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Enabling Delta Life

Practical solutions for adaptation in land use planning, water and coastal zones

How to make better informed anticipatory decisions

Ad Jeuken

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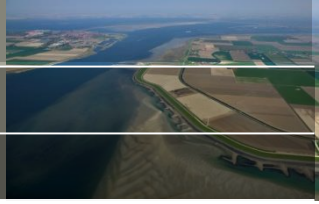
World Bank, Washington, May 11, 2015

Aim today



Identify major gaps and challenges for adaptation due to existing regulatory, land-use planning, financial and market incentives; and options that you have devised to overcome these challenges.

IEG identifies already some of these major challenges

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Some best practices from Deltares' experience

- Use of an adaptive planning approach stimulating robust and flexible solutions
- Connect long term options to short term decisions.
- Objective driven analysis considering multiple options in reaching it (decrease water shortage vs. build a dam)
- Use of learning-, decision- and design tools to engage with stakeholders
- Flexibility in approaches from heavy data and model dependent to using expert knowledge

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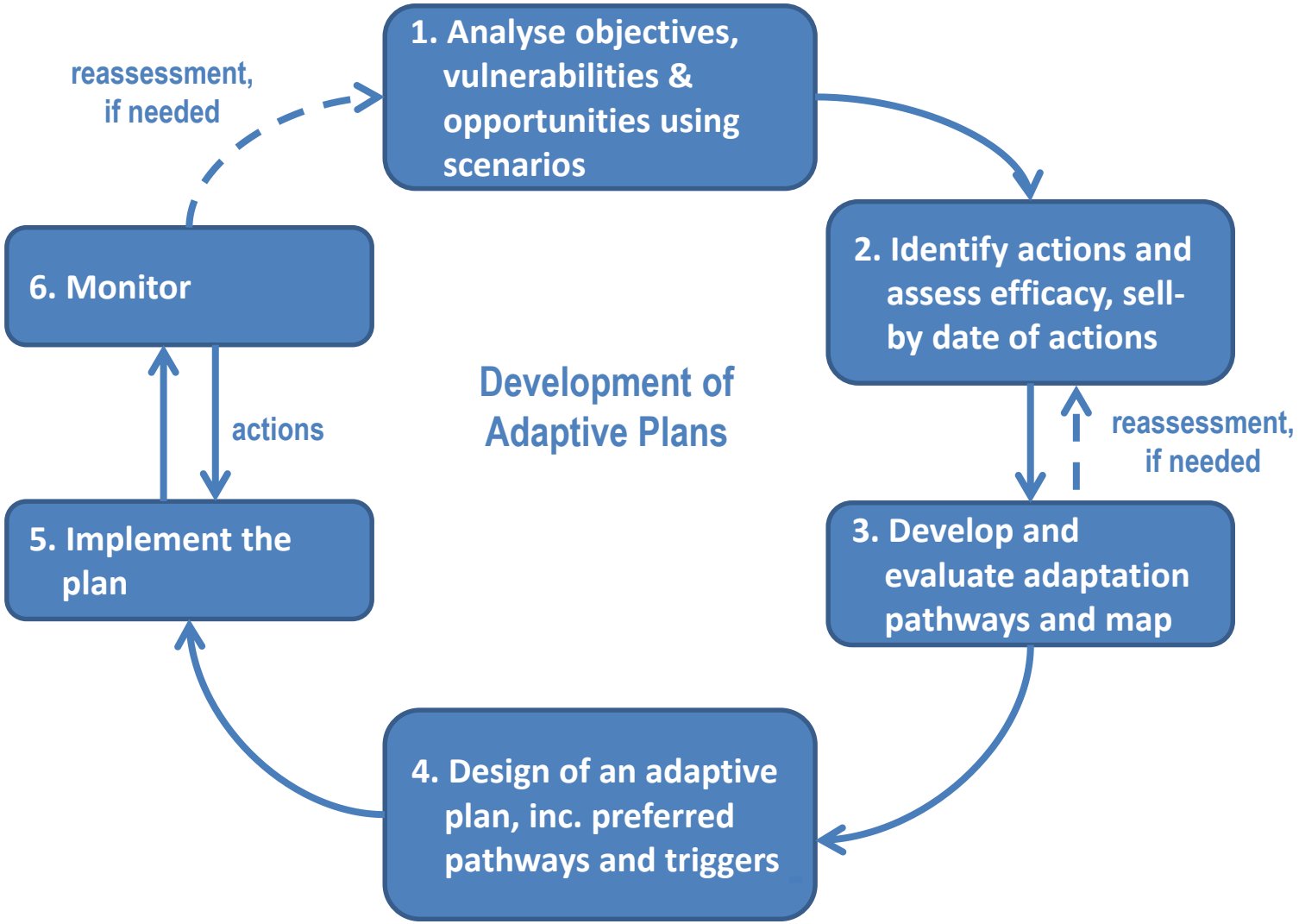
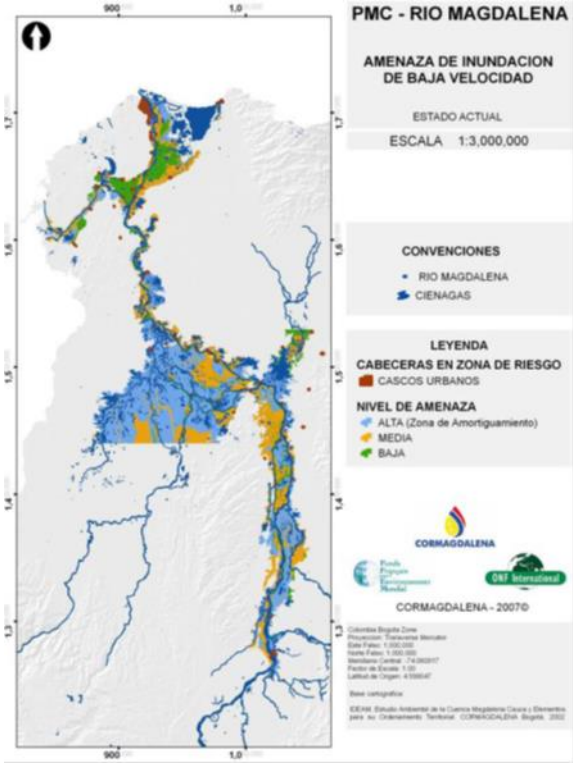
Content of presentation: tools and examples Following adaptive planning approach (DAPP)



Haasnoot et al. (2013) Glob. Env. Change. 10.1016/j.gloenvcha.2012.12.006

1. Objectives, vulnerabilties, scenarios

- Setting the scope, priorities, main obejctives
- What are key vulnerabilities of your ‘system’: sectors, critical infra structure, assets, management
- By what key external uncertain developments is this vulnerability influenced the most
- When will this lead to a need to take action?



TOOLS: Risk/Vulnerability maps, scenarios, adaptation tipping points

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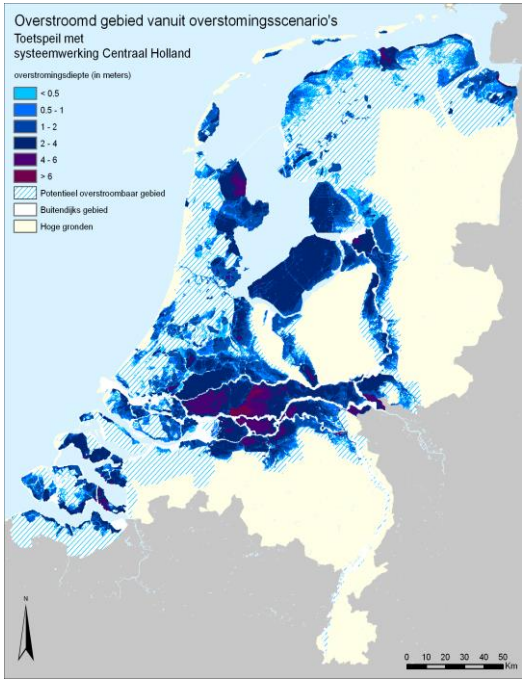
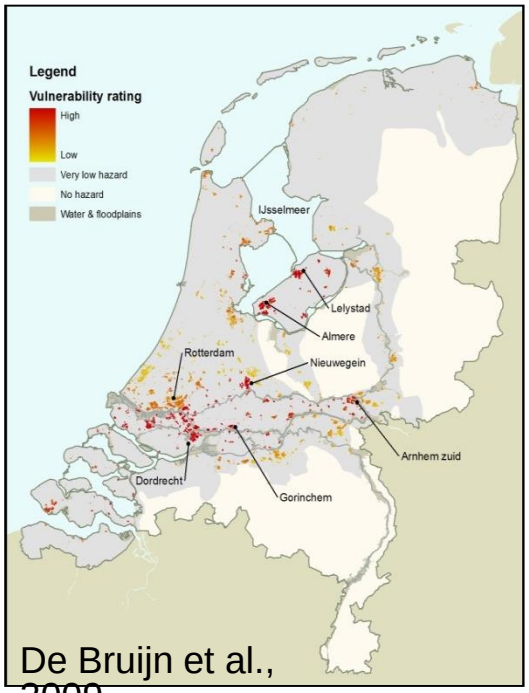
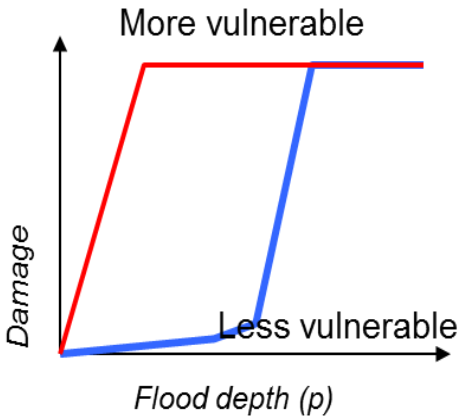
Spatial distribution of vulnerabilitues

Hazard X **Adverse consequences**





De Bruijn et al., 2009



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Flood hazard visualization

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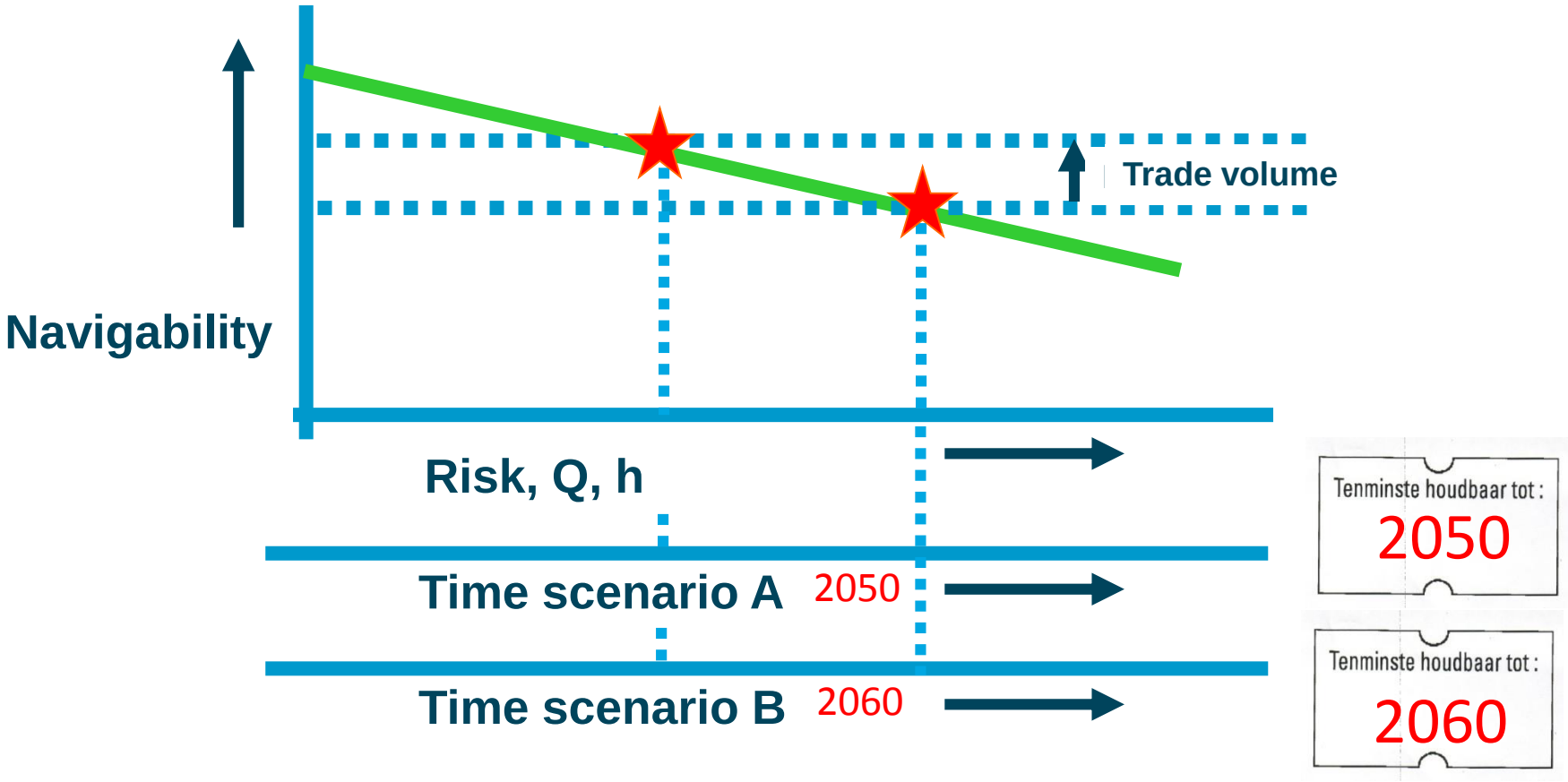
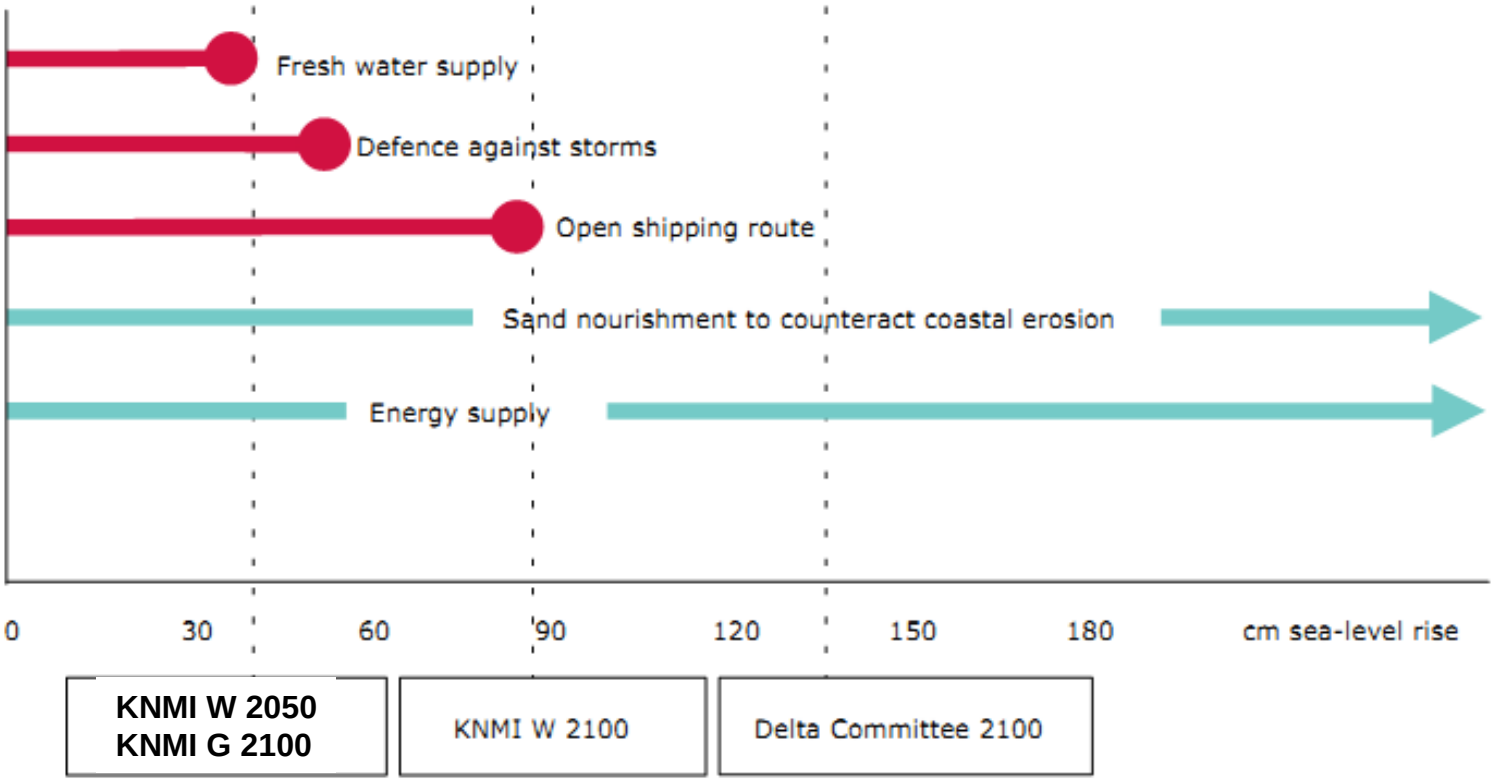
Adaptation Tipping Point & Use by date of policy action

A stress test: How much (climate) change can we cope with?
When do start to achieve missing our objectives?



Kwadijk, J.C.J. et al 2010 WIRES Climate Change DOI: 10.1002/wcc.64, Haasnoot et al 2012 Climatic Change

Example ATP, Rhine Meuse Estuary



Note: Red bullets indicate endpoints of a strategy, blue arrows indicate the strategy can cope with higher sea levels. The climate scenarios used in the Netherlands are marked with dotted lines.

Source: Jeuken et al., 2010.

EEA, 2013

2,3 define and assess options for adaptation

- Explore options for adaptation (spatial, structural, instrumental or public versus private, grey versus green)
- Do they reflect different societal perspectives?
- What is the efficiency of the individual options
- Do they include or exclude eachother
- (economic) evaluation of pathways

TOOLS: adaptation pathways, economic evaluation methods, delta ateliers

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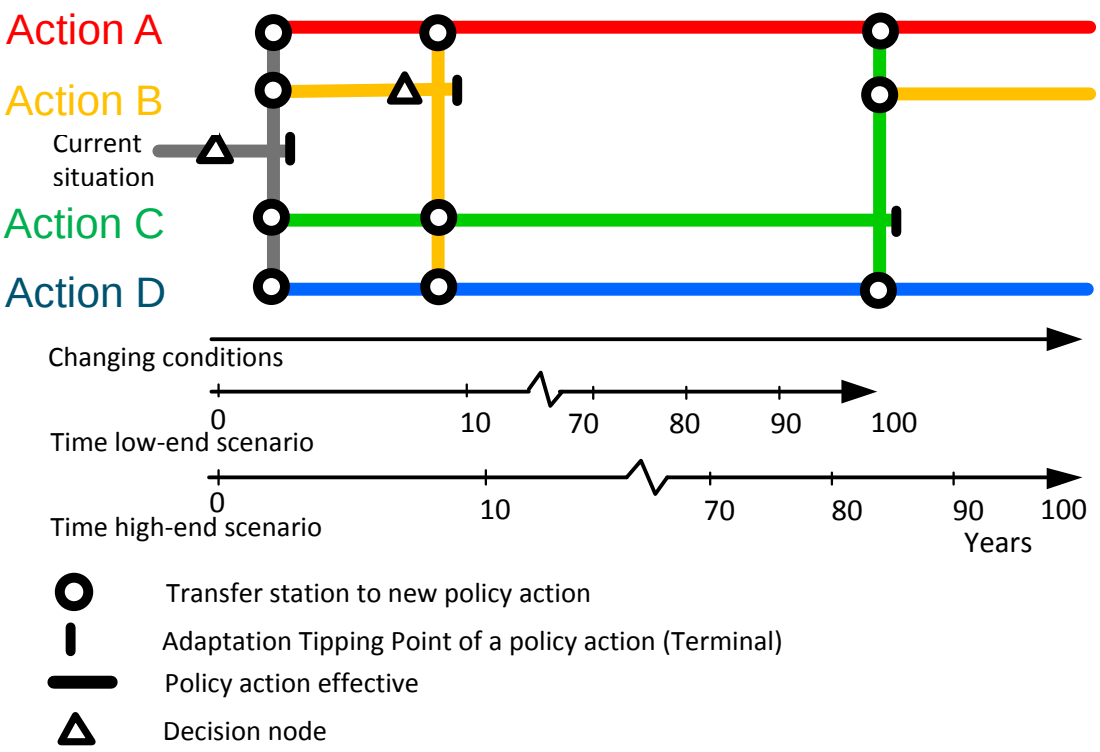
Adaptation pathways describe a **sequence of policy actions or investments** in institutions and infrastructure over time to achieve a set of pre-specified **objectives** under uncertain changing conditions,

*Haasnoot et al. (2013) Glob. Env. Change. 10.1016/j.gloenvcha.2012.12.006

An adaptation pathways map shows **different possible sequences of investment decisions**. A scorecard helps to evaluate the decisions.

Adaptation Pathways Map



Costs and benefits of pathways

Time horizon 20 years

Time horizon 50 years

Time horizon 100 years

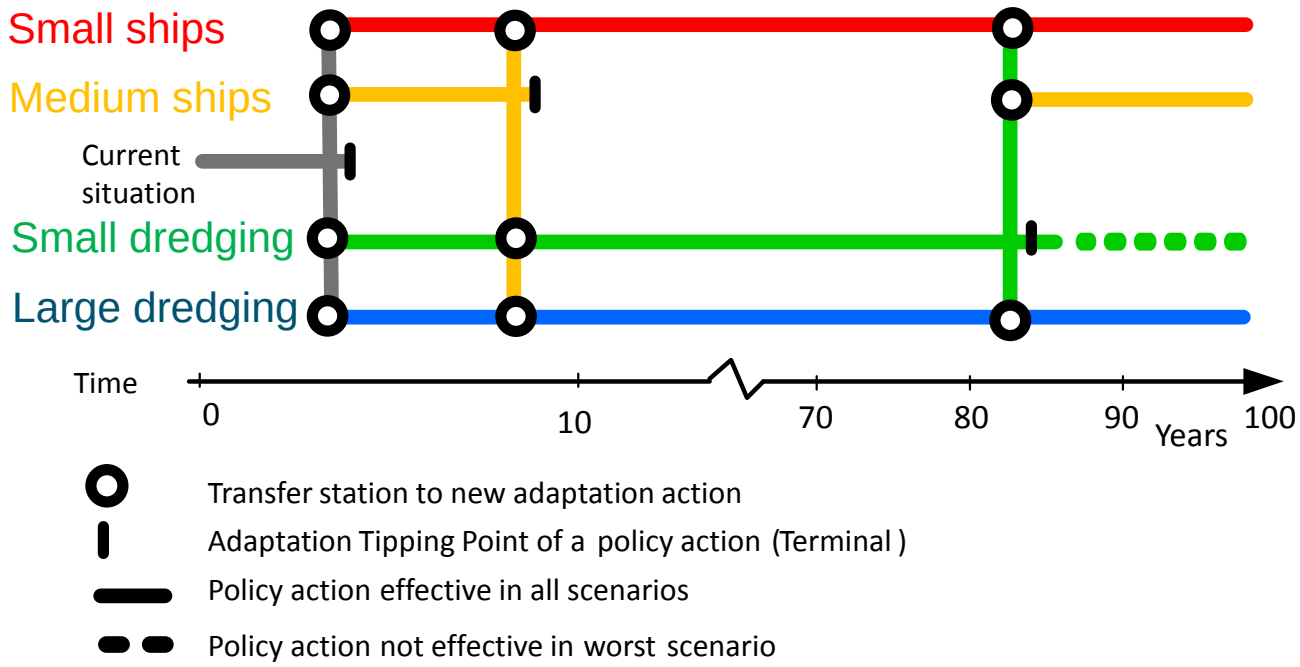
Pathway	Costs	Benefits	Co-benefits
1	+++	+	0
2	+++++	0	0
3	+++	0	0
4	+++	0	0
5	0	0	-
6	++++	0	-
7	+++	0	-
8	+	+	- - -
9	++	+	- - -

Pathways that are not necessary in low-end scenario

Haasnoot et al. (2012). Clim. Change.; Haasnoot et al. (2013) Glob. Env. Change. 10.1016/j.gloenvcha.2012.12.006

Example: Adaptation Pathways

How to keep a river navigable in a changing environment that may result in lower water levels in the river?

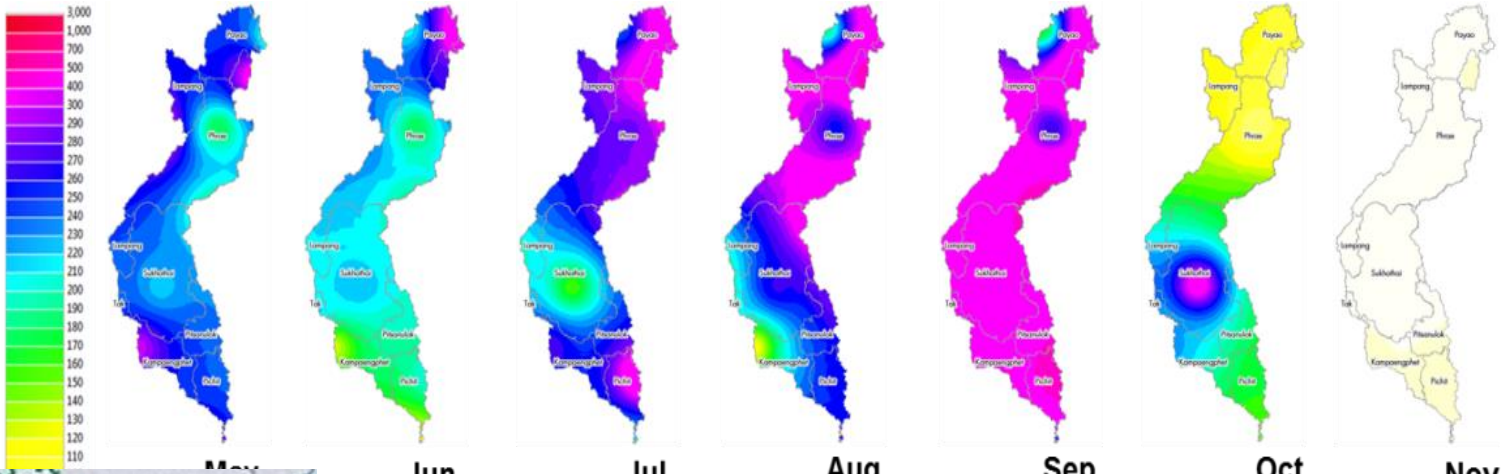


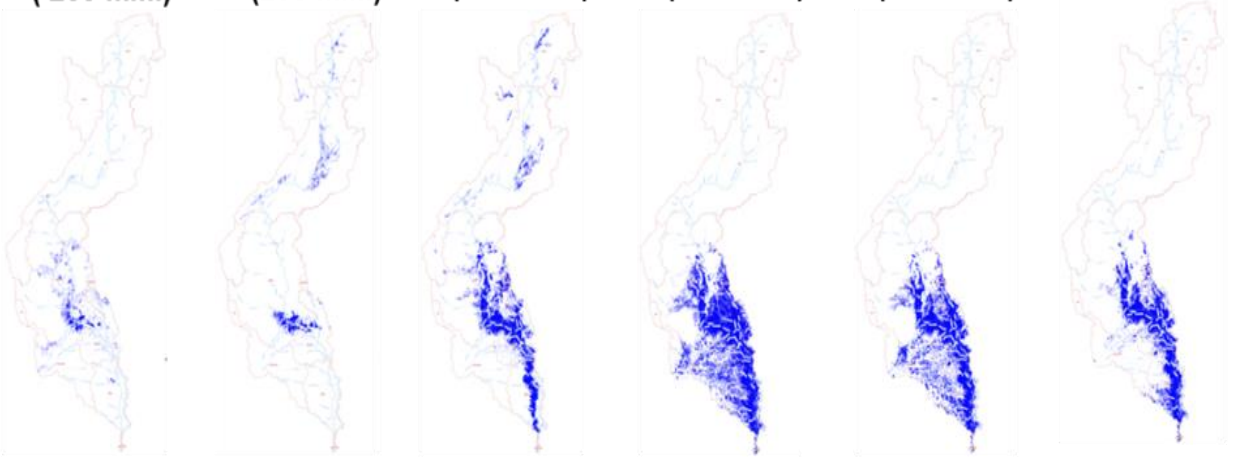
Scorecard for Pathways

	Path actions	Costs	Target effects	Side effects
1		+++	+	0
2		+++++	0	0
3		+++	0	0
4		+++	0	0
5		0	0	-
6		++++	0	-
7		+++	0	-
8		+	+	- - -
9		++	+	- - -

Haasnoot et al. (2012). Clim. Change.; Haasnoot et al. (2013) Glob. Env. Change. 10.1016/j.gloenvcha.2012.12.006

Adaptation pathways for the Yom river – after floods 2011





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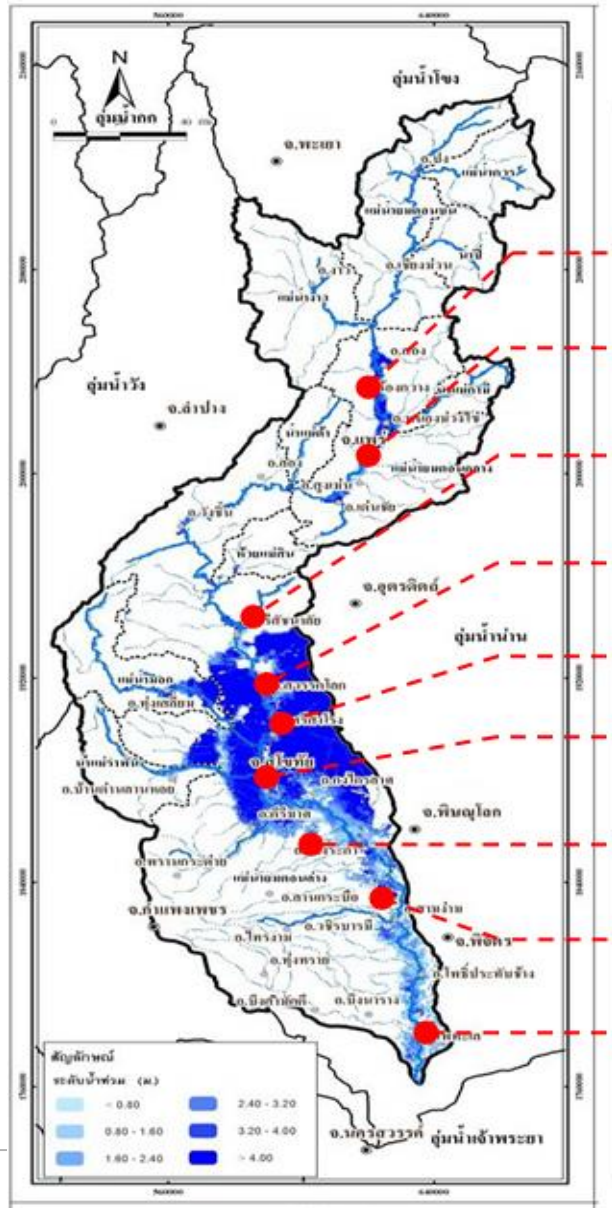
Flooding problems at Sukothai district



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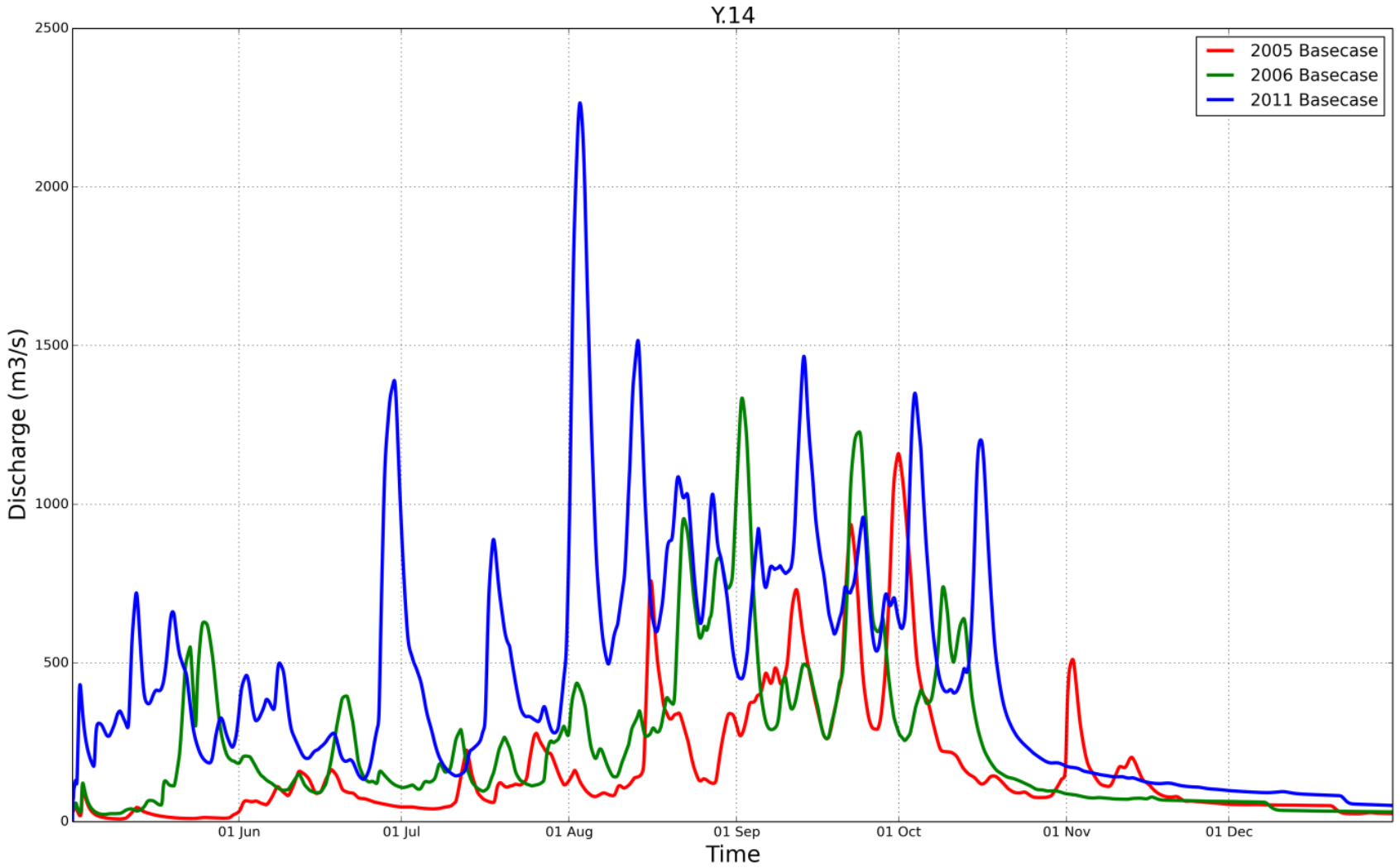
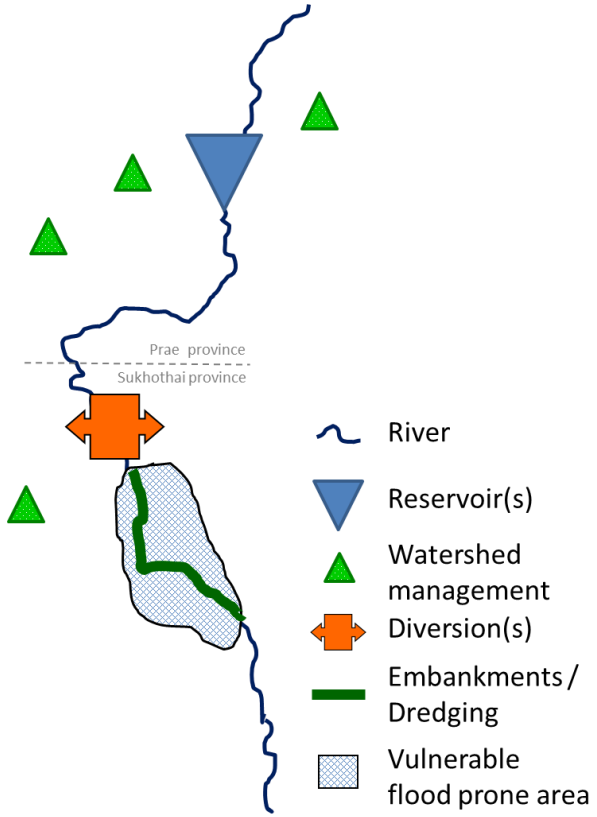
Hydrograph for the three characteristic years at the location Y.14

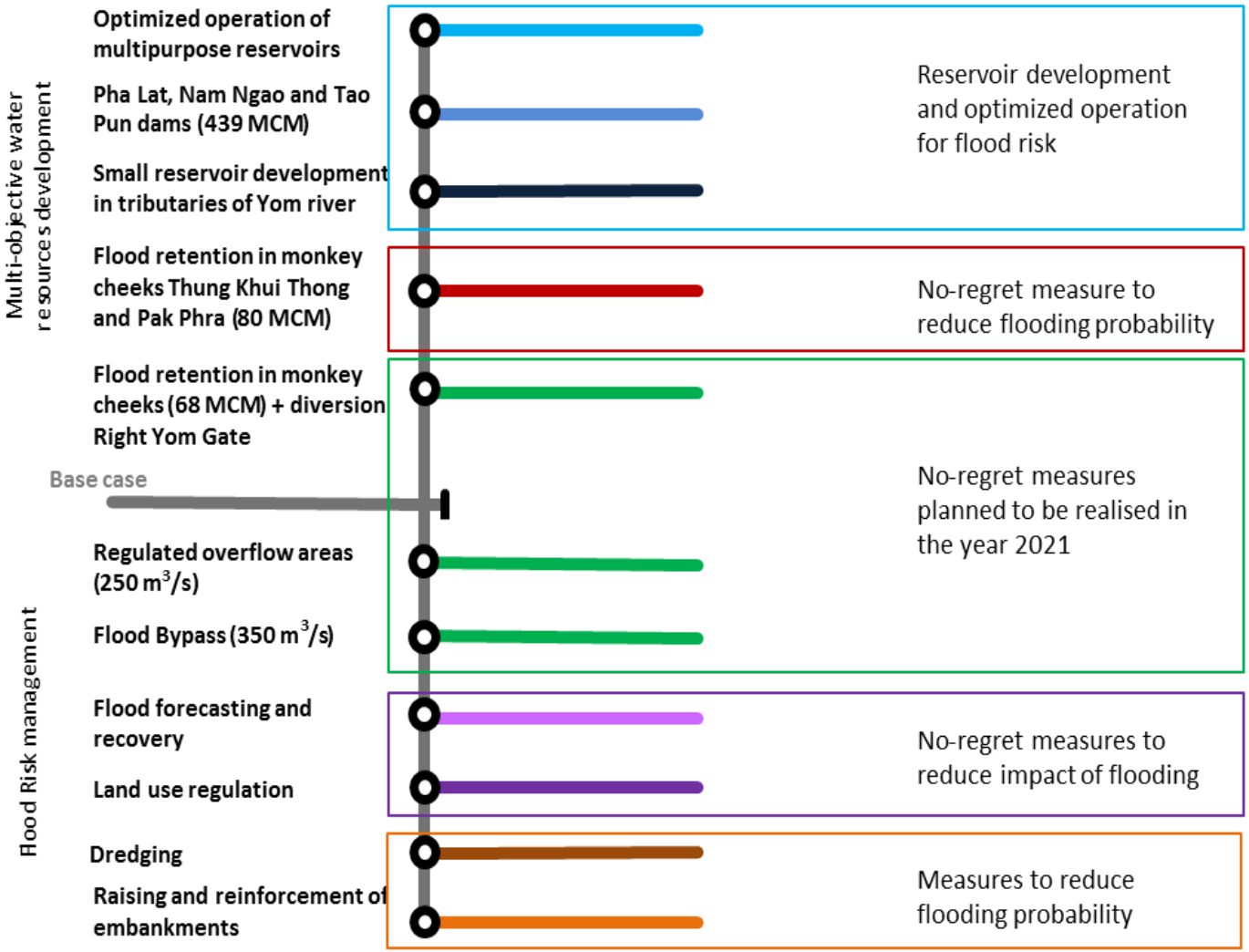


Screening of measures and plans

(R): Reduction of peak flows • *Reservoir development in Upper of Middle reach of Yom river (1 or 2 large scale reservoir(s))* • *Optimized operation of multipurpose reservoirs for flood mitigation* • *Reservoir development in tributaries of Yom river (medium scale reservoirs in various tributaries)* • *Watershed management and conservation measures, including reforestation*	**(D): Diversion of peak flows** • *Flood retention: diversion of river flow to adjacent retention areas (monkey cheeks)* • *Diversion of peak flows (to Nan river)* • *Flood Bypass around Sukothai area*
(P): Improvement protection against floods • *Raising and reinforcement of embankments* • *Dredging of river to increase the discharge capacity*	**(M): Mitigation of impacts of floods** • *Development of flood forecasting and early warning system* • *Flood response and disaster recovery plan, including awareness raising*
(V): Reduction of vulnerability for floods • *Adaptation of current land use* • *Land use regulation to reduce flood vulnerability of new developments*	



Combining different measures



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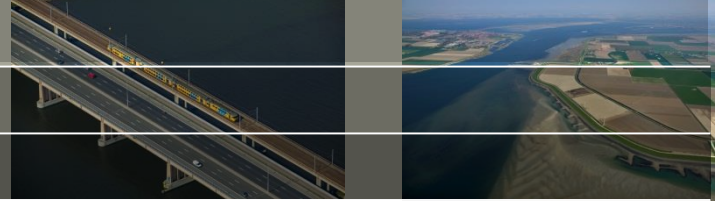
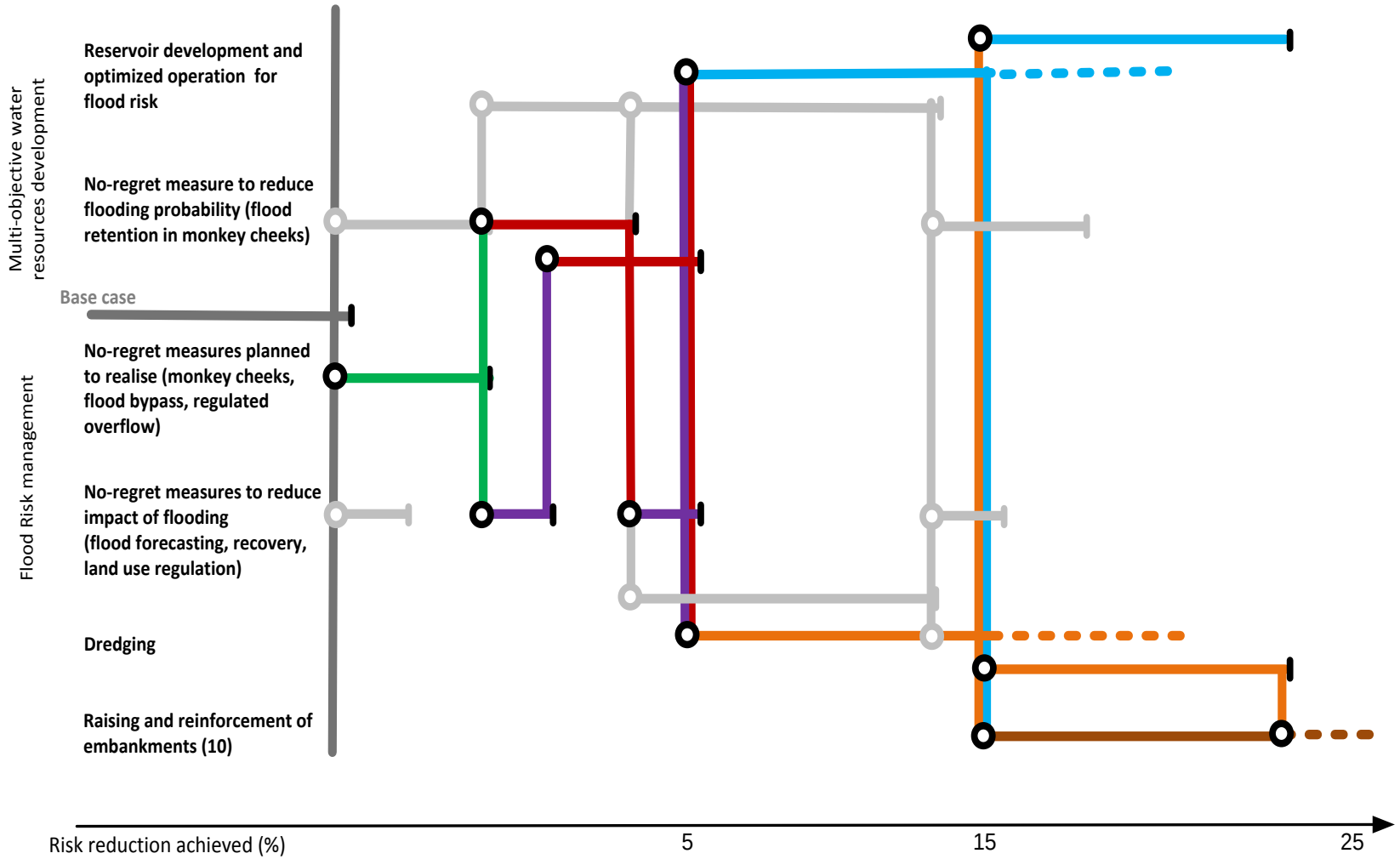
Adaptation pathways





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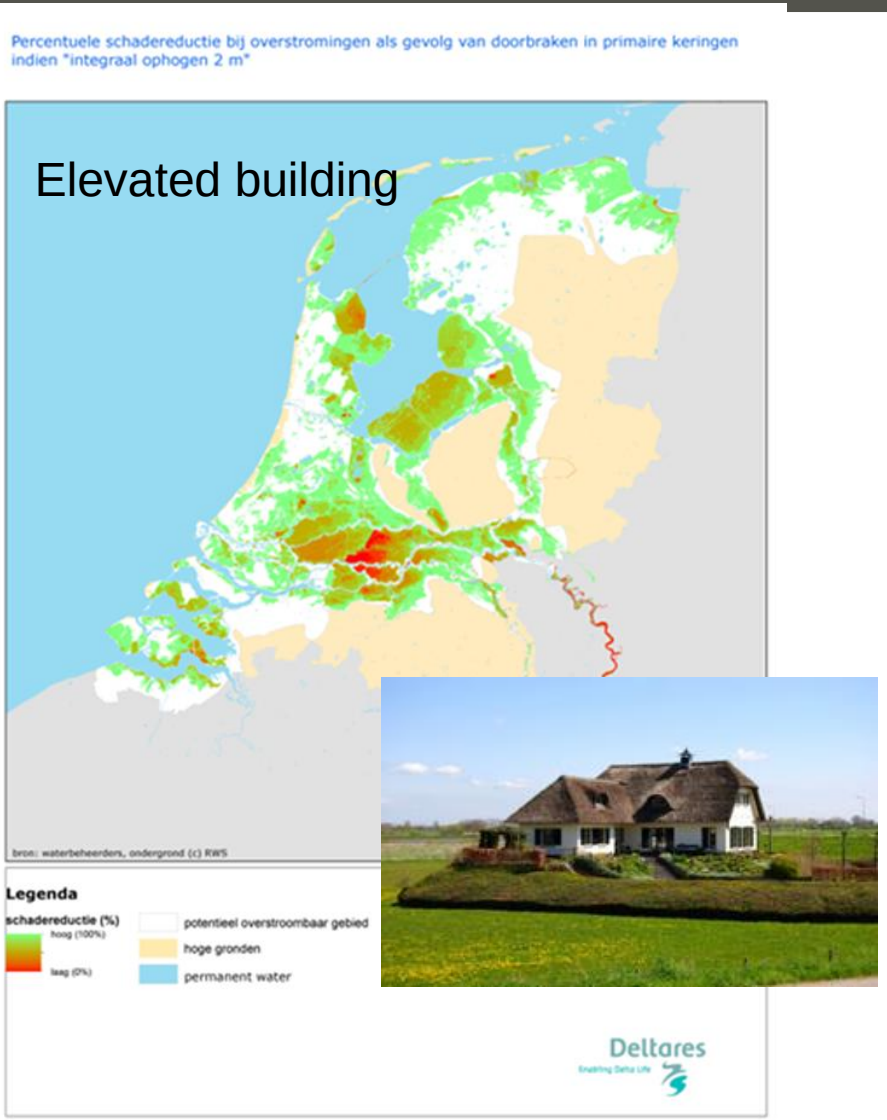
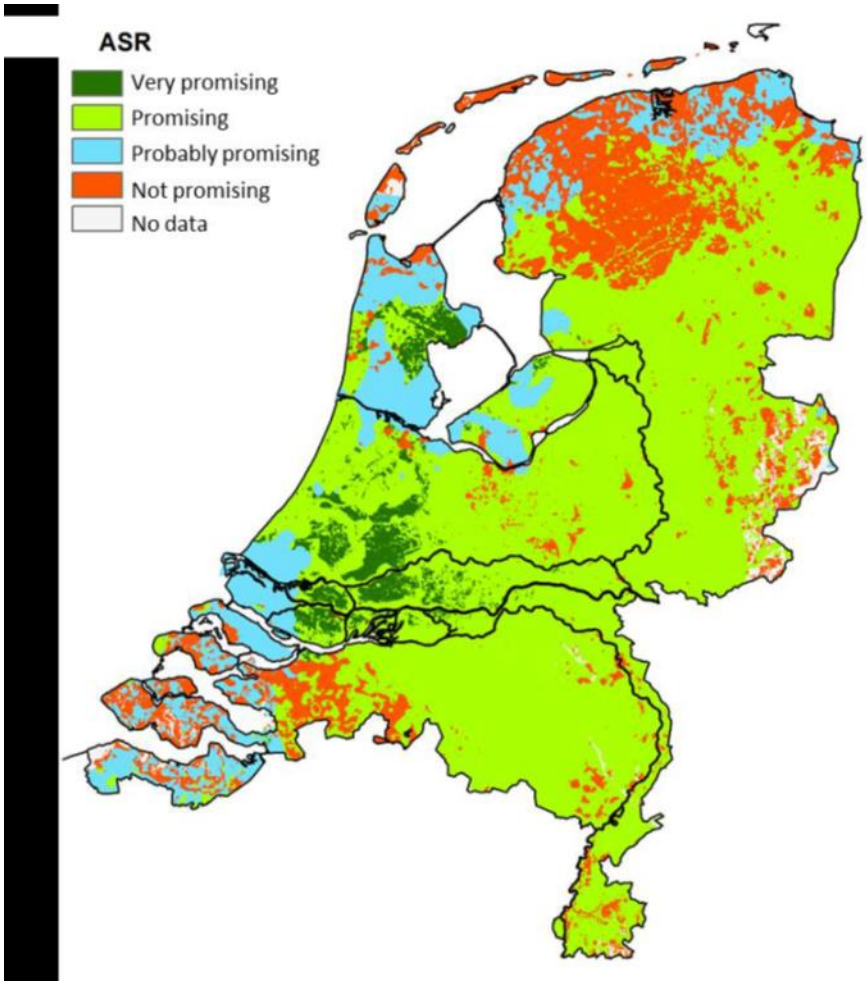
Suitability map for local scale adaptation





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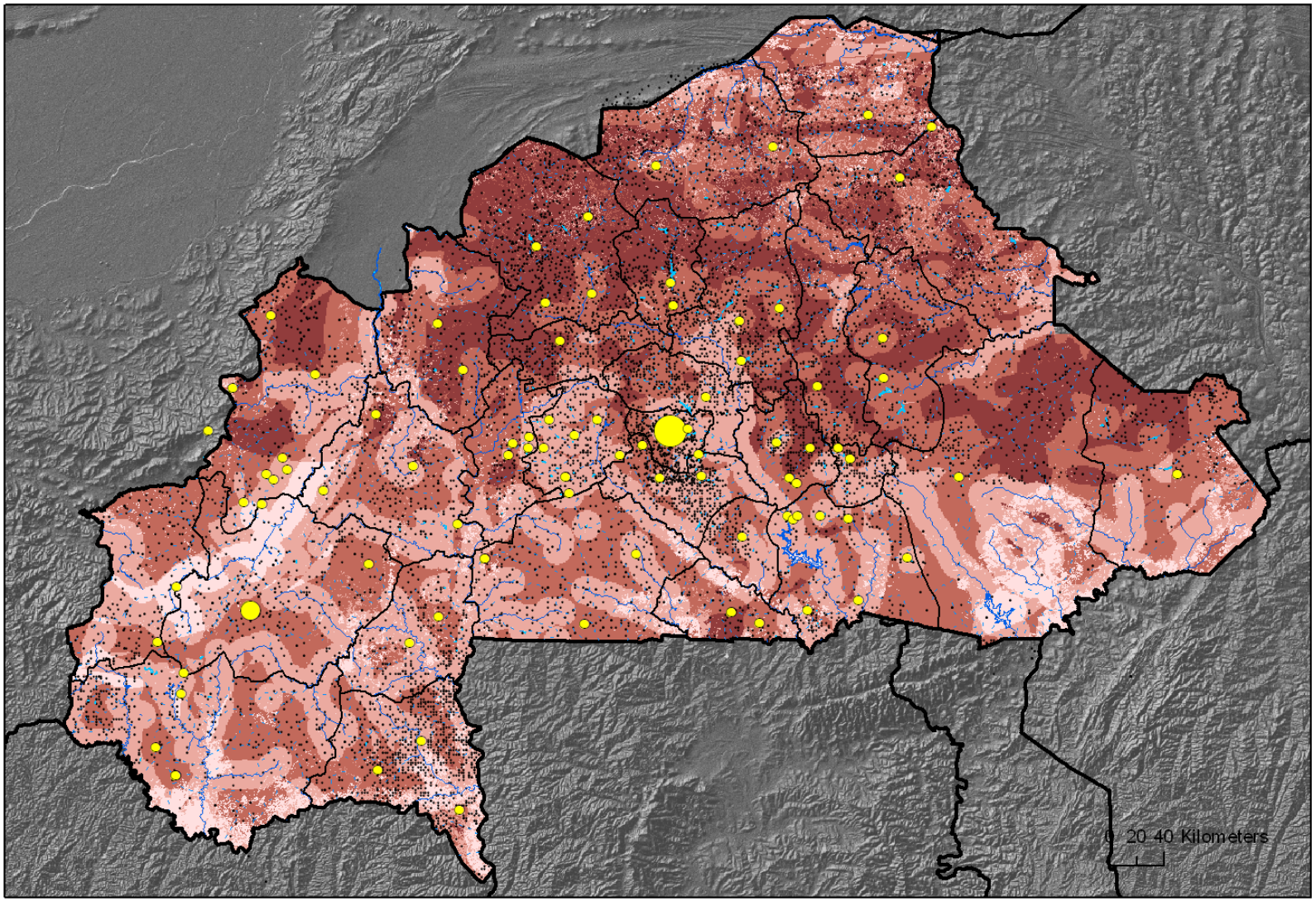
Rain water harvesting potential

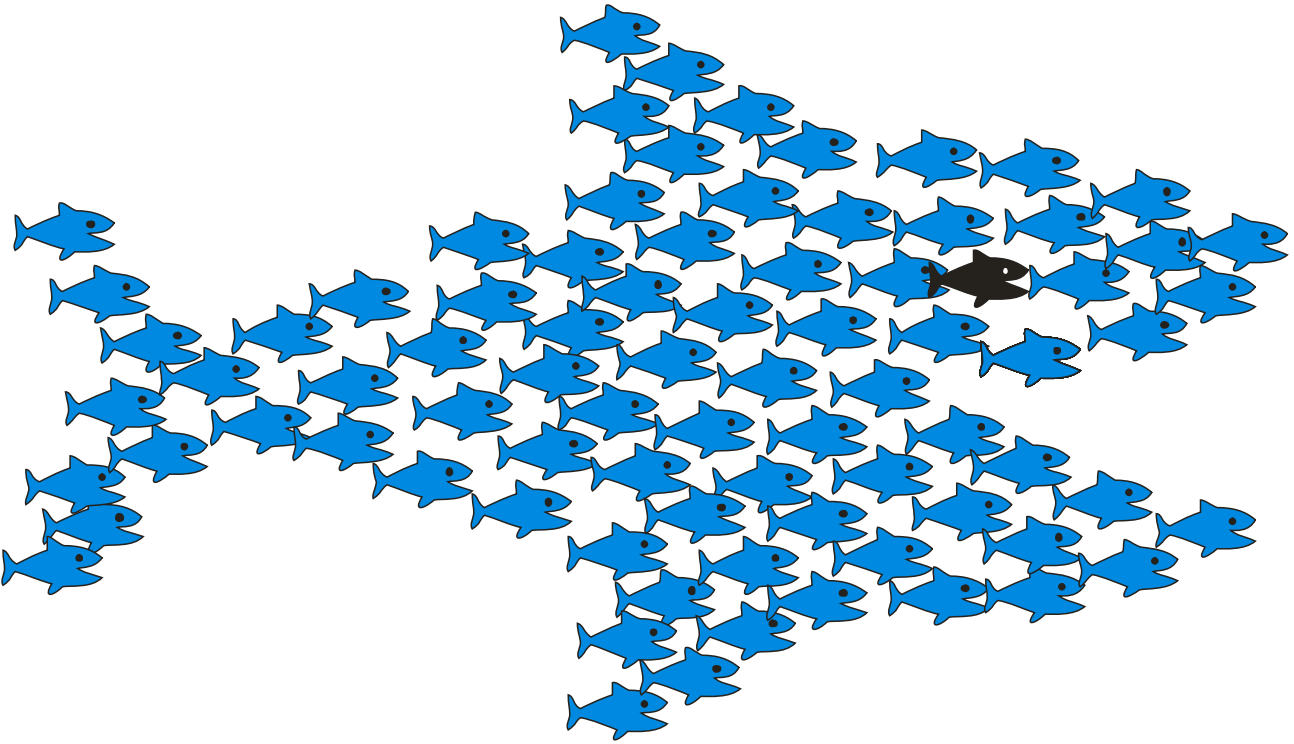
Grid

Rain Water Harvesting Potential



Can many local solution be alternative for large scale infrastructure?

Many local solutions



Climate and global Change

Could make a difference

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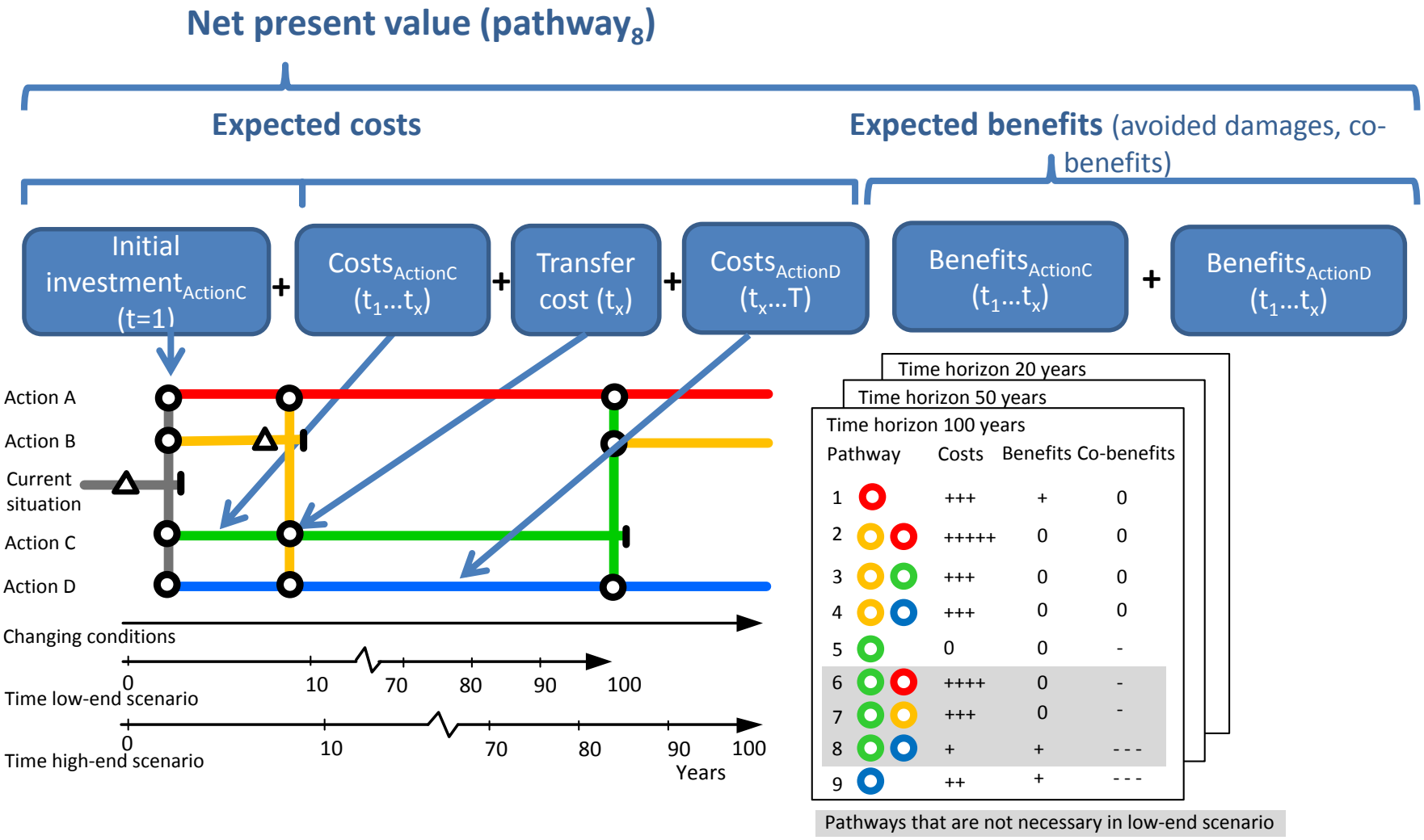
Economic Evaluation of Adaptation Pathways



4. Design and implement plan

To connect interactively:

- Land use planners - (technical) experts (“knowledge and design”)
- Hydraulic objectives - local initiatives
- Those who have Costs with benefits
- Abstract ideas - images/maps

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Goals of the Masterplan Beira 2035

1. Increase the possibilities of economic growth = Opportunities
2. Decrease the threats of climate change = Threats
3. Improve the living conditions = Opportunities

Make a safe, prosperous and more beautiful Beira

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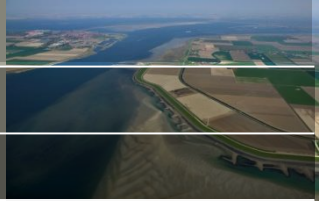
Projection of Future Growth



	Current	Projection 2035	
		Low scenario (2.25%)	High scenario (4.25%)
Population	443.000	827.000	1.422.000
Residential areas	7.743 ha	11.366 ha	16.991 ha
Industrial area	580 ha	1.375 ha	3.150 ha
Port area (total area)	442	575 ha	1.270 ha
Port area (net area terminals)	78 ha	237 ha	527 ha
Area requirements 2035	8.765 ha	13.320 ha	21.100 ha

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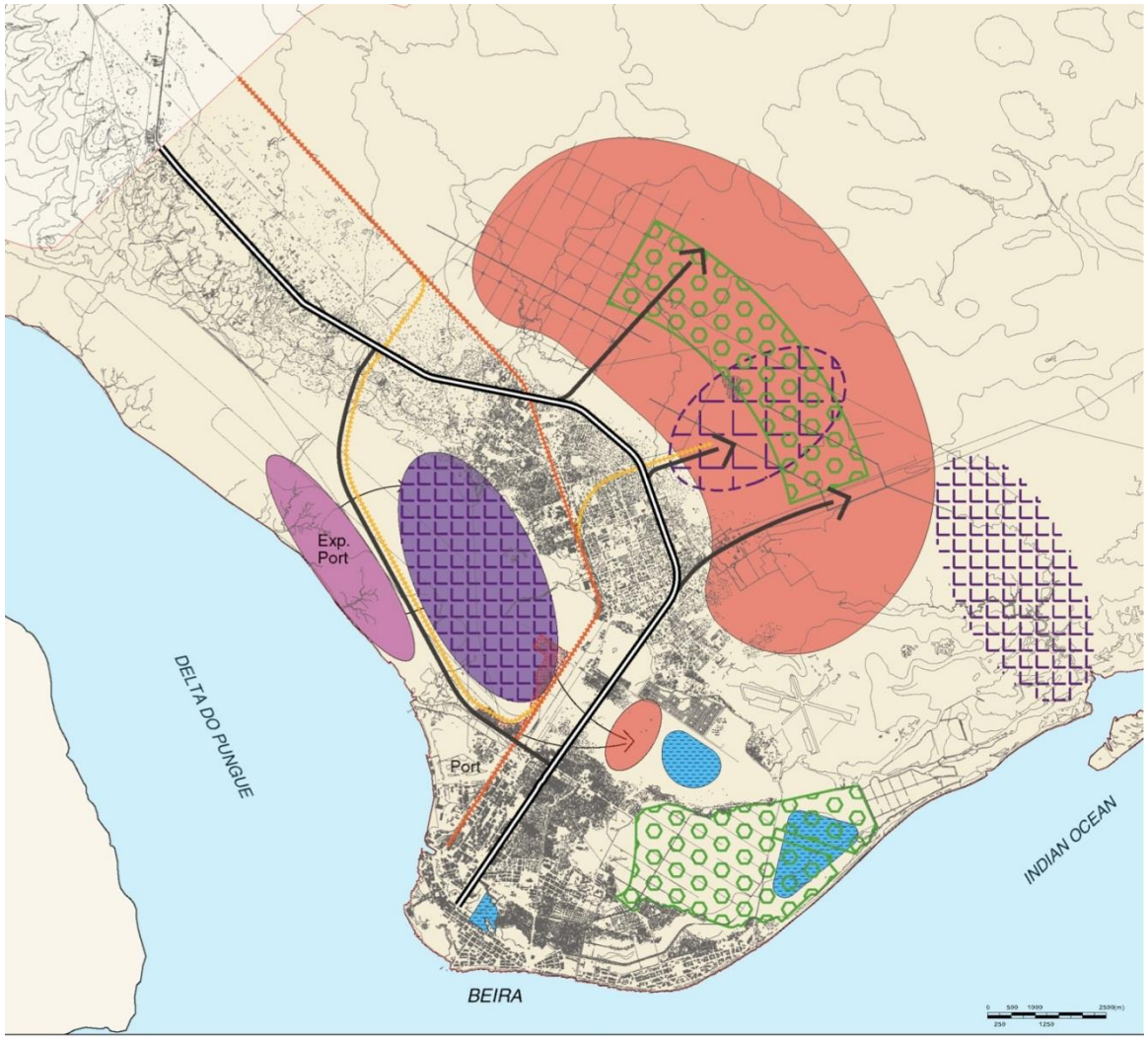
Urban development plan according to stakeholders



Legend

- existing mainroad
- new mainroad
- increased public transport via existing railway
- new railway
- expansion port
- expansion industry
- moving existing residential area
- expansion residential area/cidade satelite
- retention area
- tourism zone

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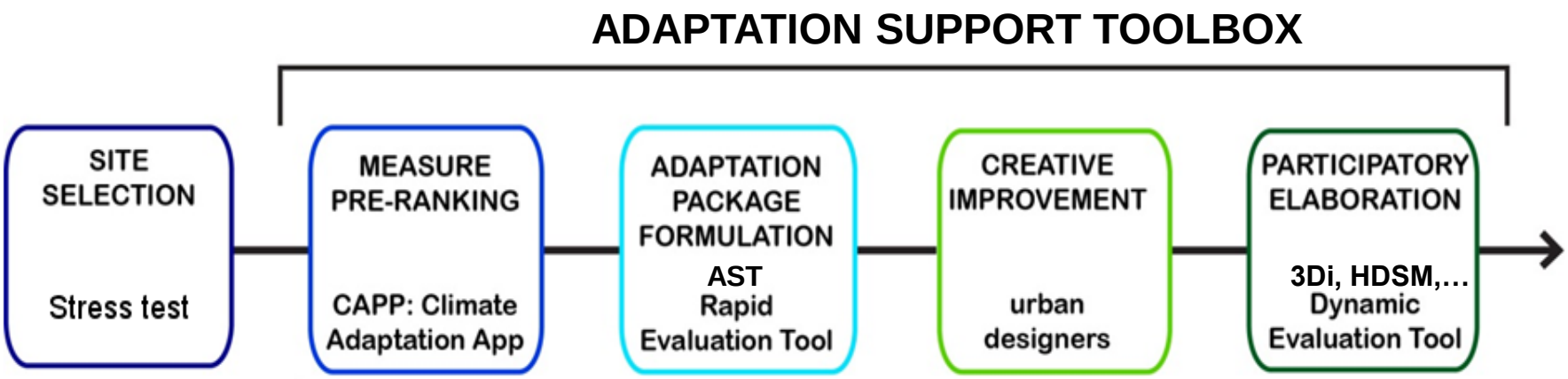
Adaptation Support Toolbox for Urban adaptation



Output:	ranked list of measures	2 - 3 alternative adaptation packages	strengthened design & innovation	design ready for decision making

Blue Green Dream

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Climate Adaptation App

climate changes spatial planning

www.climateapp.org

ADAPTATION SOLUTIONS

FILTER

Project type
- Redevelopment

Scale
- Neighborhood

Adaptation target
- Groundwater flooding

Land use
- City Centre

Dominant soil type
- Peat

Surface level and slope
- Sloping area
- Flat area on high ground
- Flat area on low ground

28 Adaptation solutions

Reset

CLIMATE INFORMATION

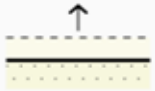
ABOUT

ADAPTATION SOLUTIONS

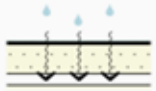

Canal


Seepage barrier


Improved construction site preparation

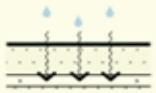

Raising land


Raising the groundfloor level

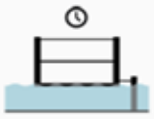

Infiltration and Transport-sewer

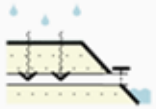

Emergency supplies and utilities


Pumping station


Drainage below surface level


Constructions on piles


Amphibious (floatable) constructions


Smart-drain (groundwater)

Adaptation Support Tool

Blue Green Dream

ALTERRA WAGENINGEN UR

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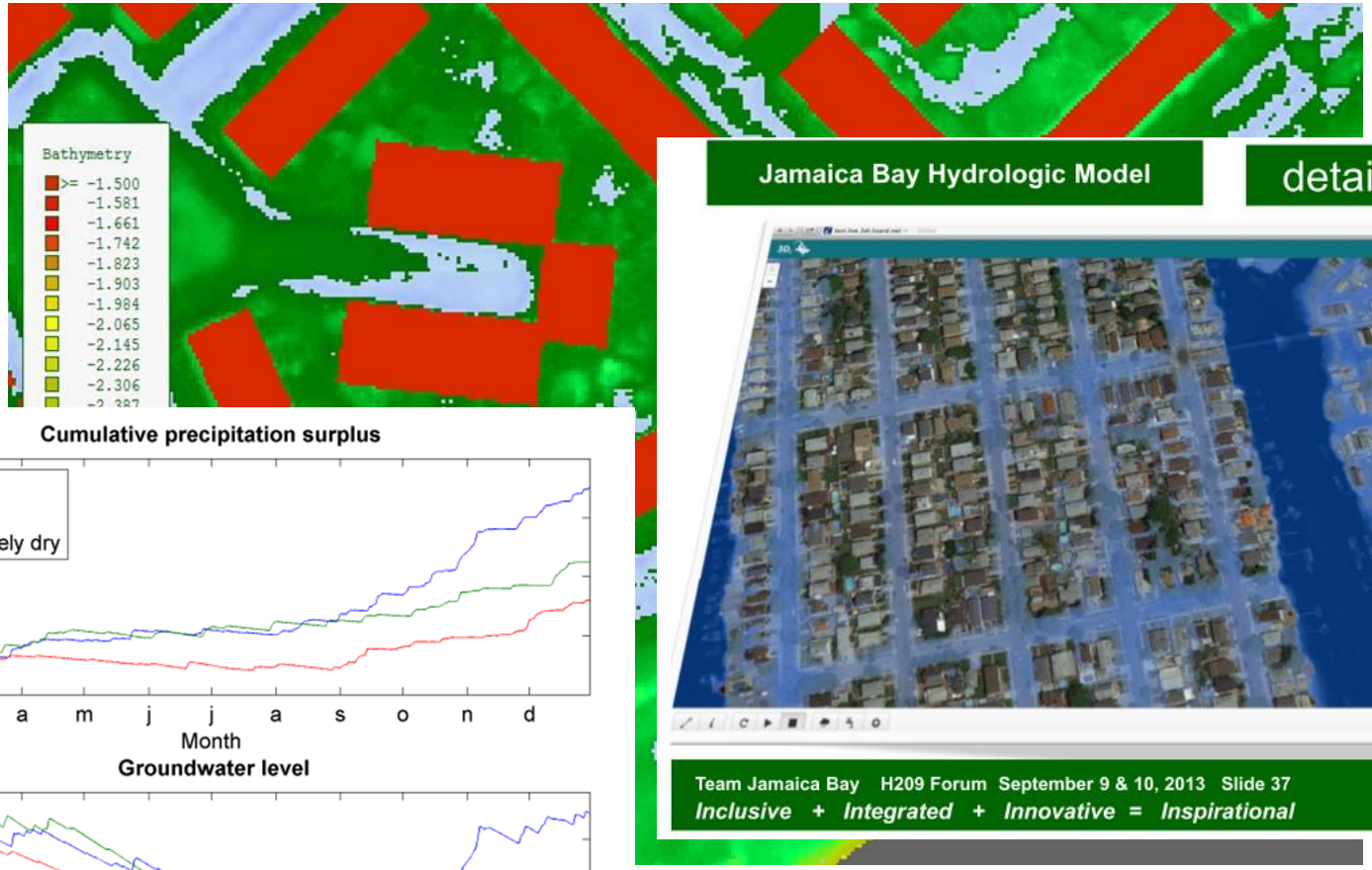
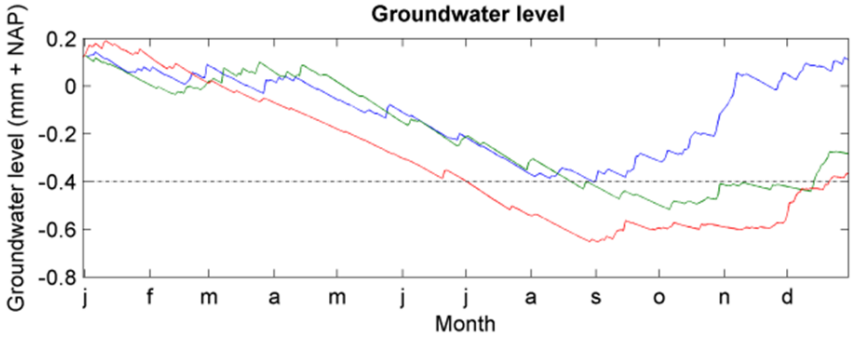
Dynamic Evaluation Tool

to visualize dynamic effect of adaptation measures





http://www.3di.nu/3di-videos/

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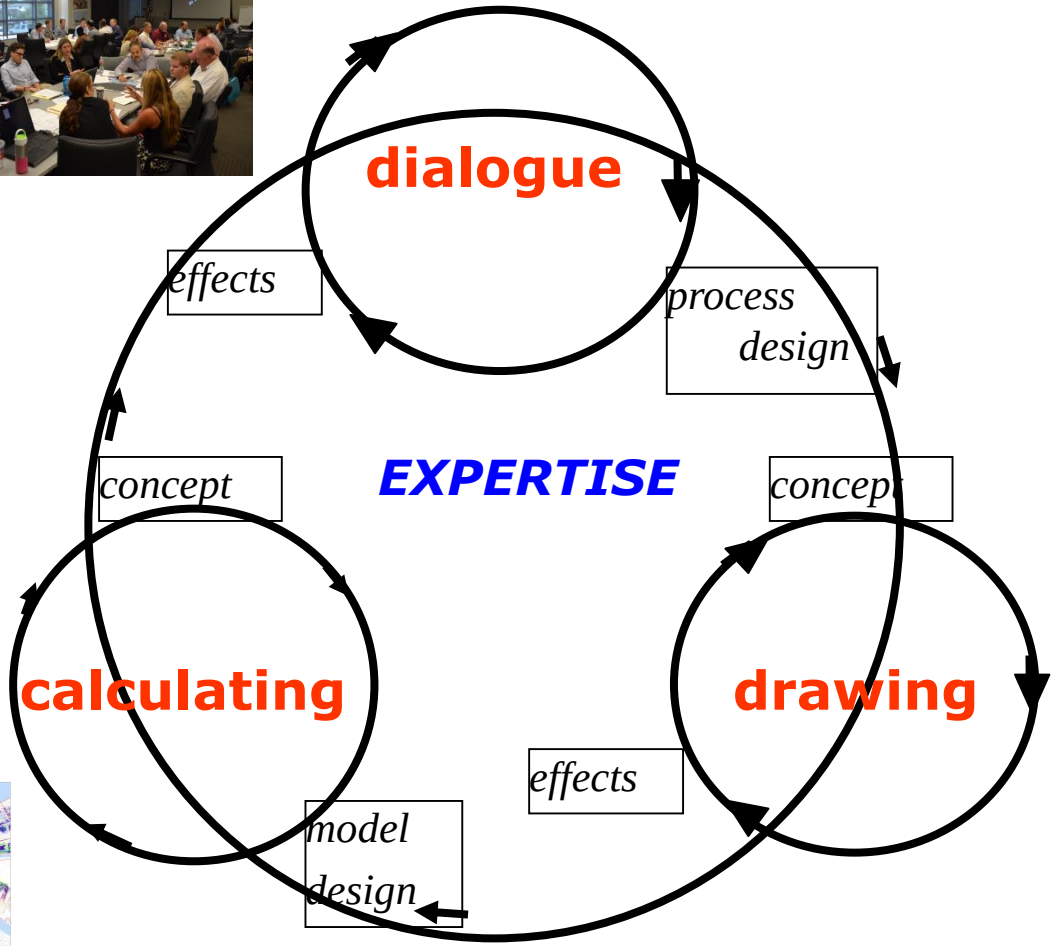
Creating resilience:
a process of dialogue, design & engineering



Van de Ven F.H.M., S.P. Tjallingii. P. Baan, P. van Eijk en M. Rijsberman (2005) *Water in Drievoud; benaderingen voor stedelijke waterplannen* .(Triple Water; approaches for urban water management planning), Eburon, Delft, ISBN 90 5972 096

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To conclude

- Use of an adaptive planning approach stimulating robust and flexible solutions
- Connect long term options to short term decisions.
- Objective driven analysis considering multiple options in reaching it
- Use of various learning-, decision- and design tools to engage with stakeholders
- Flexibility in approaches from heavy data and model dependent to using expert knowledge
- The real challenge is in the implementation, but it helps if there is support by key stakeholders and sound information base

3rd Annual Workshop on Decision Making Under Deep Uncertainty

3 & 4 November 2015, Delft, The Netherlands

http://deepuncertainty2015.deltares.nl | Contact: deepuncertainty2015@deltares.nl

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Flooding of Deventer, Luud Riphagen

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