Climate and Soils

Guideline No 6.

It is important to know the climate and soils of your property, as it will influence the type of dairy effluent management system that can be implemented.

Times of the year when rainfall exceeds evaporation, or soil temperatures are low will identify when spreading of effluent is not advisable and storage of effluent is required.

Soil types will influence the type of lining required in effluent ponds.

Soil type will influence the amount of effluent that can be spread at one time, and the spreading rate.

This Guideline provides a general outline of the regional climate and soils, and how they influence the choice of an effluent management system and the spreading of effluent on crops or pastures.

The Mount Lofty Ranges and Greater Adelaide region

The Mount Lofty Ranges and Greater Adelaide region is bounded to the north by the Gawler River, and to the south, the region takes in the Fleurieu Peninsula. The eastern boundary delineates the eastern hills from the Murray Plains. The ranges are the prominent feature of the region, with Mount Lofty being the highest point at 727 metres.

The Climate of the Region

The region has a Mediterranean climate with hot dry summers and mild to cool wet winters. The rainfall in parts of the region is amongst the highest in the state, up to 1100mm around Stirling.

Chart 6.1 shows a period during winter in which effective[1] rainfall exceeds evaporation in a number of districts. It is during this time that in normal years pasture growth is not limited by soil moisture, soils are generally wet, and the spreading of effluent from dairy sheds is not advised in those districts.

Storage of effluent during this period may be required, and a pond for winter storage of effluent should be factored into the effluent management system.

Chart 6.1 depicts these months for different rainfall recording stations. You will need to determine the location nearest to your property.

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[1] Effective rainfall can be estimated from average rainfall. Average rainfall in months with less than 75 mm multiply by 0.6, months over 75 mm multiply by 0.8.

Chart 6.1 Months Effective Rainfall Exceeds Evaporation

LOCALITY	MONTHS EFFECTIVE RAINFALL EXCEEDS EVAPORATION	Apr	May	Jun	Jul	Aug	Sep
Aldinga	0						
Angaston	0						
Birdwood	3			■	■	■	
Bridgewater	4		■	■	■	■	
Freeling	0						
Gawler	0						
Greenock	0						
Gumeracha	3			■	■	■	
Inman Valley	3			■	■	■	
Lenswood	4		■	■	■	■	
Lyndoch	1			■			
Mclaren Vale	1				■		
Mount Bold	4		■	■	■	■	
Mount Crawford	2			■	■		
Mount Pleasant	2			■	■		
Myponga	4		■	■	■	■	
Nuriootpa	0						
Parawa	4		■	■	■	■	
Port Elliot	0						
Roseworthy	0						
Stockwell	0						
Tanunda	0						
Two Wells	0						
Uraidla	4		■	■	■	■	
Victor Harbor	1				■		
Williamstown	2			■	■		
Woodside	3			■	■	■	
Yankalilla	2			■	■		

Chart 6.1 shows the months for which wet weather storage of dairy shed effluent is likely to be required in the Mt Lofty Ranges region.

Actual storage time may need to be extended for two weeks before and two weeks after the months shown to allow soil moisture conditions to become suitable for irrigation. For example, Myponga shows a period when rainfall exceeds evaporation for four months but the actual storage required could extend from mid-April to mid-September – a period of five months, or 150 days.

Developing an irrigation schedule based on crop water use and soil moisture deficit principles will give better accuracy to the calculation of minimum storage time.

Spreading Effluent During Times of High Rainfall

Spreading of effluent during the period when rainfall exceeds evaporation may be possible depending on the ability of pastures or crops to utilise the nutrients applied.

To utilise the nutrients applied in effluent the pastures or crops must be actively growing. Temperatures can affect growth rates and the rate of uptake of nutrients.

Effects of Temperature on Pasture Growth

Temperature has a significant effect on pasture growth. High and low temperatures can inhibit the growth of pastures and crops. Excessively high temperatures are not common in the Mt Lofty Ranges, but the region does experience low temperatures during winter, which may reduce the growth of pastures. Low temperatures slow down the mineralisation of the nitrogen in dairy shed effluent and restrict the uptake of nutrients by plants. This means that the nutrients in effluent applied during this period will not be taken up by plants and therefore increase the risk of them entering surface or groundwater systems.

Months when average minimum temperatures are less than $6^{o}C$ and average maximum temperatures are less than $15^{o}C$ are likely to have soil temperatures of less than $10^{o}C$, which will cause mineralisation of nitrogen and pasture growth to both slow down dramatically.

Charts 6.2 and 6.3 show the months during which average daily temperatures could be expected to limit mineralisation and pasture growth.

Chart 6.2 Months with Average Minimum Temperatures Less Than $6^{o}C$

LOCALITY	MONTHS AVERAGE MINIMUM TEMPERATURE IS LESS THAN $6^{o}C$	Apr	May	Jun	Jul	Aug	Sep	Oct
Bridgewater	4			■	■	■	■	
Gawler	2				■	■		
Lenswood	0							
Mount Crawford	5		■	■	■	■	■	
Myponga	4			■	■	■	■	
Nuriootpa	4			■	■	■	■	
Roseworthy	0							
Two Wells	1				■			
Uraidla	0							
Williamstown	5		■	■	■	■	■	

Chart 6.3 Months With Average Maximum Temperatures Less Than 15°C

LOCALITY	MONTHS AVERAGE MAXIMUM TEMPERATURE IS LESS THAN 15°C	Apr	May	Jun	Jul	Aug	Sep	Oct
Bridgewater	3							
Gawler	1							
Lenswood	5							
Mount Crawford	3							
Myponga	3							
Nuriootpa	3							
Roseworthy	0							
Two Wells	0							
Uraidla	5							
Williamstown	3							

The charts show the months during which pasture growth is likely to be inhibited by low temperatures in the Mt Lofty Ranges.

Low pasture growth means that the uptake of nutrients by the pasture is also low.

During the months in which pasture uptake of nutrients is low, the spreading of dairy shed effluent is not advisable. Storage is recommended over this period until pasture growth and the uptake of nutrients by the pasture increases.

Advantages of Storing Effluent Over Slow Pasture Growing Periods

There are distinct advantages in storing the effluent over the period when pasture growth is low. Superior utilisation of the nutrients it contains will be achieved when spread during the spring and summer months. This will help offset some of the cost of installing an effluent storage. Another significant advantage is the saving in the additional infrastructure, which would be required to spread the effluent over a larger area. For example, based on pasture growth rates, if the effluent is not stored, the area required for spreading the effluent could be from 4–8 times the area required for spreading in spring and summer. This would require a much larger investment in the distribution system.

Determining Effluent Storage Period

The period of the year during which spreading of effluent is not advisable can be determined by combining the data from charts 6.1, 6.2 and 6.3. This can be done by combining the relevant data into a simple table.

An example for the Myponga district is shown in Chart 6.4 below.

Chart 6.4 Example of combined climate data for Myponga.

LOCALITY	Limitation to Spreading Effluent	Apr	May	Jun	Jul	Aug	Sep	Oct
Myponga	Effective Rainfall exceeds evaporation							
Myponga	Minimum Temperature less than 6°C							
Myponga	Maximum Temperature less than 15°C							

Chart 6.4 shows a period from May to August when effective rainfall exceeds evaporation, and a period from June to September when minimum temperature is less than 6^{o}C, while the average maximum temperature is less than 15^{o}C during the period June to August.

The recommended storage period is from the earliest marked month up to and including the latest marked month. The climate data indicates that dairies in the Myponga district should have an effluent storage period from May through to the end of September.

To find the recommended storage period for your district enter the relevant data from charts 6.1, 6.2 and 6.3 in the chart below. If data is not available for your exact location use the nearest or most relevant data in the charts.

The recommended storage period is from the earliest marked month up to and including the latest marked month.

Chart 6.5 Combined climate data for your district

LOCALITY (enter the name of the recording station for the climate data)	**Limitation to Spreading Effluent**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
	Effective Rainfall exceeds evaporation							
	Minimum Temperature less than 6^{o}C							
	Maximum Temperature less than 15^{o}C							

Calculating Effluent Storage Capacity

Once the storage period is defined the minimum storage volume can be calculated. The storage capacity will be the sum of the:
1) dairy shed and yard wash-water;
2) rainfall and runoff which lands on the dairy yards and roof that drains to the effluent system
3) rainfall on the storage pond itself.

In order to calculate the volume of water that is captured by the yards, roof and storage pond local rainfall data needs to be used. The 90 percentile rainfall figures of the contributing storage months is then multiplied by the area of the dairy catchment, (rainfall and runoff which lands on the dairy yards and roof that drains to the effluent system). The 90th percentile rainfall is approximately 1.5 times the average rainfall for the specific period.

Other areas feeding effluent into the ponds must also be accounted for, such as laneways, adjacent yards, and feeding sheds or feed pads. Again, the 90 percentile rainfall should be used.

Soils in the Mount Lofty Ranges and Greater Adelaide region

The soils of the Mount Lofty Ranges and Greater Adelaide region contribute enormously to the region's environmental, economic and social prosperity.

The soils of the region are highly variable. While the Mount Lofty Ranges have some of the most fertile and productive soils in the State, there are also many steep, rocky areas, and areas which are not suitable for agricultural production.

The better soils in the region have generally been used for horticulture and dairying particularly where supplementary water is available.

A noteworthy feature of coastal and some inland areas is the occurrence of acid sulphate soils. While these are natural features, the drainage and development of these areas can release acidic groundwater into estuaries and streams. There can be significant implications for fish and other organisms and for infrastructure such as pipes and foundations. Currently there is limited information about this issue.

Effect of Soil Type on Pond Sealing

It is important to know the type of soil you are dealing with in order to determine what effluent management system to implement. If your area has little or no clay, you will have to look at lining your pond with imported clay or an artificial liner. If you do have a clay soil or plan to use imported clay, it must be tested to ensure that it will hold water. All ponds must be sealed watertight.

Effect of Soil Type on Effluent Spreading

The spreading and utilization of dairy effluent by crops or pastures is influenced by soil type. Sandy soils have a higher infiltration rate than clay soils and have a higher risk of passing nutrients below the root zone of the crop. Clay soils on the other hand will cause surface runoff of applied effluent at lower application rates than sandy soils, because the applied effluent is more easily able to soak into the sandy soils.

Soil type therefore can influence the amount (maximum millimetres per application) and the rate (maximum millimetres per hour) at which effluent can be applied.

It is important to recognize the soil types on your property and apply effluent according to soil water holding and infiltration characteristics.

Slope will also affect infiltration rate. Steeper slopes generally cause greater surface runoff and need lower application rates (millimetres per hour) to prevent this happening.

Chart 6.6 shows general data for different basic soil types.

Chart 6.6 Typical Water Holding Capacity, Infiltration and Application Rates

Soil Type	Available Water Holding Capacity (mm/m)	Infiltration Rate (mm/hr)	Irrigation Application rate (mm/hr)#		
			0 – 5% slope	5 – 10% slope	Over 10% slope
Coarse and fine textured sands, and loamy sands	20 – 60	12 – 25	10 - 20	8 - 16	5 – 10
Moderately coarse textured sandy loams, loam, sandy clay loams and silt loams	80 – 130	9 – 20	8 – 16	6 – 11	4 - 8
Medium textured very fine sandy loams, loam, sandy clay loams and silt loams	130 – 160	5 – 8	4 - 6	3 – 5	3 – 4
Fine textured sandy clays, silty clay, and clay	Silty clay 130 - 160 Clay 160 – 250	1 - 4	Less than 4	Less than 3	Less than 3

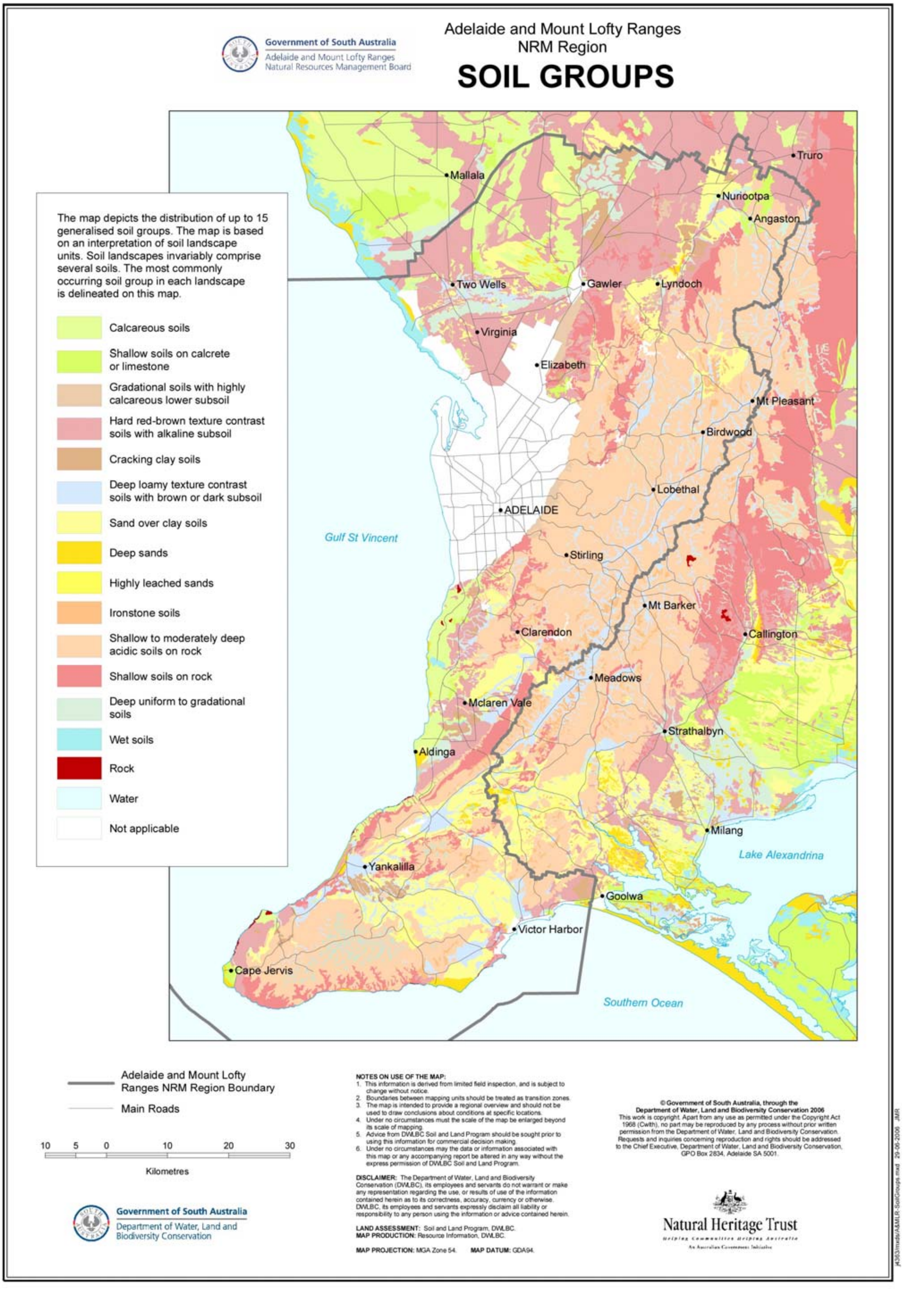
Application rates are for bare ground. Rates may be increased with good plant cover.

Map of Soil Types in the Mount Lofty Ranges and Greater Adelaide region

The soil map below provides an overview of the many soil groups across the Mount Lofty Ranges and Greater Adelaide region.

Before installing an effluent management system, it is important to obtain more detailed information on the soil types in your region. Soil tests should also be conducted on the suitability of the soil for pond construction. Soils are probably the most variable aspect of your farm.

Maps can provide a general overview of the soil type and its properties but only a detailed investigation of the soil properties will provide all the right details for the installation of a system that will hold water.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SOIL GROUPS
The map depicts the distribution of up to 15 generalised soil groups. The map is based on an interpretation of soil landscape units. Soil landscapes invariably comprise several soils. The most commonly occurring soil group in each landscape is delineated on this map.
Calcareous soils
Shallow soils on calcrete or limestone
Gradational soils with highly calcareous lower subsoil
Hard red-brown texture contrast soils with alkaline subsoil
Cracking clay soils
Deep loamy texture contrast soils with brown or dark subsoil
Sand over clay soils
Deep sands
Highly leached sands
Ironstone soils
Shallow to moderately deep acidic soils on rock
Shallow soils on rock
Deep uniform to gradational soils
Wet soils
Rock
Water
Not applicable
Truro
Mallala
Nuriootpa
Angaston
Two Wells
Gawler
Lyndoch
Virginia
Elizabeth
Mt Pleasant
Birdwood
Lobethal
ADELAIDE
Gulf St Vincent
Stirling
Mt Barker
Clarendon
Callington
Meadows
Mclaren Vale
Strathalbyn
Aldinga
Milang
Lake Alexandrina
Yankalilla
Goolwa
Victor Harbor
Cape Jervis
Southern Ocean
Adelaide and Mount Lofty Ranges NRM Region Boundary
Main Roads
10 5 0 10 20 30
Kilometres
Government of South Australia
Department of Water, Land and Biodiversity Conservation
NOTES ON USE OF THE MAP:
1. This information is derived from limited field inspection, and is subject to change without notice.
2. Boundaries between mapping units should be treated as transition zones.
3. The map is intended to provide a regional overview and should not be used to draw conclusions about conditions at specific locations.
4. Under no circumstances must the scale of the map be enlarged beyond its scale of mapping.
5. Advice from DWLBC Soil and Land Program should be sought prior to using this information for commercial decision making.
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