ANTWERP'S SHALLOW SUBSURFACE: UNLOCKING ITS POTENTIAL FOR A SUSTAINABLE FUTURE THROUGH DETAILED GEOLOGICAL STUDY AND VOXEL MODELING.

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The urban subsurface offers many opportunities in addressing challenges like sustainable energy supply, groundwater management, utilization of underground space, raw materials and climate adaptation. However, to map its full potential, a deep understanding of the shallow urban subsurface is necessary. In Antwerp (Flanders, Belgium), major infrastructure works are planned at its port and the urban periphery in the near future. Therefore, the Flemish government has ordered VITO to model the local shallow subsurface. The project is being guided by a stakeholder-consortium consisting of different government agencies related to environment, geotechnical research, mobility and public works. During the project, interaction with on-site tests was monitored offering the opportunity to discuss data and geological insights to be incorporated in the model, and to exchange samples of the site investigations for preservation by the government on the long term. The government's primary goal was to examine the degree of detail in which the shallow subsurface can be mapped to gain a better understanding of the types of sediments and their properties that can be expected during major infrastructural works in the near future, including the delineation of the anthropogenic with in-situ sediments. On the other hand, the government wants to raise the awareness of the subsurface by publishing the 3D model in an easily accessible 2D Viewer (https://www.dov.vlaanderen.be/portaal/?-module=ondiepmodelantwerpenverkenner).

The city-scale model of Antwerp is a test case for other urban areas in Flanders. The model is highly detailed, based on the interpretation of thousands of boreholes and cone penetration tests (CPTs) and outcrop studies. In particular the interpretation of CPTs has added detail to the model. The model shows the expected spatial distribution and thickness variation of the Boom Clay, the Neogene sands, the Pleistocene, Holocene and an indication of the anthropogenic deposits.

To construct the model, existing boreholes and CPTs managed in the regional Flanders Soil and Subsoil Database (DOV) were lithostratigraphically interpreted, coded and converted into different voxel parameters. The model consists of more than 21 million voxels with dimensions of 25 x 25 x 0.5 m and extends to a depth of 50m below sea level. Lithofractions have been assigned (shares of peat, clay, silt, fine sand, medium sand, coarse sand, and gravel) by 3D-interpolation using software program Rockworks®. The voxel model also includes information about expected glauconite content, presence of shell admixtures, carbonate content, bedrock and concretions for every lithostratigraphical unit.

The model is since 2022 available online as a prospective instrument for geological, geotechnical, and hydrogeological applications or research for the Antwerp region.