

MANAGING SALINE SOILS : CANADIAN PRAIRIES

by

Les Henry

February 24, 2010 U of S : Soils & Crops

SNAPSHOT

- **PROBLEM SOILS**
 - Acid, Calcareous, True Alkali
 - Saline, Solonetz

- **Saline Soils**
 - Details Later

PROBLEM SOILS

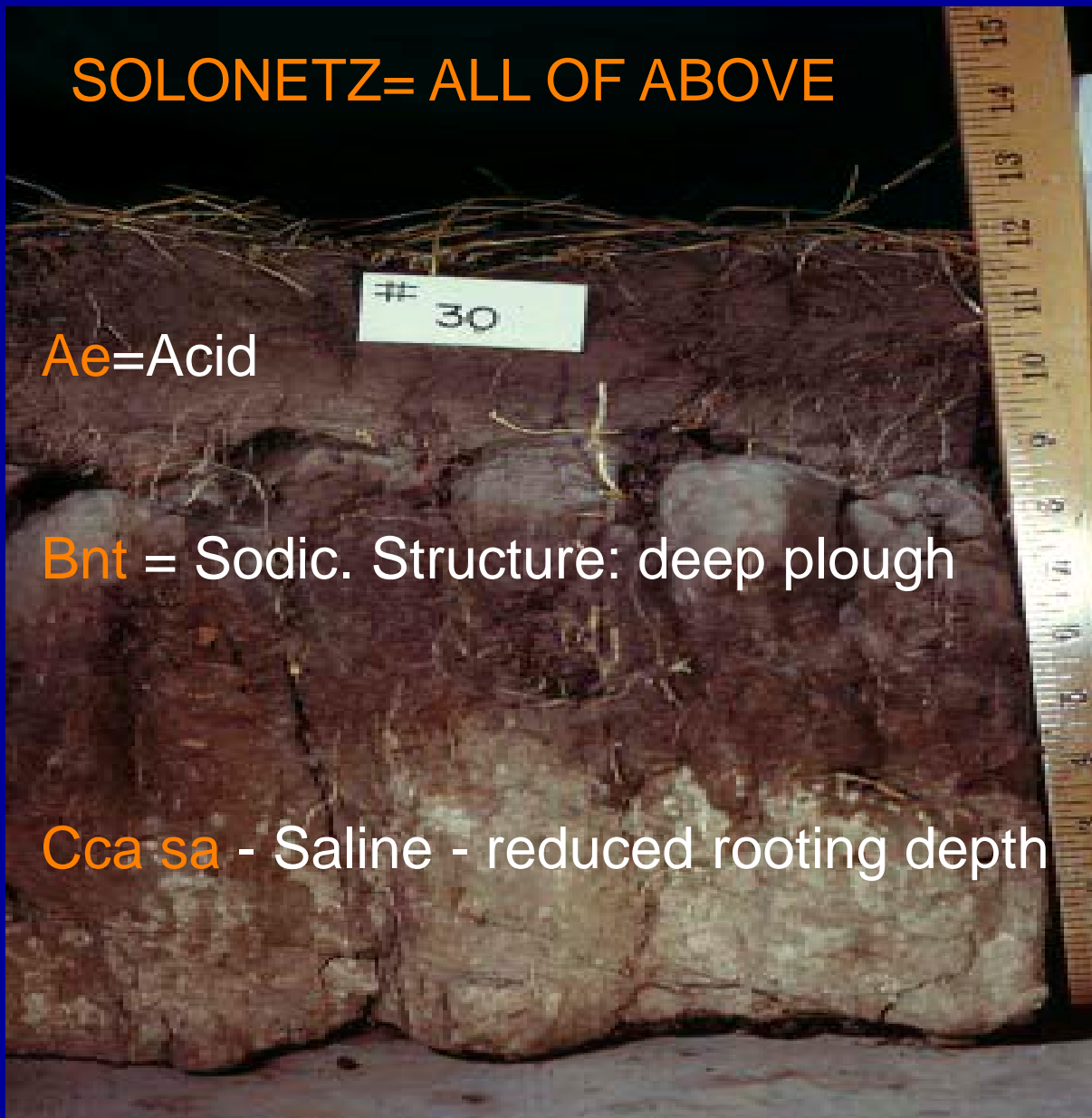
- **ACID** = $\text{PH} < 6$: Add Lime: P Fert.
 - Scott area SK; Peace R 1/3 of acres
- **CALCAREOUS** : High Lime
- **TRUE ALKALI**: $\text{PH} > 8.5$ Rare
- **SALINE** : Too Much Salt
- **SOLONETZ** : All of the Above

SOLONETZ= ALL OF ABOVE

Ae=Acid

Bnt = Sodic. Structure: deep plough

Cca sa - Saline - reduced rooting depth





Canada-Saskatchewan
Agreement
on Soil Conservation

The Nature and Management of Salt-Affected Land In Saskatchewan



Available on
Sask Ag Website

Canada

Saskatchewan

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Saline Soils

- What Salts - and measurement
- Basic Mechanism of Salinization
- Groundwater Flow Mechanisms
- Reclaiming Saline Soils
- Managing Saline Soils
- Precision Farming and Saline Soils

THE SALTS - Solubility grams/liter @ 20C

HIGHLY SOLUBLE

CaCl_2 - 427

MgCl_2 - 353

MgSO_4 - 300

NaCl - 264

Na_2SO_4 - 160

Slightly Soluble

CaSO_4 - 2 (Gypsum)

Insoluble

CaCO_3 - 0.01 (Lime)



Measuring Soil Salinity - in lab

Saturated Paste - is gold standard

Non Saline 0-2 mS/cm (or dS/m) OK

Slightly Saline 2-4 Sensitive plants affected

Moderately Saline 4-8 Most Ccrops affected

Severely Saline 8-16 Only tolerant plants survive

Very Severely Saline 16+ FORGET IT

Many Labs use 1:1 or 1:2 Extract or suspension

MAKE SURE YOU INTERPRET THE RIGHT DATA



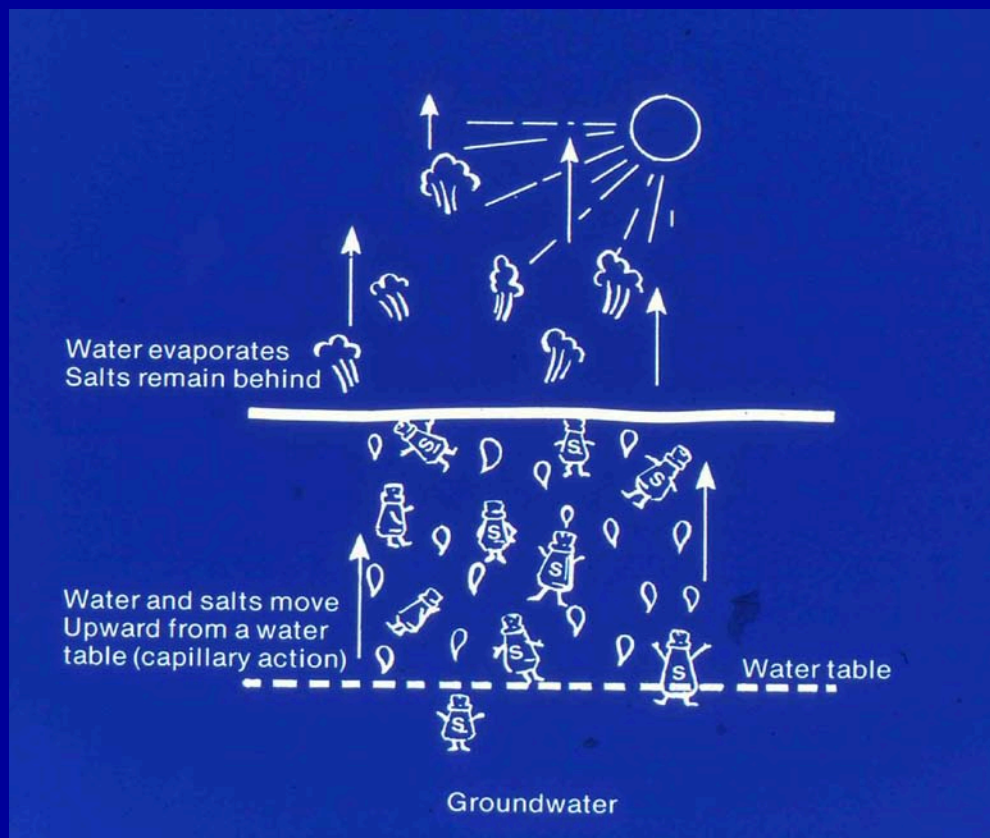
Wilkie

~ 1980s



SOIL SALINITY IS A WATER PROBLEM

- * Water Table High - Suction Lift
- * Evaporation > precipitation



Mechanisms to Maintain High Water Table in Dry Times

- * Side-Hill Seep
- * Evaporitic(Bathtub) Ring around sloughs
- * **Artesian Discharge**

WIND - can also salinize from the top -
Old Wives Lake

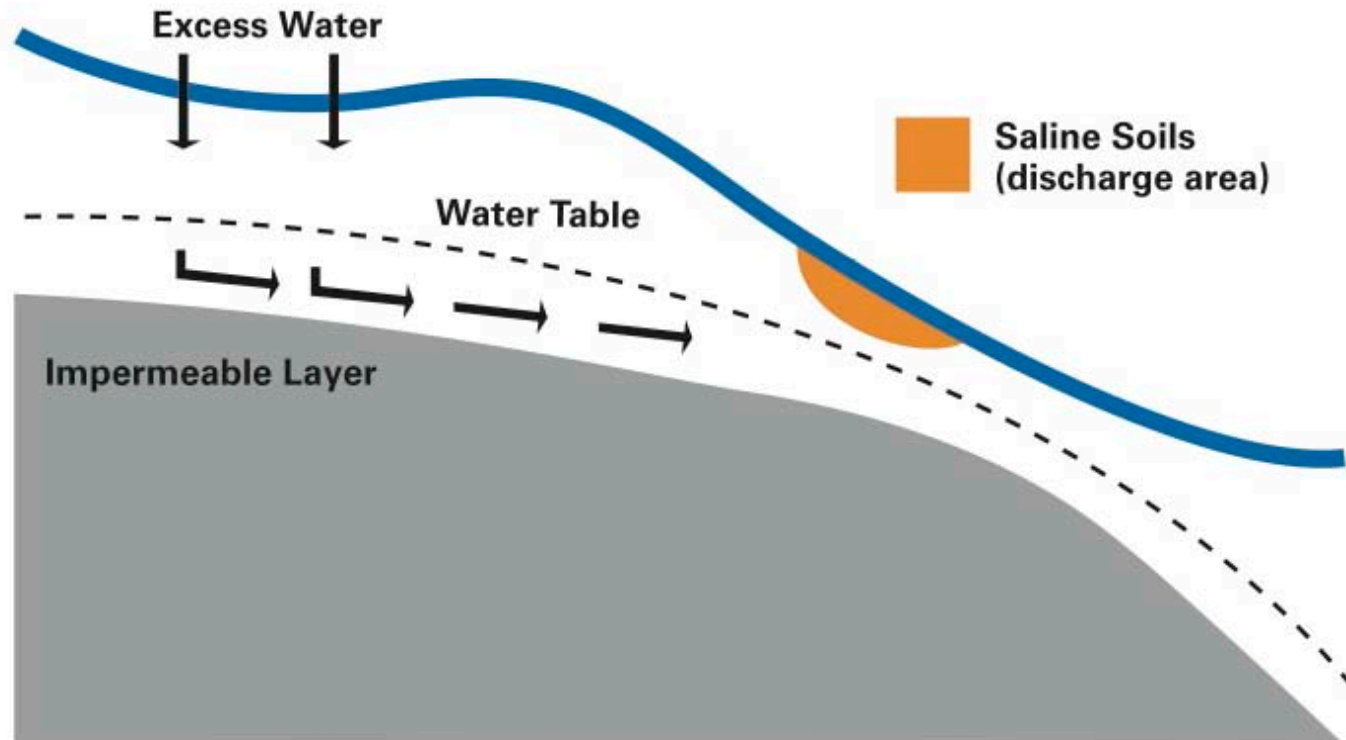
OLD WIVES LAKE : OCTOBER 1987

Not Fog, Not Smog, Not Vog:

Salt From Old Wives Lake

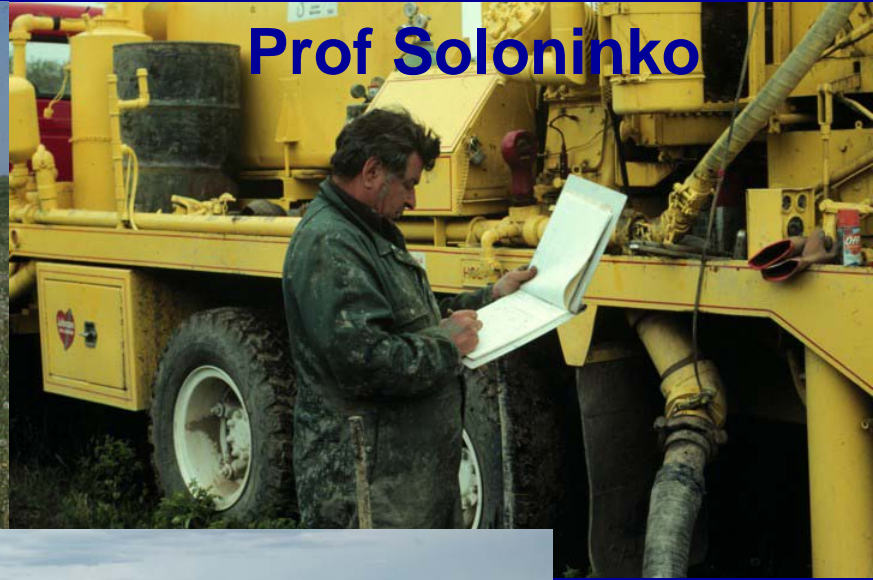
Side Hill Seep - Montana, Alberta, SW Sask

Plant Alfalfa Here



1982-1994 -Field Studies

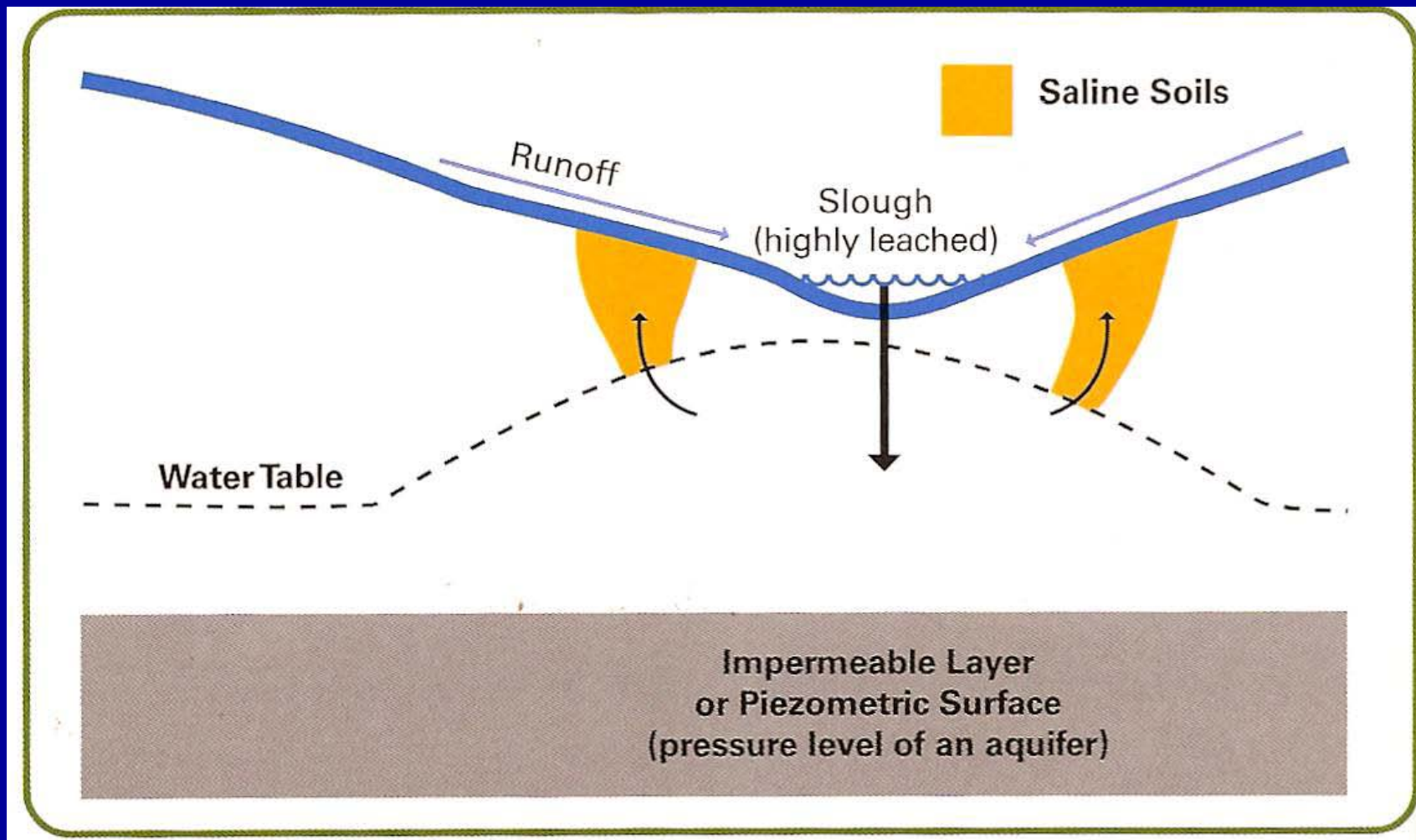
Dig a little Deeper- Think a little Broader



Highwood Bench, Fort Benton, Montana

Salts still there after many years 'remediation'

Evaporitic (Bathtub) Ring



Duval Sask. Black is frozen kochia in saline rings
around the sloughs

Piezometric (pressure) surface of Hatfield Valley
Aquifer system is the fundamental cause



EM = 35/24

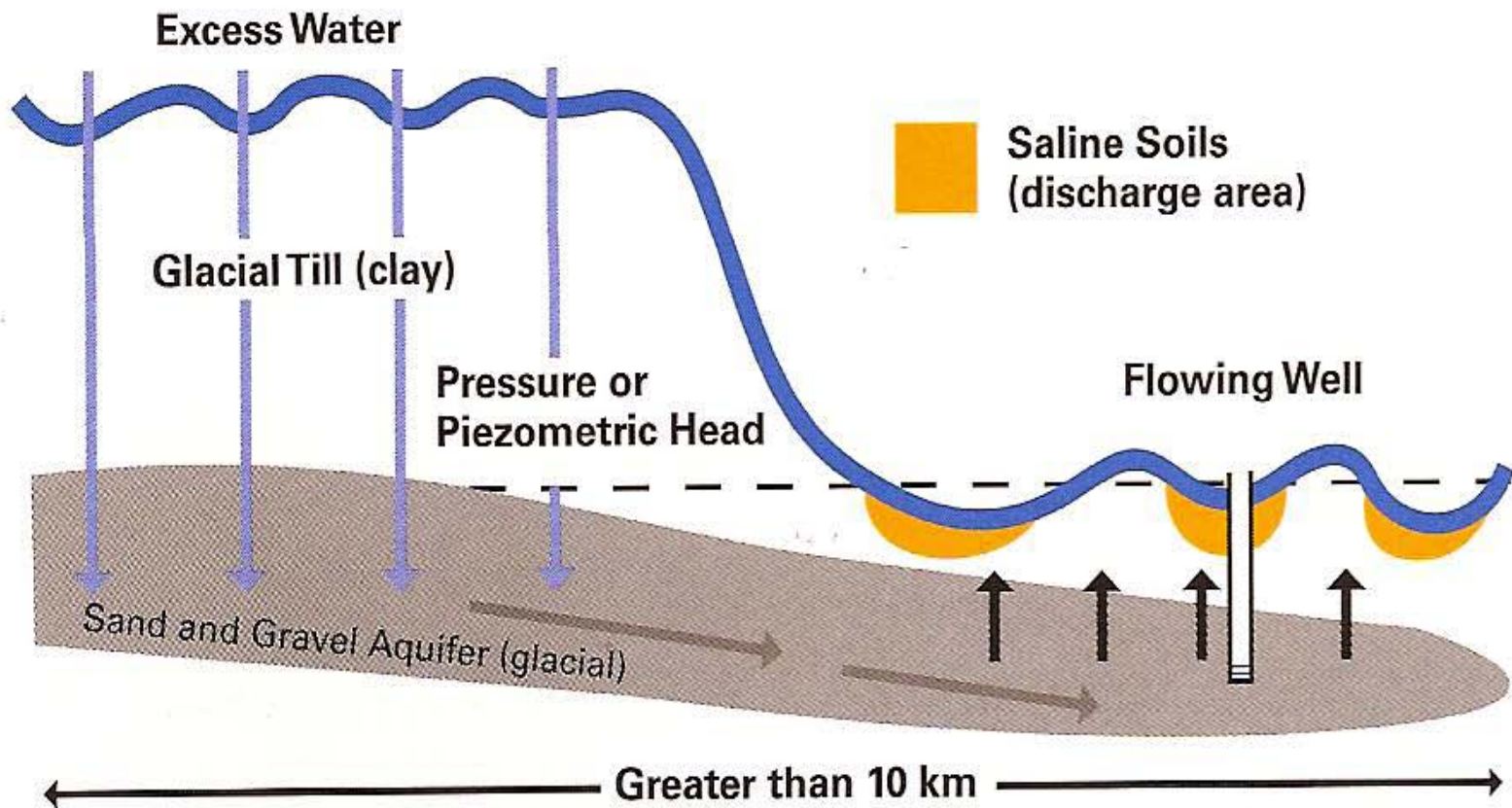
EM 150/105



Artesian Discharge:

Dominant Mechanism in Sask.

Flowing Wells Common



University of Saskatchewan : Gooddale Farm



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RECLAIMING SALINE SOILS

Kelley, W.P. 1937. The reclamation of alkali soils. Calif. Ag Exten Bull #717.

- * Ca + Mg Salts - Drain + Leach

- * Na Salts - Saline-Sodic

Add gypsum, drain and leach

RECLAIMING SALINE SOILS

- 1. Drainage
- 2. Leaching
- 3. See 1 PLUS 2

HARD WATER MAKES SOFT LAND

SOFT WATER MAKES HARD LAND

*Most of our saline soils have 'hard' salts so gypsum is not required.

* If we have hard water aquifer can use that water to leach

Tile Drainage Alone = No Solution





Leaching Alone

Looks Good Short Term



BUT ??



Water Table: Soon at Soil Surface

Outlook : CSIDC; Terry Hogg , Laurie Tollefson
Drainage + Leaching = Long Term Solution



MANAGING SALINE LAND: SELL IT IN THE WINTER TIME

MANAGING SALINE LAND:

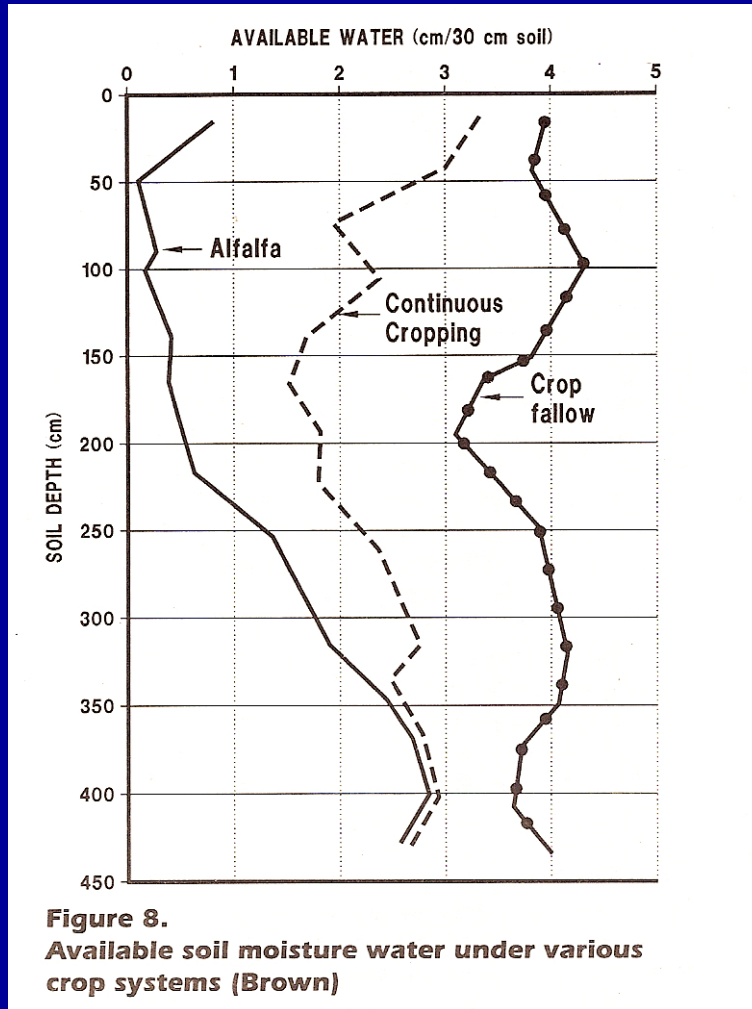
- Crop Rotation - Avoid Summerfallow
- Crop Selection
 - Barley , Canola most tolerant
 - Pea, Bean least tolerant
 - Forages - Now have AC Saltlander

AAFC Swift Current Current -Salt
Tolerance Testing Facility:Harold Steppuhn

Durum & Soft Wheat > CPS and CWRS

YEAR A BIG FACTOR : RAIN IN MAY -
SALTS GO AWAY

Alfalfa and the Water Table



Paul Brown

USDA

Montana

1970s-1980s

Fast Forward : 2007 Rosewood Subdivision Saskatoon



Hillcrest Cemetery : Flowing well drilled in 1962

South of Hillcrest Cemetery - Summerfallow:

Water Truck Went Down : **Water Table 1 meter**



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Same Land - Alfalfa for 7 Years

Water Table > 8.9m



SALINE SOILS AND PRECISION FARMING

- Saline soils are very fertile - i.e. many nutrients. High soil test nitrate 12-24” often saline
- Map saline soils on a quarter and fertilizer to add = ZERO

Mapping Saline Soils : Do Your Homework

Much info about NW22 from office

*Soil Maps - Framework to think in

*Topographic maps, waterwell maps , geology maps

*Old Municipal assessment

*Air Photos and Satellite Imagery

www.flysask.ca www.saskagrimap.ca Google Earth

Old assessment - at U of S Archives

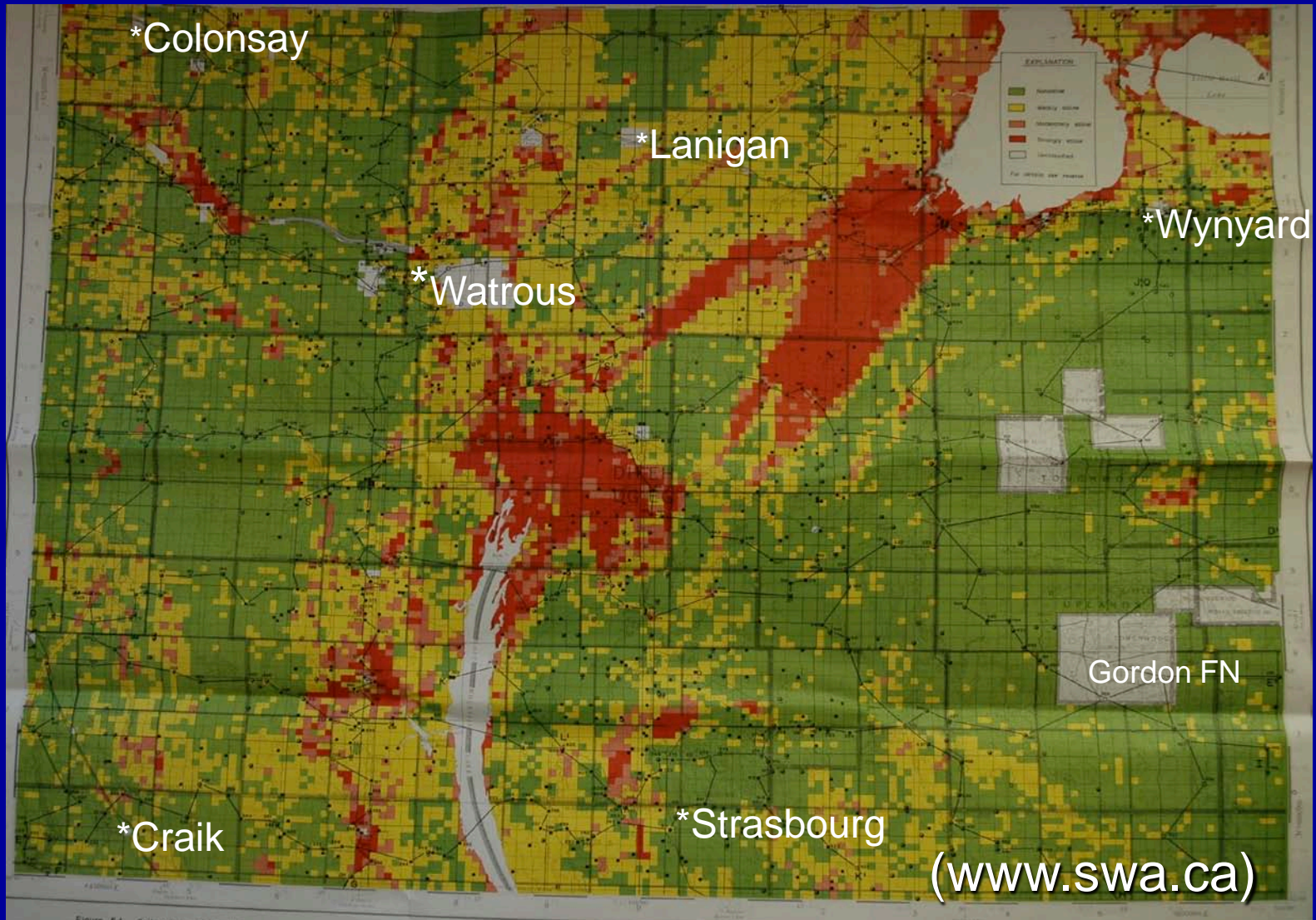
- need to be scanned and made available

N.W.				SEC: 18 TWP: 36 RGE: 4 MER: 3		R.M. or L.I.D. No. 344		N.E.			
Acres	Index	Value		Miles From Market	P.L.C.			Acres	Index	Value	
125	58	2828	26.5		-5.5			145	59	3336	3100
Land Owner				Land Owner City of Sault Ste Marie				Land Owner			
* Old farmyard				ESIEL-TUC - K145				Disc. 3% \$ 100			
Sub-total \$ 2743				WS-WSK 15				Sub-total \$ 3236			
Gross \$ 2818				WS-WSK 15				Gross \$ 3281			
Net \$ 2800				ESIEL-TUC - K125				Net \$ 3300			
S.W.				TUC-ESIEL - K95		ESIEL-TUC - K30		S.E.			
95	60	2228	2750	60	60	60	60	93	60	2246	3000
30	58	679		WS-WSK 12.6		30	56	655			
Sub-total \$ 2815				ESIEL-TUC - K93				Disc. 3% \$ 90			
Gross \$ 2853				ESIEL-TUC - K5				Sub-total \$ 2901			
Net \$ 2850				ESIEL-TUC - K5				Gross \$ 2930			
Land Owner Centre Development Ltd.				Land Owner G. B. Farms Ltd.				Net \$ 2950			
Valuator				Date							

Salinity deductions

Soil Salinity map - made with assessment and other info

Wynyard 72P NTS Sheet



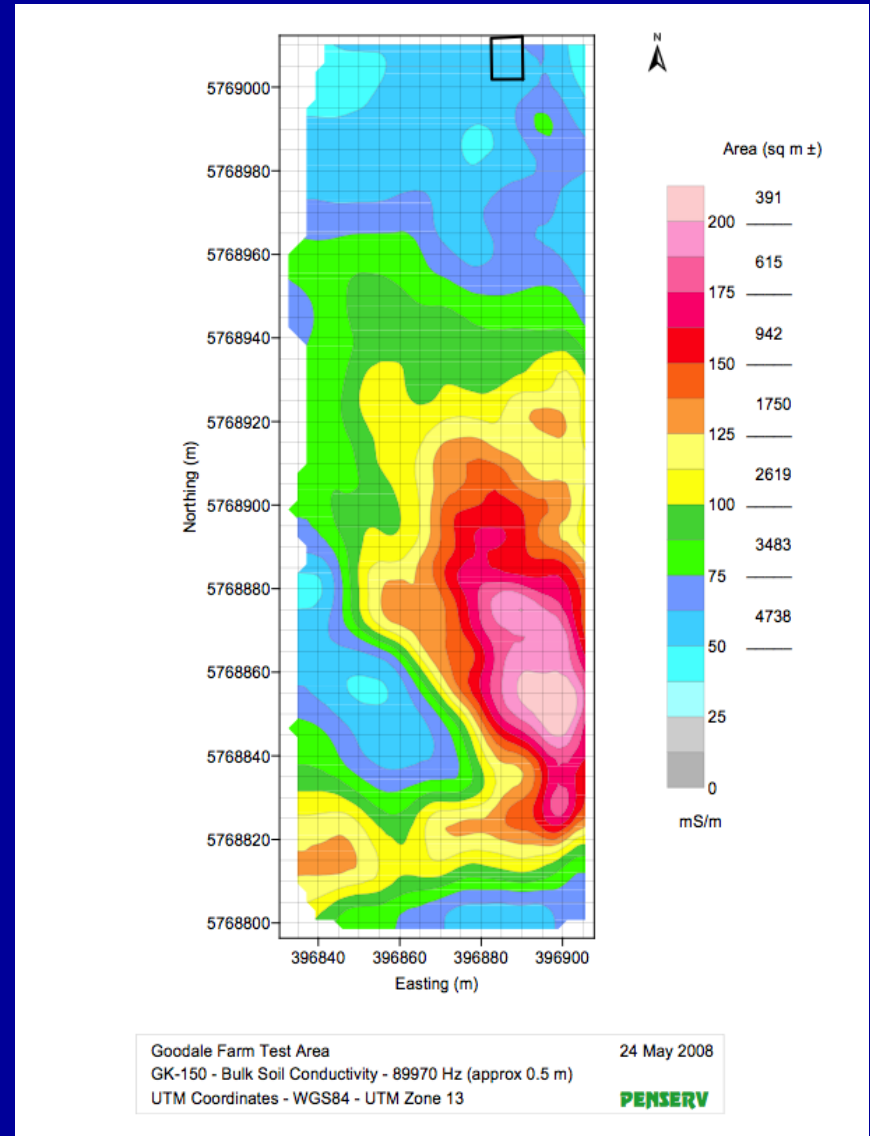
Google Earth -from Sasktel ??? Who Knows Access??



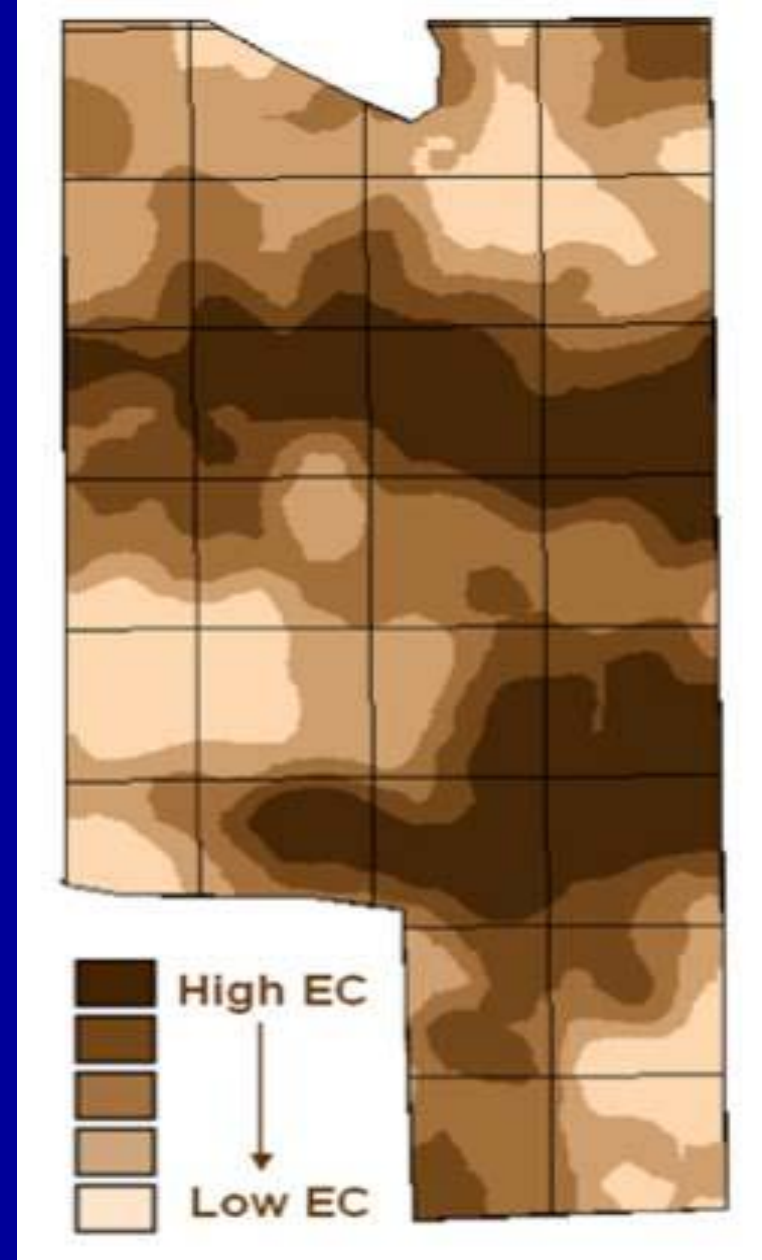
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Mapping Salinity with EM38



Salinity Mapping with Veris Technology



THE END

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