

**NITROGEN REMOVAL AT COLD WATERS:
PILOT TRAILS WITH MBBR TECHNOLOGY**

IVL SWEDISH ENVIRONMENTAL RESEARCH INSTITUTE Ltd

BSAP-2020-08

Report prepared 23.5.2025

Executive summary of the project

Swedish wastewater treatment plants (WWTPs) along the north-eastern coast of the Baltic Sea, currently have no general requirements for nitrogen removal, which is only necessary if local conditions in the receiving water bodies are poor. However, with the revision of the EU Wastewater Directive, nitrogen removal in cold climates is likely to become increasingly relevant. This project aimed to expand knowledge on nitrogen removal using MBBR (Moving Bed Biofilm Reactor) technology to enable cost-effective treatment at low water temperatures.

During the investigation of various WWTPs in the region, the most significant factor influencing wastewater temperature was found to be the proportion of extraneous water, which had a greater impact than geographical location. The project concluded that heating the wastewater was not economically viable for the case study in Sundsvall or for other treatment plants along the northern coast.

Pilot trials were conducted at Sundsvall's Fillan WWTP, utilizing two MBBR lines with both pre- and post-denitrification, operated at different temperatures. The trials revealed minimal differences in the temperature sensitivity of nitrification and denitrification processes in the MBBR system. For every degree of temperature reduction between 5°C and 12°C, the reduction rates of both processes decreased by approximately 8%.

Complete nitrification was maintained throughout the study, except during brief periods of operational disturbances and increased loads, though denitrification proved to be the most challenging aspect of nitrogen reduction, particularly during the snowmelt period when conditions were less favourable. Nonetheless, the project demonstrated that nitrogen removal from municipal wastewater is feasible even at temperatures below 5°C. However, in many WWTPs in the affected area, larger basin volumes are required, and depending on the level of nitrogen removal needed, operational costs could be high for example due to the need of addition of external carbon source.