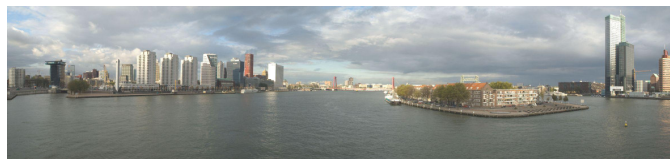


Delta programma Rijnmond- Drechtsteden: towards adaptive water management and spatial planning

To prepare for different scenarios of climate change

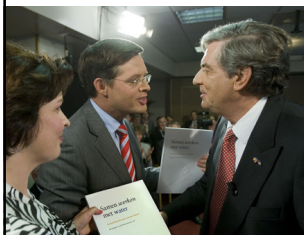
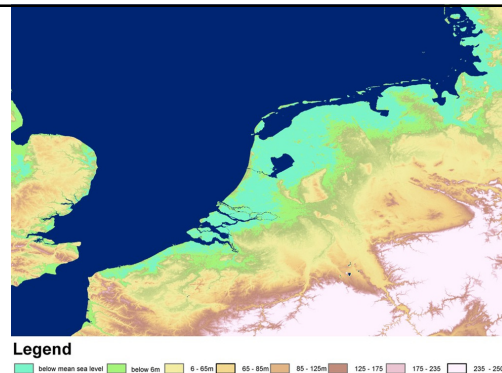
Jaap Graveland
Deltaprogramma Rijnmond-Drechtsteden



The Netherlands are vulnerable

Delta commission:

- Delta program
- Delta Fund
- Delta commissioner
- Delta Act
- Recommendations about measures



Adapting before
disaster strikes

Political decisions
in 2014



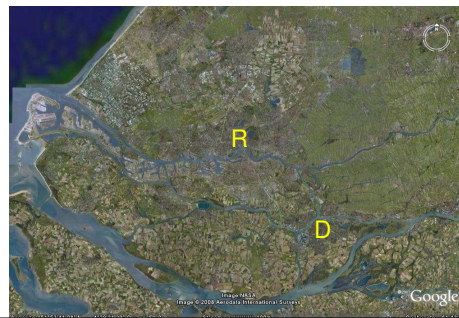
Rijnmond-Drechtsteden

One of six regional programs

Commissioned by depts. of Water Mgmt,
Spatial Planning

Team with participants from Rotterdam,
Dordrecht, Water Board, Province, Port of
Rotterdam, depts. of Water Mgmt, Spatial
Planning

Regional Steering Committee



Characteristics

Densely populated

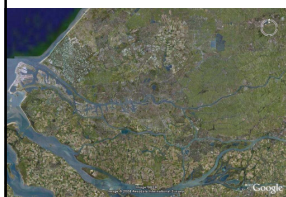
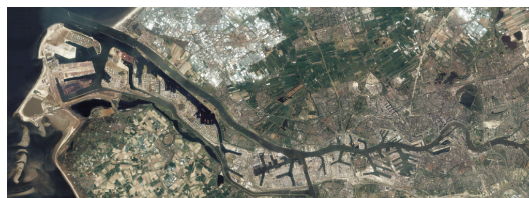
Economy, harbour

Large unembanked areas in cities

Low-lying rural areas (subsiding)

River and sea

Storm surge barriers



Our study

Problem analysis of water/climate

Identify regional spatial-economic ambitions – scenario study

Specify resulting challenge: water solutions supporting regional ambitions

Explore possible solutions

first generation

second generation

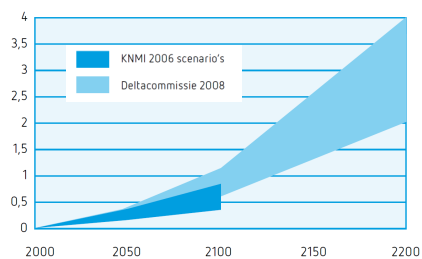
Deliver decision-information

Advice Steering Committee (2013)



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Specification of the problem: regional consequences of climate change



Climate-scenario	Rhine discharge Lobith [m ³ /s]	Sea level rise relative to 2006 [m]	Storm duration [hr]
Present	16.000	–	29
KNMI'06 G ⁺	18.000	0,60	35
Delta comm scenario	18.000	1,30	35

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Water levels

Location	MHW [m+NAP] (TMR2006)	Increase relative to present climate [m]	
		KNMI G ⁺	Delta commission
		Sea level +0,60 m	Sea level +1,30 m
		Q _{rijn} : 18.000 m ³ /s	Q _{rijn} : 18.000 m ³ /s
Rotterdam	3,6	0,5	1,2
Dordrecht	2,9	0,4	0,9
Moerdijk	2,7	0,5	1,0
Hellevoetsluis	2,6	0,4	1,1
Dalem	6,0	0,7	0,8

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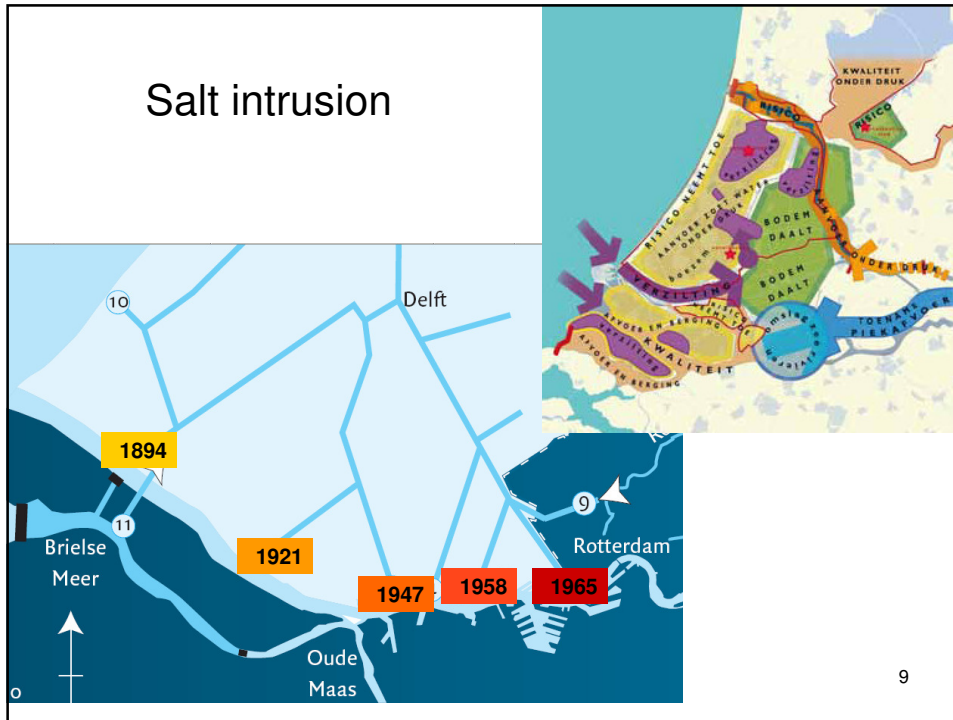
and Maeslant storm surge barrier



Climate scenario	Closing frequency [per yr]
Present	1x per 12 yrs
KNMI'06 G ⁺	1x per yr
Delta commission scenario	30x per yr

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Salt intrusion



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Five economic and spatial ambitions

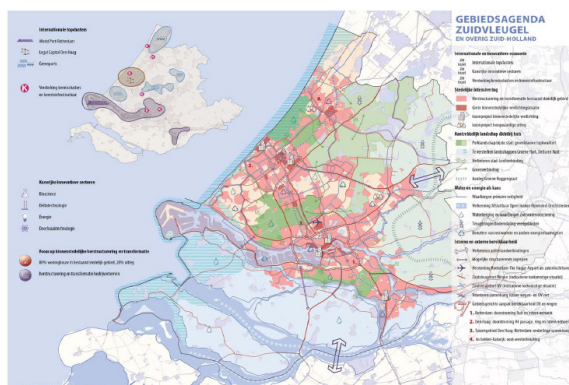
Urbanization (Rotterdam 60.000, including 10.000 in unembanked areas)

Innovative economy (e.g. harbour, greenports)

Improvement of mobility

Connecting cities with rural areas

Energy and durability



The challenge: identify and exploit chances

Find solutions for safety and fresh water

That also support economic/spatial ambitions

Examples:

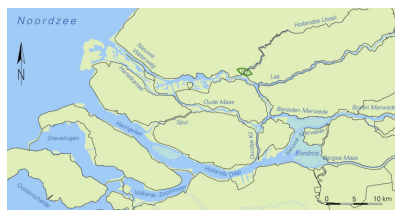
temporary water storage basins

Delta dikes

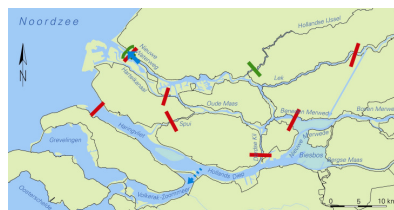


Four extreme 'first generation' solutions

Open



Closed



Open/closed sea



Open/closed sea and river



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Criteria for evaluation of solutions

Effectiveness in solving the water problem

Contribution to realisation of economic and spatial ambitions

Negative effects on 'functions' (agriculture, nature, ...)

Effects on other regions

Costs



Dilemma: uncertainties but...

Uncertainties:

Climate

Economy, population

Cultural values

=>

Postpone decisions about
(costly) water measures



...making decisions about water is urgent

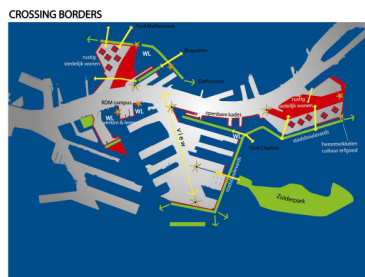


Present situation in unembanked areas

Urban development, planned dike reinforcement programmes

Required preparation time

Decisiveness attracts investors



Unknown territory

Combined strategy of measures:

Robust (e.g. space reservations)

Flexible (e.g. 'soft' dike reinforcements, pumps, parachute barrier)

Postpone (e.g. dams)

Adaptation pathways for water

From one solution to another, depending on climate, economy, values: if..., then..., else...

Examples:

Open/closed seaside ?=> Open/closed seaside and riverside ?=>

Closed

Open/closed seaside ?=> open (requires space reserv.)

Looks okay, but ...
remaining uncertainty for developers

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Adaptation pathways for spatial planning: coping with (remaining) uncertainties

Vital functions and inflexible functions: assume worst case scenario (climate, water measures) => robust (high dikes, high ground levels, floating constructions)



Less vital or more flexible functions: assume moderate scenario (climate, water measures), and and change construction or use if necessary

Other pathways?





Questions, suggestions?

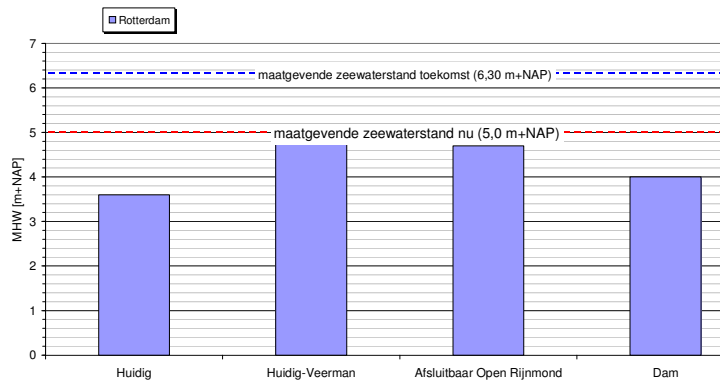
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Alternatieven Helemaal dicht of helemaal open



Voorbeeld van dilemma: effect faalkans kering



Voor Dordrecht: afsluitbaar open meer effect, berging ZW Delta meer effect

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Afsluitbaar open

- Weinig effect zoetwatervoorziening
- Voor dijken Rotterdam is faalkans doorslaggevend
- Dordrecht meer effectief
- Ook buitendijks meer effect bij Dordrecht



Blauw gebied: geen/gering effect afsluitbaar/open, verkleinen faalkans Maeslantkering biedt kansen.

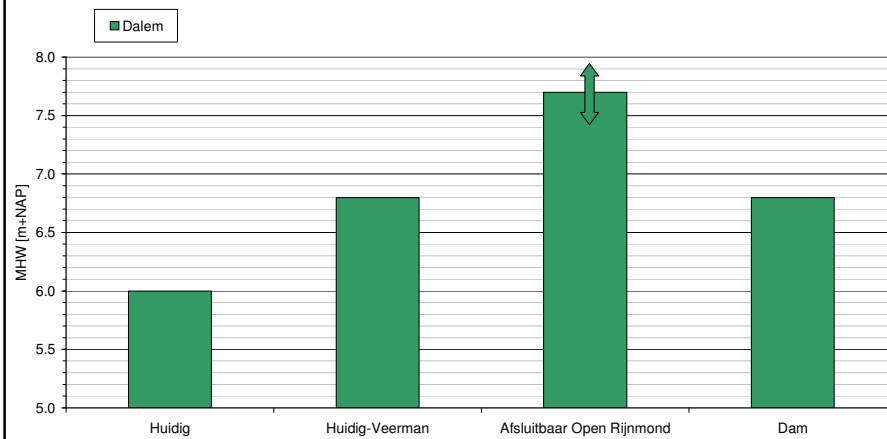
Licht groen: (gering) positief effect, verkleinen faalkans Maeslantkering vergroot positieve werking.

Donker groen: duidelijk positief effect.

Rood: negatief effect. Afsluitbaar open kan hier tot hogere waterstanden leiden. (bron: Rene Plek, Provincie ZH)

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Extra: samenhang/afwenteling



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