

## **Combining scientific and societal challenges: a water supply case study from the Koster Islands, Sweden**

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Until now, groundwater in coastal areas has not received much attention in Sweden, neither from water authorities nor the research community. Extractable volumes from bedrock aquifers are too small for the public water supply of larger permanent settlements. However, of the 450,000 private wells in Sweden, many are located in attractive coastal areas or on islands, creating pressure on groundwater resources during the summer months as periods with low or no natural groundwater recharge. This situation is exacerbated as municipalities receive increasing applications to build summerhouses, or to convert existing ones into permanent residencies. In view of such rising demands, as well as the growing awareness of potential environmental impacts and climate change, Swedish municipalities recognize groundwater usage in coastal areas is a major concern. However, the responsibility for private wells is left almost exclusively to their owners, and obligations in the water sector are distributed over a wide range of authorities which operate on local, regional, and national scales (1). Therefore, it remains unclear how to deal with and administer the related challenging questions which are of varying legal, social, economic, environmental, and hydrological natures.

Here, we present intermediate results of an ongoing investigation on the “Koster” archipelago which forms an “in-a-nutshell” example of a coastal zone with such groundwater use. With around 300 annual permanent residents, but up to 6000 summer overnight guests in peak season, water supply, largely based on 800 private wells, is at its limit. Water availability forms an obstacle to future development and even the current operation is considered unsustainable, leaving the municipality to decide how to secure future supply. The municipality favors a “large scale technical solution” (either a pipeline from the mainland or a large desalination plant) while many locals prefer to keep the existing private wells. While hydrology constitutes a boundary condition, other concerns, e.g., legal and economic, weigh high.

Our research group was asked to provide an objective, neutral assessment of the islands’ water availability under present and future scenario conditions. We performed a large measurement campaign over an entire hydrological year involving measurements of groundwater quality and quantity, water balance, and recharge calculations, as well as online surveys and interviews. The conditions on the archipelago are complex, and many scientific challenges are present. Our investigation is embedded in a larger project that looks at various dimensions of the problem. However, it appears that the question of groundwater availability and its spatial and temporal distribution is crucial. Water is abundant, but not always at the right place at the right time. Decentralized solutions are possible, but continuing with the current system is not. This provides a great challenge for our objectivity and neutrality, especially when communicating complex results of the investigation in appropriate and meaningful ways. Thus, the Koster Islands are not only a microcosm for Swedish coastal groundwater problems, but also for a wider range of issues combining scientific and societal challenges.

1. Lewis J, Sjöström J, Höök M, Sundström B. The Swedish model for groundwater policy: legal foundations, decision-making and practical application. *Hydrogeol J.* 2013;21(4):751-60.