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## What if floating ecosystems naturally cleaned polluted waters?

# Floating Filters

Within Reach

Transitional

Visionary

As an effective nature-based solution, floating wetlands are optimally designed using advanced machine intelligence for various water networks and locations, naturally filtering polluted water networks and making them clean and safe.



### UNCERTAINTIES

Nature, Technology

MEGATREND (Most significant)

Evolving Ecosystems

#### TRENDS

Community-Based Solutions New Materials Sustainable Waste Management

### TECHNOLOGIES

Biotechnology Nanotechnology

### SECTORS IMPACTED

Agriculture & Food Chemicals & Petrochemicals Energy, Oil & Gas, & Renewables Government Services Health & Healthcare Infrastructure & Construction Materials & Biotechnology Real Estate Travel & Tourism Utilities

#### KEYWORDS

Eutrophication Floating Wetlands Public Health Wastewater Treatment Water Pollution Globally, about

80%

of industrial and domestic wastewater is **released back into ecosystems untreated**, severely impacting both human health and aquatic ecosystems

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### WHY IT MATTERS TODAY

Globally, about 80% of industrial and domestic wastewater is released back into ecosystems untreated.<sup>673</sup> This percentage is often higher in low-income countries, which lack wastewater management systems,<sup>674</sup> and in areas experiencing rapid increases in population and economic growth.<sup>675</sup>

Contaminated water negatively affects human health. For example, excess nitrogen in drinking water is associated with colorectal cancer, thyroid disease, and neural tube defects,<sup>676</sup> and the association between water nitrate concentrations and methaemoglobinaemia – a blood condition that primarily affects infants – is well established.<sup>677</sup> Additionally, algal blooms – caused by an excess of nitrogen and phosphorus – produce toxins that can cause rashes, liver and kidney problems, respiratory conditions, and neurological issues.<sup>678</sup> People are exposed to the blooms through eating contaminated fish, swimming in or drinking the affected water, or breathing contaminated air.<sup>679</sup>

Contaminated water negatively impacts ecosystems as well. Excessive nutrients, and the algal blooms they create, deplete the level of oxygen in the water, leading to eutrophication and its characteristic dead (hypoxic) zones, where aquatic life cannot survive.<sup>680</sup> More than 97% of the Baltic Sea area has been affected by eutrophication due to past or current disproportionate inputs of phosphorus and nitrogen.<sup>681</sup> Floating wetlands can remove up to 91.7% of total nitrogen and 98.4% of total phosphorus.<sup>682</sup> They have the ability to increase sulphate-reducing bacteria by 30%<sup>683</sup> and, in some designs, remove over 70% of sediment.<sup>684</sup>



### Small floating wetlands offer a natural solution for water purification and filtration, using advanced machine intelligence, biotechnology, and plant genetic information to optimise designs for

specific climates and water qualities

### THE OPPORTUNITY

Besides beautifying urban areas and attracting wildlife,<sup>685</sup> small floating wetlands offer a natural solution for water purification and filtration. Using advanced machine intelligence, biotechnology, and genetic plant information, optimal designs and plant species are selected for specific natural ecosystems, water qualities and climates. Built-in, self-powered sensors provide performance feedback and alerts during maintenance and when disposal is needed.

With roots that grow into the water, wetland islands improve water quality by trapping sediments<sup>686</sup> and filtering pollutants. At the same time, the roots absorb nutrients from the water which microbes convert into other compounds that help purify the water.<sup>687, 688</sup> As a self-contained ecosystem, each island acts as a moving filter that requires minimal maintenance. Guided by simulations or digital twins, multiple islands form a networked system that collaboratively optimises water purification.



### BENEFITS

Improved water quality; enhanced biodiversity; increased carbon sequestration; ecofriendly wastewater treatment; lower costs; enhanced urban aesthetics.



### RISKS

Long-term maintenance and disposal costs and challenges; potential for invasive species or other ecosystem imbalances to be introduced; potential for rate of pollution to exceed rate of filtration.