



Water Cycle Safety Planning in The Netherlands

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- **City of Eindhoven: background & characteristics**
- **WCSP Eindhoven:**
 - Risk identification
 - Measures
- **Conclusions and recommendations**



Eindhoven



EINDHOVEN

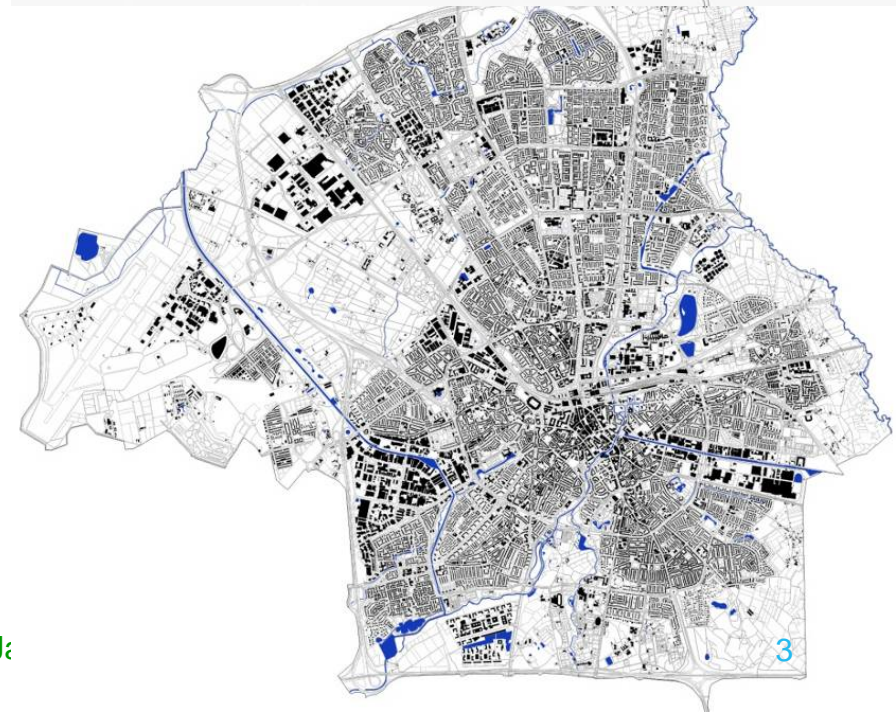
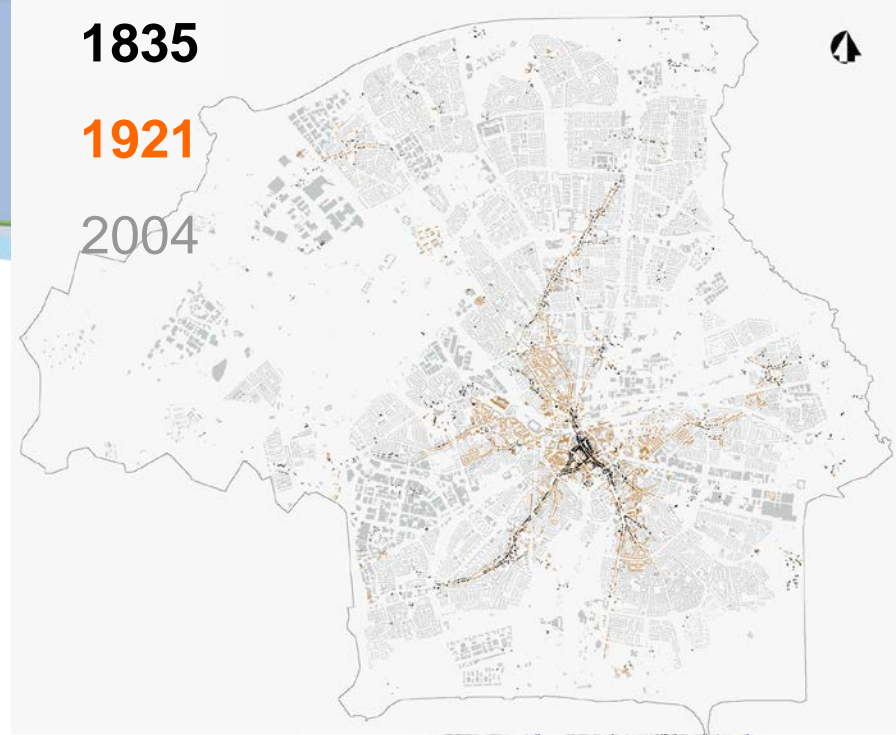


Prepared enabling change

1835

1921

2004



Aarhus, 21 – 23, Jk



2011



1945



A 'historic challenge' in a new city



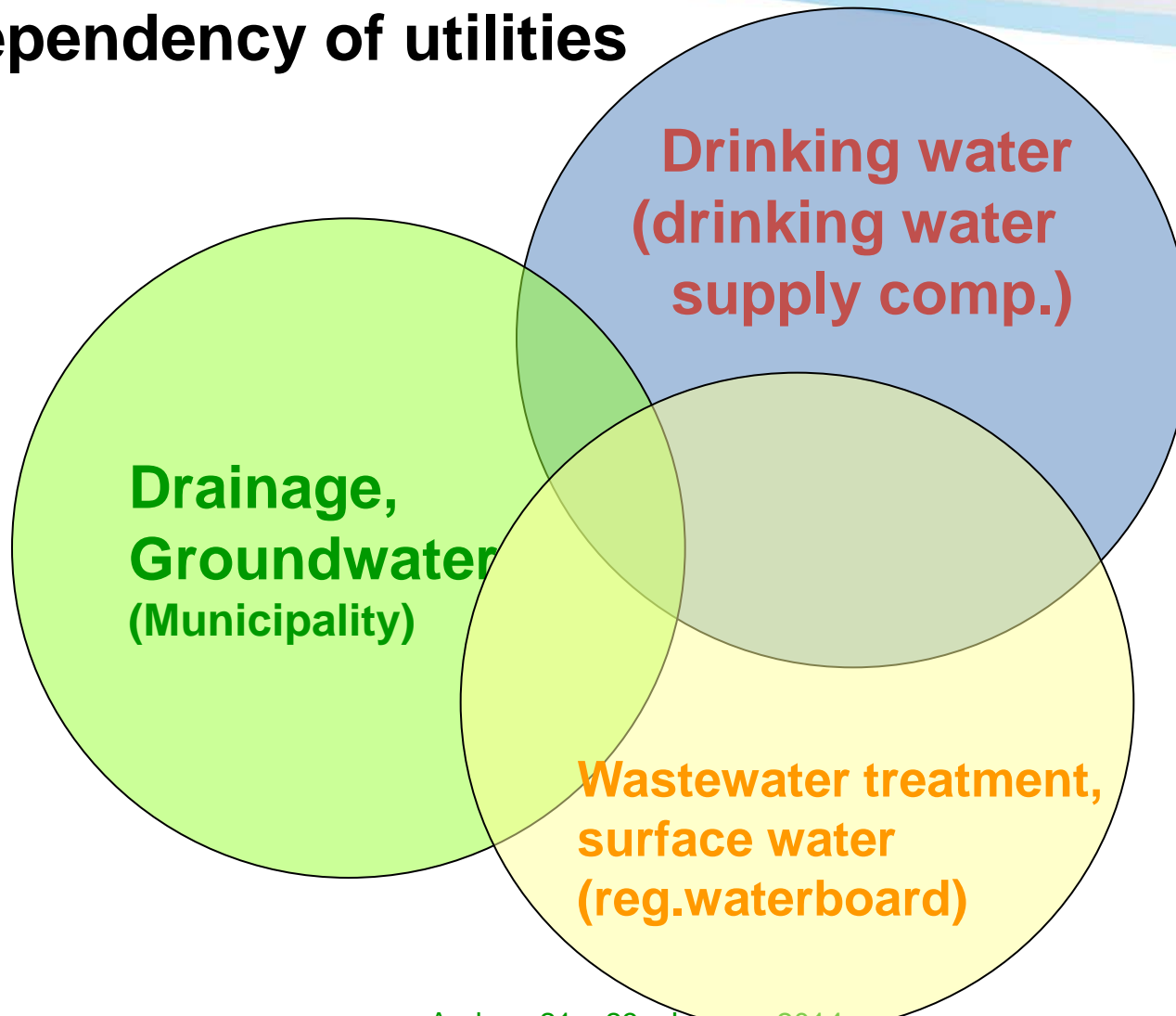
- **Old watercourses have been closed or connected to sewage**
- **WWTP and sewage capacity is insufficient**
- **In building design and spatial planning no attention was paid to the geo hydrological setting**







Interdependency of utilities





- **2 start meetings, 3 workshops with all stakeholders**
- **‘Pragmatic approach’: WCSP as a tool, not a goal**
- **1st workshop:**
 - **Characterise urban water system**
 - **Identification of climate change risks**
- **2nd workshop**
 - **Characterise and prioritize identified risks**
- **3rd workshop**
 - **Integrate system safety plans, check risks**
 - **Identify and evaluate measures**



4 'scenarios'

- **Rising temperature**
- **Long period without precipitation**
- **A winter period with high precipitation**
- **Extreme rainfall events**



- **Drinking water: legionella growth at a large scale**
- **Surface water > 25 C**
 - Ecological danger due to < O₂-concentrations
 - Industrial processes (no discharge of cooling water)
 - Algae, botulism (health)
 - Nuisance: visual, odor
 - Drying up of streams, ponds ; might increase heat island effect
- **Recreation increases: waterquality is more important (higher demands to CSO's, algae etc)**
- **WWTP: adding oxygen is necessary**



Long period without precipitation

- **Sludge growth in sewage**
 - Extreme rainfall event causing problems in discharge capacity (-> CSO's) and WWTP -> surface water quality
- **Deteriorating surface water quality (no discharge), and more vulnerable to pollution**
- **Visual quality of surface water deteriorates**
- **Increasing drinking water demand**
- **(Agricultural) use of water is limited/prohibited**
- **Fire dept. might need more surface water in stead of drinking water**



A winter period with high precipitation

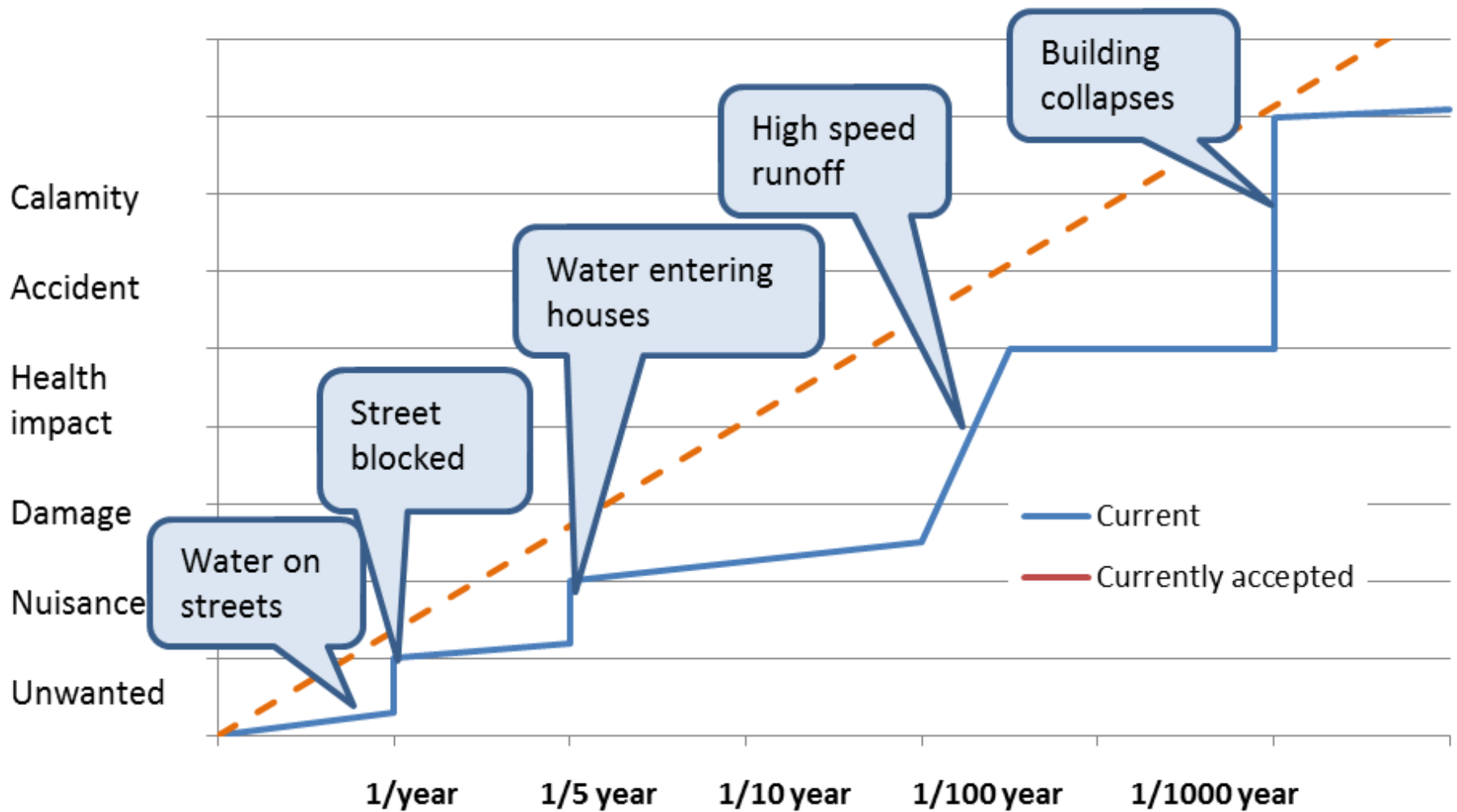
- **Increased discharge of river basin up stream (long period)**
 - **Inundation urban areas, causing:**
 - **Health issues (blocking cso's)**
 - **Damage to houses/real estate**
 - **Making maintenance activities more difficult**
 - **Disturb traffic, public events**
 - **Disrupting WWTP**
 - **Surface water (may be with CSO-water) entering ground water wells for drinking water**
 - **High ground water levels causing groundwater entering basements, cellars, et cetera in houses/real estate**



- **Flooding from storm water (water on street), causing**
 - Health issues (combined sewer system flooding)
 - Damage to houses/real estate
 - Making maintenance activities more difficult
 - Disturb traffic, public events
- **Malfunctioning of waste water chain, causing**
 - Bad surface water quality (sludge, CSO's, effluent WWTP) for ecology, recreation
 - Flooding of (smaller) surface water that receives these discharges
- **Less infiltration of rain water due to extremer events, causing less addition to ground water, causing lower ground water levels (impact on ecology,..)**

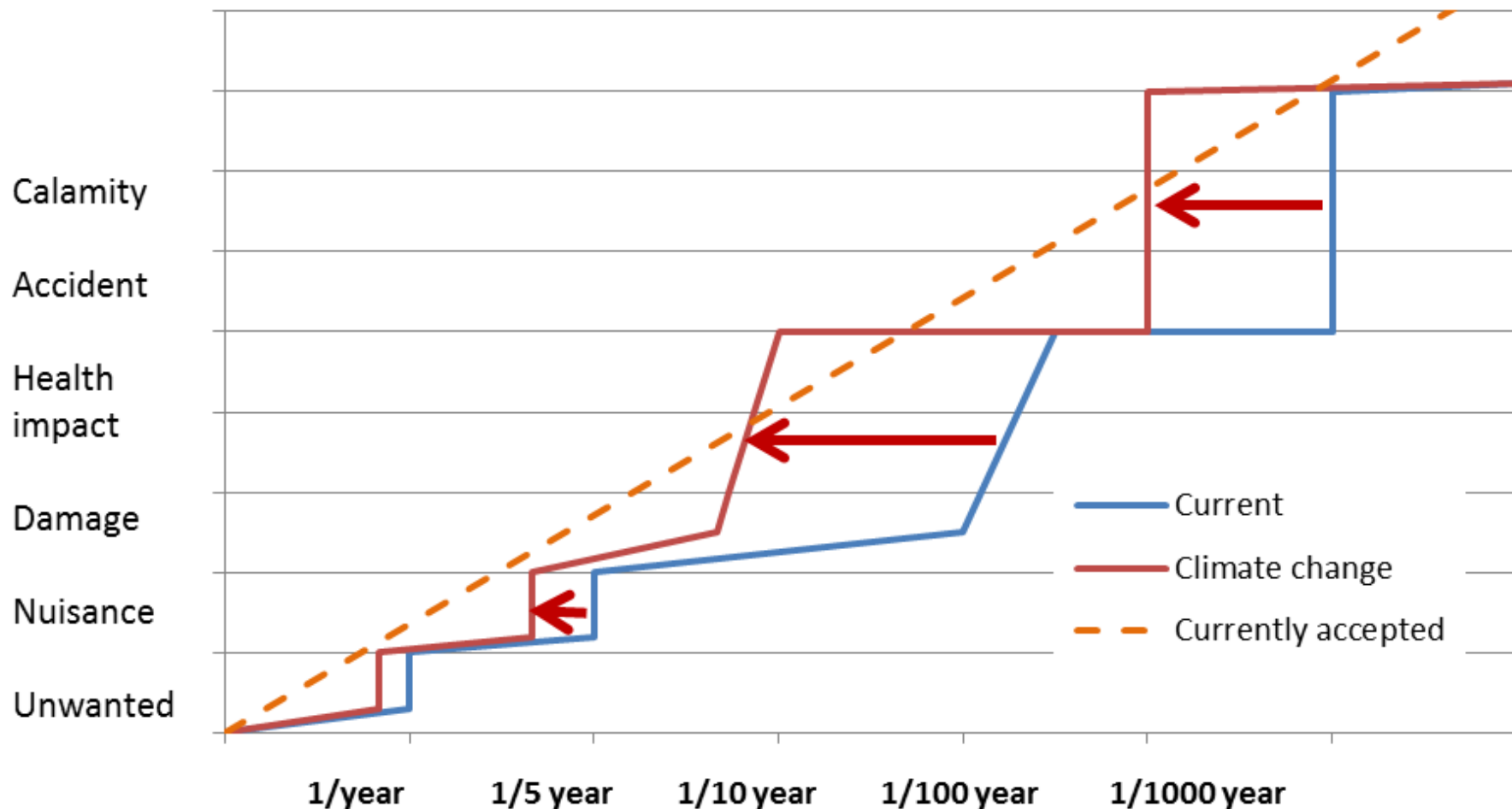


Likelihood and consequences





Measures and accepted consequences





- **Integrated control of sewage and wastewater systems**
- **Raising (or re-installing) sidewalk curbs**
- **From combined to separated sewer systems**
- **Raising groundwater wells (prevent flooding)**
- **Prevent and remediate of groundwater nuisance in houses**
- **Flight havens for fish in surface water to survive events with low oxygen**



- **Content**
 - No serious health or safety issues are expected
 - Focus on environmental and economical risks
 - Flooding, surface water quality , ground water control
- **Communication**
 - Platform to exchange knowledge & identify new risks
 - Tool to communicate with management, politicians, public
- **Inspiration**
 - Catalyst for other activities, e.g. QRA, automated control of sewage systems



Gaining adequate knowledge of present functioning and malfunctioning of all urban water management aspects.

Improving and introducing instruments to predict (quantitative and qualitative) consequences of future climate changes (or events), to be able to determine risks that will occur.

Increasing transparency of and cooperation between all stakeholders involved in urban water management. Due to this, partners increasingly worked together on other projects connected to integrated urban water management.

