IWAS
Brazil
ÁGUA-DF

der Bundeswehr Universität München

Urban drainage as sustainable environmental service

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Final Workshop - Project IWAS ÁGUA DF
Integrated Water Resources Management in Distrito Federal – DF
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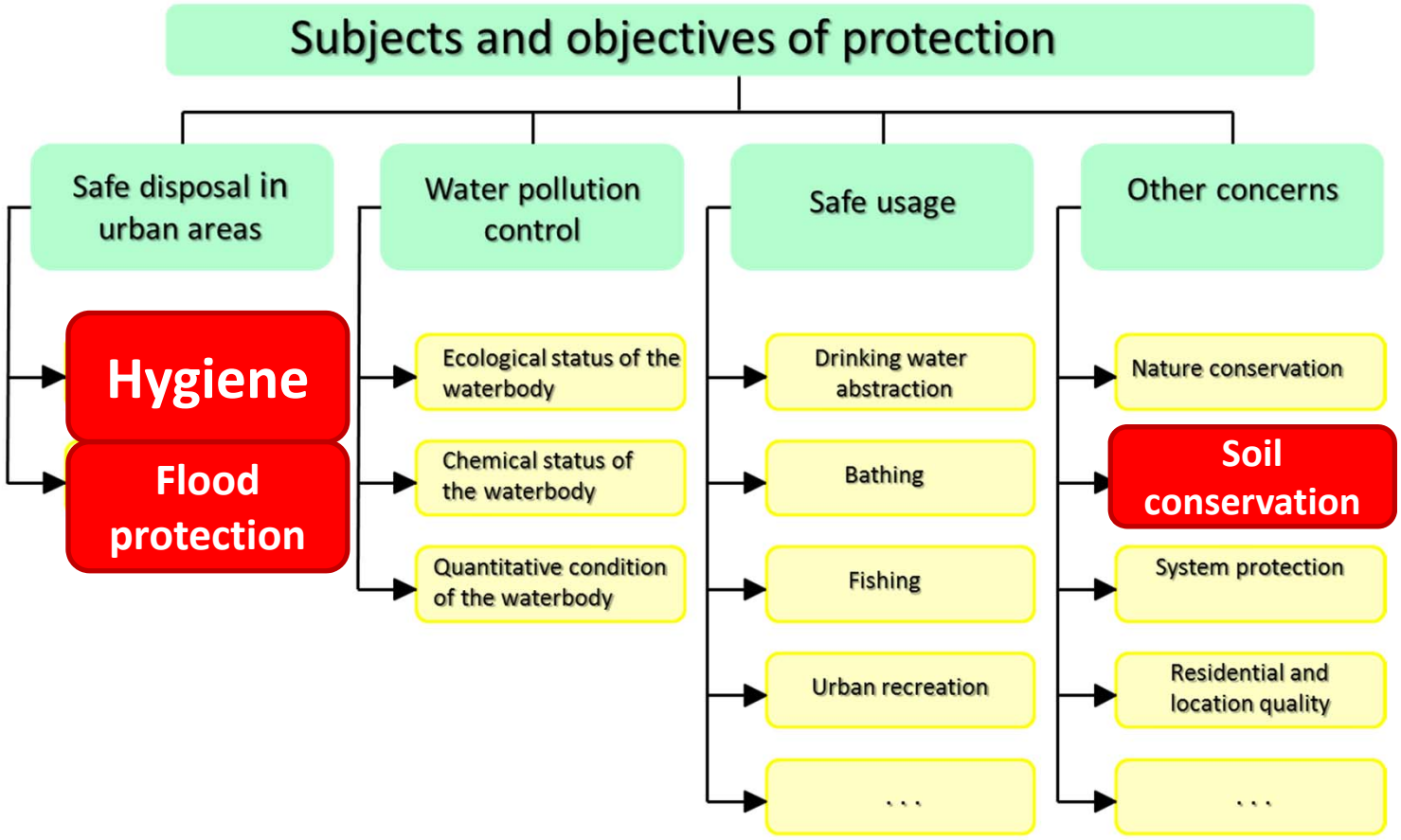
Overview

1. Principals of integrated urban drainage
   - Subjects of protection and goals
2. Focus on Brasília
   - Current situation, future risks and perspectives
3. Urban development and stormwater management
4. Stormwater modeling

Principals of integrated urban drainage

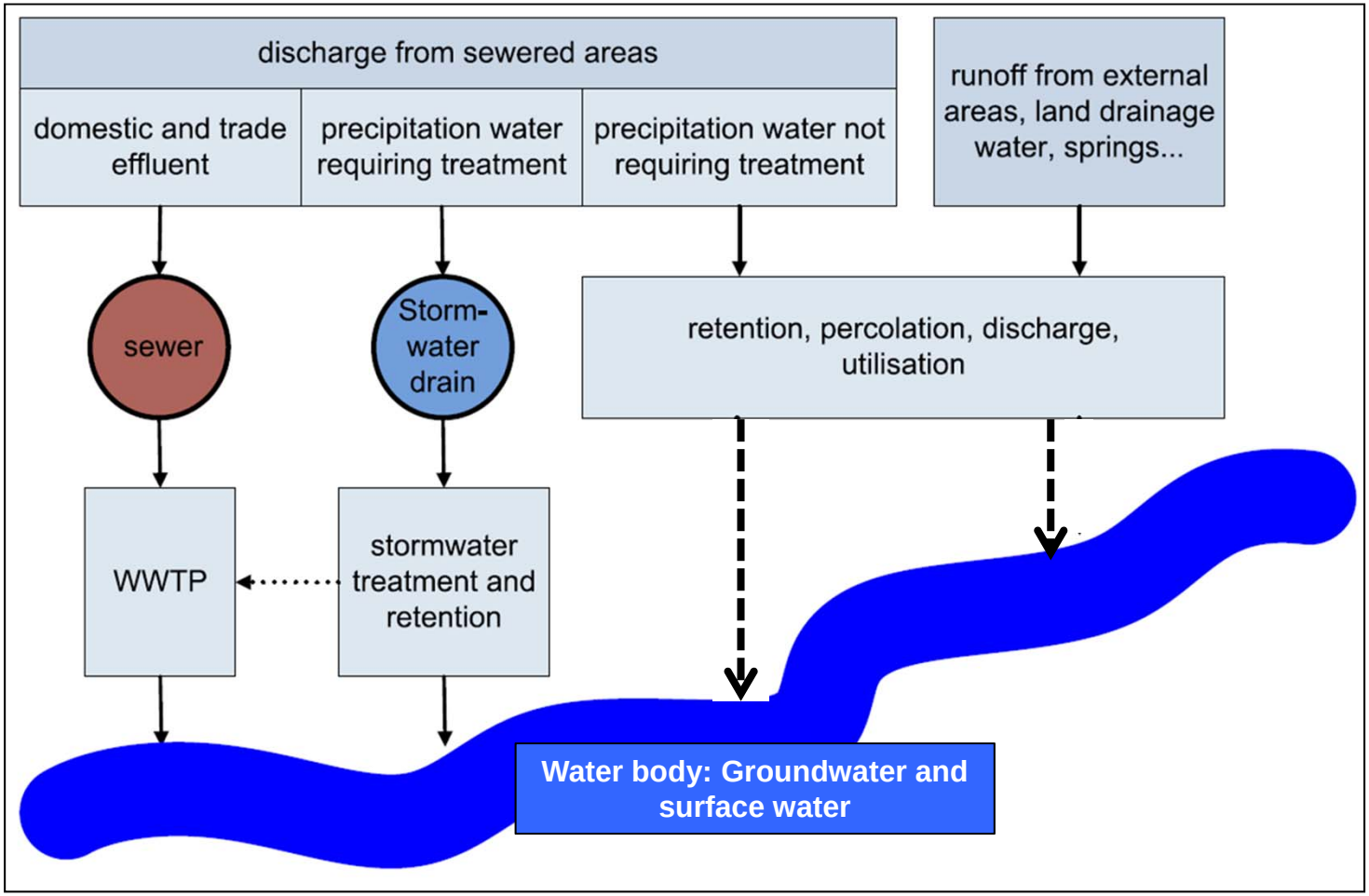
Subjects and objectives of protection



Source: DWA – A 100

The drainage System

Discharge into the receiving water body



Goals of stormwater management

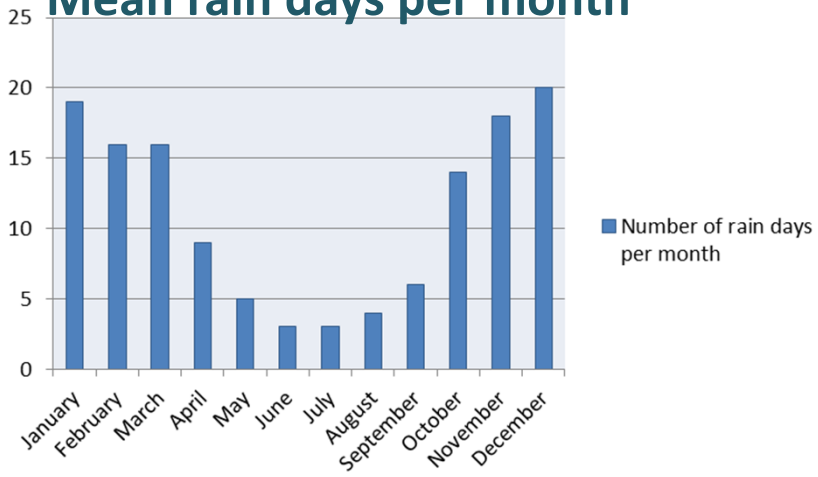
- Minimize disadvantages of the conventional drainage principle (collection and discharge)
  - Minimize flood peaks
  - Adapt water balance to the natural water cycle
  - Minimize water bodies pollution
  - Reduce costs
- Achieve constant drainage comfort

Source: NOVACAP 2012

Climate in Brasília

Influences on runoff processes and stormwater management

Mean rain days per month



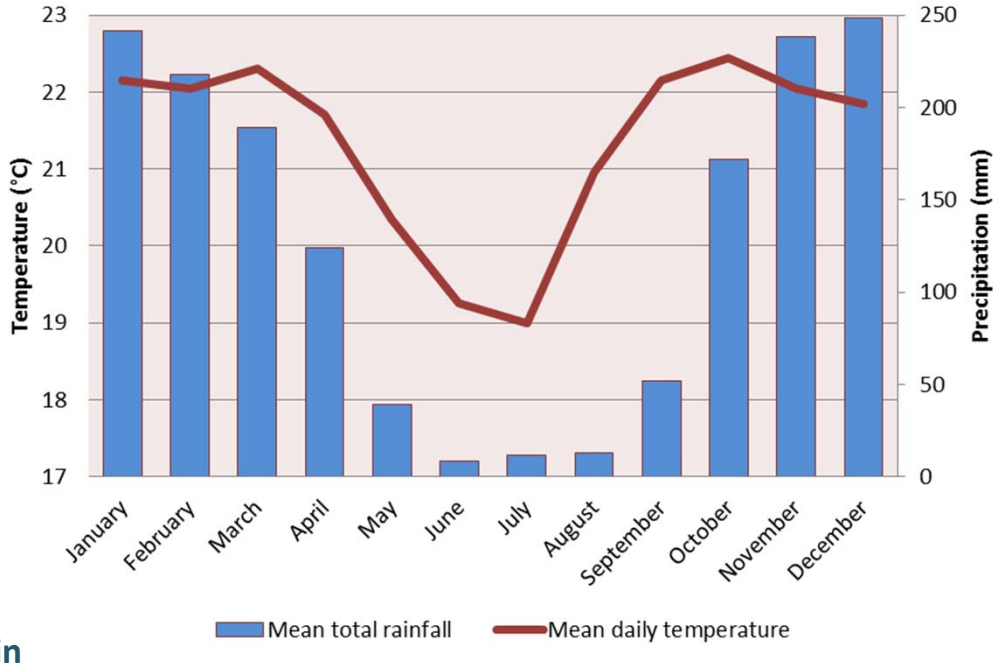
Rainfall per year (mm)	
Average	1393,56
Maximum	2900,5
Minimum	875,2

In comparison…

Average rainfall in Germany:

840 mm/year

Mean temperature and rainfall



First flush effect

Soils in Brasília

Influences on runoff processes and stormwater management

- Predominant soil types: latosols and cambisols
  - Limited ability of the soils to drain away stormwater
- Increasing population (2,2 % per year, comparison with Germany: -0,3 %) results in increase of sealed areas

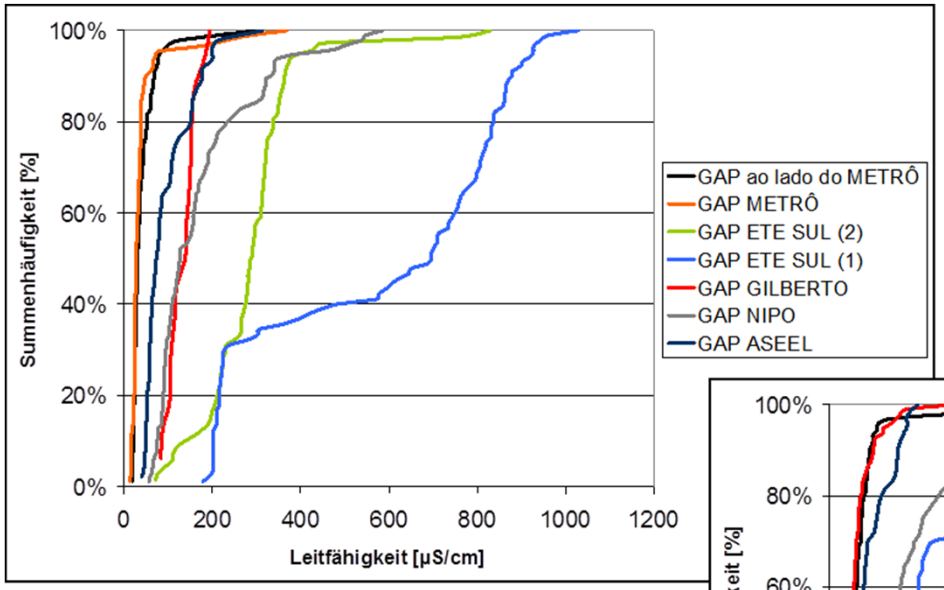
Sources: www.aboutbrasilia.com, www.wordpress.com, www.sinus.org.br

Degree of pollution: hazards for lake Paranoá

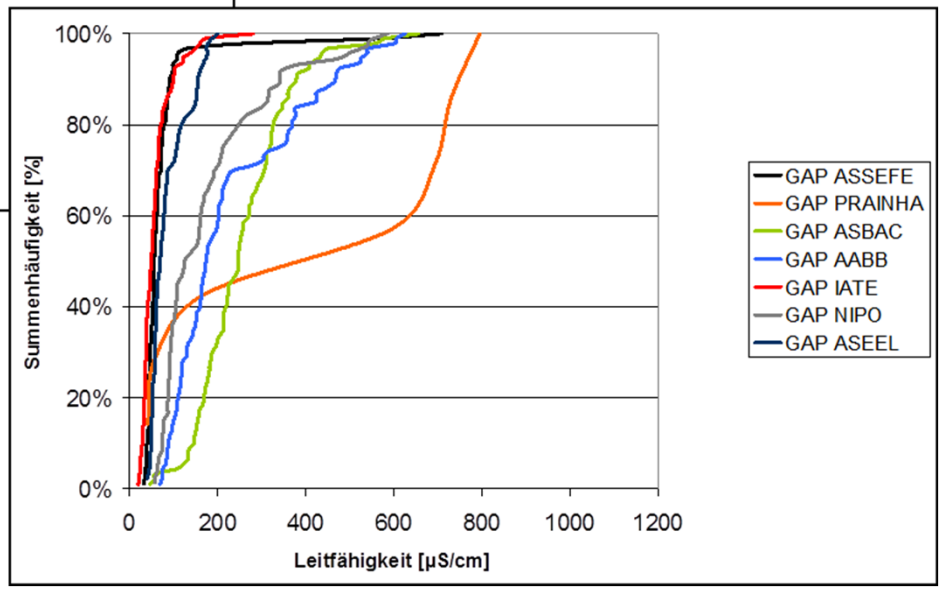
- High surfaces pollution loads after dry periods?
- Constant pollution:
  - Illegal connections – inflow:
    - High pollution load from stormwater discharging points
    - Strong hydraulic charge at wastewater treatment plants (WWTP´s)
  - Damaged sewers – infiltration and exfiltration

Source: NOVACAP 2012

Analysis of the first monitoring period 2003-2006



Conductivity = pollution degree

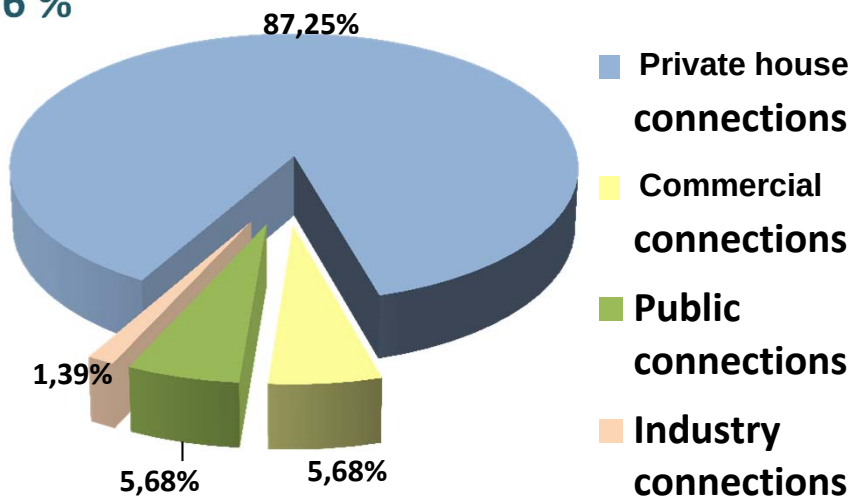


GAP:
stormwater discharging point

Segmentation of sewer connections in Brasília

Sources of impact on the urban drainage system and resulting water quality

Connection degree: 96 %



...just little influence from industrial waste waters

Maintainance

Comparison of sewer connections and cleaning rate

Parameter	Unit	Bavaria	Baden-Wuerttemberg	Brasilia
Degree of connection to the sewer systems	%	98	99,8	96
Specific total sewer length	m/p	10,15	5,84	7,71
Sewer cleaning/total sewer length	%	14,64	16,61	9,06

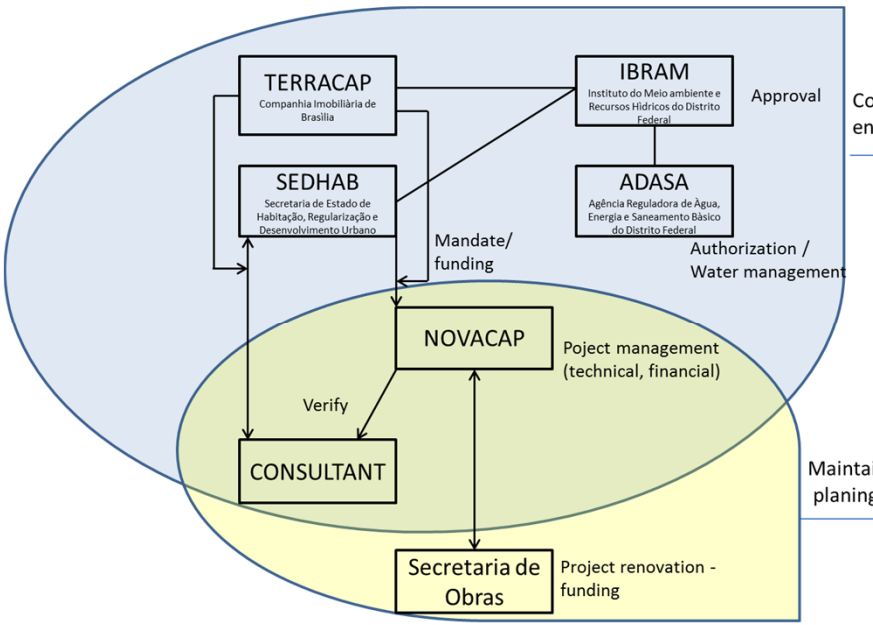
Annotations:

- Brasília`s specific total sewer length (red) is the sum of wastewater: 2,89 meter per person and stormwater drain length: 4,82 meter per person
- The value for sewer cleaning is just for wastewater sewers (blue)

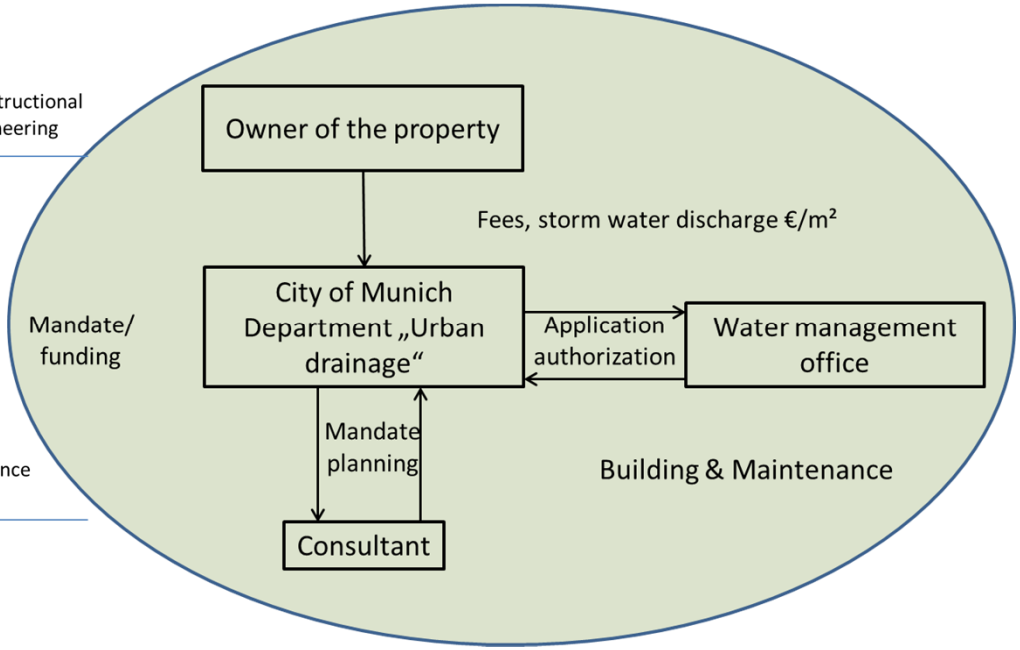
Organisation of urban drainage in Brasília and Munich

Project management for new construction and renovation of stormwater facilities

Brasília



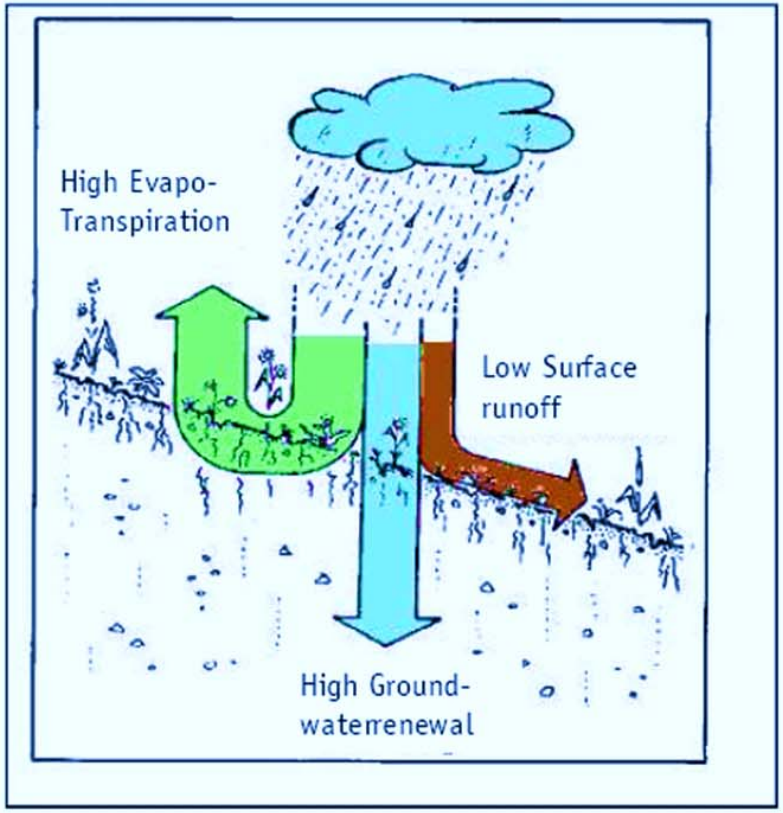
Munich



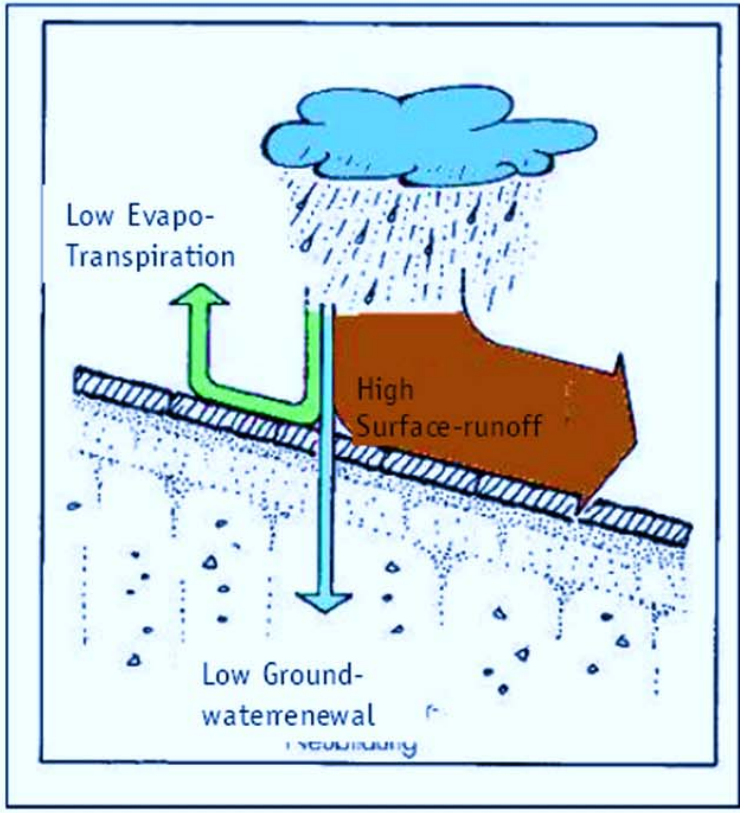
Stormwater management

Impact of surface sealing on the water cycle

Natural water cycle

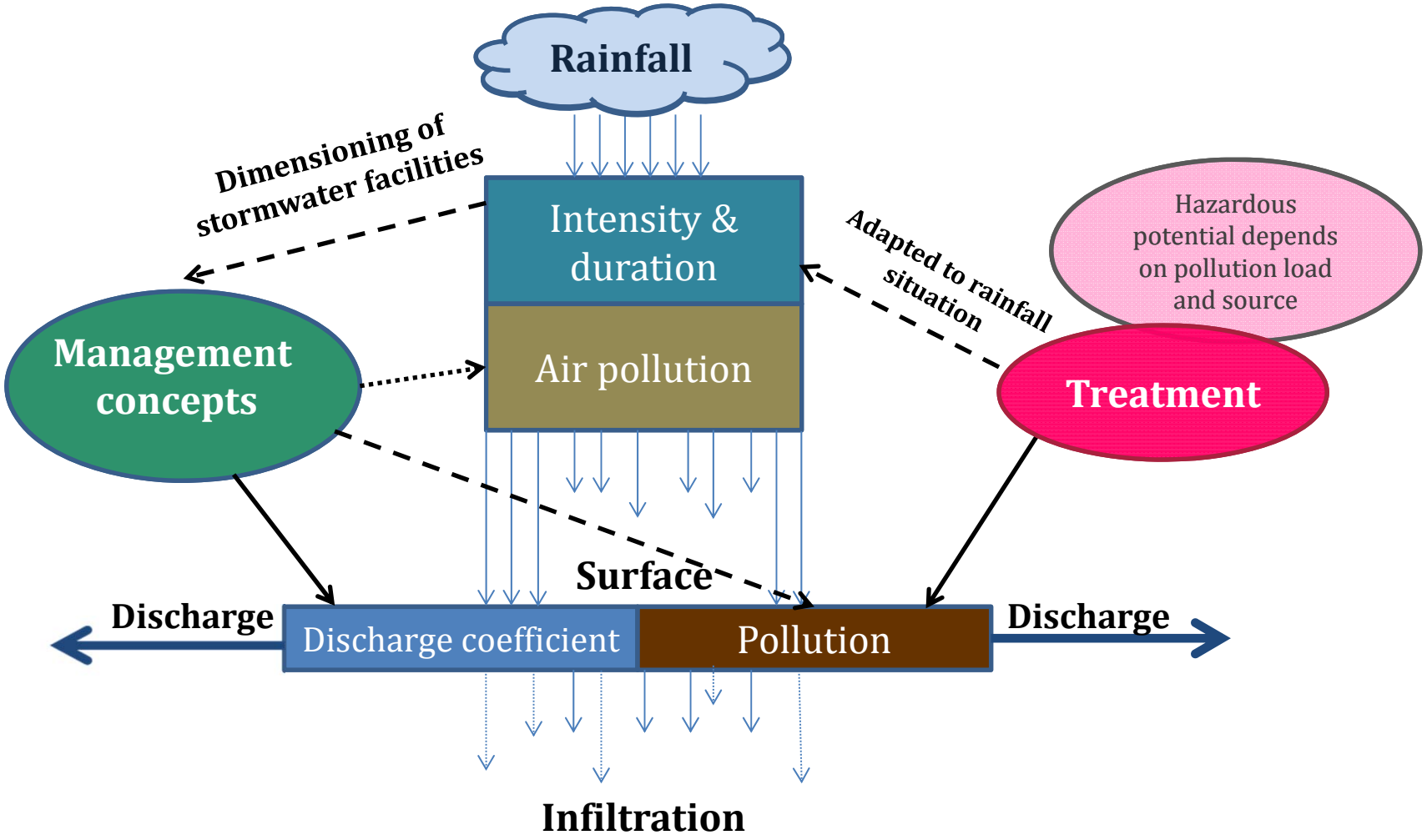


Urban water cycle



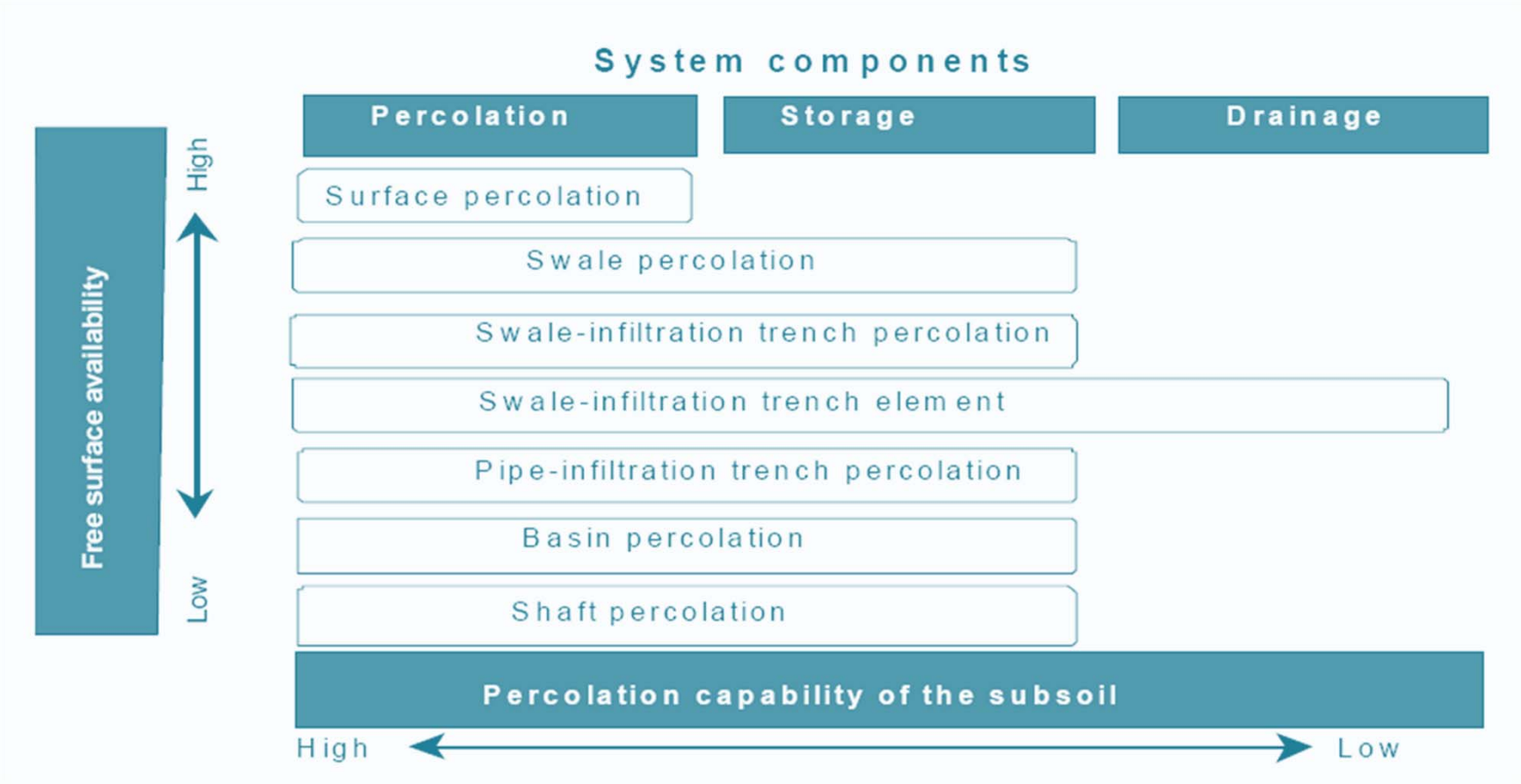
Source: Geiger and Dreiseitl 1995

Influencing factors on stormwater management



Capabilities of percolation facilities

Dependent on surface availability and infiltration ability of the soil



Source: DWA-A 118, 2005

Examples for percolation facilities

Roof greening

Percolating surface coverings

Source: Bayerisches Landesamt für Umwelt 2009

Examples for percolation facilities

Surface percolation

Soil filter

Source: Bayerisches Landesamt für Umwelt 2009

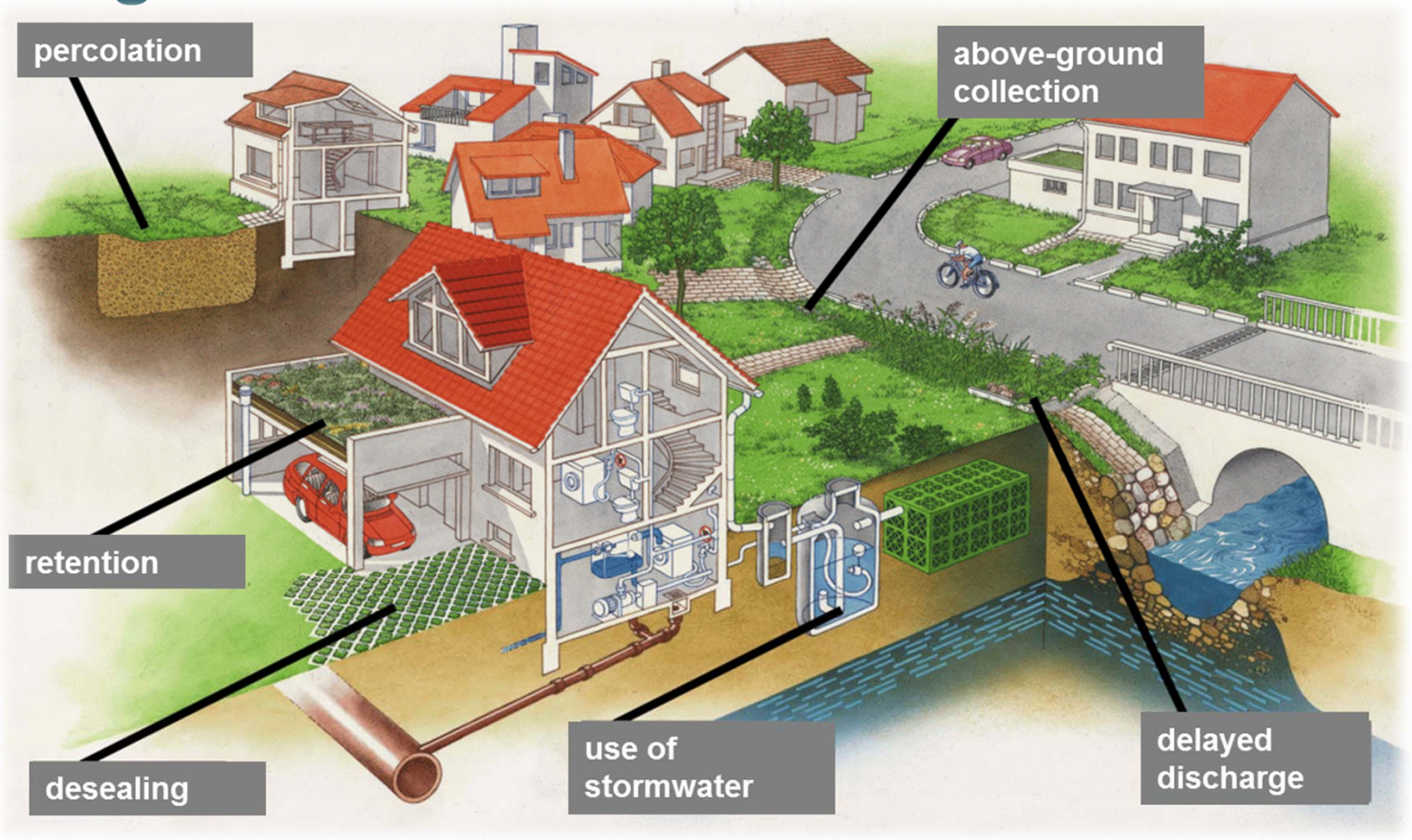
Examples for percolation facilities

Swale percolation

Trench percolation

Source: Behörde für Stadtentwicklung und Umwelt Hamburg 2006

Combination of elements for stormwater management



Source: www.wwa-an.bayern.de

Rainwater drainage problems in Distrito Federal

Urban drainage as sustainable environmental service

Management programme of Distrito Federal`s urban water drainage

DF`s waters

MANAGEMENT PROGRAM OF DF`s URBAN WATER DRAINAGE

- **PROGRAM`s OBJECTIVE**
  - **Improvement of Urban Drainage Systems, solving recurrent problems of floods, protection of springs and rehabilitation of erosion and strengthening the legal and institutional framework of the DF for the management of water resources.**
- **PROGRAM`s COMPONENTS**
  - **Implementation and Recuperation System Urban Rainwater Drainage**
  - **Environmental Restoration - Erosion and Protection of springs**
  - **Development and Institutional Strengthening**

MANAGEMENT PROGRAM OF DF`s URBAN WATER DRAINAGE

URBAN DRAINAGE INTERVENTION

TAGUATINGA:

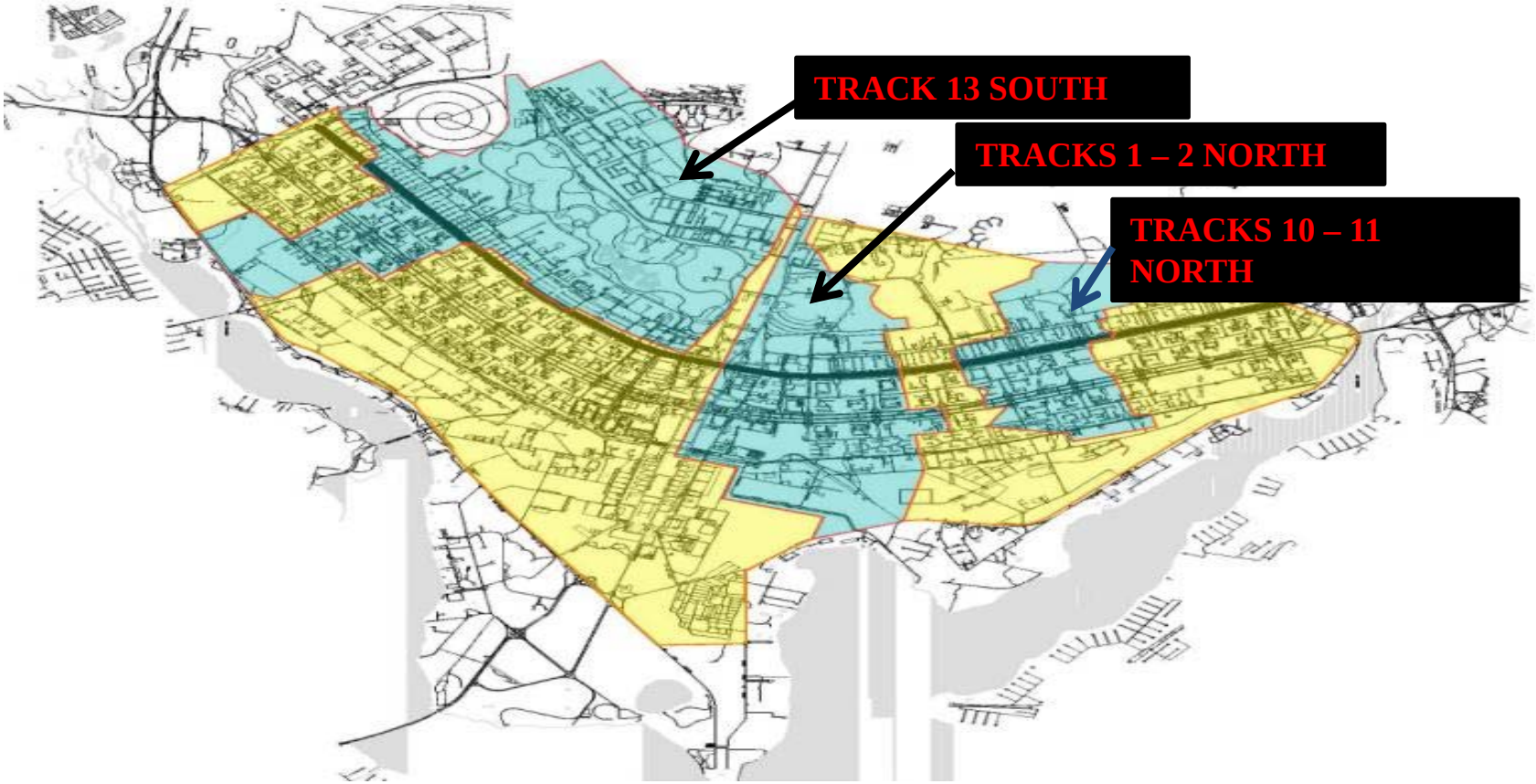
- **Blocks QNA,QNB,QNC,SC,QSA e QSB**
- **Blocks QND, QNE, QI – Hélio Prates.**

PLANO PILOTO:

- **Tracks 01 e 02 North**
- **Tracks 10 e 11 North**
- **Track13 South – Parque da Cidade**

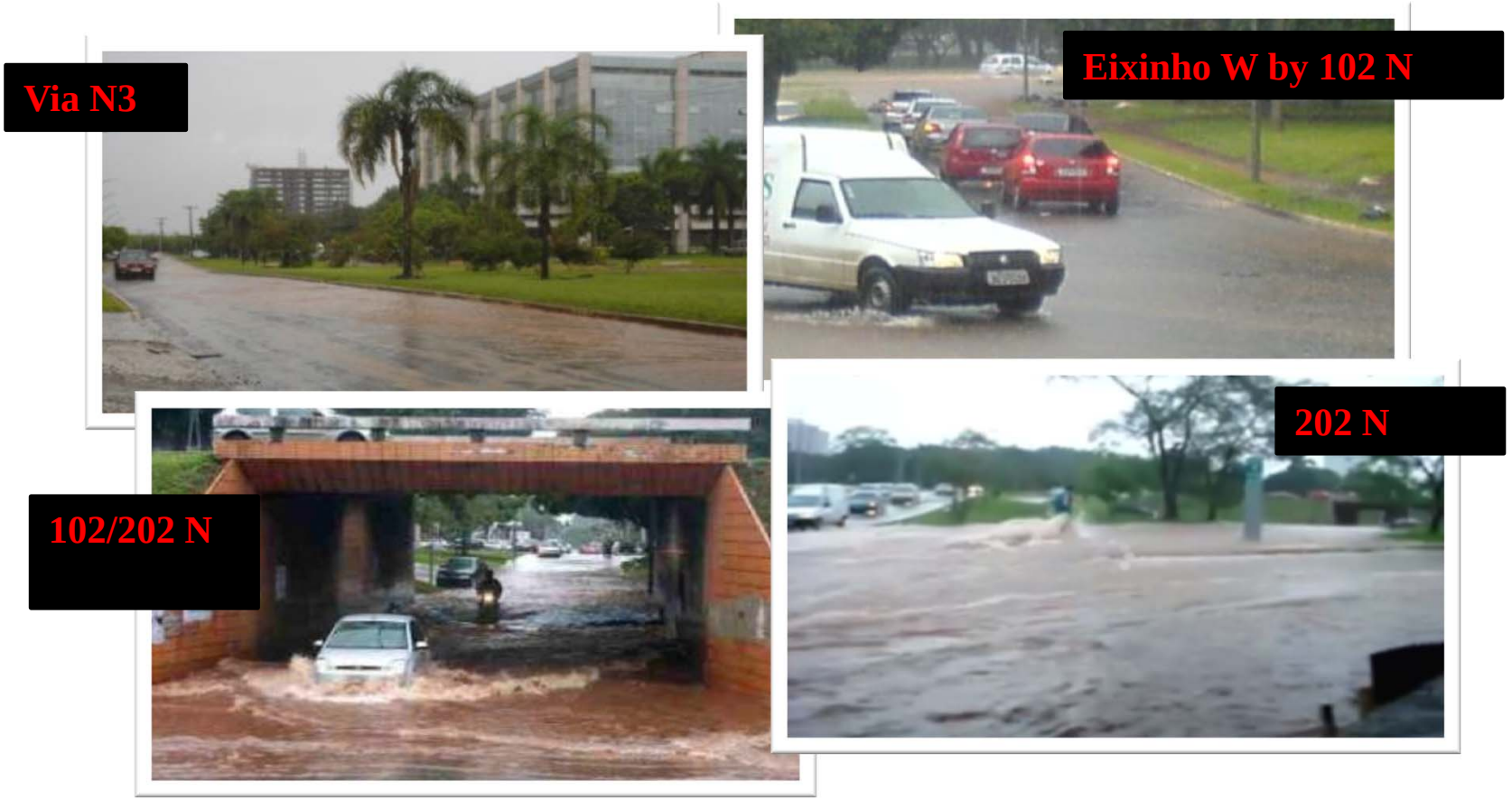
PROGRAMA DE GESTÃO DAS ÁGUAS DE DRENAGEM URBANA DO DF

SOLUTION OF CRITICAL SPOTS OF PLANO PILOTO`s FLOODING



DRAINAGE INTERVENTIONS – TRACKS 01 AND 02 NORTH

FLOOD`S PREFERED PATHS AND SPOTS

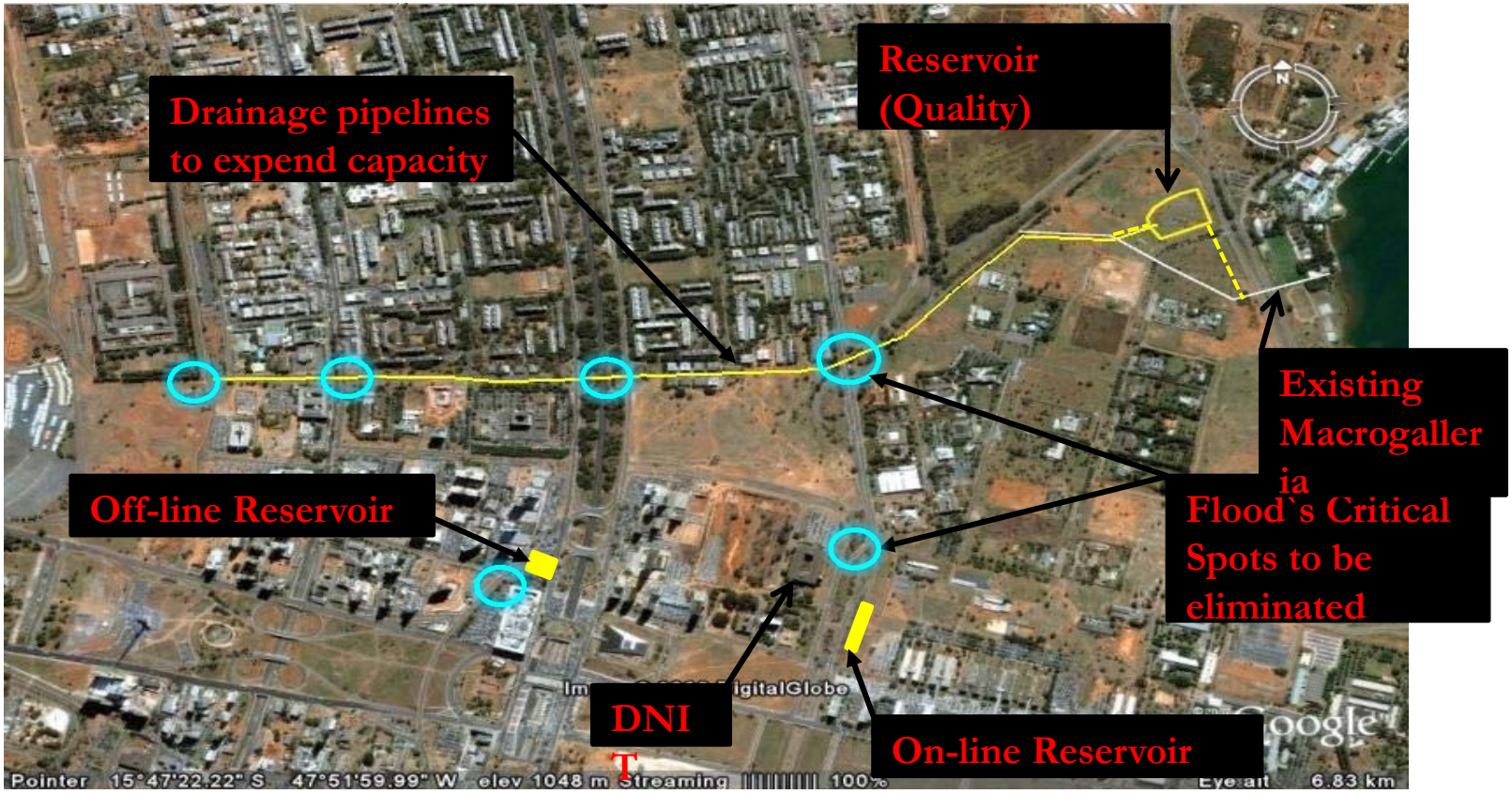


DRAINAGE INTERVENTIONS – TRACKS 01 AND 02 NORTH

FLOOD`S PREFERED PATH AND SPOTS

DRAINAGE INTERVENTIONS – TRACKS 01 AND 02 NORTH

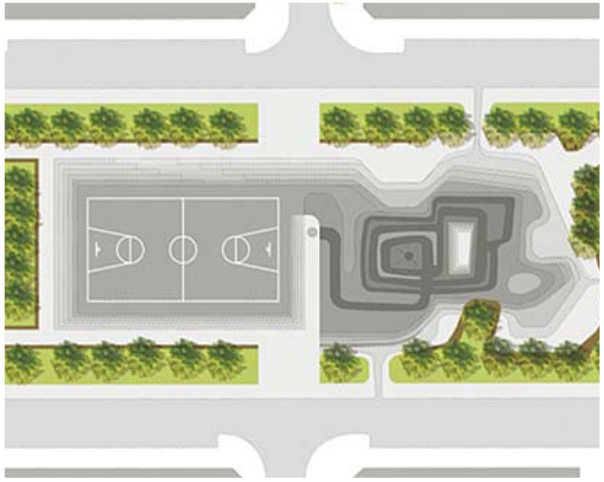
PROJECT`S GENERAL CONCEPTION – BEST ALTERNATIVE



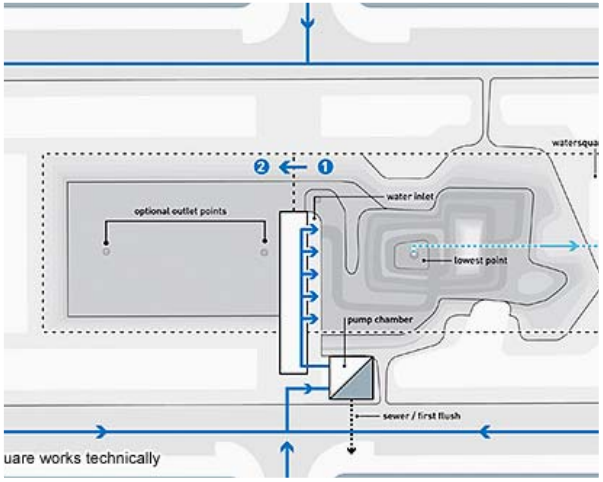
Opportunities for urban development with focus on resilient urban drainage and stormwater management

Example: City of Rotterdam

Exemplary design



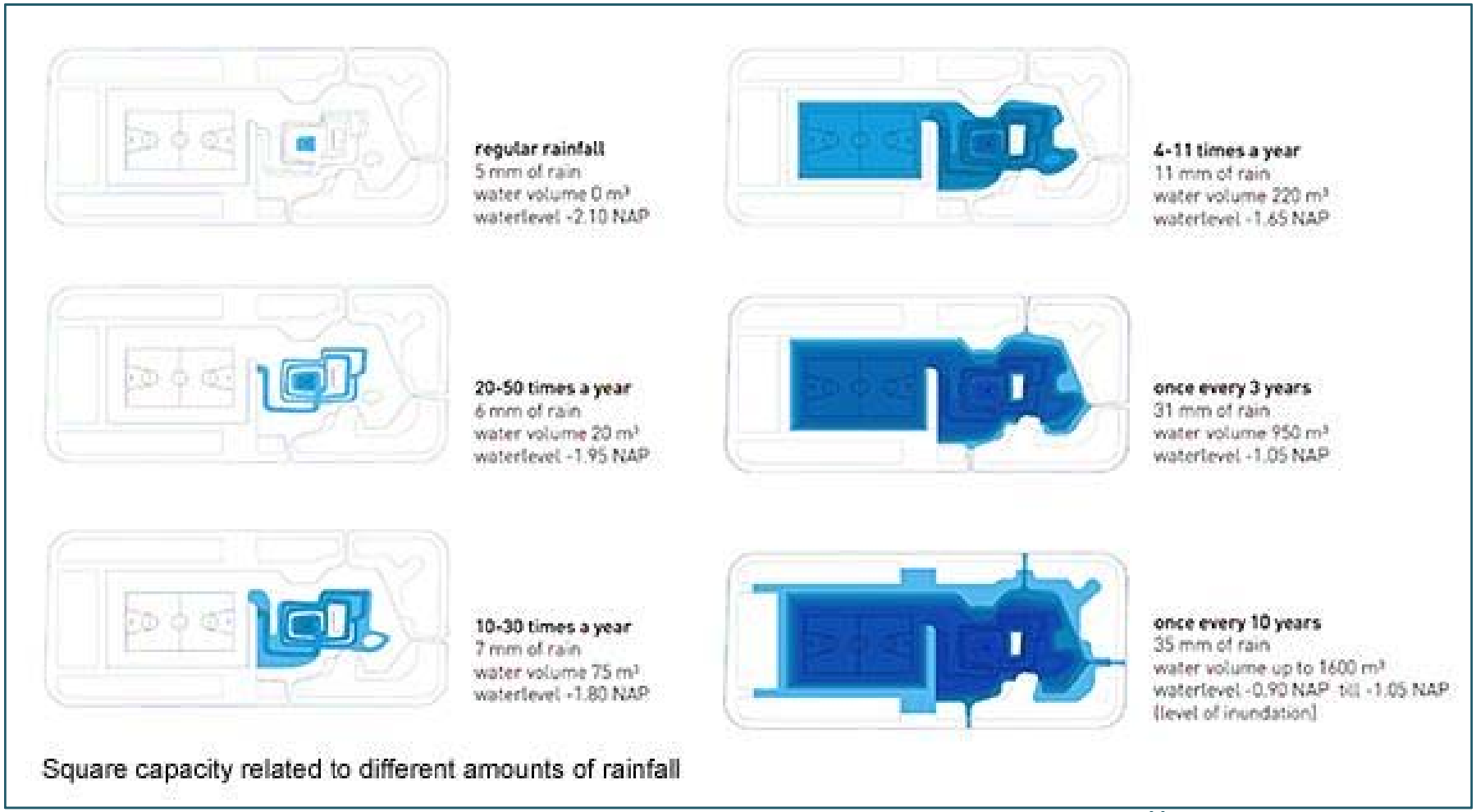
Plan in situation



How the watersquare works technically

Source: http://www.urbanisten.nl

Consideration of extreme events

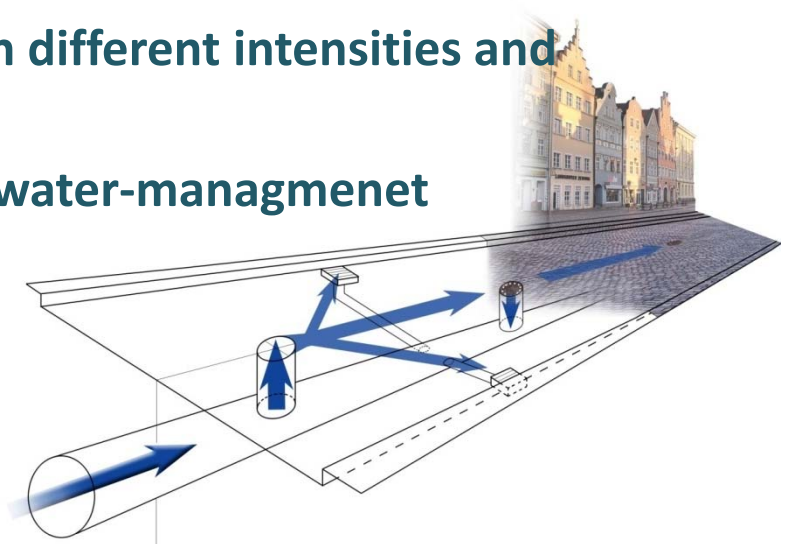


Square capacity related to different amounts of rainfall

Source: http://www.urbanisten.nl

Stormwater modeling

- Hydrodynamic modeling of stormwater flow on surface
- Hydrodynamic modeling of stormwater sewer flow
- Bi-directional coupeling of surface and sewer via inlets
- Calculation for different rainfall-events with different intensities and durations
- Calculation for different elements of stormwater-managmenet



Achievements:

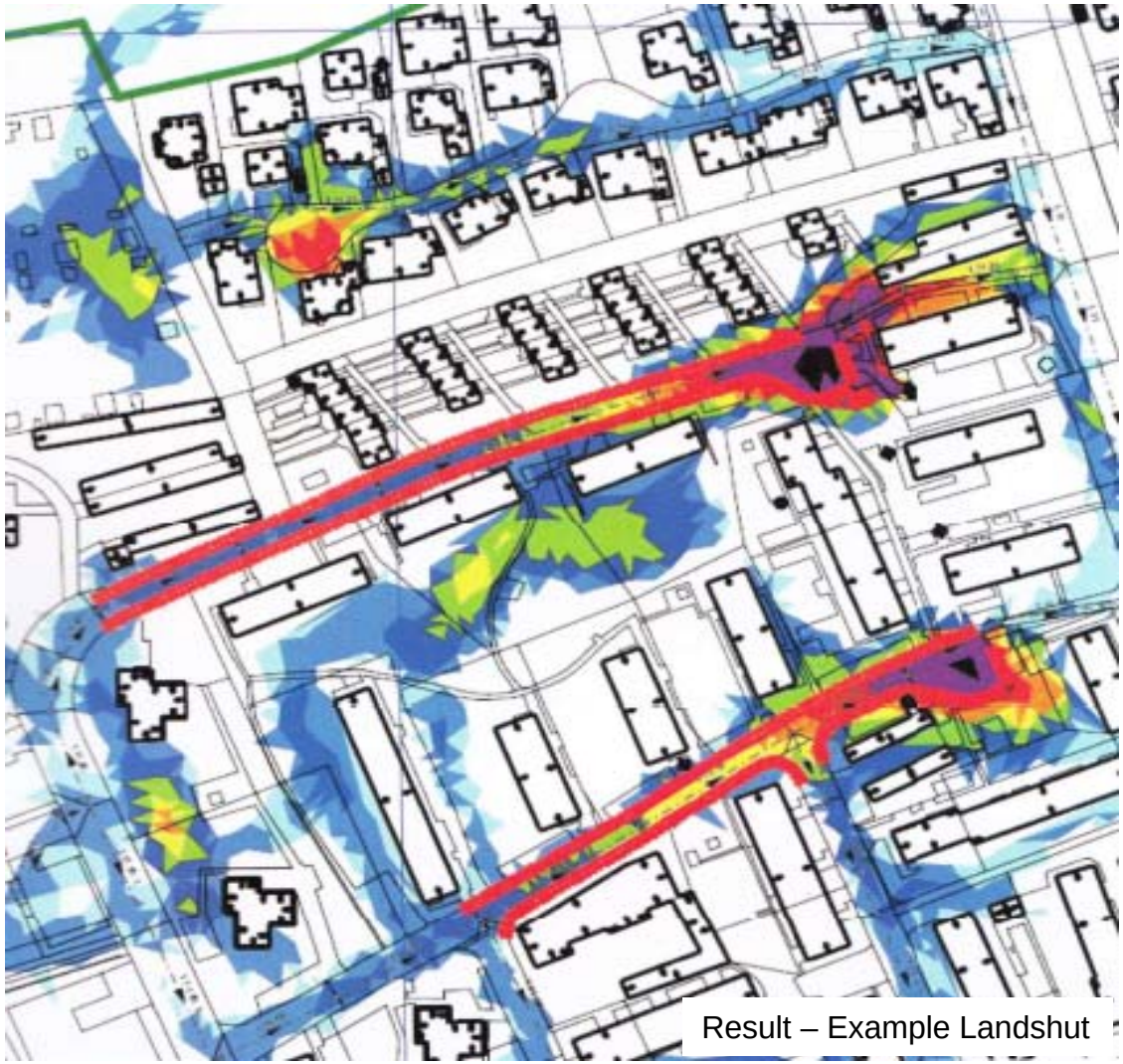
- Floodmapping
- Planning tool for flood protection methods
- Assessment about the effectivity of elements of stormwater-manamgent depending on rainfall intensity and duration
- …

but world wide less experience!

Stormwater modeling – example Brasília

pilot area Brasilia

pilot area – model



Result – Example Landshut

Stormwater modeling – data requirement

Standard stormwater sewer calculation

- pervious and impervious areas (location!)
- land utilization
- soil (infiltration!)
- stormwater drainage system (material, location, age, …)
- rainfall-data

advanced stormwater sewer calculation

- exact and dense data of the surface (LiDAR, …)
- location and height of curbs
- location and kind of inlets
- for flood affected areas aggregation of (surface-)data
- location and dimension of vertical structures (walls, …)
- location and dimension of flood relevant structures (e. g. basement garages)

IMPORTANT: measurements for calibration are always necessary!

Conclusion: future risks and perspectives for Brasília

- Current situation of stormwater management: Collection and discharge into the Lake Paranoá
  - Recommendation for future:
    - Enhance percolation
    - Achieve drainage comfort
    - Protect groundwater and lake (relieve environment)
- Data collection important for future planing (land use, soil, rainfall…)
- Combination of stormwater management and urban development worthwhile

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