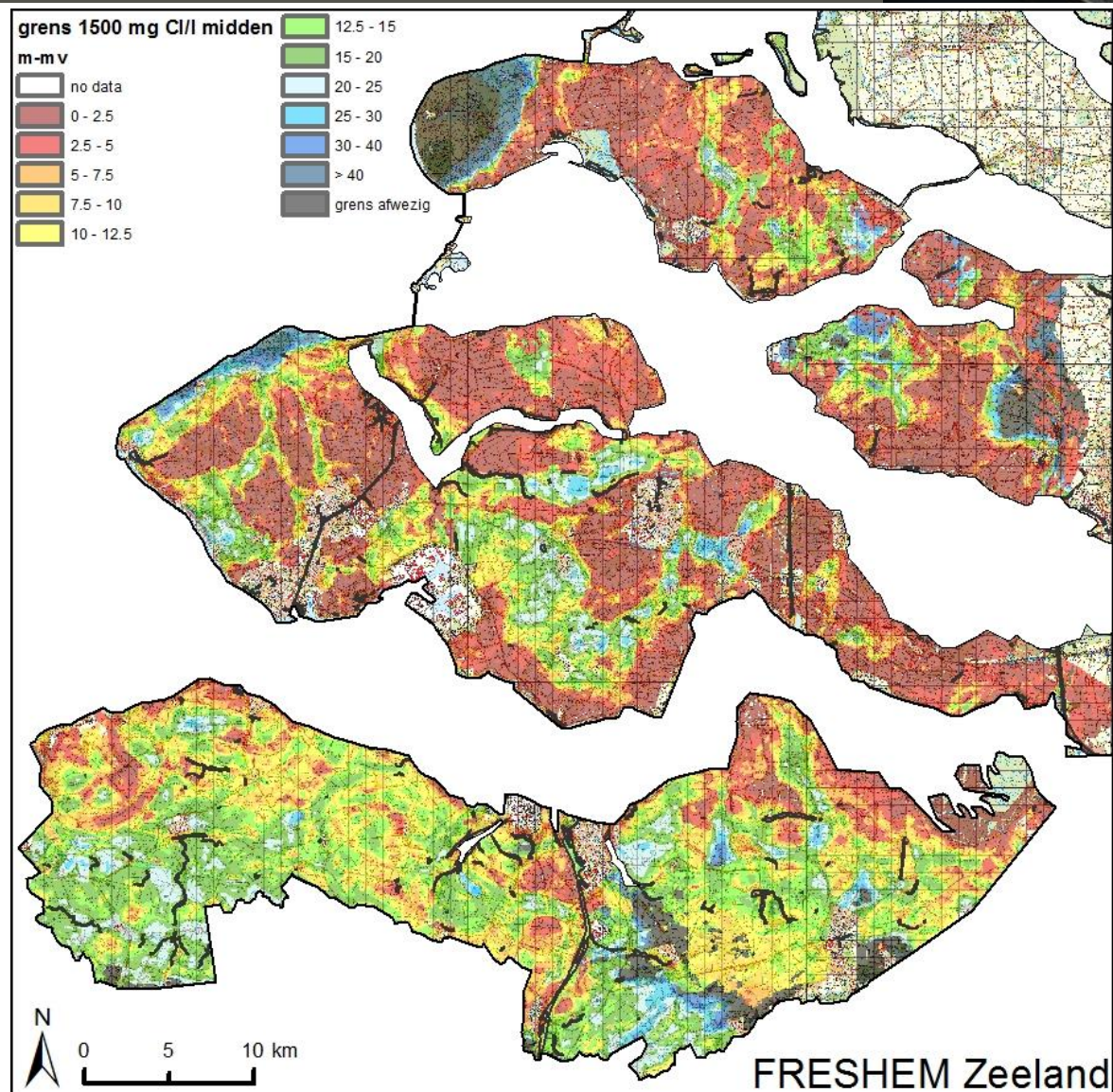


Drains2Buffer

Nieuwe drainage voor vergroting regenwaterlens in
zoute kwelgebieden

Perry de Louw

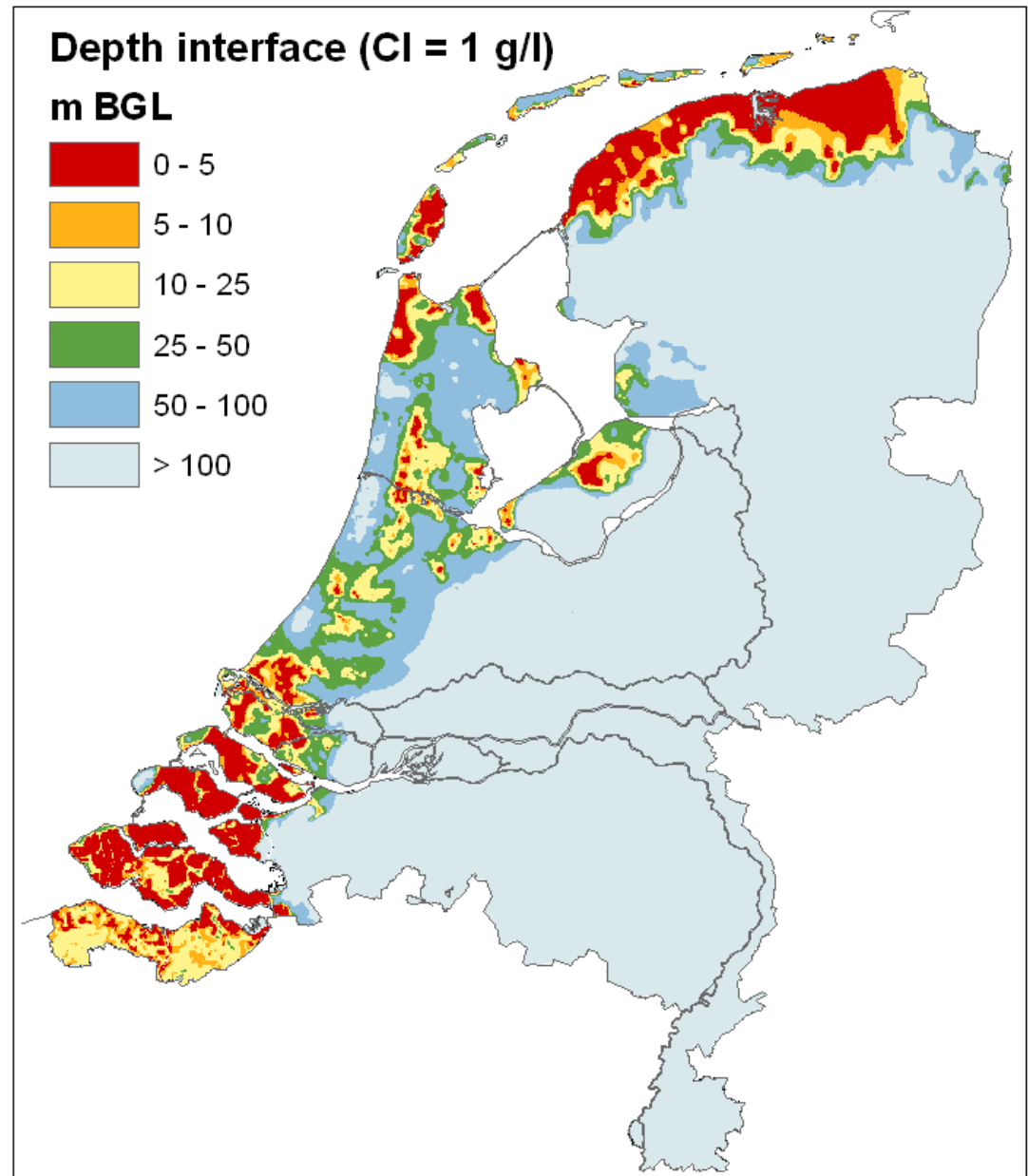
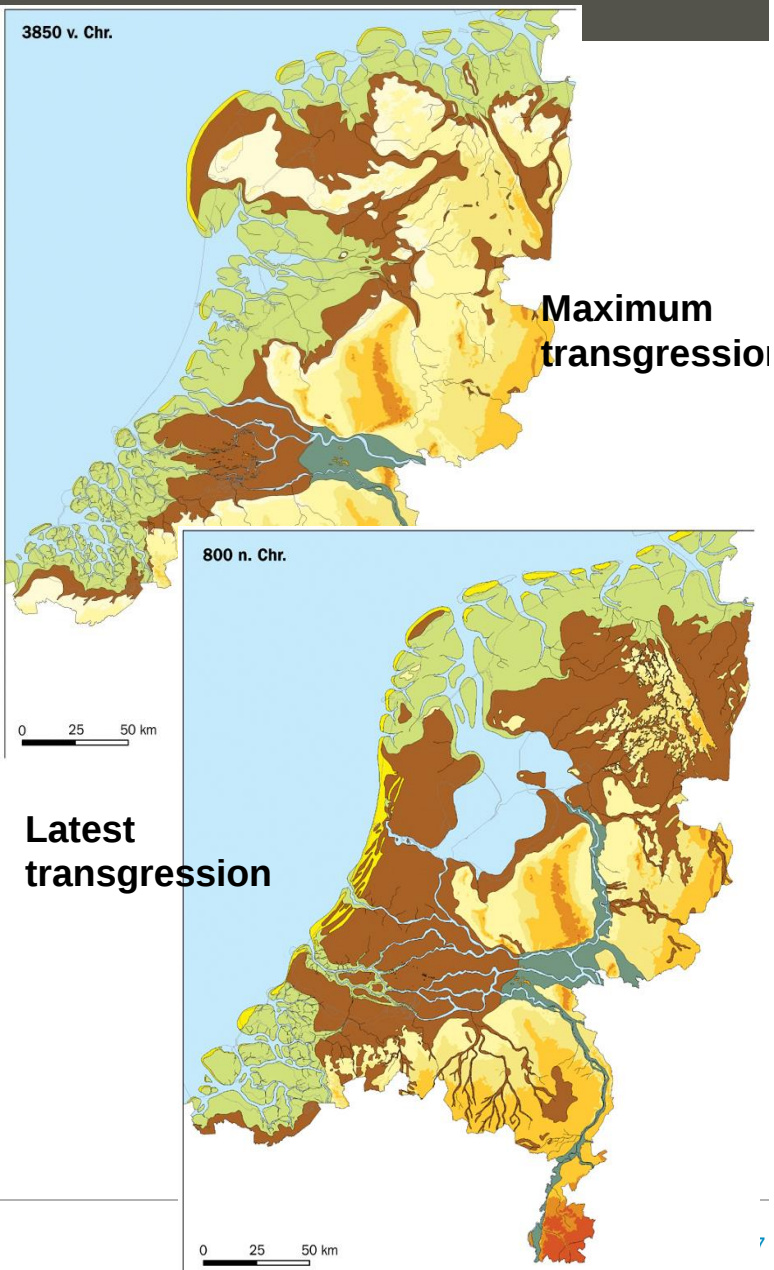
Zeeland is zout



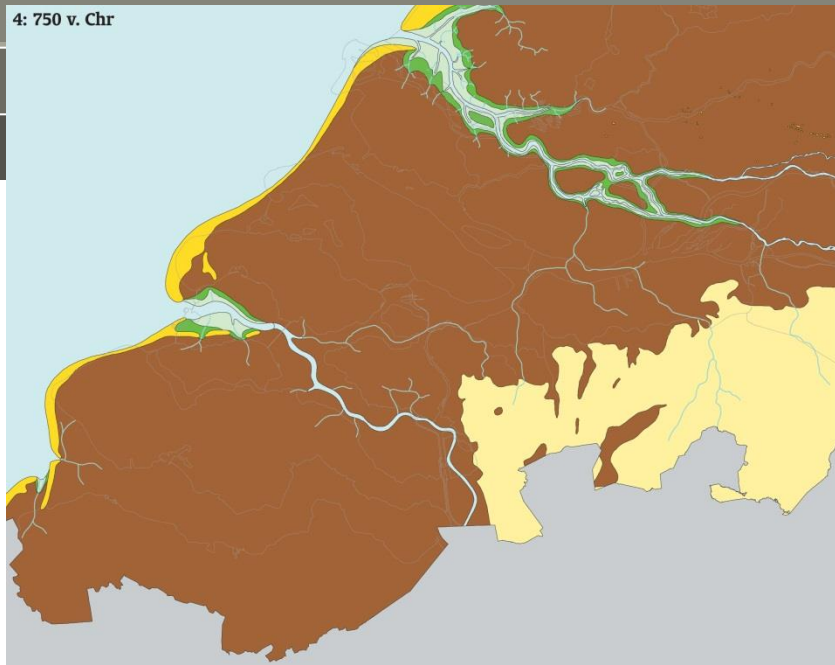
23-6-2017

Deltares

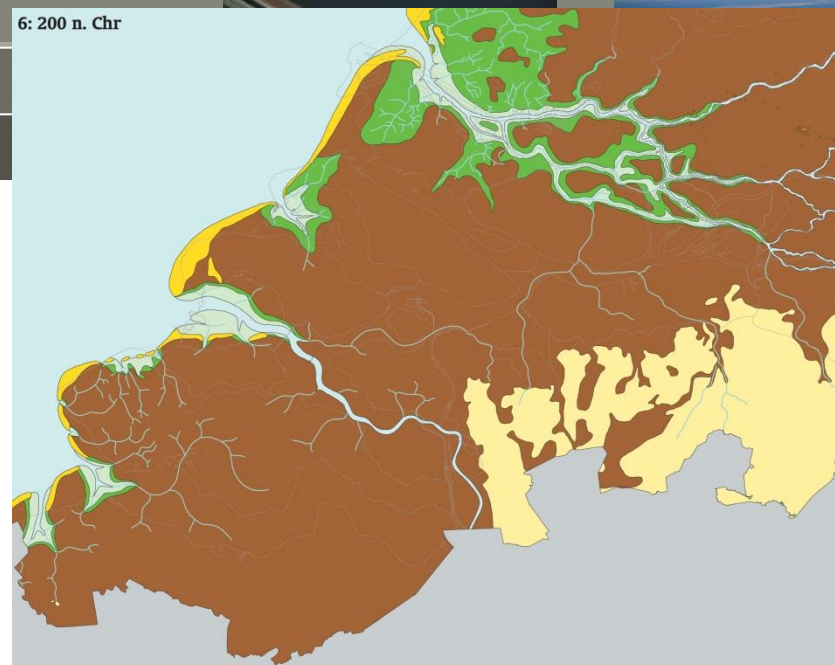
Waar komt het zout vandaan?



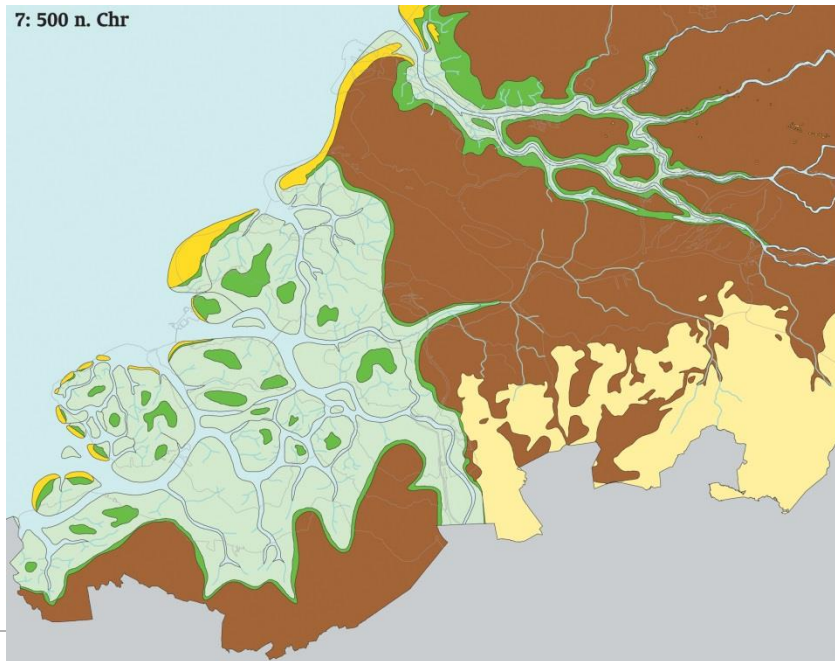
4: 750 v. Chr



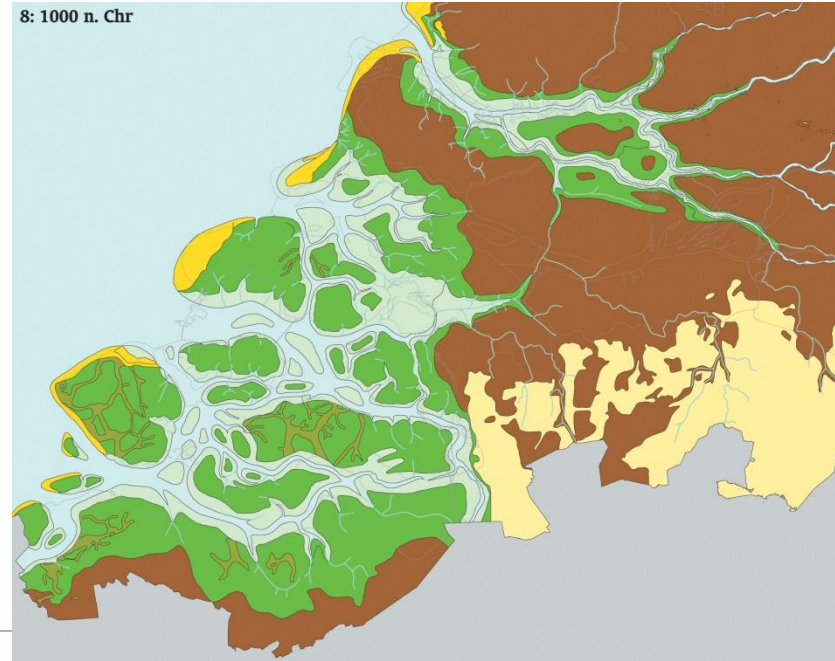
6: 200 n. Chr



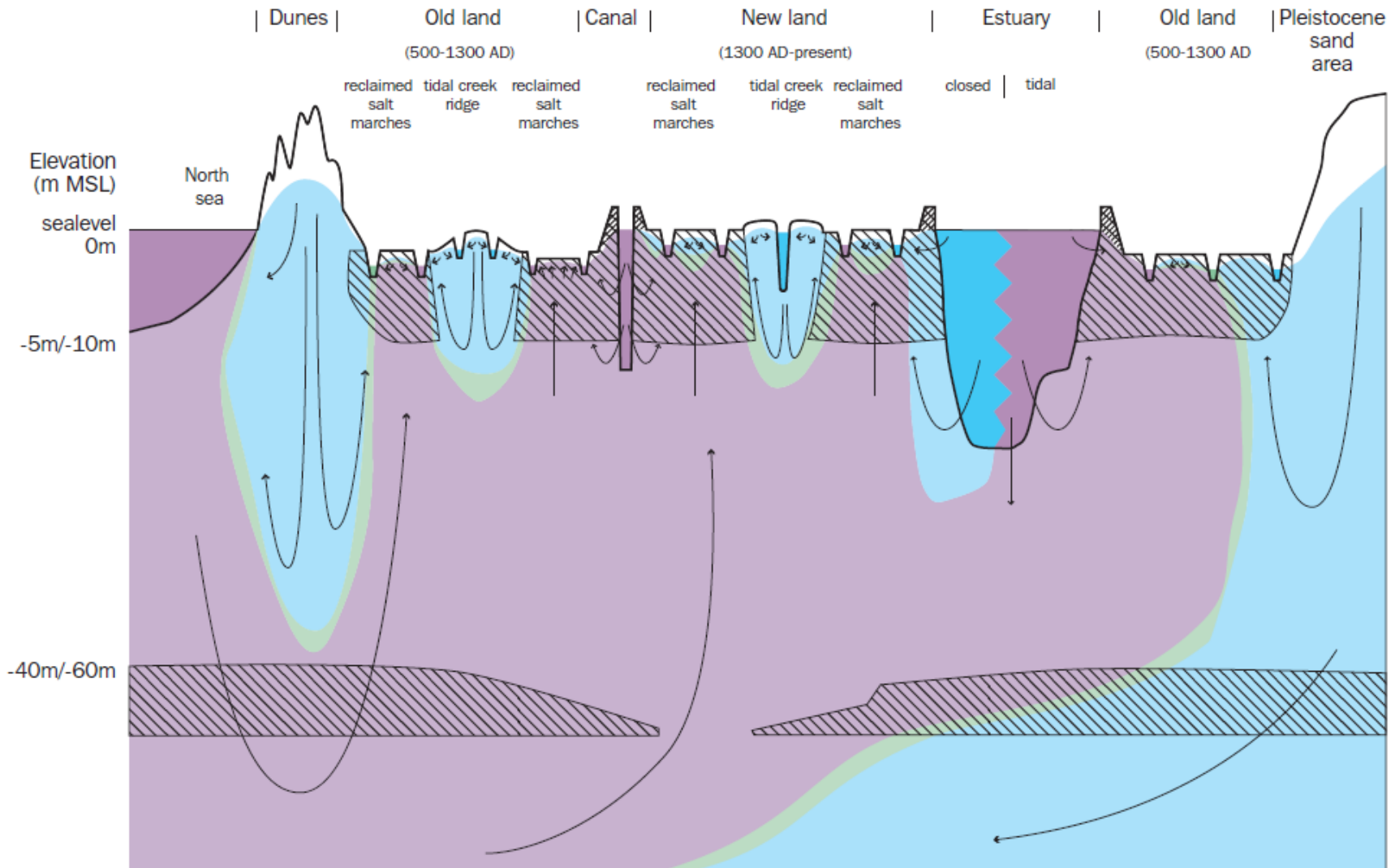
7: 500 n. Chr



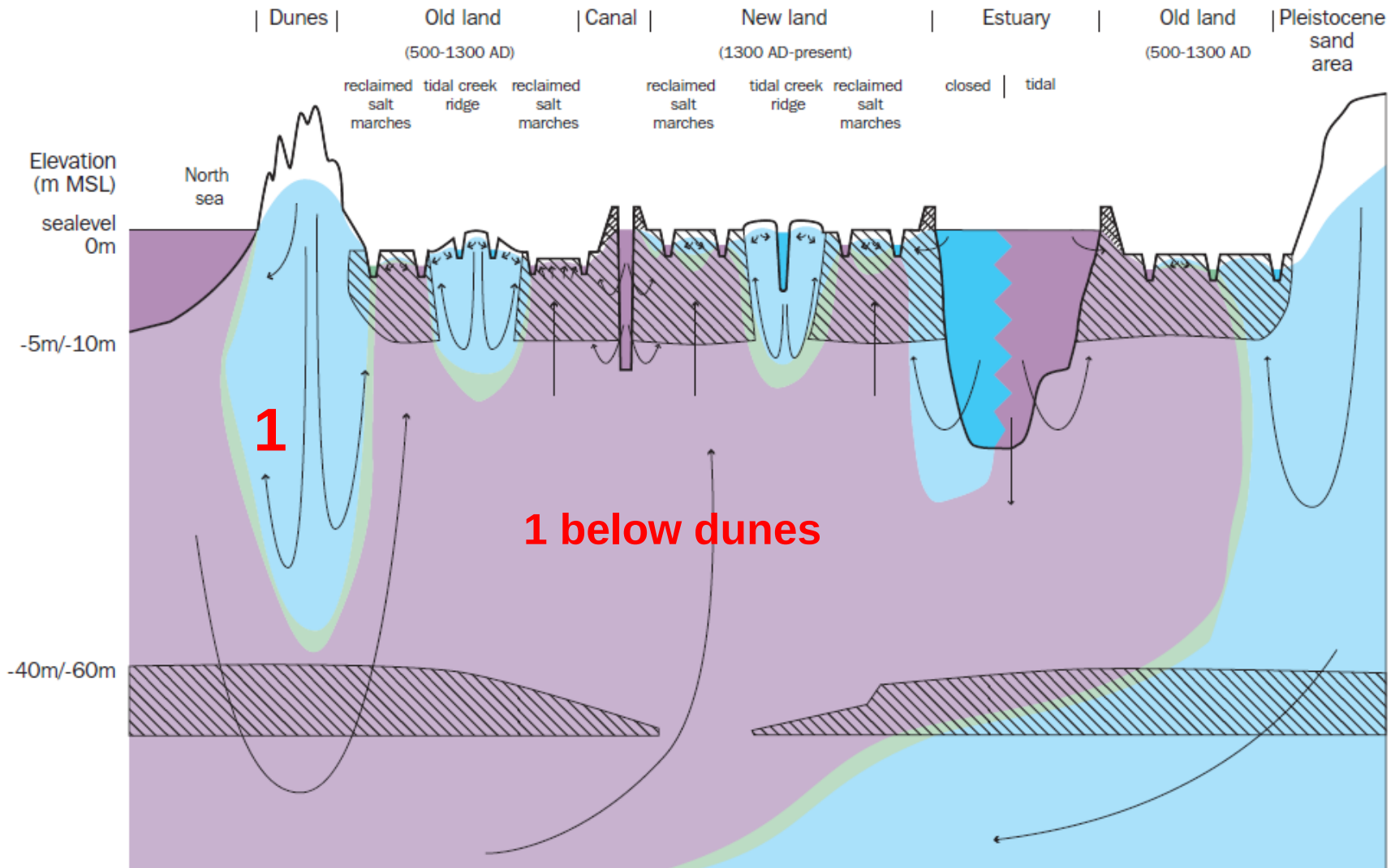
8: 1000 n. Chr



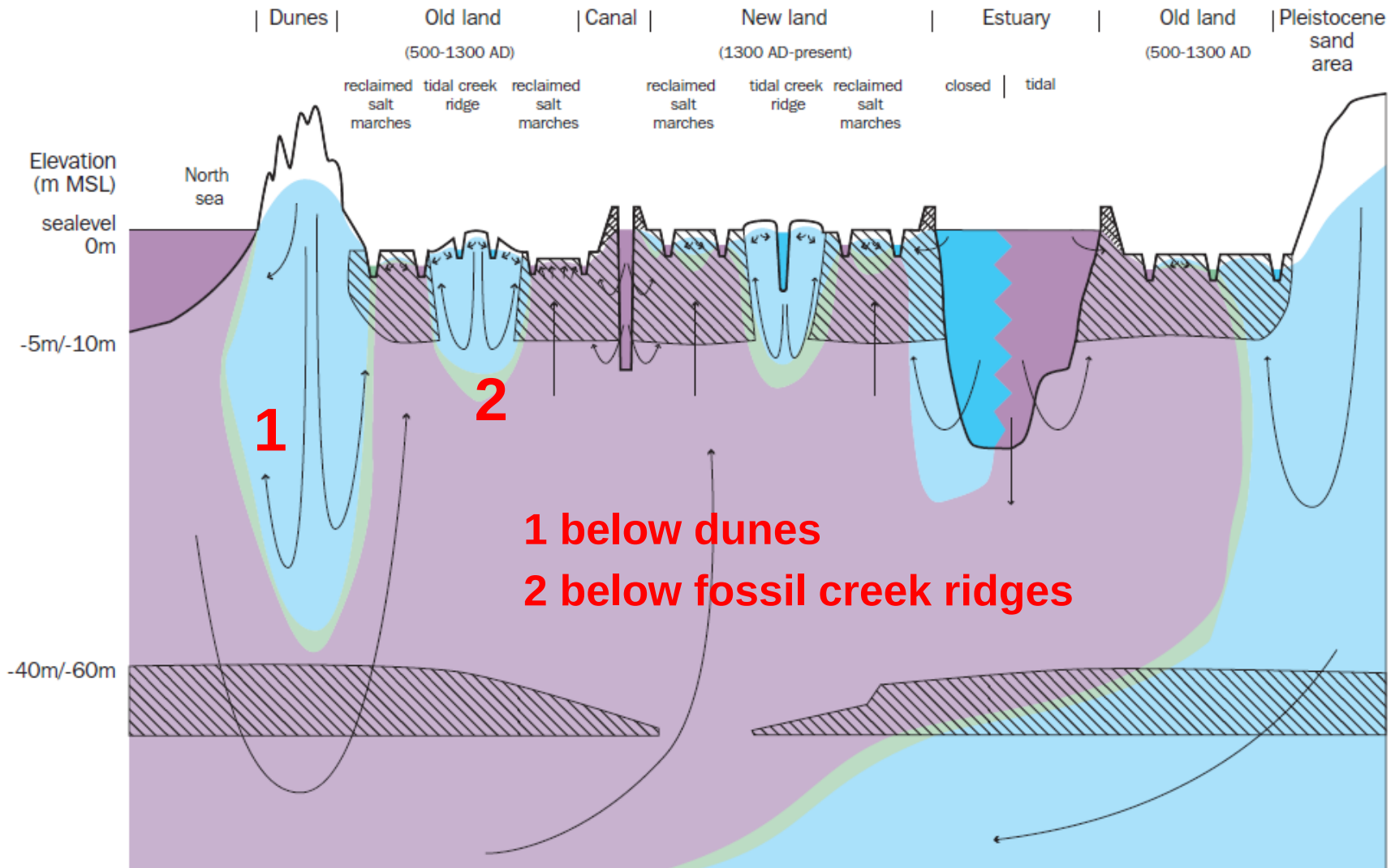
Three types of freshwater lenses in Zeeland



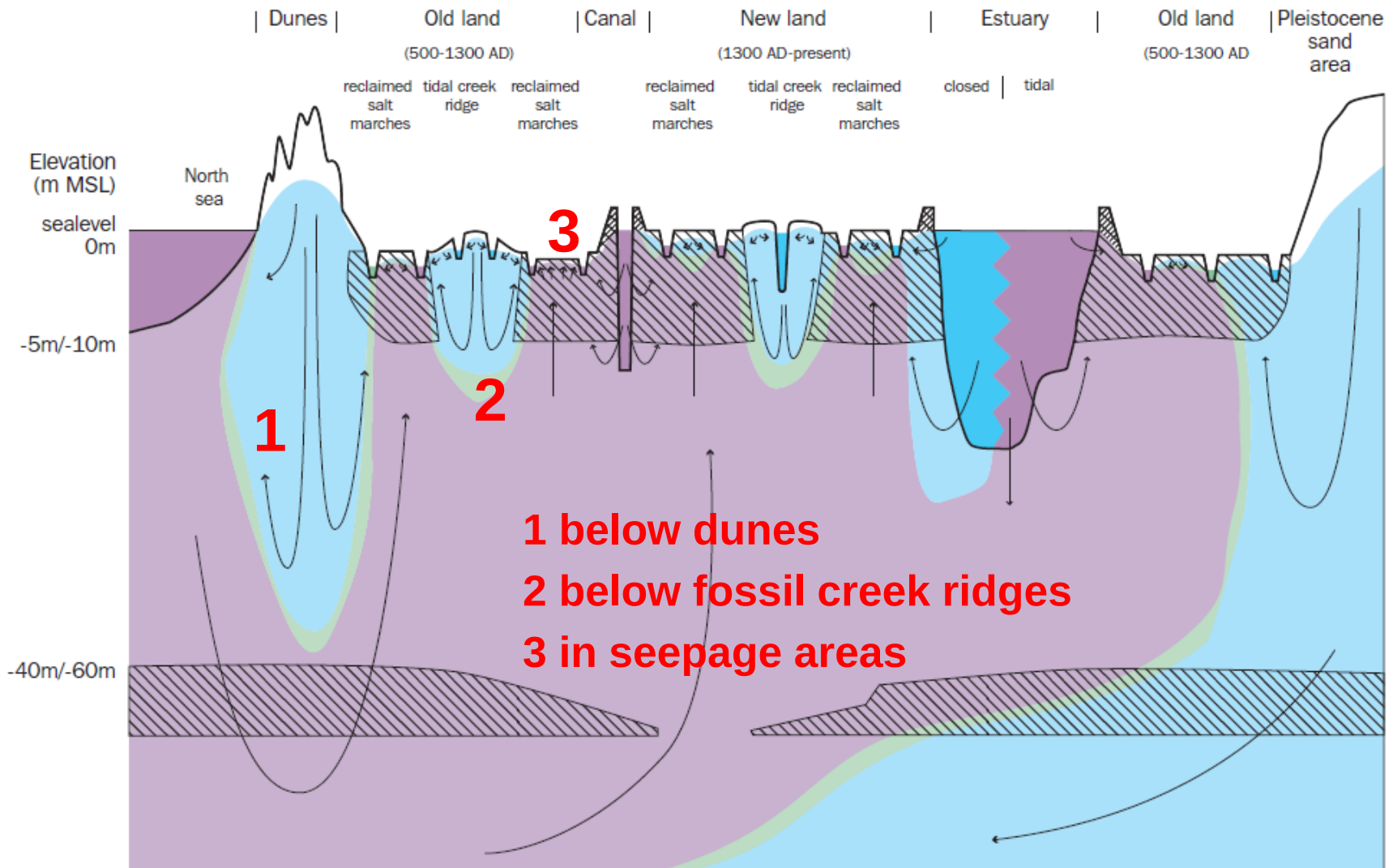
Three types of freshwater lenses in Zeeland



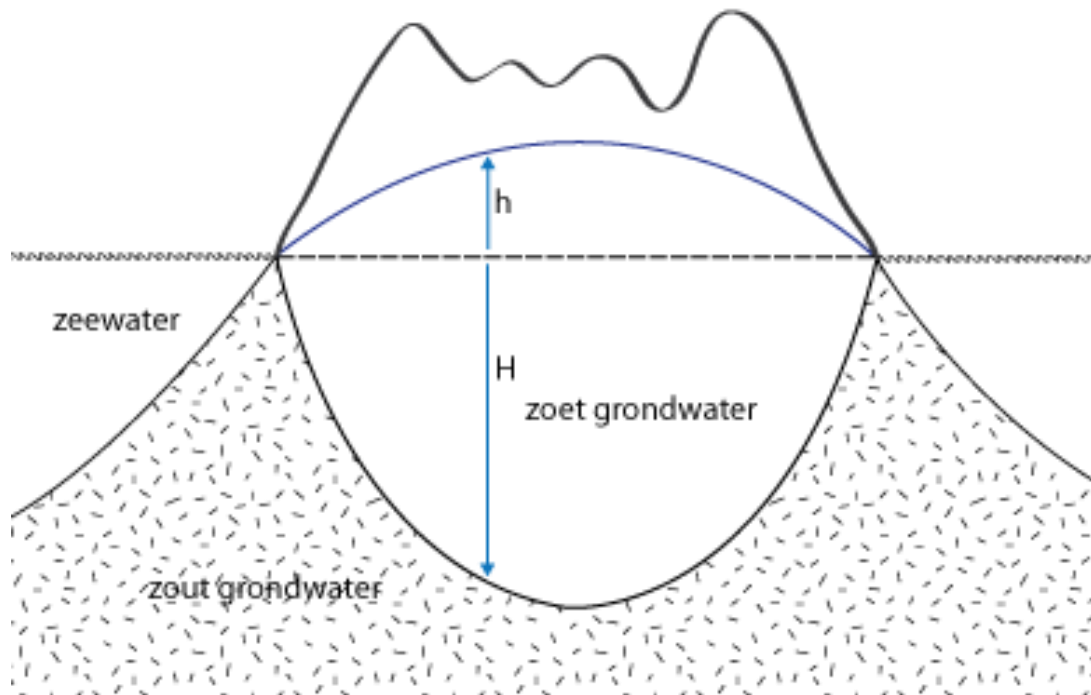
Three types of freshwater lenses in Zeeland



Three types of freshwater lenses in Zeeland



Badon Ghyben - Herzberg (1888): BGH-lenzen



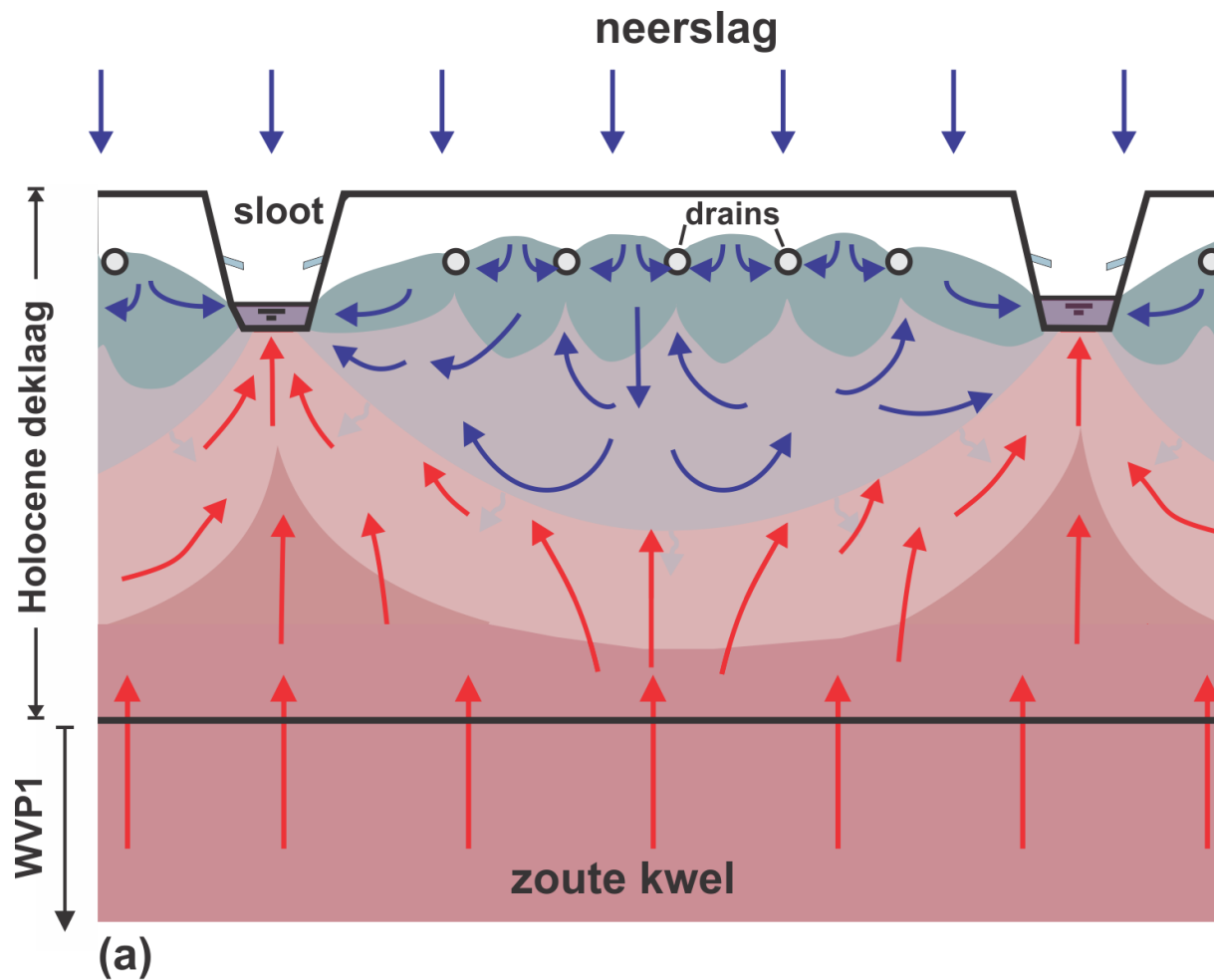
Density:

Seawater = 1025 kg/m³

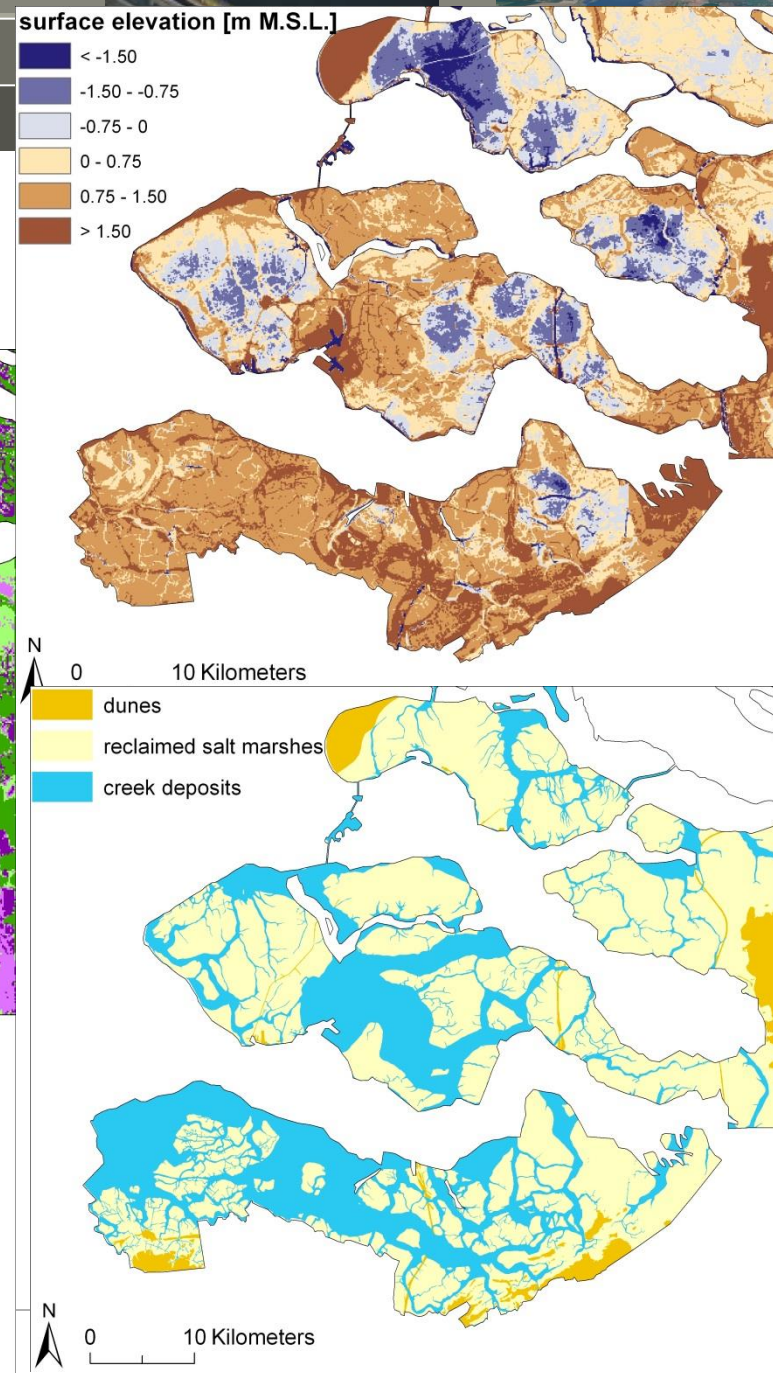
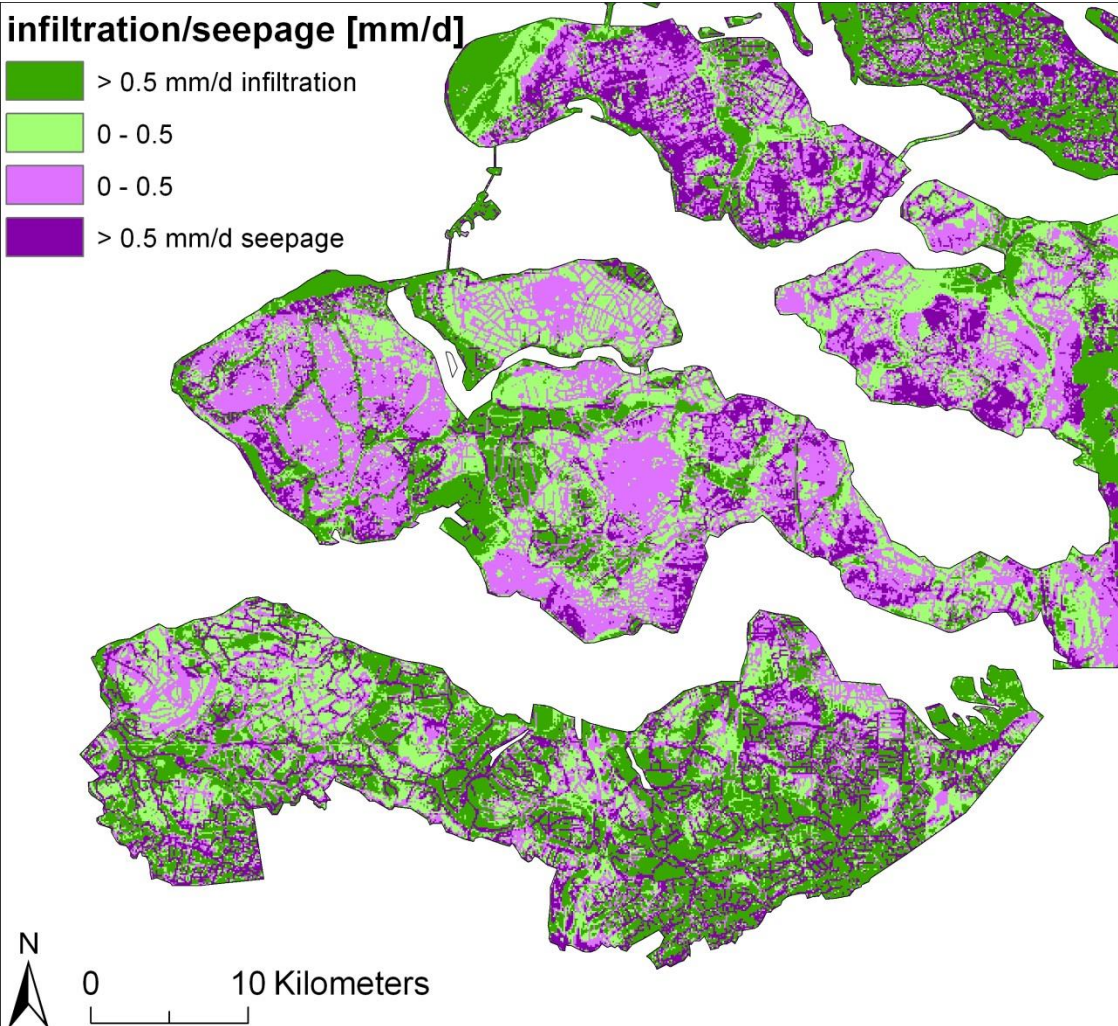
Freshwater = 1000 kg/m³

$$H(x) = 40 \cdot h(x)$$

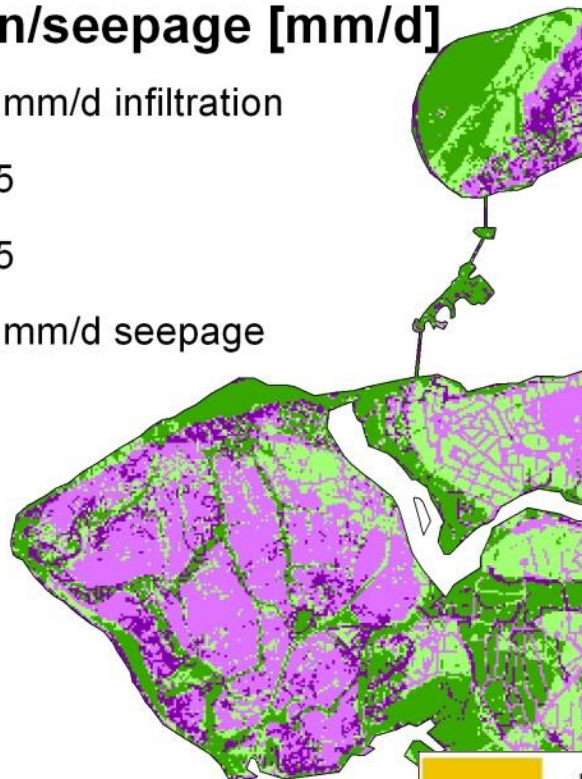
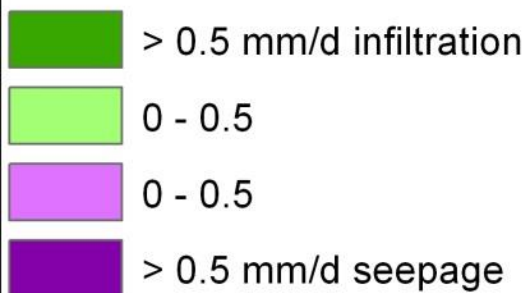
Regenwaterlens in zout kwelgebied



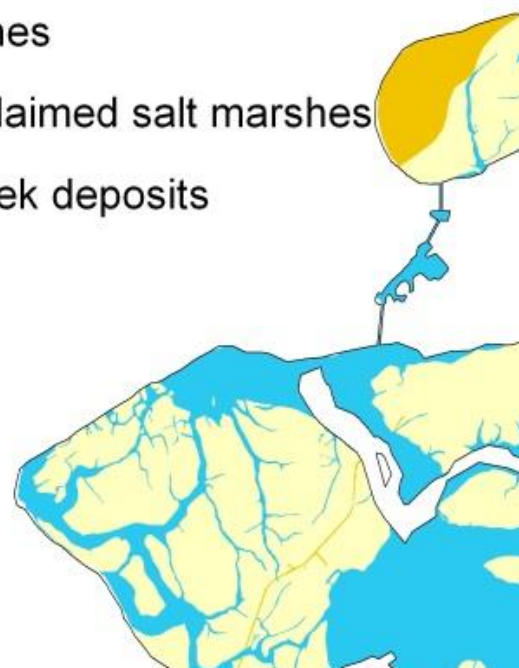
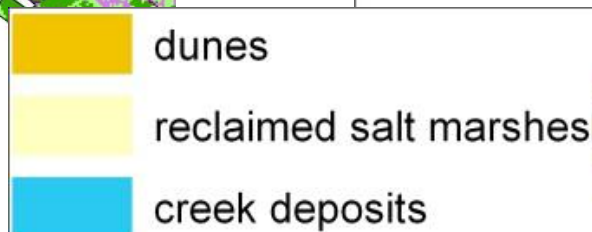
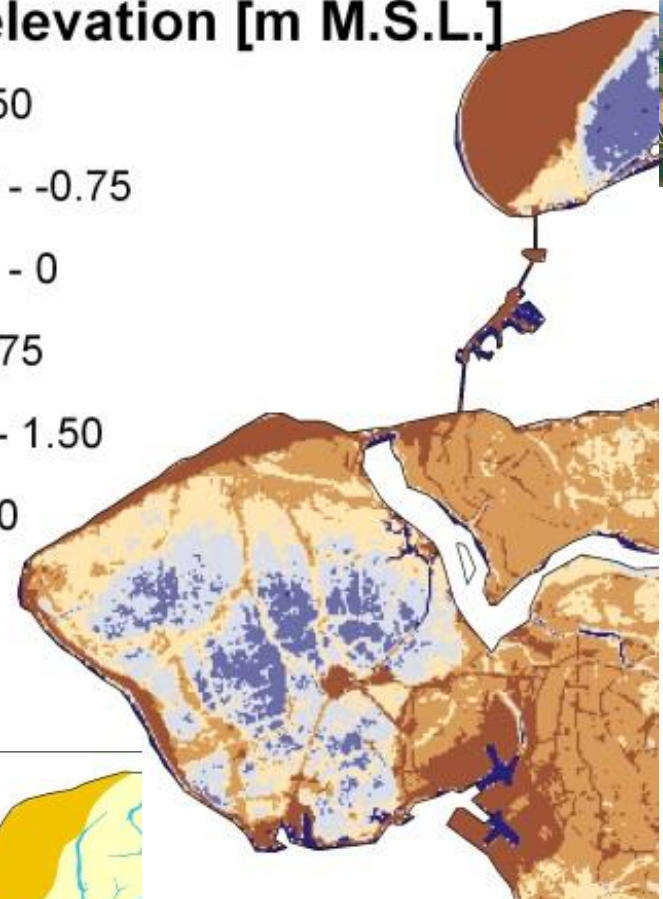
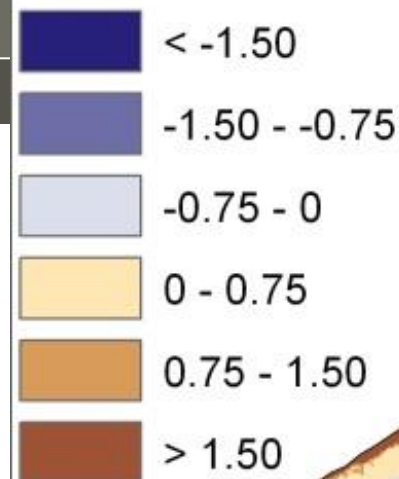
Kwel in infiltratie in Zeeland



infiltration/seepage [mm/d]



surface elevation [m M.S.L.]

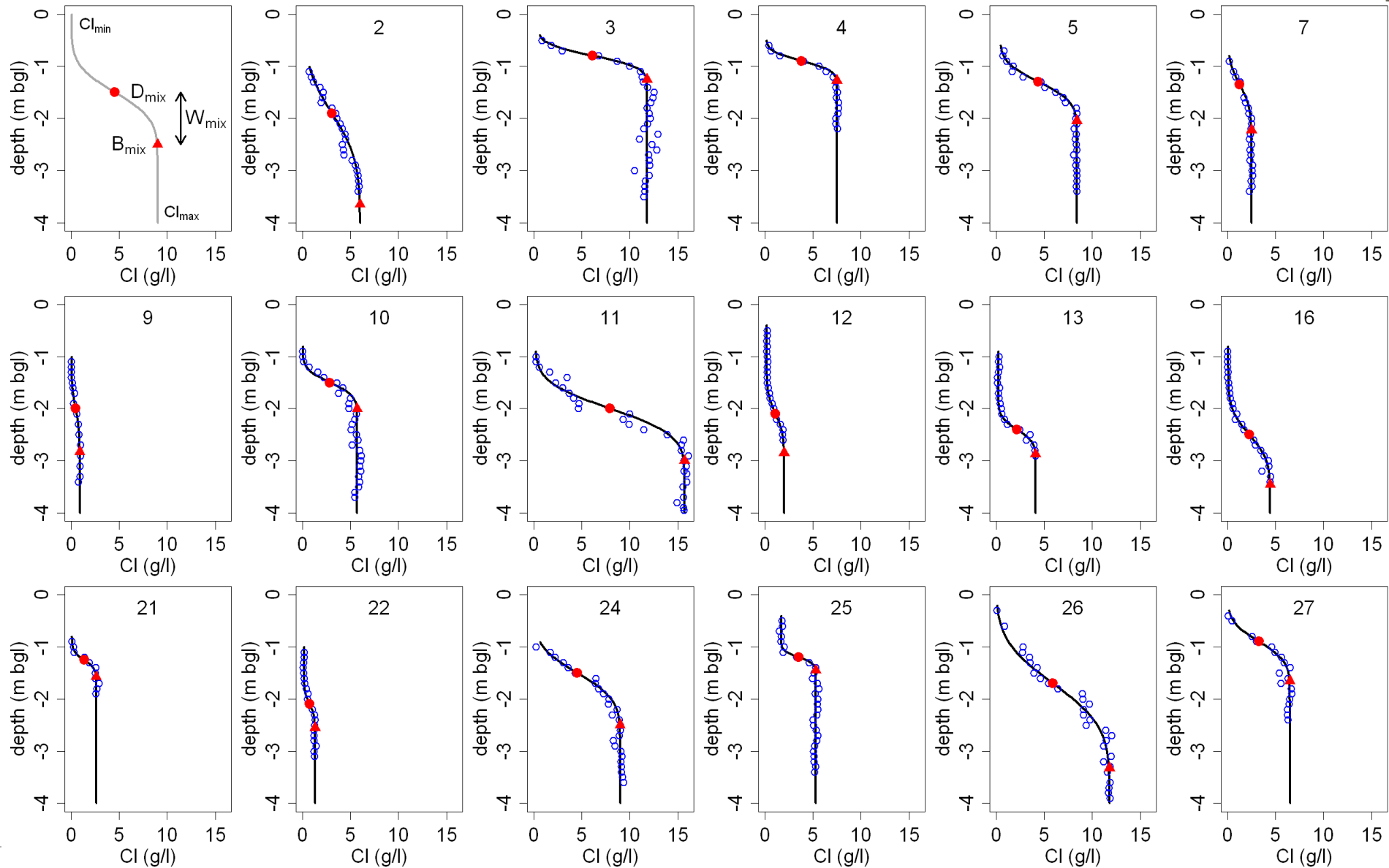
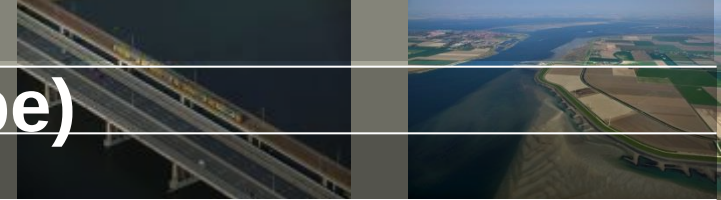


Deltares

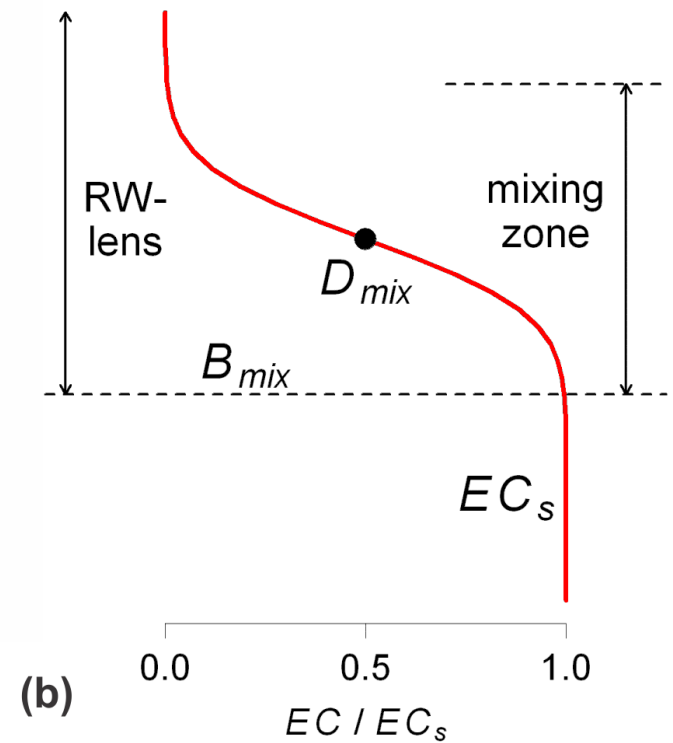
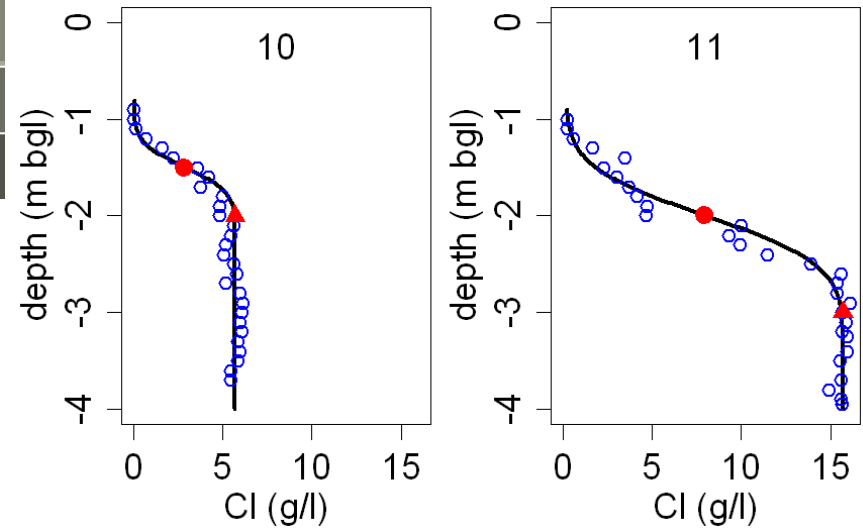
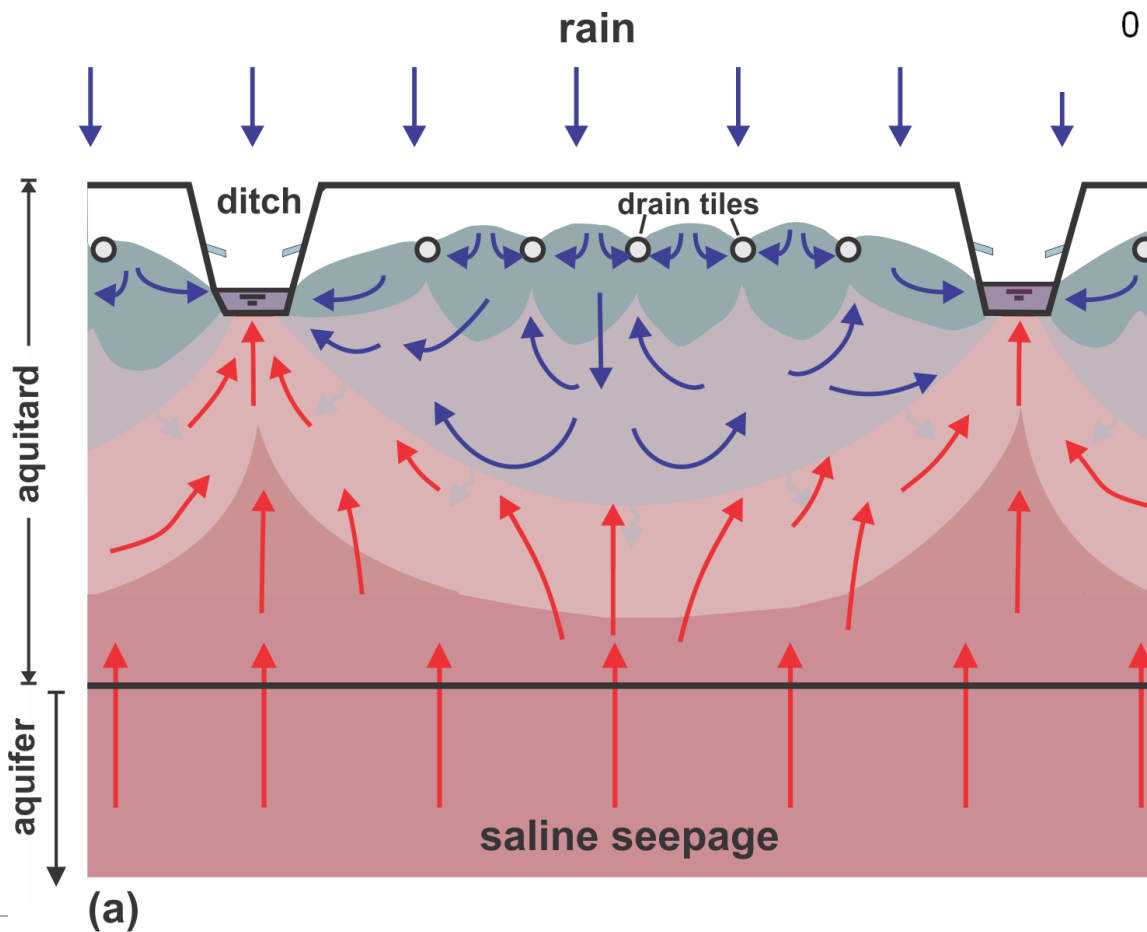


TEC probe

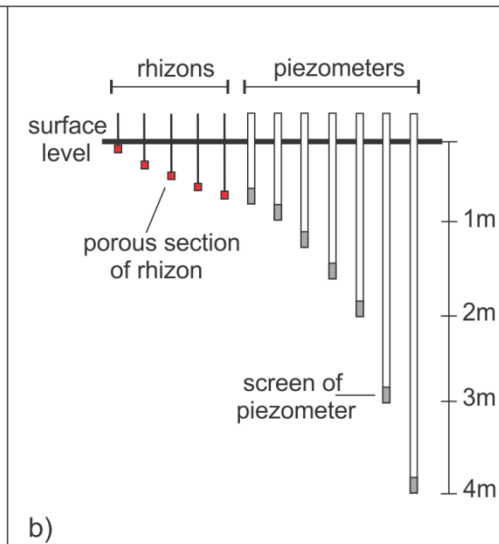
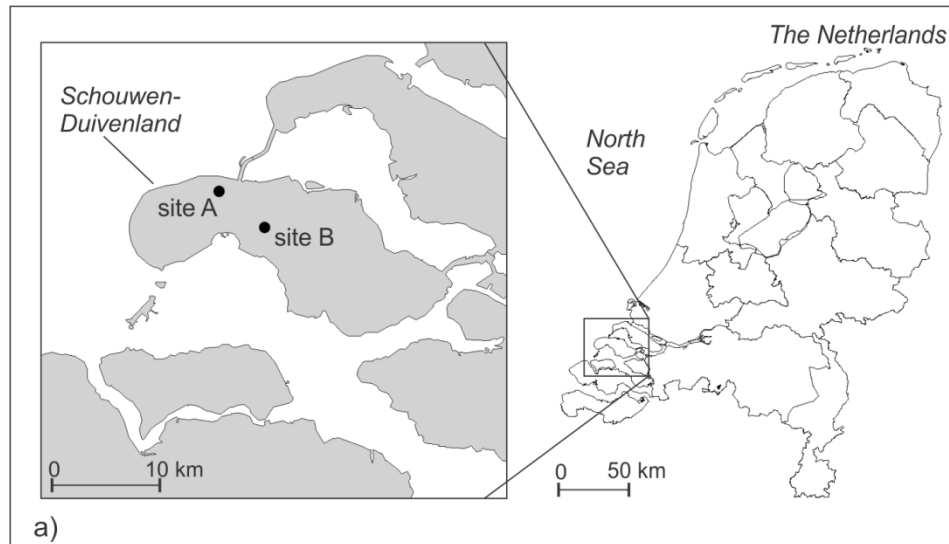
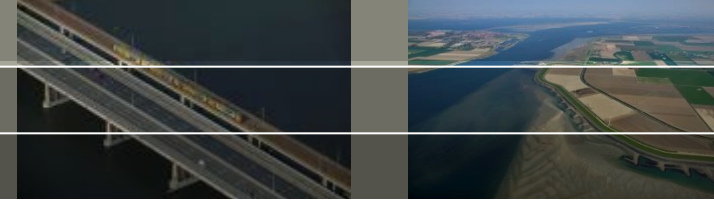
Prikstok-resultaten (TEC-probe)



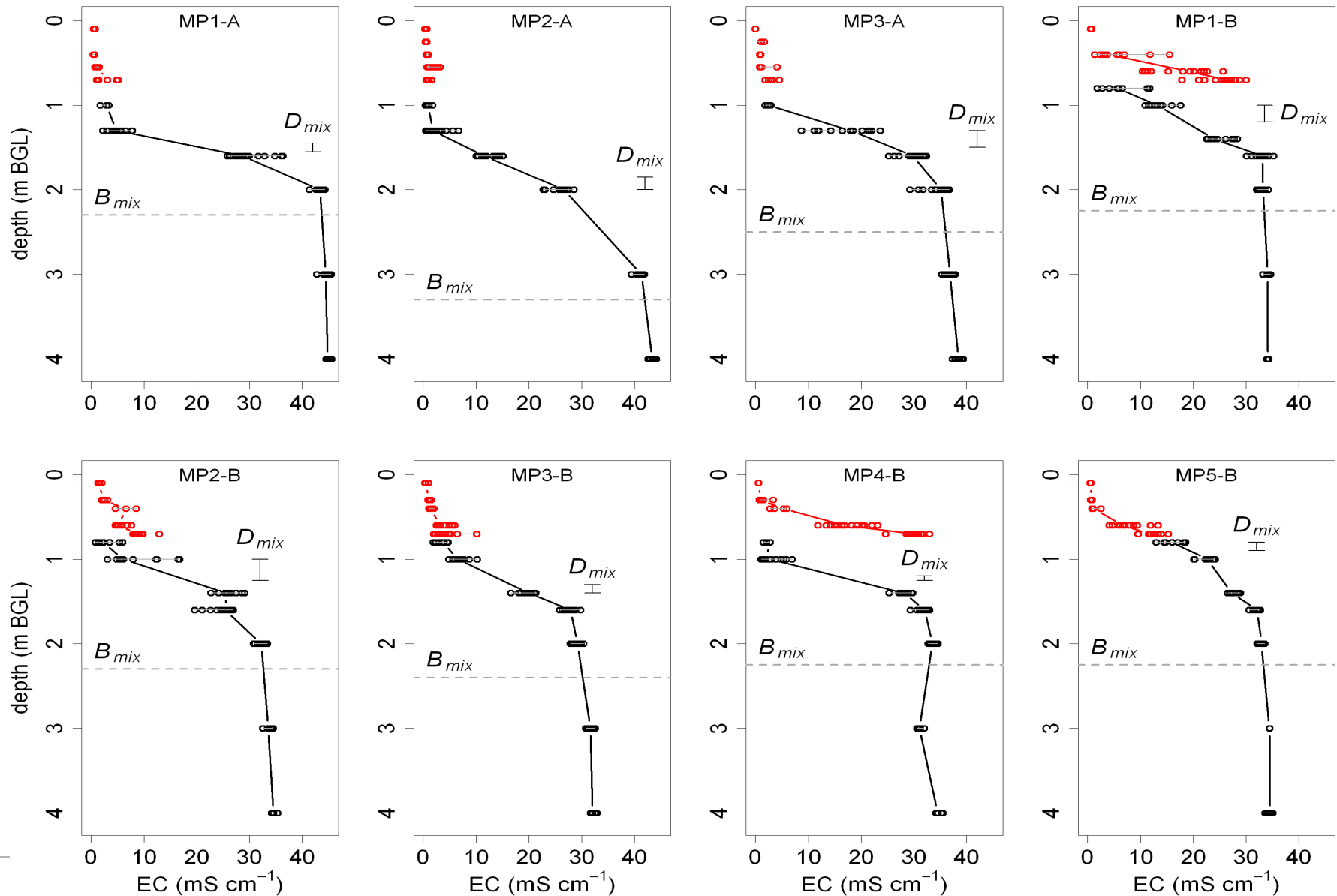
Regenwaterlens karakteristieken



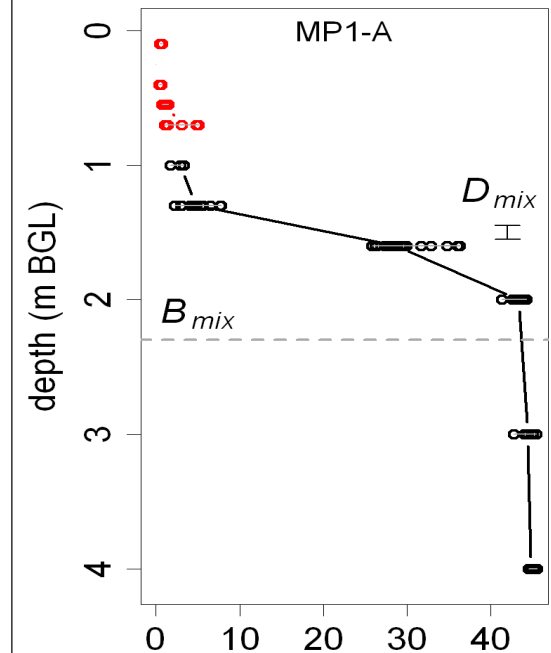
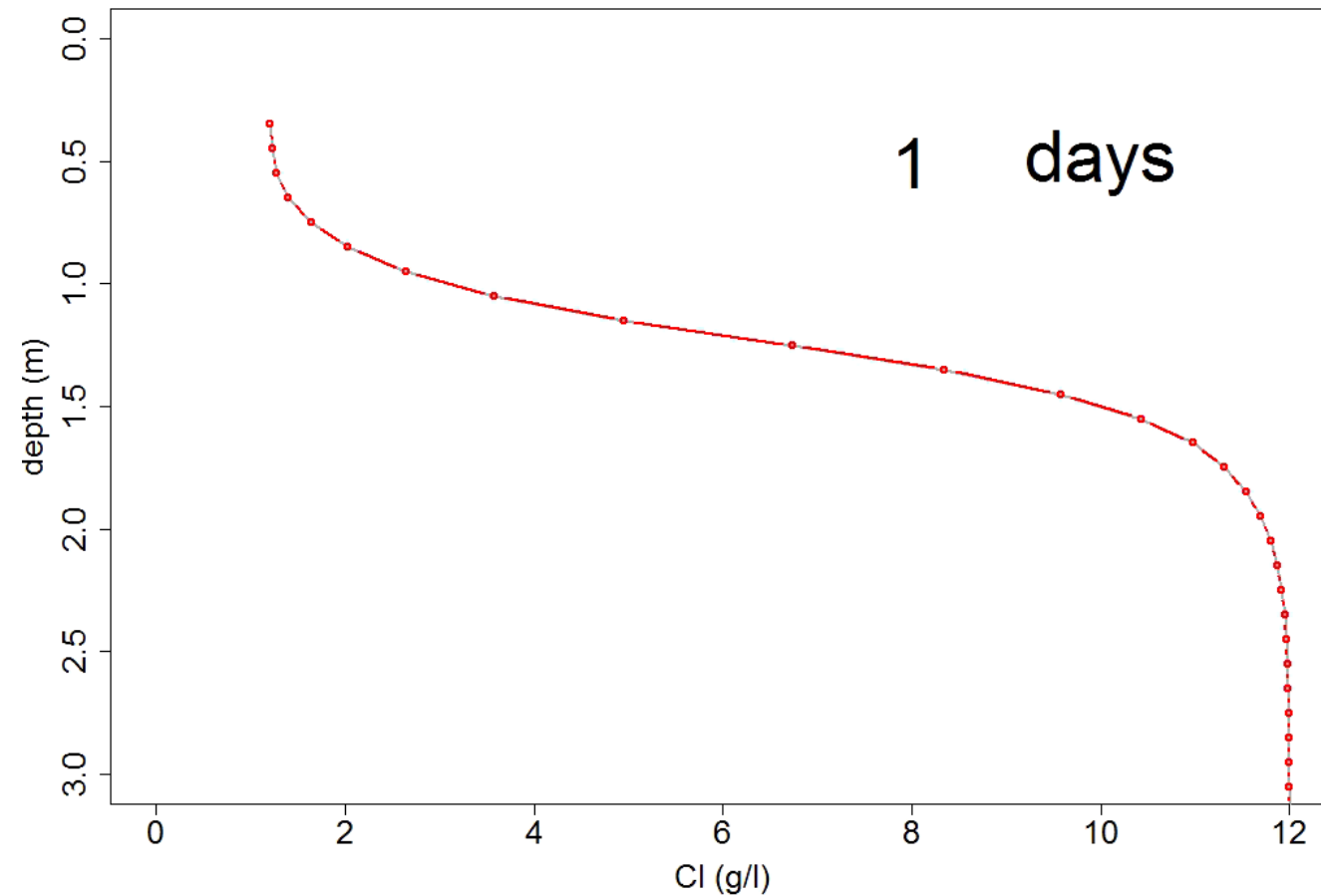
RW-lens dynamiek



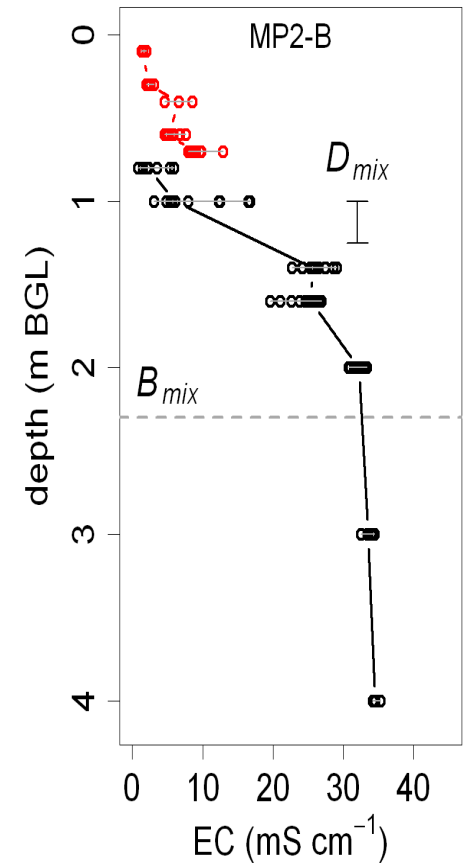
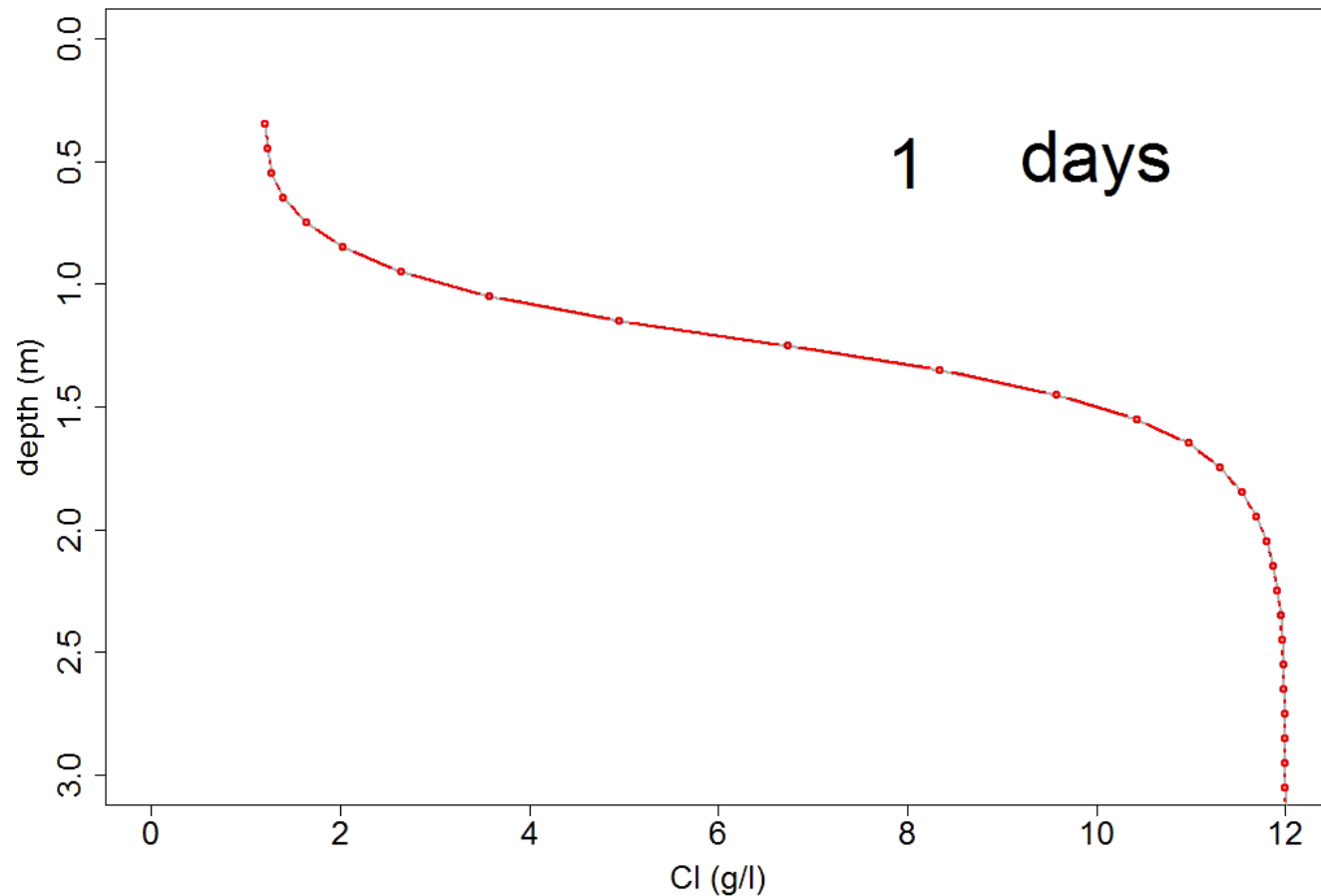
Dynamics of soil- and groundwater salinity



Modeled dynamics of groundwater salinity profile



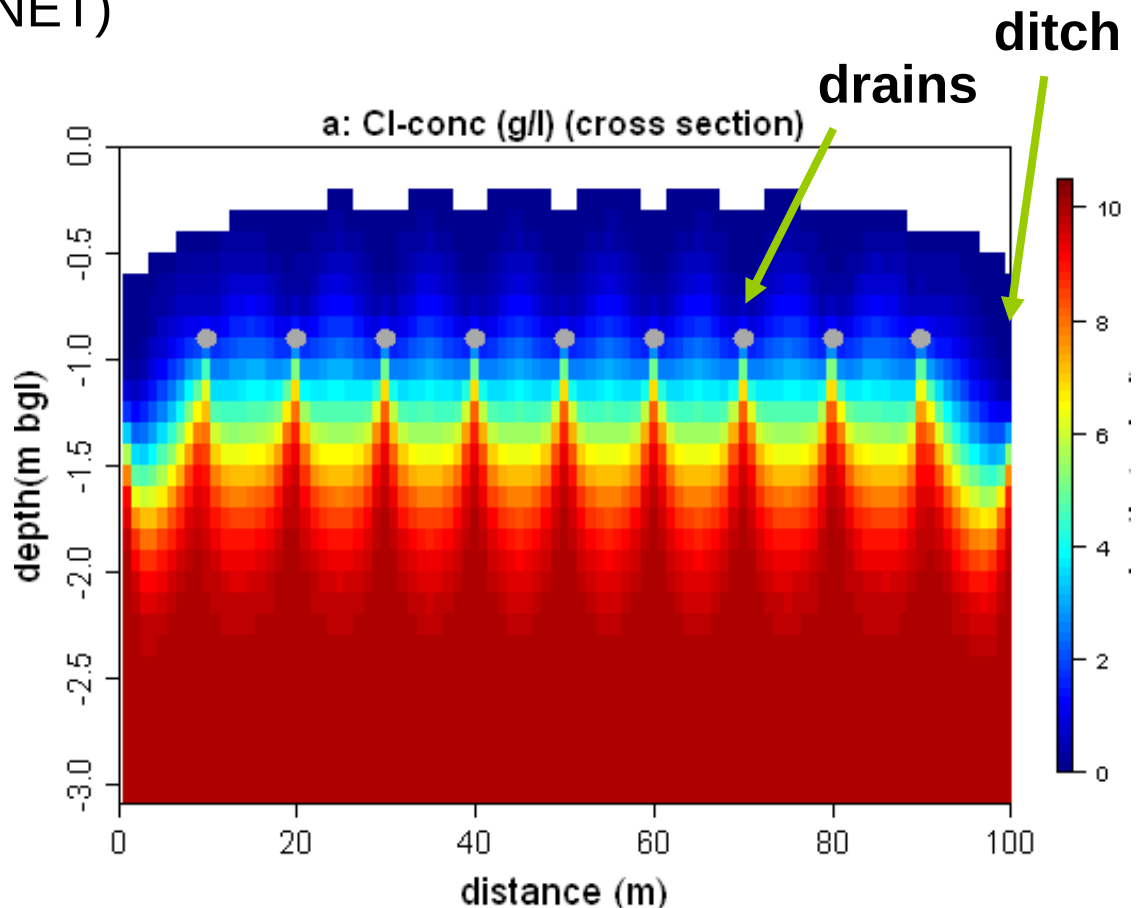
Root zone salinity: decapitation of RW-lens -> capillary rise of saline groundwater in summer



Dunne regenwaterlenzen in zoute kwelgebieden zijn erg kwetsbaar voor klimaatverandering

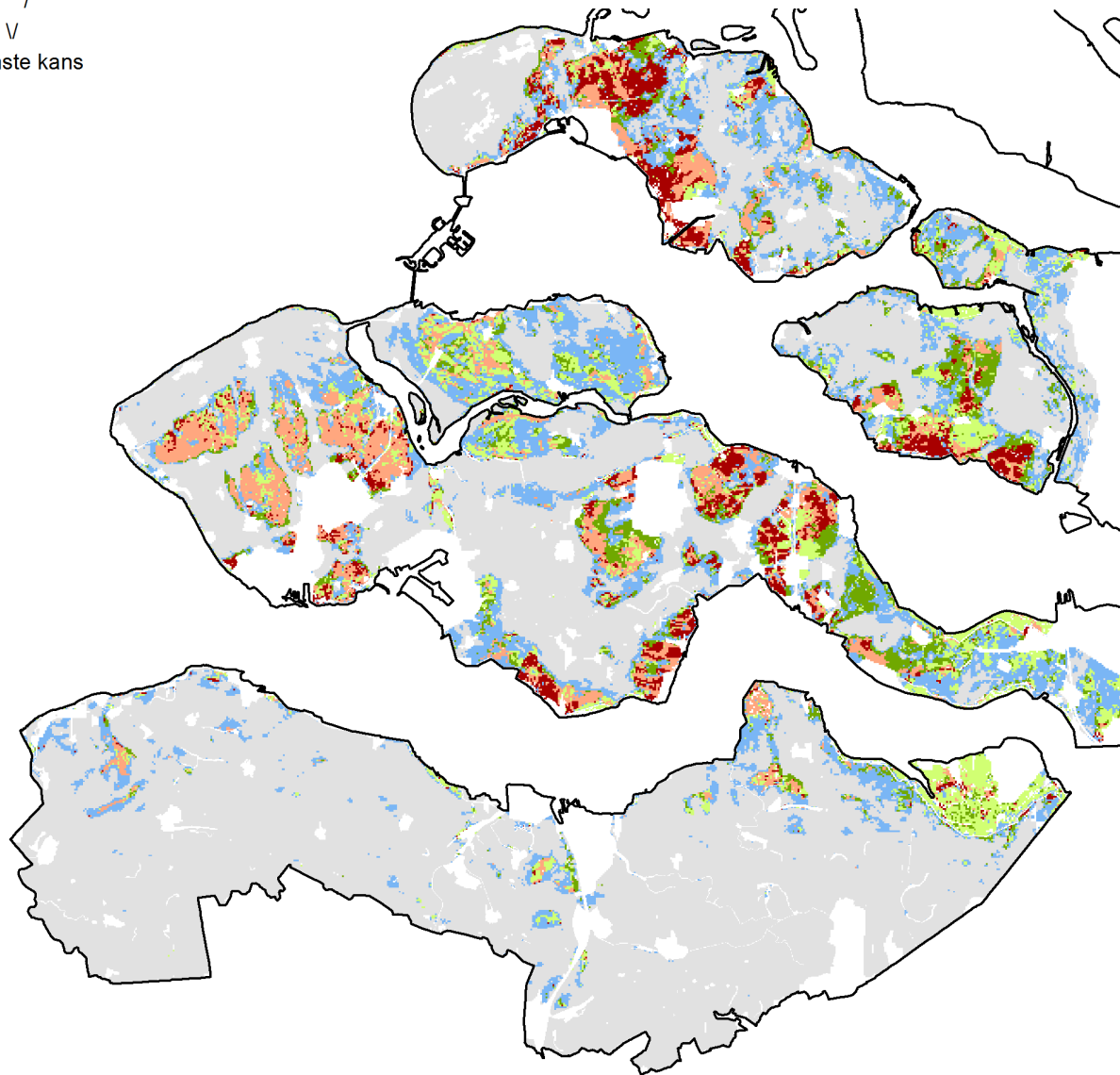
Belangrijkste factoren die lensdikte bepalen

- Grondwateraanvulling (NET)
- Kwelflux
- Drainage diepte



D: Kans op zout in de wortelzone

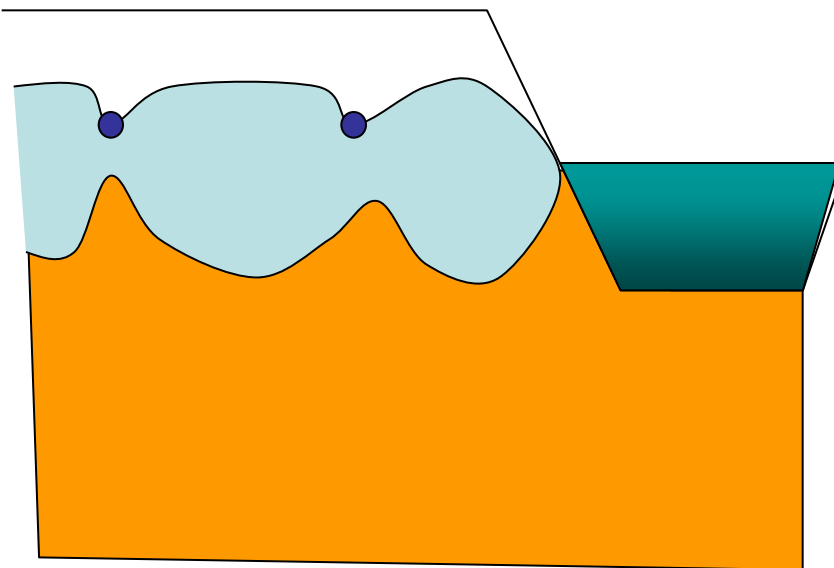
- D1: grootste kans
- D2 \ /
- D3 \ /
- D4 \ /
- D5 V
- D6 kleinste kans
- No data



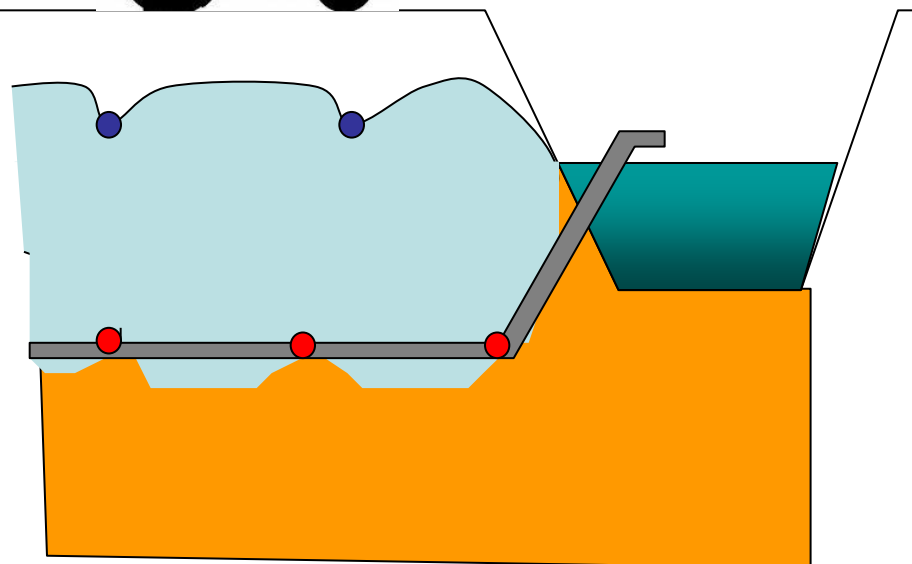
0 2,75 5,5 11 16,5 km

Dikkere regenwaterlenzen door diepere drainage

Drains2Buffer



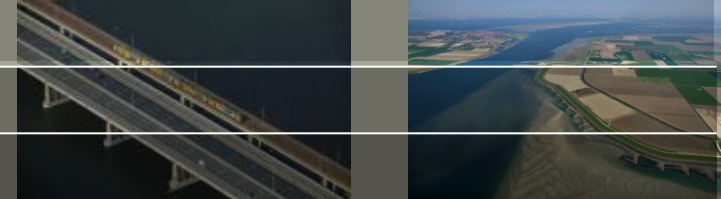
**Traditional
drainage**



Drain2buffer



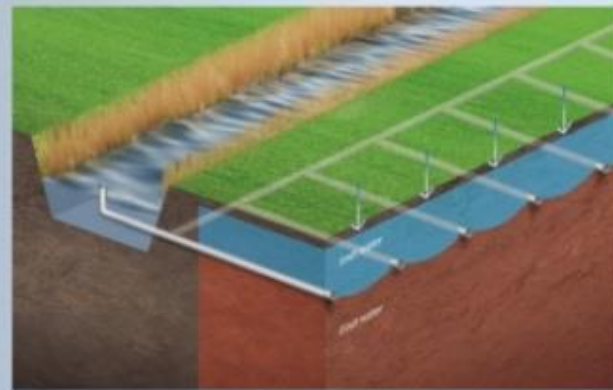
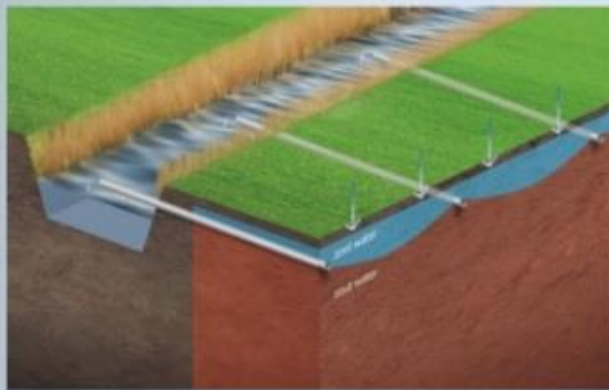
Drains2Buffer



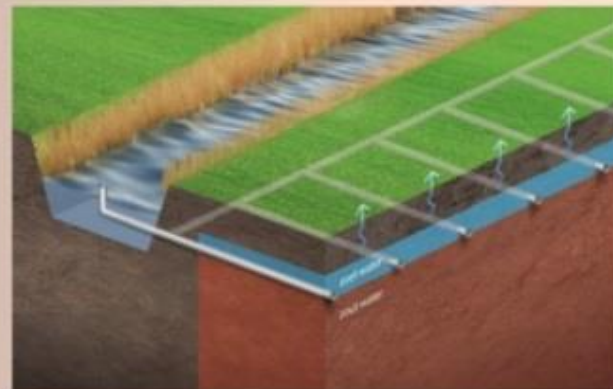
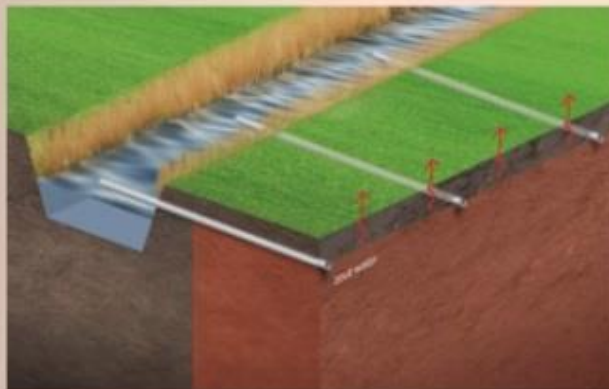
Huidige situatie

Nieuwe situatie

Natte
periode



Droge
periode



Ontwerp perceel Kerkwerve



 Verzameldrain, oude drains, afvoerrichting (put)
 Verzameldrain, nieuwe drains, afvoerrichting (put)
 Referentieperceel
 Testdeel 1
 Testdeel 2
 Drain (bestaand)
 Drain (nieuw te leggen, dieper)
 Drainafstand oude drains
 Drainafstand nieuwe drains

Toelichting:
 Referentieperceel en testdeel 1 hebben een drainafstand van ong. 10 meter.
 Testdeel 2 heeft een drainafstand van ongeveer 8 meter.

Oude drainage:

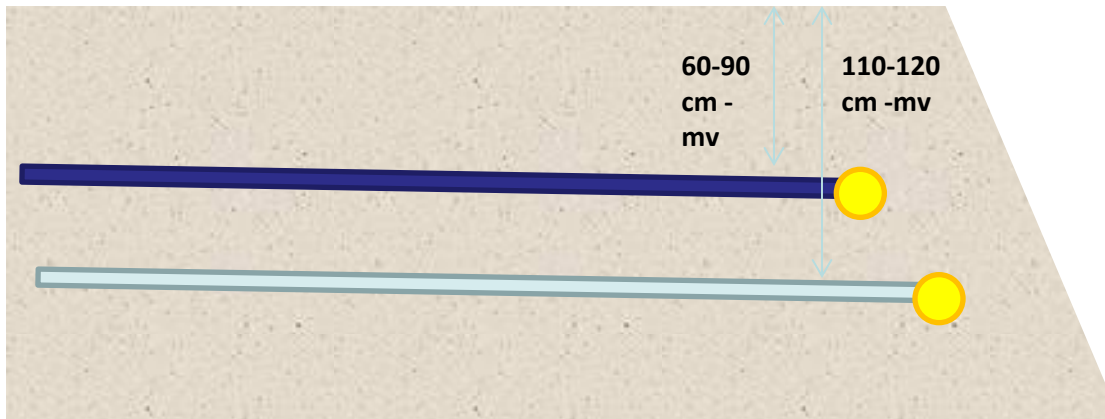
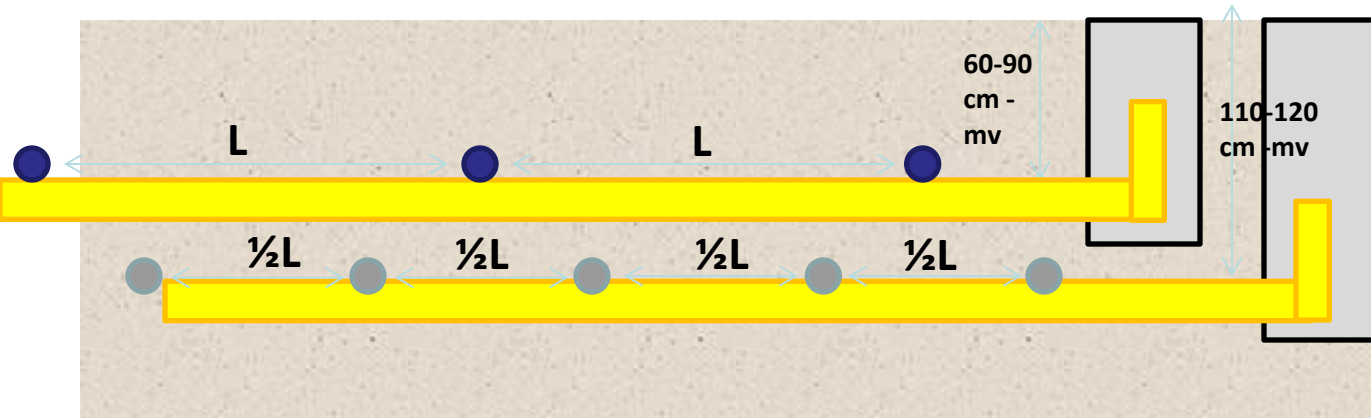
- Afstand 8 – 10 m
- Diepte 0.6 – 0.9 m – mv

Nieuwe drainage:

- Afstand 4 – 5 m
- Diepte 1,20 – 1,30 m – mv
- Peil op 0,6 – 0,9 m-mv

Ontwerp- zijaanzicht

(geldt voor testdeel 1 en testdeel 2, bij het referentieperceel worden alleen de bestaande drains op een verzameldrain gekoppeld)



-  Verzameldrain
-  Bestaande drain
-  Bestaande drain
-  Nieuwe drain
-  Nieuwe drain
-  Nieuwe drain

Toelichting:

Nieuwe drains worden gelegd op ongeveer de halve afstand van de bestaande drains (L) en op grotere diepte. Via een verzameldrain wordt de afvoer van de bestaande (oude) en de nieuwe drains (apart van elkaar) bijeengebracht en afgevoerd naar een put.

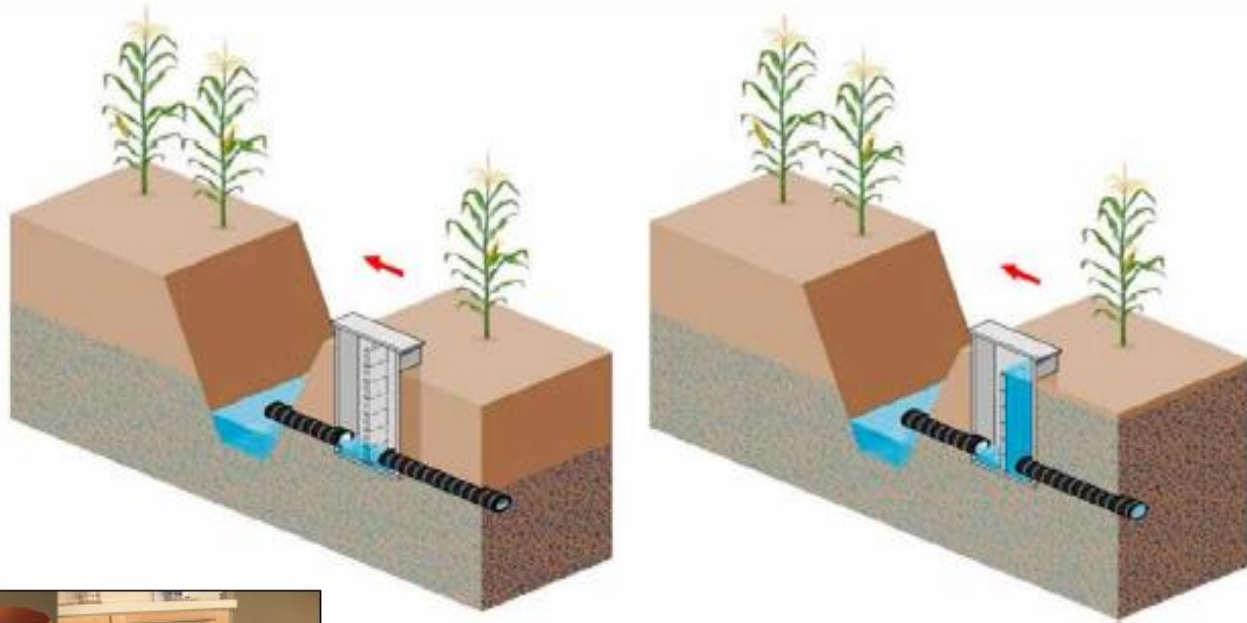
Per drain is nog een voorziening voor doorspuiten en inspectie nodig.

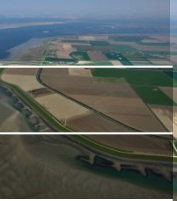
Regelbare drainage

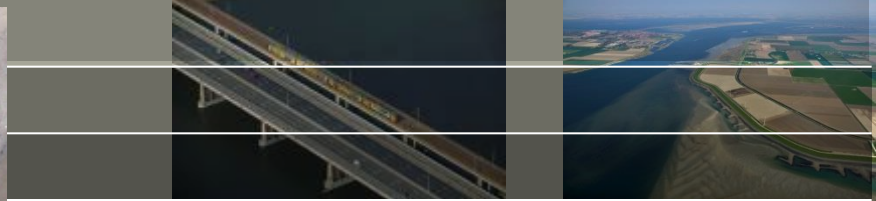
Method

Drain tubes are connected to a collector drain which is connected to a control unit. The drainage level can be controlled in the control unit. Low during wet periods when agricultural activities are planned, and high levels to increase the water table and store water for dry periods.

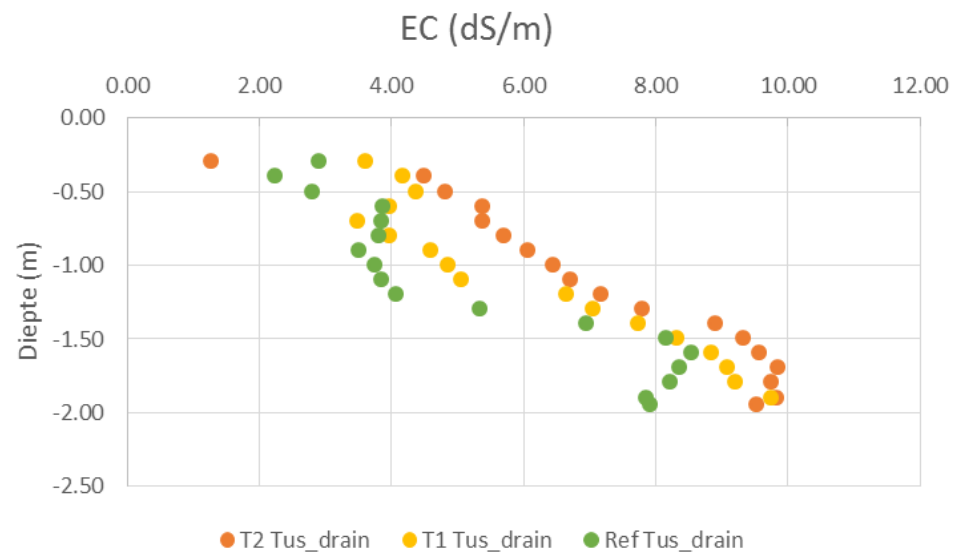
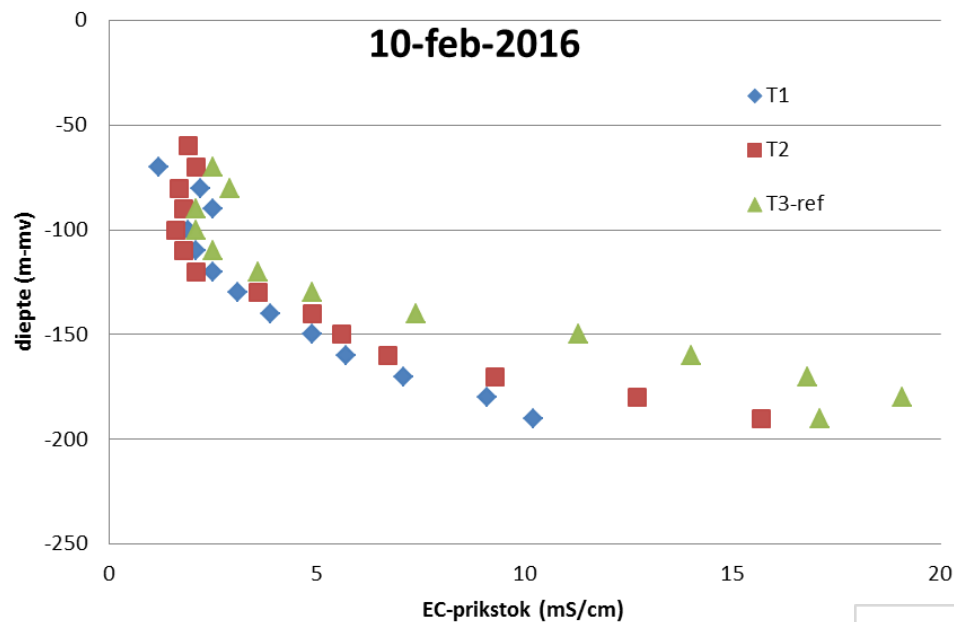
The farmer is much more in control of the water management of his field.



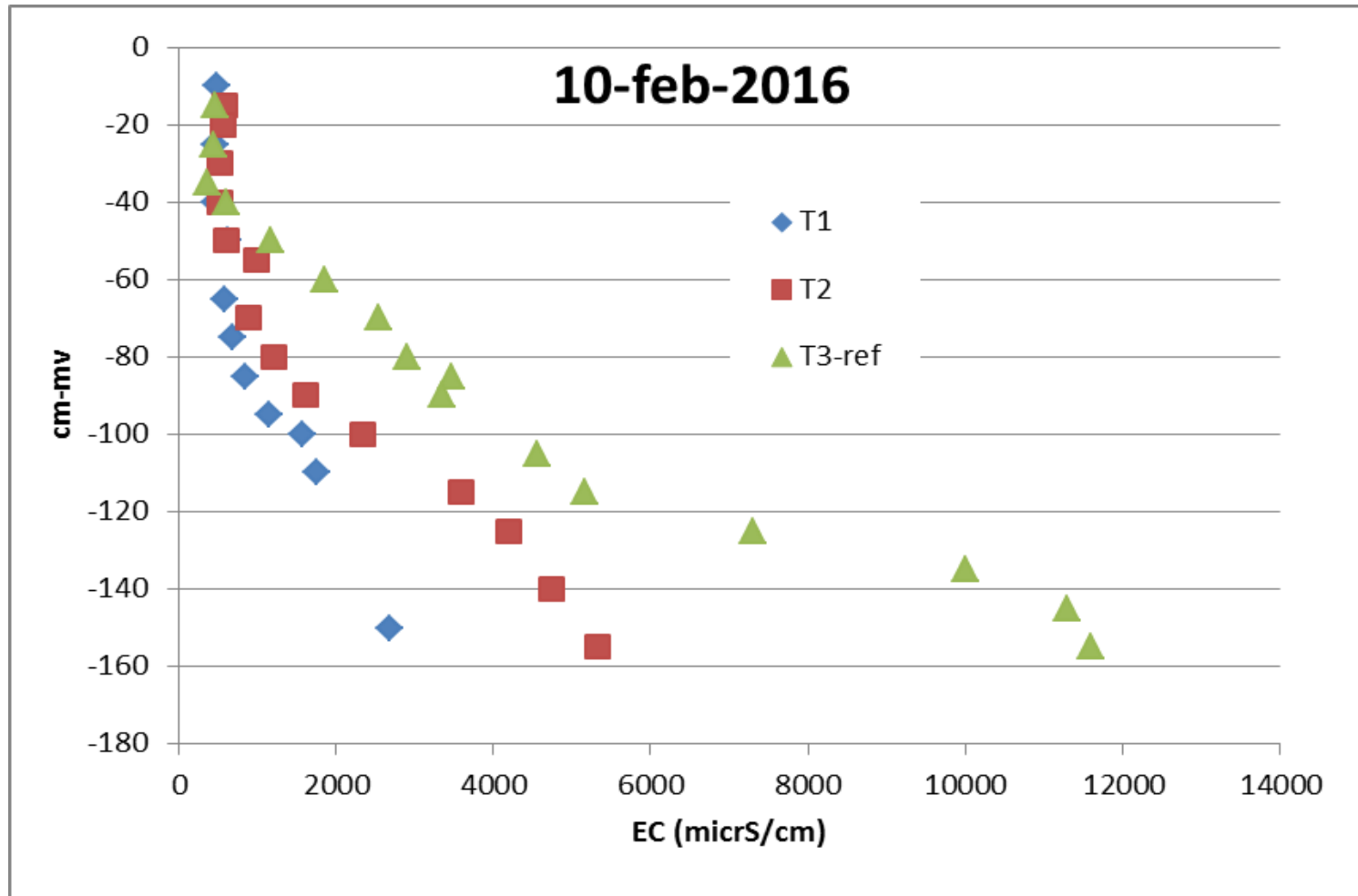




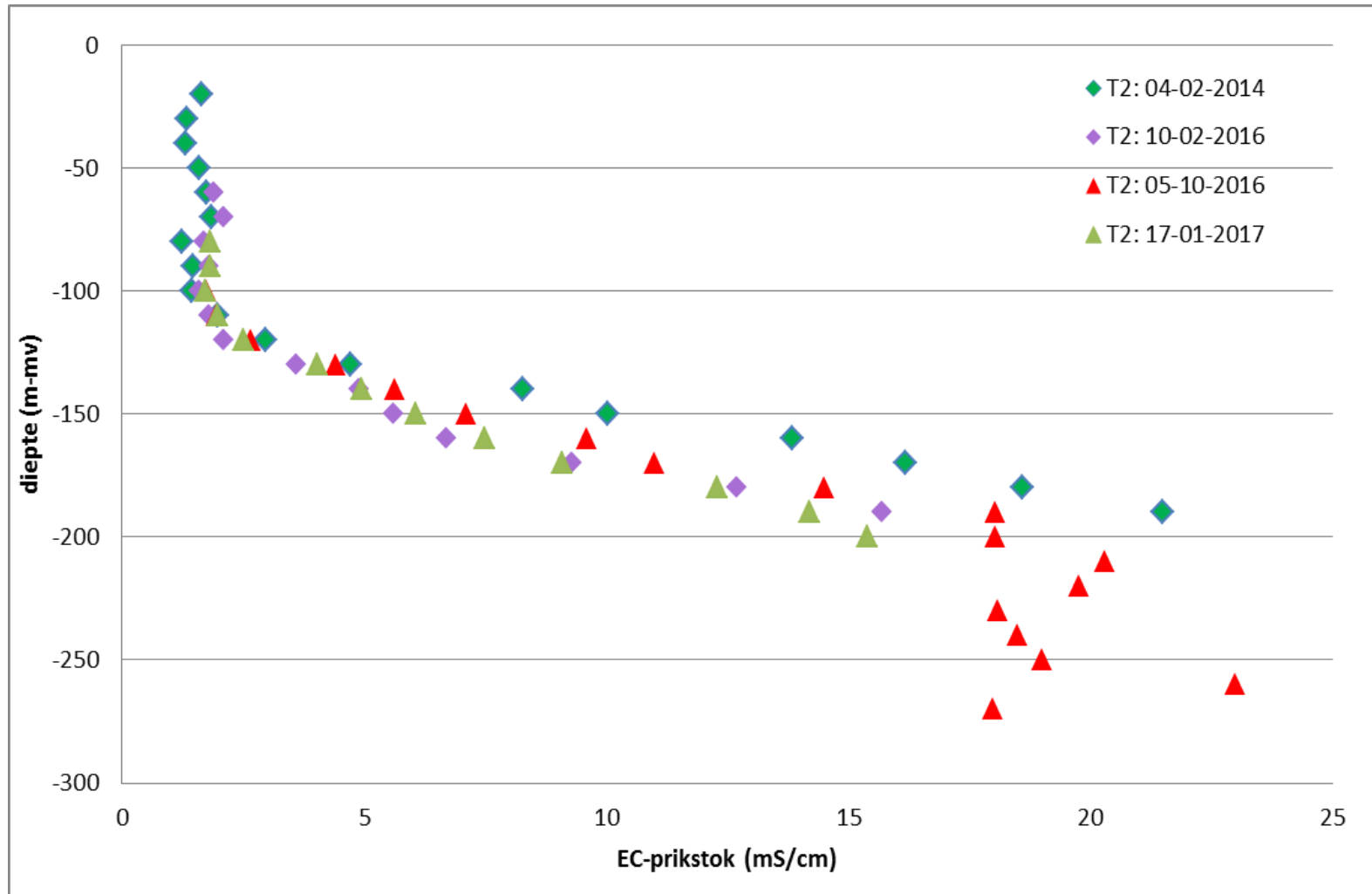
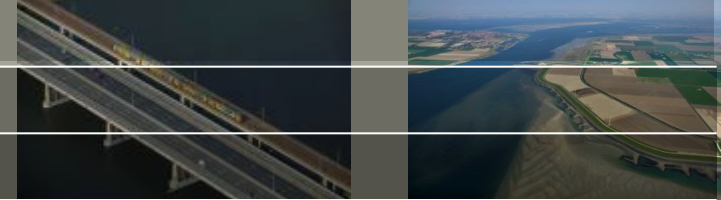
Prikstok-metingen en Trime-metingen



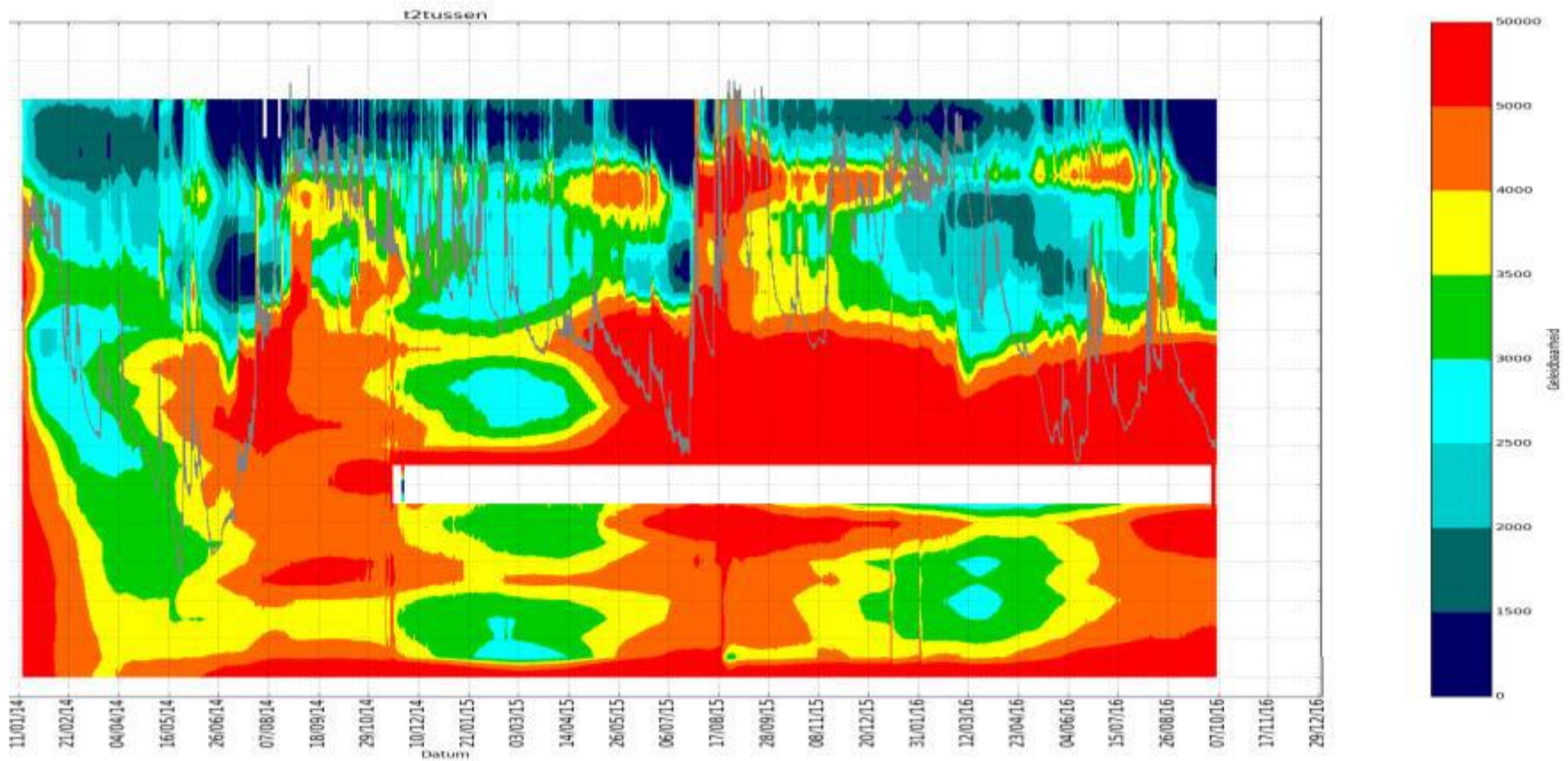
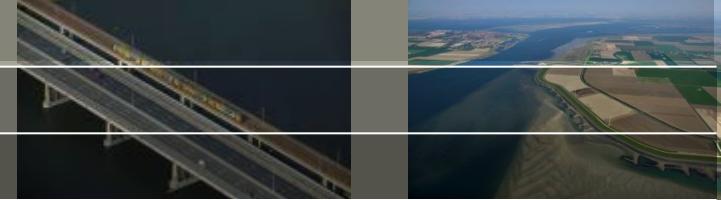
Zoutgehalte obv bodemonmonsters



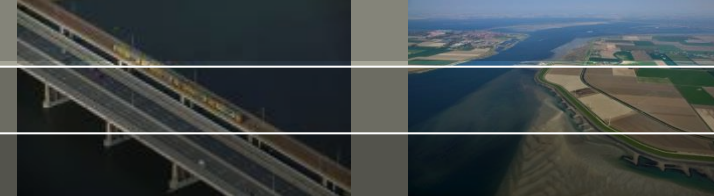
Prikstokmetingen in de tijd



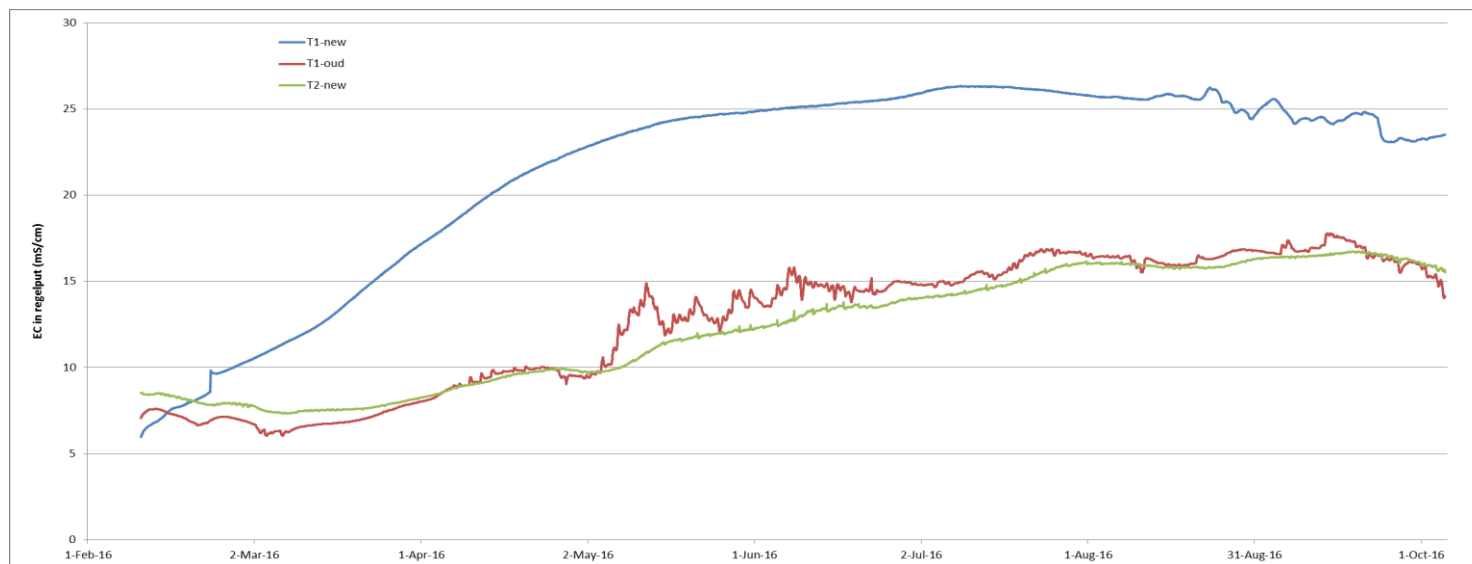
Soil-probe metingen



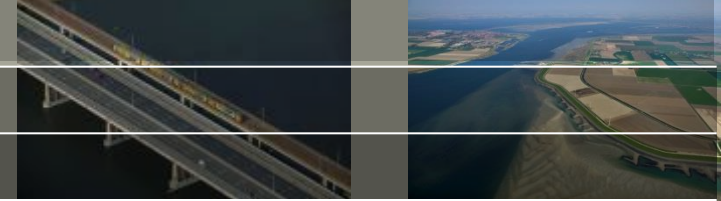
Afvoer en zoutgehalte drains



	T (sec)	stijging (m opp regel)	Q (m3/dag nr drains)	opp-drain	Q (mm/dag)		
regelput 1 - traditie	320	0.12	0.173407	5.618371	6	2700	2.080878
regelput 1 - nieuw	550	0.11	0.173407	2.996464	6	2700	1.109802
Regelput 2 - traditie	180	0.14	0.173407	11.65292	6	2700	4.315895
Regelput 2 - nieuw	390	0.13	0.173407	4.994107	6	2700	1.849669



Bevindingen tot nu toe



Diepere drainage werkt: afvoer < dan ondiepe drainage (ongerijpte klei) maar groot genoeg

Metingen lijken verzoeting aan te tonen, verdere uitwerking nodig

Aanbeveling: bij nieuwe drainage altijd regelbare drainage toepassen:

- (1) Sturen van grondwaterstand en bodemvocht in perceel
- (2) Drains2Buffer toepassen in zoute kwelgebieden voor vergroting lens

Meerkosten regelbare drainage / drains2buffer tov traditionele drainage vallen mee.