



Fresh water supply and water quality in the Netherlands at national and regional scale

a Knowledge for Climate Programme

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Knooppunt Klimaat 01-12-2011

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Content

- Introduction: fresh water availability in the Netherlands
 - from groundwater
 - and surface water
- The Knowledge for Climate programme on Fresh Water Supply

this presentation: waterquality is salinity

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The 'low-lying' lands: Netherlands

The facts:

- a deltaic area with 3 rivers: Meuse, Scheldt & Rhine
- ~25% of land surface is lying below mean sea level
- ~65 % would be flooded regularly if there were no dunes and dikes
- ~8 million people would be endangered



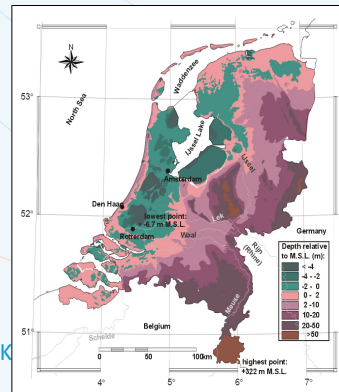
River flooding 1995



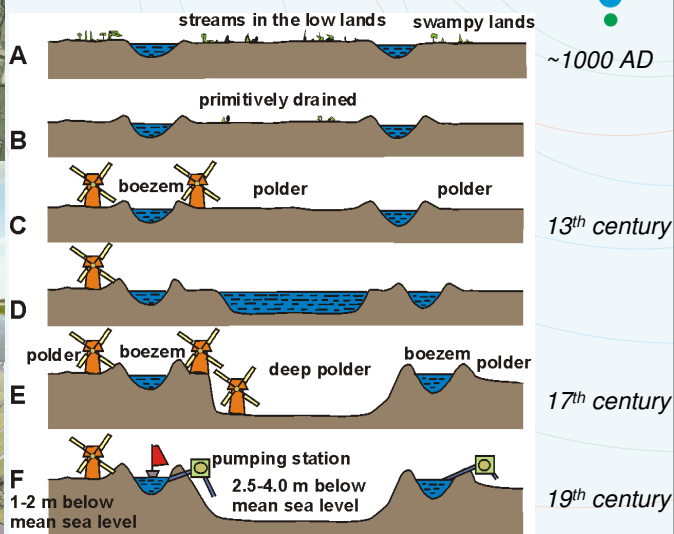
The Flooding of 1953



Kennis voor K



Development of the Dutch 'Polder' Landscape

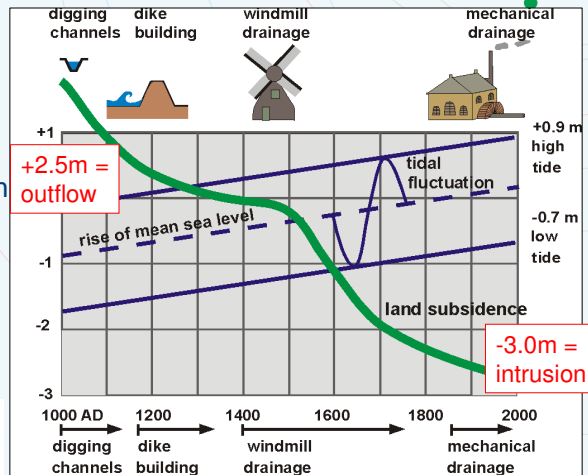
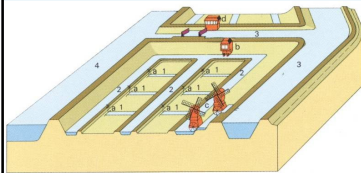


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From fresh water outflow to salt water inflow

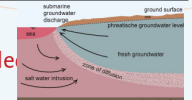
Historical subsidence of the ground surface in Holland

- Causes:
- Autonomous processes
- Land subsidence
- Abrupt land reclamation
- Climate change
- Sea level rise
- Change in net recharge



— Ground surface

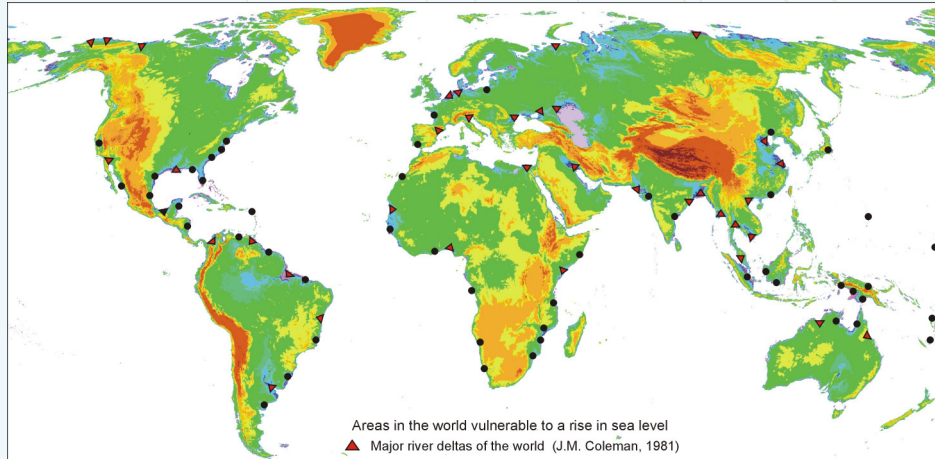
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- To get an idea about the possible future effects of
- SLR and climate change in your delta ...
- *evaluate of the past water management in the Dutch delta*

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Coastal groundwater vulnerable to sea level rise



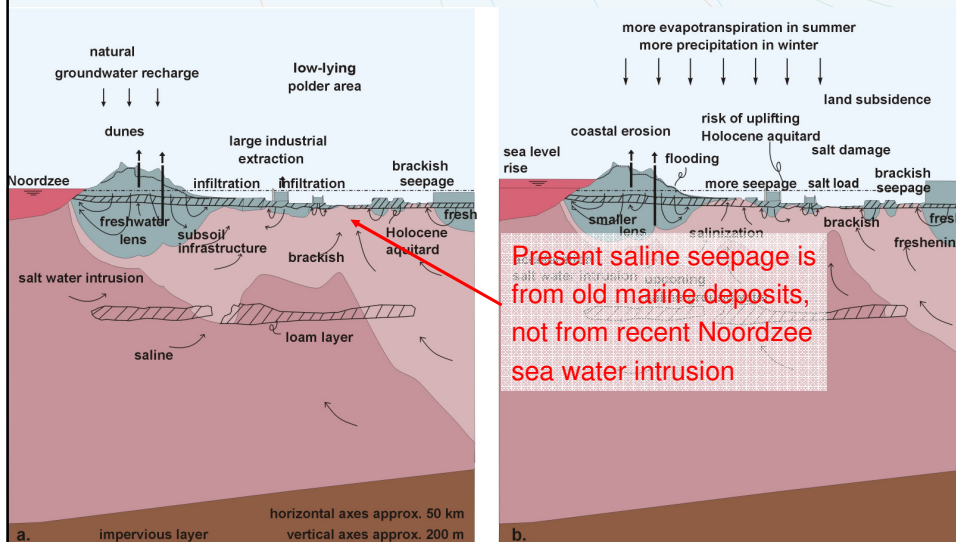
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A (Dutch) groundwater system

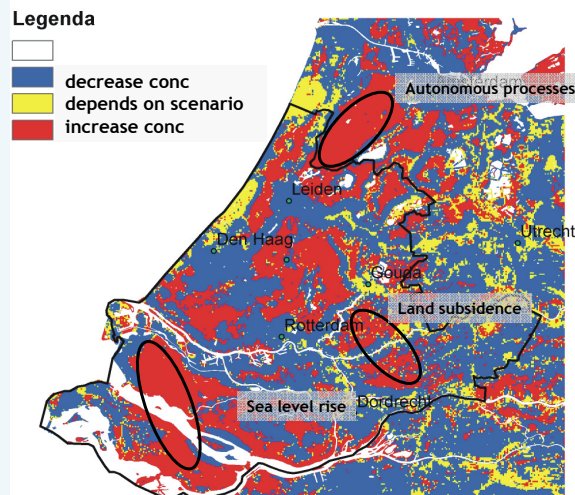


Present processes

Future changes



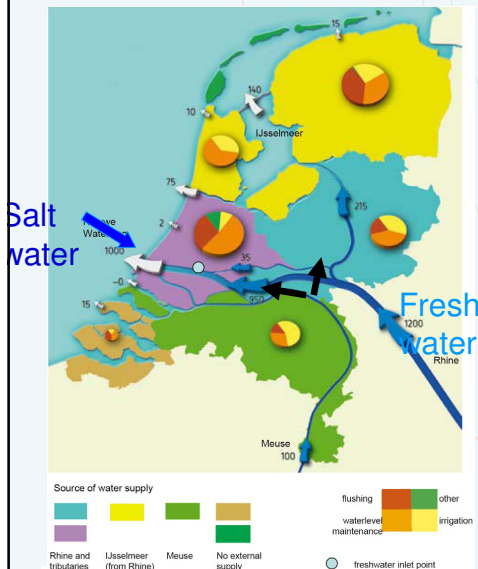
Estimated effect in 2075 on salinity



Increase or decrease concentration for all climate scenarios G, G+, W, W+

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Current fresh water strategy (surface water)



Distribution of river discharge (m³/s) over the main watersystem attribution to the regional systems in dry year (ca. 1:10 year).

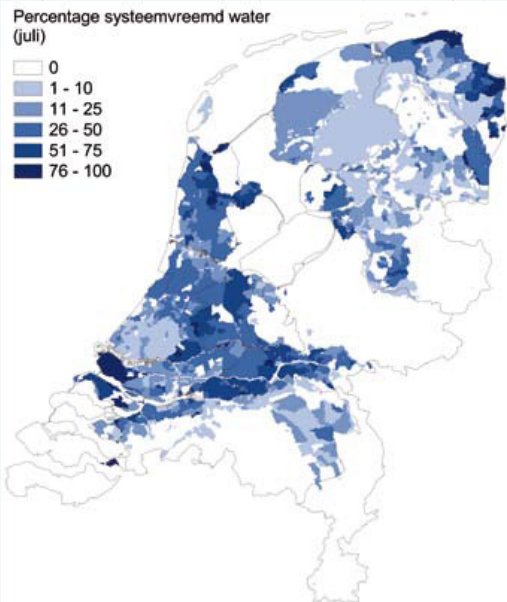
- Distribution network and wateragreements
- Priority categories in case of shortage
- LCW - Drought Early Warning System
- 70% of Rhine water at low flow used for flushing NWW

accessibility for ships and SALT



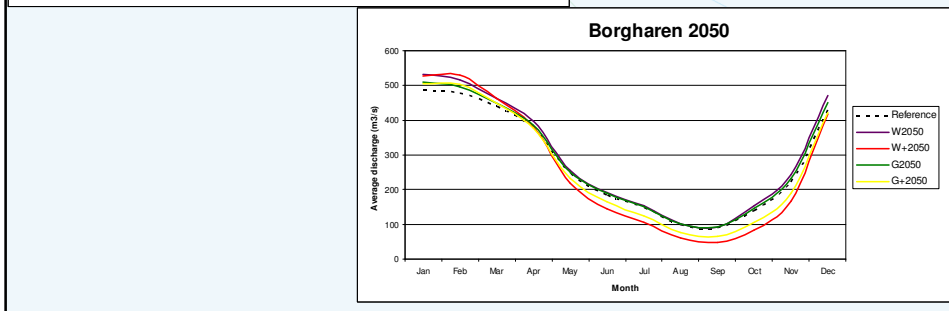
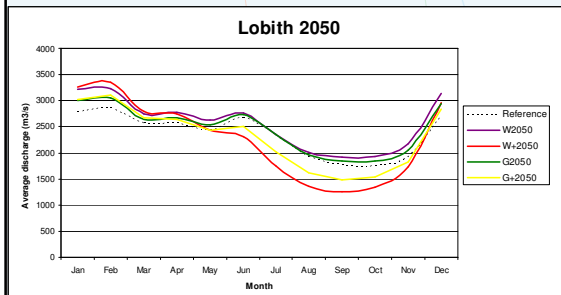
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Percentage water externally supplied (dry summer)

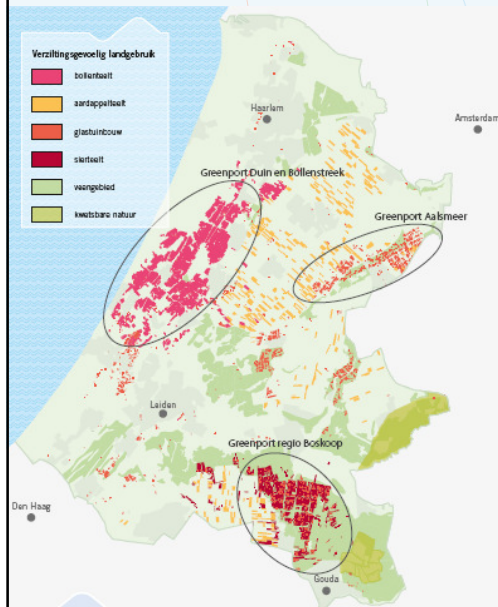


nowledge for Climate

Climate change -> possible decrease of river discharges



Future development of water use a.o. greenports



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Main research questions



- How may the boundary conditions for fresh water availability and demand change?
- What measures for adaptation are available and potentially succesful?
 - What can be achieved by watermanagement
 - What can be achieved by crop / nature management
 - what can be achieved by water technologyTo become regionally more self reliant
- What sort of uncertainty is encountered and how to design robust and flexible strategies
- Focus on low-lying areas in western part of the Netherlands
 - salt intrusions play a major role
- Mix of PhD (7), Post-doc and 'applied' research

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Cases - driving our research

Work Package 6: 3 Cases

- Case study 'Groene Ruggengraat' - climate proof water and land use in coastal meadows of the Netherlands
- Case study 'Haaglanden' – towards a more robust, self-sufficient fresh water supply of the Haaglanden region (focus on glasshouses-horticulture)
- Case study 'Zuidwestelijke Delta' – climate proof and sustainable water use in Dutch Delta area
- Research aims to contribute to long-term regional adaptation strategies
- With particular attention to stakeholder involvement

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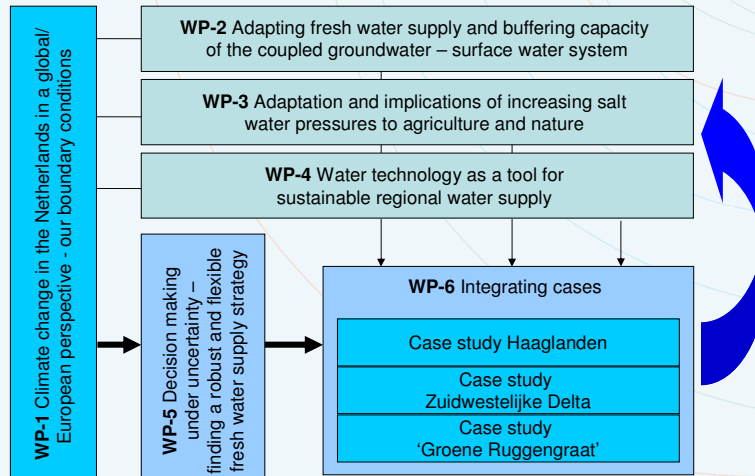
Stakeholders

- Hotspots Rotterdam, ZWD, Haaglanden incl. waterboards, provinces and municipalities
- Province South Holland
- Ministries V&W, LNV
- Project office Green Heart
- SBB, Natuurmonumenten
- (Z)LTO
- STOWA
- OASE, St. Donatius

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Work packages

Boundary conditions, Measures, Assessment and decision making, Cases



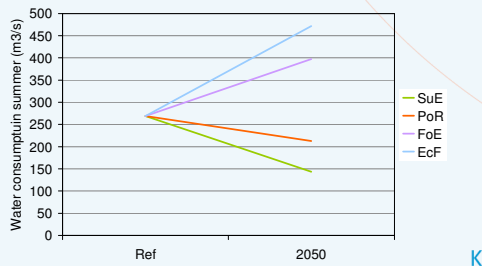
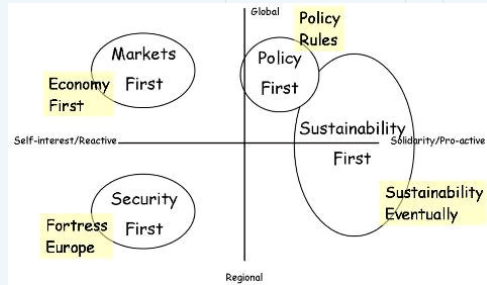
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Some examples form ongoing research

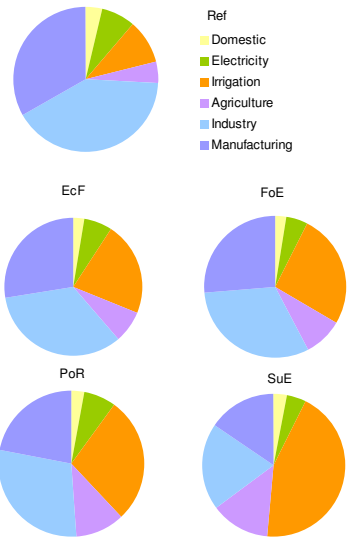


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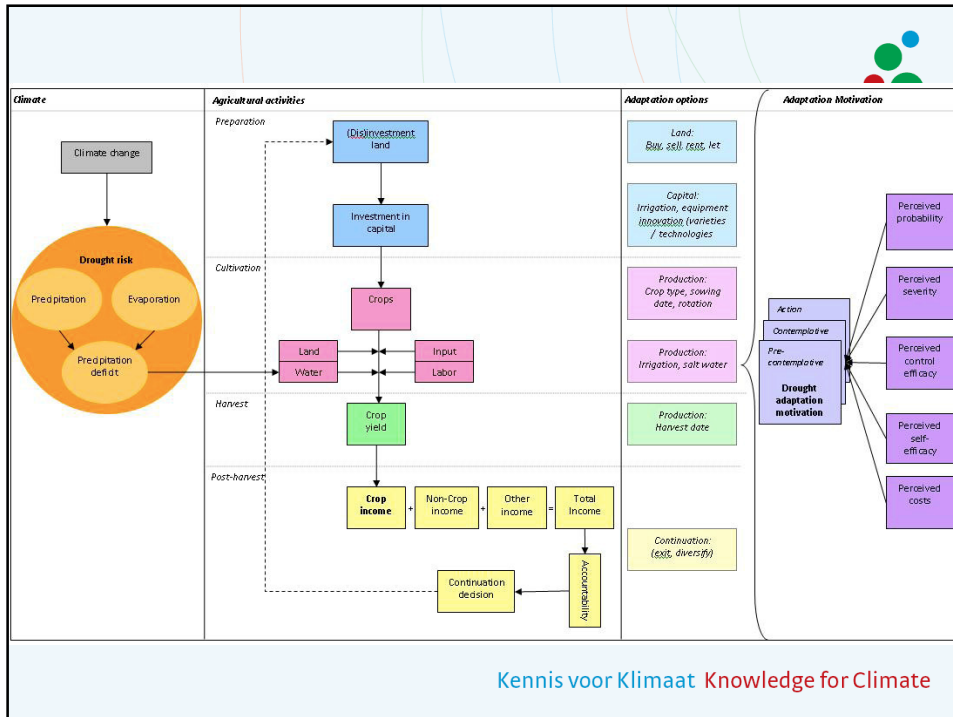
EU scenes – sociaaleconomische scenario's



Water consumption

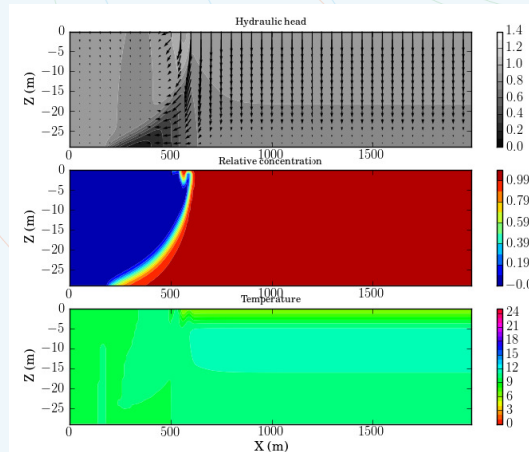
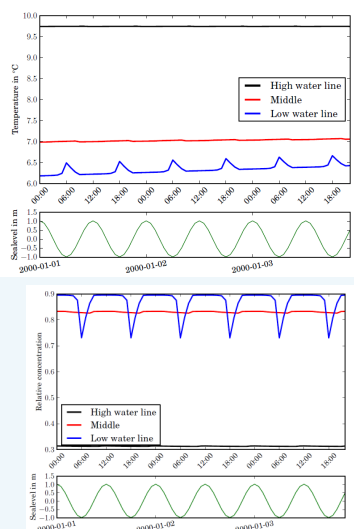


Kennis v



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Effecten kustsuppletie op grondwaterstroming strand en zoet – zout verdeling duinen (modellen)



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WP 3.2 Adaptation to dry and saline conditions by crop cultivation exploiting brackish water and saving fresh water

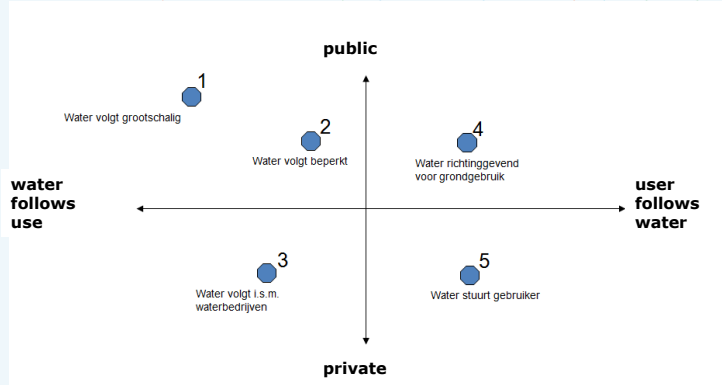


- Growth and physiological salt response of different crops
- Growth of *Salicornia spp.* in a seawater drop-irrigation system.
- Field experiment: cultivation of quinoa, barley, beet, alfalfa and lupine.
- **If we understand physiological responses in tolerant crops, we might be able to use this information for crop improvement**



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How do measures fit into national fresh water supply strategies?



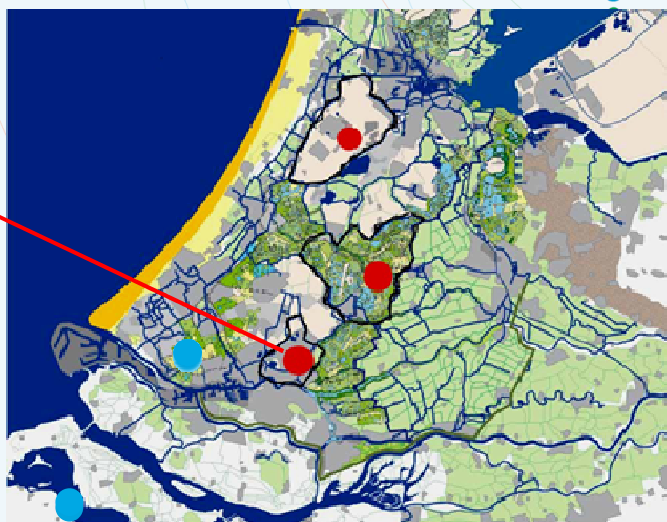
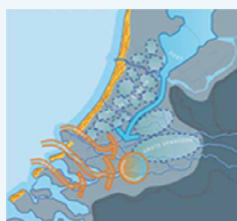
<p>Conditioneren van watersysteem op perceel</p> <p>Vergroting afstand of verhoging niveau van drainagemiddelen</p> <p>Afvangen brakke kwel door kwetschern met diepe drains</p> <p>Combinaties berging en drainage</p>	<p>Eigen watervoorzienig</p> <p>Opvang en recirculatie regenwater</p> <p>Ontzillen brak water</p> <p>Ontzillen brak water met MEMSTILL technologie</p> <p>Aanpassen agrarisch landgebruik</p> <p>Feelstelsystem zoete gewassen</p> <ul style="list-style-type: none"> - bodemstructuur - nutriëntenvoorziening - drip/sprinkler irrigatie <p>Gewasenschappen veranderen (veredeling, genetische modificatie en halofyten)</p> <p>Overstap op zoutminnende gewassen</p> <p>Overstap op zoutminnende aquacultuur</p> <p>Interne watervoorziening door seizoensberging</p> <p>Kreekruggen / strandwallen</p> <p>Diepe aquifers door zoet water projectie</p>	<p>Waterlevering</p> <p>Reprijsing waterlevering</p> <p>Externe wateraanvoer</p> <p>Aanvoerende en afvoer via de watergangen</p> <p>Interne watervoorziening door berging</p> <p>Kreekruggen / strandwallen</p> <p>Diepe aquifers door zoet water projectie</p> <p>Verzekeringen / Fondsvorming</p>	<p>Normering en watervoorziening differentiëren in ruimte en tijd</p> <p>Ruimtegebruik sturen</p> <p>Verplaatsen verziltinggevoelige teelt</p> <p>Stedelijke ontwikkeling</p> <p>Ontwikkelen van natuur</p> <p>Brak watervoorziening zilte bochten mogelijk maken</p> <p>Herziening natuurdoeltypen</p> <p>Sturen brakke stromen</p> <p>Compartmenteren brakke kwelgebieden</p> <p>Zonering op basis van beschikbaarheid zoet water</p> <p>Concentreren brakke kwel door doorpraken/ verdiepen slootbodems</p> <p>Concentreren van kwel langs de randen van diepe polders</p> <p>Dubbel slootpeil</p>	<p>Externe wateraanvoer</p> <p>Polder water hergebruik / hercirculatie</p> <p>Gescheiden aan en afvoer via watergangen</p> <p>Interne watervoorziening door berging</p> <p>Seizoensberging in open waterreservoirs</p> <ul style="list-style-type: none"> - bassin (seizoensberging) - natuurgebied gebruiken als opslag - aanleg tussenboezems <p>Zoetwaterlenzen op percelen door verlageng van slootpeilen</p> <p>Tegengaan brakke grondwaterkwel</p> <p>Peilverhoging in watergangen / polder</p> <p>Waterwinning in het watervoerend pakket onder de Holocene deklaag</p> <p>Dichten van wellen</p> <p>Waterlevering</p> <p>Waterakkoorden en waterovereenkomsten externe aanvoer</p>
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De Casestudies binnen Groene Ruggengraat



(Focus deze ppt)



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Wat betekenen scenario's voor inlaat?

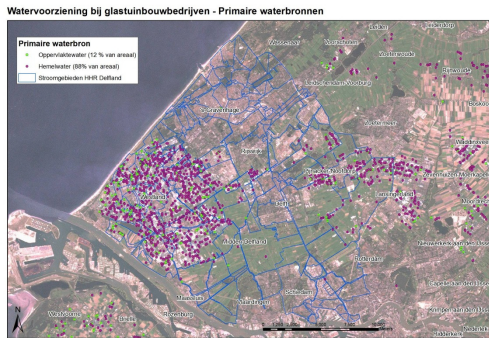


Tabel 5.2.: Het inlaatregime onder de verschillende scenario's voor het Schilthuis gemaal, de Snelle Sluis en de KWA route (Bergsluis).

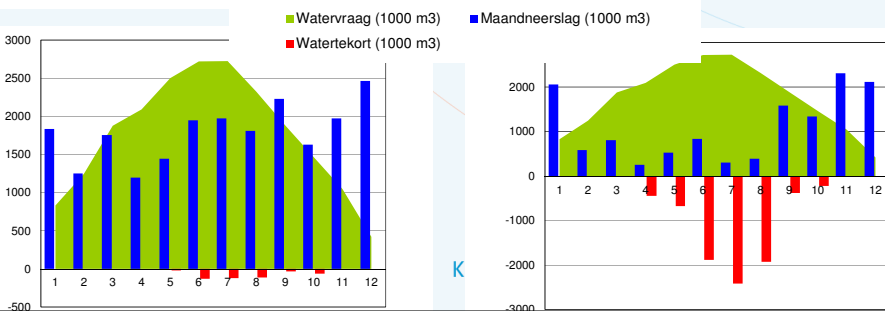
		G 200	G 600	W+ 200	W+ 600
Schilthuis (Nieuwe maan)	Aan	1 jan – 11 juli	1 jan – 24 juli	1 jan - 23 jun	1 jan -27 jun
	Uit	12 jul – 31 dec	24 juli – 31 dec	13 jun – 31 dec	27 jun -31 dec
Bergsluis (KWA)	Aan	16 aug – 19 okt	Nooit	20 jul – 29 nov	14 aug - 7 nov
	Uit	1 jan – 16 aug 20 okt – 31 dec	Nooit	1 jan – 19 jul 30 nov – 31 dec	1 jan – 13 aug 8 nov – 31 dec
Snelle Sluis (Hollandse Zee)	Aan	1 jan – 16 aug 20 okt – 31 dec	1 jan – 31 dec	1 jan – 19 jul 30 nov – 31 dec	1 jan – 13 aug
	Uit	16 aug – 19 okt	Nooit	20 jul – 29 nov	14 aug – 7 nov

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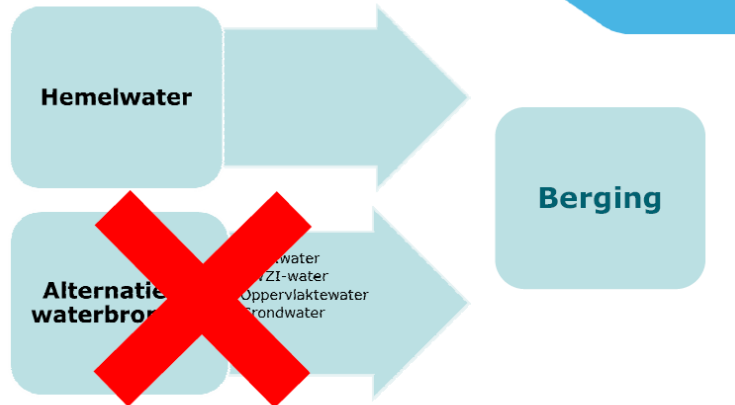
Watervraag glastuinbouw



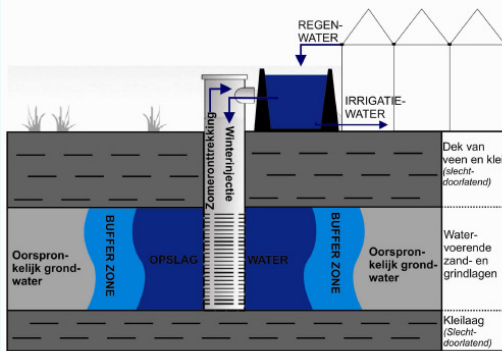
1601 bedrijven
3225 ha
Water nodig: 28 Mm³



1. Intro: Duurzame alternatieven voor ontziltig?



2. Het hoofd onder het maaiveld: de tuinder de diepte in (II)



Verschil:
kortdurende opslag
 (vervanging bassin)

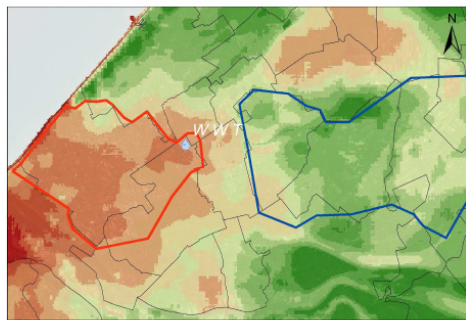
en
langdurige opslag
 (uitbreiding bassin)

Zelfvoorzienend??

3. Het hoofd boven het maaiveld (I)

Kansenkaart op basis van REGIS II.1

Legend
 Westland
 Eastland



0 3 6 12
 Kilometers



Consortiumpartners



UNIVERSITY OF TWENTE.



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Thanks for your attention

For further information:

- on the fresh water supply programme:

<http://knowledgeforclimate.climate-research-netherlands.nl/climateproof-fresh-water-supply>

- on Deltares and Delta research: USB stick

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