



City of
Gothenburg

Gothenburg

Orientation Sweden and the City



Sweden

- Fifth largest country in Europe. The size of California and Oregon together
- 9 700 000 inhabitants, sparsely populated, 22 people/sq.km
- 85 % in the southern half
- 21 counties and 290 municipalities



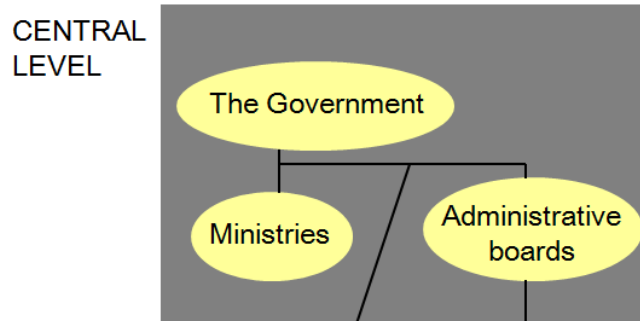
Constitutional monarchy



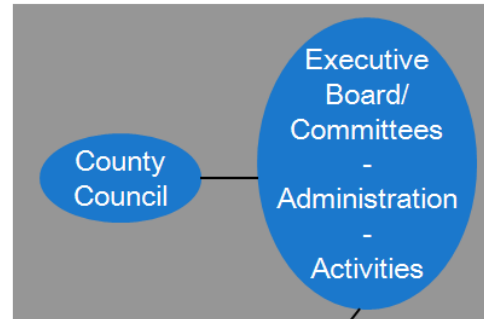
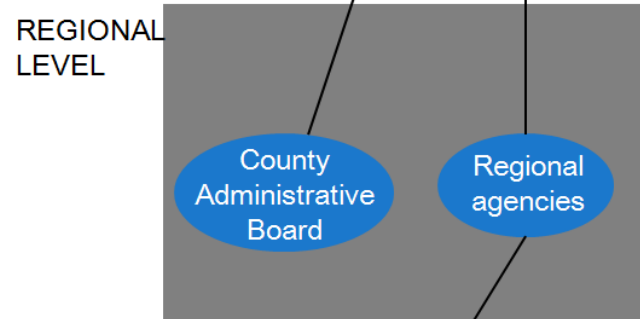
- King Carl XVI Gustaf
- King since 1973
- No political power
- Representative /ceremonial

Levels in the administration

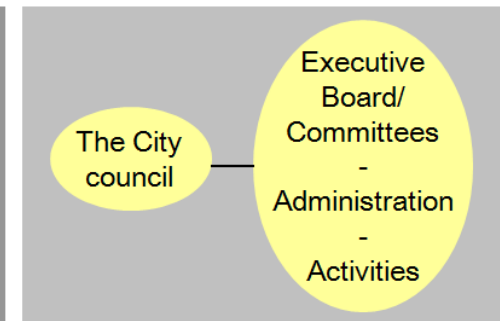
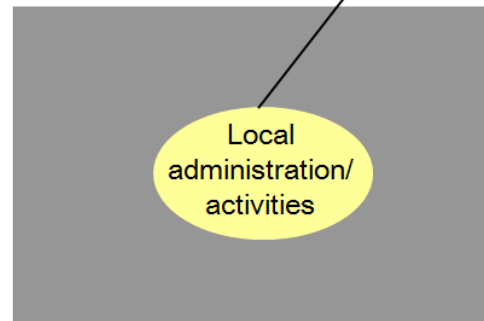
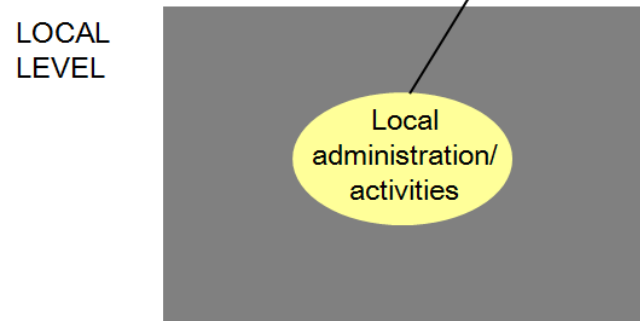
The State (the Riksdag)



The County



The Municipality



City of Gothenburg – in brief

10 city district committees

Appx 20 specialist administrations

Appx 60 public companies

Appx **49 000** employees

of which **30 000** in the city district committees

City of Gothenburg – in brief



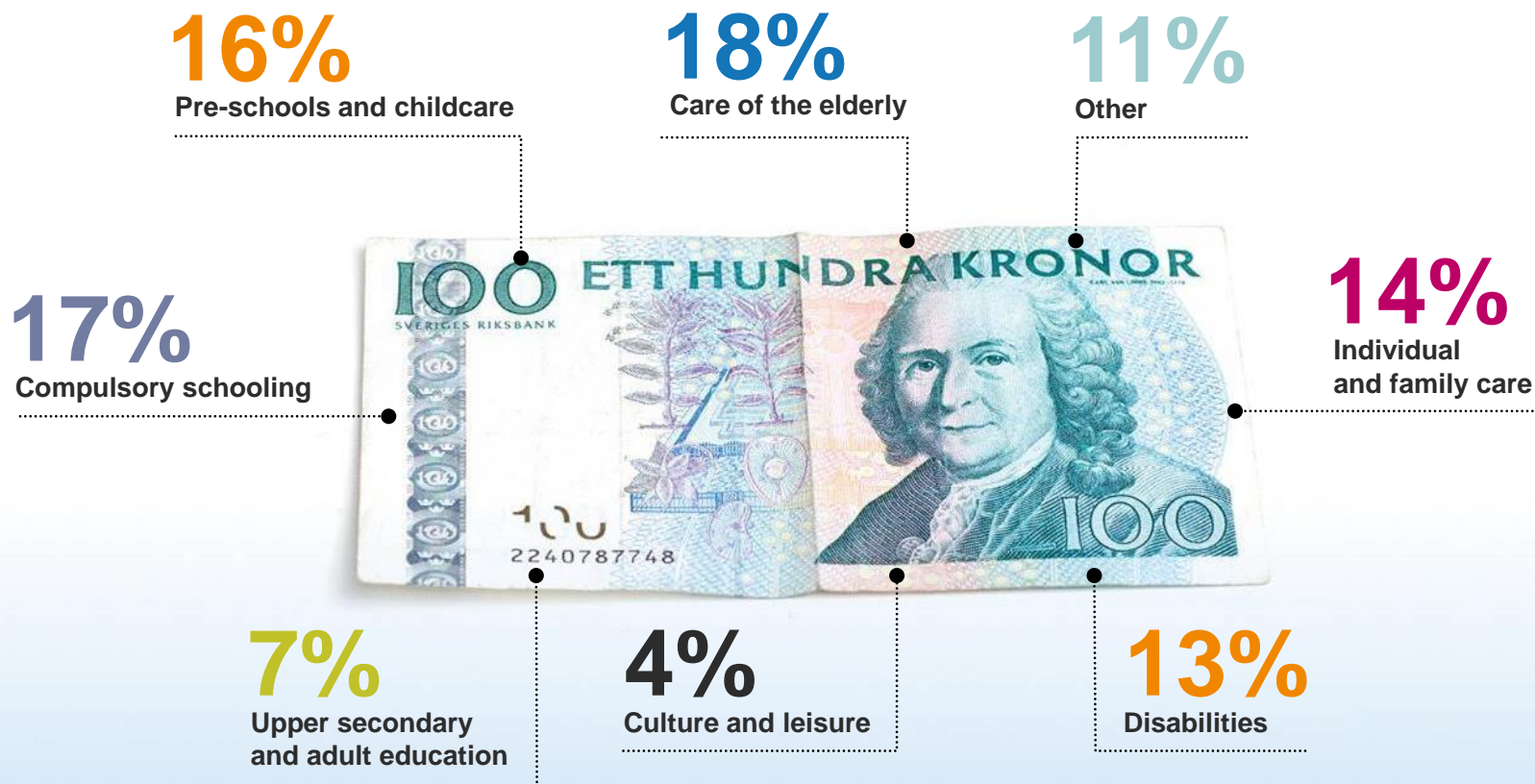
34 billion

SEK turnover

1 175 politicians

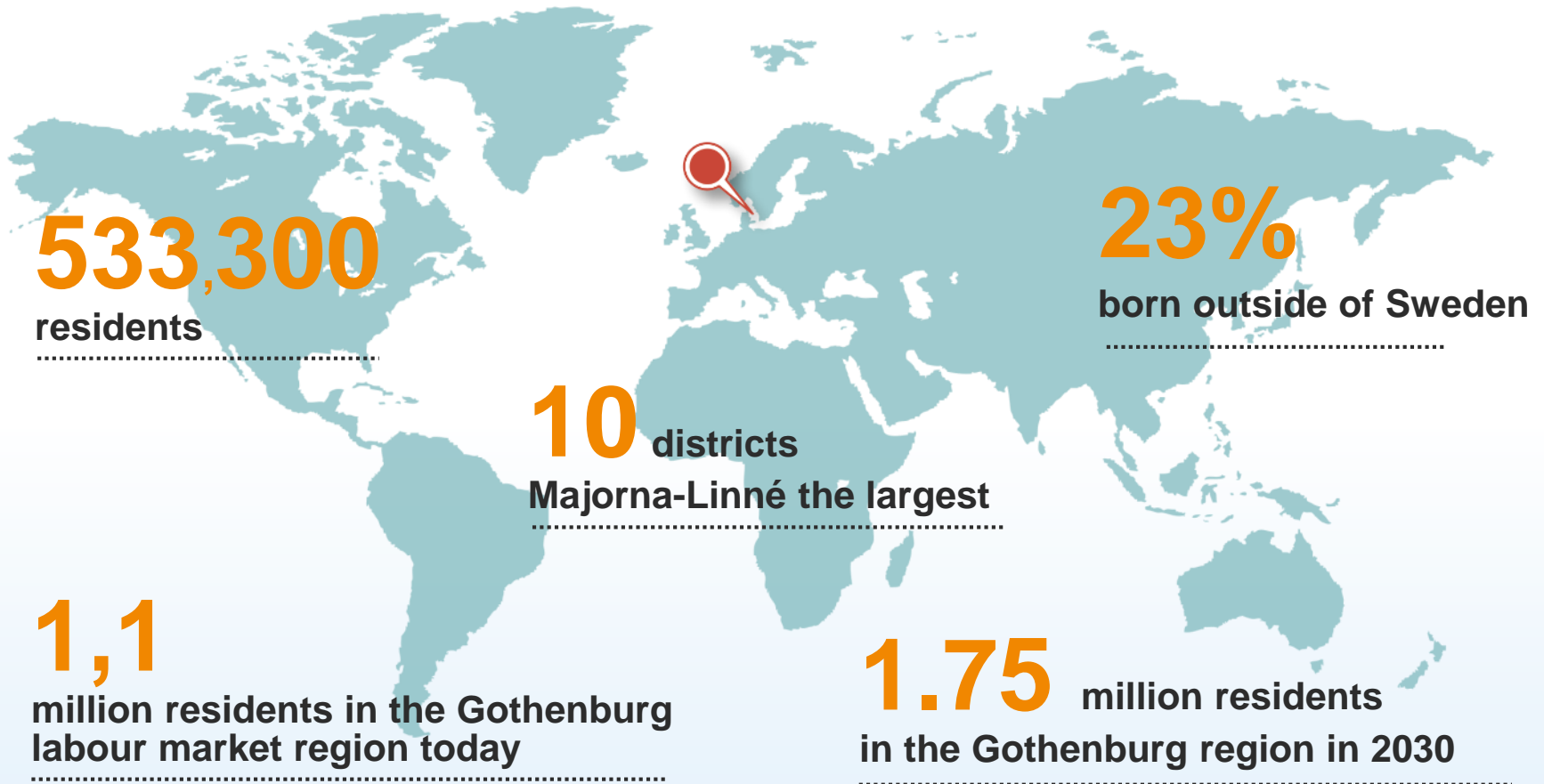
appx 1,300 – 1,400 assignments

Where does the money go?



Health, schools and social care account for 85% of the City of Gothenburg's costs.

Gothenburg – an evolving city of the future



A city open to the world



18th century

Built by Dutch and Germans Developed into a shipping and trading city, partly thanks to the Swedish East India Company

.....

19th century

The industrial city evolves thanks to expertise from England and Scotland

.....

20th century

The economy grows with workers from countries like Italy, Greece, the former Yugoslavia and Finland

.....

A city open to the world



21st century

migration from around the world and
diversity among residents of
Gothenburg

7,200 new residents in 2013

Great strengths and opportunities

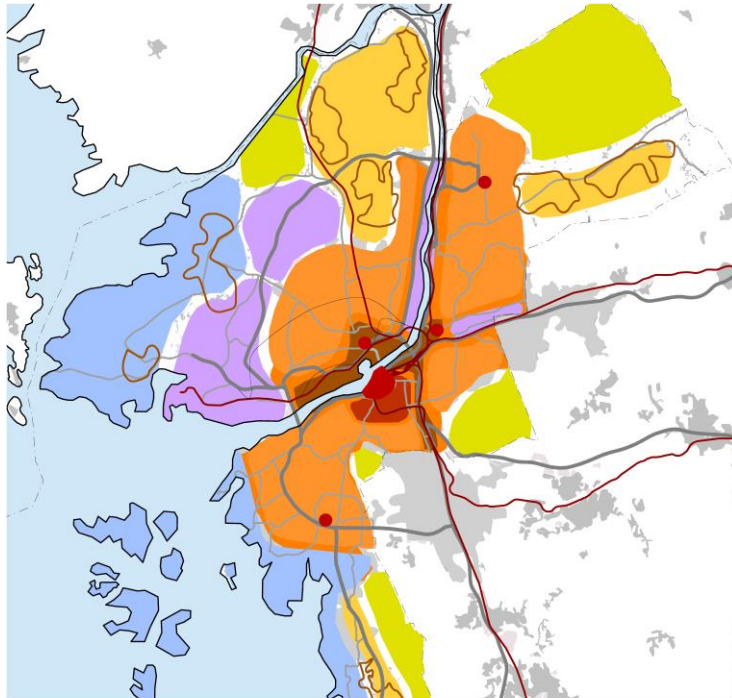


Gothenburg is growing – but the aim is to shorten distances



- New roads, bridges, cycle paths and expanded public transport will make it easier to get around in the city, both for private individuals and the business sector.
- Better public transport and new hubs will make it easy for local people to travel in a sustainable way – within the city, in the wider region and to the world beyond.
- We will continue to grow – but not at the expense of the environment.

A close city – Gothenburg 2035



- Centrala Göteborg - Innerstaden
- Centrala Göteborg - Förynelseområden
- Mellanstaden
- Ytterstaden - Framtida utvecklingsområden
- Kustnära områden och skärgården
- Storindustri, hamn och logistik
- Naturområden
- Utredningsområde för framtida bebyggelseområden

680,000

residents of Gothenburg in 2035

70–80,000

new homes, including 50,000
in the existing city, of which
25,000 in River city

80,000

more jobs of which 50,000 in River city

Source: Expansion planning 2013

River city – inclusive green dynamic



City of
Gothenburg



A SUSTAINABLE CITY – OPEN TO THE WORLD

ElectriCity – a collaboration for sustainable public transport



- New bus route from 2015; noiseless, emission-free electric buses from Volvo will run between Johanneberg Science Park and Lindholmen Science Park.

- The buses can drive in places in the city that are not currently accessible – the bus route therefore also opens up new opportunities for how cities and densely-populated areas are planned.

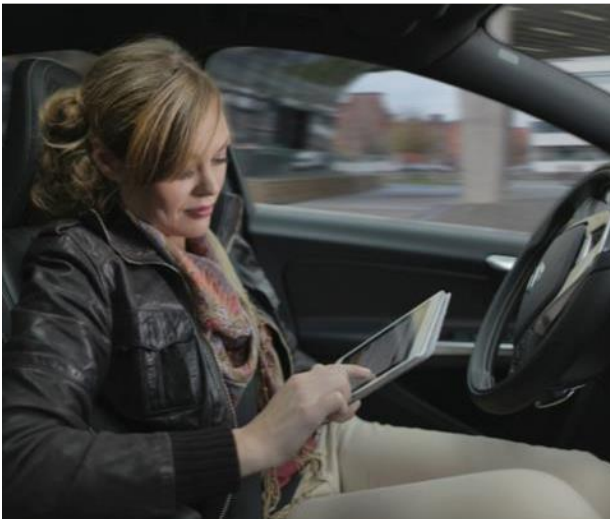
- It is also a way for the Volvo Group to test new technology. For the City of Gothenburg it is about contributing to sustainability, and developing services that can benefit residents.

DriveMe – self-driving cars for sustainable mobility



Gothenburg is also an arena for the world's biggest large-scale pilot project in autonomous driving. It involves 100 self-driving Volvo cars which will be driven on public roads in Gothenburg in 2017.

In addition to improving traffic safety, self-driving cars are considered an eco-friendly choice.



Drive Me

SELF-DRIVING CARS FOR
SUSTAINABLE MOBILITY

2021 – more than an anniversary

In 2021 Gothenburg will be 400 years old, and we are celebrating by making our city into an even better place, together. All the way up to the anniversary. And far beyond.



Close to the water



Building bridges



Open spaces

A sustainable city – open to the world



A SUSTAINABLE CITY – OPEN TO THE WORLD



City of
Gothenburg

The city is expanding over low land

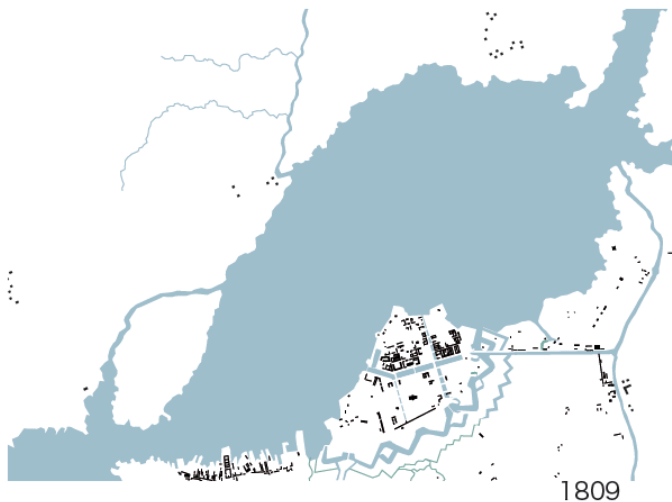
Future extreme weather means consequences

Hydromodel

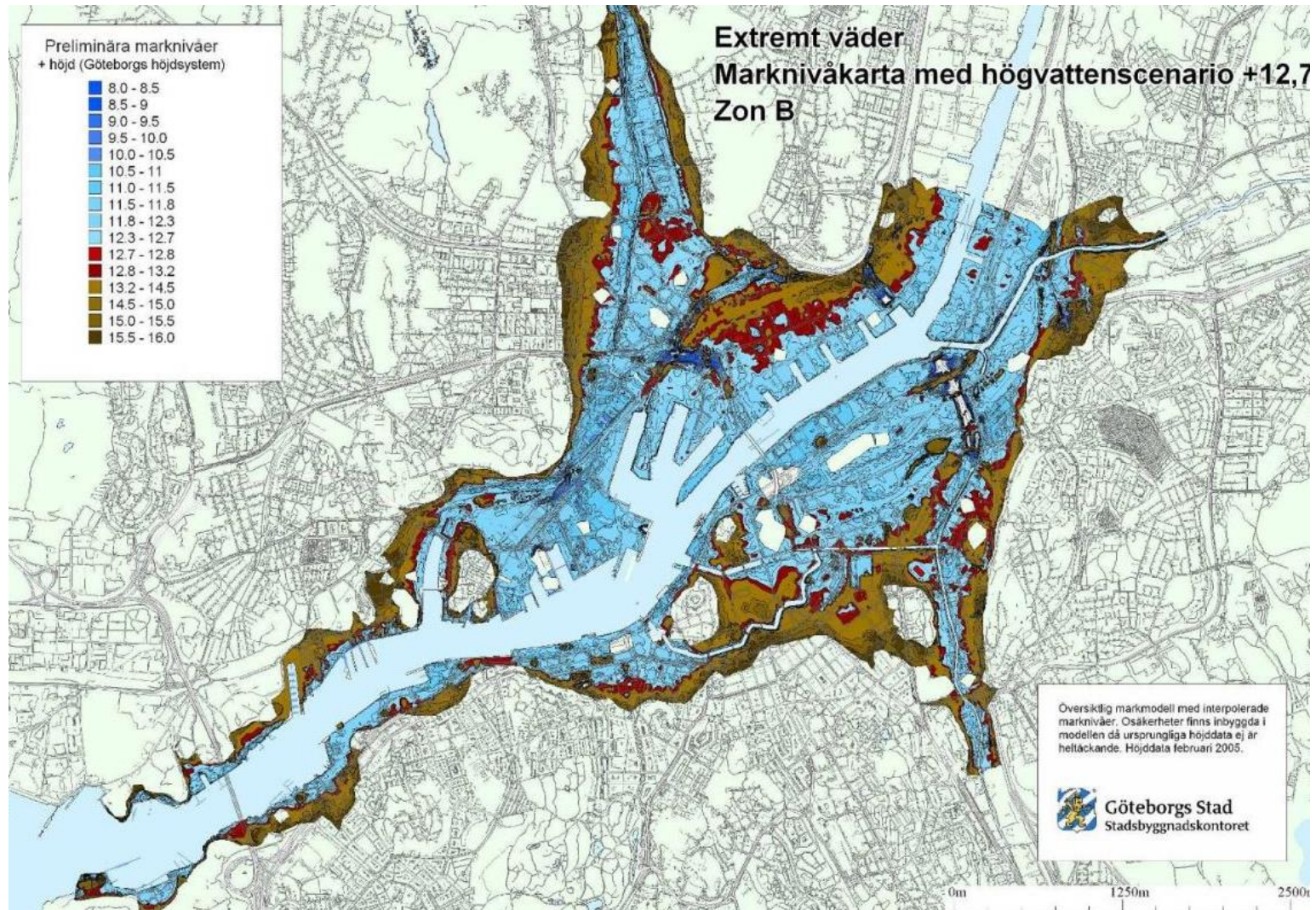
Strategy and protection

Lack of national level

The City has expanded over wetlands



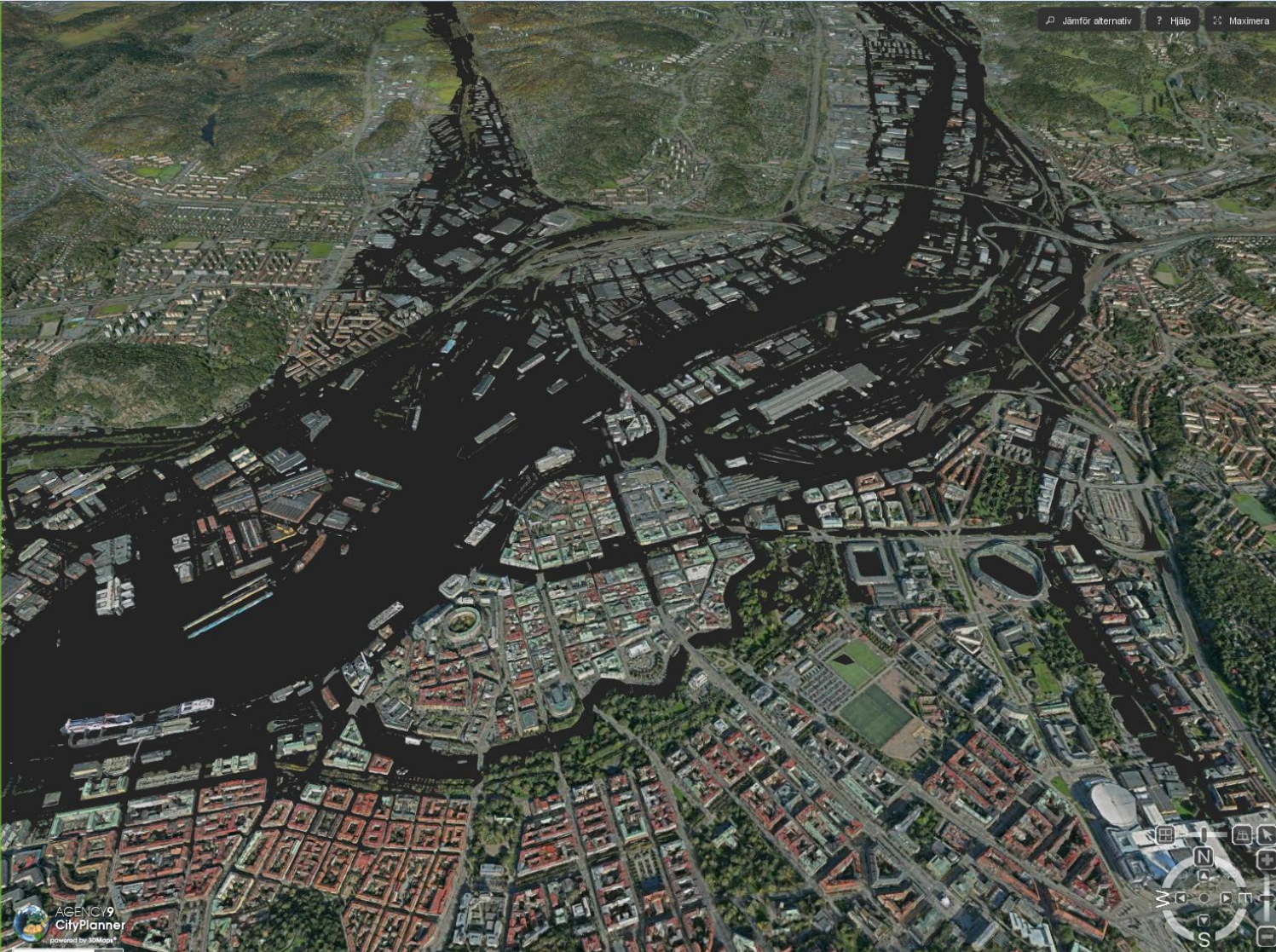
A future extreme weather event



From www.goteborg.se



City of
Gothenburg



Jämför alternativ ? Hjälp Maximera

Stigande vattennivåer

Textstorlek ● ● ●



GÖTEBORGS STIGANDE
VATTENNIVÅER

Under vecka 39 pågår FN:s klimatkonferens i Stockholm. Den 27/9 släpper klimatpanelen nya värden för havets nivå 2100. Göteborg har arbetat med klimatanpassningsfrågor i över 10 år.

Staden gör flera saker för att möta klimatförändringarna. Staden samordnar sedan 2004 förvaltningar och bolag för att ha kontroll på läget, informera varandra och genomföra åtgärder. Stadsbyggnadskontoret bygger en hydromodell klar 2014 för att simulera effekter av olika vattennivåer. Utifrån den kommer vi att kunna prioritera rätt insatser.

I 3D-stadsmodellen har vi grovt illustrerat 3 nivåer utan skyddsåtgärder. Extremt högvatten idag, som varar några timmar, i centrum är 1,8 m över normalnivån. Troligt värsta värde från klimatpanelen är att havet kommer att stiga med 1 m till 2100. Eftersom panelen arbetar med scenarier är det en osäkerhet i siffrorna varför ett intervall sätts exempelvis från 0,3 m till 1 m. Om alla osäkerheter pekar åt samma håll kan vi få en tvåmetershöjning till 2100.

Like Share

Tweets 5

g+ 0

Dagens extrema högvatten +1,8 m

Visa

Som ovan med 1 m högre havsnivå +2,8 m

Göm

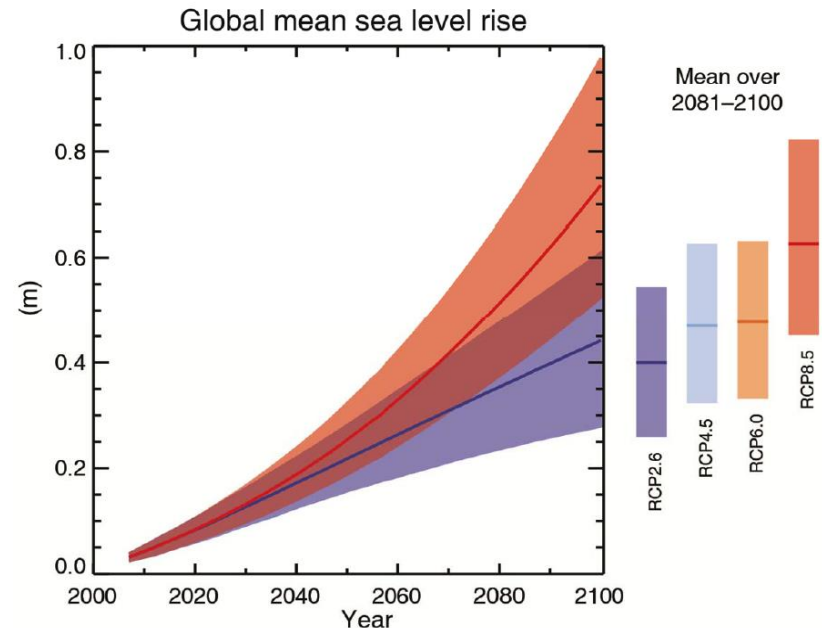
Som ovan med 2 m högre havsnivå +3,8 m

Visa

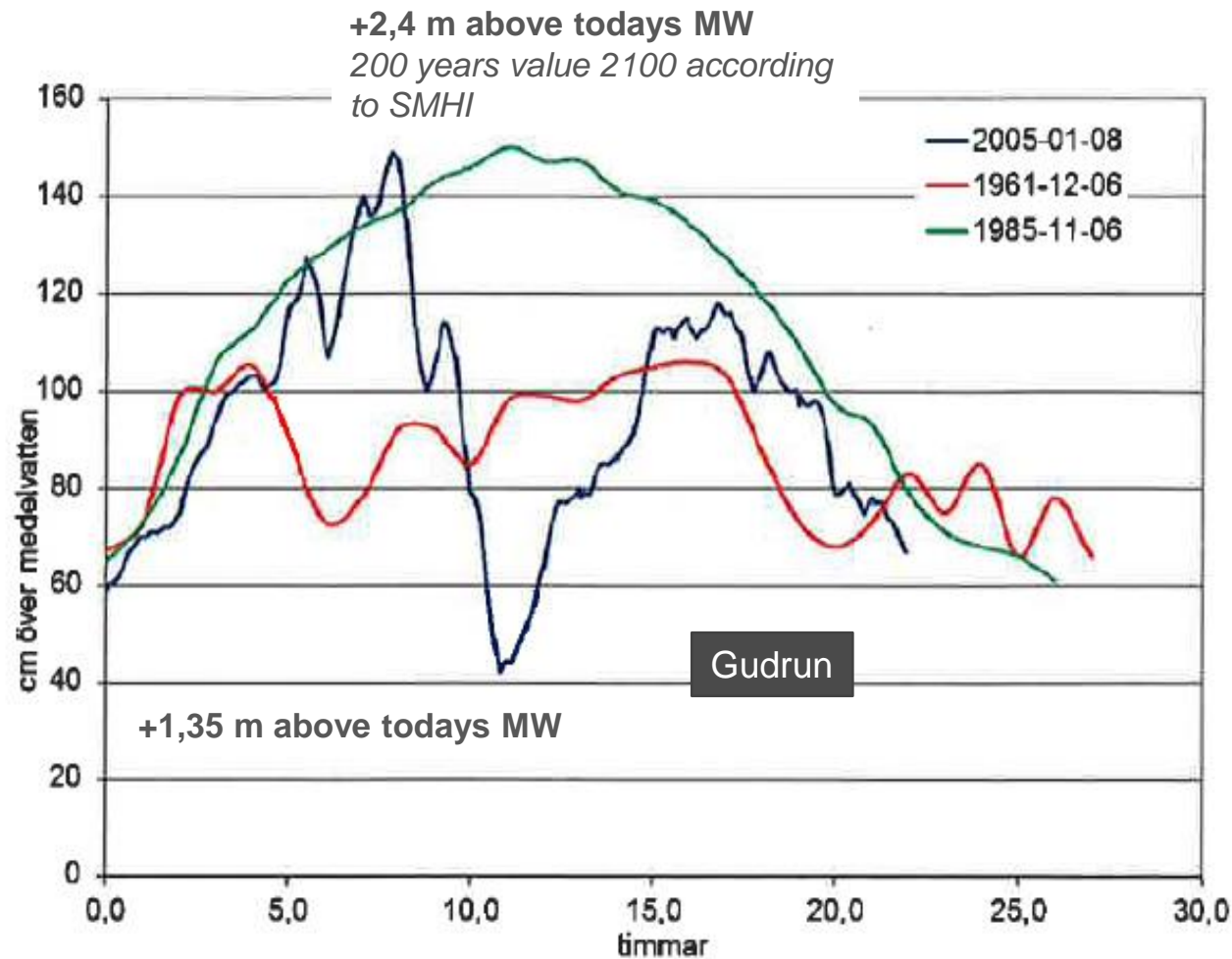
Climate change Rising sea levels

- Mean water level 2100 + 0,7 m (0,98 m)
- Land rise effect about 0,3 m
- **RCP 8,5**
 - Carbon dioxide emissions three times today.
 - Methane emission rises sharply
 - Earth population is 12 billion
 - Slow technology development
 - High dependence on fossil fuels
 - No additional climate policy

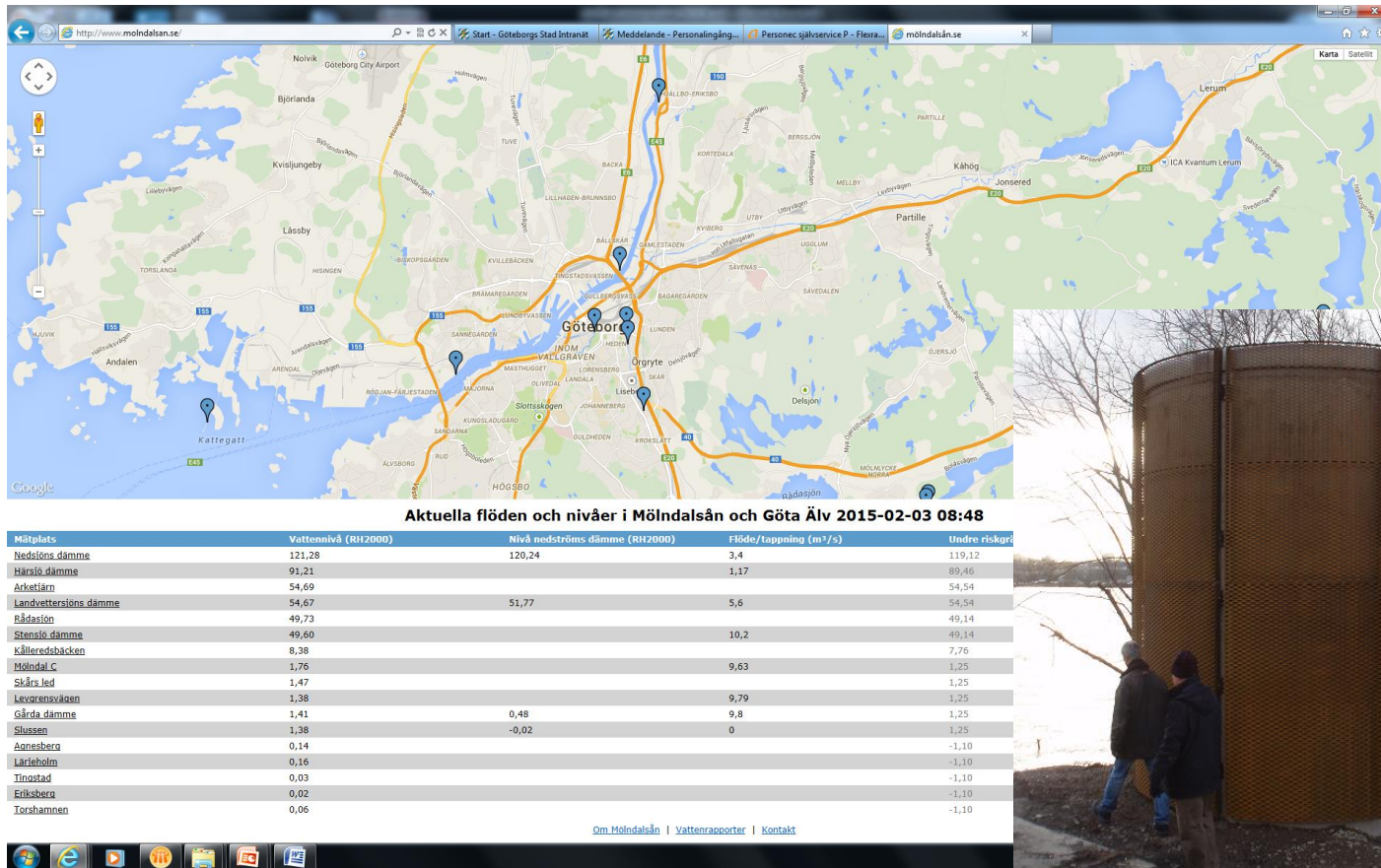
Figure SPM.9 [FIGURE SUBJECT TO FINAL COPYEDIT]



High water levels



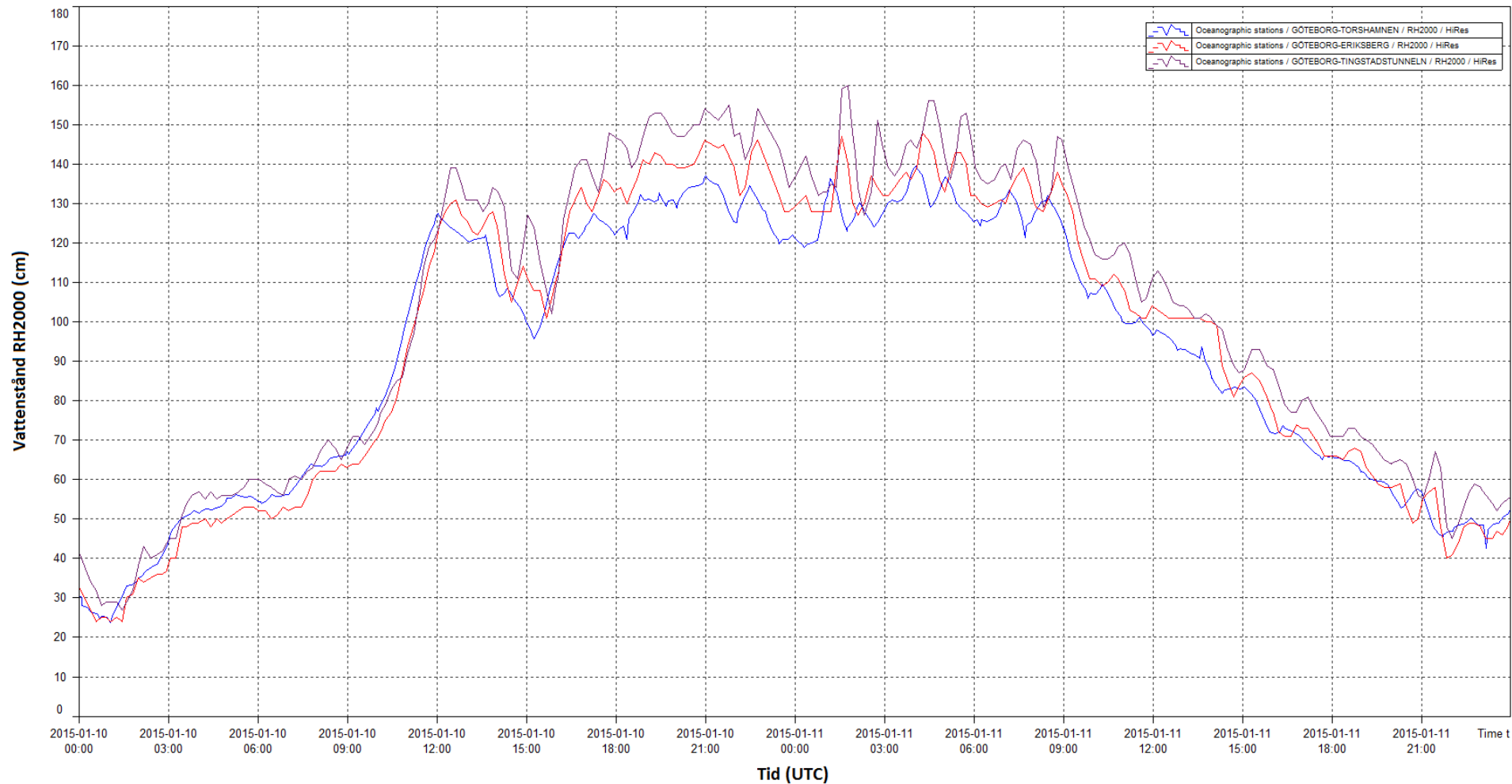
Water level meters



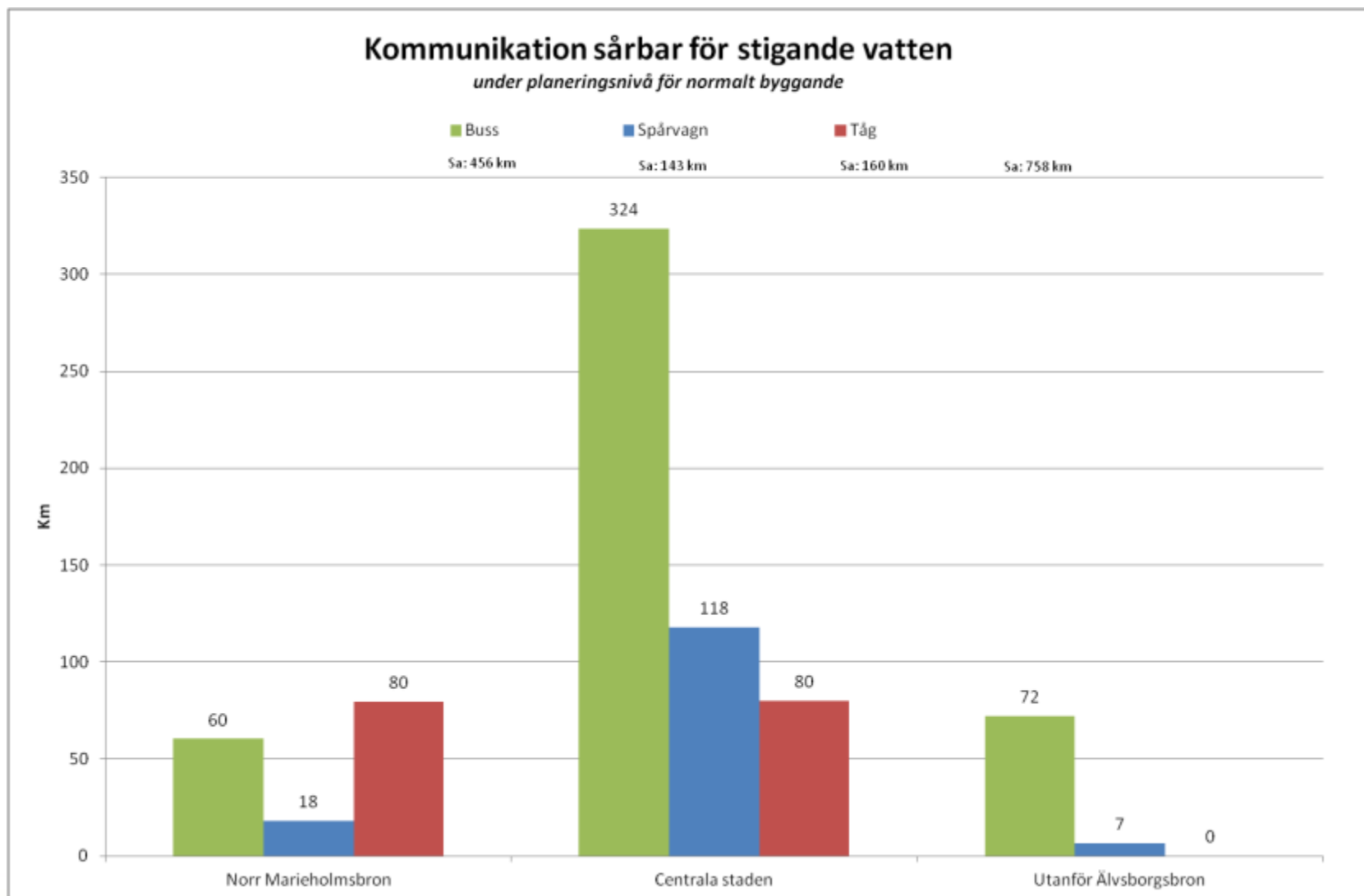
Egon

SMHI

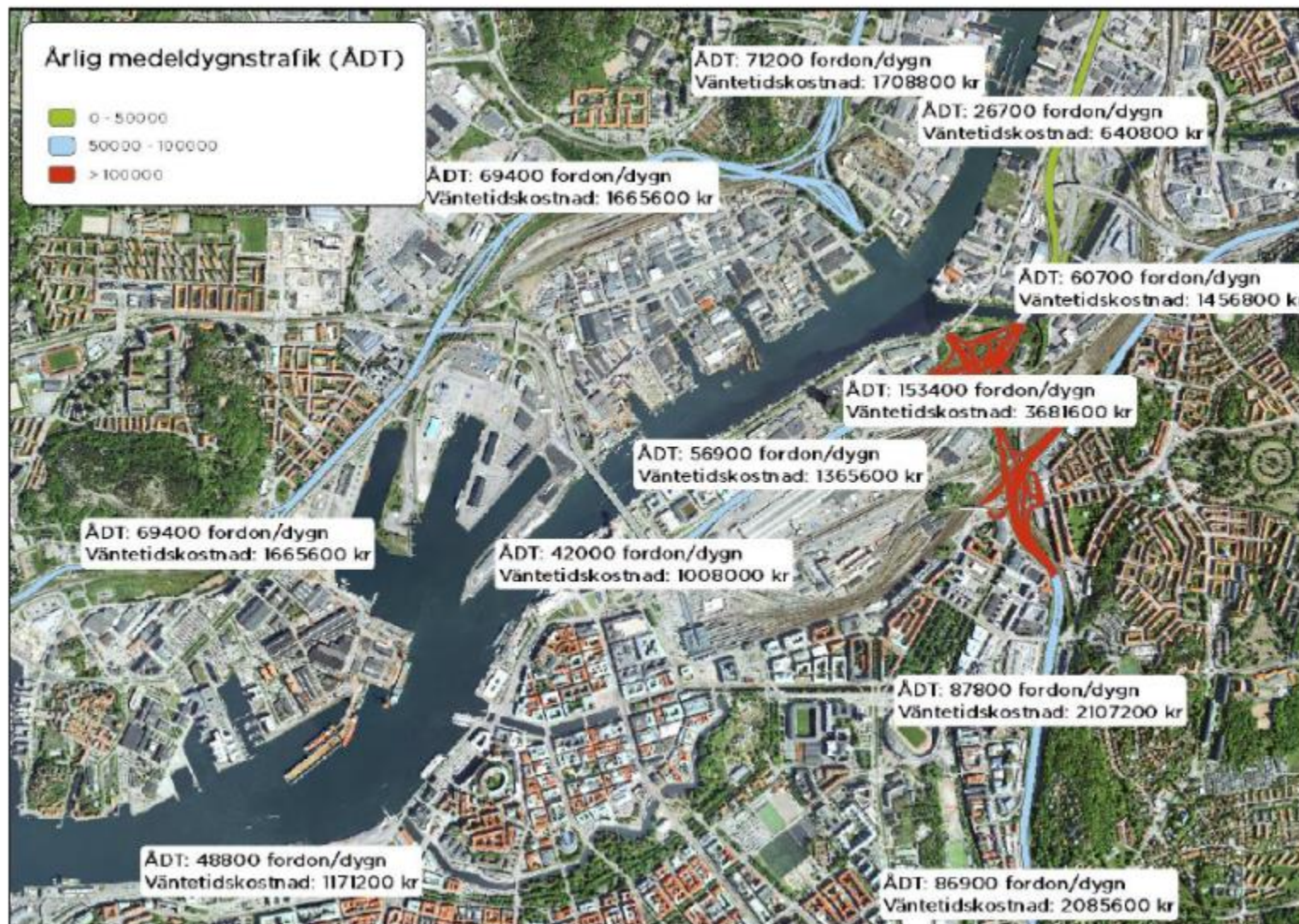
Göteborg 10 - 11 januari 2015



Vulnerability communication

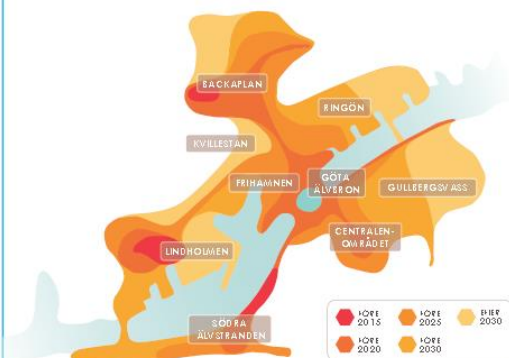


Damage costs for traffic standing still

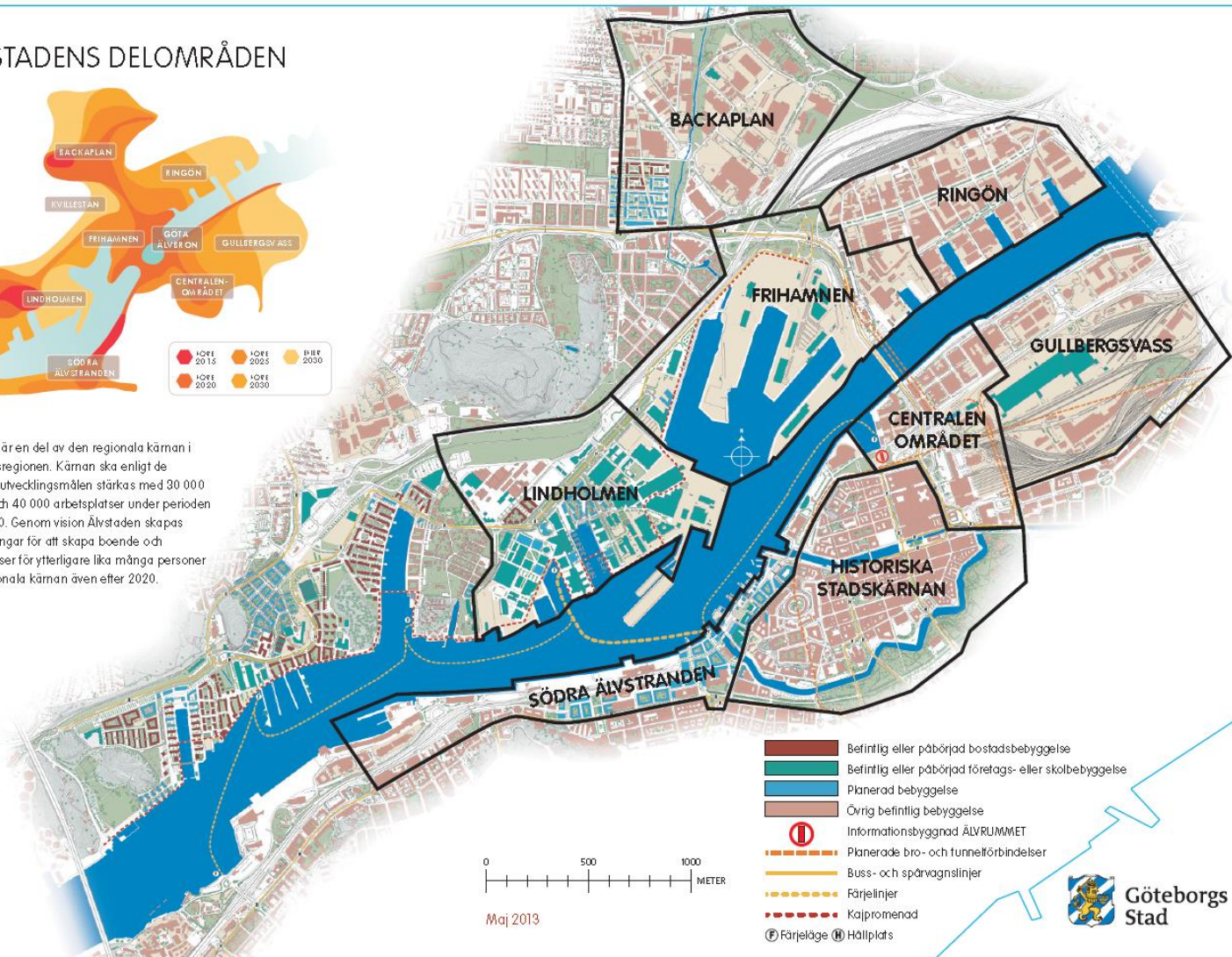


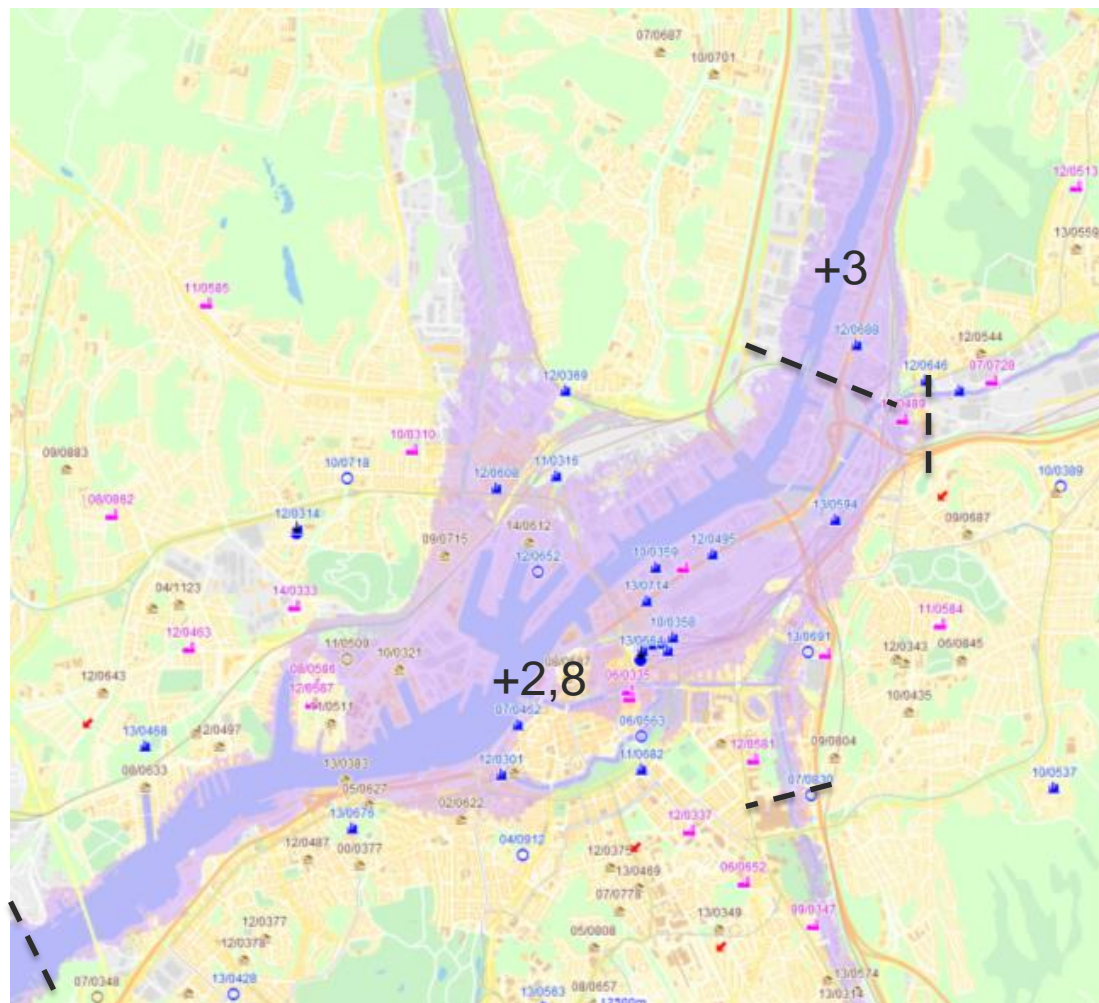
Expansion plans

ÄLVSTADENS DELOMRÅDEN



Älvstaden är en del av den regionala kärnan i Göteborgsregionen. Kärnan ska enligt de regionala utvecklingsmålen stärkas med 30 000 boende och 40 000 arbetsplatser under perioden 2006-2020. Genom vision Älvstaden skapas förutsättningar för att skapa boende och arbetsplatser för ytterligare lika många personer i den regionala kärnan även efter 2020.

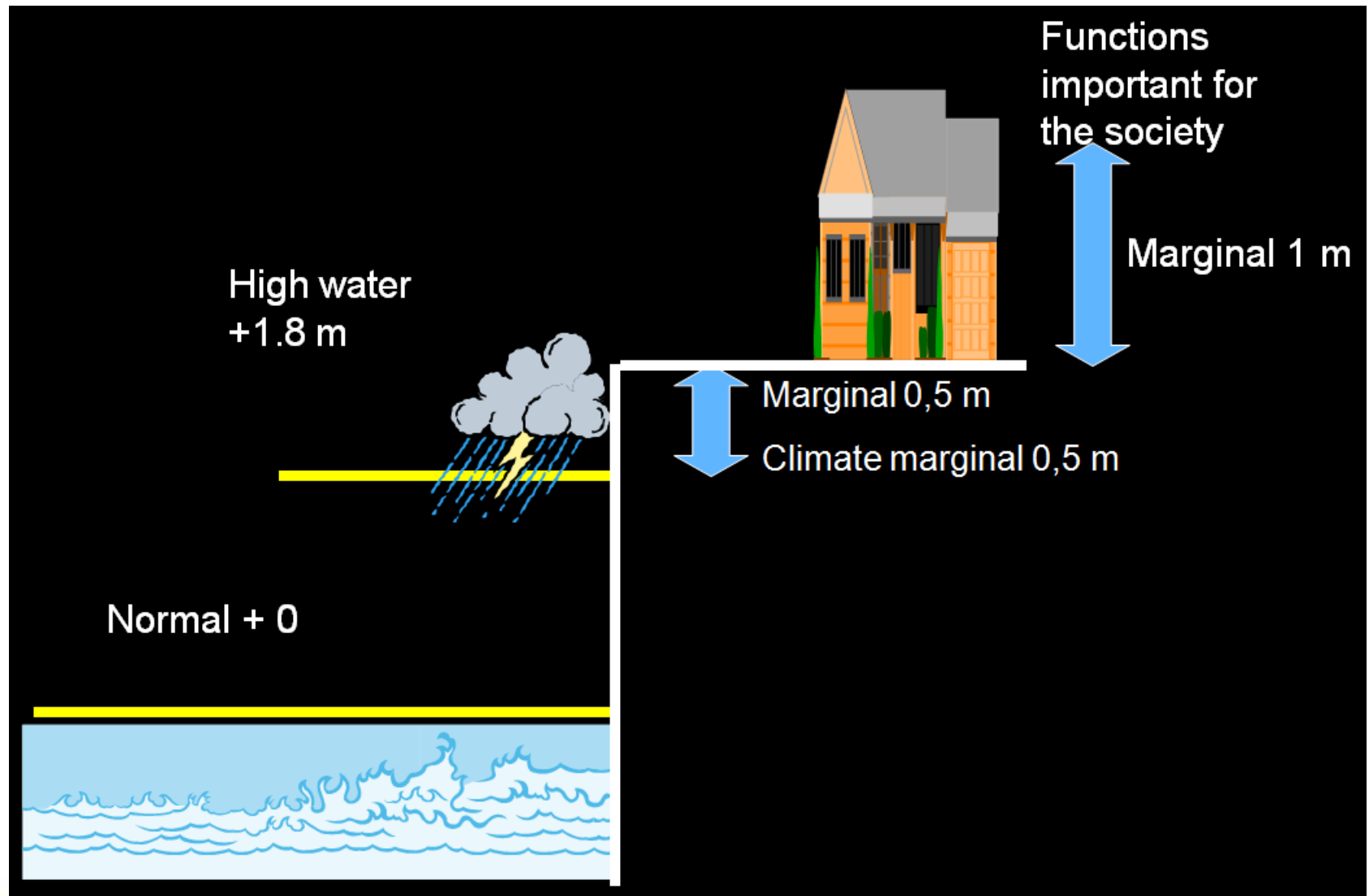




Planning levels

Central City

Criteria for selection of protection- current planning levels



The hydro model



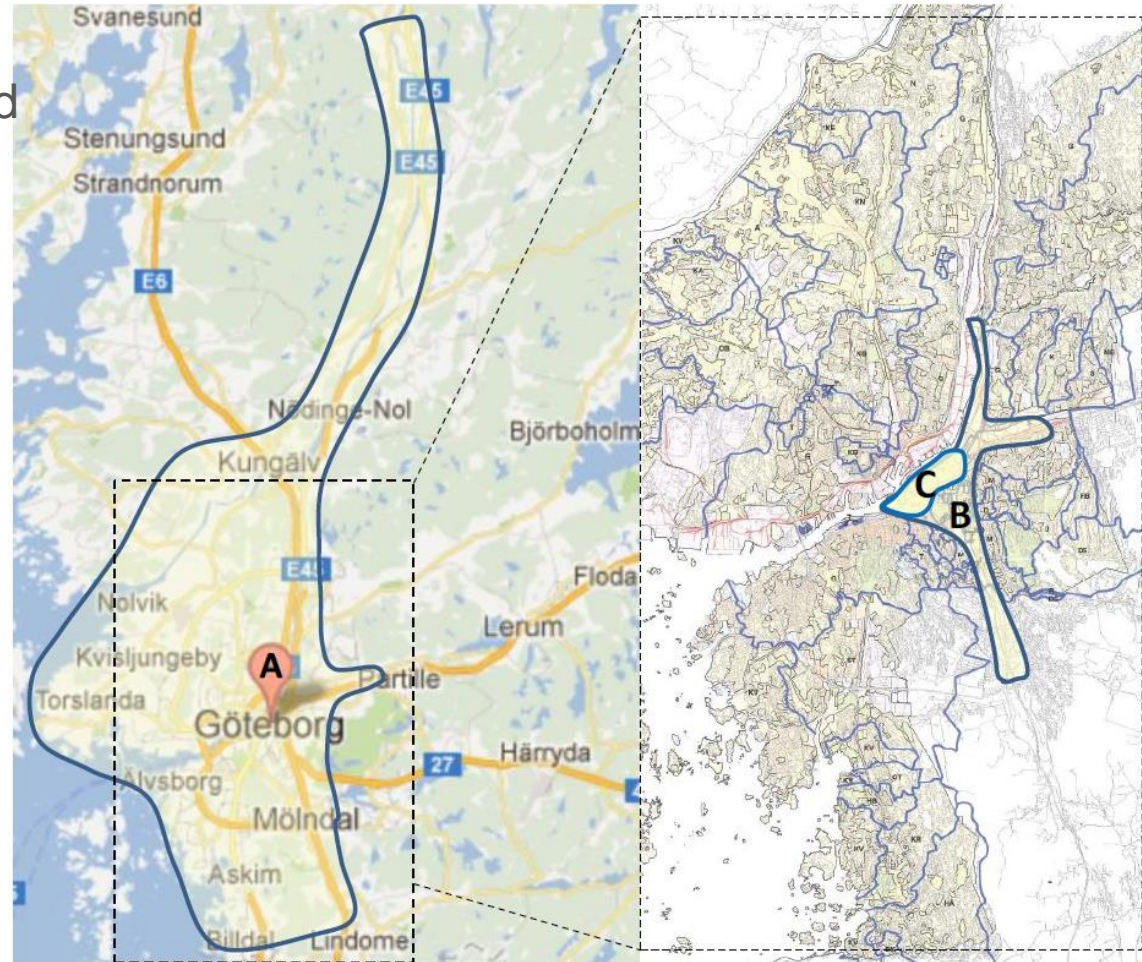
Simulates future water levels
Flows, rainfall high sea levels etc

Evaluate protection measurments

Basis for climate adaption strategis

Hydro model - parts

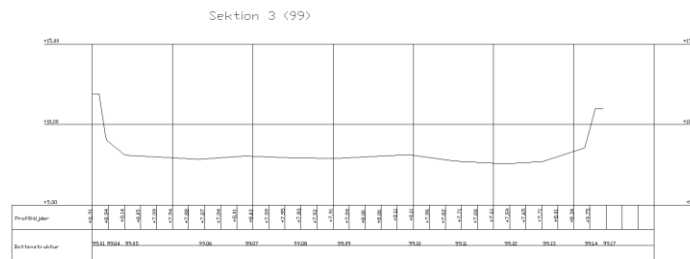
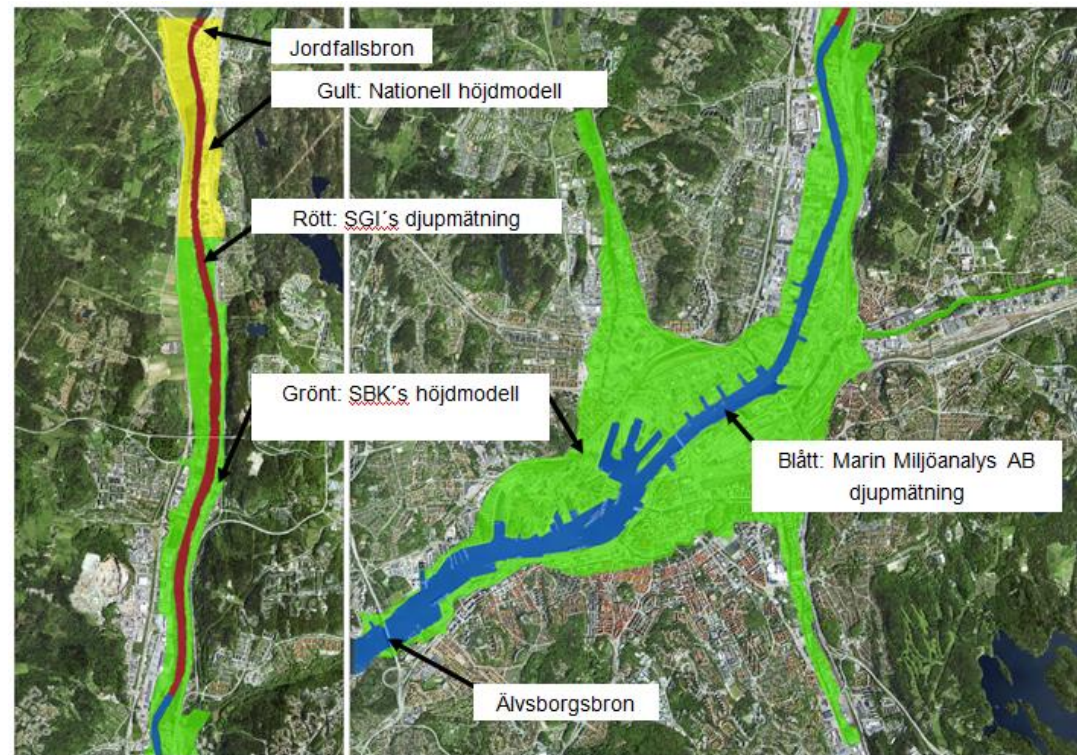
1. Central GBG– heavy rainfall and high sea levels
2. Mölndalsån and Säveån – high water from sea and high flow
3. River side protection and local dams year 2100
4. Storm surge barriers year 2100
5. CBA



- 4 independent models
- 48 simulations

Input - data

Bathymetri
Elevation data
Pipes under the ground
Bridges/structures in water
Existing hydraulic models
Land use
Aerial photographs
Contour of buildings
Functions important for the society
Damage costs



Current work

Risk assessment for a robust society

Tools for administration and make the hydromodel available

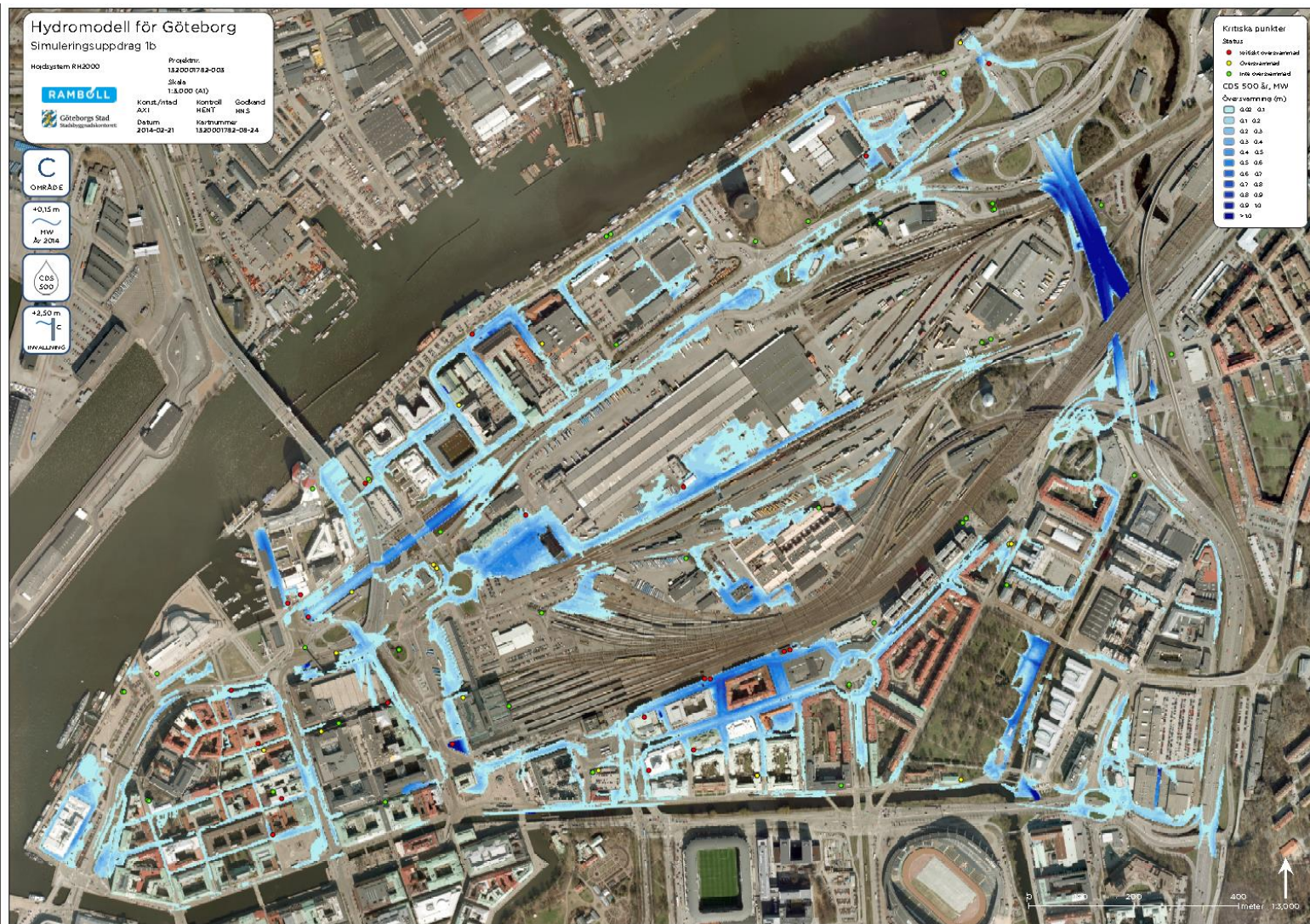
Decision process

Lobbing against the national level

Deepend comprehensive plan on the theme water



Heavy rain fall 500 year return time



High sea level, combined with high flow in the stream

Kritiska Punkter

Status

- Kritiskt översvämmad
- Översvämmad
- Inte översvämmad

Max nivåer

- ✕ Maximal översvämningsnivå (m)

Portar

- ⬮ Stängd

Flödesvägar

-

Skyddsvallar

- Permanent
- Mobil

AK_Å1_HQ2100_26t_S

Översvämning (m)

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- > 1.0

A
OMRÅDE

Å1

2 m³/s
HQ 2100
Kvillebäcken

+2,55 m
PEAK 26 h
År 2100

Hydromodell för Göteborg

Simuleringsuppdrag 3b

Regn: 65 mm/dag
Höjdsystem RH2000

Projektnr.
1320001782-004

Skala
1:7.000 (A1)

RAMBOLL

 Göteborgs Stad
Stadsbyggnadskontoret

Konst./ritad
AXI

Datum
2014-05-14

Kontroll
HENT

Kartnummer
1320001782-08-31

Godkänd
HNS



Important conclusions

Storm surge barrier requires river side protection

Large utility regulation Säveån, the Göta River

Long periods of closure - requires pumping

Closing criteria controlled by frequency

Flood Level behind barrier

Pump capacity

Control Ability

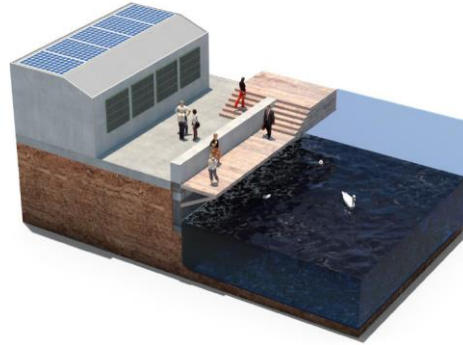
Prediction Ability

Example +1.5 m

2014: 1.6 years

2100: 14 times / year

•Strategy



Critical
time



City of
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Mid term

Long term

HHW
+1,8

HHW
+2,3

HHW
+2,6

År 2014

År 2050

År 2100

Strategy mid long term

New buildings

Apply existing levels of planning
Basic principle protection through elevation
Function based approach
Deviations require risk assessment
Technical protection—possible to build 1 m higher level
Set aside land for future protection



Existing buildings

Risk assessment
Risk Picture determines the need for object protection

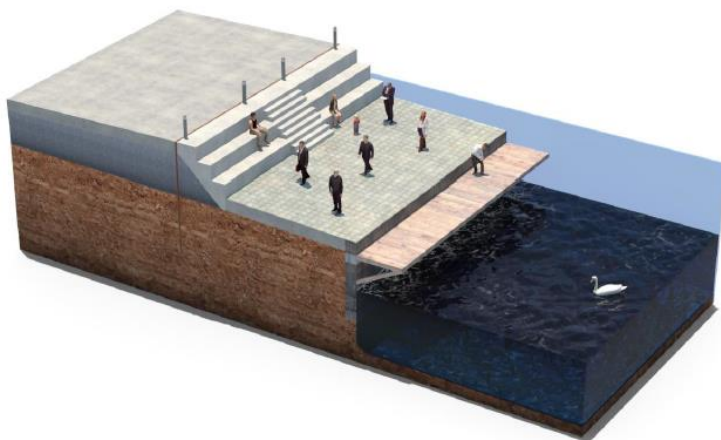


Principal solution for river side protection

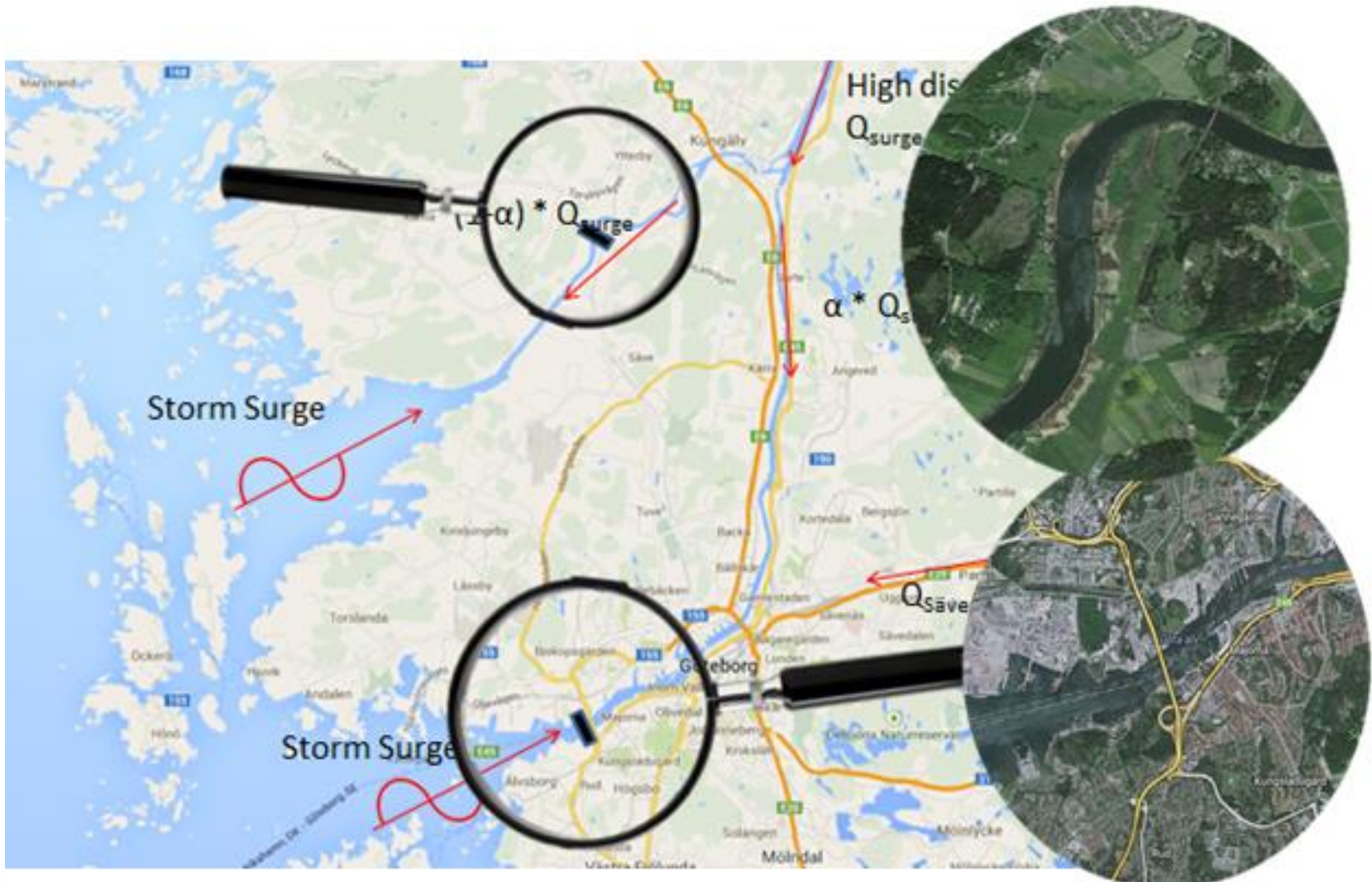


BETECKNINGAR

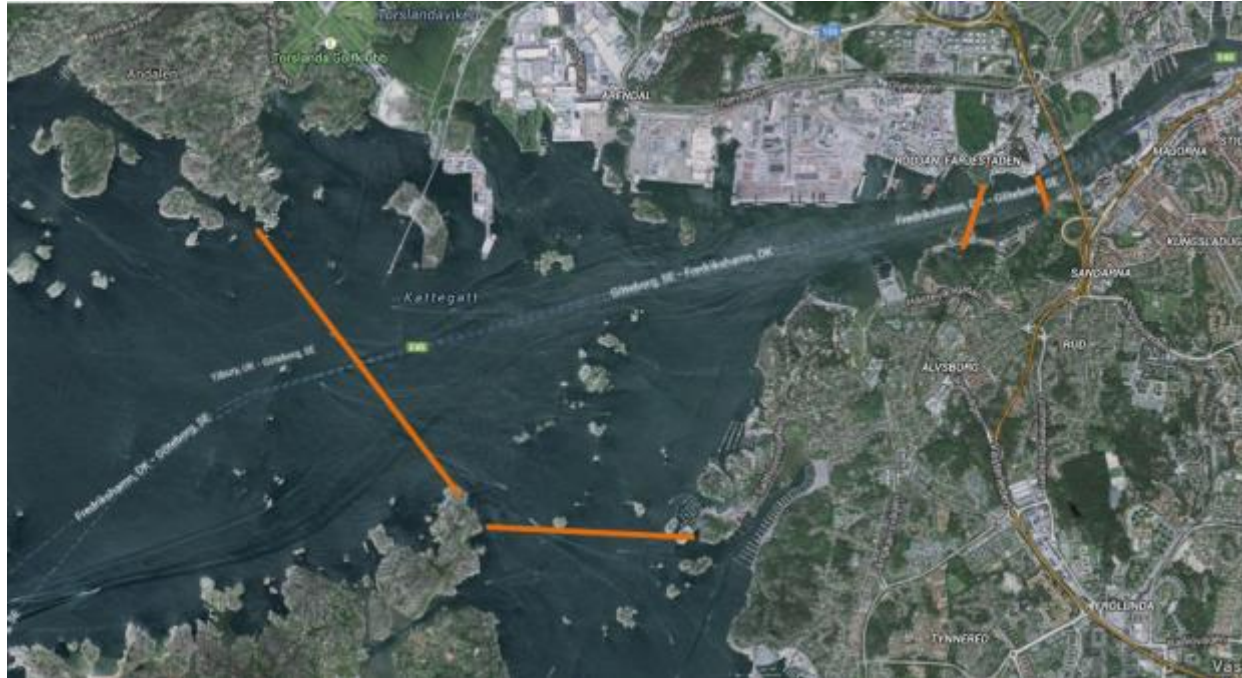
- Alt 1. Skydd placerade på kajplan
- Alt 2. Skydd placerade på kajkant
- Alt 3. Skydd i form av vall längs slänt
- Alt 4. Skydd i form av mur längs slänt
- Alt 5. Ny konstruktion
- Område som får översvämmas
- ▨ Ej tillfredsställande stabilitet baserat på erhållet underlag från SBK
- ... Sträcka som bör få ny kajkonstruktion



Storm surge barrier



Älvsborg storm surge barrier



- “Robust” alternative:
 - Segment gates (Thames barrier)
- “Navigational alternative:
 - Horizontal sector gates (Maeslant-barrier)

Technical specification

3 submerged segment gates

Connecting levee between gates and pumping station

11 pumps 115 m long



Second option

2 sector gates

Each gate ~ 75m long

Total span 150 meters

Pumping station integrated with abutment
(but complex)

Abandoned in view of cost and complex
integration of pumping station

Preferred option for maritime navigation



Visitor centre



- Visitors centre close to the barrier
- Example Maeslantbarriären in Netherlands



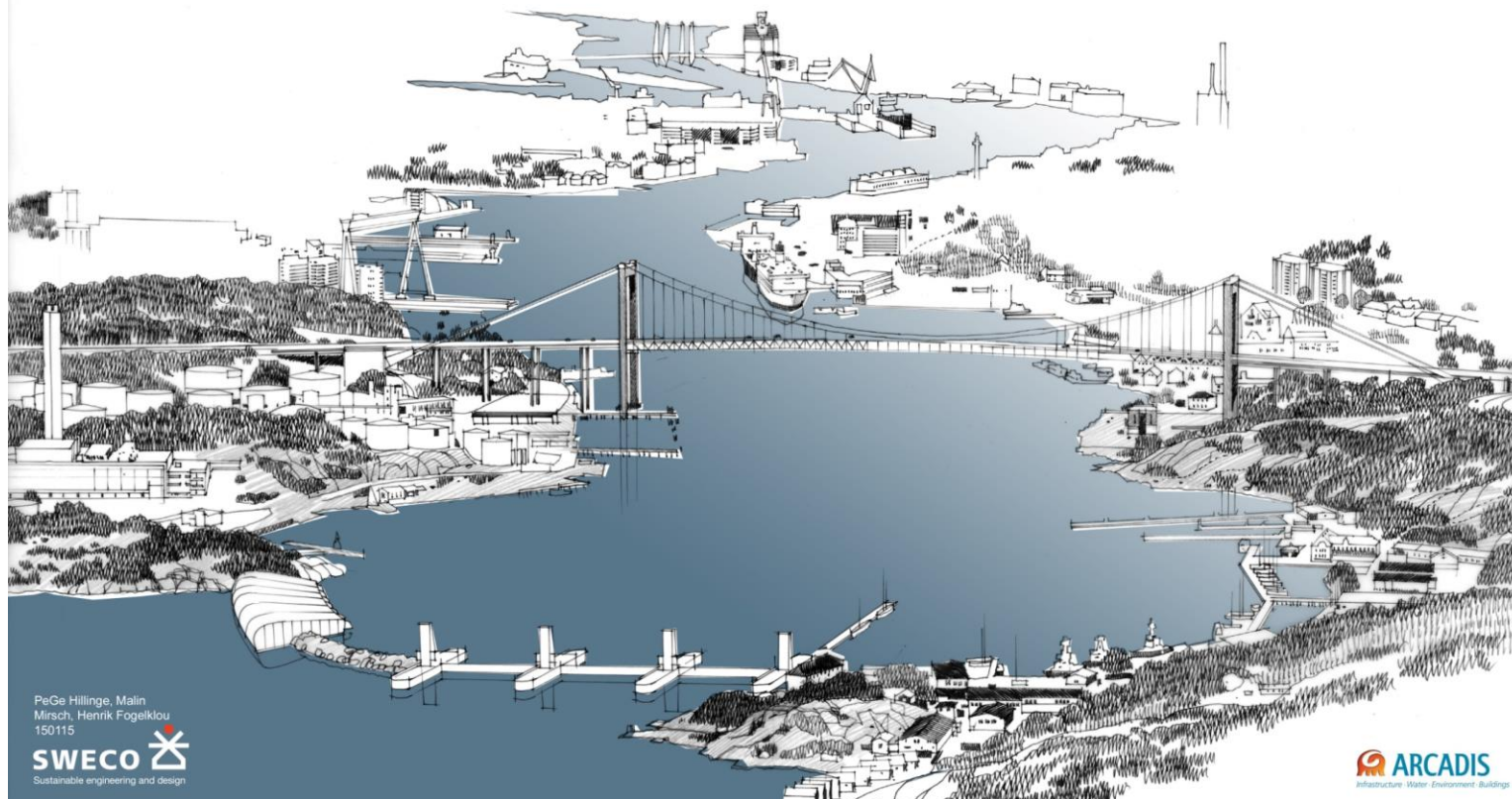
Barrier Älvsborgsbron



City of
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STORMBARRIÄR ÄLVSBORGSBRON

ALTERNATIV A, STÄNGD



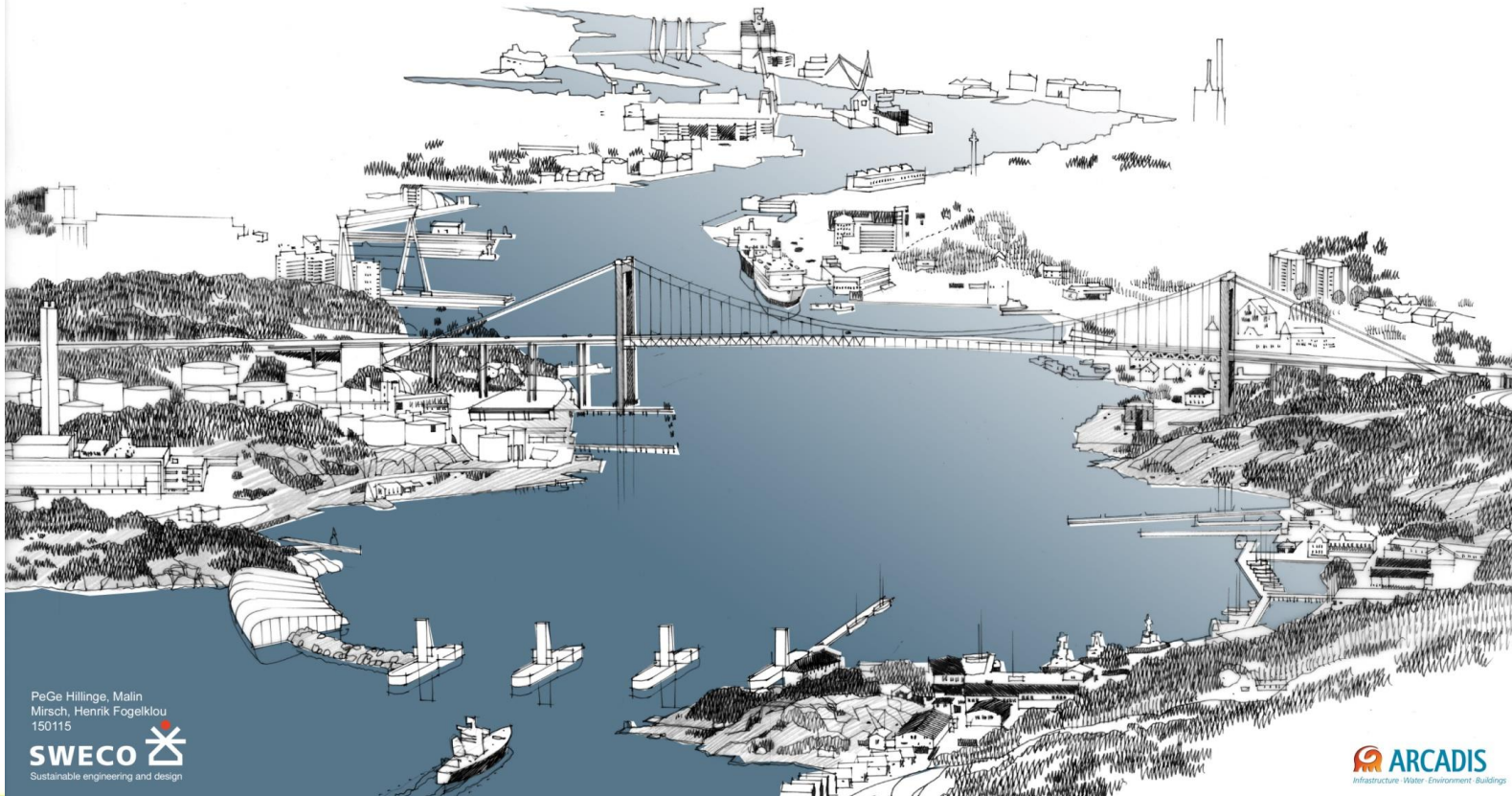
Barrier Älvsborg



City of
Gothenburg

STORMBARRIÄR ÄLVSBORGSBRON

ALTERNATIV A, ÖPPEN



PeGe Hillinge, Malin
Mirsch, Henrik Fogelklou
150115
SWECO 
Sustainable engineering and design

 **ARCADIS**
Infrastructure · Water · Environment · Buildings

Barrier Nordre Älv



Location 3 is adopted (at existing Ormoskärmén). Existing salinity control barrier can be replaced and the function taken over by the new barrier

Locations 1 and 2 are of limited added value in view of flood protection, but are within protected habitat

Nordre Älv



Submerged segment gate located in the river bed
Pumping station at floodplains
Levees on the floodplains

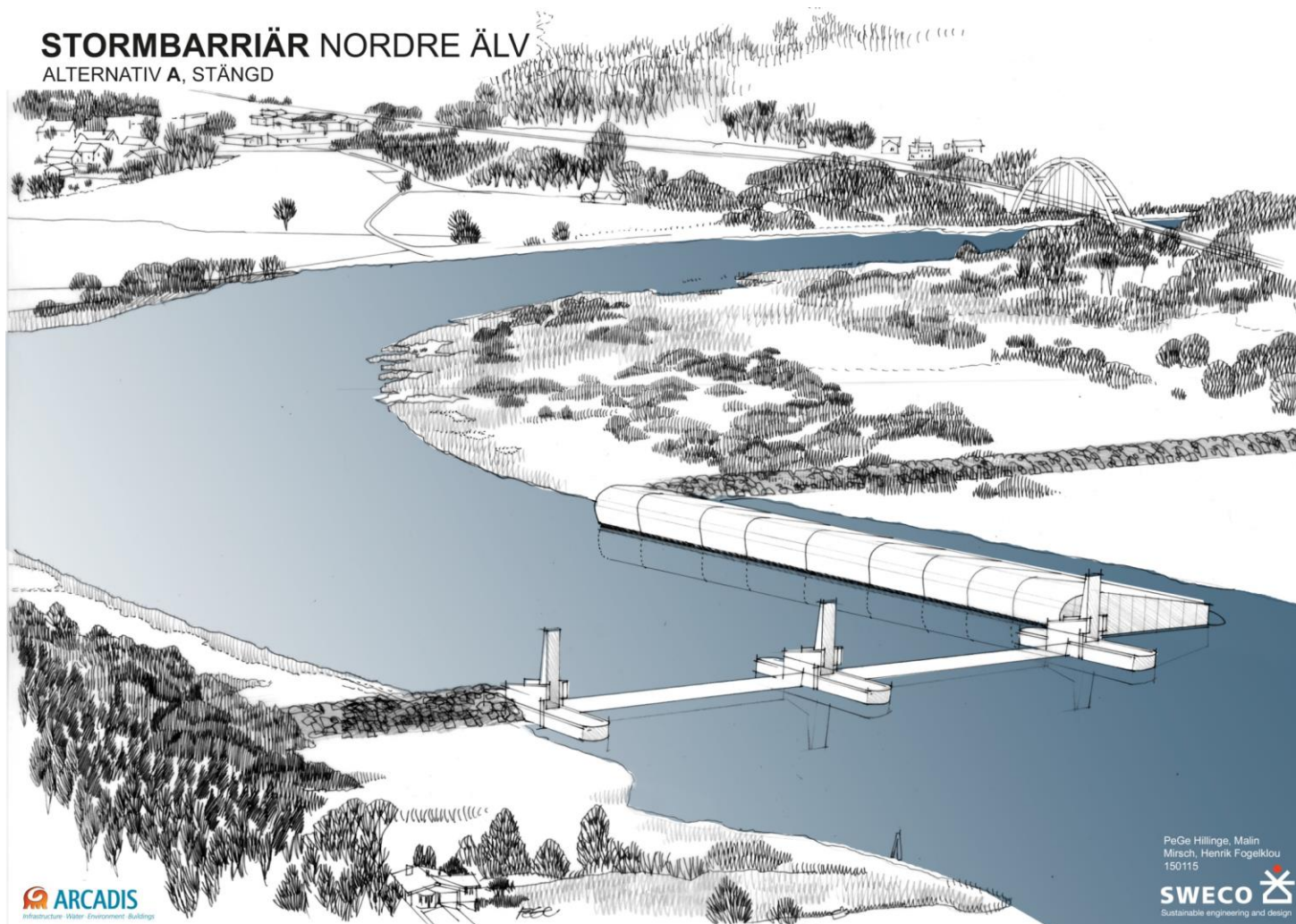






STORMBARRIÄR NORDRE ÄLV

ALTERNATIV A, STÅNGD

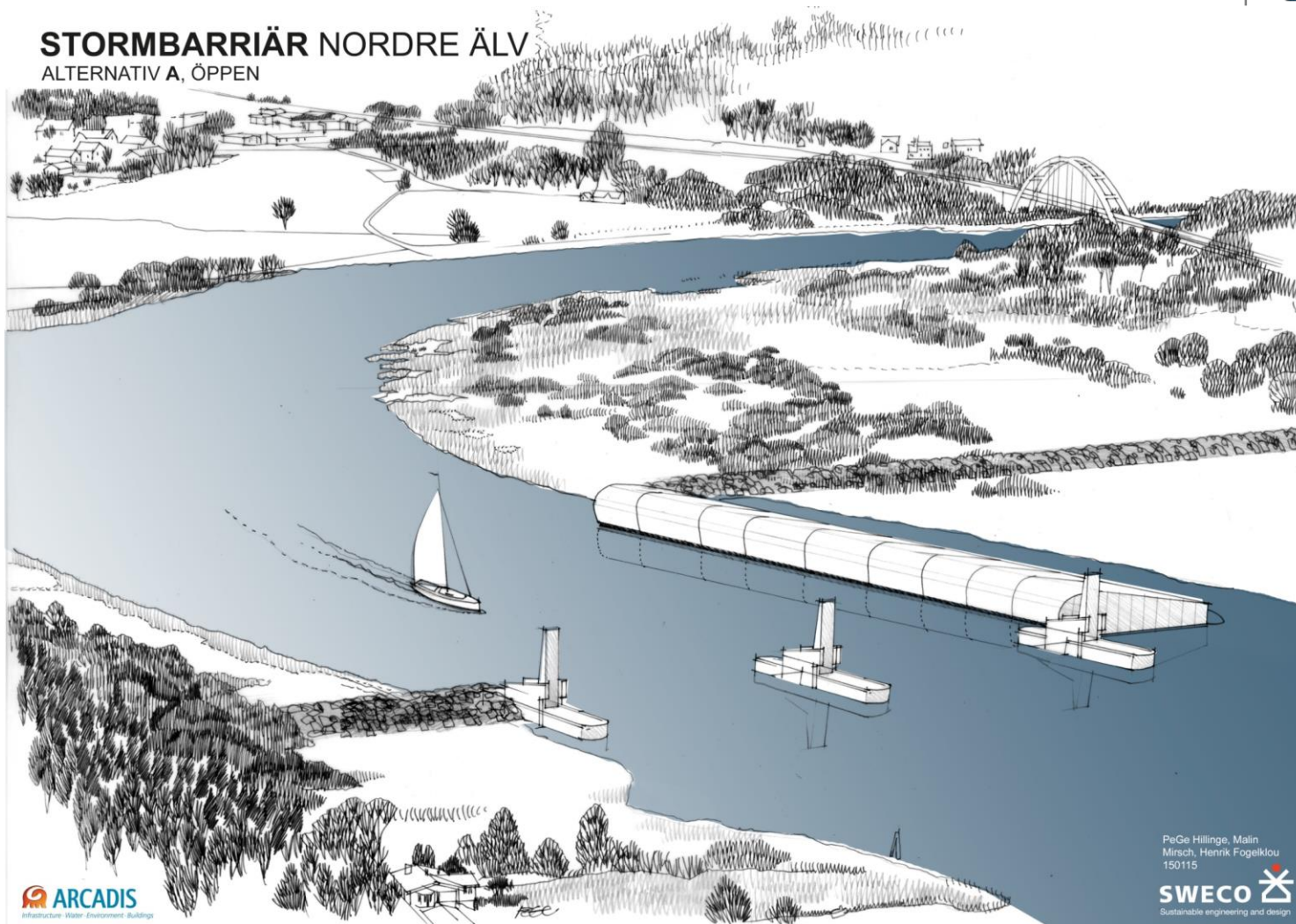




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STORMBARRIÄR NORDRE ÄLV

ALTERNATIV A, ÖPPEN



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Mirsch, Henrik Fogelklou
150115

 **SWECO**
Sustainable engineering and design



Costs million Swedish Crowns

- Älvsborgsbron
 - Barrier: 1940 (1360-2920)
 - Pumping station: 1100 (775 – 1650)
- Barrier Nordre älv
 - Barrier: 790 (550 – 1190)
 - Pumping station: 1410 (990 – 2120)
- Total: 5259 (3680 – 7870)



Risks and uncertainties

- Geotechnical information is scarce, especially at Älvsborgbron (possible consequence: increased cost of foundation)
- Projections of future sea levels and discharges
- Discharge from the smaller streams
- Political decision-making process
- Permitting (especially related to environmental aspects)



Experiences from the Netherlands



City of
Gothenburg

- Decision-making on (large) storm surge barriers is complex
- Historic examples show decades of decision-making (several “false starts”)
- Transparency/traceability is crucial in all studies undertaken

On the national level

- Laws and regulations need to be adapted; roles and responsibilities as well as strategies and goals should be made clearer.
- There is a need to outline how the costs of adaptation should be distributed among actors and how resources for prioritized measures can be guaranteed.



No distinct flood governance policy domain on national level

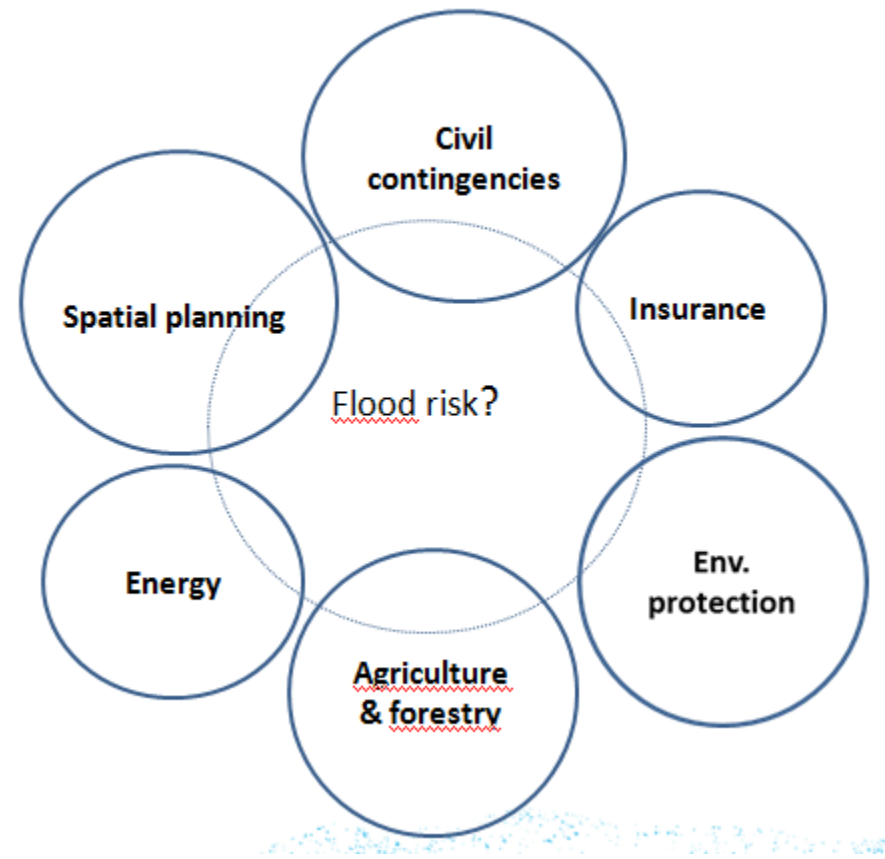
Fragmented flood risk governance

Municipalities and private persons as
main actors

Support from the state

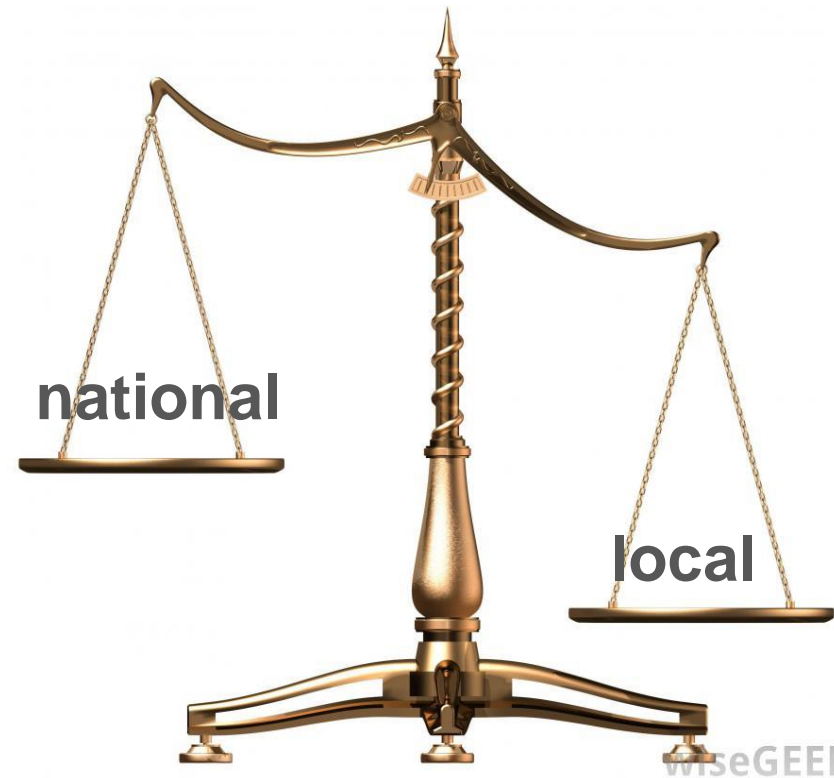
Dispersed legislation

EC, PBL, LAV, LSO, LXH, etc.




Division of responsibilities between national and local level

- Strengths and weaknesses with municipal self-government:
- + Flexibility to account for local risks and conditions
- - Lack of resources



Remarks

- Growing national concern – local level forerunner
- Fragmented across policy areas (discourses, actors, rules and resources)
- Strengths and weaknesses with the municipal self-government
- The lack of coordination and integration on the national level may limit the adaptive capacity of the country as a whole
 - limited guidance from the national level (authorities, private actors and the general public)
 - investments in permanent defence structures costly also for large municipalities
 - public awareness is low while expectations on public authorities are high

- 
- An aerial photograph of a city, likely Oslo, showing a dense urban area with a river winding through it. The city is surrounded by green hills and mountains. The text is overlaid on the image.
- More water in the future
 - We have got the tools
 - We still have some time



City of
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