# Urban rainwater harvesting from niche to mainstream: challenges and opportunities for planning

Urban rainwater harvesting from niche to mainstream: challenges and opportunities for planning

**Lina Suleiman (lina.suleiman@abe.kth.se)**
**ABE/ KTH**

**UrbanRain: (http://www.urbanrain.se/)**

# Urban Rainwater Harvesting systems (URHs)

## Outline

Background
Main principles OF URHs
Case studies & Methods and research themes
Hammarby Sjöstad
Årstafältet,
Hornsgatan
Consluions
Recommendations

# Urban Rainwater Harvesting systems (URHs)

## Background

Urbanisation

Water quality (runoff and surface water pollution)

Alteration of water cycle

Climate change / heavy rains, floods, droughts, heat Island effect

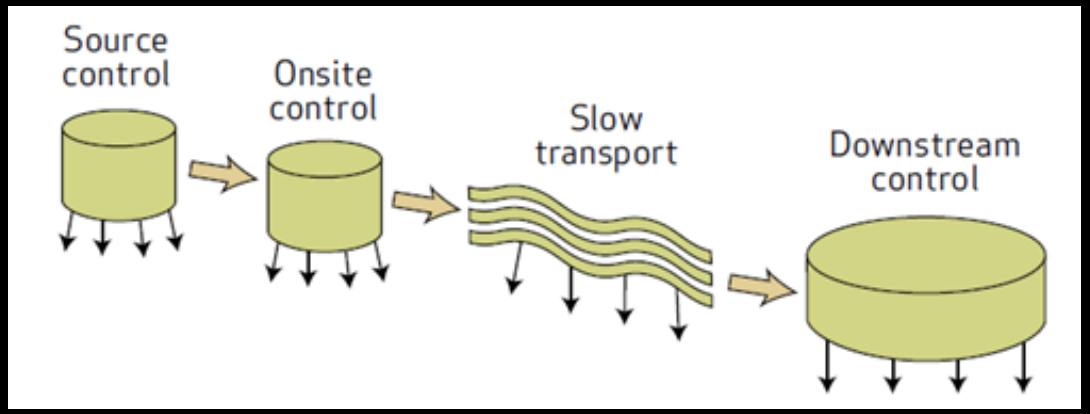
Imbalance of groundwater

Economic costs

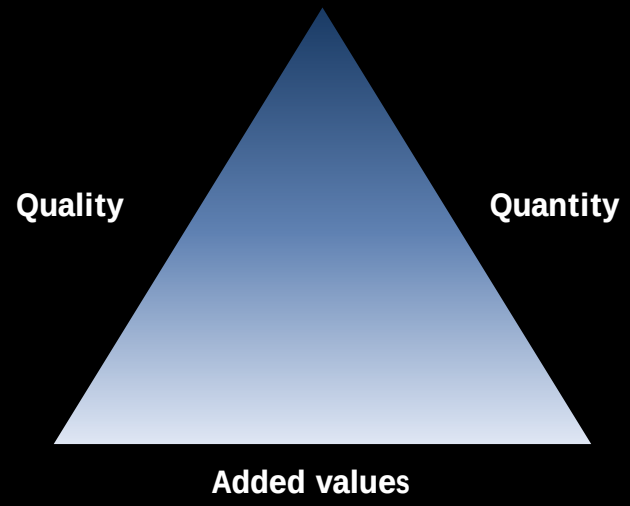
# Urban Rainwater Harvesting systems (URHs)
# Main principles

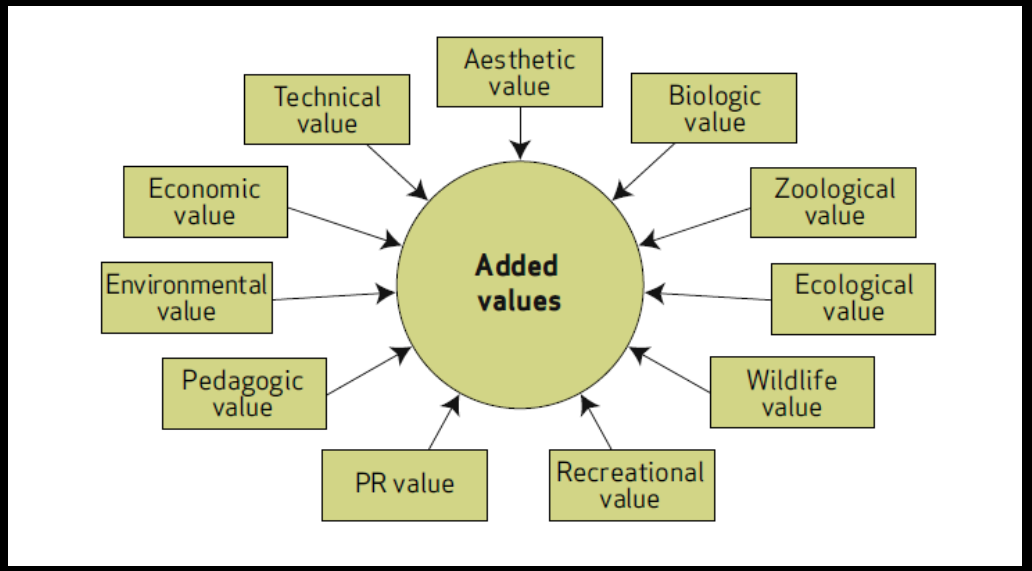
| | |
|---|---|
| **Conventional (Pipe solutions)** | **Alternative solutions SuDS or SUMS, URHs** |
| **Problem** | Potential/ resource |
| **Discipline nature** | Mimic and be harmonic with nature |
| **Engineering/functions** | Sociotechnical/ functions and added values |
| **Centralised & blue print & large scale Water Engineering** | Decentralised & locally appropriate, and small-scale Integrated planning |

# Urban Rainwater Harvesting systems (URHs)
## Main principles




Stahre, P (2008): Blue-Green Fingerprints in the City of Malmö, Sweden, Malmö's way towards a sustainable urban drainage




Stahre, P (2008): Blue-Green Fingerprints in the City of Malmö, Sweden, Malmö's way towards a sustainable urban drainage

# Urban Rainwater Harvesting in Stockholm

## Hammarby Sjöstad , Årstafältet, and Hornsgatan

# Urban Rainwater Harvesting systems (URHs)

## Methods

- Policy and planning documents
- Project reports
- Personal communications:
  - Dialogue using a catalogue of questions
  - Writing
  - Phone calls
- Sites visits

# Urban Rainwater Harvesting systems (URHs)
## Research themes

Context
Driving forces & values (purposes)
Actors
Technology
Processes: Planning, implementation and maintenance
Learning & Impacts

# Hammarby Sjöstad

Urban development of a new district with focus on integrated environmental solutions of different infrasystems

**Driving forces**

- A growing Stockholm
- A world leader in environmental technology
- Export Swedish know-how to mega cities

Environmental values

Strong political & financial

# Hammarby Sjöstad
## Actors

City administrations
SWC (Program level of planning and detailed planning)
Project team
Consultant Firms (developers, designers, construction)

Systems users and citizens  are completely absent

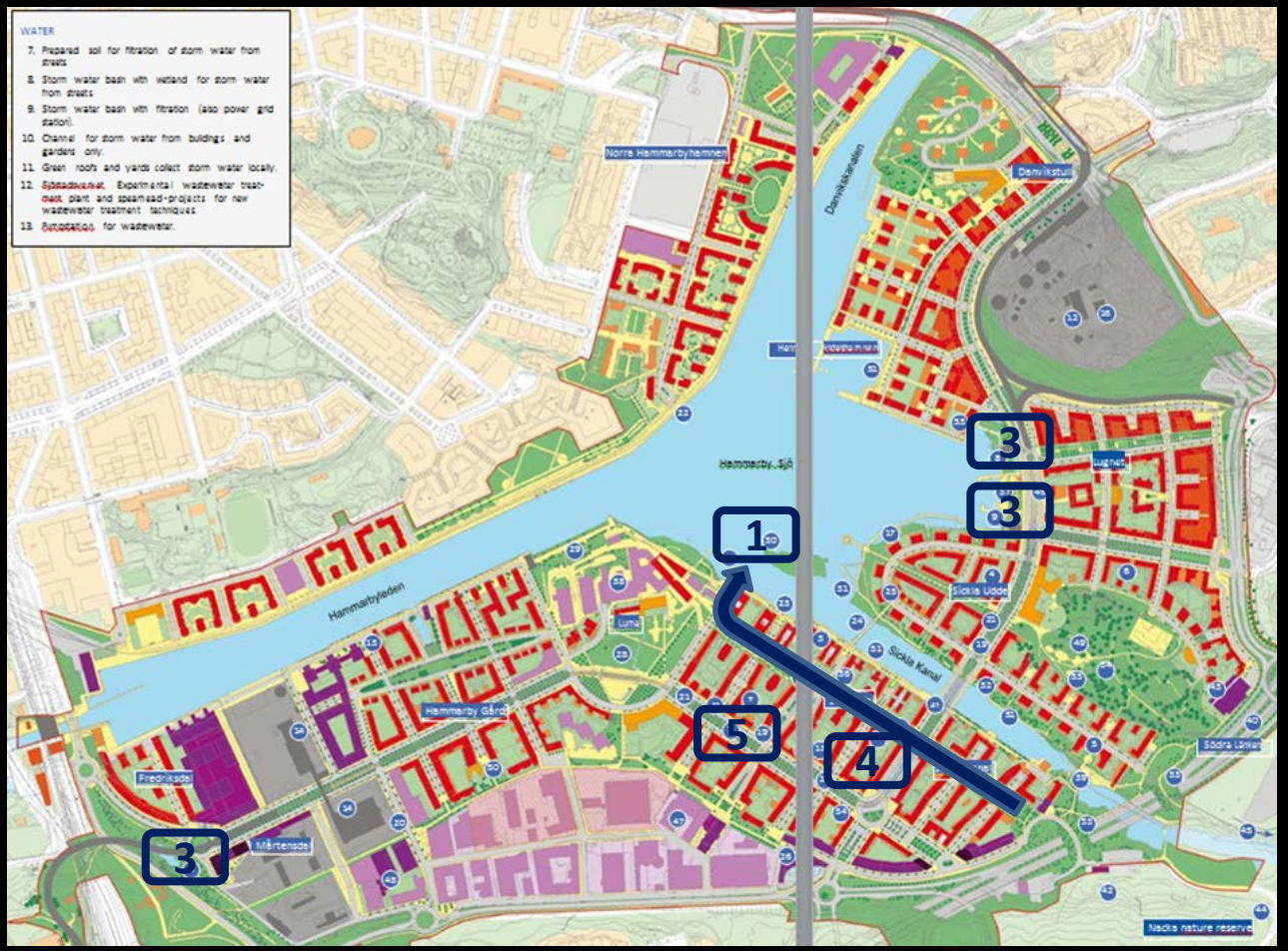
# Hammarby Sjöstad
## Processes

Vison, Program & Project organization
Powerful and strategic leadership
Integrated and holistic planning
Municipal-enterprises collaboration
Not always conflict-free but deliberative and collaborative

# Hammarby Sjöstad
## Technology

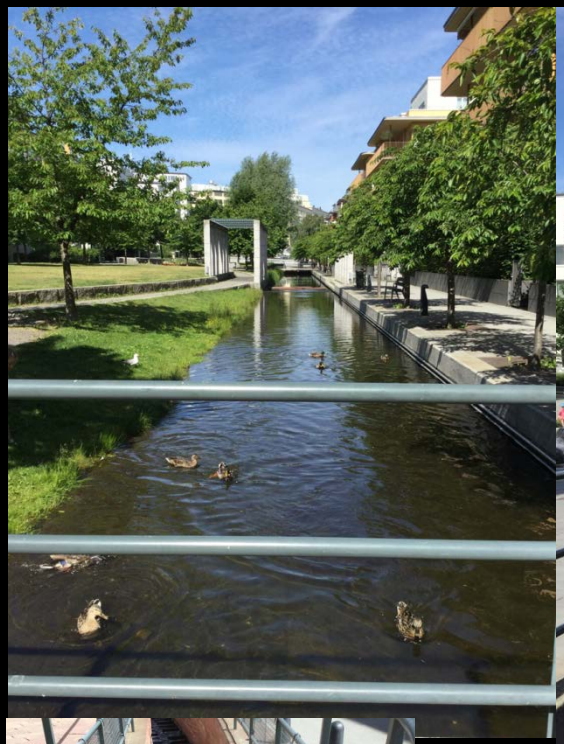
1. Water canal-park ‘Sickla Kaj’
2. ‘Mårtensdal’
3. Wetland & basin in ‘Lugnet’
4. Green roofs
5. Soil for water infiltration

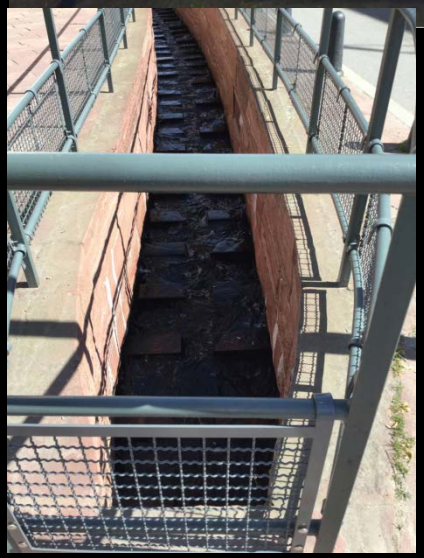
Innovative systems & the city should be proud of



# Hammarby Sjöstad

## Water canal-park ‘Sickla Kaj’





UrbanRain

# Hammarby Sjöstad

## Lugnet Terrass


# Hammarby Sjöstad
## Mårtensdal

# Hammarby Sjöstad

## Technology

Contractors resistance for open water solutions “risky”
SWC: operational role
Technical solutions were not based on collective agreement
Water canal & Technical faults ‘Water canal phobia’
Alteration of development plans has made RWHs un-functional (Lugnt)

# Hammarby Sjöstad
## Learning & impacts

No appropriate maintenance & fussy and grey zones of responsibilities

Traditional maintenance vs. new systems

Outsourcing

Lack of monitoring programs

No systematic learning: same problems, discussions and difficulties

# Hammarby Sjöstad
## Learning & impacts

- A higher level of planning (a new planning culture)
- Cross-sector collaboration and integrated planning
- Attractive urban environment & a sense of pride
- A test bed to try different solutions for education in practice
- It was not too difficult to plan and implement
- Inspiring for replication in similar projects
- Transferability to other contexts: China, India, Canada, Moscow and Macedonia

- Lack of public education
- Social learning is not institutionalised into guiding planning principles

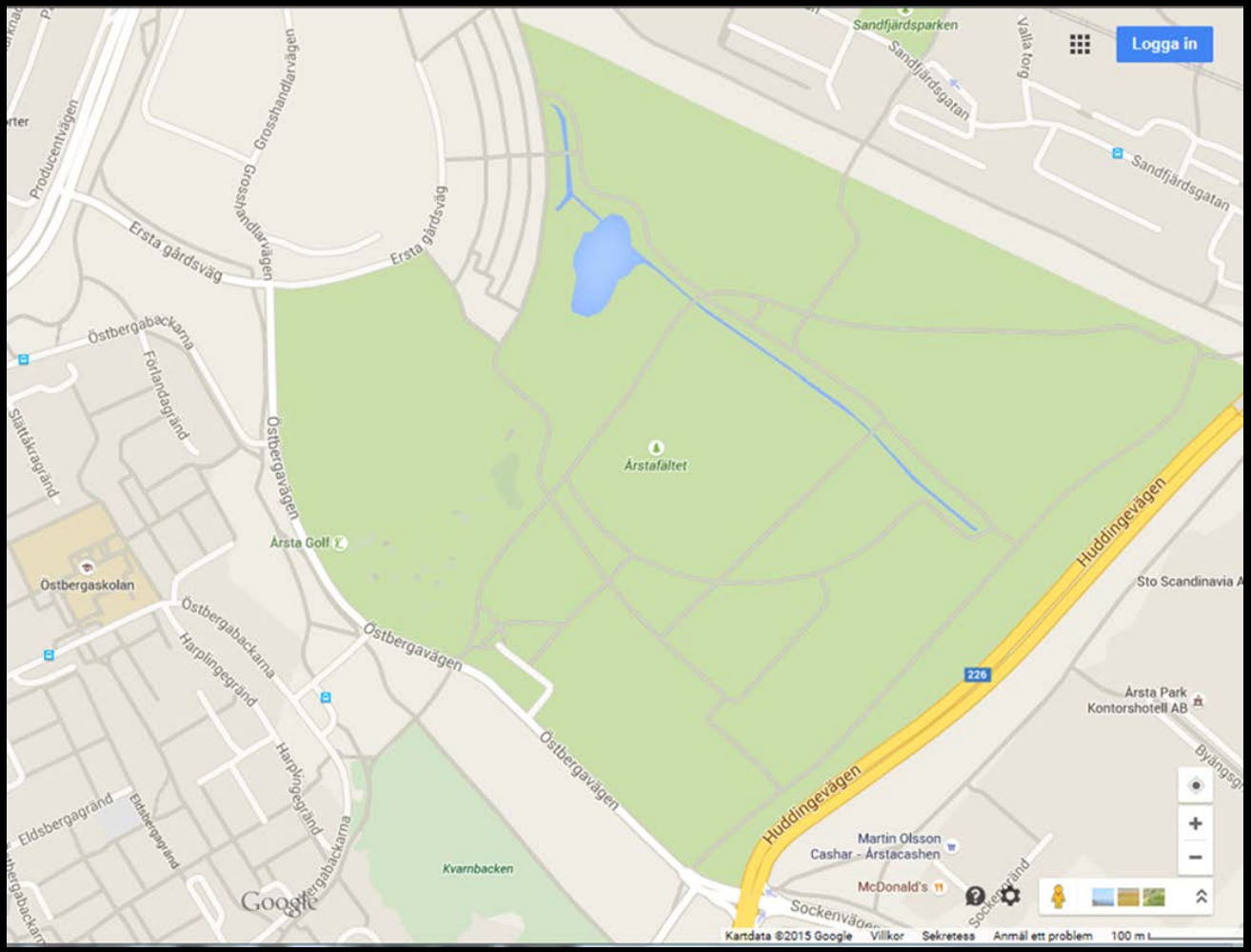
# Årstafälttet

From landscape park  to a new urban development with very high ambition (scale and quality requirements) of URHs

Driving forces (existing URHs)

- Environmental
  - Reduce the water load & the risk of overflows
  - Clean the water
  - Restoration of dry stream
- Biodiversity
- Cultural values
- Pedagogic

# Årstafälttet
# Technology




Source:

UrbanRain

**Urban rainwater harvesting from niche to mainstream: challenges and opportunities for planning**

# Årstafälttet
# Technology

Water Ponds & Park
Street planation
Raingardens
Housing blocks should treat 25% of the rainwater locally

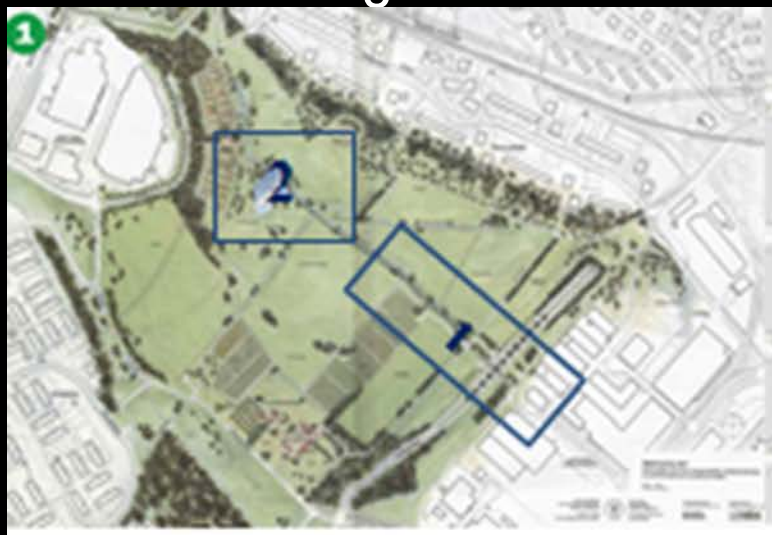



Figure 1


Figure 2

Figure 1: URHs in the LP Source: DP 93045
Figure 2: URHs in the plan of new Årstafältet

# Årstafälttet

## Driving forces

- Housing demand
- Stockholm will be a world leader in environmental and energy technology
- Legislations of  stormwater strategy

## Environmental

- Avoid the risk of erosion and land-sliding
- Cope with the climate change pressures
- Reduce pollution and improve water quality
- Irrigation of vegetation
- Create cooling effect in summer

## Sociotope and biotope values

- Attractive urban environments and public places for meetings
- Biodiversity

# Årstafälttet
## Technology

Source: Detaljplan för Årstafältet park, Årsta 1:1 mm i stadsdelarna Östberga och Enskedefältet, SDp 2011-03366

# Årstafälttet
## Actors

The city administrations (land development planners, city planners, and traffic planers),
Consultancy firms (White Architecture, Atkins, SWECO, and WSP), and
Infrastructure companies including SWC
Swedish University of Agricultural Sciences
Plantation firms

# Årstafälttet
## Processes

Inside:

Two separated meetings:
Group 1: pipelines infrastructure companies including SWC to coordinate the pipes beneath the grounds.
Group 2: city administrations (landscape and urban planners) with private consultants
Consultants and Project groups managers as mediators

Outside:
Nätverket Årstafältet (NÅ, Network Årsta Field)

# Årstafälttet
## Processes

Not the planning culture but the planning re-arrangement

"If SWC are not involved early in the planning process then how SWC should fulfil their obligations?"

A growing positional tension between city administrations and SWC

Architects want "blank canvas" vs.

"They (SWC) do not bring in other values"

# Årstafälttet
## Processes

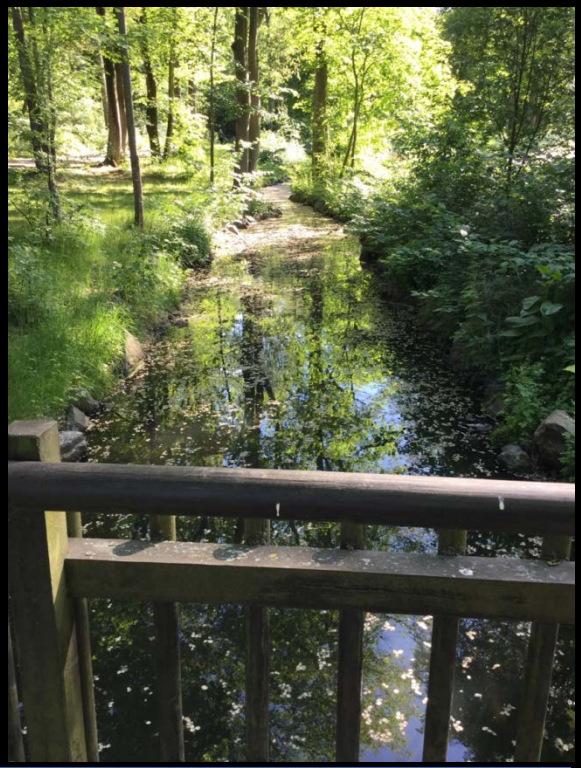
Maintenance organization: Who should do what?

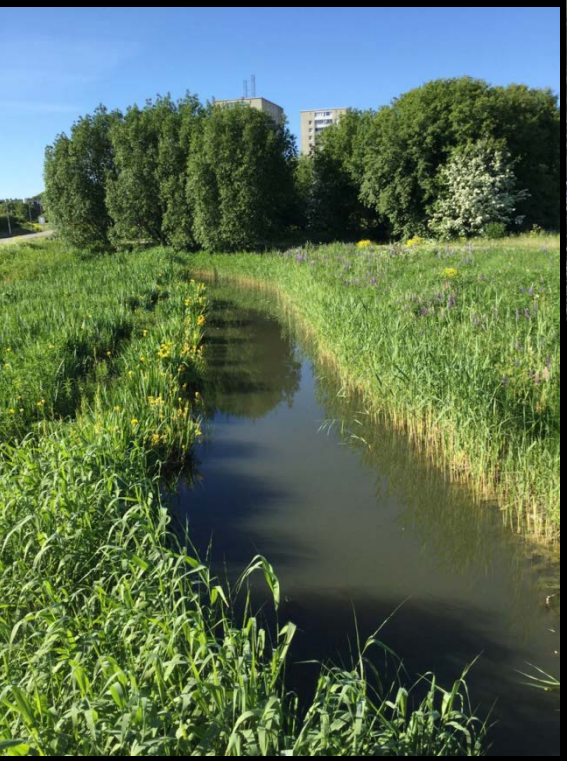
High uncertainty

- Size/water quantity
- Geo-hydraulic
- Plantation and efficiency
- Safety
- Maintenance expertise

Need for more experts

# Årstafälttet





Source: own photos

# Environmental Restoration of Hornsgatan

## Driving forces

A political decision
Reduce air pollution  according to EU directive
Improving environmental quality
Reduce the risk of flooding, the load on storm water systems & water pollution

# Environmental Restoration of Hornsgatan

## Actors

The City Council

City administrations

- The Traffic Administration (Trafikkontoret)
- The Environmtal Office “Miljöförvaltningen”
- Infrastructure companies (Stockholm Water Company )

Contactors

& Now: SLU-the University of Agriculture

# Environmental Restoration of Hornsgatan
## Processes

- An individual tested idea
- Resistance from civil engineers
- Developed by listing to people, picking up ideas, collecting pieces of information from different parts of the world

# Environmental Restoration of Hornsgatan Technology

## Tree plantation beds using structural soil

- Stabilise the soil
- create good growing conditions for trees with the use of stormwater

# Environmental Restoration of Hornsgatan
## Processes

## Implementation Challenges

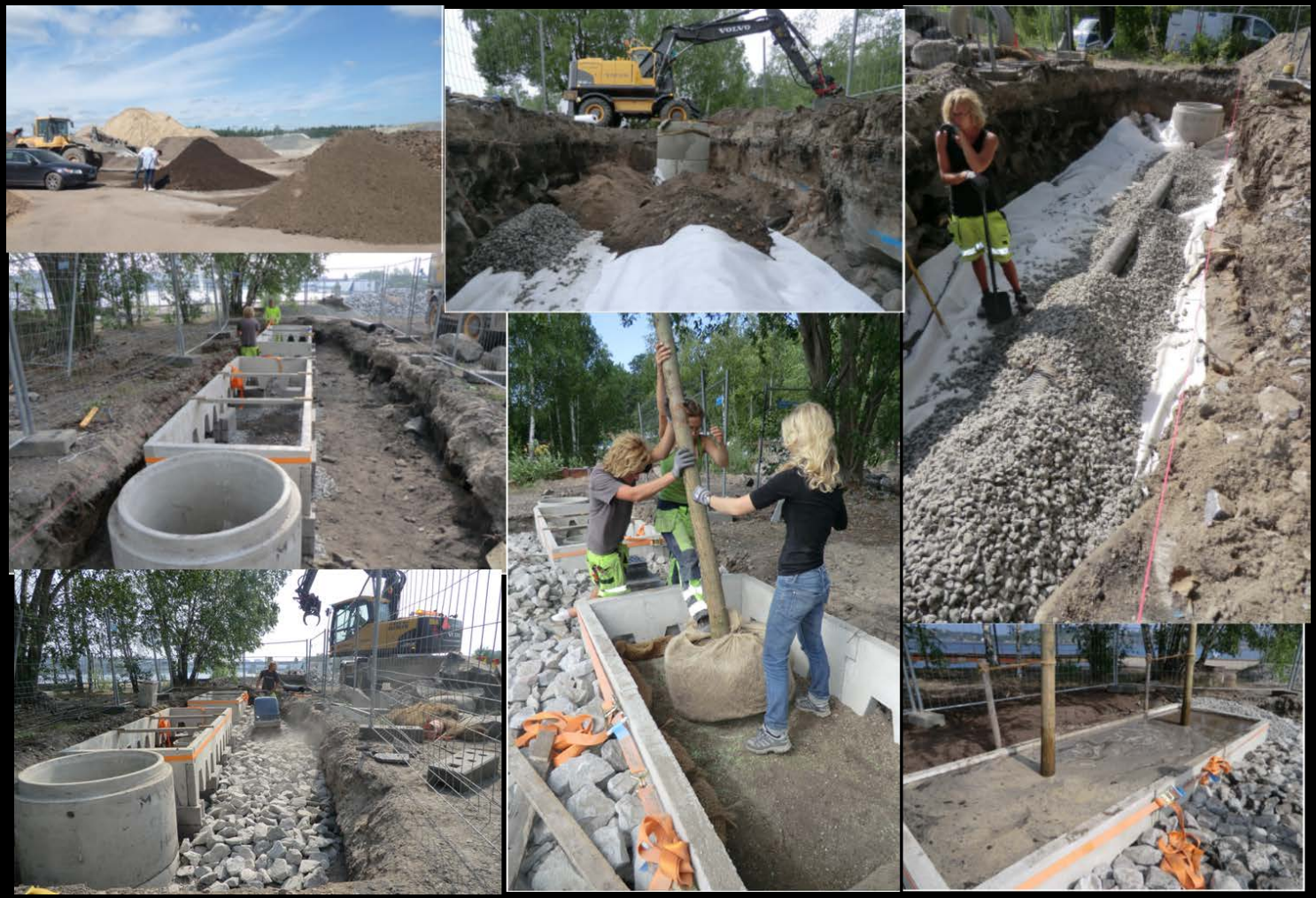
- Contractors could not understand the drawings
- Narrow sidewalks of the street
  - Strong Politicians: "You should do it"
- Diversion of pipelines (extra cost)
- Fears of water and trees root system underground
- Learning by doing
- Mainstreaming: Replication in new and old built environment

# Environmental Restoration of Hornsgatan
## Impacts

"Even in a very tight section of a city; one can propose  solutions and make it happen"

Source: Alvem, B-M.& Embrén B. (2014)

# Technology (URHs)



# Urban Rainwater Harvesting systems (URHs)

Climate change & consequences

# Urban Rainwater Harvesting systems (URHs)

## Conclusions

Lack of operational understanding of URH facilities as one system (technical functions – added values)

New systems VS. traditional maintenance practices

- Water quality and quantity-SWC
- Surface water- traffic office
- Parks- local administration

3 water cycle or one ?

Optimization- trade off and synergies

- Systems users
- Integrated planning in early stage (landscape planning & water open systems planning)
- New expertise
- outsourcing

# Urban Rainwater Harvesting systems (URHs)
## Conclusions

"The city has a higher driving force to have the open stormwater systems than Stockholm Water", (Interview)

Organization , Uncertainty, Liability & Financing ?

"The city has to break down the policy into numbers that can be given to engineers and should put demands on the houses" (Interview)

"We have the pressure to be in the front but it is hard to be on the front when it takes too long time. And to be the front now it is not to be in the front in 5 years. We have to try to be before the front" (Interview) .

- The law and legislations are not up to date
- Database of URHs (multi- public and private actors, multi-urban sector)

# Urban Rainwater Harvesting systems (URHs)
## Recommendations

- Renegotiating positional power and reordering relations of planning systems to include SWC
- Need for new expertise- physical features of the space & purposes
- Who plan and design the system should be also responsible for operation, maintenance, and evaluation
- A ‘ how to optimise a system’ -based capacity building programs for practitioners
- Educational and training materials to educate the next generation of future actors
- A public training program to educate citizens
- Researchers-practitioners collaboration

# Urban Rainwater Harvesting systems (URHs)

"It is strange that it's so hard to understand….it feels like it could be quite easy to redevelop how it was before the city came in place and you can almost use the same things. …my dream is to make underground streams and rivers" (Interview )