Equipment

Guideline No 9.

When considering a dairy effluent management system you need to evaluate the system as a whole. This means not only deciding on the best kind of system that suits your dairy but also the type of supporting equipment that might be required.

This includes sumps and storage tanks, pumps, pipes and sprinklers.

Sumps and Storage Tanks

Sumps are in ground collection points for dairy effluent prior to storage or applying it to pasture. They can be designed for either minimum storage or buffer storage. When deciding to install a collection sump, you need to be clear about which type of sump you will be installing.

In minimum storage sumps, the effluent has to be pumped out almost as quickly as it flows in. The effluent does not have time to settle and therefore agitation is not usually necessary in these sumps. However, a stone trap is **essential** to minimise problems with the pump. The sump acts as a collection point only and problems can occur if the pump fails.

Backup systems for minimum storage sumps should always be incorporated into the design plan. A minimum backup storage equivalent to two days of effluent production should be in place to ensure that effluent can be contained in the event of a breakdown. Effluent should be able to flow to this emergency storage by gravity and not require pumping.

(Refer to Guideline No. 4 : Emergency Backup Plans).

Buffer storage sumps give more capacity to cope with pump failure since the sump should be designed to store the effluent from two or more days without overflowing. A buffer storage sump should be emptied after each milking to reduce the need for agitation to keep solids in suspension. A stone trap will help to minimise problems with the pump.

Trafficable sumps are used to settle out solids, making the remaining liquid easier to pump. Sumps that hold effluent for any length of time need to be at least 20 metres from the milk room.

Storage tanks are designed to store the effluent for one week or more. They can be used in combination with slurry tankers or pumped direct to pasture.

Tanks which are pumped usually require mixing to keep manure solids in suspension. Ensure that the mixer and the pump can be removed easily for cleaning or maintenance.

Sumps or storage tanks which are used to spread direct to pasture may also require wet weather storage for the period of the year when rainfall exceeds evaporation and effluent can not be spread on paddocks safely.

Pumps

Pumps are critical in most effluent management systems, yet they probably cause more problems than any other part of the system. As a general rule, the more effective the solids separation system, the fewer problems which will occur with the pumps.

Use a pump that is designed to handle dairy effluent. If the effluent contains solids it is important to select a pump that has the capacity to pump rapidly enough to prevent solids settling out in pipe-work.

Reliability is essential as the consequences of having a pump out of action for any length of time can be serious. All pumps will break down occasionally and need maintenance. Mount the pump in a position where it is easy to access. It is strongly recommended that you use a purpose-built manure pump, regardless of whether or not a solids separation system is used.

Agitation of the effluent to be pumped keeps the solids in suspension and can help the performance of the pump. A bypass line or a freshwater hose inlet are simple methods to keep the collection vessel agitated. Mechanical stirrers can also be used.

Tips on Managing Your Dairy Effluent Management System

Over the calving period, watch out for afterbirth entering and blocking the stone trap.

Avoid having loose material on races running up to the farm dairy. Wood chips placed on races near the yard area are commonly brought into the dairy by the cows and block the drains, sump inlets and pump.

Clean out screens, filters and solid traps regularly. Coarse materials moving through pumps and piping will cause damage and wear.

Regular maintenance of the effluent management system will reduce the number of breakdowns and allow the system to function as planned.

Maintain drains and repair broken or badly laid concrete to prevent effluent from ponding.

Rubberware and ear tags commonly block sumps. A rubbish drum should be placed outside the farm dairy for bags, tubes and other disposable items.

Characteristics of some common types of effluent pumps are shown in the table below.

Characteristics of some common types of pumps

Type of pump	Maximum solids content	Pump head (m)	Power needs range (kW)	Applications	Comments
Conventional centrifugal (horizontal shaft)	5%	>60	2.2 - 35	recirculation	must have high quality effluent
Open and semi-open vertical shaft	15%	<25	2.2 - 40	transfer to storage, gravity irrigation, tanker filling	low lift capability avoids priming and foot valves
Submersible centrifugal	15%	<10	2.2 - 7.5	transfer to storage	low lift capability, uncommon
Diaphragm	20%	<10	0.75 - 7.6	transfer to storage	very simple in operation
Helical screw (rotor)	6%	>60	2.2 - 30	sprinkler irrigation, pumping over long distance, pumping to elevated storage	good for high solids; abrasive material can destroy stator
Piston pump	20%	<10	7.5	transfer to storage of fibrous material, sludge pumping	limited use for effluent, good for solids and slurries
Vacuum pump	10%	max lift 3.5 m	3.75 - 40	tanker loading, priming siphons	good for livestock effluent

Pipes

The type of pipe required will depend on what the pipe is expected to carry. If the pipe is expected to move effluent containing solids by gravity, at least 150 millimetre pipe will be needed. Blockages will be a problem with anything less than this. Separating out the solids makes it easier to move the remaining liquid.

Talk to your supplier about what you will need for your particular circumstances. Distance pumped, head and presence or absence of solids all need to be considered when designing the system. You also need to consider what effect sunlight might have on the performance of the pipe. If the pipe is designed to be buried, leaving it on the surface may reduce its performance and will shorten its life.

When choosing and laying out the pipe-work consider the following:-

- If the fall is from one in 60 to about one in 80, use 200 millimetre pipe if relying on gravity. If the fall is less than this, use a pump.
- Use sewer class pipe rather than storm water.
- If pumping more than about 100 metres or more than about 10 metres static head, use 75 millimetre, class 4.5 pipe. 50 millimetre pipe can be used for shorter distances or lower heads.

- UPVC pipe can normally handle higher pressures than polythene pipe but has less flexibility to handle surge pressure.
- Leaving PVC pipe uncovered on the surface for only a few months can halve the life of the pipe compared to being installed underground.

Sprinklers

Regardless of whether raw effluent or effluent from which the solids have been removed is being spread, use a sprinkler which has been designed to handle effluent.

Whether the sprinkler is a single skid mounted sprinkler or a travelling irrigator, the spray jet must be flexible enough to pass solids larger than the nozzle diameter.

Injection of dairy effluent into centre pivots and permanent sprinkler systems requires that the sprinklers be set up to handle the type of effluent injected. Effluent, which is free of solids either by settling or filtration, can be spread through all types of conventional sprinklers. Effluent, which contains solids, will need to be spread through sprinklers that have been set up to handle solids.

What changes will I have to make to my irrigator so that I can irrigate with dairy effluent?

Conventional sprinklers will need to be fitted with flow control nozzles to allow for solids, which can block regulators and nozzles.

Impact sprinklers are able to handle solids that are smaller than the smallest nozzle diameter. These will generally have lower efficiency and uniformity than conventional sprinklers.

Centre Pivot Irrigator

Big gun sprinklers are capable of handling larger solids but require higher operating pressures to operate. Both the efficiency and uniformity of irrigation are low. Big gun supply lines can be underslung from conventional centre pivot systems which will allow two separate methods of irrigation – fresh and effluent.

Travelling irrigators will require flexible jets that can pass solids and prevent blockages. Milking liners can be fitted as a “nut and tail” assembly in place of rubber nozzles. The throw from the travelling irrigator will be dependent upon the liner bore size and the pressure at the nozzle, which will be determined by the delivery rate of the pump and the delivery line friction head.

Travelling Manure Irrigator

Milk Liner Nozzle

Move all sprinkler systems regularly to avoid effluent ponding on a small area. The length of time stationary sprinklers should remain in position before being moved and the speed of movement of travelling irrigators or centre pivot systems can be calculated using the "Nutrient Budget Calculator" spreadsheet[1] .

Plan an easy way of moving skid mounted sprinklers.

An effective cut-off mechanism is essential on travelling irrigators.

Spray pot sprinklers can also be effective but they tend to have a small wetted diameter and poor distribution pattern.

Slurry tankers

Slurry or vacuum tankers are useful for moving semi-liquid effluent and they can cope with most of the material which ends up in storage ponds. They provide more flexibility than other spreading systems as they can access more of the farm. Slurry tankers are unlikely to be suitable for large herds due to the time required by the dairyfarmer, or the cost of contractors to spread large amounts of effluent.

As with collection sump systems, wet weather storage will be required for the period of the year when rainfall exceeds evaporation and effluent cannot be spread on paddocks safely with slurry tankers.

Tankers are generally expensive but there is scope for either using a contracting service or for neighbours to share one. Make sure that the tanker is well cleaned before it comes onto your farm.

A slurry tanker fitted with a dribble bar effluent spreading system	Spreading effluent using a slurry tanker fitted with a splash plate spreading system
	

Where the tanker is travelling between farms the onus is on the landowner to ensure that the contractor cleans the tanker, wheels, and his boots before he arrives, so that no effluent or manure is visible.

Where possible farms with BJD scores over 7 should be visited last.

[1] The Nutrient Budget calculator is available though the Dairy Effluent Technical Officer for the project, your dairy company field officer, or the EPA. See Guideline 19 for contact details.