Land Drainage Design

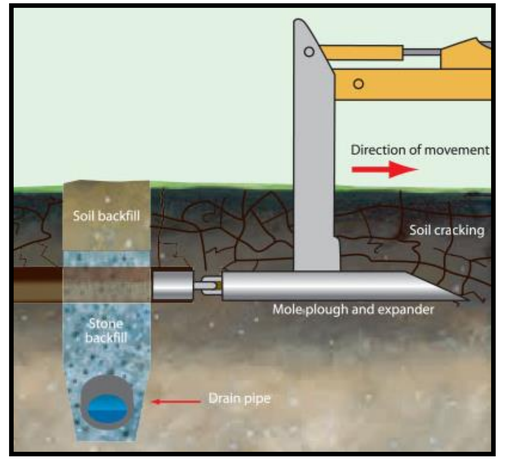
Problem Diagnosis

- Soil Test Pits - at least 2.5 m deep
- Design varies with soil type
- Water enters through permeable layers
- Other layers need help

Shallow Drainage System

Mole/Gravel Mole drain/Subsoiling:

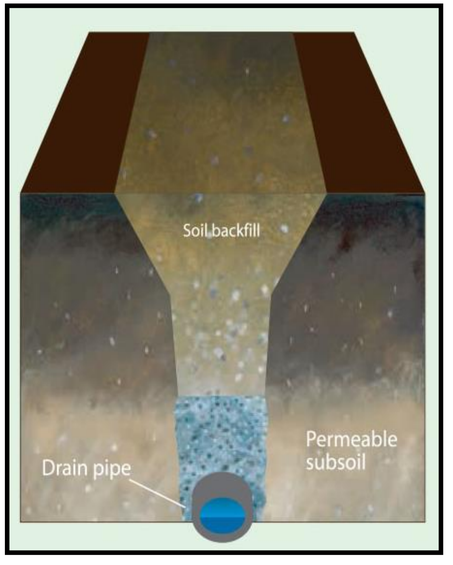
- Aim to fracture and crack the soil
- Effectiveness depends on:
  - Soil clay/stone content
  - Implement used
  - Weather conditions
- In tandem with collector drains



Groundwater Drainage System

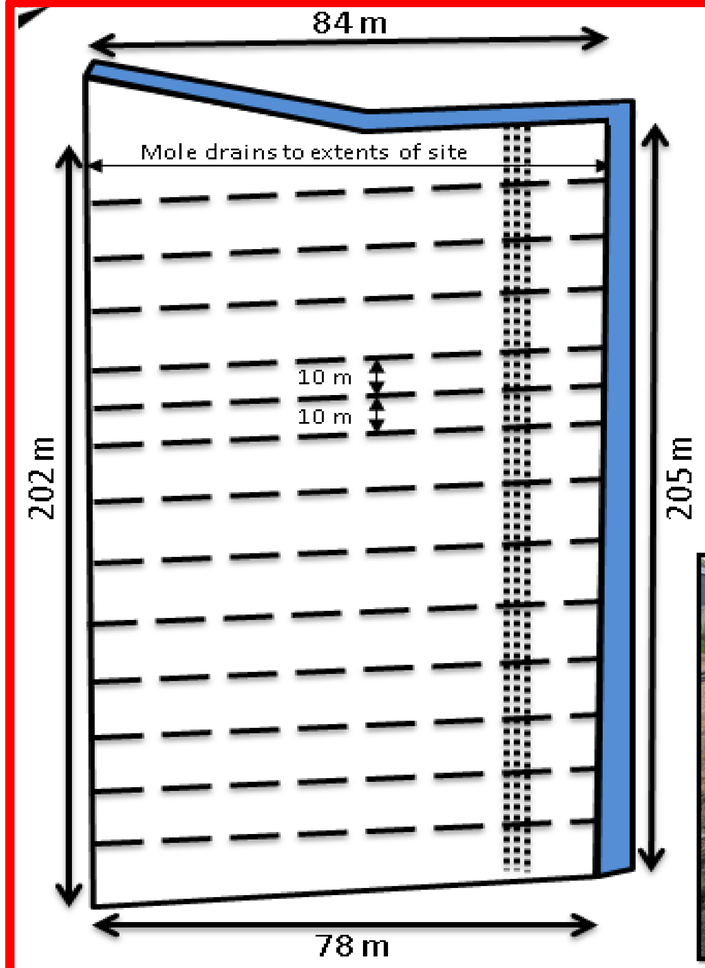
Conventional or deep pipe drains:

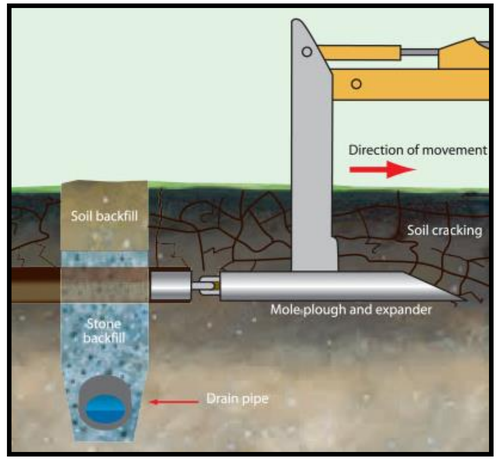
- Where natural movement of grounwater
- Where water can percolate to water table



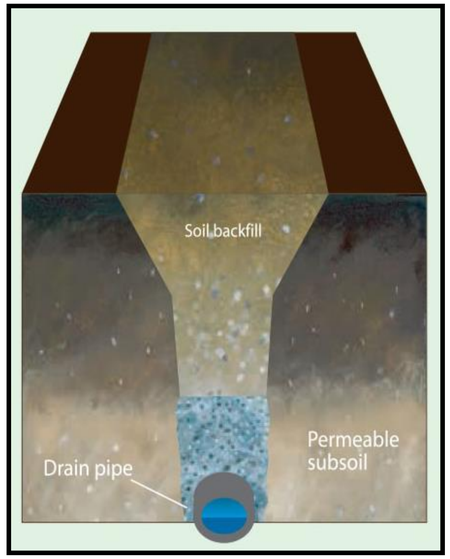
Land Drainage Design

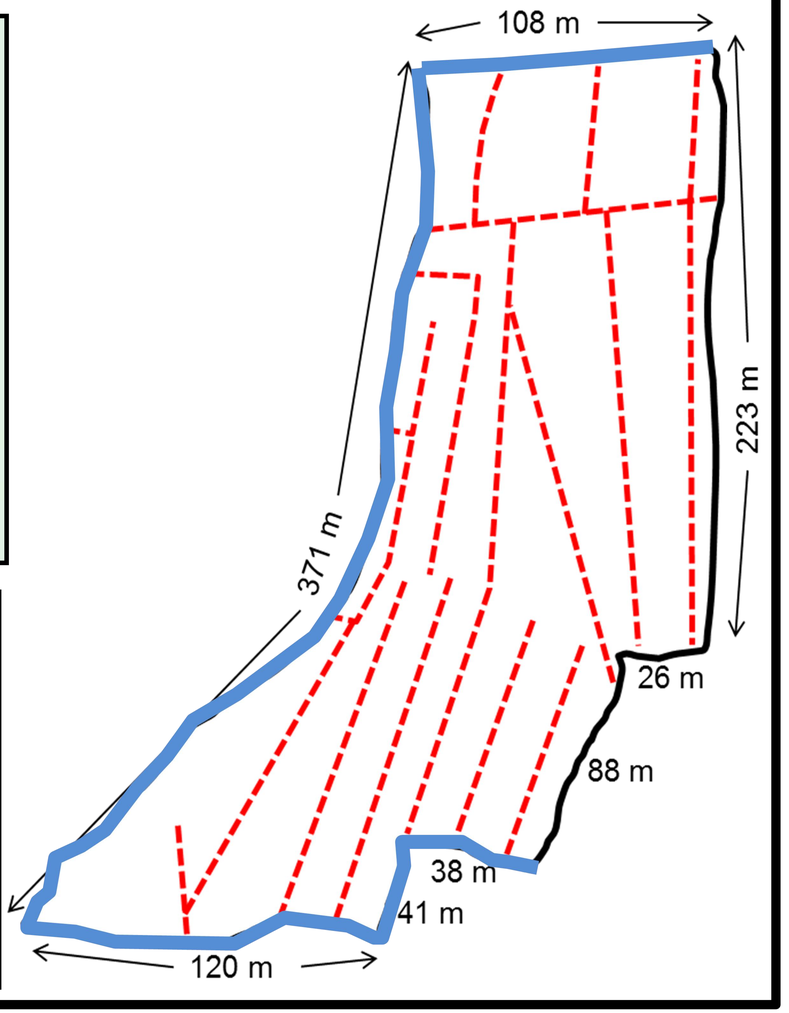
Paddock 30-2013



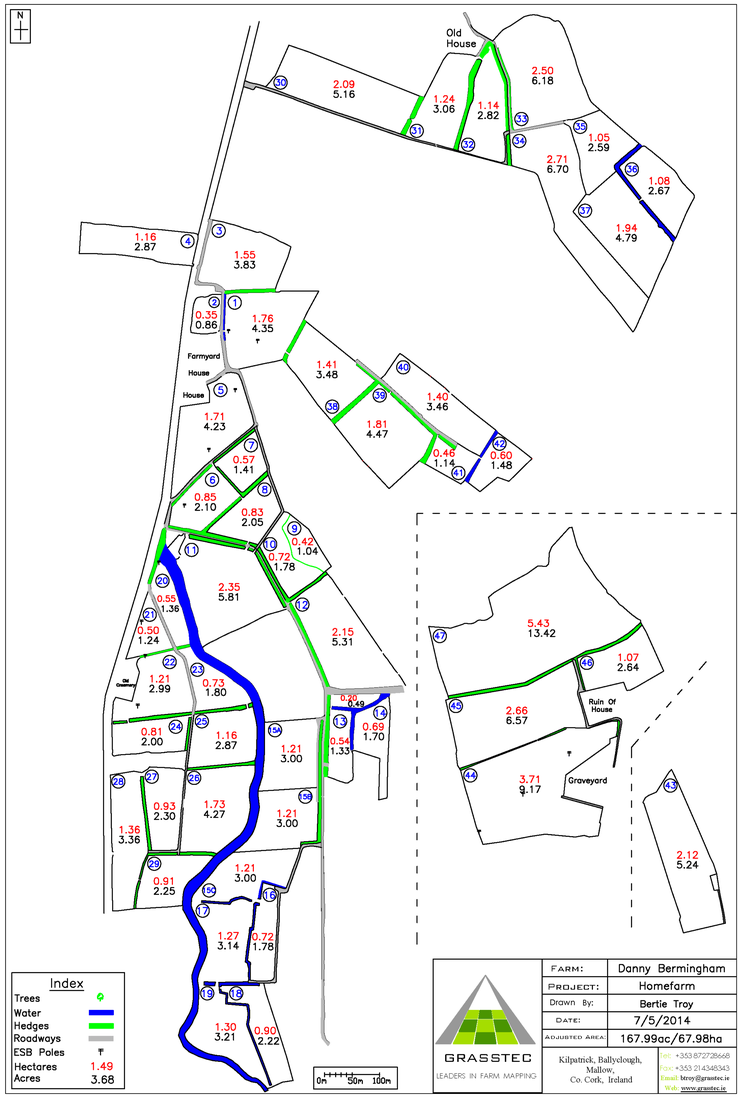


Paddock 15-2018





Grazing Infrastructure Audit



	Adequate	Needs Attention	Not fit for purpose
Paddocks			
Size	70	30	0
Access	60	40	0
Drainage	50	30	20
Fragmentation	50	50	0
Roadways			
Sufficient	70	10	20
Width	90	10	0
Quality / Cow flow	50	10	40
Spur Roads	50	20	30
Water Supply			
Source/pressure	100	0	0
Pipe network	80	20	0
Troughs no & size	70	30	0

Paddock Layout

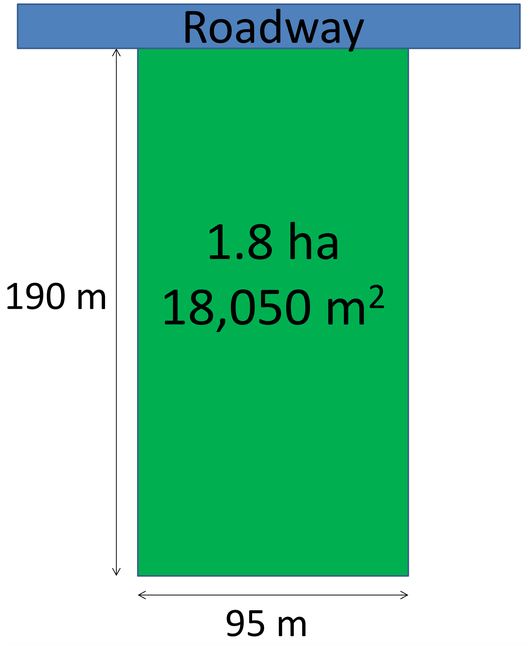
Considerations

Subdivision of grazing area:

- Allow adequate grass allocation
- Large enough for full herd
- Rectangular/Square in shape
- Avoid deep paddocks with no road access
- Multiple access for flexibility

Creating Paddocks

- Decide ideal number of grazings
- 100 cows:
  - 1.2 ha for 24 hours
  - 1.8 ha for 36 hours
- Consistent size of paddocks
- Configure roads and water systems to suit
- **A number of mapping services available**



Key points

- Ideal depth to width ratio of 2:1
- Large paddocks – grass regrowths are grazed if over 3 grazings per paddock
- Small paddocks – insufficient grass for one grazing, extra supplementation required.

Roadway Construction

Considerations

Good roadways :

- Efficient paddock access
- Faster and easier stock movement
- Less lameness
- Less mastitis
- Cleaner cows and milk

Construction

- Ideally a thin layer of topsoil removed
- Base trunking: 200-300 mm (8-12”) of hardcore material
- Surface blinding: 50-75 mm (2-3”) of fine stone free material
- Compact each layer using a vibrating roller

Cross fall	1:15 to 1:20
Road slope	Max of 3:1
Fencing	50 cm from edge of road
Materials	Trunking: 2 t/m, Blinding: 0.5 t/m (for 4m width)

Key points

- Repair roadways regularly. Maintain surface layer
- Avoid sharp bends - swept bends at corners and T-junctions to avoid bottlenecks
- Remove restrictions and distractions to cow-flow

Water system infrastructure

Maintaining water supply

- Good water supply is vital
- Supply to paddocks dependent on:
  - Water source and pumping capacity
  - Pipe sizes and layout
  - Jet size at ballcock
  - Trough capacity

Impact of Pipe Size

- Pressure loss in small pipe sizes
- Pressure loss is proportional to pipe length
- Flow area of ¾” pipe is 2 times that of ½”
- Flow area of 1” pipe is 4 times that of ½”

Cow water intake	60 - 110 litres/day - typically 4 litres water per litre milk produced
Main pipe layout	Ring/Loop system preferable
Trough size	Allow 5-7 litres/cow

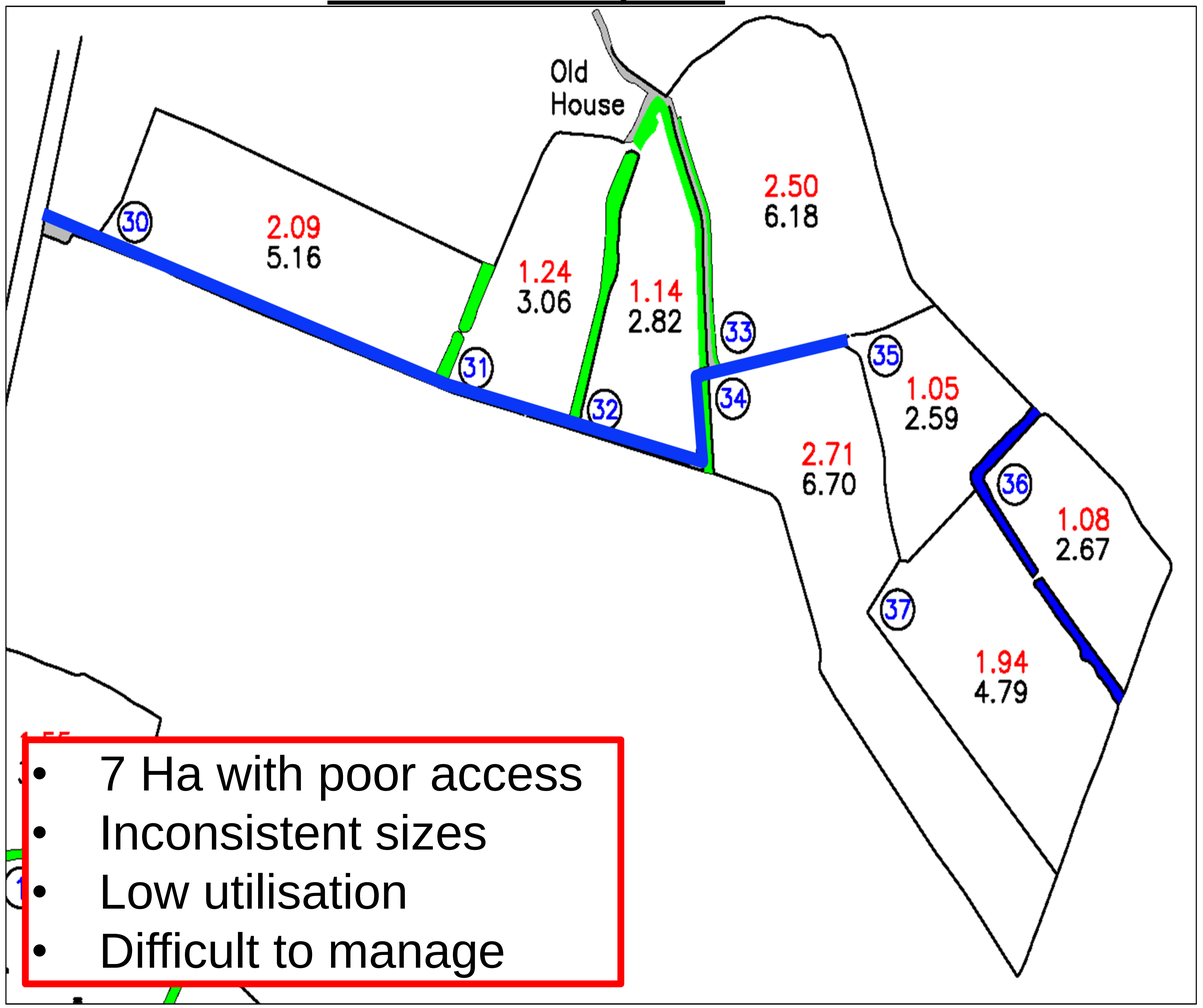
Aim for flow rate of 0.2 litres/cow/min.

Impact of ballcock jet size

	12.5mm (½”) Ballcock of 3.6 bar		
Jet type (pressure)	Low	Medium	High
Jet size (inch)	3/8”	1/4”	1/8”
Flow Rate (l/min)	42	32	8

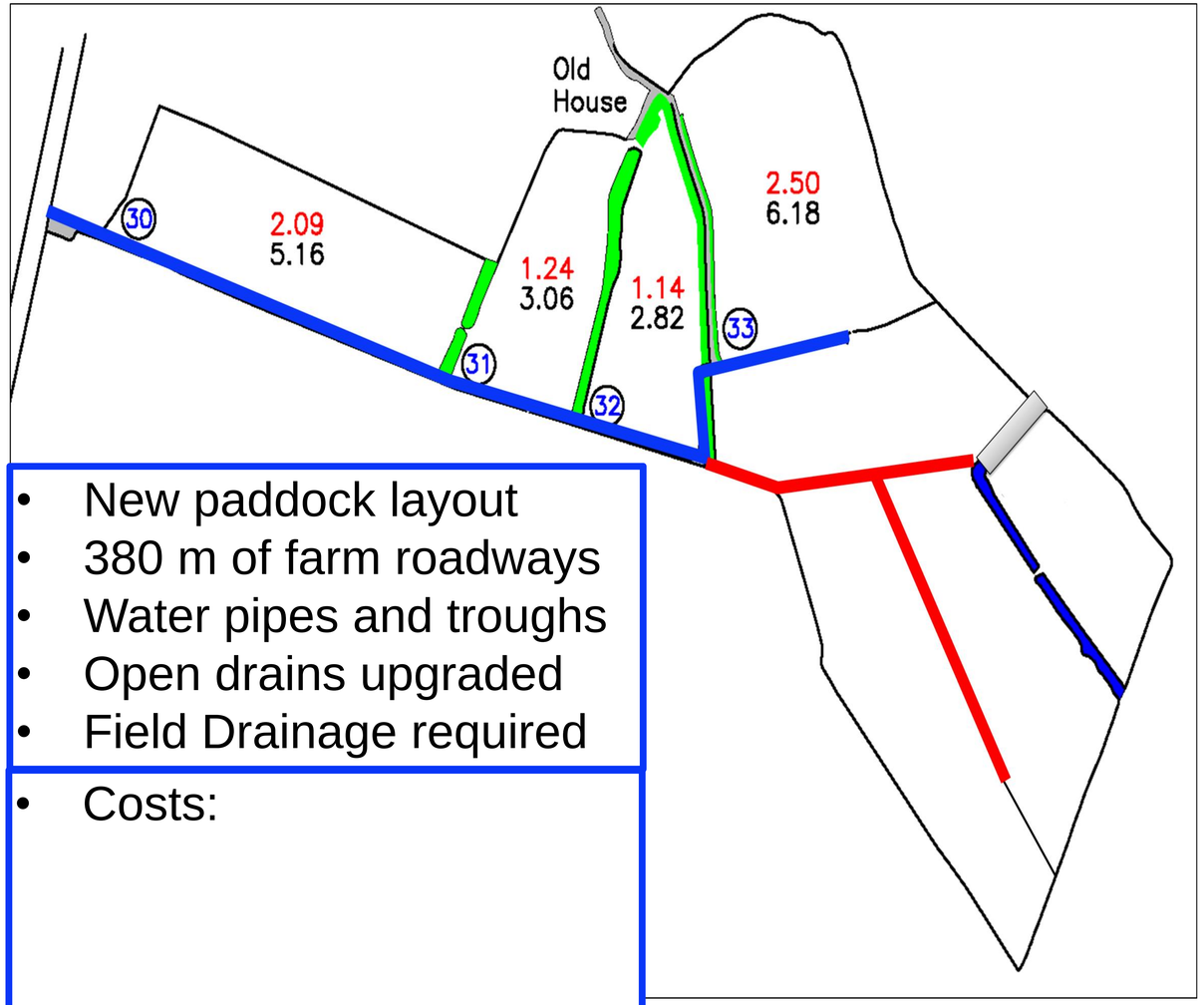
Paddock Layout

Previous Layout



- 7 Ha with poor access
- Inconsistent sizes
- Low utilisation
- Difficult to manage

New Layout



- New paddock layout
- 380 m of farm roadways
- Water pipes and troughs
- Open drains upgraded
- Field Drainage required

- Costs: