



Living with water in Amsterdam

Paulien Hartog, strategic advisor Waternet

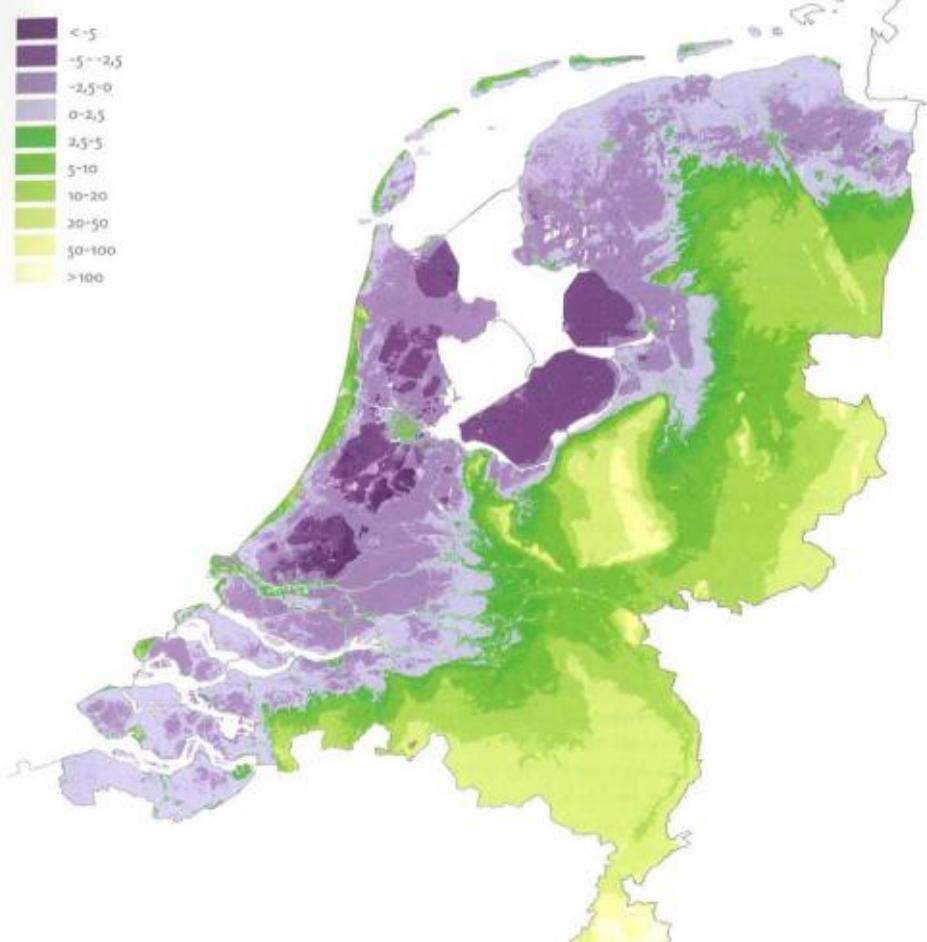


waternet

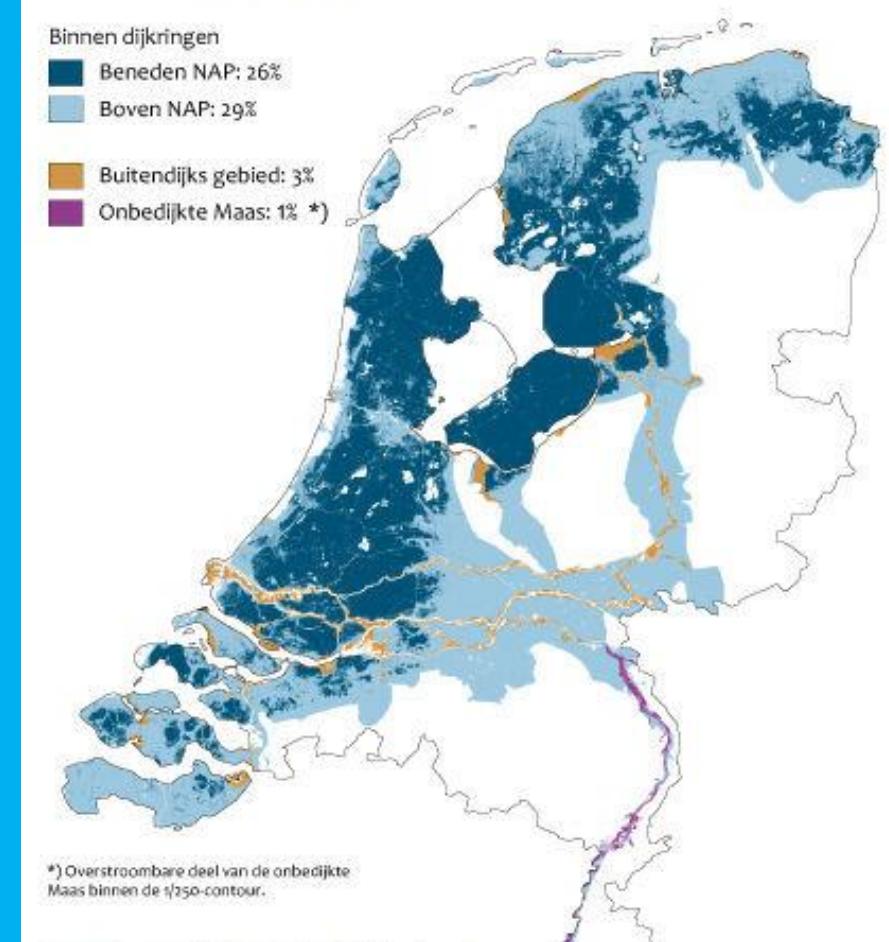
regional public water authority
amstel gooi en vecht
city of amsterdam

The Netherlands

Elevation



Flood sensitive area



Cross section Amsterdam

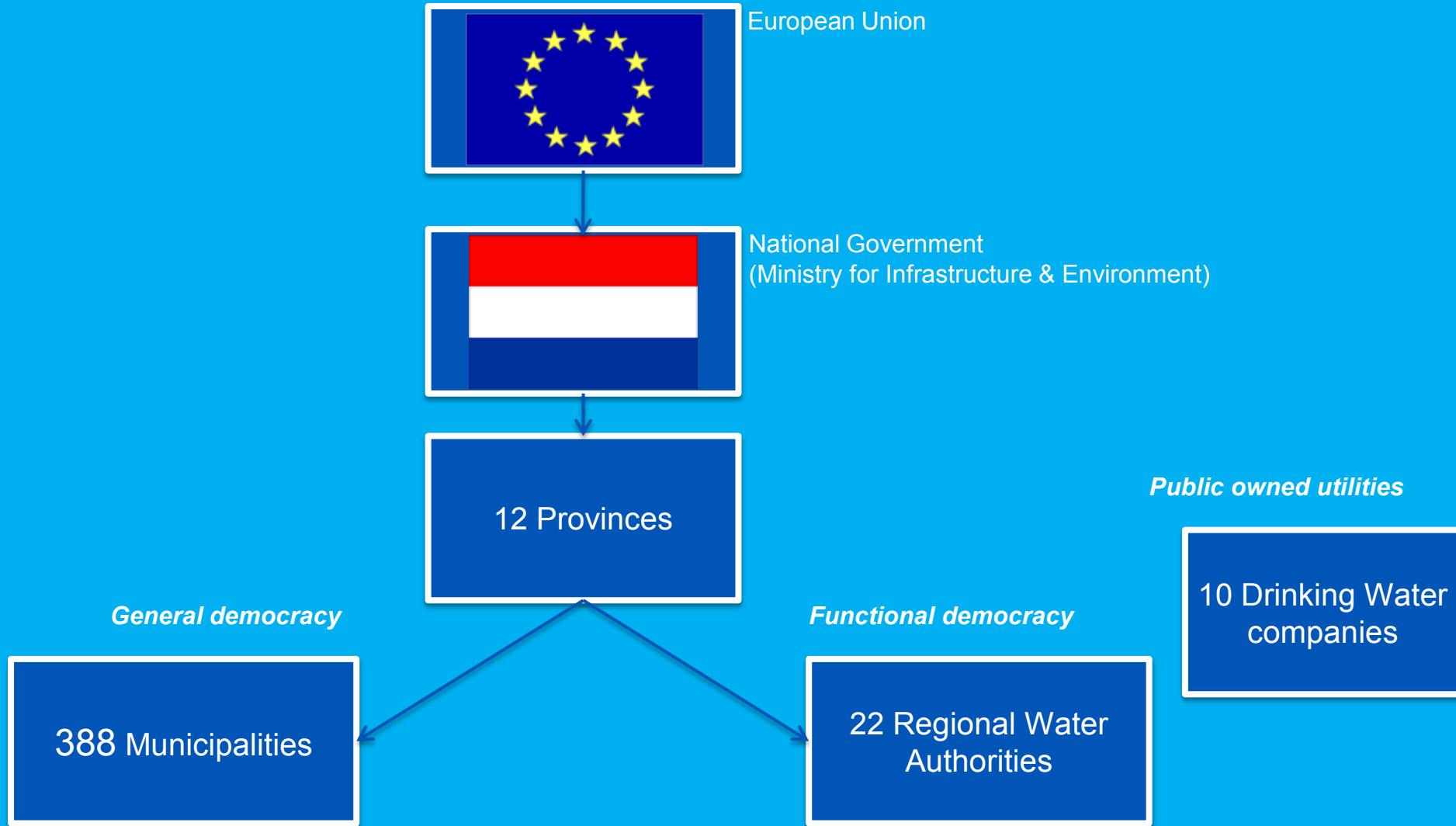




AMSTERDAM WATER GOVERNANCE



Dutch water government



NL water tasks and financing

Task	Who?	Finance?	NL Annual turnover (million €)
• Drinking water & resources	Drinking water companies	Charge	1.370
• Stormwater • Sewerage • Groundwater	Municipalities	Local levy	1.360
• (Regional) flood protection • (Regional) surface water management • Wastewater treatment	Regional Water Authorities	Regional levy	2.790
• (National) flood protection • (National) surface water management	National Water Authority (Rijkswaterstaat)	National tax	1.010

Public water government



City of Amsterdam

- Drinking water
- Sewerage
- Storm water
- Groundwater
- Shipping and inland waterways



regional public water authority amstel gooi en vecht

- Flood protection
- Water level management
- Water quality control
- Waste water treatment

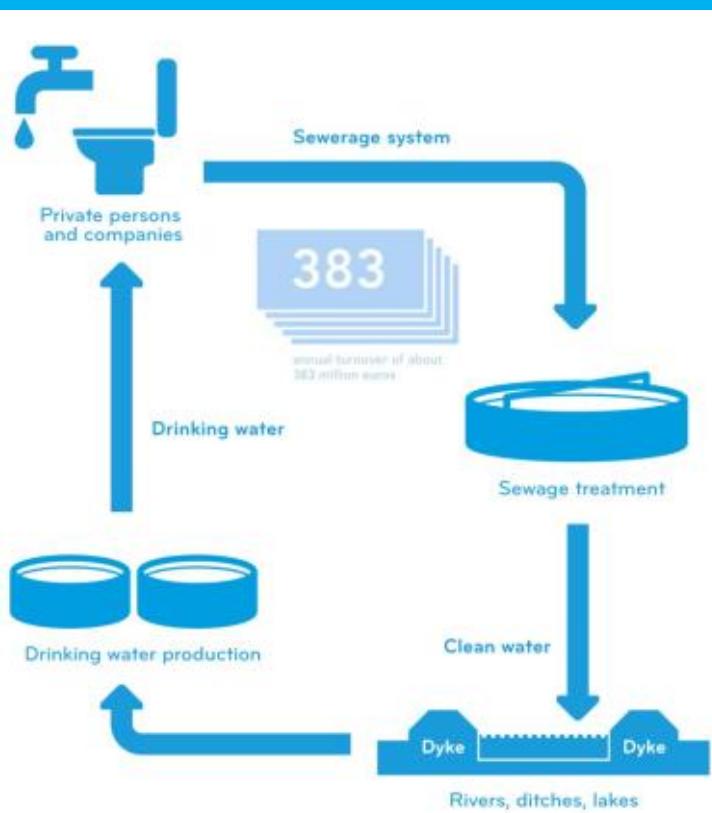


waternet
regional public water authority
amstel gooi en vecht
city of amsterdam



Core values

- Expedient
- Sustainable
- Customer oriented



Tariff

a 4 person household in 2016 has to pay:

- Watermanagement levy: € 144
 - Waste water treatment levy: € 159
 - Drinking water charge: € 205
 - Sewerage levy: € 151 +
- Total watercosts:** € 659

= total cost recovery

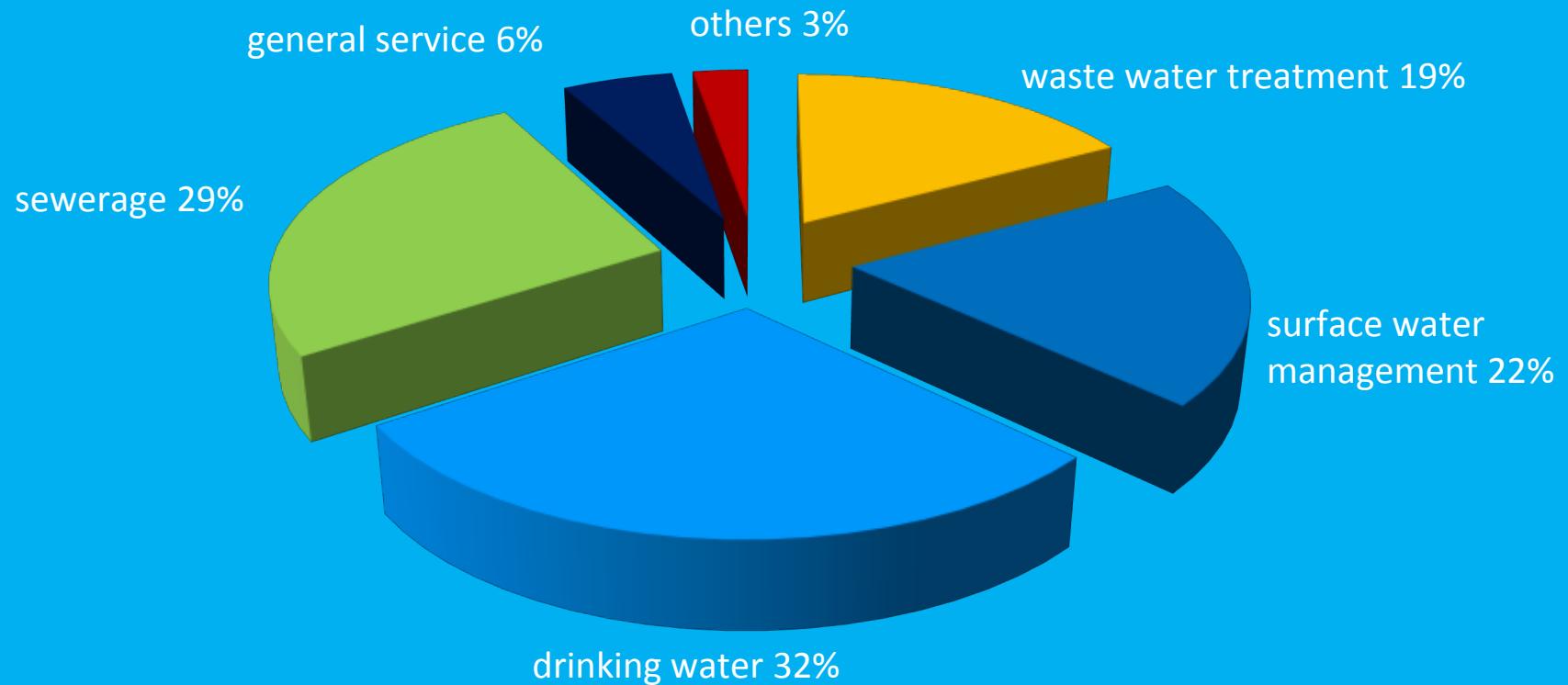
= 2% average annual income

Non profit customer service

- Satisfied customers 83%
- Brand awareness 91%



Waternet budget 2016





Key: Collective governance and financing





employees
1770
working together on the water cycle



IJmuiden

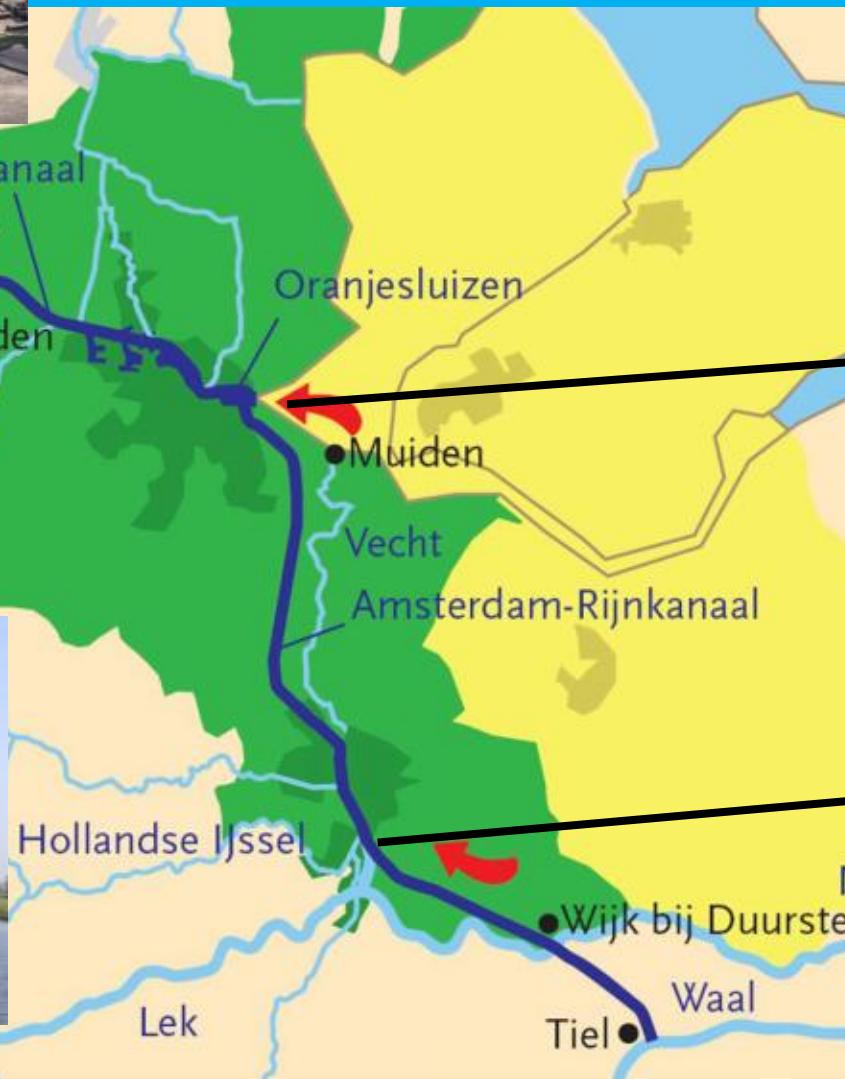
sluice and pump for normal
discharge



Regional watermanagement



Many regional area pumps

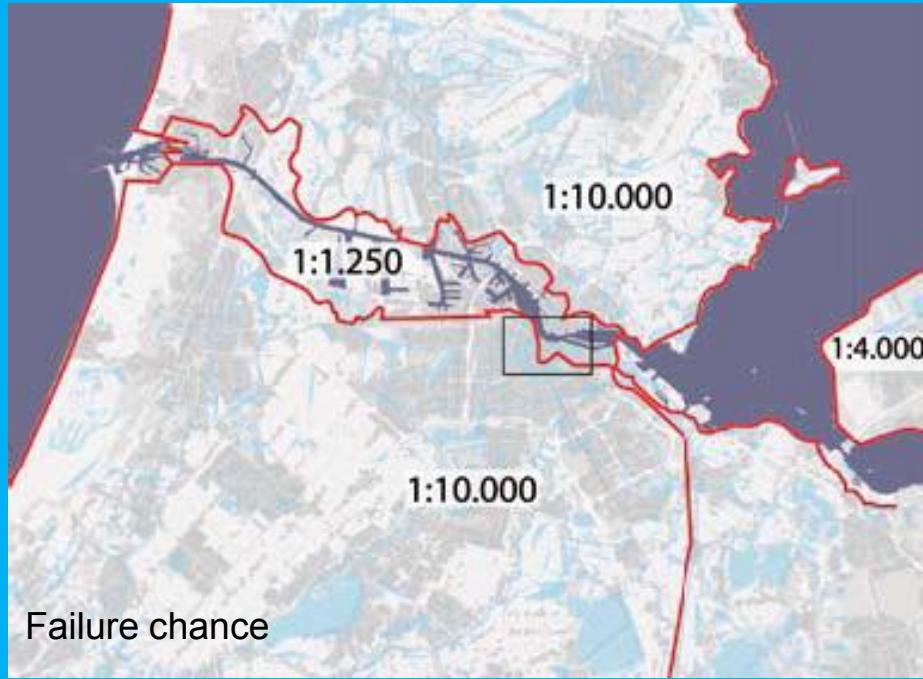


Zeeburg pump:
emergency inlet and outlet



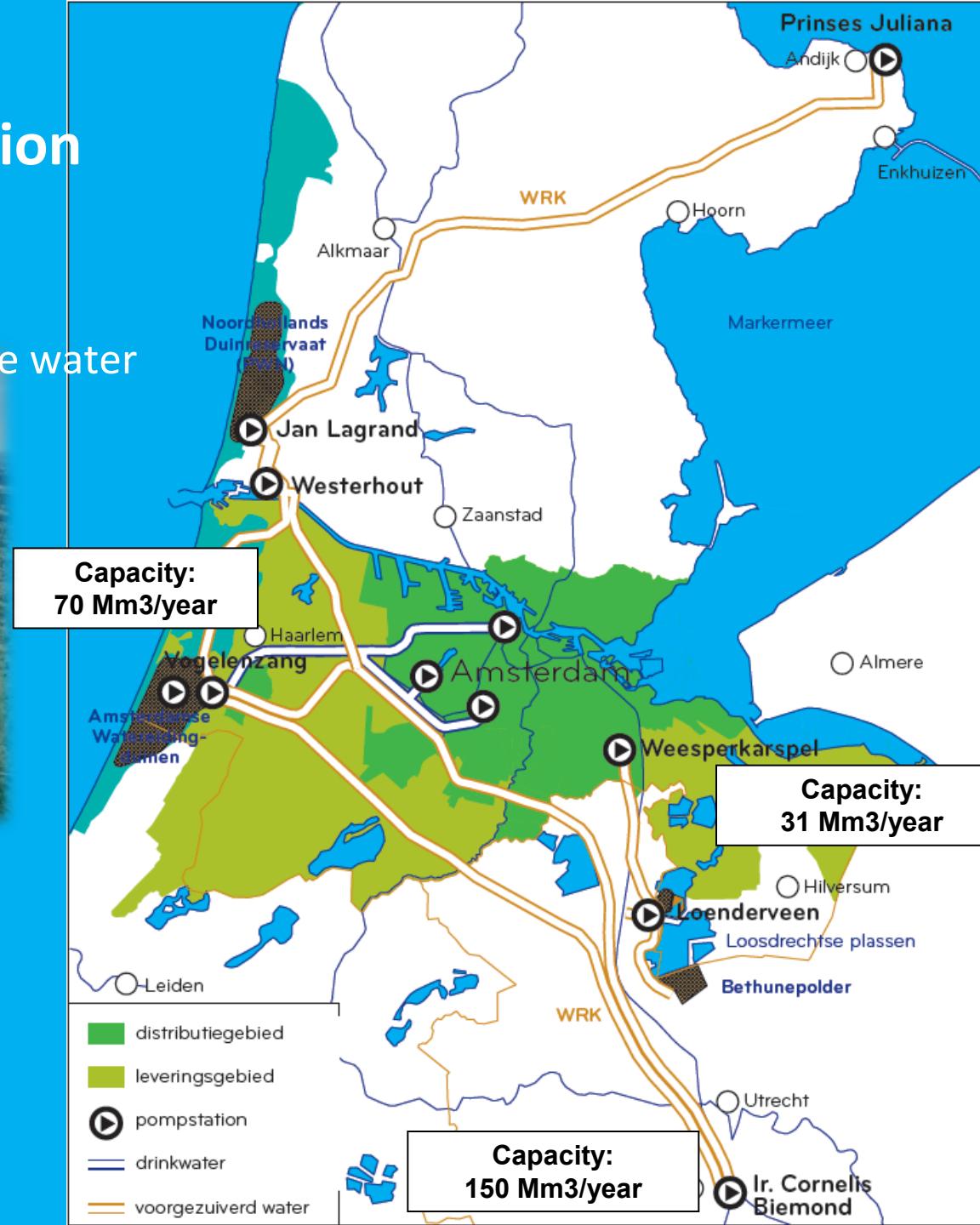
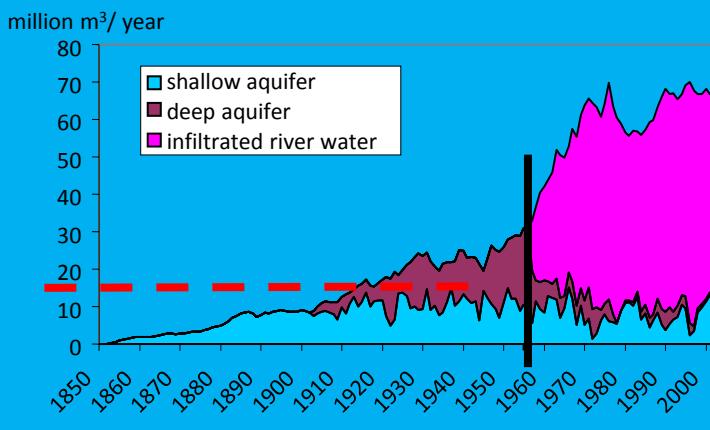
Sluice for inlet from river Rhine

Flood protection (sea/river)



Potable water production

- by artificial aquifer recharge with river water (since 1957)
- by after treatment of seepage water



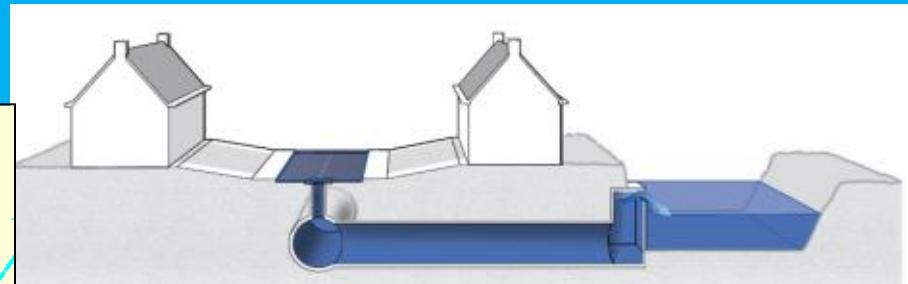
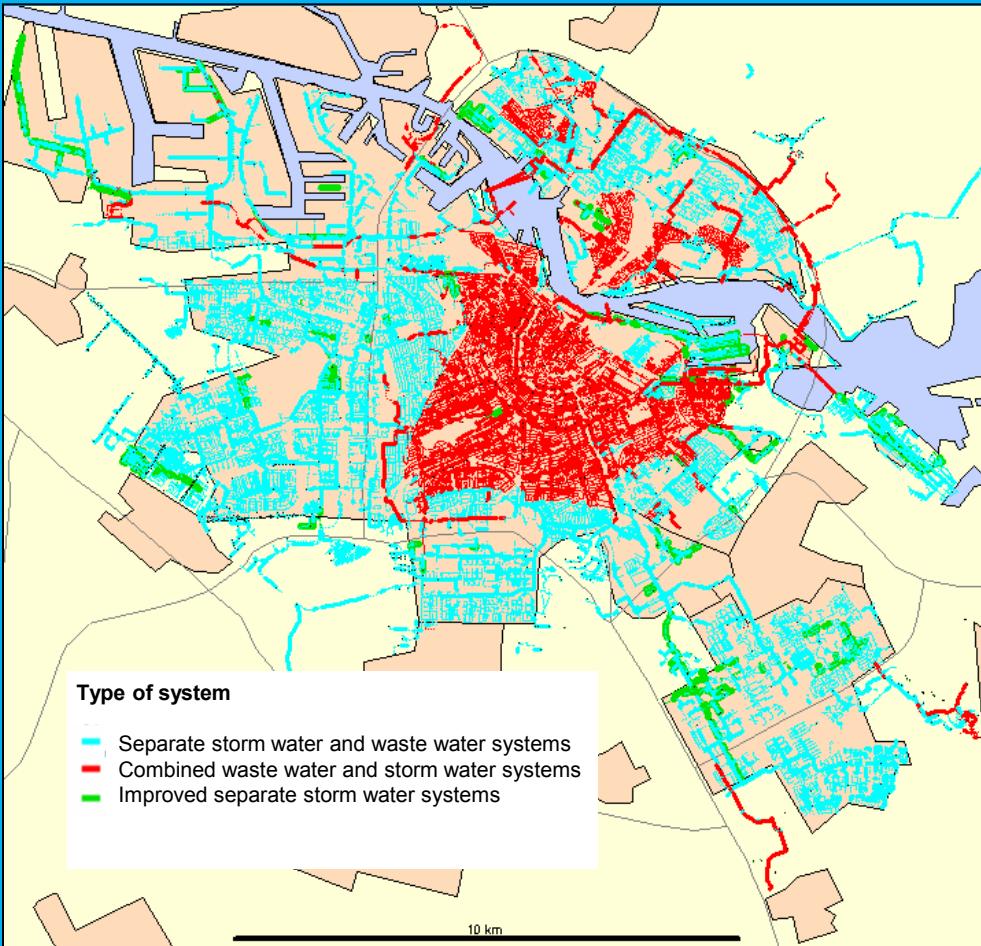
Waste water collection and treatment



- Central plant in harbour area (2006)
- 100% of buildings connected
- Reuse of energy and resources from waste water
- Biogas 12 million m³/year
- Phosphate reactor produces 500 ton struvite/year



Stormwater system in Amsterdam



Separate sewer: underground discharge to surface water (100-500 m)

Combined sewer: underground storage and discharge to central waste water treatment plant

Extreme events: above ground street storage

Present: Connecting water



Climate resilient city



Attractive city

Circular economy



Queen Maxima (2013)



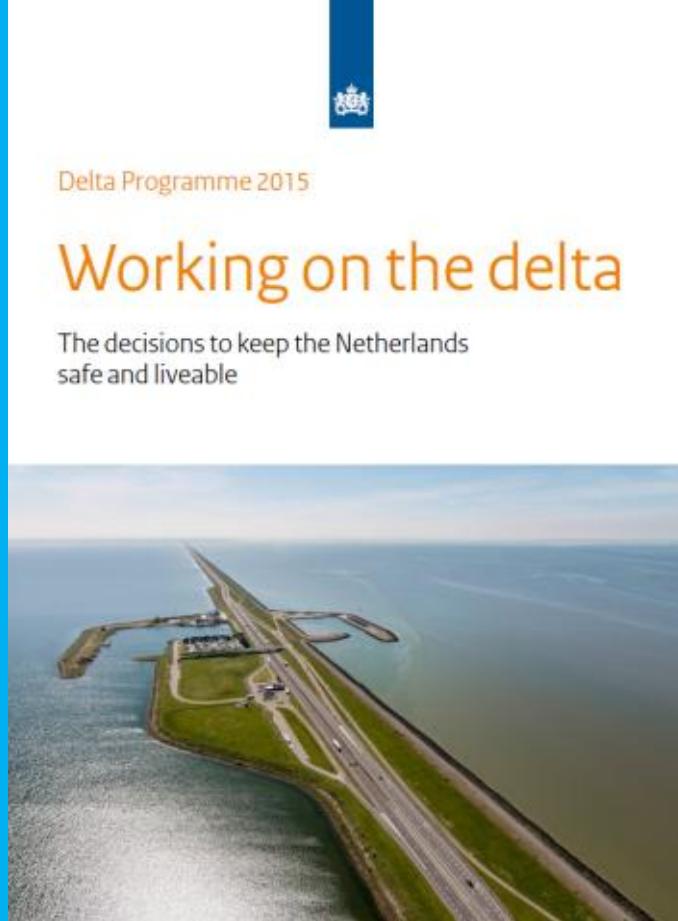


RESILIENT CITY

- Flood resilient vital infrastructure
- Rainproof

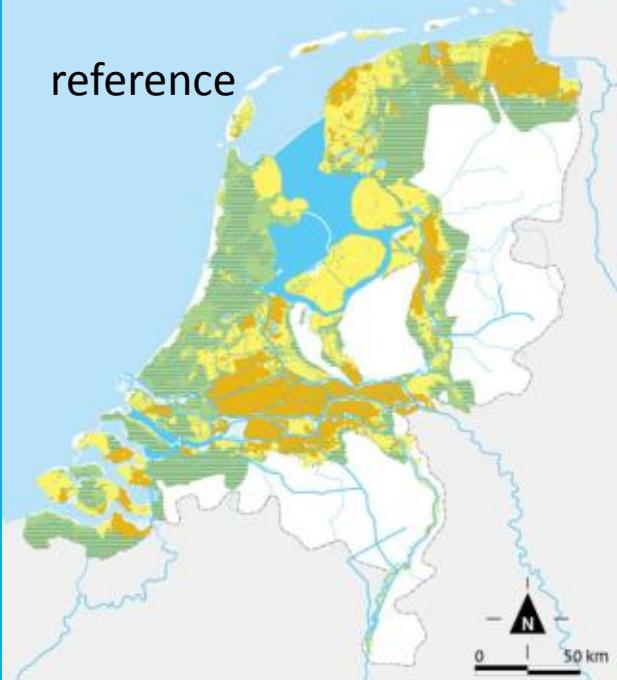


National Deltaprogramme

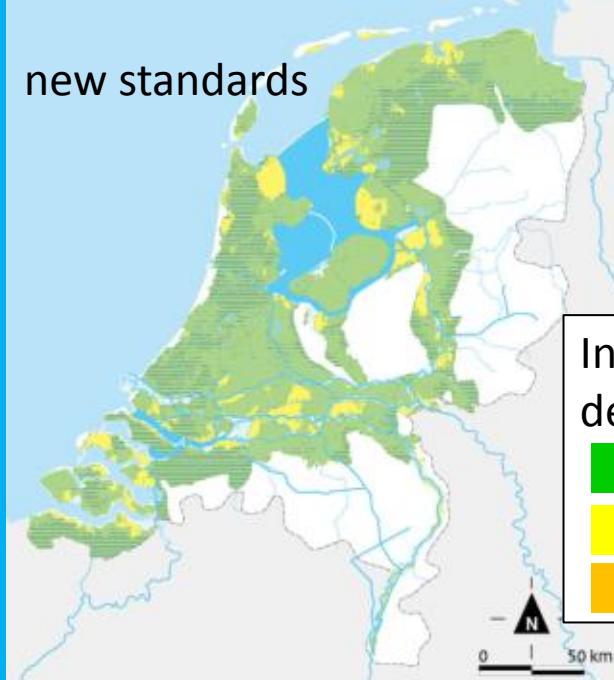


- 5 Delta decisions
 - Flood risk management
 - Freshwater
 - Spatial adaptation
 - Lake IJsselmeer
 - Rhine-Meuse Delta

reference



new standards



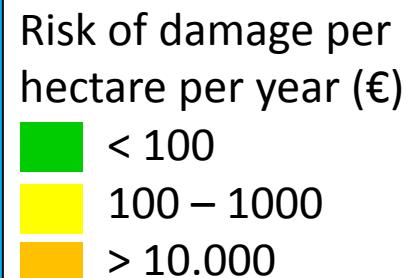
Flood resilience: Better prevention

Planned investment:
11-14 billion € (2015-2050)

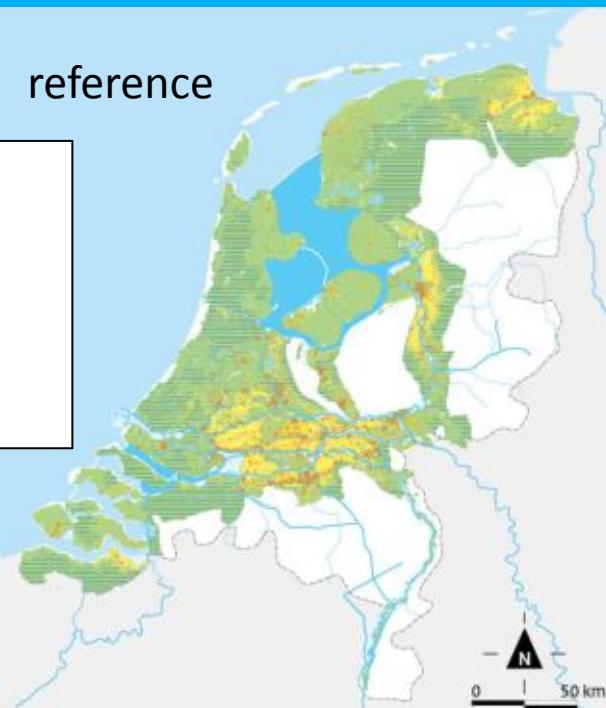
Individual yearly risk of
death by flooding

- $< 10^{-6}$
- $10^{-6} - 10^{-5}$
- $> 10^{-5}$

reference



new standards



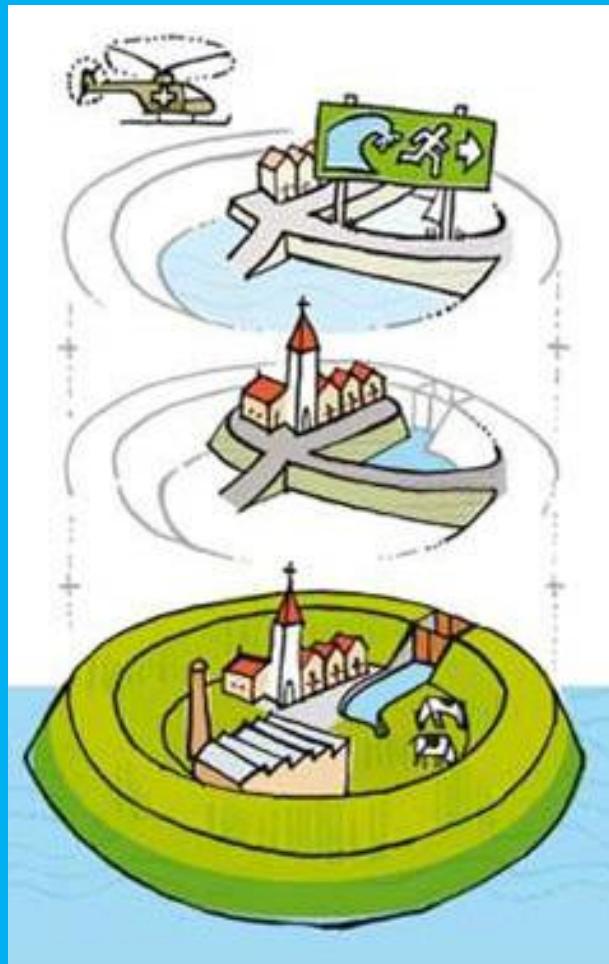


Flood resilience: Multi layer safety approach

disaster
management

physical
planning

prevention



flood threat from sea and river





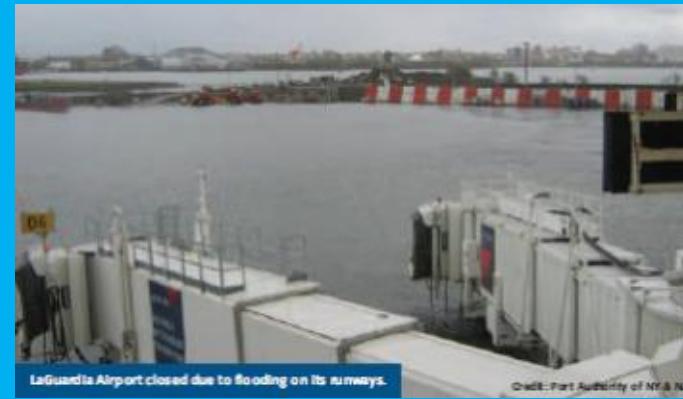
Accumulated flood risk map



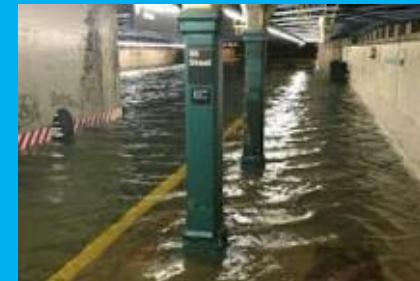
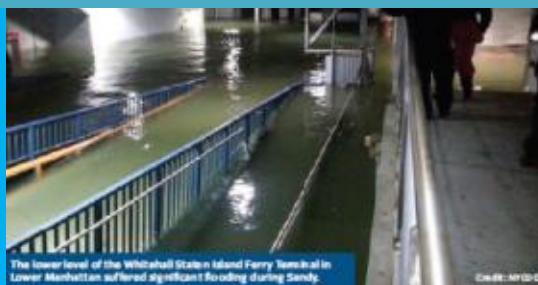
Optimal prevention (high economic value)
Special focus on robust and resilient critical infrastructure



New York: hurricane Sandy 2012

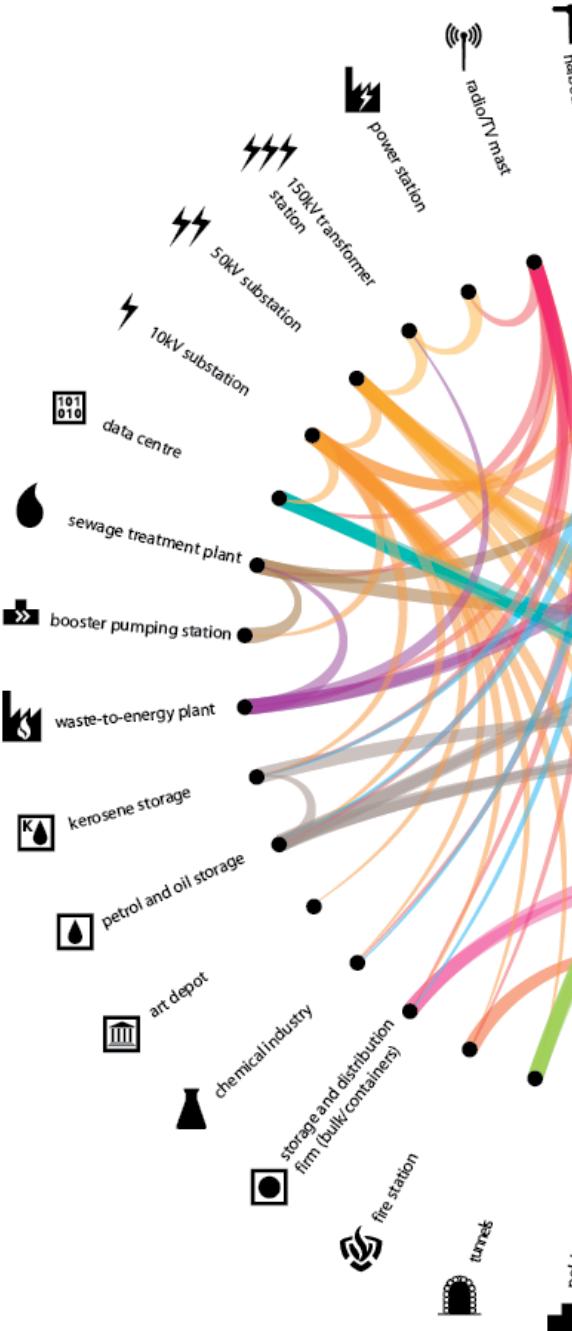


Flood vulnerability of vital infrastructure!

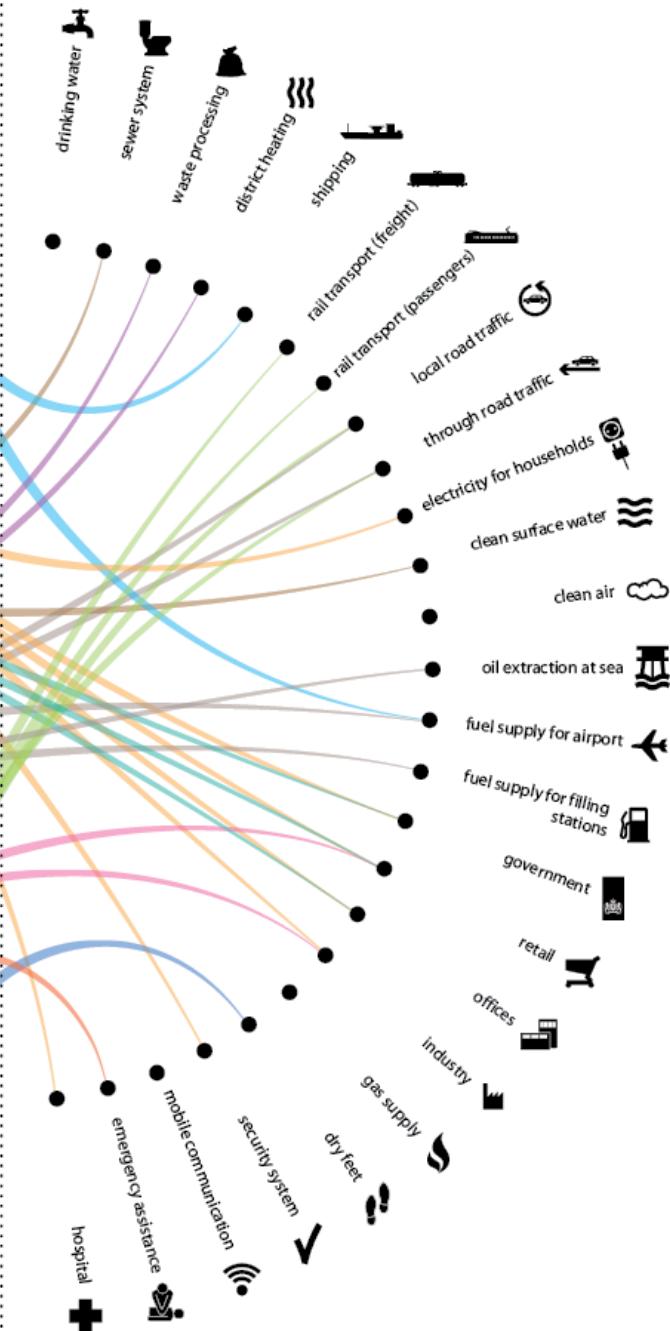


Chain effects, dependencies

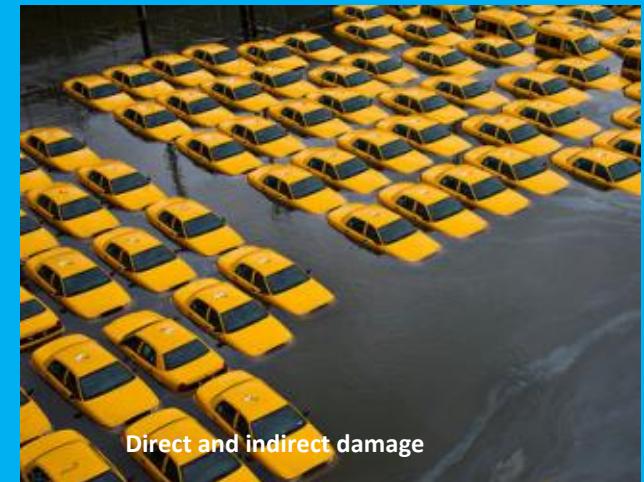
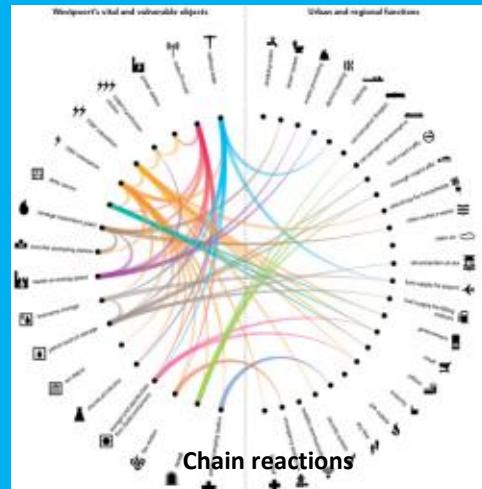
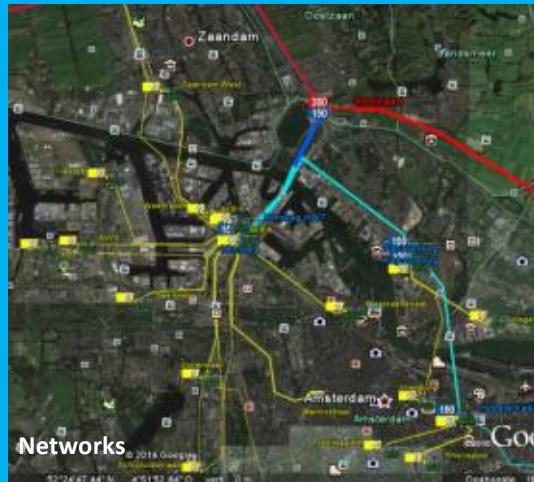
Westpoort's vital and vulnerable objects



Urban and regional functions



Waterproof Westpoort: Integrated approach in a complex urban area



understanding

solutions

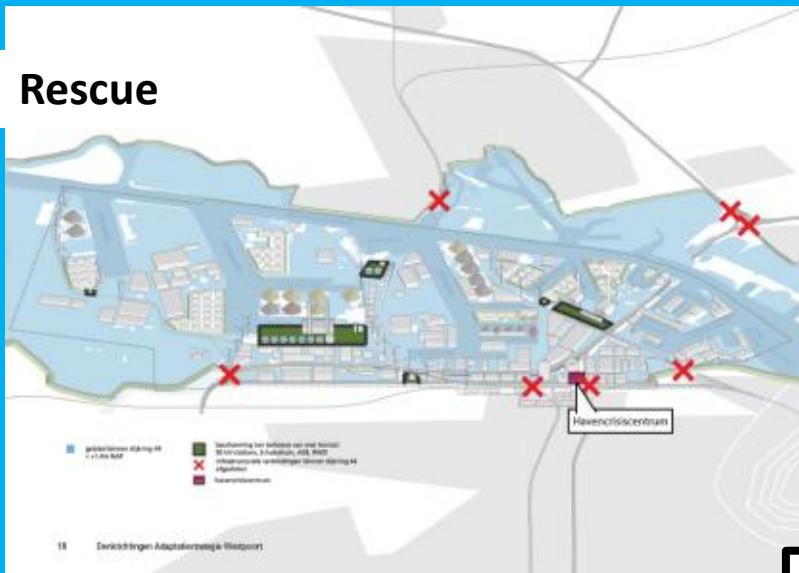




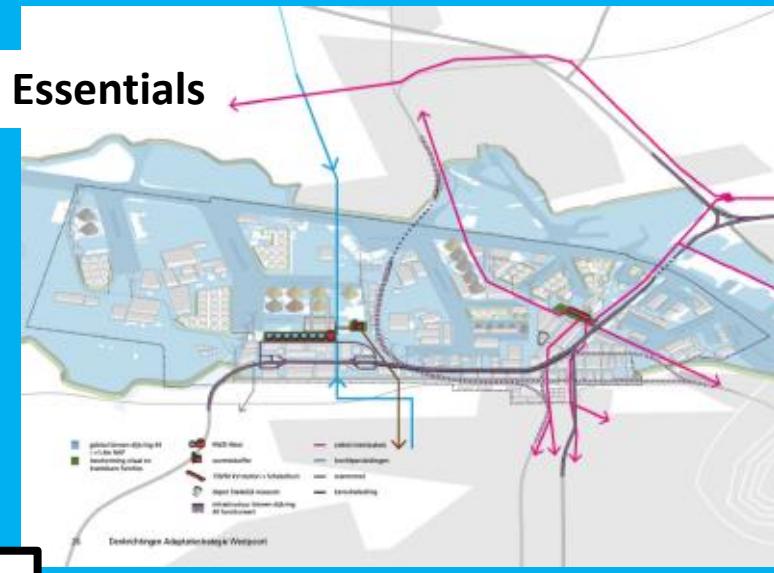
Strategies



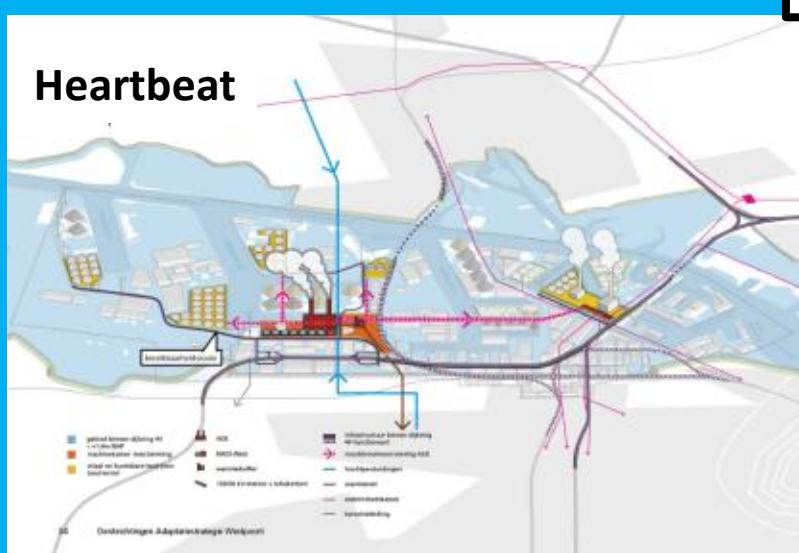
Rescue



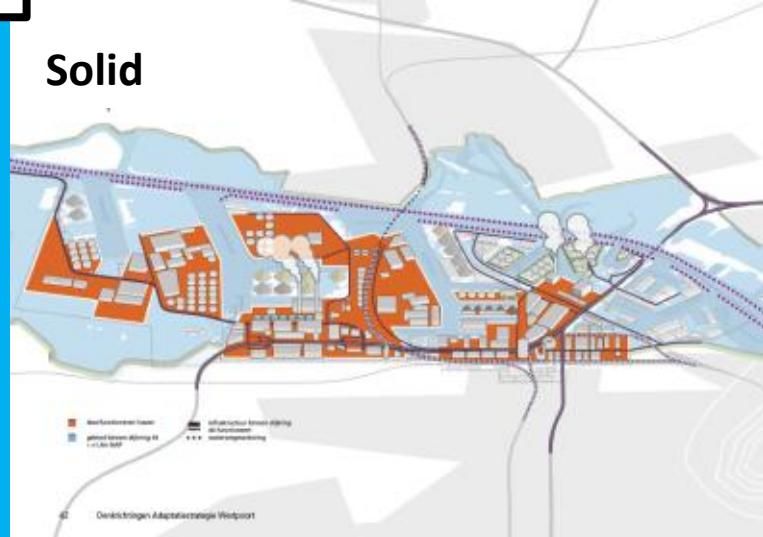
Aware



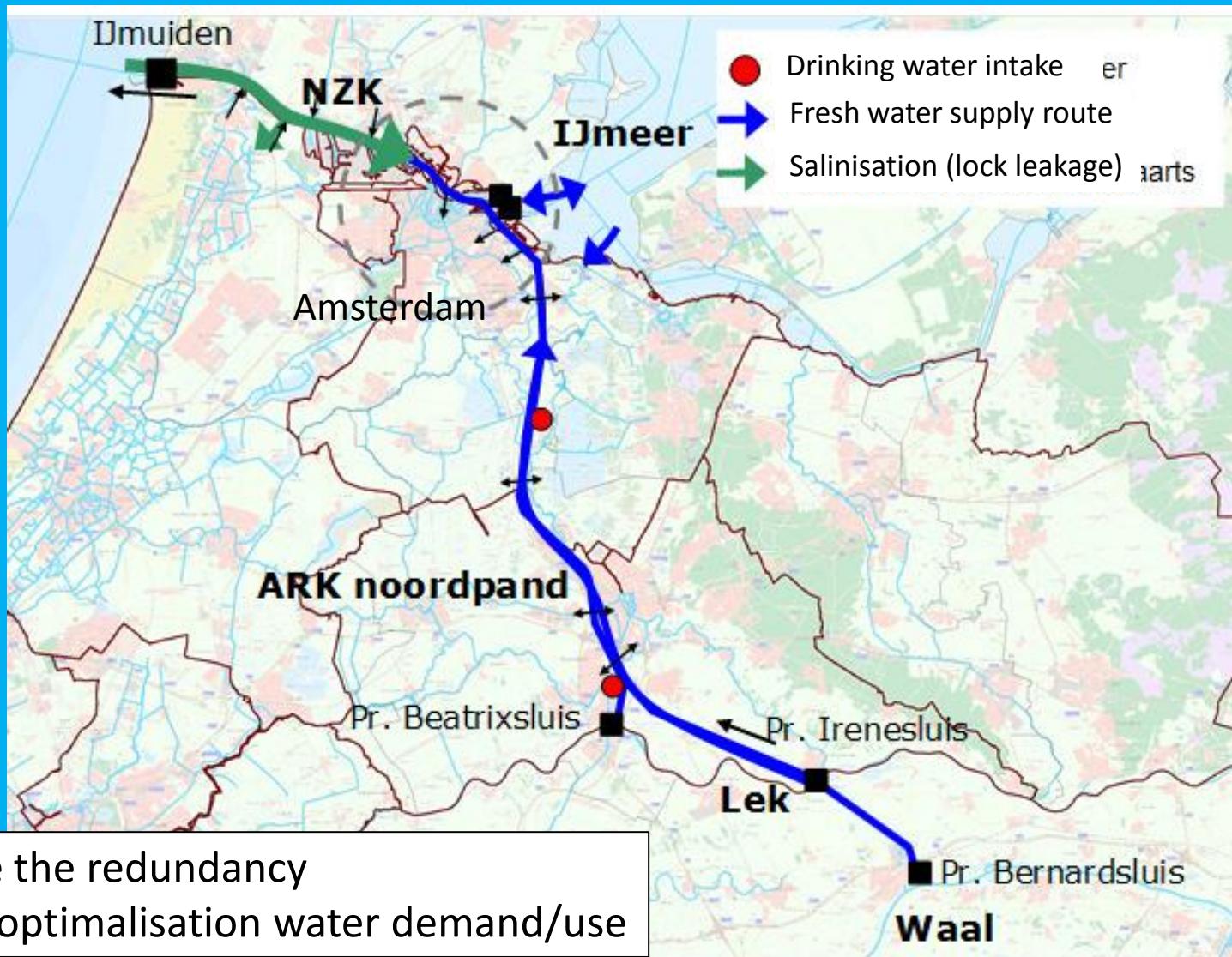
Heartbeat



Solid

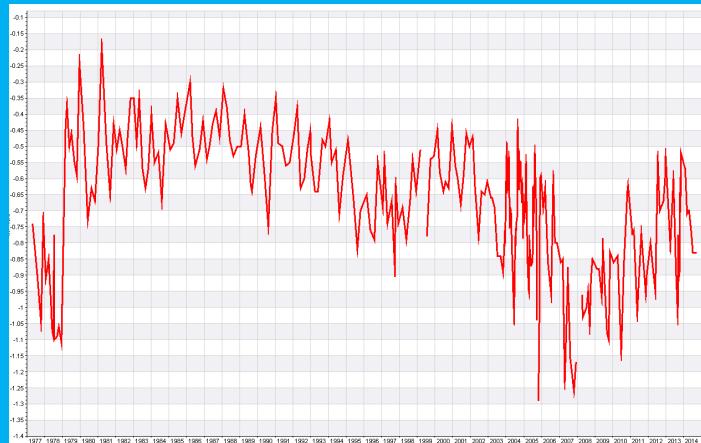


Regional Fresh Water strategy



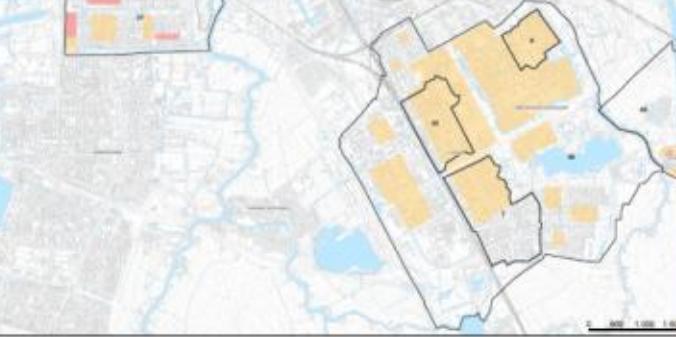
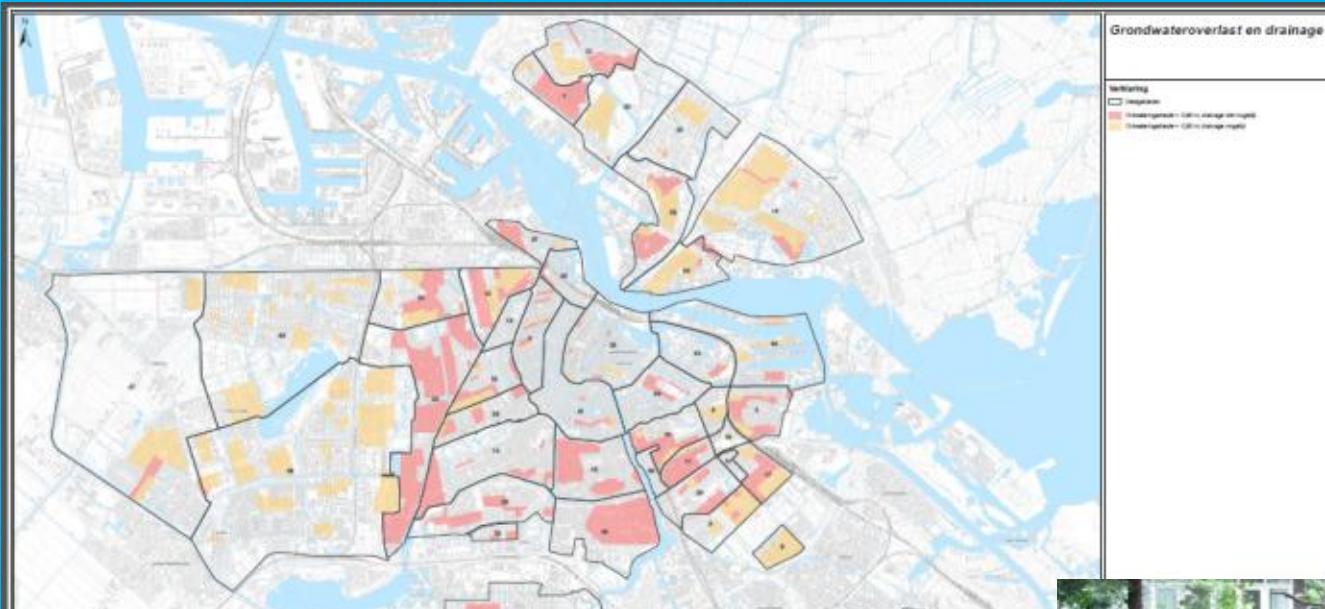


Groundwater resilience?



3000 groundwater level monitoring points in Amsterdam

Groundwater levels too high: nuisance and damage





Groundwater levels too low: nuisance and damage



Private responsibility versus
public duty of care...



More frequent by climate change?

Flood resilience: extreme stormwater events

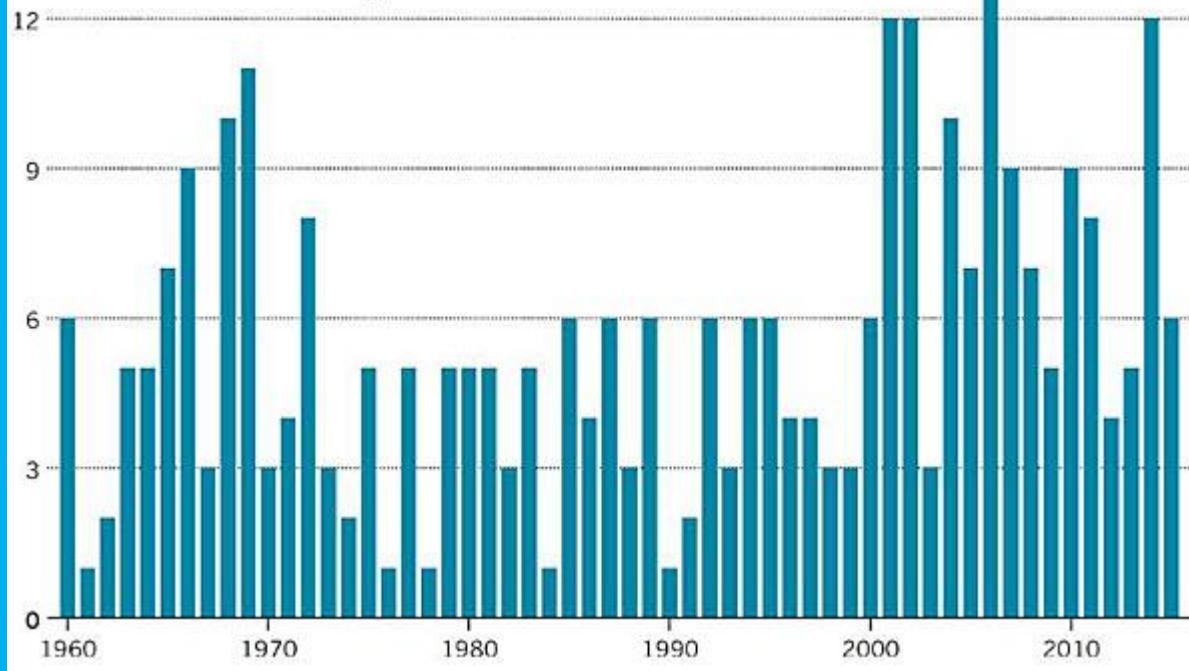




Climate is changing: Higher frequency of extreme rainfall

More frequent cloudbursts

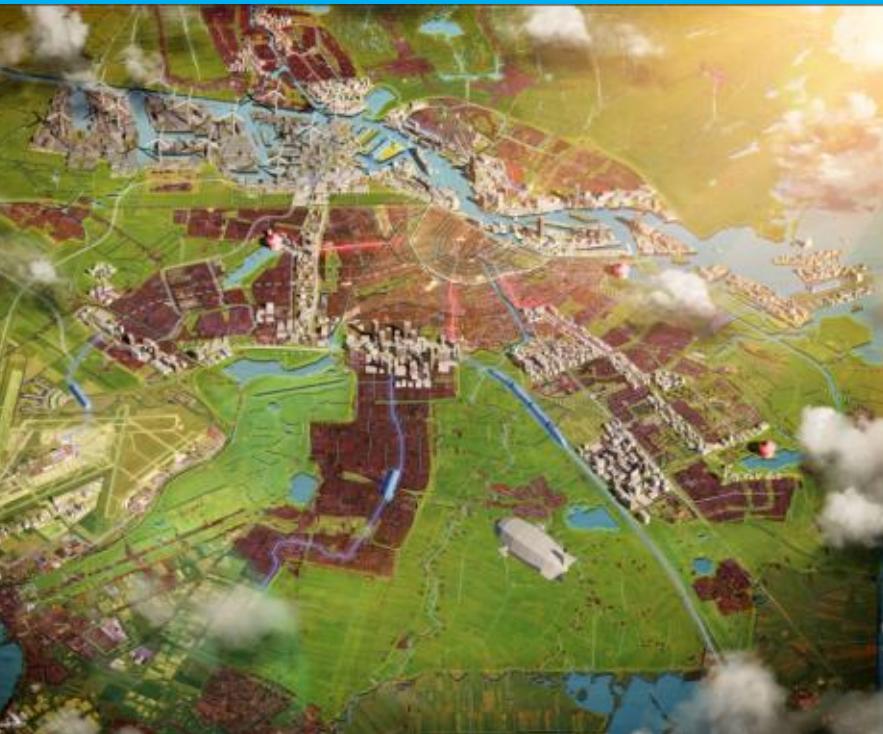
Number of days in summer with more than 50 mm rainfall



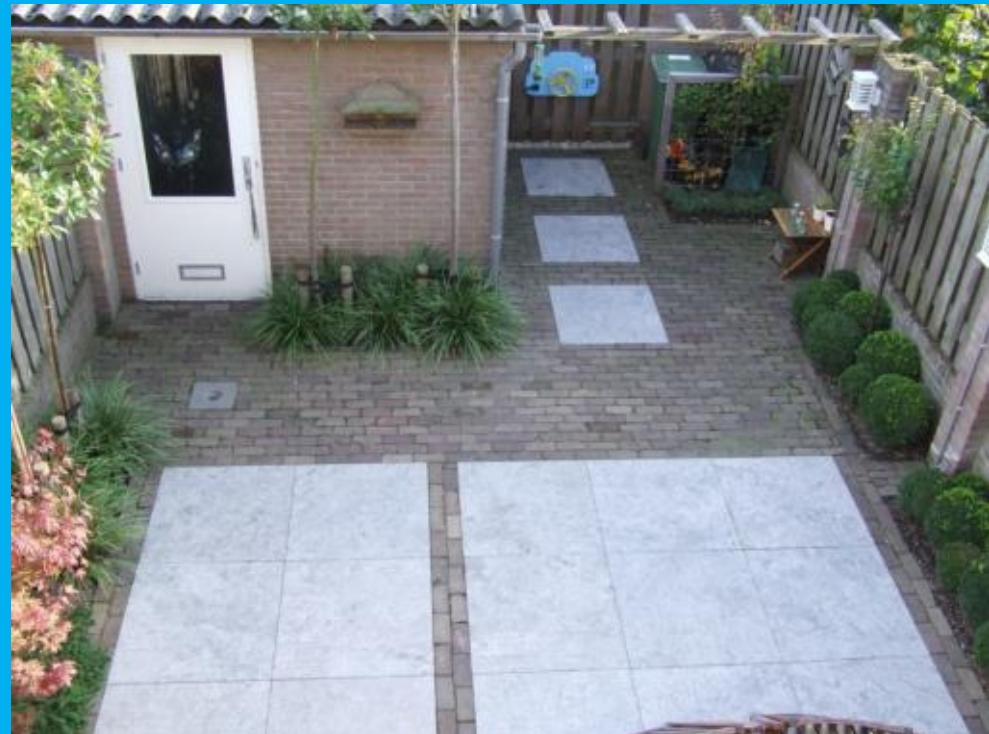


Denser city with more hard surfaces

2040: 70.000 new dwellings planned within city boundaries



Paving gardens





Wake up call: Cloudburst Amsterdam 2014



60-70 mm in 2 hours



New initiative: Amsterdam Rainproof

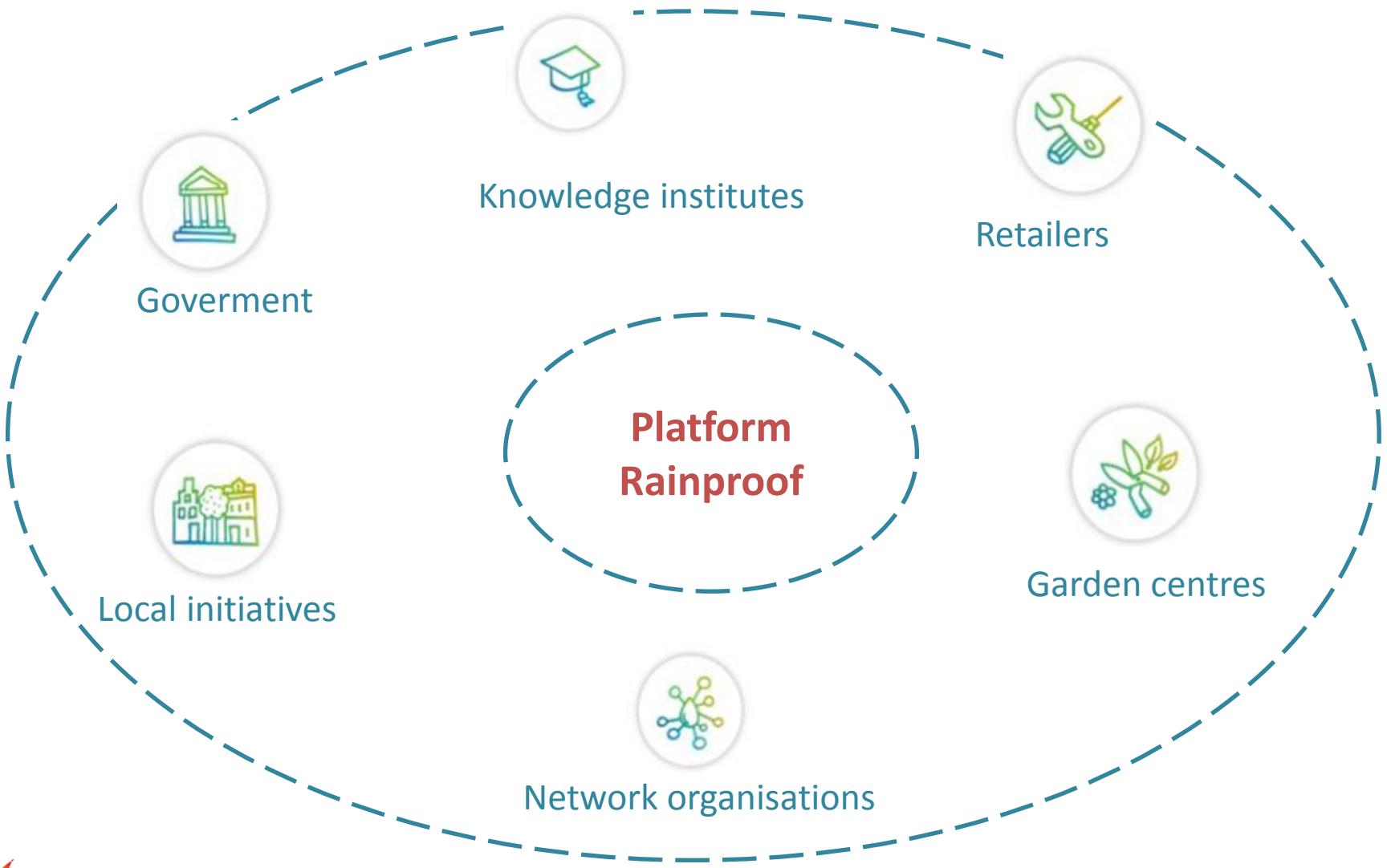
- Dedicated team
- Network approach
- Main target: mainstreaming rainproof in urban network
- 2014-2017

	The dedicated approach	The mainstreaming approach
<i>Agenda-setting</i>	Political agenda	Policy department agenda
<i>Framing</i>	Main objective (explicit)	Added value (implicit)
<i>Resources</i>	New resources (specific bureau)	Existing resources
<i>Policy design</i>	Special policy	Synergies in policy objectives
<i>Implementation</i>	Conformance	Performance

Source: Based on Uittenbroek *et al.* 2014



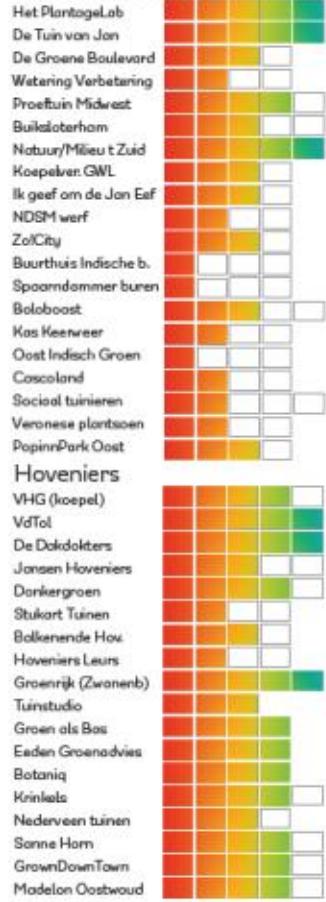
Network approach



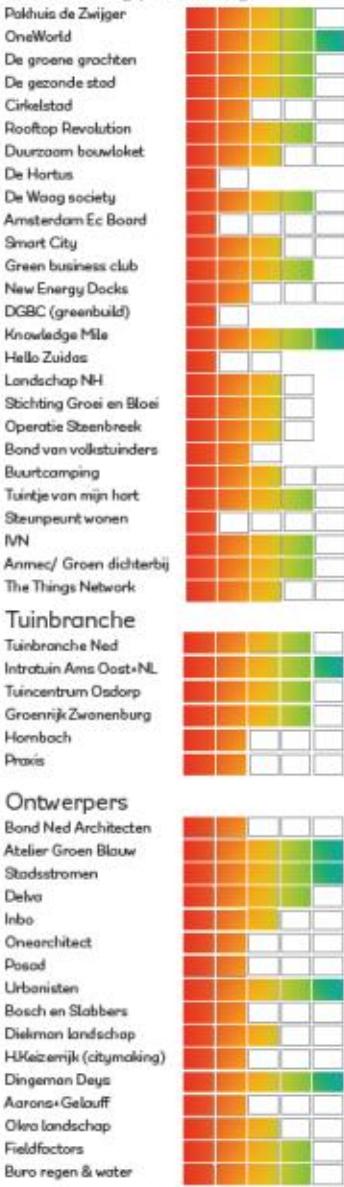
Amsterdam
Rainproof

Rainproof Netwerk Amsterdam

Buurtinitiatieven



Netwerk org / Stichting



Woningcorporaties



Legenda



Infographics with tips

It's raining harder and harder, and our city can't handle it

Make Amsterdam Rainproof.
Visit rainproof.nl to see what you can do.

Amsterdam Rainproof
every drop counts

Copenhagen
2 July 2011
Extreme downpour
90 mm of rainfall in just 2 hours that day.
The result: 15 billion euros in damage.

Amsterdam
30 July 2014
Major downpour
90 mm of rain from the sky within a few hours. Services overflooded, houses flooded, and traffic came to a standstill as canals filled with floodwater.

Heavy rainfall
20 mm on hour is the volume of rainfall that our sewers can process. When it rains harder, the water finds a different route.

Rainbow keeps no house dry, even cars, and businesses and canals are less clean.

What's wrong?
We increasingly have to deal with extreme rainstorms. They make our city vulnerable. As the city fills up with buildings and paved surfaces, there's nowhere left for the rainwater to go. The result: Increasing flooding and damage, also near you.

What you can do
Everyone can contribute by introducing smart solutions, big and small, to prevent damage, and by using rainwater for example to water your garden. And it makes your neighbourhood more beautiful! Join in Every drop counts. Increase our city's sponge capacity and make Amsterdam Rainproof.

Roof
A green roof helps hold excess rainwater. It reduces loss of water through infiltration and evaporation. In addition, it allows rainwater to be used for example at cover storage or to be used for even better for storing rainwater.

Building
By having a sponge roof, a green roof or blue roof, higher floodable by the front door and no water damage in the basement, old houses measure half a year less damage. This way your house stays more intact!

Neighbourhood
Low permeability pavements, rain gardens along the building fronts and permeable paths near your home in your neighbourhood now mean that rainwater can infiltrate the ground and creates a better living space.

Garden
If you have a garden, balcony or roof terrace, set up a barrel with a tap on the side so you can water your plants with rainwater. Rainwater harvested from your roof can replace a tap or a bucket of tap water if you're not using it.

Street
Rainproofing a street is as easy as laying a hollow road, and a high kerb. Urban infiltration systems, such as permeable paving stones, can collect rainwater and filter it directly into the ground, cutting the open air and make the city more beautiful.

Square
Rainwater that falls on roofs, open spaces and trees growing on roofs can be collected in a place to play with water – and make it easier to accommodate heavy rain.

Park
Create parks, squares and other public areas that incorporate water storage and slow down its movement through the surrounding landscape. They are good for climate and biodiversity, and they're great places to play.

Amsterdam Rainproof
every drop counts

Together, we can catch those raindrops and make Amsterdam Rainproof

Make Amsterdam Rainproof Visit rainproof.nl to see what you can do.

Make your neighbourhood rainproof.

How? Use these tips!

Amsterdam Rainproof

Amsterdam Rainproof: that's you, us and all the people of Amsterdam working together. We share a common goal: to help Amsterdam handle the increasingly frequent downpours. Downpours are becoming more intense and the frequency is increasing. Rainwater falls directly into the streets. The urban areas cause damage, primarily because the city is increasingly paved in buildings, asphalt and private gardens – no infiltration can seep through.

Introducing Rainproof! Introduce to together...

If you add improvements to your house or garden, make them Rainproof. If you'd like to see even bigger difference, work with others on joint initiatives. Rainproof wants to link citizens, organizations, companies, government and public servants in ongoing projects and initiatives. Whenever we work together we can transform Amsterdam into a city that uses smart solutions to make the best of heavy rainfall.

...that make the difference.

The following suggestions offer tangible tips that you can do – as a local resident or a professional. Visit Rainproof for a complete overview of what you can do, easily or after consultation for transforming your city. Let's know! We'd be happy to tell you to other Rainproof locals.

Together, we are Amsterdam Rainproof

1 Green / blue roof

A green or blue roof can collect rainwater. Installing a green roof reduces the temperature of the building and its surroundings. A blue roof collects rainwater and directs it to a drainage system. Rainwater can be collected in a large reservoir (reservoir) or in a smaller tank (cistern). Rainwater can also be used for irrigation. Rainwater can be collected in a reservoir and used for drinking water, washing laundry or watering plants.

2 Small front garden

On average, half a square meter of grass can produce more rainwater than a roof. This means that more rainwater can be collected using a small front garden. Rainwater can be collected in a drainage system. Rainwater can also be used for irrigation. Rainwater can be collected in a reservoir and used for drinking water, washing laundry or watering plants.

3 Open gutter

An open gutter is a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

4 Urban infiltration strips

Rainwater infiltration strips are a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

5 Infiltration zones

Infiltration zones are a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

6 Green between the tram rails

Green between the tram rails is a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

7 Water-permeable paving

Water-permeable paving is a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

8 Speed bumps

Speed bumps are a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

9 Grass concrete blocks

Grass concrete blocks are a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

10 Water square

A water square is a square space in which rainwater is collected. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

11 Infiltration crater

Infiltration craters are a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

12 Rainwater pond

Rainwater ponds are a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

13 Reinforced utilities

Reinforced utilities are a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

14 Detached downspout

Detached downspouts are a simple way to collect rainwater. Rainwater is collected in a bucket or barrel. Rainwater can be used for drinking water, washing laundry or watering plants.

Make your neighbourhood rainproof. Visit [rainproofnl](#) to see what you can do.

Website



Straat



Tijdens een豪雨 kan jouw straat gebruikt worden om tijdelijk regenwater op te slaan of het water juist zo snel mogelijk af te voeren. Lees hier rainproof ervaringen, tips en tricks.

Ik ben geïnteresseerd in

Binnen stadsdeel

Selecteer voor type

Selecteer voor stadsdeel



Mijn straat rainproof

Amsterdamse straten worden intensief gebruikt door voetgangers, spelende kinderen, auto's, fietsers en bussen. Maar wist je dat een straat ook een straat heeft tijdens een hevige regenbui? De straat is namelijk gebruikt worden om tijdelijk regenwater op te slaan, of het water juist zo snel mogelijk af te voeren.

[Lees verder >](#)



Tips om je straat rainproof te maken

De gemeente beheert de openbare ruimte, maar jij kunt veel zelf doen!



Regenwatervijvers



Tegels eruit, groen erin



Intensieve groene daken



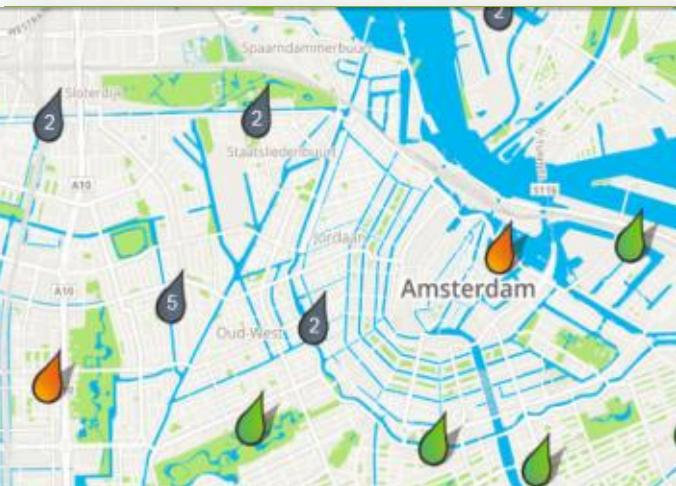
Regenton



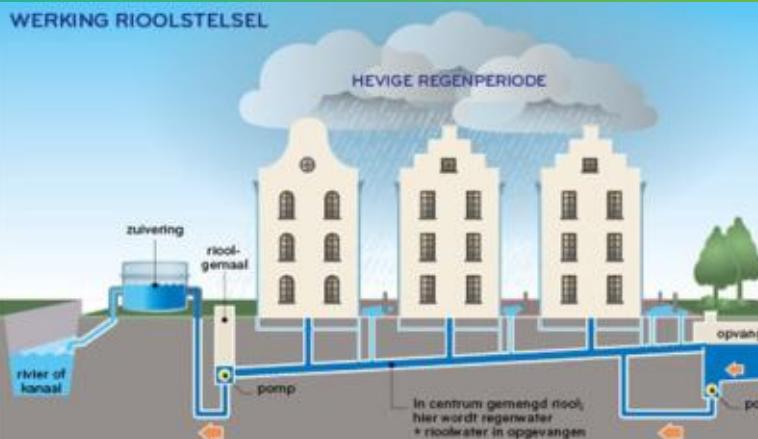
Infiltratiestroken met bovengrondse opslag



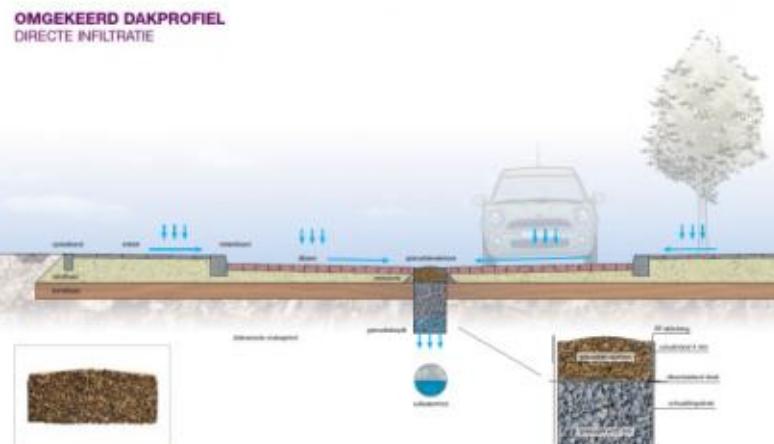
Greppels



WERKING RIOOLSTELSEL

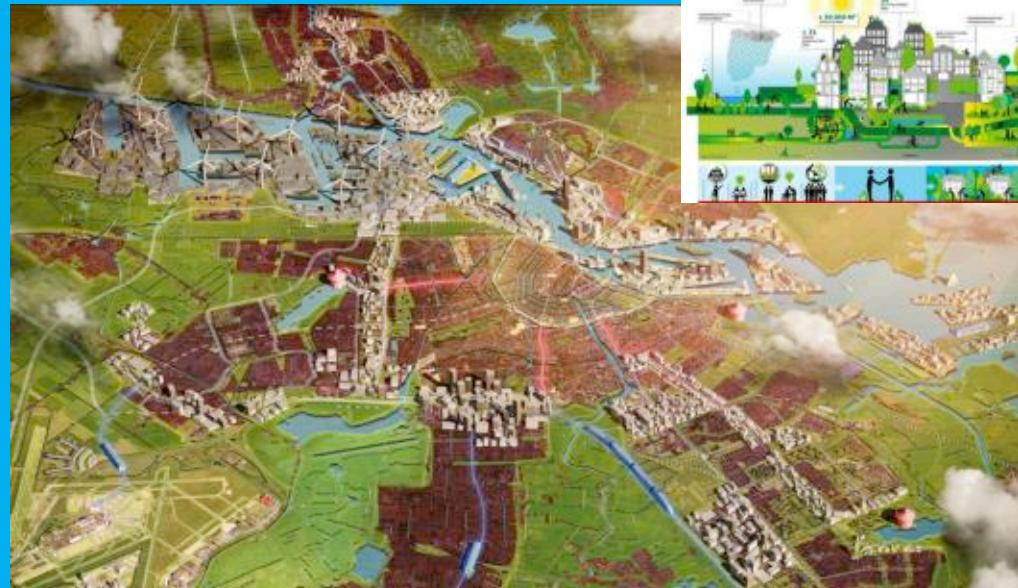


OMGEKEERD DAKPROFIEL DIRECTE INFILTRATIE





Policy mainstreaming



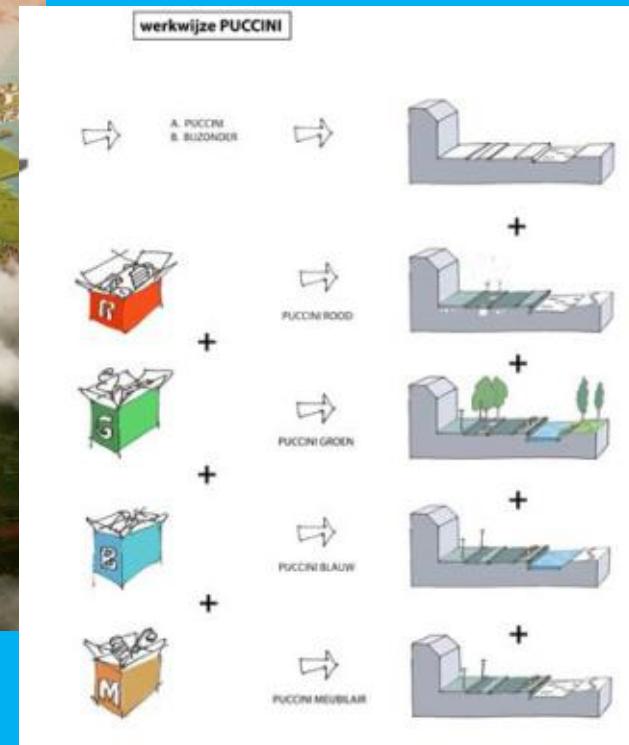
Green Agenda:
Rainproof criterium for funding



Sewage Plan:
Ambition 60 mm/h event
without damage



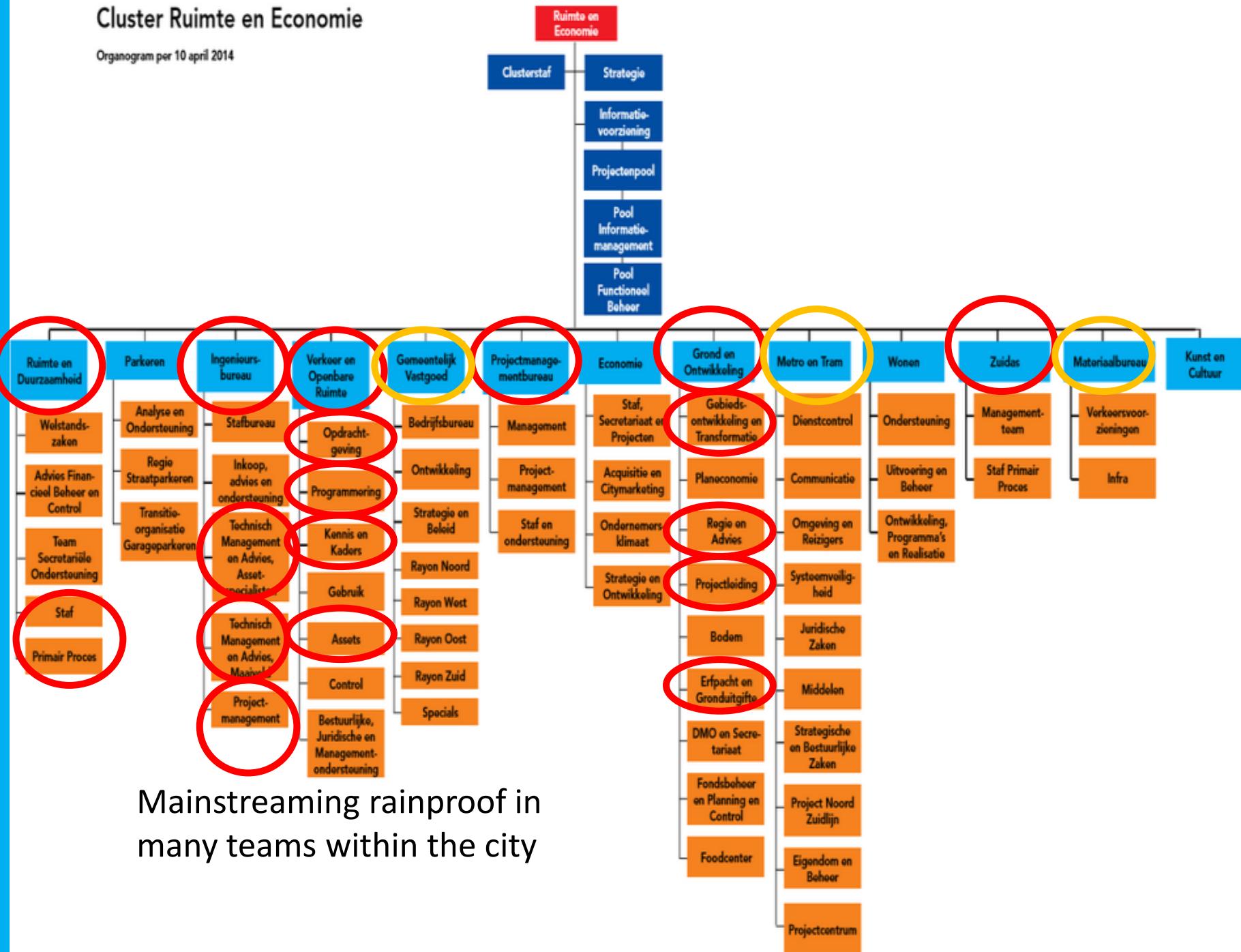
Building “enveloppe”:
70 mm storage/48 h



Asset management framework:
Rainproof materials and profiles

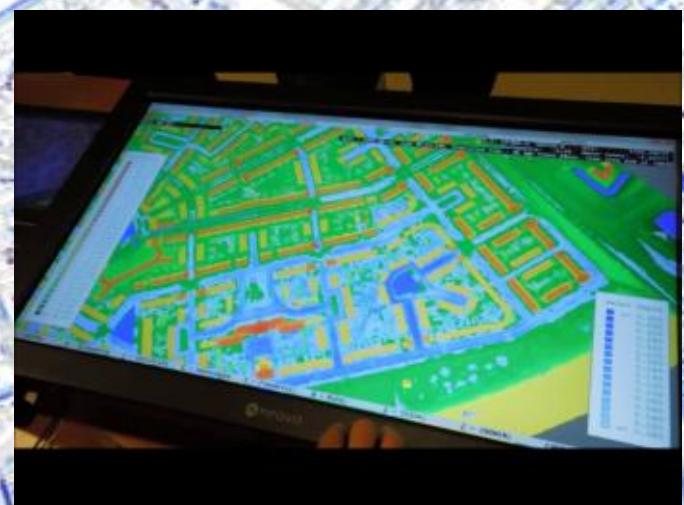
Cluster Ruimte en Economie

Organogram per 10 april 2014



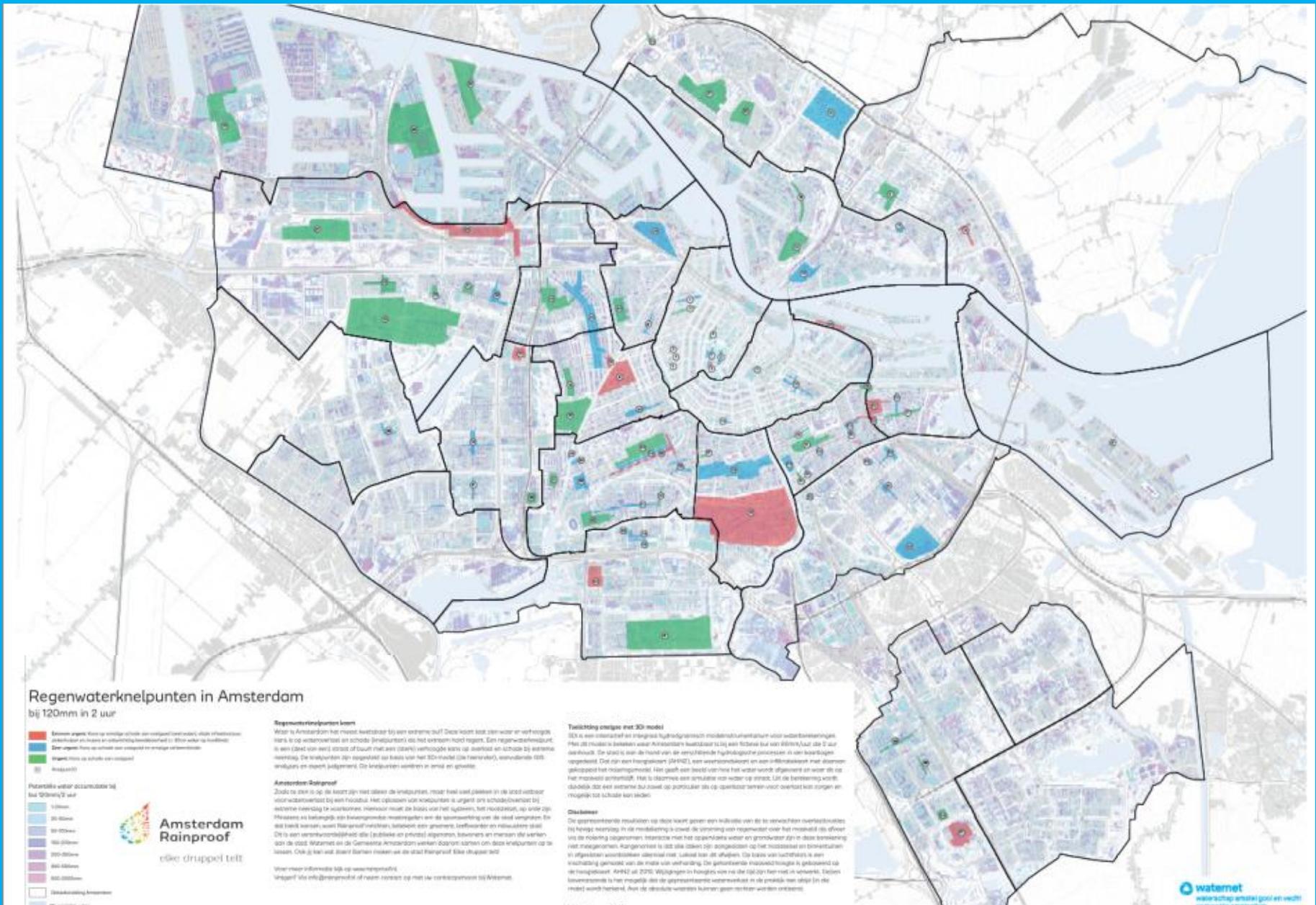


Knowledge: improvement of vulnerability assessment



simulation cloudburst in Amsterdam with WOLK (Tauw, 2013)

Wet spots prioritised



Entrepreneurial development actions





- Finance by crowdsourcing
- Professional advice
- Neighbourhood helpers





Amsterdam Rainproof

every drop counts



paulien.hartog@waternet.nl
paulien@rainproof.nl
www.rainproof.nl
(in Dutch)



INTERNATIONAL COLLABORATION





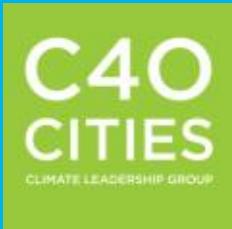
Amsterdam International Responsible Capital





International collaboration water

- Sharing knowledge (partner cities and utilities)



- Social responsibility (UN Social Development Goals)

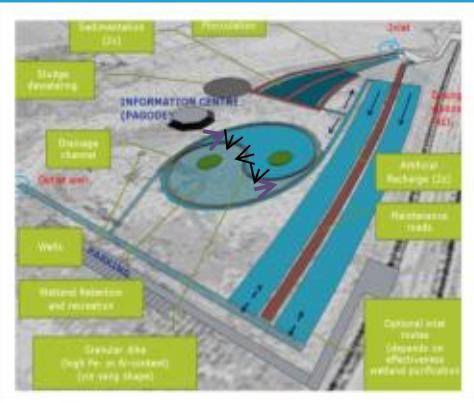


- Aid and trade (Amsterdam, region or NL)





China (2014): Pilot Deyang Artificial Recharge





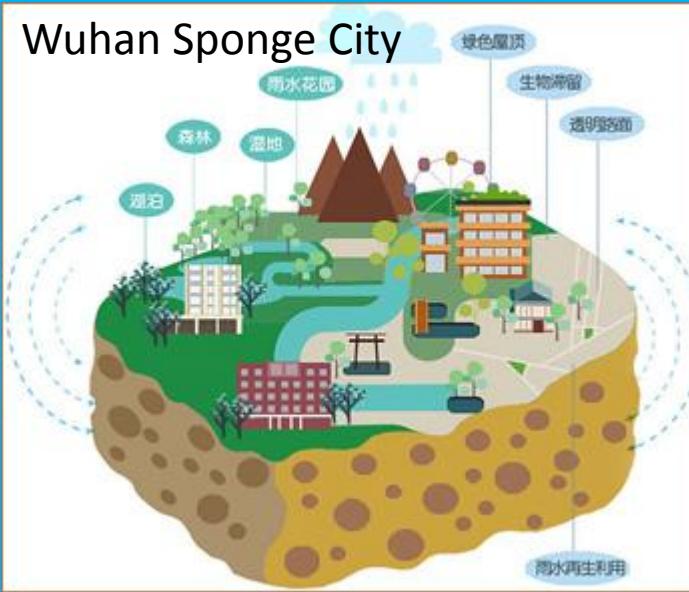
India (2015): Tata Trust rural support program





Collaboration on resilience

Wuhan Sponge City



- Direct sharing with cities (C40 cities)
- Public private cooperation
- Learning together, capacity building



THE IMPLEMENTATION OF THE
COPENHAGEN CLOUDBURST
MANAGEMENT PLAN



30 October - 3 November 2017

The Amsterdam International Water Week (AIWW) is the platform for new alliances and fresh ideas: connecting industry, science, business, policy and technology.



Your one stop shop for inspiration, expertise, leadership and solutions, offering a unique combination of events:

- The AIWW conference
- Aquatech Amsterdam
- Floodex Amsterdam
- Excursions to 'Living Lab' the Netherlands
- Sarphati Sanitation Awards
- Young Water Professionals Programme

Let's achieve real breakthroughs
Come to the Amsterdam
International Water Week

www.internationalwaterweek.com





paulien.hartog@waternet.nl



I amsterdam.[®]