Heavy Soils

Agriculture and Food Development Authority

Soil Classification & On-farm Implications

Dr. Brian Reidy

Heavy Soils Program Meeting

Monday 30th January, 2017

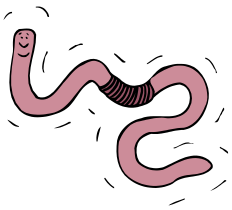
Time

R

P

B

Time



C

Soil

Two glaciations

- Weichsel (most recent) and Saale

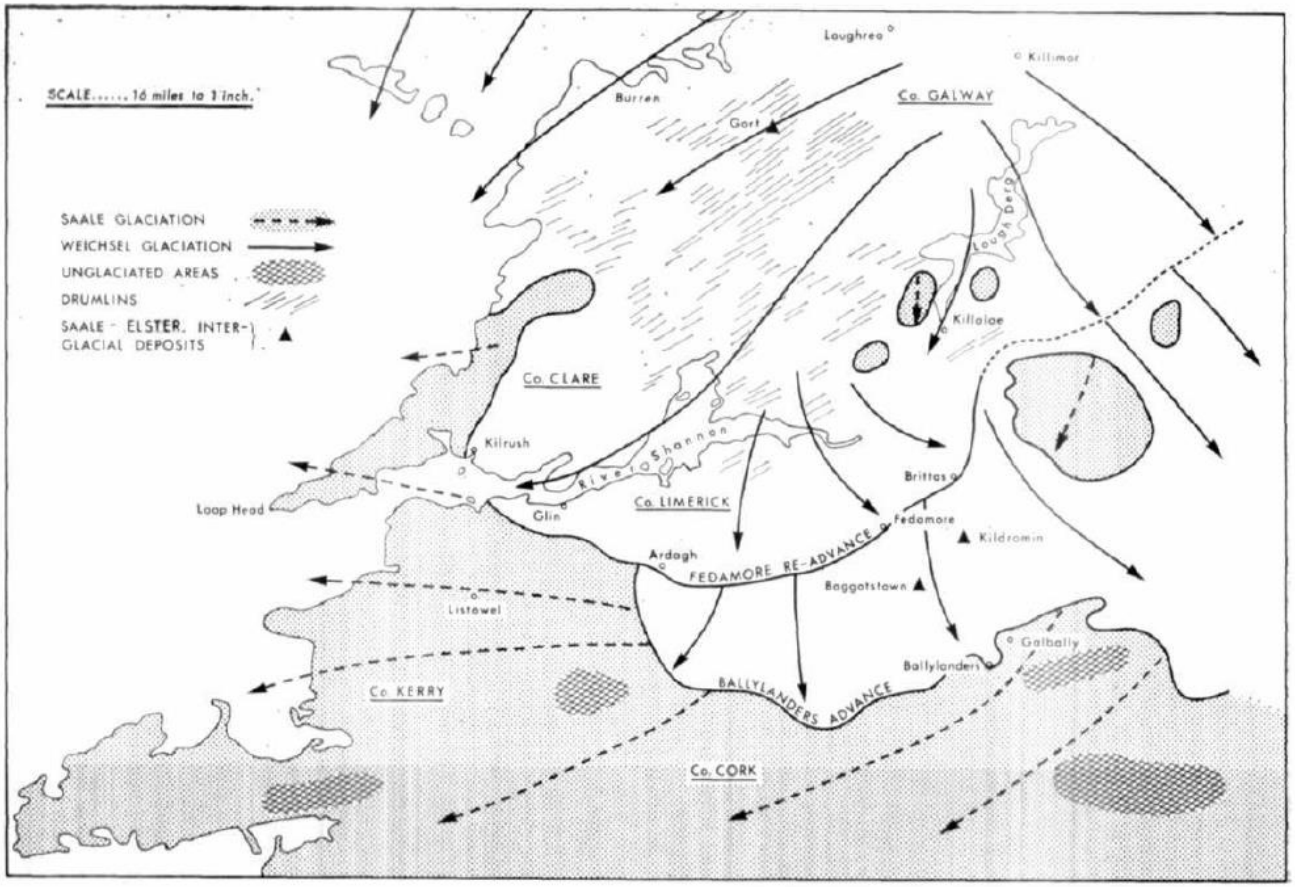


Fig. 6: Ice streams of the Saale and Weichsel Glaciations in the Limerick-Clare region

Understanding Soils & landscapes

Lithosol

Blanket Peat

Podzol

Basin Peat

Luvisol

Groundwater Gley

Brown Podzolic

Brown Earth

Surface Water Gley

Rendzina

Sandstone

Limestone

Alluvium

Peats

- Organic Matter recycling depends on
  - –Oxygen, temperature, neutral pH, etc.
  - –Organic matter accumulates if any of these become limiting

- Waterlogging (reduced Oxygen availability):
  - –Peaty gleys
  - –Basin Peats

- Acid conditions:
  - –Peaty podzols
  - –Blanket peats

Gleys

- Ground Water Gleys
  - –Water-logging due to high water-table
  - –Low-lying areas
    (often receiving inflow of run-off & seepage)

- Surface Water Gleys
  - –Water-logging due to impermeable horizons
    - "Perched" water-table
    - True water-table often quite deep
  - –Downward movement of water impeded

Luvisols

- Commonly formed on limestone drift
- ~ Movement of clay particles down the profile
  - Accumulation lower down in soil profile – clay coats on peds/clods
- Slow process (Bt horizon

  $\rightarrow 10^3 – 10^4$ years)

Brown Podzolics (Acid Brown Earths)

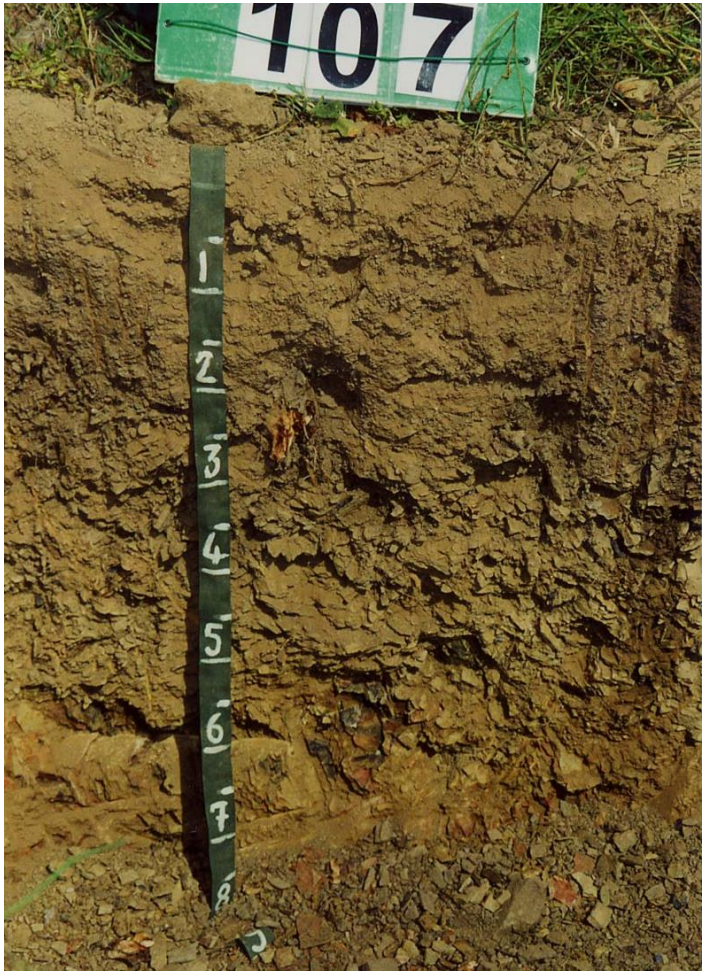
- ~ Acidification

- Excess Rainfall over ETp
  - –Soluble salts percolate downward (Ca, Mg, K, etc.)
  - –
- Soil pH decreases
  - –Basic cations replaced by H^+ ions

- Most common in:
  - –Free draining soils
  - –Parent material low in basic cations (non-limestones)

- Reddish brown B horizon

- Reason why soils receive lime



Podzols

- Podzol: “Pod” = Soil
  “Zol” = Ash

- Very slow process
  E horizon⟶ >10,000 yrs

- Movement of Fe, Al, (& Mn), and SOM the profile
  - –Accumulates in lower down (Bs)
  - –E horizon (zone of depletion) pale in colour, left at surface
  - –Often quite thin (Iron pan)

Brown Earths

•These soils are well drained mineral soils.

•They have not suffered from serious cases of leaching (loss of minerals)

•They have a uniform profile (i.e. No distinct horizons or layers)

•The Brown Earths in Ireland are mainly found in areas where the underlying rock is acidic, and therefore the soil is acidic.

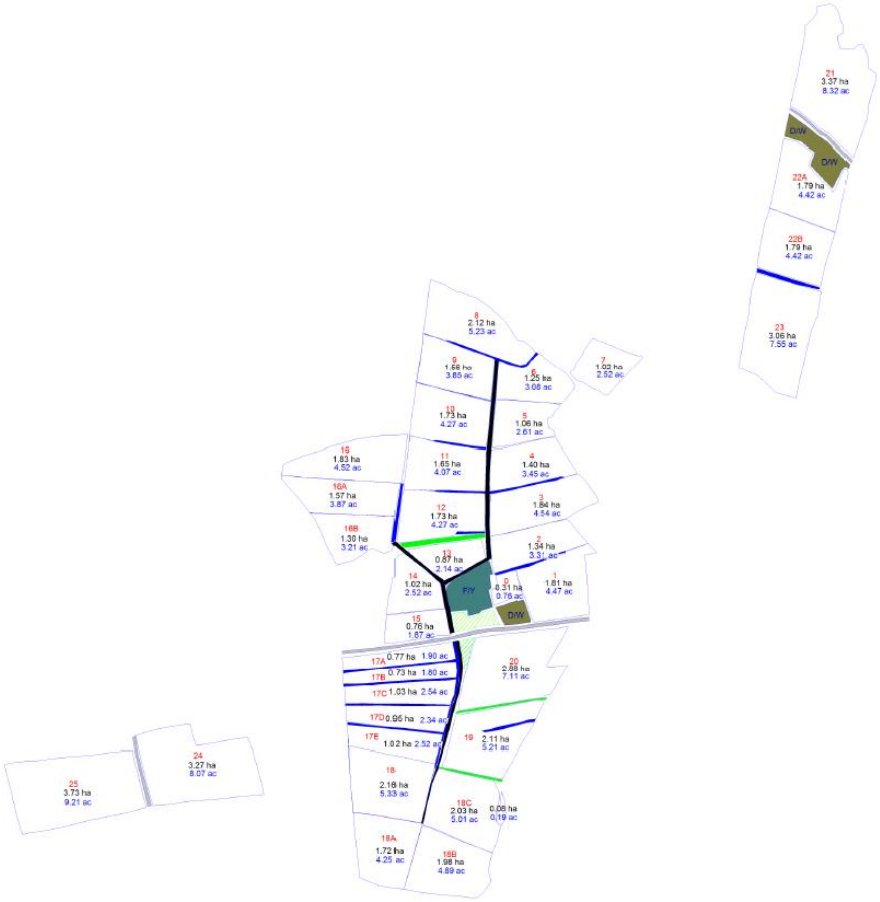
•With regular liming and fertilising these soils can be very productive.

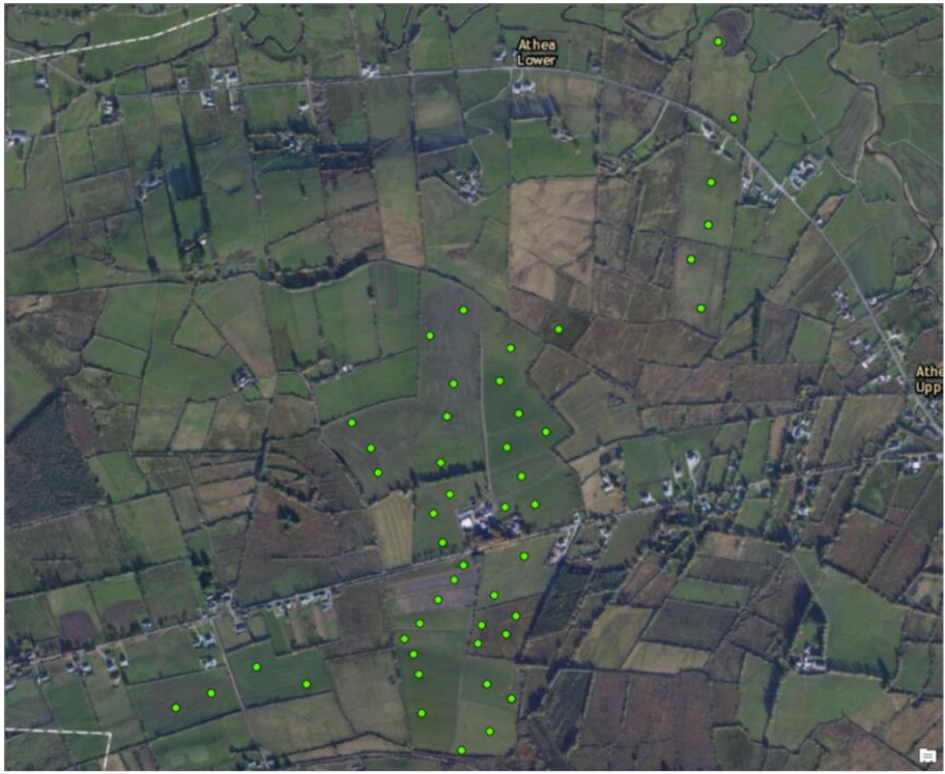
•Brown earth soils have an extensive use range, however they are used mainly for grazing.

•They are the soils of the Golden Vale – East Limerick, South Tipperary, Waterford, and North and West Cork, and are all excellent producers of grass for the liquid milk market.

Athea - Leahys Farm

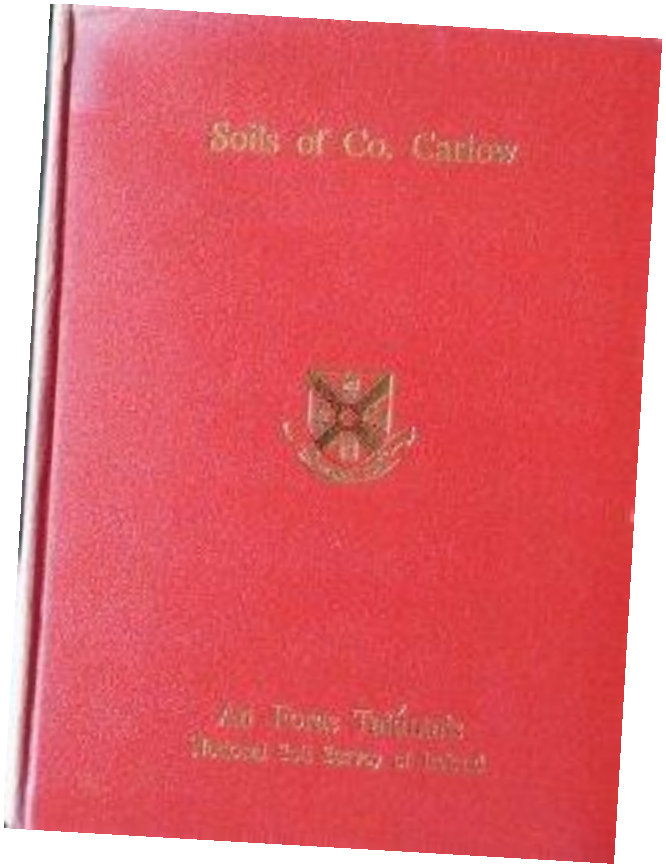
Overview


21
3.37 ha
8.32 ac
D/W
D/W
22A
1.79 ha
4.42 ac
22B
1.79 ha
4.42 ac
23
3.06 ha
7.55 ac
6
2.12 ha
5.23 ac
9
1.56 ha
3.85 ac
8
1.25 ha
3.08 ac
7
1.03 ha
2.52 ac
10
1.73 ha
4.27 ac
5
1.06 ha
2.61 ac
18
1.83 ha
4.52 ac
11
1.65 ha
4.07 ac
4
1.40 ha
3.45 ac
18A
1.57 ha
3.87 ac
12
1.73 ha
4.27 ac
3
1.84 ha
4.54 ac
18B
1.30 ha
3.21 ac
13
0.87 ha
2.14 ac
2
1.34 ha
3.31 ac
14
1.02 ha
2.52 ac
F/Y
0.31 ha
0.76 ac
1
1.81 ha
4.47 ac
D/W
15
0.76 ha
1.87 ac
17A 0.77 ha 1.90 ac
17B 0.73 ha 1.80 ac
17C 1.03 ha 2.54 ac
17D 0.96 ha 2.34 ac
17E 1.02 ha 2.52 ac
20
2.88 ha
7.11 ac
19
2.11 ha
5.21 ac
16
2.16 ha
5.33 ac
18C
2.03 ha
5.01 ac
0.08 ha
0.19 ac
18A
1.72 ha
4.25 ac
18B
1.98 ha
4.89 ac
24
3.27 ha
8.07 ac
25
3.73 ha
9.21 ac


Athea
Lower

County Limerick soil report

- Detailed information on soil type/formation
- Geology/pedology
- High resolution 1:100,000
- Caveat – a lot of soil series have changed names or are combined
- Soil associations are different



http://gis.teagasc.ie/soils

epa Environmental Protection Agency

teagasc Cranfield University

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Irish Soil Information System

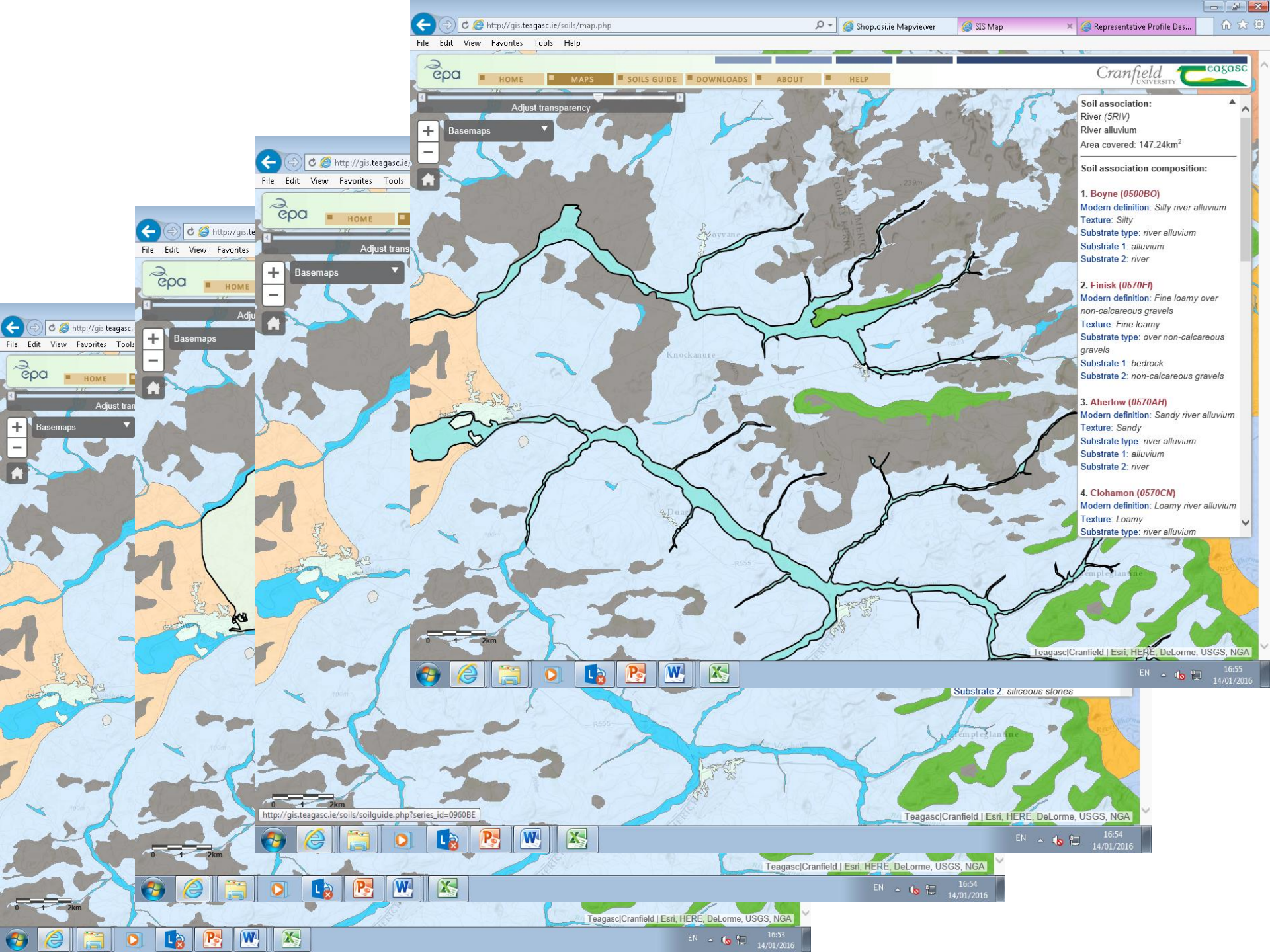
Farming activities have long been heralded as being a critical developer and shaper of the rural landscape and environment which exist in Ireland today. Historically, farmers have engaged in resource protection solely out of necessity to sustain their production capacity through generations. However, what has changed in recent times is the way in which environmental protection must be implemented at farm level: we have now entered a new era of legislation driven by environmental protection and legislation at a global and European scale.

Critical to the successful development of such strategies is the knowledge on the location of our soils,

News

Irish Soils Information System - Phase 1 complete!
The new Irish Soils Information system (Phase 1) will be jointly launched by Teagasc and the EPA on Sept 15th

International Year of Soils 2015
The FAO have declared 2015 as International Year of Soils. More details


http://gis.teagasc.ie/soils/map.php
Shop.osi.ie Mapviewer
SIS Map
Representative Profile Des...
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HELP
Cranfield UNIVERSITY
teagasc
Adjust transparency
Basemaps
Soil association:
River (5RIV)
River alluvium
Area covered: 147.24km²
Soil association composition:
1. Boyne (0500BO)
Modern definition: Silty river alluvium
Texture: Silty
Substrate type: river alluvium
Substrate 1: alluvium
Substrate 2: river
2. Finisk (0570FI)
Modern definition: Fine loamy over non-calcareous gravels
Texture: Fine loamy
Substrate type: over non-calcareous gravels
Substrate 1: bedrock
Substrate 2: non-calcareous gravels
3. Aherlow (0570AH)
Modern definition: Sandy river alluvium
Texture: Sandy
Substrate type: river alluvium
Substrate 1: alluvium
Substrate 2: river
4. Clohamon (0570CN)
Modern definition: Loamy river alluvium
Texture: Loamy
Substrate type: river alluvium
Knockanure
Templeglantine
Teagasc|Cranfield | Esri, HERE, DeLorme, USGS, NGA
0 1 2km
EN
16:55
14/01/2016
Substrate 2: siliceous stones
http://gis.teagasc.ie/soils/soilguide.php?series_id=0960BE
16:54
14/01/2016
16:53
14/01/2016

Irish SIS

- Three Subgroups identified
- Kilrush 0700, Typical Surface-water Gley
  - *Fine loamy drift with siliceous stones*
- Borrisoleigh 0960, Humic Brown Podzolic
  - *Fine loamy over shale and slate bedrock*
- Boyne 0500, Typical Alluvial Gleys
  - *Silty river alluvium*
- How does this compare to onsite?

Home farm - Catena

•Mid slope incline of both very similar

–Combinations of Typical Brown Earths 1100 and Stagnic Brown Earths 1130

–Substrate: drift in places and bedrock in places depending on soil depth

•Upper slopes

–Stagnic Brown Podzolics 0930 become more common

–Substrate bedrock

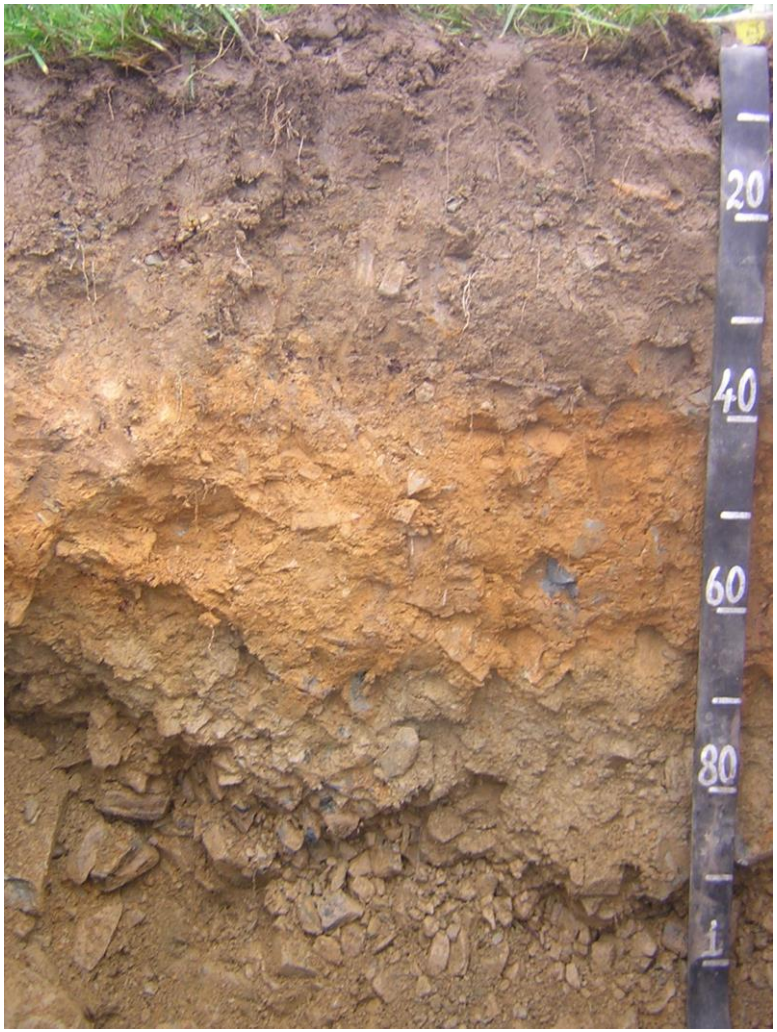
Home farm – Catena cont.

- Toe slope first plateau
  - –Humic Surface-water Gley 0760
- Toe slop 2nd plateau, lower elevation
  - –Humic Groundwater Gley 0660

Alluvial - Catena

Profile Pit locations

Stagnic Brown Earth 1130



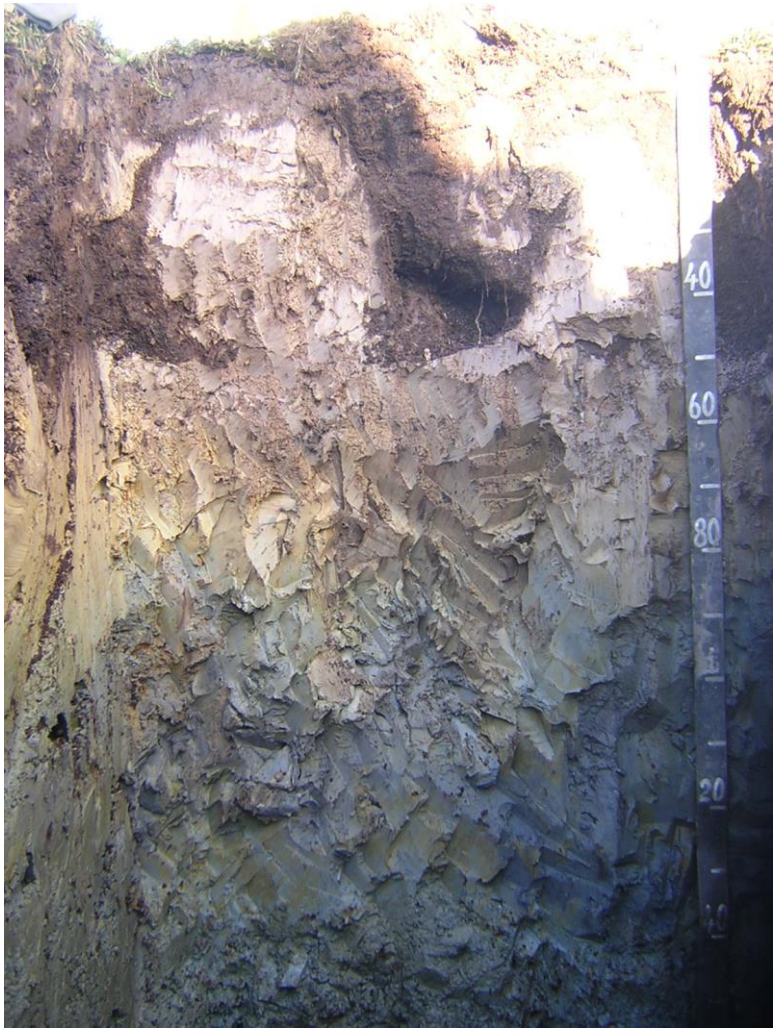
- Paddock 18 C
- Fine loamy over shale bedrock
- Series – Duarrigle
- This section of farm likely to have pockets of Brown Podzolics also

Typical Brown Podzolic 0900

- Paddock 18B
- Dyke on southern end of farm, on hill incline
- ~30 m long trench
- ~3 m deep
- Soil is shallow – 60/80 cm
- Bedded shale further down the profile
- Fine loamy over Shale bedrock
- Cupidstownhill

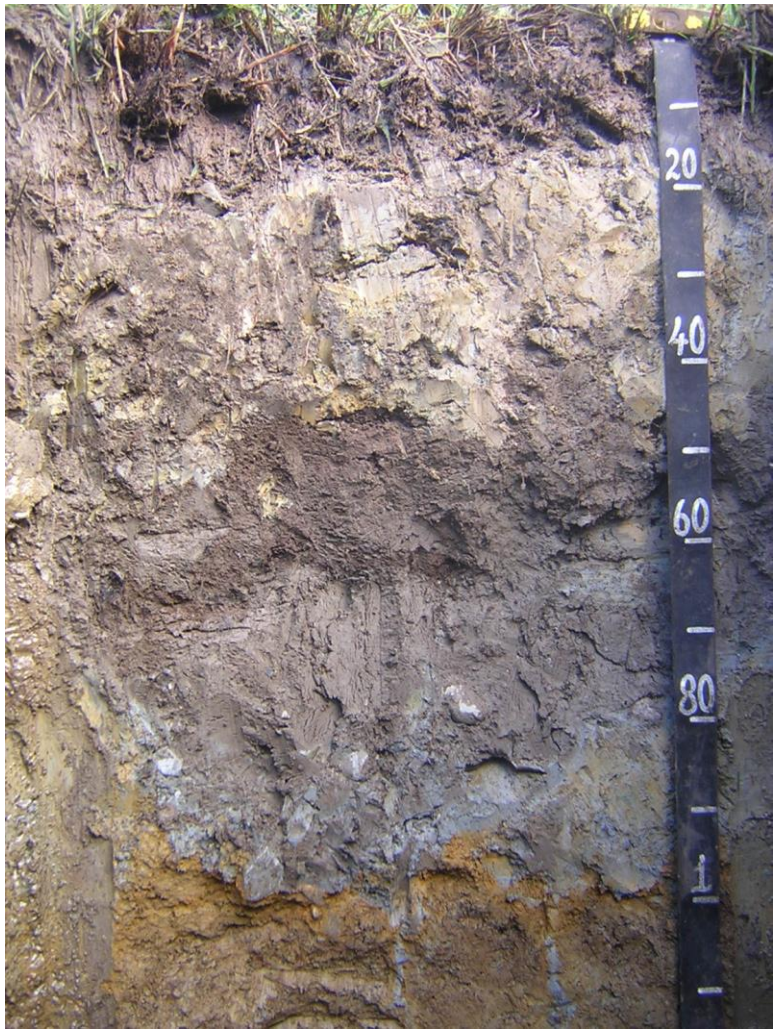
Fe/Al features

Humic Surface Water Gley



- Paddock 20
- Clayey drift with siliceous stones
- Series – Cluggin
- Irregular horizon boundary
- Causes ploughing – site preparation for drainage etc.
- Likely to be Ballygree series (Silty drift) also in this area

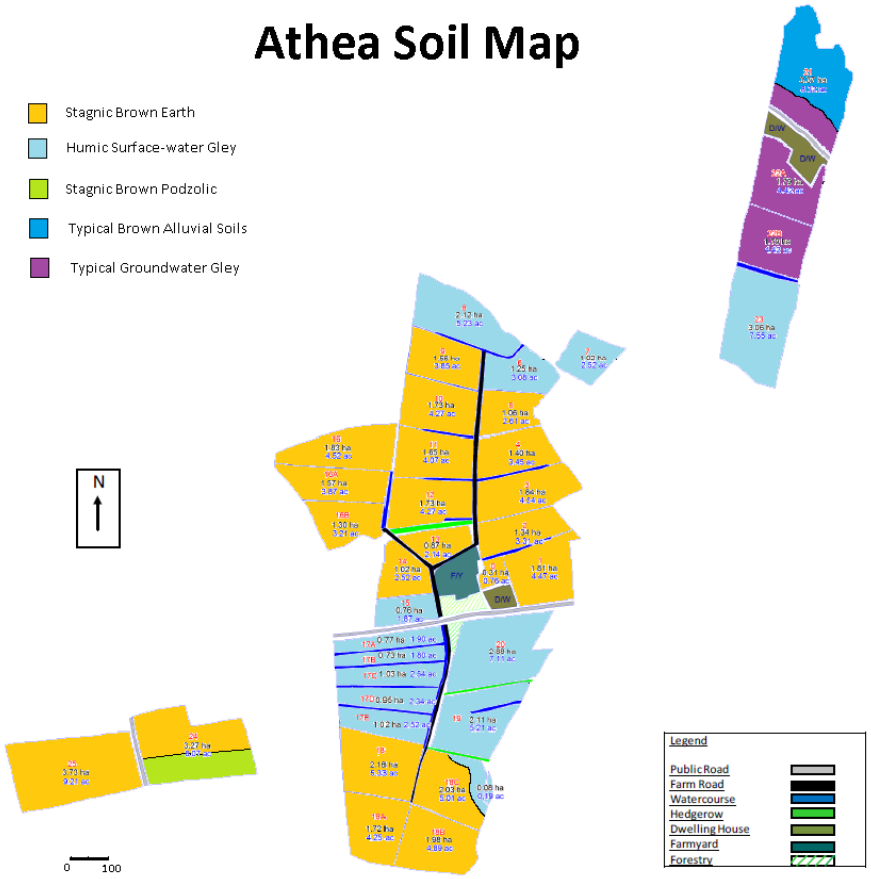
Humic Groundwater Gley



- Paddock 7
- Silty drift with siliceous stones
- Series Noonan
- Water table between 60 and 80 cm in area
- Springs
- Stagnic channels

Water burden

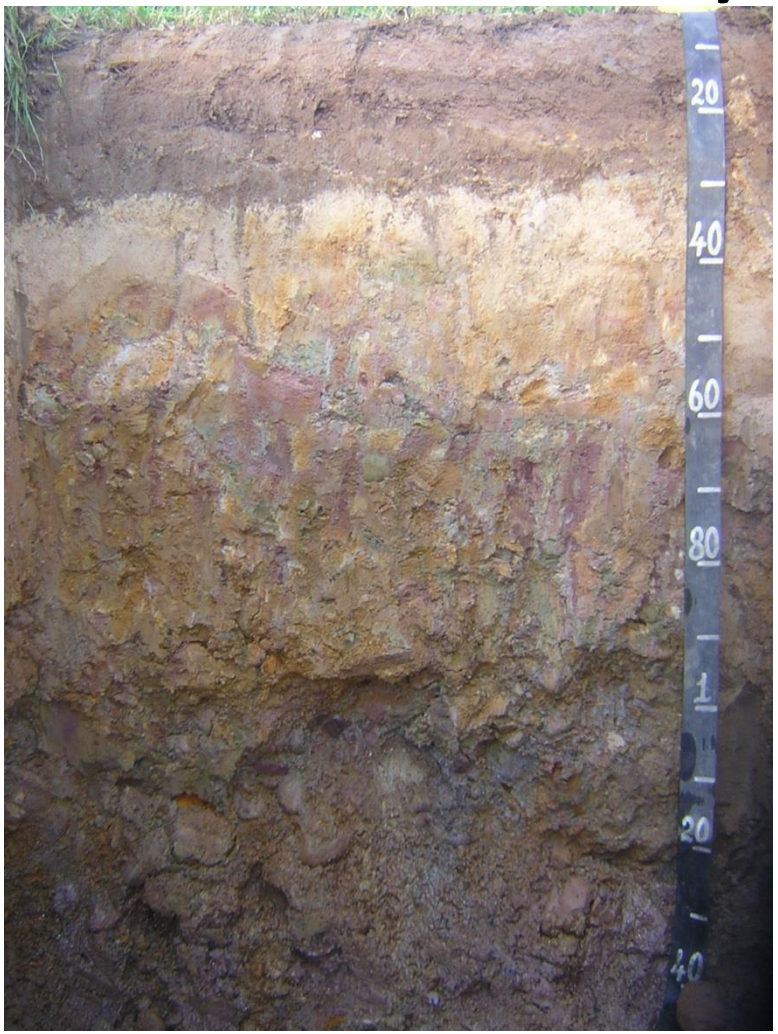
Athea Soil Map 1.0



Rossmore, augers

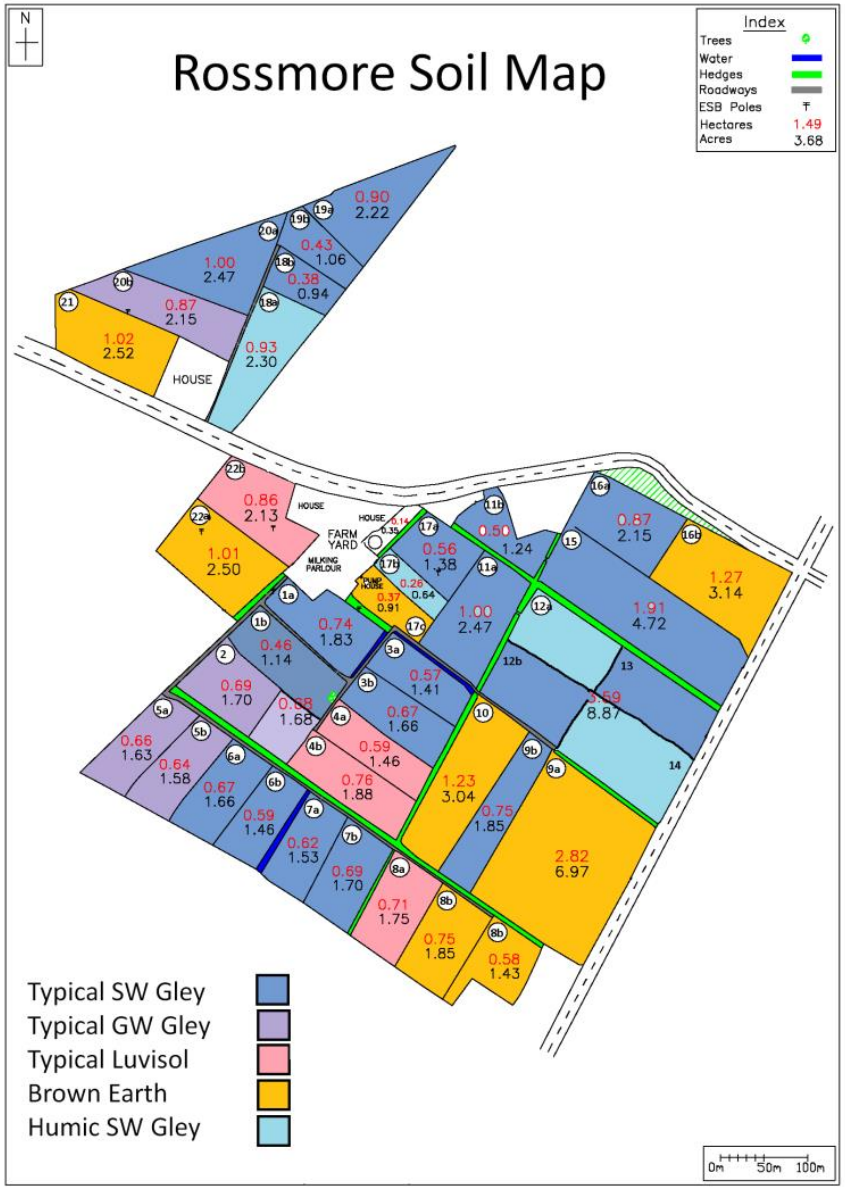
Rossmore, pits

Rossmore P7, P20 Typical Surface-water Gley, Kilrush/Kilpierce



Rossmore P17

Humic Surface-water Gley
Gortaclareen

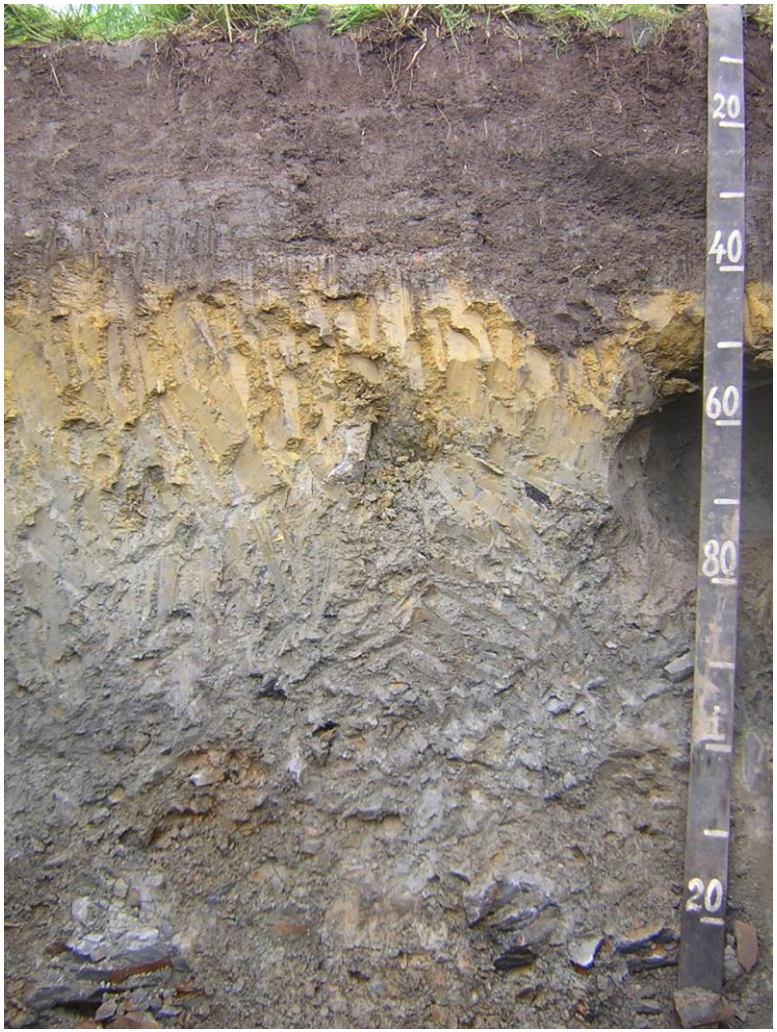

Rossmore Soil Map
N
Index
Trees
Water
Hedges
Roadways
ESB Poles
Hectares 1.49
Acres 3.68
HOUSE
FARM YARD
MILKING PARLOUR
Typical SW Gley
Typical GW Gley
Typical Luvisol
Brown Earth
Humic SW Gley
0m 50m 100m

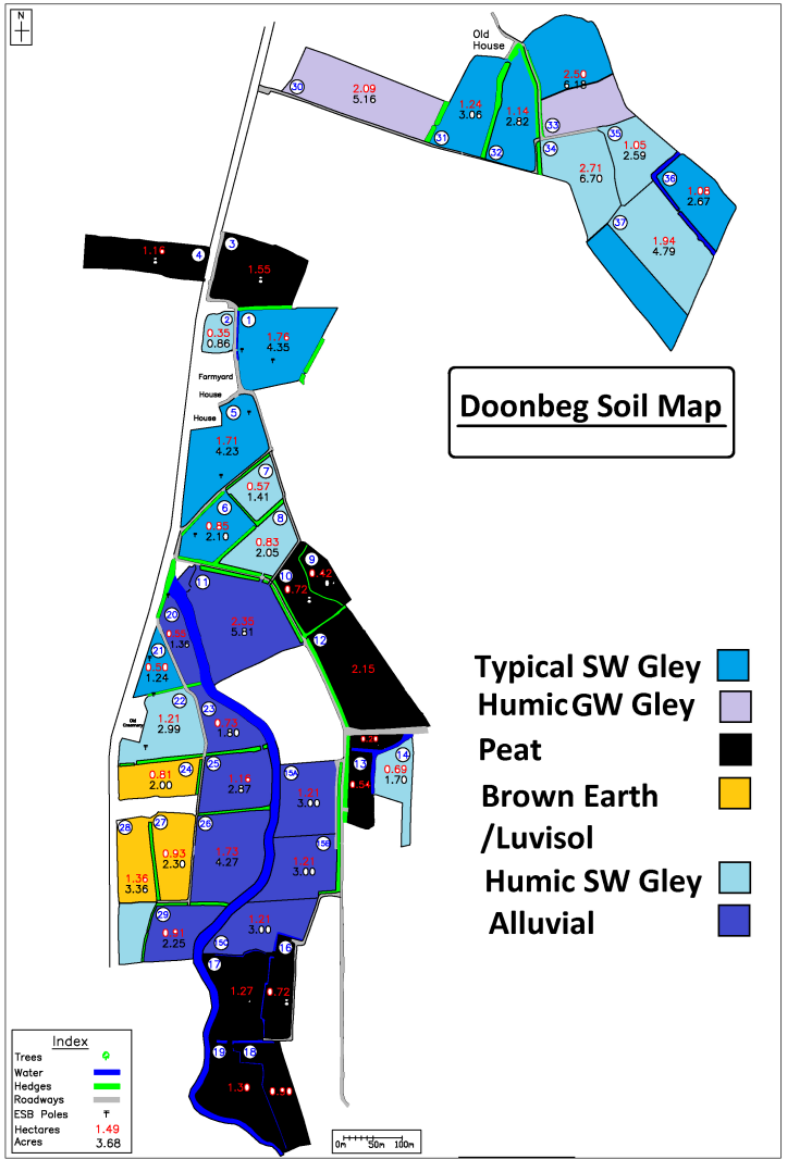
Doonbeg, augers

Doonbeg, pits

Doonbeg P30, GWG Kilpierce 16
Alluvial Gley, Feale

Doonbeg P28, HSWG Ballygree P1, HSWG Gortaclareen




N
Old House
Farmyard
House
House
Doonbeg Soil Map
Typical SW Gley
Humic GW Gley
Peat
Brown Earth /Luvisol
Humic SW Gley
Alluvial
Index
Trees
Water
Hedges
Roadways
ESB Poles
Hectares 1.49
Acres 3.68
0m 50m 100m

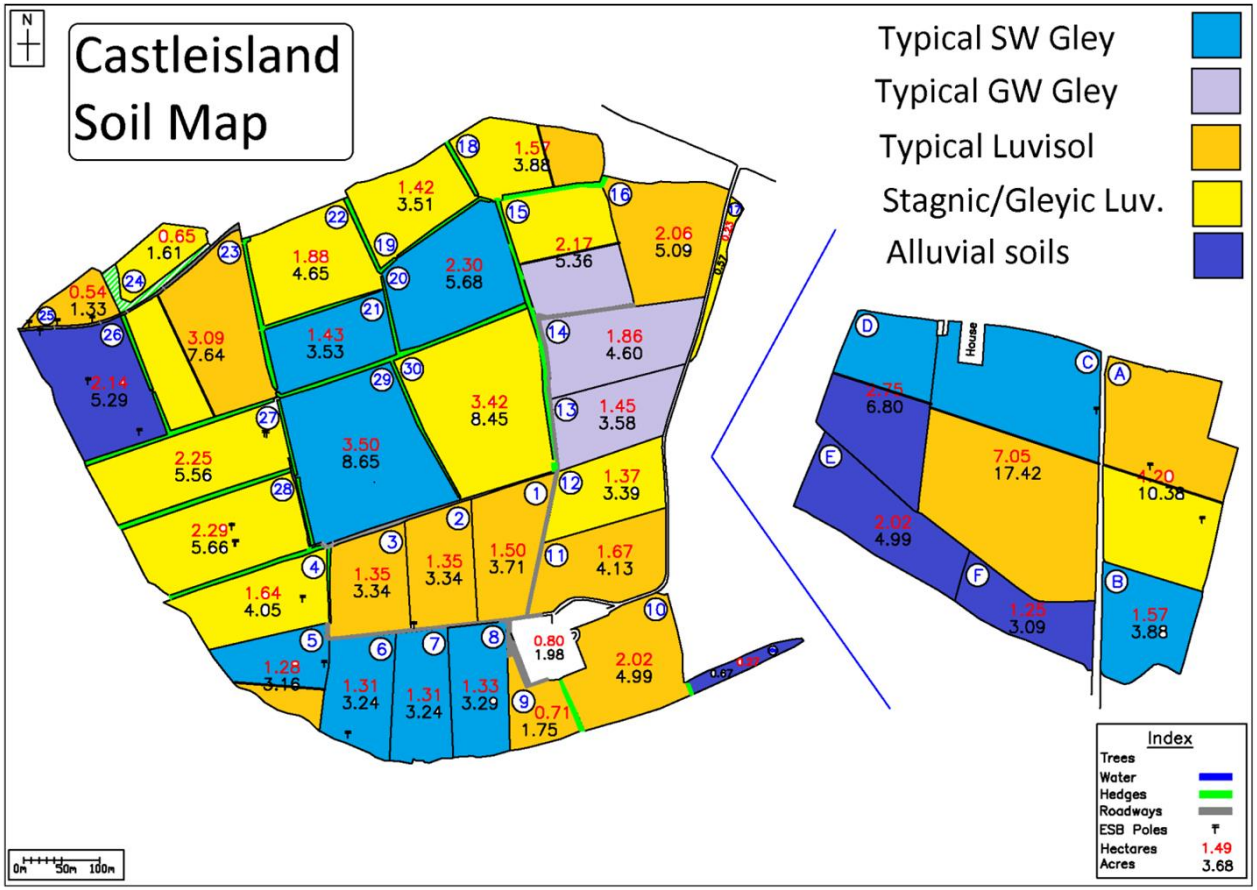
Castleisland, augers

Ballygree, Castleisland

Castleisland P6 Stagnic Luvisol, Gortavoher. P30, HSWG Ballygree

Castleisland, paddock F, Humic Alluvial Gley, Camoge &
paddock C Stagnic Luvisol, Gortavoher

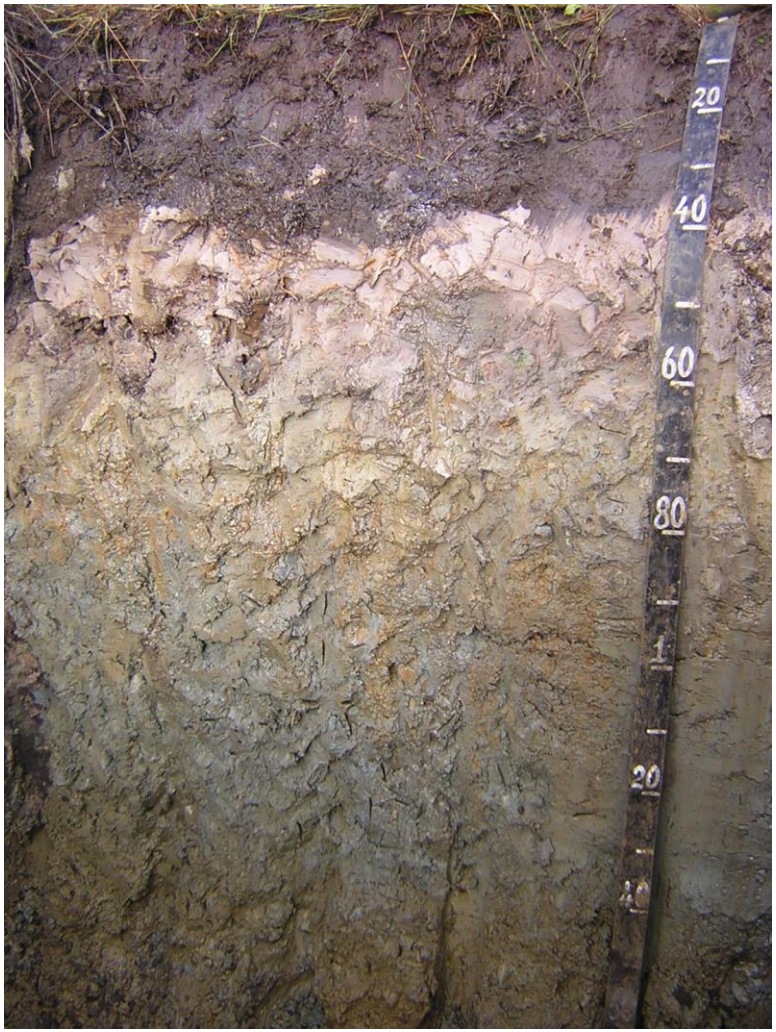
Castleisland soil map



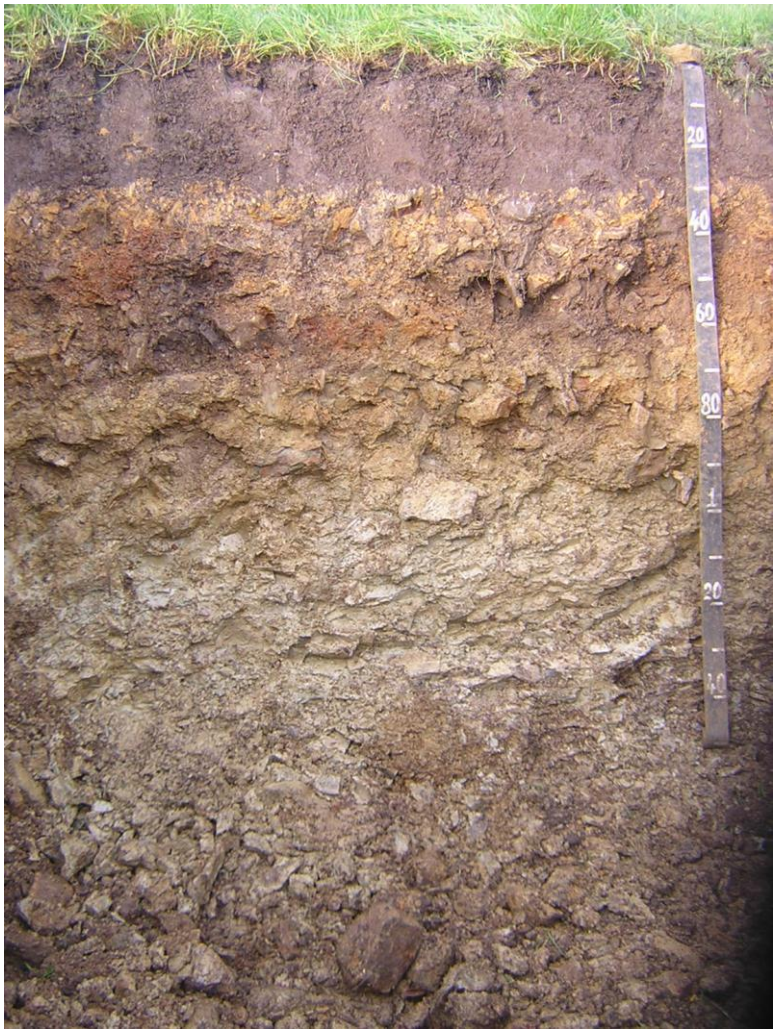
Kiskeam, augers

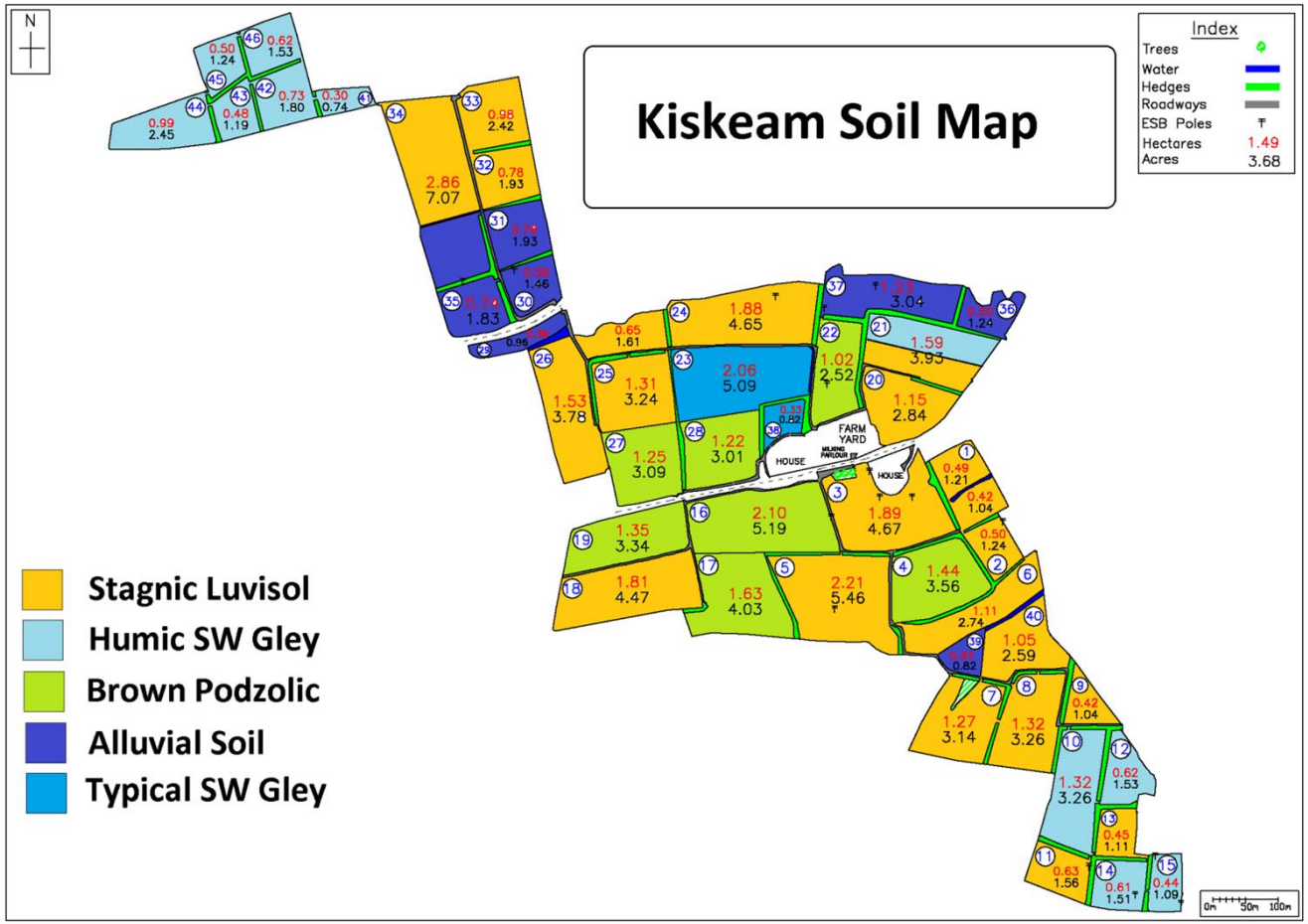
Kiskeam, pits

Kiskeam paddock 37, Humic Alluvial Gley, Feale
and paddock 22, Humic Brown Podzolic, Borrisoleigh



Kiskeam - Paddock 34 Humic Surface-water gley, Ballygree
and paddock 19, Anthric-Humic Brown Earth, Ashgrove Anthropic



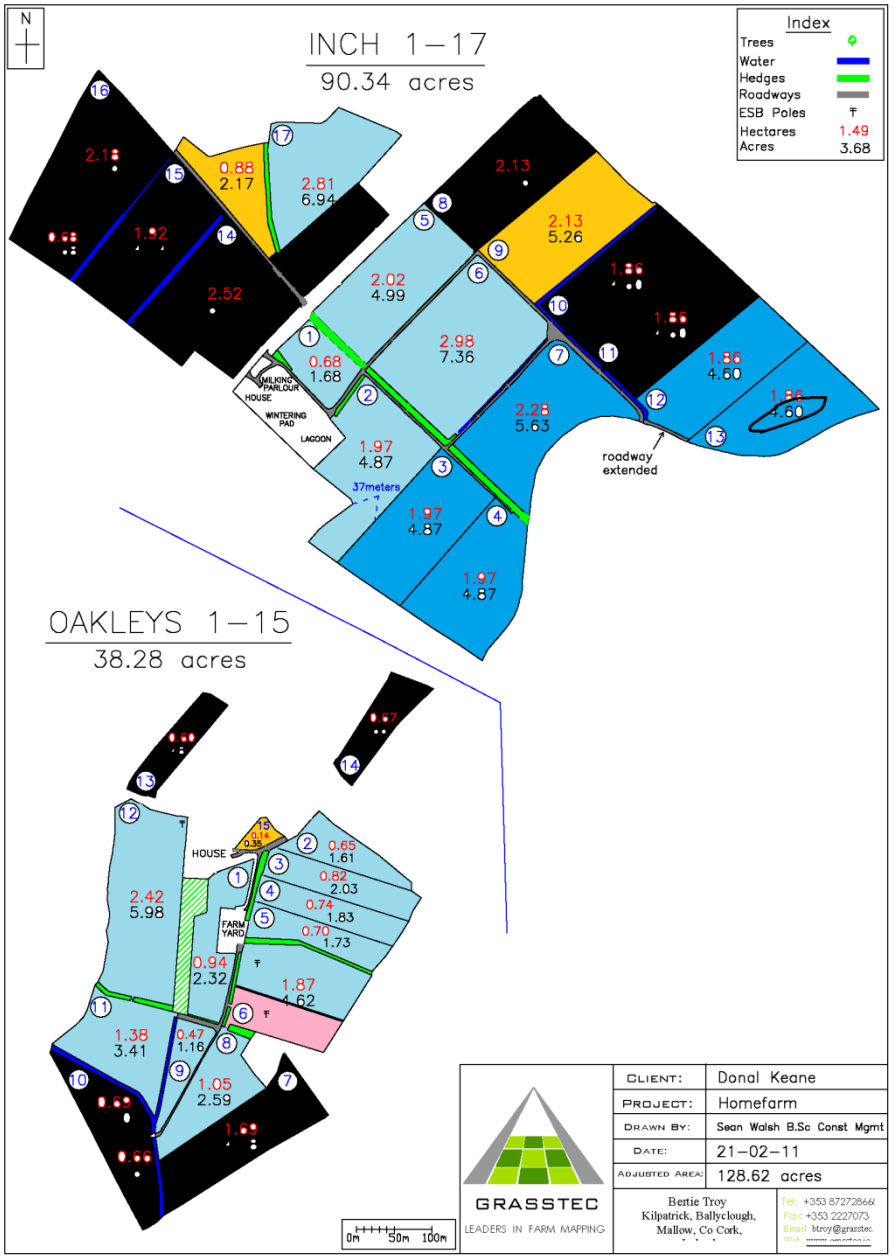

Kiskeam Soil Map
Index
Trees
Water
Hedges
Roadways
ESB Poles
Hectares 1.49
Acres 3.68
N
Stagnic Luvisol
Humic SW Gley
Brown Podzolic
Alluvial Soil
Typical SW Gley
FARM YARD
HOUSE
HOUSE
MILKING PARLOUR
0m 50m 100m

Lisselton - Inch

Lisselton - Oakleys

Lisselton, P2, HSWG, Gortaclareen

P4,Typical Brown Alluvial Soil, Suir
P14 Blanket peat, Aughty drained

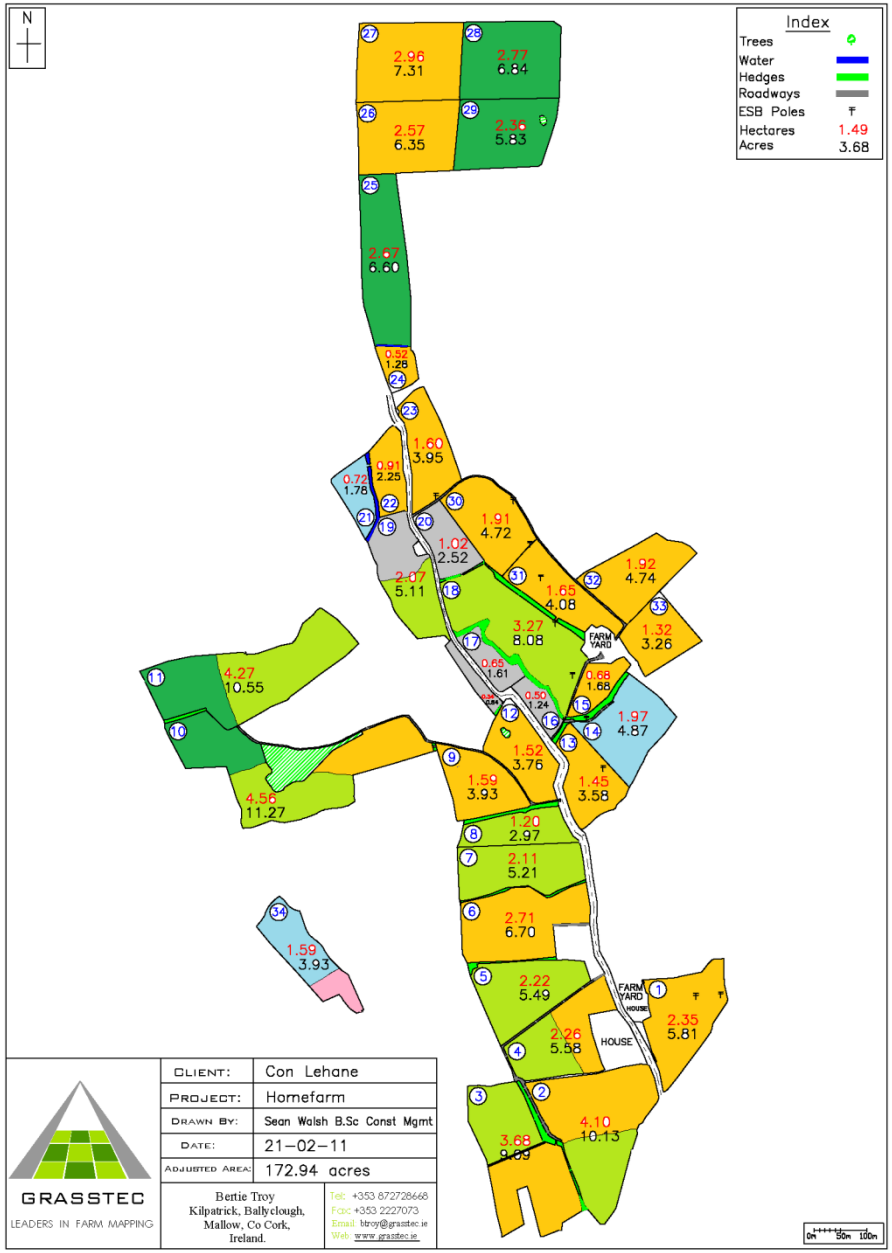


Lisselton Provisional - Soil Map

Ballinagree augers

Ballinagree P8, Anthric Humic Brown Earth, Ashgrove anthropic

Ballinagree P20, Iron-pan Stagno Podzol, Knockastanna



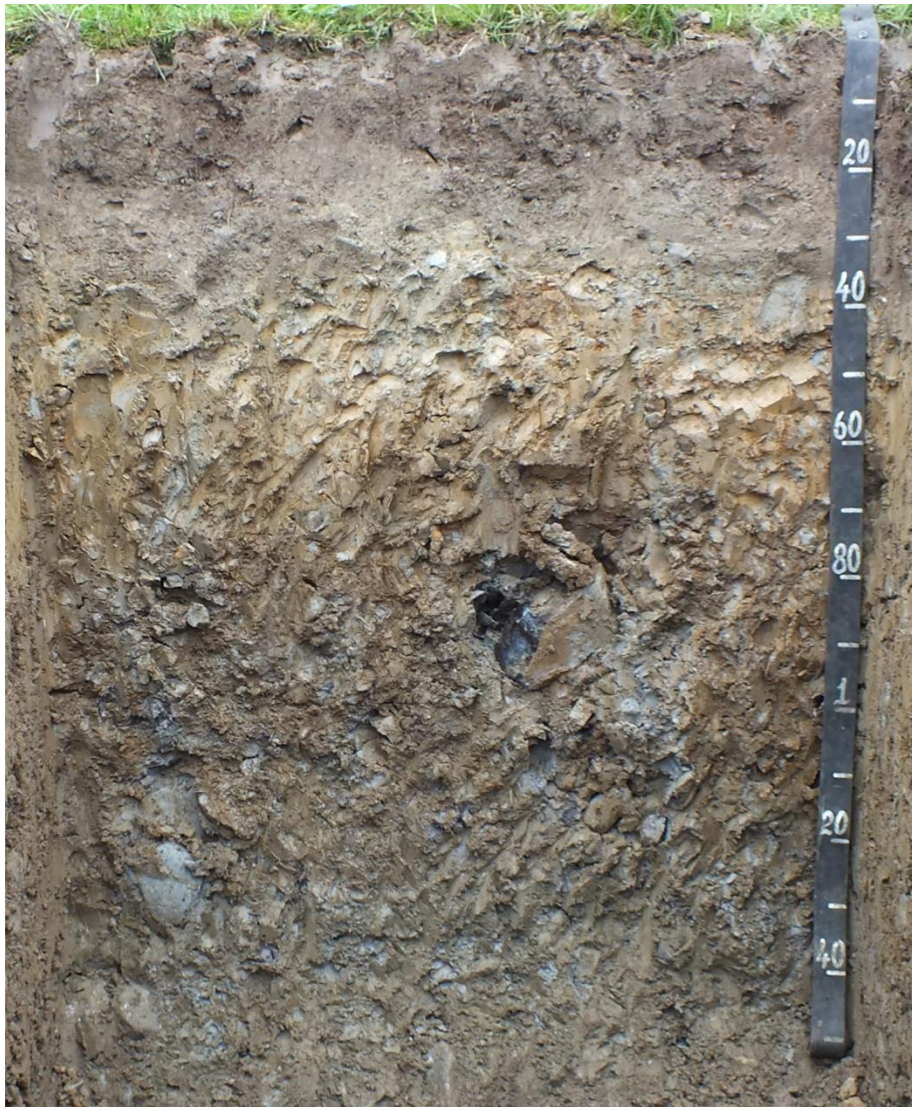
Ballinagree – provisional soil map

Swans Cross auger points

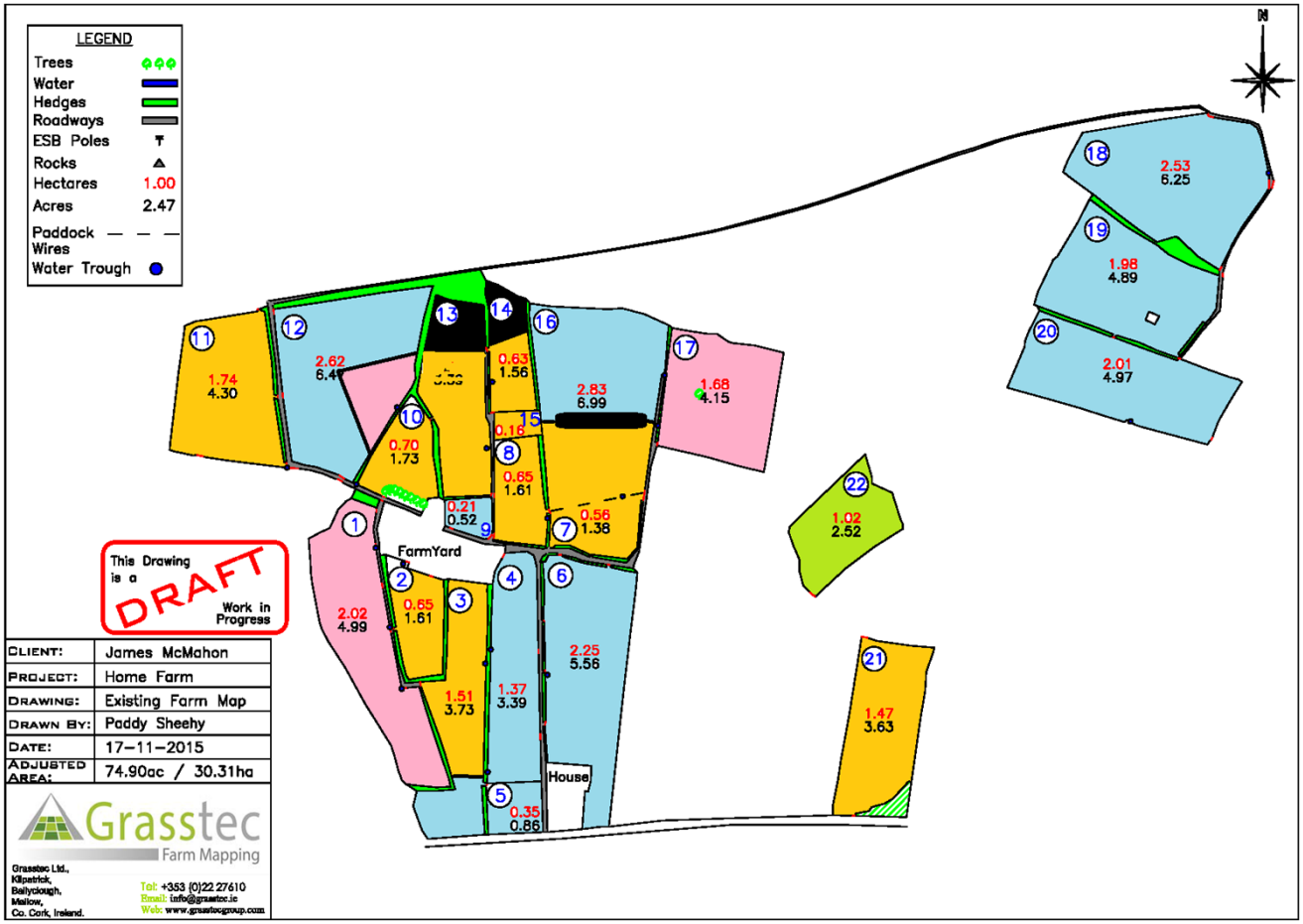
Swans Cross P18, HSWG, Gortaclareen

Sand lens

Swans cross P17, Stagnic Luvisol Gortavoher, P4, HSWG, Gortaclareen



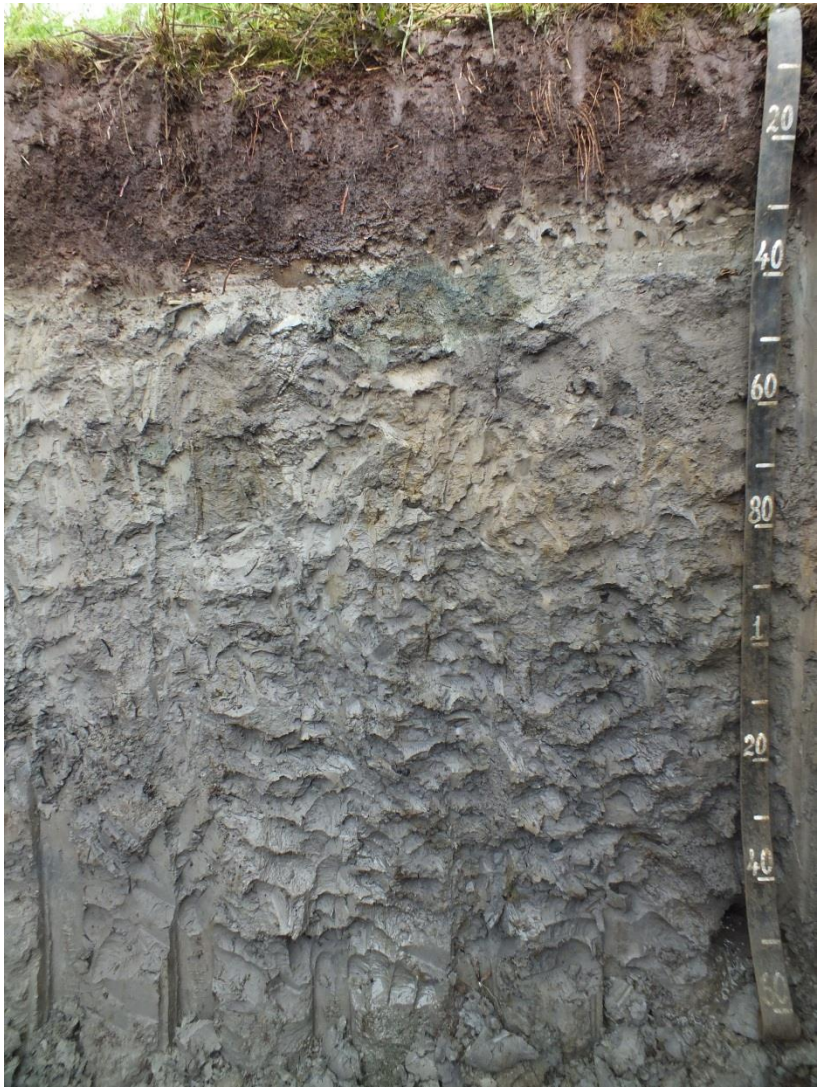
Swans cross – provisional soil map



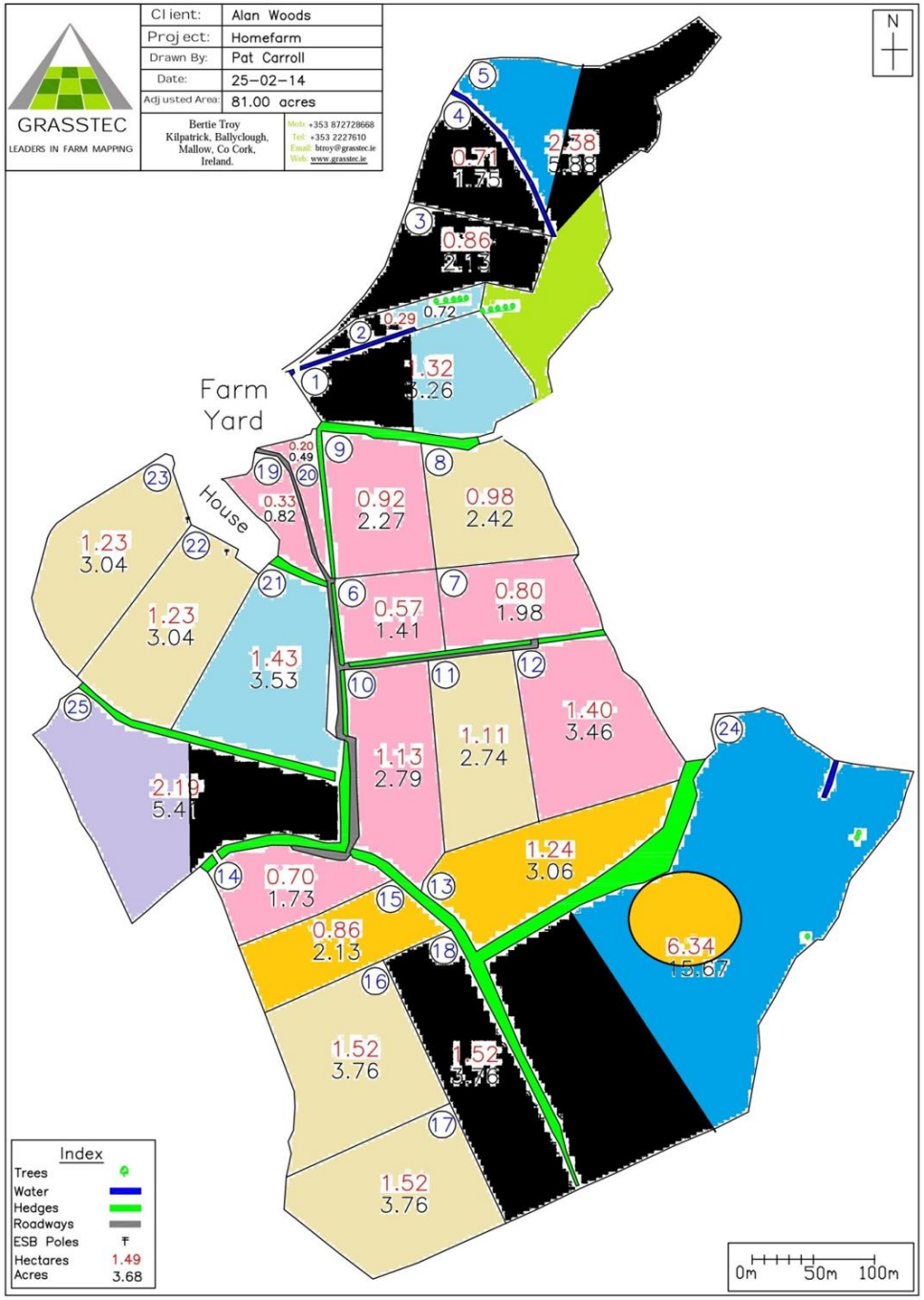
Crossmolina auger points

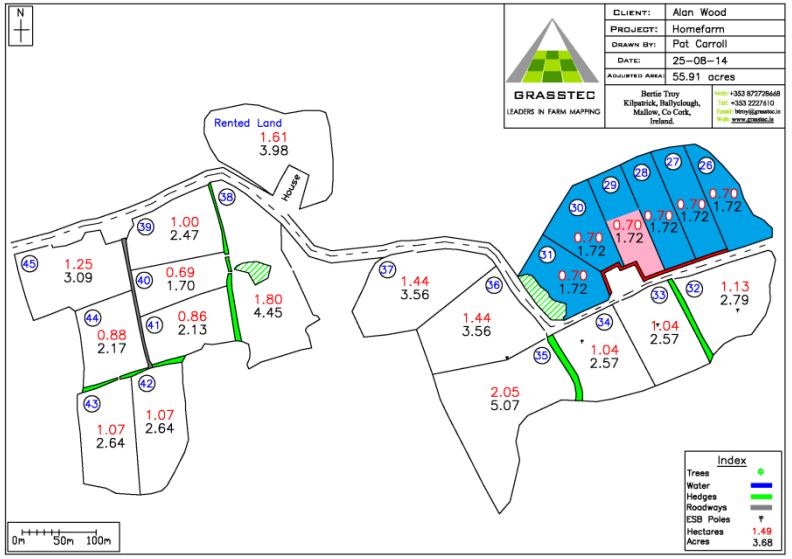
Crossmolina P 21, TSWG, Kilrush, P16, Typical Luvisol, Dunboyne

Crossmolina P32, Humic Alluvial Gley, Milquarter, P42, Typical Luvisol, Dunboyne



Provisional Map - Crossmolina

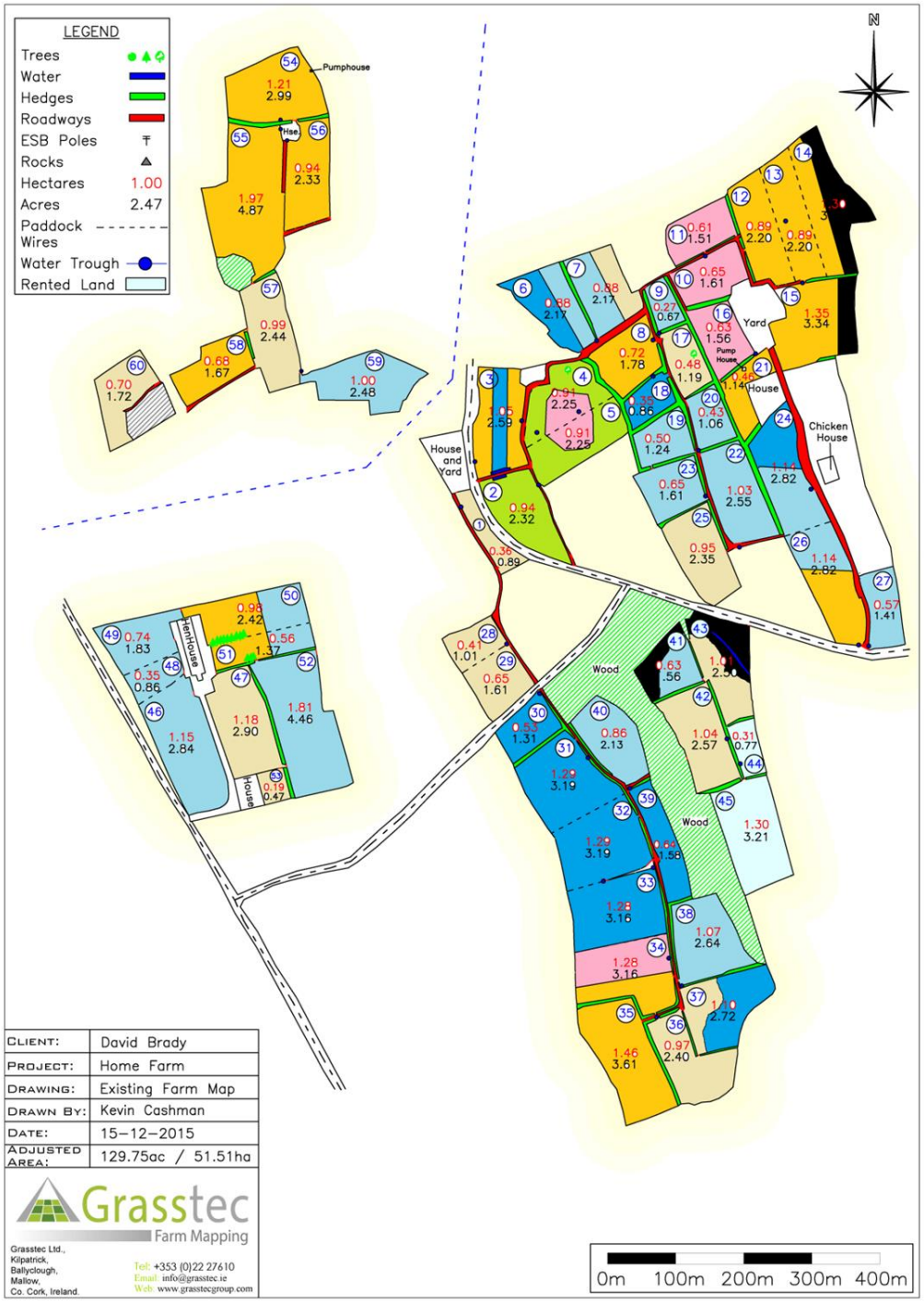




Stradone auger points

Stradone P13, Stagnic Brown Earth, Duarrigle, P20, TSWG, Kilrush.

Stradone P39, Humic Alluvial Gley, Kilcullen



Provisional soil map - Stradone

- Continuous process to combat – boil ups
- Completely saturated zones
- Move and change regularly