



## **Landslide risk assessment in the Göta Älv river valley to limit consequences of climate change on society**

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Higher temperatures, higher average precipitation and increased occurrence of extreme rainfall events are some expected climate changes in Sweden during the coming 70-100 years. Due to the changing climate the risk for floods, erosion and landslides are expected to increase in large parts of the country. To prevent extensive floodings and damages of cities and infrastructure around Lake Vänern, it is necessary to allow controlled overflow from Lake Vänern through the river Göta Älv. An overflow in the river, in turn, leads to increased risk for erosion and landslides along the Göta Älv valley. In order to meet the upcoming climate changes and to handle the increasing flows through the river, we need to improve the knowledge of the stability of the entire river bank. The Swedish Government has commissioned the Swedish Geotechnical Institute (SGI) to investigate the landslide potential of the Göta Älv valley, taking the predicted climate changes into consideration. The investigated area includes the parts of Göta Älv that could be affected by the increased flows from Lake Vänern; areas where the increased flow will affect stability and where landslides could cause serious damages or damming of the river. The investigation area includes c. 90 km of the Göta Älv river plus tributaries in connection to Göta Älv.

In the landslide risk analyses developed for Göta Älv, the likelihood of landslides and estimation of the subsequent consequences are included. The methodology involves mapping of landslide hazards and a judgement of the risk area on the basis of a risk matrix. The landslide risk analysis allows for an assessment of where geotechnical reinforcements would be necessary. A cost estimation for the required reinforcement measures is also provided. In areas where the estimated risk for a landslide is low (e.g. limited consequences), stability mapping in accordance with the model used by the Swedish Civil Contingencies Agency (MSB) is developed; mapping that extends beyond residential areas.

The submarine river topography has been mapped by multi-ray sonar and automatic stations measuring slope-inclination, groundwater- and porewater pressure and water level has been installed around and in the river. However, there is a need for improving the mapping methods of the river, including data gathering and risk estimation. The outer and inner erosion potential of the Göta Älv is not fully known and more information regarding the river floor and shores are required. Hence, analysis and measures of erosion and sediment transportation, combined with the bathymetric and topographic conditions, are performed. Moreover, new methods for landslide risk analyses that include the impact of climate change on geotechnical conditions (e.g. porewater pressure) are evaluated.