HYDROGEOLOGICAL STUDY AND NUMERICAL MODEL OF GROUNDWATER RISE MITIGATION ACTIONS EFFECTS IN THE GLACIAL - FLUVIOGLACIAL TERRITORY OF GRANDATE (COMO, NORTH ITALY)

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The development of industry in Europe caused groundwater levels to fall up to tens of metres below ground level. As the water tables were so deep it was often assumed they could be safely ignored. Over the last 10-20 years a reduction in groundwater abstraction has led to a rise in water levels almost everywhere (Wilkinson, 1985).
On November 2014, the Municipality of Grandate, located 10 km southward the Como lake, had to deal with a great emergency caused by the flooding of several underground facilities of buildings and factories located in its territory. Grandate municipality entrusted Politecnico di Milano with the hydrogeological study of its territory in order to understand the causes of the groundwater flooding and prepare a pre-feasibility study concerning possible actions to be taken for groundwater control in order to avoid future occurrences. The study demonstrated the reason of the floods was the concurrence of two causes: the groundwater rising -which is happening in this zone and generally in Lombardy Region (Alberti et. al, 2001; Colombo et al. 2017)- and the abnormal quantity of rainfall that occurred in 2014. The territory setting makes the area of Grandate like a big bucket, surrounded by morenic hills, where water flows from the zones at higher elevations, infiltrates in the plain and hardly discharges southward. In fact, for the uplift of the bedrock, the outflow section shrinks in the southern zone of the plain. The hydrogeological conceptual site model was then the base for a transient numerical model developed to analyse the system behaviour under different scenarios. The flow model was applied to evaluate the effectiveness of some alternative actions for groundwater drawdown and seasonal control. The pre-feasibility study has been developed with reference to 2 kinds of possible mitigation actions: 1) public/private wells relocation and pumping rate increase and 2) low enthalpy geothermal open loop systems implementation. For the first case the wells don't need to extract continuously because the model suggests that it's possible to avoid further occurrences of floods by controlling the groundwater level when it rises up a threshold value. This level of alarm has been set 5 m below the ground. When groundwater exceeds the threshold, it's suggested to extract water from 8 pumping wells. This action creates in the area subjected to the flooding a groundwater drawdown of about 6 m in three months. In case of heavy rainfall period (typically autumn), this is sufficient to avoid flooding of underground structures.

References

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