

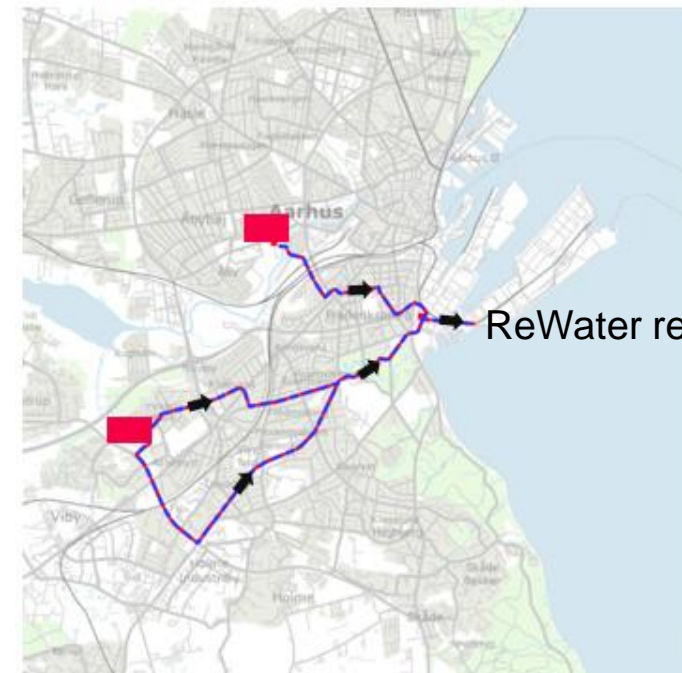
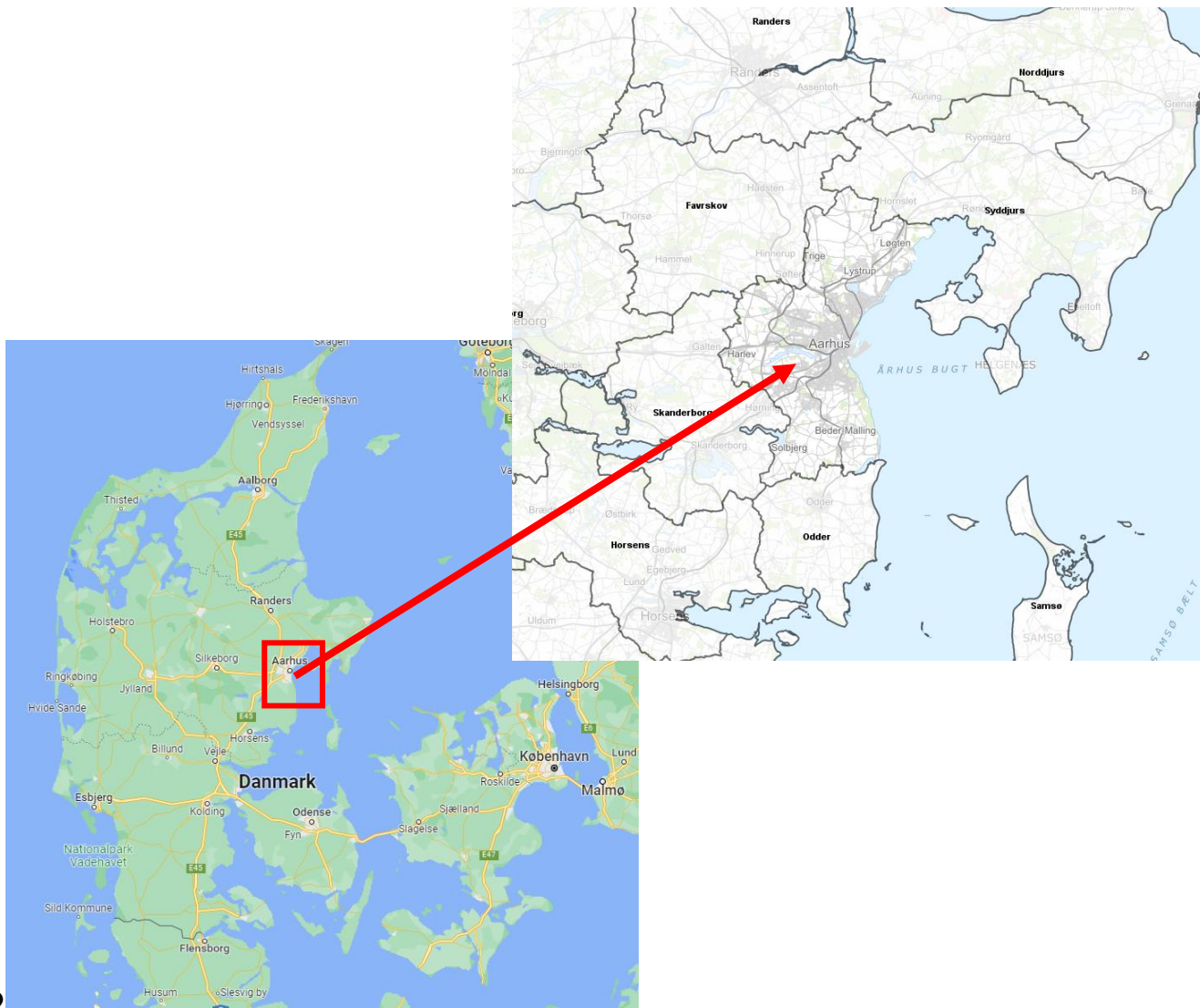
# Fuldskala monitorering af svovlbrinte til kalibrering af procesmodellering i Aarhus

EVA-Temadag: Spildevandet lugter  
– Hvad gør vi ved det?


Esther Vollertsen

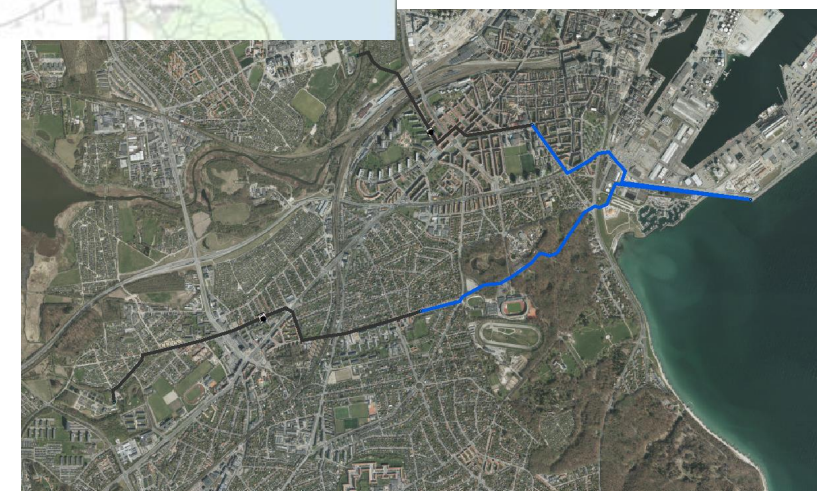


# Introduktion



ReWater rensesanlæg

 Rensesanlæg som nedlægges



# Målemetoder

Absorptionsmåling  
(grab-samples,  
Øjebliksmåling)



Væskefasesensorer

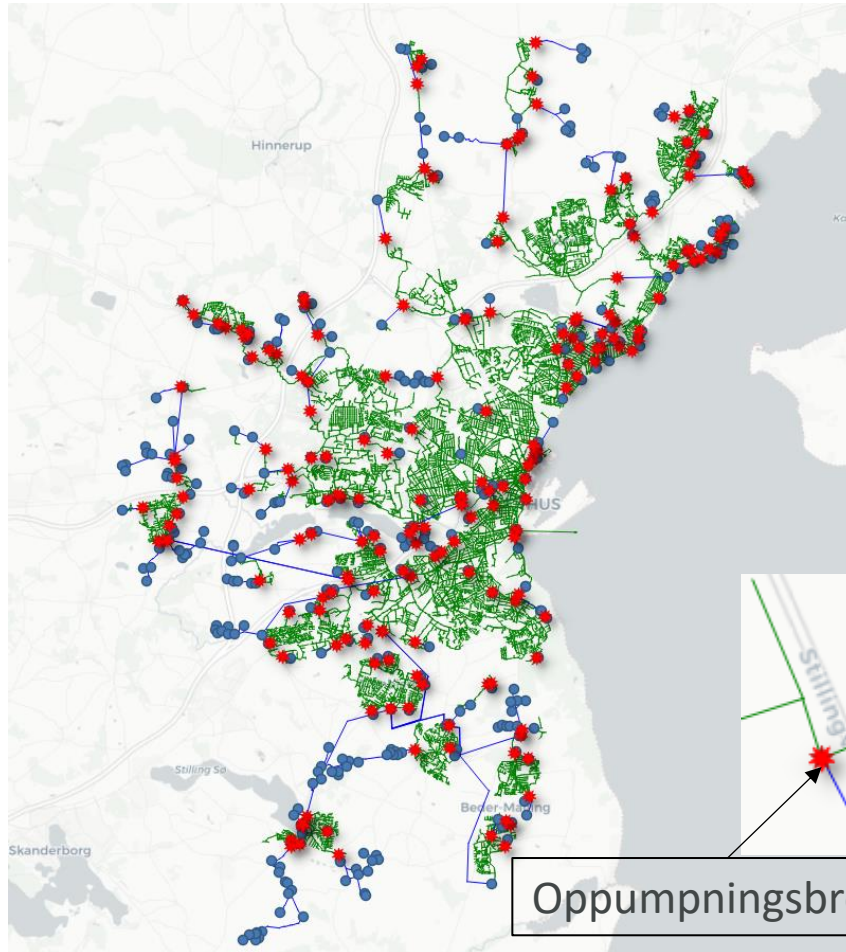


Gasfasesensorer





# Hvordan vælger man placering af målestationer?

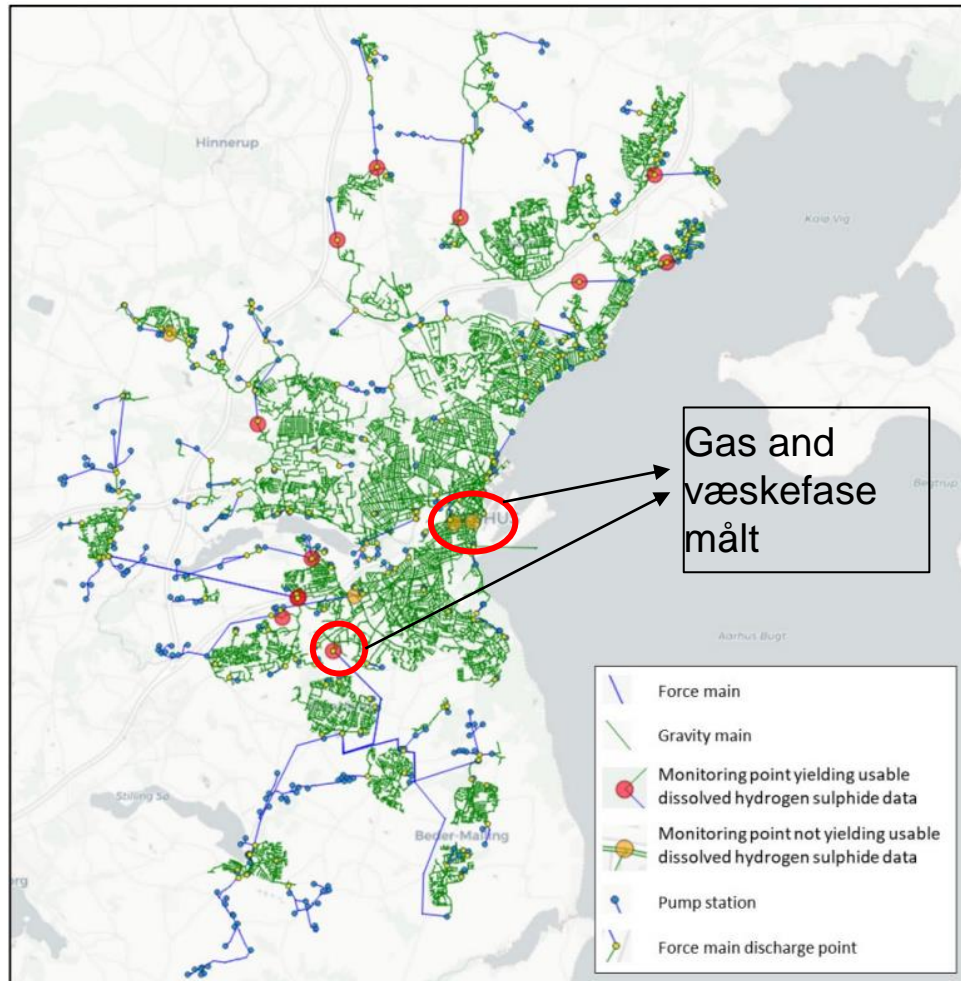


Hvor der er en trykledning, er der potentielt en risiko for svovlbrintedannelse.

Pumpestation

Oppumpningsbrønd

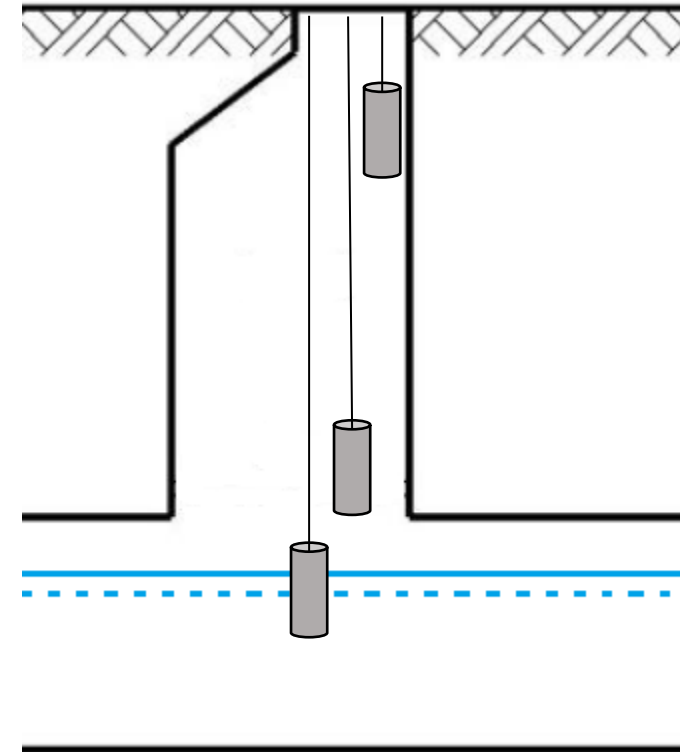
# Placering af målestationer



- Lokationer udvalgt på baggrund af Mega-WATS model og lugtklager.
- **Målt på 6 lokationer ad gangen.**
- Målt gennem længere tid, minimum 3 tørvejrskdage hvert sted.
- **Målekampagnen varede i 1 år.**
- Data indsamlet for alle sæsoner.

# Måling i væske eller i luften

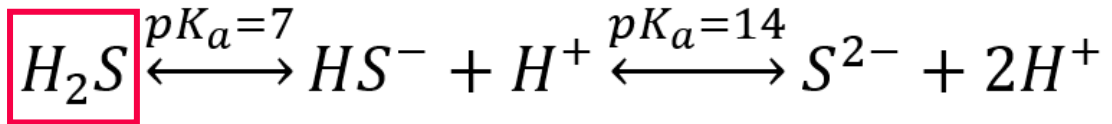
- Hvad er formålet med målingen?
- $H_2S$  koncentrationen fortyndes og omsættes jo længere fra kilden man måler.
- Turbulens
- Målinger i vandfasen er mere stabile.



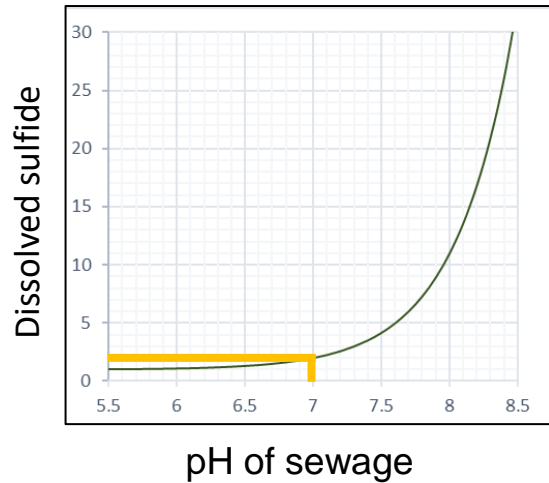
# Sulfilogger™



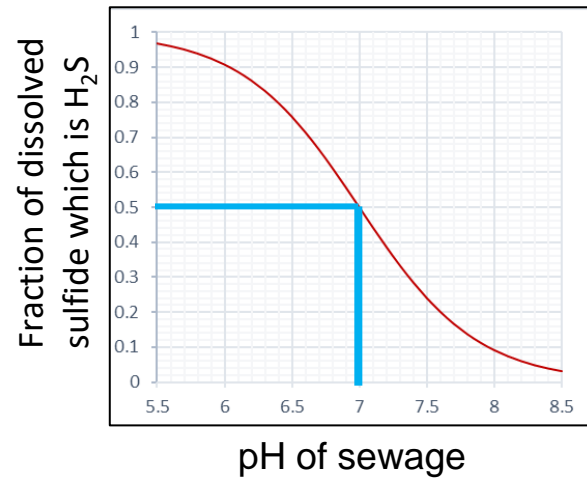
Sulfilogger.dk



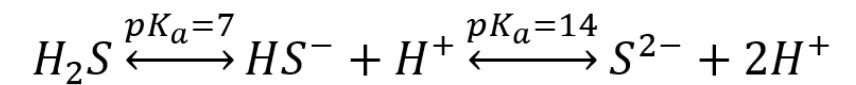
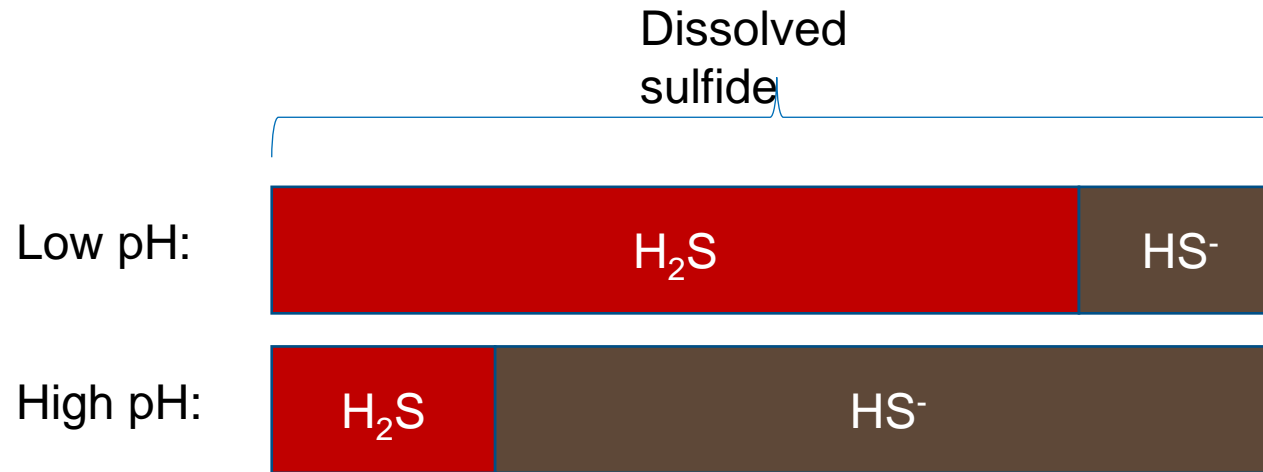
Dissolved sulfide when Sulfilogger measures 1 mg/L  $H_2S$



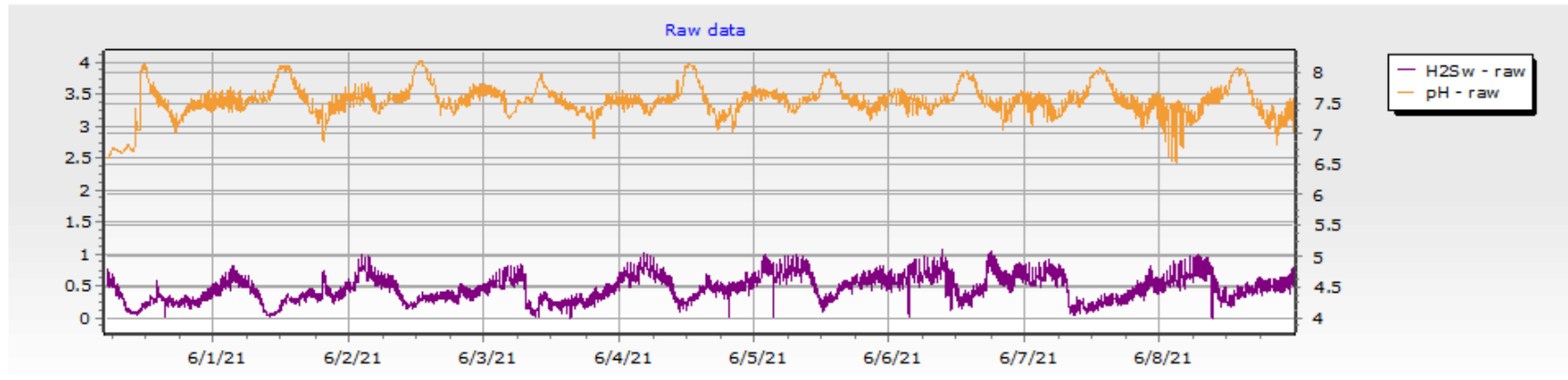
$H_2S$  measured by Sulfilogger



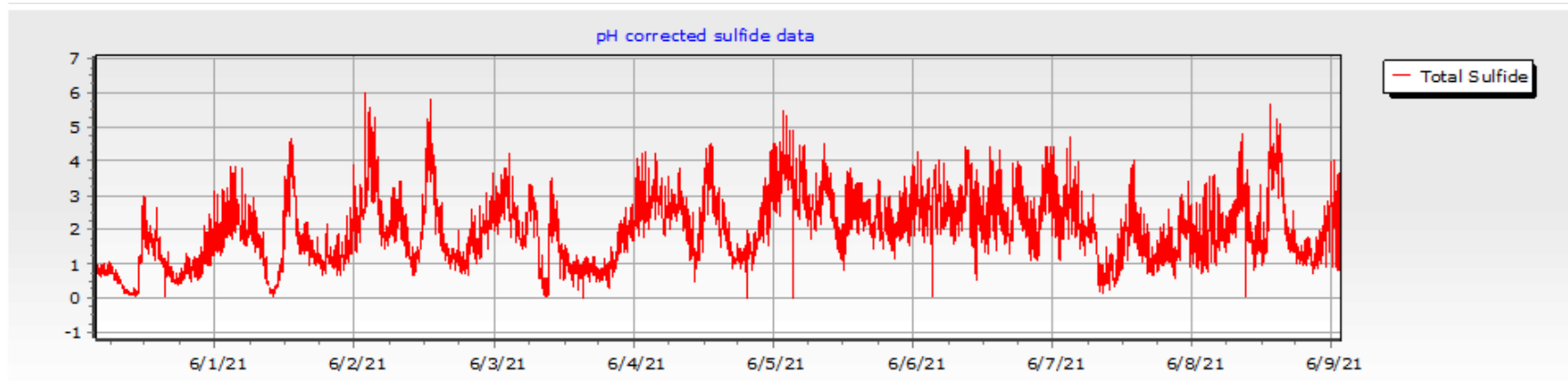
Measured H<sub>2</sub>S + Measured pH -> dissolved sulfide





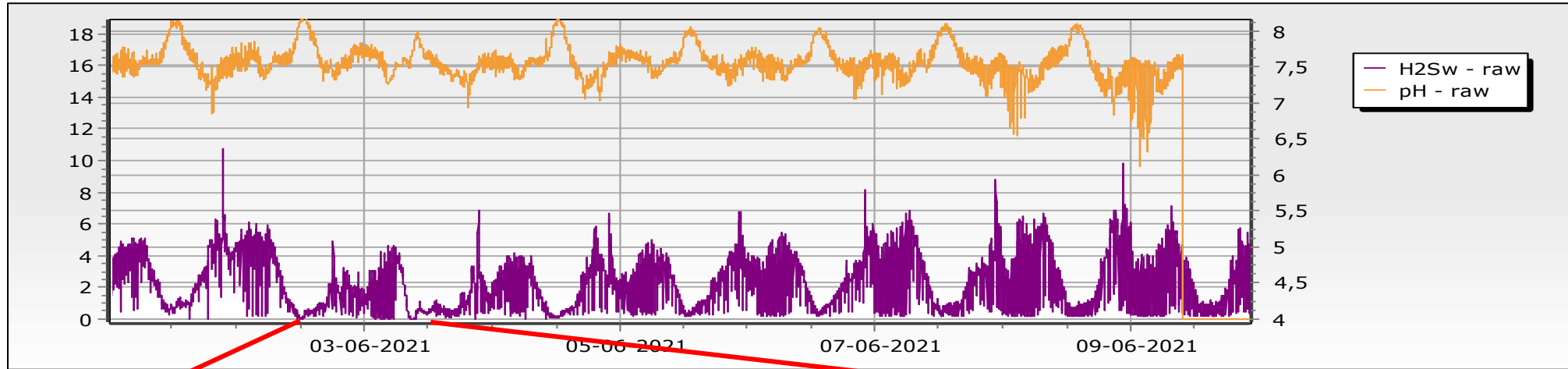


Continuously measured pH  
+  
Continuously measured H<sub>2</sub>S  
=  
Dissolved sulfide

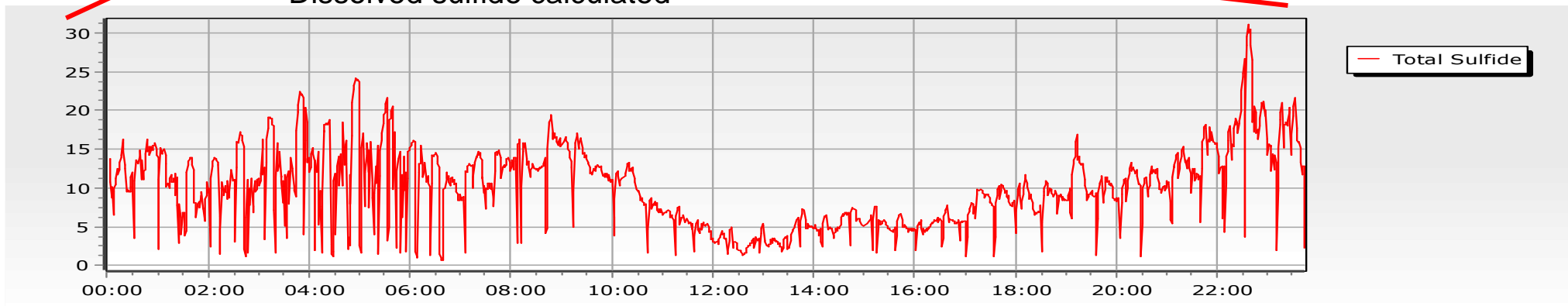


# Sulfilogger målinger

Raw data

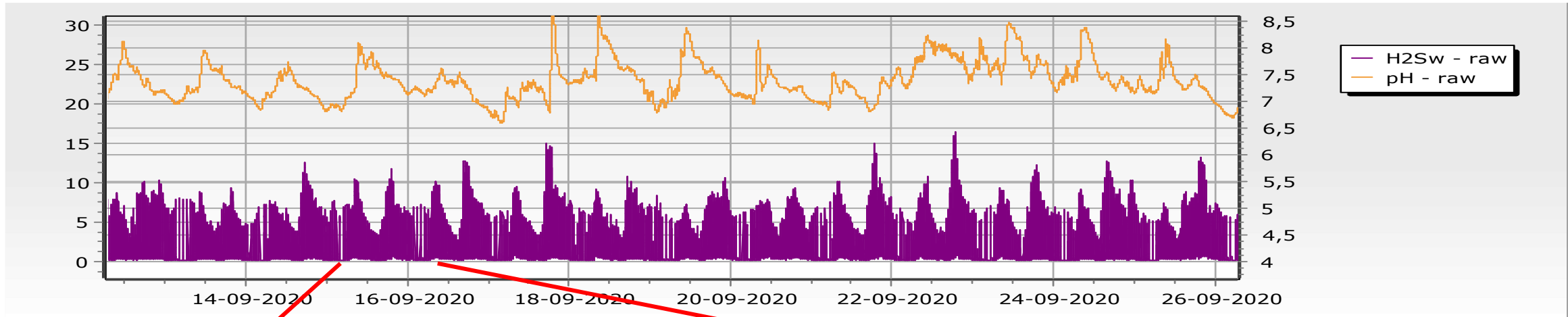


Dissolved sulfide calculated

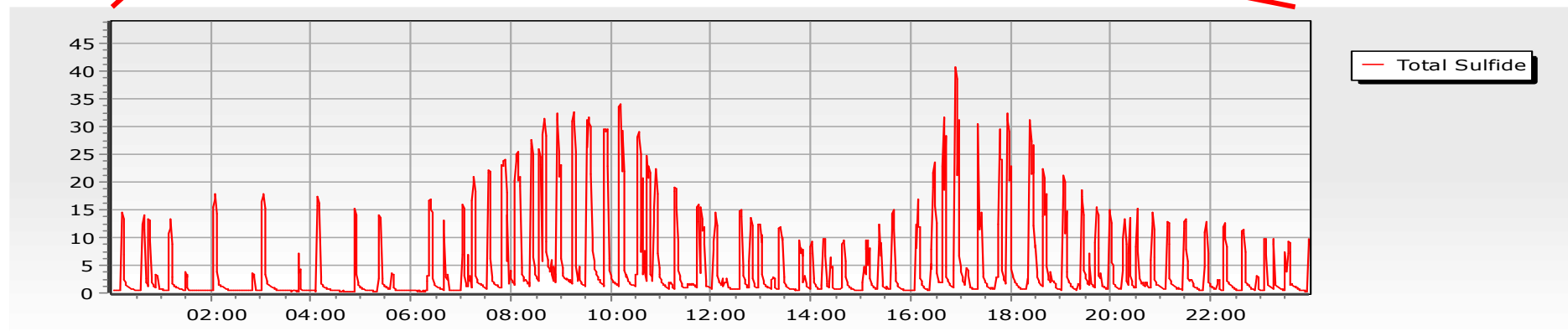


# Sulfilogger målinger

Raw data

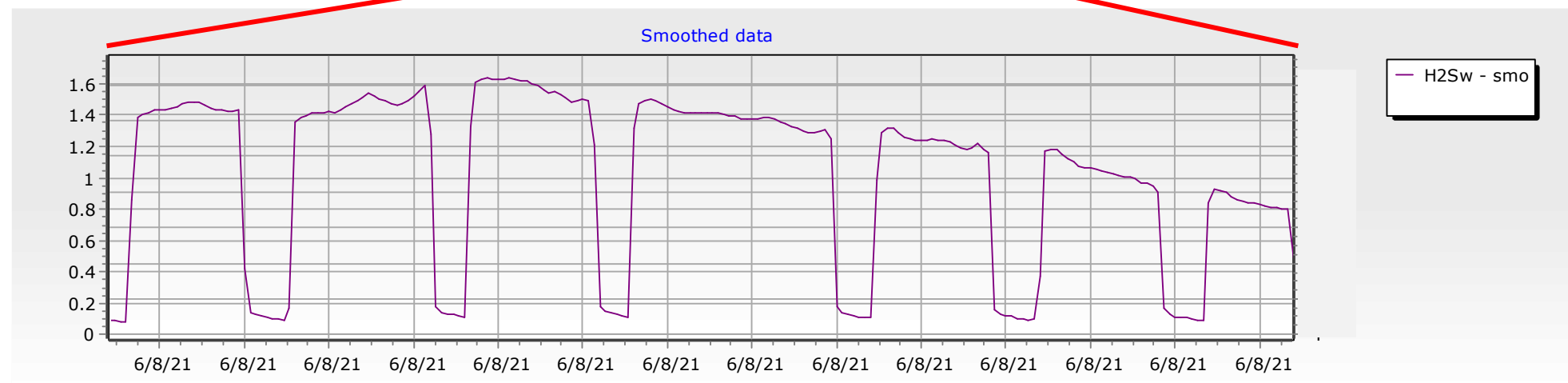
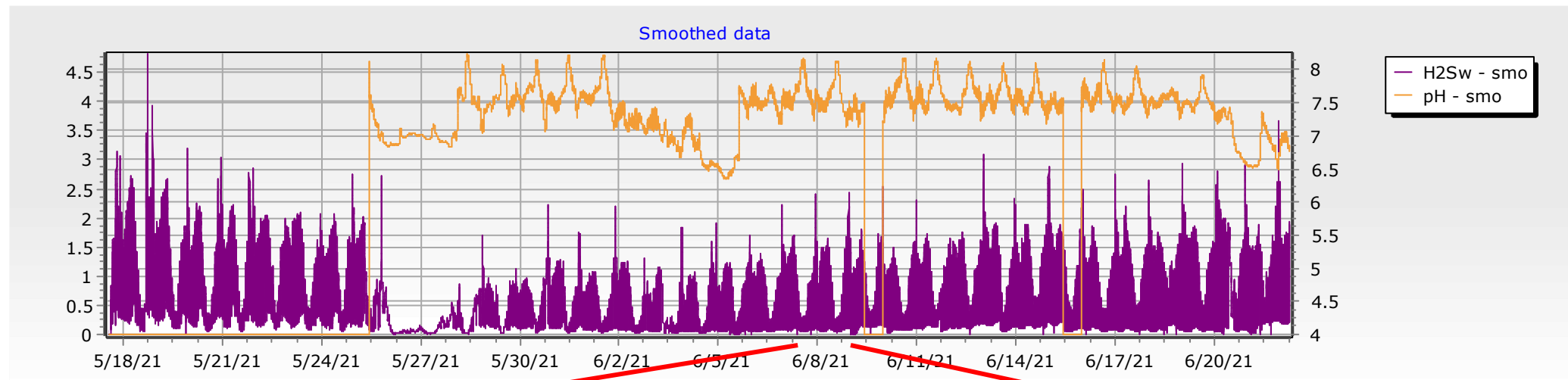


Dissolved sulfide calculated

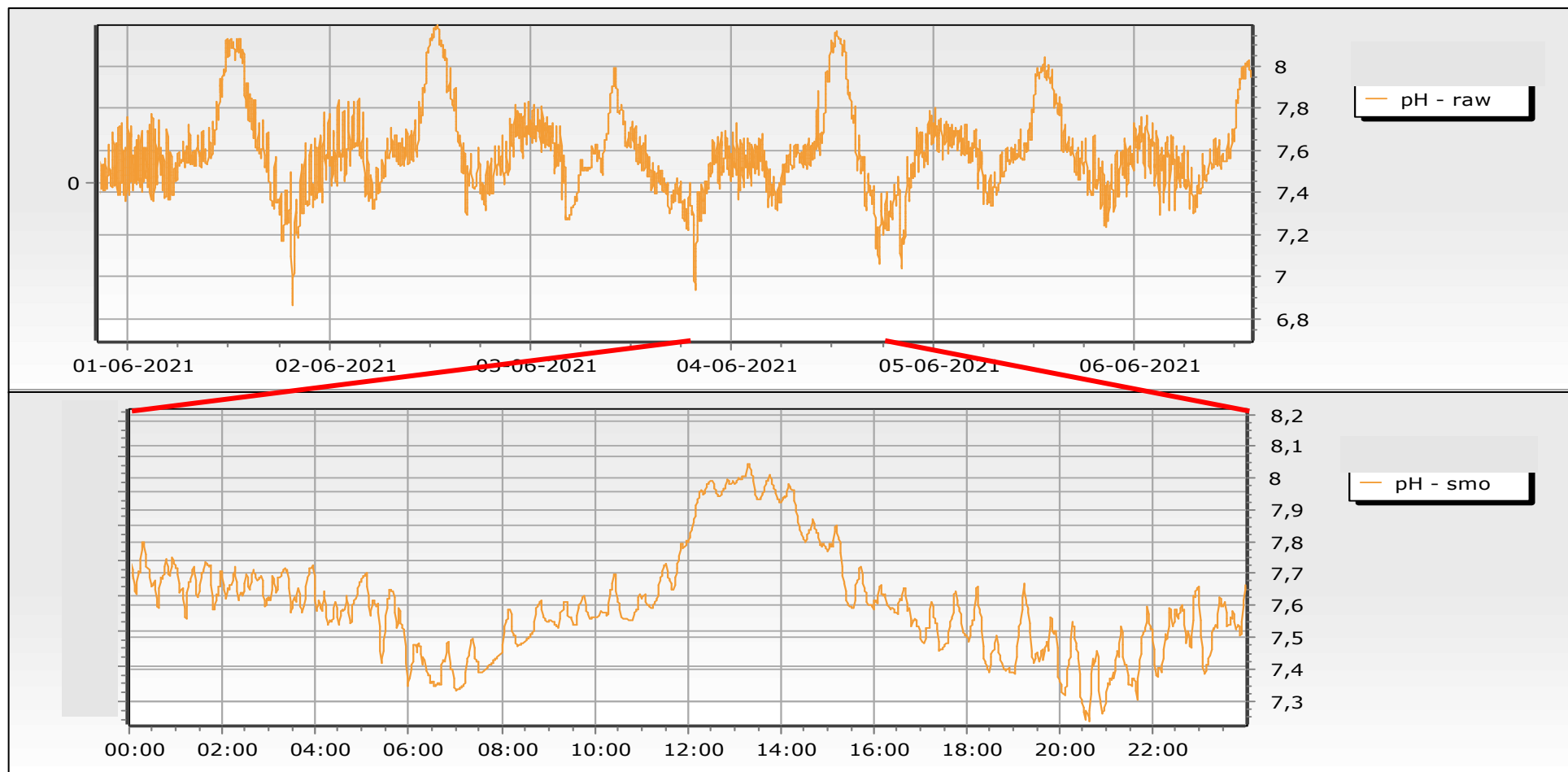




# Variation grundet pumpestart og stop



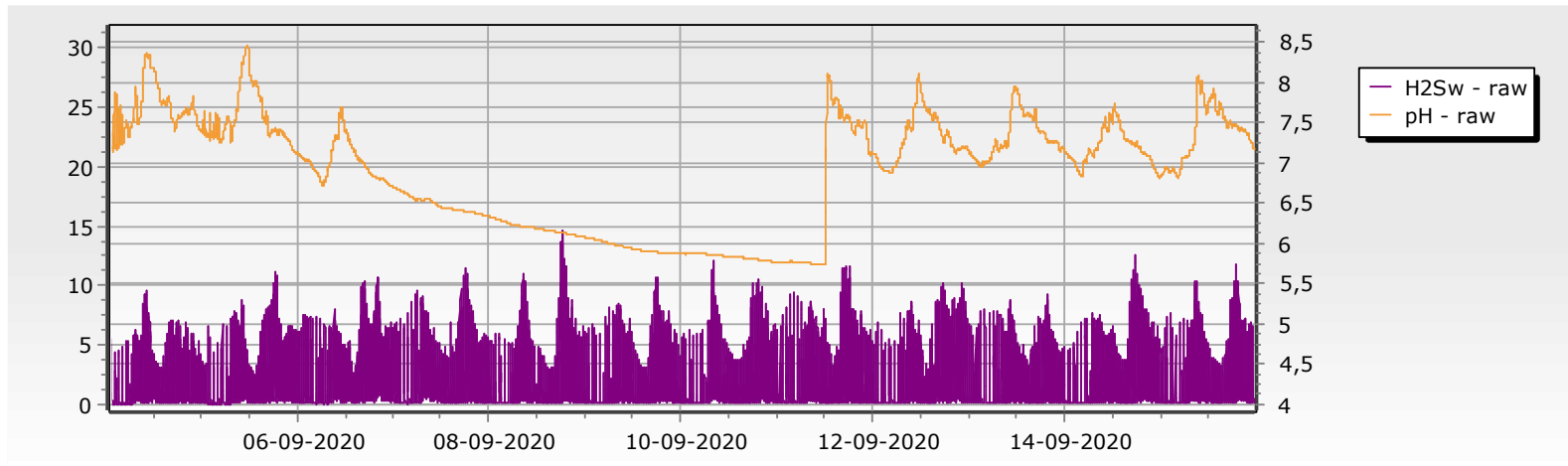
# pH målinger



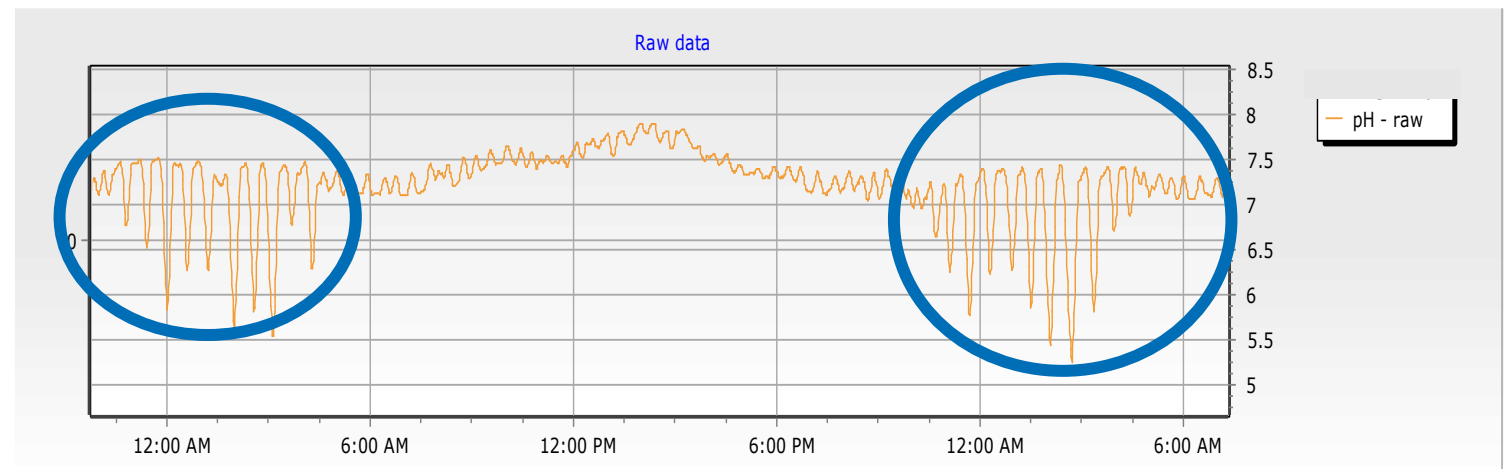
# Challenges with getting reliable measurements

The sewer is a harsh environment for the devices, which hence must be frequently maintained.

In Denmark, the amount of wastewater flowing in the pipes is often low.

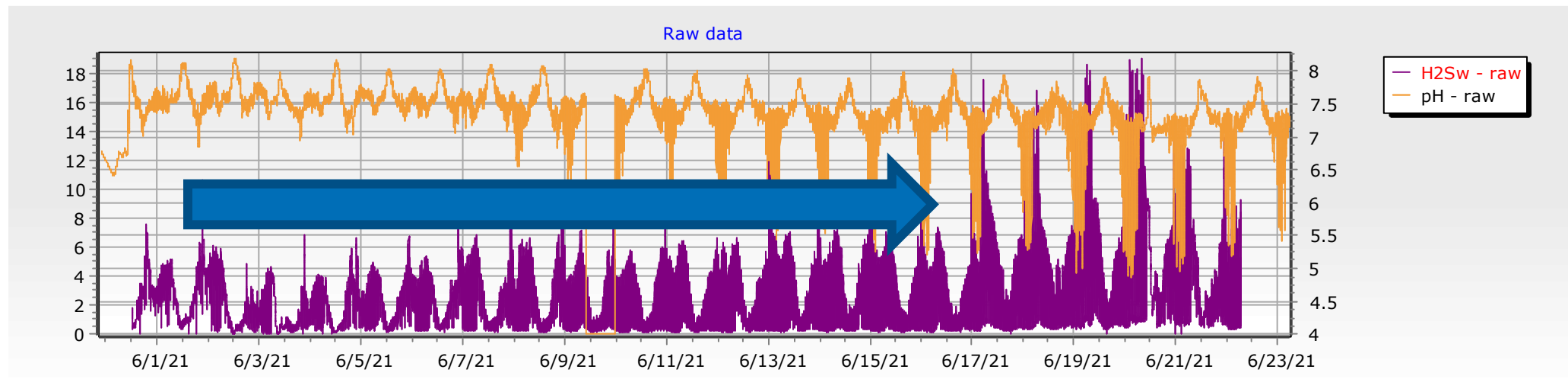
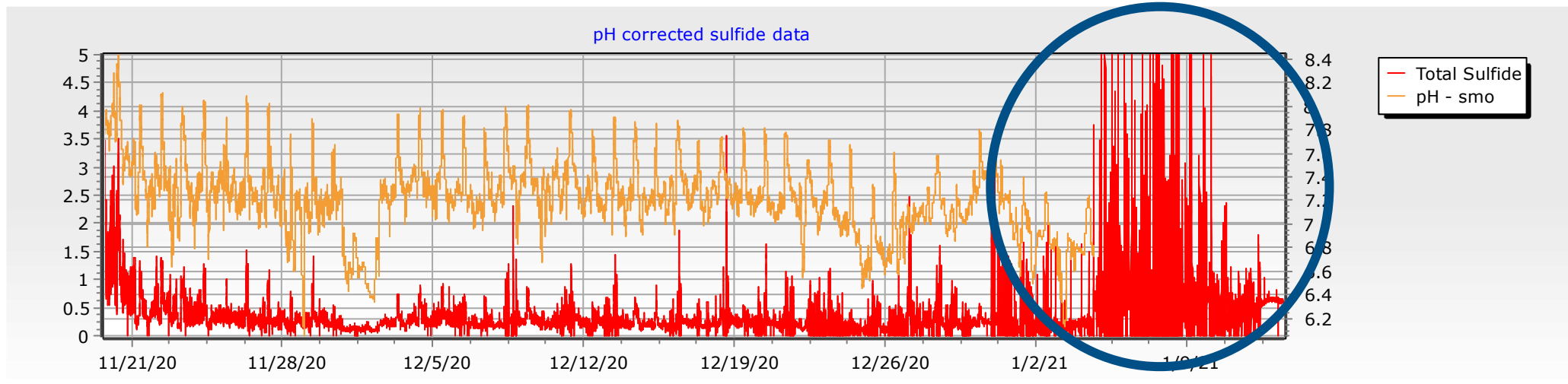


- Debris on the device.
- Drifting of the sensor signal.
- Calibration intervals.
- Low flow in the pipes, especially during the night.





# More challenges with Measurements



# Lessons learned

- Measuring H<sub>2</sub>S in the water is quite straightforward
- Measuring pH in the water is more tricky
- Beware of practical issues like keeping the sensors in the water

# Resultat af kalibrering

- Hvad lærte vi om systemet?
- Kom der nogle overraskelser?
  
- Vi fik primært bekræftet de indledende resultater.
- Det vigtigste ved modellering er at have styr på flow og COD.

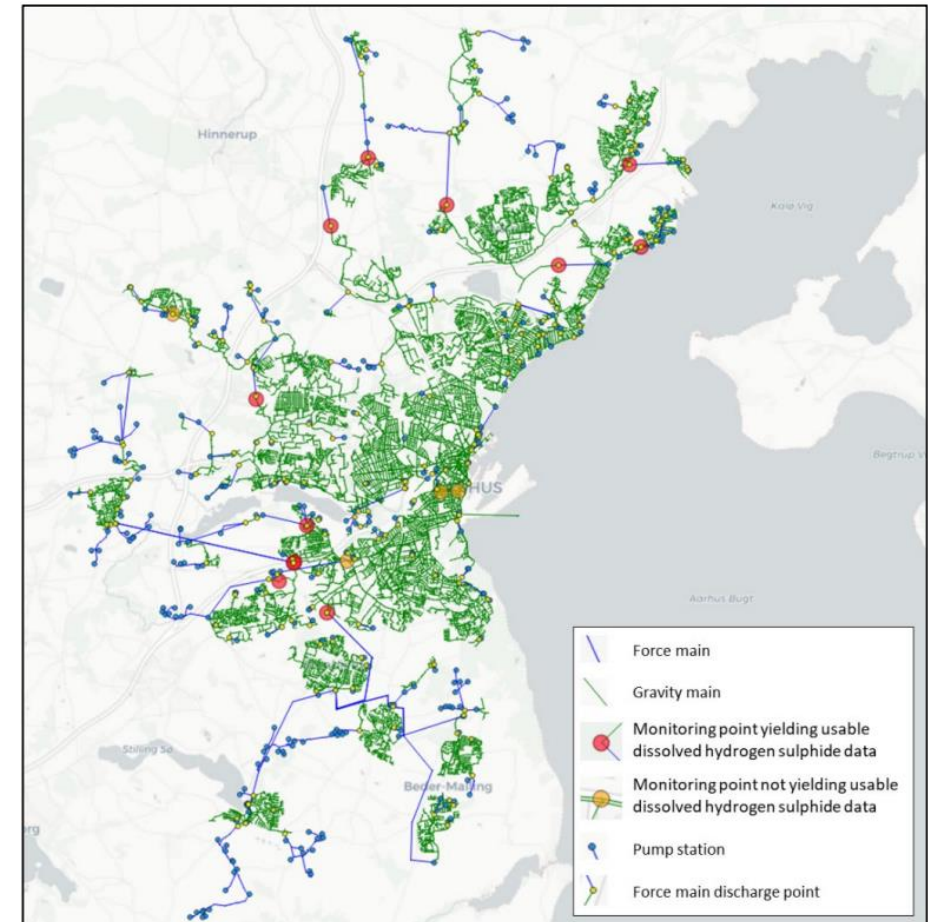


# Is it worth the effort?

- As always: It depends
- YES, if you need quantitative data on dissolved sulfide
  - For example, for model calibration
  - For example, for calculating the dosing of chemicals
- NO, if you simply need to qualify if there is an H<sub>2</sub>S issue or not
  - For example, customer complaints

# An example of where it pays off: Mega-WATS model calibration

- Results from measurements implemented into the model.
- 5 industries with high COD and water usage.
- COD, pH and flow from the 4 existing wastewater treatment plants.



# Planning tool – asset management

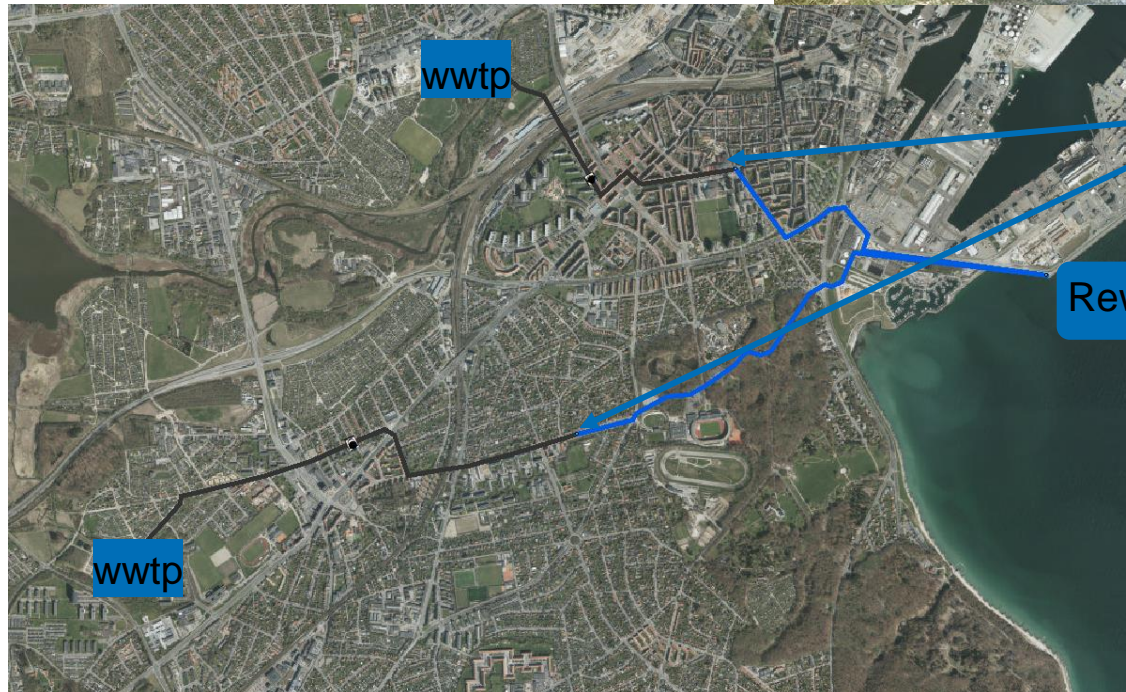
## Planning tool

The model can be used to try different scenarios or calculate the effect of planned urban areas.

Rewater, a new wastewater treatment plant scheduled to open in 2028.

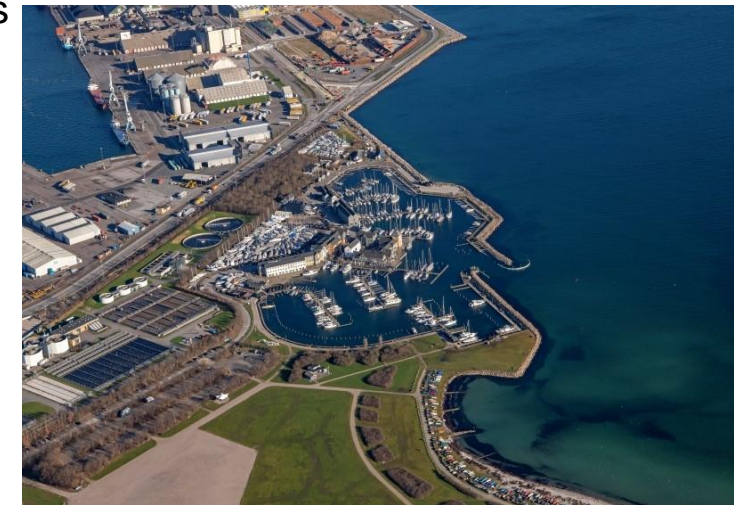


As asset management tool it is possible to use the results to predict when the pipes need to be renewed due to corrosion.



Force main ends

Rewater treatment plant

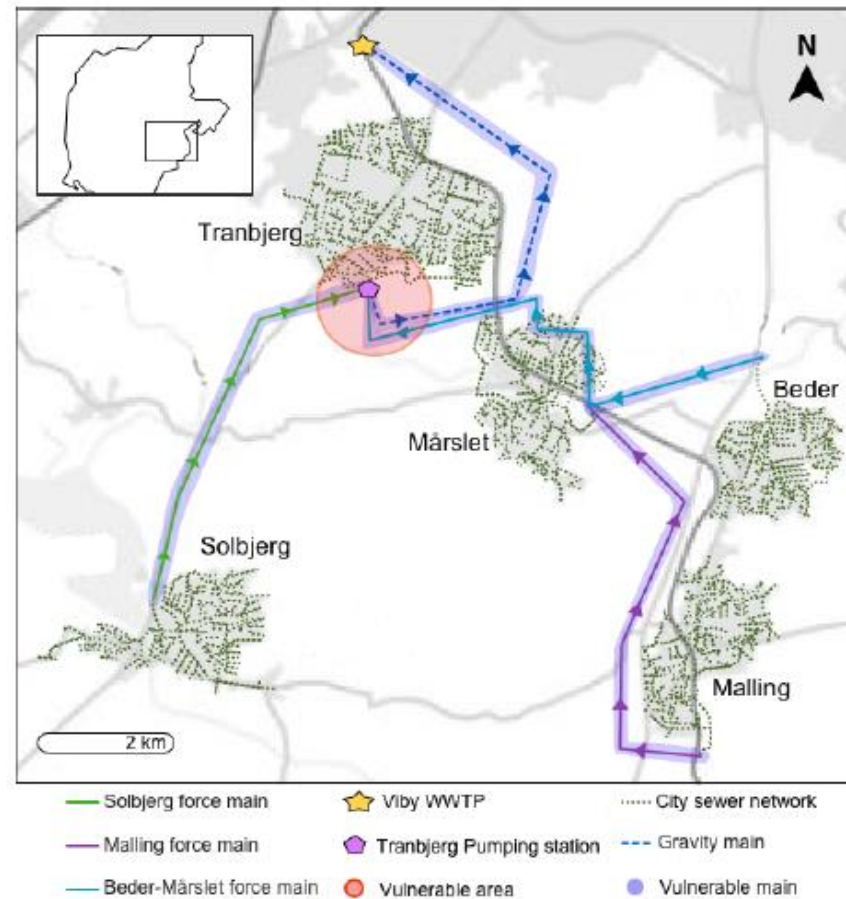




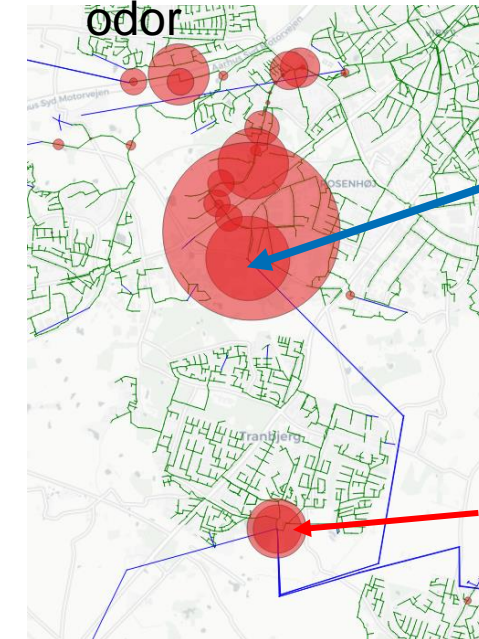
# Odor problem case

## The issue

- WWTP decommissioned
- Long force mains
- Gravitation through odor-sensitive areas
- Major odor issues



## Mega-WATS prediction of odor



Downstream discharge manhole

Old WWTP

\*Vestergaard, N.H (2023) A nature-based solution to remove hydrogen sulphide.

# Problem løst med muslingefilter

- Muslingefilter
  - Naturligt uden kemikalier





# Tak for opmærksomheden

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aarhusvand

