FLOOD RISK PROBLEMS AND GOVERNANCE IN STOCKHOLM
AS SEEN FROM A WATER AND WASTEWATER COMPANY

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I’VE DONE SOME RESEARCH


Floods 1985–2009
OUTLINE

• Stockholm – Geography
• Record of flooding problems
• Expected climate change effects
• Attempt to describe the swedish governance down to the municipal level
• Measures taken to meet flooding risk
STOCKHOLM

Demography
Sweden
9.8 Million
22p/km²

Netherlands
16.8 Million
404p/km²

Sthlm County
2.2 Million
341p/km²
STOCKHOLM "BETWEEN THE LAKE MÄLAREN AND THE SEA"
CLIMATE STOCKHOLM

- Average monthly temperature 7.6 degrees ranging from -11 to 21.5 degrees last 30 years.

- Normal precipitation 560 mm/year (372-778, 2013, 2012) Some of the rain falls as snow. Some years the snowmelt can cause high flows in streams and sewer network

- A Ten Year Storm: 14 mm/10 min, 26 mm/60 min, 60 mm/24 hrs
- A Hundred Year Storm: 32 mm/10 min, 60 mm/60 min, 143 mm/24 hrs

Sewer systems
CLIMATE CHANGE

- Climate Change prognosis:
  - Warmer
  - Higher frequency of heavy rains
  - More rains in winter, dryer summer than today.
  - Raised sea levels
  - ...
THE POSTGLACIAL REBOUND "BLESSING"

10,000 years ago
1 km of ice covering Sweden

Global sea level rise
Net change
Postglacial rebound

Sea Level rising 3.2 mm/year 1993-2010

- Malmö: -1 mm/year
- Gothenburg: 2 mm/year
- Stockholm: 4 mm/year "Sea is still sinking"
SMALL DIFFERENCE IN WATER LEVEL

Water Source for over 2 million people round lake Mälaren (1.5 in the Stockholm Area)!

Brackish water  Sweet water

Baltic Sea water level  Lake Mälaren water level

0.17 m  0.86 m
THE CHALLENGES FROM A SEWER POINT OF VIEW

- Aging sewer network. Built in over a 100 years.
- High exploitation rate
- Low renovation rate
- City becoming more dense (more water from households, more rainwater to sewers, less detention at large rain events). Often "the straw that broke the donkeys back" - problem
- Exploitation in less suitable areas regarding to flooding
- Future higher frequency of heavy rains.

More water to an already existing sewer network

The Stockholm Water Company has to "solve it" when the planning is already done – (Getting better though)
DIFFERENT TYPES OF FLOODINGS

• Fluvial
  • *Flows causing damage as the capacity of the stream is not sufficient*
  • Floodings from high sea and lake levels.
• Pluvial (heavy – mostly short term - rain events)
  • *Surface flooding*
  • *Basement flooding from sewer network*
FLOODINGS IN THE STOCKHOLM REGION THE PAST 100 YEARS - SHORT VERSION

• Overall: relatively few problems.

• Intense rains causing the sewer network to be overloaded and cause basement floodings, surface floodings and large overflows are the main causes.

• High lake water levels of Lake Mälaren can cause flooding but mostly affecting farmland outside of Stockholm. Close to flooding of the metro in 1999 due to unsufficient flow capacity in the sluices of Stockholm.

• So far almost no problems with high sea levels. Partly because of a still ongoing land rise/rebound after the last ice age but also due to small risk of wind induced rising of the sea level since Stockholm is situated on the "lee side" of Sweden. In year 2050 sea rise due to climate change is expected to be faster than the land rise.

• Some problems with overflowing streams like in 2015 an industrial area and surrounding houses were flooded after a 80 year rain event during 12 hours.

Some economical damage but no casualties.
FLOODING DUE TO HIGH HEAVY RAINS

1980 Basement floodings
URBAN WATER – NOT A MERE PIPE QUESTION!
NEW RECOMMENDATIONS SEWER SYSTEM DESIGN FROM THE SWEDISH WATER AND WASTWATER ASSOCIATION 2016

Dimension criteria 10 y rain
DECENTRALIZED GOVERNING

Government

21 Counties

290 Municipalities
RESPONSIBILITIES

- **Parliament** - Legislative

- **Counties** - Supervise the implementation of laws. Floods Directive

- **MSB** – Swedish Civil Contingencies Agency - The MSB is responsible for issues concerning civil protection, public safety, emergency management and civil defence as long as no other authority has responsibility. No measures for storms since they’re unpredictable and too short-term.

- **Swedish Water and Wastewater association** - Setting up guidelines concerning water and wastewater. Although not a formal authority setting national design standards

- **Municipalities**
  
  - Local self governing implementing laws and guidelines from counties, government, eu..
  
  - **Stockholm Planning Office** – to conduct safe building planning (only 10 y liability)
  
  - **Stockholm Traffic department** – to drain streets of water. Possible connection to Stockholm Water pipes and trenches
  
  - **Stockholm Water Company** – to provide safe routing of water connected. 10 year perspective
WATER KNOWS NO BOUNDARIES

- Falling through the cracks
- Lack of legislative support for implementation of Sustainable Stormwater Management
- Government starting a review of laws on the sustainable stormwater management area
INSURANCE COST FOR NATURE CATASTROPHIES

• Rising
  • Traditionally Wind damage during storm and fire the major nature related damage
  • In 2014 floodings rising to 25% of water related damage (usually round 6%)
  • Usually round 15 to 30 million € but in 2014 100 million €
• Raised awareness and concern among the insurance companies
• Agreement on refunding of costs by the wastewater companies if water damage from the municipal sewersystem or if the stormwater carrying sewer system is underdimensioned (10 years of return time)
• Not longer ”Sudden and unpredicted”?
MAPPING OF FLOODING RISK DUE TO LAKE WATER LEVELS AND HEAVY RAINTS
COUNTY ADMINISTRATIVE BOARD
IN PRACTICE – WHAT ARE WE DOING?

• Technical

• Changing regulation of Lake Mälaren in order to reduce flood risk

• Rebuilding the Sluice gates to allow a bigger outflow (to 2023 approx)

• Applying a Climate factor in pipe design 1,2 – 1,25

• The water and wastewater company shall strive for reducing of excess water entering the system.

• Lowest allowed building level on lakeside and on seaside

  • County Administrative Board 200 yrs, Sthlm Municipality 100 yrs

• Building a wall in the Archipelago in the future?
• Governance

• *Stockholm City Comprehensive plan 2010*
  
  • Large population increase expected from 750,000 to 1,000,000 in 20 years.
  
  • Sustainable Stormwater Management mentioned. The principles of the City’s Stormwater Strategy should be implied.
  
  • Climate change vulnerability mentioned as risk of saltwater intrusion into lake Mälaren when sea levels rise.

• Challenges for the technical infrastructure mentioned

• Overall very little concerning climate change.

• Stockholm Stormwater Strategy

• *The citybodies shall collaborate to work according to principals of sustainable stormwater management*
IN PRACTICE CONTINUED

• City budget and Owners directive for the Stockholm Water Company   2016

• ”The demands for exploitable land in combination with ongoing climate change puts high demands for city planning and the strategical work with green areas, waters and cityscapes for recreation and biological diversity”

• The Company shall work preventive to stop floodings of buildings due to heavy rainfalls. Bigger overflows of the sewer system shall be fixed. The company will assist the municipal executive board with handling and taking measures to meet a changed climate. Specifically:

  • Conduct a mapping of vulnerable areas prone to flooding during heavy rains

  • In cooperation with other municipal bodies start a pilot project for sustainable stormwater practices
REFLECTION - DIFFERENT SCALE OF PROBLEMS

France 2015
"at least 20 casualties"

Sweden 2015
Some housing areas and schools flooded from a 100 year event. "Peaceful"

Swedes likes precautions!