# Assessing climate risks and vulnerability in groundwater and wastewater management

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# Introduction

**Finland** ~ 5M inhabitants

- Sparsely populated (18 inhab./m ²)

**Water supply**

- About 50 % of water supply rely on groundwater abstraction and 15 % on managed aquifer recharge (MAR)
  - About 5000 groundwater areas and most remarkable ones are situated in glaciofluvial formations
  - Large cities use surface water
- Most of the water utilities are small and rely on groundwater → no disinfection
- About 5 % of population receive drinking water from own well

**Sanitation**

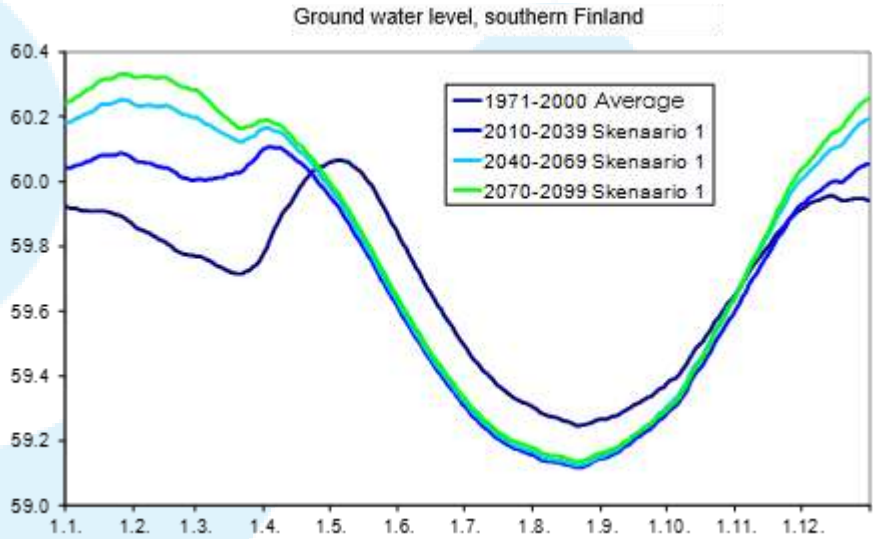
- 85 % of population is connected to a sewer network
- Aging infrastructure causes increasing challenges

Photo: Vuokko Laukka

# Introduction

## Climate change in northern conditions

- Overall precipitation increase
- Extreme weather events
  - Floods and droughts
  - Amount of storm water



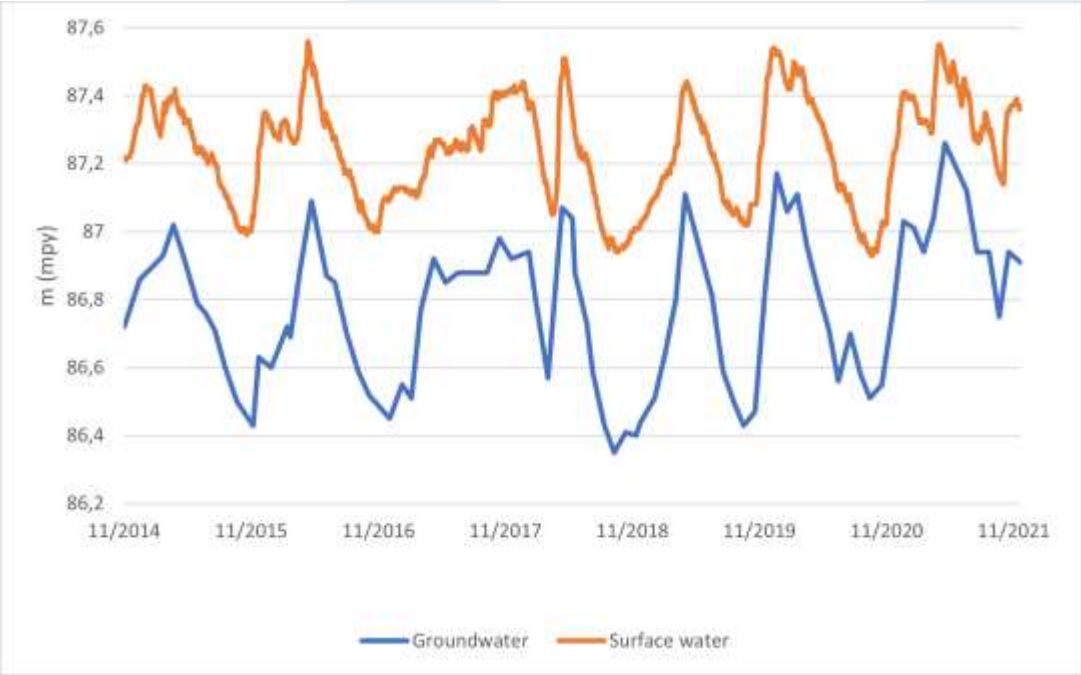

Source: Veijalainen ym. 2012. Suomen vesivarat ja ilmastonmuutos – vaikutukset ja muutoksiin sopeutuminen. WaterAdapt-projektin loppuraportti

# Groundwater as vulnerable raw water source

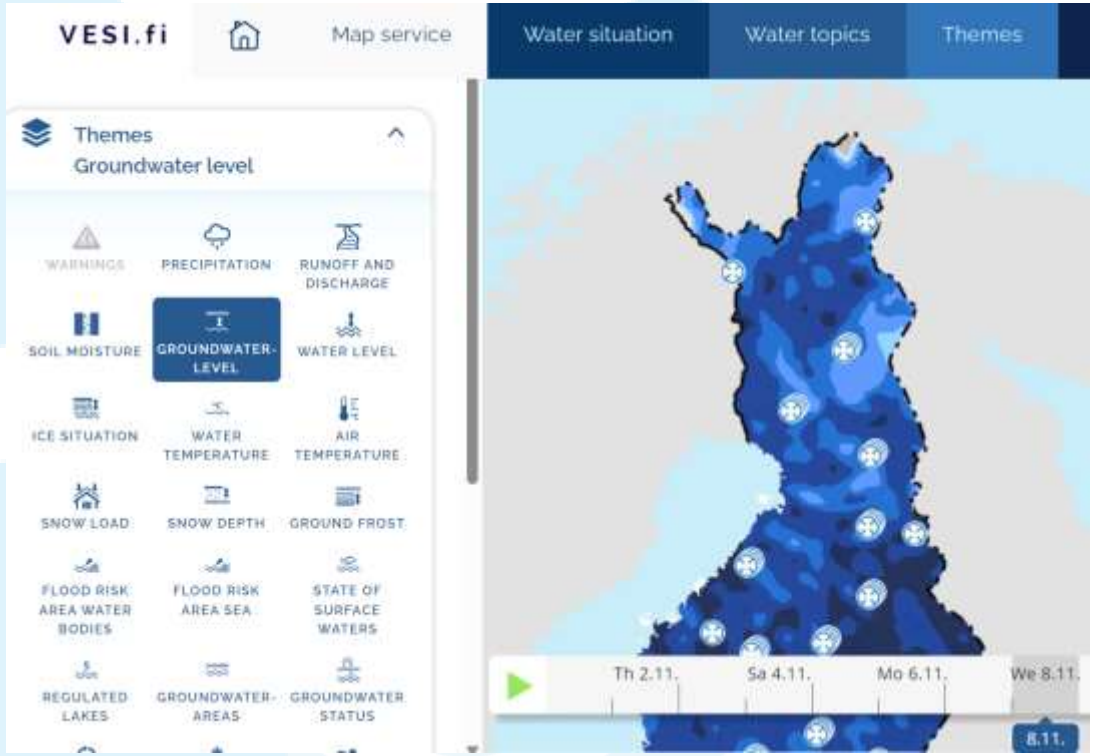
- Groundwater areas are small (ca 1-2 km2) and aquifers are shallow with high water conductivity
  - → susceptible to changes
- Floods and excessive rainfalls
  - Surface water cause problems in microbiological quality of groundwater
- Droughts can cause regional impacts on groundwater levels
  - Unintentional bank infiltration increases
  - Increase in bacterial and iron content and decrease in oxygen level
- Frost & groundwater
  - Lack of frost causes increase in amount but decrease in quality

Photo: Jari Rintala

# Groundwater levels




Source: Rintala, J & Britschgi, R. 2023. Pohjavedenottamot ja rantaimeytyminen.




Source: https://www.vesi.fi/en/karttapalvelu/

# Sewage networks and wastewater treatment

- Increasing storm water together with aging infrastructure leads to increasing amount of wastewater overflows
  → Environmental and health risks
- Increase in the amount of harmful substances

Photo: Suvi Lehtoranta

# Conclutions

Main vulnerabilities

- Extreme weathter events
  - cause problems in groundwater quality
  - increase the amount of wastewater overflows

  →Increased risk of water born deseases
- Impact on national level is still small but on regional and local level it can be remarkable

Opportunities

- Water utilities have high quality technical and capacity level for climate change adaptation, however, small utilities may not have enough resources
- Collaboration between utilities
- National water information systems and tracking stations for groundwater
- Storm water management

# Thank you!

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Photo: Vuokko Laukka