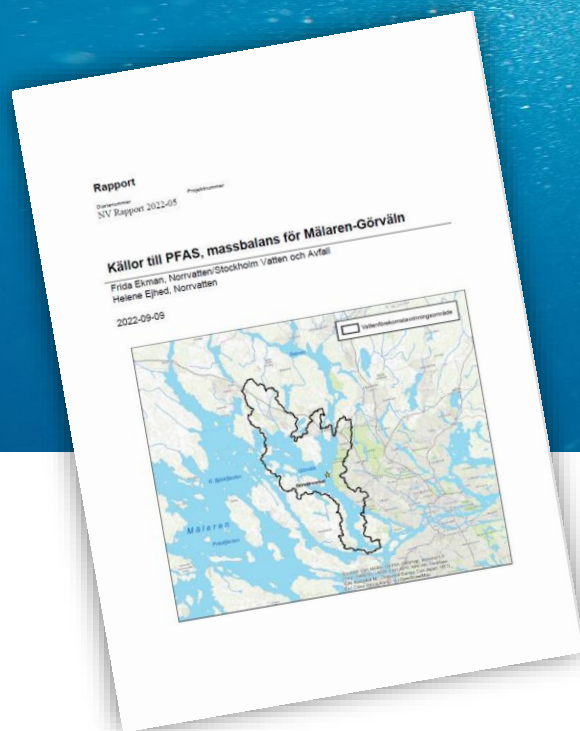


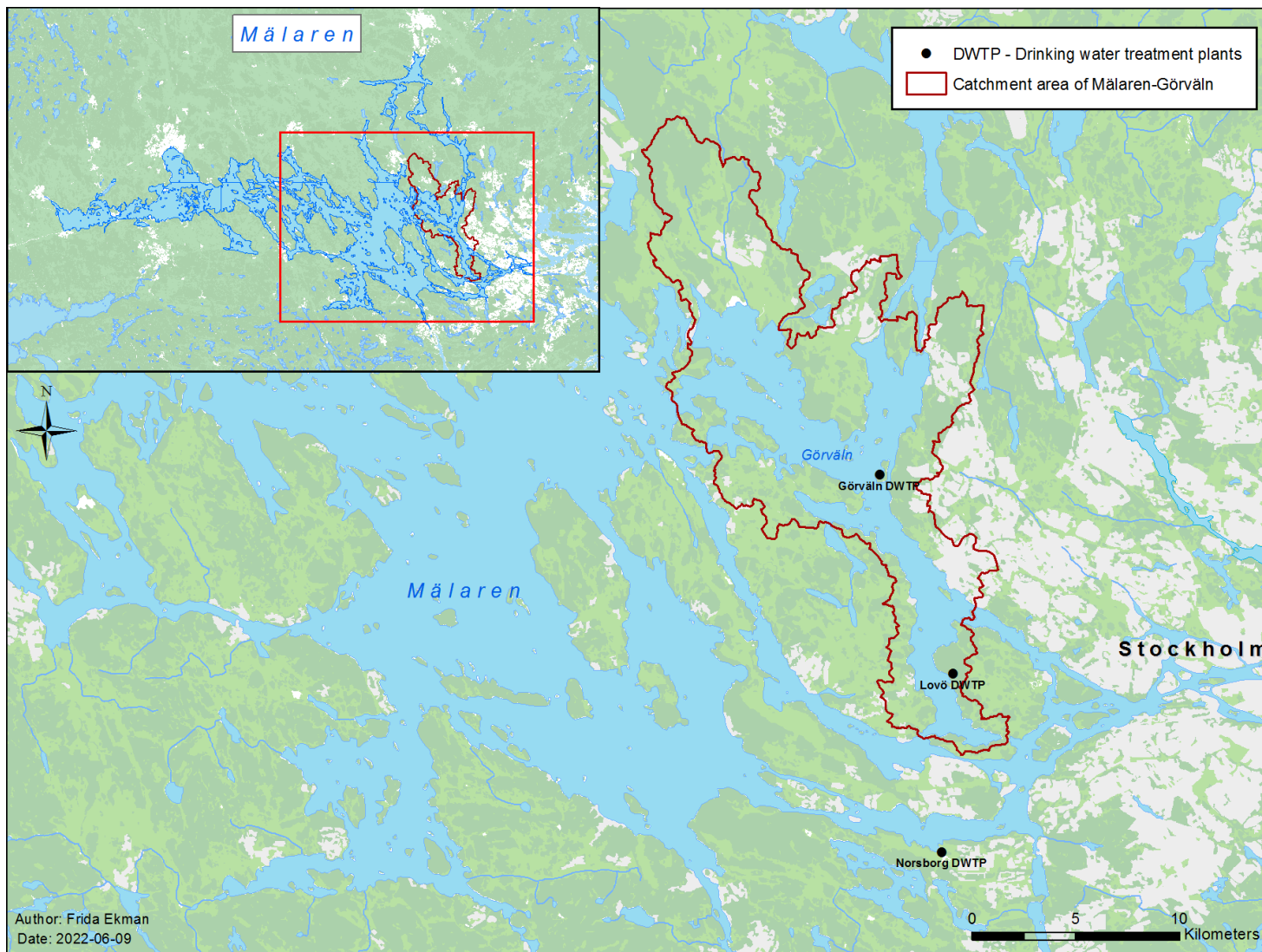
Upstream sources of Per- and polyfluoroalkyl substances (PFAS) to raw water in lake Mälaren-Görvälän

Frida Ekman (SVOA) & Helene Ejhed (Norrvatten)



Swedish title:

Källor till PFAS, massbalans för Mälaren-Görvälän



Görvål, Lovö and Norsborg DWTP produces drinking water to approx. 2 million people

Background

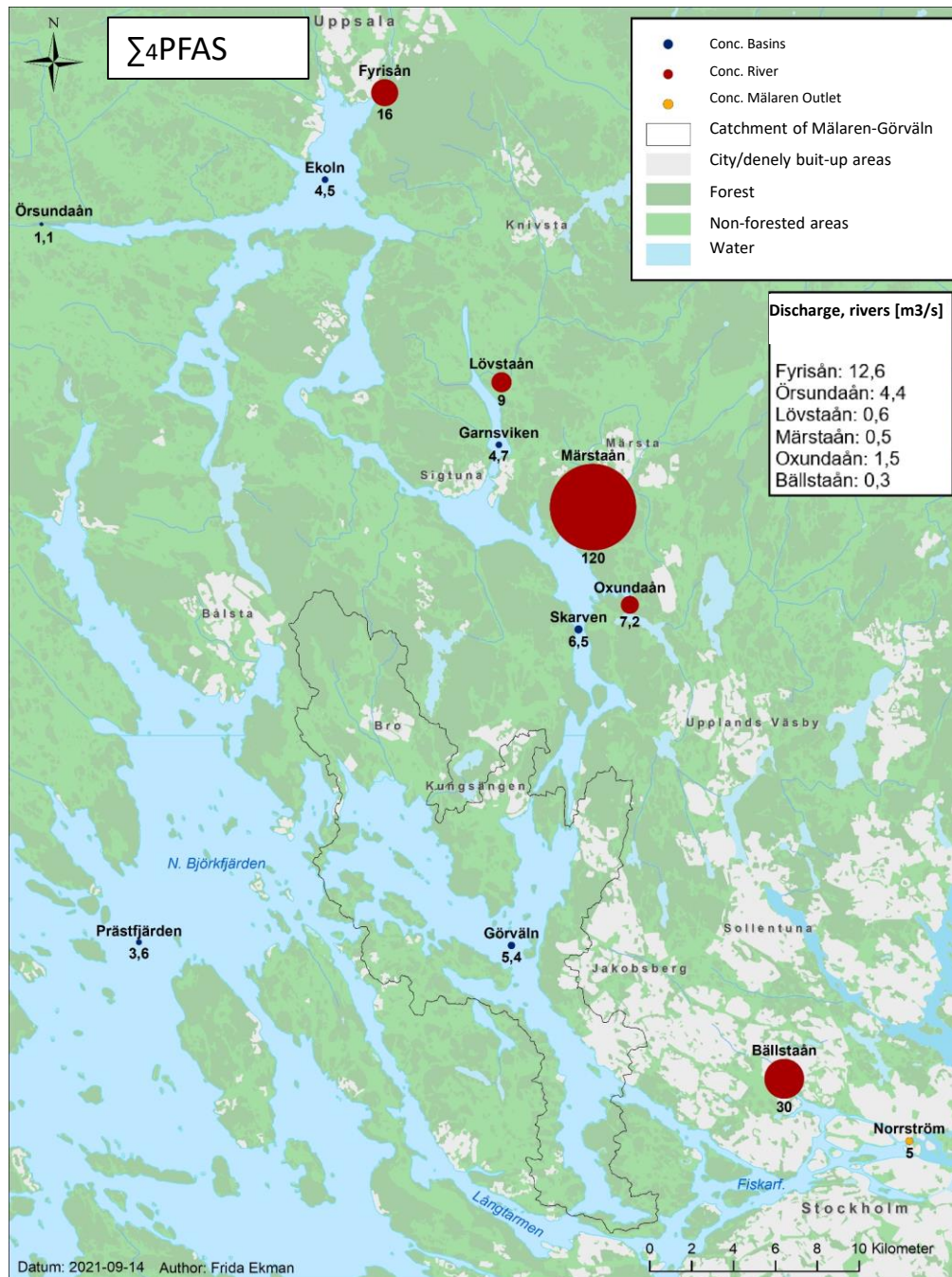
Upstream sources of PFAS to raw water in lake Mälaren-Görvån

- EU drinking water directive (2020)
 - \sum_{20} PFAS = 100 ng/l
- EFSA, TWI (2020):
 - \sum_4 PFAS: 4,4 ng /kg body weight

Sweden:

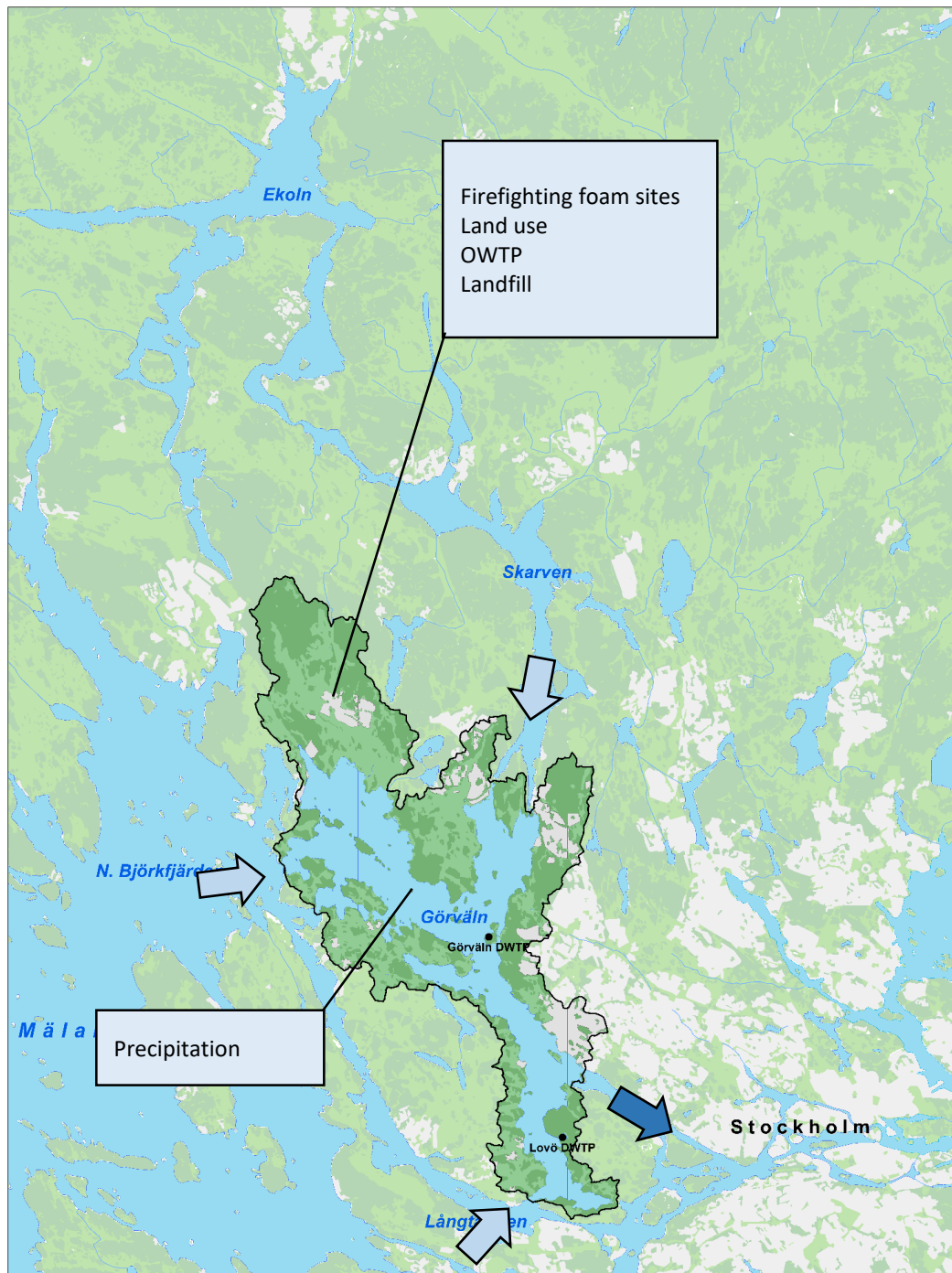
- Previous limit: \sum_{11} PFAS = 90 ng/l
- New Safety Threshold:
 - \sum_{21} PFAS = 100 ng/l
 - \sum_4 PFAS = 4 ng/l
 } Implemented jan 2026
- In the eastern part of Mälaren:
 - \sum_4 PFAS = 3-6,5 ng/l

Past year: 4 ng/l



Objective

Calculate a mass balance for the catchment area of Mälaren-Görvål (kg/year).



Outflow – \sum Inflows

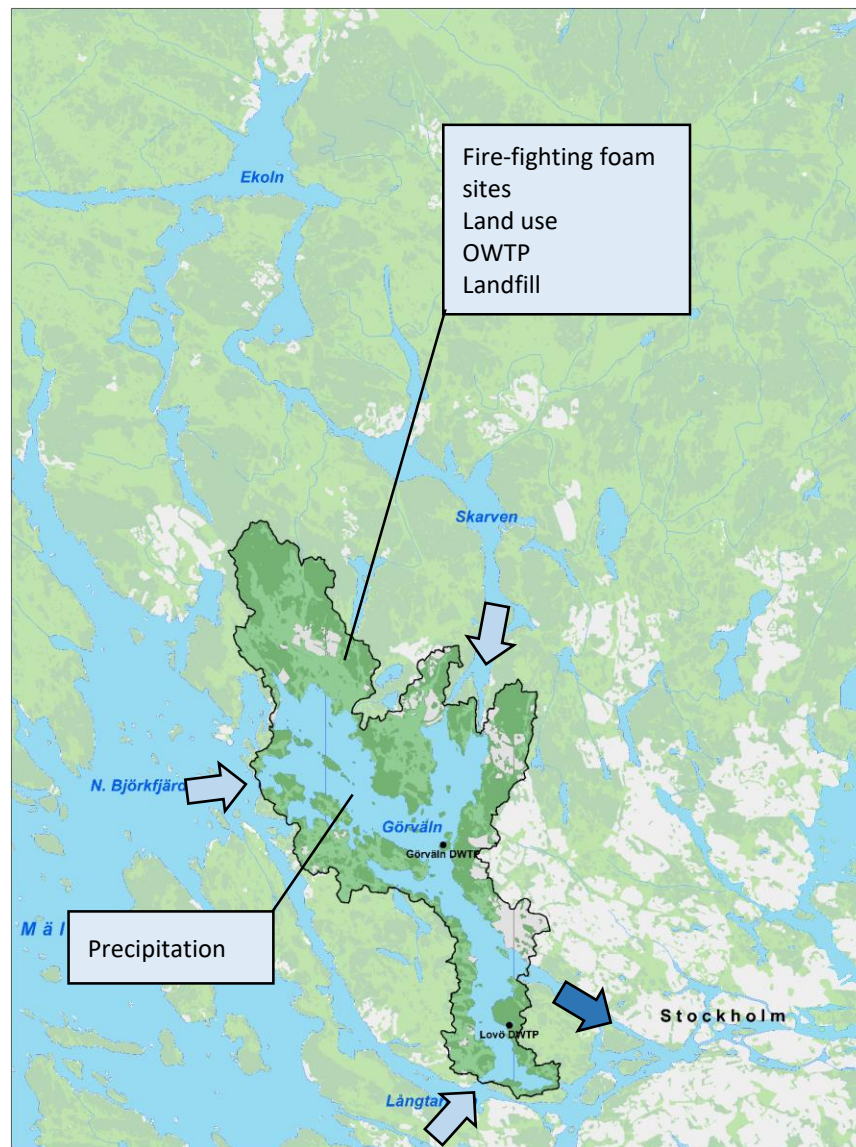
- Inflows from adjacent basins
- Sites where firefighting foam has been used
- Different Land uses
- One Landfill
- On-site waste water treatment plants
- Precipitation

Goal

- Develop a method for calculating PFAS mass-flows
- Priorities upstream measures and efforts

Method

All data used are based on data from previous projects



Σ Inflows

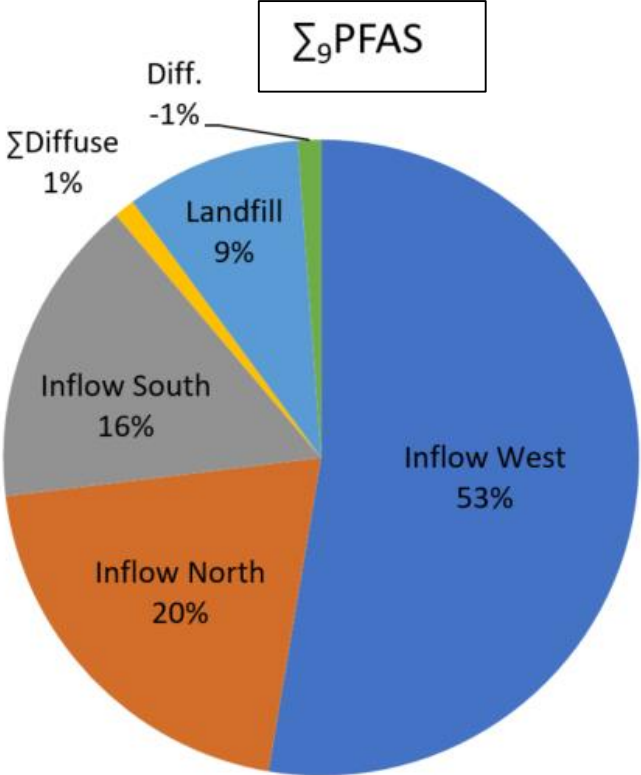
- Inflows from adjacent basins
- Sites where fire-fighting foam has been used
- Different Land uses
- One Landfill
- On-site waste water treatment plants
- Precipitation

→ Simplification, generalisations:

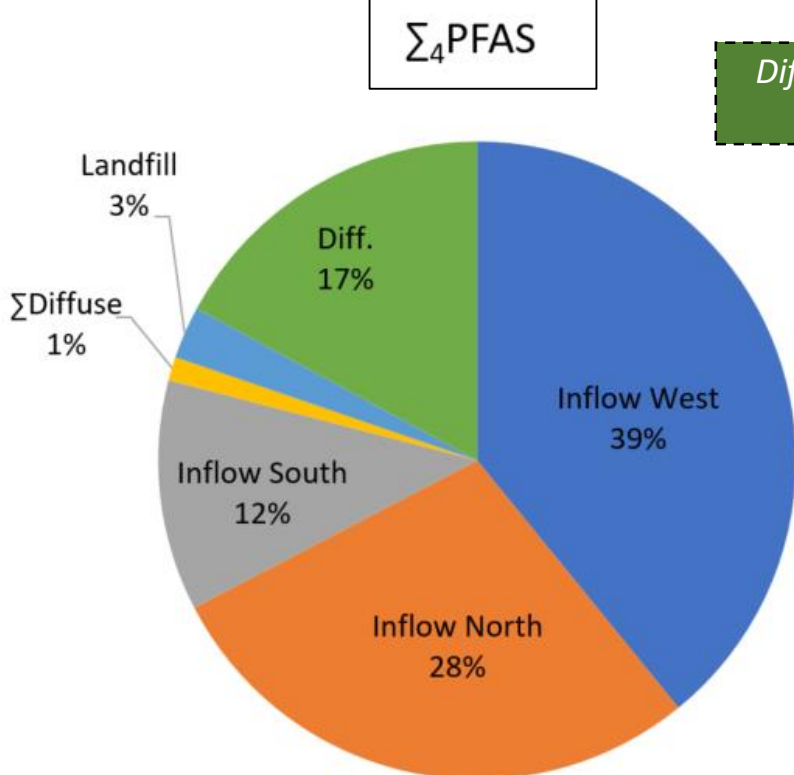
Results should be interpreted as indications,

→ An idea of the magnitude of different massflows in relation to each other

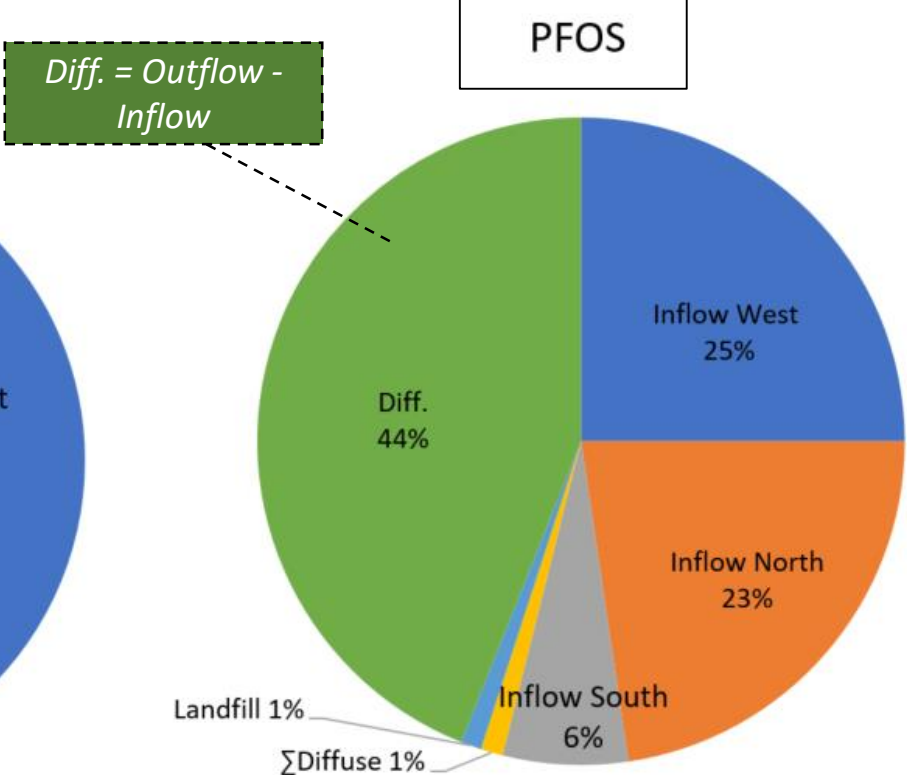
Results



Outflow = 31 kg/y

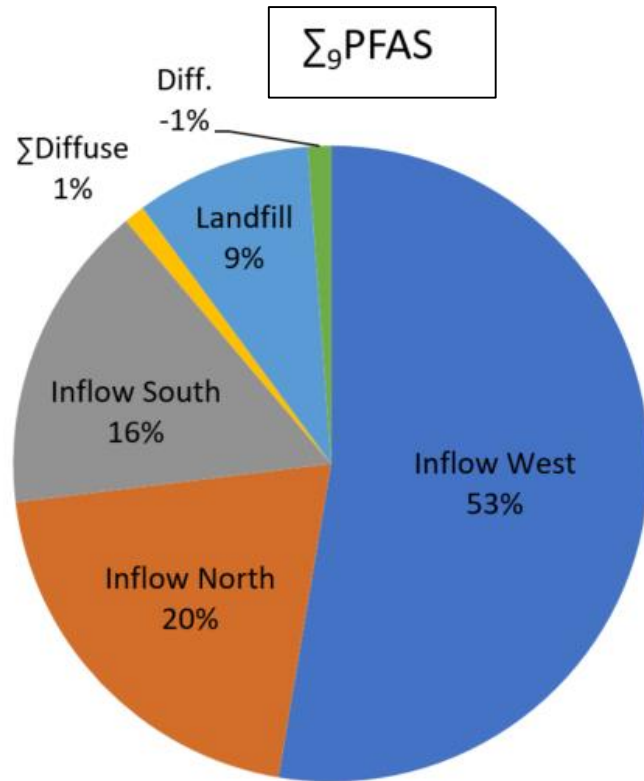


Outflow = 16 kg/y



Outflow = 6,4 kg/y

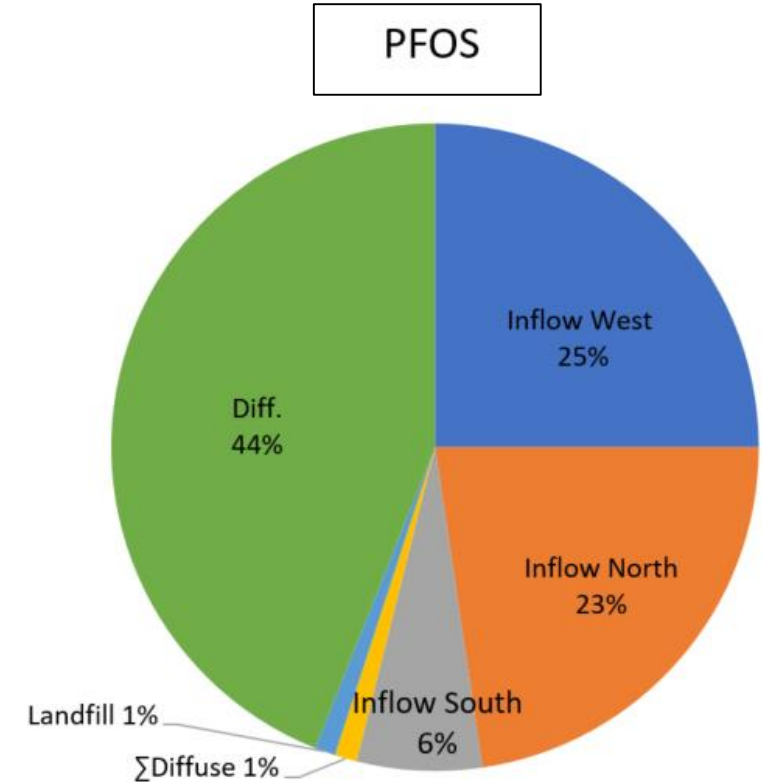
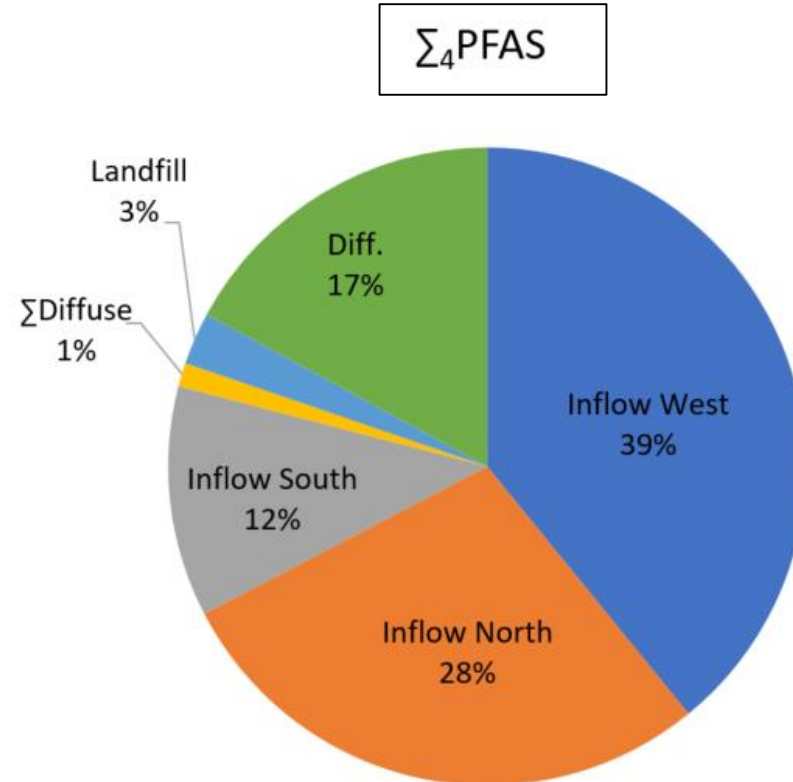
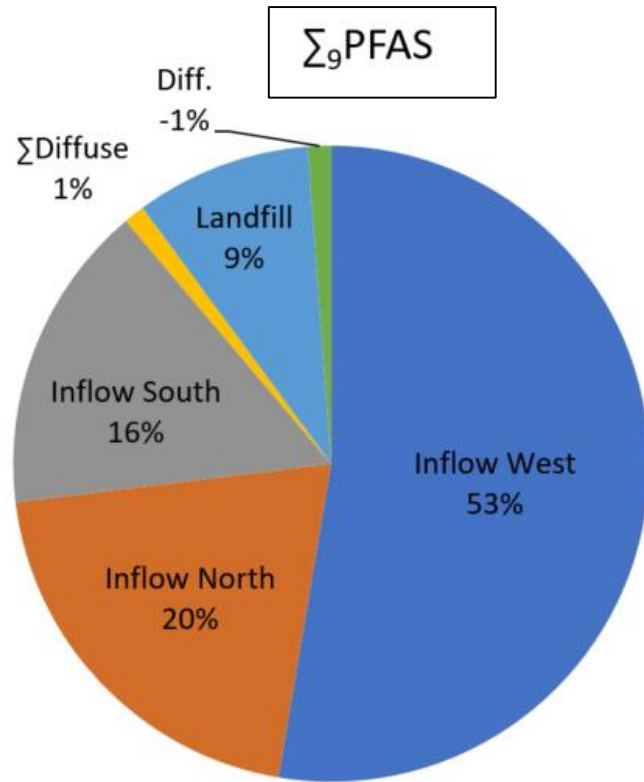
Results



Outflow = 31 kg/y

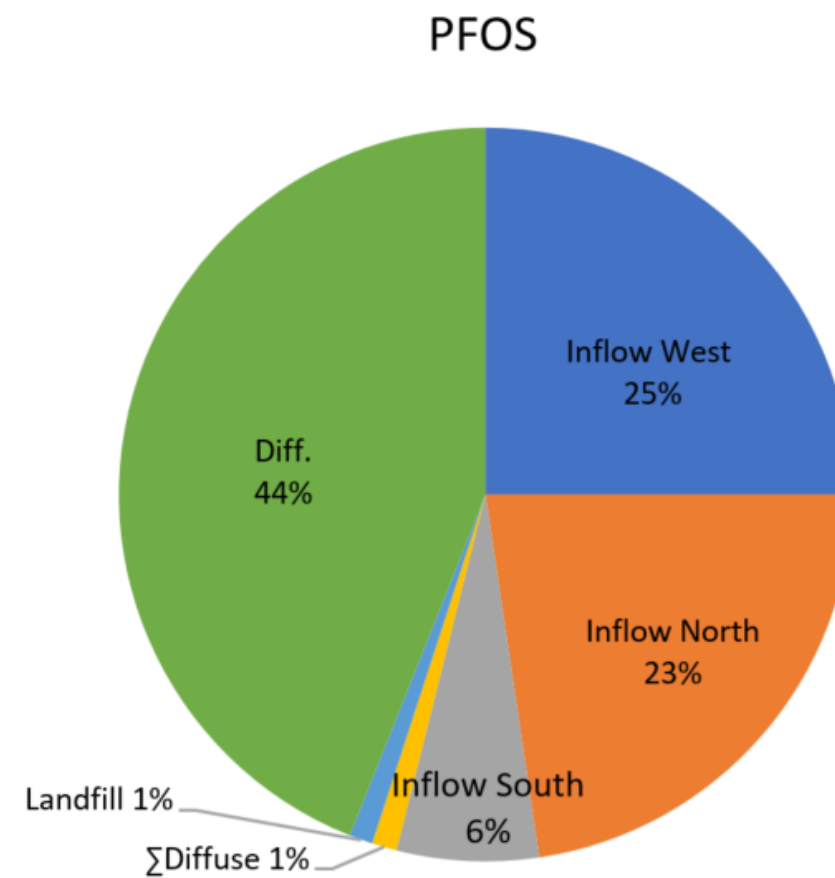
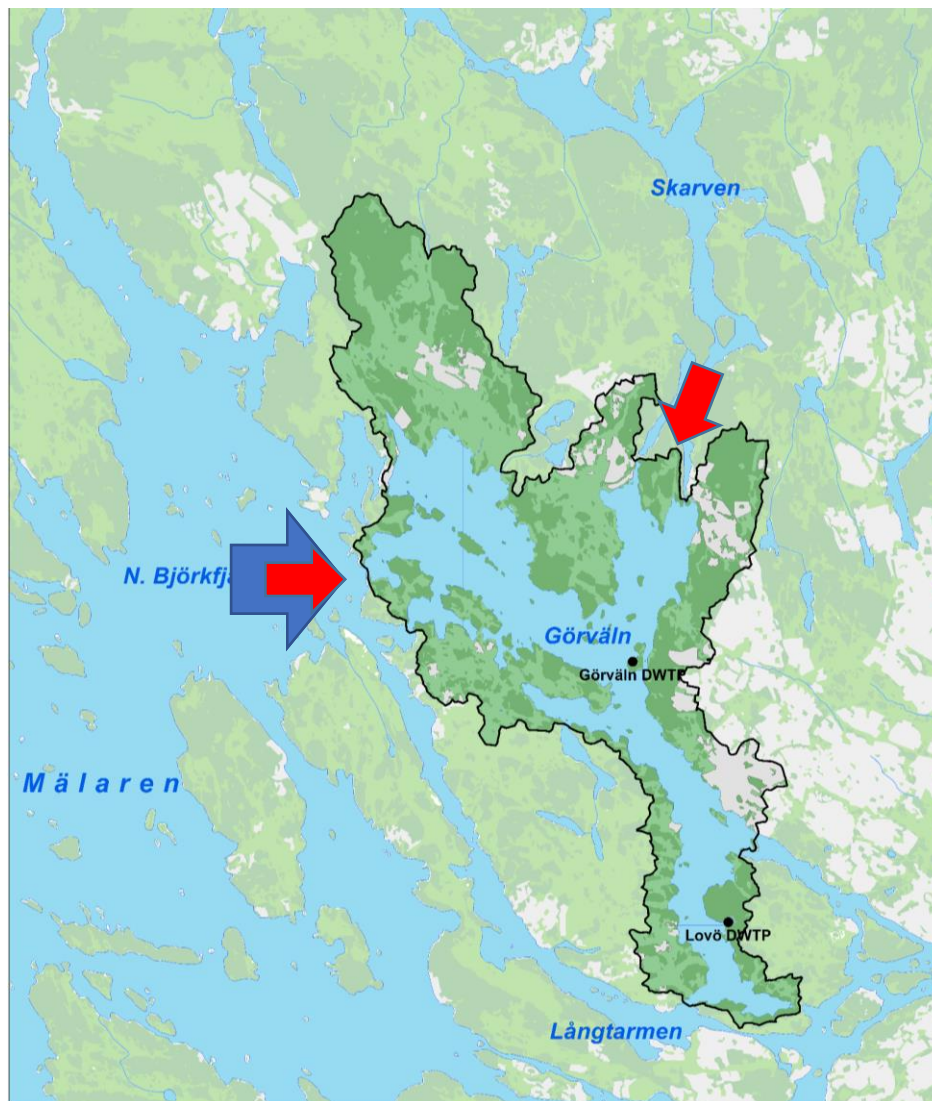
- Σ Diffuse = Fire-fighting foam, precipitation, OWTP, Land use
→ Negligible input
- The inflow from adjacent basin are the major inflow of PFAS
→ Low concentrations but high water flow
- Landfill significant contribution

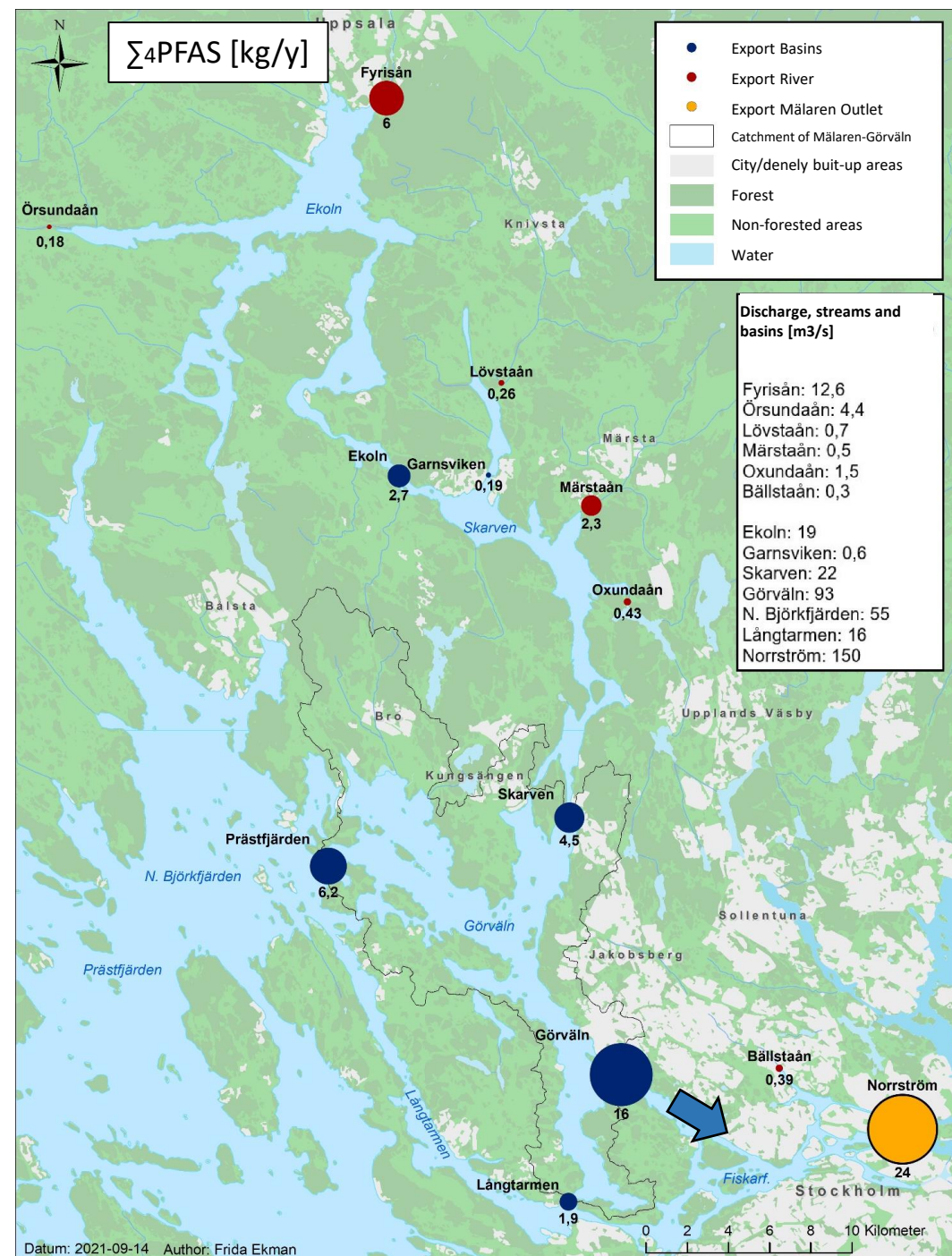
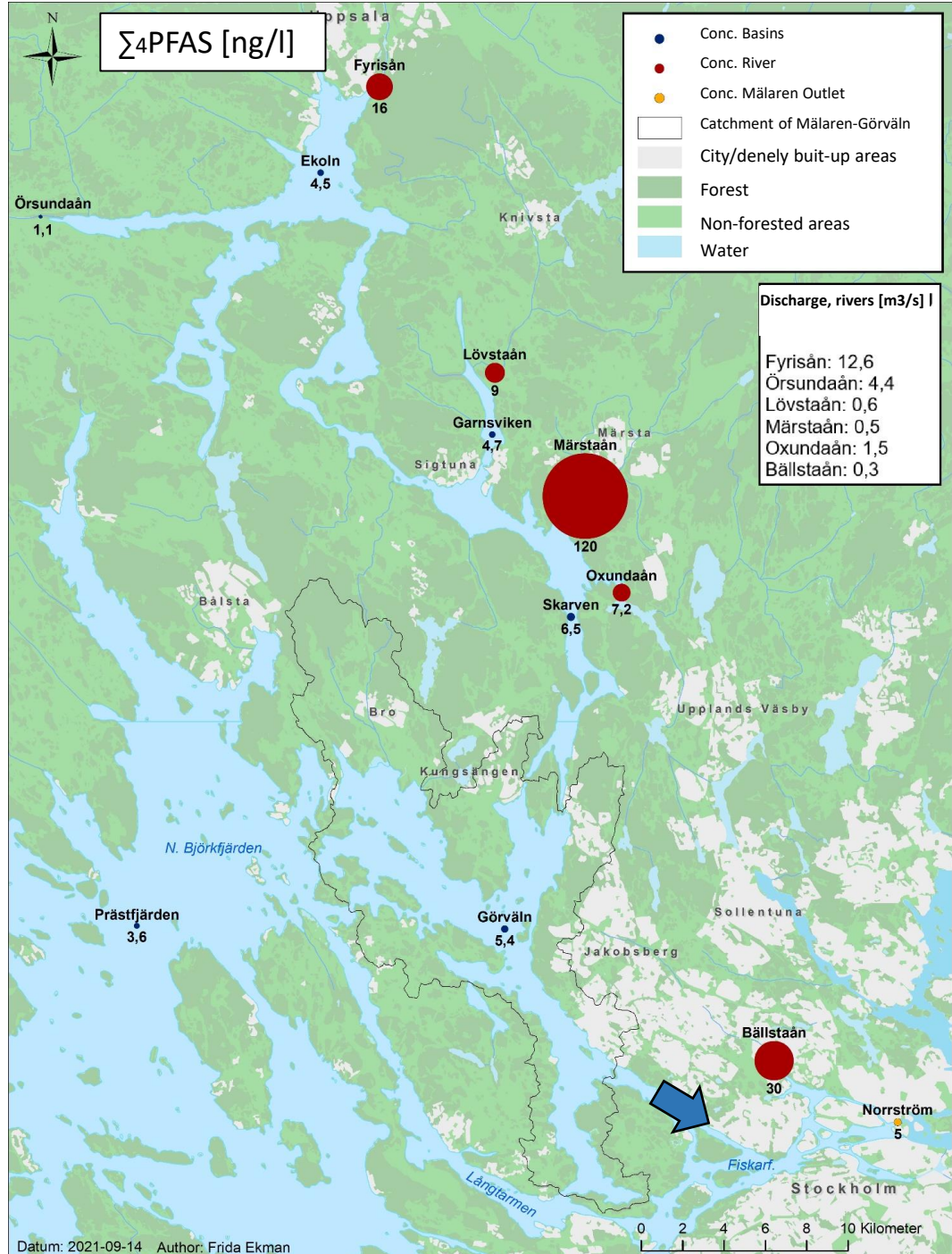
Results



- The differences between outflow and inflow: highest for PFOS
→ Inflow in the mass balance are missing

Results





Conclusions

- Biggest source of PFAS to Mälaren-Görvälän: Adjacent basins
 - Important with up-stream work in the entire Mälaren
- 50 % of the PFOS leaving Görvälän, could not be explained by any of the inflows included in this project. Where does that PFOS come from?
 - Point sources are important to include.
- Higher inflow than outflow to some of the norther basins – sedimentation?
- Mass flow calculations are an important tool in mapping pollutions

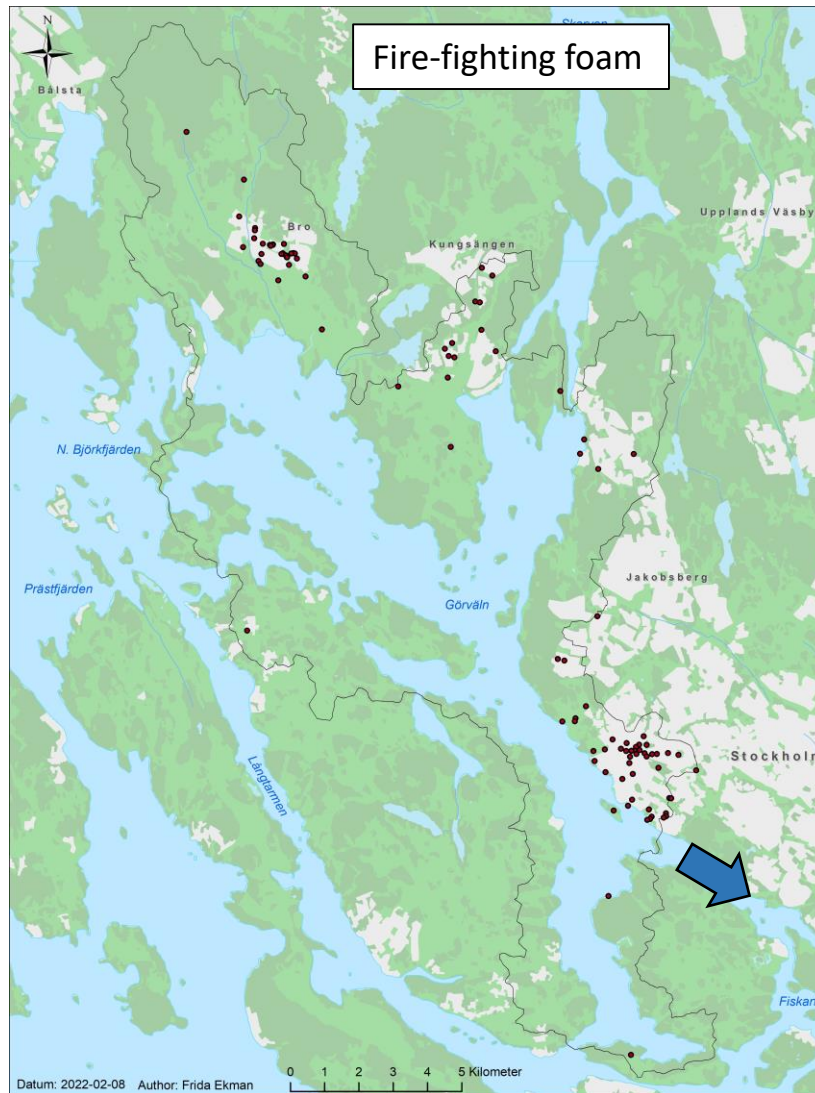
What happened after?

- In general we have received a very positive response
 - Presented at Conferences, meetings with organisations, municipalities and “Länsstyrelsen” etc
- Communicative tool – Giving “substance” to nanograms of PFAS
- Received comments from the Military (Försvarmakten och Fortifikationsverket) and Ragn-Sells (the owner of the landfill)
- New Project:
 - Focus on PFAS in the Water protection area of Eastern Mälaren



Focus on PFAS in the Water protection area of Eastern Mälaren

- Area of Focus: Entire Waterprotection Area of Eastern Mälaren (WPA)
- Collaboration with three municipalities around the WPA (Stockholm, Järfälla och Ekerö)
 - Map three suspected PFAS hot-spots
- New measurements at in- and outlets in Eastern Mälaren's sub-basins
- Update of the PFAS massbalance
- Report planned to be finished in October 2023



Method

Sites where fire-fighting foam has been used

- 100 sites within the catchment area
- Leakage: 3 % per year
 - Based on a study modelling leakage of PFOS from Arlanda Airport to Mälaren

Land use

- Forest, agriculture: Background concentration same as precipitation
 - No sludge is spread within the catchment area

Basins and streams

- Modelled water flow (SMHI) and measured concentrations

Landfill

- Estimated using average concentration for other landfills
 - We have now received more accurate data