C14 - Flood-proofing Horsens Town Centre
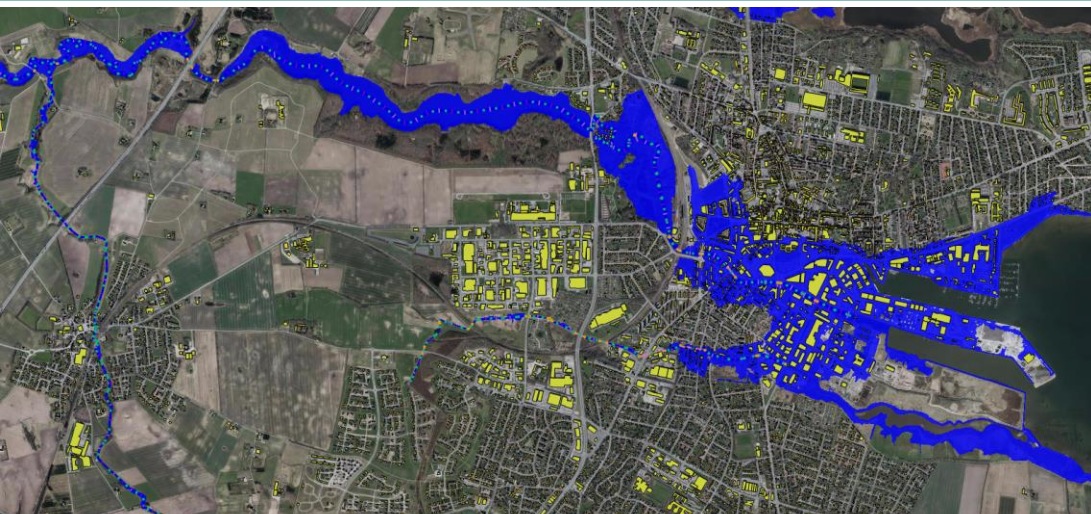
- use of hydraulic modelling

May 3rd 2022

Rasmus Rønde Møller

Horsens Kommune **samn** FORSYNING
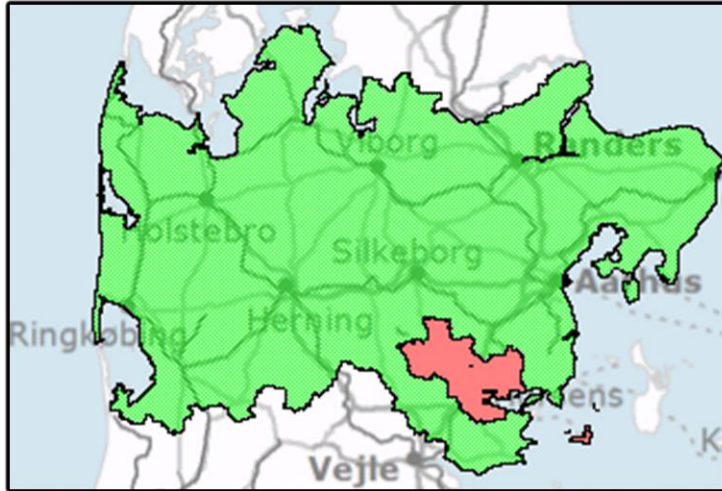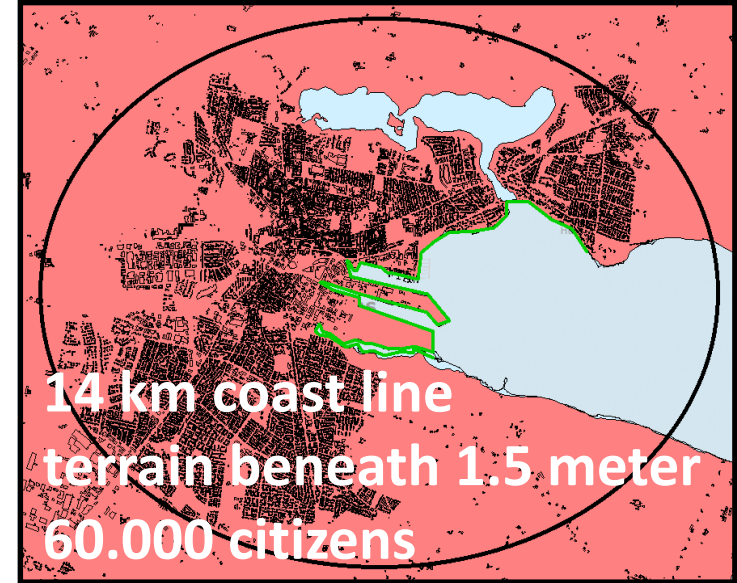
LOCATION
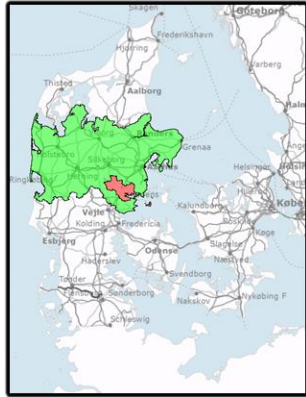
Central Region Denmark
Horsens Municipality

Denmark

Horsens Town center

14 km coast line
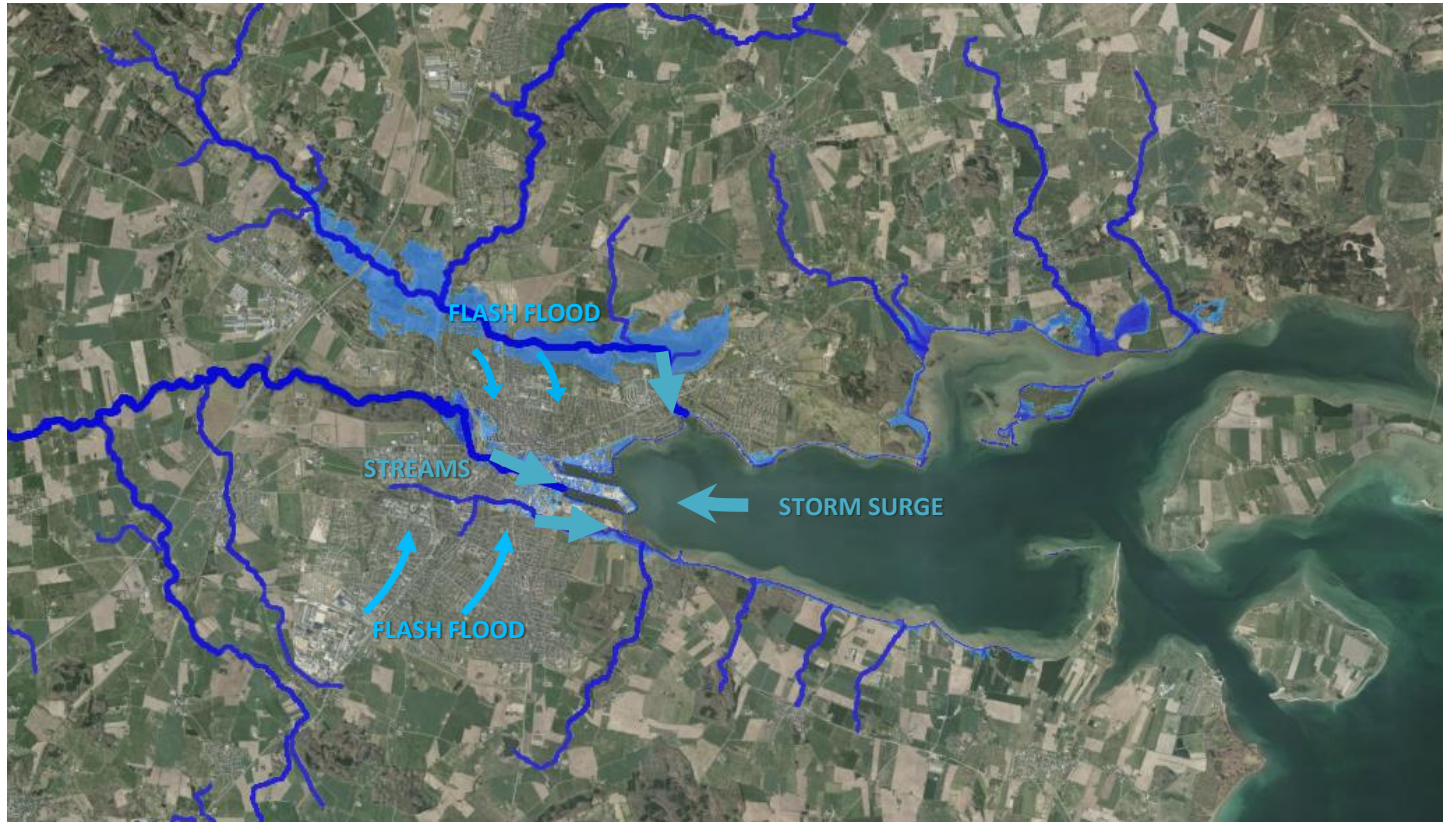terrain beneath 1.5 meter
60.000 citizens

Topics

Brief overview of modelling acitivities in Horsens Town center

- Storm surge protection
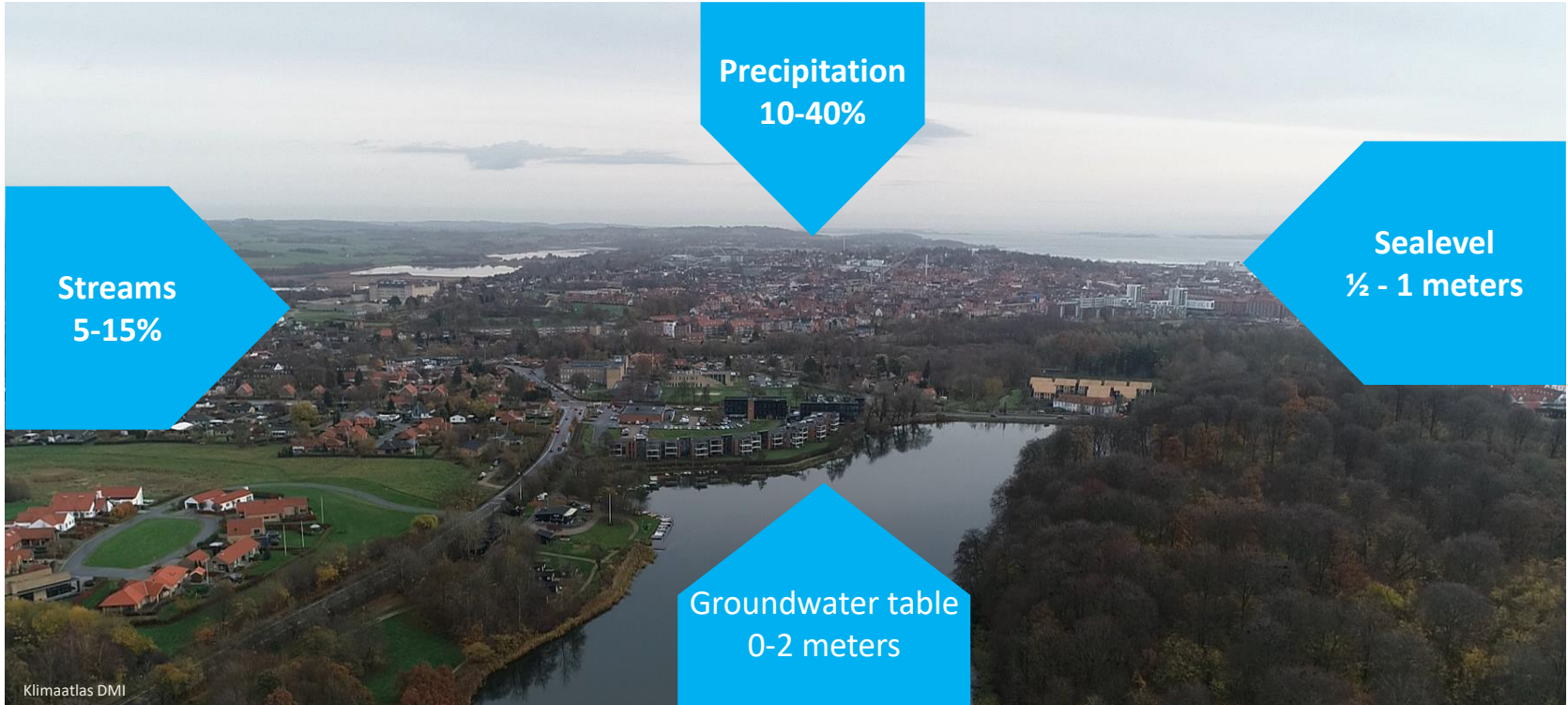- Longterm solutions handling rainwater and water courses

The challenge

FLASH FLOOD

STREAMS

STORM SURGE

FLASH FLOOD

Denmark/Horsens Town - water increase 2100?

Precipitation
10-40%

Streams
5-15%

Sealevel
½ - 1 meters

Groundwater table
0-2 meters

Klimaatlas DMI

Experienced several

storm surges   flash floods

Horsens Municipality plan

Horsens Town — designated as risk area

known flodding events

https://webkort.horsens.dk/spatialmap
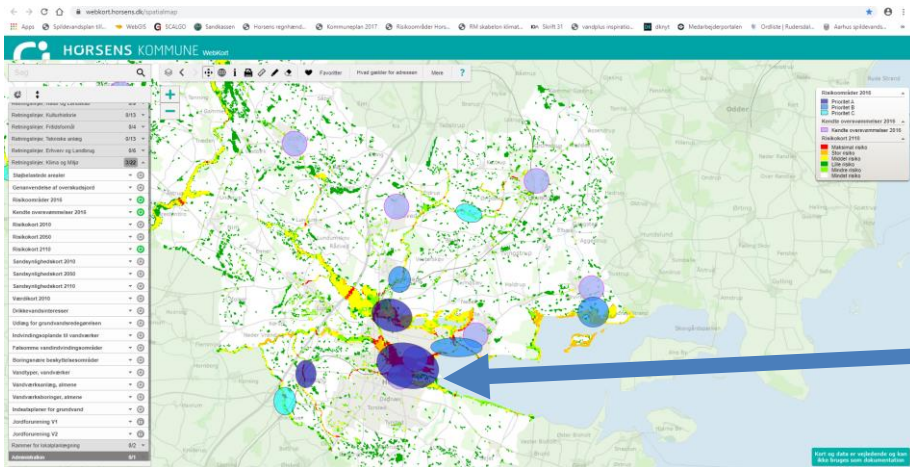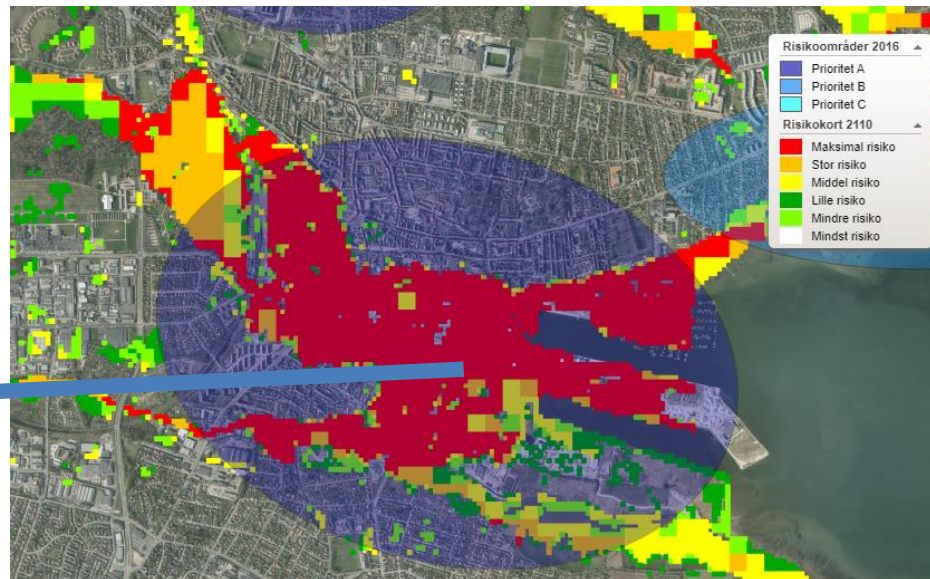
Urban development
-a driver for climate adaptation

CHALLENGE AND OPPORTUNITY

New sewer systems
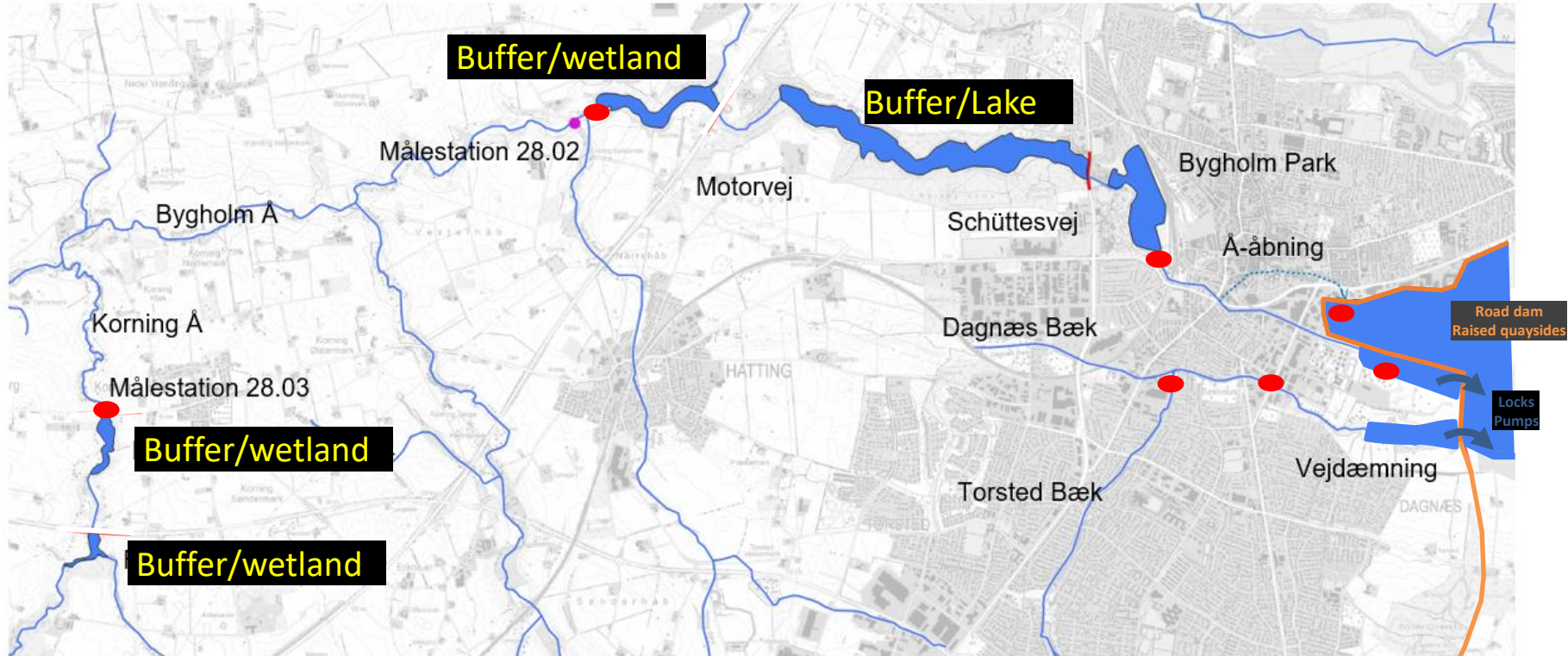- separating rainwater
- wastewater

Harbour in transformation

Trafic infrastructure
- new bypass road

Future water infrastructure /flooding protection

Water level / hydrometric station

C2C project
future main **water** infrastructure

- Retain water in wetlands?
- Retain water in a lake upstream the town
- Harbour in transformation – raising quaysides
- New bypass road as dam – harbour basin -> buffer
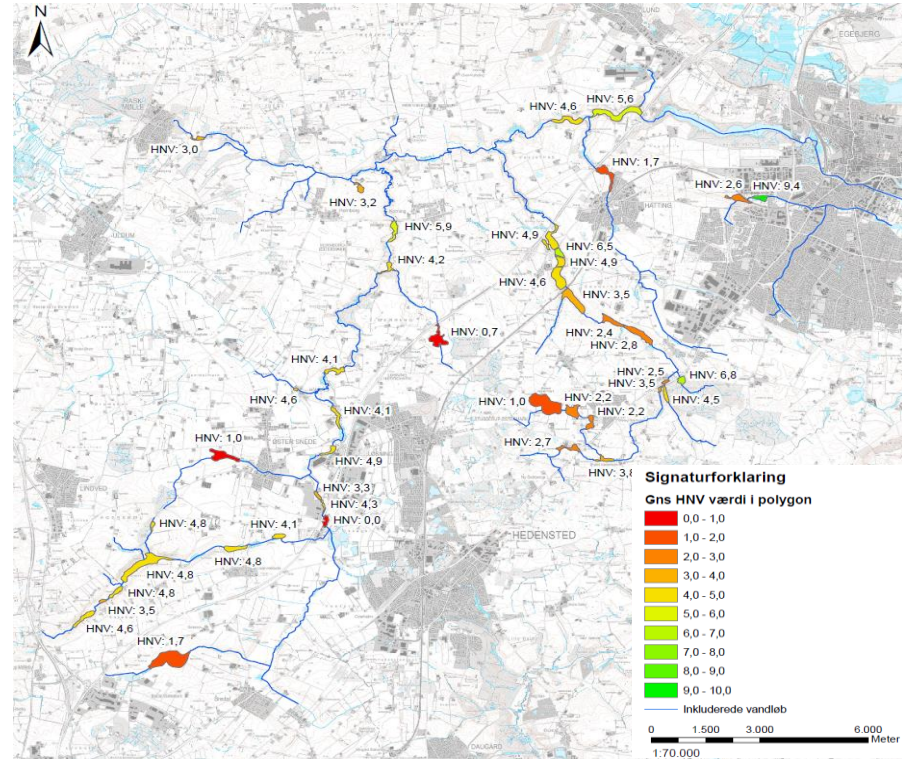- Establish locks and maybe a pumping facility?

Wetlands

Lake/buffer

Storm surge

Harbor basin/ buffer

Dike/ring road
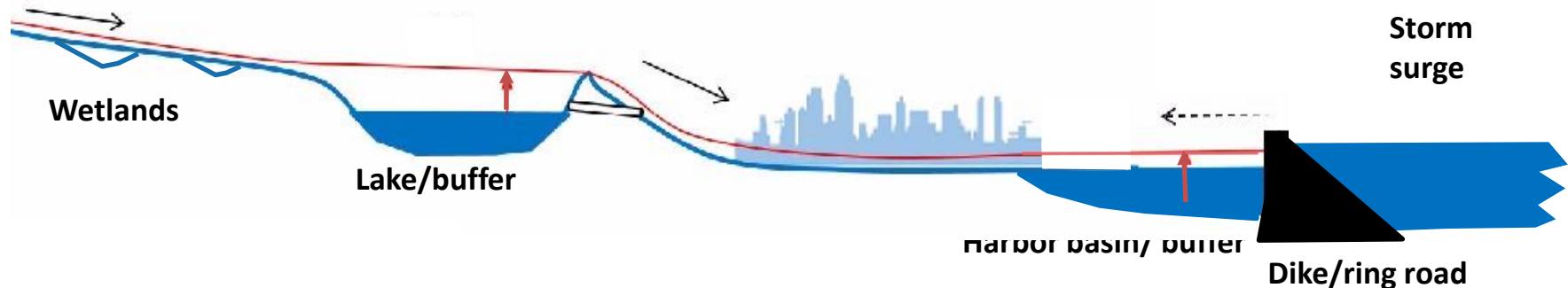
Initial screening
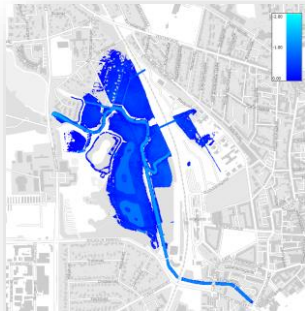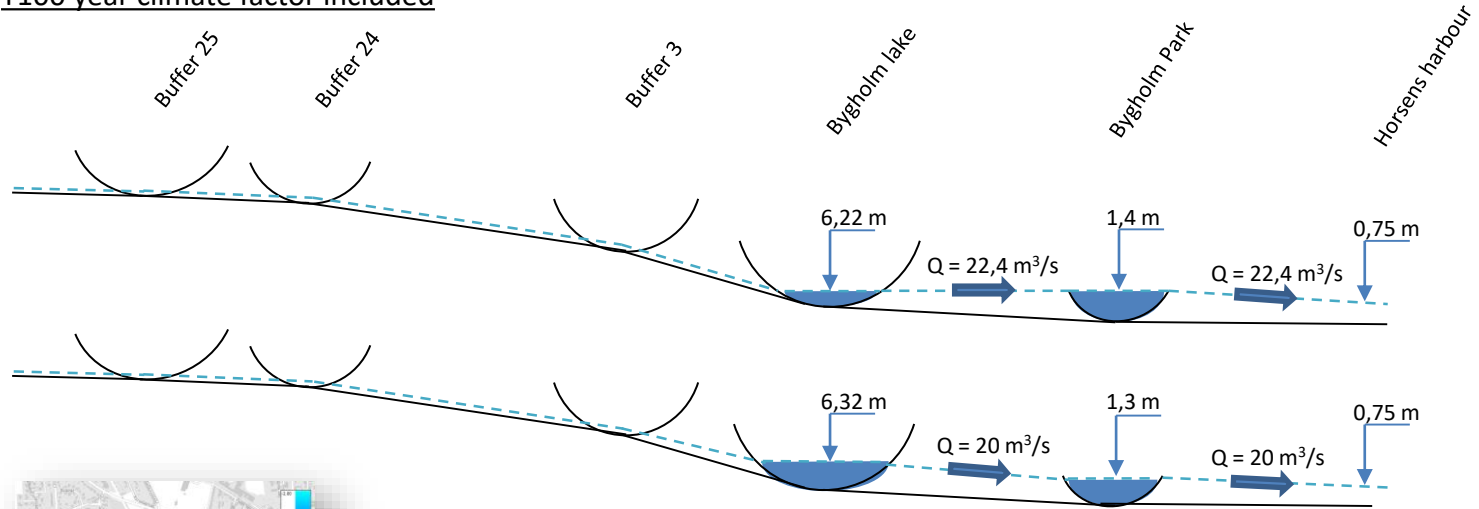## retaining water in the catchment area

42 potential locations

High Nature Value (HNV)

Volumes not significantly reducing flooding risk in Horsens town.

How much water is conducted through the city from the water course?

T100 year climate factor included

Analytical modelling
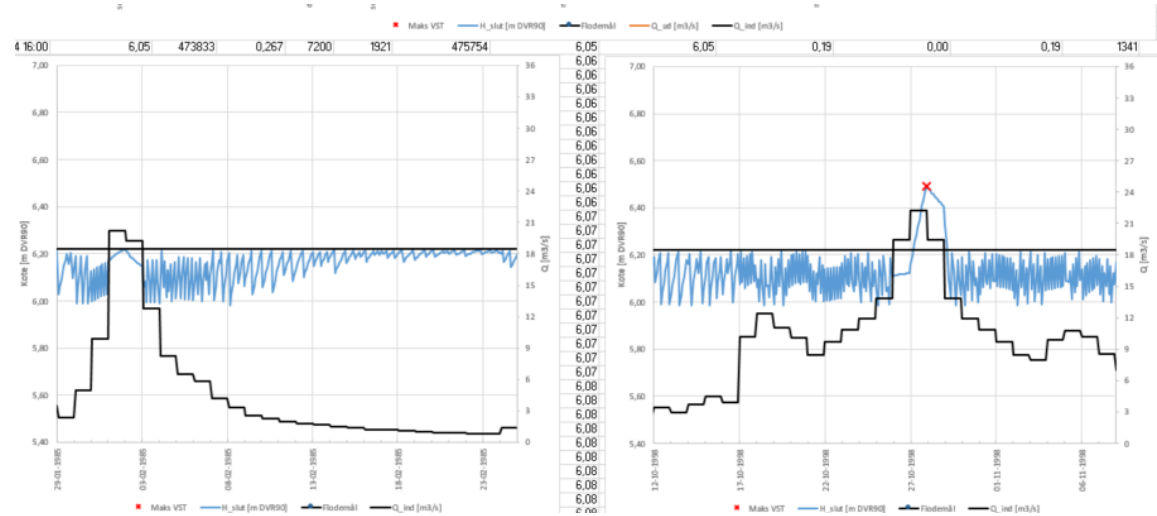## -calculating lake/bassin filling time and discharge

Historical runof events
+ climate factor

Bassin – water level
Filling time
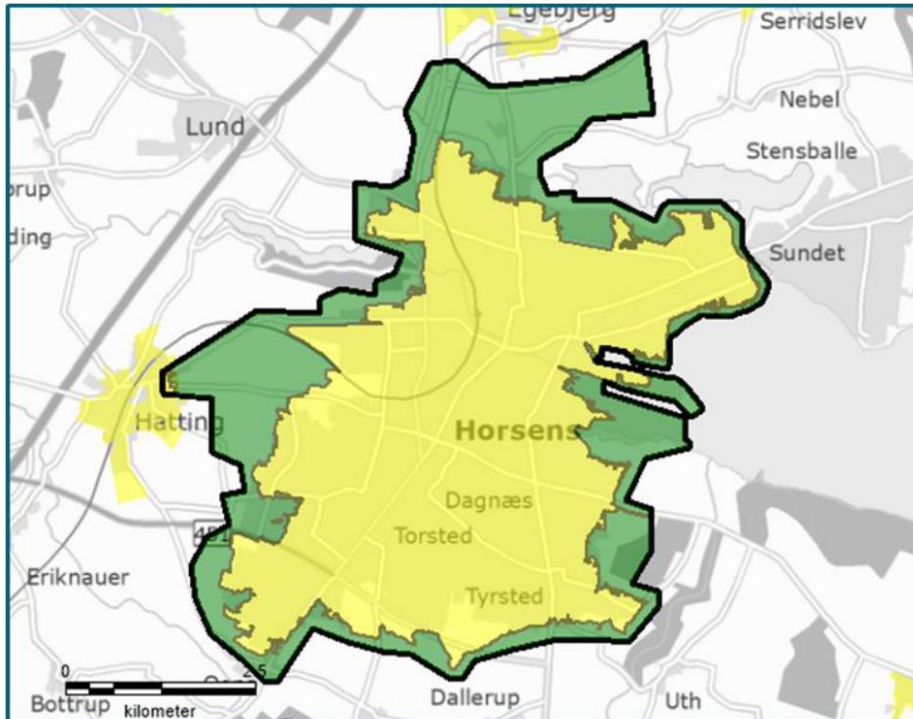Calibrating threshold values
for sluice
Sluice dimension (m3/sec)

Rain water contribution from the paved town area

Several flooding scenarious

-combinations of precipitation, watercourse runoff events and storm surges

Model domaine Horsens Town

Mike Urban
Sewer catchment area
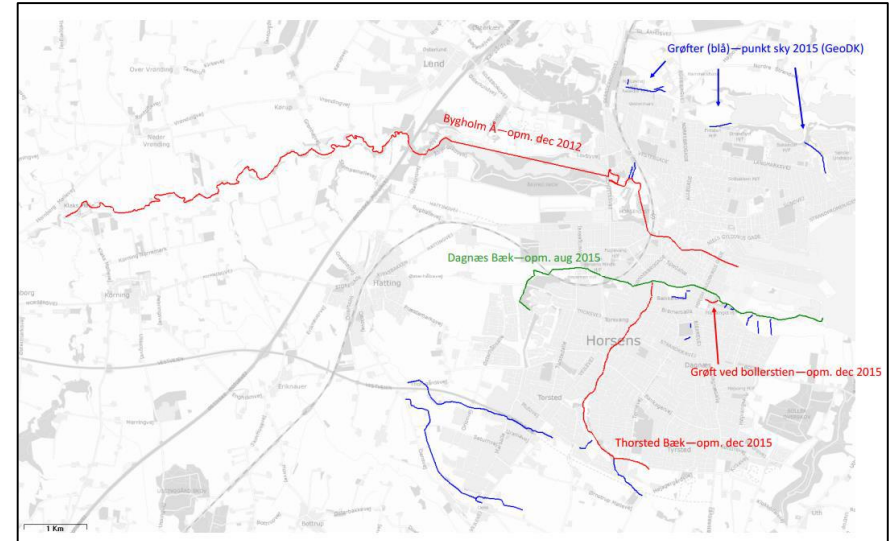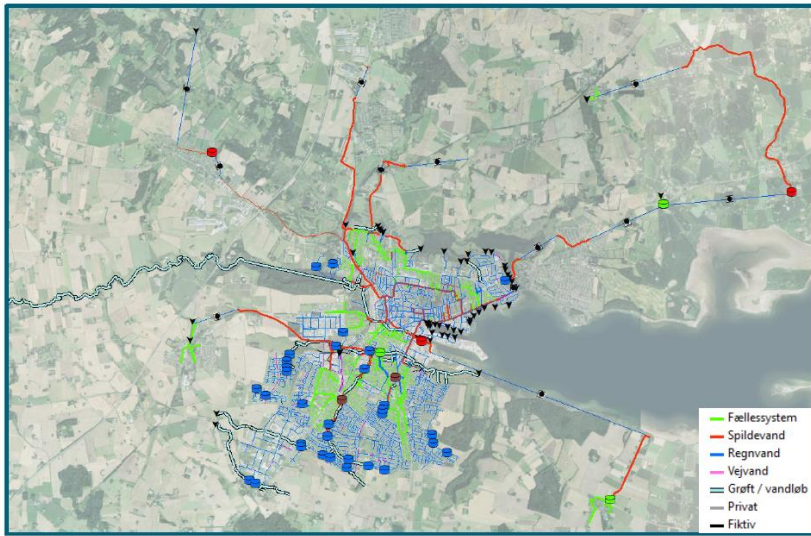
Mike 21FM
Topographic catchment area

Mike 21
Flooding sewers
Terrain
Water courses included

Mike model setup

-numerical model domain

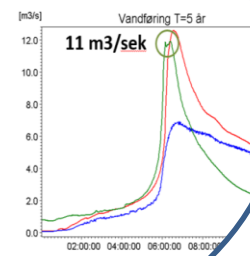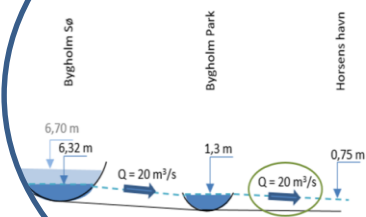MIKE 21FM (flooding)   ⟷   Mike Urban (sewer)

⬍

Water course model

Danish adviser

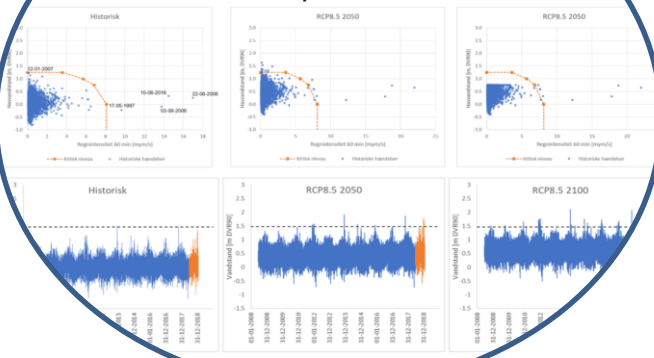# Study examples

Sections also needs LRD (Local Rainwater Drainage)
- in roads and public places
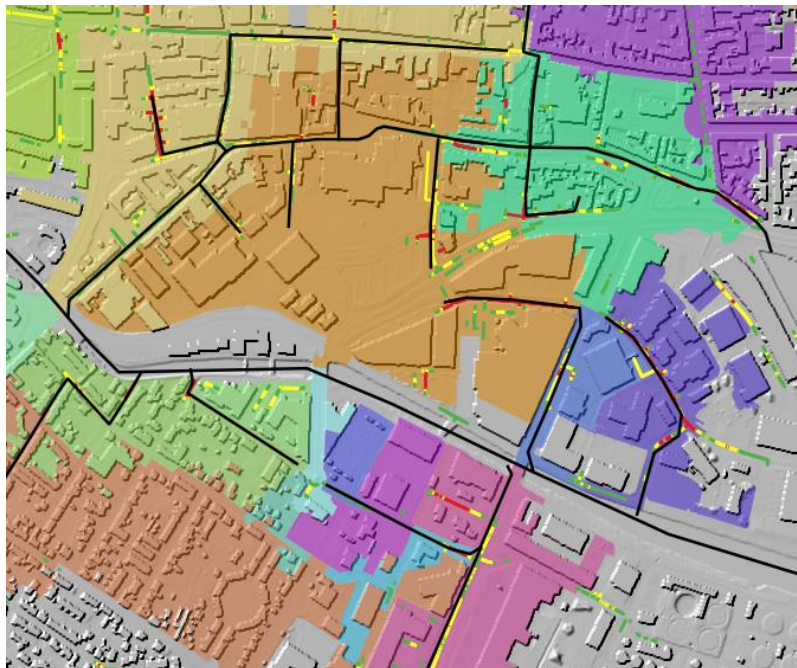
Overview future water infrastructure


Risk area

Reinforced road dam and new sluice

Road dam 2,6 m high water locks pumping system

Road dam locks and pumps

Floodprofing

- sea level RCP 8.5 100 year events in 2100
- stream flow untill 100 year events in 2100
- flooding directly from sewers until terrain 4 meter, at 5 year events in 2100

- and in simultaniety

-secure run off from a total of 156 ha of paved catchment area

- secure 25 outlets at the Bygholm water course

156 ha sewer
catchment area
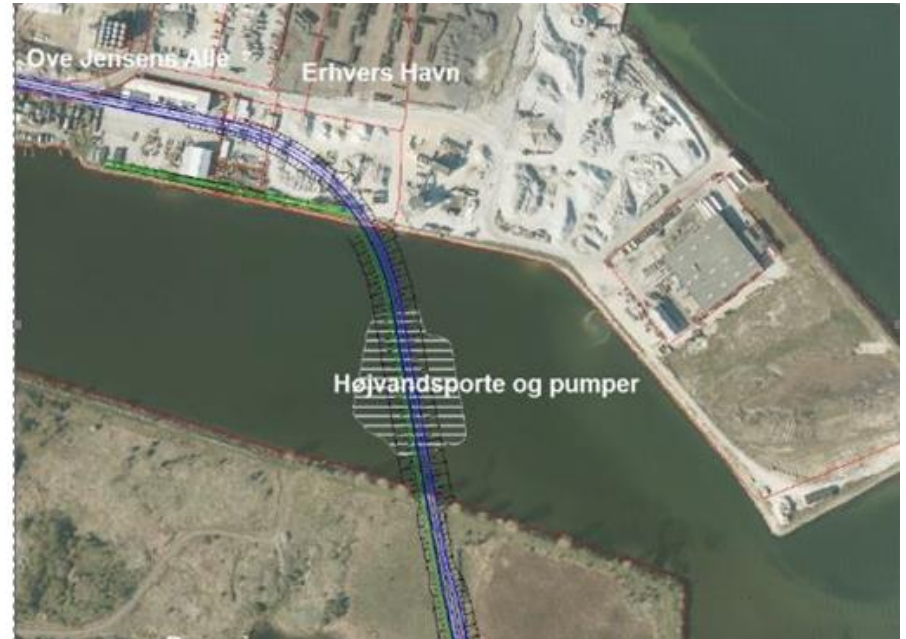

Horsens Kommune samn
FORSYNING
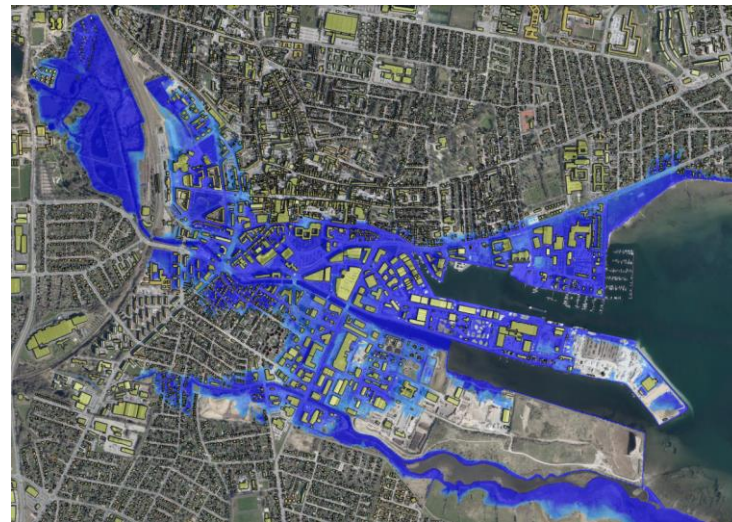
New bypass road and raising quays as storm surge barrier

New bypass road – storm surge barrier
Storm surge locks and pump system

Archimedes screw pump