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Adaptation Support Tools for Urban Land and Water Management and Room for River

城市土地和水管理的适应支持工具与河道扩容

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“Acting Together for Low Carbon, Livable, and Prosperous Cities” “共同为低碳、宜居和繁荣城市行动”

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- **Our flooding challenges 洪水挑战**
- **Solution strategy 解决策略**
- **Adaptation planning and design 适应规划和设计**
- **Adaptation Support Tool 适应支持工具**
- **Room for the River 河道扩容**

Flooding (coastal, fluvial, pluvial, groundwater)

洪水 (沿海, 河流, 雨水, 地下水)

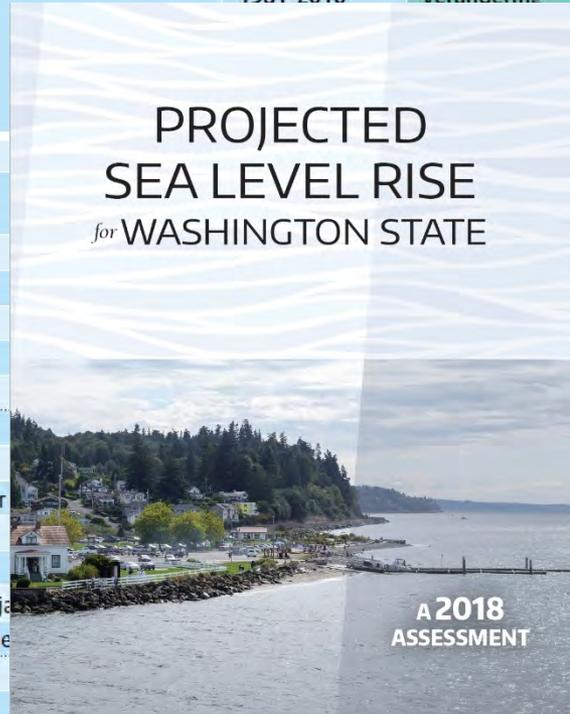


..while climate changes, sea level rises, ...

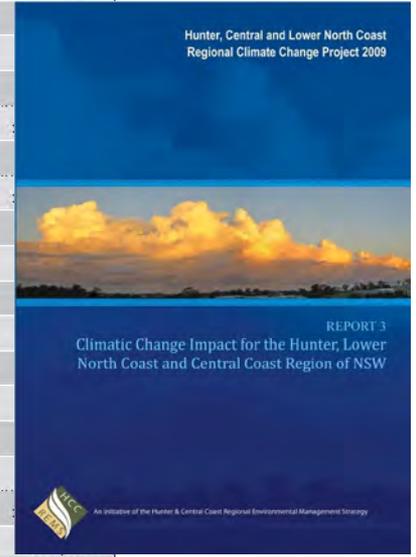
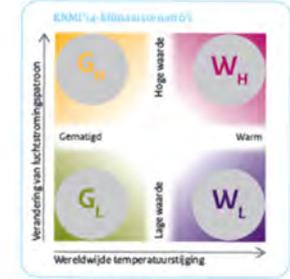
..气候变化, 海平面上升,



Seizoen A)	Variabele	Indicator	Klimaat B) 1981-2010	Gemiddelde verandering	Natuurlijke variaties gemiddeld over 30 jaar D)
		absoluut niveau E)			± 1,4 cm
		tempo van verandering			± 1,4 mm/jaar
		gemiddelde			± 0,16 °C
		gemiddelde hoeveelheid			± 4,2%
		inbestraling			± 1,6%
		potentiële verdamping (Makkink)			± 1,9%
		per jaar			± 39 uur
		per jaar zuid e			± 0,48 °C
Lente	Temperatuur		17,0 °C	+0,9 °C	
Zomer	Neerslag		224 mm	+0,2%	
	Neerslag	jaar wordt overschreden D)	44 mm	+1,7 tot +10%	
			15,1 mm/uur	+5,5 tot +11%	
			43 dagen	+0,5%	
	Zonnes		153 kJ/cm ²	+1,9%	
	Vochtigheid		77%	-0,6%	
	Verdamping		266 mm	+3,5%	
	Droogte	urende het groeiseizoen D)	144 mm	+4%	
Herfst	Temperatuur	gemiddelde	10,6 °C	+1,0 °C	
	Neerslag	gemiddelde hoeveelheid	245 mm	+5,5%	



	17,0 °C	+0,9 °C
	224 mm	+0,2%
jaar wordt overschreden D)	44 mm	+1,7 tot +10%
	15,1 mm/uur	+5,5 tot +11%
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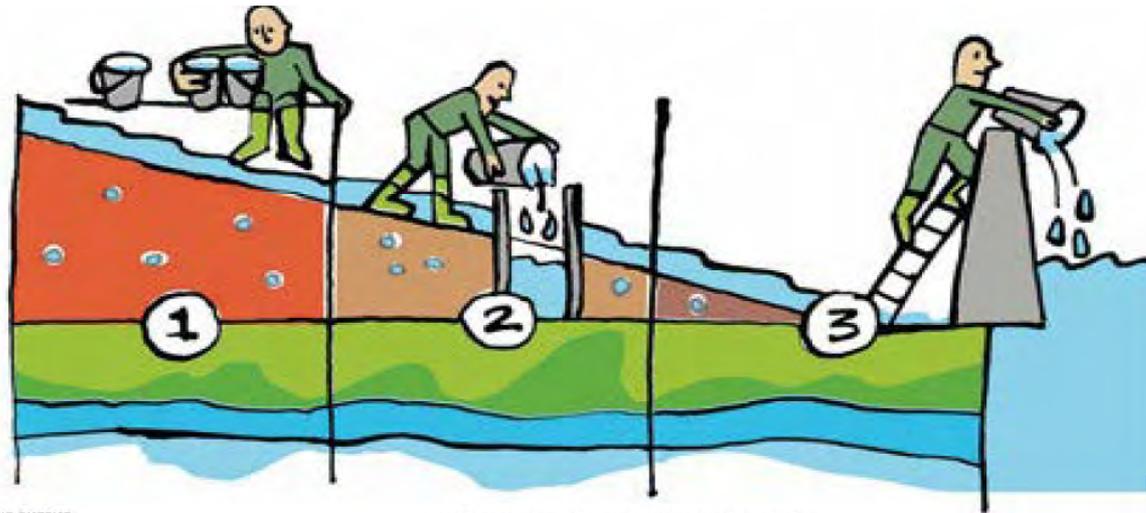
Solution strategy #1: Retain & Store!

解决方案策略#1：保留和蓄存！

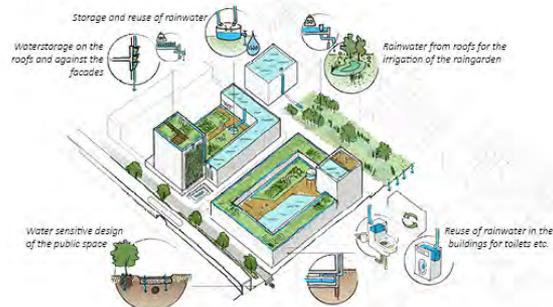
Re-/Detain and Store **at the source** to avoid overloading the drainage capacity and flooding downstream

在源头储水，以避免超过排水渠能力和洪水过载

Retain Store Drain



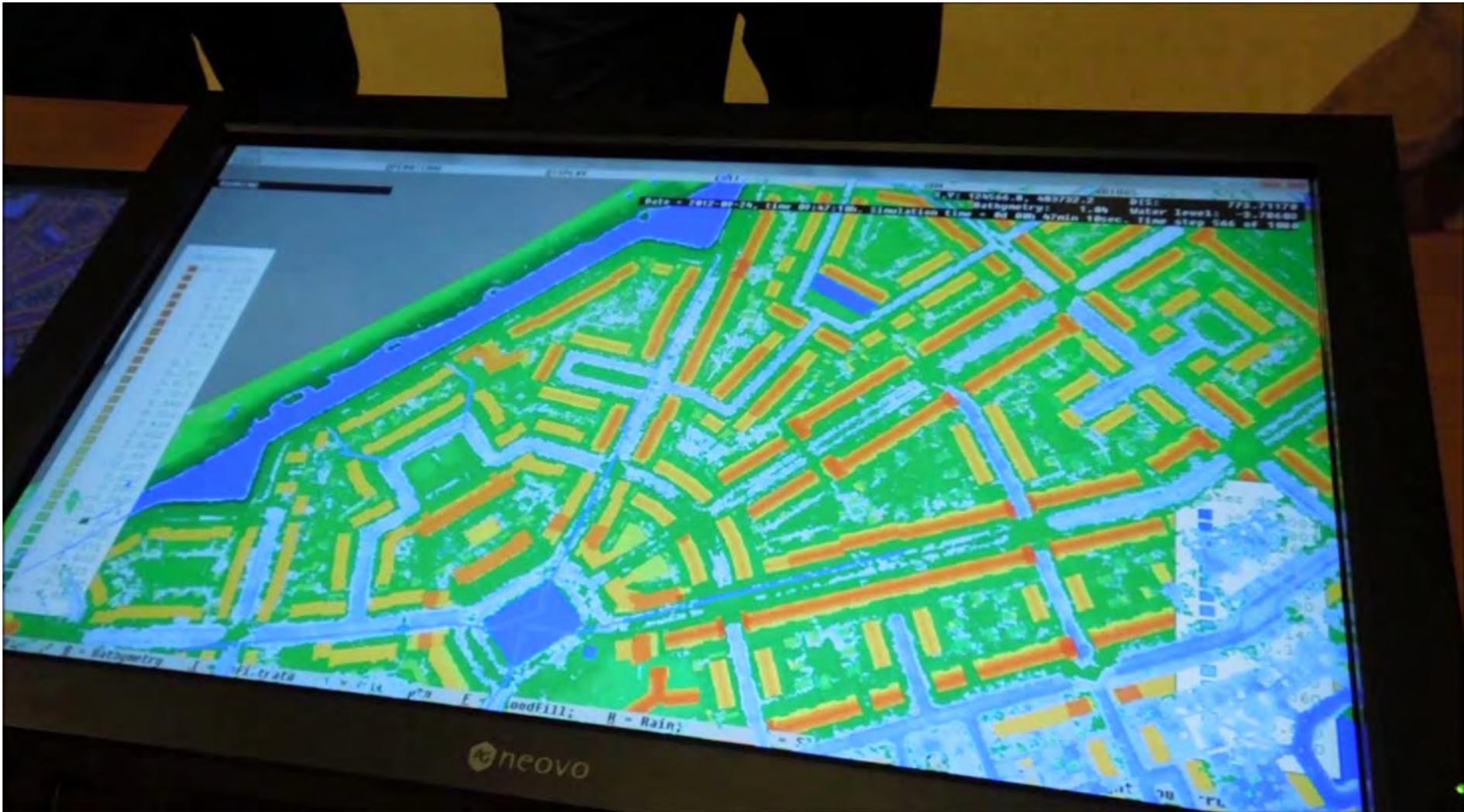
CLIMATE ADAPTATION IN THE NEW DEVELOPMENTS IN THE ZOHO-DISTRICT



LOD (Lokalt omhändertagande av dagvatten)

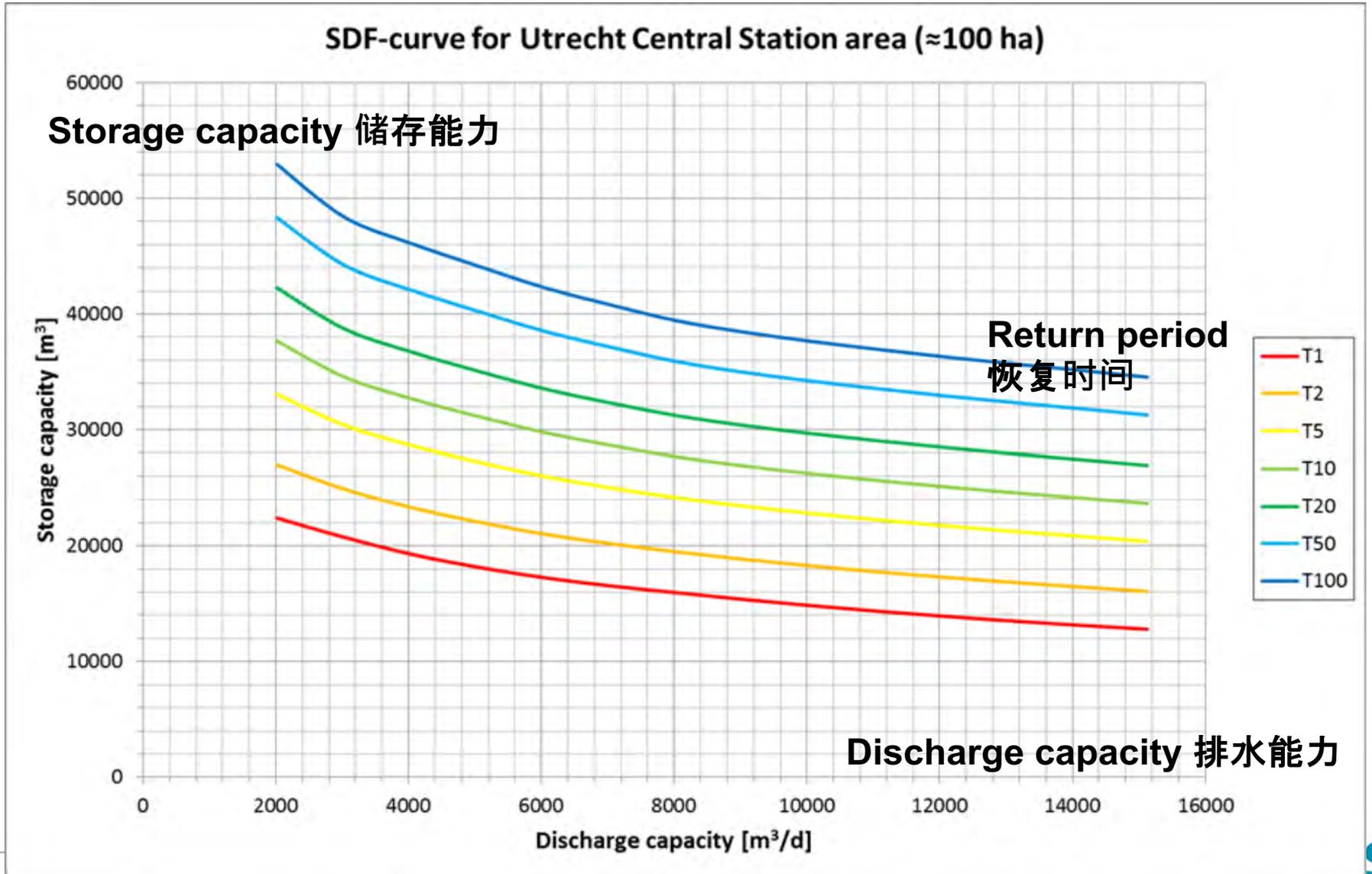


'Sponge size' assessment 评估'海绵规模'



hydrologic / hydraulic modelling to assess water retention assignment
水文/水力模型评估蓄水任务

Stormwater retention assignment 暴雨储存



Lots of measures can be taken 采取多种措施



Fluted gutters



Prefab fluted gutter



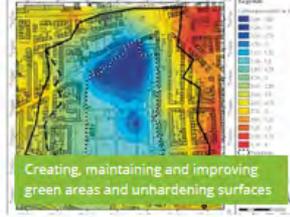
Open gutters



Green squares and playgrounds



Private green gardens



Creating, maintaining and improving green areas and unhardening surfaces



Covered gutters



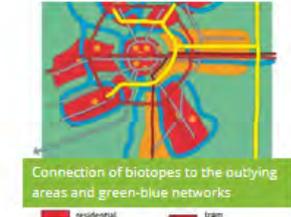
Hollow roads



Ditches



Urban forests and parks



Connection of biotopes to the outlying areas and green-blue networks



Urban wetlands



Open water channels



Use of groundcover and shrubbery



Porous paving materials



Retention roof



Grass fields and flower meadows



Urban farms



Ground infiltration



Infiltration meadows and infiltration strips with above-ground storage



Rainwater ponds for buffering and purification of moderately polluted water



Rainwater ponds for buffering and purifying extremely polluted water



Bioswales



Green riparian zones and wet biotopes



Rainwater ponds for buffering and purifying extremely polluted water



Nature-friendly bioswales



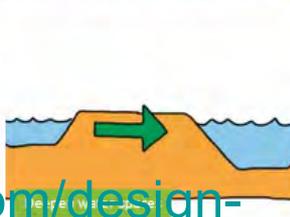
Gravel layers/trenches/reverse drainage



Infiltration meadows and infiltration strips with above-ground storage



Ground infiltration



Blue-green measures preferred over grey ones

蓝绿色措施优于灰色措施



Grey measures 灰色措施

Blue-green measures 蓝绿色措施

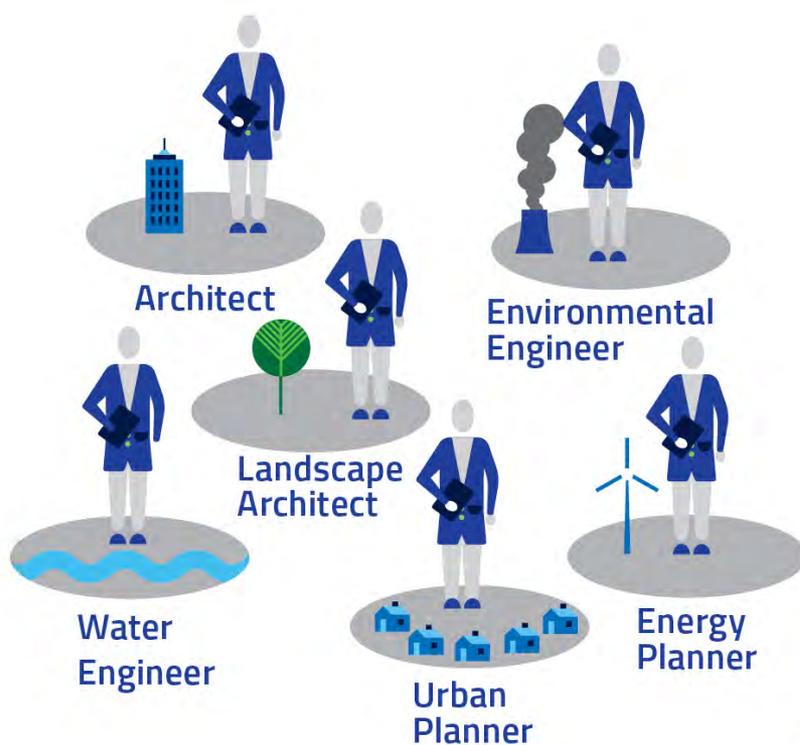
less space, subsurface
地表下层较少的空间,
rigid, public investment
严格的公共投资

more space, visible, multi-functional
更多可见, 多功能空间
flexible and cost-effective
灵活且有成本效益



Collaborative planning required for blue-green 蓝绿色措施需要协同规划

experts from many disciplines + local stakeholders
来自许多学科专家和地方利益相关者



Adaptation Support Tool 适应支持工具

to find out what can be done where & how effective that is



Blue Green Dream

Setup Measures Layers Cases

Search Search measure

- 1 Helophyte filter 64.0
- 2 Private green garden 60.0
- 3 Green roofs with drainage delay 57.0
- 4 Seasonal storage (extra storage height of surface water) 57.0
- 5 Extra intensive green roof 57.0
- 6 Urban agriculture 57.0
- 7 Adding shrubbery in streetscape 57.0
- 8 Adding grass/herbs in streetscape 57.0
- 9 Smart-drain (groundwater) 54.1
- 10 Cooling with water elements: ponds 54.0
- 11 Bank infiltration 54.0

Google

SA

ALTEERRA WAGENINGEN Deltara

Overview Detail Export Target

Contribution

Climate

- Storage cap. 92.5% 100.0%
- Heat red. 1.7% 0.0%
- Normative runoff 66.0% 0.0%
- Evapotranspiration 0.0% 0.0%
- Groundwater recharge 0.0%

Water quality

- Nutrient red. 2.8% 1.0%
- Obs. pollutants 3.7% 0.8%
- Pathogens red. 3.1%

Potential

- Retention pot 4.3% 0.0%
- Safety pot 2.9%
- Soc cohesion pot 3.4%
- Health pot 3.9%

Costs

Construction k€ 4127

Annual Maint. k€ 341

Active measures

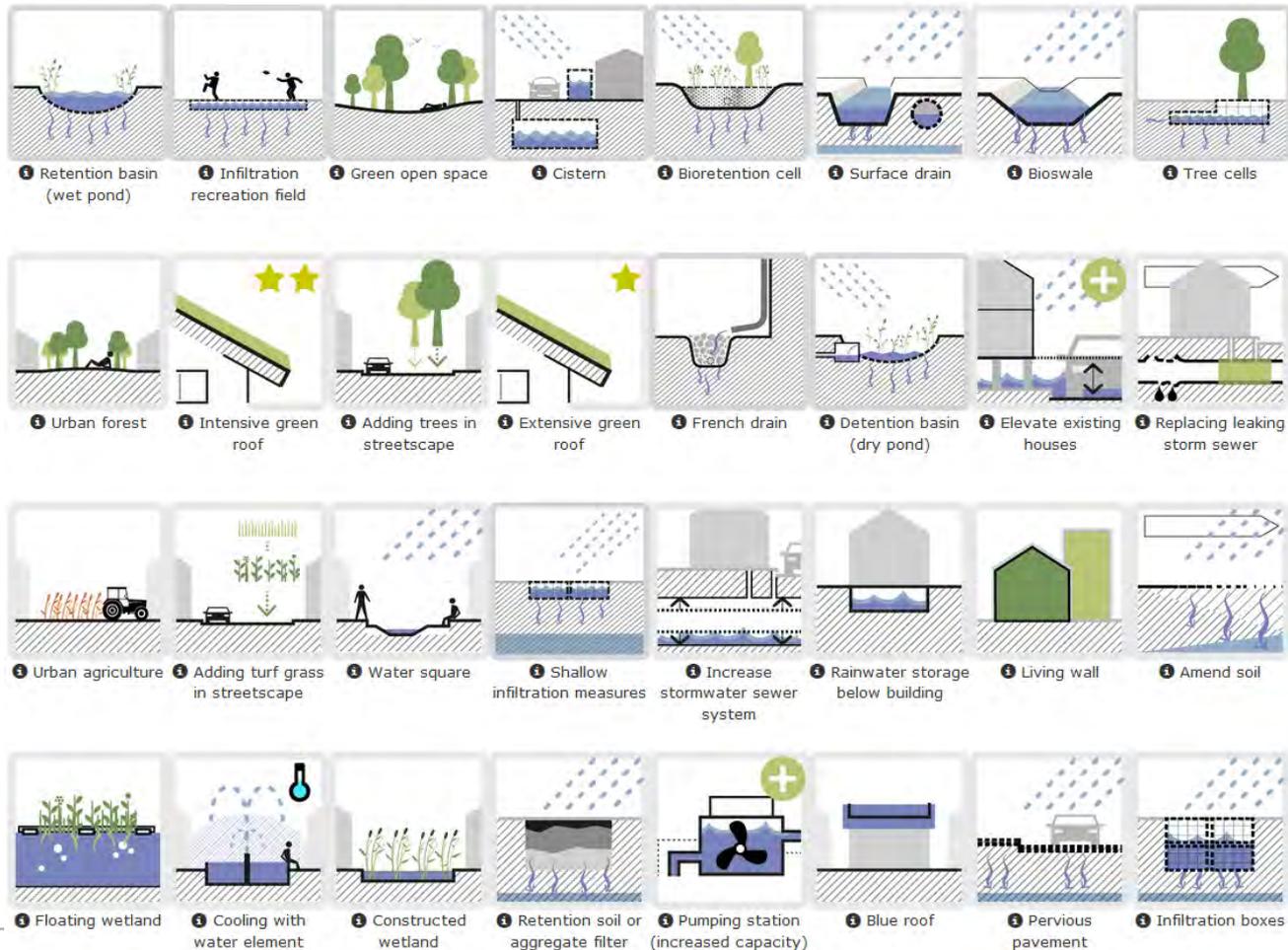
- Project Area
- Wetting surfaces (of gardens)
- Disconnecting paved surface:
- Water squares
- Urban agriculture
- Green roofs with drainage de
- Porous pavement
- Bioswales / Infiltrating filter
- Tree pit bioretention
- Rainwater retention pond



Adaptation Support Tool to see 适应支持工具

- what can be done 可以用来做什么

- where, and how effective that is 应用领域，效果如何

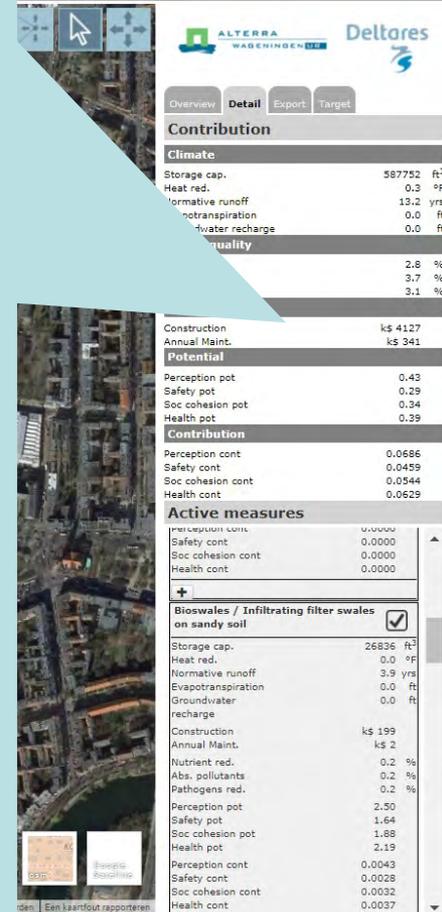
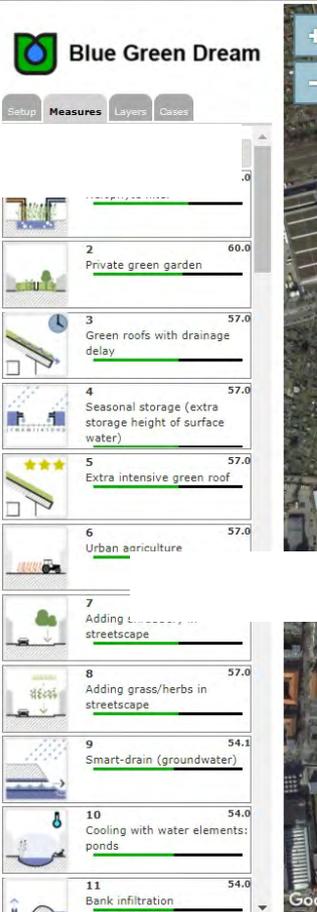


Adaptation Support Tool 适应支持工具

Van de Ven, Frans H.M., Robbert P.H. Snep, Stijn Koole, Reinder Brolsma, Rutger van der Brugge, Joop Spijker, Toine Vergroesen (2016). Adaptation Planning Support Toolbox: Measurable performance information based tools for co-creation of resilient, ecosystem-based urban plans with urban designers, decision-makers and stakeholders, Environmental Science & Policy, <http://dx.doi.org/10.1016/j.envsci.2016.06.010>

Resilience performance indicators include: 弹性性能指标包括：

- Retention capacity 蓄水能力
- Peak flow reduction 峰值流量减少
- Groundwater recharge 地下水补给
- Cooling effect 降温功效
- Water quality improvement: 水质提高
 - Nutrients 营养
 - HMs, PAHs, mineral oil, etc
 - Bacteriological quality 细菌质量
- **Costs of implementation & maintenance 实施和维护成本**
- Perception 感知
- Safety 安全
- Health 健康
- Social cohesion 社会凝聚力



Utrecht - Beurskwartier



Adaptation Support Tool 2.0 适应支持工具2.0

Toolbox Climate Resilient City www.crctool.org

Klimaat Bestendige Stad Toolbox Ast CID Alternatief Groep Frans Robbert

Toegepaste maatregelen

- Urban wetlands
- Fontein, watervallen en watermuren
- Groene daken
- Infiltratievelden en infiltratiestroken met bovengrondse opslag
- Stadsbossen
- Infiltratiekragen
- Waterdaken/blauwe daken
- Groene daken met afvoertraging
- Holle en schuine wegen
- Ondergrondse bergingskelder
- Ontharden: Verharding eruit, groen erin

Legend

- Projectgebied CID
- Luchtfoto (PDOK)

Resultaten

Klimaat

- Bergingscapaciteit:
- Herhalingstijd factor:
- Grondwater aanvulling:
- Evapotranspiratie:
- Hitte reductie:
- Koele gebieden:

Kosten

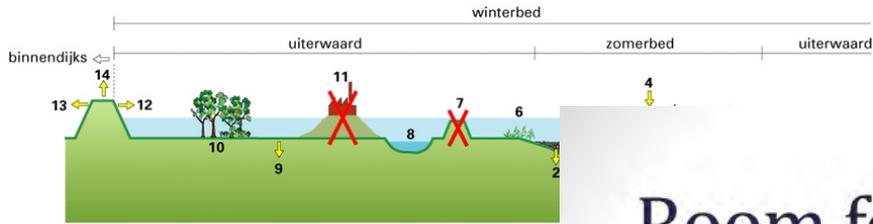
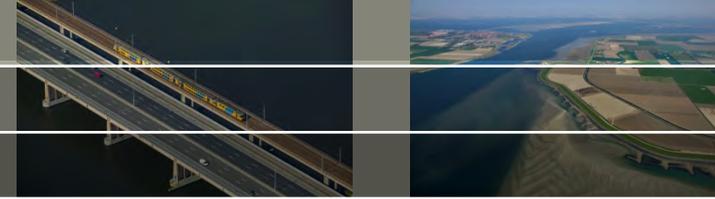
- Aanleg:
- Onderhoud:

Creating urban resilience together 共同创造城市韧性



The New Orleans - Adaptation Support Tool 新奥尔良 - 适应支持工具

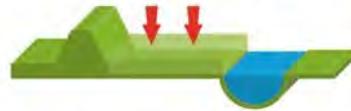
Room for the River 河流扩容



- | | |
|-------------------------------|----------------------|
| 1 = versmallen | 8 = nevengeul |
| 2 = verlaging kribben | 9 = verlaging |
| 3 = baggeren | 10 = vegetatie |
| 4 = terugstorten sediment | 11 = verwijderen |
| 5 = vaste laag | 12 = dijkverbetering |
| 6 = natuurvriendelijke oevers | 13 = dijkverlegging |
| 7 = verwijderen zomerkade | 14 = dijkverhoging |

Room for the River (The Netherlands)

Lowering of floodplains



Deepening summer bed



Water storage



Dike relocation



Lowering groynes



High-water channel



Depoldering



Removing obstacles



Strengthening dikes



Only in areas in which creating more room for the river is not an option.

[video](#)

SOURCES: Room for the River Project

Room for the River projects 河流扩容项目



> 30 projects



Room for the River projects 河流项目空间



Bommelerwaard/ Loevestein



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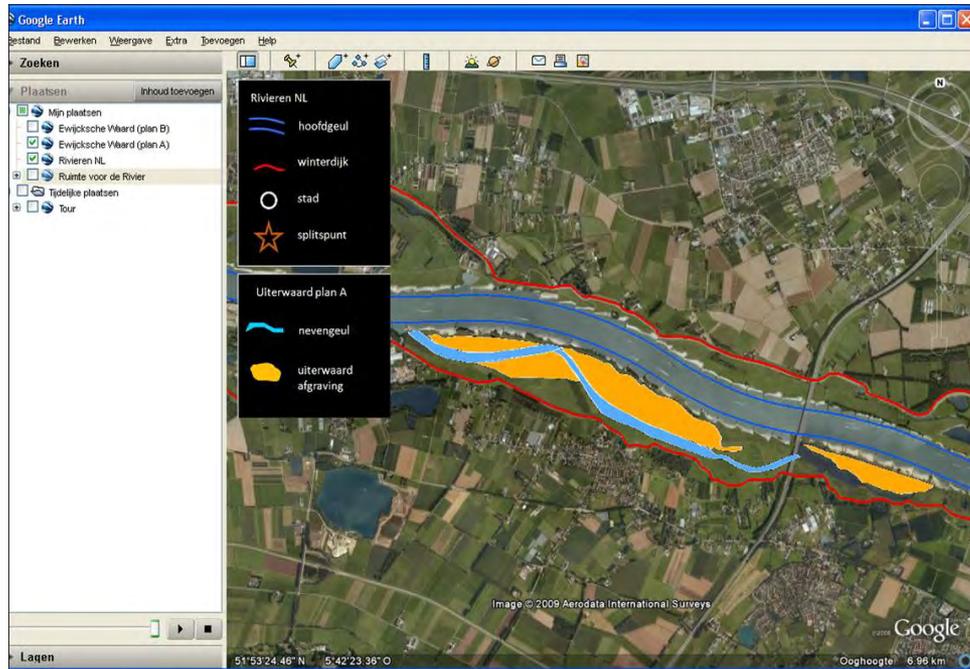


Natalya
WEDDING PHOTOGRAPHY

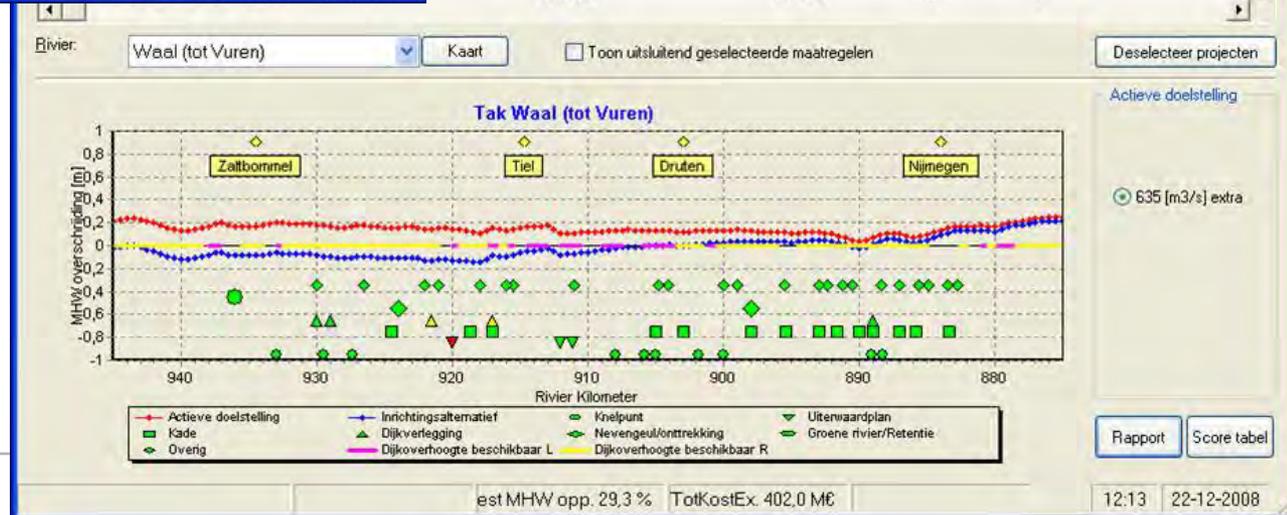


Blauwe Kamer Rhenen

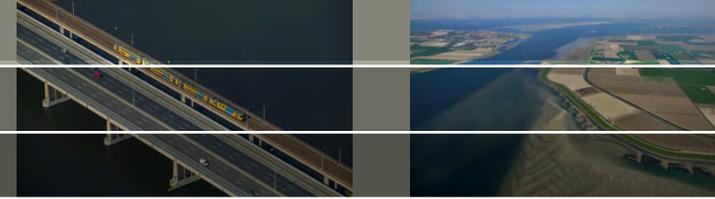
Toolbox Room for the River 河流扩容工具箱



	23	26	31	41
kosten		verandering oppervlakte	verandering natuurwaarde	verlies van woningen
		landbouwgrond		
[miljoen Euro]	[hectares]	[oordeel]	[aantal]	
12	0	0	0	
2440	-2383	+++	387	
438	-34	0	0 (!)	
402	-32	0	0 (!)	
113	-19			



Conclusion 总结



- On site retention is key to avoid local and downstream flooding
源头蓄水是避免局部和下游洪水的关键
- This storage requires space 储水需要空间
- This space can be used multi-functional and provide services
这个空间可以多功能使用并提供服务
- These functions and services bring many more benefits, economic, social and emotional, in addition to retention
除了储水之外，这些功能和服务还带来更多的经济、社会和情感方面的好处
- Blue-green, ecosystem based adaptation measures provide all this
基于生态系统的蓝-绿适应措施提供了全部这些
- Selection of measures is a multi-disciplinary spatial planning problem
选择措施是一个多学科的空间规划问题
- Planning support toolboxes help planning and decision making
规划支持工具箱有助于规划和决策

Closing 結束



Thank you for your attention! 谢谢您的聆听!

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