Soil survey is essential for agricultural drainage

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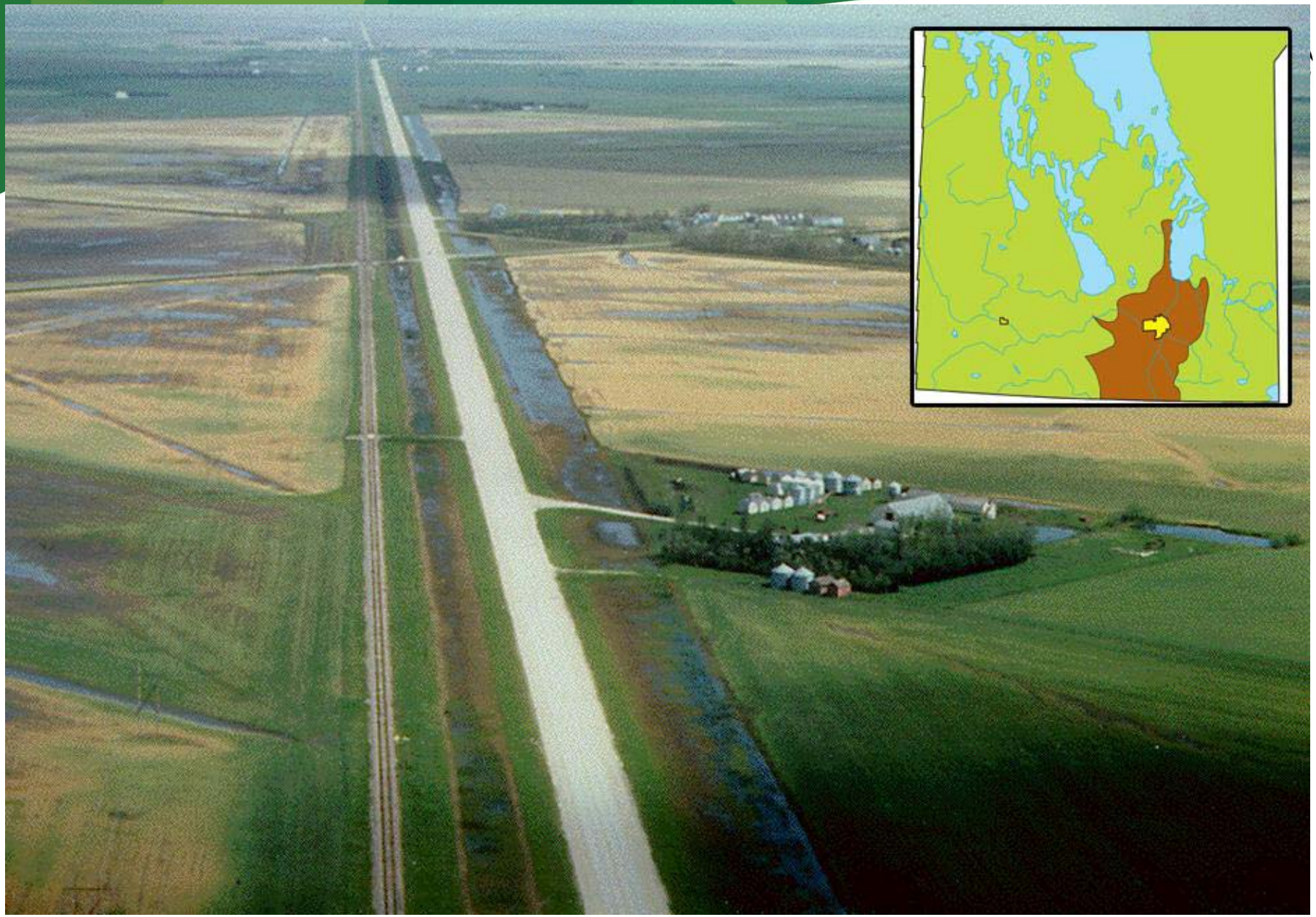

“Clays” area - Red River Valley

How, where, ... ?

Agricultural drainage

➔using surface ditch or subsurface tile / pipe to remove excess water from soil profile

➔ by either gravity or artificial means.

➔ Increase crop production

➔ enhance soil conservation

➔Improve field access, save fuel

➔ Minimize the need of converting more land into ag-farm

Agricultural drainage

Excessive rainfalls adversely affect agricultural production in Manitoba

37% of Manitoba Crop Insurance's payouts for crop losses are due to excess moisture.

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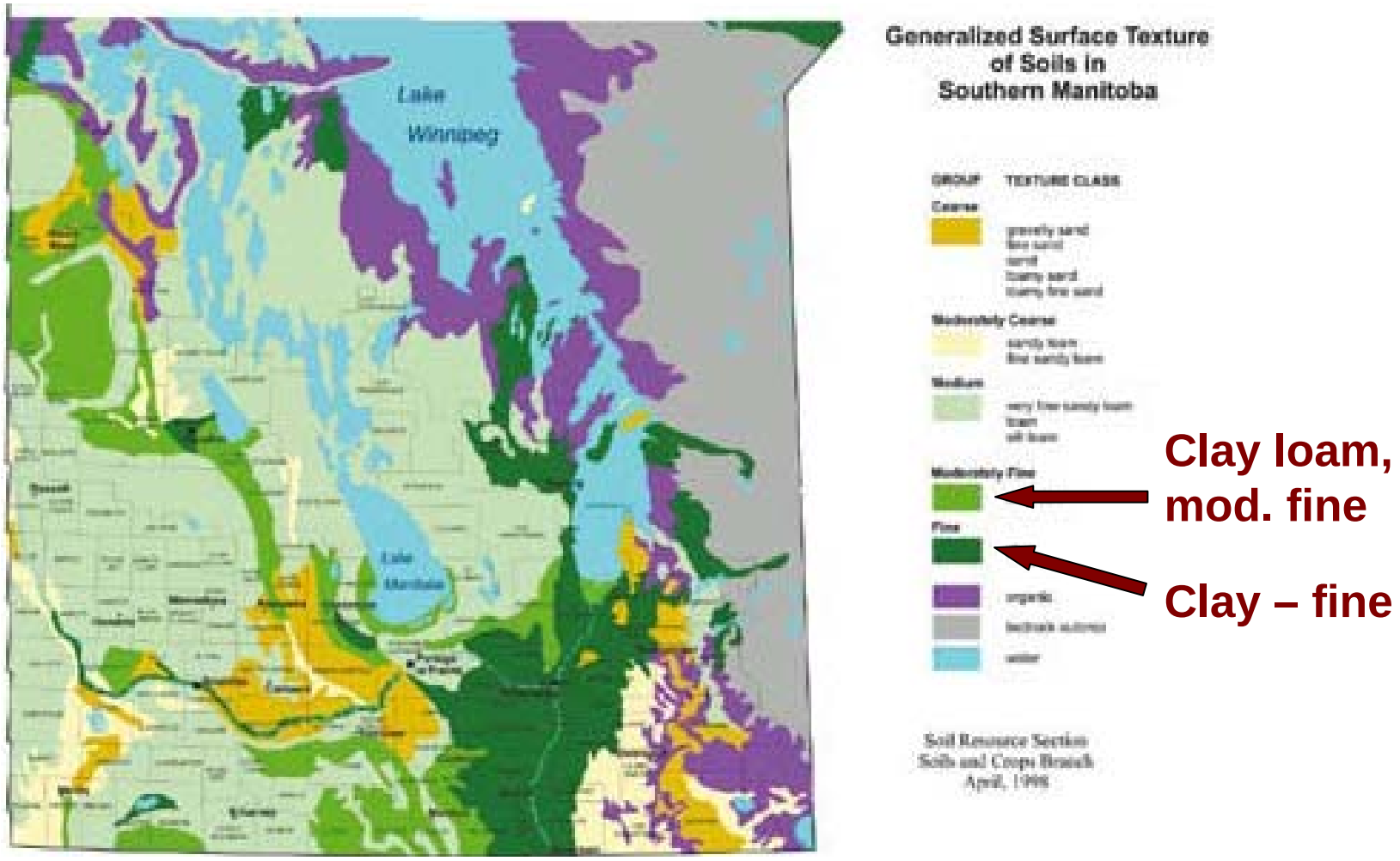
➔ Agriculture production would not be possible on 2.5 million acres without a suitable drainage system.

19 million acre - farm land

http://www.extension.umn.edu/distribution/cropsystems

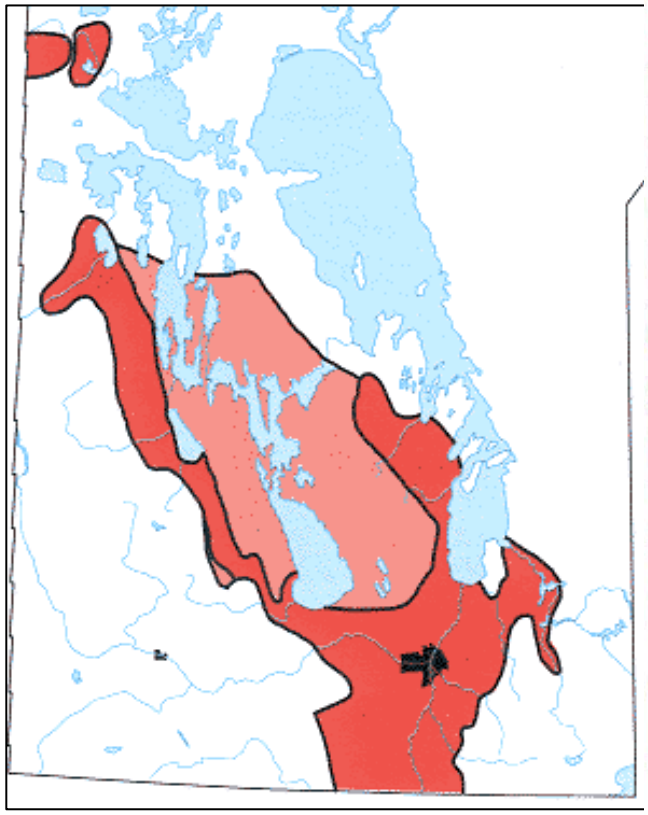
Drainage is affected by soils, climate, … …

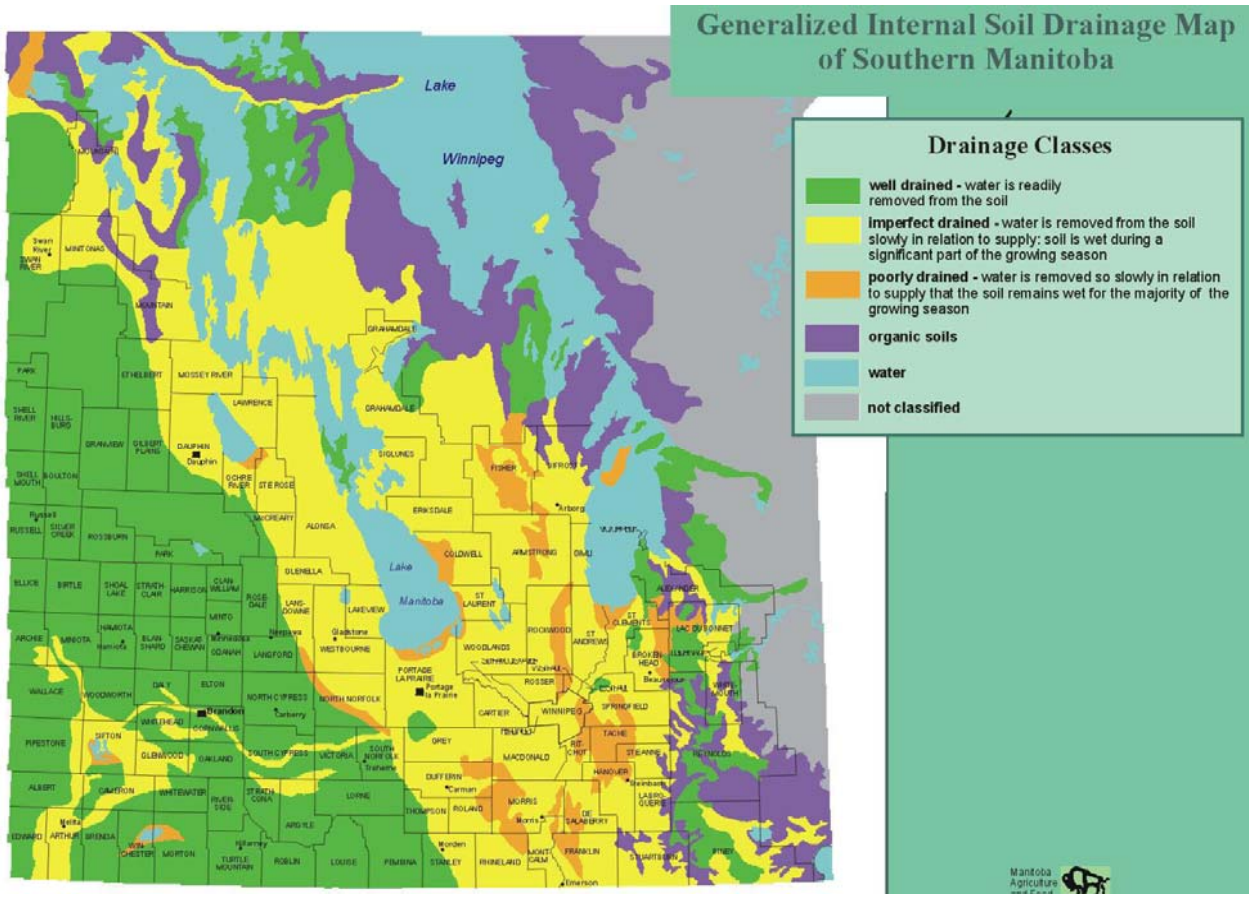


Generalized Surface Texture of Soils, Southern MB

MAFRI, Soil Management Guide, 2008

Areas requiring artificial drainage





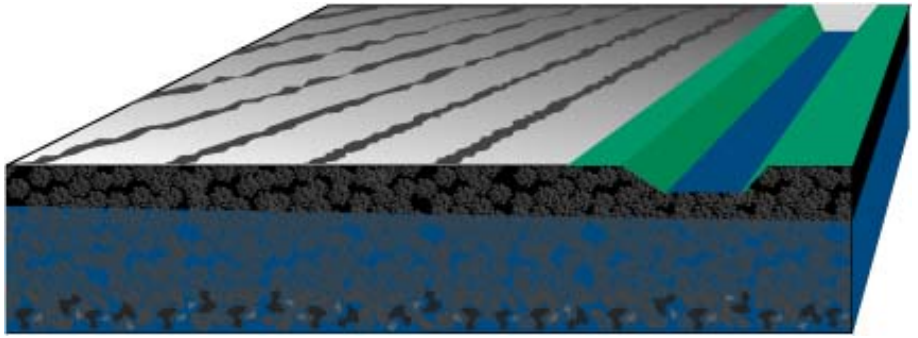
Artificial drainage benefits 5.5 million acres.

Manitoba Drainage Standards, Section 7.3.2.
Steve Topping, Water Stewardship / Drainage Programs, 2007

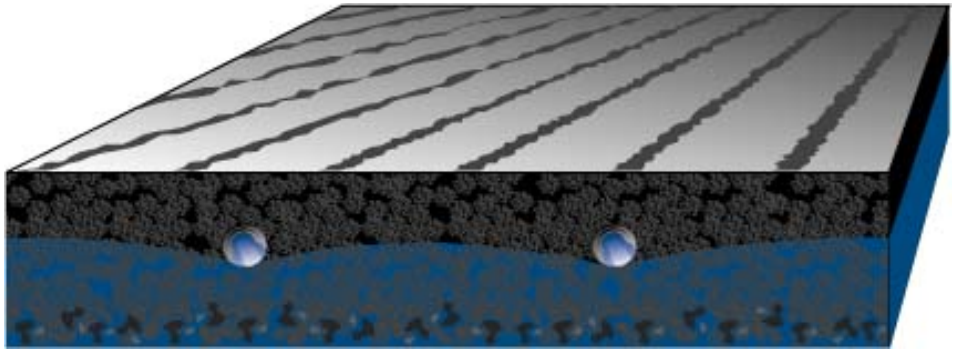
Natural drainage is poor
Rain water ponds for long periods in summer.

clay and loam areas ➔ drainage

➔ **Strategic trenching**



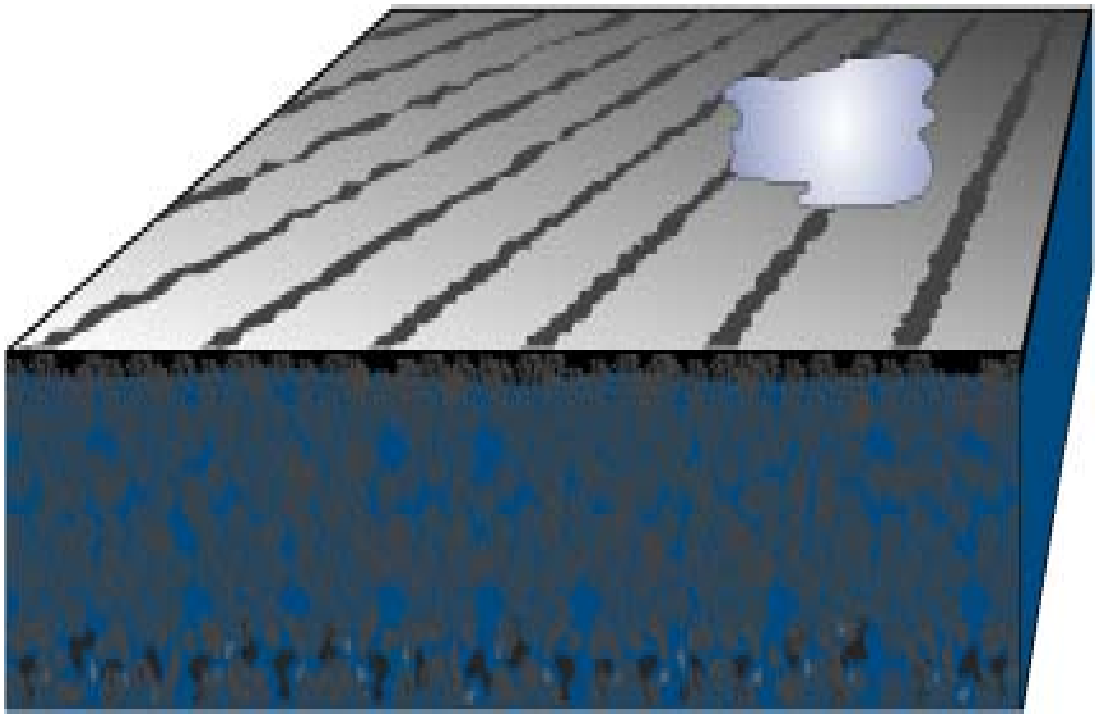
➔ **Buried tiles & pipes**



http://ohioline.osu.edu/b871

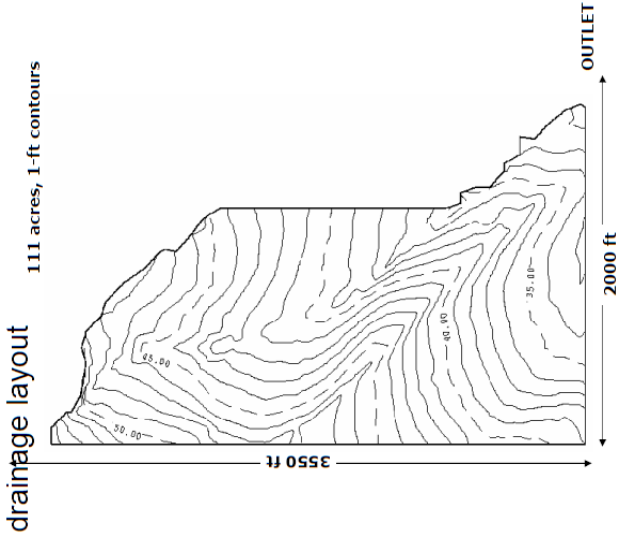
Agricultural drainage needs info

- ➔ soils
- ➔ topography
- ➔ Climate
- ➔ Crops



How to drain as quickly, cheaply, uniformly as possible ?

Soil survey



➔ **Tailored to drainage design & construction**

➔ Drainage need – area, size, scale (***farm vs. watershed***)

➔ Type of drain (surface or underground drainage)

➔ Subdrain spacing & depth requirements

➔ Construction methods & materials - special soil conditions
- parameters

➔ Post-construction mgt requirements

Features & Issues

- ➔Soil base map, NTS map & air photo
- ➔ Field visual observation
- ➔ Pit allocation
  - ➔ ***VARIABILITIES***: soils, textures, elevations, drainage capability

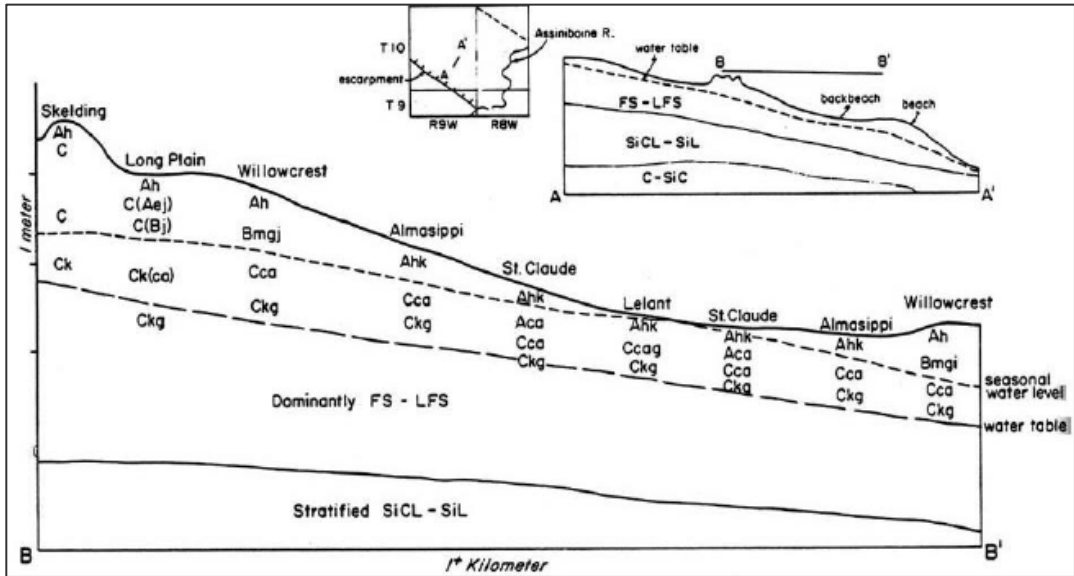
- ➔ Profile examination -- sampling & lab analysis
- ➔ Sufficient inspection pits – hydraulic conductivity
- ➔ Soil-landscape map & profile pit data
- ➔ Land use / soil boundary map - description & recommendation
- ➔ Drainage regime map
- ➔ Location & delineation - problem areas
- ➔ Existing & potential drain outlet

Soil survey provides -

key physical features:

- ➔ elevation
- ➔ soil texture
- ➔ slope & orientation
- ➔hydraulic conductivity
- ➔depth to impermeable layer
- ➔natural soil drainage capacity
- ➔depth to GW table
- ➔depth to bedrock
- ➔ surface runoff conditions

- •Spatial distributed
- •Strategically covered



Agricultural drainage

- ➔ Approach
- ➔ Capability
- ➔ Cost
- ➔ Efficiency
- ➔ Sustainability

How to make drainage system in most cost-effective way?

Agricultural drainage

- ➔ Design
- ➔ Installation
- ➔ Monitoring
- ➔ Evaluation
- ➔ Maintenance

Soils & areas most susceptible to excess water:

- *Clay layer in profile*
- *Poor or imperfect internal drainage*
  - *-- gleyed & reducing status*
- *Water table close to surface*
- *Ag Capability "W"*
  - *-- Wetness limitation*

➔ **How to achieve drain soundly planned and designed ?**

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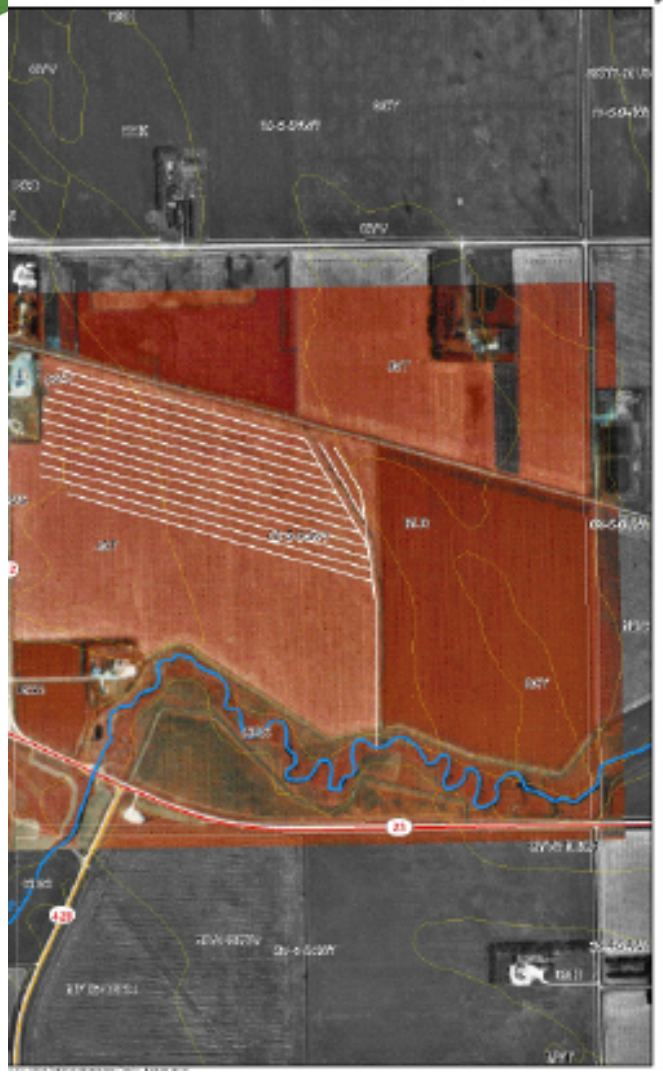
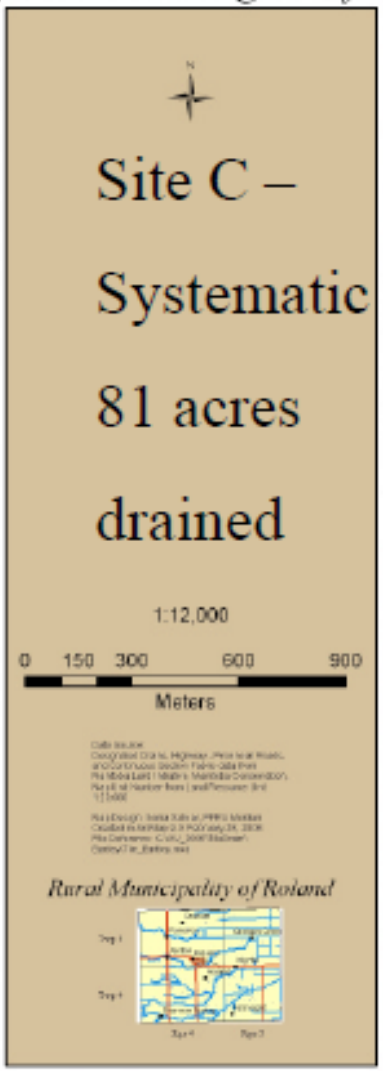
Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada

Bruce & Bob Bartley: Tile Drainage Performance Assessment





1:12,000

Bruce Shewfelt & Michelle harland, PFRA, 2006, Tile Drainage -Manitoba Experiences

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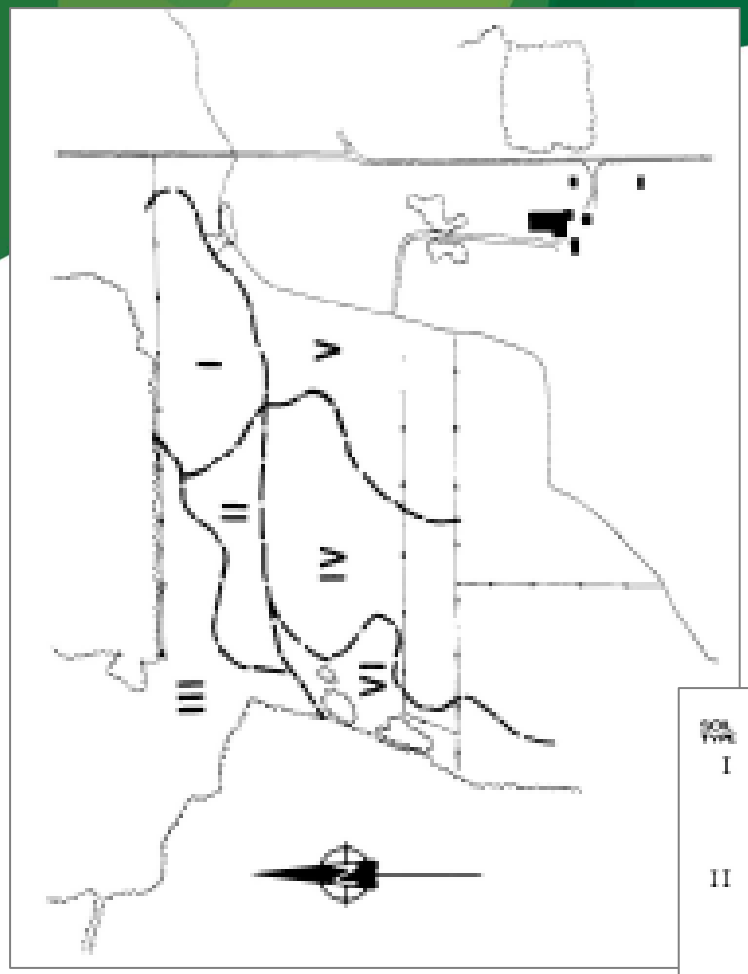
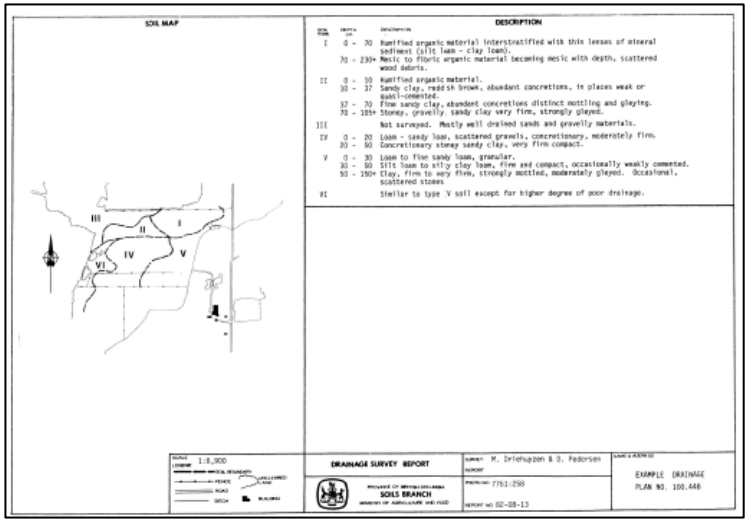




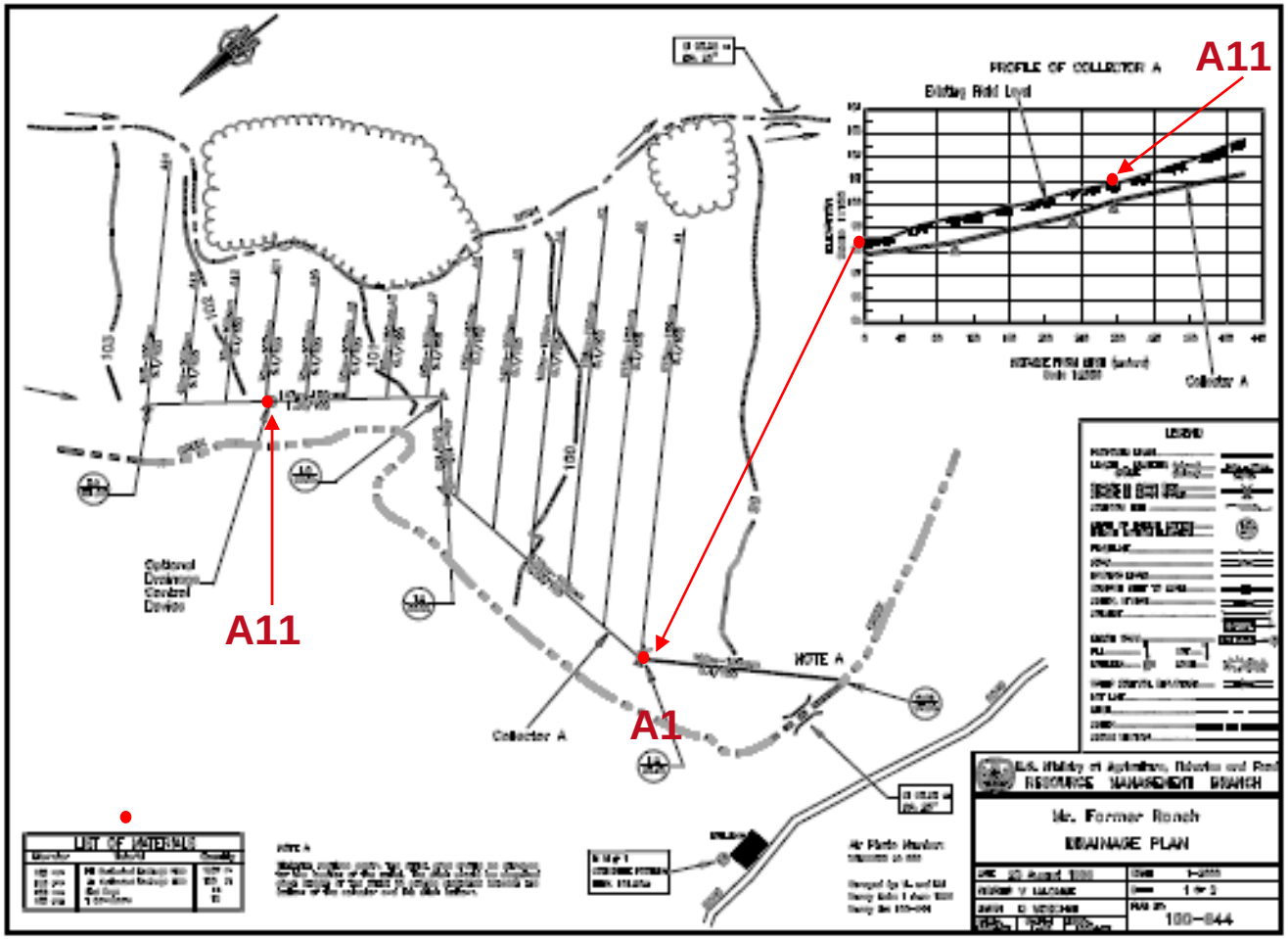
DESCRIPTION

SOIL TYPE	DEPTH cm		DESCRIPTION
I	0 -	70	Humified organic material interstratified with thin lenses of mineral sediment (silt loam - clay loam).
	70 -	230+	Mesic to fibric organic material becoming mesic with depth, scattered wood debris.
II	0 -	10	Humified organic material.
	10 -	37	Sandy clay, reddish brown, abundant concretions, in places weak or quasi-cemented.
	37 -	70	Fine sandy clay, abundant concretions distinct mottling and gleying.
	70 -	105+	Stoney, gravelly, sandy clay very firm, strongly gleyed.
III			Not surveyed. Mostly well drained sands and gravelly materials.
IV	0 -	20	Loam - sandy loam, scattered gravels, concretionary, moderately firm.
	20 -	50	Concretionary stoney sandy clay, very firm compact.
V	0 -	30	Loam to fine sandy loam, granular.
	30 -	50	Silt loam to silty clay loam, firm and compact, occasionally weakly cemented.
	50 -	150+	Clay, firm to very firm, strongly mottled, moderately gleyed. Occasional, scattered stones.
VI			Similar to type IV soil except for higher degree of poor drainage.

Soil survey map - farm drainage, 1:8,900

BC Ministry of Agriculture and Food

Drainage plan, 1:2,000



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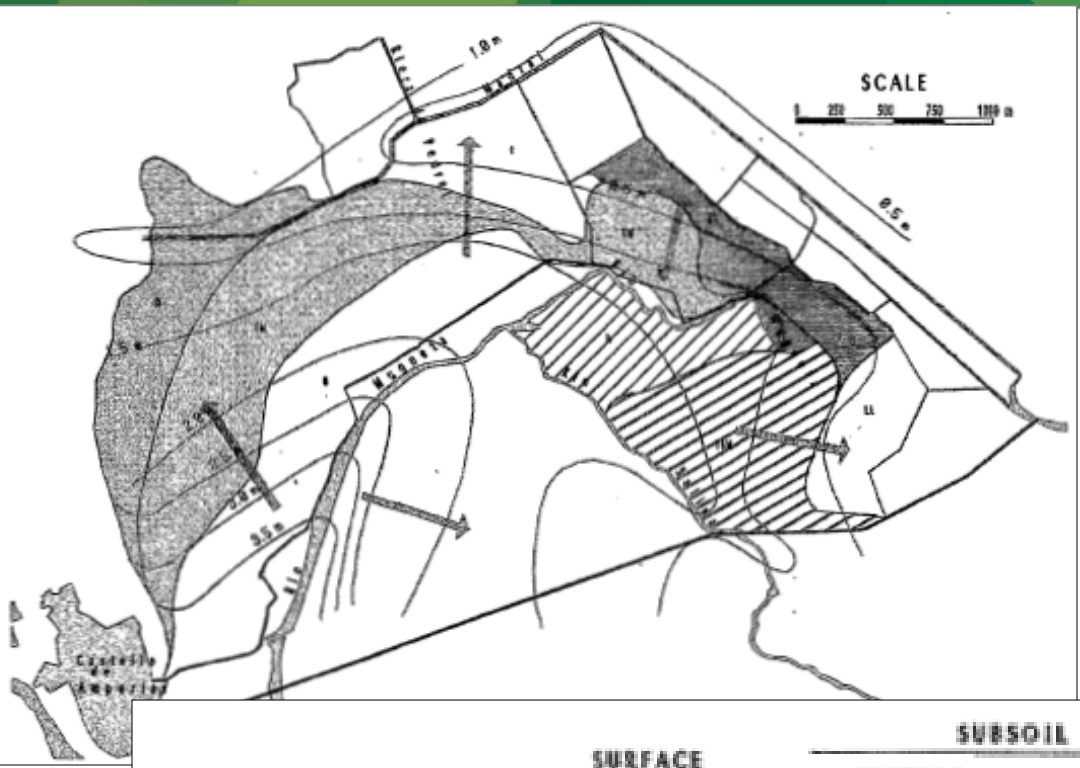

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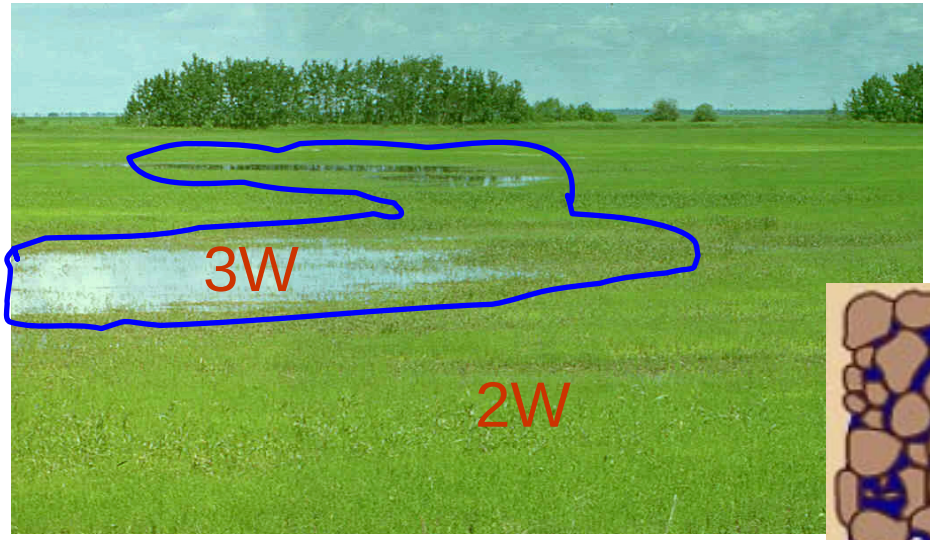
Section IV, Muga area, NE Spain
1:5,000

MARTINEZ BELTRAN,, MADRID, SPAIN, Options Méditerranéennes, International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM)

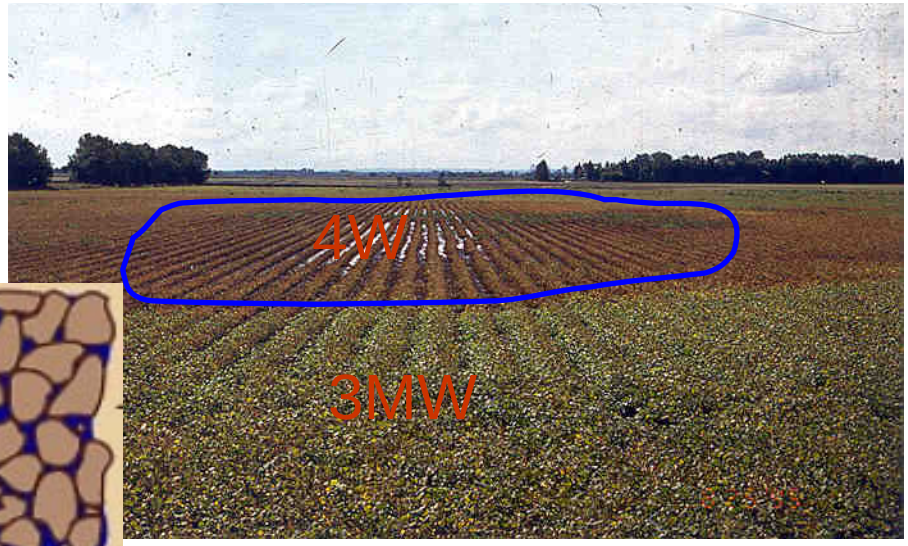
CODE	MAPPING UNIT	SURFACE SOIL TEXTURE	SUBSOIL TEXTURE	SUBSOIL K (m/d)	IMPERVIOUS BARRIER DEPTH(cm)	IMPERVIOUS BARRIER TEXTURE	GR.W.T. DEPTH (m)	DRAINAGE REQUIREMENTS L(m)/P(m)
B	Mugueta levee	Loam-Sandy loam	Loamy sand	2.0	3.0	Clay	1.5	-
TM	Mugueta transition	Silty loam	Sand-loamy sand	2.0	2.6	Silty clay (gley)	0.9	50/1.3
D	Backswamp	Silty clay	Silty clay (Pseudgley)	2.0	2.0	Silty clay (gley)	0.5	30/1.3
t	Pedret-tidal flat transition	Silty clay	Silty-clay	1.6	3.0	Silty clay (gley)	1.1	30/1.3
tt	Upper tidal flat	Clay loam	Coarse sand shells	8.7	2.1	Silt	1.0	
tl	Low tidal flat	Silty clay	Coarse sand shells	8.7	1.2	Silt	0.8	Wet land
B/	Salins-Mugueta levee	Silty loam	Loamy sand with loamy clay layers	3.9	2.8	Silt	1.4	-
Tsm	Salins-Mugueta transition	Silt-silty loam	Sand with silty clay layers	2.7	1.7	Silt	0.9	30/1.3

Drainable excess water – where & how much?

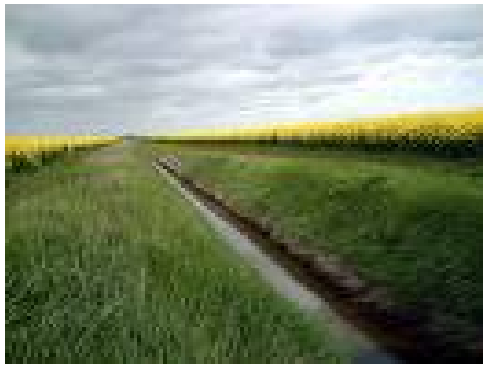
Wetness in clay soils



Wetness in sandy soils



Thank you !



Questions and Comments ?