

SALINITY and TILE DRAINAGE Concepts and Results

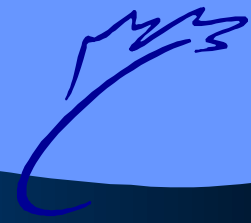


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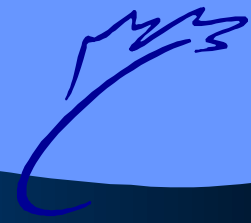
Outline



- **Salinity Processes**
- **Salinity Risk**
- **Salinity Mapping**
- **Tile Drainage and Salinity**
 - **Salinity Reduction**
 - **Tile Water Quality**
- **Summary and Questions**



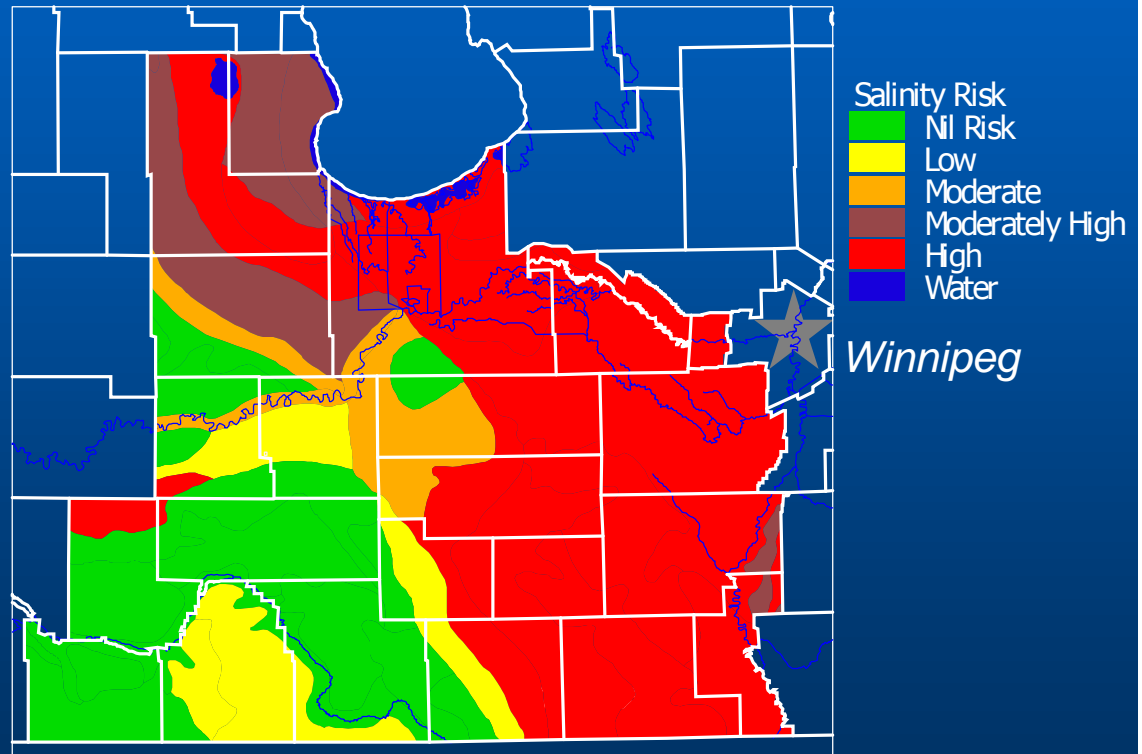
Is Salinity A Concern for Your Farm?



- salts common in Manitoba soils

Morden District Salinity Risk

67% of
soils in South
Central Manitoba

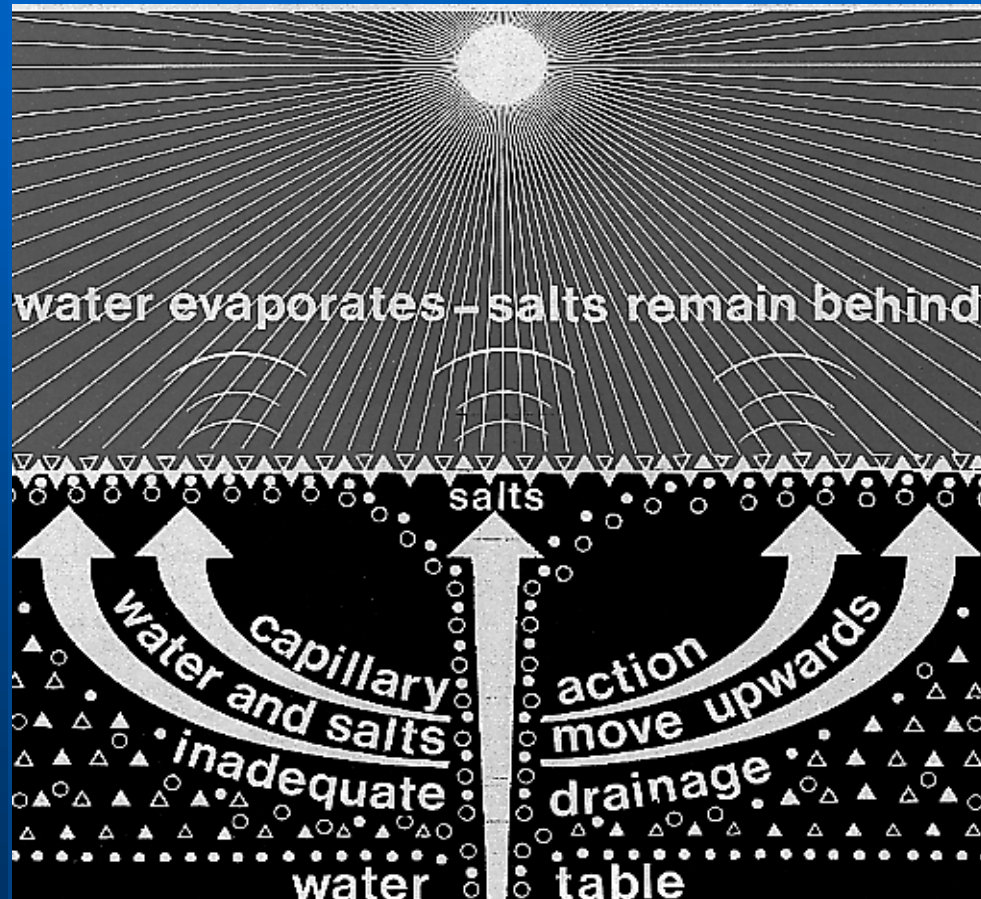


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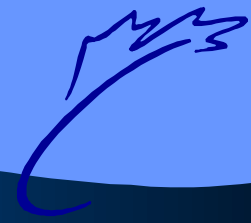
How do Salts Build Up?



- parent material high in soluble salts
- imperfect drainage
- high water tables
- cropping
- artesian pressure
- side hill seeps



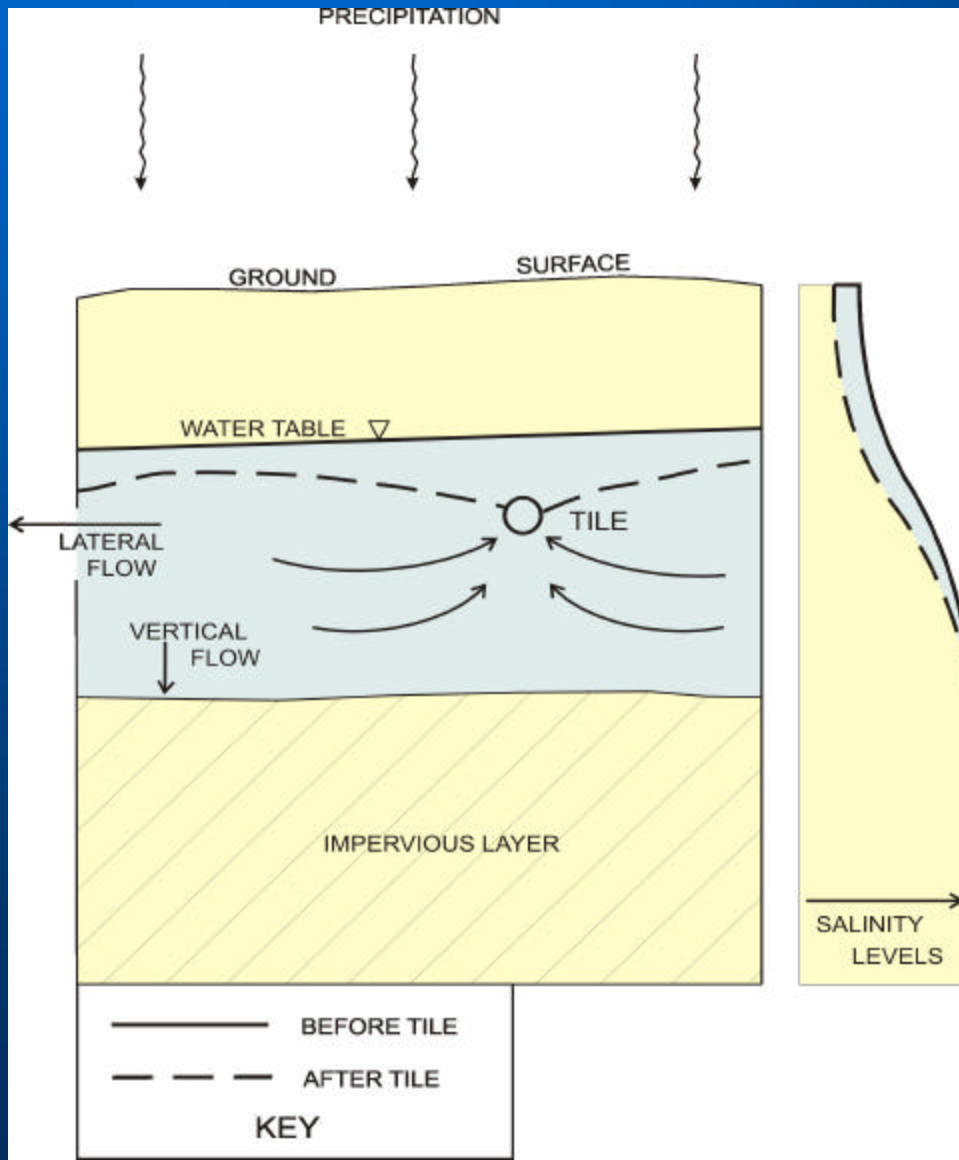
Salinity Risk – External Factors



- Increased precipitation
- Irrigation
- Impeded surface drainage
- Increased evaporation (e.g. row crops)



Salinity and Tile



- Lower water table
- Improved lateral drainage
- Downward flux salts from root zone
- Decrease in root zone salinity
- **SHIFT IN EQUILIBRIUM !**

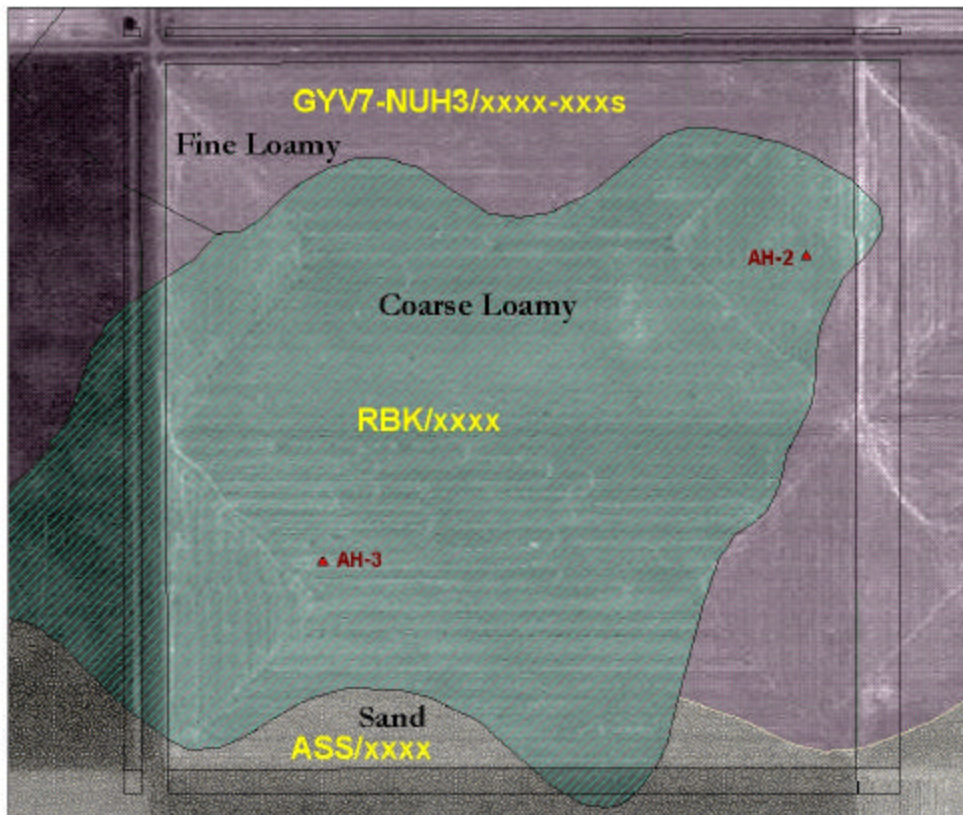
Salinity – How Much and Where ?



- 1:20,000 Soils Maps
- Water Table Levels
- EM Mapping
 - EM 38
 - EM 31
 - Veris
- Soils Profiles
 - Texture
 - Salinity



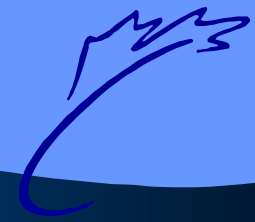
1:20000 Soils Maps



- Soil series
- Xxxs – salinity designation
- Bulk rating for polygon
- Good for highlighting
 - soils at risk or already very saline
 - land requiring more investigation and baseline characterization
 - future monitoring



The EM38 Meter



- principle of conductivity
- field level indicator
- root zone conductivity (two depths 2' and 5')
- salinity, texture, uniformity, moisture
- needs calibration !



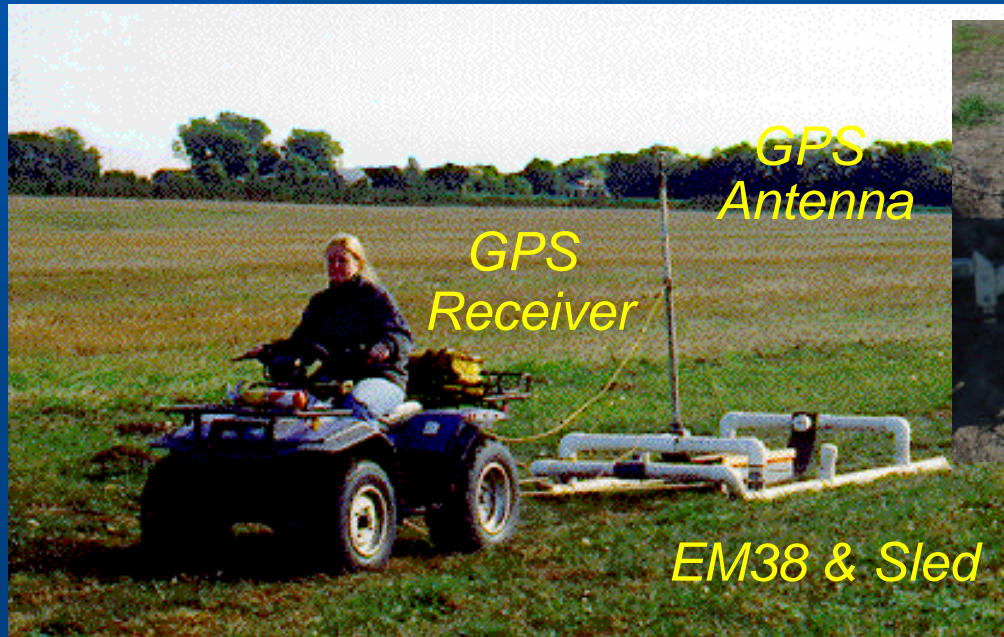
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EM 38/GPS System

- simultaneous position and EM readings
- 20 km/hr with readings every 2 seconds



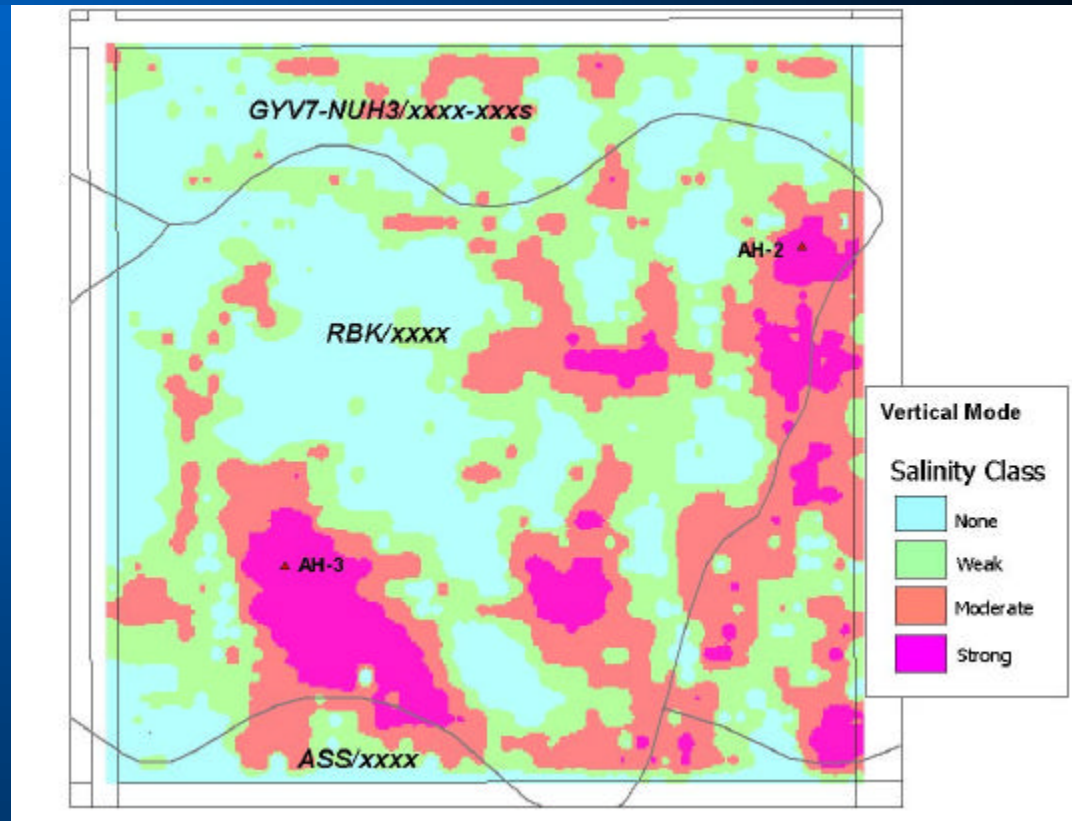
EM38/GPS → GIS

- GPS field data - - >> PC
- ArcView GIS creates a map
 - EM 38 Horizontal (0.75 m)
 - EM 38 Vertical (1.5 m)
- Map used to target soil sampling for verification and calibration
- Map used to quantify salinity by class of severity and distribution



EM38 Mapping

- Extent and severity of salinity
- More accurate than 1:20000 map
- H to 0.75 m (2.5 ')
- V to 1.5 m (5 ')
- Infer salinity profile
- More salt at depth
- Great tool for future monitoring



Soil Sampling

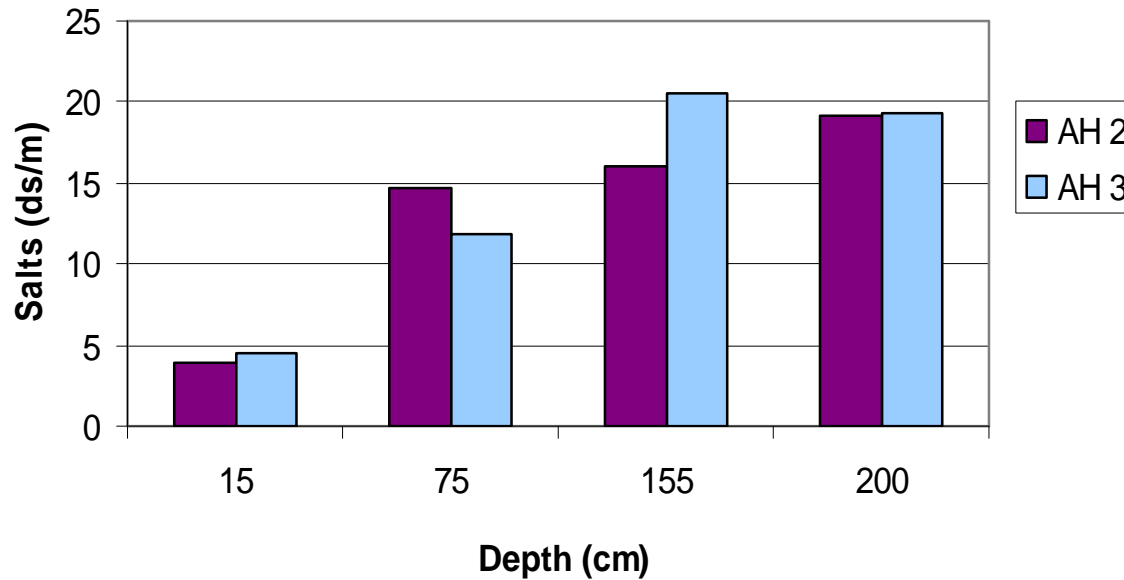


- **Verify and calibrate EM readings**
- **Baseline data**
- **Types and nature of salts**



Example Soil Sampling

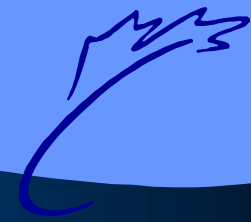
Salt Levels in Soil Samples
at Weibe's - NW 20-12-9 w1
September 3, 1998



Depth (cm)	Electrical Conductivity (ds/m)	EM38 Reading V/H
0-15	4.49	284/195
65-75	11.83	
145-155	20.50	244/188
200	19.30	

AH 3	0-15	4.49	5400	730	207	284/195
AH 3	65-75	11.83	3600	1330	400	
AH 3	145-155	20.50	1800	2090	498	
AH 3	200	19.30	3500	2650	536	

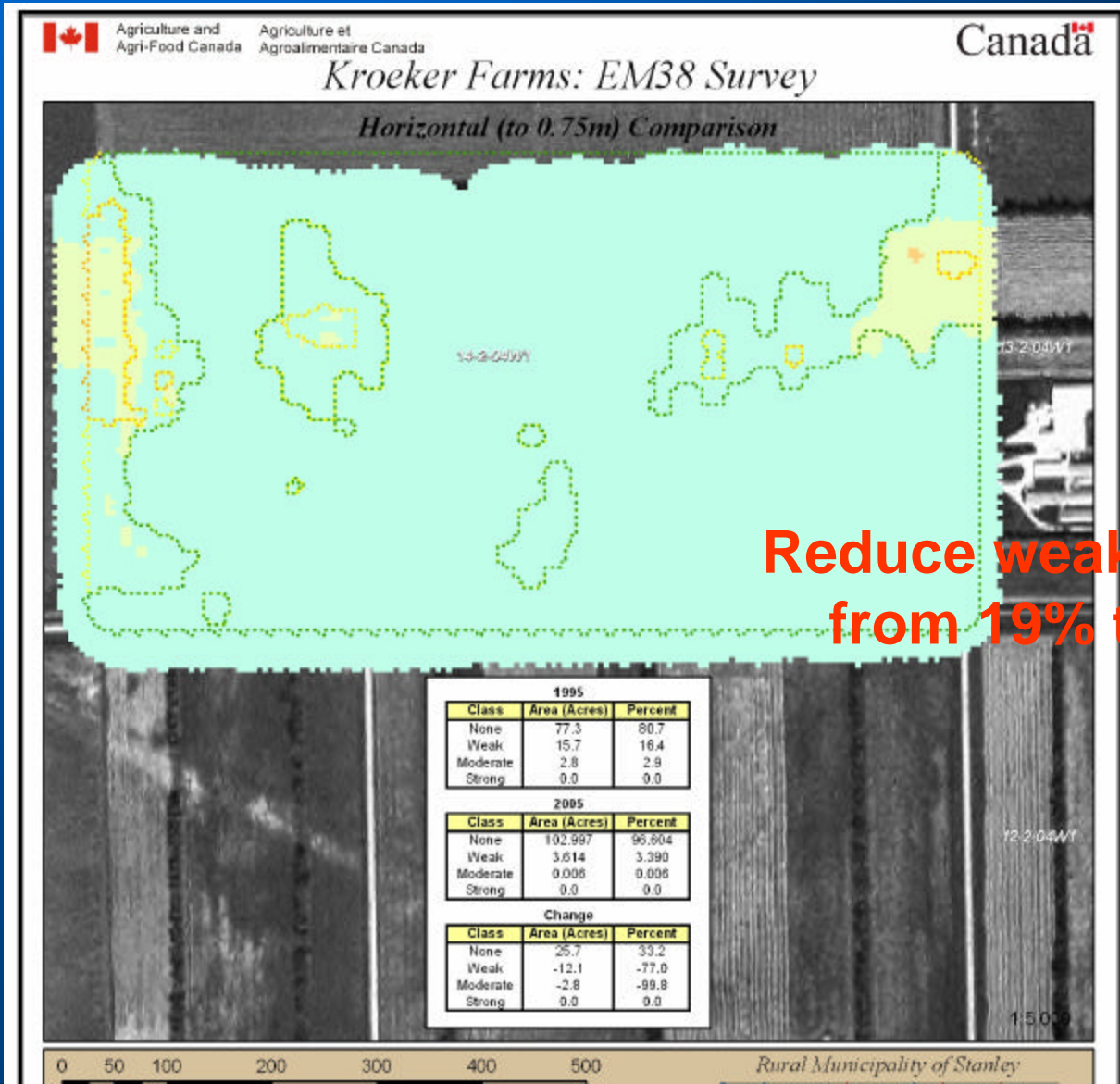
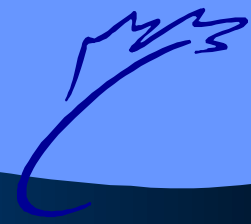
What Will Tile Do ?



- Rid profile of salts – NOT
- Reduce Root Zone salinity – POSSIBLE
- Impact Environment – PERHAPS



Example – Kroeker Main Farm EM38H - 1995 to 2000 - to 2.5'



Reduce weakly and moderate
from 19% to 3% of parcel

EM38 V - 1995 to 2005 - to 5'



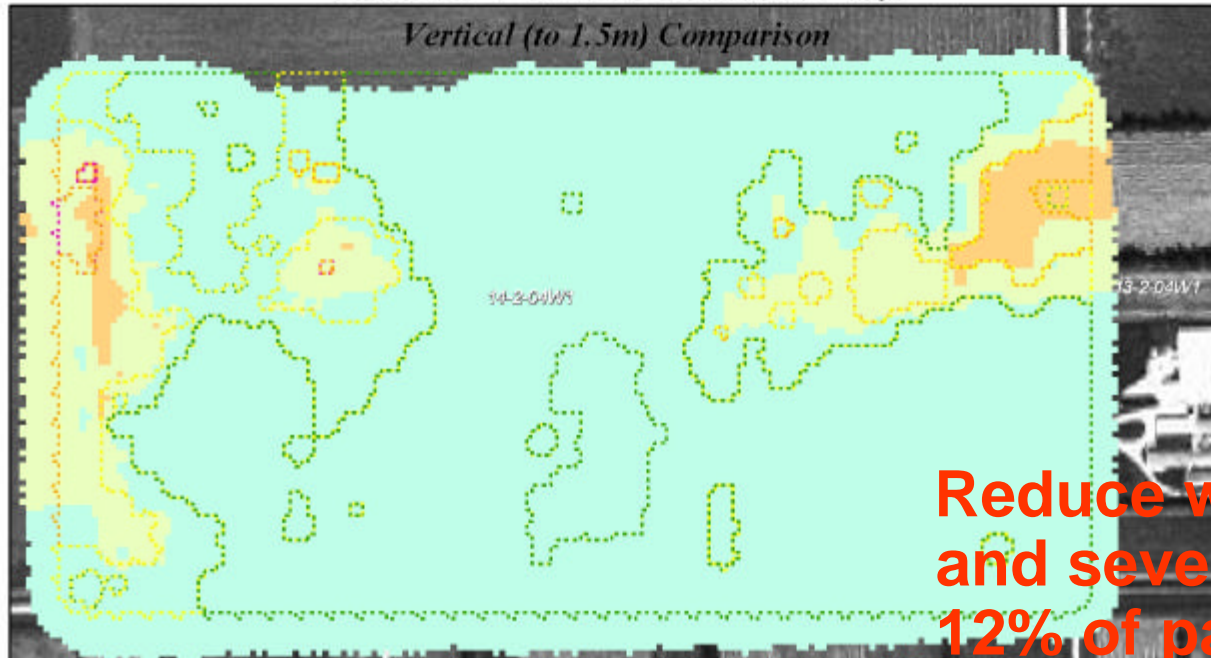
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Kroeker Farms: EM38 Survey

Vertical (to 1.5m) Comparison



1995		
Class	Area (Acres)	Percent
None	61.7	65.9
Weak	21.4	22.8
Moderate	10.0	10.7
Strong	0.6	0.6

2005		
Class	Area (Acres)	Percent
None	93.7	88.2
Weak	10.5	9.8
Moderate	2.1	2.0
Strong	0.0	0.0

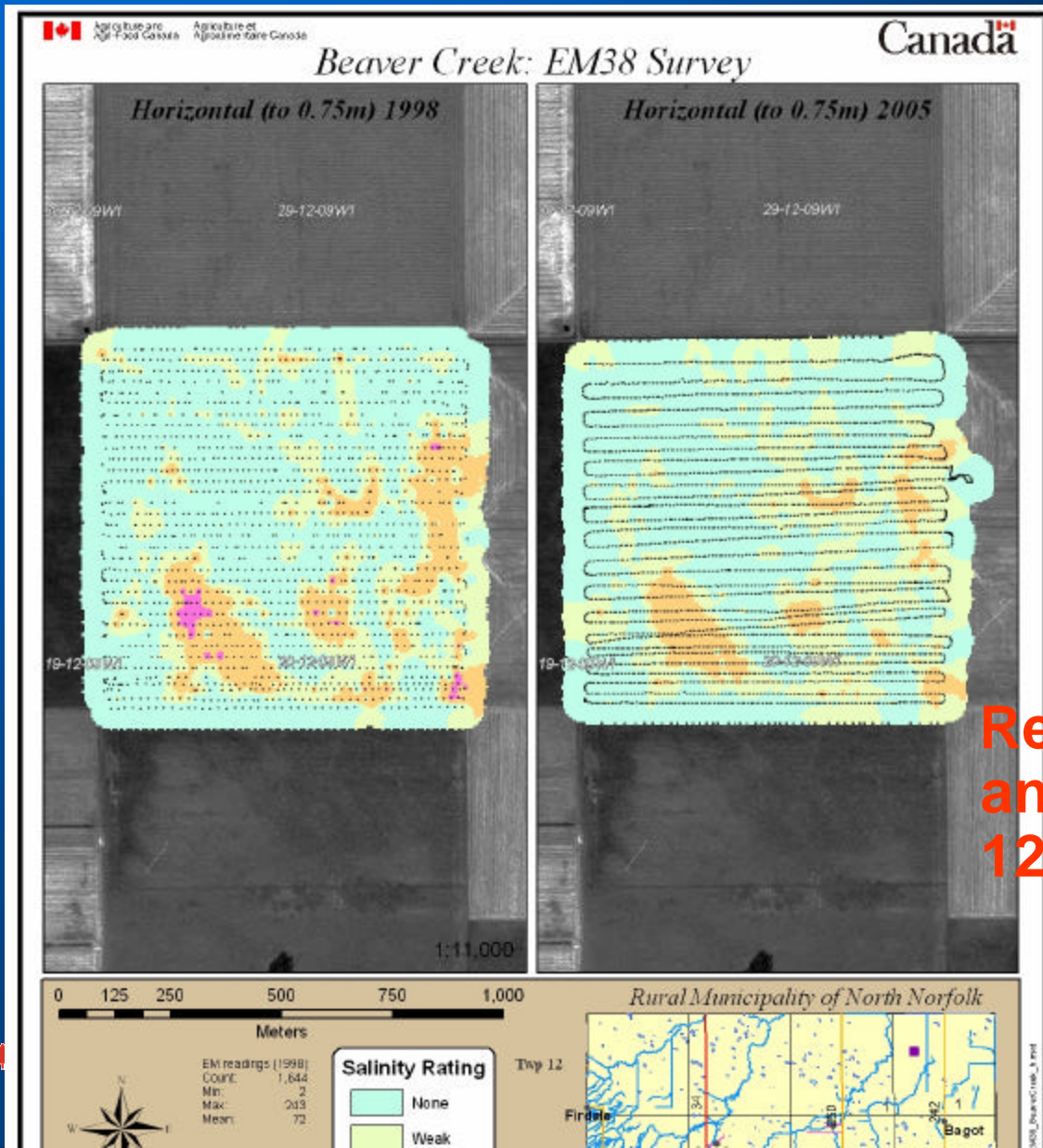
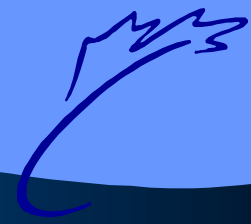
Change		
Class	Area (Acres)	Percent
None	31.9	51.7
Weak	-10.9	-51.1
Moderate	-7.9	-78.9
Strong	-0.6	-100.0

Reduce weakly, moderate and severe from 34% to 12% of parcel

Reduce severe and moderate from 11% to 2%

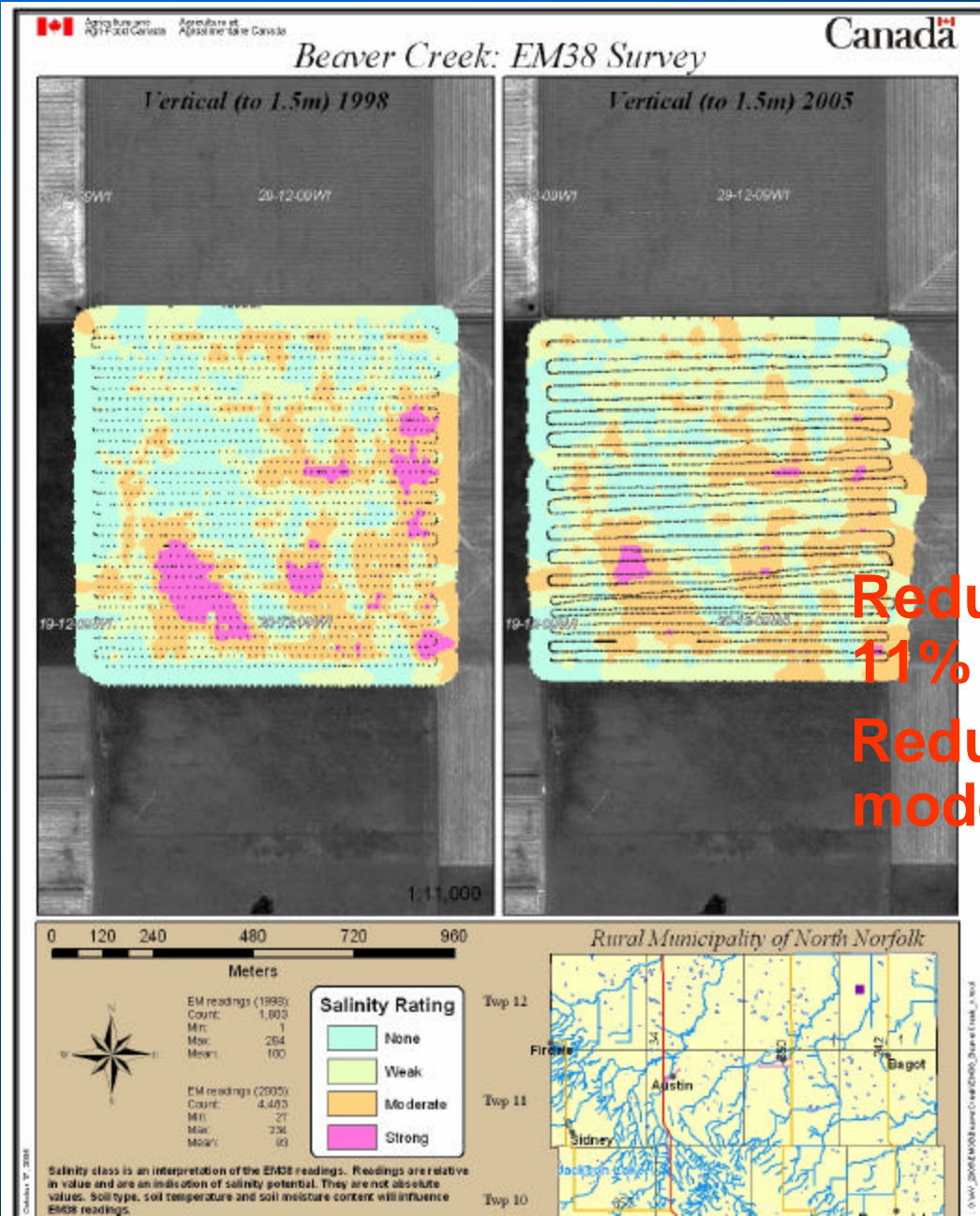
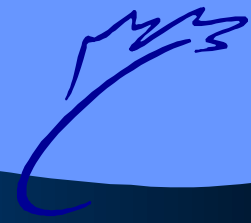
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Example – Beaver Creek EM38 H - 1998 to 2005 - to 2.5'



Reduce moderate and strong from 12% to 5% of parcel

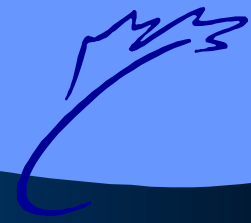
EM38 V - 1998 to 2005 - to 5'



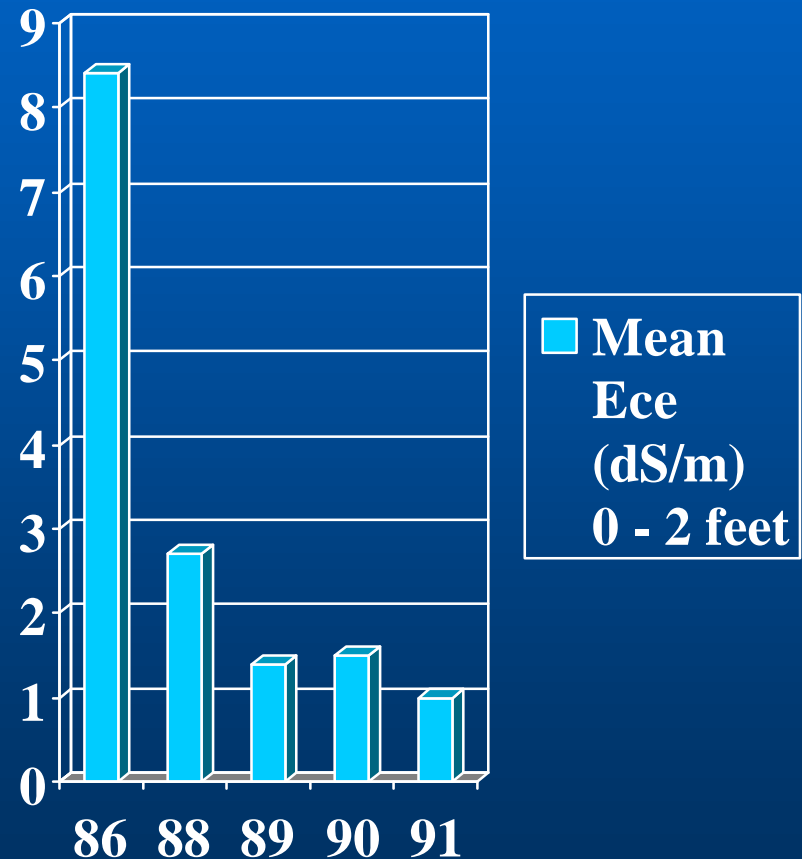
Reduce moderate from
11% to 5% of parcel

Reduce severe and
moderate from 7% to 1 %

Example – SIDC



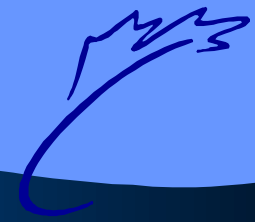
- Reclaimed 20 acres
- Leaching water - 1 to 1.5 feet per year for 4 years
- Increase non-saline from 20% to 80% of field
- No longer Moderate or Severe Salinity



Tile Impact – Water Quality

- Conductivity
 - Max. 5070 uS/cm (May)
 - Min. 1140 uS/cm (Aug)
- Nitrate-N
 - Max. Conc. 59 ppm (Jul)
 - Min. Conc. 3 ppm (Aug)
- Water recycled to reservoir !





Net Impact ?

- **Reduced salinity = improved yields, increased cropping options**
- **Sustainability considerations**
 - Improve surface drainage
 - Cropping options – increase water use
 - Depth and spacing of tiles
 - Recycle water
- **Timelines ?**
 - Leaching volume
 - Tile spacing
- **Net Return ?**
 - Severity
 - Impacts on Environment
 - Value land



QUESTIONS ?