



Verziltingsrisico op perceelsniveau

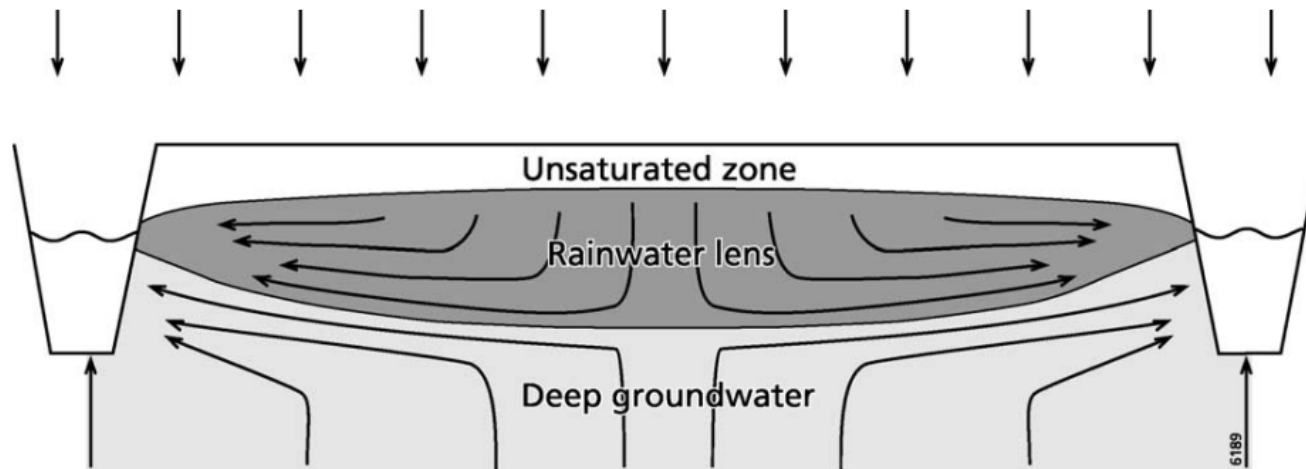
12 NOV 2019

Jouke Velstra



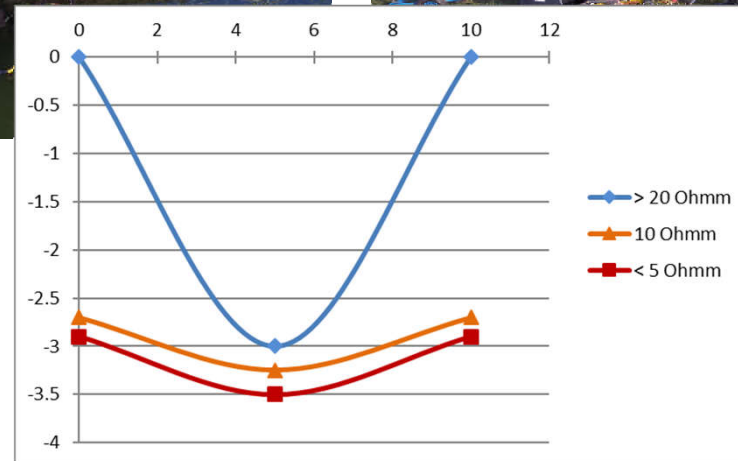
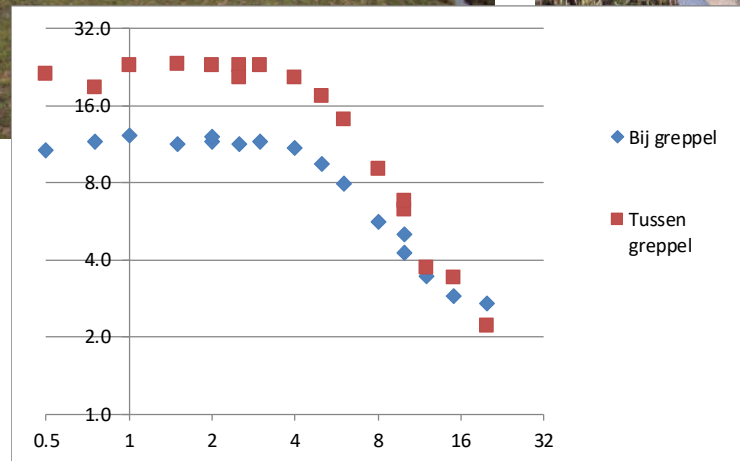
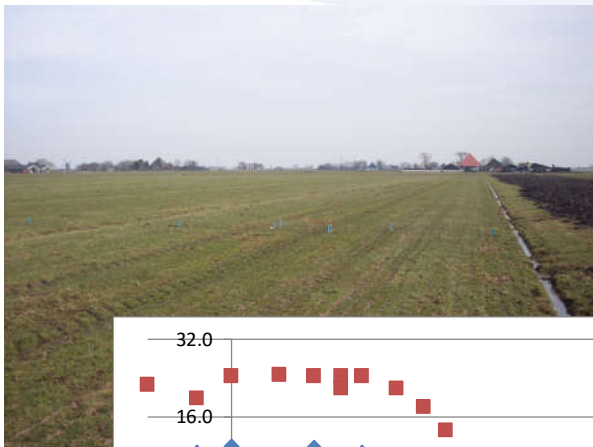
www.acaciawater.com

Dit was het concept in 2000 van een neerslaglens



- Poot, A. en P. Schot, 2000. Neerslaglenzen: vorm en dynamiek. Stromingen, jaargang 6, nummer 4, bladzijde 13-26

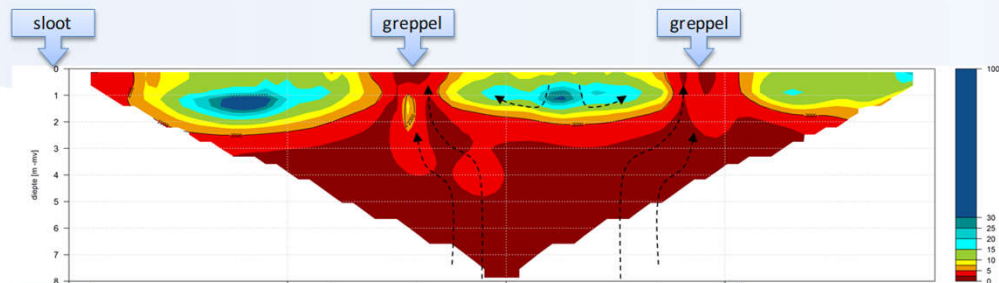
Eerste (VES) metingen 2006/2007



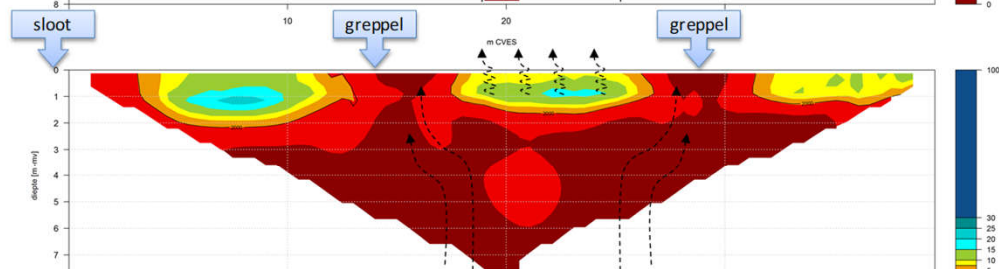
ERT - Metingen



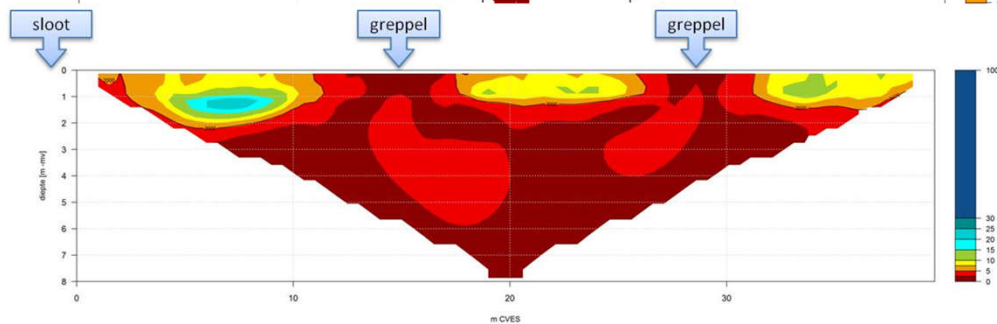
May 2009



October 2009

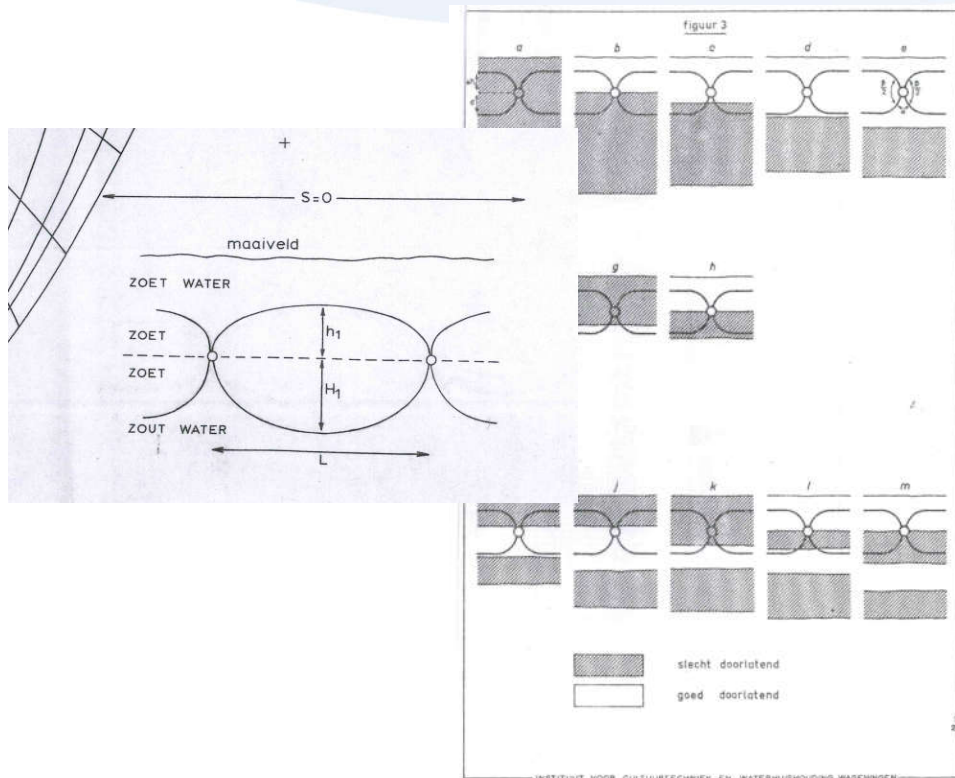


April 2010

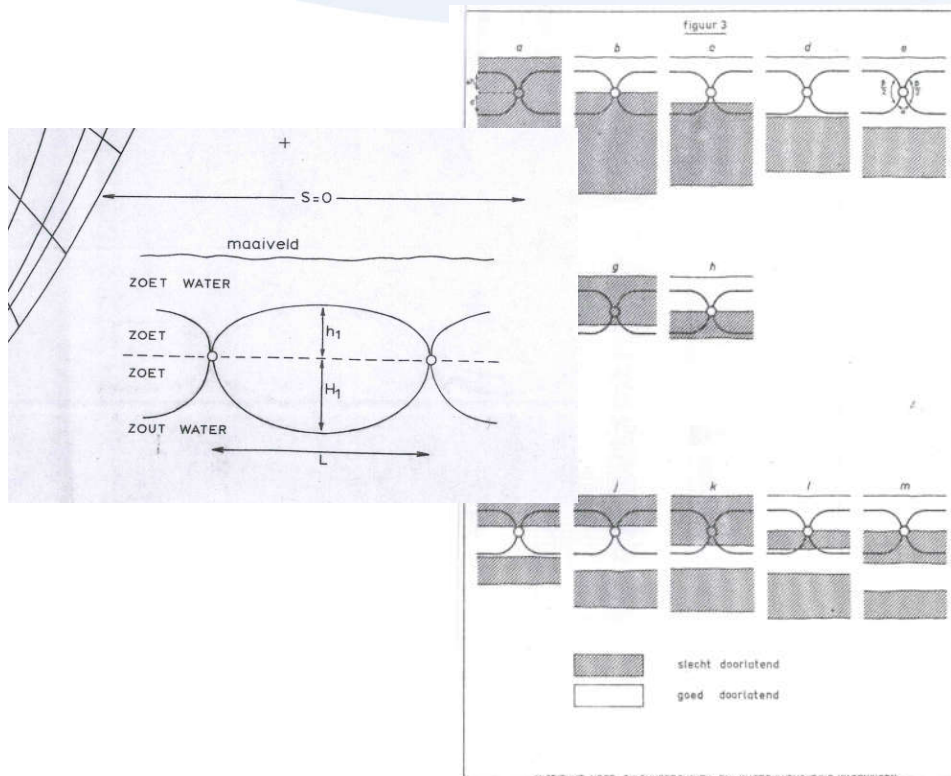


Door strenge winter met ijs
en sneeuw geen
grondwateraanvulling

Ernst -> 1957 !

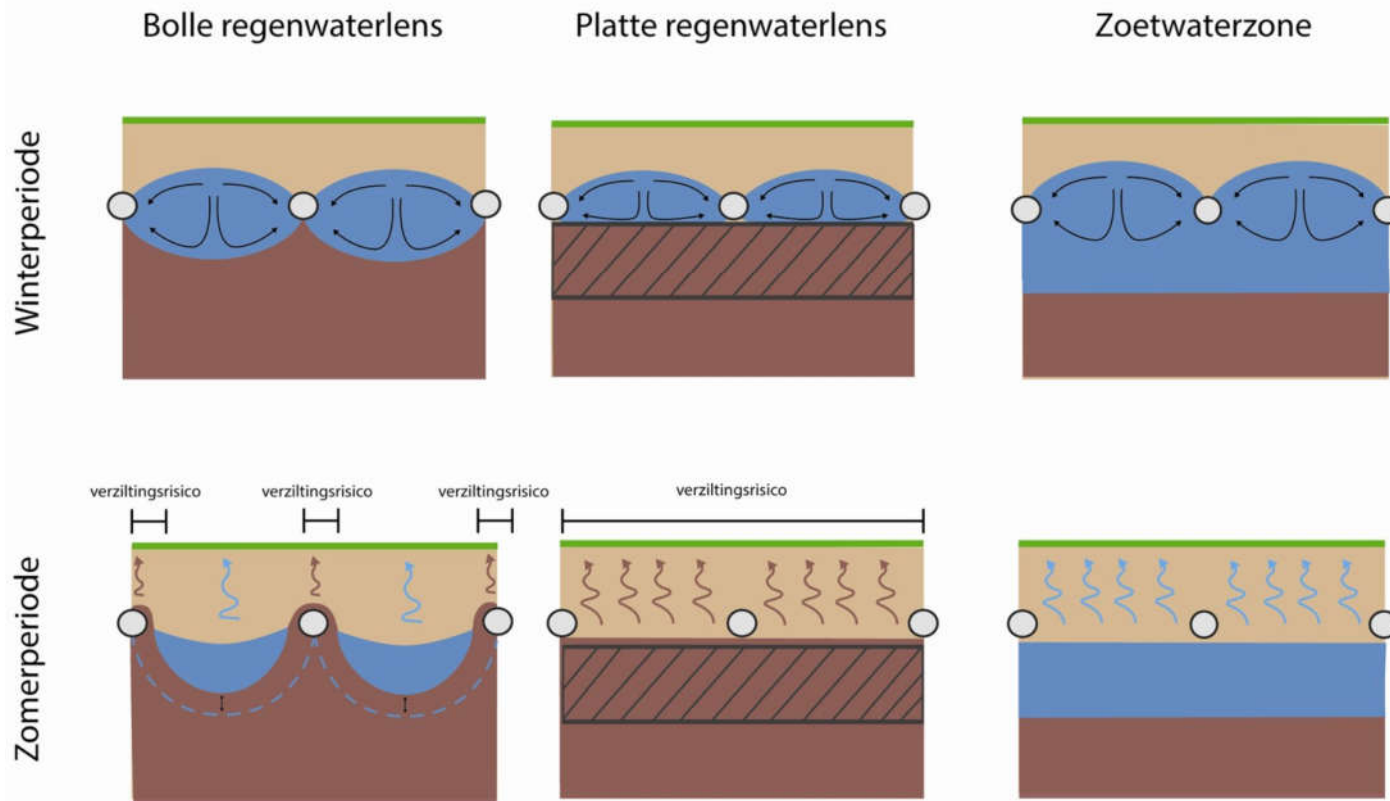


Ernst -> 1957 ! -> uitleg 1961



$$\begin{aligned} \Delta h_1 &= \frac{NL^2}{4k_1(d+\Delta h_1)} & \Delta h_2 &= \frac{SL}{\alpha k_1} \ln \frac{L}{2r} & \frac{\beta}{\alpha} &= \frac{N}{S} \\ \Delta h_1 &= \frac{NL^2}{4(k_1\Delta h_1+k_2d)} & \Delta h_2 &= \frac{SL}{\alpha k_2} \ln \frac{L}{2r} & \alpha &\leq \pi \\ \Delta h_1 &= \frac{NL^2}{4k_1(2D_{o1}+\Delta h_1)} & \Delta h_2 &= \frac{SL}{\alpha k_2} \ln \frac{L}{D_{o1}} + \frac{SL}{\alpha k_1} \ln \frac{D_{o1}}{r} & \frac{\beta}{\alpha} &= \frac{N}{S} \\ \Delta h_1 &= \frac{NL^2}{4k_1(d+\Delta h_1)} & \Delta h_2 &= \frac{SL^2}{8k_1D_{o1}-4k_1d} \\ \Delta h_1 &= \frac{NL^2}{4k_1(d+\Delta h_1)} & \Delta h_2 &= \frac{SL^2}{4k_1(2D_{o1}-d)} + \frac{SL}{\alpha k_1} \ln \frac{D_{o1}}{r} & \frac{\beta}{\alpha} &= \frac{N}{S} \\ \Delta h_1 &= \frac{NL^2}{4k_2d+4k_1\Delta h_1} & \Delta h_2 &= \frac{SL}{\alpha k_1} \ln \frac{L}{2r} & \alpha &= \frac{S}{N+S} \pi \\ \Delta h_1 &= \frac{NL^2}{4k_2(d-D_{o1})+4k_1(D_{o1}+\Delta h_1)} + \frac{NL}{\beta k_1} \ln \frac{D_{o1}}{r} & \left. \begin{aligned} \Delta h_2 &= \frac{SL}{\alpha k_2} \ln \frac{L}{2D_{o1}} + \frac{SL}{\alpha k_1} \ln \frac{D_{o1}}{r} \end{aligned} \right\} & \frac{\alpha}{\beta} &= \frac{S}{N} \\ & & & & \alpha &\leq \alpha_2 \leq \pi \\ \Delta h_1 &= \frac{NL^2}{4k_2d+4k_1\Delta h_1} & \Delta h_2 &= \frac{SL}{\alpha k_1} \ln \frac{L}{2r} + \frac{SL}{\alpha k_2} \ln \frac{D_{o1}}{r} & \alpha_2 &\approx \pi \end{aligned}$$

Drie type situaties



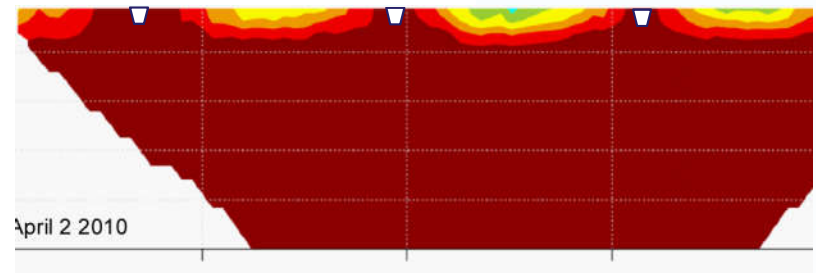
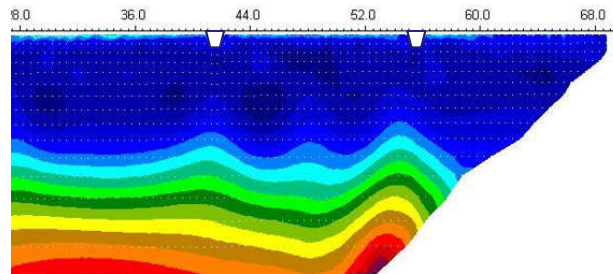
Effect van kwel



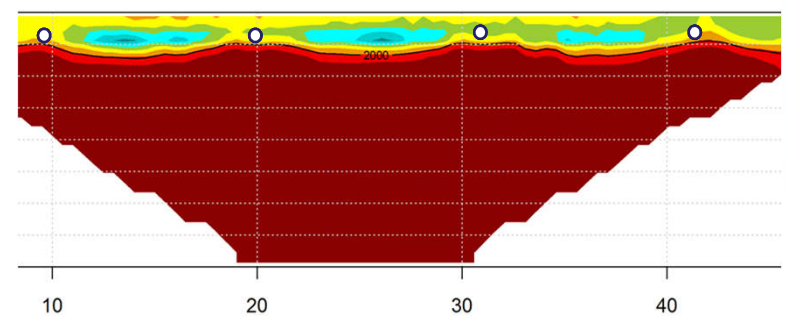
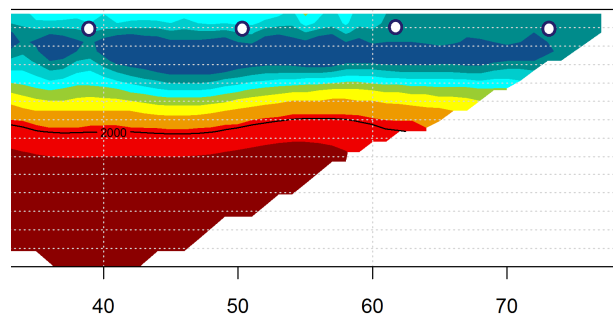
Kwelneutraal / geringe kweldruk

Kwel / hoge kweldruk

Greppel



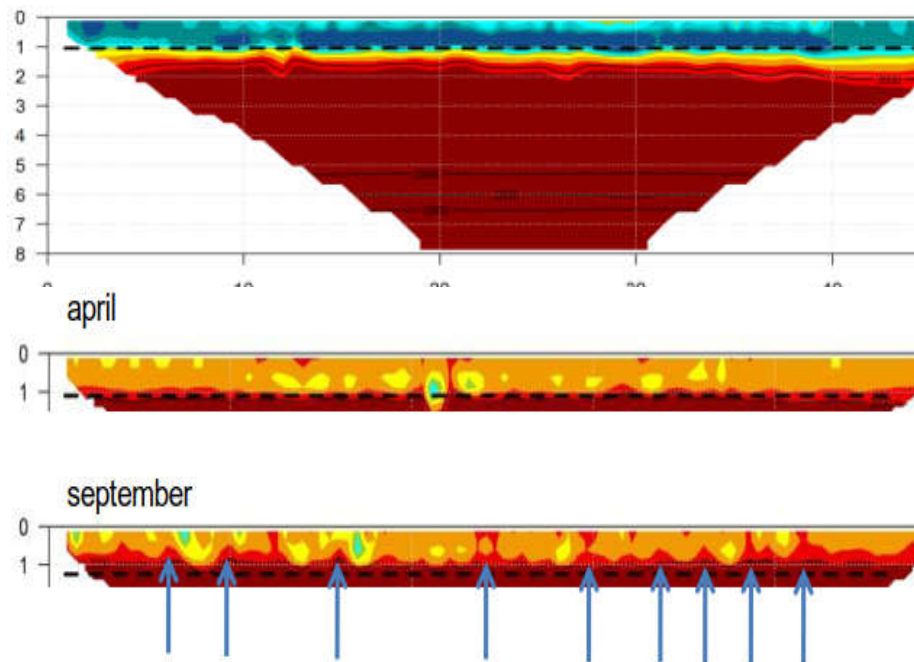
Buisdrainage



Bodemopbouw (contrast)



- Zand op klei of
- gerijpte op ongerijpte klei

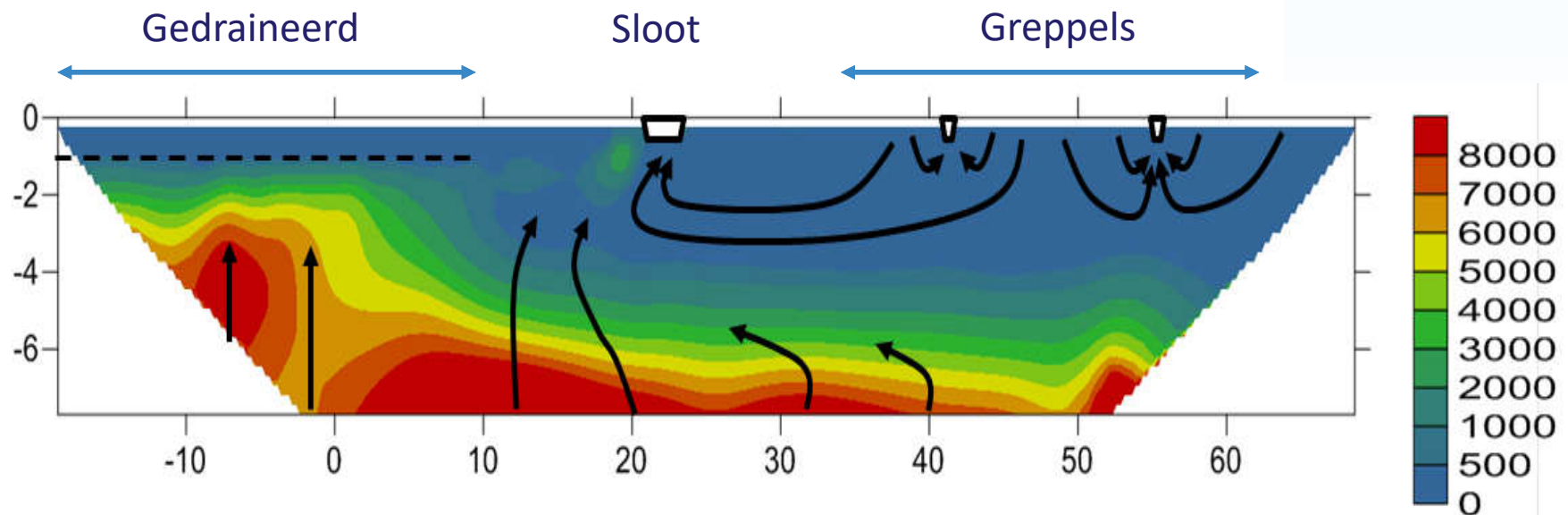


Optrekkend zout in zomer

Verskil in gemiddelde grondwaterstand / ontwateringsdiepte



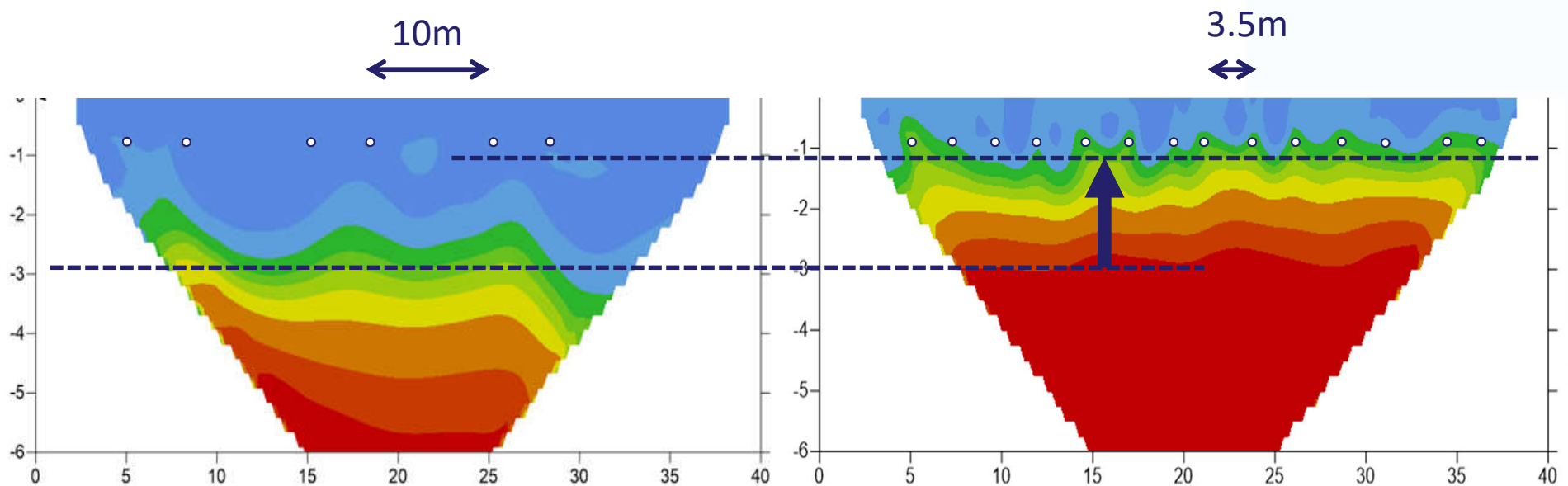
- GWS gedraineerd lager dan bij begreppeld
- Verskil in 'lensdikte' is ca 2m



Effect van drainageafstand

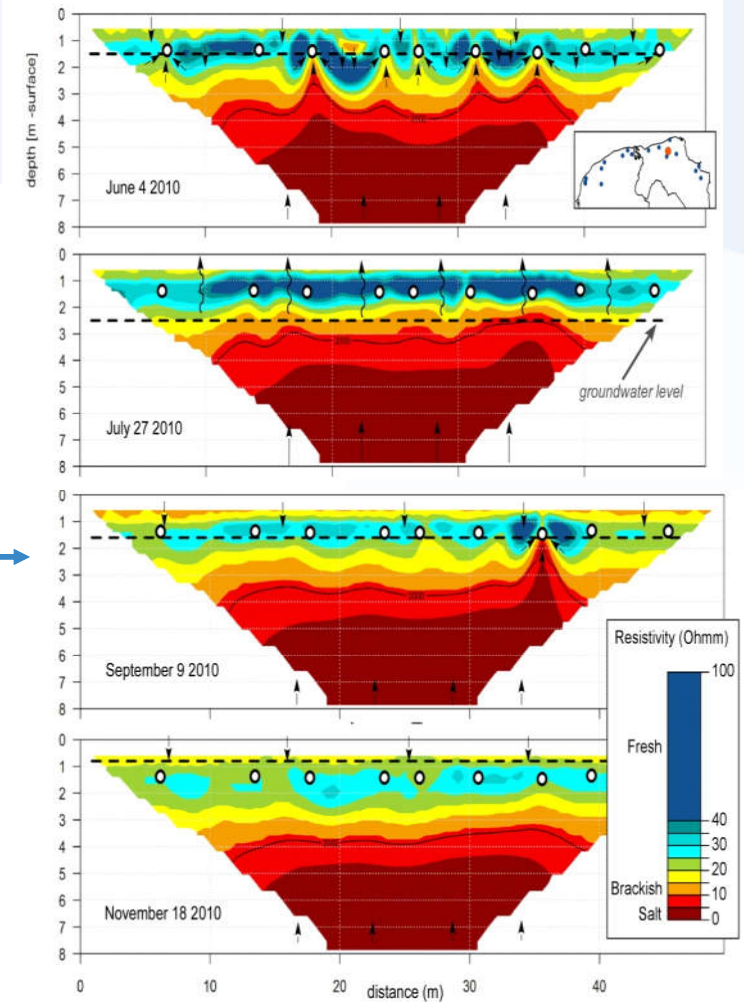
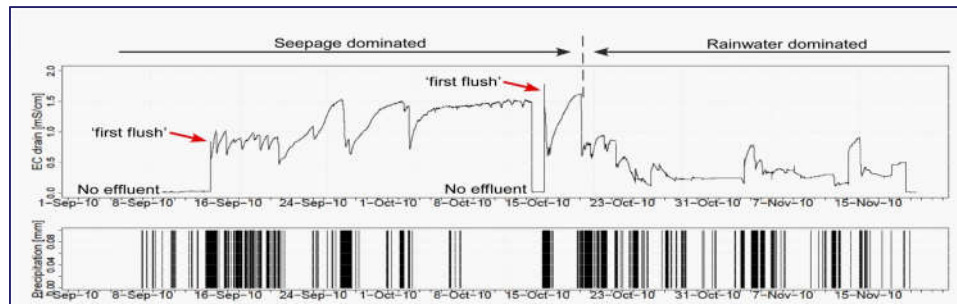
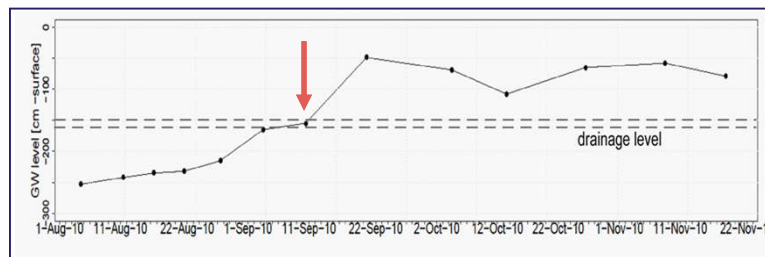


- Door kortere drainafstand forceren van verzilting

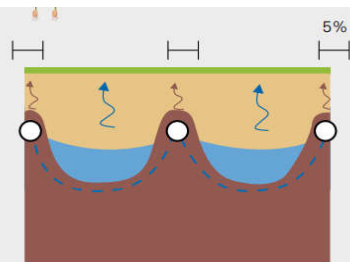
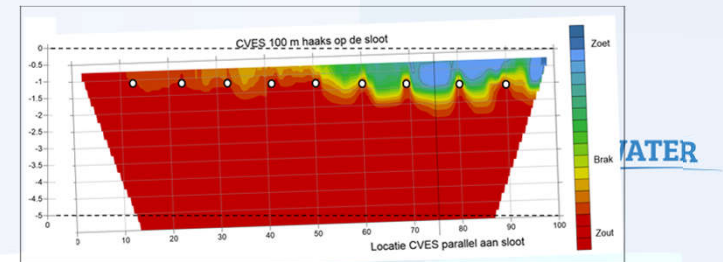


Dynamiek

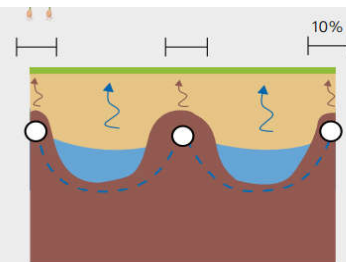
- Kan ook heel snel reageren
- Niet echt een lens maar eerder upconing
- Eén drain ligt net wat dieper
- Inzicht in zoutgehalte afvoer uit percelen



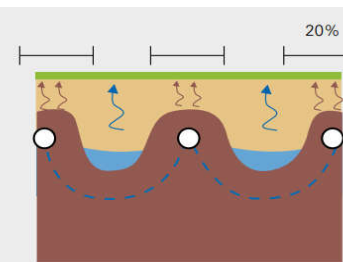
Schade door verzilting



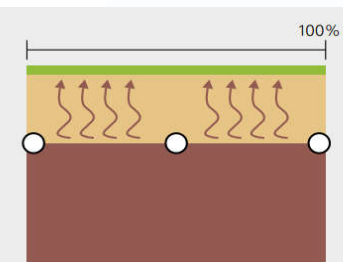
 €200 - €100 ha/jaar
 €460 - €55 ha/jaar




 €405 - €195 ha/jaar
 €925 - €110 ha/jaar



 €810 - €395 ha/jaar
 €1850 - €215 ha/jaar

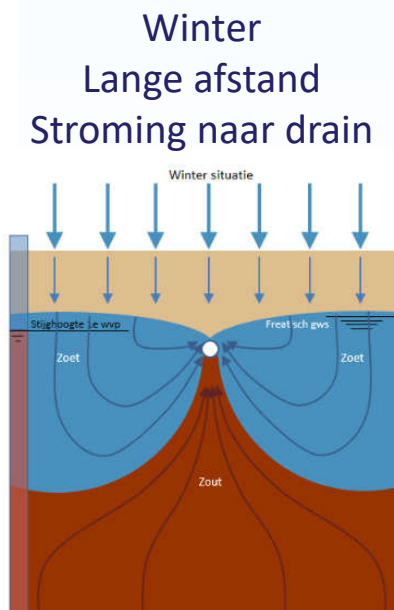
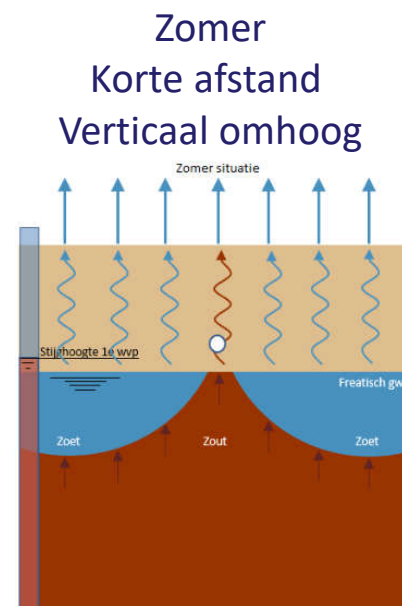
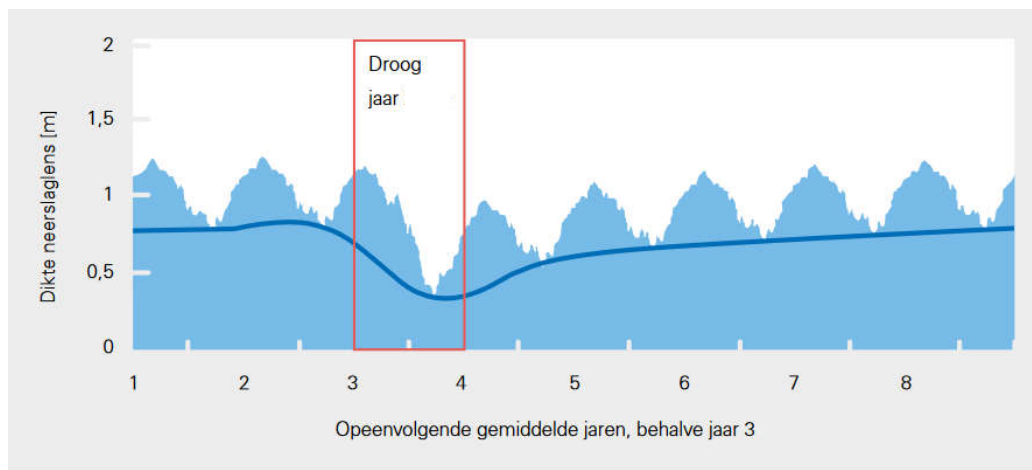


 €4050 - €1970 ha/jaar
 €9000 - €1000 ha/jaar

Effect verzilting vs verzoeting



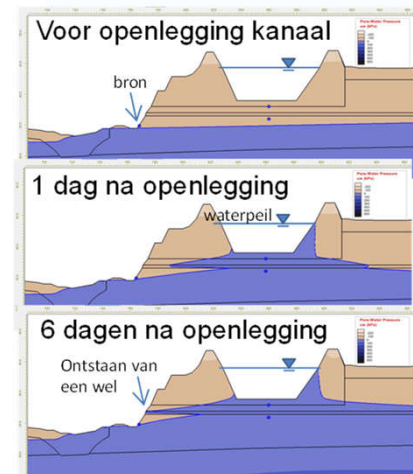
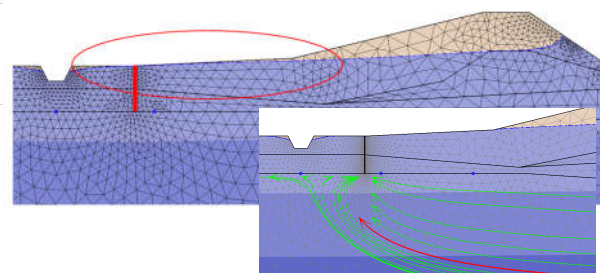
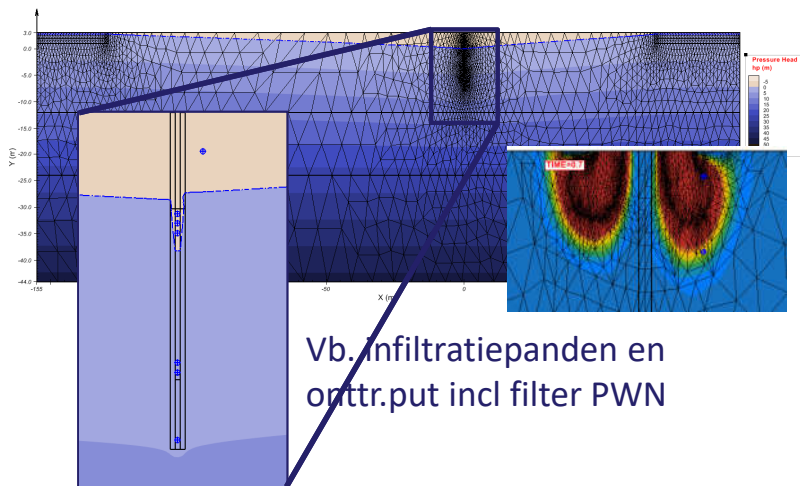
- Impact van een droog jaar
- Kan jaren duren voor hersteld is op oude lensdikte



Modellering op perceelschaal



- Op basis van FlexPDE (flexibel partial differential equations)
- Volledig geïntegreerde code verzadigde & onverzadigde zone met dichtheidsafhankelijke stroming
- Adaptive FEM grid
- Combineren van cm schaal tot tientallen m schaal

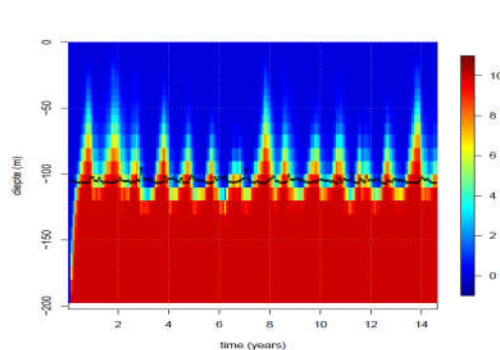


Vb. effect Julianakanaal

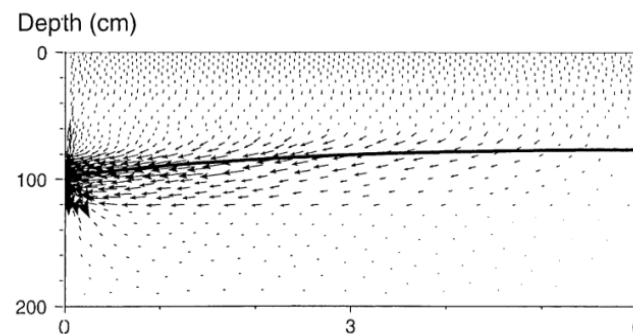
Modellering op perceelschaal



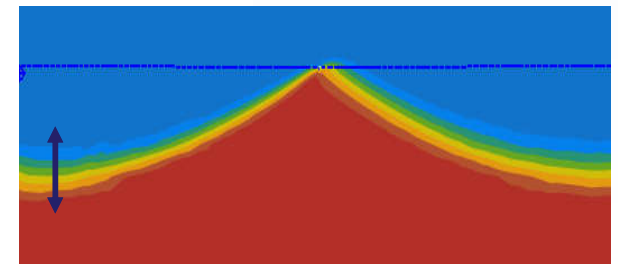
- Op basis van FlexPDE (flexibel partial differential equations)
- Volledig geïntegreerde code verzadigde & onverzadigde zone met dichtheidsafhankelijke stroming
- Adaptive FEM grid
- Combineren van cm schaal tot tientallen m schaal



Optrekkend zout naar wortelzone



Stroming onverzadigde zone

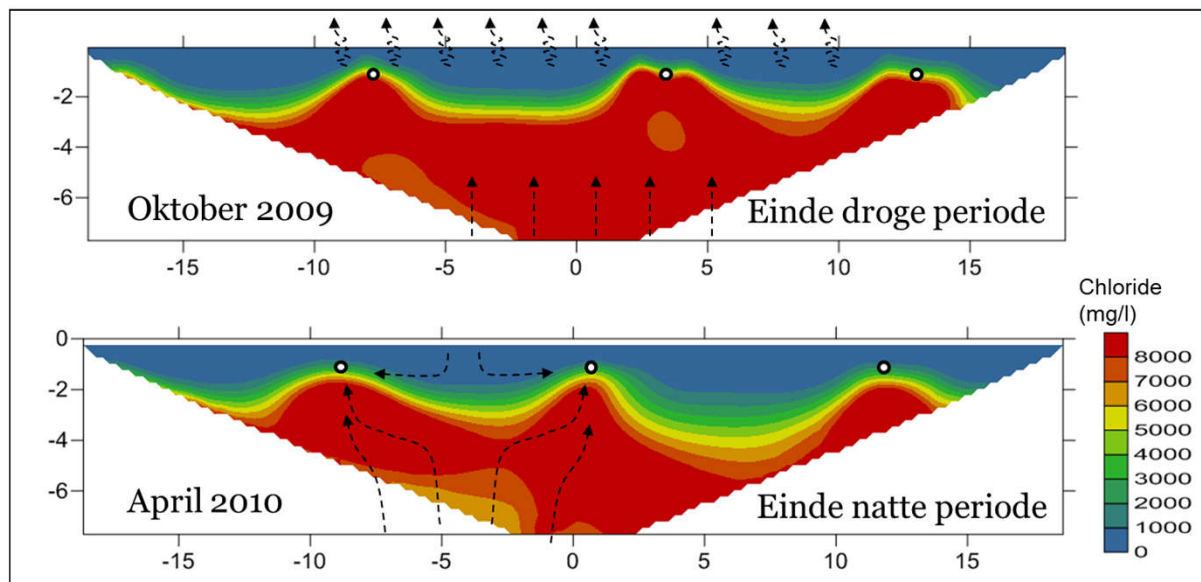


Dichtheid relevant
zeker als je maatregelen doorrekend

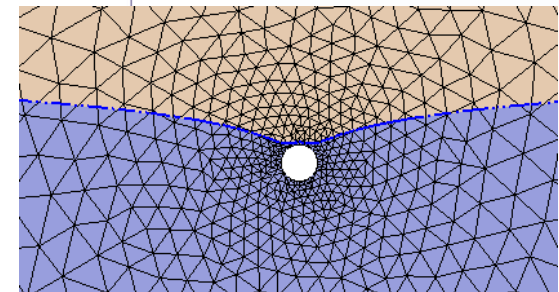
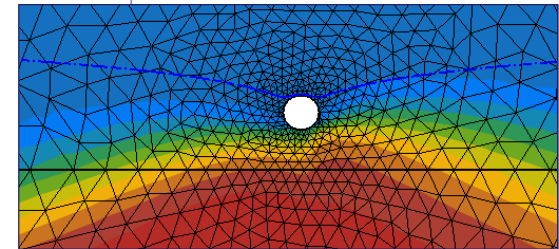
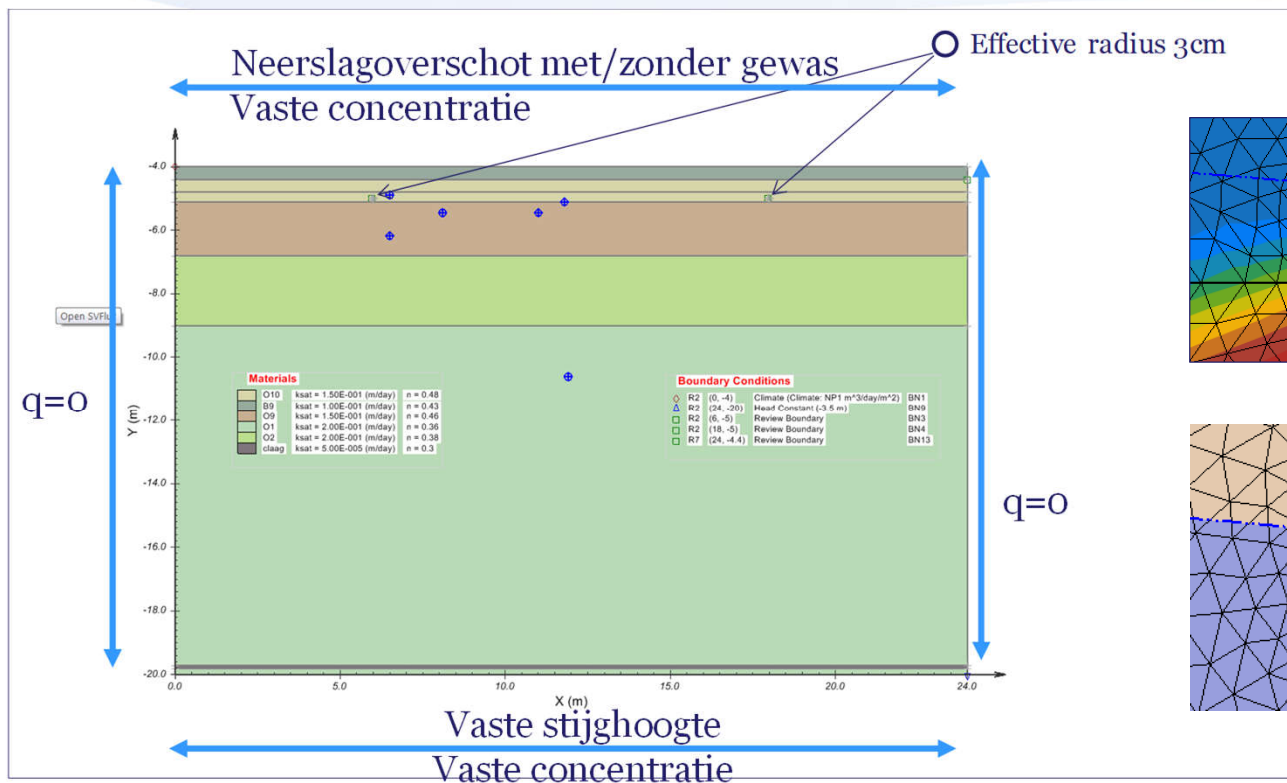
Modellering op perceelschaal (gedraineerd perceel Schermer)



- Voorbeeld zavelperceel in de Schermer
- Gedraineerd op ca. 10m drainafstand



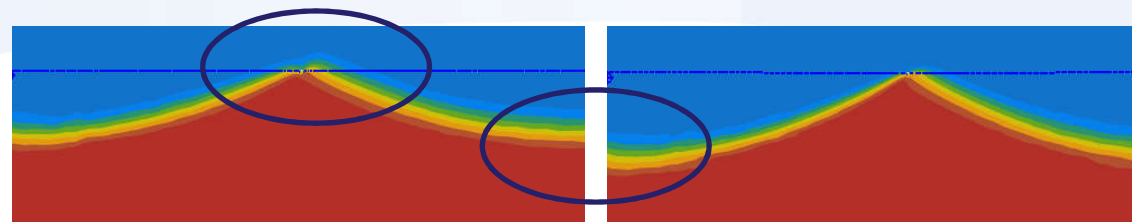
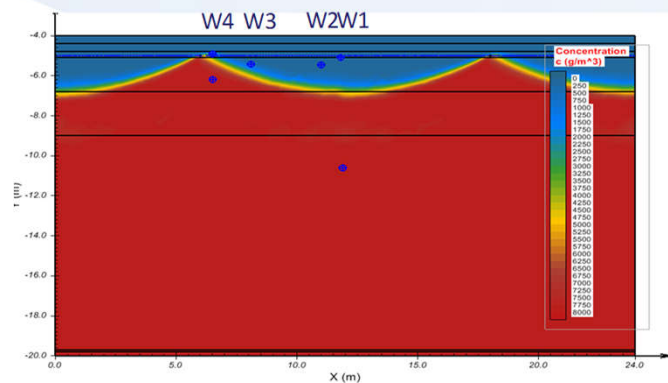
Schematisatie



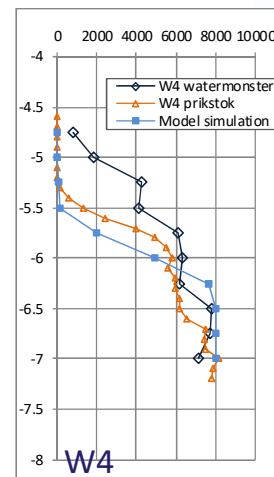
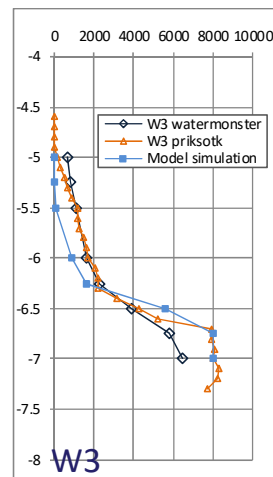
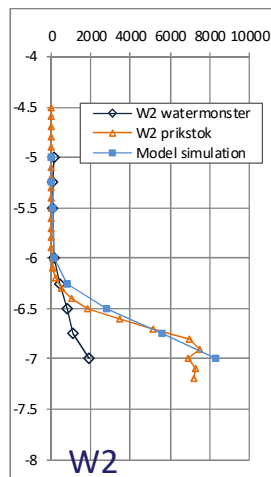
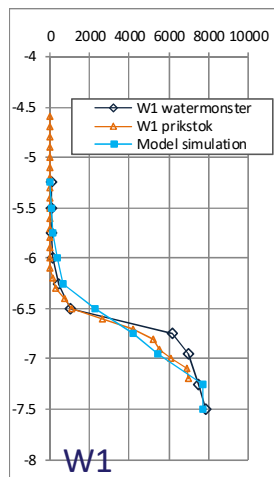
Simulatie neerlaglens



Optrekkend zout bij drain



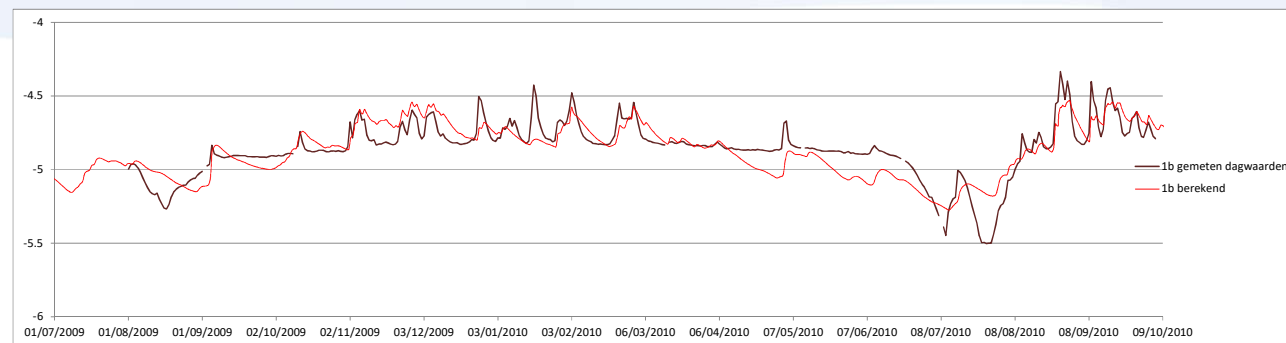
Fluctuatie grensvlak



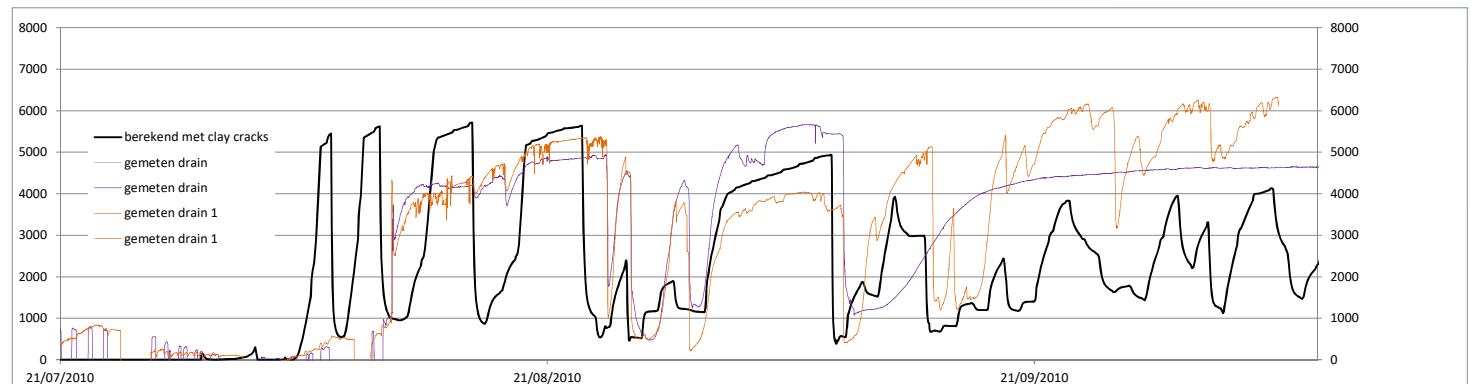
Grondwaterstand en draineffluent



- GWS



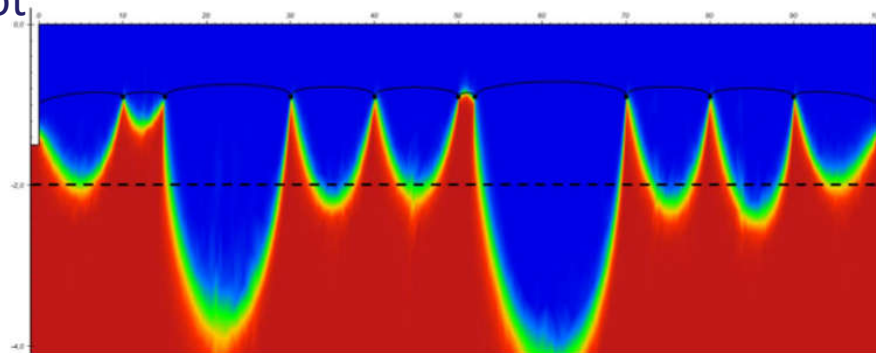
- Chloride
drain effluent



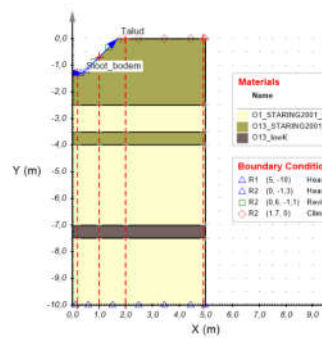
Invloed sloot beperkt



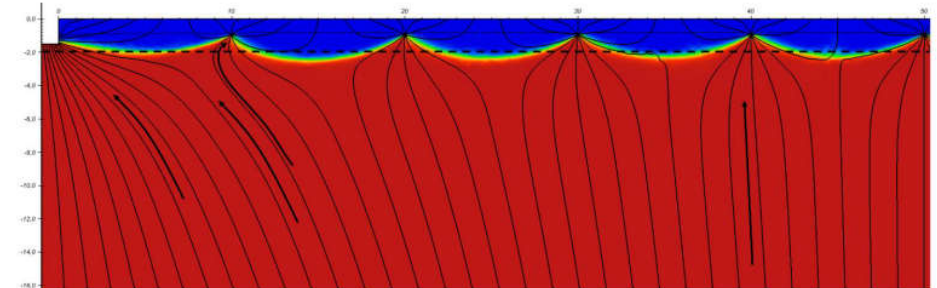
Sloot



Sloot



Sloot

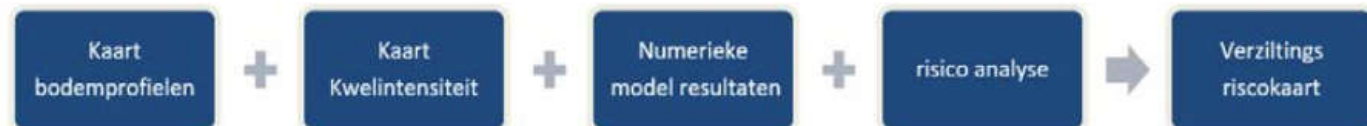
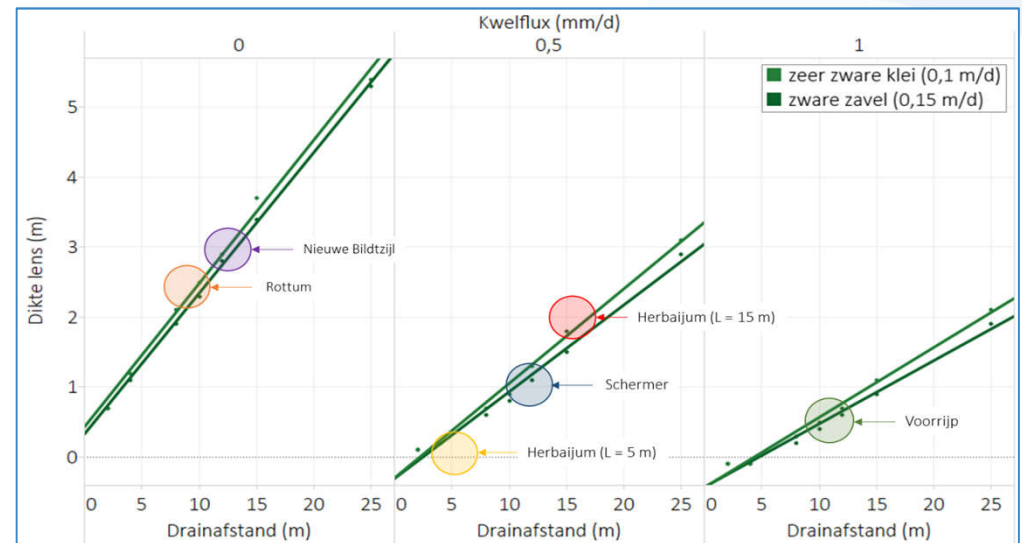
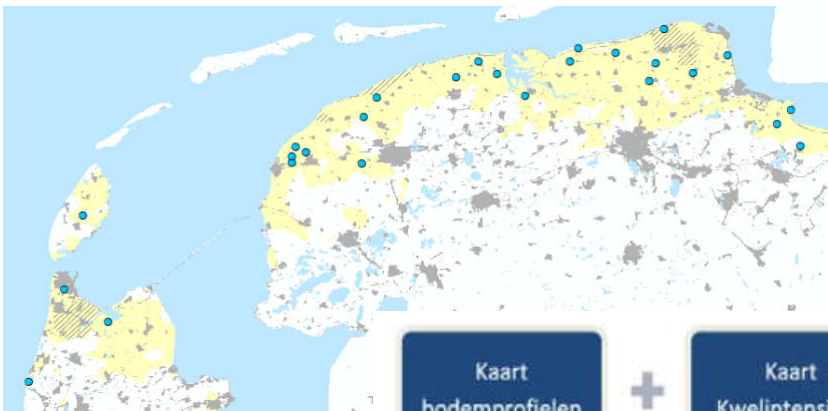


Figuur 8 – Figuur 3 inclusief stroombanen en een X:Y verhouding van 1:1.

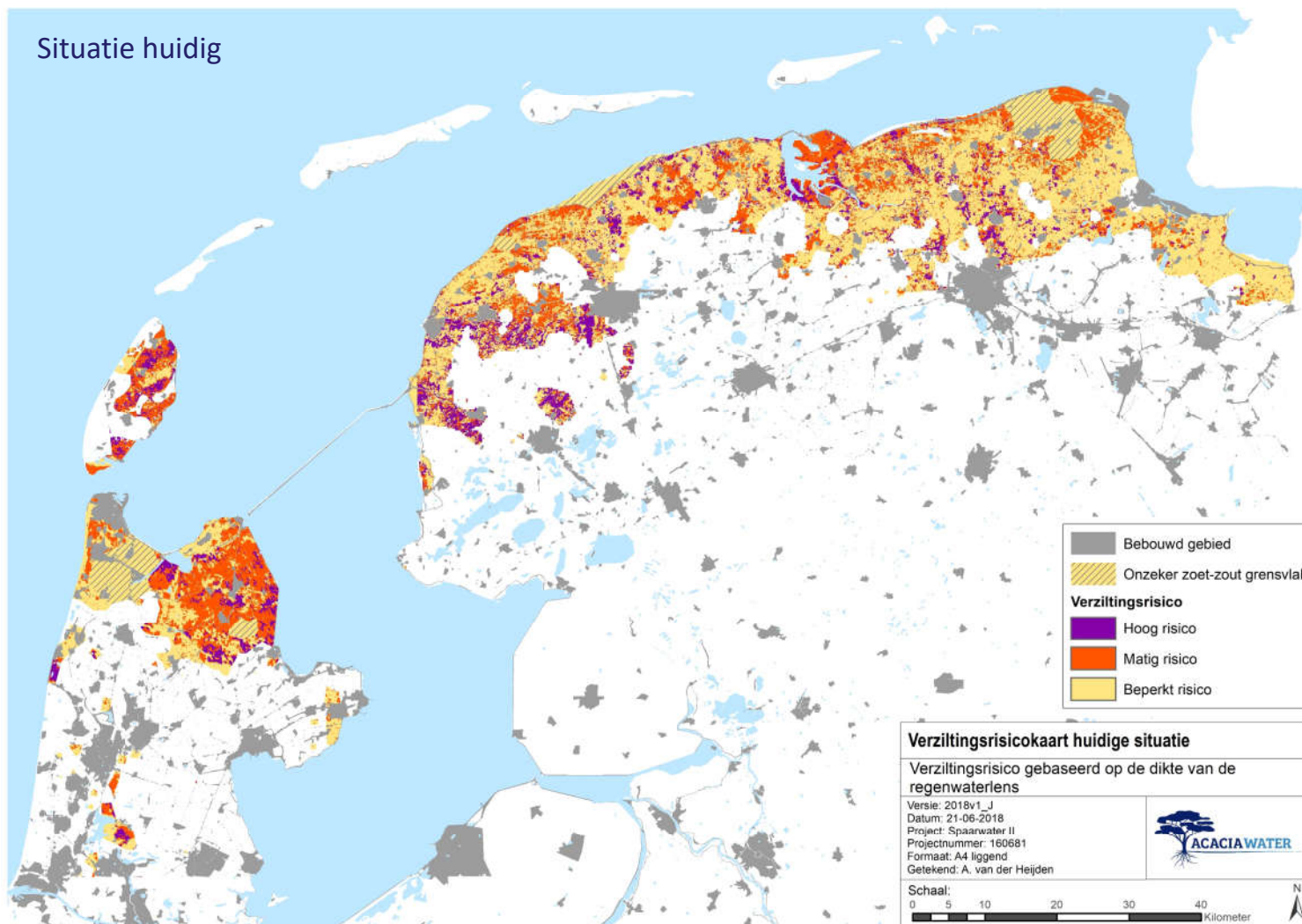
Van modellen naar risicokaart



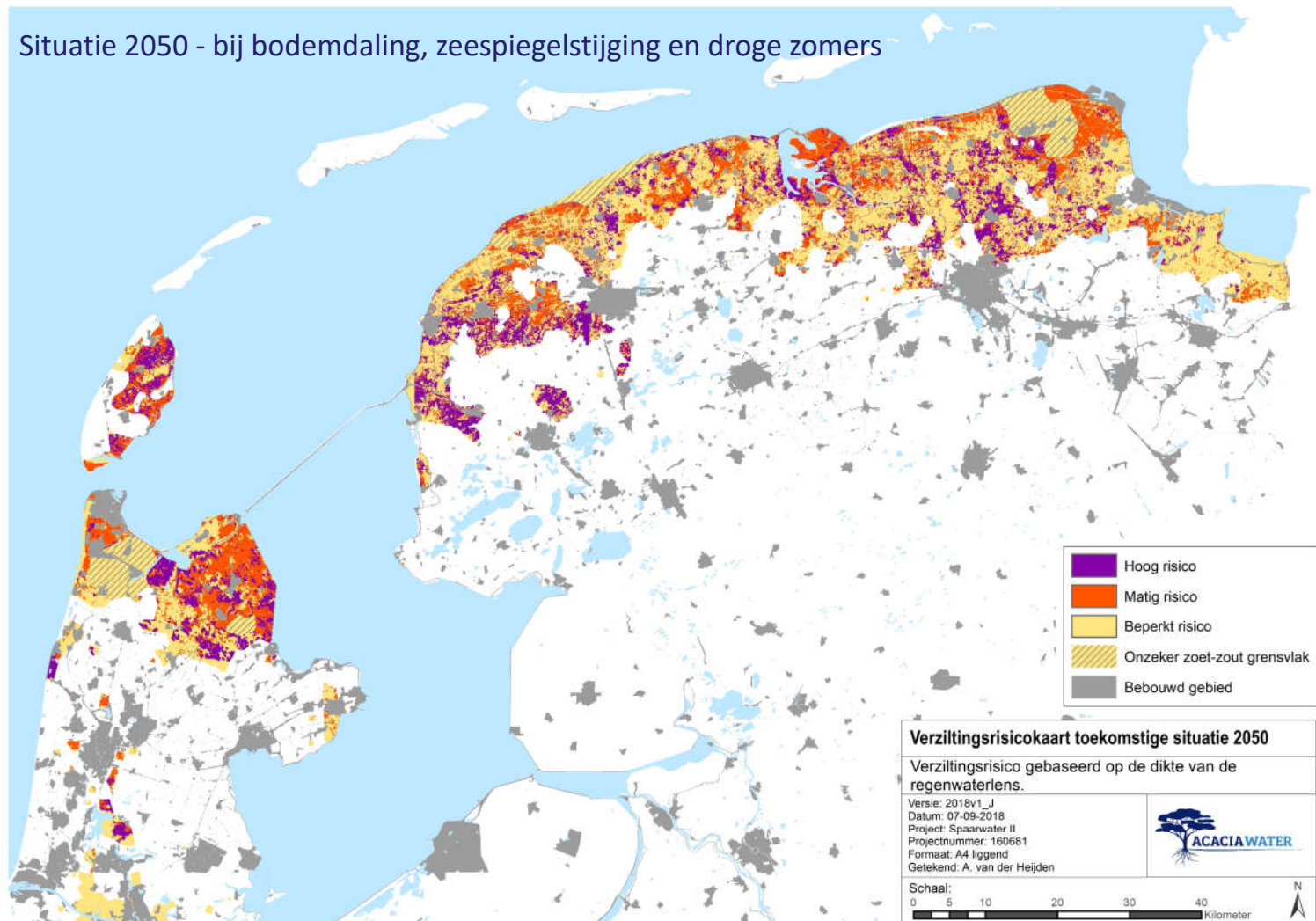
- kweldruk, drainafstand, draindiepte, bodemtype
- >200 perceelsmodellen



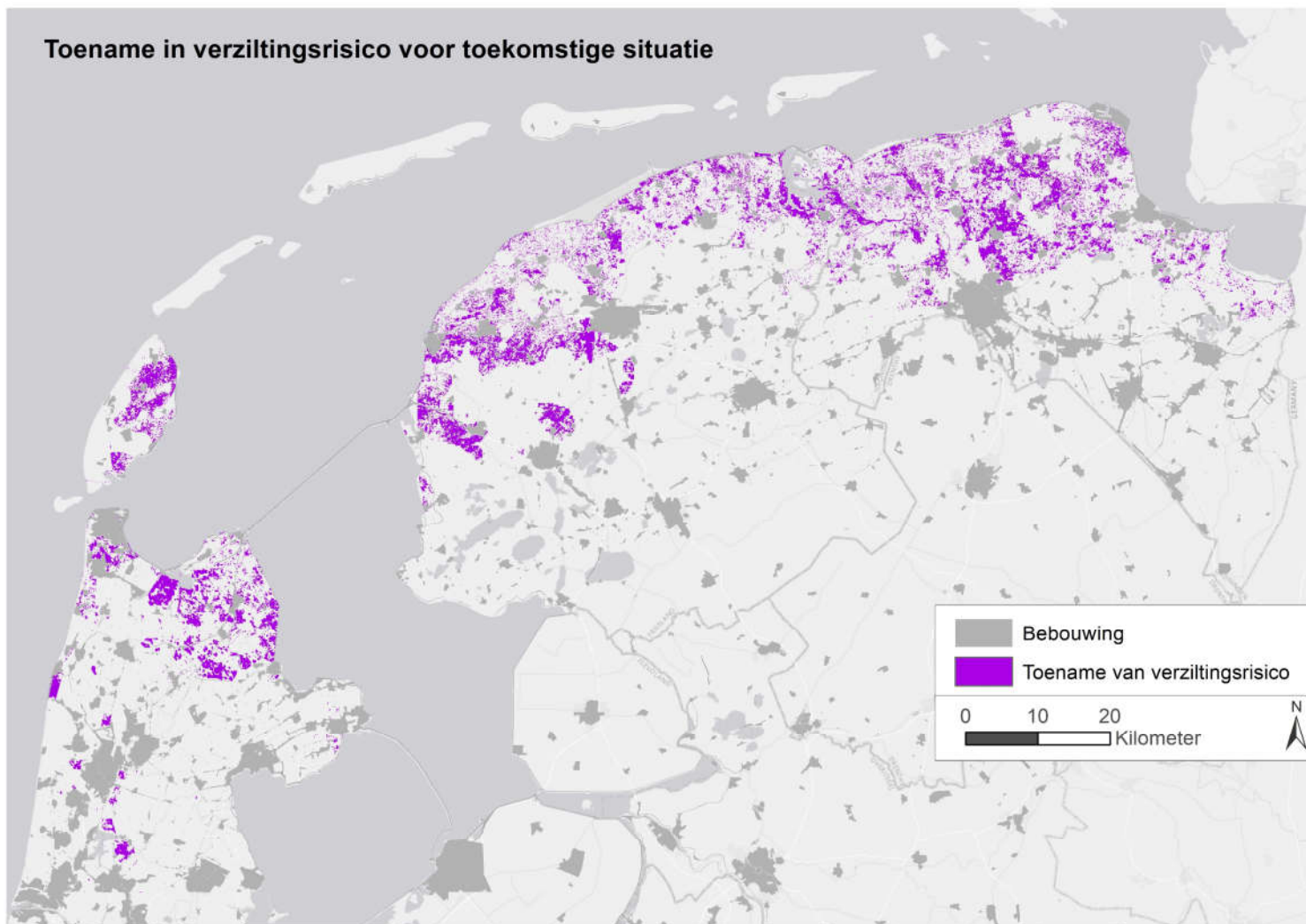
Situatie huidig



Situatie 2050 - bij bodemdaling, zeespiegelstijging en droge zomers



Toename in verziltingsrisico voor toekomstige situatie





Meer informatie o.a. www.spaarwater.com

Bedankt voor uw aandacht

van Hogendorpplein 4, 2805 BM Gouda

telefoon: 0182 - 686 424

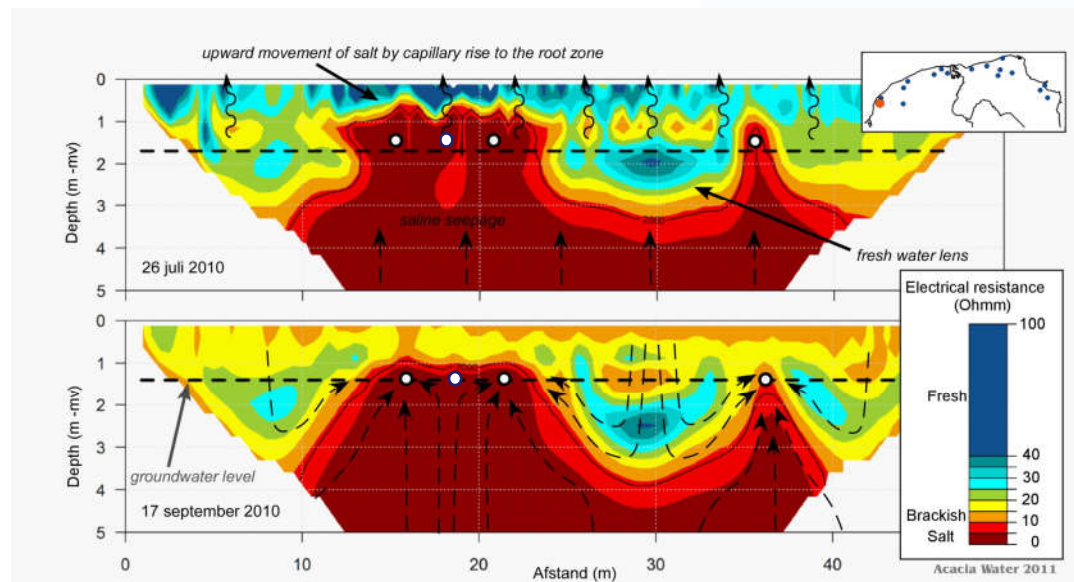
info@acaciawater.com | www.acaciawater.com

12 NOV 2019

Effect van drainageafstand



- Scherpe overgang zoet – zout
- Vertikale fluctuatie ca. 50cm
- Drainafstand bepalend



Example of bi-convex lens



- Diminishing lens and increased area of risk for salinisation

