Waterproofing of wet areas within residential buildings*

AS 1428.1–2001, *Design for access and mobility – General requirements for access – New building work*

HB52–2000, *The Bathroom Book*

AS 4299–1995, *Adaptable housing*

AS 3958.2–1992, *Ceramic tiles – Guide to the selection of a ceramic tiling system*

AS 1428.2–1992, *Design for access and mobility – Enhanced and additional requirements – Buildings and facilities*

AS 3958.1–1991, *Ceramic tiles – Guide to the installation of ceramic tiles*

BCA, Part 3.8.2, *Wet areas*

Queensland Government Department of Housing Residential Design Manual 5.2 Floor coverings http://www.housing.qld.gov.au/initiatives/smarthousing/publications/rdm/requirements/houses/5/house_52.htm

B1.2 Hot water

Hot water is essential for daily living, particularly for washing people and cleaning. When selecting hot water systems, consider the residents' needs, household population, climate, water quality, energy usage, type, and both the capital cost of the system and the running costs. Hot water system capacity should be based on peak demand times in each household and a minimum of 50 litres of hot water per person per day, at a temperature of 50 to 60°C[9], is suggested as a guide for working out the hot water system size.

An inefficient hot water system can put a strain on the household's budget and at least half of the energy bill can be spent heating water. People on a low income may not be able to afford high energy bills and this can result in loss of power and subsequent loss of hot water. Consider using solar or gas systems that do not rely on electrical power and, if using an electric system, aim for an efficiency of at least 50 litres of hot water for every kilowatt hour of electricity.

Water that is too hot can cause severe burns, particularly to children and elderly people. It is a mandatory requirement in Australia that hot water systems in new houses and, if carrying out major changes to plumbing systems including hot water systems in existing houses, that hot water systems are fitted with tempering valves that control the water temperature to washing points in the house.

9 Hot water should be stored at no less than 60°C to prevent growth of harmful organisms; the hot water temperature at shower, bath and basin should be tempered at a maximum of 50°C to prevent scalding; a minimum hot water temperature of 45°C is required at all hot water outlets allowing for temperature loss between the hot water system and the outlets.

Poor quality water that impacts on the function and durability of hot water systems and associated valves directly affects operational and maintenance costs because of the need for frequent replacement of hot water systems and parts. It is important to carefully research and specify all components of the hot water system including storage tank, element, sacrificial anode, relief valves, tempering valves and solar panels (if applicable) to achieve the best outcome for the local water quality.

Data show that just over half of all hot water systems installed (51 per cent) are electric and have large capacity heating elements. Whilst 80 per cent of these systems were able to deliver water at temperatures above the required 45°C, almost half (47 per cent) were producing water above 62°C, increasing both the risk of burns and the cost of running the house.

Solar hot water systems were the second most common system type (40 per cent), with gas, heat pump and solid fuel systems comprising only 6 per cent of all systems. Most solar systems have electrical boosters to supplement the solar energy.

Survey data shows that hot water pressure relief valves continued to perform poorly (26 per cent), but since 2003 there has been a 20 per cent increase in the number of valves functioning. Faulty valves waste hot water and residents' money, as well as being a possible safety risk.

Design and specification

Confirm the specified hot water system will:

- deliver at least 400 litres of hot water, including recharges, at a minimum temperature of 45°C at hot water tap points around the house during a 24-hour period
- provide hot water at peak demand times regardless of weather conditions
- operate with the available water pressure – this is particularly important for places with low pressure and for low pressure systems
- function efficiently in relation to variable water quality
- function in the variable climatic conditions.

Ensure:

- the hot water system is located close to the shower
- the re-charge time on gas or electric units will deliver the required quantity of hot water
- pressure relief valves on roof mounted hot water systems discharge to a 'tundish' or drain and not onto the roof, as high levels of mineral salts and/or the copper in the hot water system will corrode the roofing and gutters
- ground level hot water systems are installed on a plastic tray, on a concrete or masonry pad, rather than timber or steel frames which can deteriorate rapidly
- hot water supply pipes are 'lagged' (insulated) to improve efficiency
- tempering valves where required and installed are suited to local water conditions, are specified and are located in a valve box that is easily accessible for maintenance and adjustment

- the temperature of the hot water to the kitchen sink is not tempered as hot water can be useful in breaking down grease in kitchen sink drainage
- an electrical isolation switch is provided for maintenance of roof mounted systems
- instantaneous gas hot water systems have an automatic ignition rather than a pilot light
- the hot water system is fitted in accordance with AS/NZS 3500.4.2:1997, Amendment 1 – 2002, *National plumbing and drainage code – Hot water supply systems – Acceptable solutions*, clause 1.6.1.

In areas where water quality is poor, consider:

- specifying a sacrificial anode and element suited to the specific water quality
- using electric elements of less than 2400 watts because larger elements have a quicker rate of calcification
- specifying the tempering valve to the specific water quality
- using 'jacketed' solar hot water systems with heat exchange fluids in the panels rather than using local poor quality water
- installing a removable metre length of pipe on the hot water supply side of the system that can easily be replaced when it becomes calcified.

Consider energy saving measures such as:

- using an electric element of less than 2400 watts because larger elements can significantly increase running costs
- off-peak electricity but make certain the hot water system can meet demand between heating cycles and the storage tank is well insulated
- solar systems with a 'one-shot' booster switch that heats the water to a set temperature then automatically turns off
- heat pump or heat exchange system where access to a refrigeration mechanic is available.

Quality control

During construction and before making the final payment, check that:

- the water temperature is greater than 45°C at all tap points in the house, is stored at 60°C at the hot water system, and is tempered to shower, bath and basins tap points to a maximum of 50°C
- the overflow from the pressure relief valve drains safely to ground
- the pressure relief valve does not drain to the roof or gutter to avoid corrosion
- the specified sacrificial anode and element has been provided
- the safety switch fitted on a dedicated circuit for the hot water service is working
- all hot water pipes are lagged

- hot water systems externally installed in cyclonic or high wind are fitted with cyclone brackets and are protected from accidental damage.

Before making the final payment, trade test:

- cold water pressure relief, isolating valve and hot water pressure relief valve
- that pressure relief valve drainage flows safely to the ground and away from the house and hot water system
- an electrical isolation switch is provided on the roof for a roof mounted system or in the ceiling for a ceiling mounted system.

For solar hot water systems:

- trade test that solar panels are facing within 5° of north
- trade test that solar panels are mounted so that the angle of the panels from the horizontal plane is equal to the location's latitude, for example if the location's latitude is 30° south then the angle of the panels will be 30° from the horizontal plane
- trade test that the heat exchange fluid has been correctly added or replenished and the system is sealed
- trade test that the solar booster has been connected if mains power is available
- check that the solar panels are protected from stones and branches
- check that the solar panels are not shaded by buildings or trees.

For gas hot water systems:

- trade test that the system, all connections, fittings and the flu are located as required under regulations
- check the gas installation has a compliance plate or certification.

For heat pump hot water systems:

- trade test the installation
- check the panel installation in 'split' type models where heat exchange panels are separated from the cylinder
- check the fan and air filter pads in 'compact' type models
- check that the system does not require additional refrigerant gas.

Maintenance

As part of cyclical maintenance, at least once a year:

- check that the kitchen tap point delivers hot water at 60°C and that all taps requiring tempered hot water deliver water to a maximum temperature of 50°C.

- check that all pressure relief and isolating valves are functioning and arrange for a plumber to replace if required
- check and re-fill the heat exchange fluid in solar hot water systems
- check and repair lagging on all hot water pipes
- replace the tap washers, as leaking hot water taps reduce the hot water available to residents and increase the household's energy bill.

As part of cyclical maintenance, at least once a year, trade test:

- the condition of the sacrificial anode and electric element and replace if required
- the main hot water storage cylinder for corrosion or build up of mineral salts
- the hot water system thermostat is set at 60°C
- the condition of collector panels and the heat exchange fluid in solar hot water systems
- the condition of collector panels or air filter pads of heat pump systems, and that the system is filled with refrigerant gas.

Survey data

Hot water	Percentage of houses	Total houses surveyed	Change since 2003*
Power type			
Electric powered hot water system	51%	3,653	
Solar powered hot water system	40%	3,653	
Gas powered hot water system	6%	3,653	
Heat pump hot water system	0%	3,653	
Solid fuel hot water system	0%	3,653	
No hot water system	2%	3,093	
System component performance			
Hot water pressure release/relief valve functional	74%	2,988	++
All other hot water system valves functional (stop valve and cold water pressure relief valve where needed)	74%	2,971	
Element capacity not applicable as house has either gas, heat pump, solid fuel or no booster system	15%	2,863	
Electric hot water system with element capacity less than 1800 watts	7%	2,863	
Electric hot water system with element capacity between 1800 to 2400 watts	24%	2,863	

Hot water	Percentage of houses	Total houses surveyed	Change since 2003*
Electric hot water system with element capacity greater than 2400 watts	50%	2,863	
No element size information	8%	1,422	
System capacity			
Hot water systems producing more than 50 litres of hot water per person per day (where houses were occupied at time of survey)	43%	3,587	
System temperatures greater than 45°C (minimum required)			
Total of all hot water systems	**74%**	**3,582**	
– of all electric powered hot water systems	82%	1,854	
– of all solar powered hot water systems	66%	1,472	
– of all gas powered hot water systems	61%	230	++
– of all heat pump hot water systems	93%	16	
– of all solid fuel hot water systems	10%	10	
System temperatures greater than 62°C (water too hot, increasing the chances of burns and running costs)			
Total of all hot water systems	**34%**	**3,582**	
– of all electric powered hot water systems	47%	1,854	
– of all solar powered hot water systems	20%	1,472	
– of all gas powered hot water systems	15%	230	
– of all heat pump hot water systems	0%	16	
– of all solid fuel hot water systems	0%	10	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

Centre for Appropriate Technology Inc. '*Hot Water*' Bush Tech Brief #1, *Our Place*, 17, Winter 2002, Alice Springs, http://www.icat.org.au/documents/ op17.pdf

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Pholeros, P 1997, *Energy and Water Use Required for Health in Housing on the Anangu Pitjantjatjara Lands North West of South Australia*, for UPK Nganampa Health Council Inc., pp. 1-6

Apunipima Cape York Health Council, Centre for Appropriate Technology Inc., Healthabitat and Pormpuraaw Community Council 1997, *Pormpuraaw Housing for Health, Towards a Healthy Living Environment for Cape York Communities*, project report, pp. 40-3

Pholeros, P, Rainow, S. & Torzillo, P 1993, *Housing for Health, Towards a Healthy Living Environment for Aboriginal Australia*, Healthabitat, Newport Beach, pp. 45, 90-1

B1.3 Taps

A house may have twenty taps or valves, including two shower taps, two basin taps, two laundry tub taps, two washing machine taps, two yard taps, a toilet cistern stop tap and cistern valve, two bath taps, two kitchen taps, a hot water system relief valve, stop valve and cold water relief valve and a main house isolation valve. If any of these taps do not work, residents will be less able to carry out the Healthy Living Practices. One dripping tap can waste up to 600 litres of water a day and hot water lost through leaking taps can increase the household energy bill. If many taps are leaking in a community water system, the water supply and waste water systems will be adversely affected. See C1.2 Water quantity and demand management.

Taps should be given careful attention when designing and specifying new works with consideration of the local water quality, easy maintenance and use by people with arthritis or limited mobility. When selecting taps, consider:

- how and where the tap is mounted, for example bench mounted taps are easier to maintain than wall mounted taps and may be easier for people with disabilities to use but bench mounted taps can cause water damage to the bench if not well installed
- the body material, tap 'bodies' are commonly made of brass, but plastic and stainless steel bodies may be better when the water has low alkalinity or contains high levels of mineral salts
- whether the tap uses a washer or ceramic disc, washers are cheap and easy to replace and tend to be longer lasting in water that contains sand, grit or other particles (river water) but ceramic disc taps are easier for children and people with disabilities to use and can have fewer maintenance requirements if the water is free of particles
- the seat material, stainless steel seats are readily available and last longer than brass seats, particularly when the water has low alkalinity or contains high levels of mineral salts
- the handle type, lever handles and 'flick' mixers are easier for people with disabilities to use and plastic handles should be avoided
- the use of flow regulators in poor water quality, which can cause constant maintenance problems.

Simple changes to tap specification and installation can reduce maintenance, improve performance and enable all residents to easily use the taps.

Data on the performance of hot and cold water taps in all areas of the house continue to show a difference in performance, with hot water taps recording poorer performance than cold water taps.

Design and specification

Ensure:

- that all parts of the selected tap, including the handle, flange, seat, spout and pillar, are made of durable materials which are suited to local water conditions
- tap ware is standardised for easy maintenance and allows for handles to be changed to capstan or lever handles if required to meet the needs of residents with disabilities
- in the laundry, taps are positioned at the side of the tub within easy reach for people with disabilities.

Consider:

- the benefits of anti-vandal tap handles that are less likely to work loose and fall off the fitting
- using 'flick mixer' type taps or lever handles and quarter turn ceramic cartridge taps for people with arthritis or limited strength
- using ceramic cartridge and mixer taps where water does not contain high levels of particulates
- installing flow restrictors to achieve greater water conservation and reduce water costs where water quality is suitable
- incorporating a service panel to access wall mounted taps for maintenance
- selecting stainless steel seats in areas with poor water quality.

Quality control

During construction and before making the final payment, check that:

- the taps and spouts are secure
- there is water flow from all taps and spouts and the hot and cold water have been correctly connected to hot and cold taps
- taps and spouts are not leaking or dripping
- spout strainers are free of plumbing waste that could have been flushed through the pipes during construction
- tap handles are easy to turn on and off
- if anti-vandal taps have been specified, check that the grub screws have been installed and the handles cannot be removed
- a manufacturer's warranty is provided for the taps.

Maintenance

As part of cyclical maintenance:

- check for leaks in all taps and spouts, including yard taps
- consider replacing all tap washers regularly to prevent leaks and reduce wear to the tap seat.

When upgrading houses, select new taps to suit local water quality and consider standardising taps in all houses for easy maintenance. Also, ensure compliance with the Adaptable Housing Standard by locating laundry taps at the side of the tub, using capstan or lever handle tap sets with a single outlet and locating taps in kitchens as close as possible (approx 300mm) from the front of the sink.

Survey data

Taps	Percentage of houses	Total houses surveyed	Change since 2003*
Houses with yard taps			
No yard taps	4%	3,660	
1 yard tap	26%	3,660	
2 yard taps	59%	3,660	
3 or more yard taps	11%	3,660	
Houses with all yard taps OK	63%	1,631	
Wet area taps			
Shower – functional hot water tap	73%	3,639	
Shower – functional cold water tap	77%	3,641	
Basin – functional hot water tap	73%	3,360	
Basin – functional cold water tap	75%	3,401	
Bath – functional hot water tap	67%	2128	‹
Bath – functional cold water tap	69%	2,129	‹‹
Washing machine – functional hot water tap	69%	3,541	
Washing machine – functional cold water tap	75%	3,562	
Laundry tub – functional hot water tap	70%	3,045	
Laundry tub – functional cold water tap	74%	3,047	‹
Toilet cistern – functional stop cock (shut off valve)	77%	3,639	
Hot water system taps and valves			
Functional hot water pressure release or relief valve	74%	2988	++

Taps	Percentage of houses	Total houses surveyed	Change since 2003*
All other hot water system valves functional (cold water pressure limiting valve (if installed), and the hot water system shut off valve)	74%	2,971	«
Kitchen taps			
Kitchen – hot tap functional (hot water OK)	61%	3,620	
Kitchen – hot tap not functional (hot water OK)	10%	1,666	
Kitchen – cold tap functional (cold water OK)	68%	3,627	‹
Kitchen – cold tap not functional (cold water OK)	15%	1,669	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS 1428.1–2001, *Design for access and mobility – General requirements for access – New building work*, section 1.1.3

Bailie, R., Carson, B., McDonald, E. 2004 'Water supply and sanitation in remote Indigenous communities – priorities for health development' in *Australian and New Zealand Journal of Public Health*, Vol 28, No 5: 409-413

Pholeros, P, Rainow, S & Torzillo, P. 1993 *Housing for Health, Towards a Healthy Living Environment for Aboriginal Australia*, Healthabitat, Newport Beach

B1.4 Washing young children – baths and tubs

Regular washing of children can prevent the spread of disease and improve health. Every house requires at least one facility where babies and children can easily be washed. Ideally, this would include a tub for washing babies and a bath for washing children.

Ceramic hand basins are usually too small for washing babies and baby baths may not be available in the local store. Residents often use the laundry tub to wash young children because it is large and at a good height. Consider installing a large laundry tub, greater than 40 litre capacity.

If incorporating a bath tub in the wet area, avoid using a combination shower/bath as this can be difficult and dangerous to use, particularly for older people or people with disabilities. Plan the bathroom to allow an adult to attend to at least two children in the bath at once. Set out the bathroom for maximum accessibility for a person with limited mobility. When specifying a bath, consider durability, size and how it will fit within the overall wet area layout.

Data shows that the laundry tub provides the greatest opportunity to wash a small child, with 90 per cent of houses having a secure laundry tub. Baths are available in more than half of all houses (58 per cent). Although more houses had basins that could be used to wash a young child compared to 2003, the availability of these facilities was limited to 36 per cent of all houses in 2006.

Design and specification

Ensure:

- facilities are available for washing children in every house, including at least one large tub or easily accessible bath, with tempered hot water, cold water and drainage to a waste water drainage system
- Baths and tubs are fitted in accordance with AS/NZS 2023:1995 Baths for ablutionary purposes and AS/NZS 1229:2002 *Laundry troughs and tubs*.

Consider:

- providing a 70 litre flush line tub with hot and cold water supply in the laundry or bathroom, set into a bench top, which will provide space for changing nappies, drying and dressing a child
- alternatively, providing a larger hand basin in the bathroom to wash a baby
- when providing a tub in the laundry, specifying a bypass drain for the washing machine to prevent dirty waste water from the washing machine flowing into the laundry tub
- using a swivel spout and locating taps to prevent injury to children being washed in the tub
- connecting the laundry taps to the hot water tempering device to prevent scalding, particularly if the laundry tub taps will also be used for hand washing or for washing children
- providing a bath for washing children
- fitting a grab rail around the bath for children and elderly people to safely step in and out of the bath
- providing a bench/seat near the bath for drying and dressing a child
- using a chain to secure the tub/bath plug
- providing soap holder, shelves out of reach of children, towel rails, grab rails and hooks near the bath and/or tub.

Quality control

During construction and before making the final payment, check that:

- there is hot and cold water supplied to the tub and that the bath, taps and spouts do not leak
- drainage is connected to the tub and/or bath and does not leak
- the laundry tub is fixed and well sealed to the wall or bench
- the bath has been securely supported at the base and water-proofed to adjoining walls
- the wall behind the laundry tub and/or bath has been waterproofed and lined with a water impervious surface such as wall tiles, laminated sheet, sheet vinyl or stainless steel, which is sealed to the bath, tub or bench
- the bath or tub are not cracked or damaged
- a swivel spout is fitted if specified

- there is a plug, secured on a chain to the tub and/or bath
- a bypass drain is provided for the washing machine in the laundry tub or by a separate waste pipe.

Ensure:

- the builder provides a warranty for the waterproofing of the bathroom area
- a manufacturer's warranty is provided for the, tub and/or bath, and basin.

Maintenance

As part of cyclical maintenance, check that:

- the hot and cold taps and drainage are all working
- there is a plug at the tub and/or bath
- the waterproofing is intact and there is no sign of mould or water penetration in the surrounding walls
- the fixtures and fittings are secure
- there is no water damage to benches and cupboards.

Survey data

Washing young children – baths and tubs	Percentage of houses	Total houses surveyed	Change since 2003*
Houses with basin or tub (excluding laundry tub) big enough to wash a young child	36%	3,401	++
Laundry tub suitable for washing young children	98%	3,057	
Secure laundry tub	90%	2,985	
Laundry tub with independent washing machine waste outlet	68%	3,617	+
Houses with baths	58%	2,145	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS/NZS 1229:2002 *Laundry troughs and tubs*

AS/NZS 2023:1995 *Baths for ablutionary purposes*

Bailie, R., Stevens, M., McDonald, E., Halpin, S., Brewster, D., Robinson, G. and Gutheridge, S. 2005 'Skin infection, housing and social circumstances in children living in remote Indigenous communities: testing conceptual and methodologies approaches' in *BMC Public Health*, 2005, 5: 128

B1.5 Showers

A functioning shower is important for health. All parts of the shower should be designed, built and maintained to enable people to wash themselves at least once a day. The shower contains a number of interdependent parts that must be working to provide benefit to the residents of the house.

Data shows that shower areas could have the following faults:

- poor quality water can corrode taps and cause leaks and wastes water (27 per cent of hot water taps not working)
- poor quality water can also block shower rose holes (38 per cent not working), which can lead to residents removing the shower rose
- if shower bases and walls are not completely waterproofed, water will penetrate the walls and damage the supporting floor structure (30 per cent of walls show signs of water penetration)
- if floors do not fall to floor drains (34 per cent floors not drained), water will pond, make the floor less safe and more difficult to clean
- shower trays, hobs and showers over baths can limit accessibility for elderly people and people with disabilities (51 per cent of houses that have a bath have a combined shower and bath)
- lack of door locks for privacy (35 per cent), no clothes hooks (66 per cent), no shelves (61 per cent) and lack of towel rails (52 per cent).

Design and specification

Ensure:

- the shower rose and taps are located so that the water spray stays within the shower cubicle
- the taps are located outside of the shower stream, so they can be turned on and off without the risk of scalding hands or any part of the body
- the shower area is graded to the shower floor drain, which should be a minimum diameter of 100mm, located directly under the main shower stream and at the lowest drainage point in the room; this width will allow inspection of the drain at quality control stage
- the shower cubicle can be used by people with limited mobility and by parents assisting children (1160mm x 1100mm clear shower area)
- soap and shampoo can be stored in the shower area, and clothes hooks, towel rails, grab rails and shelves are securely fixed near the shower cubicle
- the shower cubicle is fully waterproofed and shower bases and joints between baths, showers and walls are detailed to prevent leaks in accordance with AS 3740 *Waterproofing of wet areas*
- that, if the shower is separated from other wet area facilities, there is a space for people to dry and dress in the shower room and that personal items can be stored away from the water stream and water spray created during showering.

Consider:

- waterproofing all walls in the shower cubicle to above the height of the shower rose and extending the water resistant wall lining to this height
- using fixed or single swivel wall-mounted roses and avoid multi-jointed shower arms and plastic shower roses
- using water saving shower roses if the water quality shows low levels of mineral salts
- providing a grab rail in the shower and next to the entry to the shower for support
- incorporating a folding seat in the shower enclosure, which complies with AS 1428.1
- providing at least one shower in each house that can be accessed by people with disabilities that complies with AS 1428.1 *Design for access and mobility*
- providing a second capped outlet in the shower for future provision of a hand held shower rose, particularly when a ceiling mounted shower rose has been used
- recessing the soap holder to reduce the likelihood of injury
- avoiding sliding shower screens because they require frequent maintenance
- using polycarbonate screens instead of glass for greater durability and safety
- providing external showers as a secondary showering area.

Quality control

During construction and before making the final payment, check that:

- the shower rose:
  - directs water onto the person and does not cause leaks or drainage problems
  - has large holes where water quality is poor
  - is water efficient in areas where there is good water quality
- the shower area floor falls to the floor drain
- if using a shower tray, that the base is fully supported with non-shrink grout
- the corners, shower bases and wall junctions are sealed to prevent leaks
- the builder has provided a warranty for the wet area waterproofing.

Maintenance

As part of cyclical maintenance, check that:

- hot and cold water is available
- the drains are working
- there is a good flow of water from water saving shower roses and flow limiting devices, especially for locations with poor water quality
- tap handles are secure, can easily be turned on and off, and are not leaking.

Survey data

Showers	Percentage of houses	Total houses surveyed	Change since 2003*
Shower, toilet and laundry are separated and can be used independently	74%	3,660	
Functional shower rose	62%	3,643	
Functional shower drain	89%	3,640	
Shower – functional hot water tap	73%	3,639	
Shower – functional cold water tap	77%	3,641	
Shower walls: sound and well sealed	70%	3,642	
Floor finish in shower	76%	3,643	
Shower floor graded to waste point	66%	3,642	
Combined bath and shower	51%	2,135	
Functional shower room door and lock (inside only)	65%	3,640	
Functional clothes hook(s) in shower room	34%	3,644	‹
Functional towel rail(s) in shower room	48%	3,644	+
Functional shelves in shower room	39%	3,643	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS 1428.1–2001, *Design for access and mobility—General requirements for access—New building work*

HB52–2000, *The Bathroom Book*

Anda, M & Ryan, J 1998, *Saving water for healthy communities: a workbook for Aboriginal communities*, Remote Area Developments Group, Murdoch University, Perth, p. 5

Pholeros, P. 2002 'Housing for Health and Fixing Houses for Better Health' in *Environmental Health*, vol 2, no 4: 34-38

B1.6 Wet area drainage

When drains fail to work, waste water pools in wet areas or flows into other parts of the house and this can have serious health consequences for the residents.

If there are no floor drains, or the grade of the floor does not fall to the floor drain, water will pond in the wet areas and make the floors slippery, more difficult to clean, and cause damp and mould. The long term effects of pooling water can include rot, rust, termite attack and eventually, structural failure.

Data demonstrates that surveyed houses lacked grades that fall to the floor drain in the following areas: shower floors (34 per cent), floors beneath bathroom basins (37 per cent) and toilet floors (50 per cent).

Design and specification

Ensure:

- water can flow to a floor drain from every point in the laundry and bathroom
- the falls to the floor drain are even to prevent water pooling on the floor
- the floor grade in the shower area has a minimum of 25mm from the wall or door threshold to drain (and generally 1:80 shower, 1:100 bathroom) if the bathroom is 2x2m and the waste is central from wall to waste = 1000 and falls 10mm, this would be difficult to check/achieve without ponding
- fall to the floor drain, the shower waste is lower than the main bathroom floor drain and has a minimum 100mm drains up to floor level are used in all locations even if fittings within the wet area reduce to a smaller diameter drain
- all floor drains are accessible for maintenance and there is an inspection opening in the external drainage line
- that, if the floor drain is blocked, the wet area floor levels are designed to allow waste water to flow out of the house rather than into living areas
- wet area drainage complies with AS/NZS 3500.1:2003 *Plumbing and drainage – Water services* and AS/NZS 3500.2:2003: *Plumbing and drainage – Sanitary plumbing and drainage*.

Consider:

- providing floor drains in toilets to avoid flooding the house if the toilet overflows, and to make it easier to clean the floor
- using stainless steel screw-in floor drain grates rather than plastic floor drain grates
- specifying the use of puddle flanges at all floor drains
- avoiding the use of dry floor wastes, as these discharge waste water to the yard area, which may attract frogs, toads, cockroaches and snakes, and can be covered with soil
- that if a dry floor waste is used, the waste water will discharge above ground level to a safe point in the yard and not under the house, and the dry floor waste is fitted with a 'frog flap'.

Quality control

During construction, check:

- the slab set downs allow for minimum floor grades before concrete is poured, or
- the sub-floor framing is set down or graded to allow for minimum floor grades before floor sheet material is fixed.

Before making the final payment, check that:

- all floors are graded to a floor drain by rolling a golf ball on the floor (no mess) or tipping a bucket of water over the floor (mess)
- every drain can remove at least one full bucket of water
- the levels of floor drains are not lower than the surrounding ground
- the exit points of dry floor waste outlets are above ground level and are not blocked
- all drains can be accessed for maintenance and there is an inspection opening to the external drainage line.

At handover, before making the final payment, trade test:

- all drains, including in-ground drainage to ensure that they are working
- the overflow system, by simulating a blockage and ensuring waste water flows out of the house
- the base of waste water traps for grout, mortar and builders' waste.

Maintenance

As part of cyclical maintenance:

- test all drains are working and that water is not pooling in wet areas.

Survey data

Wet area drainage	Percentage of houses	Total houses surveyed	Change since 2003*
Shower – functional shower cubicle drainage	89%	3,640	
Shower – no floor waste outlet	11%	1,685	
Shower – functional floor waste outlet	74%	3,638	
Shower – floor waste outlet not functional	21%	3,638	
Shower – floor graded to waste point	66%	3,642	
Basin – functional drainage from the basin	86%	3,398	+
Basin – no floor waste outlet	12%	1,442	
Basin – functional floor waste outlet	70%	3,390	

Wet area drainage	Percentage of houses	Total houses surveyed	Change since 2003*
Basin – floor waste outlet not functional	24%	3,390	
Basin area – floor graded to waste point	63%	3,388	
Bath – functional drainage from the bath	90%	2,130	‹
Bath – no floor waste outlet	6%	720	
Bath – functional floor waste outlet	77%	2,132	
Bath – floor waste outlet not functional	21%	2,132	
Toilet – functional toilet passes full flush test	86%	3,639	
Toilet – no floor waste outlet	36%	1,699	
Toilet – functional floor waste outlet	50%	3,654	+
Toilet – floor waste outlet not functional	33%	3,654	
Toilet area floor graded to waste point (or to a waste outlet next to the toilet area)	50%	3,660	
Laundry – functional washing machine drainage	79%	3,579	
Laundry – no floor waste outlet	20%	1,654	
Laundry – functional floor waste outlet	55%	3,608	
Laundry – floor waste outlet not functional	35%	3,608	
Laundry – functional laundry tub drainage	89%	3,047	
Laundry floor graded to waste point	56%	3,610	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS/NZS 3500.1:2003: *Plumbing and drainage – Water services*

AS/NZS 3500.2:2003: *Plumbing and drainage – Sanitary plumbing and drainage*

Building Standards and Policy Branch 2000, Ministers Specification SA 78A: Housing on designated Aboriginal land, Planning South Australia

Nganampa Health Council Inc., South Australian Health Commission and Aboriginal Health Organisation of South Australia 1987, *Report of Uwankara Palyanyku Kanyintjaku, An Environmental and Public Health Review within the Anangu Pitjantjatjara Lands*, Alice Springs, pp. 14-15

B1.7 Turning water off for plumbing maintenance

Water isolation valves disconnect each house from the mains water supply to allow for plumbing maintenance. Known as stop valves or shut off valves, they are used when changing tap washers, repairing pipes or taps and when there is a major water leak. Valves need to be specified in housing works and consideration needs to be given to the type and location of the water isolation valve.

Survey data show that even teams with the advantage of local knowledge could not find isolation valves in over half the houses surveyed (52 per cent) and, of those valves that were found, 22 per cent were not working. Time spent by plumbers searching for isolation valves uses scarce housing maintenance funds.

If plumbers cannot find the isolation valve, they will be forced to manage repairs by either shutting off the main water supply to many houses or attempting to do repairs by reducing the water pressure, which involves opening up all taps in the house requiring maintenance. Both these options are unacceptable.

Data also shows that functioning water meters were only found in 50 per cent of surveyed houses. Water management requires basic tools such as isolation valves and water meters to be functioning to allow the housing manager to monitor water use and to assist in completing repairs to the water system of a house.

Design and specification

Ensure:

- there is an easily accessed, above ground isolation valve, for example fixed to a wall of the house, which cannot get 'lost' under landscaping or fencing
- the pipes to and from the water isolation valve are protected from motor cars and mowers
- the type of valve is suited to the water quality.

Consider:

- using ball valves, rather than 'jumper' or 'gate' valves, where water quality is poor
- installing a second valve on houses where the service provider insists on a below ground valve at the property boundary
- selecting water isolation valves that have fixed handles and avoid the using anti-vandal valves that do not have a handle
- installing a water meter to assist in water demand management and detecting leaks.

Quality control

During construction and before making the final payment, check that the valve:

- is of the type specified
- is located where specified and is secure
- can be turned on and off and, if it is a jumper valve or gate valve, turn fully on then back one turn to prevent the valve 'binding' shut in the fully open position
- if a meter was specified, it has been installed and is working.

Maintenance

As part of cyclical maintenance:

- check the water isolation valve can be turned off and on and turn jumper or gate valves fully off, then fully on, and then back one turn
- read the water meter and record water use and if a house has a high meter reading, ask the plumber to check for leaks.

Survey data

Turning water off for plumbing maintenance	Percentage of houses	Total houses surveyed	Change since 2003*
Water isolation valve not found	52%	3,651	
Water isolation valve found and functional	37%	3,651	«
Water isolation valve found but non-functional	22%	1,699	
Water meter not found	51%	1,699	
Water meter found and functional	50%	3,659	+
Water meter found but non-functional	26%	3,659	

* See 'Changes in the conditions of houses' on page XXX for an explanation of the symbols used in this column.

Standards and references

AS 4796-2001: *Water supply – Metal bodied and plastic bodied ball valves for property service connection*

B2 Washing clothes and bedding

B2 Washing clothes and bedding

Regular washing of clothes and bedding, which helps to remove any bacteria, dirt, fleas, mites and other irritants or infection, can help reduce the incidence of infectious diseases, such as diarrhoeal disease, respiratory infections, scabies and other skin infections.

Providing washing machines is generally seen as the responsibility of residents, however it may be worth considering supplying commercial type washing machines in houses or in a community laundry to ensure access to reliable, large capacity washing machines. Supplying front-loading washing machines could reduce power and water consumption.

B2.1 Laundry design

Washing clothes and bedding is important to residents and the laundry is likely to be in constant use. A study of laundry use recorded an average of four washing machine loads per day per house (Tietz 1994) and data shows that 75 per cent of surveyed houses had a working washing machine. Therefore a laundry should provide storage space for dirty washing, ample space and services for a washing machine, possibly a dryer, and shelves or cupboards to store cleaning products. Benches, cupboards, floors and wall finishes need to be robust and suited to use in a wet environment. The laundry should also be designed for use by people with disabilities.

A washing machine requires its own taps, waste outlet and power point. If only one set of taps is provided for the washing machine and laundry tub, the machine is more difficult to use, and repeated connecting and disconnecting of the hoses will wear out the fittings. Providing a level, sealed surface for installation of a washing machine will also reduce wear and tear on the machine.

There is no evidence that washing clothes in hot water will achieve improved health outcomes. Given that heating water is one of the major costs of running a house, discuss with the resident capping the hot water tap at the washing machine. This will make more hot water available for washing people and will probably reduce energy bills.

Laundry tubs may be used for many purposes, including storing clothes before or after washing, hand-washing clothes, washing hands, bathing young children, cleaning or filling buckets and large cooking pots, and rinsing fishing or hunting gear. Providing two large laundry tubs can make it easier to carry out more than one of these activities at the same time. Avoid using tubs with built-in plastic or metal cabinets which are prone to rust, can attract cockroaches, and are hard to secure from children.

Design and specification

Ensure:

- there is an accessible space for the washing machine next to the tub, that is at least 900mm wide and at least 700mm deep to suit twin tubs or commercial washing machines and doors should not block any of this space

- there are taps and a waste outlet, which could be a bypass on the side of the laundry tub, specifically located for the washing machine
- there is a power point near the washing machine that is located away from the tubs and taps to prevent contact between power cords and water
- there is at least one 70 litre washing tub next to the washing machine space
- water can drain from the laundry area floor via a floor drain or external opening when there is a plumbing failure, if the washing machine overflows and for cleaning purposes
- the grade of the floor will allow a washing machine to be placed and levelled in that position but the floor falls to the drain to prevent water pooling under the washing machine
- the entire floor area, the floor to wall junctions and the walls behind the tub and washing machine are waterproofed and lined with tiles, laminated sheet product, sheet vinyl or other water-resistant wall linings
- the floor finish is slip resistant
- high level, rust-proof shelves are provided for storage of cleaning products.

Consider:

- providing a double tub or two separate tubs
- using an flush line tub and providing bench space next to the tub
- making provision for the washing of children at the laundry tub, see B.14 *Washing young children - baths and tubs*
- connecting the laundry taps to the hot water tempering device to prevent scalding, particularly if the laundry tub taps are also used for washing hands or children
- providing a soap holder and towel hook near the tub
- using weather protected power points and switches in the laundry with a minimum rating of IP53
- providing additional space and power points for a clothes dryer or freezer to be kept in the laundry
- providing circulation space into and within the laundry for use by a person with a disability, 1550mm clear space in front of fixtures, and locating the taps and power points within reach for a person in a wheelchair
- providing a lockable cupboard for potentially dangerous laundry and cleaning products, and/or a tall broom cupboard or hooks for brooms and mops
- talking with residents about not using the hot water tap for the washing machine.

Quality control

During construction and before making the final payment, check that:

- at least one 70 litre tub is installed with dedicated taps, spout and drainage, and that it is secured to the bench top or the wall

- there is a clear space that is at least a 900mm wide and 700mm deep for the washing machine with dedicated taps and specific waste water outlet, which could be a bypass on the tub
- the washing machine can be plugged in without running electrical leads under or over taps or the tub, and these can be easily reached by a person in a wheelchair
- the laundry floor can drain to a floor drain or external point and water will not flow back into the house
- the area has been waterproofed, the floors and walls are lined with a water-resistant material and the builder has provided a warranty
- there is a lockable cupboard for cleaning products
- benches, cupboards, soap holders, towel rails, additional power points and any other items that have been specified or shown on the drawings have been provided.

Maintenance

As part of cyclical maintenance, check that:

- the taps for the washing machine and tubs are working and not leaking, replace washers if the taps are dripping, check the washing machine taps are not left in the fully open position by opening fully, then turning back one turn
- the drains for the washing machine and tub and the floor drains are working
- the washing machine pipes are flexible and are not leaking at either end
- there is a drain pipe from the washing machine to a dedicated drain
- power points are secured to the wall and are tested as safe
- the tub and surrounding bench or cabinet are secure and in good condition
- there is a plug attached by a chain to the laundry tub.

Dusty environments and water with high salt levels will shorten the life of washing machines. To make washing machines last longer in these conditions, consult manufacturers about maintenance costs and factory modifications.

Survey data

Laundry design	Percentage of houses	Total houses surveyed	Change since 2003*
Houses with one laundry	97%	1,674	
Houses with two laundries	1%	1,674	
Laundry tub and waste water			
Laundry tub present	98%	3,057	
Laundry tub secure	90%	2,985	
Laundry tub hot water tap functional	70%	3,045	

Laundry design	Percentage of houses	Total houses surveyed	Change since 2003*
Laundry tub cold water tap functional	74%	3,047	‹
Functional laundry tub waste outlet	89%	3,047	
Laundry tub plug	39%	2,985	+
Laundry floor waste outlet	80%	1,654	
Laundry floor waste outlet functioning	55%	3,608	
Laundry floor graded to waste point	56%	3,610	
Laundry shelf at least 1500mm above floor	42%	3,619	
Laundry power points			
No power point near washing machine	3%	1,652	
Functional washing machine power point	84%	3,605	
Functional weather-protected power point	40%	3,573	
Washing machine power point safely located	89%	3,575	
Washing machines			
Washing machine space at least 700mm wide (note – this question has now been changed to 900mm wide)	94%	3,620	+
Houses with a working washing machine	75%	3,616	
Separate taps for washing machine	80%	3,615	
Functional hot water tap	69%	3,541	
Functional cold water tap	75%	3,562	
Functional washing machine drainage	79%	3,579	
Independent washing machine drainage	68%	3,617	+

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS/NZS 3000:2000, Amendment 1–2001, Amendment 2–2002 *Electrical installations*

Centre for Appropriate Technology Inc. 1996, *Our Place*, 1st edn, pp. 12-13

Tietz, C 1994, *The Washing Machine Report*, Transform, Waverley, New South Wales

B2.2 Drying clothes and bedding

Some houses do not have a place to dry clothes, bedding or towels. Drying in sunlight is preferable as the ultraviolet light can sterilise clothes and bedding and is also cost-free, unlike an electric clothes dryer that uses a large amount of energy.

Design and specification

Ensure:

- there is an outdoor clothes drying area that is easily accessible from the house.

Consider:

- installing robust clothes lines around the edge of the house or in the yard where it is accessible from the laundry and gets sunlight and breezes, but is not in full view from the street
- locating the clothes line in a private screened area
- in areas with high rainfall, locating clothes lines in covered, ventilated areas such as a verandah, and providing clear roof sheeting over part of this area to help with drying
- using a fixed clothes line rather than a rotary or folding clothes line to avoid moving parts
- providing a slip resistant concrete path or paving to, and around, the clothes line to prevent ground erosion and improve access to the line
- providing lighting to the path and to the drying area
- designing the path to provide access for people using a wheelchair or mobility frame
- installing a lower level clothes line, or a line that can be lowered, for use by people with disabilities.

Quality control

During construction and before making the final payment, check that:

- the clothes line is installed where specified
- the clothes line is securely fixed in the ground or to a wall
- the paths to and around the clothes line are accessible
- the clothes lines have been tensioned.

Maintenance

As part of cyclical maintenance:

- check that clothes lines are functioning
- tighten loose lines
- replace rusted or broken lines
- repair or clean path to clothes line.

Survey data

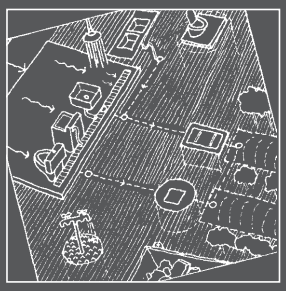
Drying clothes and bedding	Percentage of houses	Total houses surveyed
Area available and secure for drying clothes		
No fenced yard	31%	3,661
Yard area at least 900 square metres	37%	3,661
Yard area less than 900 square metres	33%	3661
Functional yard fence and gates	41%	2,952
Weather conditions suitable for drying clothes at time of survey		
Fine and sunny	69%	3,660
Cloudy or rain	26%	3,660
Strong winds	2%	3,660
Areas around the house able to be used for drying clothes		
No verandah	16%	3,661
Verandah on one side of the house	30%	3,661
Verandah on two sides of the house	35%	3,661
Verandah on three sides of the house	10%	3,661
Verandah on four sides of the house	8%	3,661

Note: This data focuses on access to drying areas that are currently available in the surveyed houses; there are no survey data on the availability of clothes lines.

Standards and references

Pholeros, P 1991, *AP Design Guide, Building for Health on the Anangu Pitjantjatjara Lands*, Nganampa Health Council Inc., Alice Springs, p. 35

B3 Removing waste water safely



B3 Removing waste water safely

Waste water in the living environment can make people sick. If people come into direct contact with waste water, or if their water supply is contaminated with waste water, there is a greater risk of transmitting bacteria and virus that cause disease. These risks are also increased if animals, vermin or insects that have been in direct contact with waste water can pass bacteria on to people.

Removing waste water safely from the house and surrounding living area, and managing it safely at a community level, is important for people's health. This section discusses essential items of waste water health hardware in the house and surrounding living area.

Communal waste water systems that take waste water from the surrounding living area and treat it at a central point are discussed in section C3 'Waste water'.

A household waste water disposal system must include the following components:

- a toilet
- drains from baths, showers, basins, sinks, laundry tubs and floors in these areas
- a floor drain and a grate to prevent objects going down the drains and blocking the pipes
- water trap or seal on each drain, which is a water-filled bend in the pipe under the drain to prevent bad smells spreading from the drain into the house
- drainage pipes that connect and fall to a main house drain located in the yard, which flows into a system for treating and disposing of the waste water
- inspection openings in the drainage pipes and house drain, for maintenance removing blockages
- vent pipes that discharge above the roof to remove bad smelling and volatile gases from the drain pipes
- an overflow relief gully for waste water to discharge into the yard and prevent overflow into the house if there is a blockage in the drain pipes.

These components need to be regularly maintained. Approximately 70 per cent of all maintenance funding used during Housing for Health projects over the past 12 years has been spent on fixing waste water drainage components.

Waste water from houses is described as 'black water' or 'grey water'. Black water is waste water from the toilet. Grey water is waste water from the shower, laundry, basins and kitchen. Grey water can account for up to 90 per cent of the waste water from a house. Research[10] has shown that grey water is not the 'safe' part of the waste water produced by the house as was commonly assumed. If grey water is not properly collected, treated and disposed of, it may have negative health effects on residents.

10 Khalife, MA, Dharmappa, HB & Sivakumara, M 1997, *Safe Disposal of Waste water in Remote Aboriginal Communities*, University of Wollongong, Wollongong.

B3.1 Flush toilets

Flush toilets are a simple and hygienic way to remove black water from the house. Low water use dual flush cisterns are very efficient and a regular maintenance program to prevent leaking cisterns will also reduce water consumption.

It is recommended that each house should have at least one toilet, located separately from other wet area facilities, and in a lockable cubicle.

It is also important that a hand washing facility is provided either adjacent to the toilet or immediately outside the toilet area. Washing hands after using the toilet is important in preventing the spread of disease, particularly hepatitis.

Design and specification

Ensure:

- there is at least one toilet in the house
- if the toilet is in a separate cubicle, the cubicle has a minimum depth of 1250mm in front of the toilet and 900mm clear width excluding door swings and fixtures, to allow use by people with disabilities and an adult assisting a child
- there is a hand washing facility, either a basin or tub, inside the cubicle or immediately outside
- a dual flush cistern is used and the pan is compatible with the cistern
- a stop valve for the toilet cistern is specified to allow the cistern to be turned off for maintenance
- there is an external inspection opening for maintaining the toilet drain
- the pan is properly bedded and securely fixed to the floor and the cistern and pipes are securely fixed to the pan or wall
- there is a toilet roll holder
- the door is fitted with a privacy lock that can be unlocked from the outside in an emergency
- inward opening doors have lift-off hinges that doors are cut down to allow easy removal in an emergency
- the cubicle has natural light and ventilation and an electric light
- there is storage for spare toilet rolls and toilet brushes at a level away from the reach of young children and animals
- there is provision in the structure of the walls for grab rails in accordance with AS 1428.1 *Design for access and mobility*
- toilets are fitted in accordance with AS/NZS 3500.5:2000: *National Plumbing and Drainage – Domestic installations*.

Consider:

- providing a second toilet that may be accessed from outside living areas
- using a plastic cistern that is less likely to be damaged during transport to remote locations
- using a 6/3 litre, six litres for a full flush and three litres for a half flush, or approved lower dual flush cistern
- providing a floor waste drain to prevent flooding in the house if the toilet overflows and to make it easier to clean the floor, using a 100mm diameter water charged floor waste drain with falls to the waste point
- fitting hand rails next to the toilet for the frail aged and people with disabilities
- providing at least one toilet that complies fully with AS 1428.1 *Design for access and mobility*, or that can be adapted in the future for use by the frail aged and people with disabilities.

Quality control

During construction and before making the final payment, check that:

- a dual flush cistern has been provided and that the cistern and pan are compatible
- a cistern stop valve is installed
- a toilet roll holder is securely attached to the wall and there is high storage
- a hand basin is provided nearby
- provision has been made for future fitting of grab rails.

Before making the final payment, trade test that:

- the pan is secure
- the pipes are stable and drain away from the house, and have been tested before backfilling
- inspection openings and vents comply with local regulations.

Maintenance

As part of cyclical maintenance, check that:

- the stop valve is operating and is not permanently open due to build up of mineral salts
- the toilet can be flushed and the cistern refills in less than three minutes
- the pan does not move when pushed gently from side to side and it is not cracked
- the door and privacy lock are secure
- the toilet roll holder is secure and there is a supply of toilet paper that can be stored out of the reach of children and animals
- the floor waste drain is functional
- ventilation, such as a window, can be opened and closed.

Survey data

Flush toilets	Percentage of houses	Total houses surveyed	Change since 2003*
Single flush cistern	37%	3,639	
Dual flush cistern	63%	3,639	‹
Full flush test OK (a standard test used on every toilet)	86%	3,639	
Cistern fully refills in less than three minutes	82%	3,638	
Functional toilet cistern	77%	3,640	
Functional toilet pan	83%	3,645	
Functional toilet cistern stop valve	77%	3,639	
Functional toilet door and lock	66%	3,660	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS/NZS 3500.5:2000: *National Plumbing and Drainage – Domestic installations*

Apunipima Cape York Health Council, Centre for Appropriate Technology Inc., Healthabitat and Pormpuraaw Community Council 1997, *Pormpuraaw Housing for Health, Towards a Healthy Living Environment for Cape York Communities*, project report, p. 35

Pholeros, P, Rainow, S & Torzillo, P. 1993, *Housing for Health, Towards a Healthy Living Environment for Aboriginal Australia*, Healthabitat, Newport Beach, p. 45

B3.2 House drains

An effective functioning drainage system should safely remove waste water from the house. Each fitting and drain should collect waste water and drain it from the house to the treatment system. It is essential that all parts of the drainage system, including pipe sizes, fittings and falls are designed and constructed as specified and are well maintained.

The data show that, in over a quarter of surveyed houses, there were obvious signs in the yard area that the waste water drainage system had failed. Seventy three per cent of houses showed no sign of drainage system failure in the yard area.

Survey data on the diameter of the shower drain, which is usually the highest water-using area of the house, show that only 64 per cent of houses had the recommended 100 mm diameter floor drain.

Design and specification

Ensure:

- there are floor drains in all wet areas and that a 100mm diameter drain is used
- each floor drain has a grate to prevent objects blocking the drain
- the size of all drain pipes is noted on the drawings and the pipes are sized according to plumbing and drainage standards
- inspection openings are noted on the drawings
- a vent at the top of drainage lines is shown on the drawings, as required
- if a waste stack is used for a double storey house, it is vented
- the position of the overflow relief gully is shown on the drawings and it is not near a door or outside the kitchen window
- if 'P-traps' are used for any fixtures, the exposed pipe is protected from accidental damage
- drains are installed in accordance with AS/NZS 3500.5:2000: *National Plumbing and Drainage – Domestic installations*.

Quality control

Ensure:

- the building contract includes a requirement that all drainage works be inspected and tested before trenches are backfilled
- that these drainage inspections are undertaken by a plumbing inspector with qualifications to certify the works.

During construction check:

- the drains have been set out as shown on the drawings
- the exposed tops and ends of drain pipes are covered and sealed to prevent concrete and rubbish getting into the pipes and causing blockages
- barriers are erected to prevent falls into the drainage trenches or damage to the pipes
- all drains have the required fall in the direction that the water has to flow
- the size of drains gets bigger, not smaller, in the direction that the water will be flowing
- drains that are suspended under houses are supported at regular intervals with brackets and hangers, and that in coastal areas, brackets that will not rust are used
- vent pipes, overflow relief gully and inspection openings have been installed
- exposed drains, stacks, gullies and vent pipes are protected from accidental damage by vehicles, mowers and weed cutters

- where any tiling is being installed in the house, check floor drains carefully to ensure that left over grout, used to seal between the tiles, has not washed down the house drains
- drains are water tested before backfilling and ensure all grates are fitted to floor drains after testing
- that downpipes from the roof gutters are not connected to the waste water disposal system.

Before making the final payment, check that:

- the plumber has provided a trade certificate for the works
- the works have been tested and approved by a plumbing inspector
- 'as-built' drawings are provided on completion of the works.

Maintenance

As part of cyclical maintenance:

- run water through all drains to check they are working properly; if the drains overflow or there are leaks under or around the house, contact a plumber to check and fix the drains
- check that caps are fitted on all inspection openings and replace any missing caps; if the caps are frequently being removed by children, consider using a small amount of silicone or a screw on the outside of the caps to secure them but remember that a plumber needs to be able to remove the inspection opening cap for maintenance access
- check the grates on floor drains and drains in fixtures, such as the basin drain and kitchen sink, are in place to prevent blockages and replace missing or broken grates
- check that there is a mesh cap on the top of all vent pipes
- check the grate is in place on the overflow relief gully.

Survey data

House drains	Percentage of houses	Total houses surveyed
All drainage around the house OK (this question records if drainage failures are obvious in the yard area around the house)	73%	3,662
Shower waste drain at least 100 mm diameter (smaller drains increase the chance of blockage)	64%	3,639

Standards and references

AS/NZS 3500.5:2000: *National Plumbing and Drainage – Domestic installations*

B3.3 Septic tanks, common effluent drains and on-site effluent disposal systems

Septic systems are commonly used to treat waste water. Septic systems might include one tank that combines all black and grey water or two tanks that divide the black and grey water. A grease trap may be installed on the kitchen drain to prevent grease or food solids getting into the septic system.

Waste water is treated by bacteria that live in the septic tank. The longer the water is held in the tank, the better the treatment. Crowded households may produce large quantities of grey water from constant use of the washing machine, shower and bath. If a large amount of grey water is constantly produced, it will shorten the treatment time of waste water in the septic tank. It may be necessary to provide a larger tank or two tanks to ensure the waste water receives sufficient treatment time. Leaking taps also increase the amount of water entering the septic system and can further reduce treatment time.

Treated waste water is called 'effluent'. In some communities, the effluent is piped from each house to a collection point for further treatment and disposal. This is called a Common Effluent Drain system (CED). Effluent disposal can also occur at the house site through absorption trenches, which consist of underground trenches that allow the water to soak into the ground. Other types of on-site effluent disposal systems may be used in specific soil type and climatic conditions, such as a high rainfall or high water table, including evapo-transpiration beds or mounds, sand filters, and soakage wells. Waste water from septic tanks can also be drained to underground irrigation systems to water shade trees, ground covers, fruit trees or shrubs.

Septic systems may fail because of poor design and construction, insufficient maintenance, damage by cars, lawn mowers, backhoes, edge trimmers and fires or because they are too small for the population in the house. Septic systems that match the household size are a cost effective and relatively low maintenance way to treat and assist in the disposal of waste water in remote areas.

Data show that septic tanks are used in almost half of the surveyed houses (42 per cent). These systems treat water that may then be disposed of by either common effluent drain systems or local disposal of waste water in the house yard.

Design and specification

When designing the waste water system, take into account:

- the advantages of septic tanks over deep sewer systems or other types of waste water treatment
- the majority of waste water to be treated will be grey water and therefore, composting toilets designed to treat toilet or black waste water will not reduce the need for grey water treatment
- the number of people, including visitors, that will occupy the house, to calculate the number and size of septic tanks that will be required

- the soil type, natural drainage and flood patterns to determine the best disposal system and the disposal area required and arrange to have the soil tested. Get a geotechnical report if you are not sure.
- state, territory and local government requirements for septic tank systems.

Ensure:

- the tank(s) have the capacity to deal with peak population loads
- if used, soakage trenches have the capacity to deal with peak population loads and are designed to suit the soil type and climatic conditions
- the soakage trench base has a slight fall away from the drain
- the tank and trenches, if used, are protected from vehicle access by using mounds, fences or slabs
- if using a grease trap, that the size of the grease trap and length of the trench is adequate for the load and soil conditions
- permeable materials such as gravel, but not sand or soil, are used to backfill disposal trenches and form mounds
- the tanks, trenches and grease trap can be accessed by a pump out truck for maintenance
- septic tanks are installed in accordance with AS/NZS 1546.1:1998 *On-site domestic wastewater treatment units – Septic tanks*.

Consider:

- providing a septic tank of at least 4000 litre capacity, using two tanks of 2000 litres each plumbed (connected) 'in series', or having separate tanks for black and grey water
- including a 'resting trench' to assist with peak loads and extend the life of the disposal field
- implementing strategies to prevent flooding of the septic system by stormwater, such as grading the site away from the septic system and installing cut-off stormwater drains, absorption pits and gutters
- facing the waste water disposal area in a sunny part of the yard area to improve evaporation rates
- using a distribution box to spread effluent evenly between all effluent disposal trenches
- in areas with a high rainfall or high water table, using evapo-transpiration mounds rather than absorption trenches
- locating the septic tank and effluent disposal area down wind of the house, to minimise smells entering the house
- using spreader bars on the bottom of the trench doming to prevent collapse and maximise the effluent disposal area
- using single bollard barriers around septic tanks and effluent disposal fields to prevent vehicle access, but allow maintenance access
- using products in effluent disposal trenches that allow traffic to drive over them without causing collapse or damage.

Quality control

Ensure:

- building contracts include a requirement that all septic tank and effluent disposal works be inspected and tested before being backfilled
- organise for these septic tank and effluent disposal inspections to be undertaken by an inspector with qualifications to certify the works.

During construction, check that:

- layout plans for all services are provided before construction commences
- openings are covered and barriers are erected to prevent people falling into the septic tank during construction
- the septic system construction is supervised, ideally by three inspectors:
  - state or territory health department or local council
  - building project supervisor
  - local environmental health worker
- vehicle barriers are erected around effluent disposal trenches during and immediately after construction, to prevent damage by builders' and residents' vehicles
- drains have been water tested before backfilling.

Before making the final payment, check that:

- 'as-built' drawings are provided on completion of the works
- the plumber has provided the certificate of plumbing and septic tank installation required by local, state or territory regulations
- the size of the septic tank(s) and length of trenches is as specified and/or shown on the drawings
- the total length of soakage trenches is suited to local regulations, soil type and climate
- the falls of all pipes and trenches are as specified
- trench materials have been installed to the manufacturer's specification, including the use of spreader bars on trench doming
- the septic tank and effluent disposal trenches can be accessed for pump out and maintenance
- the yard is graded to direct stormwater away from the waste water system and to drain waste water away from the house if the waste water system fails
- the separation between parallel trenches is approximately 2500mm
- there is an inspection opening at the end of all effluent disposal drainage lines
- down pipes are not connected or discharging to the waste water system
- a distribution box is provided to ensure that waste flows evenly to soakage trenches, and is accessible for maintenance.

Before making the final payment, trade test:

- the septic system by passing at least 2000 litres of water through the system ~~th~~is will indicate leaks or poor grading of pipes and trenches and allow for fixing before the handover of the house.

Maintenance

As part of cyclical maintenance:

- check that the lid and covers to inspection openings on the septic tank are secure
- if lids are broken or in poor condition replace them to prevent people accidentally falling into the tank
- check that the septic tank is in good condition and if there is any evidence of the tank leaking, organise for a plumber to inspect and replace the tank, if necessary
- check that the downpipes from the roof have not been connected to the waste water system and that water running off the roof does not flood the area near the septic tank or the effluent disposal area
- every six to 12 months, check whether the septic tank or grease trap needs to be pumped out and organise a pump out if required
- inspect effluent disposal trenches every two to three years to check they are working properly, they should be damp but not full of water, and organise for new trenches to be built if the trenches have failed
- ensure a fence or barrier is in place to prevent vehicle damage to the septic tanks and trenches.

If a house that has a septic system is subsequently connected to a sewer system or an alternative waste water system, it may be necessary to 'decommission' the septic tank. In this circumstance, ask a waste disposal contractor to remove all waste from the tank and effluent disposal trenches. If possible, remove the tank and effluent disposal trenches from the site and fill the area with sand. If access to the septic tank is restricted, at least remove the lid of the septic tank and demolish the bottom of the tank to allow drainage. Backfill the remaining tank cavity with compacted sand.

Survey data

Septic systems and on-site waste disposal	Percentage of houses	Total houses surveyed	Change since 2003*
No waste water system	3%	3,658	
Septic system	42%	3,658	++
Septic tank and common effluent drain system	28%	3,658	
Septic tank and soakage trenches	14%	3,658	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS/NZS 1546.1:1998: *On-site domestic wastewater treatment units – Septic tanks*

Department of Natural Resources 1999, *Interim Code of Practice for On-Site Sewerage Facilities*, Queensland Government Printer, Brisbane

Khalife, MA, Dharmappa, HB & Sivakumara, M 1998, "An Evaluation of Septic Tank Performance in a Remote Australian Village Provides Insight for Optimizing Onsite Treatment Systems", *Journal of Water Environment Research*, Edition 4, Volume 10, USA, Water Environment Federation, pp 33-36

Mandurah Shire Council, Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 2005 *Decommissioning of Septic Tanks*, City of Mandurah, WA

Martin, M. 2005, *Septic Tanks and Absorption*, Bush Tech #27, Centre for Appropriate Technology, Alice Springs

Marshall, G 2004 *Monitoring of septic tanks on Central Australia remote Aboriginal communities*, NT Department of Health and Community Services in conjunction with the Centre for Sustainable Arid Towns, Alice Springs

Pholeros, P, Rainow, S & Torzillo, P 1993, *Housing for Health, Towards a Healthy Living Environment for Aboriginal Australia*, Healthabitat, Newport Beach, pp. 25, 76-80

South Australia Department of Health guidelines available at: http://www.dh.sa.gov.au/pehs/branches/wastewater/maintain-septic-tank.htm

Northern Territory Department of Health guidelines available at: http://www.nt.gov.au/health/healthdev/environ_health/application_forms/septic_tanks.shtml

B3.4 Aerated waste water treatment systems

Aerated waste water treatment systems use bacteria to treat waste in one or two tanks before pumping the treated water out for local disposal. The treated water can be used to irrigate gardens through underground systems, but must not be used in sprinklers or micro-sprays because there is a risk of contamination.

An aerated waste water treatment system must have electricity to pump air into the treatment tanks and pump out the effluent. This type of waste water system requires regular doses of chlorine and three-monthly maintenance by a specialist or a trained local operator. Before specifying an aerated waste water treatment system or any other package treatment system, confirm that these essential criteria can be met. Also confirm that the system will work with the water quality and average household population.

Design and specification

Ensure:

- the system components, tank and below ground irrigation lines, are big enough to deal with peak population loads
- the soil is suitable for below ground effluent disposal
- reliable electricity is available
- maintenance staff are available and affordable for the chlorine dosing and three-monthly service
- irrigation lines are below ground
- the tanks and irrigation lines are protected from vehicles
- that an overflow system has been incorporated to ensure that the waste water does not flow into the house yard if the system fails
- the tanks and irrigation lines can be accessed for maintenance.
- the system is installed in accordance with AS/NZS 1546.3 2001 *On-site domestic wastewater treatment units – Aerated waste water treatment systems*.

Consider:

- irrigating a sunny area of the yard to improve evaporation rates
- locating the tanks down wind of the house to minimise odours entering the house.

Quality control

Ensure:

- that building contracts include a requirement that all in-ground drainage works be inspected and tested before they are backfilled
- organise for these in-ground drainage work inspections to be undertaken by an inspector with qualifications to certify the works.

During construction check that:

- the manufacturer has certified the design of the system to suit the water quality, household population and climate and that the design has been approved by local or state/territory authorities for use in this area
- layout plans for all services are provided before construction commences
- openings are covered and barriers are erected to prevent people falling into the tanks or excavations during construction

- construction of the system is supervised, ideally by three inspectors:
  - state or territory health department or local council
  - building supervisor
  - community environmental health worker or other health worker
- vehicle barriers are erected around the works during and immediately after construction to prevent access by builders' and residents' vehicles.

Before making the final payment, check that:

- electricity is connected to the system and all moving parts are working
- 'as-built' drawings are provided on completion of the works
- the plumber provides the certificate of plumbing and aerated system installation required by local, state or territory regulations
- total length of irrigation lines is suited to local regulations, population and climate
- the tanks and irrigation lines are accessible for maintenance
- the yard is graded to direct stormwater away from the system and to ensure that waste water will drain away from the living area if the waste water system fails.

Before making the final payment, trade test the aerated waste water system by passing at least 2000 litres of water through the system - this will indicate performance of pumps, leaks or poor grading of pipes and allow for fixing before the handover of the house.

Maintenance

As part of cyclical maintenance:

- refill the chlorine required by the system, as recommended by the manufacturer
- ensure the entire system is serviced by a licensed contractor every three months or as required by the manufacturer.

Survey data

Septic systems and on-site waste disposal	Percentage of houses	Total houses surveyed
Houses using an aerated waste water system	1%	3,658

Standards and references

AS/NZS 1546.3 2001 *On-site domestic wastewater treatment units – Aerated waste water treatment systems*

Downs, S 1997, *Aerobic Waste Water Treatment Systems in Aboriginal Communities* (draft report), Centre for Appropriate Technology Inc., Alice Springs

Khalife, M 2001, *Waste water workshop*, sponsored by the Aboriginal Housing Authority of South Australia and Nganampa Health Council Inc.

Marshall, G 2000, 'Sewage' in G. Harris (ed.) *Environmental Health Handbook: A Practical Guide for Remote Communities*, Menzies School of Health Research, Casuarina, Northern Territory, pp. 107-20

Marshall, G 1998, *Sewerage Systems in Remote Indigenous Communities*, cat. no. 98/8ex, Centre for Appropriate Technology Inc., Alice Springs

Van Dok, W 2000, 'The Water-efficient Garden: A Guide to Sustainable Landscaping in Australia', *Water-efficient Gardenscapes*, Glen Waverley, Victoria

B3.5 Dry toilets

Dry toilets do not use water and can be useful where water supply is extremely limited. There are two types of dry toilets: pit toilets with waste going directly into a hole in the ground or pit, and composting toilets where waste goes into a sealed container or cavity installed above the ground or in the ground. A dry toilet can be a useful addition to a flush toilet for crowded households. Dry toilets do not usually dispose of grey water.

The advantage of a pit toilet is that it is cheap to construct, requires little maintenance and has no moving parts. Disadvantages include the need to dig a large hole and to relocate the toilet when the pit is full. In high rainfall areas with a high water table, the pit will need to be lined to avoid collapse, can fill up with water, may smell and may pollute the water supply.

Composting toilets cost more to build and require regular maintenance. However, a composting toilet that is well constructed and sized to match the house population will not produce much odour and can be used for many years. Since composting toilets are located above a compost container, this often requires stairs and can make access difficult for people with limited mobility.

As with any other toilet, dry toilets need toilet roll holders, privacy locks, light, good ventilation, and a high shelf for toilet roll storage. A hand washing point should be provided near the dry toilet to prevent the spread of disease. Survey data show that five per cent of surveyed houses had a dry toilet.

Design and specification

When specifying and installing a pit toilet, ensure that:

- it is located away from water courses and bores, check local building regulations for recommended distances from a water source, but as a guide a minimum of 100m is recommended
- the bottom of the pit is above the highest water table level
- the pit is fully lined if it is close to a bore or water course or if there is a high water table

- the pit is well vented, drawing air into the pit through the toilet bowl and exhausting air via a dark coloured pipe exposed to the sun that will act as a thermal chimney extending above the roof line, to ensure smells are taken away.

When specifying and installing a composting toilet, ensure that:

- the residents are comfortable with the idea of emptying the chamber and disposing of the compost material, and that this does not conflict with any cultural beliefs
- the type and size of toilet is suited to the household population and expected fluctuations in usage
- the residents have the resources and skills to undertake necessary maintenance
- if the toilet requires a fan, electricity is available
- there is enough space under the building to install, access and maintain the compost chamber.

When specifying any dry toilet system, ensure that:

- it is conveniently located for use by residents
- it is down wind of living areas
- it has natural and electric lighting
- there is adequate natural ventilation
- a locking door, toilet roll holder and shelf are provided in the cubicle
- hand washing facilities are provided near the toilet
- the pit or chamber and vent are protected by fly screens.

Consider:

- building a path between the house and the toilet, which is slip resistant and accessible to people with disabilities
- using a self-closing toilet lid, to provide more protection against flies
- designing the cubicle to comply with AS 1428.1 *Design for access and mobility*, and locating the hand washing point that can be accessed by people with disabilities
- providing the capacity to install grab rails in the future.

Quality control

During construction and before making the final payment, check that:

- the toilet and cubicle are built as specified
- the composting toilet has been installed to the manufacturer's requirements and a certificate has been provided
- there is access to the composting chamber for maintenance
- it is not possible for stormwater to enter the pit or container

- the toilet pan and lid are stable and secure
- the toilet roll holder and shelf are securely attached to the wall
- there is a hand washing point nearby
- if specified, the installations are accessible for people with disabilities.

Maintenance

As part of cyclical maintenance, check that:

- the pan does not move when pushed gently from side to side
- the door and privacy locks are secure
- the toilet roll holder is secure
- fly screens are intact and preventing access for insects or vermin
- there is a water supply to the hand basin.

As part of cyclical maintenance:

- move the pit toilet every five to 10 years, depending on the level of use
- empty the waste container of a composting toilet regularly, most systems require emptying every 6 to 12 months.

Survey data

Septic systems and on-site waste disposal	Percentage of houses	Total houses surveyed
In-ground pit toilet	2%	1,961
Contained composting toilet	3%	1,961

Standards and references

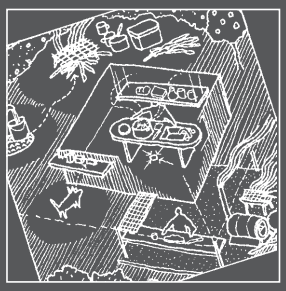
Martin, M. 2004, Waterless Composting Toilets, Bush Tech #23, Centre for Appropriate Technology, Alice Springs

Martin, M. 2003. *Pit Toilets*, Bush-Tech 15, Our Place Magazine. Centre for Appropriate Technology, Alice Springs

Martin, M. 2002. *Choosing the right toilet*, Bush-Tech 15, Our Place Magazine. Centre for Appropriate Technology, Alice Springs

Khalife, MA, Dharmappa, HB & Sivakumara, M 1998, "An Evaluation of Septic Tank Performance in a Remote Australian Village Provides Insight for Optimizing Onsite Treatment Systems", *Journal of Water Environment Research*, Edition 4, Volume 10, USA, Water Environment Federation, pp 33-36

B4 Improving nutrition – the ability to store, prepare and cook food



B4 Improving nutrition – the ability to store, prepare and cook food

Indigenous people have high rates of obesity, diabetes, cardiovascular disease and renal disease. *The primary determinants of these conditions are poor diet and lack of exercise. Poor nutrition is also a critical determinant of infectious diseases in children*. In remote locations, changing to a healthy diet is complicated by factors such as low household income, high cost of food, local store management practices, and the ability to store, prepare and cook food at home.

A reliable water supply is critical for improving nutrition. Drinking water is essential for life and potable water is also required for cooking and mixing food, cleaning food utensils and cooking equipment, and for washing teeth and dental appliances.

When designing a house, consult residents about their cooking preferences. Consider the type of foods that are stocked in the local store and find out what foods might be gathered from gardens, the sea or the bush. Find out how many people are likely to use the house, whether these people belong to different family or generational groups, what traditions the family observe about the cooking and eating of food, and whether the kitchen might be used by people with disabilities. Ask about how food is prepared and what types of stoves, ovens, appliances and utensils are used for cooking. This information indicates the ways that food might be stored, prepared and cooked in and around the house and is essential for the design of indoor and outdoor kitchens that will suit the needs of residents.

The survey data show that only about five per cent of houses have all the health hardware needed to perform this fundamental healthy living practice. Most kitchen areas in surveyed houses showed poor design and construction, use of poor quality materials and health hardware, and a lack of maintenance. The poorest performing items in the house were:

- the kitchen bench material
- the splash back behind the kitchen sink
- a lack of high level storage out of the reach of children and animals
- the performance of all parts of the stove and oven
- the performance of refrigerators and freezers, if they were available.

B4.1 Quality of drinking water

Many Indigenous communities in rural and remote areas do not have access to drinking water. In extreme circumstances, the water will not be safe to drink because it contains micro-biological contaminants that can cause acute gastric disease and other illnesses. When the water is safe to drink, it is called ‘potable’ water, but it may taste ‘bad’. Poor tasting water can have an impact on health, nutrition and household costs because:

- cordial might be added to water to hide the bad taste or people might drink soft drinks instead of water, and both these products contain high levels of sugar
- if expensive bottled water or soft drinks are purchased, this reduces the money available to buy healthy foods
- people may drink less fluid than required for healthy living.

In communities where the water quality is poor, consider ways to provide a small volume of quality drinking water to at least one tap in the kitchen, such as installing household filters or providing a rainwater tank connected to the kitchen. A micro-reverse osmosis unit, which converts a small quantity of poor quality water into potable water, may be an option.

It should be emphasised that small-scale technologies such as micro-reverse osmosis units require a regular maintenance regime in order to be effective. Similarly, unless membrane and filter drinking water treatment devices are properly maintained they can become contaminated and may provide a false sense of security to residents trying to protect themselves from poor water quality.

Rainwater tanks are low-maintenance, requiring only simple skills when compared to other water system options and treatment methods. Although badly maintained rainwater tanks are potentially a health risk, well-maintained supplies can provide a valuable source of good quality drinking water for the life of the infrastructure (up to 15-20 years).

Survey data show that just over a quarter of houses surveyed had a rainwater tank (26 per cent) and less than half the houses had guttering and downpipes that could be linked to a rainwater tank.

For more information about water quality, see section C1.1 'Water quality and treatment systems'.

Design and specification

If providing rainwater tanks for drinking water, ensure that:

- tanks, water pipes and taps are located where they will not be at risk of damage by vehicles, mowers and weed cutters
- the roof area is kept clean by pruning any over hanging trees, avoiding the use of roof mounted evaporative coolers, and ensuring roof-mounted hot water systems do not discharge overflow water onto the roof or into the gutters
- a first flush diverter is fitted to the rainwater tank to divert polluted roof water away from the tank and the diverter can handle large volumes of water if the roof area is greater than 250m2.
- the rainwater is filtered before it reaches the kitchen tap
- the main tap or outlet is slightly above the bottom of the tank to allow any contaminants to settle and do not pollute the water as it is taken from the tank
- a second outlet is fitted at the bottom of the tank to allow it to be fully emptied for cleaning and de-sludging
- fittings, taps, strainers and first flush diverters are accessible for maintenance and cleaning
- all openings are screened with mesh to keep out insects, frogs, birds and vermin
- water from the first flush diverter and tank overflow is directed to a garden area or a drain to prevent pooling that can lead to mosquito breeding or erosion
- a pressure pump, or a hand pump for reduced maintenance, is fitted and has the capacity to supply drinking water to the house but gravity systems are simpler than a pressure pump and require less maintenance

- skills are available on the community to provide maintenance for pressure pumps
- if the tank will be located on a stand, the stand has been designed and certified by an engineer to suit the soil and wind conditions
- the rainwater tank is secure, 'tied down', in high wind areas, remember that it may not always be full of water
- a non-return valve is fitted if the tank's water is connected to a mains water supply
- the house has a back-up drinking water option in case the tank becomes contaminated, is taken off line for cleaning and maintenance, or if power is not available to an electric pressure pump; options could include a second tank or mains water connection.

If installing household water filters or treatment systems, ensure that:

- the type of filter or treatment system that is specified will actually improve the water quality, for example, the filter will remove the pollutants making the water taste bad or will remove any bacteriological contaminants
- the filter or treatment system is placed in an accessible position to allow cartridges to be easily replaced and to enable the filter to be maintained
- replacement cartridges and parts are available locally and are affordable
- if the system depends on electricity, such as a pressure pump, there is sufficient treated water stored for the household to use during a power outage, or there is an alternative water supply, such as a rainwater tank.

Quality control

For rainwater tanks, before making the final payment, check that:

- the rainwater tank and fittings have been installed correctly, are well secured, with down pipes and roof gutters able to supply the tank
- there is water in the tank for testing the system
- a first flush diverter is installed and is working
- left-over building materials and rubbish have been removed from the roof
- rainwater is piped from the tank to the kitchen with a pump, where required
- the position of the taps and outlets means that most of the tank water can be used and the tank can be emptied for maintenance
- a non-return valve is fitted, if appropriate
- entry and overflow points to the rainwater tank are screened with mesh.

For household water filters or treatment systems, before making the final payment, check that:

- the filter or treatment system has been installed correctly, can be accessed for maintenance and has been certified by the plumber or supplier
- the water is potable when it comes out of the filter, based on a water quality test.

Maintenance

As part of cyclical maintenance, test:

- the quality of the water from the rainwater tank or household filter and treatment system.

For rainwater tanks, as part of cyclical maintenance:

- check and clean the rainwater collection system, including roof, gutters, down pipes, inlet points and tank overflow
- secure, repair or replace broken or rusted gutters or down pipes
- empty and clean the inside of rainwater tanks to remove the build up of algae and sediment or after a known contamination event, the tank should be rinsed with chlorine after cleaning to return to a sanitary condition
- check that the rainwater tank tap is working and change the washer, if necessary
- check and repair the mesh screens to inlet points and tank overflow
- empty the first flush diverter and check that it is working.

For household water filters or treatment systems, as part of cyclical maintenance:

- replace the cartridge or other replaceable parts in household filters and treatment system
- associated pressure pumps should be regularly tested and the electrics checked.

Survey data

Drinking water quality	Percentage of houses	Total houses surveyed
Rainwater tank	26%	3,099
Rainwater tank functional	20%	3,099
Gutters and down pipes present	49%	1,699
Gutters and down pipes present and functional	33%	1,699

Standards and references

CAT (Centre for Appropriate Technology). 2006. *How to Look After Your Rainwater* – Pictorial publication for remote Indigenous communities managing rainwater tanks. Alice Springs: Centre for Appropriate Technology

CAT (Centre for Appropriate Technology) and CRCWQT (Cooperative Research Centre for Water Quality and Treatment). 2006. *Rainwater Tanks in Remote Australia*. Centre for Appropriate Technology, 'Our Place' Magazine 27: insert

Grey-Gardner R, A Wright and S Boyce 2006. *Harvesting Water that Falls on Country: Planning for rainwater tanks in remote Australia*. Alice Springs: Centre for Appropriate Technology

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Plazinska, A.J. 2001. *Microbiological Quality of Rainwater in Several Communities on the Anangu Pitjantjatjara Lands in South Australia*. Bureau of Rural Sciences, Canberra.:35

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B4.2 Food storage

The ability to store food safely and hygienically will reduce household costs because less food is wasted; more money is available for groceries, which improves the household's diet and nutrition. To store food, residents need storage that is cool, dry, well ventilated and protected from dogs, rodents, insects and other pests.

Cupboards need to be built out of waterproof materials that are resistant to rot and insect infestation. Some residents also need a lockable food pantry.

A properly functioning refrigerator is also an essential item of health hardware for storage because it allows people to store meats and fish, fresh fruit and vegetables, dairy products and eggs, which are important for good nutrition. A poorly functioning refrigerator can spoil food, consume high amounts of energy use and reduce the household budget. Studies have shown that refrigerators of identical size can cost anywhere from 60 cents to $2 a day to run, depending on efficiency and the condition of door seals .

The refrigerator and food storage cupboards need to be accessible for all members of the household, including people with disabilities.

Survey data show that combined refrigerator/freezers were available to less than 75 per cent of households. Although improved since 2003, less than half (47 per cent) of the fridge compartments in these appliances within surveyed houses could store food at an acceptable temperature. The number of surveyed houses with the freezer compartments in these appliances operating at an acceptable temperature (67 per cent) also improved since 2003.

The number of houses with storage above bench height, which is out of reach of young children, animals, insect and vermin, improved since 2003, was only available in around a third of all surveyed households (38 per cent).

Design and specification

Ensure:

- cupboard materials are resistant to water penetration, mould, rot and insect infestation, consider sealed plywood, recycled plastic, and other resistant materials
- under-bench cupboards have doors to prevent access by children and animals
- there are at least two linear metres of cupboards or shelves built above bench height for storage of food or utensils out of the reach of children and animals, and that under-bench storage with doors is accessible for people with disabilities
- there is a space within the kitchen for a refrigerator that is at least 800mm wide, is well ventilated, and protected from heat sources such as direct sun through a window, an uninsulated western wall, or the heat of a stove or oven
- there is a power point in the refrigerator space that is on a dedicated power circuit, fitted with an RCD (residual current device), and accessible when the refrigerator is in place
- the entire kitchen area is well ventilated and well lit, to prevent the build up of mould and to deter cockroaches and vermin
- cupboard handles are D-type, and are located towards the top of under-bench cupboards and towards the bottom of overhead cupboards for easy access.

For cupboards, consider:

- using screened vents or panels of mesh in doors to ventilate cupboards and pantries and to keep insects and vermin out
- building all cupboards and drawers a minimum of 300mm off the floor to deter vermin and make it easier to clean the floor
- in tropical areas, using mesh shelves to improve ventilation, prevent mould, and stop cockroaches
- fitting a high level, secure cupboard for dangerous items such as cleaning products and medicines, and having a secure cupboard that is accessible for people with disabilities
- providing animal and vermin proof food storage areas in bedrooms in multi-family households.

For refrigerators, consider:

- providing adequate space for large, energy-efficient refrigerators in all houses
- liaising with the local store to ensure they stock energy-efficient refrigerators
- providing additional space and power points in the kitchen or laundry area for an additional freezer
- providing additional screened vents in the floor, walls and ceiling around the refrigerator space to improve the performance and energy efficiency of the appliance
- providing a lockable, ventilated, walk-in pantry with extra space for a refrigerator or freezer, in households where food security is an issue for residents.

Consider making provision for people with disabilities to access storage areas, including:

- providing a clear circulation space of at least 1550mm in the kitchen
- having lower or adjustable benches
- providing removable or mobile under-bench cupboards
- providing refrigerators with the freezer located under the fridge compartment to provide better access.

Quality control

During construction and before making the final payment, check that:

- the materials used for making cupboards and shelves are as specified
- all cupboards and shelves are securely fixed to the walls, particularly cupboards that are above the floor
- food storage cupboards are screened and ventilated and built according to the drawings
- floor and wall junctions are sealed to prevent access by vermin and insects
- there is a working lock on the pantry door
- there is a well ventilated space at least 800mm wide, with a well located power point, for the fridge.

Maintenance

As part of cyclical maintenance, check that:

- the cupboard door handles, locks and hinges are working
- the shelves, cupboards and screened pantry or food storage areas are in good condition
- the kitchen is free of insects and vermin, and consider a regular pest management program.

As part of cyclical maintenance, test the working temperature inside the refrigerator:

- freezer should be minus 10°C or colder
- refrigerators should be no warmer than 4°C.
- if these temperatures are not achieved, check:
  - door seals
  - location of the refrigerator or freezer in the house
  - air circulation around the refrigerator and freezer.

Consider:

- organising an annual fridge maintenance program to improve access to storage of nutritious food.

Survey data

Food storage	Percentage of houses	Total houses surveyed	Change since 2003*
Shelves and cupboards			
Kitchen storage below bench height – less than 5 square metres (less low level storage is better)	57%	1,959	
Kitchen storage above bench height – greater than 5 square metres (more high level storage is better)	38%	3,630	++
Kitchen cupboards – none	11%	1,670	
Kitchen cupboard condition adequate	47%	1,670	
Kitchen cupboard condition inadequate	42%	1,670	
Kitchen ventilated – improved food storage conditions	86%	1,671	
Refrigerators			
Houses with no refrigerator or freezer	22%	3,633	
Houses with combined refrigerator/freezer	73%	3,633	
Houses with a refrigerator but no freezer	7%	1,678	
Houses with a freezer but no refrigerator	4%	1,678	
Refrigerator capacity and function			
No information on refrigerator capacity available	6%	2,320	
Refrigerator capacity less than 250 litres	24%	2,320	
Refrigerator capacity between 250 litres to 350 litres	41%	2,320	
Refrigerator capacity greater than 350 litres	29%	2,320	
Freezer temperature minus 10°C or colder	67%	2,756	+

Food storage	Percentage of houses	Total houses surveyed	Change since 2003*
Fridge temperature colder 4°C or less	47%	2,763	++
Refrigerator and freeze – no excessive ice or frost	72%	1,203	
Refrigerator – door seals OK	80%	1,207	
Additional freezer available	35%	3,524	
Additional freezer temperature 10°C or colder	73%	1,240	++

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS/NZS 3000:2000, Amendment 1–2001, Amendment 2–2002 *Electrical installations* (known as the Australian/New Zealand Wiring Rules)

Pholeros, P 1997, *Energy and Water Use Required for Health in Housing on the Anangu Pitjantjatjara Lands North West of South Australia*, for UPK Nganampa Health Council Inc., Alice Springs, p. 8

South Australian Department of Human Services 2001, *Eat Well SA* Forum Report, Food Supply in Rural South Australia – A Survey on Food Cost, Quality and Variety.

Tietz, C 2000, 'Kitchen Design, Installation and Maintenance' in G Harris (ed.), *Environmental Health Handbook: A Practical Guide for Remote Communities*, Menzies School of Health Research, Casuarina, pp. 155-72.

Australian Greenhouse Office, *Energy rating information*, http://www.energyallstars.gov.au

B4.3 Preparing food – sinks and benches

The ability of people to prepare food hygienically depends on the availability of well designed and constructed benches, a splash back that is easy to clean and helps with maintaining kitchen hygiene, and a functional sink that is well sealed to the kitchen bench.

Common problems with benches, splash backs and sinks include:

- rotting benches and cupboards due to water from the sink penetrating the bench material
- decayed wall structure behind the bench and sink because the splash back between the sink and wall has failed
- use of inferior bench top and splash back materials, which result in the work area becoming unhygienic because it is too hard to clean and/or it becomes infested with cockroaches and ants
- choosing bench materials that cannot tolerate hot items, sharp knives and that are not suitable for cutting up large items of food
- building benches that are too short or too narrow to store kitchen utensils safely or prepare food

- installing sinks that are too small to in which to clean large pots or frypans
- selecting single drainer sinks with limited space to store both dirty and clean dishes.

Non-waterproof materials such as particle board, timber, fibre cement and sheet concrete are not recommended for benches and splash backs, also materials that are difficult to clean, such as mosaic tiles or textured laminates should not be used.

Two critical items of health hardware that are essential for preparing food, benches and splash backs, were still performing poorly in 2006, but showed a trend towards improved performance since 2003. A third of surveyed houses (34 per cent) did not have benches suitable for preparing food and a large proportion of surveyed houses (41 per cent) had poor splash backs behind the sink area, which would encourage dampness below benches, provide habitat for cockroaches, and may lead to structural damage in the longer term.

Design and specification

Ensure:

- that waterproof materials are specified for the benches and splash back, and that these are well detailed and specified in the drawings and in the building contract
- that heat and fire proof materials are used for the bench and splash back to allow hot pots to be safely put on the bench straight from the stove or oven
- the sink has the capacity to wash, and fill large pots and frypans, has two drainers or a drain area integrated in the bench top for storing both dirty and clean dishes
- anti-vandal taps and a swivel spout are specified, with a spout that will allow large pots to be filled
- the junction of the bench top to the splash back, and the sink to the bench, are sealed with a mechanical flashing, not a silicone joint, to prevent water penetration and pest infestation
- there is lighting over the bench areas
- flooring is slip resistant and is continuous under the benches
- at least one double power point is located within 300mm of the front of the bench for greater accessibility.

Consider:

- installing a stainless steel, or post-formed laminated bench, with an integrated splash back to reduce junctions between the wall, bench and sink
- extending splash backs to the underside of overhead cupboards
- using stainless steel or galvanised metal, or other robust materials, for the bench framework and supports, and avoid particle board or non-waterproof materials
- providing a double bowl sink
- providing deeper sections within the bench to suit multiple cooking appliances

- designing some parts of the under-bench cupboards to allow easy removal to provide access for people with disabilities
- designing the bench and splash back to allow easy removal for repair and maintenance, or to be adjusted to a different height without damaging other cupboards and the wall finishes
- designing the kitchen to eliminate, or minimise, the need for sealants such as silicone, which attract ants by using solid infill panels, collars, grommets, routed or grooved joints
- planning the kitchen with a continuous bench top between the fridge and stove/oven to allow people with disabilities to safely slide hot or cold items from the fridge or the stove/oven along the bench
- providing at least one work surface of 800mm length that is adjustable in height from 750mm to 850mm
- using a kitchen sink bowl that is a maximum of 150mm deep, can be adjusted to heights from 750mm to 850mm or can be replaced to allow access for people with disabilities
- providing a clear circulation space between benches of 1550mm
- locating all power points and taps according to AS 1428 *Design for access and mobility* and AS 4299 Adaptable housing
- providing a bench area for a microwave oven at a height of 750mm to 1200mm above floor level that can be easily reached by people with disabilities
- where clear floor space is provided under the sink, ensuring that there are no sharp or abrasive surfaces under the sink, and that all exposed hot water pipes and surfaces are insulated or otherwise covered
- locating the oven next to an adjustable height or replaceable work surface
- providing a work surface of minimum 800mm in length next to the cook top and at the same height
- making sure that the circulation space at the doors complies with AS 1428.1 *Design for access and mobility*
- providing an outdoor preparation area for bush foods with robust bench, water supply and drain.

Quality control

During construction and before making the final payment, check that:

- all between-bench junctions and the splash back, sink, cupboards, walls and appliances are sealed
- anti-vandal taps are installed
- the sink drains are functioning
- bench and splash back materials comply with the specifications.

Maintenance

As part of upgrades, consider:

- retro-fitting an integrated bench, splash back and sink.

As part of cyclical maintenance, check:

- junctions between bench, splash back and wall are sealed
- bench has not been affected by heat or moisture.

Survey data

Preparing food – sinks and benches	Percentage of houses	Total houses surveyed	Change since 2003*
Sinks			
Single bowl sink	69%	1,955	
Double bowl sink	31%	1,955	
Kitchen sink – hot water and tap functional	61%	3,620	
Kitchen sink – cold water and tap functional	68%	3,627	‹
Functional kitchen sink spout	71%	3,627	
Kitchen benches and splash backs			
No kitchen bench available	4%	1,671	
Bench material solid and can be cleaned	66%	3,630	++
Splash back sealed to prevent water penetration	59%	3,630	+

* See 'Changes in the conditions of houses' on page18 for an explanation of the symbols used in this column.

Standards and references

Tietz, C 2000, 'Kitchen Design, Installation and Maintenance' in G Harris (ed.), *Environmental Health Handbook: A Practical Guide for Remote Communities*, Menzies School of Health Research, Casuarina

B4.4 Cooking

Cooking preferences and needs vary between households. Some families will use a basic stove to cook, while others may use a range of cooking appliances, including microwave oven, rice cooker, deep fryer, electric frying pan, toaster and electric kettle. Some families might want a barbeque area outside, while others will use a full outdoor kitchen with sink, bench and cooking facilities.

A stove with a cooktop and oven is an essential item of health hardware that is usually provided with the house. Survey data show that nine per cent of surveyed houses had no cooktop installed and 15 per cent of houses had no oven. When houses that were surveyed did have access to a stove, only 59 per cent of cooktops had all hotplates and control knobs working, whereas 70 per cent of ovens were functional.

It is important to select stoves that are designed to cater for regular use, are easy to clean and maintain, and can easily be removed for repairs or replacement. 'Off-the-shelf' upright stoves with a combined cooktop and oven are very common, but the cheaper models are often not designed to cater for the demands of a large family or harsh environmental conditions. Upright stoves provide nesting places for rodents and cockroaches in the exposed areas at the back and on the bottom of these appliances.

Cooking can be very expensive for the household, with an electric hotplate costing over $4 a day to run. Gas can be cheaper where it is available, but in rural and remote locations the cost of gas cooking can be as high as the cost of using electricity. It can be difficult to supply and change gas bottles where reticulated gas is not available. Residents may worry about the safety of gas, which means it may not be the preferred cooking option. Survey data indicates that gas cooking appliances are less common (19 per cent) than electric appliances (72 per cent).

Design and specification

When specifying the stove, discuss with the residents:

- the type of stoves that have been previously used and the successes or failures experienced
- the benefits of standardising stoves across the locality or region to increase purchasing power and to rationalise spare parts and maintenance
- the benefits of electric versus gas cooking in terms of running costs, ability to replace gas bottles, availability of electricians or gas fitters for maintenance, and preferences for cooking with gas or with electricity
- the benefits of upright stoves versus cooktops and wall ovens, and the merits of using a separate cooktop and oven that can be fully sealed into a benchtop versus the difficulty and expense of repairing and replacing these units
- the need to provide separate cooktops and wall ovens that can be accessed by people with disabilities.

For all stoves, ensure that:

- stoves and outdoor cooking facilities are specified and detailed in the building contract
- the cooktop has elements or burners suited to big pots, with a minimum number of removable parts
- there is capacity on, and around, the stove top for large pots to overhang the hotplates on both sides
- behind the stove, there is an easy to clean splash back at least 600mm high

- no cupboards, shelves or low windows are located above the stove
- the stove is secured to prevent children climbing on it and tipping it over, using an anti-tilt bracket, but can be removed for cleaning and maintenance
- there is space around the stove for cleaning, and there are no small gaps between the stove and bench or cupboards that cannot be cleaned
- there are power points for a variety of cooking appliances located away from the stove and sink
- the kitchen has natural ventilation for the removal of cooking fumes and odours.

Consider:

- providing an exhaust fan or other types of mechanical ventilation to remove cooking fumes and odours
- making provision for a microwave oven on a shelf or deeper bench area with a power point)
- specifying stove models that have cooktop and oven knobs that are robust, difficult to remove, and out of reach of children
- installing ovens between 400mm and 1000mm above the floor, with side-opening doors and a bench immediately next to the oven to allow access for elderly people and people with disabilities
- vermin-proofing the rear and bottom of stoves with mesh or a reliable and safe vermin kit and confirm that this does not make the stove unsafe or void the stove warranty.
- a model that has controls at the front or side of the stove with raised crossbars for safe grip by people with disabilities
- providing a clear circulation space of 1500mm x 820mm to allow a forward approach to the cooktop by people with disabilities, no more than 500mm of this clear floor space should extend under the cooktop
- providing an outdoor cooking area on the verandah or in the yard in addition to an indoor kitchen
- when selecting and locating outdoor cooking equipment, identifying the local area fire restrictions and risks as well as what food is likely to be cooked
- specifying a different type of fuel for the outdoor cooking area, to allow the outdoor kitchen to be used when gas or electricity is not available for the indoor kitchen.

For electric stoves:

- ensure that an isolation switch is fitted within easy reach on the wall near the stove and that the stove is connected to a separate electrical circuit
- specify solid hotplates, which are stronger than coil elements, but can corrode when used in tropical and coastal areas

- consider installing a stove timer switch to cut off power after a time specified by residents, to prevent the stove operating for long periods resulting in wasted electricity and expense to the household
- where possible, use a plug, cable and power point to connect the stove to electricity, rather than a fixed connection, to allow the stove to be removed for cleaning, maintenance and replacement.

For gas stoves:

- consider using bayonet type gas connections for gas cooking appliances
- specify a gas fuse to all burners and the oven to cut off gas supply when there is no flame
- consider making provision for a portable gas cooker connected to a small gas bottle as a cooking option.

Quality control

Before making the final payment, check that:

- cooking equipment and kitchen components are installed as detailed and specified in the contract
- all burners, elements, oven and grill are working
- all control knobs are fitted
- the oven door opens and fully seals when the door is shut
- the stove has been secured with an anti-tilt device
- vermin-proofing has been installed, if specified
- shelves have not been fitted over the stove
- the outdoor kitchen has been constructed as designed.

For an electrical stove, trade test:

- the timer switch for the oven and stove
- the isolation switch and check it has been installed in a location that can be reached by people with disabilities
- the installation of a separate oven and stove circuit.

For a gas stove, trade test:

- the installation is fully operational and issue a certificate of compliance.

Maintenance

As part of cyclical maintenance, check that:

- all stove burners or elements are working
- the oven is working
- all control knobs are fitted and working
- the oven door opens properly and fully seals when closed, and that the glass is not cracked
- on electric stoves, the timer, isolation and safety switches are working.

Consider:

- organising annual maintenance and cleaning of all stoves to extend the life of the stoves.

When upgrading houses, consider:

- installing a timing switch on electric stoves to cut off electricity after a time specified by residents, for example, two hours
- replacing electric stoves with other cooking options that will be cheaper to use and discuss the advantages and disadvantages with residents and housing manager
- installing a stove with side or front controls with raised crossbars, which are easier for people with disabilities to grip.

Survey data

Cooking food	Percentage of houses	Total houses surveyed	Change since 2003
Energy available for cooking			
Electricity	95%	3,661	
Bottled gas	22%	3,661	
Mains gas piped to the house	3%	3,661	
Cooktops			
No cooktop	9%	3,631	
Electric cooktop	72%	3,631	‹
Gas cooktop	19%	3,631	
Wood or oil burning cooktop	1%	3,070	
All cooktop hotplates and control knobs working	59%	3,312	

Cooking food	Percentage of houses	Total houses surveyed	Change since 2003
Ovens			
Oven installed (gas or electric combined, or separated from cooktop)	85%	3,631	
Oven working (gas or electric)	70%	3,104	+
Alternative cooking options			
Houses with other ways to cook in the house (frying pans, microwave ovens, and so on)	53%	1,672	
Outside cooking areas	41%	3,662	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

AS 1428.1–2001, *Design for access and mobility – General requirements for access – New building work*

AS 4299–1995, *Adaptable housing*

Peter, S. and Tietz, C. 1997 in B Lloyd (ed.), *Indoor stoves for remote communities*. NTRC report, 97/8, Centre for Appropriate Technology Inc., Alice Springs

Teitz, C 2000, Kitchen Design, Installation and Maintenance in G Harris (ed.), *Environmental Health Handbook: A Practical Guide for Remote Communities*, Menzies School of Health Research, Casuarina, pp. 155-72

B4.5 Kitchen design generally

If houses are overcrowded there may be a need for many places to cook inside the house, on verandah areas and outdoor cooking areas in the yard. Cooking preferences may differ between age groups, regions and type of food available.

Whether the facilities are located in the house or in the surrounding yard area, all the component parts of the kitchen should support the storage, preparation and cooking of food to improve the nutrition available to all family members. The following list summarises the main design issues detailed in preceding B4 subsections.

The summary of house function data in Appendix 1 shows that only five per cent of surveyed houses had a kitchen that allowed residents to store, prepare and cook food.

Design and specification

For indoor cooking areas, consider:

- locating the kitchen where it is easily accessed from inside and outside eating areas, and can be accessed by people with disabilities
- ensuring the kitchen has natural light and ventilation
- shading or protecting the kitchen from hot afternoon sun
- making provision for high level storage and bench space, as set out in previous sections
- allowing enough space for a fridge and freezer to be stored in the kitchen
- locating the kitchen away from the access to bathroom and toilet areas
- using non-slip water proof flooring, such as a welded sheet vinyl
- using an easy-to-clean wall surface from floor to underside of benches or cupboards, such as vinyl wall sheet or large ceramic tiles
- waterproofing the floor, the floor wall junctions to the underside of cupboards and behind the sink
- supplying non-tempered hot water at the kitchen sink (approximately 60°C) to help flush grease and fats through the waste pipes
- providing a separate tap for supplying rainwater at the kitchen sink
- providing a floor waste outlet to help when cleaning the kitchen
- providing a space for a kitchen rubbish bin that features a secure lid, can be lined and is not easily accessed by dogs and children
- selecting and locating power points, switches, stove controls and taps to allow people with disabilities to reach and use them.

For verandahs and yard kitchens, consider:

- locating the outdoor cooking area where it is protected from extreme weather conditions, such as winter winds and summer sun
- providing a robust, waterproof bench, finished in a material like stainless steel
- including a sink or tub with running water and connected to the drainage system, for washing food and utensils
- providing high shelves to store food and utensils away from children and animals, sheltered from the weather
- creating a dry, secure place to store fire wood that is away from the walls of the house
- providing a place to cook, such as a barbeque or drum oven, ideally using a different fuel from the inside stove
- supplying a secure storage area for the rubbish bin to deposit food scraps and kitchen waste

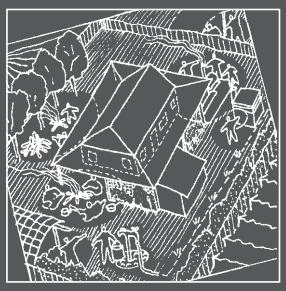
- making a sheltered place to eat
- providing a slip resistant path between indoors and the outdoor cooking area, which is accessible to people with disabilities.

References

Wright, A. 2006 R*eview of the robust bin in 5 sites across WA*. Centre for Appropriate Technology and Department of Housing and Works

Centre for Appropriate Technology *Drum Oven* http://www.icat.org.au/documents/drum_oven.pdf#search=%22drum%20oven%22

B5 Reducing the impacts of over-crowding



B5 Reducing the impacts of over-crowding

Crowded living conditions increase the risk of the spread of infectious diseases, such as meningococcal disease, rheumatic fever, tuberculosis and respiratory infections. In a crowded house it can also be more difficult to access health hardware, such as hot water, showers and clothes washing facilities. To reduce these risks, consider how to minimise the effects of crowding when planning the living environment.

At the beginning of a housing project, it is essential to estimate the number of people likely to be using houses, especially at peak times. As the following example shows, estimated population per house cannot be calculated by simply dividing a community's population by the number of houses in the community.

In a community with 300 people and 50 houses, it could be assumed that an average of six people live in each house. Consultation with the community may reveal that only 25 of the 50 houses have health hardware working, and residents of the non-working houses have to use the houses in which health hardware is working, which means the average house population would be 12 people.

If a sports carnival is held in the community or during the annual wet season, the population could double or treble and the demand on working houses to could increase to 24–36 people per house.

Beware estimating house population by dividing population by house numbers because this could mean that houses will not be designed to have sufficient space and health hardware, and the residents will experience increased health risks.

It is also possible that specific parts of a house can become crowded at particular times. For example, in extreme climatic conditions, all members of the household are likely to congregate in the one room of the house that is able to be cooled or heated and this can lead to the increased spread of infection, even in small households.

Even if all houses in a community are fully functional, some families will choose to live in large, multi-generational households, despite other houses being available in the community. These families will not necessarily consider their house to be crowded, but could suffer health effects if the health hardware is not adequate for the number of people living in the house. A large household population can also cause health hardware to fail prematurely simply because it is constantly in use. Large populations may also result in high power bills for the main residents unless energy efficiency has been considered in house design and specification.

More houses can reduce the negative impacts of over-crowding, however the example above shows that it is also necessary to design for peak populations. This can be achieved by providing more health hardware in houses, developing the yard and edges of houses to provide more household service, cooling and heating several rooms in the house, providing additional sleeping areas, and ensuring the health hardware in most houses in a community is functioning most of the time through regular maintenance.

B5.1 Performance of health hardware in large households

When designing new houses, upgrading a house or developing a maintenance program, find out from residents and housing managers how many people are likely to be living in and using the health hardware in the house and yard.

When undertaking a housing project, obtain population data, including seasonal variations and peak periods, from as many sources as possible such as residents, the housing manager, community council, health clinic and local store. These data sources may vary significantly, but the combined data will help to estimate the potential size of the household, to ensure the house is designed to minimise the negative impacts of crowding.

Data shows a significant variation between the living areas per person available in households. Where less people live in the house (0–4), an average 47.9 square metres is available per person. In large households (10 people or more), an average 9.3 square metres is available per person.

Design and specification

Ensure:

- health hardware such as taps, shower fittings, laundry tubs, washing machines, power points and light switches are good quality, will withstand high usage in large households and can be used by people with disabilities
- that enough hot water is available to meet the needs of the household and cope with fluctuations in household population
- there are clothes washing and drying facilities sufficient to meet the needs of the household
- toilets and wet area services meet the requirements of the household size, and are separated so that shower, laundry and toilet facilities can be used by several people at once
- at least one toilet and shower area is sized to be accessible to people with disabilities or can be adapted in the future to be fully accessible
- the waste removal system is adequate for the population size and can cope with expected peak loads in the house
- there are at least two options for cooking food, and the food storage areas in the kitchen are sufficient for household size
- the bedrooms have heating and/or cooling systems suited to the climate, and people will not have to share one cooled or heated common space for sleeping
- the plan of the house and the location on site can accommodate future alterations and additions.

Consider:

- the privacy needs of people using the house and implications of local cultural requirements
- reducing the operating costs of all health hardware by using energy efficient options for, in order of priority: hot water, cooking, heating and cooling
- installing a second outdoor toilet such as a dry toilet, or a second toilet and wet area facilities in the house that can easily be accessed from outside areas
- installing outdoor cooking facilities as well as an indoor kitchen
- specifying robust windows and doors and associated hardware that will withstand high usage
- having solid core or semi-solid core doors throughout the house, because they are more durable, require minimal maintenance and provide better sound proofing between rooms
- specifying durable floor coverings and wall finishes that will withstand high levels of use
- that bedrooms will often be used by more than one person and should be sized to fit two or three mattresses and associated storage space
- the orientation, shading, insulation, and installation of active heating and cooling systems to moderate the local climate and allow people to use all parts of the house throughout the day and night
- locating a hand basin in bedrooms used by people who have long term illnesses or reduced mobility.

Quality control

During construction and before making the final payment, check that:

- all health hardware has been provided as specified in the drawings and the contract, and that the health hardware is fully functional.

Maintenance

As part of cyclical maintenance:

- organise regular assessment and maintenance of essential health hardware for houses with large populations.

Survey data

House size and population	Percentage of houses or areas in square metres	Total houses surveyed
House area		
House area less than 100 square metres	41%	3,615
House area greater than 100 square metres and less than 200 square metres	52%	3,615
House area greater than 200 square metres	6%	3,615
People per house		
0 to 4 people per house	49%	3,614
5 to 10 people per house	44%	3,614
More than 10 people per house	7%	3,614
For houses with population of 0 to 4 people		
Average population	2.5	1,770
Average area in square metres	118	1,770
Average area (square metres) per person	47.9	1,770
For houses with population of 5 to 10 people		
Average population	6.2	1,577
Average area (square metres)	126	1,577
Average area (square metres) per person	20.4	1,577
For houses with population of 10 people or more		
Average population	13.6	267
Average area (square metres)	125	267
Average area (square metres) per person	9.3	267

Note: The house sample is reduced because the 'number of bedrooms' question was not asked in some projects.

Standards and references

Booth, A. and Carroll, N. 2005 *Overcrowding and Indigenous health in Australia*, Discussion Paper No 498, Centre for Economic Policy research, Australian National University

Pholeros, P, Rainow, S & Torzillo, P 1993, *Housing for Health, Towards a Healthy Living Environment for Aboriginal Australia*, Healthabitat, Newport Beach, p.p. 24-30.

Ross, H 1987, *Just for Living, Aboriginal perceptions of housing in northwest Australia*, Aboriginal Studies Press, Canberra.

B5.2 Developing the edges of the house and the yard

The effects of crowding can be reduced by designing useful yards and 'edge' spaces around the house, such as verandahs, decks, sleep-outs, shady areas for summer, and sunny, wind protected areas in winter. Allowing space between houses will increase the size of the yard and the capacity to use it for different activities. It will also reduce the overall level of crowding in the community.

Data show over a third of houses have yard areas larger than 900 square metres, which offer potential for developing the areas around the houses, for example, for food planting, shade planting, and cooking.

Around a third of housing has no yard fencing, and less than half of all houses had a yard fence and gates in good condition.

Design and specification

Ensure:

- the edges of the house in hot or tropical climates catch cool summer breezes
- house edges are accessible to people with disabilities
- house edges in cooler climates catch the winter sun and shelter from cold winds
- the design of the house and yard allows for the resident or community housing organisation to change, adapt or extend the house to meet future needs.

Consider:

- ways that outdoor living areas support cultural practices such as avoidance relationships, and relieve over-crowding at times of peak population
- providing at least one outdoor living area that is positioned to suit prevailing weather conditions, and that the outdoor area is shaded, rain-protected, well lit, and easily accessed from the house
- making the outdoor living area(s) suitable for visitors to sleep in
- in cold climates, providing an outdoor fire pit for warmth during winter
- providing insect/privacy screening to outdoor living areas
- installing at least two yard taps on robust tap stands with drainage directly underneath
- providing additional outdoor cooking facilities, such as a drum oven or barbeque
- including rainwater tanks as an additional source of water for people using yard areas
- making the yard area safe, particularly for children, by enclosing it with robust fencing materials and providing car and pedestrian gates at key access points
- planning yard services, such as septic disposal trenches, dry toilets, air conditioning units and hot water discharge points away from outdoor living areas

- grading the yard area to drain away from outdoor living areas and edges of the house
- providing and securing rubbish bins in yard areas.

Consider designing the yard area so that it is accessible to people with disabilities, by:

- selecting a level or gently sloping site with up to 1:14 gradient
- providing a well lit, continuous, accessible path of travel and clear line of sight from street frontage and vehicle parking to entry, complying with AS 1428.1 *Design for access and mobility*
- providing additional paths and walkways which are continuous, slip resistant and hard surfaced, with gradients complying with AS 1428.1
- pathway lighting which is at a low height to avoid glare and provides a minimum of 50 lux at ground level
- building wide pathways to suit people using a walking frame
- locating drainage grates so they do not run parallel to the direction of travel and can be crossed in a wheelchair
- ensuring the width of car parking spaces, garages and carports suit people using wheelchairs or prams.

Quality control

During construction and before making the final payment, check that:

- the edges of the house and the yard comply with the detailed specifications
- the yard has been graded to drain away from living areas
- fences and gates are installed and secure.

Maintenance

As part of cyclical maintenance, check that:

- fences and gates are in good condition
- yard taps are available, working and drained
- outdoor cooking facilities are functional.

Survey data

Developing the edges of the house and the yard	Percentage of houses	Total houses surveyed	Change since 2003*
Fencing and increasing the potential development of the yard area			
No fenced yard	30%	3,661	
Fenced yard area at least 900 square metres	37%	3,661	
Fenced yard area less than 900 square metres	33%	3,661	
Houses with yard fence and gates	78%	2,952	
Houses with yard fence and gates all in good condition	41%	2,952	++
Cooking and water			
Outside cooking facilities	41%	3,662	
No yard taps	4%	3,660	
1 yard tap	26%	3,660	
2 yard taps	59%	3,660	+
3 or more yard taps	11%	3,660	+
Water meter found and functional	50%	3,659	
Water isolation valve available and OK	25%	3,651	
Rainwater tank	26%	3,099	
Rainwater tank functional	20%	3,099	
Outside cooking areas	41%	3,662	
Houses with food planting	25%	3,662	
Wind break planting (as a positive sheltering feature in cold climates and not a hindrance to airflow in tropical climates)	22%	3,662	
Rubbish and waste systems			
Rubbish system (kitchen bin and regular collection of rubbish available)	46%	3,099	
Septic tank lid protected from damage	60%	1,089	
Working motor cars in yard			
None	56%	3,660	
1	28%	3,660	
2	10%	3,660	
3 or more	6%	3,660	

* See 'Changes in the conditions of houses' on page 18 for an explanation of the symbols used in this column.

Standards and references

Fantin, S. 2003 "Yolngu Cultural Imperatives and Housing Design" in Memmott, P. & Chambers, C. (ed) *Take Two. Housing design in Indigenous Australia*. RAIA, Canberra

Murphy, P & Sinatra, J 1997, *Landscape for Health, Settlement planning and development for better health in rural and remote Australia*, ORA RMIT Outreach Australia Program, Melbourne, pp. 70-1

Pholeros, P, Rainow, S & Torzillo, P 1993, *Housing for Health, Towards a Healthy Living Environment for Aboriginal Australia*, Healthabitat, Newport Beach, pp. 48-73, 82-5

B5.3 Storage

Lack of storage can be inconvenient in a house with a small population but when a house population increases, the availability of storage may impact on the safety and health of residents.

Storage is discussed in other sections of this guide, particularly in B.4 'Improving nutrition, the ability to store, prepare and cook food' and B.6 'Reducing the negative effects of animals, insects and vermin'. Important issues that relate to storage are summarised below.

Design and specification

Ensure:

- high level secure storage is provided in bathrooms and laundries for medicines and chemicals, to prevent accidental poisoning
- some secure storage is provided that could be used by people with disabilities
- there are plenty of rails, hooks and shelves for storage of clothes, towels and toiletry items in bathrooms, to prevent these items being placed on the floor where they could block drains
- kitchens include high level shelves and cupboards for storage of food and utensils away from dogs, cockroaches, rats and other vermin
- there are cupboards in bedrooms, hall ways and the laundry, to prevent clothing and bedding being stored on the floor where it is at risk from worms and mites carried by animals and other bacteria that can result in transmission of disease
- shelving materials are strong and resistant to damp, mould, rot and insect infestation.

Consider:

- providing lockable kitchen cupboards or a lockable pantry
- in large households, providing each bedroom with a small lockable cupboard for secure storage for medicines
- providing cupboards that can be accessed by people with disabilities, including using D-handles on cupboards and locating them to allow people with disabilities to reach them

- that bedrooms will probably be used by more than one person, and sufficient cupboards need to be provided to store the personal possessions of several people
- including lockable storage in living areas for residents to securely store televisions and other electronic items
- building ventilated and storm proof, outside storage for lawn mowers, bins, car parts, hunting and fishing equipment, and fuel, to separate children from these potentially dangerous items and enable secure storage during cyclones or high winds
- providing dry storage for fire wood in houses that have wood burning heaters or stoves
- including reels or hooks for storing garden hoses above the ground, to reduce damage by animals, lawn mowers and grass trimmers
- securing sections of the verandah with wire mesh and lockable door to store items such as tyres, garden tools, car parts.

Quality control

During construction and before making the final payment, check that:

- all storage has been provided as specified in the contract and is secure.

Maintenance

As part of cyclical maintenance, check that:

- storage is in good condition and is secure.