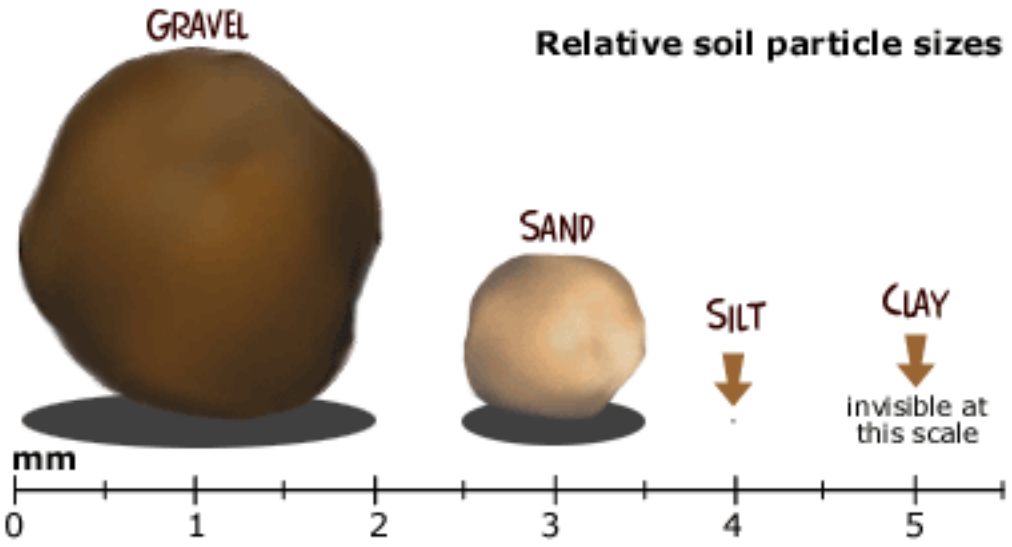
How landscape and climate affect effluent management (6-61)

There are three main landscape and climate factors which play a role in the success of effluent application:

- The soil drainage characteristics
- Landscape contour
- Climate (rainfall and soil moisture deficits)

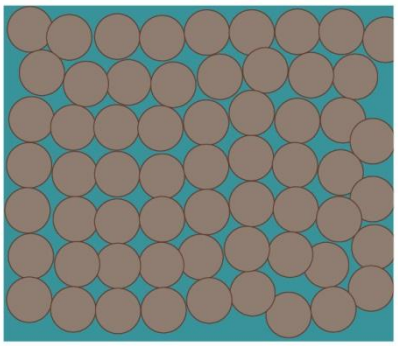
These factors must be taken into account when planning effluent management and application to land.

Soil texture and drainage

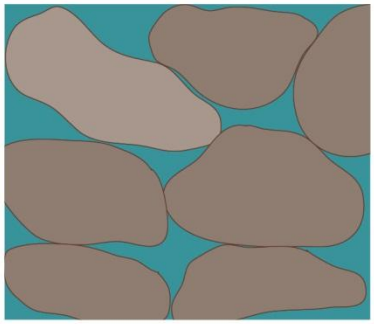


Soil texture affects the infiltration rate (speed) of water moving down through the soil, and also the way soil particles hold onto water in the soil (water holding capacity).

The water holding capacity and the current water content of the soil determine the depth of effluent/water which can be applied before it goes past the root zone to groundwater.



Clay Soils



Sandy Soils

Clay soils have smaller particle sizes, and smaller pores. They can hold more water than coarser soils, and also hold onto the water more tightly.

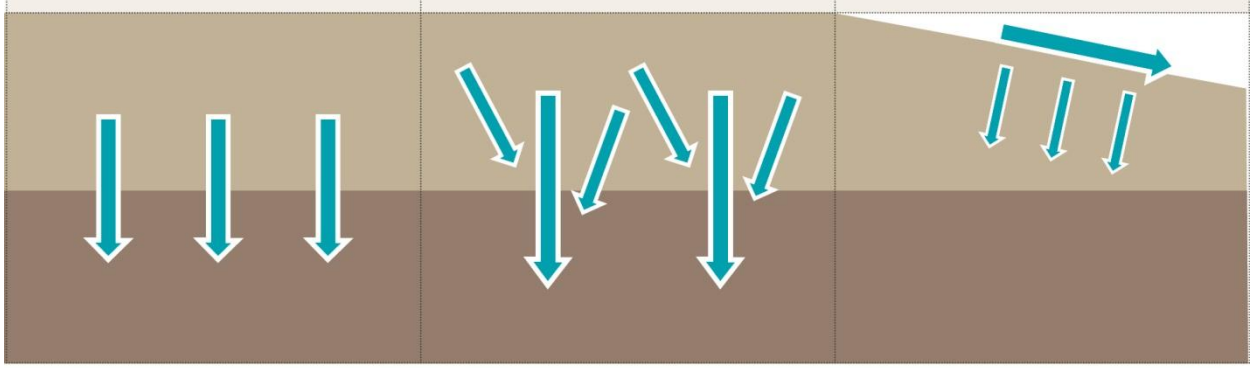
Sandy soils have larger pores and hold less water, but make it easier for the plant roots to extract the water.

Soil is like a sponge, the amount of water a soil can hold is determined by the soil texture. The water holding capacity (WHC) is expressed as a depth, in mm/m. It varies from 45-55mm/m for sand to 175-190mm/m for clay.

Soil drainage

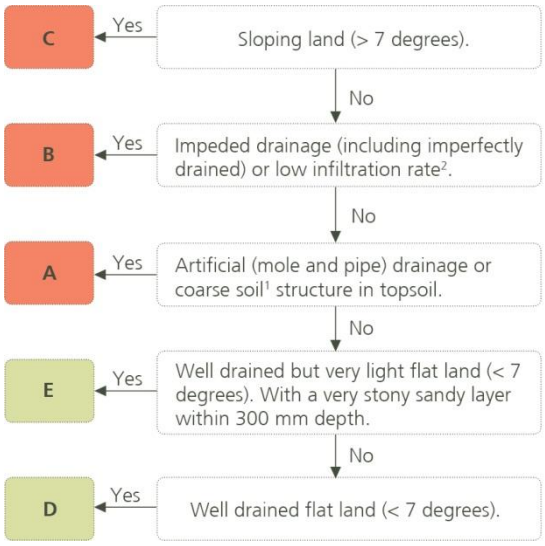
Soil drainage can be characterised by three methods of water movement through or over the soil:

Matrix flow	Preferential flow	Surface runoff
• Uniform movement down through the soil	• Water fast tracks through soil through cracks and channels	• Very little infiltration, water moves across the surface or ponds
• High infiltration rates • Well drained soil profile • High porosity • Fine soil structure	• Poor natural drainage • Mole and pipe drainage • Heavy or very coarse soils	• Influenced by: • Length of slope and steepness • Soil moisture content • Soil infiltration rate • Ground cover and land-use • Soil compaction



Soil and Landscape Classifications and risk profiles

This classification system is used to determine an appropriate effluent application depth and effluent storage requirements (using the Pond Storage Calculator). Soil and landscape features may be categorised into one of the five classifications noted below.



The soil risk decision tree shows the 5 risk categories with those in red **High Risk (A,B,C)** and those in green **Low Risk (D,E).**

¹ Soils with 80% or more soil aggregates captured on a 10 mm sieve within the top 300 mm soil layer are considered to have coarse soil structure.

² Low soil infiltration rate is defined as 10 mm/hr or less.

This table describes effluent considerations related to the risk class.

Category	A	B	C	D	E
Soil and landscape feature	Artificial drainage or coarse soil structure	Impeded drainage or low infiltration rate	Sloping land (>7°) or land with hump & hollow drainage	Well drained flat land (<7°)	Other well drained but very light flat land (<7°)
Risk	High	High	High	Low	Low
Application depth (mm)	< SWD[1]	< SWD	< SWD	< 50% of PAW[2]	≤ 10 mm & < 50% of PAW[2]
Storage requirement	Apply only when SWD exists	Apply only when SWD exists	Apply only when SWD exists	24 hours drainage post saturation	24 hours drainage post saturation
Max depth: High rate tool	10 mm	10 mm	10 mm[3]	25 mm[4] (10 mm at field capacity)	10 mm
Max depth: Low rate tool	25 mm	25 mm	10 mm	25 mm	10 mm

[1] SWD is the soil water deficit

[2] PAW is the plant available water in the top 300 mm of soil

[3] Only applicable when instantaneous application rate from the irrigator is less than the infiltration rate

[4] Suggested maximum application depth when a suitable SWD exists (≥ 15 mm)

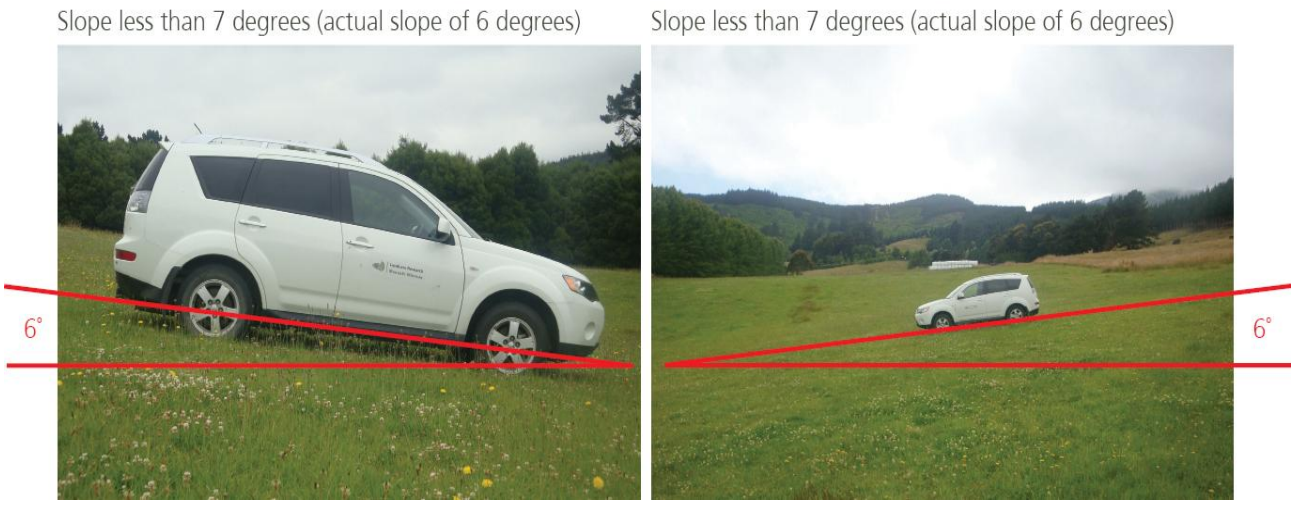
For all the risk categories the application rate should always be less than the soil infiltration rate otherwise you will get ponding (on sloping land the instantaneous application rate needs to be less than the soil infiltration rate or you will get run-off).

Soil and landscape categories A and B

Special care needed – Application depth must be less than soil water deficit. These soils suit low rate application systems because of improved control over application rate and depth.

Soil and landscape category C

Special care needed - Application depth must be less than soil water deficit and application rate must be less than soil infiltration rate. A low rate application system is the only practical way of applying effluent without ponding (at the bottom of slope) and runoff. The pictures below show a car parked on a 6 degree slope, to provide an indication of a sloping landscape.



Soil and landscape category D

Ideal for applying effluent, because soil behaviour under drainage is less of an issue. Both high rate and low rate application systems can give good control.

Soil and landscape category E

Soils drain well, but the topsoil is very thin. Do not apply more than 10mm of effluent at a time.

In summary if your soils fit into any of the following points, it is a high risk soil and effluent irrigation on these soils will require special management.

High risk soils:

- If sloping land greater than 7 degrees
- artificial (mole/pipe) drainage
- hump and hollow land
- impeded drainage
- peat soils
- low infiltration rate soils
- coarse structured soils

If the soil does not have any of these characteristics, then it is likely to be a **low risk soil**. DairyNZ has developed a resource entitled *Pocket guide to determine soil risk for farm dairy effluent application*. This can be ordered from the website.

Many of the soils in New Zealand have been mapped in detail and may help you determine the soil characteristics on your farm. Visit www.smap.landcareresearch.co.nz

Soil mapping

Soil types and risk profiles vary across a farm depending on soil forming features. The best way to fully manage the variation and implications of the varying soil types is to have a farm scale soil map produced. Soil maps provide information for fertiliser, effluent and water irrigation planning, cropping and grazing rotation decisions, and other farm management decisions.

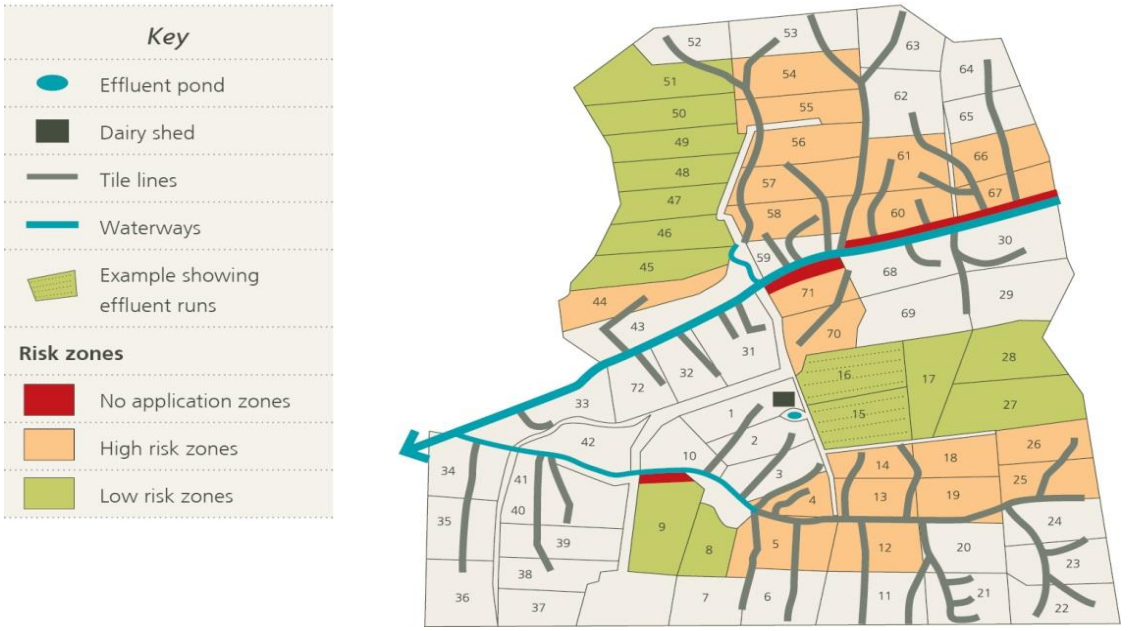
Effluent application plans

All farms contain high-risk and low-risk areas for effluent irrigation. An effluent application plan can help to identify suitable areas of the farm for effluent application and areas to avoid. All staff need to be aware of the effluent plan. Check your consent conditions for any restrictions on applying effluent after rainfall events and any rest period specified between applications. It is usually recommended paddocks are rested for 10-14 days between applications.

Making a plan:

- From a map of the farm, identify waterways, natural drainage patterns, soil types and sub-surface drainage, prevailing wind direction and neighbours' dwellings.
- **Low risk areas** are ideal for effluent application (shown in green on the map below); note irrigator runs for each paddock and high risk or no-application zones.
- **High risk zones** include mole or tile drainage areas, very wet soils or very free-draining areas with porous subsoil and accessible groundwater (shown in orange on the map below).
- **No-application zones** include all land within 20m of a drain, waterway or bore, or the boundary of a neighbouring property (shown in red in the map below)

If you have to irrigate over mole and tile drains, try to have runs that go across the drains, rather than down the length of them. When soils are wet or very dry, decrease application depth or defer application until conditions are more suitable for irrigation.



Apply effluent to the riskier soils when conditions permit. Save the low risk soils for poor weather conditions.

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