A global perspective on the local challenges of water in Bath

Kees van Leeuwen (David Parkin Lecture 5 Feb 2019)

Dutch Water Sector

Drinking water companies produce and supply drinking water (10)

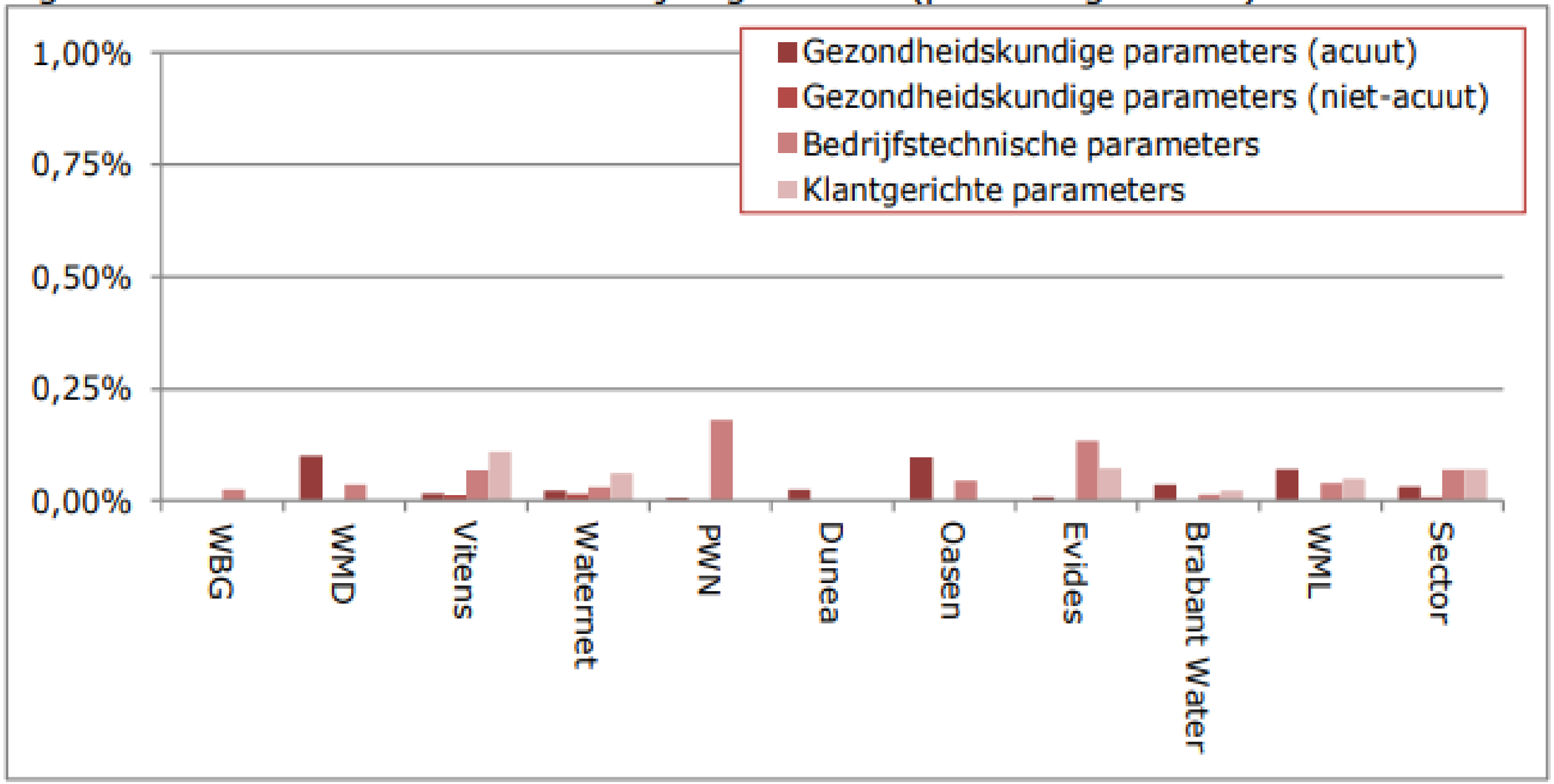
Water boards manage water regionally and treat wastewater (21)

Municipalities are responsibly for the sewer system (388)

Rijkswaterstaat manages large bodies of water
Provinces manage ground water (12)

Benchmarking water utilities. Started voluntary now legal requirement

Figuur 2.3: Gemeten normoverschrijdingen 2015 (percentage totaal)

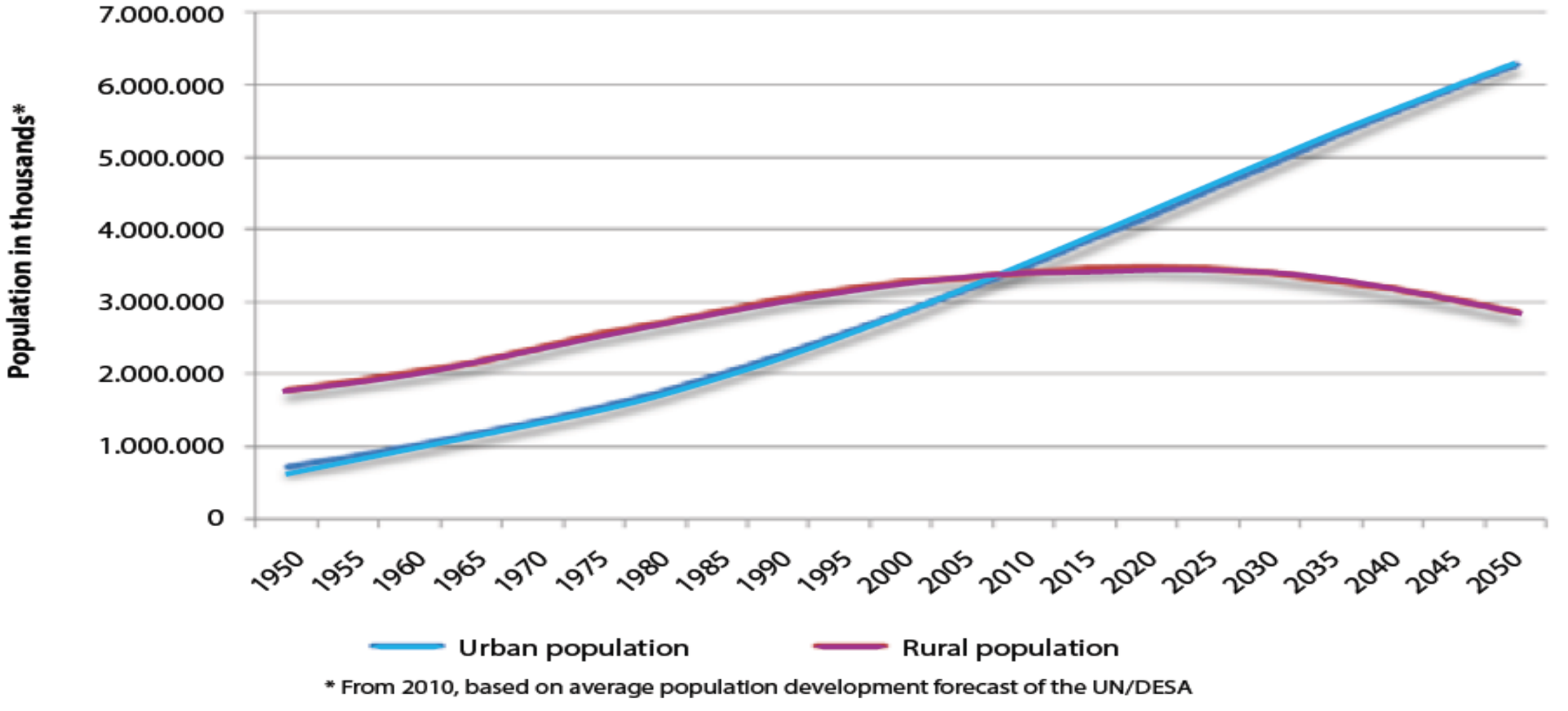


KWR Watercycle Research Institute

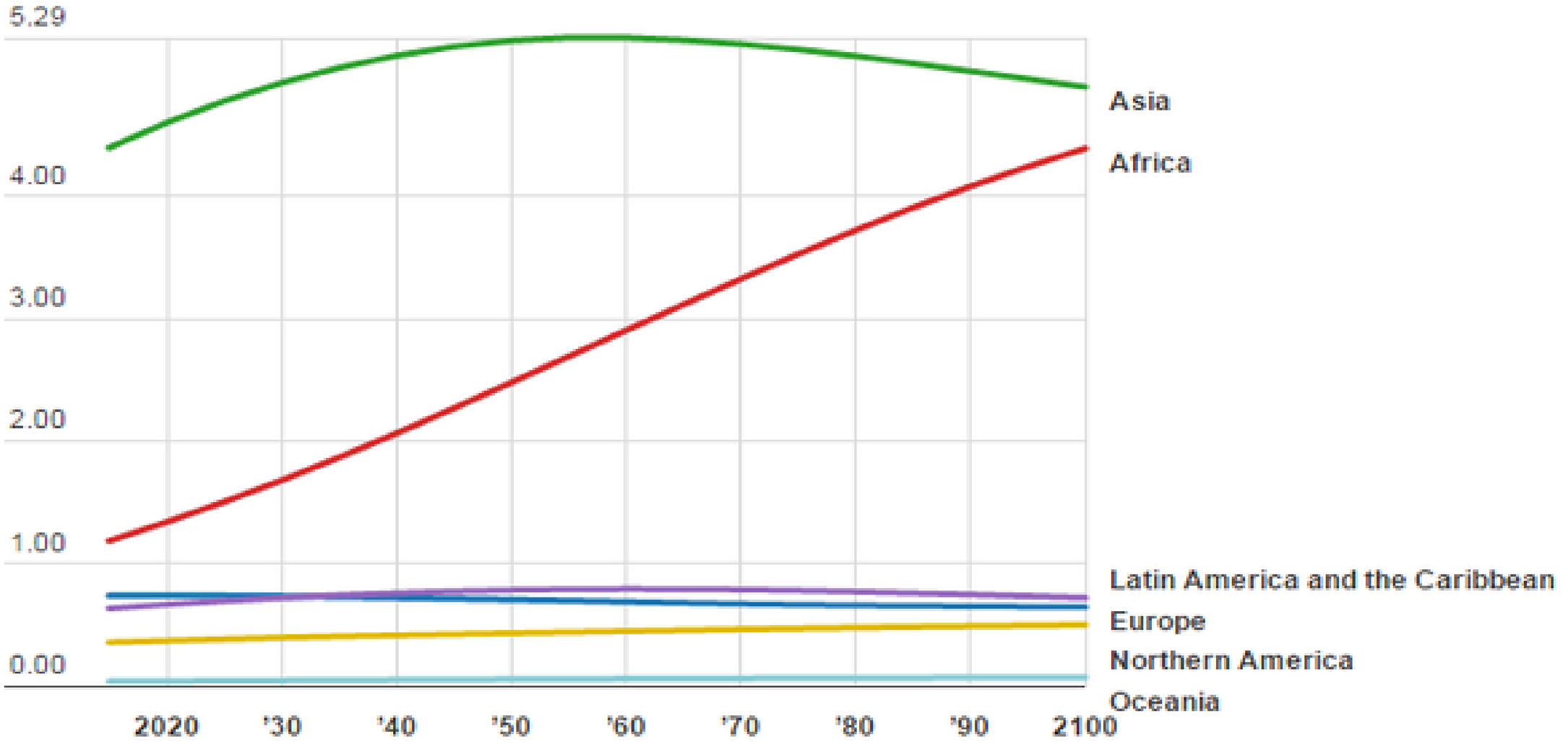
KWR Watercycle Research Institute

Content

Growth Global Population

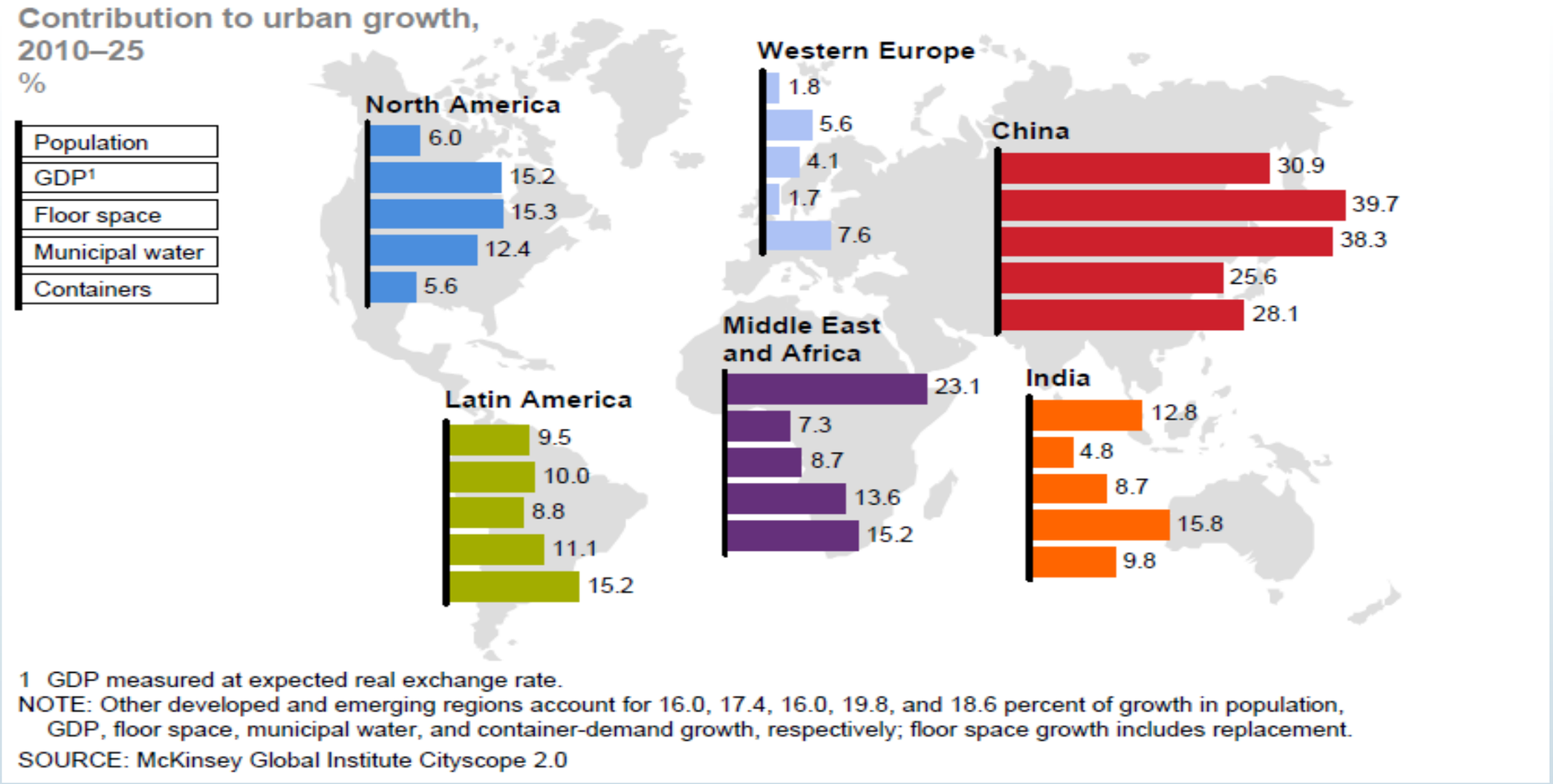


UN Regional Population Projections (Billions, 2015 - 2100)



Source: UN Medium-Variant Projection, 2015 Get the data

Growth predictions (%) in cities for 2010-2025



1 GDP measured at expected real exchange rate.
NOTE: Other developed and emerging regions account for 16.0, 17.4, 16.0, 19.8, and 18.6 percent of growth in population, GDP, floor space, municipal water, and container-demand growth, respectively; floor space growth includes replacement.
SOURCE: McKinsey Global Institute Cityscope 2.0

Source: Dobbs et al., 2012

Megatrends in cities

Urbanization

Urban areas of the world are expected to absorb all the population growth expected over the next four decades.
By 2050, urban dwellers will likely account for 86 % of the population in the more developed regions and for 64 % of that in the less developed regions.

Climate change

Climate change may worsen water services and quality of life in cities.

Water use & water scarcity

Water withdrawals have tripled over the last 50 years. In 2030, there will be a 40% supply shortage of water.

Sanitation

Currently, 2.5 billion people are without improved sanitation facilities.

Human health

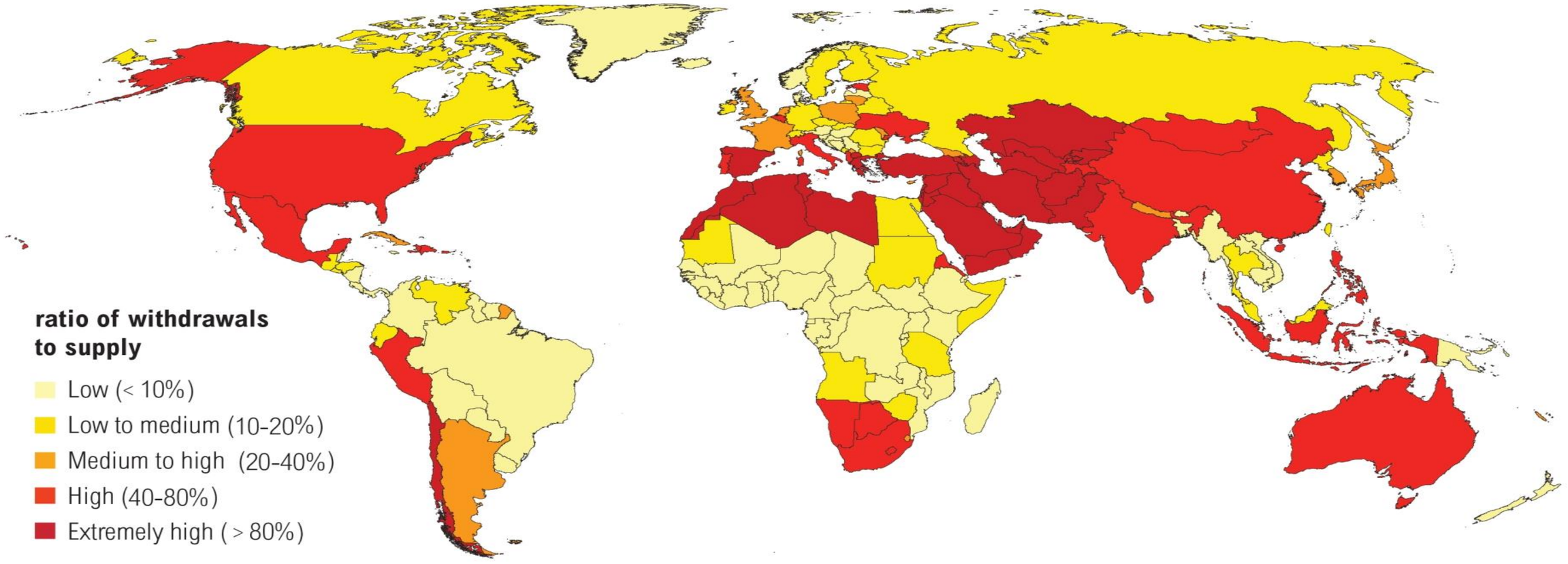
Currently, 3.4 million people - mostly children – die from water-borne diseases every year.

Hazards

Water-related hazards account for 90% of all natural hazards.

Source: Van Leeuwen 2013

Water Stress by Country: 2040



NOTE: Projections are based on a business-as-usual scenario using SSP2 and RCP8.5.

For more: ow.ly/RiWop

WORLD RESOURCES INSTITUTE

HEAT WAVES (EEA 2011)

- In Europe, of those natural disasters occurring in recent decades, heatwaves have caused the most human fatalities. During the summer of 2003 the heatwave in Central and Western Europe was estimated to have caused up to 70 000 excess deaths over a four-month period.

- It is highly likely that the length, frequency and/or intensity of heatwaves will increase.

- Present day design of many cities with few green urban areas but many artificial surfaces aggravates the impact of heatwaves within cities, in particular by increasing night-time temperatures.

CLIMATE CHANGE MITIGATION & ADAPTATION

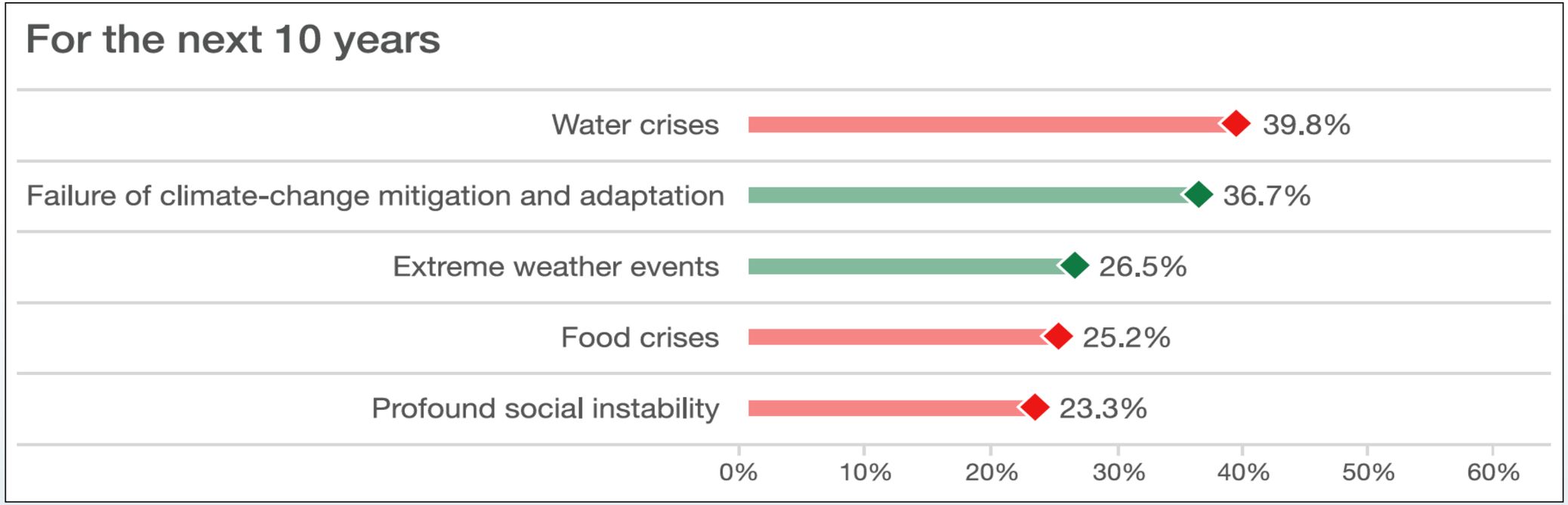
Cost of Floods in EU (IIASA 2014):
€ 4.9 billion a year on average from 2000-2012 and € 23.5 billion by 2050
Frequency of larger events increase from once in 16y to once in 10 y

⟶ damage per year will increase 5 times

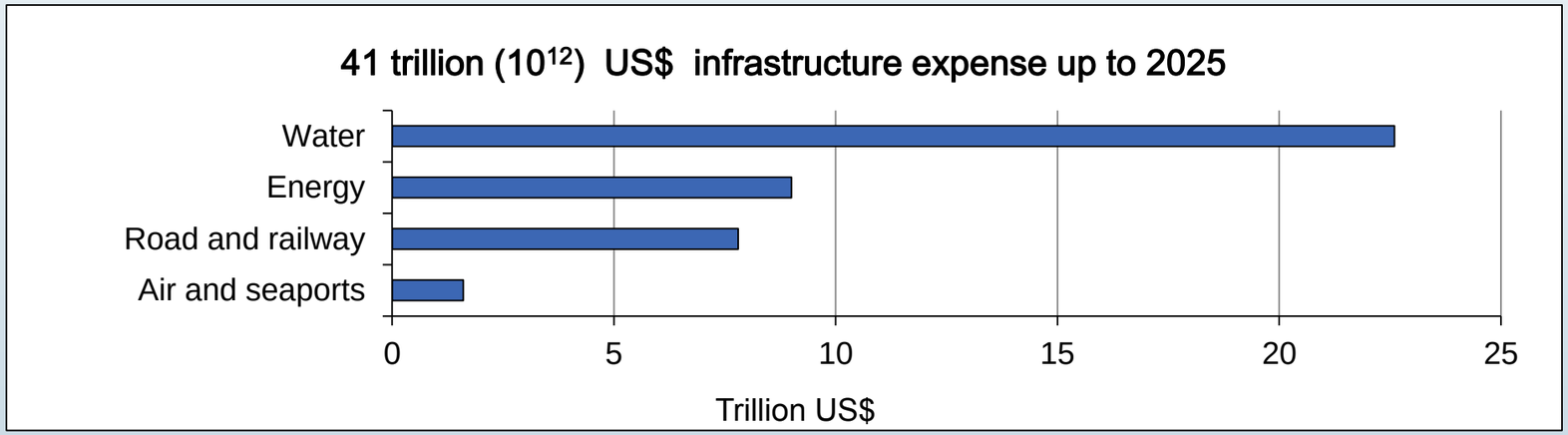
Cost of Katrina (USA):
† 1,836 and US$ 81 billion

Copenhagen: Climate adaptation measures greatly outweigh the future damage. Savings for the next 100 years are estimated at: 2.6 - 3.2 billion.

COSTS of INACTION: Benefits of Climate Change Mitigation and Adaptation are beneficial for cities. **Cities need to be prepared!**



World Economic Forum, 2015



UNEP, 2013

UNEP (2013). City-level decoupling

PLAN or WASTE YOUR MONEY

“Sooner or later, the money needed to modernise and expand the world’s urban infrastructure will have to be spent. The demand and need are too great to ignore. The solutions may be applied in a reactive, ad hoc, and ineffective fashion, as they have been in the past, and in that case the price tag will probably be higher than US$40 trillion. After all, infrastructure projects are notorious for cost overruns. But perhaps the money can be spent proactively and innovatively, with a pragmatic hand, a responsive ear, and a visionary eye. The potential payoff is not simply the survival of urban populations, but the next generation of great cities.”

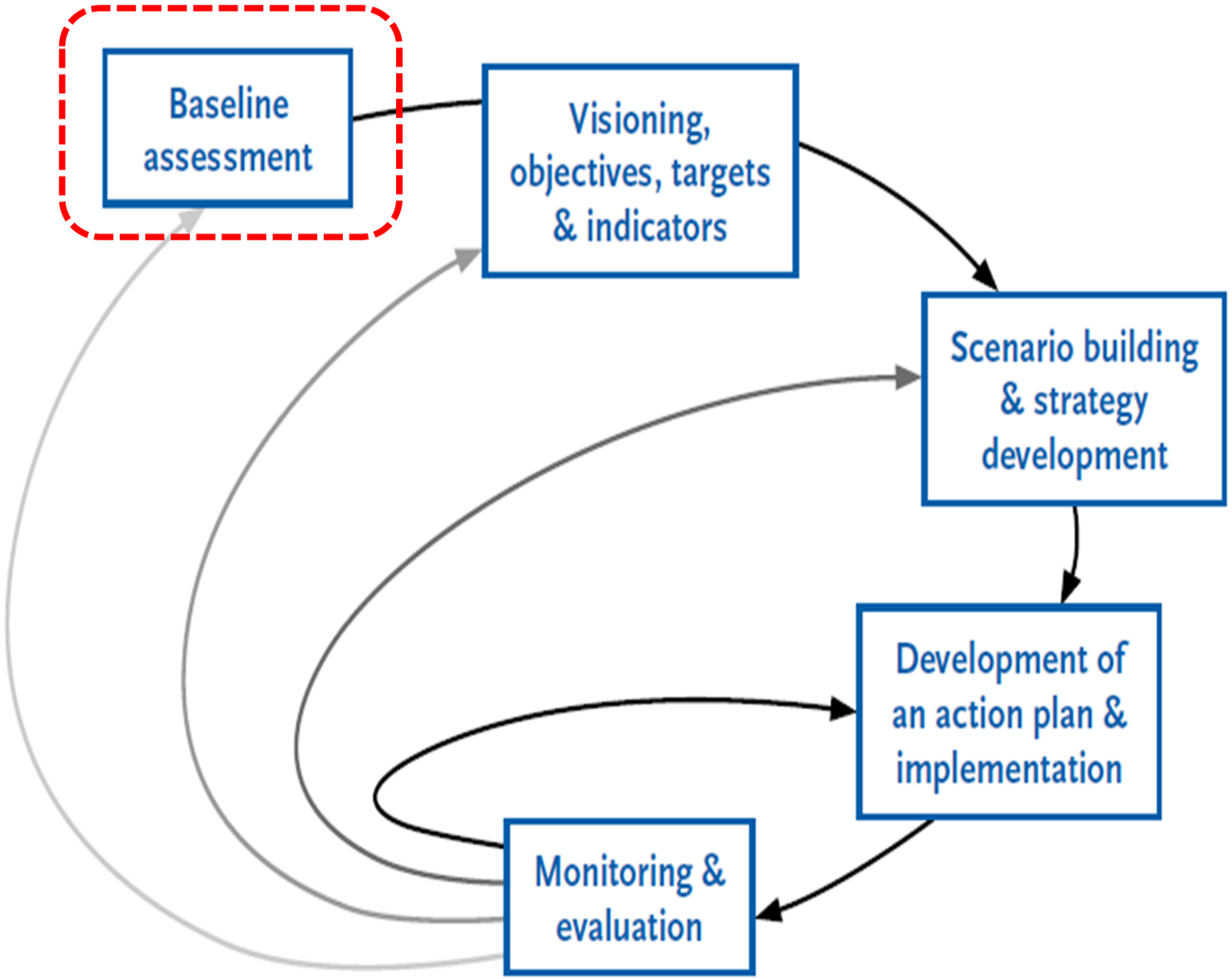
REGRETTABLE TRANSITIONS

“Cities in developing countries may be able to engage in large-scale investments in alternative urban infrastructure technologies to leap frog towards more sustainable solutions rather than wasting valuable resources to implement what must later on be dismantled”

Cities need a long-term vision and strategy

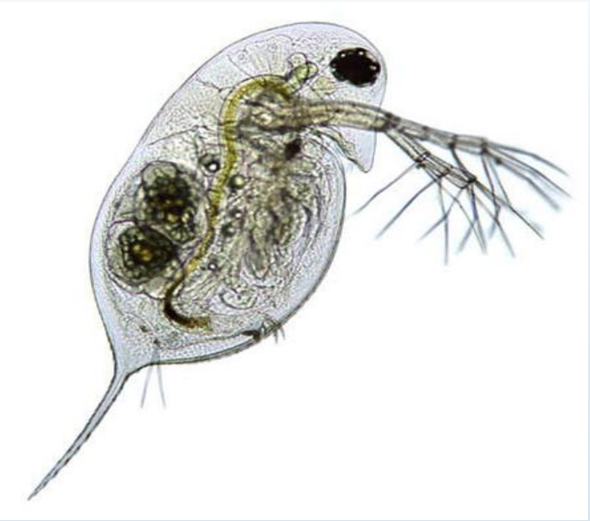
Cities need to start investing in adaptation measures based on a **long-term vision and strategy and by sharing best practices** *(Van Leeuwen, 2014).*

The longer political leaders wait, the more expensive adaptation will become and the danger to citizens and the economy will increase *(Jacqueline McGlade, former EEA Executive Director).*



GENERATION TIMES OF SOME 'SPECIES'

Species	Generation time
Bacteria	≈ 0.1 d
Algae (*Chlorella sp.*)	≈ 1 d
Waterfleas (*Daphnia sp.*)	≈ 10 d
Snails (*Lymnaea sp.*)	≈ 100 d
Rats	≈ 1 y
Politicians	≈ 5 y
Man	≈ 25 y
Cities	>100 y



Modified after Van Leeuwen en Vermeire (2007)

Content

1. Our global challenges
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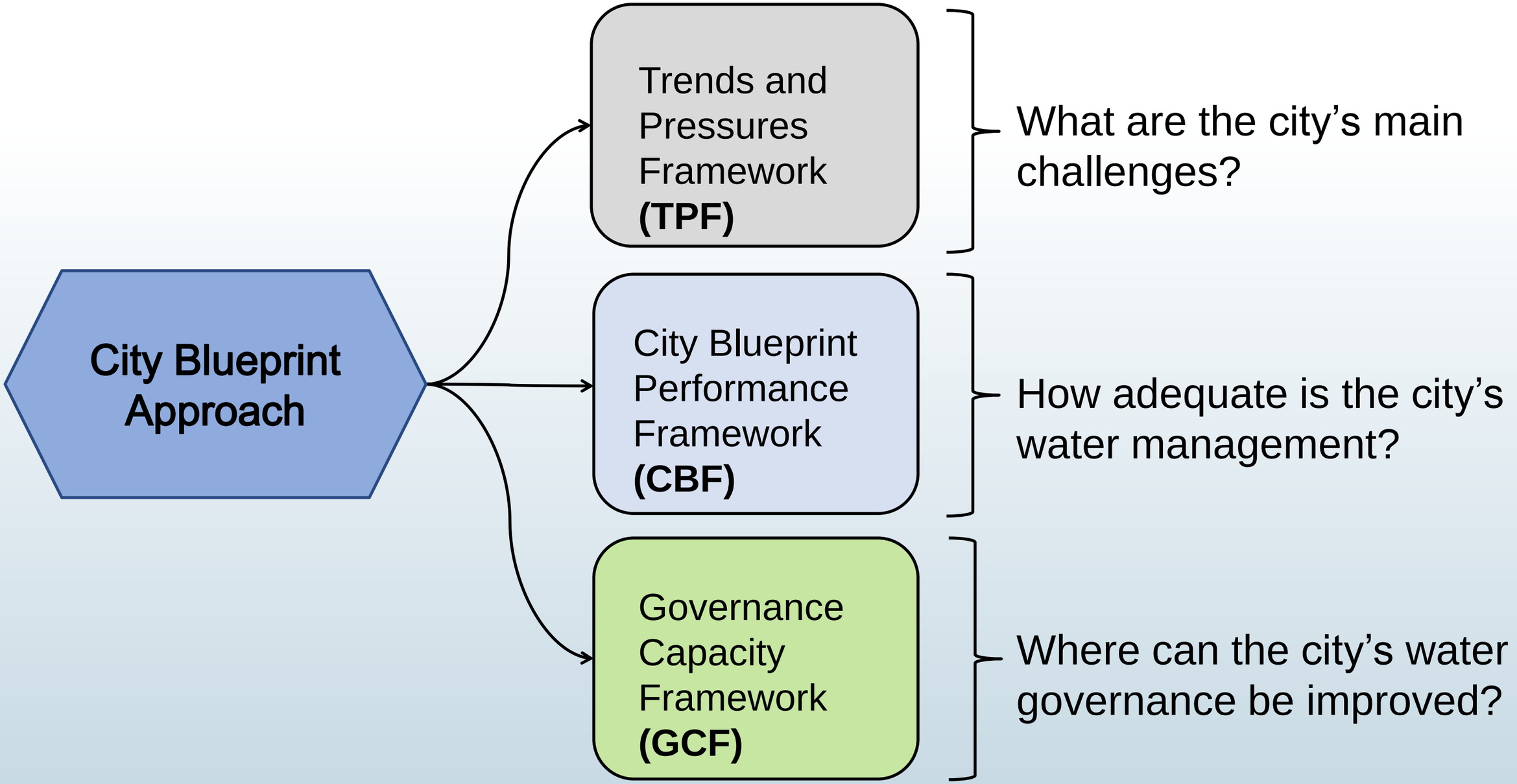
3. Results
4. Co-benefits in city planning
5. Conclusions
6. Further info


City Blueprint Approach
Trends and Pressures Framework (TPF)
City Blueprint Performance Framework (CBF)
Governance Capacity Framework (GCF)
What are the city's main challenges?
How adequate is the city's water management?
Where can the city's water governance be improved?

Trends and pressures framework

city blueprints		
	Social	1 Urbanization rate
		2 Burden of disease
		3 Education rate
		4 Political stability
	Environmental	5 Flood risk
		6 Water scarcity
		7 Water pollution
		8 Heat risk
	Financial	9 Economic pressure
		10 Unemployment rate
		11 Poverty rate
		12 Inflation rate

0	No concern	1	Low concern	2	Medium concern	3	Concern	4	Great concern

5 Flood risk	Urban drainage flood
	River peak discharges
	Sea level rise
	Land subsidence
6 Water scarcity	Freshwater scarcity
	Groundwater scarcity
	Salinization and/or seawater intrusion
7 Water pollution	Surface water quality
	Biodiversity
8 Heat risk	Heat island effect

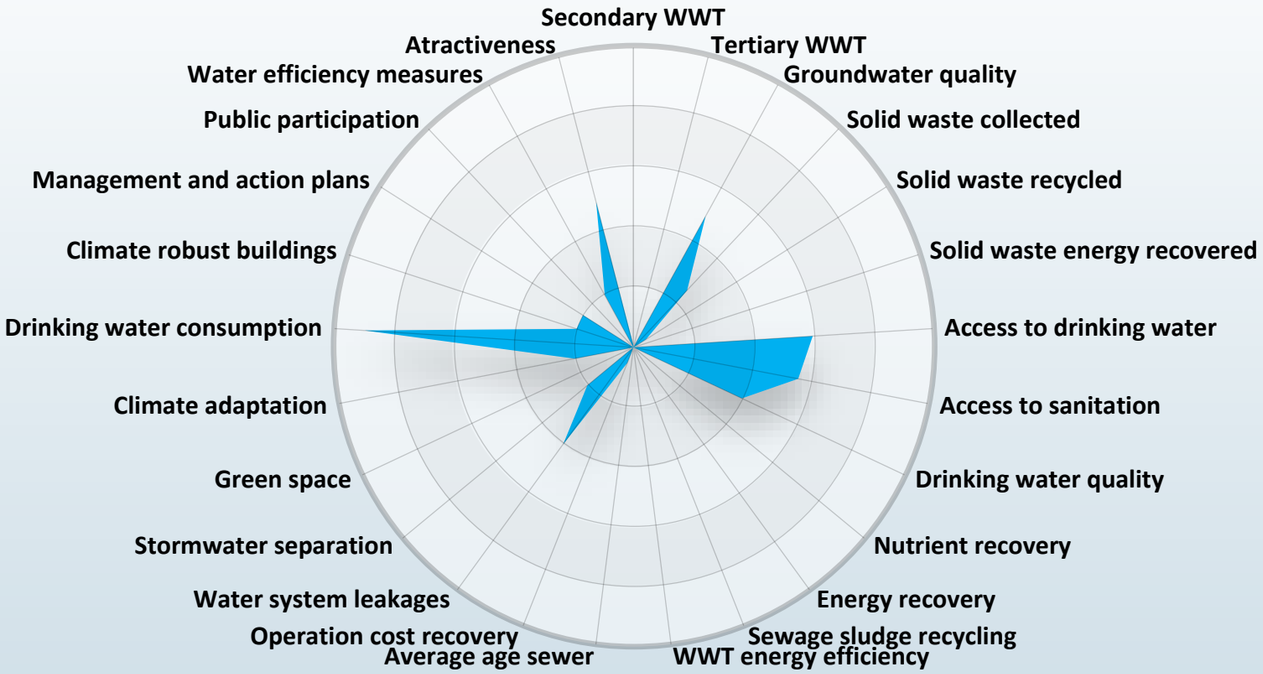
Three examples

			Dar es Salaam	Melbourne	Amsterdam
Trends and pressures	Social	1. Urbanization rate	4	1	1
		2. Burden of disease	3	1	0
		3. Education rate	3	0	1
		4. Political instability	2	1	1
	Environmental	5. Water scarcity	2	1	1
		6. Flood risk	3	2	3
		7. Water quality	1	2	2
		8. Heat risk	3	4	1
	Financial	9. Economic pressure	4	0	1
		10. Unemployment rate	1	1	1
		11. Poverty rate	4	0	0
		12. Inflation rate	3	2	1

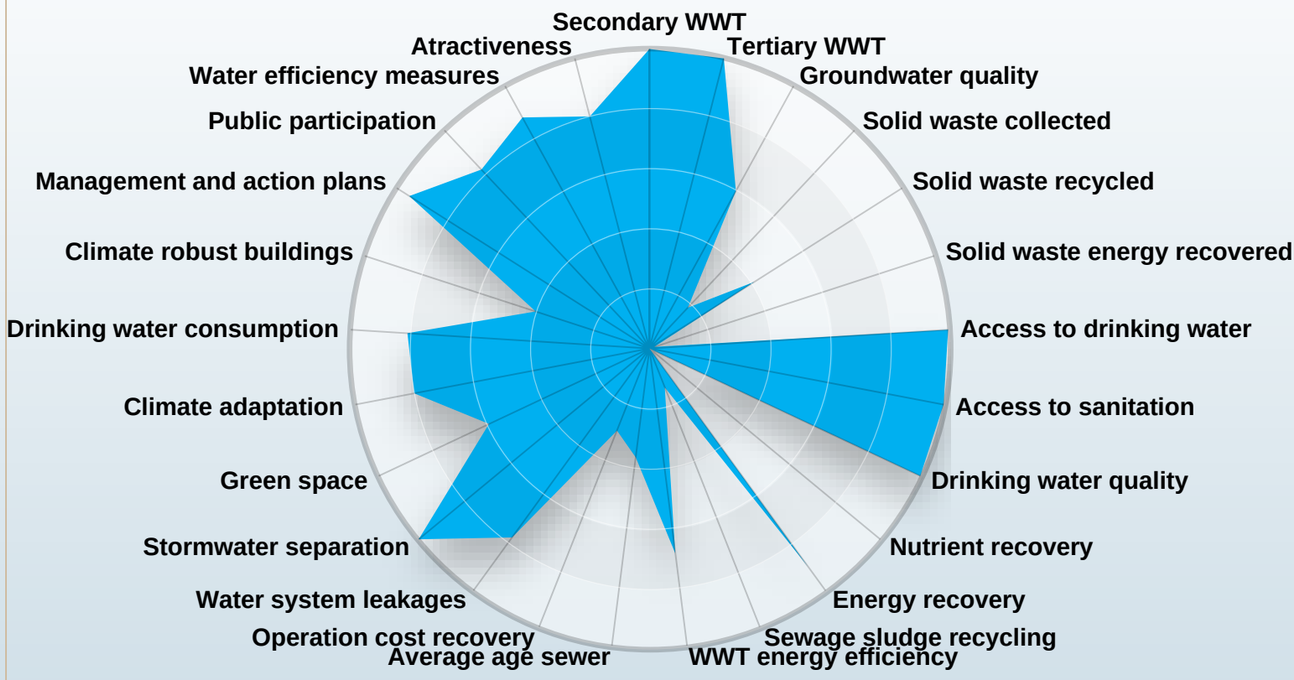
City Blueprint performance framework

Goal	**Baseline assessment** of the sustainability of Urban Water Resources Management
Indicators	Twenty-five indicators divided over seven categories: 1. Water quality 2. Solid waste treatment 3. Basic water services 4. Wastewater treatment 5. Infrastructure 6. Climate robustness 7. Governance
Data	Public data or data provided by the (waste) water utilities and cities based on a questionnaire
Scores	0 (concern) to 10 (no concern)
BCI	Blue City Index, the geometric mean of 25 indicators which varies from 0 to 10
Stakeholders	Water utility, water board, city council, companies, NGOs, etc.
Process	Interactive with all stakeholders involved early on in the process

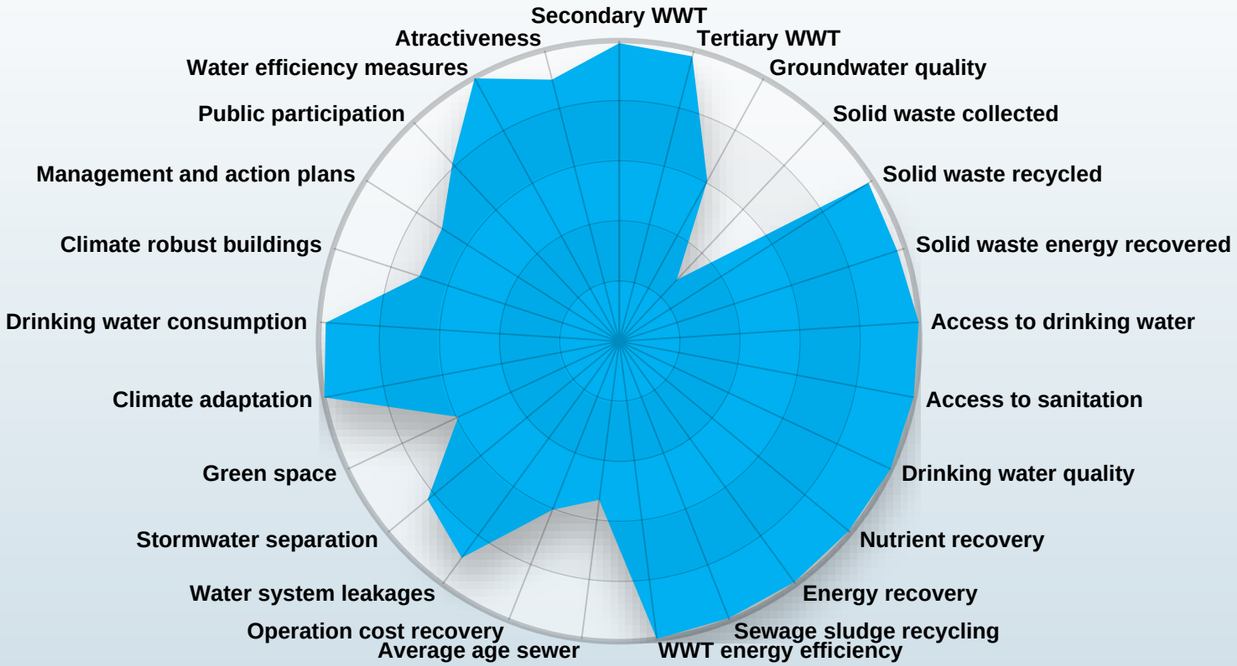
Dar es Salaam (BCI 1.3)



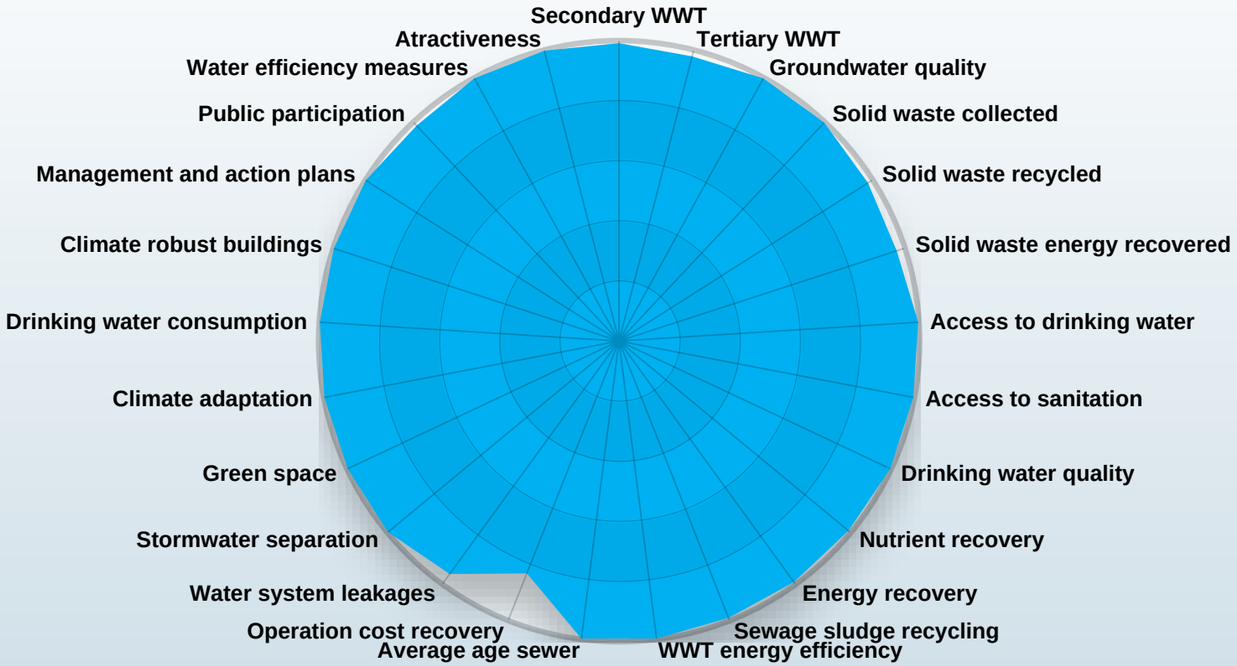
Melbourne (BCI 5.4)



Amsterdam (BCI 8.3)

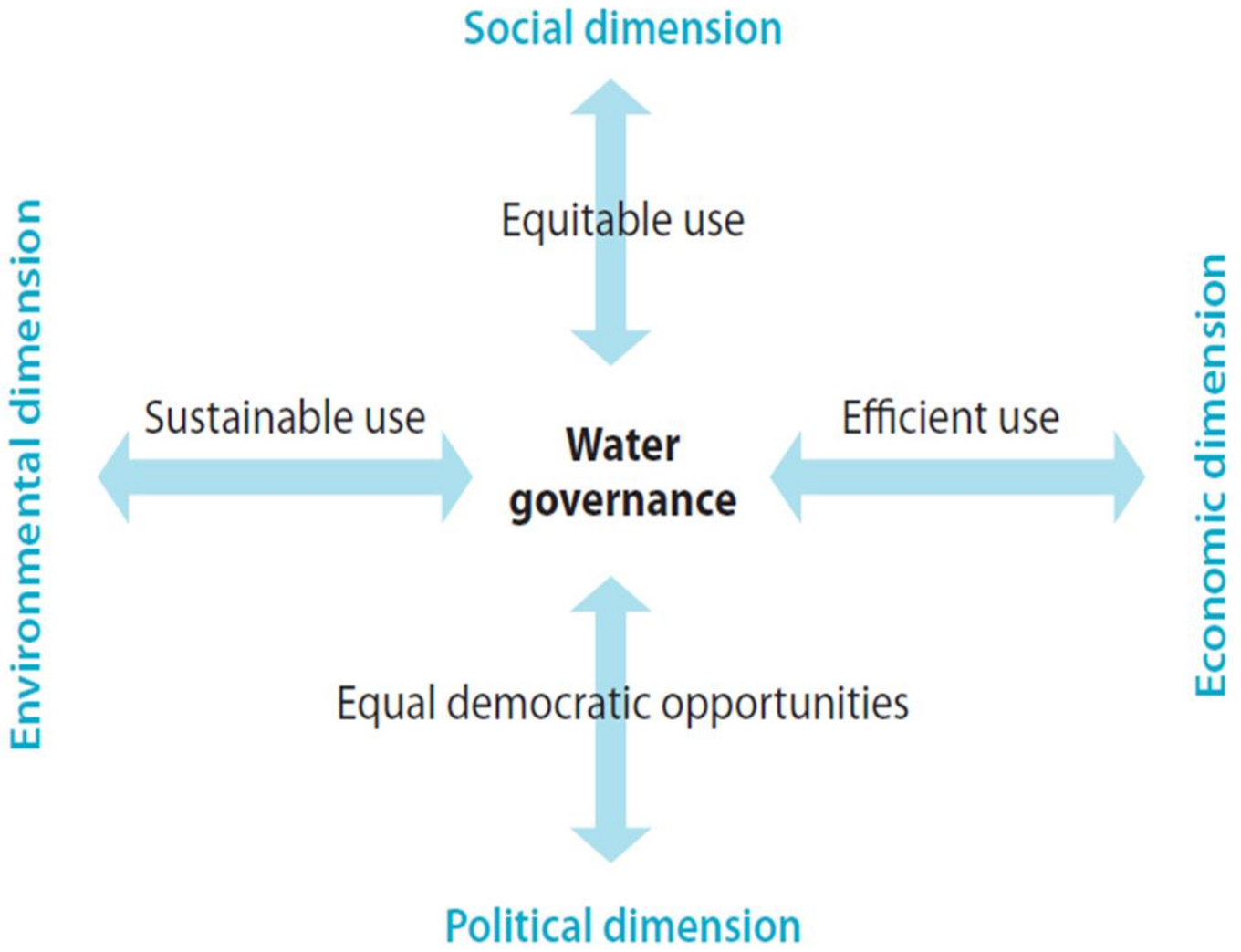


Best indicator score for each indicator based on 70 cities



Water Governance

According to the UN, ‘water governance encompasses the political, economic and social processes and institutions by which governments, civil society and the private sector make decisions about how best to use, develop and manage water resources’.



Water Governance

OECD (2015)

Water Governance Capacity Framework

Dimensions	Conditions	Indicators
Knowing	1 Awareness	1.1 Community knowledge 1.2 Local sense of urgency 1.3 Behavioral internalization
	2 Useful knowledge	2.1 Information availability 2.2 Information transparency 2.3 Knowledge cohesion
	3 Continuous learning	3.1 Smart monitoring 3.2 Evaluation 3.3 Cross-stakeholder learning
Wanting	4 Stakeholder engagement process	4.1 Stakeholder inclusiveness 4.2 Protection of core values 4.3 Progress and variety of options
	5 Policy ambition	5.1 Ambitious and realistic goals 5.2 Discourse embedding 5.3 Policy cohesion
	6 Agents of change	6.1 Entrepreneurial agents 6.2 Collaborative agents 6.3 Visionary agents
Enabling	7 Multi-level network potential	7.1 Room to maneuver 7.2 Clear division of responsibilities 7.3 Authority
	8 Financial viability	8.1 Affordability 8.2 Consumer willingness to pay 8.3 Financial continuation
	9 Implementing capacity	9.1 Policy instruments 9.2 Statutory compliance 9.3 Preparedness

Water-related challenges

1. Flooding

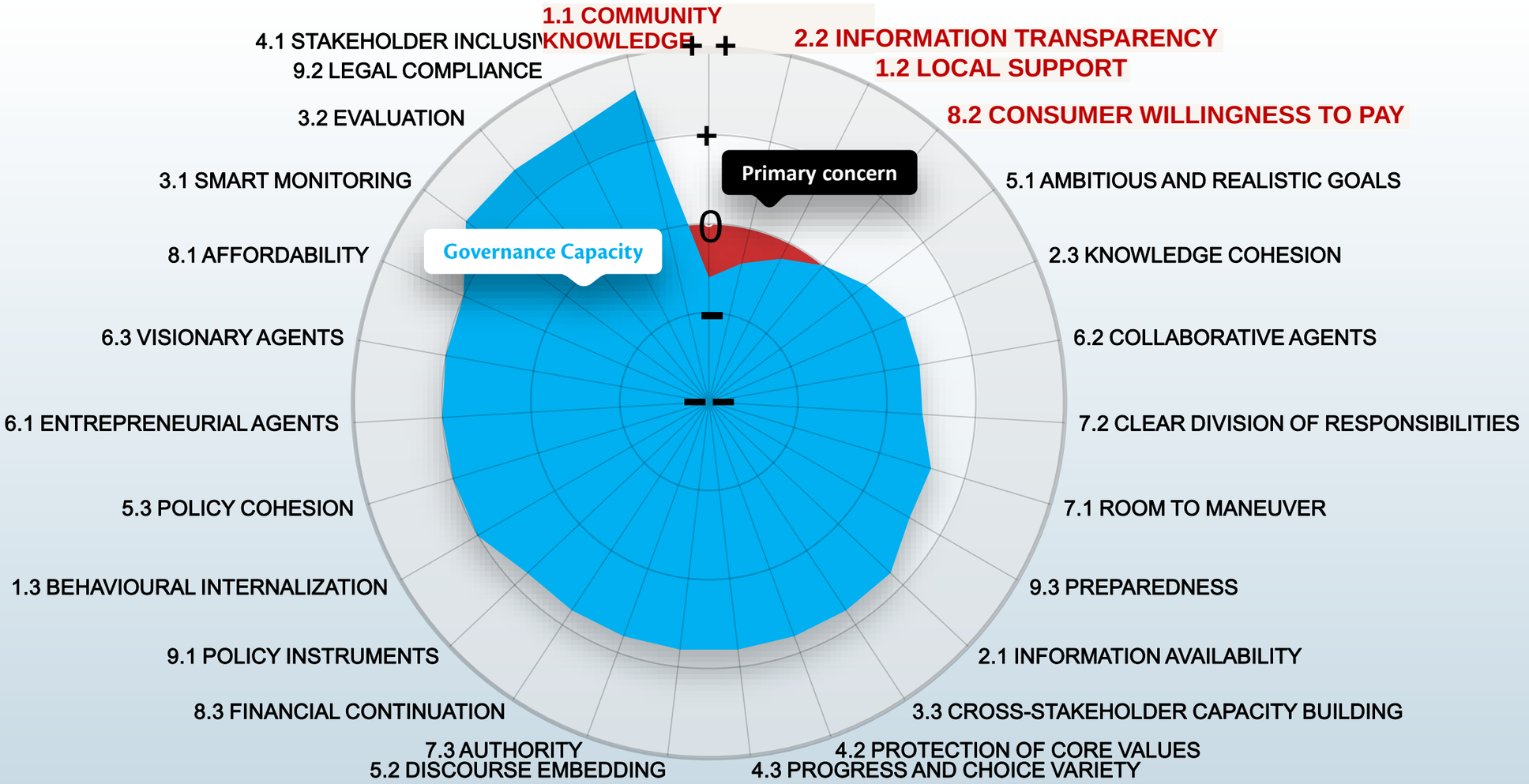
2. Urban Heat Islands

3. Water Scarcity

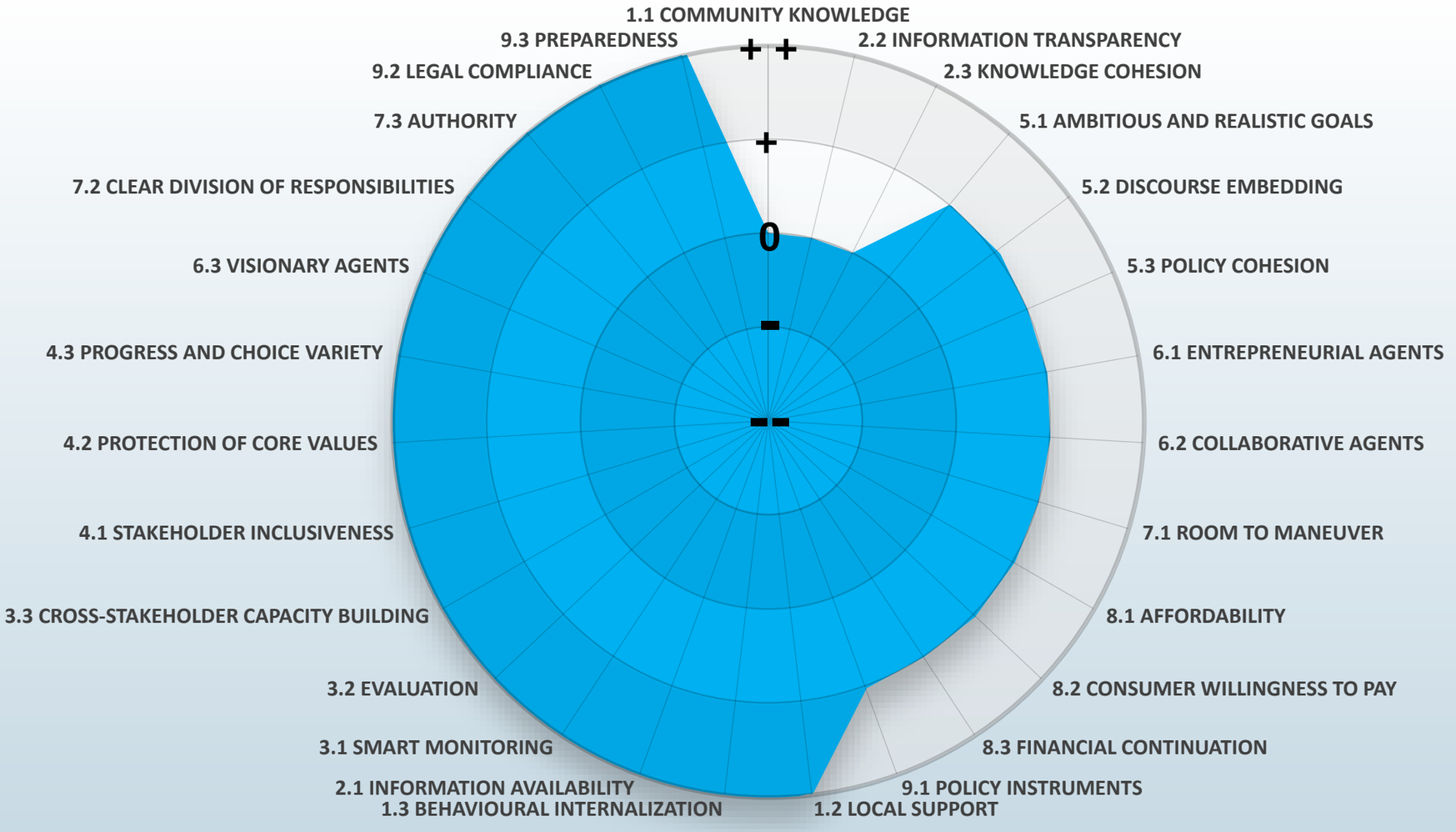
4. Wastewater disposal and treatment

5. Solid Waste collection, disposal and treatment

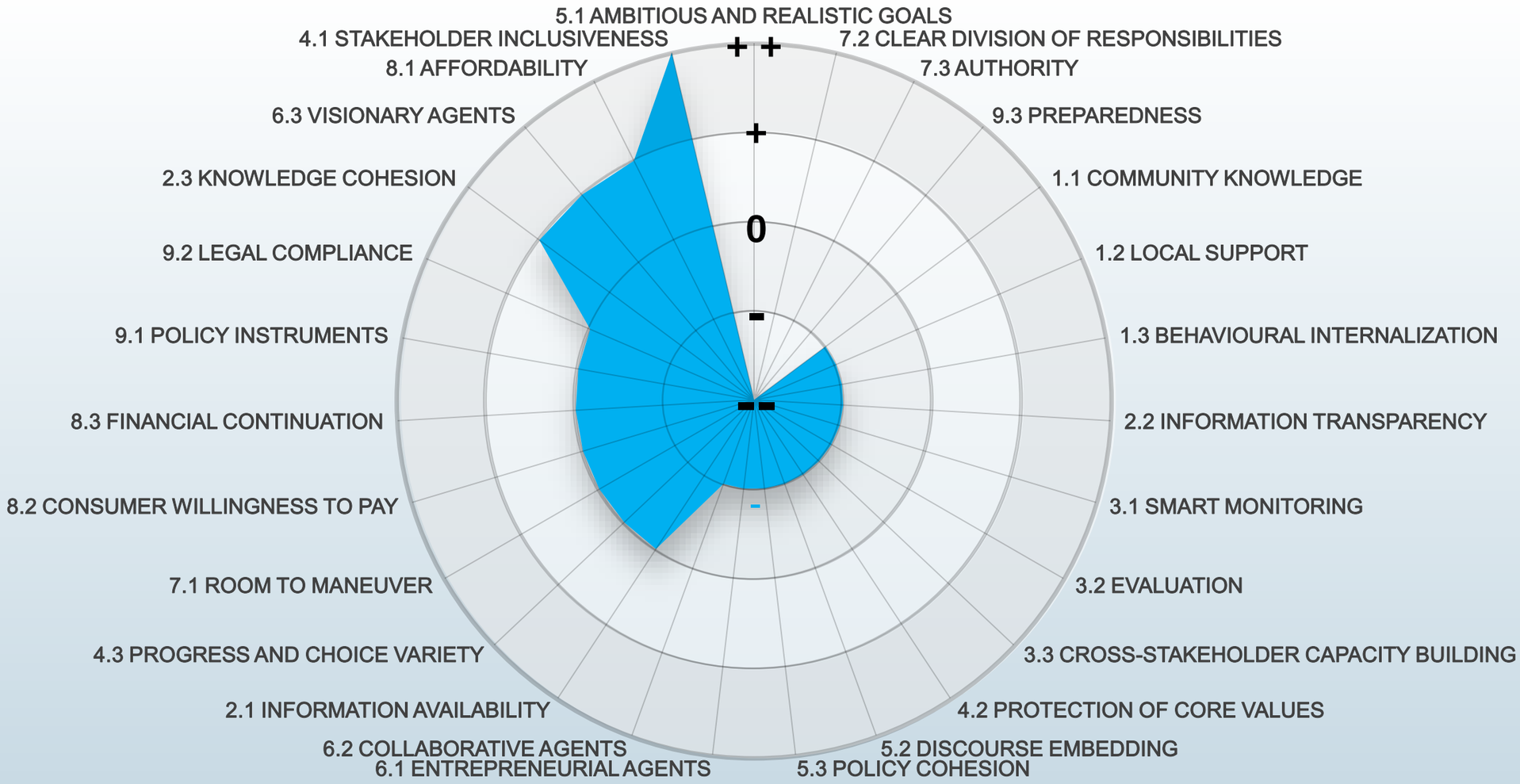
Governance Analysis Amsterdam



GCF Flood Risk Amsterdam



GCF Urban Heat Islands Amsterdam



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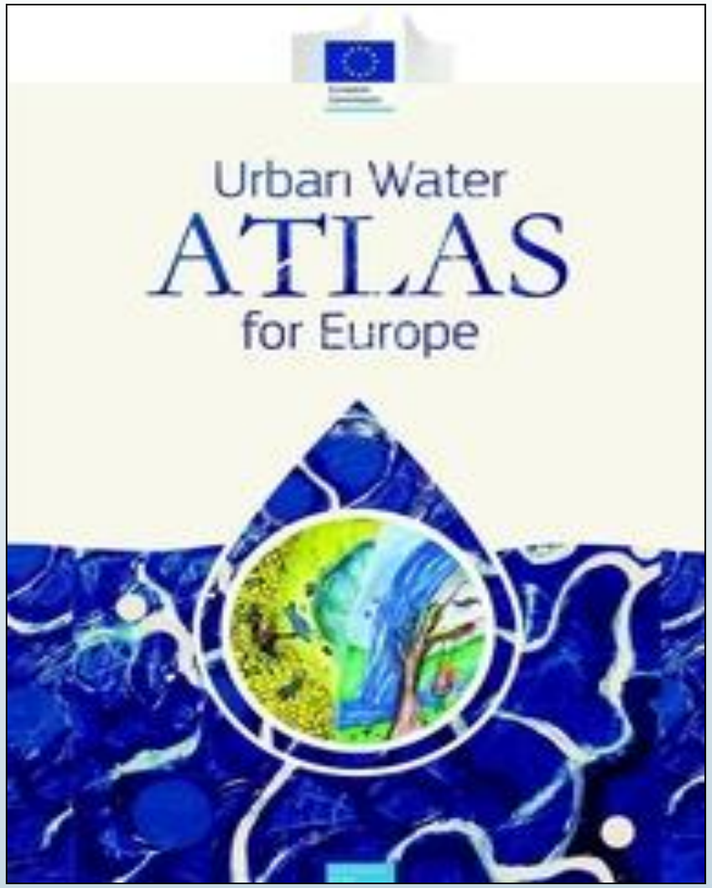
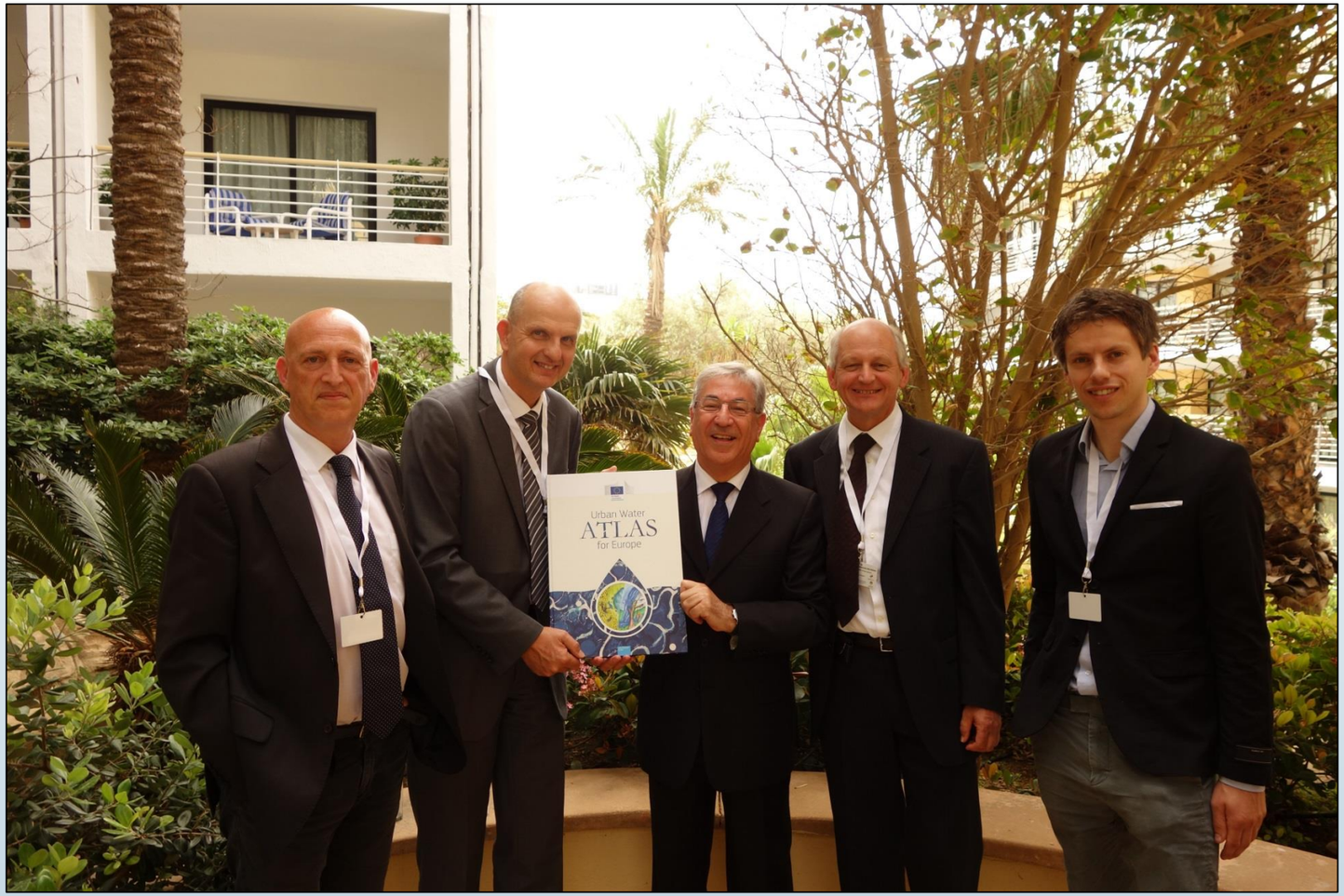
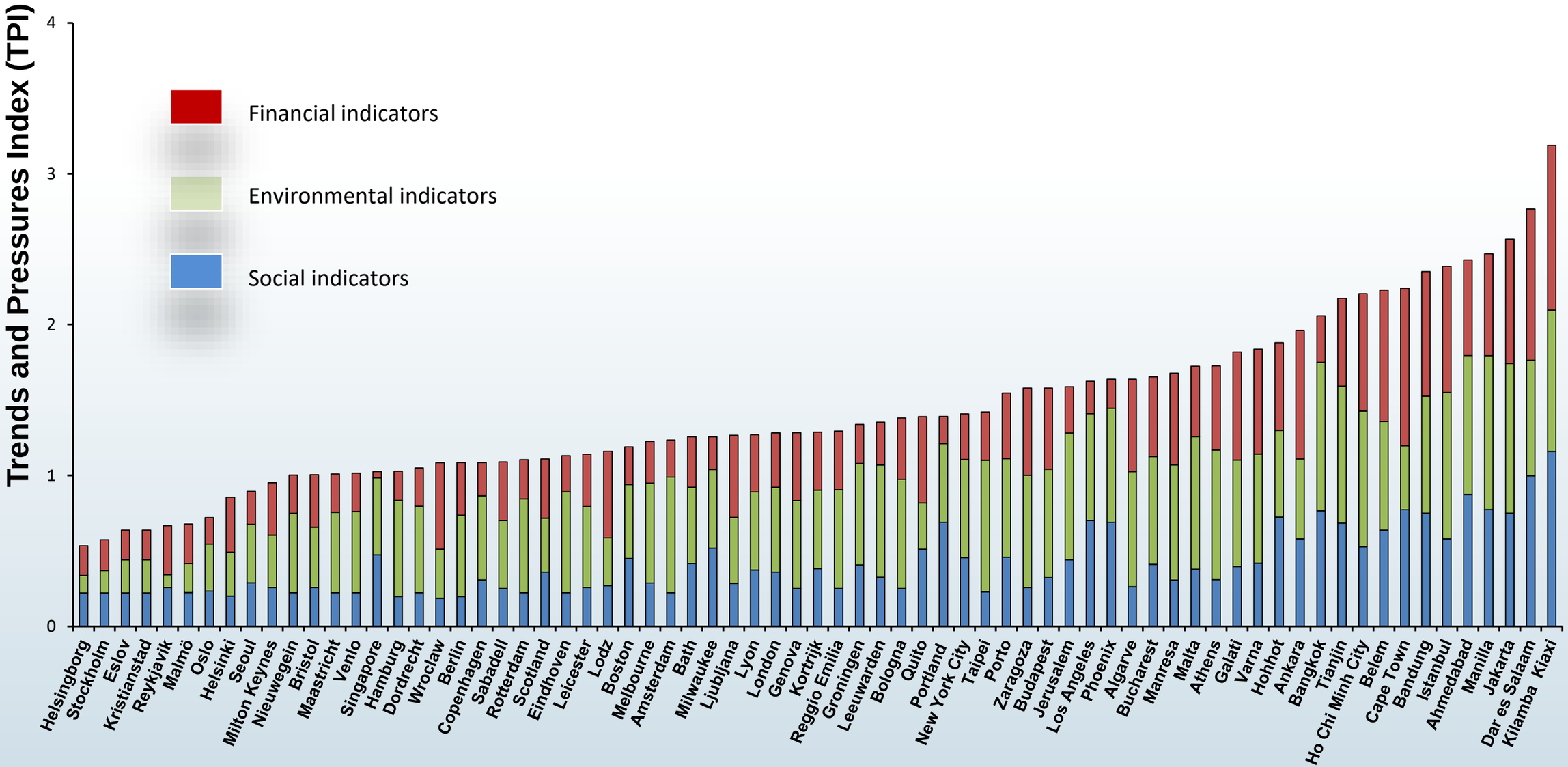
The Urban Water Atlas for Europe

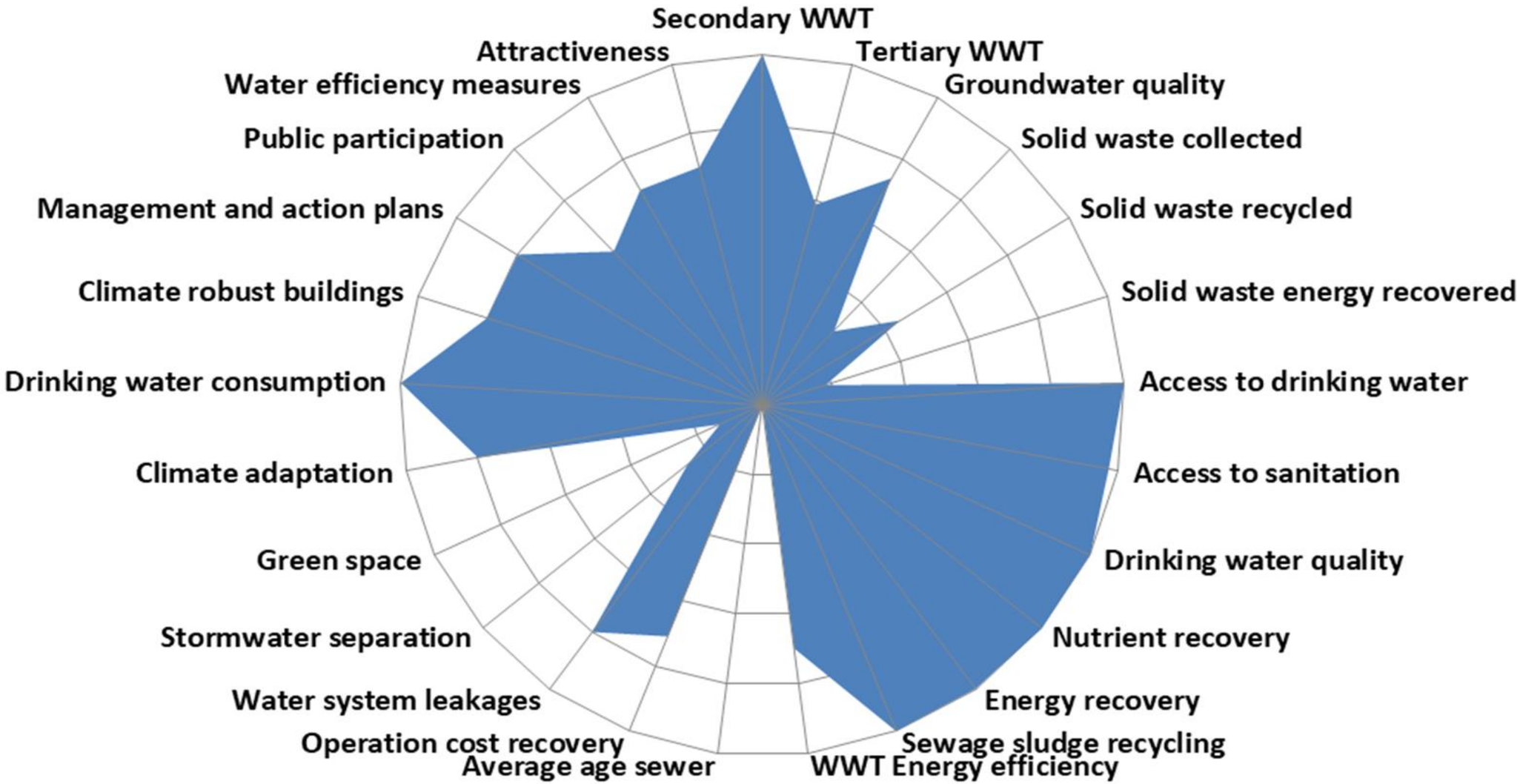
Awareness for water!

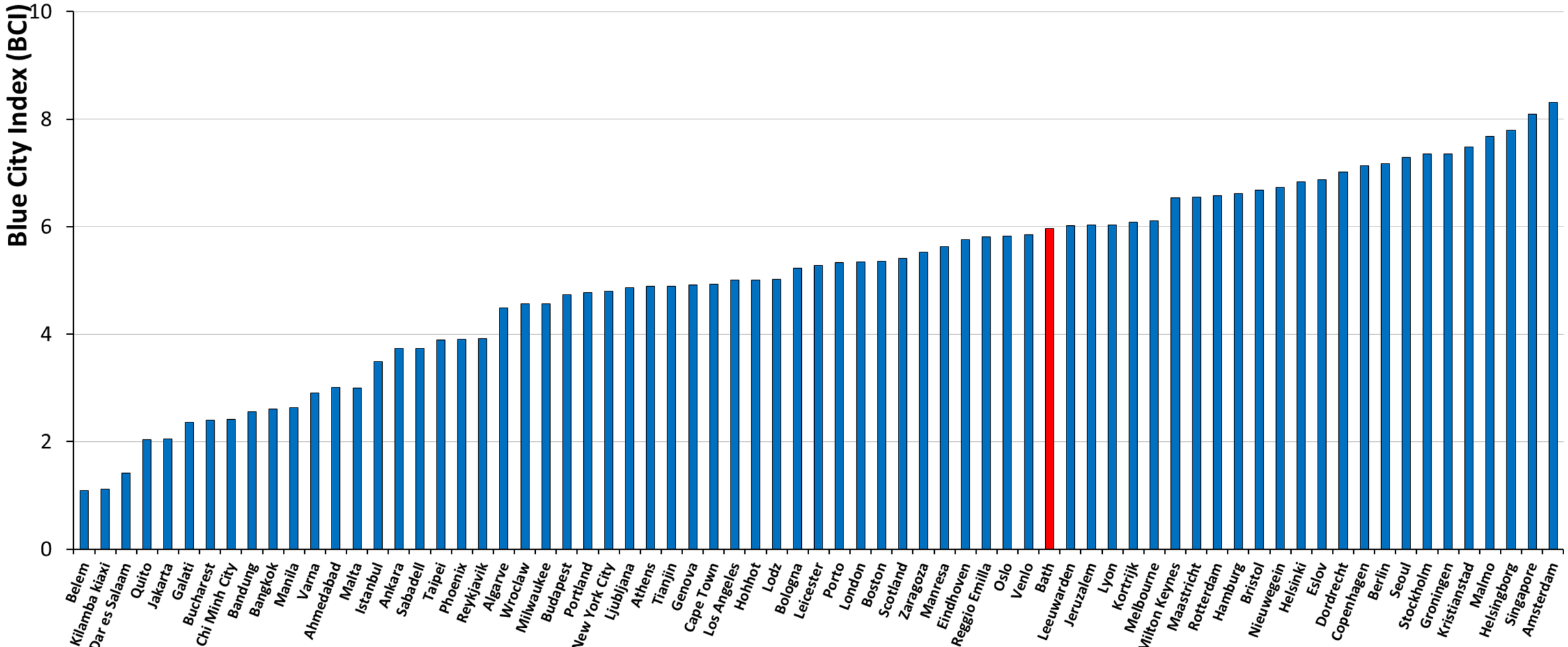


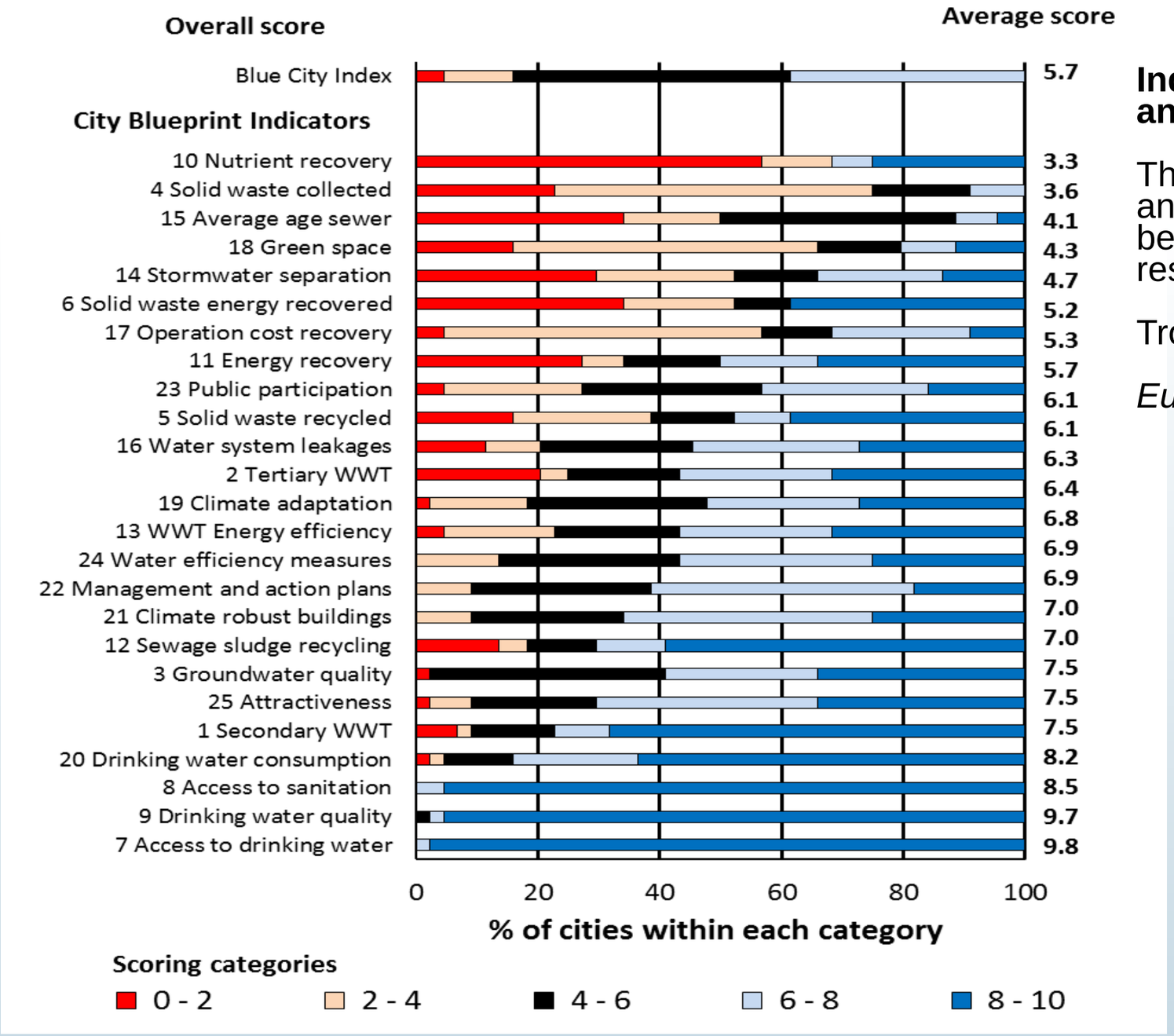



Trends and Pressures Index (TPI)
0
1
2
3
4
Financial indicators
Environmental indicators
Social indicators
Helsingborg
Stockholm
Eslov
Kristianstad
Reykjavik
Malmö
Oslo
Helsinki
Seoul
Milton Keynes
Nieuwegein
Bristol
Maastricht
Venlo
Singapore
Hamburg
Dordrecht
Wroclaw
Berlin
Copenhagen
Sabadell
Rotterdam
Scotland
Eindhoven
Leicester
Lodz
Boston
Melbourne
Amsterdam
Bath
Milwaukee
Ljubljana
Lyon
London
Genova
Kortrijk
Reggio Emilia
Groningen
Leeuwarden
Bologna
Quito
Portland
New York City
Taipei
Porto
Zaragoza
Budapest
Jerusalem
Los Angeles
Phoenix
Algarve
Bucharest
Manresa
Malta
Athens
Galati
Varna
Hohhot
Ankara
Bangkok
Tianjin
Ho Chi Minh City
Belem
Cape Town
Bandung
Istanbul
Ahmedabad
Manilla
Jakarta
Dar es Salaam
Kilamba Kiaxi

City Blueprint of Bath (BCI 6.0)




Blue City Index (BCI)
10
8
6
4
2
0
Belem
Kilamba kiaxi
Dar es Salaam
Quito
Jakarta
Galati
Bucharest
Ho Chi Minh City
Bandung
Bangkok
Manila
Varna
Ahmedabad
Malta
Istanbul
Ankara
Sabadell
Taipei
Phoenix
Reykjavik
Algarve
Wroclaw
Milwaukee
Budapest
Portland
New York City
Ljubljana
Athens
Tianjin
Genova
Cape Town
Los Angeles
Hohhot
Lodz
Bologna
Leicester
Porto
London
Boston
Scotland
Zaragoza
Manresa
Eindhoven
Reggio Emilla
Oslo
Venlo
Bath
Leeuwarden
Jeruzalem
Lyon
Kortrijk
Melbourne
Milton Keynes
Maastricht
Rotterdam
Hamburg
Bristol
Nieuwegein
Helsinki
Eslov
Dordrecht
Copenhagen
Berlin
Seoul
Stockholm
Groningen
Kristianstad
Malmo
Helsingborg
Singapore
Amsterdam



Indicator scores of 44 municipalities and regions in Europe.

The bars in red, pink, black, light blue and dark blue represent indicator scores between 0-2, 2-4, 4-6, 6-8, 8-10, respectively.

Trommsdorff, Koop & Van Leeuwen

European Background report WWF8

Categorization of cities

BCI	
■ 0 – 2	Cities lacking basic water services
● 2 – 4	Wasteful cities
● 4 - 6	Water efficient cities
● 6 – 8	Resource efficient and adaptive cities
▲ 8 - 10	Water wise cities


BLUE CITY INDEX
0-2
2-4
4-6
6-8

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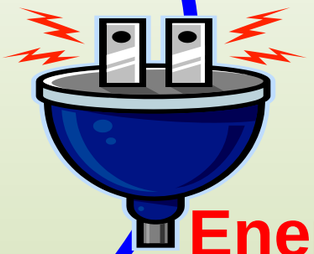
Solid waste

Biodiversity
green & blue space

ICT

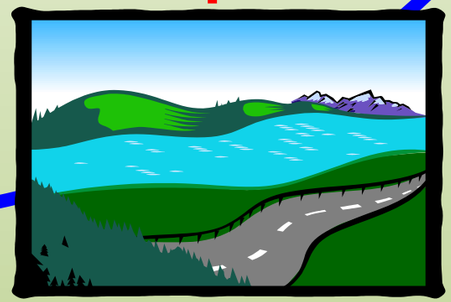
Waste water

Governance

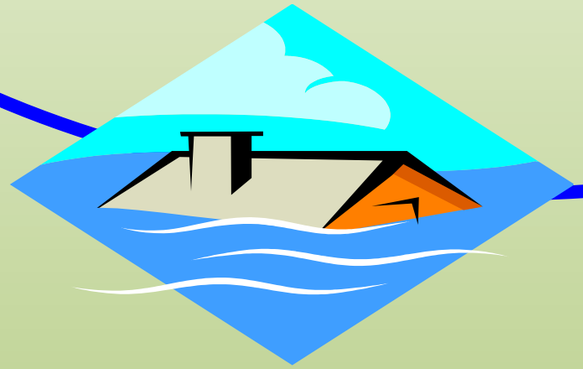


Energy

Transport

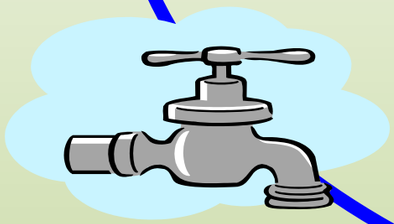


Houses, shops,
offices & factories



Climate adaptation

Water
supply



Intermezzo: interactions are win-win's (co-benefits is cash)

Example: In a family with 2 persons (n=2), the number of interactions is only 1. If you increase the family size to 3, 4, 5, or 9 persons in total, the number of interactions increases to 3, 6, 10, and 36, respectively.

Formula: Number of Interactions = ½n (n-1)

Moral: Combining infrastructural activities (city planning) by focussing on long-term integral planning provides many co-benefits (win-win's) and enormous cost-saving!

Co-benefits of measures in long-term city planning

Policies	Number of issues (n)	Number of P.I.[a]	Issues addressed	Interactions addressed	Missed P.I.	Missed P.I. (%)
Smart cities[b]	9	36	3	3	33	92
Smart cities[c]	9	36	6	15	21	58
Smarter cities[d]	9	36	9	36	0	0 (!)

a) P.I.= Potential Interactions; b) EU smart city policy 2012 (ICT, Transport; Energy; c) Idem plus water & waste; d) all topics addressed

Example Bilthoven (NL)

The past:

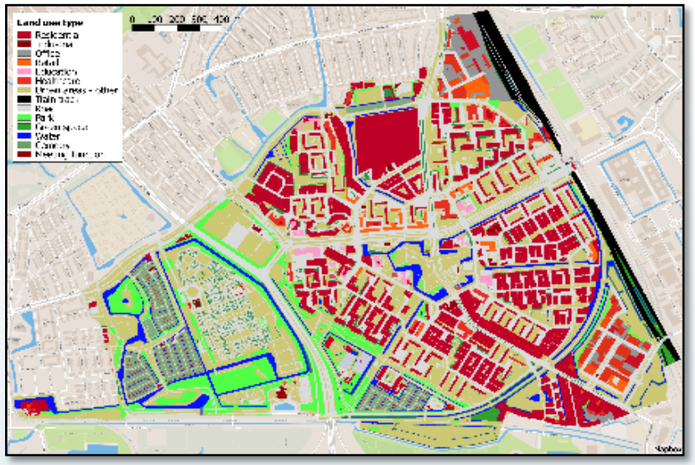
- Safety (highschools; >2 †/yr
- Traffic jams because of main north-south train connection with UTRECHT CS

The present:

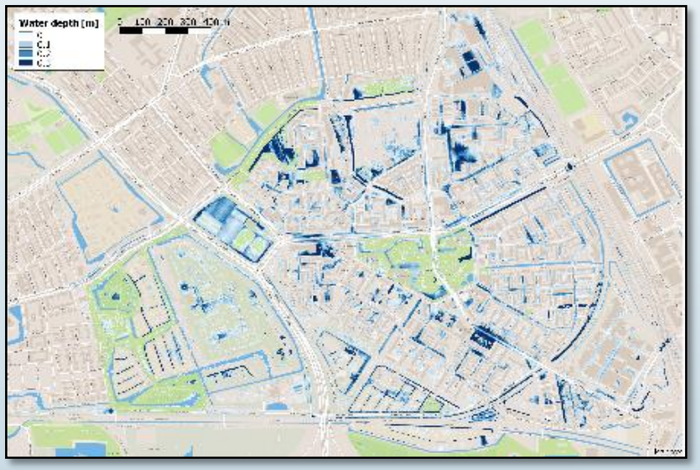
- Safety!
- Separation of traffic
- No traffic jams
- New bicycle path to UU
- Attractive centre with restaurants/shops
- New water mains
- Renewed sewer pipeline
- Less air pollution/noise
- Ownership of citizens
- Improved quality of life in general

Cost of Inaction: urban flood damage estimation

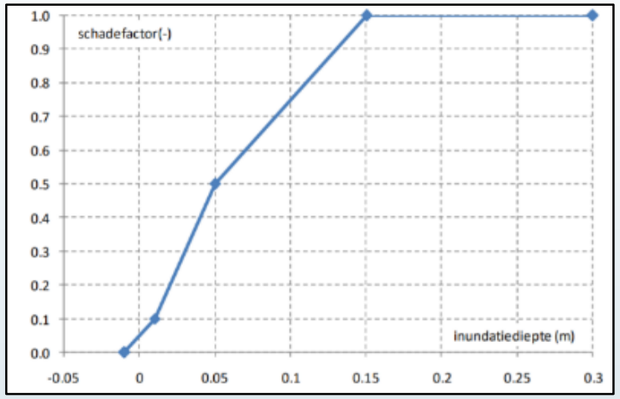
Land use map



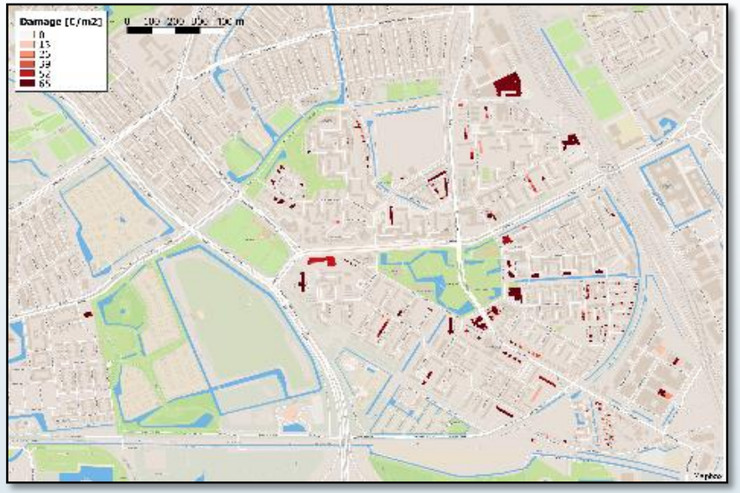
Water depth map



Damage functions



Direct damage estimate

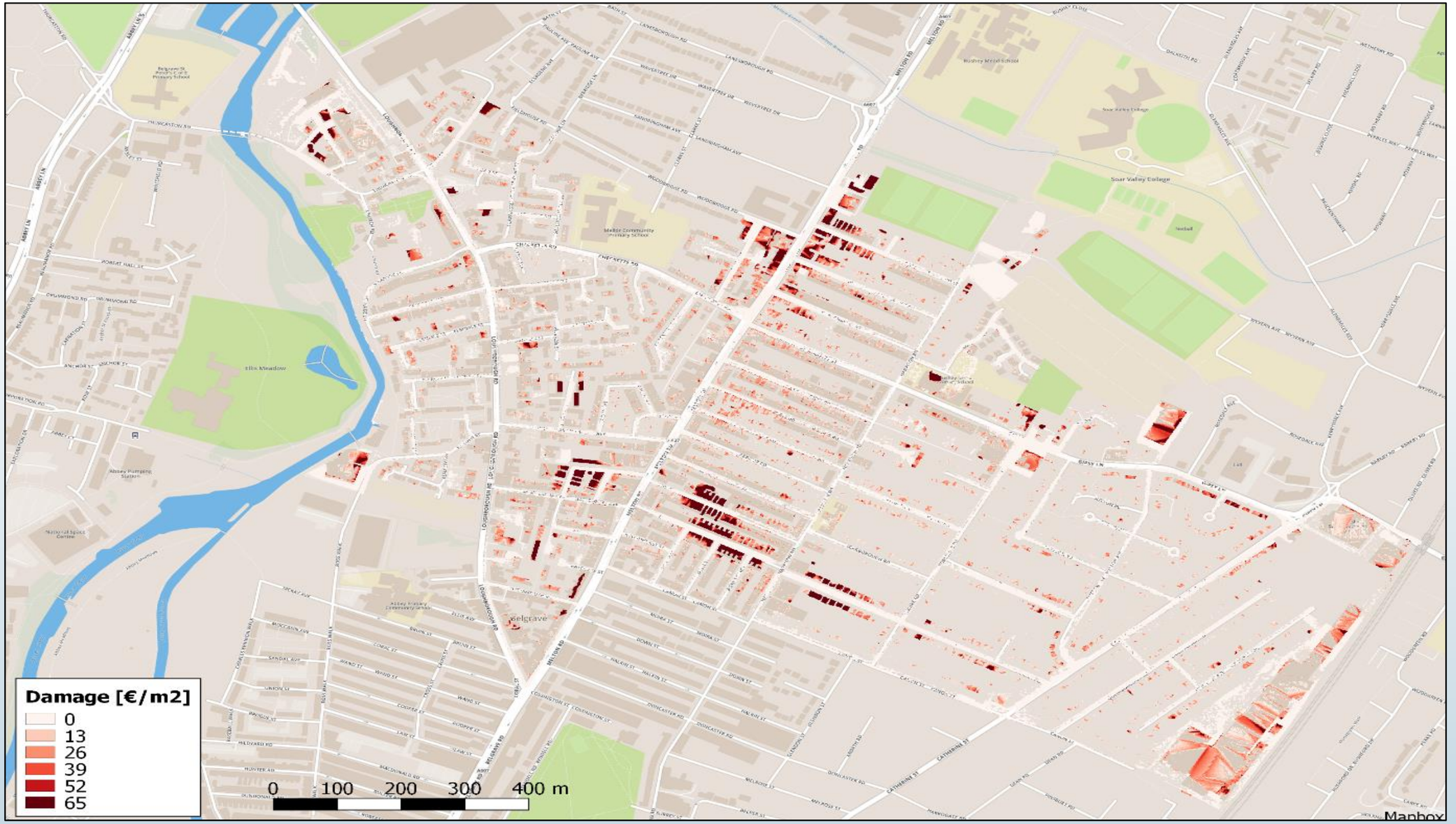


(60mm/1-hour rainfall)

Flood damage estimation Belgrave area (Leicester)

Flood damage estimation Belgrave area (Leicester)

Flood damage estimation Belgrave area (Leicester)



Conclusions: the seven C's of Water-Wise Cities:

- Citizen-centered: create healthy and liveable cities for people
- Children and grandchildren first: focus on anticipatory long-term strategies
- Co-creation: involve stakeholders right from the start
- Co-design: comprehensive & coherent planning by: integrating water and other sectoral agenda's
- Co-benefits or win-win's must be explored. This leads to:
- Cost-effective & efficient solutions. Share them by:
- Collaborative learning: enhance city-to-city learning

6. Further information:

1. City Blueprint website of EIP Water: http://www.eip-water.eu/City_Blueprints
2. City Blueprint website of Watershare®: http://www.watershare.eu/
3. Netwerch2o: http://www.netwerch2o.eu/
4. BlueSCities: http://www.bluescities.eu/
5. Power: http://www.power-h2020.eu/
6. OECD: http://www.oecd.org/env/watergovernanceprogramme.htm
7. Wetskills: http://wetskills.com/

David Parkin and Global Chair:

1. City Blueprint and Trends and Pressures of Bath
2. Inauguration Prof Jan Hofman
3. WISE CDT Summerschool participation & presentation (Tom Arnot)
4. UNESCO visit in Paris to establish further collaboration
5. Collaboraton in EU H2020 Nextgen https://nextgenwater.eu/
6. Co-publication Future Urban Water System (in review)
7. Co-editors of a Special Issue Water Management and Governance:

https://www.mdpi.com/journal/water/special_issues/Challenges_Water_Management_Governance_Cities


Thank you for your great hospitality & support
See you soon at KWR Watercycle Research Institute