

DESIGN CONSIDERATIONS

The physical aspects of the dairy facility contribute to the performance of the milk harvesting system, as well as the comfort of the cows and the milkers. The benefits of a well-designed dairy include:

- reducing costs by getting the design right the first time;
- a safe and pleasant working environment for milking staff; and
- higher productivity and profit from greater efficiency.

There are numerous things to consider when planning or modifying a dairy. This chapter contains ideas to consider on the following:

- **Site considerations** p197
Vehicle access, location, alignment of building.
- **General infrastructure** p199
Water supply and storage, effluent management, herd management systems, plumbing and pumps, electrical supply, concreting.
- **Inside the dairy** p202
Milking area – operator controls, electrical controls, pit depth, pit width, pit floor and drainage, the milking platform, cow angle – milking position, message points, water access in the pit, feeding systems.
Related areas – milk room, plant room, chemical store, other storage, people facilities, handling facilities.
- **CowTime Cost Cutters** p211

Information in this chapter will assist in designing a dairy facility that is efficient, safe and pleasant to work in.

Key principles to keep in mind ...

Cows, people, facilities

When planning a new dairy, it is important to keep in mind the three key elements of milk harvesting. Designing a new dairy is a chance to make sure the each of the elements is well integrated.

- Any new dairy should support good cow-flow.
- The dairy design should enhance the comfort of cows and milking staff.



Chapter 2 – Cows, people, facilities.

The bottom line

When planning a new dairy, it makes sense to draw up a wish list first. This initial planning is the first step in sorting out priorities.

- Once the 'must have' priorities have emerged, financial analysis of the cost implications can begin.
- Decisions need to be analysed in terms of the impact the proposed changes will make to milker and cow comfort – somethings may be worth paying more for.



Chapter 10 – Doing the sums.

Project management

Building a new dairy is a big undertaking. Most farmers are not project engineers and have plenty of other work to do on the farm. A project manager is a valuable asset on many dairy construction projects. It is their responsibility to make sure that things happen on time and fit properly.

The farmer will still need to do his/her own research during the planning phase of the project. They must have a good idea of what they want before they commit themselves to a major project.

- A project manager can remove a lot of the stress from those who may not have the skills, the time or the desire to do the overall co-ordination.
- Skilled project managers can be a valuable aid in completing a dairy project on time, within budget and provide some confidence of a good-quality result.

Make sure the project manager understands issues such as cow-flow and has a good track record.



QuickNote 3.2 – Changing milk harvesting infrastructure.



Reduce stress and give someone else the headaches! Consider using a project manager.

Site considerations

The site for a new dairy should provide easy access for cows and vehicles, and make the most of natural light.

Vehicle access

Vehicle access and tracks need to be considered carefully when siting a dairy.

- Milk tankers must be able to turn around by the dairy.
- Access may also be required for trucks that deliver feed – space must also be allocated for silos, etc.
- Parking for staff vehicles and tractors may be required.



Tanker approach and road safety should be carefully considered.

Location

Ideally, the dairy should be located as close to the centre of the grazing area as possible. This keeps cow walking time to a minimum. This helps to reduce lameness and increases the time when cows can graze and rest.

- The dairy should be sited so that cows can enter the rear of the yard directly from the laneway and can flow directly out of the dairy with as few turns as possible.
- Other major considerations include the access to power (especially 3-phase), drainage for effluent, local water supply, position relative to water courses and local by-laws.



Figure 9.1: Construction of a new green field site dairy.

Source: National Milk Harvesting Centre.

Alignment of building

The alignment of the dairy building will depend on how much protection is needed from the weather.

- Aligning the dairy building so that cows enter from the north increases the amount of light entering the milking area – this helps reduce the growth of algae.
- If a northern alignment is not possible, due to site constraints, alignment towards the east is suggested.
- Some dairies are built with no walls around the milking platform area at all, except for the milk room and office area. Another option places walls on the weather side only to provide protection from prevailing winds.
- Dairies in hot climates need to consider shading and air flow. Movable side panels are one way to increase ventilation.



Dry floors reduce slippery areas.

General infrastructure

The design phase takes into account all aspects of general infrastructure and should result in a well-integrated milk harvesting system.

Water supply and storage

Modern dairies use a great deal of water.

- A reliable quantity of water must be available for the dairy.
- Storage may be above or below ground – it may be necessary to accommodate water of differing qualities.

Effluent management

Effluent management, including both drainage and storage, needs to be considered for any new dairy site.

- Ideally, the dairy should be high enough so that the effluent can flow down hill to the sump or effluent pond or ponds.
- The siting of ponds may require consultation with a regional effluent officer or governmental planning agency.

Effluent is a nutrient resource often overlooked on farms.

- Give consideration to reusing water for yard washing or distribution onto paddocks.
- On farms where the effluent is pumped directly onto paddocks, less space is required for storage, but a greater infrastructure is required for its distribution.



Whatever system is developed, nutrient must not escape into waterways or leave the farm. Effluent should not create undue odour, nuisance or nutrient build-up.



Storage ponds should be adequately fenced.

Herd management systems

The requirements of a computerised herd management system, and the way the user will interact with the components, needs to be considered in the design phase.

- Extra space for components such as electronic ID antennae, cow entry races and auto drafting needs to be considered early in the overall design process.
- Expert advice is usually needed to ensure these systems operate effectively, and so save time and frustration.



These systems need to be integrated into the design – not tacked on afterwards.

Plumbing and pumps

It is important to identify what plumbing and pumping needs are necessary when planning the dairy facility.

- Consult with an electrician and a plumber to identify the number of motors and what their loads will be.
- Organising water and effluent plumbing is a job that must be done right. Do not expect the plumber or electrician to walk into an almost completed building and then make it work.
- Advance planning can save much frustration and extra cost later.



Mixing water and electricity can be fatal. Know when professional help is needed.



Cover all sumps to prevent falls (and drowning).

Electrical supply

Consult with an electrician and dairy equipment suppliers early on, to make sure that it is possible to obtain the correct voltage supply.

- Don't be caught with an almost-finished project that relies on 3-phase power and then find out it is not available.
- Check that the supply is consistent and that there will not be problems with voltage fluctuations.
- There are phase converters that can solve 3-phase power supply problems.
- Work out what the total electrical power load will be. Discuss with the power supply company what options are available to reduce power costs.
- Make sure that all ironwork, including concrete reinforcing, is connected by solid welds, to provide good earthing. Proper earthing and good-quality electrical equipment should help reduce the potential for problems.



Don't forget to determine what the back-up plan will be if the power goes off. Will a generator, dynamo or PTO connection be available? Will it be a matter of just having to wait for the power to come back on? How will cows be moved off the platform in a rotary if the power goes off during milking? Develop a back-up plan in the early stages of planning and discuss it widely.



Electrical isolation switches should be lockable.



Always use a qualified electrician.

Concreting

Many well-designed facilities have failed due to poor concreting, both in terms of the quality of the concrete and its finishing.

- It is important to have the correct strength in the concrete where needed.
- A surface that is excessively rough will impair cow-flow and may cause lameness. Slippery surfaces will result in injuries to cows and people.



Dairy concreting is a specialist job and it is vital to get it right – leave it to the professionals.



Yard surface, p70.

Inside the dairy

Milking area

The milking platform and the milkers' pit need to be carefully designed to provide comfortable environments for both the cows and the milkers.

Correct sizing of the pit and platform and thoughtful placement of all equipment should shorten work routine times, reduce milker fatigue and maintain cow and milker comfort.

Operator controls

Any controls the milker must operate should be sited in the pit for maximum convenience.

- Convenient controls reduce the need for haste and can minimise the risk of injury if problems arise.
- Entry and exit gates should be able to be operated from any location in the pit.



Automated operator controls simplify the milking process, but the safety risks associated with their use must be carefully considered.



A well laid out working environment with handy controls reduces the stress of those milking.

Electrical controls

It is often possible to connect several operations to a single switch. Dials can be located in a convenient spot in the milking area so that the milker can monitor them without having to leave the pit.

- When installing electrical controls on monitors, keep the system as simple as possible for the milker.
- Sequence controllers may be used in the milking process and to control an automatic washing system.
- Sequence controllers mean the milker can concentrate on the job at hand – these controls make the milker's job simpler and training relief milkers easier.

Pit depth

Many dairies have pits that are too shallow – a problem in herringbone and rotary dairies alike. This can lead to considerable problems for milkers over a period of time.

- The most ergonomic height to work at is between hip and shoulder (see Figure 9.2).

- In a rotary, platform height should also be between 850-1000 mm high – about waist height.
- In general, pits from 850 mm to 1000 mm deep are about hip deep for most milkers.
- It is better to build a pit too deep, rather than too shallow. Deeper pits can be adjusted for shorter milkers by using matting or some form of platform.
- Deeper pits give better visibility of teats and udders.
- Deeper pits are generally better from an OH&S point of view, as less bending is involved.
- Higher platforms may make installation of milking equipment easier as well.

Some dairies in the USA and Europe have installed adjustable pit floors that can be adjusted to suit the employees' height or varied during different stages of the milking process.

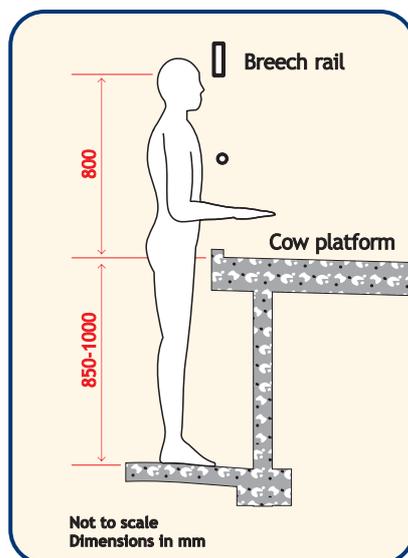


Figure 9.2: Platform height for ergonomic milking.

Source: Based on a diagram in 'A Complete Guide to Dairy Design Systems', VDA.



Ergonomically designed work areas prevent injury and operator fatigue.

Pit width

The width of the pit depends on the type of dairy.

- Swingover dairy pits are generally between 1600-1800 mm wide – the use of swing arms to improve cluster alignment helps make wider pits possible.
- In double up pits width is not an issue. Commonly starting at 2000 mm, examples exist of pits up to 4000 mm wide. Greater width means more walking is required to do the milking tasks, but the working area is less cluttered.
- The floor of the work areas should slope towards the milking platform.
- Platform overhang size depends on the equipment being installed – for example, lowline milking equipment or jetter systems.
- Platform overhang is generally between 100-450 mm.

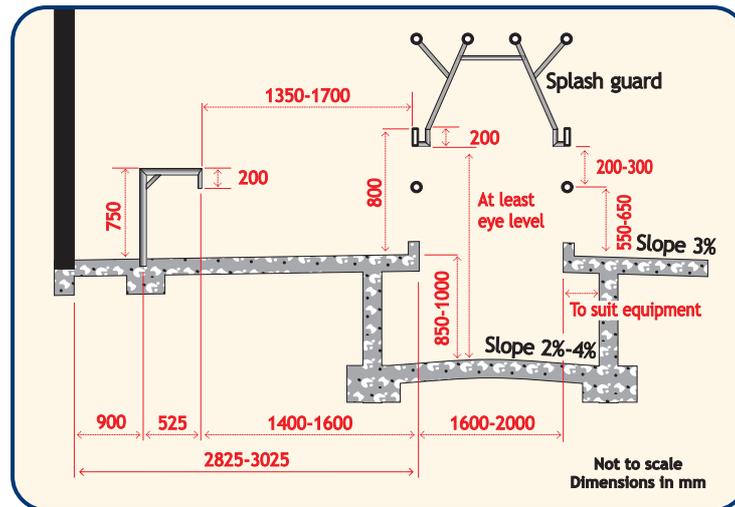


Figure 9.3: Pit dimensions.

Source: After a diagram in 'A Complete Guide to Dairy Design Systems', VDIA.

Pit floor & drainage

The surface and slope of the pit floor has a big influence on how tired those working in the dairy will feel at the end of milking. Pit floor drainage is also an OH&S issue.

- The pit floor should be raised 45 mm in the centre of a standard pit, falling to the pit walls. This raises the heels and eases the strain on the milker's calf muscles.
- Soft flooring (or soft footwear) can reduce milker fatigue.
- Drainage should run along the platform sides. The pit drain should not interfere with the working floor area.



Keep pit floors clear of hoses and other items by providing convenient, safe storage space in the pit.



Clean, non-slip flooring and steps prevent injuries.



Dry, well-drained floors reduce slippery areas.

The milking platform

The space provided on the milking platform is critical for cow comfort and the dimensions should accommodate the largest cow size in the herd – now and in the future. Better to provide more room than less and allow for adjustable breast rails where possible.

- The platform should slope away from the pit by 2-3%. This way, water and effluent flow away from the rear of the cow.
- Breast to rump rail space should be in the range of 1350-1700 mm. The best way to determine appropriate sizing is to measure a number of larger cows in the current herd.

- Too much space from the breast to rump rail allows cows too much movement – this makes clusters harder to attach from the pit. Too little space will cramp cows.
- Allowances should be made for changes to cow size in the future – adjustable breast rails are ideal.
- The rump rail should be above the eye level of the milker, with splash guards draining to a gutter on the pit side of the rump rail.
- On rotary platforms, kick rails and rump rails are located at similar heights to those of herringbone dairies. Breast to breech rails distances are also similar.
- Kick rails 600 mm above the cow platform may assist to protect milkers.

Indexing systems are not yet common in Australian dairies. They push the cows back to the rump rail after they have gained their place on the milking platform. This helps to ensure that udders are accessible to milkers and are suited to rapid exit dairy types.



Kick rails will reduce injury if positioned correctly.



Splash guards protect milkers from urine and dung while in the pit.

Cow angle – milking position

The angle that cows stand on the milking platform determines how much width each milking position is allocated. Generally, cows are positioned at an angle of 80° to 90° or stand at a 45° angle (see Figure 9.4).

- For cows standing at 80° to 90°, allow a width of 550 mm to 660 mm per cow – if stall gates are installed the space needed for the equipment can take the distance per cow up to 720 mm.
- Cows standing at 80° to 90° are perhaps the safest to milk. Attaching clusters through the rear legs reduces the chance of being kicked.
- Fewer clusters are kicked off at a milking position of 80° to 90°, reducing the subsequent need for reattachment or adjustment.
- With the cows standing closer together there is also less overall walking required to milk the cows. Dairies can be shorter but a bit wider.
- For cows standing at 45°, it is common to allow a width of 850 mm to 1000 mm per cow.

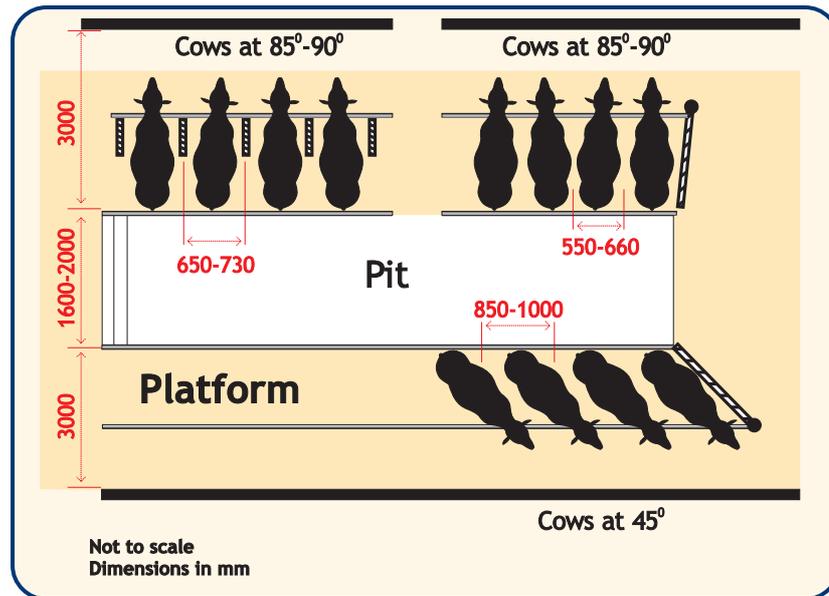


Figure 9.4: Cow spacing at various angles.

Source: After a diagram in 'A Complete Guide to Dairy Design Systems', VDIA.



It is important to anticipate the number of cows that will be milked in the facility in the future. It is easier to allow space for more milking positions in the original design than to physically extend the pit and dairy at some later date.

Message points

Most milk harvesting systems and factory quality assurance systems have an easy recording system for the milking staff to use while they milk.

- Consider where message points such as a white board will be positioned. Milkers will need easy access to record treated cows and note other important information as the milking progresses.



Use and review accident recording logs to identify potential hazards.

Water access in the pit

Water points should be easily accessible in the pit. These are useful for operating a washdown hose or providing water to wash dirty teats.

In colder areas overseas, some pits have warm water running through the pit floor. This helps to warm up the floor, to make the environment more milker-friendly on cold days.



Good drainage and non-slip floor surfaces reduce the risk of slipping.

Feeding systems

It is important to make sure that, whatever feeding system is installed, that it is easy and quick to use.

- Mechanical systems that are manually activated require milkers to allocate some time to dispensing feed – this must be factored into the work routine.
- Manually distributing feed into a trough can result in over-milking if feed distribution takes longer than the time required for the cows to milk out.
- Some dairies have feeders activated by a switch on the exit gate. This eliminates the need for the milker to take any action to feed the cows.
- Make sure the roof is high enough to fit the feeding system in.
- Consider computerised feeding systems if feeding for individual cow production.



Quick Note 5.3 – Herringbone feeding systems; Quick Note 5.4 – Rotary feeding systems



Drive chains, belts and augers on feeding systems must be fully enclosed.



Adjust the feeder to minimise the number of ‘pulls’ required to dispense feed when using manual feed systems. Avoid repetitive strain injuries.

Related areas

Milk room

If the milk vat is located inside, it is important to consider the ease of access for the tanker driver.

- If possible, design the milk room so that it is easy to remove a wall, so the vat can be replaced as the herd size grows.
- Large roller doors, window walls and sliding doors clad with lightweight polycarbonate can all be removed if the need arises.
- Check regulations applicable to the design of the milk room. Quality assurance requirements must be complied with – discuss compliance with factory field officers.



Plan for potential expansion. Most farms are producing more milk than they did 5 years ago. Also, some milk processors are requiring producers to store milk for more than 24 hours.



Some vats are classified as ‘confined spaces’ and are potentially lethal to anyone entering them. Seek professional advice before entering any vat.

Plant room

The plant room should be sited to minimise the noise in the milking area.

- The plant room should be lockable and fitted with all necessary safety fittings and a fire extinguisher.
- Be sure to have the room well-ventilated for efficient vacuum pump cooling.
- In many dairies, the plant room is a totally enclosed brick room, only accessible from outside the milking area.



All drive belts and shafts must be fully guarded. A locked door is not sufficient.



Keep plant noise out of the milking area to reduce milker and cow stress.

Chemical store

The chemical store should also be a lockable area with easy access for delivery and to the work area.

- The storage area should be designed to contain any leakage from containers – a bund is a raised rim around the storage area that can help contain leaks.
- Labels on chemicals need to be protected, so that they are easily read.
- The chemical store should have good ventilation.
- Animal health products may need a fridge for proper storage.
- Clean and safe storage of dairy chemicals and veterinary medicines is recommended and must comply with quality assurance requirements.



Store emergency information and material safety data sheets (MSDS) relating to chemicals carefully. An emergency plan for handling chemical spills should be posted in a readily accessible location, such as the door of the storage room. Water should be nearby for use in emergencies.



Medications should be stored out of reach of children.



Provide a safe disposal receptacle for used medical sharps.



All chemicals should be stored in a secure, ventilated store.

Other storage

A number of other materials may need storing in the dairy for easy access.

- Storage may be required for ID tags and collars, spare parts, tools, herd records and notebooks, spare gloves.
- Cleaning chemicals and teat dip should be stored in a secure location.
- Liners need to be stored out of the sun, to prevent early deterioration of the rubber.



Reduce clutter around the dairy by having adequate, convenient storage space.

People facilities

Any milk harvesting system is only as good as the people operating it. Even robotic systems require human involvement!

- Consider building an office in a new dairy – increased automation and quality assurance programs mean more information is collected, analysed and requires storage.
- Offices may need secure computer facilities and Internet access.
- Some dairy designs include a tea room, access to a phone, wash room, toilet, shower, change room and childcare – these ‘milker-friendly’ facilities may be especially important in larger dairies with multiple employees.
- Access to these facilities should be possible without walking through the milking area. Consider an external door.
- Access to a phone may be useful and is a safety feature.
- Provide easy access to paper towelling, to enable the milker to clean their hands.

Some dairies place a radio or TV in the pit area, or at least mount speakers in the milking area. Remember to keep the sound to a reasonable level. Research suggests that cows like classical music more than heavy metal.



Remember: people are one of the most important assets of a farm business!



Single-operator dairies should have a system in place to alert another person of serious injuries.

Handling facilities

Well-integrated cattle handling facilities make tackling animal health tasks more efficient and safer for the stockhandler.

Crush

Managing for good herd health will require a crush.

- A crush that is accessible from the exit race from the dairy is a valuable asset.

AI race

Mating and drenching of cows is convenient to do in a race.

- Space in front and behind the restrained cows will be necessary to allow access for drenching and mating.
- Rails mounted to posts rather than the dairy or fences will provide clear walkways for access.
- For herringbone dairies, the race should be long enough to hold one side of cows. This allows whole batches to be corralled as they exit the dairy, without the need to hold some in a catch yard.
- In rotary dairies, the race should be sized to hold batches that are easy to handle. About 20 at a time is suggested to reduce loading and unloading hassles.

Cattle ramp

Cows will avoid walking directly towards bright light. They also dislike being above the ground.

- These issues can be overcome by facing the cattle ramp away from the sun and using solid fencing, so the cows can't see out the side.
- The position of the cattle ramp should not interfere with the functions of gates, races and other existing facilities.



Good facilities reduce the chance of injury from irritable cows.

Rounding up ...

Planning a new dairy facility involves careful analysis of current and future requirements.

The main working environment in the dairy should allow for efficient and safe work routines.

Planning should include analysis of general infrastructure and siting needs.



CowTime Cost Cutters

The following list contains ideas about how to get the most out of the planning stage and avoiding poor decisions and extra costs.

- Careful planning can save plenty of time and money.
- Ensure adequate drainage away from the dairy site.
- Do not cut corners on concreting – this is a critical area and best left to the professionals.
- Use natural lighting as much as possible.
- Make sure operator controls are positioned conveniently.
- Use automation where it will save time or running costs.
- Heating and/or fans (as climatic conditions require) will keep milkers happy.

Further information ...



A complete guide to dairy design systems, Victorian Dairy Industry Authority, (1993).

Dairy shed design pack, Jeff Andrews, Queensland Dept. of Primary Industries, (1995).

