

When Groundwater Rises: Understanding a Hidden Problem in Cities

Synopsis of the project: UNCONFINED (Uncovering the Capillary Fringe Zone In Shallow Groundwater Dynamics)

Understanding the Challenge

In many Danish cities, groundwater lies less than 2 meters below the ground. After heavy rain, the groundwater can rise quickly, sometimes by more than a meter, causing flooding, damaging buildings, and leakage into sewer systems. These problems are becoming worse and more frequent due to climate change.

The UNCONFINED Project

UNCONFINED is a research project led by Aalborg University, Department of the Built Environment, together with partners from COWI, as well as an advisory group from Danish water utilities and stakeholder organizations.

The goal of the project is to understand the dynamics of shallow groundwater and how it varies with season and in response to rain across different soil types and urban area uses. In addition, the project examines how groundwater interacts with urban water infrastructure, such as sewer systems and drains, as well as with natural streams.

The main assumption of the project is that the rise and fall of groundwater levels are largely controlled by the zone known as the capillary fringe. This zone marks the transition where the dry, unsaturated soil meets the fully wet, saturated soil below.

What Will Be Done

The project will include field and laboratory experiments to measure soil properties and water transport. Groundwater monitoring data from Danish cities will be analyzed and linked to soil characteristics. Furthermore, computer models will be developed to predict how groundwater responds to rainfall. This will lead to the creation of risk maps and tools that can help future urban planning and climate adaptation strategies, ensuring safer and more resilient cities.

Why It Matters

Current tools recommended for the implementation of new Danish legislation for managing groundwater in cities by the municipal water utility services are uncertain and underestimate the dynamics of groundwater. The project will therefore contribute with tools to improve the design of solutions to reduce problems related to shallow groundwater. This will reduce environmental impacts, lower the risk of groundwater flooding, and improve the economy in climate adaptation solutions.

If you want to know more

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