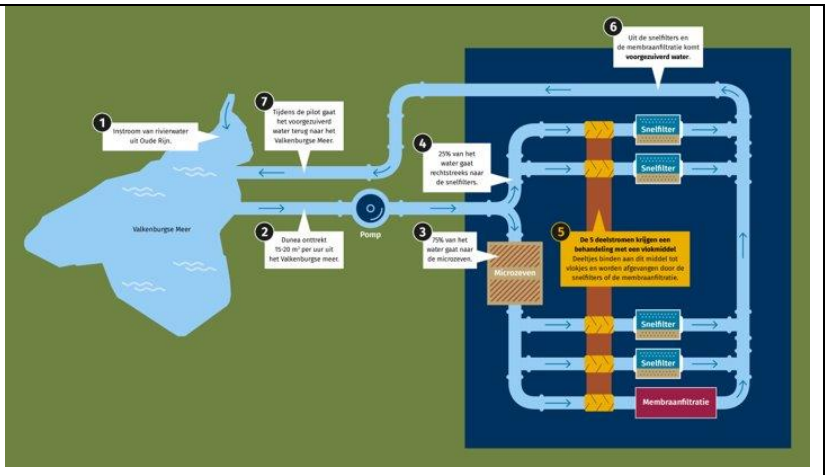
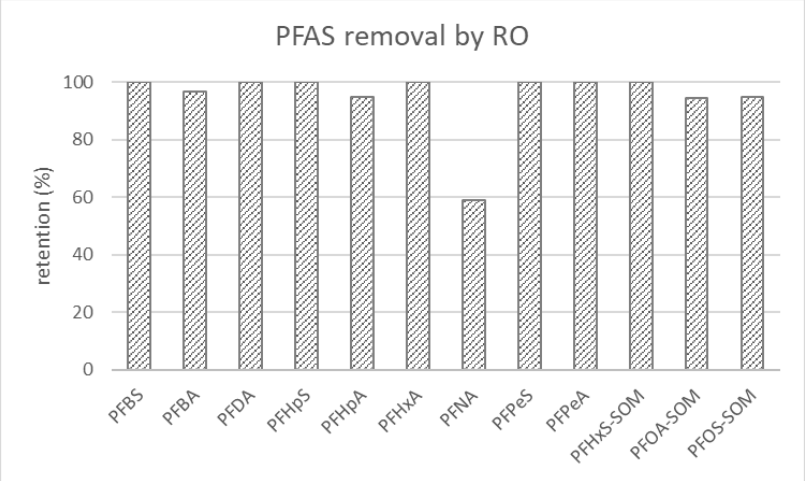
Abstract Title	Drinking water for the future: expanding natural treatment with membrane filtration
Topic	O **Improving water quality** O Resilient water systems O Circular solutions: Reuse, Recover and Recycle O Transitions in water, agro/food and energy
Challenges and Solutions	The removal of organic matter, nutrients, salts and organic micropollutants – including PFAS – from surface water is challenging in Dunea's pilot plant at Lake Valkenburg. Here, conventional rapid sand filtration is compared to ultrafiltration as pre-treatment for reverse osmosis for the direct production of drinking water.
Author(s), highlight corresponding author	1.**Suzanne van der Poel, Dunea, the Netherlands** 2. Franca Kramer, Dunea, the Netherlands 3.Brent Pieterse, Dunea, the Netherlands 4.Name, Surname, Affiliation, Country
Abstract	Dunea produces high quality and reliable drinking water in harmony with nature. The Solleveld, Meijendel and Berkheide dunes are crucial for the treatment process as they purify pre-treated infiltrated surface water from the river Meuse (managed aquifer recharge). Over 1.3 million people in the western part of the Netherlands can count on Dunea tap water 24 hours a day. However, the region is growing and Dunea is facing a tough challenge: before 2030, already an extra 10 M m^3 drinking water is required. By then, the dunes have reached their maximum capacity. Thus, additional sources and more treatment capacity are needed to ensure sufficient drinking water in the future. In 2018 Dunea developed a multi-source strategy: multiple sources for drinking water, considering source pollution, sufficient drinking water in periods of drought and the

	vulnerability of important infrastructure in a busy environment. Two sources close to home, brackish water in the Meijendel area and surface water from Lake Valkenburg (Katwijk) were identified as potential new sources. Because sources are not of constant quality and drinking water is expected to have to meet increasingly stringent standards – of which PFAS currently is an example –, more treatment technology is required in addition to flexibility in sources. The use of membrane technology does both. It is a proven technique, and a good basis for a hybrid system in the long term, to combine our natural dune system with a more technical system: direct treatment of local sources with membrane filtration, to tackle all qualitative and quantitative challenges of the future. Currently, a treatment pilot is running to investigate surface water from Lake Valkenburg as a new source for drinking water. In this presentation, results from the pilot will be shared after a year of operation. We focus on the water quality challenges of treating Lake Valkenburg water (figure 1), such as the removal of organic matter, nutrients, salts and organic micropollutants, including PFAS (figure 2). We compare conventional- and advanced treatment steps as pre-treatment for reverse osmosis (figure 1) for the direct production of drinking water. In the future this water will be mixed with the conventional produced drinking water.

Figures/diagrams/illustrations	 *Figure 1. Treatment scheme of pilot Lake Valkenburg. The abstracted water can be pre-treated by a microsieve. Conventional treatment by rapid sand filtration is compared to membrane treatment (ultrafiltration followed by reverse osmosis).*  *Figure 2. PFAS removal from Lake Valkenburg by reverse osmosis, operating at 80% recovery with a flux of 26.2 LMH.*