Resource consent conditions

When you are granted a resource consent, it will have a list of consent conditions. You need to ensure that your system complies with these conditions. When designing your system it is prudent to consider conditions relating to:

- The size of the application area
- The return period between applications
- The discharge not taking place within 150 metres of any dwelling; 50 metres from any bore, well or spring used for water supply purposes; nor within 25 metres of any surface water body
- The discharge not causing effluent to enter surface water
- The discharge not resulting in ponding that remains for more than three hours after the discharge has ceased.

Bear in mind that Fonterra also has rules on how an effluent system is designed, including how far a sump must be from the dairy shed. It is recommended that you contact Fonterra to ensure that any new system meets their requirements.

Types of spray irrigation systems

The type of spray irrigation system suitable for your farm will mainly be determined by the amount of effluent to be irrigated. Bear in mind that if effluent from a feed or wintering pad is also being irrigated, the amount of effluent produced will increase. Consequently, the system will need to be designed to accommodate an extra 33% effluent loading.

K-Line irrigation

Using an existing K-line system set up for water irrigation can save on initial capital investment. However, unless the effluent has been filtered, larger nozzles will need to be fitted. This is a very suitable option if irrigating from the last pond of an oxidation pond system. The effluent solids are almost entirely retained in the first pond, provided the outlet from the first pond is fitted with a baffle.

Travelling irrigator

A travelling irrigator is capable of spraying a large amount of effluent in one pumping, and is preferred by many farmers due to the lack of labour input compared to other systems. Large farms often incorporate the use of hydrants and buried piping, for ease of management.

Standing irrigator

Provided an appropriate sized pump is used, a standing irrigator is capable of spraying effluent over a large area. The irrigator will need to be moved regularly to avoid ponding, runoff and overloading of the soil.

Pottle irrigator

Pottle irrigators are capable of spreading effluent approximately 10 - 15 metres from the pottle, providing the pump is in good repair. This system can work well up to approximately 150 cows. If a pottle is used when milking more cows, the pottle will need to be moved very frequently, and the risk of runoff and ponding will be higher.

Gravity fed irrigation

This system relies on fall being available from the collection area at the shed. A major limiting factor of this system is that there needs to be sufficient receiving area downhill of the shed, hence, it is only suitable for small farms (100 cows or less).

Honey wagon

Effluent can be pumped and or piped to a honey wagon. This simple system is cheap to run and can result in a lot of land being irrigated, depending on the terrain. Suitable for all farms, but labour costs will increase with higher cow numbers.

Holding pond, contractors

This system is also only suitable for smaller farms, as it involves storing all the effluent in a holding pond and when the holding pond is full, employing contractors, or hiring equipment, to irrigate the effluent to land. It is extremely important that no overflow occurs from the pond and that the ponds are sealed to prevent effluent escaping to groundwater. For a farm of 150 cows, with a sealed holding pond of 1,000 m^3 capacity, the pond would need to be completely emptied every 98 days, depending on evaporation rates and stormwater inflow. Consequently, the larger the farm - the larger the cost.

Collection system

All washdown effluent from the dairy shed must enter the irrigation system. You must ensure that no effluent can escape from the system, such as by running down the race. If the entire yard does not slope to the sump, it may be necessary to create another collection area and pipe or pump this to the sump. Pit washings and milkroom also need to be directed to the sump.

Stormwater diversion

It is unnecessary and inefficient to pump clean stormwater. A stormwater diversion can be installed to ensure that any clean water that runs off the yard is diverted around the sump. Diverting the stormwater to a low point in the surrounding paddock will avoid the direct discharge of effluent to water should the system fail. In addition, the diversion should ideally be positioned prior to the sandtrap, to avoid contaminants from the sandtrap fouling the clean stormwater. Alternatively, an overflow pipe from the sump can be used to take stormwater, but it must be free of effluent before it can overflow. Ideally, the overflow pipe should also be directed to a low point in the surrounding paddock.

Sandtrap

A sandtrap will increase the life of your pump, by reducing wear and tear from effluent solids and gravel. It will also reduce blockages in the line and at the irrigator nozzles. When designing the sandtrap, you need to consider how it will be cleaned out. The most common option for new systems is a large sandtrap, which involves removing the solids using a tractor fitted with a back blade or bucket. When removed the solids need to be placed on land where they cannot enter a watercourse, and ideally, worked back into the soil as fertiliser.

Sump

The most crucial design question for a sump is its size. Ideally, the sump should be large enough to store effluent during times when the soil is too saturated to allow irrigation. This could be up to a week in wetter areas, especially during spring. An old oxidation pond is a good option as they have a large holding capacity. However, you must make sure the oxidation pond does not discharge to water.

Check with Fonterra when designing the system as they have additional rules for sumps.

Overflow contingency

All sumps need a contingency plan to cover sump overflow due to pump failure. Any overflow should be directed to a temporary holding basin. This could simply be a hollow in a nearby paddock, which does not have a subsoil drain. An overflow pipe for stormwater that discharges to a waterbody is not to discharge effluent at any stage.

Important note:

Effluent ponding or entering a waterbody due to soil saturation or pump failure is not acceptable, as the problem is foreseeable. Any new system must be designed to accommodate these eventualities.

Pump

Centrifugal pumps, manufactured especially for effluent, are best. PTO pumps or stationary pumps can be very effective for pond systems. The required size depends on the terrain, and the head/lift from the sump. Make sure that the effluent pump is of sufficient capacity so that it can keep up with the effluent inflow. This is especially important when using a small sump. A stirrer is recommended for larger sumps/ponds. Valves must be installed, to avoid effluent siphoning from the pump to the irrigator if it is down hill, and also to avoid effluent flowing back to the sump when it turns off (especially important for those systems with a float switch).

Switch type

Manual switch

This simple on/off switch is best suited to large sump systems eg ponds.

Timer

Used to ensure irrigation occurs at night, when the electricity rate is cheapest. Care should be taken to prevent sump overflow which can occur due to over filling during the day.

Float Switch/Probes

A level sensor, either a float or probes, turns the pump on and off when it reaches a certain level. This is often used in conjunction with the manual switch. The pump is manually turned on before the cows enter the yard. Overflows can occur if the pump is not on during milking, for reasons such as rain. Malfunctioning float and probe switches are a common cause of sump overflow, so they need to be well maintained.

Piping

The system that carries the effluent to the irrigator must be well maintained and strong enough to avoid splits, failed couplings and blocked hoses. Blockages can also occur at bends, such as where hydrants are fitted. Bends should be no greater than 45 degrees.

Recieving area

When choosing the site to irrigate the effluent, you must consider proximity to waterbodies, buried drains, bores, the farm dairy, farm boundaries and nearby dwellings. If possible don't irrigate over buried drains or move the irrigator frequently to avoid effluent entering such drains and flowing to a waterbody. Also consider the terrain. For example, a travelling irrigator cannot operate on steep terrain, and effluent will run off steep hillsides to nearby waterbodies.

Application area

The Taranaki Regional Council limits the application of nitrogen to land to 200 kilograms of nitrogen per hectare per year. This equates to three hectares for irrigation for every 100 cows milked, or 45 mm of raw dairy effluent per hectare per year.

Application rate

Over-application of effluent may lead to reduced pasture growth by causing ponding, saturating the soil in the root zone, or damaging pasture with excessive effluent solids. It may also lead to runoff, and breaches of consent conditions. The maximum speed at which effluent can be applied while avoiding these problems depends on the soil type (see table below).

Effluent application recommendations for various soil types under pasture cover

Soil type	Maximum application at any one time (mm)	Maximum application rate (mm/hr)	Area to be irrigated daily per 100 cows (m^2)
Sand	15	32	330
Pumice	15	32	330
Loamy sand	18	32	280
Sandy loam	24	20	200
Fine sandy loam	24	17	200
Silt loam	24	10	200
Clay loam	18	13	280
Clay	18	10	280
Peat	20	17	250

Note 1: For soils at 50% Water Holding Capacity prior to effluent application.
Note 2: For land slopes up to 8°. Application onto low to steep hills should be avoided.
Note 3: Rooting depth of pasture 0.31 to 0.76 m. Effective rooting depth for nutrient uptake 0.2 m.
New Zealand Pastoral Agricultural Research Institute Limited pers. Comm.; Standards Association of New Zealand, 1973; Livingstone, 1992; Wrigley, 1994.
Water holding capacities for various soil types from Standards Association of New Zealand, 1973.

Something that has been noted when raw effluent is applied at a thick rate is the growth of undesirable plants such as dock (Rumex sp.). Thinner rates do not seem to cause this problem.

Return period

After irrigation the land needs time to absorb and breakdown the effluent. Table 3 gives the minimum interval between irrigations. In order to manage disease risk, it may be necessary to keep stock off pasture for longer.

Minimum return period

Soil type	Application interval/return period (days)
Sand	5
Sandy loam	15
Silt loam	20
Clay loam	20
Clay	20
Peat	15

Nutrient value

There is fertilising benefit to be gained when applying effluent to pasture and cropping land. Farm dairy effluent offers a source of N, P, K and S fertilisers and trace elements to increase pasture or crop production. The organic matter in the effluent can improve soil water holding capabilities, soil aeration and drainage, and soil tillage characteristics. Application of effluent to pastoral soils may also increase earthworm numbers. Application of farm dairy effluent that has been treated by a two-pond oxidation pond treatment system offers additional benefits, as much of the nitrogen is converted to ammonia during the treatment process. This form of nitrogen is much more readily available for plant uptake.

The following table gives typical nutrient values for farm dairy effluent. Note, however, that the fertiliser value of effluent from a single property will vary between milkings and between seasons. Also, effluent stored in ponds changes in nutrient content.

Equivalent fertiliser value of effluent from 100 cows

Nutrient (kg/yr)					Solid fertiliser equivalent (tonnes/yr)
N	P	K	S	Mg	
590					1.3 of Urea
	70	540	80		1.3 - 2.2 of 50% Potash Super
				100	0.2 of Mg Oxide

Farm dairy effluent from 100 cows, spread over 3 hectares will provide approximately:

- 200 kg/ha of N.
- 23 kg/ha of P.
- 180 kg/ha of K.
- 27 kg/ha of S.
- Magnesium and calcium.

Not all the nutrients are available to plants in the first year. Most potassium is available for pasture uptake, but nitrogen and phosphorus will require time to be broken down into plant available forms.

Converting from ponds to spray irrigation

When converting from oxidation ponds to spray irrigation, bear in mind that the ponds can be incorporated into the new system. Effluent from the last pond is treated, and has a form of nitrogen that is more available to plants. Irrigating effluent from the last pond allows a greater ease of management, as there is a large storage capacity, and the effluent will be primarily liquid as the solids should be retained in the first pond. The solids can be removed from the first pond as required and used pre-seeding as fertiliser for maize or grain crops.

This system is easy to manage with regard to resource consent conditions, as the effluent is treated, and the storage capacity is large enough to avoid the need to irrigate during wet periods. The total area that needs to be irrigated will depend on the discharge from the last pond. This discharge may need to be sampled, to assess how much ammonia it contains. From this figure it will be possible to calculate the required area so that no more than 200 kilograms/hectare of nitrogen is applied to land per year.

It is best to suspend the pump from a pontoon, to pump from the second pond. The effluent should be irrigated through a:

- K-line
- Travelling irrigator or
- Standing Irrigator

It is important to note that unless dual-consent is held that allows a discharge to water and a discharge to land, the ponds must not overflow. This includes overflows or discharge through the old pond outlet. Therefore it would be prudent to install a stormwater diversion, depending on your farm's annual rainfall.

To use this option, the oxidation ponds will need to be sealed to prevent effluent escaping to groundwater and also to prevent groundwater entering the effluent ponds and reducing the storage capacity.