6.6 STAND-OFF PADS AND FEED PADS

The use of stand-off pads and feed pads can minimise soil and pasture damage that could otherwise result in annual yield losses of up to 30% from the pugged areas (refer to 2.1 Compaction and pugging). On soils prone to waterlogging, pasture damage during wet weather can be reduced by moving stock to specially constructed stand-off pads or feed pads. Even when there is efficient drainage, removing livestock from the pasture can be an advantage in wet weather. For a full list of advantages and disadvantages of stand-off facilities, refer to 2.1.1.3 On-off grazing.

To make the most of the investment in a stand-off facility, extra pasture grown must be fully utilised as grazing or cut for supplement (refer to 2.5.2.4 Utilising extra production from on-off grazing).

Effluent from a pad must be collected and treated. The farm dairy system will normally require an upgrade to cope with the additional effluent, or an additional facility will need to be provided.

Animal welfare legislation requires that animals have:

- proper and sufficient food and water
- adequate shelter
- opportunities to display normal patterns of behaviour
- physical handling in a manner which minimises the likelihood of unreasonable or unnecessary pain or distress
- protection from, and rapid diagnosis of, any significant injury or disease.

Lameness and mastitis can increase with poorly designed pads. If manure is left to build up, conditions can become unhygienic and uncomfortable for cows. However on a correctly designed and maintained pad, exposure to disease-causing organisms can be less than on a muddy paddock. Teat condition can improve if cows are moved to a well-kept pad rather than left standing in wet, muddy paddocks.

Lameness problems can be minimised at the design stage if consideration is given to:

- surface type
- drainage
- area per cow.

These must be appropriate for the frequency and duration of use.

More detailed information on stand-off pads and feed pads can be found in the Dexcel publications "Minimising Muck, Maximising Money. Design and Management Guidelines" and "Standing-Off – A Cow's Perspective."

6.6.1 Planning a stand-off or feed pad

The key factors in good design for standing off or feeding facilities depend on the main purpose (i.e. supplementary feeding or paddock protection). If both of these are relevant, the stand-off pad and feed pad structure may be combined.

6.6.1.1 Types of pads

Table 6.6-1 shows the types of pads built and their main design considerations.

TABLE 6.6-1

TYPES OF PADS

Type of pad	Purpose	Use	Design considerations
Stand-off or loafing pad (refer to Figure 6.6-1)	Taking stock off pasture during wet periods when the risk of pugging and pasture damage is high (i.e. on-off grazing)	Cows in paddocks graze for a short period (up to 4 hours) and are then moved onto the pad No provision is made for feeding	Area per cow (lying) Soft surface Good drainage Effluent collection
Feed pad (refer to Figure 6.6-2)	Primarily to improve supplement utilisation and efficiency. Hard-surface pads should not be used to stand animals off for long periods of time	Stock spend 1-2 hours on the pad eating supplements, usually sited near the farm dairy. No provision for lying down	Area per cow (feeding) Hard surface Feeding facilities Effluent collection
Wintering pad (refer to Figure 6.6-3)– combination of a feed pad and stand-off facility.	Holding stock off pasture for extended periods (e.g over several months) with feeding facilities included	Cows spend long periods on the pad. Provision is made for lying down and feeding	Area per cow and surfaces for feeding and standing/ lying Effluent collection
Wintering barns (refer to Figure 6.6-4)	Similar to wintering pad but with extra shelter provided	As above, but facility is covered or enclosed	As above, plus ventilation where enclosed

Adapted from Dexcel 2003, Dexcel 2005

FIGURE 6.6-1

STAND-OFF OR LOAFING PAD

FIGURE 6.6-2

FEED PAD

FIGURE 6.6-3

WINTERING PAD

FIGURE 6.6-4

WINTERING BARN

A 'herd home' is a specific type of wintering barn with a 'greenhouse' type roof (refer to Figure 6.6-5). It has a specially-designed concrete slatted floor that allows effluent to drop through to an underground bunker, where it dries, assisted by the raised temperature under the clear plastic roof of the herd home. While the surface slats are concrete, a soft layer of dry effluent tends to build up on top of the slats, cushioning the cows' feet. The design has the added advantage of no liquid effluent to manage, as only the dried product that sits in bunkers under the floor is removed, usually every 6 months - 1 year (refer to Figure 6.6-6). For further information on this system visit the website www.herdhomes.co.nz .

FIGURE 6.6-5

A HERD HOME

FIGURE 6.6-6

REMOVING DRIED EFFLUENT FROM BUNKERS UNDER CONCRETE SLATS OF HERD HOME

6.6.1.2 Area per cow and surface type

The area allowed per animal will affect cow comfort, behaviour and her ability to lie down. Projections should also be made at the design stage for any increase in herd size.

In most dairy shed yards, cows have around 1 m^2 per cow. For stand-off areas, a minimum of 3.5 m^2 per cow is required so that cows can lie down. Cows need to lie down for a minimum of 8 hours a day and prefer to lie for 11 hours a day. If they cannot lie while being stood off, they may lie down when put into pasture instead of grazing.

There are three features of a surface that determine cow comfort:

- softness – cows will lie down sooner on soft surfaces
- slipperiness – this affects cows' confidence to lie down without causing injury
- wetness – cows are reluctant to lie down on a wet surface.

In addition, a muddy surface can increase mastitis levels and foot problems. Drainage is critical for this reason.

For standing off, a soft, well-drained surface is best for cow comfort (e.g. woodchip, sawdust, bark, or post peelings). Lime, soft rock and metal are sometimes used but these are more difficult to maintain. Sand is another option but tends to get 'soupy' and cold. The capture of effluent can also be difficult with rock, metal and sand surfaces. Harder surfaces can be used for standing off for short spells, but over long periods will cause an increase in lameness.

Concrete is recommended for feeding areas due to ease of cleaning and collecting effluent. Concrete should be brushed or grooved to reduce slipperiness.

Table 6.6-2 shows the key considerations of area and surface for different pads and purposes. This relates primarily to the frequency and duration of use. The higher the frequency and the longer the duration that a pad is used, the softer the surface should be and the larger the area required per cow.

TABLE 6.6-2

AREA AND SURFACE FOR DIFFERENT TYPES OF PADS

Type of pad	Purpose	Area per cow*	Best surface
Feed pad	Used to feed stock for 1-2 hours a day	Length of feed race should be: 0.7 m per cow if all cows are to feed at once. 0.3 m per cow ad lib feeding	Concrete is easiest to clean and manage
Stand-off pad	Used for on-off grazing (used less than 12 hrs/day, 2 days in a row)	3.5 m^2 per cow – enough for a cow to lie down	A soft surface is more comfortable for stock – hard surfaces are only suitable for short periods. e.g. bark chip, wood chip and post peelings
Stand-off or wintering pad	Used for more than 12 hrs/day, 3 or more days in a row	5.0 m^2 per cow of soft surface for cows to lie, plus feeding facility (see length of feed race above)	Cows require a soft surface to lie down comfortably. Feeding facility should have hard surface.
Wintering pad	Used to hold stock over several months with no grazing	9.0 m^2 per cow – plenty of space for lying down plus space for ab-lib feeding	Soft surface for lying down** plus concrete for feeding

* These areas apply for a standard cross-bred cow. Add 1 m^2 per cow for large Friesians.
** Unless a specific design of concrete slats is used as in a 'herd home' type barn.

Adapted from Dexcel 2003, Dexcel 2005

6.6.1.3 Site selection

The site will usually be determined by a number of practicalities and the existing opportunities the farm offers. Refer to 6.1.3 Siting and site investigation and also consider the following:

- Food Safety Authority regulations. No feed pad, livestock housing or loafing barn can be sited within 20 m of the farm dairy or tanker loop
- access. Proximity to supplement stores and raceways will reduce operating time if feed is to be carted to the site. However, food safety regulations specify that silage, baleage and whey pits must be at least 45 m from the farm dairy, while hay and other supplementary feed (not over a concrete pad) must be 20 m from the farm dairy. Ease of stock movement on and off the site is important. Vehicles will need to get onto a feed pad for cleaning, maintenance, and feeding out. If the pad is to be used for calving, proximity to the dairy is an advantage
- drainage. Take advantage of any gentle slope (2-4°). Building well above ground level will help avoid any problems with a high water table. Do not build the pad in a low-lying area or a site where stormwater naturally flows. Do not build it in close proximity to any waterway or bore (check your Regional Council rules)
- infrastructure. A reliable water source will be needed for the facility, as well as power (for lighting and pumping effluent). Protect existing lines, pipes and cables from damage
- effluent disposal. It is illegal to allow untreated dung and urine to reach a natural waterway. If farm dairy effluent is being treated through a pond system, the pad could be sited to allow discharge into the anaerobic pond. However, the ponds must be able to cope with the extra effluent load or an additional pond constructed. Otherwise, some form of storage, with dispersal via spray irrigation or vehicle spreader will be necessary (refer to the Dairying and the Environment Committee manual Managing Farm Dairy Effluent). Space may be needed for a storage facility for pad scrapings
- orientation. A north-orientated site that is sunny and offers good shelter from the prevailing wind maximises sun to keep the pad dry and reduce bacteria. However it provides less shade than a roofed pad placed on an east-west orientation
- shelter. Existing trees or land contour can provide shelter from weather extremes. However, some trees pose a risk to stand-off pad or feed pad subsurface drains because roots may block drainage pipelines. Willows, gum trees, macrocarpa and poplars should not be within 40 m of the facility. Do not plant deciduous trees around a feed pad as they will block the effluent system

- room for expansion. Can the facility be extended if the herd size increases?
- public perception. Site the system away from busy roads or shield it from view with wind-cloth or by planting trees. Passers-by are often not aware of the value of standing cows off. To them it may appear to be 'starving cows'. They do not realise that stock are fed and that soils are being protected and future feed ensured.

6.6.2 Construction of feed pads and stand-off pads

Construction of stand-off pads and feed pads involves the following actions:

- remove grass and topsoil and shape land to slope at about 2-4° (a rise of 35-75 mm per 1 m)
- provide for effluent storage (refer to 6.6.3 Effluent and solid waste management) and if possible, for stormwater diversion so that clean rainwater falling on the pad does not enter the effluent system when the pad is not in use. A raised lip around the edge of the pad will keep surface run-off out and contain effluent within the pad
- consider electrical and water piping before laying concrete
- construct stormwater diversion channels around the facility so that clean stormwater does not enter the pad
- prepare subsurface drains and humping and hollowing if necessary (refer to 6.6.2.1 Stand-off pad drainage), directing drains to the effluent storage facility
- spread appropriate base fill material and then lay the bedding surface for stand-off pads (refer to 6.6.2.2 Stand-off pad bedding surfaces) or lay feed pad concrete (refer to 6.6.2.3 Concrete feed pad surfaces)
- construct entrances, walls or fencing (refer to 6.6.2.4 Fencing and entrances)
- provide for water (refer to 6.6.2.5 Water supply)
- provide for feeding if necessary (refer to 6.6.4 Feeding facilities)
- consider constructing a roof or enclosing the area. Roofing is an extra expense but it provides shade and shelter for cows and diverts rainfall so there is less effluent to manage. It is recommended that the advice of a competent engineer and/or builder be sought for roof design. In enclosed areas, adequate ventilation is essential (refer to 6.6.2.6 Shelter and enclosure).

6.6.2.1 Stand-off pad drainage

Drains should be laid on top of a sealed or lined base so that there is no risk of effluent leaching to groundwater. Humping and hollowing may be needed first on flat sites. Once the drains are in place, they are covered with backfill, then base course and bedding layers (refer 6.6.2.2 Stand-off pad bedding surfaces).

Diversion drains should be used to direct stormwater from surrounding land away from the pad.

Hump and hollow drainage
Hump and hollow drainage can work well together with subsurface drains on sites with little or no natural fall.

The topsoil should be removed and the area rolled. Build up humps to a 500 mm ridge at 2 m spacings, running the full length of the pad.

Each hump should be rolled 5 or 6 times before laying subsurface drains in hollows and covering with permeable backfill. A 100-200 mm layer of coarse rock can be laid on the hump and hollow surface and rolled.

FIGURE 6.6-7

HUMPING AND HOLLOWING

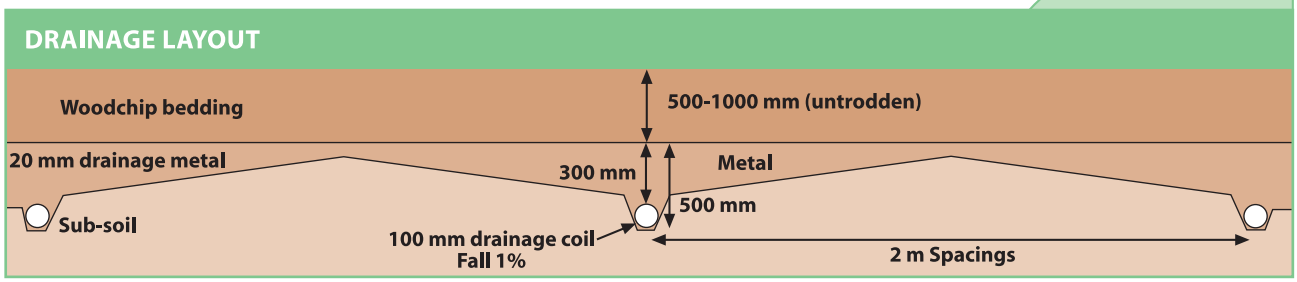
Subsurface pipe drains
Subsurface pipes should be installed in line with the longest dimension of the pad.

Where the subsoil is free-draining, a liner may be required below the pipes to ensure that there is no risk of effluent bypassing the drainage system and entering groundwater.

Pipes of 100 mm diameter should be spaced at between 1.5-3 m intervals with a minimum 1% gradient (1m fall in 100m).

The pipe should be bedded on 25 mm of backfill material and porous backfill must be placed over the pipe to a depth of 300 mm (refer to Figure 6.6-8). It should comprise gravel with particle sizes up to 40 mm or rotten rock for at least the first 200 mm. A 100 mm layer of coarse sand or permeable soil can be laid on top of that if desired before the final surface layer is put down.

FIGURE 6.6-8



Drain outlets
The drainage water must be treated, as it will contain animal dung and urine. The drainage water should be piped to an existing effluent pond system (e.g. at the farm dairy), or to a treatment facility built for the pad, or stored before applying to land. To avoid backflow, outlets to a pond should clear the top of the water level even after heavy rain. For detailed information on effluent treatment options, refer to the Dairying and the Environment Committee manual Managing Farm Dairy Effluent.

6.6.2.2 Stand-off pad bedding surfaces

Once adequate drainage is in place, a soft bedding surface can be laid (refer to Figure 6.6-8 Drainage layout). This may be:

- 500 to 1000 mm of sawdust.
- 300 mm of bark or post-peelings. Bark or post-peelings provide a good bearing surface for cows' hooves, and are free draining and long lasting.
- A combination of 300 mm of sawdust with 150 mm of bark or post-peelings on top.

If the pad rises above ground level, a small retaining wall is needed for the bedding fill.

Soft bedding can be piled up over summer and reused - stir it up to dry for the following winter. If bedding is to be reused, fouled material (i.e. bedding breaking down or incorporating dung) should be skimmed off the pad at the end of the season and removed to a sealed surface before applying to land or composting (refer to 6.6.5 Stand-off pad maintenance). The surface should be topped up annually with fresh bedding.

6.6.2.3 Concrete feed pad surfaces

Concrete feed pads should have a fall of at least 1 in 35 to prevent ponding and slipperiness, and to allow easy washdown of the facility. Tractors will not operate well on steep floors lubricated by slurry. Therefore, avoid building pad floors with a fall greater than 10 m in 100 m. The feed pad should slope to one corner for ease of effluent collection and storage.

Appropriate dimensions will be site-specific, however as a rule:

- allow 4.5-6 m wide feed lanes for ease of vehicle access
- single cow lanes should be 4.0-4.5 m wide
- double cow lanes should be at least 7 m wide
- the length of the feed face if all cows feeding at once should be 700 mm/cow
- the length if cows are feeding ad lib should be 300 mm/cow

Entrances and turning points must be wider (8-10m) to allow for free flow of stock and vehicles – try marking out the proposed area and driving the tractor and feed wagon around to test for ease of manoeuvring.

The concrete should be reinforced, and laid in sections or cut following curing to prevent cracking. The loading and surface finish depends on the use of the area:

- where the concrete will sustain heavy vehicles (e.g. feed lanes), concrete should be designed to withstand 25-30 MPa and have a smooth finish for easy cleaning
- where it will carry stock (e.g. cow lanes) it can be designed for 20 MPa and should be finished with a rougher texture to reduce slipperiness
- where both stock and vehicles will use the area (e.g. where there are feed bins or troughs) it should be designed for 25-30 MPa and have the rougher texture.

Reinforced concrete raceways, either stand alone or adjacent to a stand-off pad, may be used to feed the herd. The race will need to be at least 6 m wide in the feeding area. Crown the race slightly in the middle with fall to either side to stop effluent and rain water ponding on the race. Effluent must be collected for treatment.

Add silicate to reduce tongue corrosion and pitting in the base of feed bins or a small width along the length of feed lanes.

FIGURE 6.6-9

PAD ENTRANCE

6.6.2.4 Fencing and entrances

Provide two entrances to the pad, one at each end. It may be helpful to cover the tracks leading up to the concrete in a softer material such as post peelings, lime, or rotten rock so that there is less chance of cows carrying stones onto the pad.

A step barrier or judder bar is useful to keep entrance areas free of mud and stones, prevent the stand-off pad surface from being dragged out by cows, and divert race runoff from entering the facility (refer to Figure 6.6-9).

For fencing stand-off pads, use 7 m poles driven to a depth of 2 m at spacings of 5 m around the perimeter of the pad (refer to Figure 6.6-10). Nail wire onto the poles surrounding the site and fix artificial shelter (e.g. wind cloth) onto this support system (refer to 6.6.2.6 Shelter and enclosure).

FIGURE 6.6-10

STAND-OFF PAD POLES

Fences should be strong enough to prevent stock being pushed through. A post and rail type is probably the best. Alternatively, run a three-wire insulated electric wire around the inside of the poles at an appropriate height to deter stock from damaging the wind cloth. Stock will need to be given time and space to learn to respect the perimeter wires.

Consider having a single wire electric fence partition down the centre of the pad, or divide the pad into four quarters. This will prevent cows from pacing up and down and could be used to separate younger animals or springers from the herd, reducing competition. Provide a 4 m gate at each end of the partition.

Feed pads may have pipe barriers (similar to yards) or walls made of concrete, concrete block, or treated logs (refer Figure 6.6-11).

FIGURE 6.6-11

TIMBER WALL FEED PAD

6.6.2.5 Water supply

An adequate supply of fresh water is essential, especially when feeding dry supplements. As a rule:

- lactating cows require 70-110 litres of water per day. (As cows are fed concentrated supplements with high DM their water intake increases over 70 litres)
- dry cows require 35-80 litres of water per day.

The water trough should be on a hard standing area such as concrete to avoid muddiness. Water troughs should be placed well away from feed troughs. Preferably locate troughs along outside edge of pad to reduce risk of damage. Avoid having water troughs at end of feed troughs as they may be hit by machinery.

Allowance must also be made for water for cleaning (refer to 6.6.3 Effluent and solid waste management). The additional volume may require a variation to any existing resource consent.

Unlike farm dairy yards, recycled effluent water may be used to clean the surface of a pad, but this is not appropriate for cleaning feed lanes or feed bins.

Where hosing is the cleaning method to be used, several hydrants should be installed around the pad.

6.6.2.6 Shelter and enclosure

Wind-chill may be reduced by the use of artificial shelter (e.g. wind cloth, boarding) or fenced toetoe or trees. Care should be taken that tree roots do not interfere with the pad base or drainage system.

Hardy windbreak cloths are now available for stand-off pads that are more durable than those used in horticulture. Electric fencing should be placed on the inside of windbreak cloth to protect it from stock damage.

The wind can be useful as a drying agent when cows are not in the pad. For this reason the windward section of the shelter should be removable.

Where a structure is fully enclosed (i.e. a wintering barn), it is important to maintain adequate ventilation. Ventilation systems in animal houses have three major functions:

1. Controlling the temperature and humidity.
2. Limiting the build-up of gases (i.e. ammonia, hydrogen sulphide and methane).
3. Distributing fresh air.

Poor ventilation can result in humid conditions, unpleasant odours, high levels of ammonia and poor animal health. Ventilation outlets should be as high as possible inside the building for maximum dilution of odour outside.

6.6.3 Effluent and solid waste management

An effective effluent and solid waste management system is essential to avoid runoff and leaching that can contaminate waterways and waste valuable nutrients.

Feed pad effluent differs to dairy shed effluent in that:

- it has a higher solid content, due to a number of factors, including a higher fibre diet and waste feed being combined with effluent during cleaning
- it has a highly variable, but often higher nutrient content. Nutrient content is affected by feed type and feed quantity as well as how long cows spend on the pad between washdowns.

If cows spend a lot of time on a pad, large volumes of effluent can be deposited. Effluent treatment systems must be able to handle the combined volume of:

- the effluent – liquid and solid, including liquid draining through soft surfaces like sawdust on a stand-off pad
- all water used in the cleaning process
- any rainfall that enters the effluent treatment system off pad surfaces.

As with farm dairies, minimising the amount of water used is beneficial, as is diverting stormwater from surrounding land and from the pad when not in use. A roofed structure will greatly reduce the volume of effluent as rain will be excluded. Scraping the pad and dealing with liquid and solid effluent separately also reduces the volume of liquid effluent to be pumped or stored.

In most cases, effluent from the feed pad will be combined with dairy shed effluent and an upgrade to the farm's existing system will be required. This may include:

- greater storage through extra ponds or bigger ponds
- more frequent desludging
- more land area irrigated
- changes in irrigation equipment to deal with the high fibre content of feed pad effluent.

For hard surfaces, effluent management consists of scraping and washdown processes, with washdown water being captured, stored and treated or applied to land.

Flood washing systems are an alternative to using hose washdown over large concrete surfaces (refer to Figure 6.6-12). Flood washing has a higher capital cost than hosing, but a lower labour requirement and avoids splashing of the feed area.

Ensure the effluent sump can store the volume of flood washed effluent arriving over a short period.

FIGURE 6.6-12

FLOOD WASHING

For soft surfaces such as woodchip or sawdust, effluent draining through must be collected and treated, to prevent it leaching into groundwater. This can be done either with subsurface drainage pipe or by having a sealed or lined surface underneath sloping towards an effluent collection point. The soft materials will also absorb effluent and the top layer will need to be scraped and composted or spread onto land. A sealed surface is required to store scrapings and capture any drainage from them.

Nutrient content in any effluent or compost applied to land should be allowed for in adjusting fertiliser rates and area for land application to keep within total loadings permitted by Regional Council regulations and to avoid animal health problems from K build-up. Undertake a nutrient budget to determine the best nutrient management practices for your farm.

For detailed information on washdown systems and the storage and treatment of liquid effluent from pads refer to the Dairying and the Environment Committee manual Managing Farm Dairy Effluent or "Minimising Muck, Maximising Money."

6.6.3.1 Storage facilities for solid effluent

Because of the high solids content of feed pad effluent, it can be useful to scrape it and deal with it as a sludge rather than directing it into the normal effluent treatment system. Scraping of effluent will result in a lower volume of liquid to handle, but a more concentrated form of effluent for application back to land.

A wide scraper blade can be used to clean feed pad effluent 3-4 times per week. Rear-mounted or front-mounted scrapers for tractors are available (refer Figure 6.6-13).

FIGURE 6.6-13

REAR MOUNTED SCRAPER

The slurry may be scraped to a ramp for loading into a vehicle spreader, or to a storage facility for later removal.

A typical storage system for sludge and semi-solids has a reception store next to the stand-off pad or feed pad. A grid covers the reception store floor or walls to allow liquid through, and/or the floor is sloped so that liquids can drain away to the effluent treatment system. Effluent solids and long fibres such as hay are retained.

It is essential that any solids are stored on a properly sealed and contained site, and liquid is not allowed to drain into the soil where it could pollute groundwater.

Storage facilities should be sited at least 45 m from the farm dairy.

The base and walls of storage facilities should be impermeable to contain liquids and to prevent groundwater getting in if they are below ground. General design considerations for such storage facilities are as follows:

- above-ground storage is the most practical and is necessary where there is a high seasonal water table
- animal wastes are corrosive. Therefore, all materials which they contact, whether timber, concrete or steel, should have their surfaces treated
- a polyethylene cover or complete roof is necessary to prevent rain entering the store
- long, low, narrow stores are preferable. A series of stores will mean that one store can be filled and left to compost while another is being filled
- drainage outlets are required to allow liquid to be collected during sludge drying
- a suitable access area, able to support loaders and spreaders should surround the store
- the facility should be as close as possible to the stand-off pad or feed pad so that the sludge can be scraped across the floor and to the store.

If yard levels will allow, it is desirable to fill the storage facility from above. However, because such stores are typically above ground, a loading ramp may be needed. These should have:

- an incline of no more than 1 m in 8 m to prevent wheel-slip in damp floor conditions
- a restraining rail to prevent the vehicle from driving off the ramp
- the ramp width matching the scraper blade width.

The size of the store needed is calculated from the volume of effluent (related to duration of use) and the volume of soft bedding. The volume of effluent likely to be deposited on the pad can be calculated from figures given in the Dairying and the Environment Committee manual Managing Farm Dairy Effluent. Add to these the volume of any bedding material that may be scraped into the solids store.

Banked compound

Walls of banked compounds should be constructed on three sides with an entrance at the bottom end. The walls may be of concrete or timber construction, with sturdy retaining walls enclosing and retaining the sludge and semi-solids.

Concrete walls can be of reinforced concrete or concrete block. If using timber, have RSJs set into a substantial concrete foundation and set timber panelling onto them.

The compound walls may be up to 2 m high and the sludge and semi-solids can be stored to a higher level than this. Walls must be strong enough to contain the waste and resist the weight of vehicles pushing against them. A concrete pad strong enough to withstand the weight of fully laden vehicles should slope towards the open end. Vehicles can then drive into the facility to load and off-load. The concrete floor should have a minimum fall of 1 m in 100 m towards drainage outlets.

Liquid effluent will drain from the sludge and semi-solids. Construct a grated channel lying across the entrance to collect liquid runoff. For very wide compounds lay a further drain down the centre with the concrete floor sloping to the channel. Channels should be wide enough to allow clearing with a shovel and have a fall of 1 m in 100 m.

The runoff can then drain into facilities storing other liquid effluent and be treated accordingly (refer to the Dairying and Environment Committee manual Managing Farm Dairy Effluent).

Weeping-wall stores

Weeping-wall sludge stores are also built above ground on a concrete base. Excess liquid drains through narrow slots in the walls, is collected in a channel, and is carried to the liquid effluent facility.

The weeping-wall store is particularly suitable for wastes containing a lot of straw or soft bedding (e.g. wastes off feed pads).

The contents of the store gradually dry out, so the removable side panels can be safely taken out to access the solids for spreading on to land.

The walls are typically 2 m high and the sludge is stored at least 300 mm lower than this. The design of the weeping-wall store is similar to that of the concrete or timber banked compound - precast concrete panelling or RSJs set into a concrete foundation and supporting timber panelling. The differences in the weeping-wall store are as follows:

- the compound is fully enclosed by four walls. Some panels are easily removable to empty the contents. These removable panels should be opposite the filling point
- the panelling is spaced with horizontal or vertical slots, 25-35 mm wide, to allow excess liquid effluent to drain away. Pre-cast concrete panels should have slots down them, or the horizontal timber panelling can be spaced at these widths
- the concrete pad extends outside the walls to collect runoff from the weeping walls and carry it to a liquid effluent storage facility.

A drainage channel should completely surround the store to collect all runoff. Channels should be wide enough to allow clearing with a shovel and be installed with a fall of 1 m in 100 m.

There must be enough soft bedding material within the scrapings so that manure slurry does not run out through the slots.

6.6.4 Feeding facilities

The feed pad is usually sited near the farm dairy to allow cows to feed on their way to and from the paddocks. Supplements are loaded into the bins prior to milking using a feed-out wagon. In most cases, the feed pad borders the stand-off pad, although some dairy farms may have a feed pad without an adjacent loafing area.

For information on cows' feed requirements, see the Dexcel FarmFacts 5-22 Feed Requirements of Milking Cows and 5-23 Feed Requirements of Dry Cows or seek advice from a Dexcel Consulting Officer, farm advisor or nutritionist.

FIGURE 6.6-14

FEED PAD FACILITY

6.6.4.1 Supplement storage

Feed storage capacity is determined by the type of feed, the number of animals likely to be on the pad and the likely period it will be in use.

The storage area should be:

- well ventilated
- vermin proof
- easily accessible for feed out machinery and cleaning
- well away from waterways
- at least 20 m away from the farm dairy (45 m for silage, baleage or whey pits).

Any feed with a liquid component will need to be stored in a facility that allows leachate to be contained and collected (refer to 6.2 Silage facilities).

Finely ground feeds can create dusts and odours. Using liquid feeding systems or pellet feed can reduce the dust and may help reduce odours.

Food such as milk by-products (e.g. whey, skimmed milk) should be kept in properly covered tanks or silos. The delivery area should be concrete and all spillage easily washed away into the effluent treatment system.

Records of feed purchases must be kept for traceability purposes.

6.6.4.2 Supplement feeding facilities

When considering feeding facilities there are a number of factors that need to be taken into account:

- cost of the feeding system. Consider the capital costs of setting up the system as well as the ongoing labour and maintenance costs. Consider whether a specialist vehicle will have to be bought to fill the feeding facility
- amount of wastage. It is possible to achieve minimal wastage with some feeding systems. Feeding off the feed pad floor will result in some loss whereas feeding out of bins will minimise losses
- ease of filling. Consider the method of putting the supplements into the bin. Supplements may be fed into the bins using a cross conveyor. Alternatively, a side delivery feed-out wagon may be used. This requires the bins to be lower than the side delivery and wagons may need to be modified so that the side delivery is higher. In some systems, a loader bucket is used to put the supplement into the bins
- ease of cleaning. Cleaning feed bins requires more time than lanes, which can be scraped. However cows may push the feed out of reach in a lane, so management is required to push feed back against the base of the wall about 30 minutes after feeding begins
- keeping cows out of the bins. Ensure that the bin wall is high enough to prevent cows falling in. Provide enough space to avoid bullying. Ensure that the floor of the bin, trough or feed lane is 100-150 mm higher than the feed pad surface where the cow stands, so that feed is readily accessible. A hotwire may also be placed down the centre of the bin or trough. Headbales or bars may be constructed out of piping to prevent cows getting into the feed and to stop them lifting their heads out and throwing feed around. Set steel pipe uprights vertically into the platform at intervals to provide a support for a horizontal double pipe rail. A bottom rail can be placed at 600 mm off the ground and a top rail at 1200 mm off the ground. The uprights can also be placed to divide the bins into 700 mm feeding spaces
- row length (refer to Table 6.6-2).

Feed lanes
A 500 mm high concrete barrier should be provided to separate the cows from the feed lane. The feed lane should be raised at least 100 mm higher than the cow lane so cows can easily reach feed and effluent does not contaminate the feed lane (refer to Figure 6.6-15).

FIGURE 6.6-15
FEED LANES

Long bins or troughs
Long bins are suitable as a feed-out facility along the length of a feed pad or on the exit race from the farm dairy (refer to Figure 6.6-16).

They should be 1 m wide and 350 mm deep with a further 150 mm thickness of base.

Concrete troughs and fibreglass bins
Rectangular sheep water troughs can be used on both sides of the exit race from the farm dairy. The troughs can be ordered custom made without ballcocks and with drainage holes in the base, allowing rainwater to drain out.

Fibreglass feed bins are also available. They have a rounded shape allowing the cows to easily clean them out.

FIGURE 6.6-16

LONG BIN FEEDER

FIGURE 6.6-17

CIRCULAR BIN FEEDER

Concrete bins

Concrete feed bins are best placed to allow cows to feed from both sides. Concrete bins should be 1.5 m wide and 350 mm deep with a 150 mm thick base. Bins can also be made of wood or brick if available.

Circular bins

Supplement is dropped into circular bins using a loader bucket. The unit has gaps for several cows to feed - normally 10 to 12 cows will feed together (refer to Figure 6.6-17).

Circular bins may be constructed from 12 to 25 mm pipe and corrugated iron, or purchased ready made. They are about the same diameter as a standard water trough and need not have a floor.

Portable ring-like bins are commercially available. The bins can be moved to new locations to minimise damage to races or they can be permanently fixed. The sides are made from 0.95 gauge galvanised sheet steel. Five ring sections slot together and are held together by bolts. These can be taken apart and stored. Flanges at the top and bottom provide strength and shape.

Feed racks

Feed racks should be placed about 500 mm above the pad.

6.6.5 Stand-off pad maintenance

Good maintenance will ensure dry, clean conditions to minimise animal health problems and prolong the life of the pad.

At the end of winter a stand-off pad should be scraped down with a rear mounted tractor blade to a firm surface - usually 100 to 200 mm below the pad surface. A firm surface will indicate that the under-pad drainage is functioning correctly. Scrapings can be incorporated into cropping land, taking into account Regional Council rules regarding nutrient loadings. The remaining woodchip bedding should be windrowed to allow drying over the summer months.

It may also be necessary to scrape the top off the pad regular intervals during stand-off pad use. Removing cow pats off the pad after use will lengthen its life. Dung will speed up the breakdown of the bedding surface and may contribute to failure of the drainage system. However, some dung is inevitable, and so problems are best avoided with an excellent subsurface drainage system.

The movement of heavy vehicles on a stand-off pad should be minimised to reduce compaction and material breakdown.

When the pad is not likely to be used for some time, weeds should be sprayed.

Before the onset of the wet months, the pad should be topped up with the woodchip bedding cover. Allow 1 m^3 of sawdust or 0.5 m^3 of bark or post-peelings per animal.

Rats can make their way up pad drainage systems and block them. Rats are common where supplement storage facilities are close to the stand-off pad or feed pad area. Use traps to control them, and cover subsurface drain outlets with wire netting.

6.6.6 Stand-off and feed pad costs

Cost varies greatly according to each farm's situation.

Table 6.6-3 provides a rough guide to the range of costs that can be expected.

Roofing a stand-off area or feed pad will approximately double the construction cost.

TABLE 6.6-3

COST RANGES FOR DIFFERENT TYPES OF PADS

Type of facility	Range of cost per cow
Stand-off pad	$25-75
Feed pad	$50-375
Wintering pad	$65-318
Herd home	$1100

6.6.7 Top tips for stand-off pads and feed pads

- **Take some time at the planning stage to look at existing feed pads and stand-off pads on neighbouring farms to see what works best.**
- **Get quotes and prices from several sources. Quotes can differ significantly.**
- **Site facilities above the ground level to avoid problems associated with a high water table and ponding.**
- **Allow adequate space for cows and provide appropriate surfaces to suit the purpose of the pad and frequency and duration of use.**
- **Construct diversion channels around the pad to avoid rainwater entering and consider a roof to reduce the volume of effluent to handle.**
- **Provide for a solid storage facility and scrape the pad to reduce effluent volume.**
- **Collect all liquid effluent draining off the pad, store and treat appropriately. Design an upgrade to the farm dairy effluent treatment facility or an alternative treatment option.**
- **With concrete pads, roughen the concrete surface to prevent cows slipping.**
- **Introduce the herd to a new pad in short stints so they can become accustomed to it.**
- **Keep old cows separated from heifers to reduce bullying. Consider requirements for internal barriers or fencing and design these before pouring the concrete surface of a pad.**
- **Keep long-term winter housing well maintained, removing dirty bedding and topping up clean bedding regularly. This will reduce the risk of mastitis.**
- **Remember good pasture utilisation is essential to make the most of the investment in a pad. Plan how you will make the most of extra pasture growth from protecting your soils during wet conditions.**

6.7 DAMS, WATER INTAKES AND IN-STREAM WORKS

Structures associated with waterways can have impacts on aquatic life and downstream users. They nearly always require a resource consent from the Regional Council. Water takes for domestic and stock water are allowed under the Resource Management Act (1991) as long as they do not have adverse environmental effects. Larger water takes usually require a resource consent.

Dams can have major safety implications as well as impacting on waterways and fish migration. It is preferable to build water storage facilities away from the main channel of the waterway rather than building an in-stream dam.

6.7.1 Farm dams

The complexity, risks and obligations associated with in-stream dam building should not be underestimated. Depending on dam size, a dam failure can mean anything from a minor nuisance and cost, to major cost, damage to land and buildings, loss of life for animals and humans and criminal convictions if fault is proven.

Off-stream dams or storage ponds are generally preferable to in-stream structures where feasible. Design and construction of water storage ponds involves many of the same considerations that apply to effluent ponds (refer to the Dairying and Environment Committee manual Managing Farm Dairy Effluent).

For in-stream dams it is advisable to get engineering advice early and to thoroughly check the credentials and experience of consulting engineers. Ask to see other projects and get in contact with other people the engineer has worked for.

All parties should have insurance against the possibility of a dam failing.

Farm dams should be designed in a systematic fashion:

1. Establish the water capacity needed. The size of the dam includes the volume of water to be stored for irrigation plus allowance of 20% for evaporation and seepage
2. Consider site options. Generally the best dam sites are narrow necks which flood wide areas of fairly flat ponding areas, preferably not already in good pasture. Estimate or measure the water yield of the proposed catchment
3. Contact the Regional Council regarding the proposal
4. Survey the site, test the soil and prepare a contour plan
5. Design the embankment. This will include reference to the Building Act (1991)
6. Evaluate the potential for dam failure and associated risks
7. Estimate volumes of soil to be excavated
8. Design the spillway, fish passage and associated structures as appropriate
9. Prepare contract specifications
10. Prepare a schedule of quantities and costings
11. Prepare documentation and apply for a resource consent
12. Construct the dam.

Design and construction will be site-specific, so engineering advice should be sought on all of the above matters.

In-stream dams require a resource consent from the Regional Council. Issues which may need to be addressed include the following:

- effects on in-stream life, such as those on fish passage, water temperature, and algal and weed growth
- preventing silt from entering watercourses. This restriction influences many activities during both construction and use of the dam
- potential for water backing up and flooding upstream
- potential for flooding downstream. The engineer should design at least 2 alternatives for handling floods in the catchment when the dam is full (e.g. the outlet pipe and the spillway).

Where a group of farmers cluster together to build a dam, a title can be formed enclosing the dam. The ownership should be via a company with shareholding attached to the farmers' own titles thus capturing the capital growth for the farmer.

6.7.2 Water takes

Both surface and groundwater takes can have impacts on the environment if they are not well constructed. As these takes often require a resource consent, the conditions of the consent will be designed to avoid environmental effects and should be complied with fully.

6.7.2.1 Surface water takes

The main effects of surface water intakes on aquatic life are due to changes to the water level or flow pattern of the water body and the potential for fish to be sucked into the intake. These issues are dealt with through the resource consent process and the conditions on the consent should be followed closely to avoid harming aquatic life. Permitted takes (those that do not require a resource consent) may also have conditions that must be met to protect aquatic life. Check your Regional Council's water plans.

Typically, these conditions will include:

- a limit on the volume of water to be taken over a specified time
- screening of the intake to a specified mesh size
- a limit on pipe size and restrictions on the rate of the intake so as not to cause undue suction that could pin fish against the screen
- there may be restrictions on water takes in dry conditions
- there may be conditions around sediment disturbance during installation.

In addition, there may be conditions to protect the safety of other users of the waterway (e.g. signage and limiting the extent to which a pipe protrudes into the river channel).

6.7.2.2 Groundwater takes

The main risks with groundwater takes include:

- localised effects from draw-down that impact on other groundwater users nearby
- aquifer levels falling if the water being abstracted exceeds the recharge rate
- contamination of the groundwater aquifer with nutrients, chemicals or faecal matter.

The first of these two issues concern the amount of water being taken and are governed by Regional Council plans and consents. There may be seasonal restrictions in place when recharge rates are particularly low.

The third issue of contamination depends on construction of the bore or well-head and safe practices with agrichemicals and fertilisers. To prevent these substances travelling down the bore shaft and reaching groundwater, they should not be stored or mixed anywhere near the bore.

Figure 6.7-1 shows how a well-protected groundwater take may be constructed.

FIGURE 6.7-1

A WELL CONSTRUCTED BORE TO PROTECT GROUND WATER

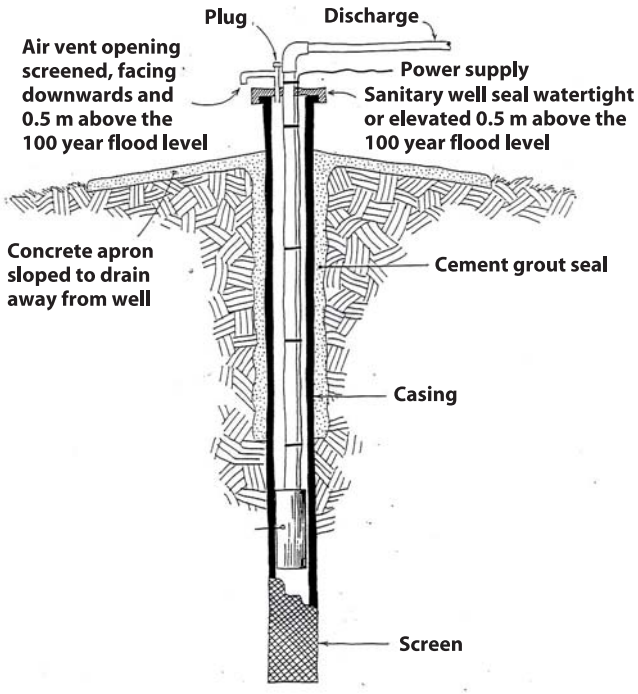


Diagram source: Ministry of Health, 1995

Photo source: Environment Waikato

6.7.3 Streambank engineering and in-stream works

It is usually preferable to control bank erosion with 'soft engineering' solutions (i.e. by establishing suitable vegetation on the banks). Sometimes, a fence can be erected well back from the stream bank and trees planted to try and stabilise the soil. This may not prevent slumping of the bank area nearest the stream, but avoids further encroachment.

However in extreme cases of instability of stream banks or beds, structures may sometimes be appropriate. Note that any in-stream works are likely to require a consent from your Regional Council and design advice should be sought from a river engineer.

Streambed erosion in normally controlled by structural measures installed across the bed and tied into the bank (e.g. rock or wood weirs or boulder clusters). Stream bank erosion may be controlled by a mix of structural measures (such as riprap, flow deflectors and groynes) and non-structural measures (vegetation).

These structures can cause alterations in flow patterns and erosion downstream, so stream conditions should be monitored following the construction of any new works.

Any work conducted in a stream is likely to require a resource consent, especially if diggers are to be used. Proposals should be discussed with Regional Council staff. In addition, if you are within a drainage scheme, drainage authority staff should be consulted.

6.7.4 Top tips for dams, water takes and in-stream works

- **Professional advice and site supervision during construction by a competent consulting engineer is essential for all major earth structures.**
- **Minimise sediment entering waterways – divert clean stormwater from the construction site and use silt traps to stop sediment reaching waterways.**
- **Protect bare earth during construction - regrass bare ground immediately. Even if a dam is not finished before winter, it should still be sown - or some other form of ground cover used (e.g. hay).**
- **Outflow from the dam should be dissipated so as not to cause erosion, and adequate flood flow provisions should be made.**
- **Ensure that surface water takes are properly meshed and that pumping rates are low enough to avoid fish becoming sucked onto the mesh. Follow resource consent or permitted activity conditions.**
- **Protect bore heads from contamination by sealing them so that pollution cannot reach groundwater easily.**
- **Consult drainage authorities as well as the Regional Council before undertaking in-stream works or streambank engineering.**

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