Drainage & wet soil management

Bill Cotching
How much water do you have to drain from your paddocks?

### Average monthly rainfall

<table>
<thead>
<tr>
<th>Month</th>
<th>Rainfall (mm)</th>
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<tbody>
<tr>
<td>June</td>
<td>99 mm</td>
</tr>
<tr>
<td>July</td>
<td>113 mm</td>
</tr>
<tr>
<td>August</td>
<td>117 mm</td>
</tr>
<tr>
<td>September</td>
<td>88 mm</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>400 mm</strong></td>
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Benefits of investing in farm drainage have been researched in Tasmania,

- 20% increase in pasture growth & utilisation (conservative estimate of the benefit)

- 100% return on investment likely in the first year after installation.
Drainage & wet soil management

- Diagnosis
- Planning
- Drainage by soil type
- Drain maintenance
- Salinity
- Acid sulfate soils
- Low cost options
Wet soils

- mud
- farmer discomfort
- pugged soil and pasture damage
- slow grass growth
- late start to seasonal growth
- slow stock movement
- restricted machinery access (bogged)
- low pasture utilisation rate
- poor shed hygiene (mastitis, high cell counts)
- bogged laneways
Causes of wet soils

- high regional water table
- landscape position - seepage
- slow permeability
- perched water table
- degraded structure
- non-wetting sands
- surface mat
- intense rainfall exceeds drainage capacity.
Poor soil drainage may be limiting plant growth to the extent that no responses are gained from increased fertiliser use.
40 cm of free draining soil?
Drainage aims to:

*C Prevent surface flooding

*C Create an unsaturated zone in the surface 40 cm of soil that increases aeration allowing for improved plant growth
Design your drainage in the winter,
install drains in the summer
You need to know the source of the water, and where it is moving in the soil.
Diagnosing the problem
Diagnosing the problem

What to look for when digging soil pits:

* Soil colours

* Where does the water flow into the pit from?
  
  from the bottom; indicates a ground water problem

  from a particular layer; indicates perched water

  from the surface; indicates surface sealing or perching.

* Layers of contrasting texture or hardness, eg. sand over clay,

* Hard concretions of various sizes and shapes,

  or soft black segregations often indicate poor drainage.
Do your holes fill with water from the bottom - even slowly?

- yes, deep open surface drains or subsurface drainage is a solution
- no, options are limited to shallow surface drains or hump & hollow
Soil colour & drainage

• Red or yellow spots or streaks (known as mottles) indicate the presence of a fluctuating watertable.

• Blueish-grey colours (Gleyed) indicate permanently waterlogged soils.
Soil colour & drainage

Peaty or humic topsoil

Very poorly drained

Rusty mottles

Grey or blue subsoil

Rusty mottles

Grey subsoil with rusty mottles

Poorly drained

Rusty mottles

Imperfectly drained

Rusty and grey mottles in subsoil

Moderately Well drained

Few rusty mottles in lower subsoil

Well drained

No mottles in profile

Rapidly drained

No mottles in profile

Sandy or stony soils

0 cm

90 cm
Planning

The first step in farm drainage design

Planning for your whole farm is essential because water draining off one part of your farm can flood lower lying areas, or cause serious problems for your neighbours. Drainage can dominate your farm layout.
Drainage influences location of:
- fences,
- shelterbelts,
- laneways and
- the shape of paddocks.

Use an aerial photograph
Beaufield — main arterial drains

Key
Existing main drains
Main drains to be Constructed
Main drains to be cleaned
Outfall
Outfall – rule No. 1

Check the levels to ensure water will flow off your farm otherwise drainage can create flooding.

Arterial drains
These major open drains must be the first part of any drainage system.

These ensure that the water can get away.

A minimum grade of 30 cm in 100m will ensure water will flow.
Arterial drain
Paddock drain
Rule No. 2

Isolate and Elevate

Isolate lower lying areas from upslope water

Elevate topsoil by lowering the water table
Isolate different areas for drainage
Elevate!
1.2 m deep

Surface spoon drain

Trench drain

1.2 m deep
Different soil types require different solutions to drainage problems.
Pegara fine sandy loam soils

Use shallow open drains

that feed into main arterial drains
Pegara fine sandy loam

- Place drains at the base of slope - to intercept water before it gets to the flats
- Install with a road grader or blade
- Turn the soil down hill
- Spread the soil wide with extra passes
- Clean out every second year with a spinner drainer
- Deep ripping won’t improve drainage.
From little things big things grow!
Sandy plains soils
Lappa, Taroona & Nugara sands
Sandy plains soils
Lappa, Taroona & Nugara sands

Use deep open drains
to provide the arteries to get the volume of water away.

* Place 60 - 100 m apart
* Install with an excavator
* Use wide, shallow surface drains to connect up
  natural hollows with the main drains
* Deep ripping subsoil pans may help.
Peat soils

* Open drains 0.5 - 1 m deep work best
* Don’t over-drain as peat shrinks and is difficult to rewet
* Check for acid drainage & don’t let water tables drop.
Hump and hollow drains

work best on soils without contrasting subsoil layers
Mole drains

Work only on clay soils
Staged drainage development is recommended.

Outfall
Main arterial drains
Paddock drains – trench or surface
Underground drains
Drain management
Drain management

Deep open ditches need to be fenced on both sides to keep the stock out and to minimise maintenance.
Drain maintenance
Drain maintenance

Drains require regular maintenance

- Spray out plant growth in the spring & autumn
- Machine clean when the drain becomes clogged with growth or silt
Laneways
Laneways

- Cambered surface with metal topping to shed water sideways

- Provide side drains to stop water entering paddocks fences on lane side of drain.

- New metal / regrade/ compact in the summer
Gateways

- *Use wider gateways to take the pressure off narrow access*
- *Drop a section of electric fence to use as a temporary gateway*
- *keep the trough well away from the gate*
Salinity management
Salinity risk

- Most of the land use change likely to result in salinity on King Island occurred decades ago,
- The groundwater systems are generally small and localised, (irrigation developments?)
- The risk of increased salinity is low.
Plants and salt

Salt-affected land produces two stressors for plants: the salt level in the soil and waterlogging.

In water logged soils the pore spaces are completely filled with water, plant roots are starved of oxygen and lack the energy to screen out salt.

So waterlogging dramatically increases salt uptake.
Salinity management

Managing salinity is all about managing waterlogging and wet areas which occur mainly in depressions or low lying parts of the landscape.

Some areas of midslope seeps occur where there is a change in slope of the surface or the underlying rock, which causes water to come to the surface.

Plant survival in waterlogged areas is primarily limited by saturated soils and poor drainage rather than salinity.
Salinity management

"The four main salinity problems on King Island are:

1. Waterlogging
2. Waterlogging
3. Waterlogging
4. A little salinity

The three main things that must been done to manage salinity on King Island are

   drainage,
   drainage and
   drainage.”

Salinity management

- Improve drainage
  drainage by soil type
  underground rock or pipe drains to tap into seeps

- Improve stock grazing management
  fence around wet/saline areas - intermittent or seasonal grazing.

- Stock exclusion with wallaby proof fencing
  planting of water and salt tolerant species of grasses, shrubs and trees.
  Mounding prior to planting of shrubs and trees will aid establishment.
Acid sulfate soils

**Sulfidic material**  pH > 4

unoxidised iron sulfides that are dark grey and black.

**Sulfuric material**  pH < 4

oxidised iron sulfates with yellow mottles, yellow jarosites and other iron-sulfate salts.

Symptoms and causes
Acid sulfate soils

Areas of Tasmania with Potential to Contain Acid Sulfate Soils

- High Potential
- Low Potential
- Extremely Low Potential
- High Potential (Subaqueous Marine)
Managing acid sulfate soils

- Minimise disturbance & drainage
- Neutralise with lime
- Reburial / flooding of potential acid sulfate soils
Dairy effluent
Costs

- Open drains
  - excavator digging 80 - 100 m/hr ($70 – 80/hr)

- Shallow surface drains
  - grader  $$$ ?

- Subsoil drains
  - backhoe, slotted agpipe, gravel backfill
  - $ 7 – 8 /m
Low cost options

- Start the winter with more grass cover gives more flexibility & greater soil protection
- Low-lying wet paddocks should be grazed early to save having to graze them on a long round in winter.
- Known dry paddocks should be targeted for later grazing.
- Try a later calving date
Low cost options

- Back fence so that cows can’t pug grazed areas
- On-off grazing; Cows can eat their daily ration within 3 hours.
  Remove the cows onto a sandy bank, lane way or sacrifice paddock for the remainder of the day.
- Feed out hay/silage on sandy banks
- Sacrifice paddock – follow up with a spring turnip crop & new pasture
- Give the cows a bigger break in wet weather
Low cost options

* Ignore the cows; Don’t ignore the problem.
  Do not go visiting the cows
  giving them an excuse to walk up and down the fence.

* Adopt more than one strategy and remain flexible.
Longer term alternatives

- Agistment
- Feedpad
- Install drainage
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Thank You!